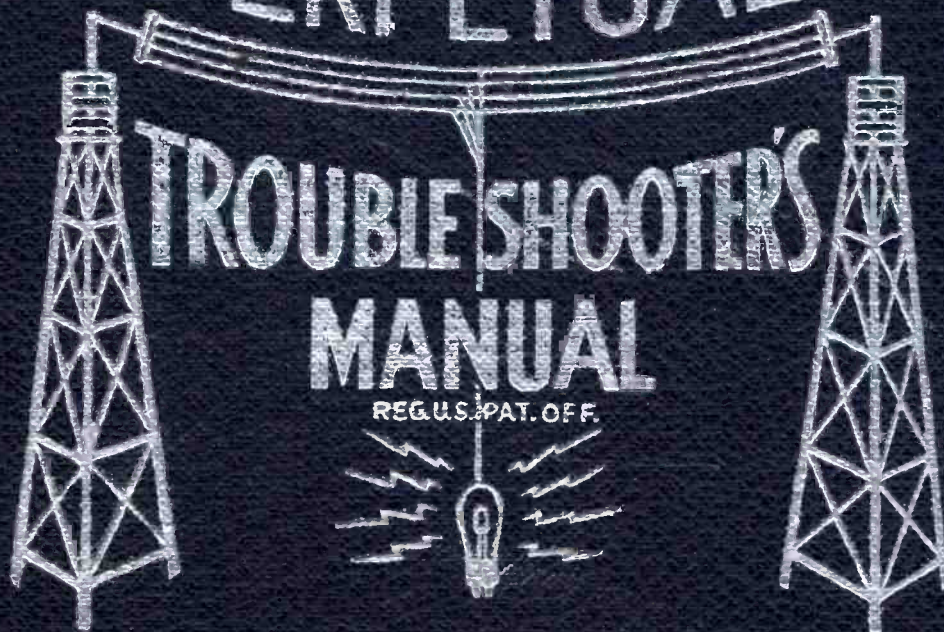


VOLUME XVII

PERPETUAL

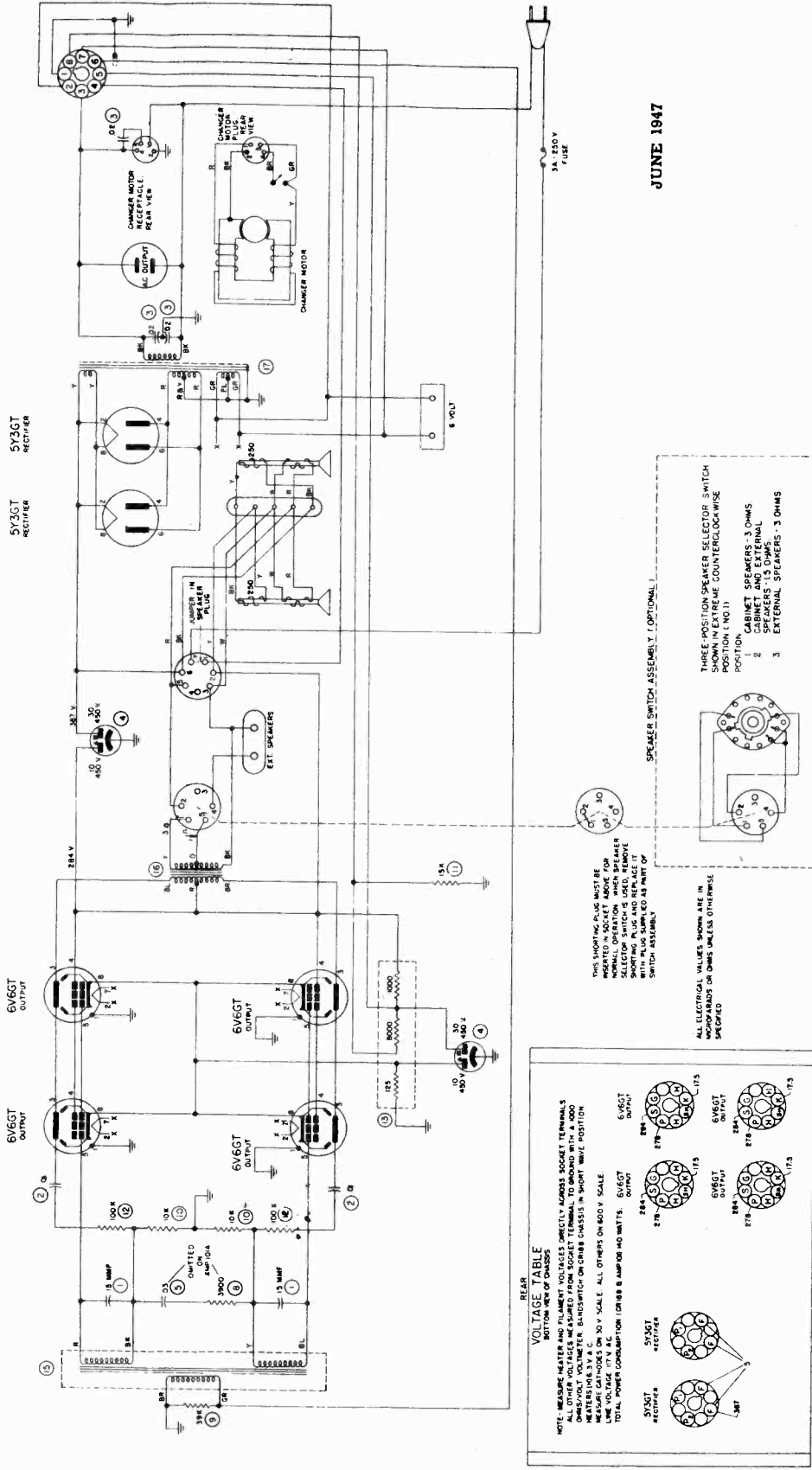


**TROUBLE SHOOTER'S
MANUAL**

REG. U.S. PAT. OFF.

JOHN F. RIDER

THE MAGNAVOX CO.



JUNE 1947

SPECIFICATIONS

Power supply.....	117 volts 50/60 cycles AC	Speakers:	No. 582815	No. 582869
Power consumption.....	* 140 watts		250 ohms	250 ohms
Power output.....	20 watts		5.0 ohms	5.0 ohms
Output impedance.....	2.5/1.7 ohms		5.0 ohms	5.0 ohms
Tubes:				
Power output (push-pull parallel stage).....	(4) 6V6GT			
Rectifiers.....	(2) 5Y3G			

*Power consumption is for amplifier and CR-188 radio chassis.

VOLTAGE TABLE
BEAR BOTTOM VIEW OF CHASSIS

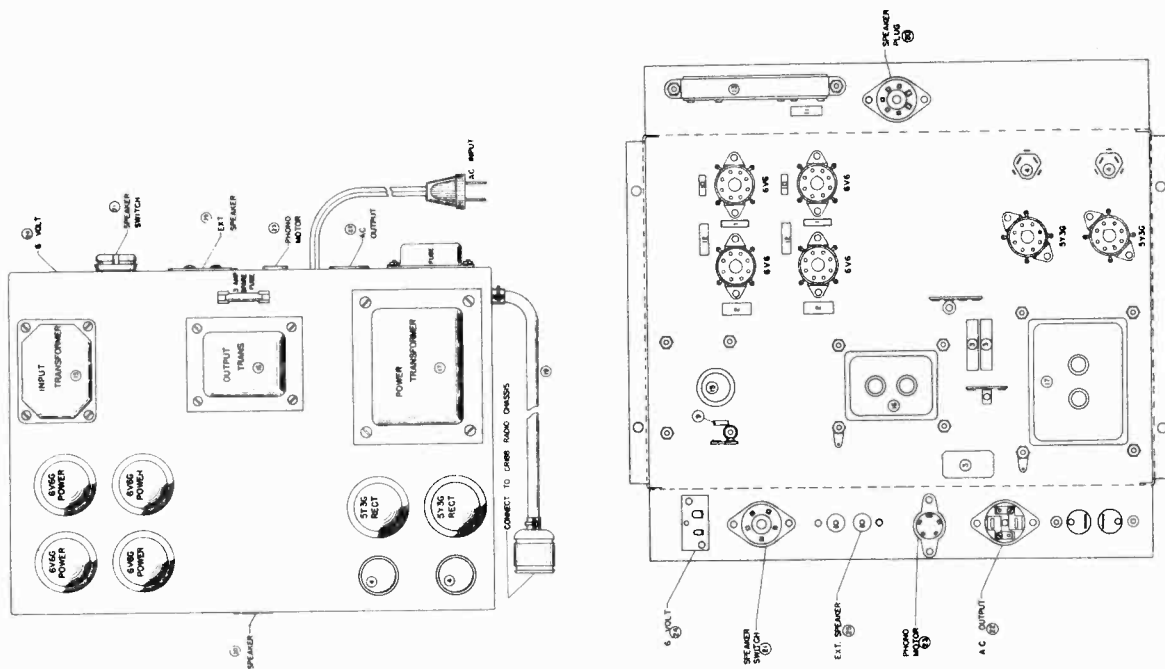
NOTE: MEASURE HEATER AND FILAMENT VOLTAGES DIRECTLY ACROSS SOCKET TERMINALS. ALL OTHER VOLTAGES MEASURED FROM SOCKET TERMINAL TO GROUND WITH A 1000 MEG OHM RESISTOR IN SERIES. RESISTOR ON CHASSIS IN SHIRT IRON POSITION. MEASURE CAPACITORS ON 50 V SCALE. ALL OTHERS ON 500 V SCALE. TOTAL POWER CONSUMPTION UNDER 8 AMP AND 110 VOLTS.

6V6GT OUTPUT SOCKET TERMINALS: 284V, 278V, 278V, 284V, 284V, 278V, 278V, 284V

5Y3GT RECTIFIER SOCKET TERMINALS: 5Y3GT, 5Y3GT

5Y3G RECTIFIER SOCKET TERMINALS: 5Y3G, 5Y3G

6V6GT OUTPUT SOCKET TERMINALS: 284V, 278V, 278V, 284V, 284V, 278V, 278V, 284V



PARTS LIST

REFERENCE NO.	DESCRIPTION	MAGNAVOX PART NO.
1	Capacitor, molded mica, .15 mmf	250107G93
2	Capacitor, paper, .01 mfd, 600 V	250129G2
3	Capacitor, paper, .02 mfd, 600 V	250129G3
4	Capacitor, electrolytic, 30-10 mfd, 450 V	270023G2
5	Capacitor, paper, .03 mfd, 400 V (AMP-101B only)	250129G4
8	Resistor, composition, 39,000 ohm ± 10% ½ W.	2300084G69
9	Resistor, composition, 10,000 ohm ½ W.	230084G81
10	Resistor, composition, 3900 ohm ± 10% ½ W.	230084G19
11	Resistor, composition, 15,000 ohm 2 W.	230086G20
12	Resistor, composition, 100,000 ohm 1 W.	230085G25
13	Resistor, wire wound, 125-3000-1000 ohm	240037G1
15	Transformer, input	320017G1
16	Transformer, output	330024G1
17	Transformer, power, 117 V, 50-60 cycle	300025G1
19	Cable and plug assembly	460557G1
20	Socket, speaker connection	180504G16
21	Socket, speaker switch	180504G6
22	Socket, power connection	180428G1
23	Socket, phonograph motor connection	180501G5
24	Socket, 6-volt	189788G2
	Socket, octal	180194G4
	Terminal board—external speaker connection	209601G2
	Fuse mounting	182467G1
	Fuse cover	182467G2
	Fuse, 3 amp, 250 V, cartridge	180157G10
	Fuse clip for spare fuse (2 required)	180236G1

METHOD FOR REMOVING CHASSIS FROM CABINET

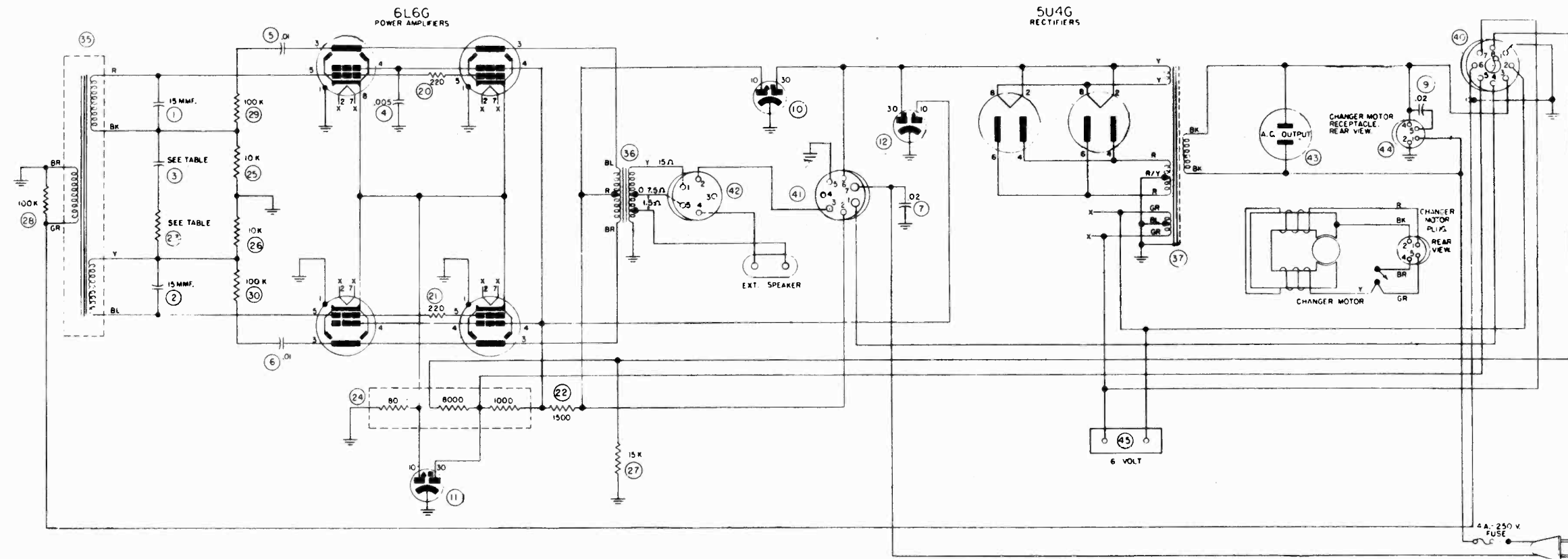
To remove the chassis, first remove all plugs and cables from the receptacles and the connector from the rear of the radio chassis. The amplifier chassis is mounted to the cabinet shelf with four screws and nuts; after they have been removed, the amplifier may be lifted from the cabinet.

ACCESSORIES

EXTENSION SPEAKER—Two screw terminals are provided on the rear of the amplifier chassis for the connection of an extension speaker line. High-fidelity permanent-magnet extension speakers are available through all authorized Magnavox dealers.

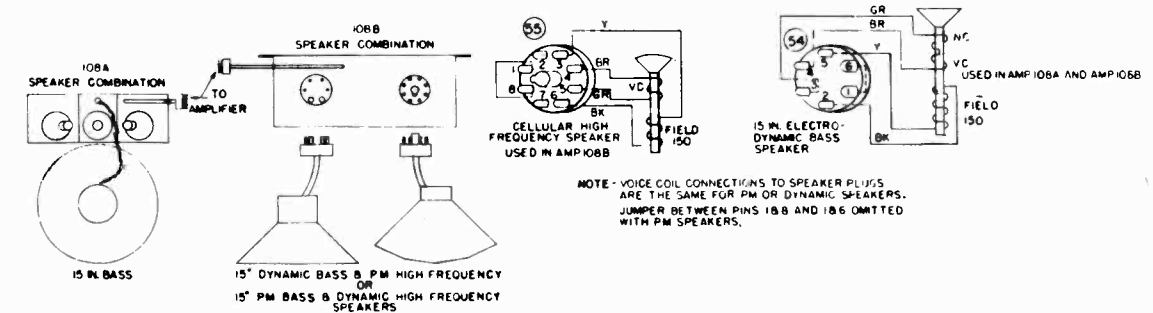
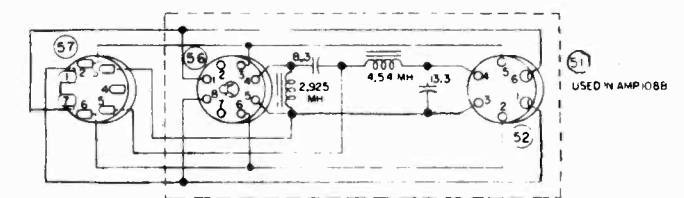
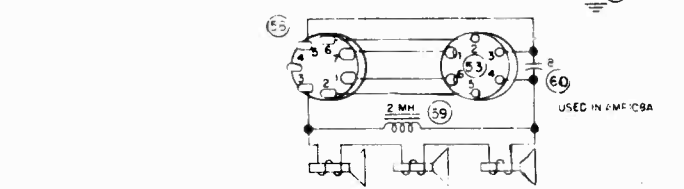
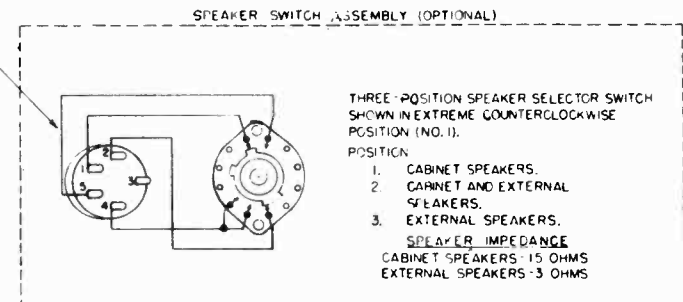
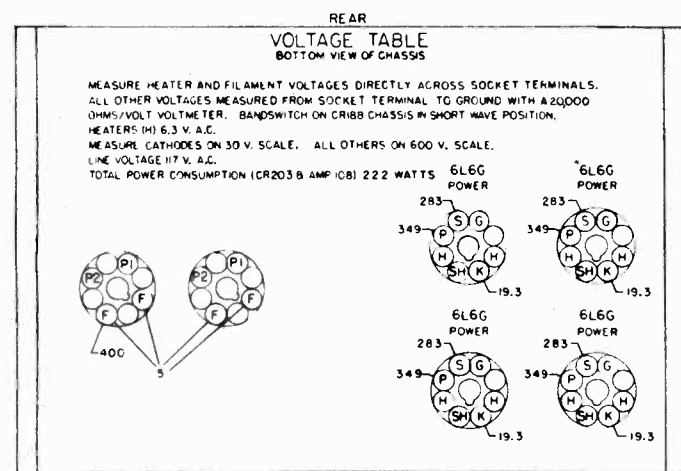
SPEAKER SELECTOR SWITCH—Provision is made in this amplifier for connecting extension speakers and a speaker selector switch. By means of this switch, the cabinet and extension speakers may be operated separately or together while maintaining the proper load on the amplifier. This is accomplished by means of a rotary switch with a connecting plug that may be purchased from any authorized Magnavox dealer. When shipped from the factory, a shorting plug is inserted in the amplifier receptacle stamped **SPEAKER SWITCH**. This plug must not be removed unless the speaker selector switch is added. Then the shorting plug is replaced with a plug that is supplied as a part of the selector switch assembly.

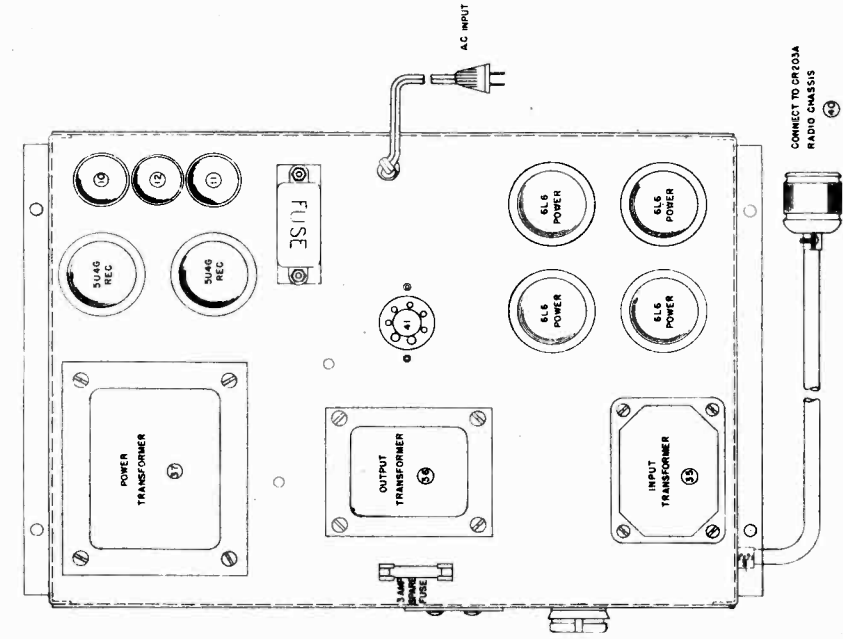
THE MAGNAVOX CO.



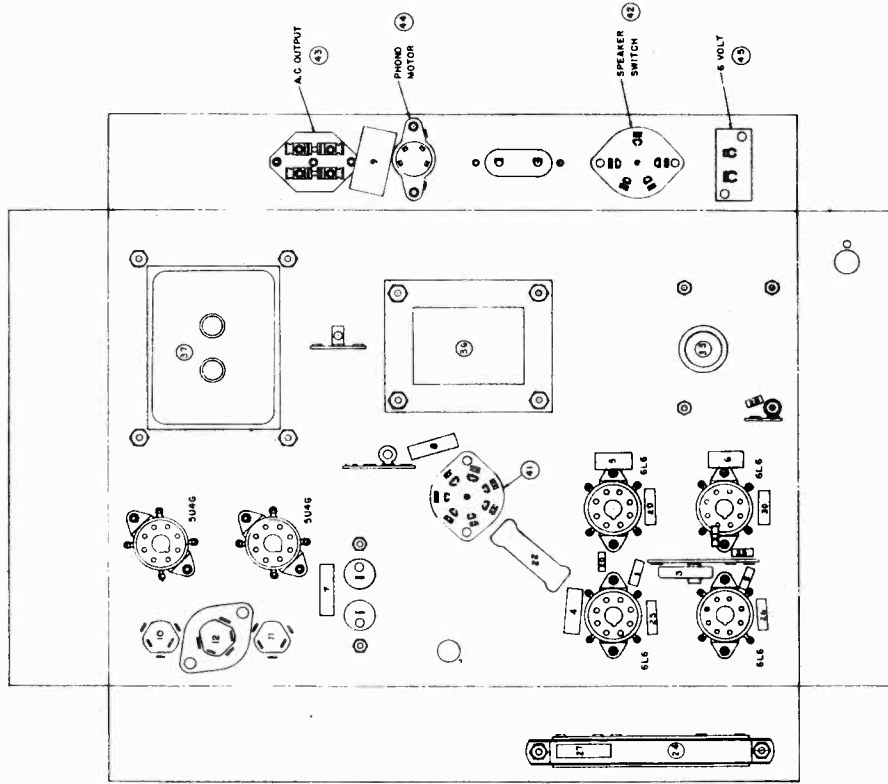
ALL ELECTRICAL VALUES SHOWN ARE IN MICROFARADS OR OHMS UNLESS OTHERWISE SPECIFIED.

THIS SHORTING PLUG MUST BE INSERTED IN SOCKET ABOVE FOR NORMAL OPERATION. WHEN SPEAKER SELECTOR SWITCH IS USED, REMOVE SHORTING PLUG AND REPLACE IT WITH PLUG SUPPLIED AS PART OF SWITCH ASSEMBLY.





- AMP-108A Speakers:** (3) No. 583003 (Tweeter) PM
 Field coil resistance 150 ohms
 Voice coil resistance 12 ohms
- AMP-108B Speakers:** (3) No. 580005 (Tweeter) PM
 Field coil resistance 150 ohms
 Voice coil resistance 12 ohms
- or:
- AMP-108B Speakers:** (3) No. 582999 (Bass) PM
 Field coil resistance 150 ohms
 Voice coil resistance 12 ohms



SPECIFICATIONS

- Power supply 117 volts 50/60 cycles AC
 Power consumption *220 watts
 Power output 45 watts
 Output impedance 15/7.5/1.5 ohms
- Tubes:
 Power output (push-pull parallel stage) (4) 6L6G
 Rectifiers (2) 5U4G

*Power consumption is for amplifier and CR-203 or CR-207 radio chassis.
 +Voice coil resistance of one speaker.

METHOD FOR REMOVING CHASSIS FROM CABINET

To remove the chassis, first remove all plugs and cables from the receptacles and the connector from the rear of the radio chassis. The amplifier chassis is mounted to the cabinet shelf with four screws. After they have been removed, the amplifier may be lifted from the cabinet.

ACCESSORIES

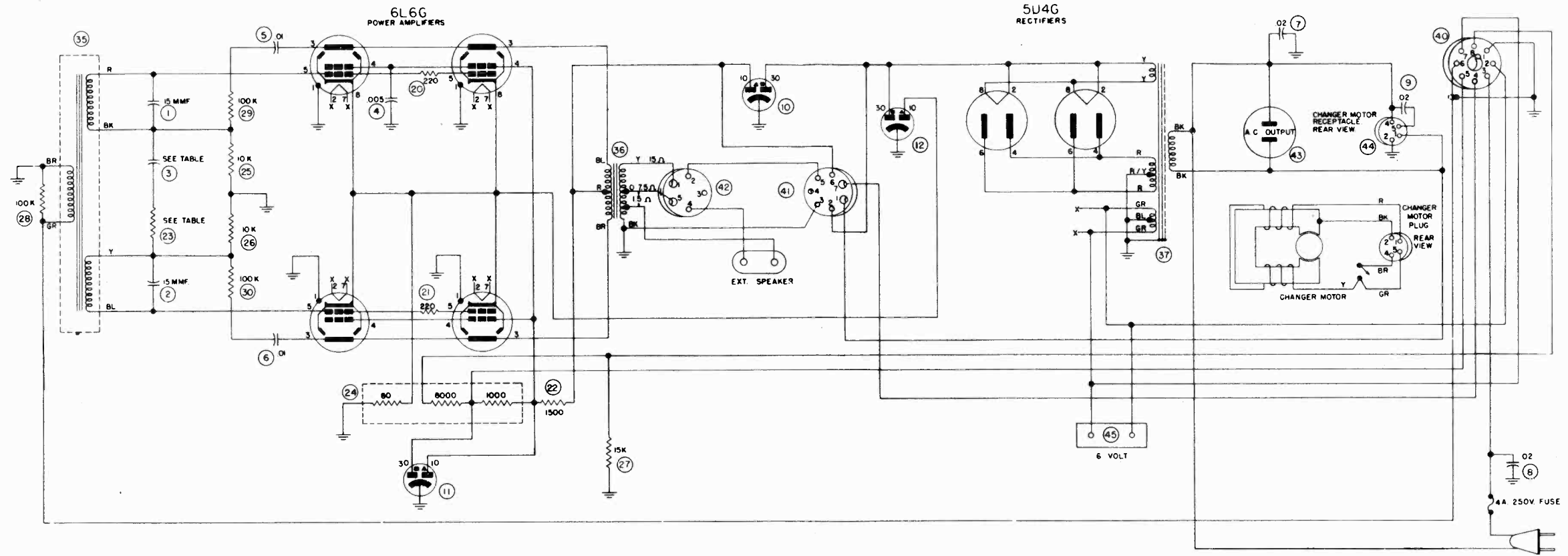
SPEAKER SELECTOR SWITCH—Provision is made in this amplifier for connecting extension speakers and a speaker selector switch. By means of this switch, the cabinet and extension speakers may be operated separately or together while maintaining the proper load on the amplifier. This is accomplished by means of a rotary switch with a connecting plug that may be purchased from any authorized Magnavox dealer. When shipped from the factory, a shorting plug is inserted in the amplifier receptacle stamped **SPEAKER SWITCH**. This plug must not be removed unless the speaker selector switch is added. Then the shorting plug is replaced with a plug that is supplied as a part of Selector switch assembly No. 880364.

EXTENSION SPEAKER—Two screw terminals are provided on the rear of the amplifier chassis for the connection of an extension speaker line. No. 582888 1 1/2-inch permanent-magnet extension speakers are available through all authorized Magnavox dealers.

PARTS LIST

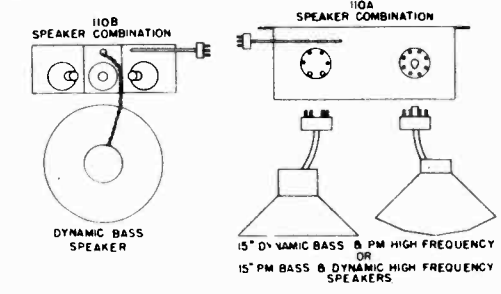
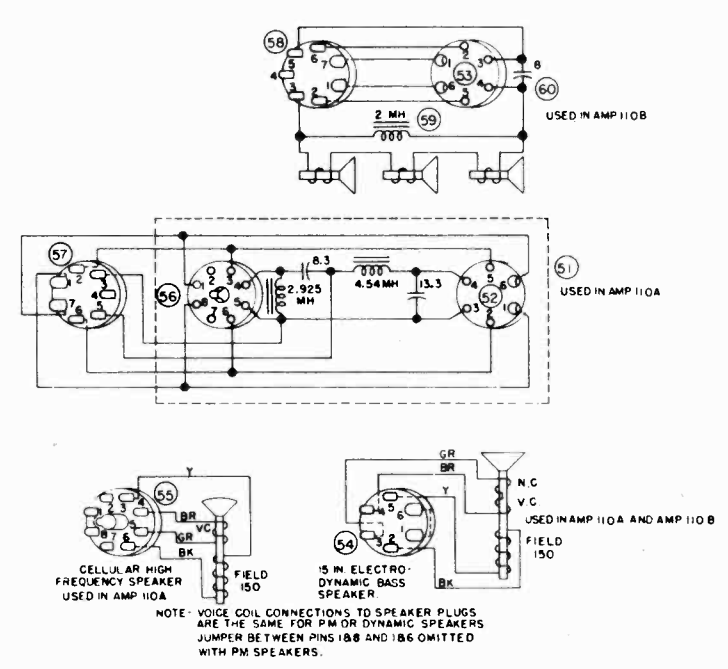
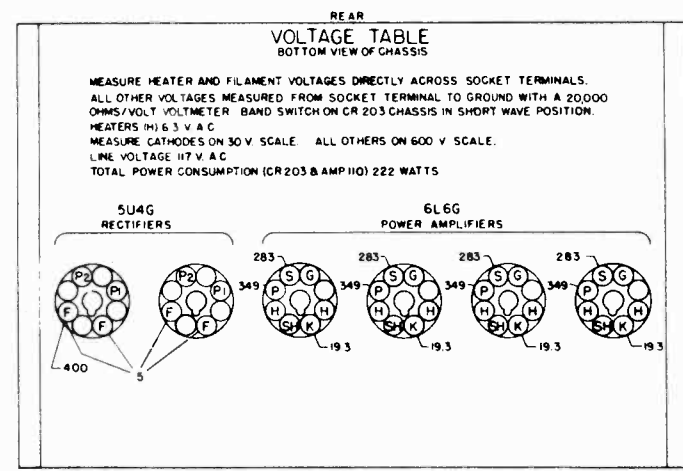
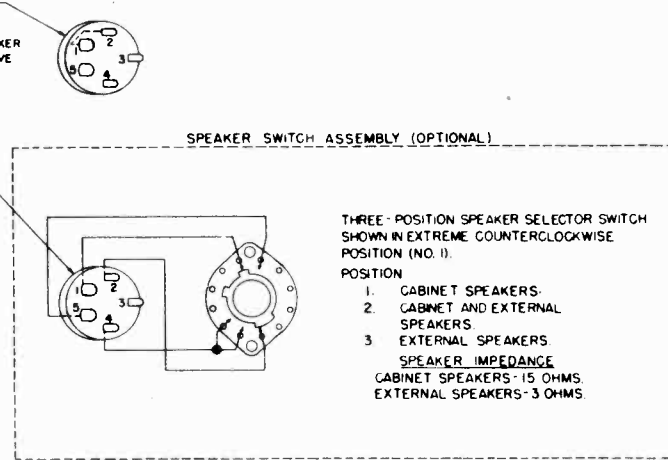
REFERENCE NO.	DESCRIPTION	MAGNAVOX PART NO.
1	Capacitor, molded mica, 15 mmf	250159G93
2	Capacitor, molded mica, 15 mmf	250159G93
3	Capacitor, paper, .03 mfd, 400 V, (AMP 108A only)	250152G25
4	Capacitor, paper, .005 mfd, 600 V	250152G41
5	Capacitor, molded paper, .01 mfd, 600 V	250159G2
6	Capacitor, molded paper, .01 mfd, 600 V	250159G2
7	Capacitor, molded paper, .02 mfd, 600 V	250159G3
8	Capacitor, molded paper, .02 mfd, 600 V	250159G3
9	Capacitor, molded paper, .02 mfd, 600 V	250159G3
10	Capacitor, electrolytic, 30-10 mfd, 475 V	270023G2
11	Capacitor, electrolytic, 30-10 mfd, 475 V	270023G2
12	Capacitor, electrolytic, 30-10 mfd, 475 V	270023G2
20	Resistor, composition, 220 ohm, 1/2 W	230084G9
21	Resistor, composition, 220 ohm, 1/2 W	230084G9
22	Resistor, wire wound, 1500 ohm, ± 10%, 10 W	240021G12
23	Resistor, composition, 3900 ohm, ± 10%, 1/2 W (AMP 108A only)	230084G69
24	Resistor, wire wound, 80-8000-1000 ohm, 3 W	240038G1
25	Resistor, composition, 10,000 ohm, 1/2 W	230084G19
26	Resistor, composition, 10,000 ohm, 1/2 W	230084G19
27	Resistor, composition, 15,000 ohm, 2 W	230086G20
28	Resistor, composition, 100,000 ohm, ± 10%, 1/2 W	230084G86
29	Resistor, composition, 100,000 ohm, 1 W	230085G25
30	Resistor, composition, 100,000 ohm, 1 W	230085G25
35	Transformer, input	320017G1
36	Transformer, output	330028G1
37	Transformer, power, 117 V, 50-60 cycle	300039G1
40	Cable & Plug assembly	460616G1
41	Socket, speaker connection	180504G16
42	Socket, speaker switch	180504G6
43	Socket, FM power connection	180428G1
44	Socket, phonograph motor connection	180501G5
45	Socket, 6 volt outlet	189788G2
46	Terminal board-external speaker connection	209601G2
51	Filter assembly (AMP 108B only)	350041G1
52	Socket, 15" speaker connection to filter (AMP 108B only)	180504G2
53	Socket, 15" speaker to tweeters (AMP 108A only)	180504G2
54	Plug, 15" speaker	180503G3
55	Plug, tweeter (AMP 108B only)	180503G5
56	Socket, octal (AMP 108B only)	180194G4
57	Plug, filter to Amplifier connection (AMP 108B only)	180503G4
58	Plug, tweeter to Amplifier connection (AMP 108A only)	180503G4
59	Coil, choke, A.F. (AMP 108A only)	350042G1
60	Capacitor, paper, 8 mfd, 100 V (AMP 108A only)	250167G1

THE MAGNAVOX CO.

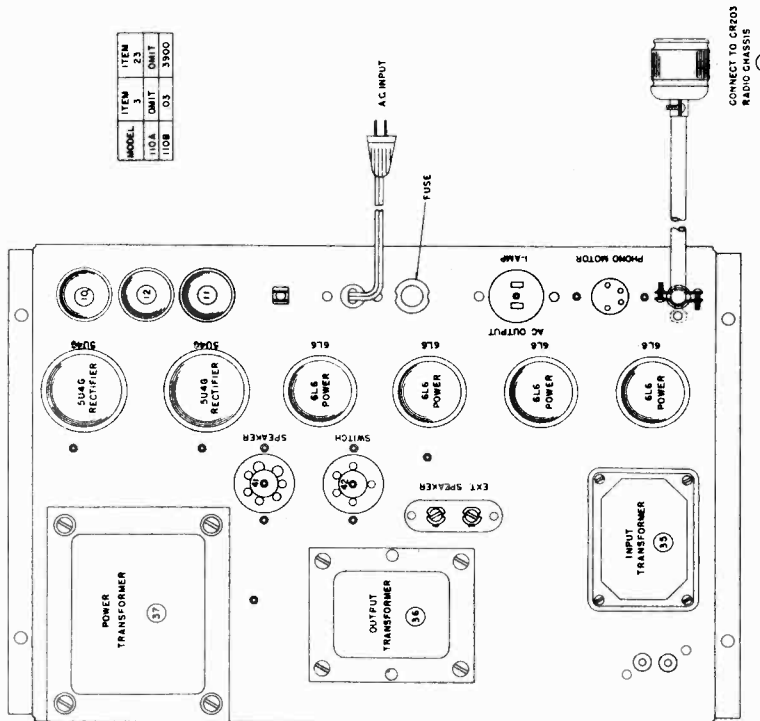


ALL ELECTRICAL VALUES SHOWN ARE IN MICROFARADS OR OHMS UNLESS OTHERWISE SPECIFIED.

THIS SHORTING PLUG MUST BE INSERTED IN SOCKET ABOVE FOR NORMAL OPERATION. WHEN SPEAKER SELECTOR SWITCH IS USED, REMOVE SHORTING PLUG AND REPLACE IT WITH PLUG SUPPLIED AS PART OF SWITCH ASSEMBLY.



AMP 110
595352

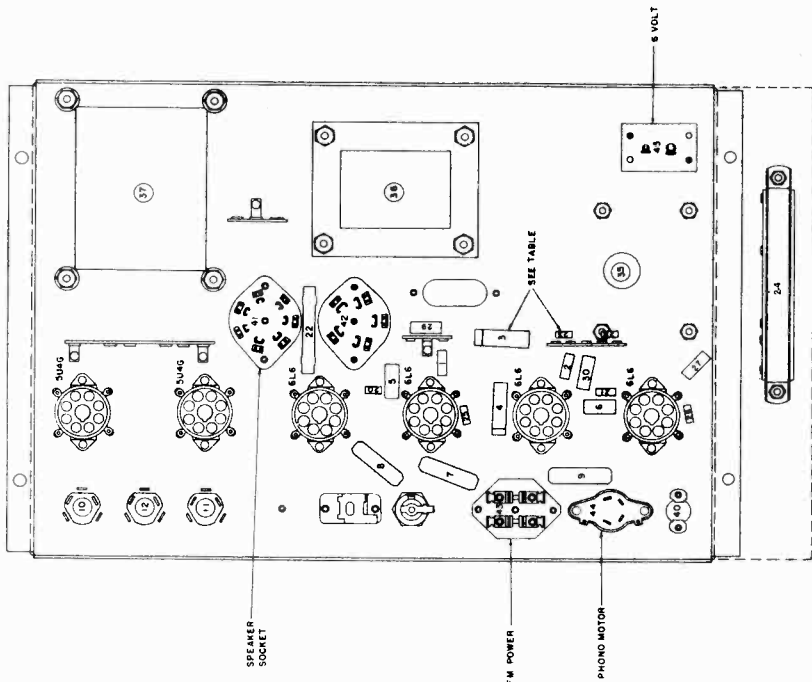


MODEL	ITEM	ITEM
110A	3	23
110B	01	3900

SPECIFICATIONS

- Power supply.....117 volts 50/60 cycles AC
- Power consumption.....*220 watts
- Power output.....45 watts
- Output impedance.....15/7.5/1.5 ohms
- Tubes:
- Power output (push-pull parallel stage).....(4) 6L6G
- Rectifiers.....(2) 5U4G

*Power consumption is for amplifier and CR-203 or CR-207 radio chassis.
†Voice coil resistance of one speaker.



- AMP-110A Speakers:
- No. 583002 (Bass) No. 580005 (Tweeter)
- Field coil resistance.....150 ohms PM
- Voice coil resistance.....12 ohms 11 ohms
- or;
- No. 582999 (Bass) No. 580006 (Tweeter)
- Field coil resistance.....PM 150 ohms
- Voice coil resistance.....12 ohms 11 ohms
- AMP-110B Speakers:
- No. 583002 (Bass) (3) No. 583003 (Tweeter)
- Field coil resistance.....150 ohms PM
- Voice coil resistance.....12 ohms †3.2 ohms

PARTS LIST

REFERENCE NO.	DESCRIPTION	MAGNAVOX PART NO.
1	Capacitor, molded mica, 15 mmf.	250159G93
2	Capacitor, molded mica, 15 mmf.	250159G93
3	Capacitor, paper, .03 mfd, 400 V, (AMP 110B only)	250152G25
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6	Capacitor, molded paper, .01 mfd, 600 V	250159G2
7	Capacitor, molded paper, .02 mfd, 600 V	250159G3
8	Capacitor, molded paper, .02 mfd, 600 V	250159G3
9	Capacitor, molded paper, .02 mfd, 600 V	250159G3
10	Capacitor, electrolytic, 30-10 mfd, 475 V	270023G2
11	Capacitor, electrolytic, 30-10 mfd, 475 V	270023G2
12	Capacitor, electrolytic, 30-10 mfd, 475 V	270023G2
20	Resistor, composition, 220 ohm, 1/2 W	230084G9
21	Resistor, composition, 220 ohm, 1/2 W	230084G9
22	Resistor, wire wound, 1500 ohm, ± 10%, 10 W	240021G12
23	Resistor, composition, 3900 ohm, ± 10%, 1/2 W, (AMP 110B only)	230084G69
24	Resistor, wire wound, 80-8000-1000 ohm, 3 W	240038G1
25	Resistor, composition, 10,000 ohm, 1/2 W	230084G19
26	Resistor, composition, 10,000 ohm, 1/2 W	230084G19
27	Resistor, composition, 15,000 ohm, 2 W	230086G20
28	Resistor, composition, 100,000 ohm ± 10%, 1/2 W	230084G86
29	Resistor, composition, 100,000 ohm, 1 W	230085G25
30	Resistor, composition, 100,000 ohm, 1 W	230085G25
35	Transformer, input	320017G1
36	Transformer, output	330028G1
37	Transformer, power, 117 V, 50-60 cycle	300039G1
40	Cable & Plug assembly	460616G1
41	Socket, speaker connection	180504G16
42	Socket, speaker switch	180504G6
43	Socket, FM power connection	180428G1
44	Socket, phonograph motor connection	180501G5
45	Socket, 6 volt outlet	189788G2
46	Terminal board-external speaker connection	209601G2
51	Filter assembly (AMP 110A only)	350041G1
52	Socket, 15" speaker connection to filter (AMP 110A only)	180504G2
53	Socket, 15" speaker to tweeters (AMP 110B only)	180504G2
54	Plug, 15" speaker	180503G3
55	Plug, tweeter (AMP 110A only)	180503G5
56	Socket, octal (AMP 110A only)	180194G4
57	Plug, filter to Amplifier connection (AMP 110A only)	180503G4
58	Plug, tweeter to Amplifier connection (AMP 110B only)	180503G4
59	Coil, choke, A.F. (AMP 110B only)	350042G1
60	Capacitor, paper, 8 mfd, 100 V (AMP 110B only)	250167G1

METHOD FOR REMOVING CHASSIS FROM CABINET

To remove the chassis, first remove all plugs and cables from the receptacles and the connector from the rear of the radio chassis. The amplifier chassis is mounted to the cabinet shelf with four screws. After they have been removed, the amplifier may be lifted from the cabinet.

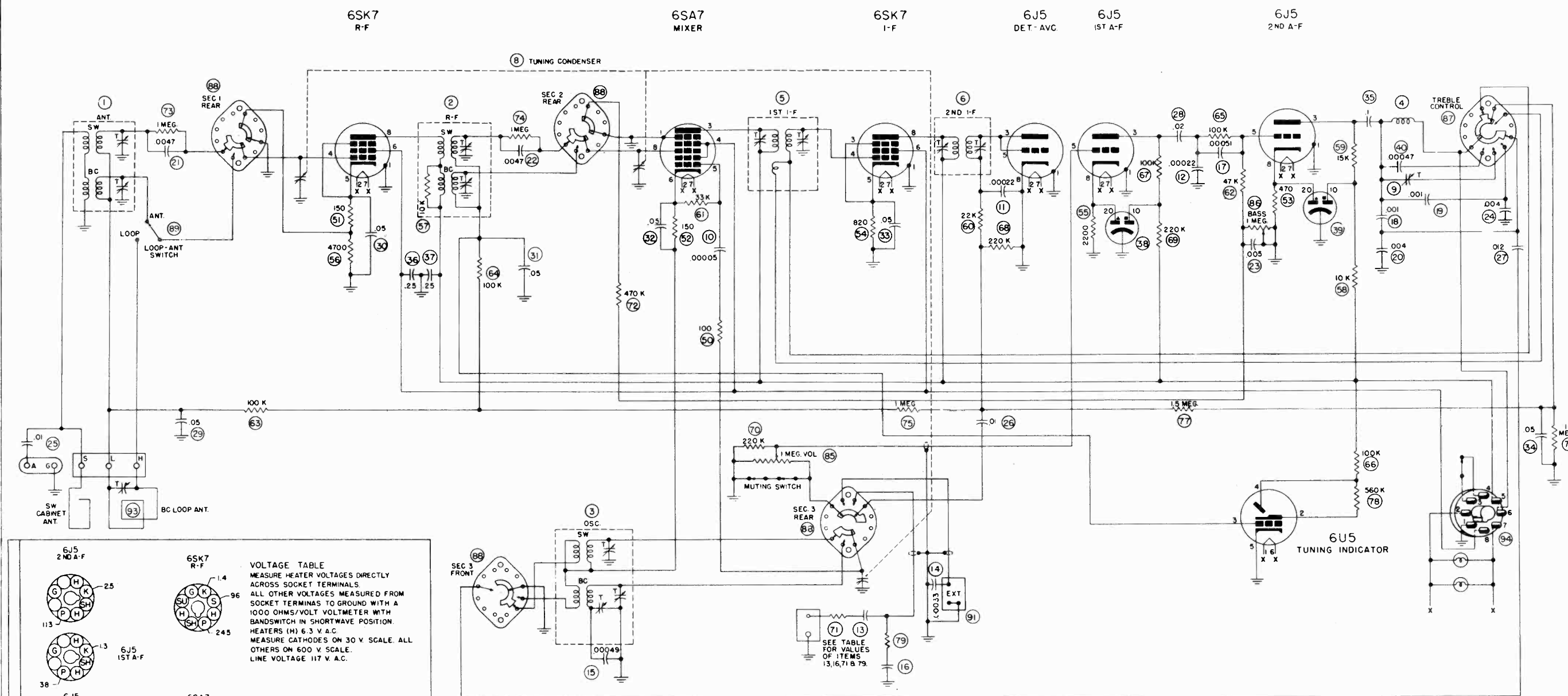
ACCESSORIES

SPEAKER SELECTOR SWITCH—Provision is made in this amplifier for connecting extension speakers and a speaker selector switch. By means of this switch, the cabinet and extension speakers may be operated separately or together while maintaining the proper load on the amplifier. This is accomplished by means of a rotary switch with a connecting plug that may be purchased from any authorized Magnavox dealer. When shipped from the factory, a shorting plug is inserted in the amplifier receptacle stamped **SPEAKER SWITCH**. This plug must not be removed unless the speaker selector switch is added. Then the shorting plug is replaced with a plug that is supplied as a part of Selector switch assembly No. 880364.

EXTENSION SPEAKER—Two screw terminals are provided on the rear of the amplifier chassis for the connection of an extension speaker line. No. 582888 12-inch permanent-magnet extension speakers are available through all authorized Magnavox dealers.

THE MAGNAVOX CO.

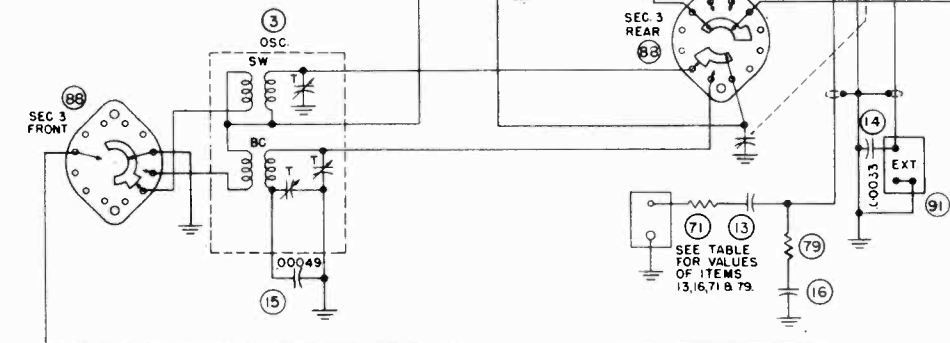
MODELS CR-203A,
CR-203B



VOLTAGE TABLE
 MEASURE HEATER VOLTAGES DIRECTLY ACROSS SOCKET TERMINALS. ALL OTHER VOLTAGES MEASURED FROM SOCKET TERMINALS TO GROUND WITH A 1000 OHMS/VOLT VOLTMETER WITH BANDSWITCH IN SHORTWAVE POSITION. HEATERS (H) 6.3 V. A.C. MEASURE CATHODES ON 30 V. SCALE. ALL OTHERS ON 600 V. SCALE. LINE VOLTAGE 117 V. A.C.

6J5 2ND A-F	6SK7 R-F
6J5 1ST A-F	6SA7 MIXER
6J5 DET-AVC	6SK7 I-F

Diagram showing pin connections for 6J5, 6SK7, and 6SA7 tubes. Pin numbers are indicated next to the terminal labels (G, K, S, H, P, SH).



ITEM	CR203A	CR203B
13	00033	00051
16	00051	00051
71	220K	OMITTED
79	OMITTED	47K

I-F 455 KC
 BAND SELECTOR SWITCH SHOWN WITH ITS CONTROL KNOB IN THE EXTREME COUNTERCLOCKWISE POSITION (SHORT WAVE).
 ALL ELECTRICAL VALUES SHOWN ARE IN OHMS OR MICROFARADS UNLESS OTHERWISE SPECIFIED.

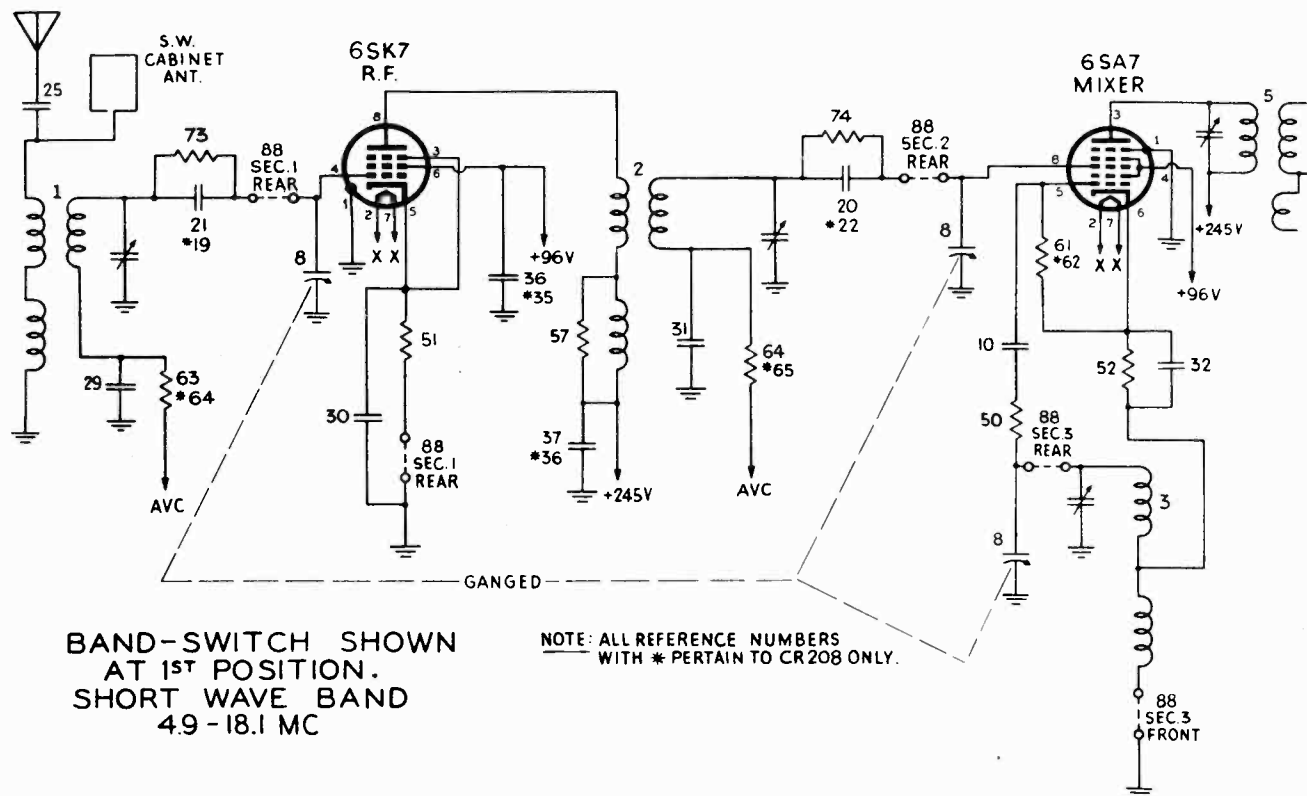
Intermediate frequency 455 kc.
 Tuning frequency range:
 - Broadcast band 530-1610 kc.
 - Short wave band 4.9-18.1 mc.

Tubes:
 R-F Amplifier 6SK7
 Converter 6SA7
 I-F Amplifier 6SK7
 Detector and AVC 6J5

First Audio 6J5
 Second Audio 6J5
 Tuning Indicator 6U5
 Dial lamps Mazda No. 44

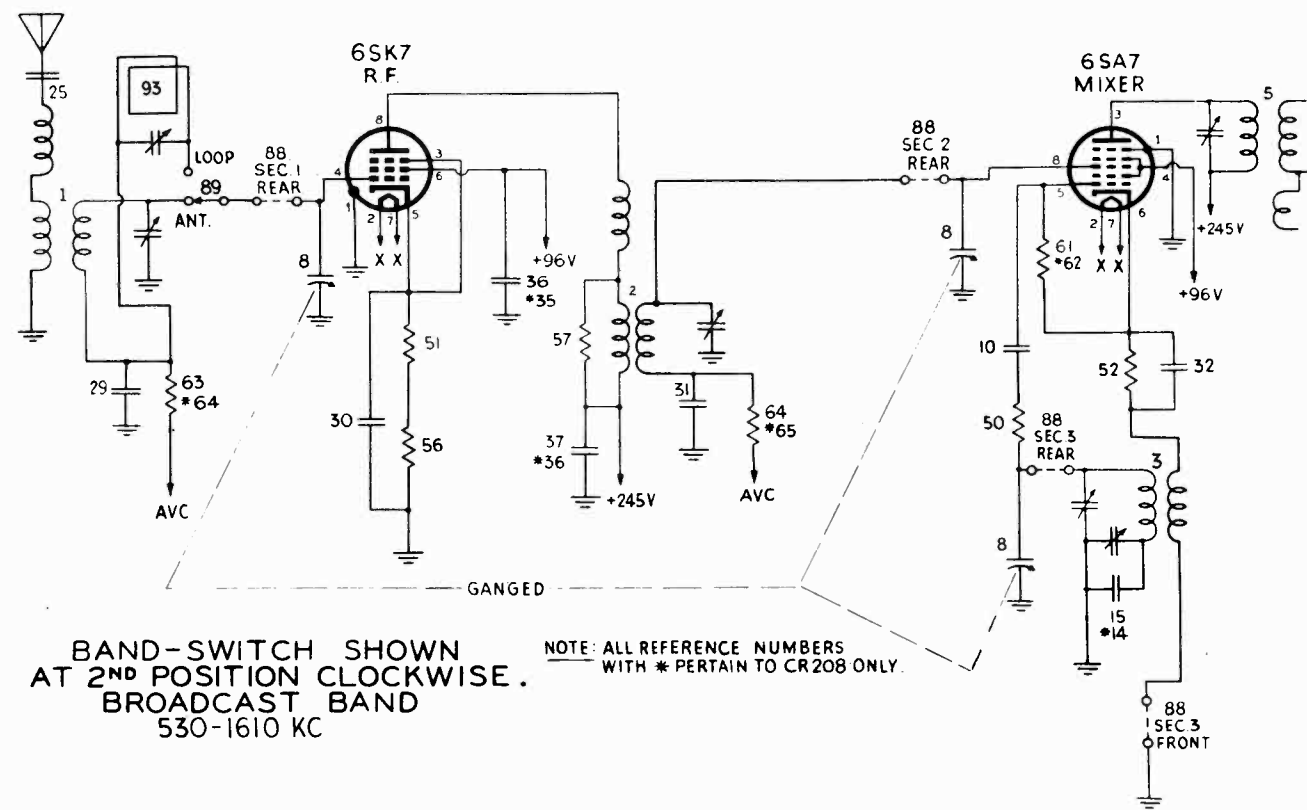
THE MAGNAVOX CO.

MODELS CR-203A, -B
MODELS CR-207A, -B, -C, -D
MODELS CR-208A, -B



BAND-SWITCH SHOWN AT 1ST POSITION. SHORT WAVE BAND 4.9-18.1 MC

NOTE: ALL REFERENCE NUMBERS WITH * PERTAIN TO CR208 ONLY.



BAND-SWITCH SHOWN AT 2ND POSITION CLOCKWISE. BROADCAST BAND 530-1610 KC

NOTE: ALL REFERENCE NUMBERS WITH * PERTAIN TO CR208 ONLY.

MODELS CR-203A, -B

THE MAGNAVOX CO.

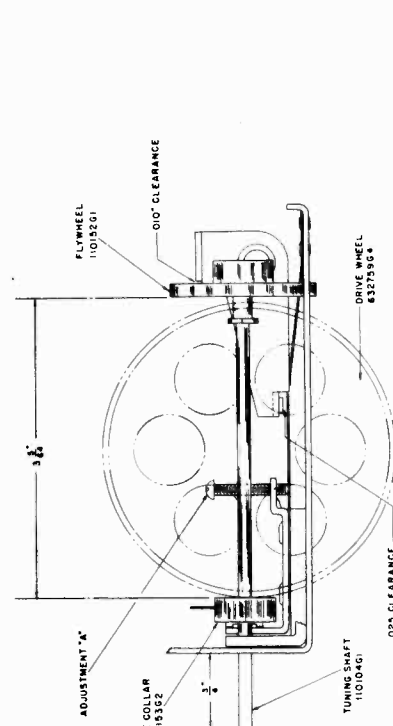


FIGURE 2

VERTICAL ADJUSTMENT OF THIS ASSEMBLY IS OBTAINABLE AFTER SCREWS "C" AND "D" HAVE BEEN LOOSENED

ALL PUSH BUTTON SHAFTS SHOULD ENGAGE TREADLE BAR AS SHOWN

0.025" CLEARANCE

0.010" CLEARANCE

0.010" CLEARANCE

0.010" CLEARANCE

0.010" CLEARANCE

0.010" CLEARANCE

0.010" CLEARANCE

0.010" CLEARANCE

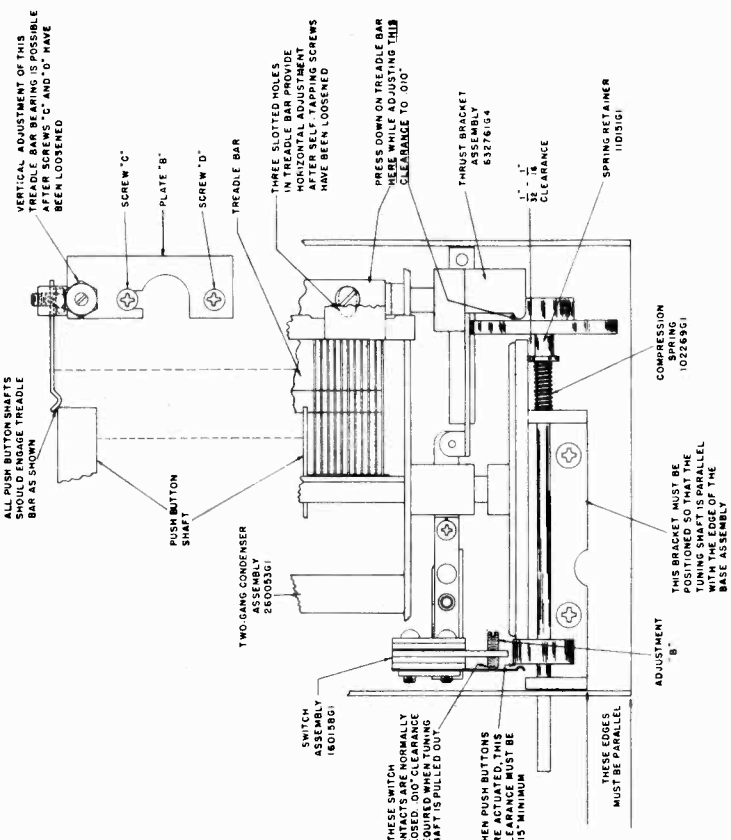


FIGURE 3

COMPRESSION SPRING 1022691

THIS BRACKET MUST BE POSITIONED SO THAT THE TUNING SHAFT IS PARALLEL TO THE BASE ASSEMBLY

ADJUSTMENT "B"

ADJUSTMENT "A"

ADJUSTMENT "C"

ADJUSTMENT "D"

ADJUSTMENT "E"

ADJUSTMENT "F"

ADJUSTMENT "G"

ADJUSTMENT "H"

sure of the front surface of the Drive Collar, when the Tuning Shaft is pulled out. The function of this switch is to open the muting circuit when setting up the push buttons. As its contacts are wired in series with the large muting switch (contacts are shorted by pressing any push button), pulling out on the Tuning Shaft causes the small switch contacts to open the muting circuit so that a station can be heard while the push button is held in and tightened. On rare occasions it may be necessary to adjust the relation between the push button bars and the Treadle Bar. Such adjustment might be required if when pushing any of the push buttons, sufficient motion is not transmitted to the Treadle Bar to cause a disengagement between the Drive Collar and the Drive wheel.

This can usually be accomplished by loosening the two screws designated "C" and "D" on Figure 3, and moving plate "B" in the direction required to correct this condition.

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:	7.0
600 kc.	1.63
6 mc.	3.4
R.F. to Converter Grid at:	3.4
600 kc.	40.0
6 mc.	35.5
R.F. on Converter Grid to I.F. Grid at:	59
600 kc.	68
6 mc.	
I.F. on Converter Grid to I.F. Grid at:	
455 kc.	
I.F. Grid to Detector Plate at:	
455 kc.	

AUDIO GAIN

Voltage required across Volume Control to produce 0.1 watt speaker output** at 400 cycles is .0072 volt with Band Selector Switch in BDCST setting.

OSCILLATOR OUTPUT VOLTAGE

The DC voltage developed across Oscillator Grid Resistor at:

600 kc.	5.8
6 mc.	5.6

* Variations of ±20% are permissible. All readings made with sufficient input signal to provide .05 watt speaker output.
** .05 watt speaker output at 400 cycles is equivalent to a reading of 0.35 volts as measured by a high-resistance AC voltmeter across the voice coil of a 100 ohm speaker.

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 effected; 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, Spring Retainer and Flywheel in the manner shown on Figure 3. Note that the Tuning Shaft must extend 3/4" from the front of the assembly and that the spacing between the rear of the Drive Collar and the front of the Flywheel must be 3.5/64". Any excess length in the Tuning Shaft may extend beyond the rear of the Flywheel. See Figure 2.
2. The distance between the rubber-tired Drive Wheel and the smaller diameter section of the Spring Retainer must be 1/32" to 1/16" (Figure 3). This adjustment is effected by loosening the two No. 6 Allen set screws in the Drive Wheel hub and sliding the wheel on its shaft until the required clearance is obtained. When the adjustment is completed, tighten the two screws in the hub of the Drive Wheel.
3. While pressing down on the Treadle Bar at the location shown on Figure 3, adjust the Thrust Bracket until the clearance between the rear of the Flywheel and the projection on the Thrust Bracket is .010" as shown on the diagram. To make this adjustment, loosen the two No. 6 Allen set screws (use No. 6 Allen Wrench—MagnaVox Part No. 800044G2) in the hub of Thrust Bracket and rotate the bracket until the specified clearance is obtained when the push buttons are NOT actuated. Tighten the two screws securely when the adjustment is completed. Press each push button and check that the Drive Collar is pushed away from the rubber-tired Drive Wheel.
4. Next, adjust the clearance in the muting switch contacts by turning the Phillips-head screw designated Adjustment "A" on Figure 2, until the specified clearance of .025" is obtained (when the push buttons are NOT actuated).
5. While pressing any one of the push buttons in as far as possible, turn the screw designated Adjustment "B" until a minimum clearance of .015" is obtained between the front surface of the Drive Collar and the switch spring directly in front of it. This setting should also cause a minimum clearance of .010" between the switch contacts actuated by pres-

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 pulley "D" temporarily.

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 $\frac{1}{4}$ " to $\frac{5}{16}$ " 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.

ALIGNMENT PROCEDURE

The alignment of this receiver requires the use of an accurately calibrated r-f signal generator and an output meter. All trimmer condenser locations are shown on the chassis layout diagram, Figure 5. The radio volume control should be turned to maximum and the signal generator output kept as low as possible during alignment to prevent the AVC from operating and giving false readings. Always set the Treble Control to SHARP TUNE before aligning the i-f stages. This is done by turning the Treble Control Knob to the No. 1 position.

I-F ALIGNMENT

1. Connect the output of the signal generator to the control grid (pin No. 8) of the 6SA7 tube through a .00025 mfd. capacitor. The ground on the signal generator should be connected to the radio chassis ground.
2. Turn the condenser gang until it is completely meshed, (low-frequency end of dial calibration) and set the band selector switch to BDCST as for broadcast band reception.
3. Adjust the signal generator to EXACTLY 455 kc. and peak the second i-f transformer and the first i-f transformer trimmers in that order.

On some models of the CR-203 chassis, the two i-f trimmers are located in the top of the respective i-f transformers as shown in the layout diagram Figure 5. In other models, one trimmer is accessible from the top and the other from the bottom of each transformer.

BROADCAST BAND ALIGNMENT

1. Remove the signal generator lead from the 6SA7 grid and connect it to the radio antenna terminal through the .00025 mfd. capacitor. The ANT-LOOP switch (89) must be in the ANT. setting.

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, loosen the set screws in the hub of pulley "D" shown on Figure 1 and make the necessary adjustment.

3. With the band selector still set for broadcast band reception, adjust the signal generator and the radio receiver to 600 kc. While rocking the gang condenser a few degrees to the right and to the left, adjust the 600 kc. oscillator paddler for maximum indication on the output meter.

SHORT WAVE BAND ALIGNMENT

1. Set the band selector switch to SW as for short wave reception and substitute a 400 ohm resistor for the capacitor in series with the signal generator lead connected to the antenna terminal on the receiver.
2. Set the signal generator and the radio receiver to 15 mc.; then adjust the 15 mc. oscillator trimmer and the 15 mc. antenna trimmer for maximum output. While adjusting the 15 mc. oscillator trimmer two peaks may be observed; only one is the correct peak for 15 mc. alignment. Screw in the trimmer to maximum capacity—then decrease the capacity until the first peak is observed. This is the correct one.

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. Turn the Treble Control to FULL RANGE (No. 4 position).
2. Connect the output of an audio oscillator to the phonograph pickup socket on the radio chassis and adjust the oscillator to EXACTLY 10,000 cycles.
3. Set the band selector to PHONO and adjust the 10 kc. trimmer (9) for minimum output.
4. If an audio oscillator is not available for making this adjustment, set the band selector to BDCST, connect an 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.

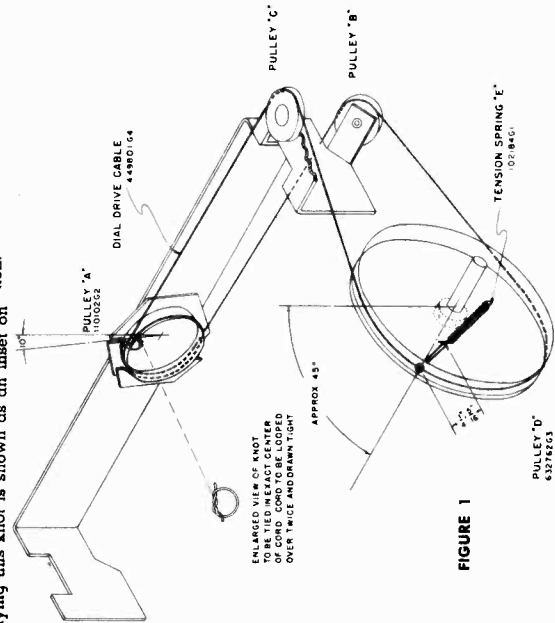


FIGURE 1

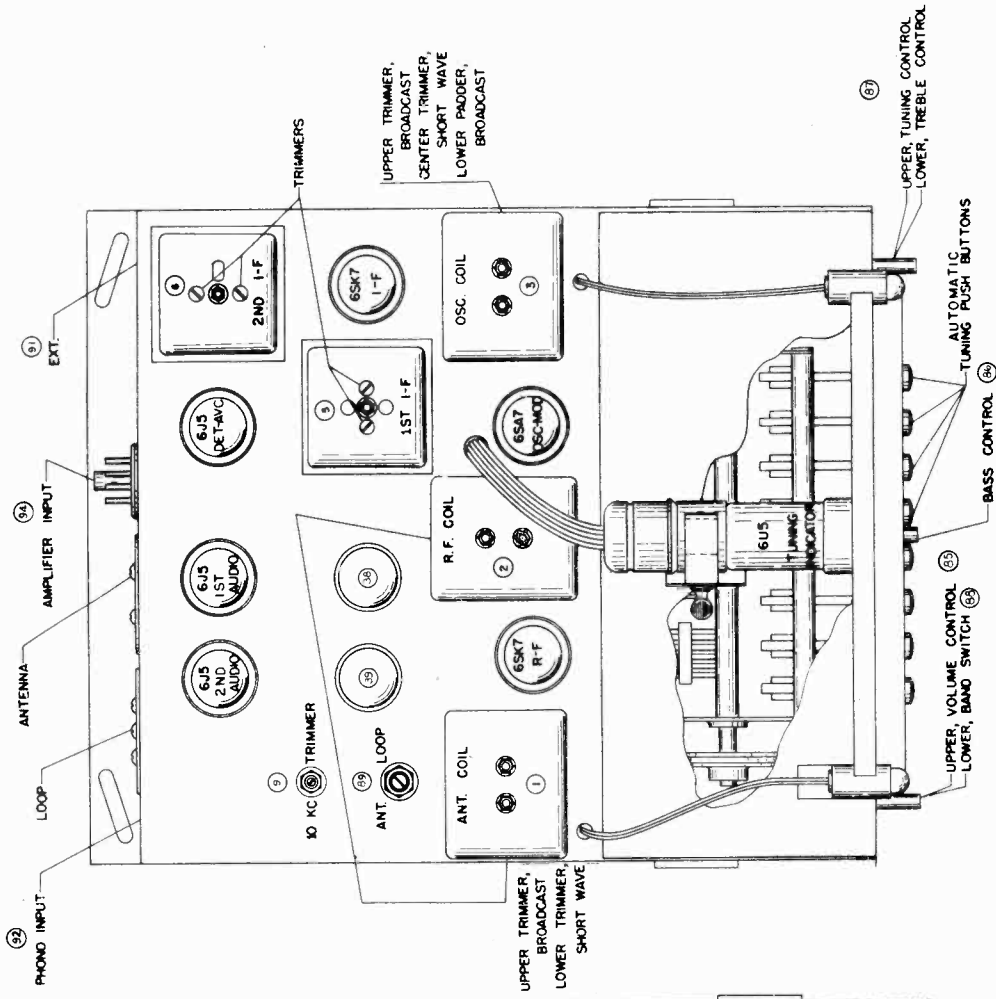
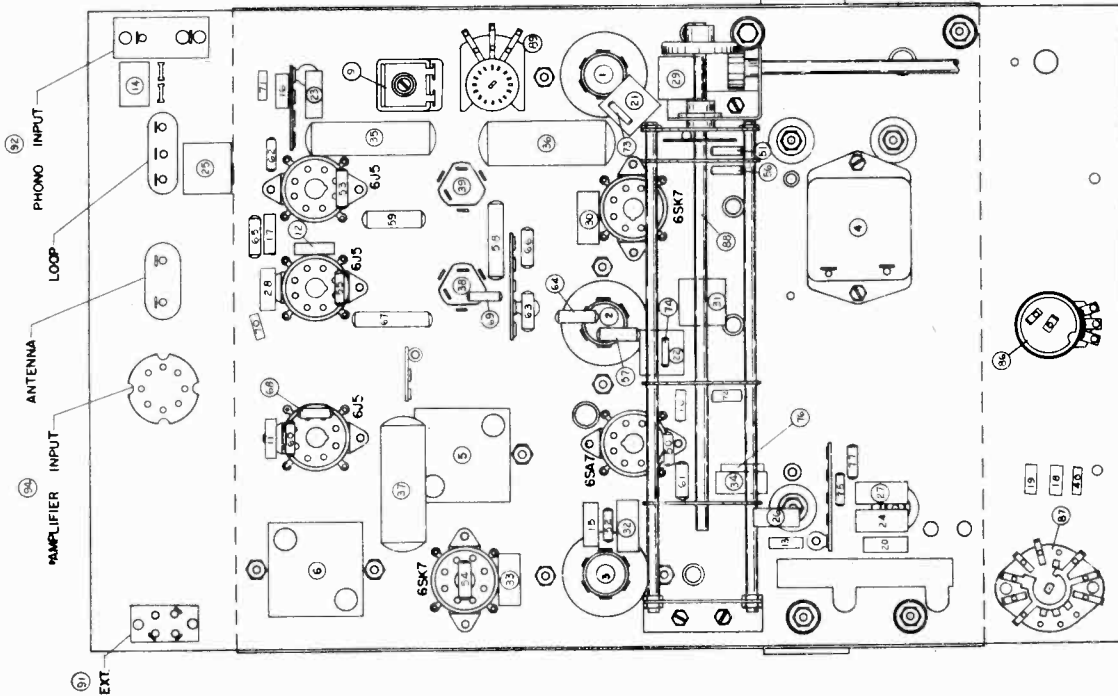


FIGURE 5



THE MAGNAVOX CO.

MODELS CR-203A, -B

REFERENCE NO.	DESCRIPTION	MAGNAVOX PART NO.
64	Resistor, composition, 100,000 ohm, 1/2 W	230084625
65	Resistor, composition, 100,000 ohm, 1/2 W	230084625
66	Resistor, composition, 100,000 ohm, 1/2 W	230084625
67	Resistor, composition, 100,000 ohm, 1 W	230085625
68	Resistor, composition, 220,000 ohm, 1/2 W	230084627
69	Resistor, composition, 220,000 ohm, 1/2 W	230084627
70	Resistor, composition, 220,000 ohm, ±10%, 1/2 W	230084690
71	Resistor, composition, 220,000 ohm, ±10%, 1/2 W	230084629
72	Resistor, composition, 470,000 ohm, 1/2 W	230084631
73	Resistor, composition, 1 megohm, 1/2 W	230084631
74	Resistor, composition, 1 megohm, 1/2 W	230084631
75	Resistor, composition, 1 megohm, 1/2 W	230084631
76	Resistor, composition, 1 megohm, 1/2 W	230084631
77	Resistor, composition, 1.5 megohm, 1/2 W	230084632
78	Resistor, composition, 560,000 ohms, (in tuning eye socket) ±10%, 1/2 W	230084623
79	Resistor, composition, 47,000 ohm 1/2 W. —CR-203B only	230084615
85	Control, volume, 1 megohm	22004562
86	Control, bass, 1 megohm, (with switch)	160161G1
87	Switch, rotary, treble control	160160G1
88	Switch, rotary, band selector	160157G1
89	Switch, rotary, loop to outdoor antenna	180061G1
91	Socket, external, input	189741G1
92	Socket, phonograph input	180427G1
93	Antenna, loop assembly	150285G1
94	Plug, octal, amplifier connection Dial Glass Assembly	

REFERENCE NO.	DESCRIPTION	MAGNAVOX PART NO.
1	Coil assembly, antenna, two band	360254G3
2	Coil assembly, I-F, two band	360254G4
3	Coil assembly, oscillator, two band	360253G2
4	Coil assembly, 10Kc, filter	360244G1
5	Transformer, first I-F	360024G1
6	Transformer, second I-F	360025G1
8	Capacitor, variable, three-gang tuning	260054G2
9	Capacitor, variable, 10Kc, trimmer	260064G1
9	Push Button Assembly for 260054G2	299610G2
10	Capacitor, ceramic, 50 mmf	250088G25
11	Capacitor, molded mica, 220 mmf	250159G100
12	Capacitor, molded mica, 220 mmf	250159G100
13	Capacitor, molded mica, 330 mmf — CR-203A only	250159G68
13	Capacitor, molded mica, 510 mmf — CR-203B only	250159G64
14	Capacitor, molded mica, 330 mmf	250159G88
15	Capacitor, silvered mica, 490 mmf, ±1%	250085G32
16	Capacitor, molded mica, 510 mmf	250159G64
17	Capacitor, molded mica, 510 mmf	250159G64
18	Capacitor, molded mica, .001 mfd	250159G133
19	Capacitor, molded mica, .001 mfd	250159G133
20	Capacitor, paper, .004 mfd	250129G7
21	Capacitor, molded mica, .0047 mfd, ±5%	250161G24
22	Capacitor, molded mica, .0047 mfd, ±5%	250161G24
23	Capacitor, paper, .005 mfd	250129G10
24	Capacitor, paper, .004 mfd	250129G7
25	Capacitor, paper, .01 mfd	250129G9
26	Capacitor, paper, .01 mfd	250129G9
27	Capacitor, paper, .012 mfd	250129G13
28	Capacitor, paper, .02 mfd	250129G3
29	Capacitor, paper, .05 mfd	250129G5
30	Capacitor, paper, .05 mfd	250129G5
31	Capacitor, paper, .05 mfd	250129G5
32	Capacitor, paper, .05 mfd	250129G5
33	Capacitor, paper, .05 mfd	250129G5
34	Capacitor, paper, .05 mfd	250129G5
35	Capacitor, paper, .01 mfd	250152G2
36	Capacitor, paper, .025 mfd	250152G21
37	Capacitor, paper, .025 mfd	250152G21
38	Capacitor, electrolytic, 20 mfd, 25 V, 10 mfd, 450 V	270023G6
39	Capacitor, electrolytic, 20 mfd, 25 V, 10 mfd, 450 V	270023G6
40	Capacitor, molded mica, 470 mmf, ±10%	250159G90
50	Resistor, composition, 100 ohm, 1/2 W	230084G7
51	Resistor, composition, 150 ohm, 1/2 W	230084G8
52	Resistor, composition, 150 ohm, 1/2 W	230084G8
53	Resistor, composition, 470 ohm, 1/2 W	230084G11
54	Resistor, composition, 820 ohm, ±10%, 1/2 W	230084G61
55	Resistor, composition, 2200 ohm, 1/2 W	230084G15
56	Resistor, composition, 4700 ohm, 1/2 W	230084G17
57	Resistor, composition, 10,000 ohm, 1/2 W	230084G19
58	Resistor, composition, 10,000 ohm, 1 W	230085G19
59	Resistor, composition, 15,000 ohm, 1/2 W	230085G20
60	Resistor, composition, 22,000 ohm, 1/2 W	230084G21
61	Resistor, composition, 33,000 ohm, 1/2 W	230084G22
62	Resistor, composition, 47,000 ohm, 1/2 W	230084G23
63	Resistor, composition, 100,000 ohm, 1/2 W	230084G25

PARTS LIST

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

GENERAL

Model CR-203 radio chassis is a two-band tuner that must be used in conjunction with a power amplifier, such as the Model AMP-108A for speaker operation. Heater and plate voltages for the CR-203 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. Models CR-203A and 203B are alike mechanically; they differ electrically in the phonograph input circuit. Circuit variations are shown on the table on Figure 4.

METHOD FOR REMOVING CHASSIS FROM CABINET

Model CR-203 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 hooks 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 S-L-H. The end of the short wave antenna that is fastened to the inside of the cabinet connects to S. Always disconnect this antenna from terminal S when an outdoor antenna is used as it may pick up noise. 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.

MODELS CR-207B,
CR-207D

THE MAGNAVOX CO.

MODELS CR-207B, CR-207D

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 4 and 5 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 5. The distance between the front of the Drive Collar and the front of the Tuning Shaft must be 1 1/2 inches as specified on Figure 4. 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 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 5. 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 ap-

plied 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 5, the three screws in the Treadle Bar must be loosened and the Treadle Bar should be moved until the required condition is obtained.

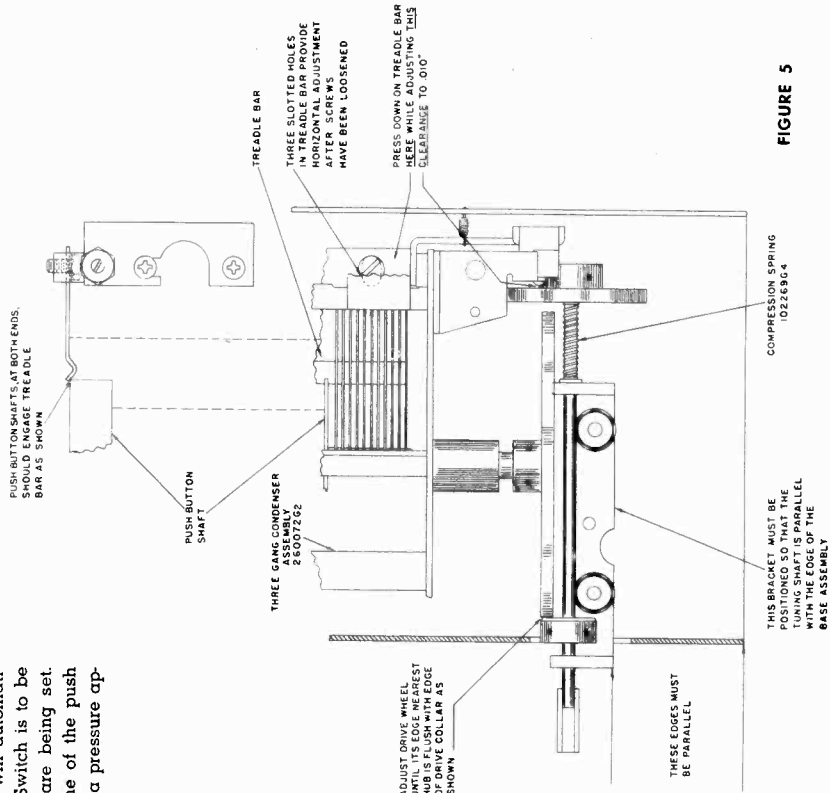


FIGURE 5

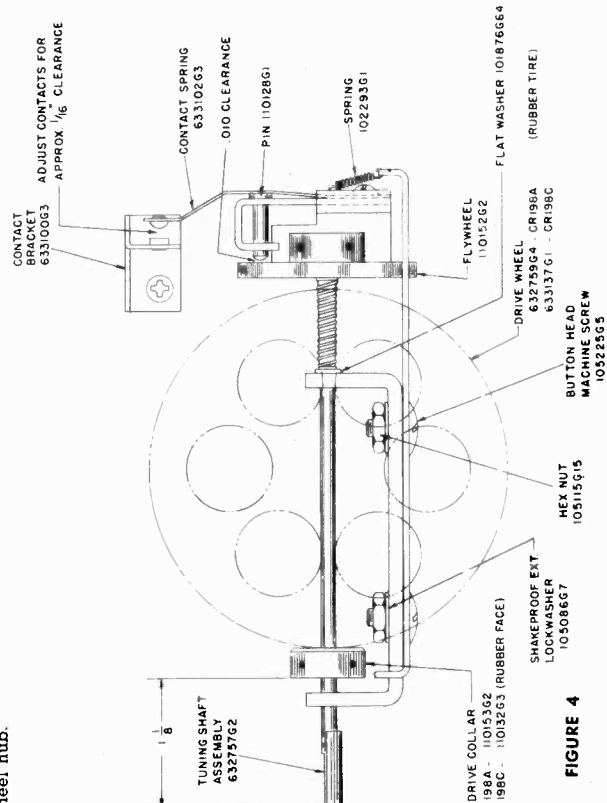
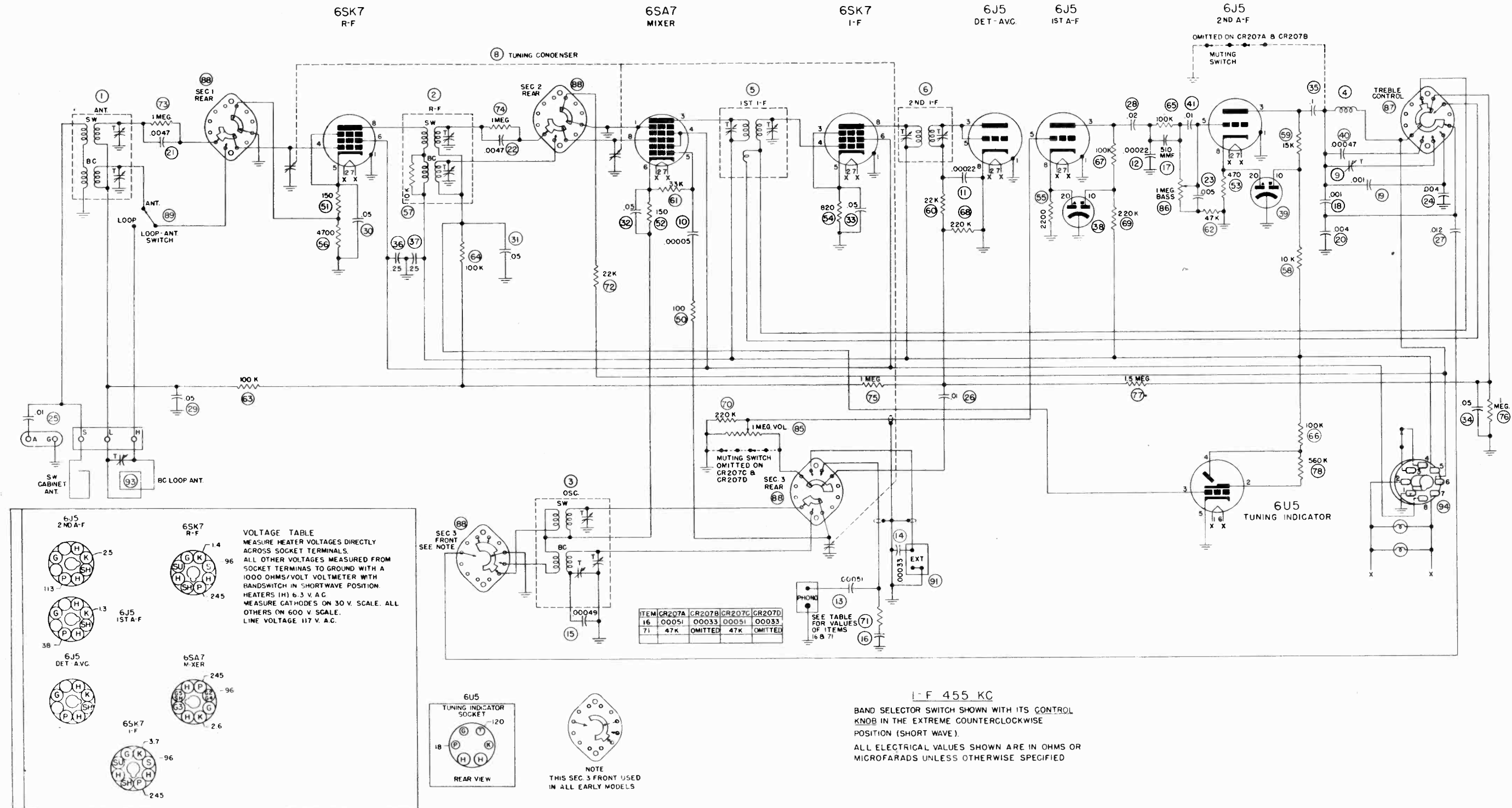


FIGURE 4

THE MAGNAVOX CO.



VOLTAGE TABLE
 MEASURE HEATER VOLTAGES DIRECTLY ACROSS SOCKET TERMINALS. ALL OTHER VOLTAGES MEASURED FROM SOCKET TERMINALS TO GROUND WITH A 1000 OHMS/VOLT VOLTMETER WITH BANDSWITCH IN SHORT WAVE POSITION. HEATERS 1H) 6.3 V. A.C. MEASURE CATHODES ON 30 V. SCALE. ALL OTHERS ON 600 V. SCALE. LINE VOLTAGE 117 V. A.C.

ITEM	CR207A	CR207B	CR207C	CR207D
16	00051	00033	00051	00033
71	47K	OMITTED	47K	OMITTED

SEE TABLE FOR VALUES OF ITEMS 16 & 71

NOTE: THIS SEC. 3 FRONT USED IN ALL EARLY MODELS

I-F 455 KC

BAND SELECTOR SWITCH SHOWN WITH ITS CONTROL KNOB IN THE EXTREME COUNTERCLOCKWISE POSITION (SHORT WAVE).

ALL ELECTRICAL VALUES SHOWN ARE IN OHMS OR MICROFARADS UNLESS OTHERWISE SPECIFIED

- Intermediate frequency 455 kc.
- Tuning frequency range:

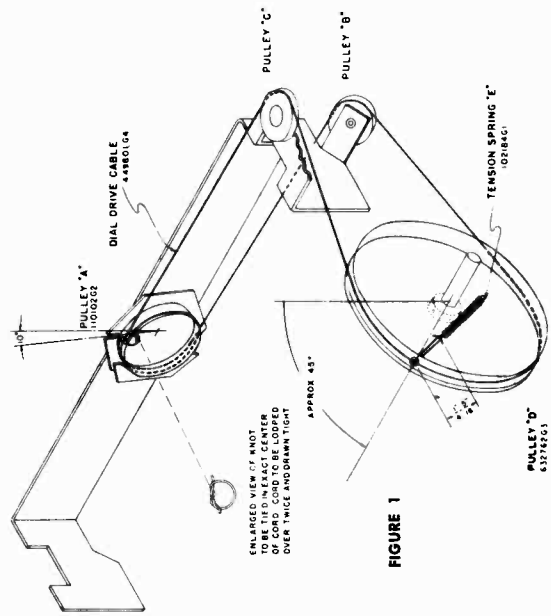
 - Broadcast band 530-1610 kc.
 - Short wave band 4.9-18.1 mc.

- Tubes:**
- R-F Amplifier 6SK7
 - Converter 6SA7
 - I-F Amplifier 6SK7
 - Detector and AVC 6J5
 - First Audio 6J5
 - Second Audio 6J5
 - Tuning Indicator 6U5
 - Dial lamps Mazda No. 44

DIAL CORD REPLACEMENT
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.



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.

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

If considerable adjustment was necessary, recheck the 600 kc. paddler setting.
5. If the loop antenna trimmer is out of adjustment it should be set after the radio chassis is in the cabinet. Set the ANT-LOOP switch (89) to the LOOP position. Adjust the signal generator to 1400 kilocycles and connect its output to a loop containing approximately five turns of wire eight inches in diameter placed eighteen inches from the receiver loop and in the same plane.
6. Set the receiver to 1400 kc. and adjust the trimmer on the receiver loop for maximum output.

SHORT WAVE BAND ALIGNMENT

1. Set the band selector switch to SW as for short wave reception and substitute a 400 ohm resistor for the capacitor in series with the signal generator lead connected to the antenna terminal on the receiver.
2. Set the signal generator and the radio receiver to 15 mc.; then adjust the 15 mc. oscillator trimmer and the 15 mc. antenna trimmer for maximum output. While adjusting the 15 mc. oscillator trimmer two peaks may be observed; only one is the correct peak for 15 mc. alignment. Screw in the trimmer to maximum capacity—then decrease the capacity until the first peak is observed. This is the correct one.

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. Turn the Treble Control to FULL RANGE (No. 4 position).
2. Connect the output of an audio oscillator to the phonograph pickup socket on the radio chassis and adjust the oscillator to EXACTLY 10,000 cycles.
3. Set the band selector to PHONO and adjust the 10 kc. trimmer (9) for minimum output.
4. If an audio oscillator is not available for making this adjustment, set the band selector to BDCST, connect an 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.

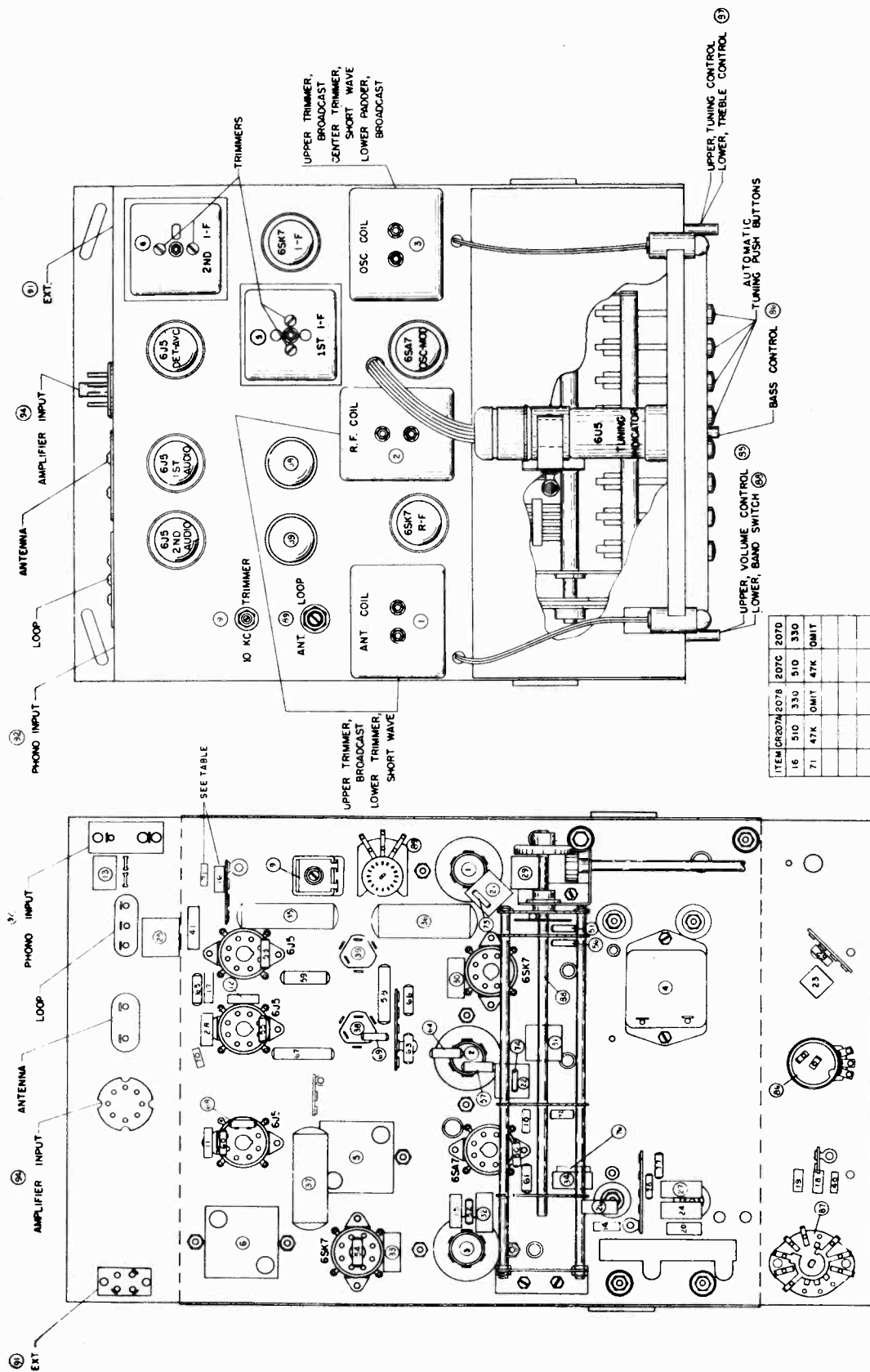
ALIGNMENT PROCEDURE
The alignment of this receiver requires the use of an accurately calibrated r-f signal generator and an output meter. All trimmer condenser locations are shown on the chassis layout diagram, Figure 7. The radio volume control should be turned to maximum and the signal generator output kept as low as possible during alignment to prevent the AVC from operating and giving false readings. Always set the Treble Control to SHARP TUNE before aligning the i-f stages. This is done by turning the Treble Control Knob to the No. 1 position.

I-F ALIGNMENT

1. Connect the output of the signal generator to the control grid (pin No. 8) of the 6SA7 tube through a .00025 mfd. capacitor. The ground on the signal generator should be connected to the radio chassis ground.
2. Turn the condenser gang until it is completely meshed, (low-frequency end of dial calibration) and set the band selector switch to BDCST as for broadcast band reception.
3. Adjust the signal generator to EXACTLY 455 kc. and peak the second i-f transformer and the first i-f transformer trimmers in that order.
4. On some models of the CR-207 chassis, the two i-f trimmers are located in the top of the respective i-f transformers as shown in the layout diagram Figure 7. In other models, one trimmer is accessible from the top and the other from the bottom of each transformer.

BROADCAST BAND ALIGNMENT

1. Remove the signal generator lead from the 6SA7 grid and connect it to the radio antenna terminal through the .00025 mfd. capacitor. The ANT-LOOP switch (89) must be in the ANT. setting.
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, loosen the set screws in the hub of pulley "D" shown on Figure 1 and make the necessary adjustment.
3. With the band selector still set for broadcast band reception, adjust the signal generator and the radio receiver to 600 kc. While rocking the gang condenser a few degrees to the right and to the left, adjust the 600 kc. oscillator paddler for maximum indication on the output meter.
4. Set the signal generator and the radio receiver to 1400 kc.; adjust the 1400 kc. oscillator trimmer and the 1400 kc. antenna trimmer for maximum output.



THE MAGNAVOX CO.

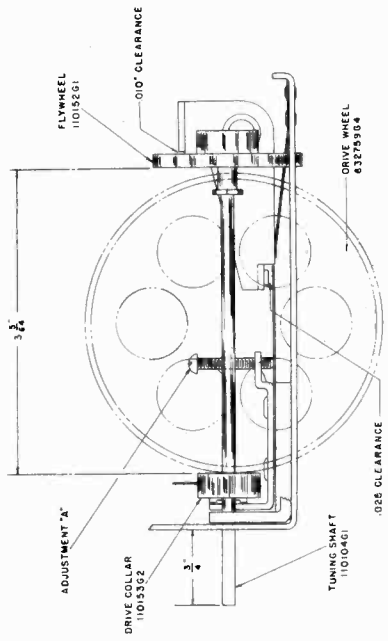


FIGURE 2

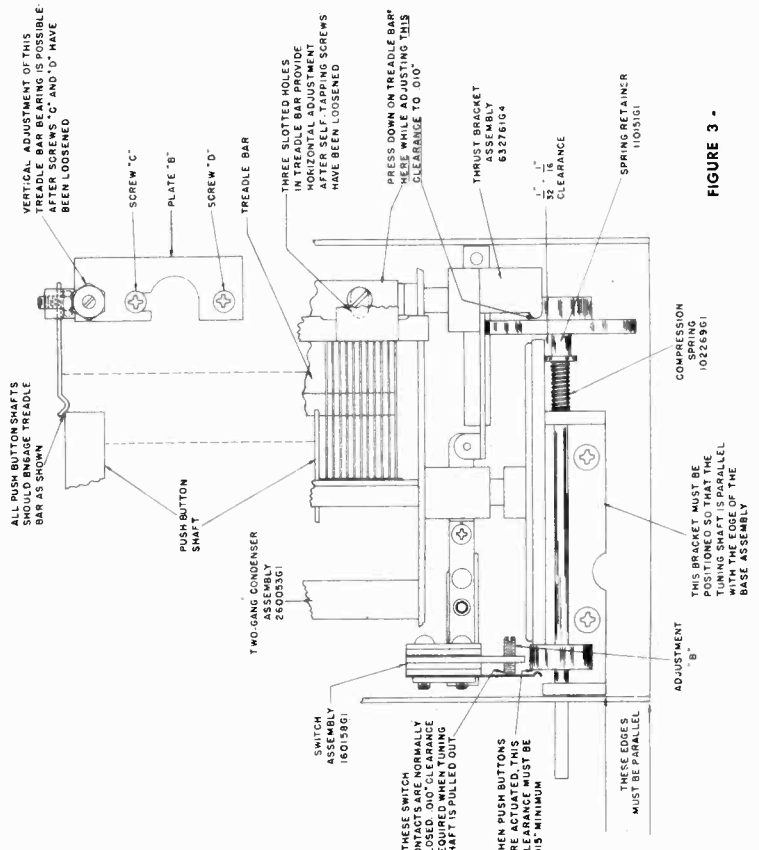


FIGURE 3

sure of the front surface of the Drive Collar, when the Tuning Shaft is pulled out. The function of this switch is to open the muting circuit when setting up the push buttons. As its contacts are wired in series with the large muting switch (contacts are shorted by pressing any push button), pulling out on the Tuning Shaft causes the small switch contacts to open the muting circuit so that a station can be heard while the push button is held in and tightened. On rare occasions it may be necessary to adjust the relation between the push button bars and the Treadle Bar. Such adjustment might be required if when pushing any of the push buttons, sufficient motion is not transmitted to the Treadle Bar to cause a disengagement between the Drive Collar and the Drive wheel. This can usually be accomplished by loosening the two screws designated "C" and "D" on Figure 3, and moving plate "B" in the direction required to correct this condition.

SPECIAL SERVICE INFORMATION

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

STAGE GAINS*

Antenna Post to R-F Grid at:	7.0
600 kc.	1.63
6 mc.	3.4
R-F to Converter Grid at:	3.4
600 kc.	40.0
6 mc.	35.5
R-F on Converter Grid to I-F Grid at:	59
600 kc.	68
6 mc.	6.6
I-F on Converter Grid to I-F Grid at:	
455 kc.	
I-F Grid to Detector Plate at:	
455 kc.	

AUDIO GAIN

Voltage required across Volume Control to produce 0.1 watt speaker output** at 400 cycles is .0072 volt with Band Selector Switch in BDCST setting.

OSCILLATOR OUTPUT VOLTAGE

The DC voltage developed across Oscillator Grid Resistor at:

600 kc.	5.8
6 mc.	6.6

*Variations of ±20% are permissible. All readings made with sufficient input signal to drive speaker output at 400 cycles is equivalent to a reading of 0.35 volts as measured by a high resistance AC voltmeter across the voice coil of 15-inch speaker.

CONDENSER GANG DRIVE ADJUSTMENTS

Models CR-207A, CR-207C

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 effected; 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, Spring Retainer and Flywheel in the manner shown on Figure 3. Note that the Tuning Shaft must extend 3/4" from the front of the assembly and that the spacing between the rear of the Drive Collar and the front of the Flywheel must be 3.5/64". Any excess length in the Tuning Shaft may extend beyond the rear of the Flywheel. See Figure 2.

2. The distance between the rubber-tired Drive Wheel and the smaller diameter section of the Spring Retainer must be 1/32" to 1/16" (Figure 3). This adjustment is effected by loosening the two No. 6 Allen set screws in the Drive Wheel hub and sliding the wheel on its shaft until the required clearance is obtained. When the adjustment is completed, tighten the two screws in the hub of the Drive Wheel.

3. While pressing down on the Treadle Bar at the location shown on Figure 3, adjust the Thrust Bracket until the clearance between the rear of the Flywheel and the projection on the Thrust Bracket is .010" as shown on the diagram. To make this adjustment, loosen the two No. 6 Allen set screws (use No. 6 Allen Wrench—MagnaVox Part No. 800044G2) in the hub of Thrust Bracket and rotate the bracket until the specified clearance is obtained when the push buttons are NOT actuated. Tighten the two screws securely when the adjustment is completed. Press each push button and check that the Drive Collar is pushed away from the rubber-tired Drive Wheel.
4. Next, adjust the clearance in the muting switch contacts by turning the Phillips-head screw designated Adjustment "A" on Figure 2, until the specified clearance of .025" is obtained (when the push buttons are NOT actuated).

5. While pressing any one of the push buttons in as far as possible, turn the screw designated Adjustment "B" until a minimum clearance of .015" is obtained between the front surface of the Drive Collar and the switch spring directly in front of it. This setting should also cause a minimum clearance of .010" between the switch contacts actuated by pres-

PARTS LIST

REFERENCE NO.	DESCRIPTION	MAGNAVOX PART NO.
1	Coil assembly, antenna, two band	36025463
2	Coil assembly, r-f, two band	36025464
3	Coil assembly, oscillator, two band	36025362
4	Coil assembly, 10kc, filter	36024461
5	Transformer, first, r-f	36002461
6	Transformer, second, r-f	36002561
8	Capacitor, variable, three gang tuning	26005462
9	Push Button Assembly for 26005462	26006461
9	Capacitor, variable, 10kc, trimmer	25961062
10	Capacitor, ceramic, 50 mmf	2501566100
11	Capacitor, molded mica, 220 mmf	2501566100
12	Capacitor, molded mica, 220 mmf	2501566100
13	Capacitor, molded mica, 510 mmf	250156664
14	Capacitor, molded mica, 330 mmf	250156654
15	Capacitor, silvered mica, 490 mmf, ±1%	250085632
16	Capacitor, molded mica, 510 mmf (CR-207A, 207C only)	250156664
17	Capacitor, molded mica, 330 mmf (CR-207B/207D only)	250156688
18	Capacitor, molded mica, 510 mmf	250156664
19	Capacitor, molded mica, .001 mfd	2501566133
20	Capacitor, paper, .004 mfd, 600V	25012967
21	Capacitor, molded mica, .0047 mfd, ±5%	250161624
22	Capacitor, molded mica, .0047 mfd, ±5%	250161624
23	Capacitor, paper, .005 mfd, 400 V	250129610
24	Capacitor, paper, .004 mfd, 600 V	25012967
25	Capacitor, paper, .01 mfd, 400 V	25012969
26	Capacitor, paper, .01 mfd, 400 V	25012969
27	Capacitor, paper, .012 mfd, 200 V	250129613
28	Capacitor, paper, .02 mfd, 600 V	25012966
29	Capacitor, paper, .05 mfd, 120 V	25012965
30	Capacitor, paper, .05 mfd, 120 V	25012965
31	Capacitor, paper, .05 mfd, 120 V	25012965
32	Capacitor, paper, .05 mfd, 120 V	25012965
33	Capacitor, paper, .05 mfd, 120 V	25012965
34	Capacitor, paper, .05 mfd, 120 V	25012965
35	Capacitor, paper, .01 mfd, 400 V	25015622
36	Capacitor, paper, .025 mfd, 400 V	25015621
37	Capacitor, paper, .025 mfd, 400 V	25015621
38	Capacitor, electrolytic, 20 mfd, 25 V., 10 mfd, 450 V	27002366
39	Capacitor, electrolytic, 20 mfd, 25 V., 10 mfd, 450 V	27002366
40	Capacitor, molded mica, 470 mmf, ±10% 500 V	250156590
50	Resistor, composition, 100 ohm, 1/4 W	23008467
51	Resistor, composition, 150 ohm, 1/4 W	23008468
52	Resistor, composition, 150 ohm, 1/4 W	23008468
53	Resistor, composition, 470 ohm, 1/4 W	23008461
54	Resistor, composition, 820 ohm, ±10%, 1/4 W	23008465
55	Resistor, composition, 2200 ohm, 1/4 W	230084617
56	Resistor, composition, 4700 ohm, 1/4 W	230084617
57	Resistor, composition, 10,000 ohm, 1/4 W	230085619
58	Resistor, composition, 10,000 ohm, 1 W	230085620
59	Resistor, composition, 15,000 ohm, 1 W	230084621
60	Resistor, composition, 22,000 ohm, 1/4 W	230084621
61	Resistor, composition, 33,000 ohm, 1/4 W	230084622

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

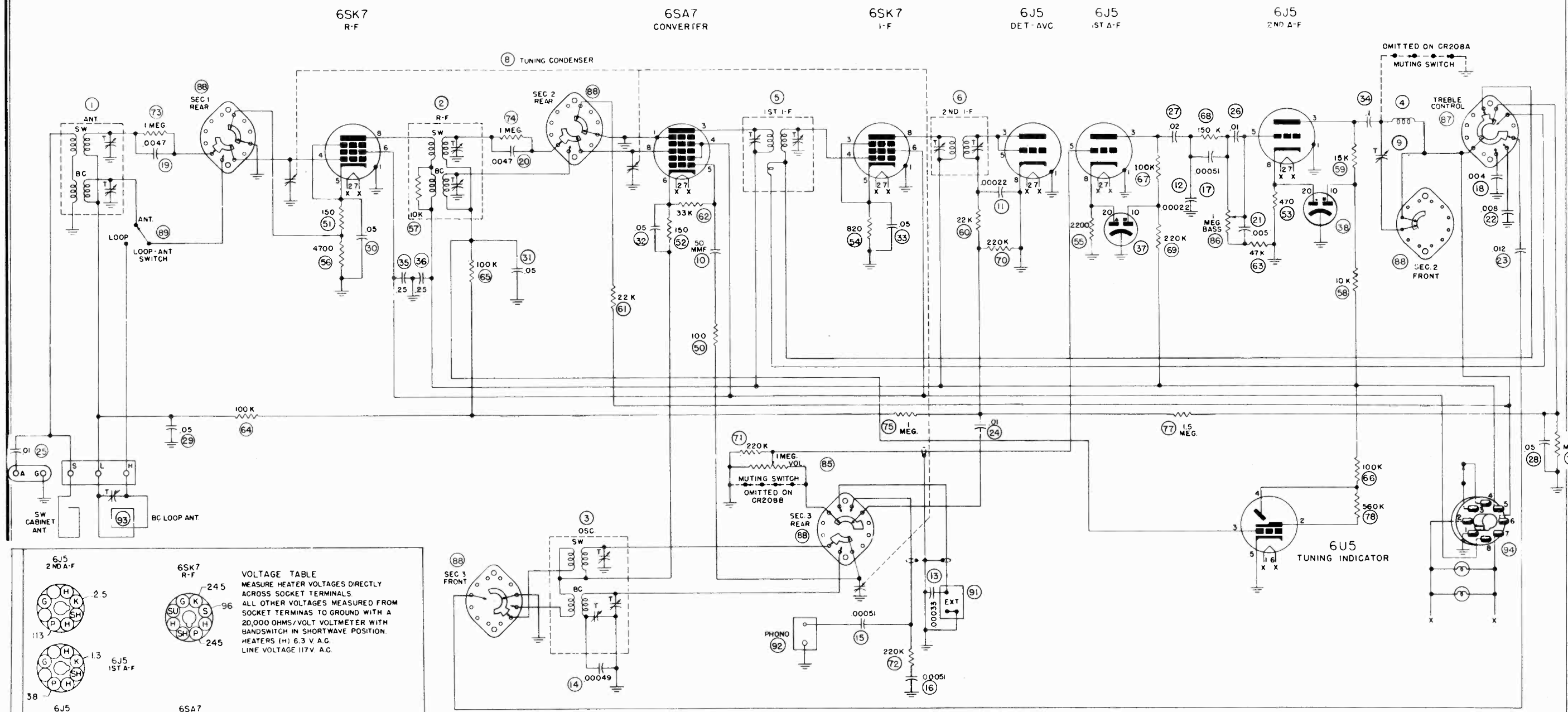
GENERAL

Model CR-207 radio chassis is a two-band tuner that must be used in conjunction with a power amplifier, such as the Model AMP-108 or AMP-110 for speaker operation. Heater and plate voltages for the CR-207 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. Models CR-207A and 207C are alike electrically; they differ mechanically in the dial drive assembly. Models CR-207B and 207D are also alike electrically and differ mechanically in the dial drive assembly. Figures 2 and 3 illustrate the CR-207A and CR-207C dial drive and Figures 4 and 5 illustrate the CR-207B and CR-207D assemblies. The electrical differences between CR-207A/207C and CR-207B/207D are shown on the schematic diagram, Figure 6.

METHOD FOR REMOVING CHASSIS FROM CABINET

Model CR-207 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 books near the front, ride inside the flanges on the

REFERENCE NO.	DESCRIPTION	MAGNAVOX PART NO.
62	Resistor, composition, 47,000 ohm, 1/4 W	230084623
63	Resistor, composition, 100,000 ohm, 1/4 W	230084625
64	Resistor, composition, 100,000 ohm, 1/4 W	230084625
65	Resistor, composition, 100,000 ohm, 1/4 W	230084625
66	Resistor, composition, 100,000 ohm, 1/4 W	230084625
67	Resistor, composition, 100,000 ohm, 1 W	230085625
68	Resistor, composition, 220,000 ohm, 1/4 W	230084627
69	Resistor, composition, 220,000 ohm, ±10%, 1/4 W	230084630
71	Resistor, composition, 47,000 ohm, 1/4 W (CR-207A, 207C only)	230084623
72	Resistor, composition, 22,000 ohm, 1/4 W	230084621
73	Resistor, composition, 1 megohm, 1/4 W	230084631
74	Resistor, composition, 1 megohm, 1/4 W	230084631
75	Resistor, composition, 1 megohm, 1/4 W	230084631
76	Resistor, composition, 1 megohm, 1/4 W	230084631
77	Resistor, composition, 1.5 megohm, 1/4 W	230084632
78	Resistor, composition, 560,000 ohms, (in tuning eye socket) ±10%, 1/4 W	230084695
79	Resistor, composition, 47,000 ohm 1/4 W.—CR-203B only	230084623
85	Control, volume, 1 megohm	220044615
86	Control, bass, 1 megohm, (with switch)	22004462
87	Switch, rotary, treble control	16016161
88	Switch, rotary, band selector	16016061
89	Switch, rotary, loop to outdoor antenna	16015761
91	Socket, external, input	18006061
92	Socket, phonograph input	18974161
93	Antenna, loop assembly	18042761
94	Plug, octal, amplifier connection	15025561
	Dial Glass Assembly	



VOLTAGE TABLE
MEASURE HEATER VOLTAGES DIRECTLY ACROSS SOCKET TERMINALS. ALL OTHER VOLTAGES MEASURED FROM SOCKET TERMINALS TO GROUND WITH A 20,000 OHMS/VOLT VOLTMETER WITH BANDSWITCH IN SHORT WAVE POSITION. HEATERS (H) 6.3 V. A.C. LINE VOLTAGE 117 V. A.C.

6J5 2ND A-F	6SK7 R-F
2.5	245
113	96
6J5 1ST A-F	6SA7 CONVERTER
1.3	245
38	96
6J5 DET-AVC	6SK7 I-F
3.7	245
18	96

6U5 TUNING INDICATOR SOCKET 120 REAR VIEW

Intermediate frequency	455 kc.
Tuning frequency range:	
Broadcast band	530-1610 kc.
Short wave band	4.9-18.1 mc.

Tubes:

R-F Amplifier	6SK7
Converter	6SA7
I-F Amplifier	6SK7
Detector and AVC	6J5
First Audio	6J5

I-F 455 KC
BAND SELECTOR SWITCH SHOWN WITH ITS CONTROL KNOB IN THE EXTREME COUNTERCLOCKWISE POSITION (SHORT WAVE). ALL ELECTRICAL VALUES SHOWN ARE IN OHMS OR MICROFARADS UNLESS OTHERWISE SPECIFIED.

Second Audio	6J5
Tuning Indicator	6U5
Dial lamps	Mazda No. 44

DIAL CORD REPLACEMENT

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.

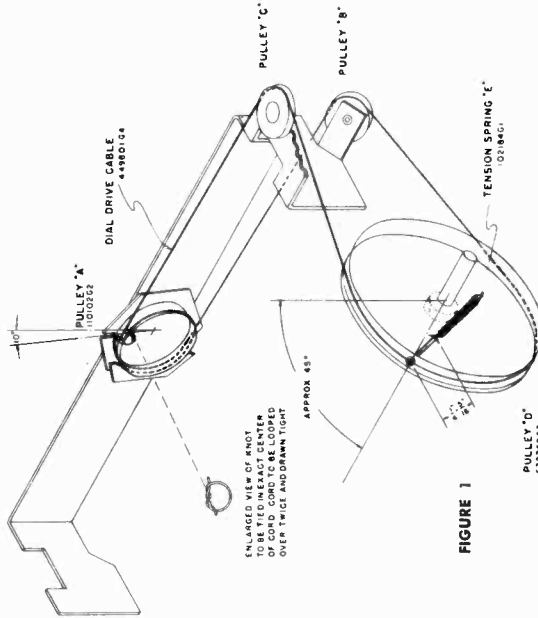


FIGURE 1

If considerable adjustment was necessary, recheck the 600 kc. paddler setting.

5. If the loop antenna trimmer is out of adjustment it should be set after the radio chassis is in the cabinet. Set the ANT-LOOP switch (89) to the LOOP position. Adjust the signal generator to 1400 kilocycles and connect its output to a loop containing approximately five turns of wire eight inches in diameter placed eighteen inches from the receiver loop and in the same plane.

6. Set the receiver to 1400 kc. and adjust the trimmer on the receiver loop for maximum output.

SHORT WAVE BAND ALIGNMENT

1. Set the band selector switch to SW as for short wave reception and substitute a 400 ohm resistor for the capacitor in series with the signal generator lead connected to the antenna terminal on the receiver.

2. Set the signal generator and the radio receiver to 15 mc.; then adjust the 15 mc. oscillator trimmer and the 15 mc. antenna trimmer for maximum output. While adjusting the 15 mc. oscillator trimmer two peaks may be observed; only one is the correct peak for 15 mc. alignment. Screw in the trimmer to maximum capacity—then decrease the capacity until the first peak is observed. This is the correct one.

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. Turn the Treble Control to FULL RANGE (No. 4 position).
2. Connect the output of an audio oscillator to the phonograph pickup socket on the radio chassis and adjust the oscillator to EXACTLY 10,000 cycles.
3. Set the band selector to PHONO and adjust the 10 kc. trimmer (9) for minimum output.
4. If an audio oscillator is not available for making this adjustment, set the band selector to BDCST, connect an 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.

BROADCAST BAND ALIGNMENT

1. Remove the signal generator lead from the 6SA7 grid and connect it to the radio antenna terminal through the .00025 mid. capacitor. The ANT-LOOP switch (89) must be in the ANT. setting.
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, loosen the set screws in the hub of pulley "D" shown on Figure 1 and make the necessary adjustment.
3. With the band selector still set for broadcast band reception, adjust the signal generator and the radio receiver to 600 kc. While rocking the gang condenser a few degrees to the right and to the left, adjust the 500 kc. oscillator paddler for maximum indication on the output meter.
4. Set the signal generator and the radio receiver to 1400 kc.; adjust the 1400 kc. oscillator trimmer and the 1400 kc. antenna trimmer for maximum output.

ALIGNMENT PROCEDURE

The alignment of this receiver requires the use of an accurately calibrated i-f signal generator and an output meter. All trimmer, condenser locations are shown on the chassis layout diagram, Figure 7. The radio volume control should be turned to maximum and the signal generator output kept as low as possible during alignment to prevent the AVC from operating and giving false readings. Always set the Treble Control to SHARP TUNE before aligning the i-f stages. This is done by turning the Treble Control Knob to the No. 1 position.

I-F ALIGNMENT

1. Connect the output of the signal generator to the control grid (pin No. 8) of the 6SA7 tube through a .00025 mid. capacitor. The ground on the signal generator should be connected to the radio chassis ground.
2. Turn the condenser gang until it is completely meshed, (low-frequency end of dial calibration) and set the band selector switch to BDCST as for broadcast band reception.
3. Adjust the signal generator to EXACTLY 455 kc. and peak the second i-f transformer and the first i-f transformer trimmers in that order.
4. On some models of the CR-207 chassis, the two i-f trimmers are located in the top of the respective i-f transformers as shown in the layout diagram Figure 7. In other models, one trimmer is accessible from the top and the other from the bottom of each transformer.

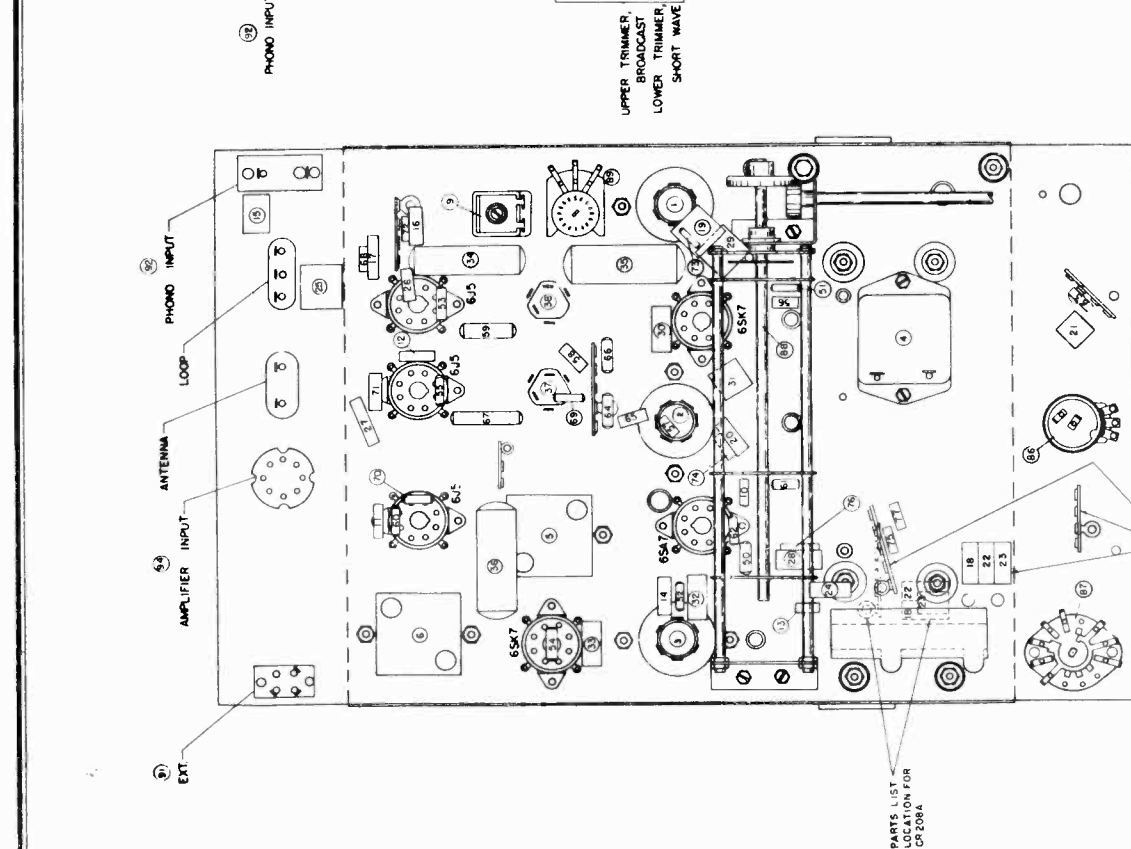


FIGURE 7

PARTS LIST LOCATION FOR CR 208A

CONDENSER GANG DRIVE ADJUSTMENTS

MODEL CR-208A

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 effected; 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, Spring Retainer and Flywheel in the manner shown on Figure 3. Note that the Tuning Shaft must extend 3/4" from the front of the assembly and that the spacing between the rear of the Drive Collar and the front of the Flywheel must be 3.5/64". Any excess length in the Tuning Shaft may extend beyond the rear of the Flywheel. See Figure 2.
2. The distance between the rubber-tired Drive Wheel and the smaller diameter section of the Spring Retainer must be 1.32" to 1.16" (Figure 3). This adjustment is effected by loosening the two No. 6 Allen set screws in the Drive Wheel hub and sliding the wheel on its shaft until the required clearance is obtained. When the adjustment is completed, tighten the two screws in the hub of the Drive Wheel.
3. While pressing down on the Treadle Bar at the location shown on Figure 3, adjust the Thrust Bracket until the clearance between the rear of the Flywheel and the projection on the Thrust Bracket is .010" as shown on the diagram. To make this adjustment, loosen the two No. 6 Allen set screws (use No. 6 Allen Wrench—MagnaVox Part No. 800044G2) in the hub of Thrust Bracket and rotate the bracket until the specified clearance is obtained when the push buttons are NOT actuated. Tighten the two screws securely when the adjustment is completed. Press each push button and check that the Drive Collar is pushed away from the rubber-tired Drive Wheel.

4. Next, adjust the clearance in the muting switch contacts by turning the Phillips-head screw designated Adjustment "A" on Figure 2, until the specified clearance of .025" is obtained (when the push buttons are NOT actuated).
5. While pressing any one of the push buttons in as far as possible, turn the screw designated Adjustment "B" until a minimum clearance of .015" is obtained between the front surface of the Drive Collar and the switch spring directly in front of it. This setting should also cause a minimum clearance of .010" between the switch contacts actuated by pressure of the front surface of the Drive Collar, when the Tuning Shaft is pulled out.

sure of the front surface of the Drive Collar, when the Tuning Shaft is pulled out. The function of this switch is to open the muting circuit when setting up the push buttons. As its contacts are wired in series with the large muting switch (contacts are shorted by pressing any push button), pulling out on the Tuning Shaft causes the small switch contacts to open, the muting circuit so that a station can be heard while the push button is held in and tightened. On rare occasions it may be necessary to adjust the relation between the push button bars and the Treadle Bar. Such adjustment might be required if when pushing any of the push buttons, sufficient motion is not transmitted to the Treadle Bar to cause a disengagement between the Drive Collar and the Drive Wheel.

This can usually be accomplished by loosening the two screws designated "C" and "D" on Figure 3, and moving plate "B" in the direction required to correct this condition.

SPECIAL SERVICE INFORMATION

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

STAGE GAINS*

Antenna Post to R-F Grid at:	600 kc.	0.4
	6 mc.	2.26
R-F to Converter Grid at:	600 kc.	3.6
	6 mc.	3.6
R-F on Converter Grid to I-F Grid at:	600 kc.	34
	6 mc.	2E
I-F on Converter Grid to I-F Grid at:	455 kc.	50.5
	455 kc.	68

AUDIO GAIN

Voltage required across Volume Control to produce 0.1 watt speaker output** at 400 cycles is .015 volt with Band Selector Switch in BDCST setting.

OSCILLATOR OUTPUT VOLTAGE

The DC voltage developed across Oscillator Grid Resistor at:	600 kc.	7.26
	6 mc.	7.59

* Variations of ±20% are permissible. All readings made with sufficient input signal to provide .05 watt speaker output.
** 0.1 watt speaker output at 400 cycles is equivalent to a reading of 0.544 volts as measured by a high resistance AC voltmeter across the voice coil of a 16 ohm speaker.

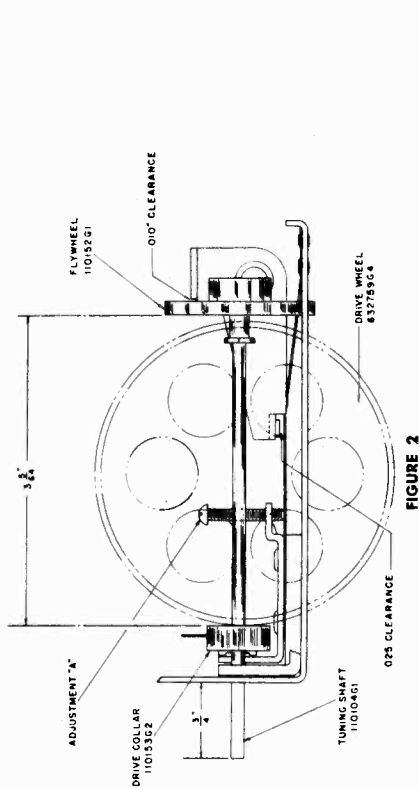


FIGURE 2

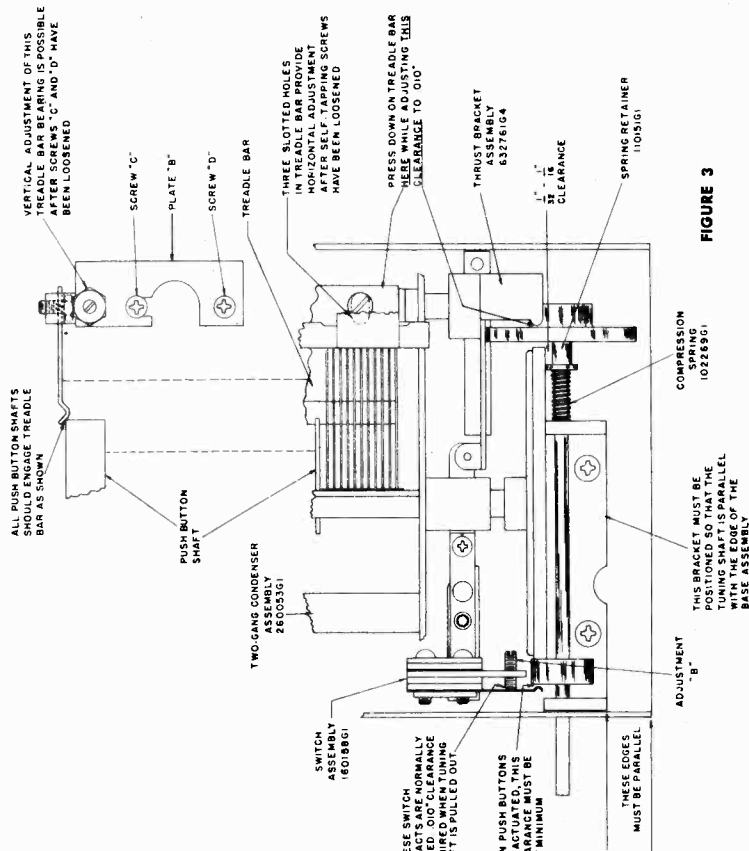


FIGURE 3

MODEL CR-208B
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 4 and 5 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 5. The distance between the front of the Drive Collar and the front of the Tuning Shaft must be 1 1/2 inches as specified on Figure 4. 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 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 5. 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 ap-

plied 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 5, the three screws in the Treadle Bar must be loosened and the Treadle Bar should be moved until the required condition is obtained.

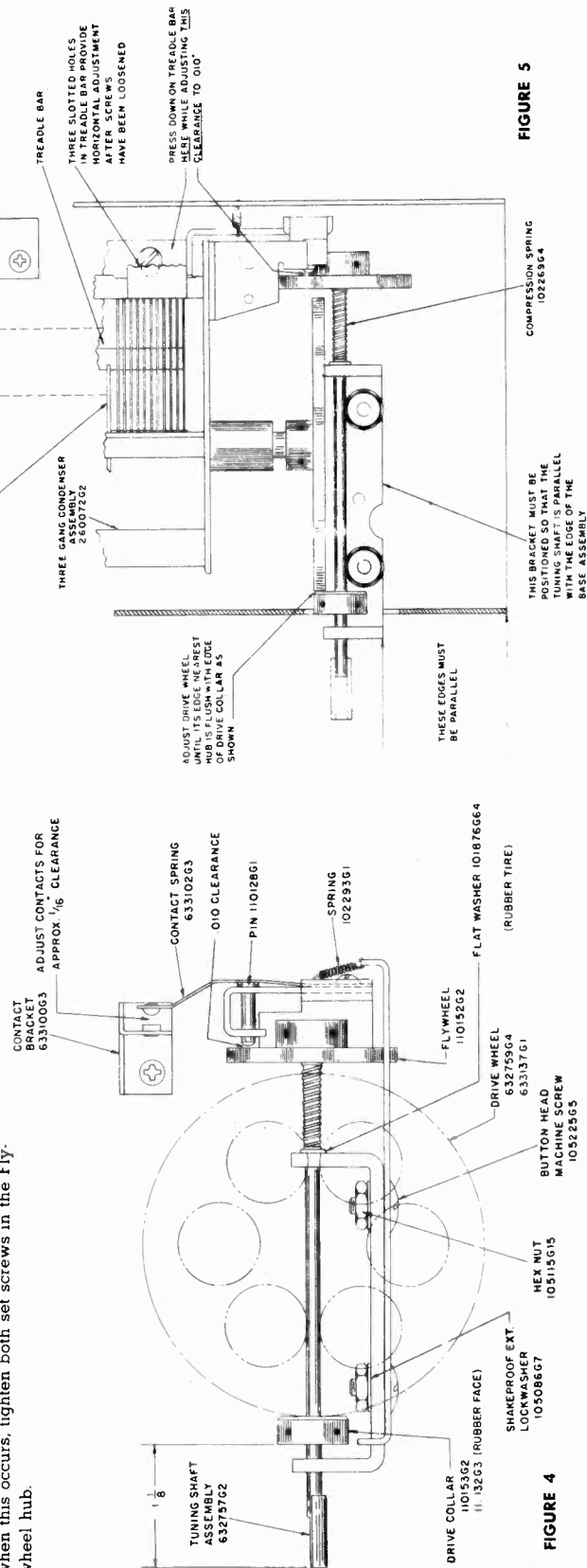


FIGURE 5

PARTS LIST

REFERENCE NO.	DESCRIPTION	MAGNAVOX PART NO.	REFERENCE NO.	DESCRIPTION	MAGNAVOX PART NO.
1	Coil assembly, antenna, two-band	360254G3	66	Resistor, composition, 100,000 ohm, 1/2 W	230084G25
2	Coil assembly, r-f, two-band	360254G4	67	Resistor, composition, 100,000 ohm, 1 W	230085G25
3	Coil assembly, oscillator, two-band	360253G2	68	Resistor, composition, 150,000 ohm, 1/2 W	230084G26
4	Coil assembly, 10kc. filter	360244G1	69	Resistor, composition, 220,000 ohm, 1/2 W	230084G27
5	Transformer, first i-f	360202G1	70	Resistor, composition, 220,000 ohm, 1/2 W	230084G27
6	Transformer, second i-f	360202G1	71	Resistor, composition, 220,000 ohm, 1/2 W ± 10%	230084G90
7	Capacitor, variable, three gang tuning	360202G1	72	Resistor, composition, 220,000 ohm, 1/2 W ± 10%	230084G90
8	Capacitor, variable, 10kc. trimmer	259610C2	73	Resistor, composition, 1 megohm, 1/2 W	230084G31
9	Capacitor, variable, 10kc. trimmer	259610C2	74	Resistor, composition, 1 megohm, 1/2 W	230084G31
10	Capacitor, ceramic, 50 mmf, 500 V	250088G25	75	Resistor, composition, 1 megohm, 1/2 W	230084G31
11	Capacitor, molded mica, 220 mmf, 500 V	250159G100	76	Resistor, composition, 1 megohm, 1/2 W	230084G31
12	Capacitor, molded mica, 220 mmf, 500 V	250159G100	77	Resistor, composition, 1 megohm, 1/2 W	230084G31
13	Capacitor, molded mica, 330 mmf, 500 V	250159G88	78	Resistor, composition, 1.5 megohm, 1/2 W	230084G95
14	Capacitor, silvered mica, 490 mmf, ±1%, 500 V	250085G32	79	Resistor, composition, 560,000 ohm, 1/2 W, ± 10% (in tuning eye socket)	230084G15
15	Capacitor, molded mica, 510 mmf, 500 V	250159G64	80	Control, volume, 1 megohm	220045G2
16	Capacitor, molded mica, 510 mmf, 500 V	250159G64	81	Control, bass, 1 megohm (with switch)	160161G1
17	Capacitor, molded mica, 510 mmf, 500 V	250159G64	82	Switch, relay, treble control	160160G2
18	Capacitor, paper, .004 mfd, 600 V	250129G7	83	Switch, rotary, band selector	160157G1
19	Capacitor, paper, .0047 mfd, ±5%, 500 V	250161G24	84	Switch, rotary, (LOOP-ANT)	180060G1
20	Capacitor, paper, .0047 mfd, ±5%, 500 V	250161G24	85	Socket, external, input	189741G1
21	Capacitor, paper, .005 mfd, 400 V	250129G10	86	Socket, phono, input	180427G1
22	Capacitor, paper, .008 mfd, ±10%, 400 V	250152G1028	87	Antenna loop assembly	150285G1
23	Capacitor, paper, .012 mfd, ±10%, 400 V	250152G1071	88	Plug, octal, amplifier connection	
24	Capacitor, paper, .01 mfd, 400 V	250129G9	89	Dial Glass Assembly	
25	Capacitor, paper, .01 mfd, 400 V	250129G9	90		
26	Capacitor, paper, .01 mfd, 600 V	250152G38			
27	Capacitor, paper, .02 mfd, 600 V	250129G3			
28	Capacitor, paper, .05 mfd, 120 V	250129G5			
29	Capacitor, paper, .05 mfd, 120 V	250129G5			
30	Capacitor, paper, .05 mfd, 120 V	250129G5			
31	Capacitor, paper, .05 mfd, 120 V	250129G5			
32	Capacitor, paper, .05 mfd, 120 V	250129G5			
33	Capacitor, paper, .05 mfd, 120 V	250129G5			
34	Capacitor, paper, .1 mfd, 400 V	250152G22			
35	Capacitor, paper, .25 mfd, 400 V	250152G21			
36	Capacitor, paper, .25 mfd, 400 V	250152G21			
37	Capacitor, electrolytic, 20 mfd, 25 V, 10 mfd, 450 V	270023G66			
38	Capacitor, electrolytic, 20 mfd, 25 V, 10 mfd, 450 V	270023G66			
50	Resistor, composition, 100 ohm, 1/2 W	230084G7			
51	Resistor, composition, 150 ohm, 1/2 W	230084G8			
52	Resistor, composition, 150 ohm, 1/2 W	230084G8			
53	Resistor, composition, 470 ohm, 1/2 W	230084G11			
54	Resistor, composition, 820 ohm, 1/2 W, ±10%	230084G61			
55	Resistor, composition, 2200 ohm, 1/2 W	230084G15			
56	Resistor, composition, 4700 ohm, 1/2 W	230084G17			
57	Resistor, composition, 10,000 ohm, 1 W	230084G19			
58	Resistor, composition, 10,000 ohm, 1 W	230084G19			
59	Resistor, composition, 15,000 ohm, 1/2 W	230085G20			
60	Resistor, composition, 22,000 ohm, 1/2 W	230084G21			
61	Resistor, composition, 22,000 ohm, 1/2 W	230084G21			
62	Resistor, composition, 33,000 ohm, 1/2 W	230084G22			
63	Resistor, composition, 47,000 ohm, 1/2 W	230084G23			
64	Resistor, composition, 100,000 ohm, 1/2 W	230084G25			
65	Resistor, composition, 100,000 ohm, 1/2 W	230084G25			

* 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.

GENERAL

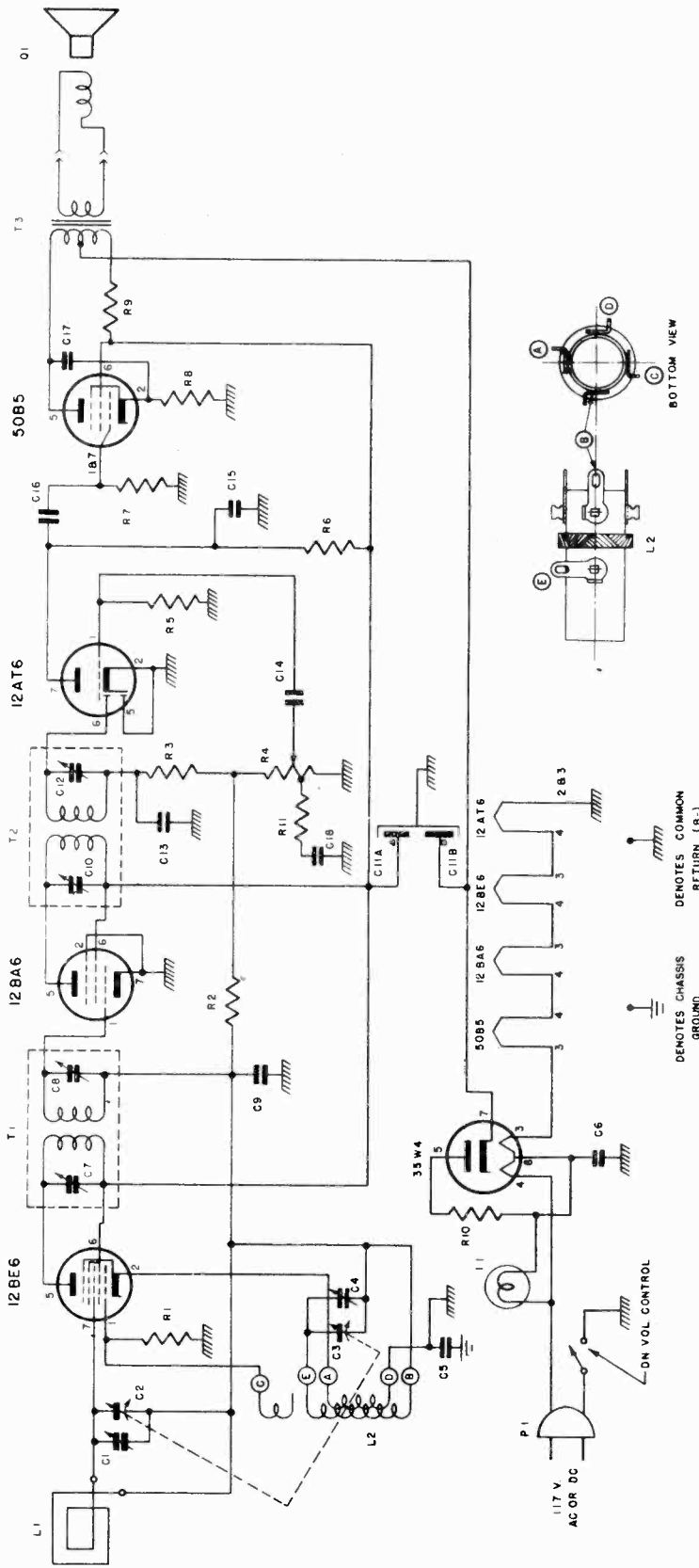
Model CR-208 radio chassis is a two-band tuner that must be used in conjunction with a power amplifier such as the AMP-101 for speaker operation. Heater and plate voltages for the CR-208 radio tuner are supplied from the amplifier chassis; it is therefore essential that the radio and the amplifier chassis be inter-connected during alignment or for other electrical service operations. Models CR-208A and 208B are alike electrically; they differ mechanically in the dial drive assembly. Figures 2 and 3 illustrate the CR-208A dial drive and Figures 4 and 5 the CR-208B assembly.

METHOD FOR REMOVING CHASSIS FROM CABINET

Model CR-208 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 hooks 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 S-L-H. The end of the short wave antenna that is fastened to the inside of the cabinet connects to S. Always disconnect this antenna from terminal S when an outdoor antenna is used as it may pick up noise. 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.

MAJESTIC RADIO & TELEV. CORP.

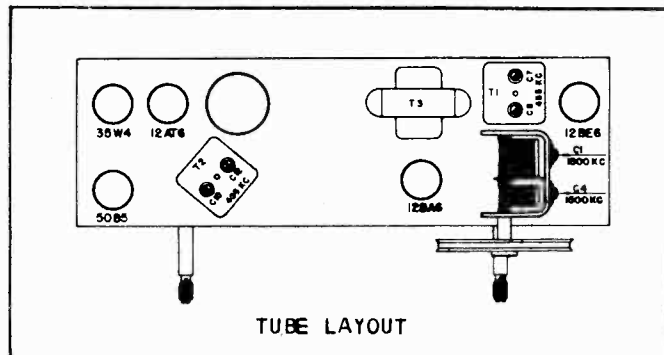
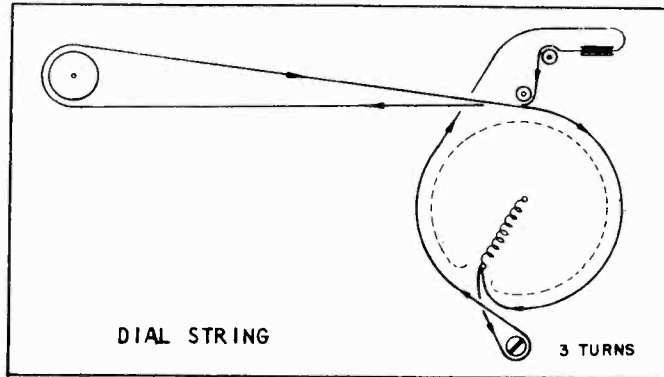
MODEL 5AK711
Chassis 5B01A



ALIGNMENT

Before aligning, set the dial pointer as follows: Close the tuning gang condenser (plates fully closed). Set the dial pointer so that it is in line with the last mark at the low frequency end of the dial scale. While aligning this receiver, turn the volume control full on, and keep the signal generator output as low as possible to prevent AVC action and false readings.

OPERATION	CONNECT OSC. TO	DUMMY ANTENNA	INPUT SIGNAL FREQUENCY	SET DIAL TO	ADJ. TRIMMERS	PURPOSE
1	Pin 7 on Converter Tube 12BE6 Socket	.05MFD	455KC Modulated	600KC	C7, C8, C10 and C12	Align I.F. Channel for Maximum Output
2	2 Turns Loosely Cpl'd. to Loop Ant.		1500KC Modulated	1500KC	C4	Set Oscillator to Dial Scale
3	2 Turns Loosely Cpl'd. To Loop Ant.		1500KC Modulated	1500KC	C1	Align Ant. for Maximum Output



VOLTAGE TABLE

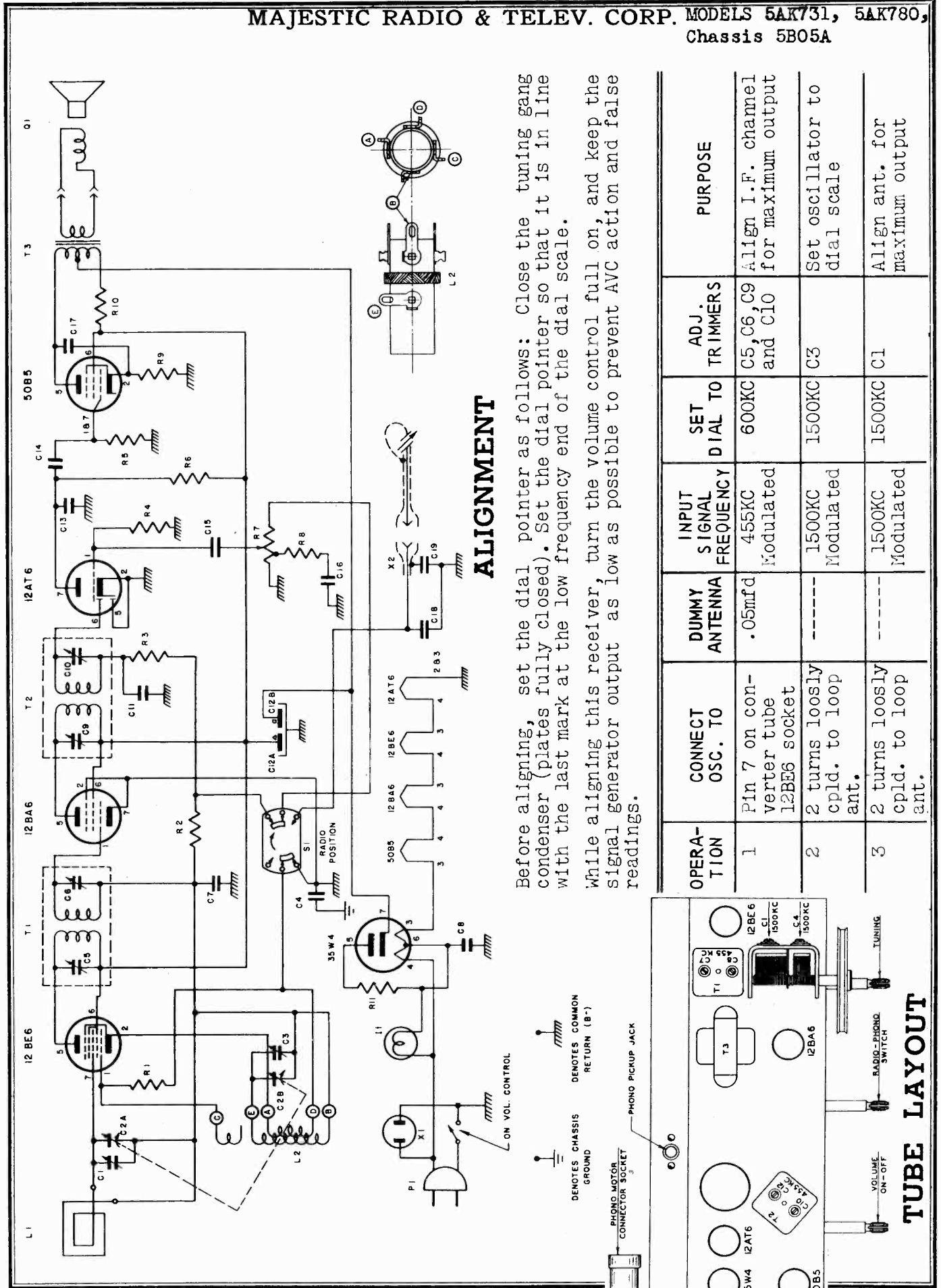
TUBE	ELEMENT	PIN	VOLTS
12BE6 Converter	Plate	5	88
	Screen Grid	6	88
	Grid	7	0.6
12BA6 I.F. Amp.	Plate	5	88
	Screen Grid	6	88
12AT6 2nd Det., AUC	Grid	1	-0.6
	Plate	7	38
	Grid	1	-0.6
50B5 Output	Plate	5	107
	Screen Grid	6	88
	Cathode	2	4.9
35W4 Rectifier	Grid	1 & 7	0
	Plate	5	117AC
	Cathode	7	115

NOTE: All voltages measured with a vacuum tube voltmeter, to B--. A full line voltage of 117 volts AC, and the volume control at minimum.

PARTS LIST

ITEM	DESCRIPTION	R11	DESCRIPTION
C1	Ant. Trimmer (on Gang)	L1	18K ohm, 1/4 watt.
C2,C3	7-31 Gang Condenser	S-1347	Loop Assembly.
C4	Osc. Trimmer (on Gang)	S-1348	Oscillator coil.
C5,C9	5-39 .01 mfd. 200V.	T1	3-161 1st I.F. Transformer
C6	5-40 .05 mfd. 200V.	T2	3-193 2nd I.F. Transformer
C7,C8	On 1st I.F. Transformer.	T3	2-20 Output Transformer
C10,C12	On 2nd I.F. Transformer.	P1	27-319 Plug and Line Cord
C11a,C11B	19-25 20 mfd. 40 mfd. 150V Electrolytic	I1	26-2 Dial Lamp Mazda #47.
C13,C15	6-151 220 mmf. 500V Mica	Q1	22-11 Speaker.
C14	5-52 .002 mfd. 200V.		15-132 Socket, Miniature tube
C16,C18	5-57 .01 mfd. 200V.		111-249 Tuning Shaft
C17	5-58 .04 mfd. 400V.		112-374 Dial plate bracket
R1,R3	01-143 22K ohms, 1/4 watt.		112-376 Dial plate
R2	01-234 3.3 megohm, 1/4 watt.		117-93 Dial scale
R4	13-33 500K ohm volume control.		129-29 Dial spring.
R5	01-255 10 megohm, 1/4 watt.		134-7 Dial cord.
R6	02-192 330K ohm, 1/2 watt.		135-16 Dial pointer
R7	01-199 470K ohm, 1/4 watt.		116-10 Cabinet top (10 colors).
R8	03-52 150 ohm, 1 watt.		116-11 Cabinet bottom
R9	03-90 1200 ohm, 1 watt.		128-67 Knobs.
R10	01-20 27 ohm, 1/4 watt.		143-5 Grill screen (speaker)
			143-6 Grill screen (ventilator)
			148-84 Carton, with fillers
			119-219 Instruction sheet.

MAJESTIC RADIO & TELEV. CORP. MODELS 5AK731, 5AK780, Chassis 5B05A



ALIGNMENT

Before aligning, set the dial pointer as follows: Close the tuning gang condenser (plates fully closed). Set the dial pointer so that it is in line with the last mark at the low frequency end of the dial scale.

While aligning this receiver, turn the volume control full on, and keep the signal generator output as low as possible to prevent AVC action and false readings.

OPERATION	CONNECT OSC. TO	DUMMY ANTENNA	INPUT SIGNAL FREQUENCY	SET DIAL TO	ADJ. TRIMMERS	PURPOSE
1	Pin 7 on converter tube 12BE6 socket	.05mf'd	455KC Modulated	600KC	C5, C6, C9 and C10	Align I.F. chanel for maximum output
2	2 turns loosely cpl'd. to loop ant.	-----	1500KC Modulated	1500KC	C3	Set oscillator to dial scale
3	2 turns loosely cpl'd. to loop ant.	-----	1500KC Modulated	1500KC	C1	Align ant. for maximum output

MODELS 5AK731,
5AK780

MAJESTIC RADIO & TELEV. CORP.

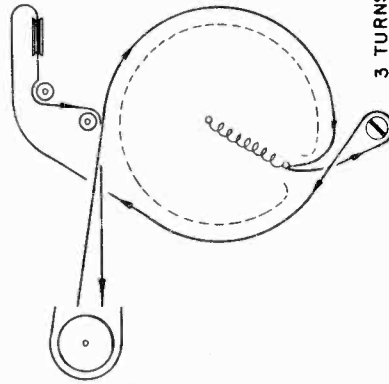
ITEM	PART NO.	DESCRIPTION
	116-18-3	Cabinet (VM 800 cut-out) 5AK731
	122-36	Escutcheon, metal (5AK731)
	126-23	Screen, speaker (5AK731)
	127-230	Handle, cabinet (5AK731)
	128-66	Knobs 5AK731
	128-79	Knob (phono-radio) 5AK731
	148-86	Carton with fillers, 5AK731
	119-225	Instruction sheet, 5AK731
	21-25	Aero changer (5AK780)
	21-28	Milwaukee changer (5AK780)
	115-38-1	Cabinet, Aero cut-out (5AK780)
	115-38-2	Cabinet, Milwaukee cut-out (5AK780)
	122-47	Escutcheon, metal (5AK780)
	128-62	Knobs (5AK780)
	128-80	Knob (phono-radio) 5AK780
	148-102	Carton, with fillers (5AK780)
	119-260	Instruction sheet, 5AK780

ITEM	PART NO.	DESCRIPTION
C1	.....	Ant. Trimmer (on gang)
C2a, C2b	7-31	Gang condenser
C3	.....	Osc. trimmer (on gang)
C4	5-39	0.1 mfd. 200V
C5, C6	.....	On 1st I.F. Transformer
C7, C8, C19	5-40	.05 mfd. 200V
C9, C10	.....	On 2nd I.F. Transformer
C11, C13, C18	6-151	220 mmf. 500V mica
C12a, C12b	19-25	20 mfd. 40 mfd. 150V Electrolytic
C14, C16	5-57	.01 mfd. 200V
C15	5-52	.002 mfd. 200V
C17	5-58	.04 mfd. 400V
R1, R3	01-143	22K ohm, 1/4 watt
R2	01-234	3.3 megohm, 1/4 watt
R4	01-255	10 megohm, 1/4 watt
R5	01-199	470K ohm, 1/4 watt
R6	02-192	330K ohm, 1/2 watt
R7	13-28	500K ohm volume control
R8	01-139	18K ohm, 1/4 watt
R9	03-52	150 ohm, 1 watt
R10	03-90	1200 ohm, 1 watt
R11	01-20	27 ohm, 1/4 watt
L1	S-1354	Loop Assembly
L2	S-1374	Oscillator coil
T1	3-161	1st I.F. Transformer
T2	3-193	2nd I.F. Transformer
T3	2-20	Output Transformer
P1	27-201	Plug and Line Cord
I1	26-2	Dial Lamp, Mazda #47
Q1	22-36	Speaker
S1	11-66	Radio-Phono Switch
	or	
X1	11-67	AC Receptacle (phono motor)
X2	15-123	Phono Pickup Socket
	15-87	Tuning Shaft
	111-252	Dial plate
	112-376	Dial background
	117-72	Dial scale
	117-94	Dial spring
	129-29	Dial cord
	134-7	Dial pointer
	135-19	Needle
	21-3	Aero Record Changer (5AK731)
	21-20	Milwaukee Record Changer (5AK731)
	21-21	VM800 Record Changer (5AK731)
	21-22	Cabinet (Aero cut-out) 5AK731
	116-18-1	Cabinet (Milwaukee cut-out) 5AK731
	116-18-2	

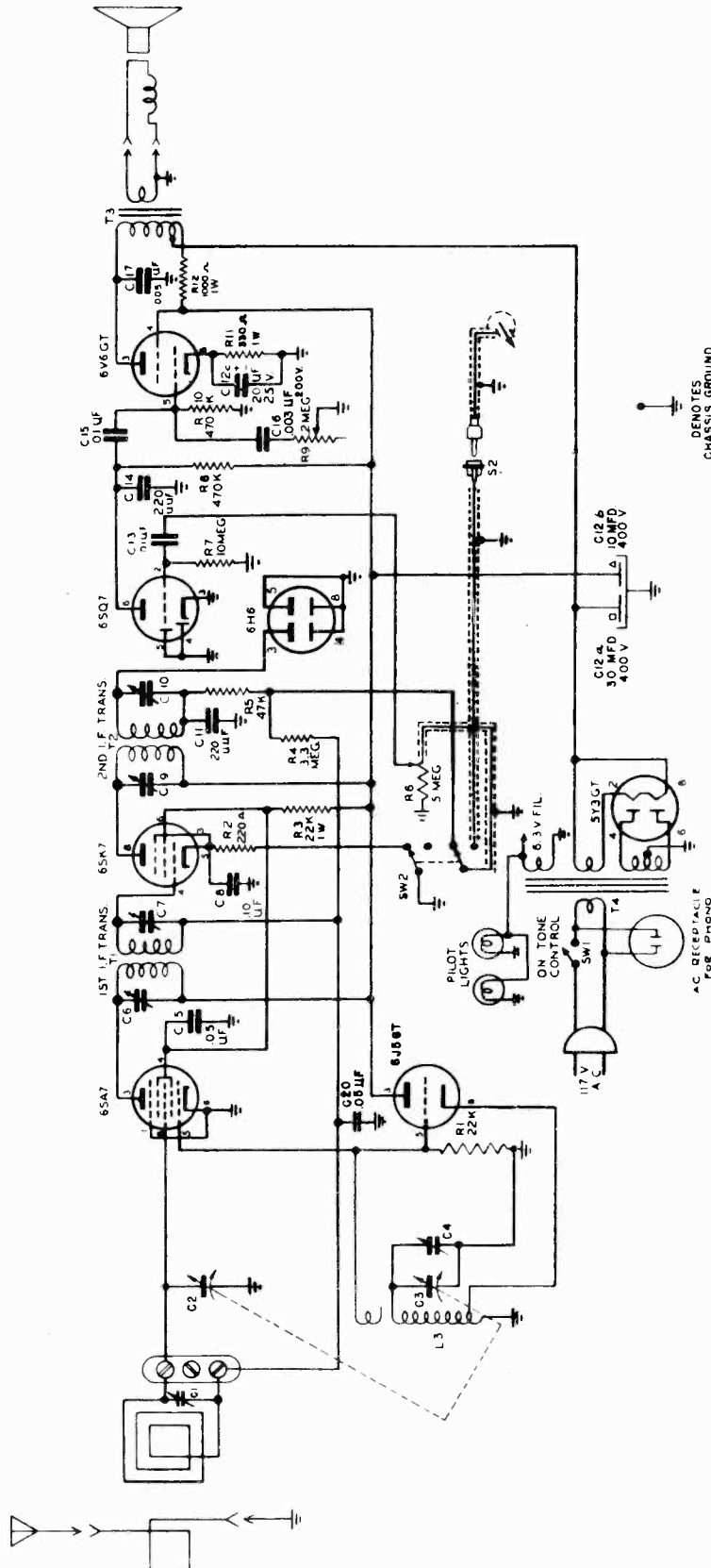
VOLTAGE TABLE

TUBE	ELEMENT	PIN	VOLTS
12BE6 Converter	Plate	5	88
	Screen Grid	6	88
	Grid	7	0.6
12BA6 I.F. Amp.	Plate	5	88
	Screen Grid	6	88
	Grid	1	-0.6
12AT6 2nd Det., AVC	Plate	7	38
	Grid	1	-0.6
50B5 Output	Plate	5	107
	Screen Grid	6	88
	Cathode	2	4.9
35W4 Rectifier	Grid	1 & 7	0
	Cathode	5	117AC

NOTE: All voltages measured with a vacuum tube voltmeter to B---. A full line voltage of 117 V.A.C., volume control at minimum and "Radio-Phono" switch in the "radio" position.



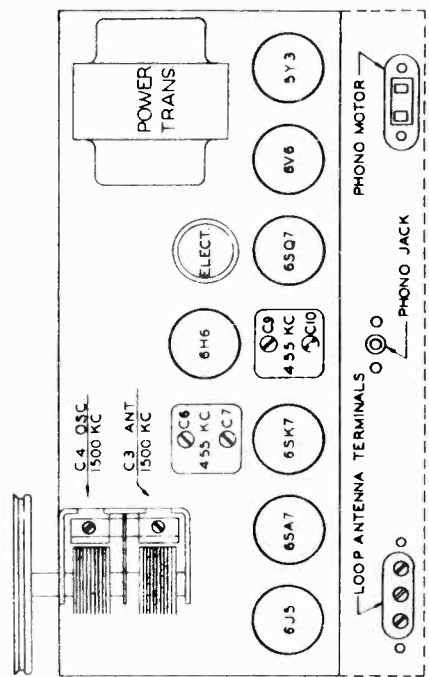
DIAL STRING



VOLTAGE TABLE

TUBE	PLATE	SCREEN	CATHODE
6SA7 (Conv.)	244	74	---
6J5 (Osc.)	244	---	---
6SK7 (I.F.)	244	74	1.6
6SQ7 (A.F.)	75	---	---
6V6 (Out)	268	243	7.5

NOTE: All voltages measured to ground with 1,000 ohm per volt meter; line 117 VAC values may vary 10 per cent.



TUBE LAYOUT

ITEM	PART NO.	DESCRIPTION	ITEM	PART NO.	DESCRIPTION
C1	7-28	Trimmer, (on gang).	R10	01-199	470K ohm, 1/4 watt.
C2, C3	7-28	Gang Condenser.	R11	03-65	330 ohm, 1 watt.
C4		Trimmer, (on gang).	R12	03-87	1000 ohm, 1 watt.
C5	5-77	.05 mfd. 600V.	T1	3-159	1st IF transformer.
C6, C7		Trimmer, (on 1st IF).	T2	3-160	2nd IF transformer.
C8	5-39	0.1 mfd. 200V.	T3	12-26	Output transformer.
C9, C10		Trimmer, (on 2nd IF).	T4	2-16	Power transformer.
C11, C14	6-151	220 mmf. 500V mica.	L3	3-158	Oscillator coil.
C12	19-26	10 mfd.-400V, 30 mfd.-400V, 20 mfd.-25V electrolytic.	SW-2	11-52	Phono-radio switch.
C13	5-57	.01 mfd. 200V.		15-87	Phono pickup socket.
C15	6-132	.01 mfd. 400V.		15-135	A.C. receptacle.
C16	015-3	.003 mfd. 200V.		24-117	3 screw terminal strip.
C17	5-61	.005 mfd. 600V.		26-2	Lamp Mazda #47.
C20	5-40	.05 mfd. 200V.		27-201	Power cord & plug.
R1	01-143	22K ohm, 1/4 watt.		117-85	Dial scale plate.
R2	01-59	22K ohm, 1/4 watt.		129-29	Dial spring.
R3	03-143	22K ohm, 1 watt.		134-7	Dial cord.
R4	01-234	3.3 megohm, 1/4 watt.		135-22	Dial pointer.
R5	01-157	47K ohm, 1/4 watt.		SI466	Loop antenna assembly.
R6	13-19	Volume control, 500K ohm.		21-10	Record changer VM-800.
R7	01-255	10 megohm, 1/4 watt.		21-11	Record changer, Milwaukee.
R8	02-199	470K ohm, 1/2 watt.		21-12	Record changer, Oak.
R9	14-6	Tone control, 200K ohm.		21-18	Record changer, Aero.
				22-30	Speaker, 8" PM.
				115-28	Cabinet.

ALIGNMENT

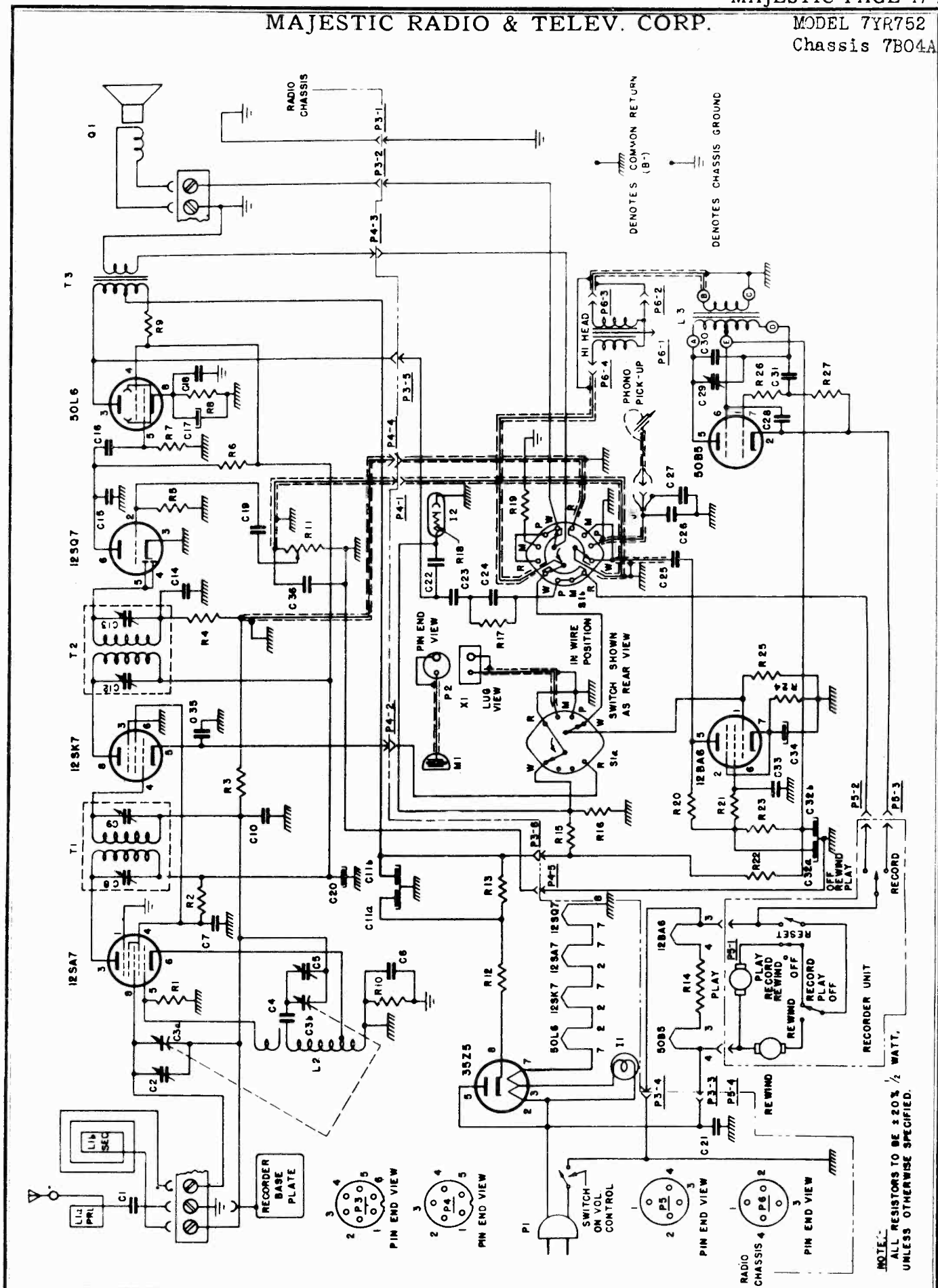
Before aligning, set the dial pointer as follows: Close the gang condenser (plates fully closed). Set the dial pointer so that it is in line with the last mark at the low frequency end of the dial scale.

While aligning this receiver, turn the volume control full on, and keep the signal generator output as low as possible to prevent AVC action and false readings.

OPERATION	CONNECT OSC. TO	DUMMY ANTENNA	INPUT SIGNAL FREQUENCY	SET DIAL TO	ADJ. TRIMMERS	PURPOSE
1	Pin 8 on Converter Tube 6SA7 Socket	.05mfd.	455 KC Modulated	600 KC	C6, C7, C9 and C10	Align I.F. Chamel for maximum output.
2	2 turns Loosly Cpld. to Loop Ant.	-----	1500 KC Modulated	1500 KC	C4	Set oscillator to dial scale.
3	2 turns Loosly Cpld. to Loop Ant.	-----	1500 KC Modulated	1500 KC	C1	Align ant. for maximum output.

MAJESTIC RADIO & TELEV. CORP.

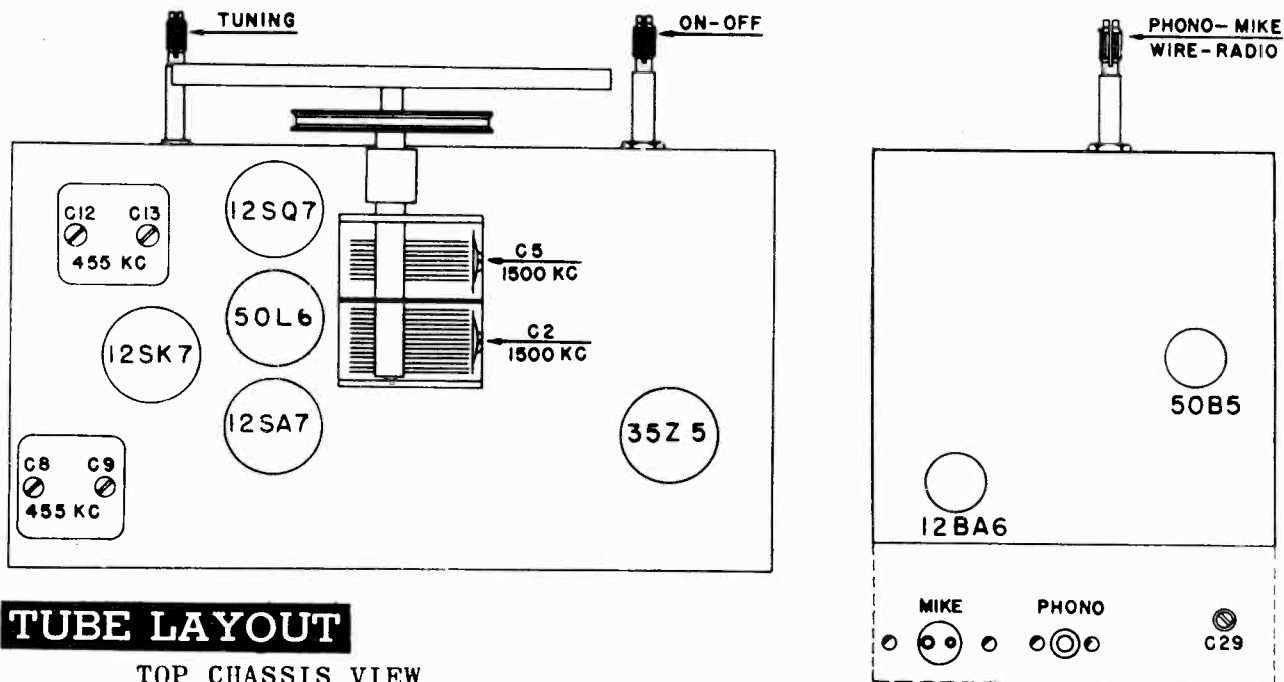
MODEL 7YR752
Chassis 7B04A



ALIGNMENT

Before aligning, set dial pointer as follows; close the tuning gang condenser (plates fully closed). Set the dial pointer so that it is in line with the last mark at the low frequency end of the dial scale. While aligning this receiver, turn the volume control full on, and keep the signal generator output as low as possible to prevent AVC action and false readings.

OPERATION	CONNECT GENERATOR TO	DUMMY ANT.	INPUT SIGNAL FREQUENCY	SET DIAL TO	ADJUST TRIMMERS	PURPOSE
1	Pin 8 on 12SA7 Converter	.05 mf.	455KC Modulated	600KC	C8, C9, C12, C13	Align. IF Channel for Maximum output.
2	2 turns Loosely Coupled to Loop Ant.		1500KC Modulated	1500KC	C5	Set oscillator to dial scale
3	2 turns Loosely Coupled to Loop Ant.		1500KC Modulated	1500KC	C2	Align. Ant. for Max. Output.



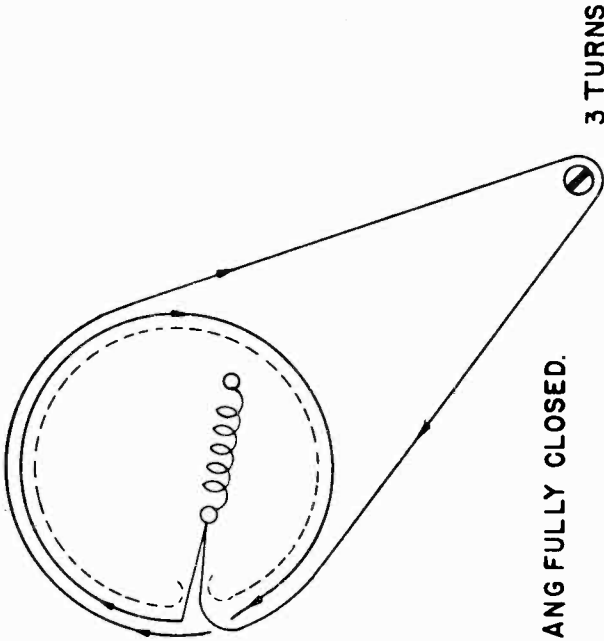
TUBE LAYOUT

TOP CHASSIS VIEW

On the small pre-amplifier sub-chassis may be seen the oscillator trimmer C29 which sets the frequency of the 40 KC erase oscillator.

DIAL STRINGING DIAGRAM

The dial stringing on this radio is conventional and presents no particular problem. If any slippage is encountered a small amount of rosin should be applied to the string.



SHOWN WITH GANG FULLY CLOSED.

VOLTAGE TABLES

TUBE	ELEMENT	PIN	VOLTS
12SA7 CONVERTER	Plate	3	80
	Screen Grid.	4	65
	Control Grid.	8	-0.7 (Zero Sig.)
	Osc. Grid.	5	-7
12SK7 IF AMP	Plate	8	80
	Screen Grid.	6	65
	Control Grid.	4	-0.7 (Zero Sig.)
12SQ7 2nd DET & AVC	Plate	6	48
	Control Grid.	2	-0.9
	Plate	3	100
50L6 OUTPUT	Screen Grid.	4	80
	Control Grid.	5	Zero
	Cathode	8	4.5
	Plate	5	117 A.C.
35Z5 RECTIFIER	Plate	8	115
	Cathode		

RECEIVER CHASSIS

Voltage measured with switch in "Radio" position

OSCILLATOR CHASSIS

Voltage measured with switches set to "Record" & "Mike"

TUBE	ELEMENT	PIN	VOLTS
12BA6 AMPLIFIER	Plate	5	35
	Screen Grid.	6	6
	Control Grid.	1	-0.3
	Cathode	7	.3
50B5 40KC OSC.	Plate	5	86
	Screen Grid.	6	86
	Control Grid.	7	-21

NOTE--

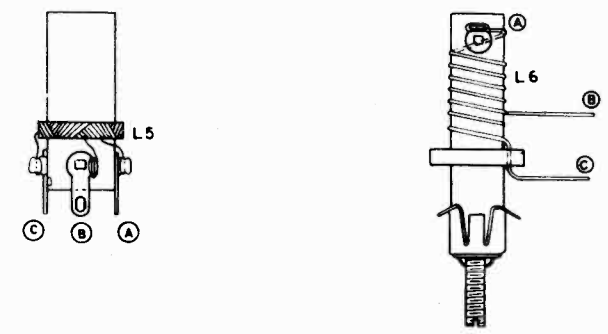
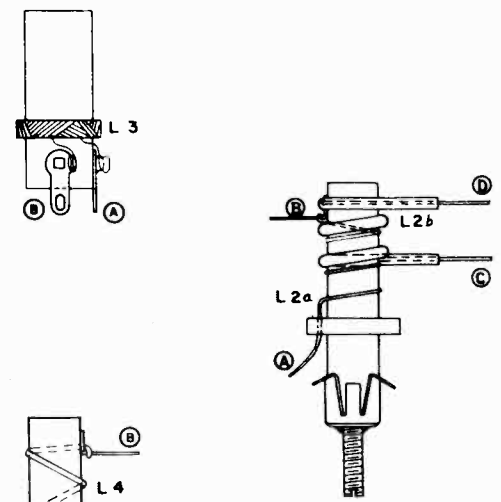
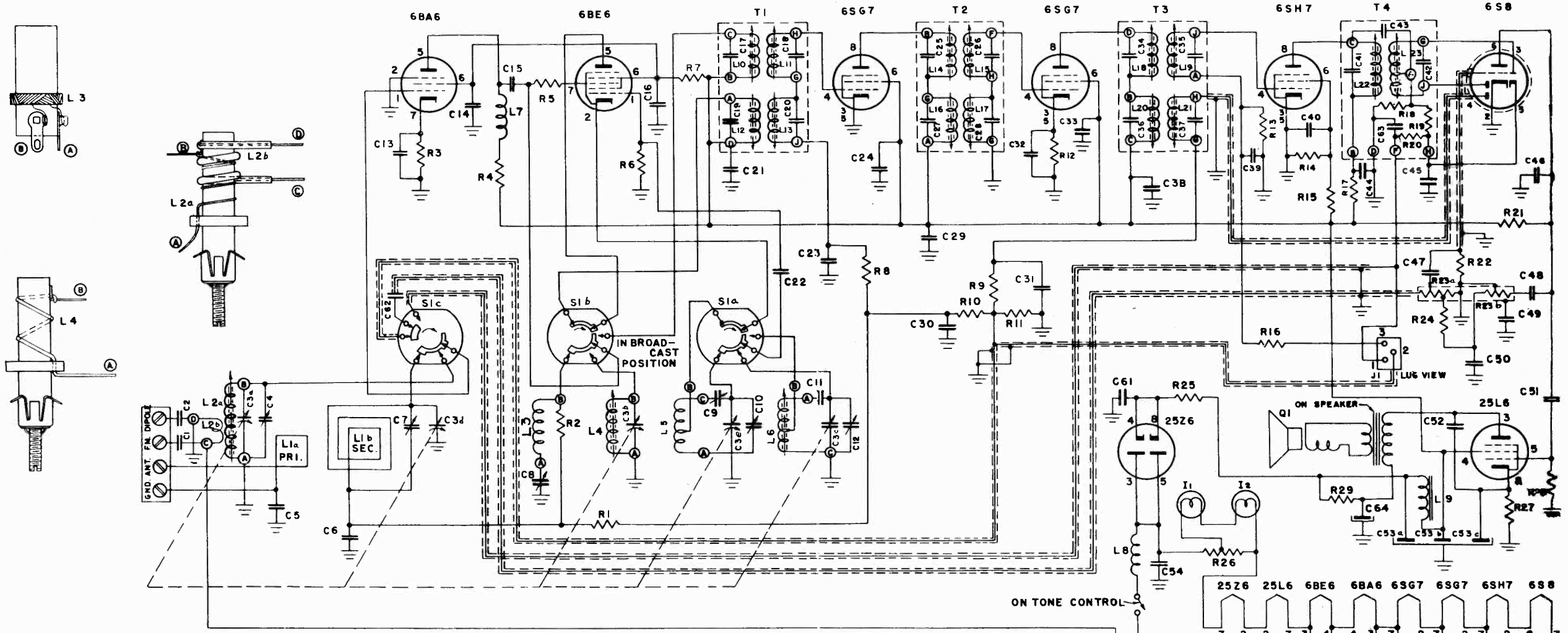
All voltages measured with a vacuum tube voltmeter to B- (not chassis).
Line Voltage 117 V.A.C.
and volume control set at minimum.

MODEL 7YR52

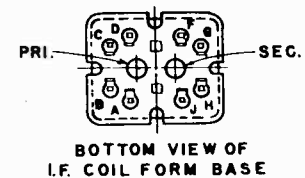
ITEM	PART NO.	DESCRIPTION	ITEM	PART NO.	DESCRIPTION
C1,C7,C16	015-5	.01 mfd. 200V	R18	—	100K ohm, Part of I2
C2	—	Ant. trimmer, on gang	R19	9-336	3 ohm, 1 watt
C3a,C36	7-24 or 7-21	Gang condenser	R21	02-227	2.2 megohm $\frac{1}{2}$ watt
C4,C6,C10, C21,C27,C35	015-8		R22	03-52	150 ohm, 1 watt
C5	—	Osc. trimmer, on gang	R23	02-174	120K ohm $\frac{1}{2}$ watt
C8,C9	—	1st IF Trimmers	R26	02-65	330 ohm $\frac{1}{2}$ watt
C11a,C11b	19-24	40 mfd-150V, 20mfd-150V electrolytic	T1	3-116	1st IF transformer
C12,C13	—	2nd IF trimmer	T2	3-117	2nd IF transformer
C14,C15	020-53	220 mmf. 500V mica	T3	12-20	Output transformer
C17,C34	19-36	100 mfd. 10V electrolytic	L1	20-30	Loop antenna assembly
C18	5-58	.04 mfd. 400V	L2	3-158	Oscillator coil
C19	017-2	.002 mfd. 600V	L3	S-1572	Oscillator coil assembly 40 K C
C20	19-32	20 mfd. 150V electrolytic	Q1	22-32	Speaker
C22	017-4	.005 mfd. 600V	I1	26-2	Pilot lamp, Mazda #47
C23	016-8	.05 mfd. 400V	12	26-19	Neon bulb
C24	017-1	.001 mfd. 600V	P1	27-202	Plug and line cord
C25	016-5	.01 mfd. 400V	P2	18-56	Plug-microphone cable
C26	6-230	1000 mmf. 300V ceramic	X1	15-146	Socket, microphone receptacle
C28	5-51	.2 mfd. 200V	J1	15-87	Phono receptacle
C29	8-33	330-960 mmf. trimmer	M1	22-47	Microphone
C30	021-56	5600 mmf. 500V mica	H1		Wire pickup head
C31	021-24	1500 mmf. 500V mica	P3	15-145	Socket, 6 contact
C32a,C32b	19-25	20 mfd. 150V. 40mfd. 150V	18-55	18-55	Plug, 6 contact
C33	015-9	.1 mfd. 200V	P4	15-101	Socket, 5 contacts
C36	6-228	700 mmf. 500V mica	18-54	18-54	Plug, 5 contacts
R1,R4,R27	02-143	22K ohms $\frac{1}{2}$ watt	P5	18-125	Socket, 4 contact
R2,R24	02-100	2200 ohm $\frac{1}{2}$ watt	18-56	18-56	Plug, 4 contact
R3	02-234	3.3 megohm $\frac{1}{2}$ watt	P6	15-144	Cable connector - record head
R5	02-255	10 megohm $\frac{1}{2}$ watt	S1	11-75	Rotary switch
R6	02-192	330K ohm $\frac{1}{2}$ watt	38-5	38-5	Insulator-phono pickup socket
R7,R16,R20 R25	02-199	470K ohm $\frac{1}{2}$ watt	117-66	117-66	Dial Scale
R8	03-52	150 ohm 1 watt	129-29	129-29	Dial cord spring
R9	03-90	1200 ohm, 1 watt	134-7	134-7	Dial cord
R10	02-185	220K ohm $\frac{1}{2}$ watt	135-14	135-14	Pointer
R11	13-14	volume control, 500K ohm	21-23	21-23	Wire recorder unit
R12	02-17	22 ohm $\frac{1}{2}$ watt	115-39	115-39	Cabinet
R13	04-59	220 ohm, 2 watt	119-261	119-261	Instruction sheet
R14	9-335	375 ohm candohm	122-38	122-38	Crystal and escutcheon
R15	02-206	680 K ohm $\frac{1}{2}$ watt	127-205	127-205	Pilot lamp jewel
R17	02-167	82K ohm $\frac{1}{2}$ watt	128-54	128-54	Knob-tuning
			128-78	128-78	Knob, Radio-phono-mike-wire
			128-56	128-56	Knob, volume
			148-101	148-101	Carton with fillers

MAJESTIC RADIO & TELEV. CORP.

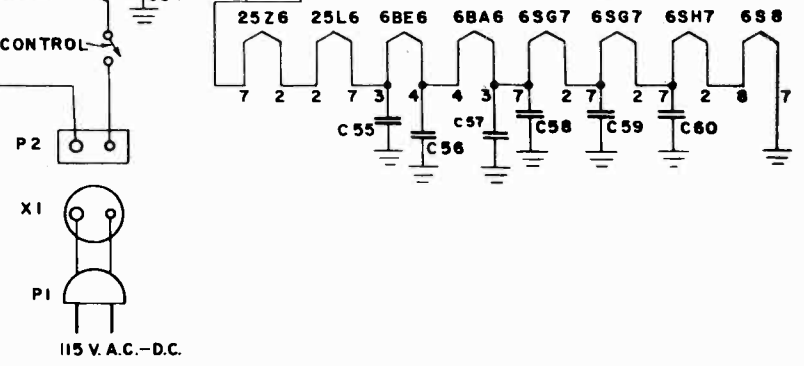
MODEL 8FM744
Chassis 3B06D



NOTE:-
BAND SWITCH IS SHOWN AS
SHAFT END VIEW.

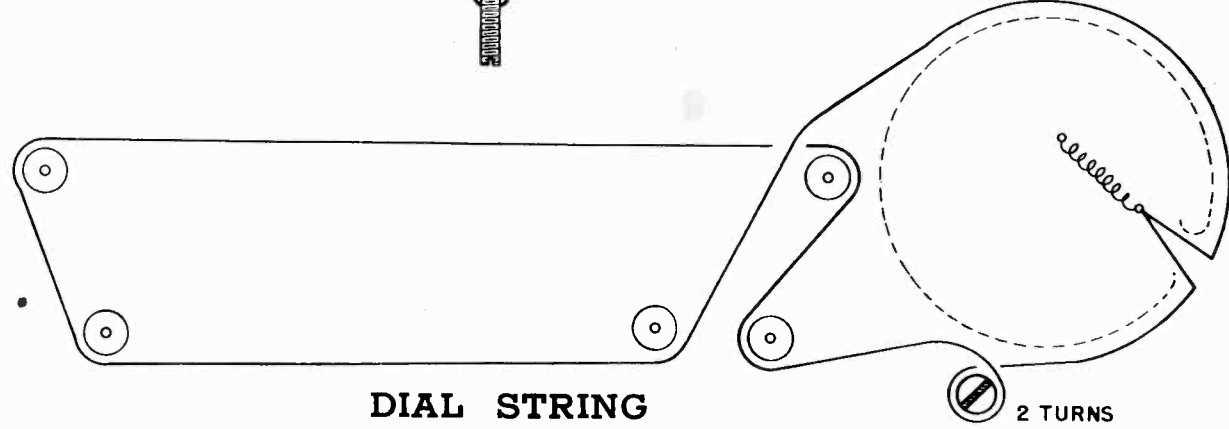


⊥
DENOTES CHASSIS
GROUND



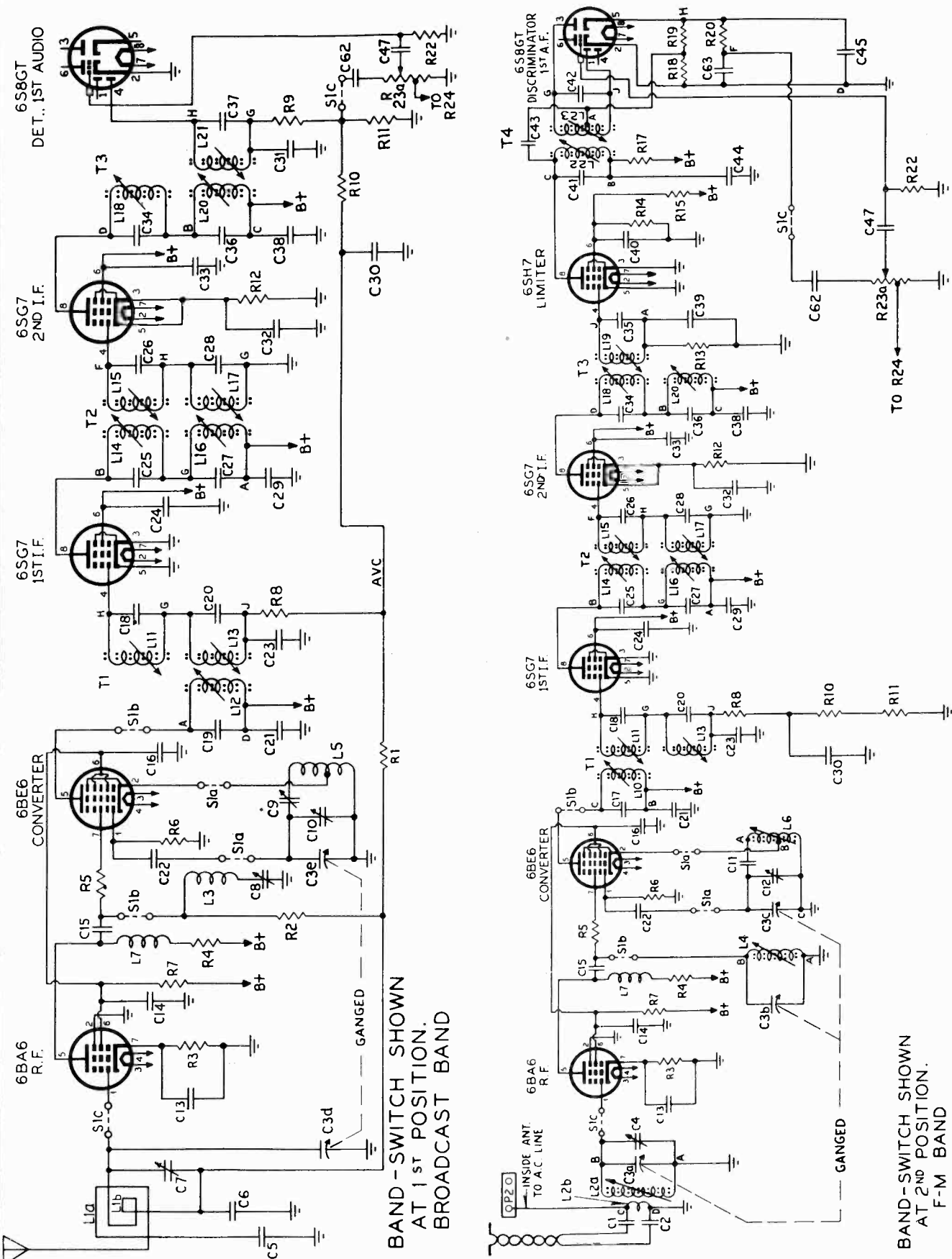
VOLTAGE TABLE

TUBE	FUNCTION	PLATE	CATHODE	SCREEN	GRID
6BA6	R.F. Amplifier	80	0.5	78	----
6BE6	Converter	100	0	78	----
6SG7	1st I.F. Amplifier	100	0	100	-0.6
6SG7	2nd I.F. Amplifier	100	.7	100	----
6SH7	Limiter Amplifier	70	0	21	-0.4
6S8GT	Discriminator, Det., AVC	50	0	---	----
25L6	Power Amplifier	105	7	100	----
25Z5	Rectifier	117AC	105	---	----



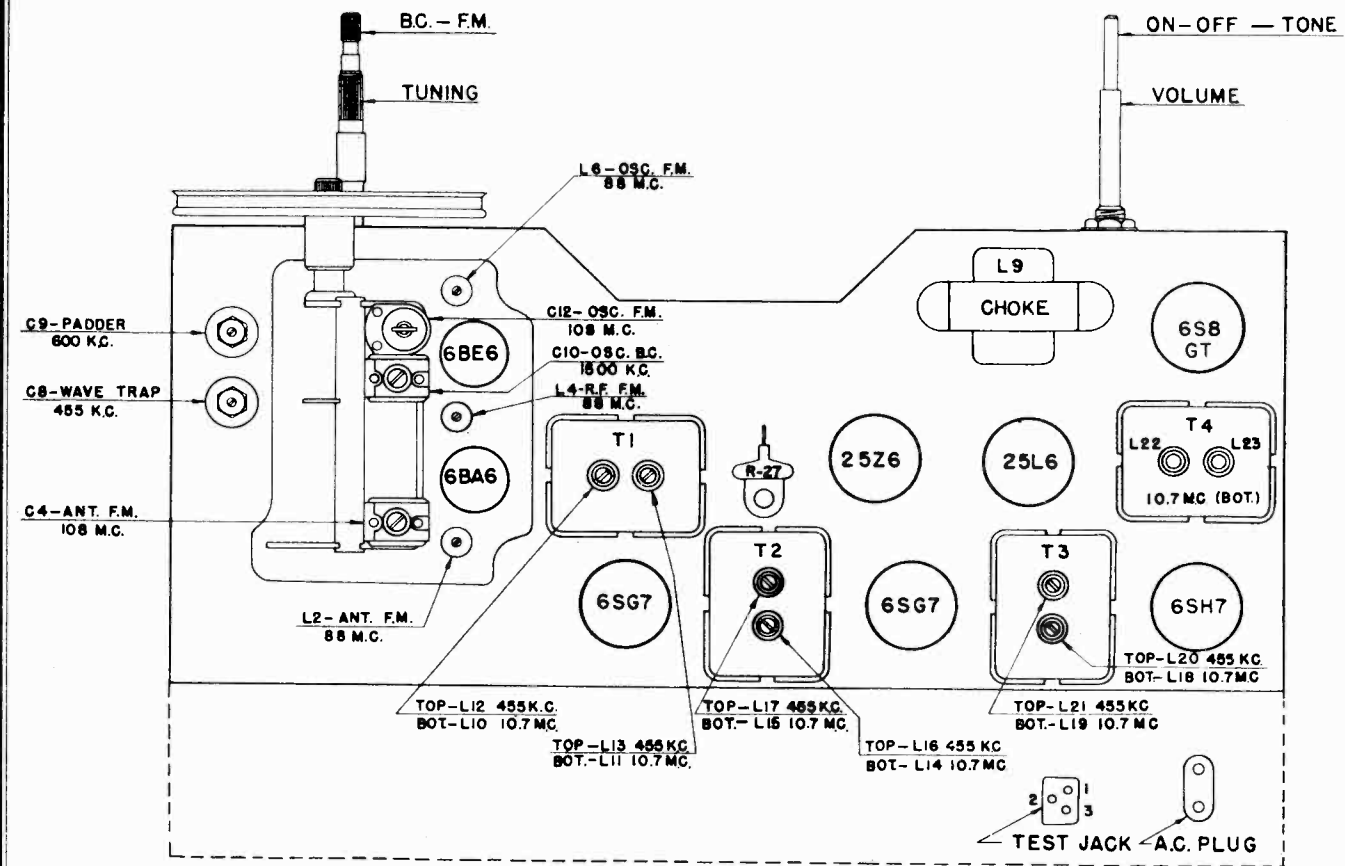
DIAL STRING

2 TURNS



BAND-SWITCH SHOWN AT 1ST POSITION. BROADCAST BAND

BAND-SWITCH SHOWN AT 2ND POSITION. F-M BAND



TUBE LAYOUT

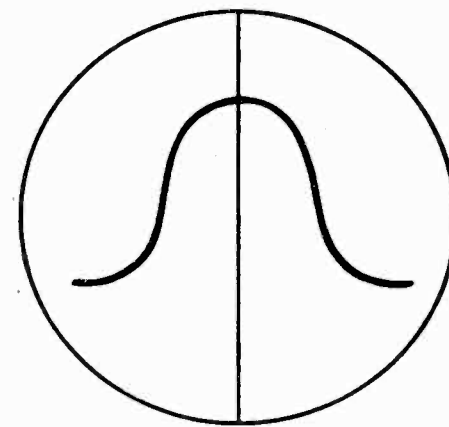


FIGURE 1

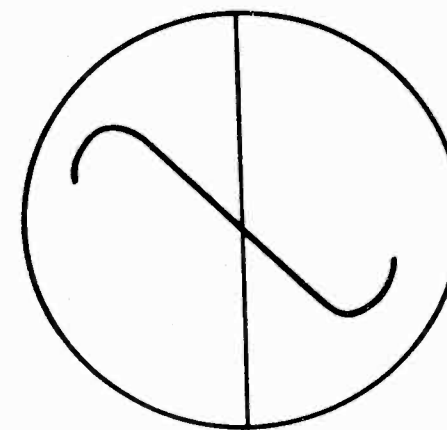


FIGURE 2

ALIGNMENT

OPERATION	CONNECT TEST OSCILLATOR TO	DUMMY ANTENNA	INPUT SIGNAL FREQUENCY	BAND	SET DIAL TO	ADJUST TRIMMERS	PURPOSE
1	Stator Plates of C3d	.05mfd.	455 KC	BC	600 KC	L12, L13, L16, L17, L20, L21	Align 1f channel for maximum output.
2	Stator Plates of C3d	.05mfd.	455 KC Modulated	BC	600 KC	C8	Adjust wave trap for maximum output.
3		-----	1500 KC Modulated	BC	1500 KC	C10	Set oscillator to dial scale.
4		-----	1500 KC Modulated	BC	1500 KC	C7	Align antenna for maximum output.
5		-----	600 KC Modulated	BC	600 KC	C9	Rock gang to track BC padder.
6(a)	Pin 4 (Grid) on 6SH7 Limiter Socket	.05mfd.	10.7 MC Unmodulated	FM	-----	L22 Coil Slug Primary Discriminator	Align Primary of discriminator for maximum reading.
7(b)	Pin 4 (Grid) on 6SH7 Limiter Socket	.05mfd.	10.7 MC Unmodulated	FM	-----	L23 Coil Slug Secondary Discriminator	Adjust secondary of discriminator for zero reading.
8(c)	Pin 4 (Grid) on 6SG7 2nd IF Socket	.05mfd.	10.7 MC Unmodulated	FM	-----	L18 and L19, Pri. and Sec. 3rd IF Coil	Align 3rd IF Transformer for maximum reading.
9(c)	Pin 4 (Grid) on 6SG7 1st IF Socket	.05mfd.	10.7 MC Unmodulated	FM	-----	L14 and L15 Pri. and Sec. 2nd IF Coil	Align 2nd IF Transformer for maximum reading.
10(c)	Lug "B" on Coil L4	.05mfd.	10.7 MC Unmodulated	FM	-----	L10 and L11 Pri. and Sec. 1st IF Coil	Align 1st IF Transformer for maximum reading.
11(c)	Antenna Terminals	300ohm Resistor	106 MC Unmodulated	FM	106 MC	C12 Oscillator Trimmer	Set oscillator to dial scale.
12(c)	Antenna Terminals	300ohm Resistor	106 MC Unmodulated	FM	106 MC	C4 Antenna Trimmer	Align antenna stage for maximum reading.
13(c)	Antenna Terminals	300ohm Resistor	88 MC Unmodulated	FM	88 MC	L6 Oscillator Slug	Set oscillator to dial scale.
14(c)	Antenna Terminals	300ohm Resistor	88 MC Unmodulated	FM	88 MC	L4, L2 Slugs	Align Antenna and RF stages for maximum reading.
15(c)	Antenna Terminals	Repeat steps 11, 12, 13, and 14 until tracking is perfect at 88 and 106 MC.					

IMPORTANT: Alignment of this chassis will in most cases be unnecessary unless an IF or RF transformer is replaced or the adjustment has been tampered with. A vacuum tube voltmeter must be used for FM alignment. An AC output meter connected across the primary or secondary of the output transformer will be satisfactory for all AM adjustments. The signal generator output should be kept just high enough to get a n indication on the meter.

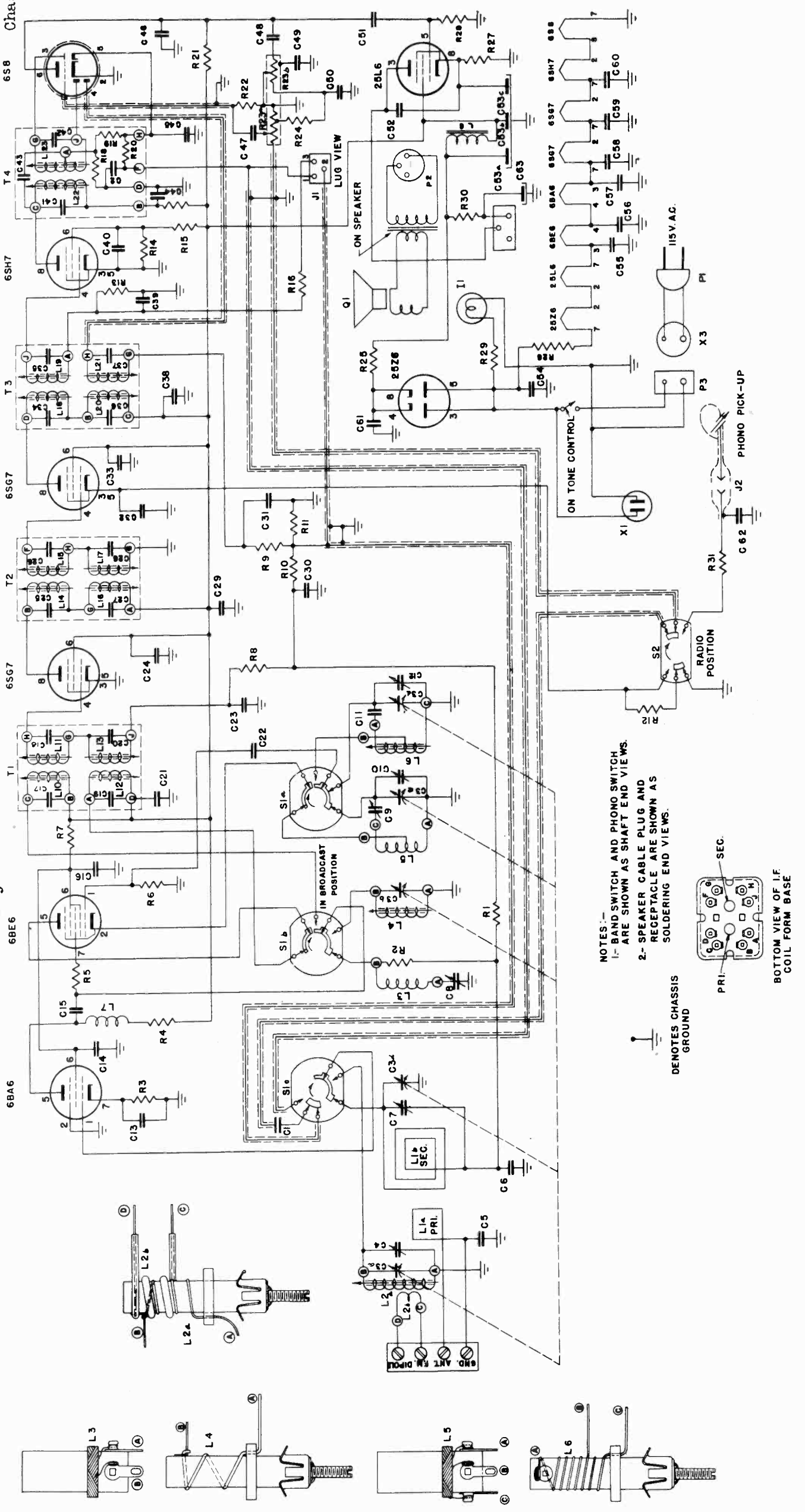
- NOTES:**
- (a) Vacuum tube voltmeter pin "A" on discriminator transformer to chassis (half discriminator load).
 - (b) Vacuum tube voltmeter pin 1 of test jack to chassis (full discriminator load).
 - (c) Vacuum tube voltmeter pin 3 of test jack to chassis (limiter grid load).
- A much more satisfactory IF and discriminator alignment may be obtained by using a 10.7 MC signal generator, frequency modulated at an audio frequency and swept approximately 600 KC (± 300 KC). An oscilloscope should be connected to test jack pin 3 and all IF slugs adjusted for a symmetrical pattern of highest amplitude. See Fig. 1. For discriminator alignment, connect oscilloscope to test jack pin 1 and adjust T4 for highest linear symmetrical pattern. See Fig. 2.

PARTS LIST

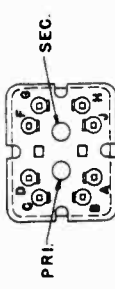
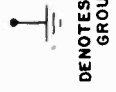
ITEM	PART NO.	DESCRIPTION	ITEM	PART NO.	DESCRIPTION
C1, C2, C39, C45	6-232	100 mmf, 500V Mica.	.R25	03-20	27 ohms, 1 watt.
C3	7-25	Gang Condenser FM-AM.	.R26	9-332	100 ohm cardohm.
C4, C10	8-35	Trimmer 2.5 - 30 mmf.	.R27	02-52	150 ohm, 1/2 watt.
C5, C23, C30, C32,			R29	02-59	220 ohm, 1/2 watt.
C49, C50	015-5	.01 mfd, 200V	.L1	S-1400	Loop Antenna Assembly
C6	015-8	.05 mfd, 200V	.L2	S-1407	F.M. Antenna Coil
C7	8-59	Trimmer 2-30 mmf.	.L3	S-1410	Wave Trap Coil
C8	8-63	Trimmer 15-115.	.L4	S-1408	FM RF coil.
C9	8-65	200 - 600 mmf Padder.	.L5	S-1411	AM Oscillator Coil.
C11	6-218	1000 mmf, 500V Mica.	.L6	S-1409	FM Oscillator Coil.
C12	8-38	Trimmer 3-13 mmf.	.L7	S-1384	RF Plate Choke.
C13, C22	6-159	47 mmf, 500V Ceramic.	.L8	S-1385	Line Choke.
C14, C15, C16, C55,			.L9	2-32	Filter Choke.
C56, C57, C63	6-230	1000 mmf 300V Ceramic	.T1	S-1389	1st IF Transformer.
C17, C41	6-247	24 mmf Ceramic, Special.	.T2	S-1390	2nd IF Transformer.
C18, C25, C26, C34, C35	6-246	33 mmf Ceramic, Special.	.T3	S-1391	3rd IF Transformer.
C19, C20, C27, C28,			T4	S-1392	Discriminator Transformer
C36, C37	6-250	750 mmf Mica, Special	.Q1	22-42	Speaker, 8" PM.
C21, C29, C38, C44, C51.	016-5	.01 mfd, 400V	.S1	11-71	Switch Shaft.
C24, C33, C40, C58,			S1a	11-71-1	Switch Wafer Section 1.
C59, C60	6-259	.005 mfd minimum disk - type Ceramic, Special	S1b	11-71-2	Switch Wafer Section 2.
C31, C46, C61	6-151	220 mmf, 500 V Mica.	.S1c	11-71-3	Switch Wafer Section 3.
C42	6-249	62 mmf Ceramic, Special	.I1, I2	26-2	Dial Lamp, Mazda #47.
C43	6-248	15 mmf Ceramic, Special	.J1	15-91	Test Jack
C47	017-2	.002 mfd, 600V.	.P1	27-201	Line Cord and Plug.
C48, C62	017-4	.005 mfd, 600V.	.P2	18-50	Plug - power connector.
C52	017-5	.01 mfd, 600V	.X1	15-137	Socket, power connector.
C53	19-44	50 mfd - 150V, 30 mfd-150V, 100 mfd 10 volt Electrolytic.		115-24	Cabinet, Table Model.
C54	016-8	.05 mfd, 400V		122-37	Escutcheon.
C64	19-32	20 mfd, 150V Electrolytic		119-244	Instruction Sheet
R1, R8, R11, R16, R21,				15-81	Tube Socket, Octal.
R28	01-199	470K ohms, 1/4 watt		15-114	Tube Socket, Miniature.
R2, R13, R17, R20	01-157	47K ohms, 1/4 watt.		16-34	Tube Socket, Miniature.
R3, R12	01-37	68 ohms, 1/4 watt.		34-20	Tube Shield, 6S8 Tube
R4, R14	02-108	3300 ohms, 1/2 watt		117-81	I.F. Coil Iron Cores, Threaded.
R5	01-3	10 ohms, 1/4 watt.		129-29	Dial Scale.
R6, R9	01-143	22K ohms, 1/4 watt.		117-84	Dial Backing.
R7	01-101	2200 ohms 1/4 watt.		134-7	Dial Spring
R10	01-227	2.2 meg ohm, 1/4 watt		135-21	Dial Cord
R15	02-132	12K ohms, 1/2 watt.		128-70	Dial Pointer.
R18, R19	01-174	120K ohms, 1/4 watt.		128-71	Knob, Volume.
R22	01-255	10 meg ohm, 1/4 watt.		128-72	Knob, Band Switch
R23	13-32	Volume - tone control with switch		128-73	Knob, Tuning.
R24	01-132	12K ohms, 1/4 watt.		148-96	Knob, Tone-on-off
					Carton with fillers

MAJESTIC RADIO & TELEV. CORP.

MODEL 8FM776
Chassis 8B07D



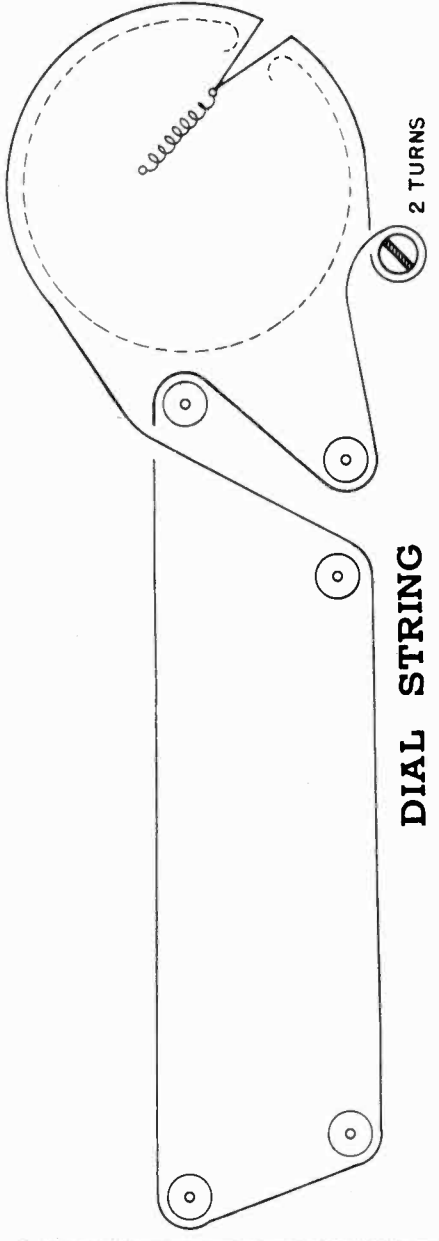
NOTES:-
1- BAND SWITCH AND PHONO SWITCH ARE SHOWN AS SHAFT END VIEWS.
2- SPEAKER CABLE PLUG AND RECEPTACLE ARE SHOWN AS SOLDERING END VIEWS.

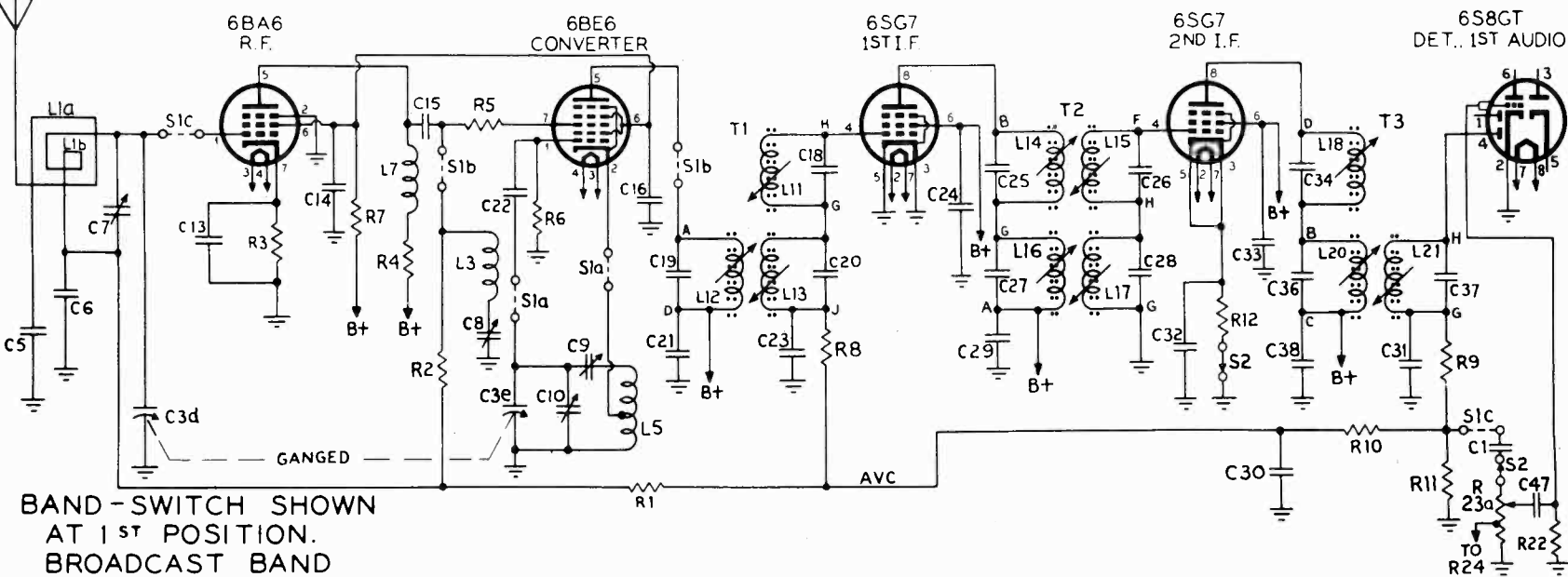


BOTTOM VIEW OF I.F. COIL FORM BASE

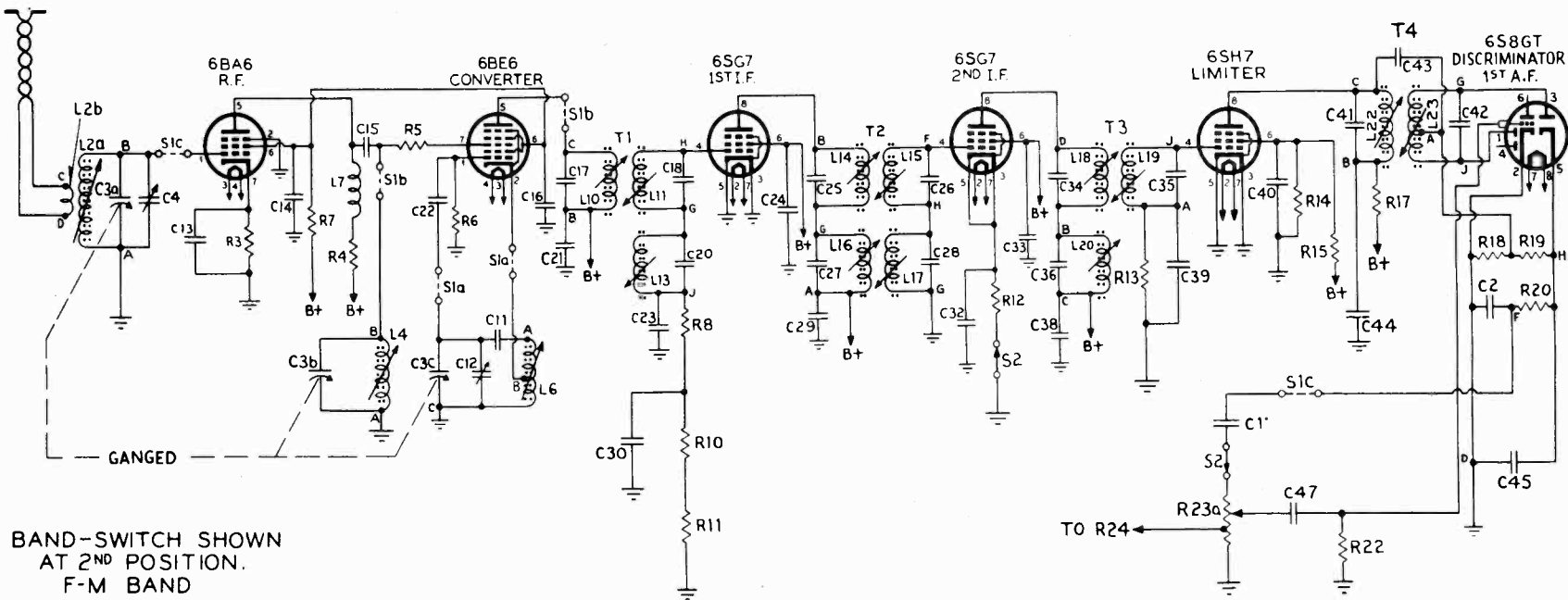
VOLTAGE TABLE

TUBE	FUNCTION	PLATE	CATHODE	SCREEN	GRID
6BA6	RF Amplifier	80	0.5	78	---
6BE6	Converter	100	0	78	---
6SG7	1st IF Amplifier	100	0	100	-0.6
6SG7	2nd IF Amplifier	100	.7	100	---
6SH7	Limiter Amplifier	70	0	21	-0.4
6S8GT	Discriminator, Det., AVC	50	0	---	---
25L6	Power Amplifier	105	7	100	---
25Z5	Rectifier	117AC	105	---	---

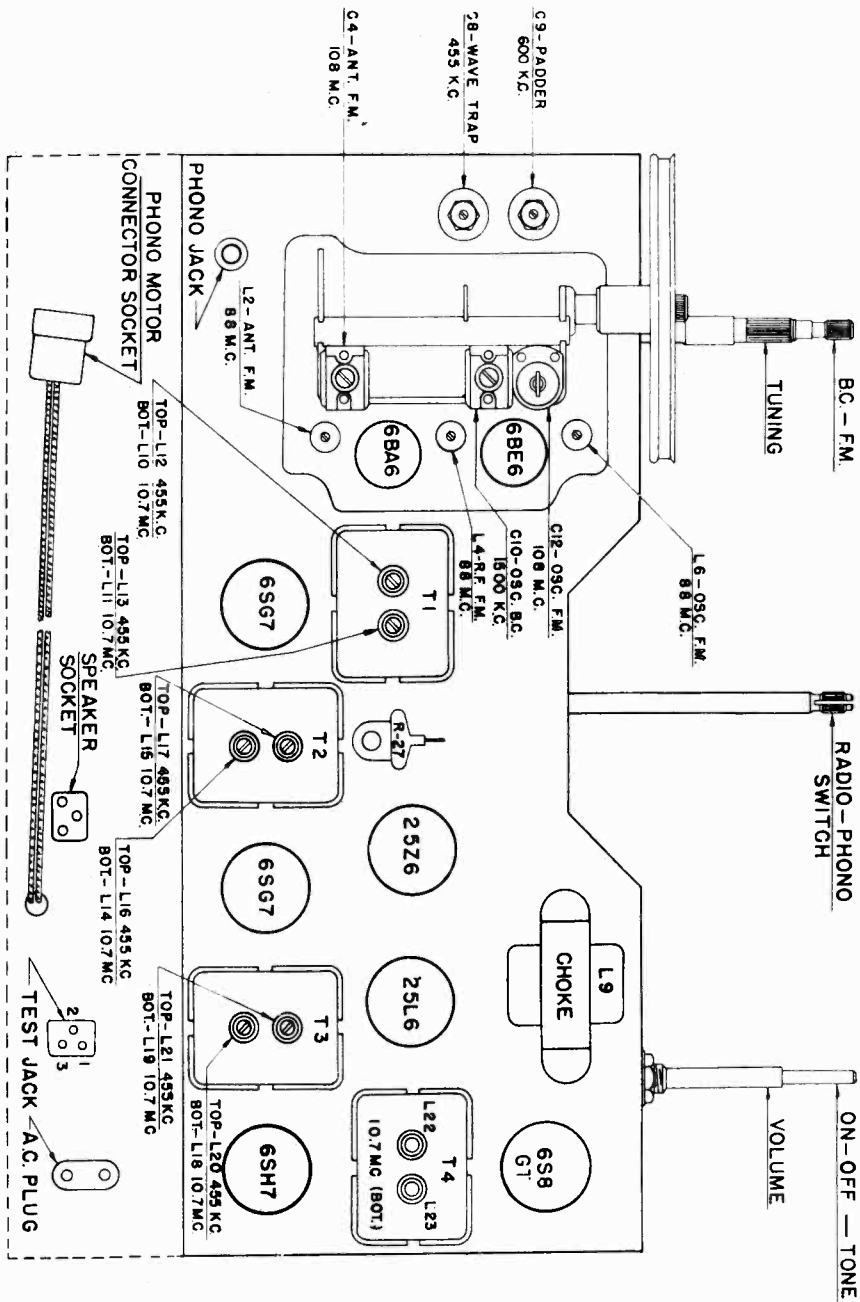




BAND-SWITCH SHOWN AT 1ST POSITION. BROADCAST BAND



BAND-SWITCH SHOWN AT 2ND POSITION. F-M BAND



TUBE LAYOUT

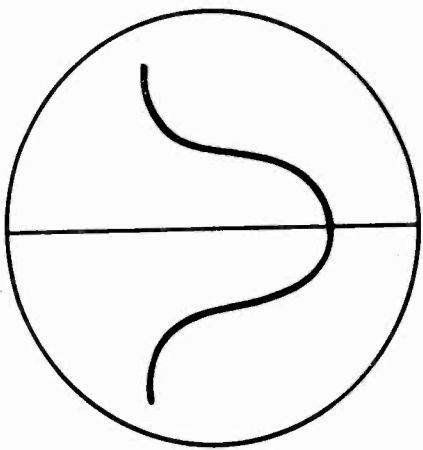


FIGURE 1

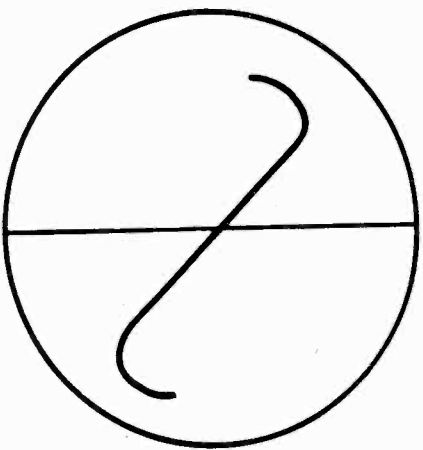


FIGURE 2

ALIGNMENT

OPERATION	CONNECT TEST OSCILLATOR TO	DUMMY ANTENNA	INPUT SIGNAL FREQUENCY	BAND	SET DIAL TO	ADJUST TRIMMERS	PURPOSE
1	Stator Plates of C3d	.05mfd.	455 KC	BC	600 KC	L12, L13, L16, L17, L20, L21	Align IF channel for maximum output.
2	Stator Plates of C3d	.05mfd.	455 KC Modulated	BC	600 KC	C8	Adjust wave trap for maximum output.
3	2 TURNS 8" DIAMETER COUPLED LOOSELY TO LOOP ANTENNA	-----	1500 KC Modulated	BC	1500 KC	C10	Set oscillator to dial scale.
4		-----	1500 KC Modulated	BC	1500 KC	C7	Align antenna for maximum output.
5	-----	-----	600 KC Modulated	BC	600 KC	C9	Rock gang to track BC padder
6(a)	Pin 4 (Grid) on 6SH7 Limiter Socket	.05mfd.	10.7 MC Unmodulated	FM	-----	L22 Coil Slug Primary Discriminator	Align Primary of discriminator for maximum reading.
7(b)	Pin 4 (Grid) on 6SH7 Limiter Socket	.05mfd.	10.7 MC Unmodulated	FM	-----	L23 Coil Slug Secondary Discriminator	Adjust secondary of discriminator for zero reading.
8(c)	Pin 4 (Grid) on 6SG7 2nd IF Socket	.05mfd.	10.7 MC Unmodulated	FM	-----	L18 and L19, Pri. and Sec. 3rd IF Coil	Align 3rd IF Transformer for maximum reading.
9(c)	Pin 4 (Grid) on 6SG7 1st IF Socket	.05mfd.	10.7 MC Unmodulated	FM	-----	L14 and L15 Pri. and Sec. 2nd IF Coil	Align 2nd IF Transformer for maximum reading.
10(c)	Lug "B" on Coil L4	.05mfd.	10.7 MC Unmodulated	FM	-----	L10 and L11 Pri. and Sec. 1st IF Coil	Align 1st IF Transformer for maximum reading.
11(c)	Antenna Terminals	300ohm Resistor	106 MC Unmodulated	FM	106 MC	C12 Oscillator Trimmer	Set oscillator to dial scale.
12(c)	Antenna Terminals	300ohm Resistor	106 MC Unmodulated	FM	106 MC	C4 Antenna Trimmer	Align antenna stage for maximum reading.
13(c)	Antenna Terminals	300ohm Resistor	88 MC Unmodulated	FM	88 MC	L6 Oscillator Slug	Set Oscillator to dial scale.
14(c)	Antenna Terminals	300ohm Resistor	88 MC Unmodulated	FM	88 MC	L4, L2 Slugs	Align Antenna and RF stages for maximum reading.
15(c)	Antenna Terminals	Repeat steps 11, 12, 13, and 14 until tracking is perfect at 88 and 106 MC.					

IMPORTANT: Alignment of this chassis will in most cases be unnecessary unless an IF or RF transformer is replaced or the adjustment has been tampered with. A vacuum tube voltmeter must be used for FM alignment. An AC output meter connected across the primary or secondary of the output transformer will be satisfactory for all AM adjustments. The signal generator output should be kept just high enough to get an indication on the meter.

- NOTES:**
- (a) Vacuum tube voltmeter pin "A" on discriminator transformer to chassis (half discriminator load).
 - (b) Vacuum tube voltmeter pin 1 of test jack to chassis (full discriminator load).
 - (c) Vacuum tube voltmeter pin 3 of test jack to chassis (limiter grid load).

A much more satisfactory IF and discriminator alignment may be obtained by using a 10.7 MC signal generator, frequency modulated at an audio frequency and swept approximately 600 KC (± 300 KC). An oscilloscope should be connected to test jack pin 3 and all IF slugs adjusted for a symmetrical pattern of highest amplitude. See Fig. 1. For discriminator alignment, connect oscilloscope to test jack pin 1 and adjust T4 for highest linear symmetrical pattern. See Fig. 2.

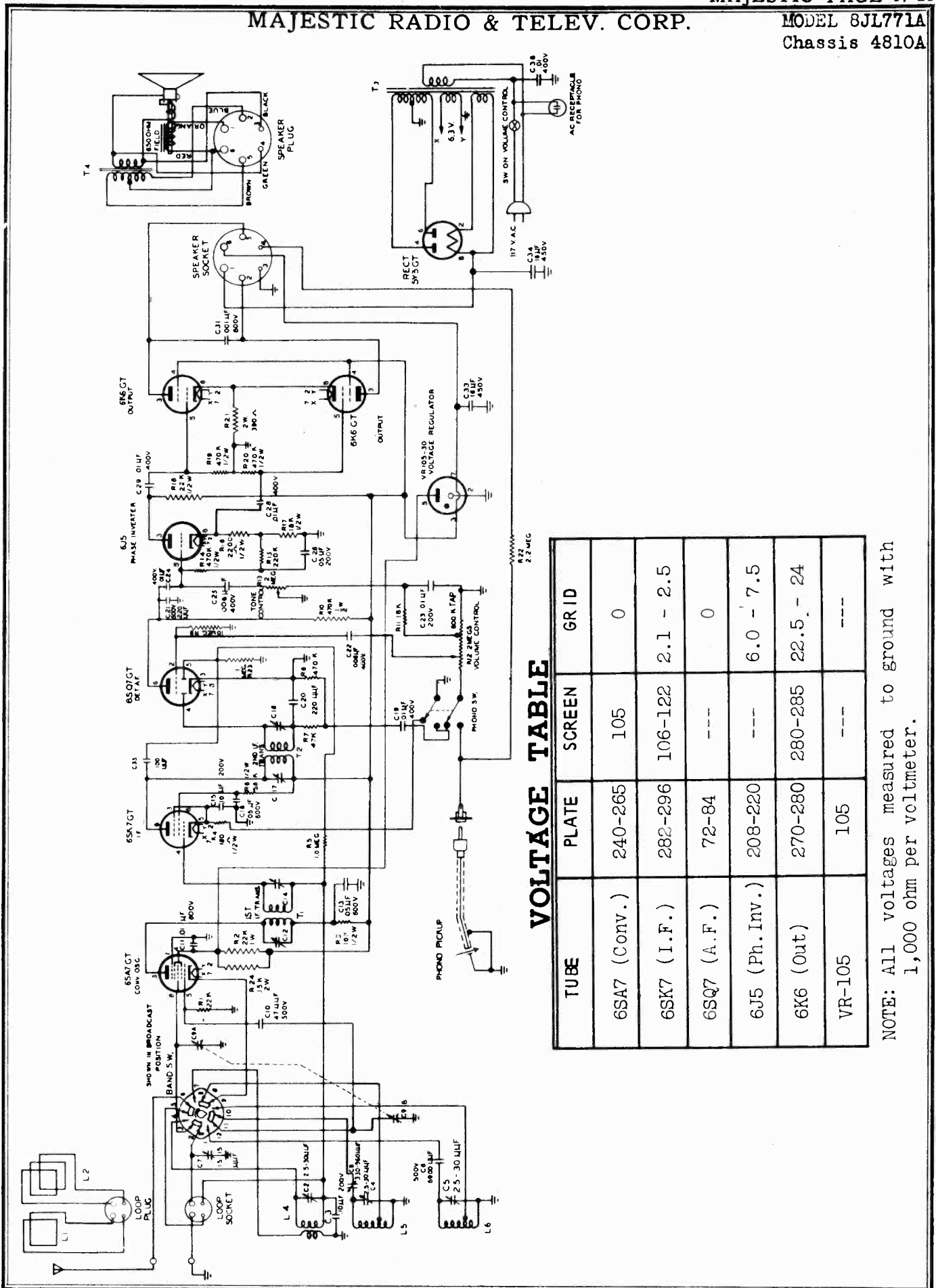
PARTS LIST

ITEM	PART NO.	DESCRIPTION	ITEM	PART NO.	DESCRIPTION
C1, C48	017-4	.005 mfd, 600V	R30	01-45	100 ohm, 1/4 watt
C2, C14, C15, C16,	6-230	1000 mmf, 300V Ceramic	L1	SL400	Loop Antenna Assembly
C55, C56, C57	7-25	Gang Tuning Condenser FM-AM.	L2	SL407	FM Antenna Coil
C3	8-35	Trimmer, 2.5 - 30 mmf.	L3	S-1410	Wave Trap Coil
C4, C10			L4	S-1408	FM RF Coil
C5, C23, C30, C32	015-5	.01 mfd, 200V.	L5	S-1411	AM Oscillator Coil
C49, C50	015-8	.05 mfd, 200V.	L6	S-1409	FM Oscillator Coil
C6, C62	8-59	Trimmer, 2-30 mmf.	L7	S-1384	R.F. Plate Choke
C7	8-63	Trimmer, 1 5-115 mmf	L8	2-32	Filter Choke
C8	8-65	200 - 600 mmf Padder	T1	S-1389	1st I.F. Transformer
C9	6-218	1000 mmf, 500V, Mica	T2	S-1390	2nd I.F. Transformer
C11	8-38	Trimmer, 3-13 mmf.	T3	S-1391	3rd I.F. Transformer
C12	6-159	47 mmf, 500V Ceramic	T4	S-1392	Discriminator Transformer
C13, C22	6-247	24 mmf, Ceramic Special.	Q1	22-45	Speaker, 10" PM
C17, C41	6-246	33 mmf, Ceramic Special.	J1	15-91	Dial Lamp
C18, C25, C26, C34, C35	6-250	750 mmf Mica Special	J2	15-87	Test Jack
C19, C20, C27, C28,	016-5	.01 mfd, 400V.	J2	11-71	Phono Jack
C36, C37	6-259	.005 mfd minimum disk-type Ceramic	S1	11-71	Switch Shaft
C21, C29, C38, C44, C51	6-151	220 mmf, 500V Mica	S1a	11-71-1	Switch Wafer, Section 1
C24, C33, C40, C58,	6-232	100 mmf, 500V Mica	S1b	11-71-2	Switch Wafer, Section 2
C59, C60	6-249	62 mmf, Ceramic, Special	S1c	11-71-3	Switch Wafer, Section 3
C31, C46, C61	6-248	15 mmf, Ceramic, Special	S2	11-72	Phono Switch
C39, C45	017-2	.002 mfd, 600V	P1	27-201	Plug and line cord
C42	017-5	.001 mfd, 600V	X1	15-123	A.C. Receptacle (Phono)
C43	19-37	100 mfd--150V, 200 mfd - 150B, 200 mfd - 10V	X2	15-91	Speaker Receptacle
C47		Electrolytic	P3	18-50	Plug, power connector
C52		.05 mfd, 400V	X3	15-137	Socket, power connector
C53		20 mfd 150V Electrolytic		18-81	Tube, Socket, Octal
C54	016-8	470K ohm, 1/4 watt		15-87	Socket, Phono Pickup
C63	19-32	47K ohm, 1/4 watt		15-114	Socket, miniature tube
R1, R8, R11, R16	01-199	68 ohm, 1/4 watt		16-34	Miniature tube shield
R2, R13, R17, R20	01-157	3300 ohm, 1/2 watt		16-39	Tube Shield, 6S8 tube
R3, R12	01-37	10 ohm, 1/4 watt		34-20	I.F. Iron Core
R4, R14	02-108	22K ohm, 1/4 watt		38-5	Insulator, Phono Pickup Socket
R5	01-3	2000 ohm, 1/4 watt		38-8	Insulator, Shaft
R6, R9	01-143	2.2 meg ohm, 1/4 watt		38-9	Insulator, Plug
R7	01-101	120K ohm, 1/4 watt		117-95	Dial Scale
R10, R31	01-227	10 meg ohm, 1/4 watt		129-21	Dial Spring
R15	02-132	Volume - Tone Control with switch.		134-7	Dial Cord
R18, R19	01-174	27 ohm, 1/2 watt		135-21	Dial Pointer
R22	01-255	100 ohm cardohm.		21-24	Oak Record Changer
R23	03-32	150 ohm, 1/2 watt.		115-37-1	Cabinet, Oak Cut-out
R24	01-132	390 ohm, 2 watt.		122-37	Escutcheon
R25	02-20			123-28	Back, Cabinet
R26	9-332			128-70	Knob (Volume)
R27	02-52			128-71	Knob (band switch) (Phono-Radio)
R29	04-69			128-72	Knob (Tuning)
				128-73	Knob (Tone, On-Off)
				128-76	Knob (Dummy)
				148-97	Carton and fillers
				19-262	Instruction Sheet

MAJESTIC RADIO & TELEV. CORP.

MODEL 8JL771A

Chassis 4810A

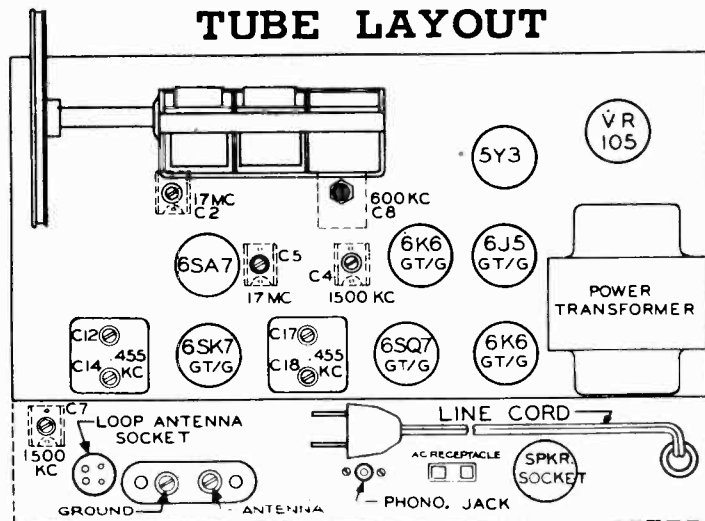


VOLTAGE TABLE

TUBE	PLATE	SCREEN	GRID
6SA7 (Conv.)	240-265	105	0
6SK7 (I.F.)	282-296	106-122	2.1 - 2.5
6SQ7 (A.F.)	72-84	---	0
6J5 (Ph. Inv.)	208-220	---	6.0 - 7.5
6K6 (Out)	270-280	280-285	22.5 - 24
VR-105	105	---	---

NOTE: All voltages measured to ground with 1,000 ohm per voltmeter.

TUBE LAYOUT



ALIGNMENT

Before aligning, close tuning condenser (plates fully meshed). Set pointer to center of extreme left hand mark on the dial.

When aligning broadcast band, connect to output of the signal generator a loop, about 12 inches in diameter, consisting of two or three turns of wire. Place this loop in a plane parallel to that of the receiver loop antenna and about a foot away from it. The receiver loop antenna should be in about the same portion relative to the chassis as it is when installed in the cabinet.

While aligning, turn the volume control full on and keep the signal generator output as low as possible.

STEP	DUMMY ANTENNA	TEST OSCILLATOR CONNECTION	TEST OSCILLATOR FREQUENCY	RECEIVER BAND-SWITCH	RE-CEIVER DIAL	ADJUST FOR MAXIMUM	NOTES
1	.01 mfd	6SA7 grid	455 KC	BC	Any quiet spot	C18, C17 C14, C12	-----
2	Loop	-----	1500 KC	BC	150	C4, C7	-----
3	Loop	-----	600 KC	BC	60	C8	Note #1
4	400 ohms	Receiver antenna post	17 MC	SW	17	C2, C5	-----

Note #1 - Rock gang while making this adjustment. Then recheck step 2.

MODEL 8JL771A

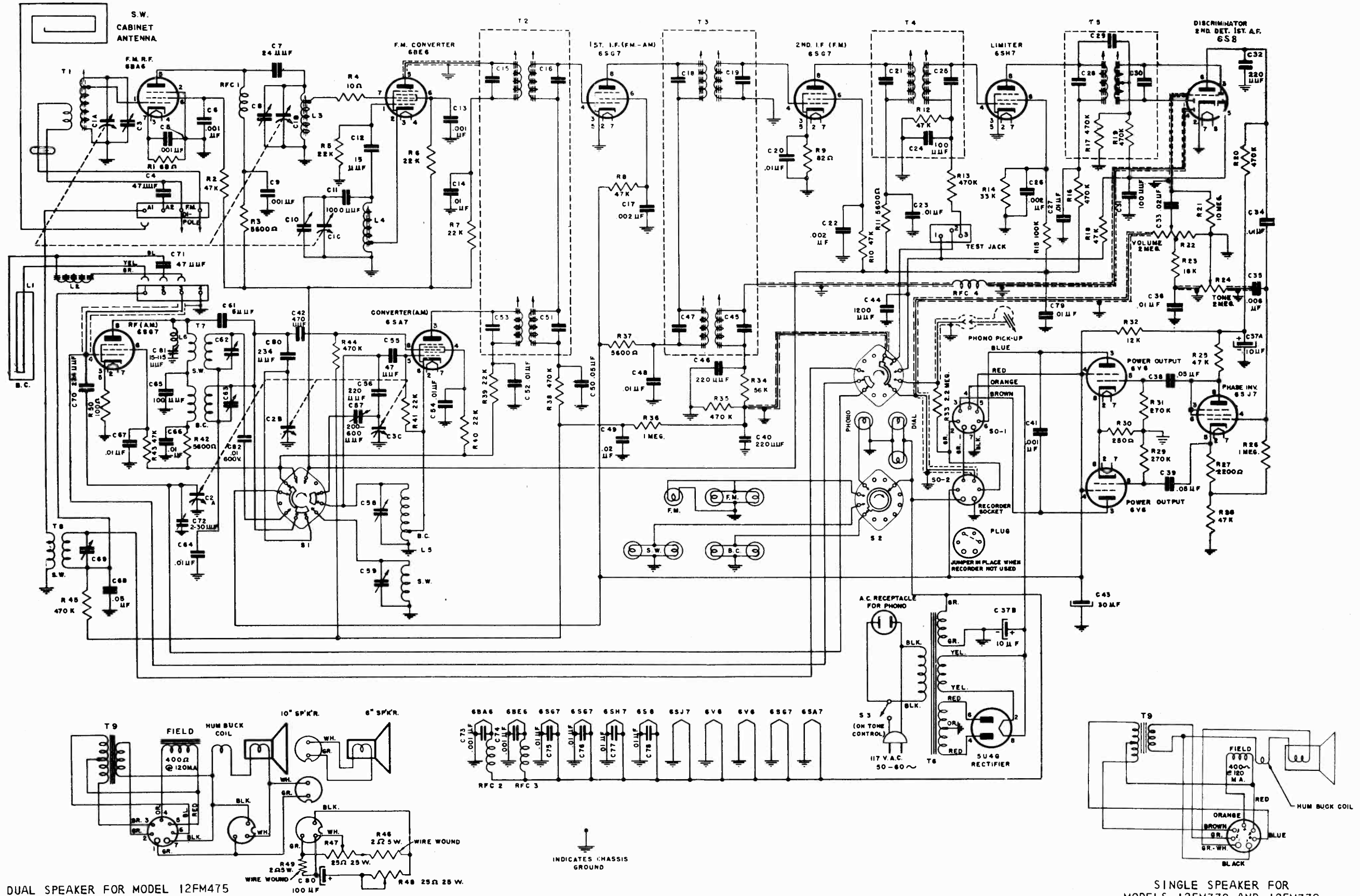
MAJESTIC RADIO & TELEV. CORP.

PARTS LIST

ITEM	PART NO.	DESCRIPTION	ITEM	PART NO.	DESCRIPTION
C2, C4, C5	8-35	Trimmer, 2.5 - 30 mmfd	R18	9-180	22,000 ohms 10% 1/2 watt
C3, C15	5-39	.1 mfd ± 40% - 10% 200 v paper	R21	9-185	390 ohms 10% 2 watt.
C6	6-177	6900 mmfd ± 10% 500 v mica	R22	9-296	2.2 megohms 20% 1/4 watt
C7	8-36	Trimmer, 1.5 - 15 mmfd	R24	9-299	15,000 ohms 20% 2 watt
C8	8-33	Padder, 330 - 960 mmfd	L4	3-120	S.W. antenna coil.
C9a, C9b, C9c	7-22 or 7-23	Tuning Condenser	L5, L6	3-118	Oscillator coil.
C10	6-159	47 mmfd ± 20% 500 v ceramic.	T1	3-165	1st I-F transformer.
C11	5-74	.01 mfd 20% 600 v paper.	T2	3-166	2nd I-F transformer.
C19, C24, C28	6-132	.01 mfd ± 30% - 10% 400 v paper.	T3	2-12	Power transformer.
C29, C36	8-41	Dual trimmer	T4	22-8-2	Output transformer
C12, C14, C17, C18	5-77	.05 mfd 20% 600 v paper.		11-46 or 11-64	Bandswitch
C13, C16	6-151	220 mmfd ± 20% mica		11-45 or 11-63	Phono-Radio Switch.
C20, C21	6-133	.006 mfd ± 20% 400 v paper		15-98	Phono-motor receptacle.
C22, C25	5-57	.01 mfd ± 40% - 10% 200 v paper.		26-7	Pilot light, Mazda #44.
C23	5-40	.05 mfd ± 40% - 10% 200 v paper.		135-29	Dial pointer.
C26	5-79	.001 mfd ± 50% -25% 600 v paper.		129-29	Dial cord spring.
C30, C31, C32	19-16	16-16 mfd 450 v electrolytic		S-1263	Dial cord
C33, C34	6-232	100 mmfd ± 20% 500 v mica.		128-45	Knob, phono-radio
C35	9-222	22,000 ohms 20% 1/4 watt		128-46	Knob, off-volume.
R1	9-186	22,000 ohms 10% 1 watt		128-47	Knob, B.C. - S.W.
R2	9-17	10,000 ohms 10% 1/2 watt		128-48	Knob, bass-treble
R3	9-272	180 ohms 10% 1/2 watt.		128-49	Knob, tuning.
R4	9-255	1 megohm 20% 1/4 watt.		128-32	Knob, plain
R5, R23	9-177	56,000 ohms 10% 1/2 watt		20-8	Loop antenna assembly
R6	9-226	47,000 ohms 10% 1/4 watt		21-26	Record changer, aero
R7	9-227	470,000 ohms 10% 1/4 watt.		22-46	Speaker, with output transformer
R8	9-213	10 megohms 20% 1/4 watt.		22-46-1	Output transformer.
R9	9-234	470,000 ohms 10% 1/2 watt.		115-35	Cabinet, console combination
R10, R14, R19, R20	9-225	18,000 ohms 10% 1/4 watt		122-42	Escutcheon, including glass
R11	13-15	Volume control, 2 megohm with SPST switch		117-92	Dial scale glass.
R12	14-4	Tone control, 2 megohms.		148-98	Carton, with fillers.
R13	9-220	220,000 ohms 20% 1/4 watt.			
R15	9-107	2200 ohms 10% 1/2 watt			
R16	9-95	18,000 ohms 10% 1/2 watt			
R17					

MAJESTIC RADIO & TELEV. CORP.

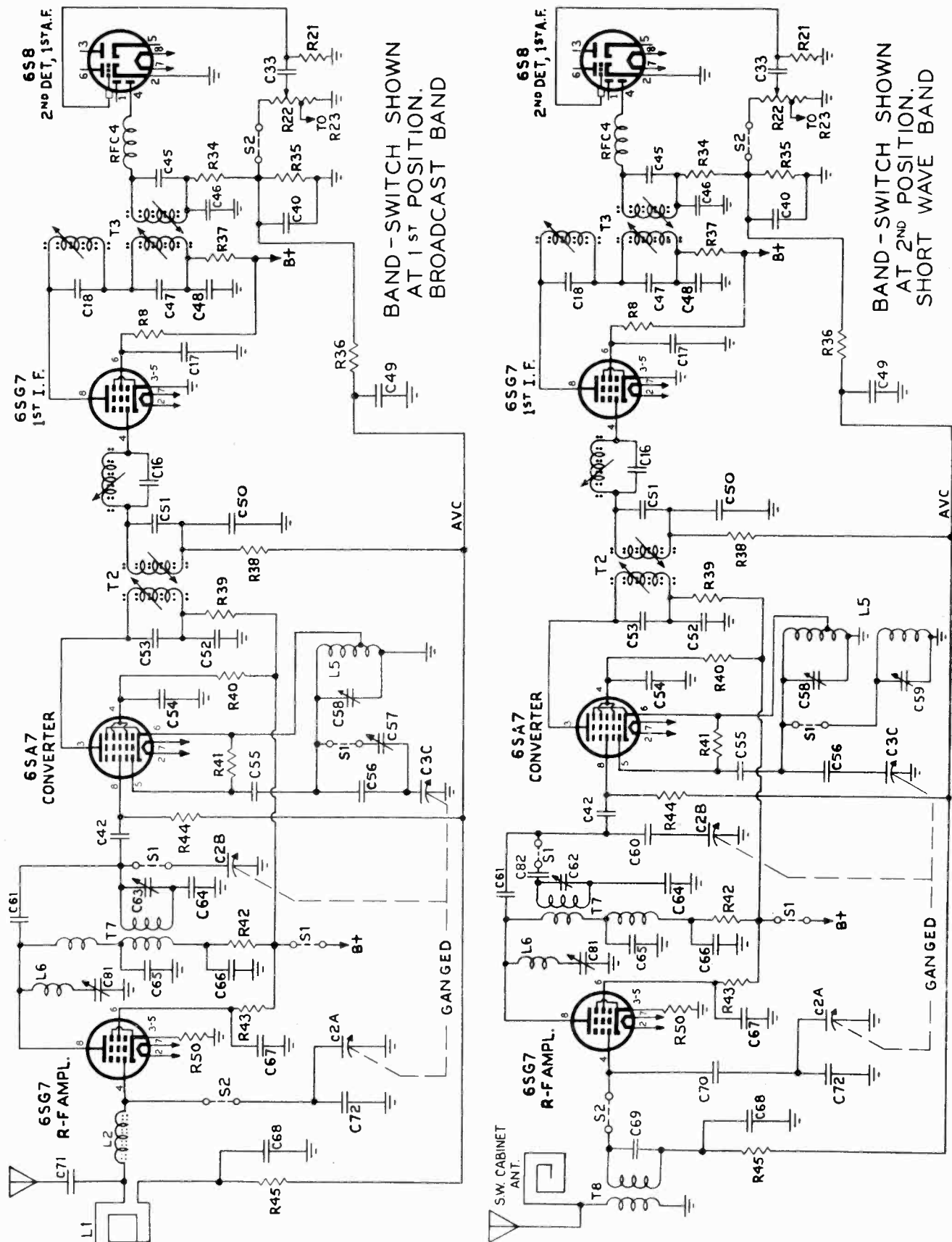
MODEL 12FM475, Chassis 41201
MODELS 12FM778, 12FM779, Chassis 12B26E



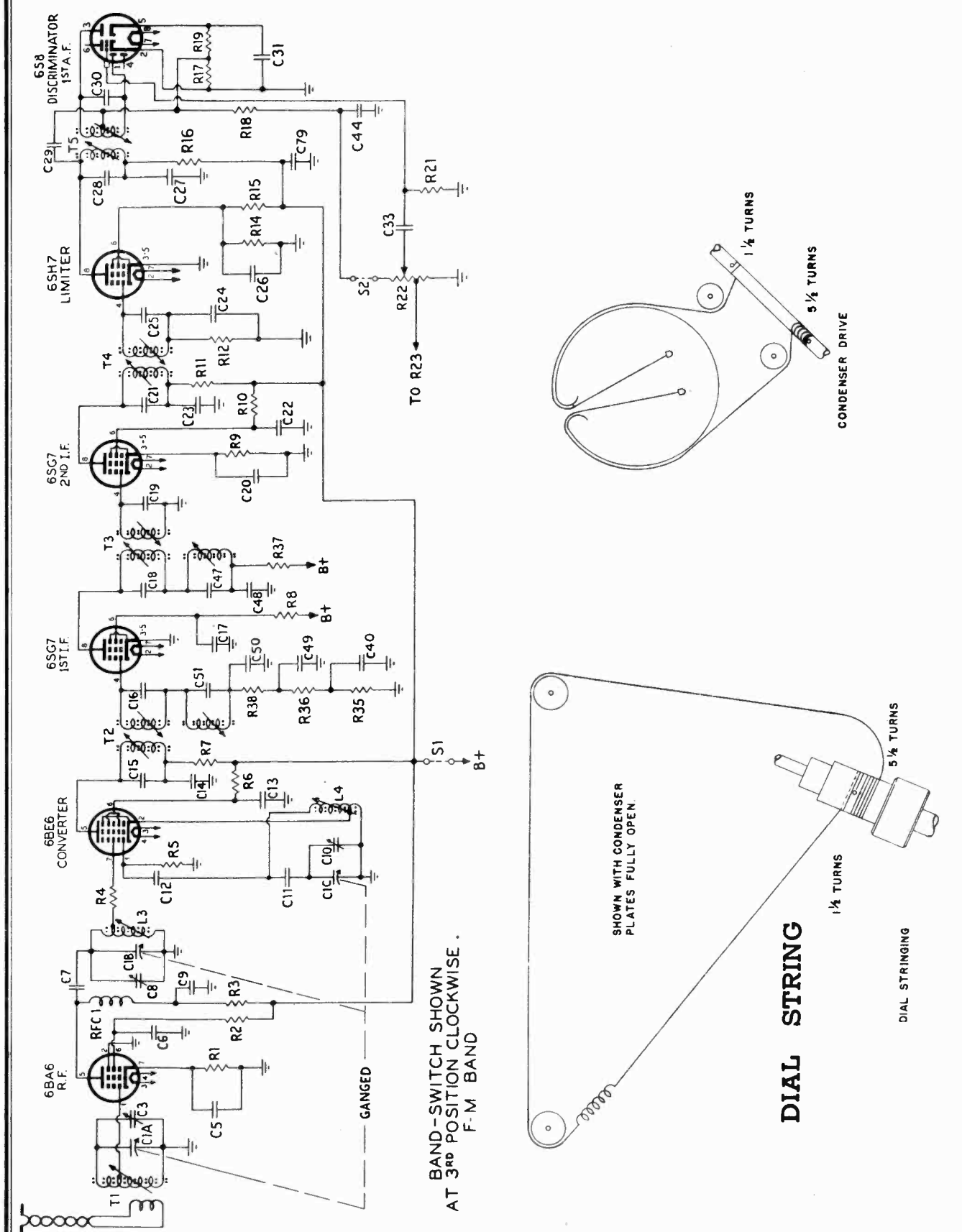
DUAL SPEAKER FOR MODEL 12FM475

SINGLE SPEAKER FOR MODELS 12FM778 AND 12FM779

"clarified schematics"



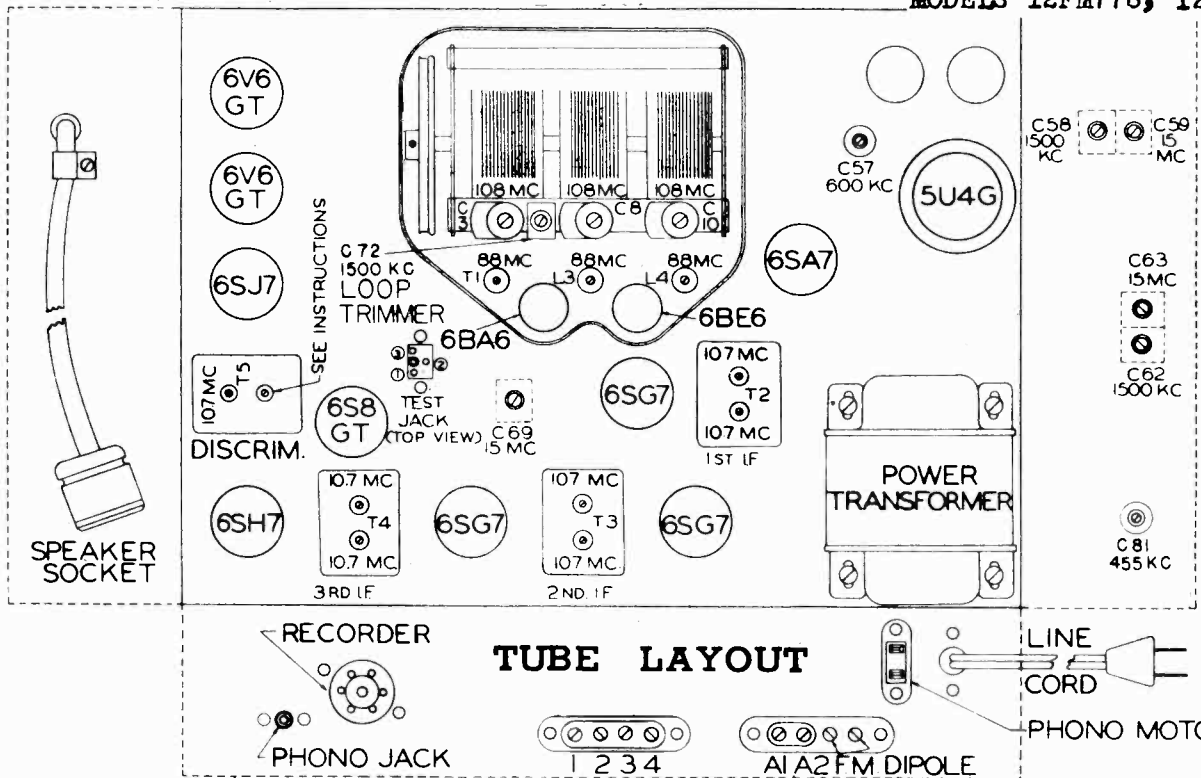
"clarified schematics"



MAJESTIC RADIO & TELEV. CORP.

MODEL 12FM475

MODELS 12FM778, 12FM779

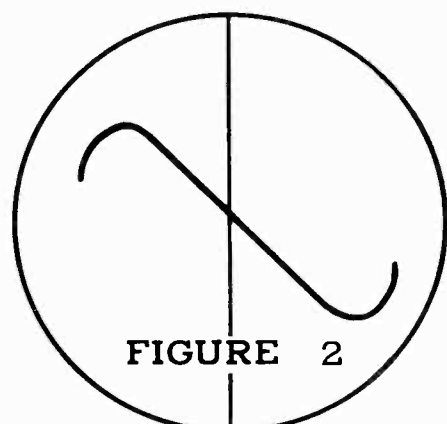
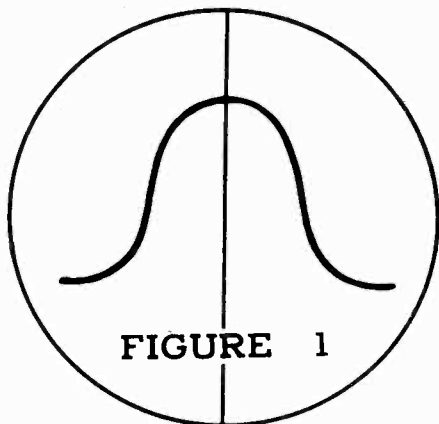


VOLTAGE TABLE

Measurements made at 117 volts line; volume control at minimum; zero signal input. Measurements made to chassis ground with vacuum tube voltmeter.

FUNCTION	TYPE	E_F	E_P	E_S	E_K	E_G
FM RF AMP.	6BA6	6.3	210	90	1	0
FM CONVERTER	6BE6	6.3	210	100	0	0
AM RF AMP.	6SG7	6.3	260	180	1	-1
AM CONVERTER	6SA7	6.3	250	90	0	---
1ST IF AMP.	6SG7	6.3	240	125	0	-1
2ND IF AMP.	6SG7	6.3	240	125	1	0
LIMITER	6SH7	6.3	3	60	0	-.6
DISC.; 2ND AMDET: AUDIO	6S8GT	6.3	80	---	0	-.8
PHASE INVERTER	6S7	6.3	160	---	80	0
POWER AMP.	6V6GT	6.3	260	270	15	
POWER AMP.	6V6GT	6.3	260	270	15	
RECTIFIER	5V4G	5	---	---	300	

TOTAL B CURRENT FROM RECTIFIER 120 MA.



MODEL 12FM475

MAJESTIC RADIO & TELEV. CORP.

MODELS 12FM778, 12FM779

OPERATION		CONNECT OSCILLATOR TO	DUMMY ANTENNA	INPUT SIGNAL FREQUENCY	BAND	SET DIAL AT	TRIMMERS	PURPOSE
1		Conv. Grid	.01mfd	455 KC	BC	600 KC	T2, T3 Bottom	Align I.F.'s
2		ONE TURN LOOP MADE WITH GENERATOR LEADS		455 KC	BC	600KC	C81	I.F. trap adjustment for minimum I.F. signal
3	1500 KC			BC	1500 KC	C58	Set BC osc. to scale at 1500 KC	
4	1500 KC			BC	1500 KC	C63, C72	Align BC RF. and Loop	
5	600 KC			BC	600 KC	C57	Rock Gang to track BC padder	
6	AI-Gnd.			400ohn	15 MC	15 MC	C59	Scale osc. at 15 MC
7	AI-Gnd.	400ohn	15 MC	15 MC	C62, C69	Align SW RF and Ant.		
8	6SQ7 2nd I.F. Grid	.01mfd.	10.7 MC	FM	88 MC	T4 top	Align for max. voltage at test jack pin 3 Rock gen. over 10.7 MC to check for symmetrical I.F. response.	
9	6SQ7 1st. I.F. Grid	.01mfd.	10.7 MC	FM	88 MC	T3 top	Align for max. voltage at test jack pin 3 Rock gen. over 10.7 MC to check for symmetrical I.F. response.	
10	Converter	.01mfd.	10.7 MC	FM	88 MC	T2 top	Align for max. voltage at test jack pin 3 Rock gen. over 10.7 MC to check for symmetrical I.F. response. Re-check peaking of T4, and T3.	
11	Converter Grid 6BE5	.01mfd.	10.7 MC	FM	88 MC	T5 primary	Align for max. voltage across discriminator load (un-used Lug bottom of T5 to ground)	
12	Converter Grid 6BE6	.01mfd.	10.7 MC	FM	88 MC	T5 secondary	Align for zero voltage across full discriminator load (Test jack pin 1 to ground)	
13	FM ant. term.	direct	108 MC	FM	108 MC	C10	Scale OSC at 108 MC (max. voltage Test jack pin 3.	
14	FM ant. term.	direct	108 MC	FM	108 MC	C8, C3	Align FM RF and Ant. (max. voltage Test jack pin 3.	
15	FM ant. term.	direct	88 MC	FM	88 MC	L4	Scale osc. at 88 MC.	
16	FM ant. term.	direct	88 MC	FM	88 MC	L3, T1	Align RF and Ant. at 88 MC repeat steps 13, 14, 15, 16 as necessary.	

NOTE: 1.

A much more satisfactory IF and discriminator alignment may be obtained by using a 10.7 MC Signal generator frequency modulated at an audio frequency and swept approximately 600 KC (±300 KC). An oscilloscope should be connected to Test jack pin 3 and all IF screws adjusted for a symmetrical pattern of highest amplitude. See FIG. 1. For discriminator alignment, connect scope to Test jack pin 1 and adjust T5 for highest symmetrical pattern. See FIG. 2.

NOTE: 2.
In all FM alignment calling for a voltage measurement at Test jack pin 3 (limiter grid resistor) keep signal generator output to such a value as will result in approximately 2 volts measured with a vacuum Tube voltmeter such as the Voltomyst, Vomax or equiv.

MAJESTIC RADIO & TELEV. CORP.

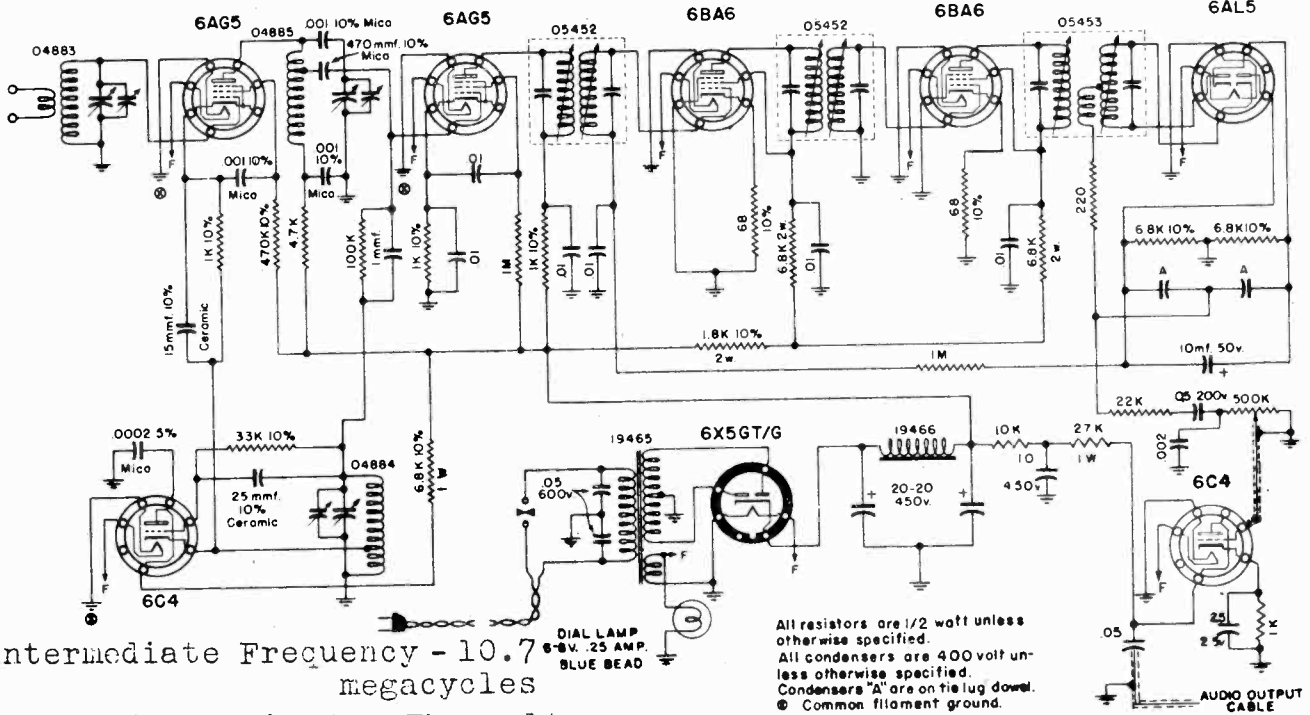
MODEL 12FM475

MODELS 12FM778,

12FM779

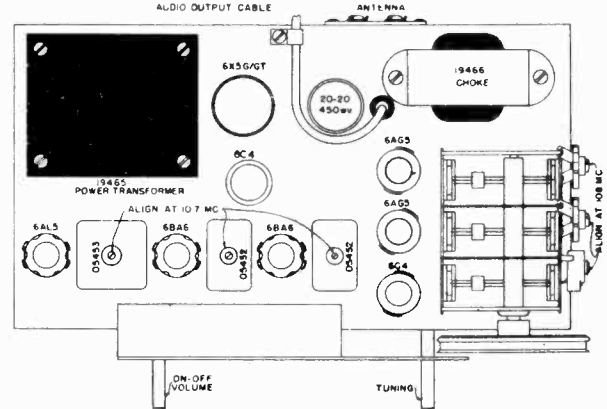
ITEM	PART NO.	DESCRIPTION		13-25	Volume Control, 2 megohms.
C1, C2	7-17	Ganged Tuning Condenser.	R22	9-225	18,000 ohms 1/4 watt
C3, C8, C10	8-38	Trimmer, 3-5 mmf.	R24	14-7	Tone control, 2 megohms, with switch
C4, C55, C71	6-159	47 mmf, 500V, ceramic.	R26, R36	9-255	1 megohm 1/4 watt.
C5, C6, C9	6-230	.001 mfd., 400V, ceramic	R27, R31	9-295	270,000 ohms 1/4 watt.
C7	6-230	24 mmf, 500V ceramic	R30	9-296	12,000 ohms 1/2 watt
C11	6-218	1000 mmf. 500V Mica.	R33	9-240	2.2 megohms 1/2 watt
C12	6-199	15 mmf. 500V ceramic	R50	01-44	56k ohms 1/4 watt
C14, C23, C27, C34, C48, C52, C54, C66, C67	5-74	.01 mfd 600V	RFC2, RFC3	3-187	6BA6 plate choke
C15, C16, C51	...	Part of 1st. IF transformer, T2.	RFC4	3-104	Filament chokes
C53	6-231	.002 mfd. 400V Ceramic	S1	11-58	Diode plate choke.
C17, C22, C26	...	Part of 2nd IF transformer, T3	S2	11-59	Band switch (r.f.)
C18, C19, C45, C47	...	Part of 3rd. IF transformer, T4.	S3	...	Band switch (pilot lights and audio)
C21, C24, C25	6-232	100 mmf. 500V Mica	T1	3-183	F.M. Ant. transformer
C28, C29, C30	6-86	.02 mfd. 500V	T2	3-173	1st IF transformer
C31	5-63	.006 mfd. 600V	T3	3-174	2nd IF transformer
C32, C40, C46	5-69	10-10 mfd. 450V Electrolytic	T4	3-175	3rd IF transformer
C33, C49	19-34	.05 mfd. 600V	T5	3-176	Discriminator transformer.
C35	5-77	470 mmf. Mica 500V	T6	2-19	Power transformer
C37A, C37B	6-102	30 mfd. 450 V. Electrolytic	T7	3-186	B. C. and S. W. R. F. Transformer.
C38, C39	19-35	220 mmf. 2 1/2 500V. Ceramic.	T8	3-185	S.W. Ant. transformer
C42	6-207	200-600 Powder	T9	15-87	phone pickup socket.
C43	6-234	Part of coil assembly L5		16-98	A.C. receptacle (phono).
C44	6-207	Part of coil assembly T7		26-7	pilot lamp #44 blue bevel.
C58, C59	6-85	Part of coil assembly T8		28-2	pilot lamp #47 brown bevel
C61, C62, C63, C65	...	Trimmer 2 1/2 30 mmf. ceramic		9-1277	condenser push rod
C69	...	10mfd. 500V Mica.		129-46	tension spring, dial
C72	...	15-115 mmf. Trimmer (Wave Trap).		134-7	dial cord, silk.
C75, C76, C77, C78	...	Broadcast Loop Antenna		135-4	dial pointer
C81	...	FM RF Coil		117-63	dial plate FM.
L1	...	AM Oscillator Coil	C80	117-61	dial plate BC 41201 chassis
L2	...	Wave Trap Coil Assembly	R46	117-90	dial plate BC 12B26E chassis
L3	...	68 ohms 1/4 watt	R47, R48	117-82	dial plate SW 41201 chassis
L4	...	5600 ohms 1 watt		117-91	dial plate SW 12B26E chassis
L5	...	10 ohms 1/4 watt		100 MF 10V electrolytic Model 12FM475	100 MF 10V electrolytic Model 12FM475
L6	...	22,000 ohms 1/4 watt		2 ohm 5 watt wirewound, Model 12FM475	Potentiometer, 25 ohm, 25 watt, Model 12FM475
R1	...	47,000 ohms 1/2 watt		6" speaker, P.M. Model 12FM475	6" speaker, P.M. Model 12FM475
R2	...	47,000 ohms (Part of T4)		10" speaker with output transformer and cable	10" speaker with output transformer and cable
R3, R11, R37, R42	...	470,000 ohms 1/4 watt.		Model 12FM475.	Model 12FM475.
R5, R41	...	33,000 ohms 1/2 watt		Model 12FM778--12FM779	Model 12FM778--12FM779
R6, R40	...	100,000 ohms 1/2 watt.		Output transformer Model 12FM475	Output transformer Model 12FM475
R7, R39	...	470,000 ohms 1/2 watt.		Cabinet Model 12FM475	Cabinet Model 12FM475
R8, R10, R25, R28, R43	...	47,000 ohms (part of T5)		Cabinet Model 12FM778	Cabinet Model 12FM778
R9	...	47,000 ohms 1/4 watt.		Cabinet Model 12FM779	Cabinet Model 12FM779
R12	...	47,000 ohms 1/2 watt		Dial grill Model 12FM475	Dial grill Model 12FM475
R13, R20, R35, R38, R44, R45	...	470,000 ohms 1/4 watt.		Dial grill Model 12FM778--12FM779	Dial grill Model 12FM778--12FM779
R14	...	33,000 ohms 1/2 watt		Record changer VM 400	Record changer VM 400
R15	...	100,000 ohms 1/2 watt.		Escutcheon glass all Models.	Escutcheon glass all Models.
R16	...	470,000 ohms 1/2 watt.		Push button assembly - all Models.	Push button assembly - all Models.
R17, R19	...	470,000 ohms (part of T5)		Push button Base escutcheon - all Models	Push button Base escutcheon - all Models
R18	...	47,000 ohms 1/4 watt		Dial masking plate - all Models.	Dial masking plate - all Models.
R21	...	10 megohms 1/4 watt.		Knob - "Acoustio Blender" Model 12FM475.	Knob - "Acoustio Blender" Model 12FM475.
				Knob Band Switch all Models.	Knob Band Switch all Models.
				Knob Tone, Tuning, volume all Models	Knob Tone, Tuning, volume all Models
				Spring Band Switch Knob.	Spring Band Switch Knob.
				R.F. Shelf Assy.	R.F. Shelf Assy.

MEISSNER MFG. DIV.
MAGUIRE INDUSTRIES, INC.



Intermediate Frequency - 10.7 megacycles

Voltage Chart - The voltages tabulated in the table below are the correct voltages which should be measured between the socket terminal and chassis with nominal line voltage and no signal. All voltages measured with a high impedance voltmeter. Allowance should be made for loading if a low impedance voltmeter is used for checking.



Power consumption - 35 watts

VOLTAGE CHART

Terminal Number	1	2	3	4	5	6	7	8
6AG5 1st Converter	0	2.1	6.3V RMS	0	260	63	2.1	
6AG5 2nd Converter	0	1.2	6.3V RMS	0	270	37	1.2	
6C4 Oscillator	184	0	6.3V RMS	0	184	—	0	
6BA6 1st I.F. Amp	-0.4	0	6.3V RMS	0	95	95	0.95	
6BA6 2nd I.F. Amp	0	0	6.3V RMS	0	84	84	0.95	
6AL5 Detector	0	0	6.3V RMS	0	0	0	0	
6C4 Audio	105	0	6.3V RMS	0	150	0	3.4	
6X5GT/G Rectifier	NC	0	240V RMS	Tie Point	240V RMS	Tie Point	6.3V RMS	287

MODEL 8-C

MEISSNER MFG. DIV.
MAGUIRE INDUSTRIES, INC.

POWER SUPPLY

Connections: This receptor must be operated on 105 - 125 volt, 50 or 60 cycle A.C. supply only.

The power cord may be inserted in the line receptacle in either one of two ways, but a reversal should be tried for any possible hum reduction during reception.

CONNECTIONS TO AN A.C.
RECEIVER

Although the receptor will operate with any radio receiver, large or small, that has terminals for a phonograph pickup, the audio quality inherent in the Frequency Modulation System will be more apparent when it is used with a regular type radio receiver having a large speaker and baffle as well as a good audio amplifier. The shielded rubber-covered lead from the receptor carries the audio output of the unit and is to be connected to the phonograph input terminals of the receiver.

Various input arrangements to the audio amplifier will be encountered in receivers of different manufacture, such as jacks of various types, terminal strips and binding posts. Your dealer will be able to supply an appropriate plug to make connections with the jack on your set. For instance, if the radio with which it is to be used is provided with a phonograph "jack", the corresponding type "plug" should be connected to the shielded lead, the outside metal shielding being connected to the frame of the plug and the inside insulated wire being connected to the

high-potential (tip) side of the plug. With the receptor placed conveniently close to the receiver, the phonograph plug may be inserted and the receptor is ready for use. When terminal strips or binding posts are used, the shielded lead from the receptor connects directly to these points without additional parts. In all cases, the outside shielding connects to the terminal which connects directly (or through a coupling condenser) to the chassis.

If your receiver has no "Phono" or "Television Sound" terminals, the additional switch and terminals can easily be installed by any competent radio service man.

CONNECTIONS TO A.C.-D.C.
RECEIVER

This receptor is not recommended for use with any A.C.-D.C. receiver because of the hazards involved in connecting this unit to an A.C.-D.C. set and because of almost insurmountable hum troubles on such sets.

OPERATING THE RECEPTOR

Turn the left hand control knob clockwise till the click is heard and the dial scale is illuminated. The radio receiver to which the receptor is connected must also be turned on, switched to the "Phonograph" position, and its volume control well advanced. Allow period of about 30 seconds warm-up time. Now with the receptor volume control turned counterclockwise, advance the volume control on

**MEISSNER MFG. DIV.
MAGUIRE INDUSTRIES, INC.**

MODEL 8-C

the radio receiver until the hum level can be heard, but not far enough that the hum level is objectionable. This is the correct operating point for the receiver volume control and it should be returned to approximately this setting whenever the receptor is used. If the above procedure is not used for determining the correct setting of the radio receiver volume control, then unsatisfactory reception may result due to overload and distortion in the receptor. Stations are selected by the right hand or tuning knob. Proper tuning will be accomplished when maximum volume level and maximum noise reduction have been attained. Although these points are very nearly coincident, tuning should always be accomplished by tuning for the "no noise" point after the maximum volume point has been located.

It is characteristic of F.M. receptors using the "ratio detector" system to show three points of tuning, located very close together on the dial, for each station. Only the center point of these three points will give best noise reduction and this is the one that should always be chosen.

NORMAL CARE AND MAINTENANCE

No maintenance of this receptor should be necessary except when poor performance indicates the deterioration of tubes or components. In case poor performance indicates the tubes and components should be checked, it should be done only by a competent service man who is equipped for the servicing of F.M. equipment.

ALIGNMENT

The equipment required for proper alignment of this receptor is an unmodulated R.F. signal generator which will cover 10.7 megacycles and a range of 88 to 108 megacycles, and a D.C. voltmeter having a low range of 1 to 5 volts D.C.

Connect the positive lead of the D.C. voltmeter to pin #5 of the 6AL5 detector tube and the negative lead to pin #7 of the 6AL5. Apply an unmodulated 10.7 megacycle signal to the grid of the second 6BA6 I.F. amplifier tube, through an .05 microfarad coupling condenser. Tune the bottom adjustment screw of the detector coil for maximum indication on the D.C. voltmeter. This completes this part of the adjustment. Next, locate the 22,000 ohm resistor which is in series with the audio lead from the detector coil. Connect the negative lead of the D.C. voltmeter to the junction of this 22,000 ohm resistor and a 200 ohm resistor. Connect the positive lead of the voltmeter to the receptor chassis. With the 10.7 megacycle 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.

I.F. ALIGNMENT

Without changing the signal generator frequency, introduce the 10.7 megacycle signal at a relatively high level into the antenna terminals. Connect the D.C. voltmeter between pins #5 and 7 of the 6AL5 detector tube. Ro-

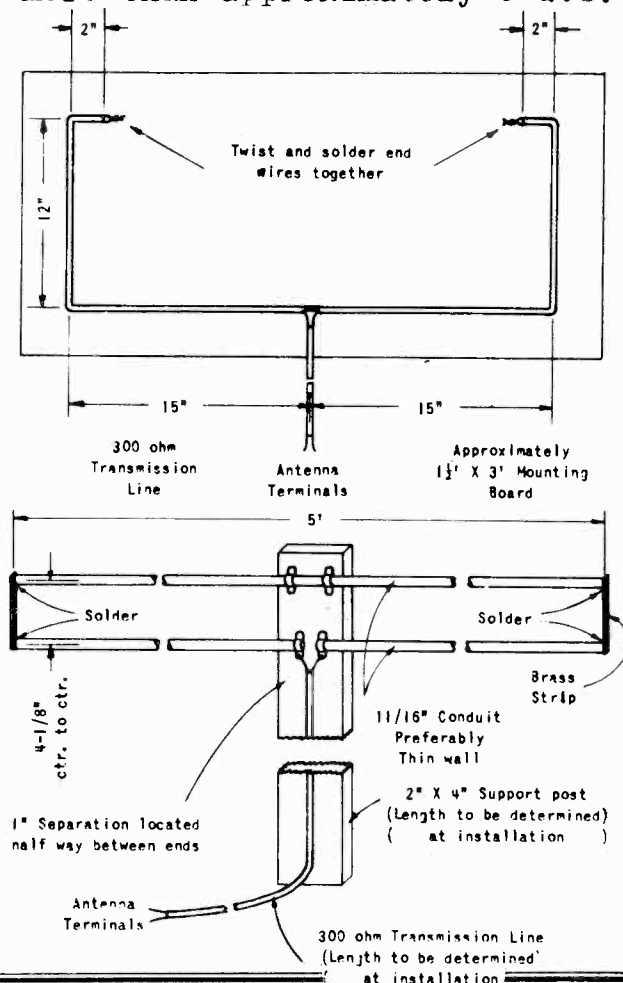
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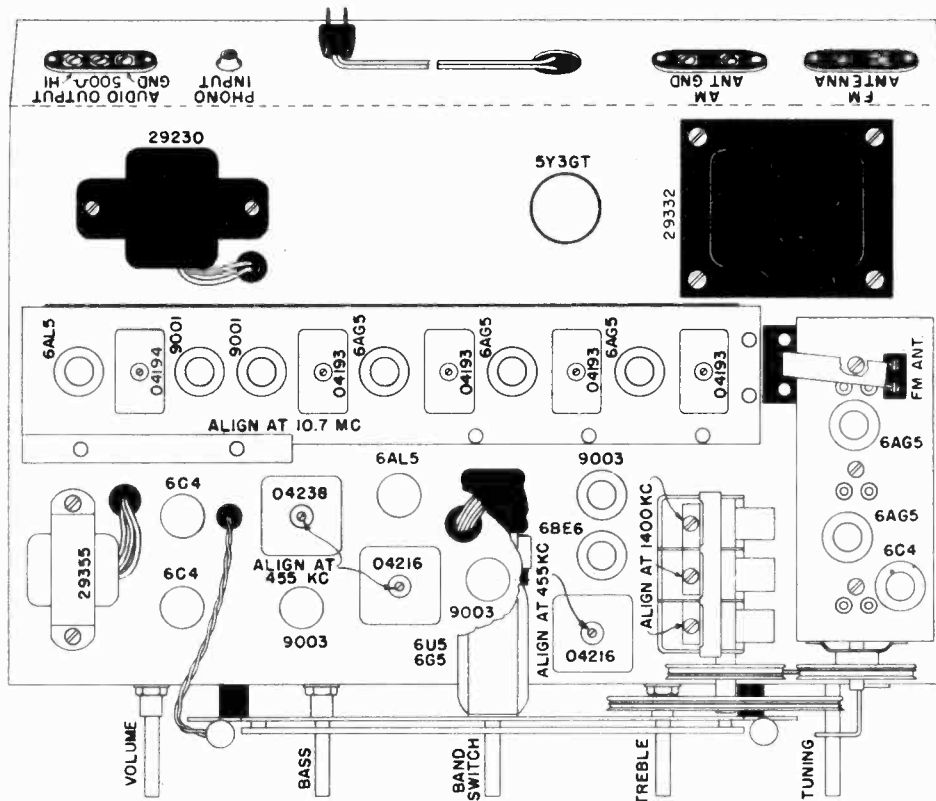
tate the tuning knob slightly to determine that the receptor is not receiving a harmonic of the signal generator and is receiving the 10.7 megacycle signal. Adjust both top and bottom screws of the two I.F. transformers for maximum D.C. indication on the meter, keeping the signal level from the generator low enough so that this D.C. voltage does not exceed 5 volts.

R.F. ALIGNMENT

The R.F. section contains a double converter system in which the oscillator operates at one half signal frequency, minus 5.35 megacycles. The image frequency is so far away from the signal frequency that it is normally not necessary to locate or pay any particular attention to the image during the alignment procedure. The D.C. voltmeter should be connected to pins #5 and #7 of the 6AL5 as it was during the alignment of the I.F. Since the chassis must be removed from the cabinet and away from the dial scale for any alignment work, index points have been stamped on the dial backing plate to facilitate alignment. Rotate the tuning knob until the gang condenser is in the fully meshed position and index the pointer with the calibration marker line farthest from the dial drum. Now rotate the gang condenser until the pointer is indexed with the marker line nearest the dial drum. The receptor should now be tuned to 108 megacycles. If the signal generator indicates that it is not tuned to 108 megacycles, rotate the oscillator trimmer (nearest the dial

drum) a small amount until the signal is tuned in with the maximum voltage indication on the meter. The receptor is now properly calibrated to the dial markers and the antenna trimmer (farthest from the dial drum) and the converter trimmer (center) should be adjusted for maximum voltage indication on the D.C. voltmeter. The converter trimmer has a slight effect on the oscillator circuit and the tuning knob should be rocked back and forth slightly during the alignment of the converter trimmer in order to locate the point of maximum output. This completes the alignment of the receptor. The sensitivity should be checked over the band and normally should not vary more than approximately 6 d.b.



MODELS 9-1091A,
9-1091BMEISSNER MFG. DIV.
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NOMINAL PERFORMANCE

Sensitivity - Less than 10
Microvolts.

Audio Fidelity - Flat with-
in ± 2 d.b. from 30 to
15,000 cycles.

Band Width at 1,000 Kc. -
Sharp 7.5 Kc. Broad 18.5
Kc.

Hum - 60 d.b. below rated
output.

Distortion - Less than 5%.
Output - 8 Volts at High
Impedance - 0.75 Volts at
500 Ohms.

POWER AMPLIFIER

A power amplifier
should be used, which will
give full output when driven
with 5 to 7 volts at high
impedance or with 0.45 to
0.65 volts at 500 ohms. If
the power amplifier has a
gain control, this control
should be set to meet the

above requirement and should
be left at this setting. If
the power amplifier requires
more than this input to
produce full output, then
the full benefit of the
automatic bass compensation
in the tuner cannot be
realized and the possibility
of over-loading the output
stages of the tuner and
producing distortion is
increased.

If the power amplifier
requires less than the
above voltages to produce
full output, then again the
full benefit of automatic
bass compensation cannot be
realized and the possibility
of hum pickup in the line
connecting the tuner to the
amplifier is increased.

If the power amplifier
requires only a small volt-
age input to produce full
output and has no volume
control, then the tuner
could be connected to the

MEISSNER MFG. DIV.
MAGUIRE INDUSTRIES, INC.

MODELS 9-1091A,
9-1091B

power amplifier through a potentiometer of .1 to 1 megohm or a voltage divider consisting of two carbon resistors, to reduce the tuner output to the proper level. Still another possibility in using such an amplifier would be to connect the low impedance output terminals of the tuner to the high impedance input terminals of the amplifier, and omit the voltage divider.

OUTPUT

Output terminals are located on back of chassis (See Fig. 1).

Two output impedances are provided, one for high impedance output and one for 500 ohm output. The high impedance output may be used for connection to an amplifier located only a few feet from the tuner and whose input impedance is 30,000 ohms or more. If the amplifier impedance is greater than 30,000 ohms and if the cable capacity approaches 1,000 $\mu\text{f.}$, then the high audio frequency response may be improved by shunting the amplifier input terminals with a carbon resistor of such a value that the resulting impedance will be approximately 30,000 ohms. As a typical example, if the input of the amplifier is a 100,000 ohm volume control, then shunting it with a 50,000 ohm carbon resistor would result in an impedance of approximately 33,000 ohms, which is close enough to the required 30,000.

Connection should be made through a low capacity,

fully shielded cable, to prevent hum pickup. If the cable capacity is over 1,000 $\mu\text{f.}$, then serious attenuation of the high audio frequencies will result and a 500 ohm line should be used, instead of the high impedance connection.

If a 500 ohm transmission line is used, then the amplifier may be located a considerable distance from the tuner and, except in the presence of strong electric fields, the line need not be shielded to prevent hum pickup. If the amplifier is not equipped for 500 ohm input, a line coupling transformer must be provided for coupling the transmission line into the amplifier.

HUM BALANCE

The tuner is equipped with a hum balance which is designed to balance out the hum originating within the tuner to a level 60 d.b. below full output. If the tuner is connected to an amplifier which is not adequately isolated from the power line, then hum will develop. Also under certain conditions, if the power amplifier is not adequately isolated from the power line, hum modulation may appear on certain stations when they are tuned in. The hum balance control, mentioned above, is only for the purpose of balancing out the hum originating in the tuner. It is pre-set at the factory and readjustment is not required, except when the 6C4 audio amplifier tubes are changed.

MODELS 9-1091A,
9-1091BMEISSNER MFG. DIV.
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This control cannot be used successfully to balance out hum which originates in the power amplifier used with the tuner.

NORMAL CARE AND MAINTENANCE

The tubes in this instrument should be checked only when poor performance indicates that the tubes have deteriorated and should be checked only by a competent service man. Whenever tubes are removed, care should be taken to replace them in their proper sockets.

Two dial lights of the 6-8 volt, .25 amp. type are used. They may be replaced in Model 9-1091B by removing the dust cover, and in Model 9-1091A by removing the unit from the cabinet. A slight counterclockwise turn with a slight downward pressure will remove the lamps from their sockets.

IF TUNER FAILS TO OPERATE

If operation of the tuner is unsatisfactory, the instructions should be read again. The antenna and ground connections should be re-checked and the power source should be re-checked to see that it is of the correct voltage and frequency and that power is available at the outlet. The power amplifier used with the tuner should be checked to see that it is functioning properly.

VOLUME CONTROL

The volume control (See Fig. 1) is provided with automatic bass compensation to take care of the bass characteristic of the human ear. At low levels, the response of the human ear to bass is low, so that a considerable amount of bass boost can be used with a pleasing effect, but at high levels, the bass response of the human ear goes up, and with normal program material, no bass boost can be tolerated. This is automatically compensated by making the bass boost circuit less effective as the volume control is turned toward maximum. To secure the full benefit of the bass control in this unit, it should be operated into an amplifier whose gain is as specified in paragraph "Power Amplifier".

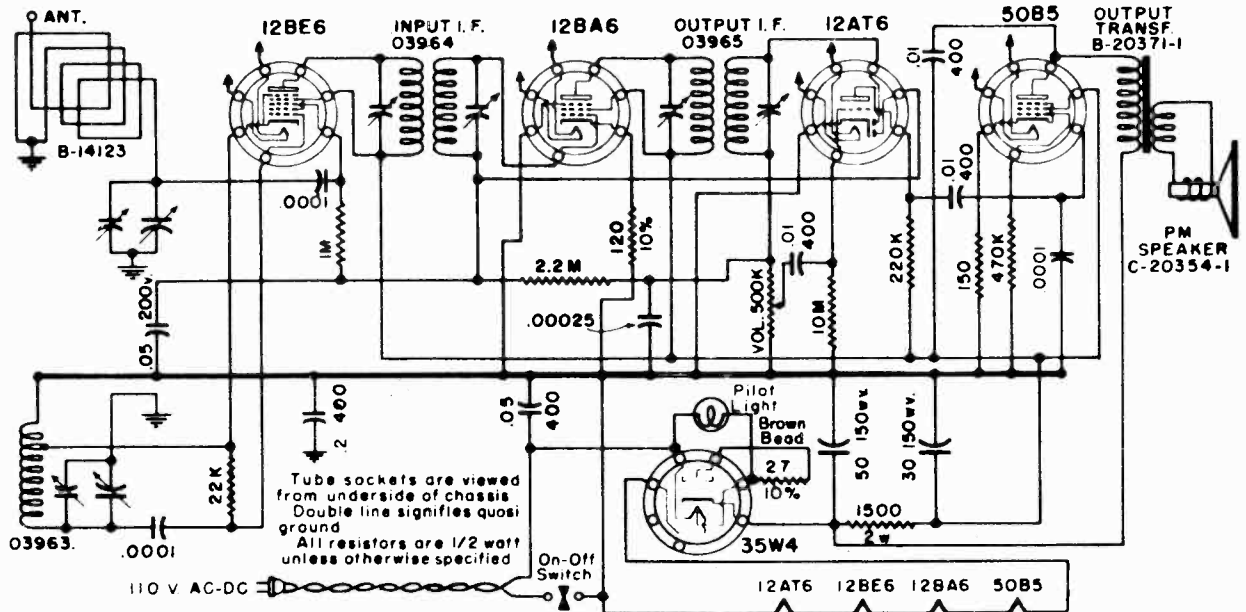
TUBES

6AG5	R.F. Amplifier (FM)
6AG5	Converter (FM)
6C4	Osc. (FM)
6AG5	I.F. Amplifier (10.7 Mc.)
6AG5	I.F. Amplifier (10.7 Mc.)
6AG5	I.F. Amplifier (10.7 Mc.)
9001	Limiter (FM)
9001	Limiter (FM)
6AL5	Detector (FM)
9003	R.F. Amplifier (AM)
6BE6	Osc.-Converter (AM)
9003	I.F. (455 Kc.)
9003	I.F. (455 Kc.)
6AL5	Detector (AM)
6C4	Audio
6C4	Audio
6U5/6G5	Tuning Indicator
5Y3GT/G	Rectifier

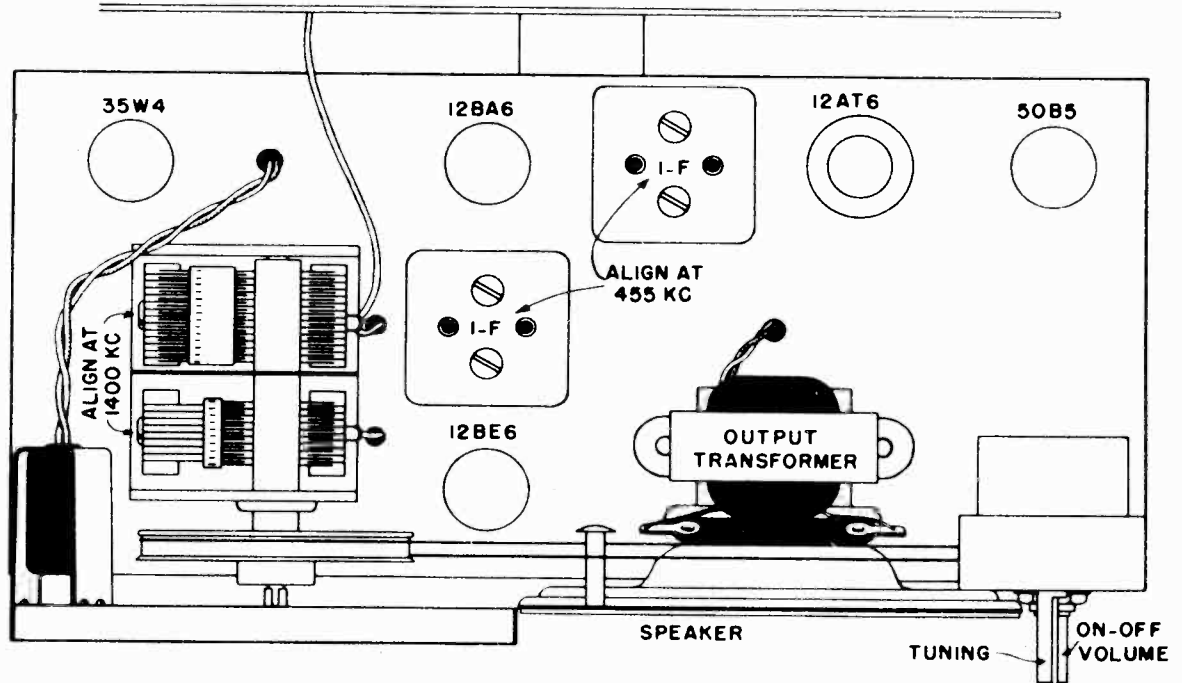
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MODELS 5A, 574

CIRCUIT DIAGRAM

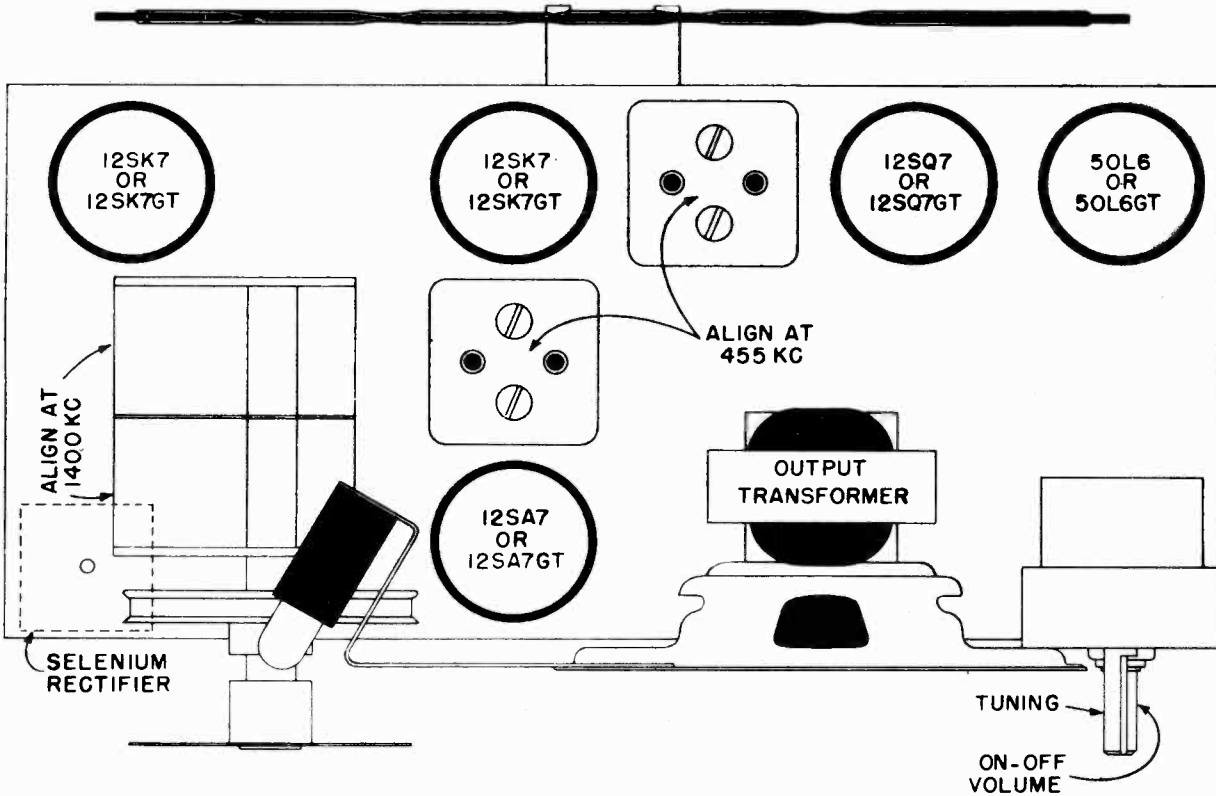
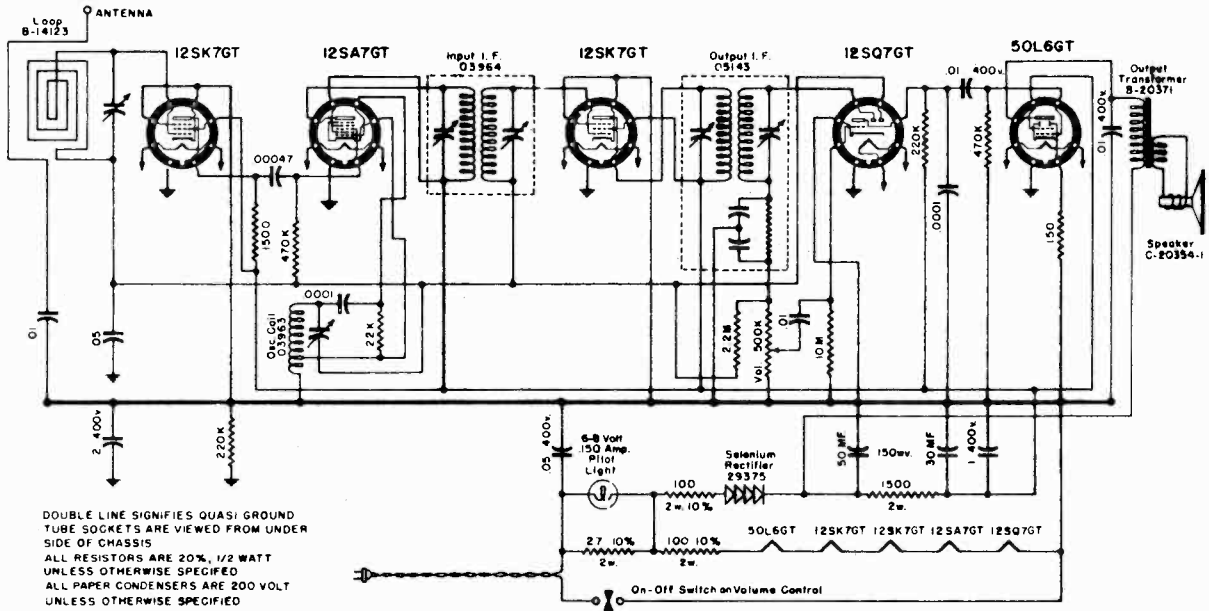


TUBE LAYOUT



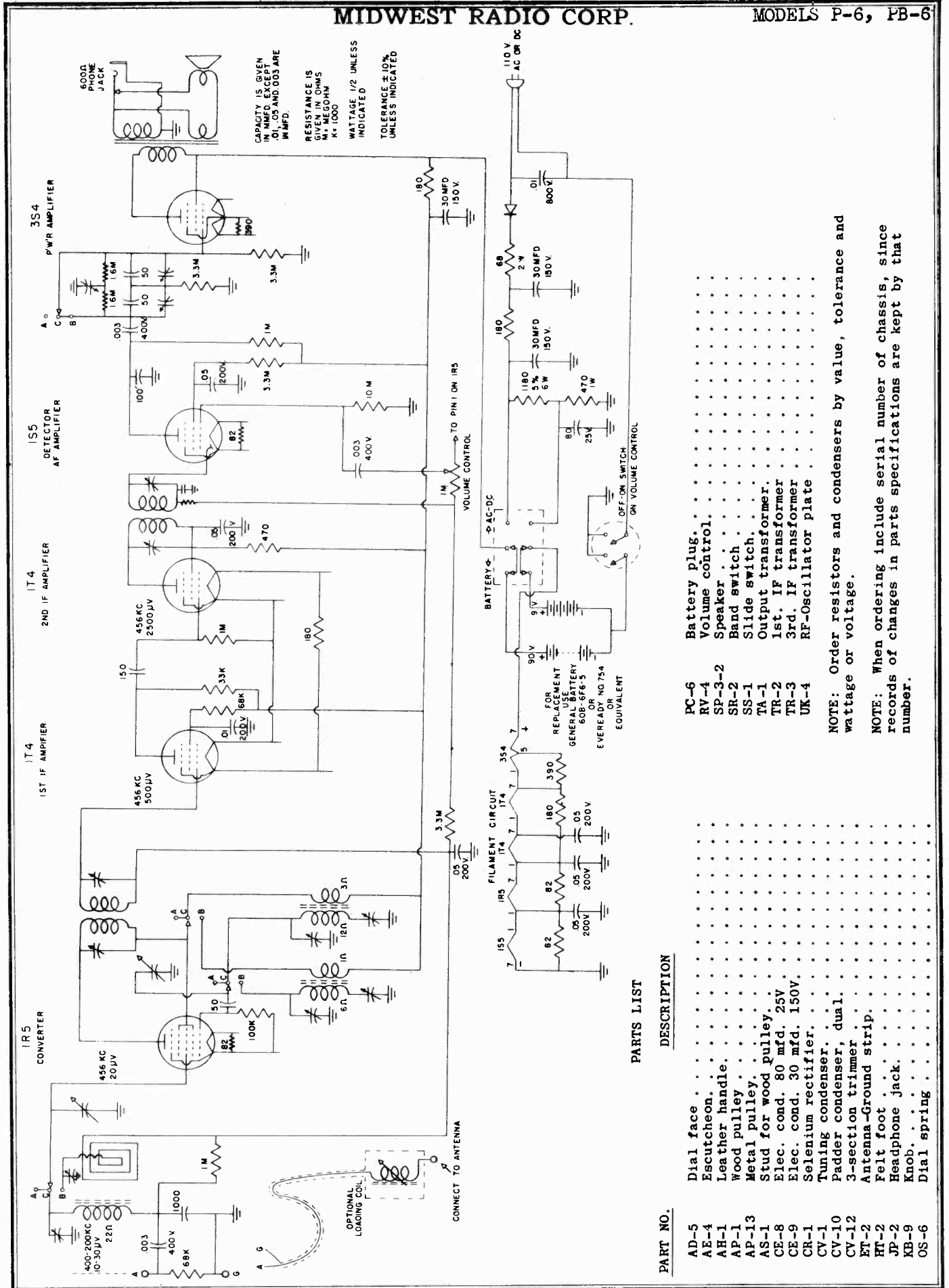
MODELS 6H, 661

MEISSNER MFG. DIV.
MAGUIRE INDUSTRIES, INC.



MIDWEST RADIO CORP.

MODELS P-6, PB-6



- Battery plug.
- Volume control.
- Speaker
- Band switch.
- Slide switch.
- Output transformer.
- 1st. IF transformer.
- 3rd. IF transformer.
- RF-Oscillator plate

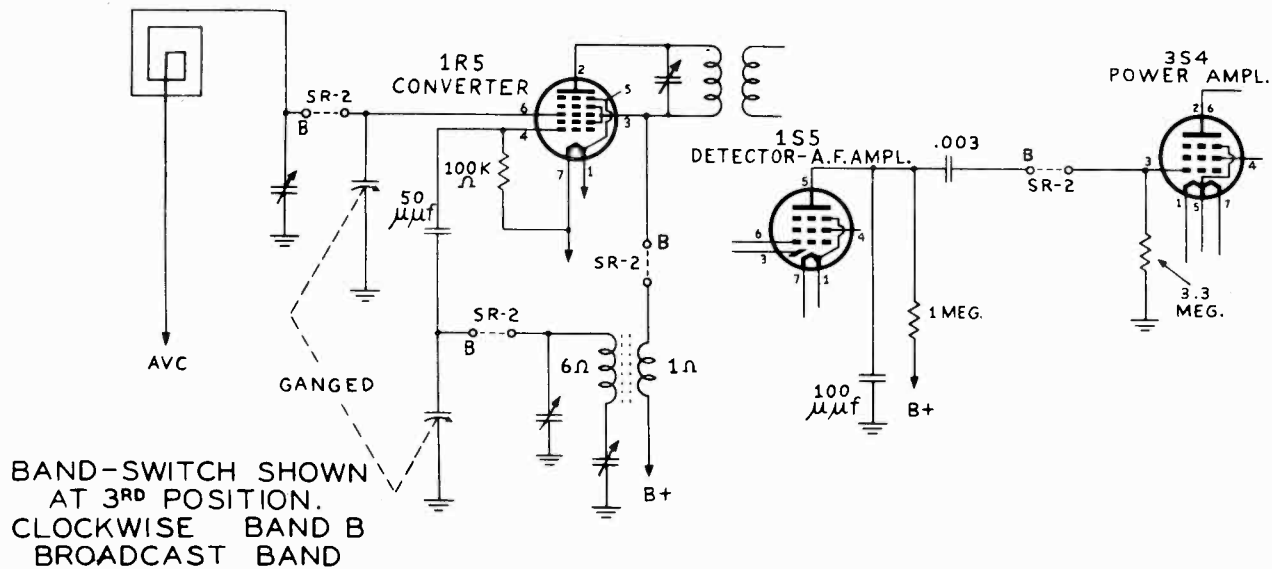
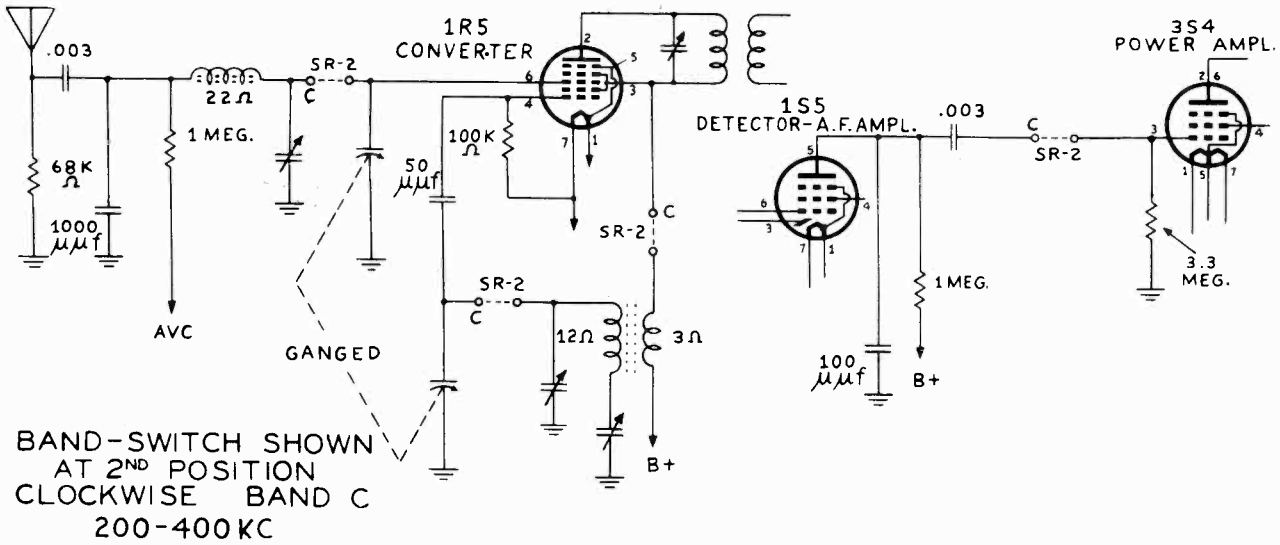
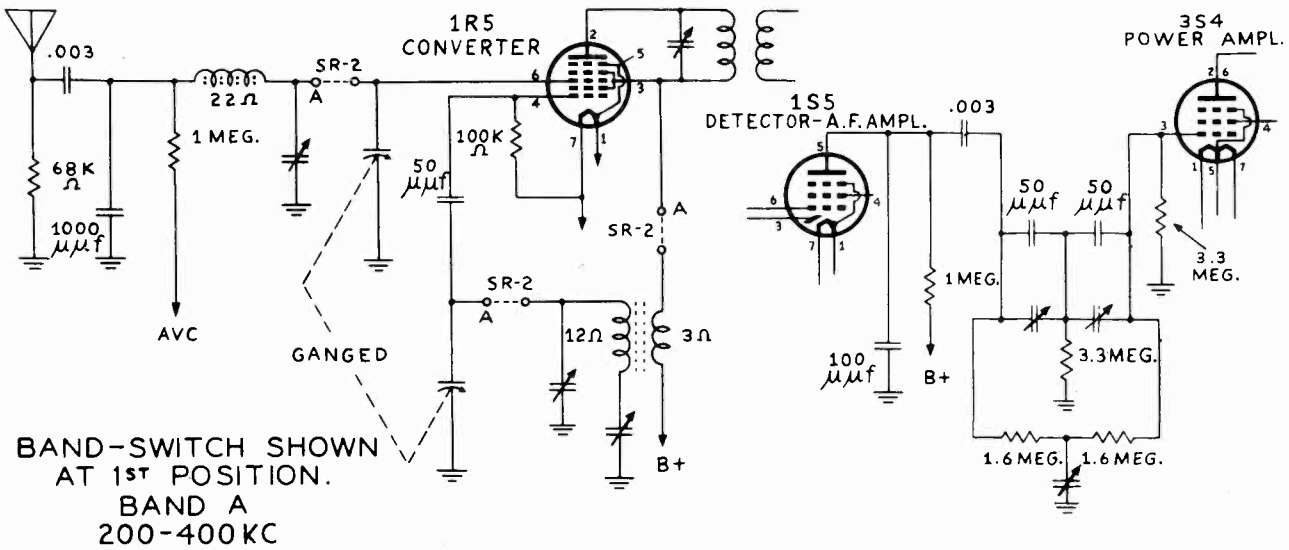
NOTE: Order resistors and condensers by value, tolerance and wattage or voltage.

NOTE: When ordering include serial number of chassis, since records of changes in parts specifications are kept by that number.

PARTS LIST

PART NO.	DESCRIPTION
AD-5	Dial face
AE-4	Escutcheon.
AH-1	Leather handle.
AP-1	Wood pulley
AP-13	Metal pulley.
AS-1	Stud for wood pulley.
CE-8	Elec. cond. 80 mfd. 25V.
CE-9	Elec. cond. 30 mfd. 150V.
CH-1	Selenium rectifier.
CV-1	Tuning condenser.
CV-10	Padder condenser, dual.
CV-12	3-section trimmer
ET-2	Antenna-ground strip.
HT-2	Felt foot
JP-2	Headphone jack.
KB-9	Knob.
OS-6	Dial spring

"clarified schematics"



Battery replacements should be made with General Dry Battery 60B-6P6-5 or Eveready Mini-Max No. 754, or equivalent. For reception on the aircraft band, a 10 to 25 foot length of wire should be connected to the receiver.

OPERATION

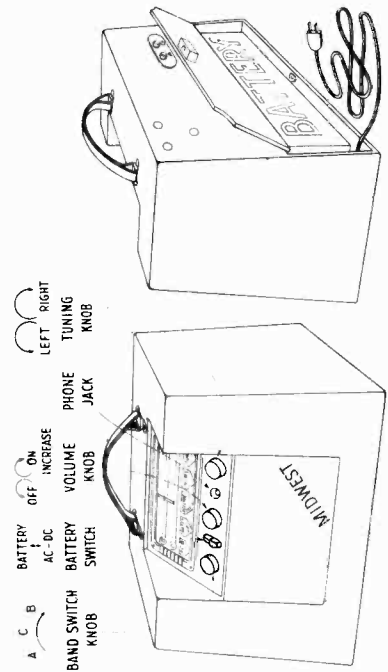


Figure 2. Model P-6 Controls

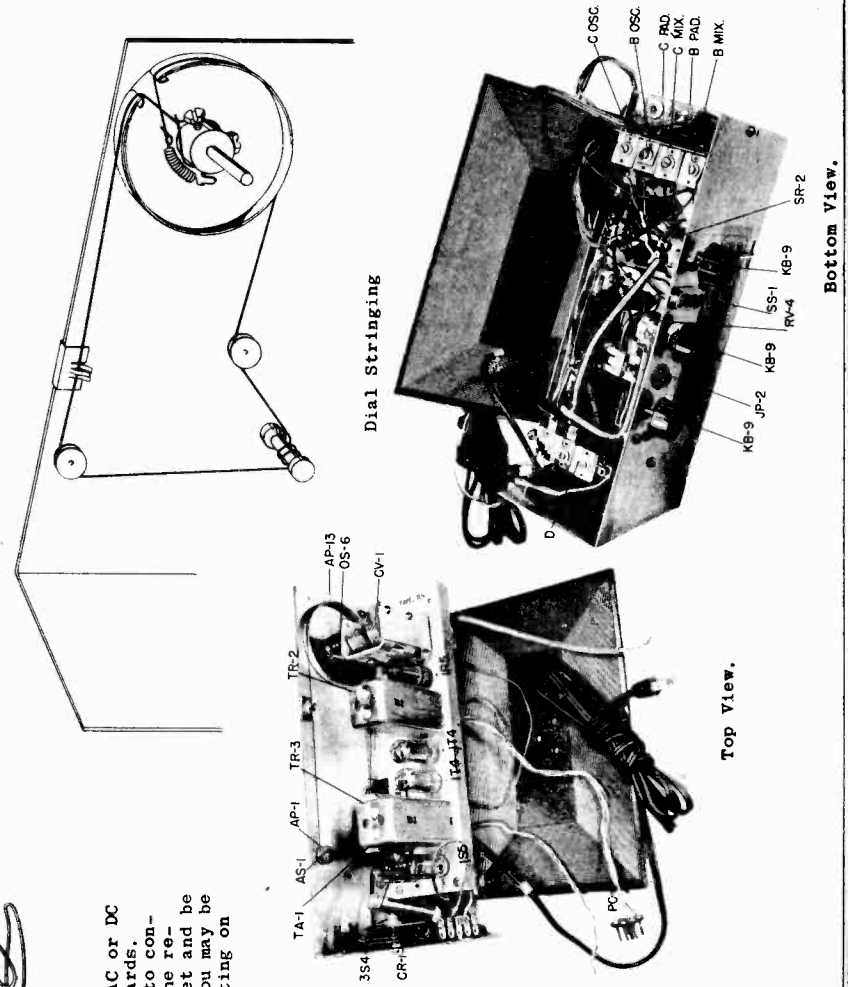
BATTERY OR AC-DC? If a source of nominal 110 volts AC or DC is not available slide the switch marked BATT up upwards. When AC or DC power is available it should be used, to conserve batteries; simply plug the cord contained in the receiver as shown in figure 2, into the available outlet and be sure to slide the BATT. SWITCH downwards otherwise you may be wasting battery current while assuming you are operating on house current.

ALIGNMENT. A VTVM should be used to read avc voltage when aligning this receiver; for 50 milliwatts audio avc voltage is approximately 0.6. The schematic shows various sensitivities which can be used to trace any lack of gain.

ALIGNMENT CHART

Connection	Signal Band	Dial	Adjustment
Through .05 mfd. to converter grid.	456 KC	B	Peak 1st and 3rd IF transformer trimmers.
Through 50 mfg. to antenna post	400 KC	C	Peak C RF and Oscillator trimmers.
None	200 KC	C	Peak C oscillator padder.
			Use local stations at either end, peak B oscillator padder on low end and peak B RF and oscillator trimmers at the high end.

DIAL STRINGING. Use a light weight flexible dial cord when replacing worn or broken cord, such as Beven-Wilcox FSN-25-12

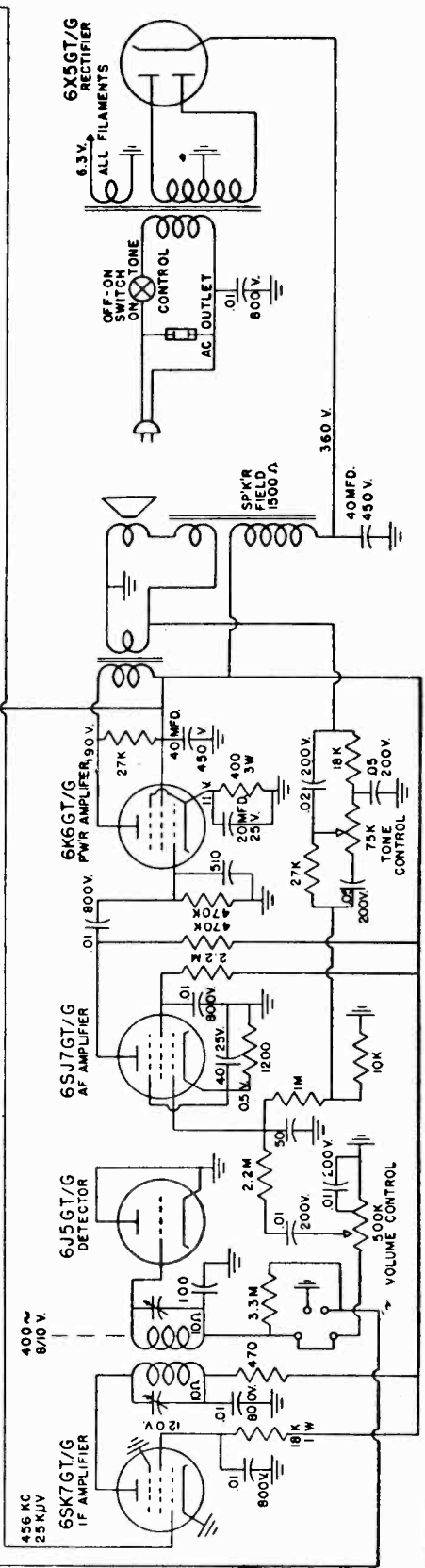
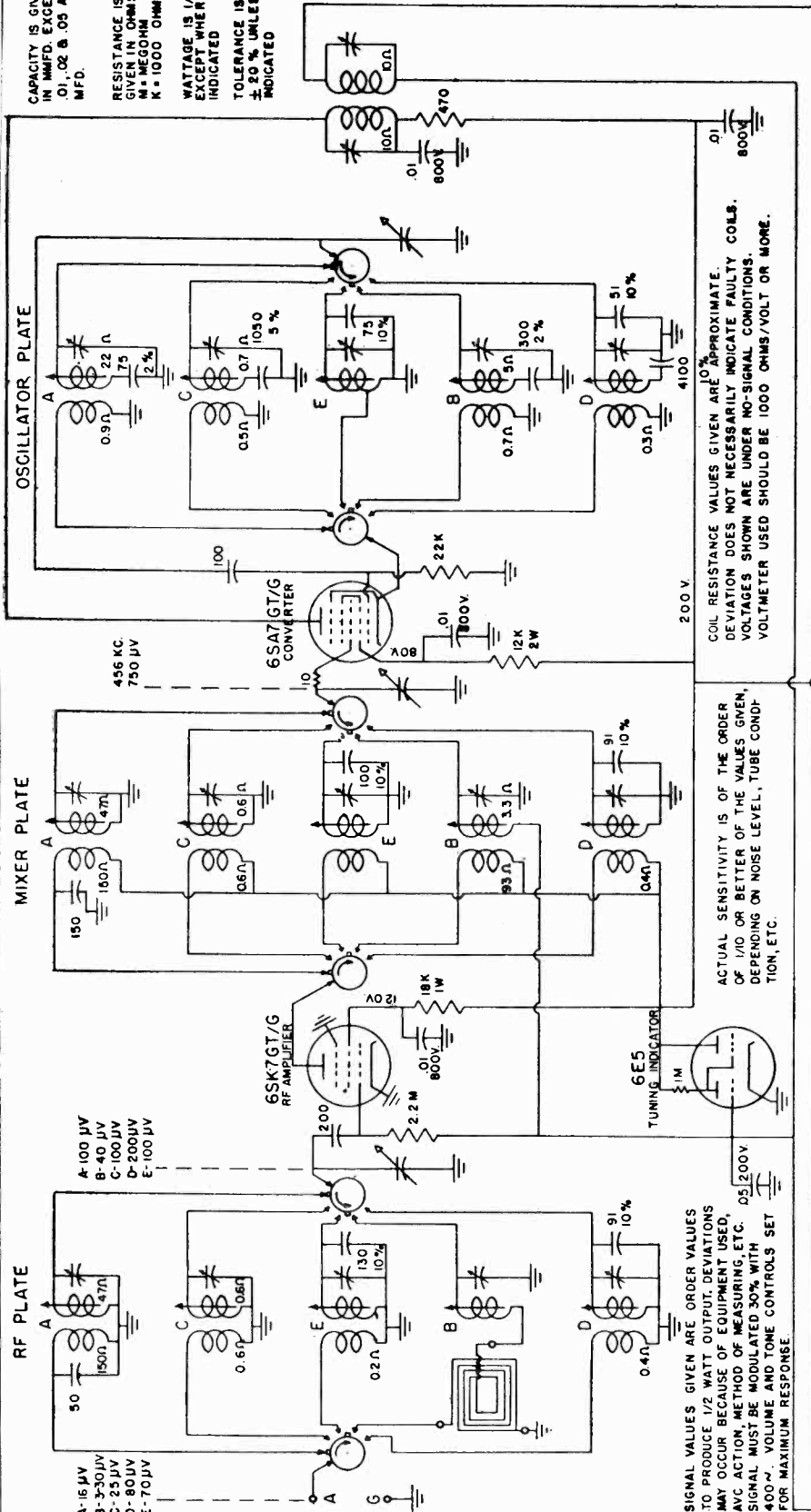


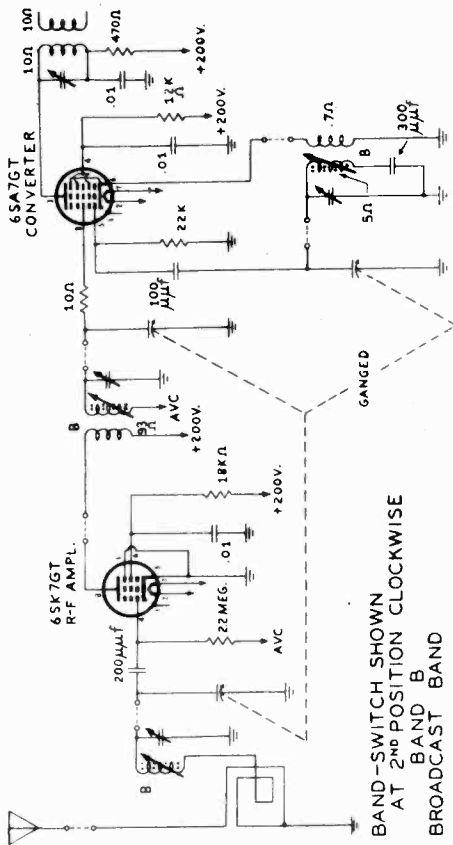
RANGE FILTER. This is a parallel T filter which rejects the 1020 cycle range tone. It should be touched up on an actual range signal. If the adjustment of the trimmers has been completely lost this procedure can be used: Feed a 1000 cycle audio tone into top of volume control through a .05 condenser. Connect a sensitive audio output meter across the headphone winding of the output transformer. Trim the condenser marked D on the bottom view, Figure 3, for minimum output. Trim simultaneously the other two trimmers for minimum output. Repeat until further reduction does not occur. Then retouch the adjustments by ear on an actual range signal. Usually the fundamental 1020 signal will completely disappear leaving some second harmonic.

MODELS S-8,
ST-8, TM-8

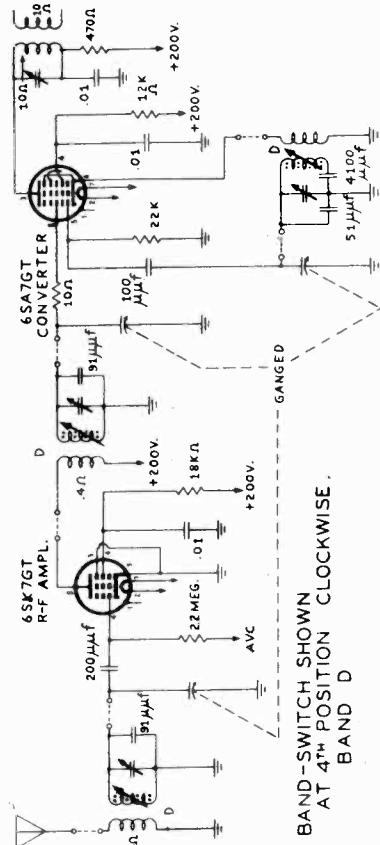
MIDWEST RADIO CORP.

CAPACITY IS GIVEN IN MMFD. EXCEPT .01, .05 & .05 ARE MFD.
RESISTANCE IS GIVEN IN OHMS M = MEGOHM K = 1000 OHMS
WATTAGE IS 1/2 INDICATED EXCEPT WHERE INDICATED
TOLERANCE IS ± 20 % UNLESS INDICATED

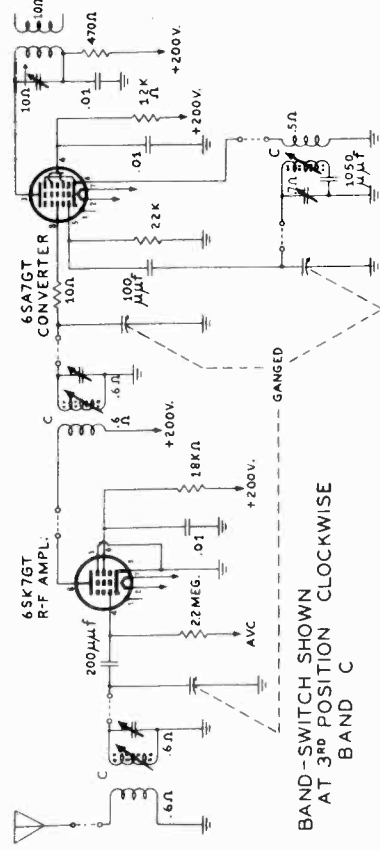




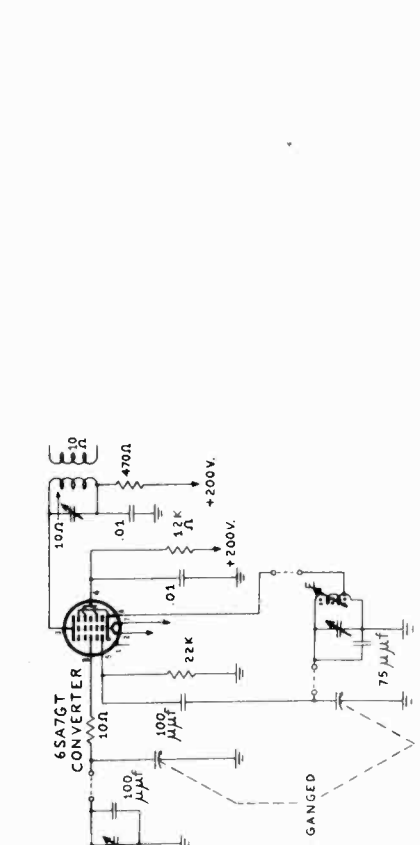
BAND-SWITCH SHOWN AT 1ST POSITION. BAND A



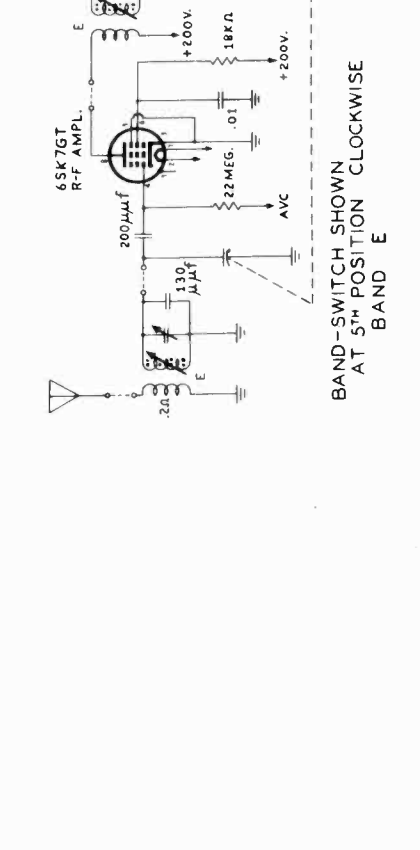
BAND-SWITCH SHOWN AT 2ND POSITION CLOCKWISE BROADCAST BAND



BAND-SWITCH SHOWN AT 3RD POSITION CLOCKWISE BAND C



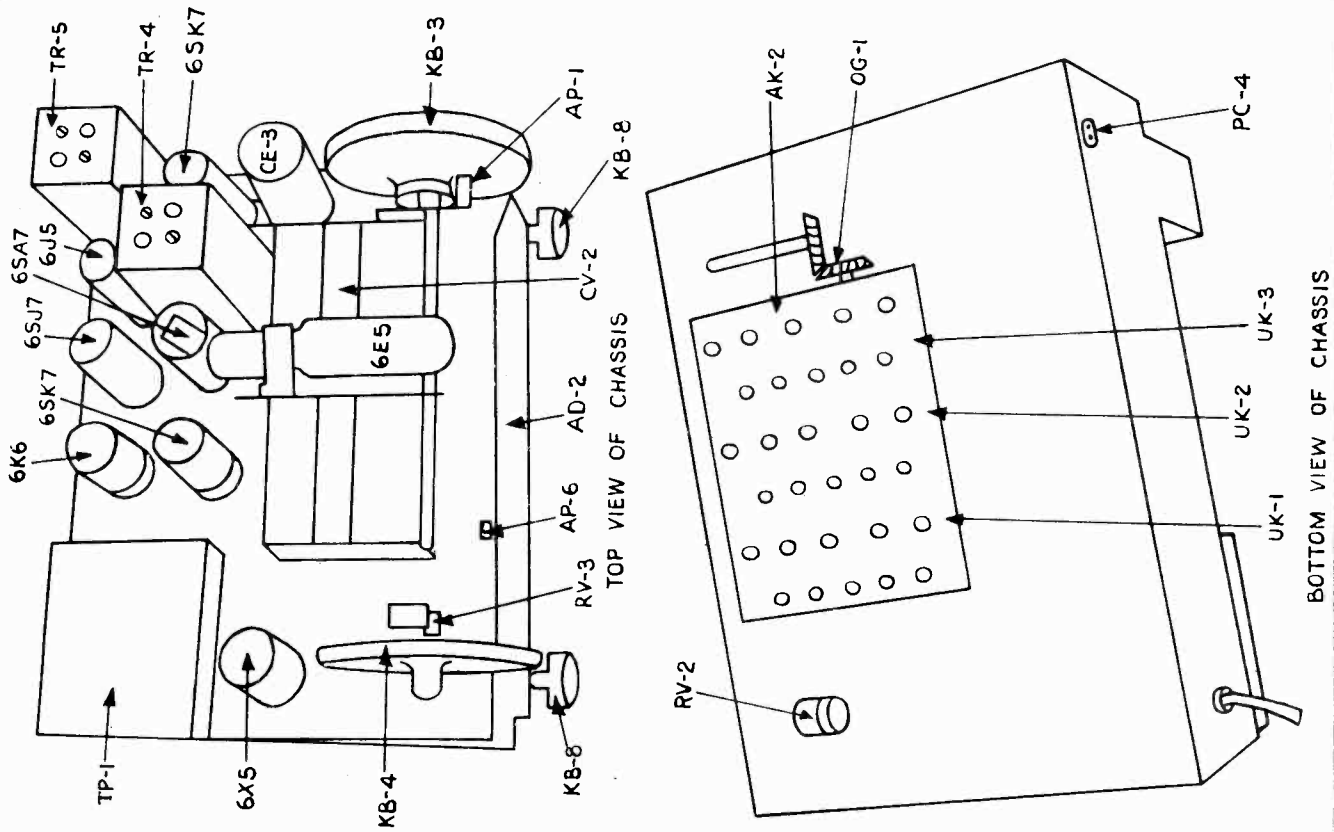
BAND-SWITCH SHOWN AT 4TH POSITION CLOCKWISE BAND D



BAND-SWITCH SHOWN AT 5TH POSITION CLOCKWISE BAND E

MODELS S-8,
ST-8, TM-8

MIDWEST RADIO CORP.



SERVICE — Series 8, Model 78, is a straight forward design, containing no trick circuits. Servicing of the coil plates or I.F. transformers should be avoided, except under special conditions, and rather than attempt to repair these assemblies a replacement should be ordered.

The Midwest Radio Corporation is anxious to help the service technician in every way; inquiries for special data will be promptly answered and your comments will be most welcome.

PARTS LIST

Part	Description
AD-2	Dial
AE-2	Escutcheon
AK-2	Coil plate cover
AP-1	Wood pulley
AP-6	Pointer
AS-1	Wood pulley mtg. stud
CE-3	Filter condenser 40-40-20
CE-4	Cathode by pass 40 mfd. 25 v
*CV-2-1	Tuning gang
EG-2	Speaker mtg. grommet
ES-13	Tube shield
IE-1	Speaker mtg. eyelet
IL-1	Panel Lamp, 6-8 volts
KB-3	Tuning knob
KB-4	Volume control knob
KB-8	Tone or Band knob
OG-1	Miter gear, pair
OS-3	Dial string spring
PC-3	Loop plug
PC-4	Phonograph plug
RV-2	Tone control
RV-3	Volume control
*SP-1	Speaker, oval 6 x 9
TP-1	Power transformer
TP-2	Universal power transformer
*TR-4	1st I.F. transformer
*TR-5	2nd I.F. transformer
*UK-1	R. F. coil plate
*UK-2	Mixer coil plate
*UK-3	Oscillator coil plate

Note: Order resistors and condensers by value, tolerance and wattage or voltage.
Note: When ordering include serial number of chassis, since Midwest records of changes in parts specifications are kept by that number.

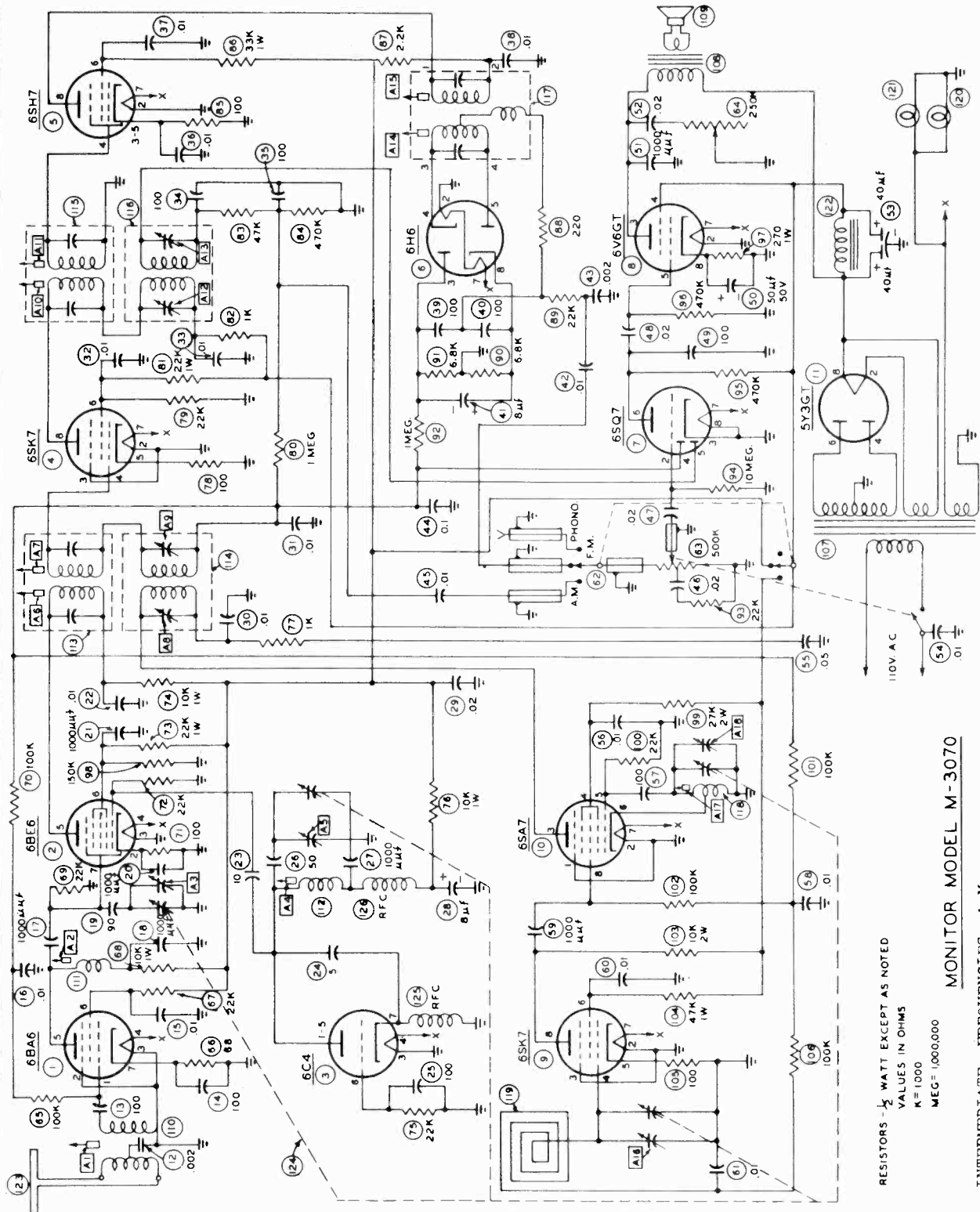
REPLACEMENT PARTS — Certain parts are available on an exchange basis; these are shown on the parts list with an "*" Figures 4 and 5 identify certain mechanical parts not shown by the schematic diagram.

Note: Modulate the signal with 400 cycles 30%. The output indicator may be an audio meter at the voice coil or a VTVM on the avc. The sensitivity figures shown on the schematic are for a 1/2 watt output; the voltage at the voice coil is 1.2 and the avc. voltage is between 2.5 and 3.5 for 1/2 watt output. Do not use signals for ALIGNMENT which will give output in excess of 1/2 watt.

ALIGNMENT — The schematic includes the various signal strengths necessary for standard output of 0.5 watt. The output indicator may be an audio frequency meter across the voice coil or a vacuum tube voltmeter at the avc. For 0.5 watt the voltage at the voice coil is 1.2 volts or 2.5 to 3.5 volts avc. if a 30% modulated signal is used. I.F. alignment should be made with band switch on "B." pointer tuned to 1000 kc. and signal to mixer grid through a .05 mfd. condenser. Trim both I.F. transformers for maximum reading.

R. F. alignment should be made in the usual manner. There is no inter-action between bands. The only precaution is that a dummy antenna be used between the generator and the antenna post on the receiver. This may be simply a 200 micro micro farad condenser in series with a 400 ohm resistor. The B band RF padder, 550 KC. is very broad and should not be adjusted. The loop must be plugged in when adjusting the B band RF trimmer, 1600 kc.

MONITOR EQUIPMENT CORP.



RESISTORS - 1/2 WATT EXCEPT AS NOTED
 VALUES IN OHMS
 K = 1000
 MEG = 1,000,000

MONITOR MODEL M-3070

Band switch
 changes B+
 connections
 only

INTERMEDIATE FREQUENCIES: A-M,
 456 KC; F-M, 10.7 MC.
 FREQUENCY RANGES: A-M, 540-1600 KC.
 F-M, 88-108 MC.

POWER CONSUMPTION:
 RADIO, 80 watts.
 RADIO AND PHONOGRAPH, 95 watts.

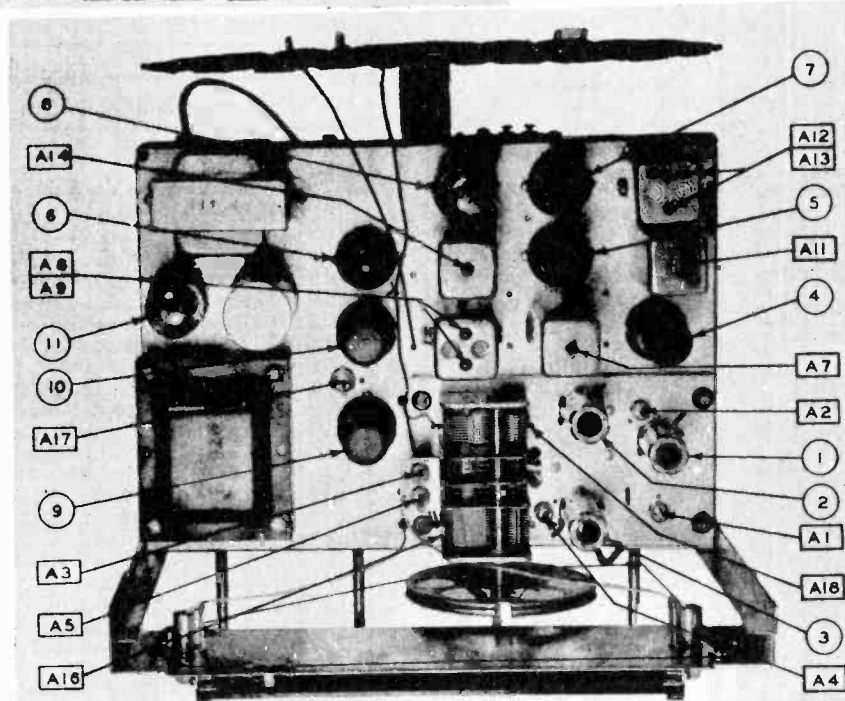
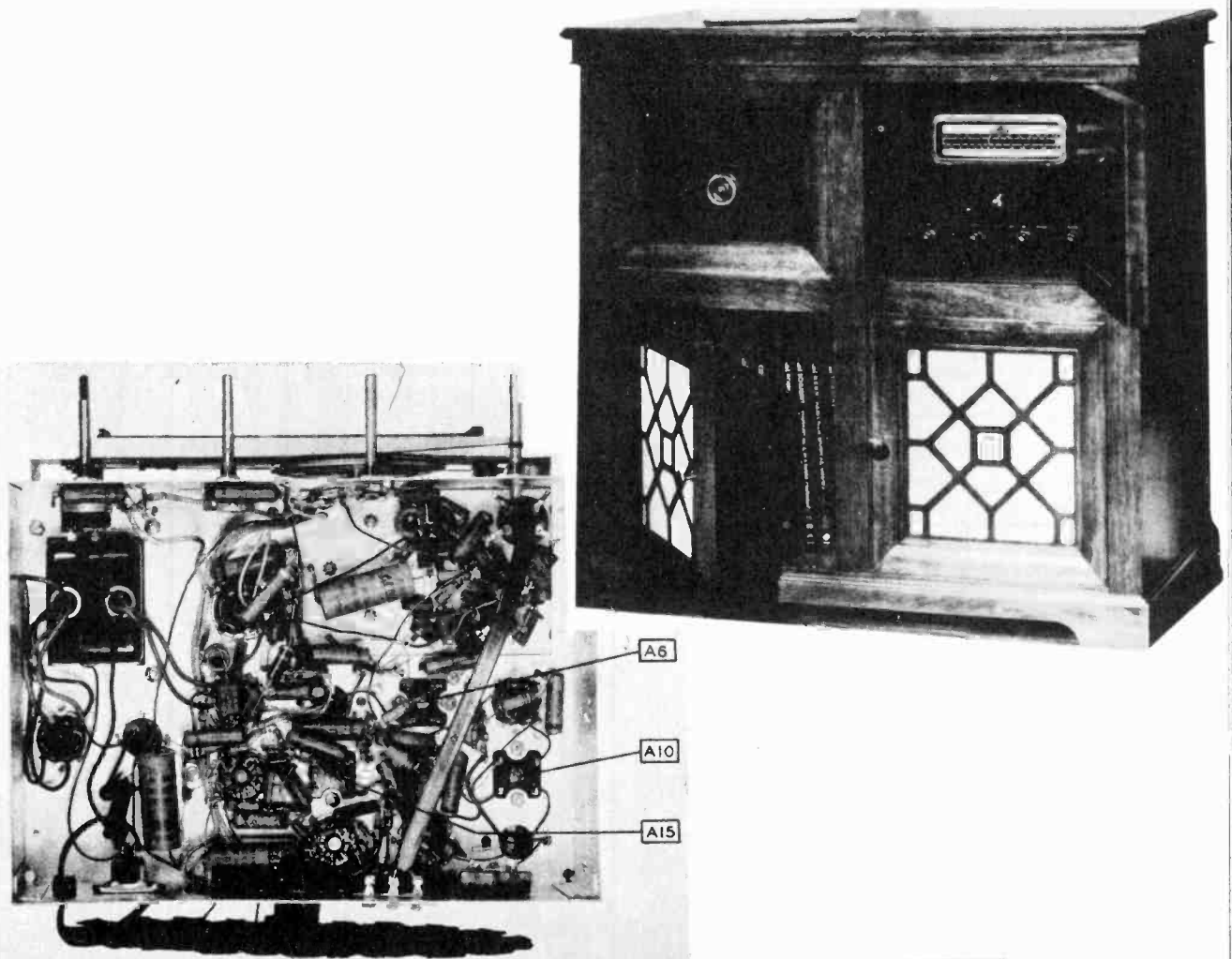
POWER SOURCE: 105-125 volts, 60
 cycles.
 POWER OUTPUT: 4.5 watts

MONITOR EQUIPMENT CORP.

A-M Alignment

Turn gang condenser to fully meshed position. Set dial pointer on the small dot to the left of the end calibration. Turn volume control to maximum volume. Use a standard A-M signal generator, with the high side coupled to the input point through a .01 uf capacitor. Ground the other side to the chassis. Connect the output meter across the voice coil of output transformer 108. The output of the signal generator should be no higher than necessary to obtain the output reading. Where loop coupling is specified, connect the signal generator output to two or three turns of wire spaced about two feet from the antenna loop.

Signal Generator and Coupling Capacitor	Signal Generator Frequency	Input to	Tuning Dial Setting	Output Meter	Adjust	Remarks
A-M Signal Generator .01 uf.	455 KC	Pin 8 6SA7	Low-Freq. End.	Across Voice Coil of 108	A13, A12, A9, A8	Adjust for max. output. Repeat
	600 KC	"	600 KC	"	A17	Adjust for max. output.
	1600 KC	"	1600 KC	"	A18	" " " "
	600 KC	"	600 KC	"	A17	" " " "
	1400 KC	Loop Coupling	Tune to signal at 1400 KC	"	A16	" " " "
F-M Alignment						
A-M .002 uf	10.7 MC	Pin 4 6SH7	Low-Freq. End.	Use D-C VTVM. Pin 3 6H6 to gnd.	A15, bottom of ratio-detector can	Adjust for max. reading.
A-M .002 uf	"	"	"	Use D-C VTVM. High Side of capacitor 43 to gnd.	A14, top of ratio-detector can	Adjust for zero voltage. At the correct setting, the slightest movement of A14 will throw the voltage positive or negative. A slow approach to zero indicates that A14 should be turned in the opposite direction.
A-M .002 uf	"	Pin 3 6SK7 item 4	Low-Freq. End.	Use D-C VTVM. Pin 3 6H6	A11, A10	Adjust for max. reading.
A-M .002 uf	"	Pin 7 6BE6	"	"	A7, A6	" " " "
Repeat last two steps.						
F-M Signal Generator Set for 75 Kc. Deviation and 400-cycle Modulation	88 MC	Dipole antenna terminals	88 MC	Output meter across voice coil of 108	A4	Adjust for max. output.
"	"	"	"	"	A2	" " " "
"	108 MC	"	108 MC	"	A5	" " " "
"	"	"	"	"	A3	" " " "
Repeat last four steps until properly tracked.						
"	98 MC	"	Tune to signal at 98 MC	"	A1	Adjust for max. output.



MONITOR EQUIPMENT CORP.

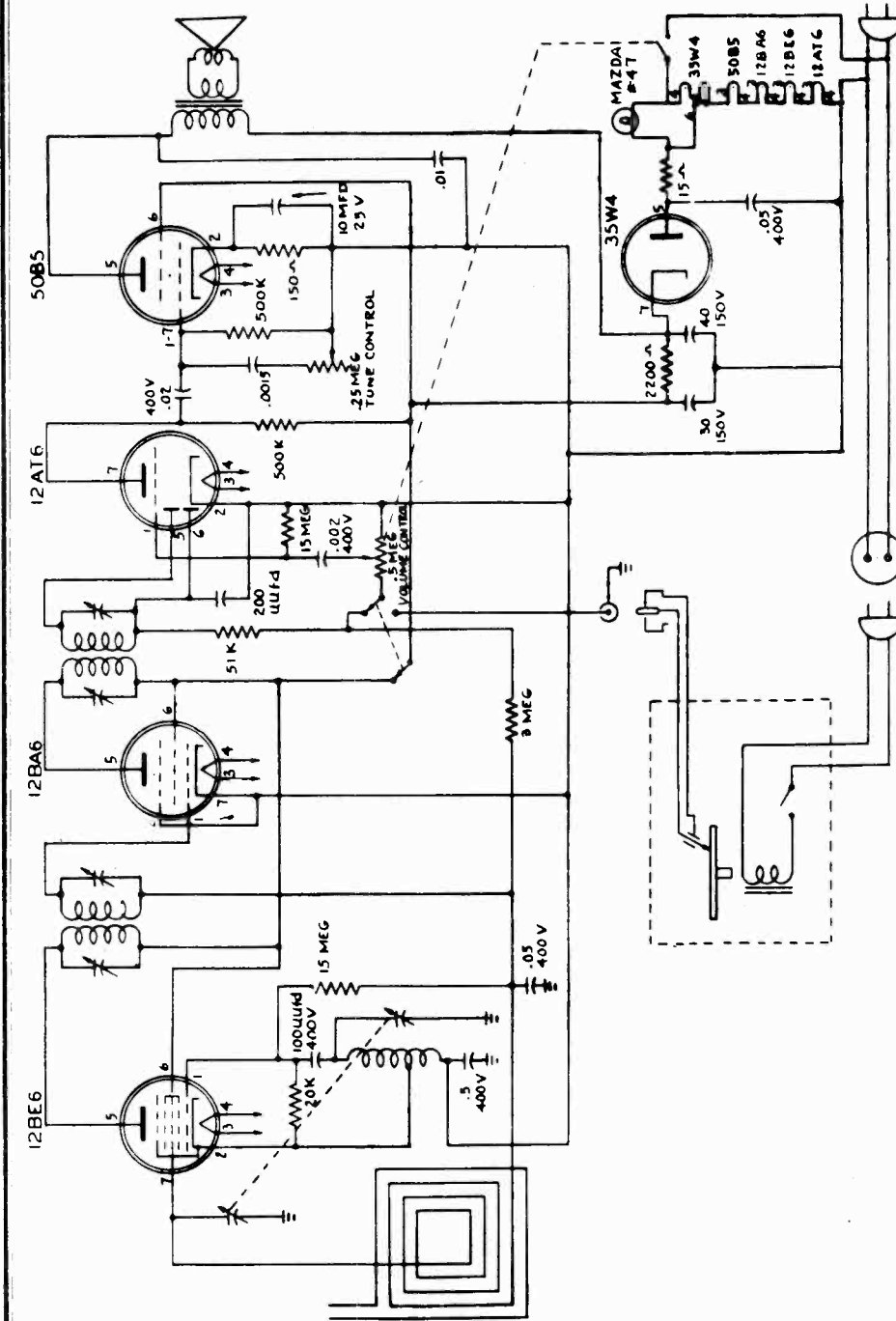
MODEL M3070

PARTS LIST				
TUBES				
Item No.	Type	Function		
1	6BA6	R-F Amplifier (AM)		
2	6BE6	Mixer (FM)		
3	6C4	Oscillator (FM)		
4	6SK7	I-F Amplifier (AM-FM)		
5	6SH7	I-F Amplifier (FM)		
6	6H6	Second Detector (FM)		
7	6SQ7	Second Detector (FM)		
8	6V6GT	Beam Power Amplifier		
9	6SK7	R-F Amplifier (AM)		
10	6SA7	Pentagrid Converter (AM)		
11	5Y3GT	Full-Wave Rectifier		
CAPACITORS				
Capacitances in uf for electrolytic and paper capacitors, uuf for mica.				
Item No.	Part No.	Cap.	Volts dcw	
12	CD-1227-3	.002	400	Paper
13	CD-1157-13	100	500	Mica
14	CD-1157-13	100	500	Mica
15	CD-1227-8	.01	400	Paper
16	CD-1227-8	.01	400	Paper
17	CD-1160-5	1000	500	Mica
18	CD-1160-5	1000	500	Mica
19	CD-1158-17	91	500	Mica
20	CD-1085-20	1000	300	Mica
21	CD-1085-20	1000	300	Mica
22	CD-1227-8	.01	400	Paper
23	CD-1245-2	10	500	Silver Mica
24	CD-1245-1	5	500	Silver Mica
25	CD-1157-13	100	500	Mica
26	CD-1245-5	50	500	Silver Mica
27	CD-1160-5	1000	500	Mica
28	CD-1247	8	450	Dry Electrolytic
29	CD-1227-10	.02	400	Paper
30	CD-1227-8	.01	400	Paper
31	CD-1227-8	.01	400	Paper
32	CD-1227-8	.01	400	Paper
33	CD-1227-8	.01	400	Paper
34	CD-1071-22	100	500	Mica
35	CD-1071-22	100	500	Mica
36	CD-1227-8	.01	400	Paper
37	CD-1227-8	.01	400	Paper
38	CD-1227-8	.01	400	Paper
39	CD-1071-22	100	500	Mica
40	CD-1071-22	100	500	Mica
41	CD-1247	8	450	Dry Electrolytic
42	CD-1227-8	.01	400	Paper
43	CD-1227-3	.002	400	Paper
44	CD-1227-15	0.1	400	Paper
45	CD-1227-8	.01	400	Paper
46	CD-1227-10	.02	400	Paper
47	CD-1227-10	.02	400	Paper
48	CD-1227-10	.02	400	Paper
49	CD-1071-22	100	500	Mica
50	CD-1246	50	50	Dry Electrolytic
51	CD-1160-5	1000	500	Mica
52	CD-1227-10	.02	400	Paper
53	CD-1248	40-40	450	Dry Electrolytic
54	CD-1227-8	.01	400	Paper
55	CD-1227-13	.05	40	Paper
56	CD-1227-8	.01	400	Paper
57	CD-1071-22	100	500	Mica
58	CD-1227-8	.01	400	Paper
59	CD-1085-20	1000	300	Mica
60	CD-1227-8	.01	400	Paper
61	CD-1227-8	.01	400	Paper

RESISTORS, FIXED			
Item No.	Part No.	Res.	Watts
65	RE-1166-107	100K	1/2
66	RE-1139-683	68	1/2
67	RE-1166-226	22K	1/2
68	RE-1168-106	10K	1
69	RE-1166-226	22K	1/2
70	RE-1166-107	100K	1/2
71	RE-1139-104	100	1/2
72	RE-1166-226	22K	1/2
73	RE-1168-226	22K	1
74	RE-1168-106	10K	1
75	RE-1166-226	22K	1/2
76	RE-1168-106	10K	1
77	RE-1166-105	1K	1/2
78	RE-1139-104	100	1/2
79	RE-1166-226	22K	1/2
80	RE-1139-108	1 meg	1/2
81	RE-1168-226	22K	1
82	FE-1166-105	1K	1/2
83	RE-1166-476	47K	1/2
84	RE-1166-477	470K	1/2
85	RE-1139-104	100	1/2
86	RE-1168-336	33K	1
87	RE-1166-225	2.2K	1/2
88	RE-1139-224	220	1/2
89	RE-1166-226	22K	1/2
90	RE-1166-685	6.8K	1/2
91	RE-1166-685	6.8K	1/2
92	RE-1139-108	1 meg	1/2
93	RE-1166-226	22K	1/2
94	RE-1139-109	10 meg	1/2
95	RE-1166-476	470K	1/2
96	RE-1166-477	470K	1/2
97	RE-1063-274	270	1
98	RE-1062-157	150K	1/2
99	RE-1046-276	27K	2
100	RE-1166-226	22K	1/2
101	RE-1166-107	100K	1/2
102	RE-1166-107	100K	1/2
103	RE-1046-106	10K	2
104	RE-1153-476	47K	1
105	FE-1139-104	100	1/2
106	FE-1166-107	100K	1/2
MISCELLANEOUS			
Item No.	Part No.		
62	SW-1069	Switch, Radio-Phono	
63	RE-1181	Pot. Vol. Cont. and Sw., 500K	
64	RE-1182	Pot., Tone Control, 250K	
107	TR-1061	Transformer, Power	
108	TR-1060	Transformer, Output	
109	SK-1016	Speaker	
110	TR-1064	Transformer, Antenna	
111	CI-1057	R-F Coil (FM)	
112	CI-1058	Oscillator Coil (FM)	
113	TR-1065	Transformer, IF (FM)	
114	TR-1052	Transformer, First IF (AM)	
115	TR-1065	Transformer, IF (FM)	
116	TR-1051	Transformer, Second IF (AM)	
117	TR-1066	Transformer, Ratio Detector	
118	CI-1059	Oscillator Coil	
119	AT-1019	Antenna Loop	
120	LA-1014-32	Pilot Light	
121	LA-1014-32	Pilot Light	
122	CK-1040	Filter Choke	
123	AS-3599	Antenna (FM)	
124	CDC-5001	Capacitor, Variable, Tuning	
125	CK-1036	R-F Choke	
126	CK-1036	R-F Choke	

MONITOR EQUIPMENT CORP.

MODEL RA50



ALIGNMENT PROCEDURE

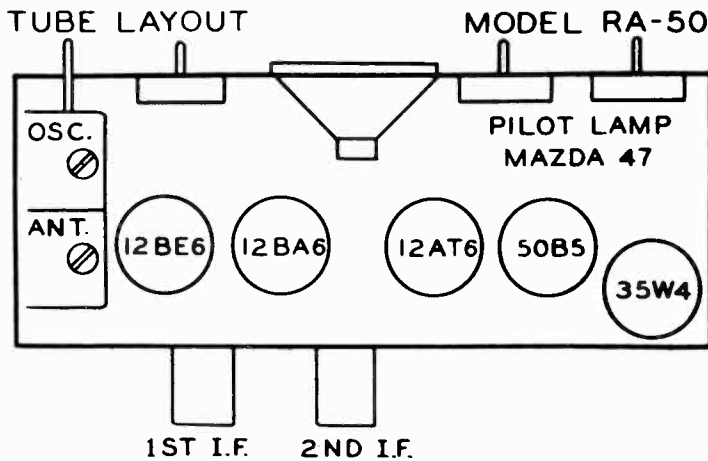
1. Turn gang condenser to full mesh position. Set dial pointer on the small dot to the left of the last calibration.
2. Connect the output meter across the voice coil.
3. Connect the output of the Signal Generator to a two-turn loop of wire and place about one foot away from loop on the set.
4. Turn volume full on. Keep output of Signal Generator as low as possible and still get deflection on output meter.

ALIGNMENT CHART

Alignment Sequence	Signal Generator	Position of Dial Pointer	Adjust for Maximum Output
1	456 kc.	Full mesh-55	2nd I.F. (2 trimmers)
2	456 kc.	Full mesh-55	1st I.F. (2 trimmers)
3	1400 kc.	1400	Oscillator Section of Gang Condenser
4	1400 kc.	1400	Antenna Section of Gang Condenser

MODEL RA50

MONITOR EQUIPMENT CORP.



TYPE: Five tube, single band, superheterodyne with Record Changer.

FREQUENCY RANGE: 540 to 1600 kc.

INTERMEDIATE FREQUENCY: 456 kc.

POWER SUPPLY: a.c.—60 cycle.

VOLTAGE RATING: 105-125 volts.

POWER CONSUMPTION: 35 watts.
(Phonograph: 15 watts additional)

POWER OUTPUT: 1.5 watts.

TUBE COMPLEMENT:

Type	Function
12BE6	Oscillator, mixer
12BA6	I.F. Amplifier
12AT6	Detector, A.V.C. Audio Amplifier
50B5	Power output
35W4	Rectifier

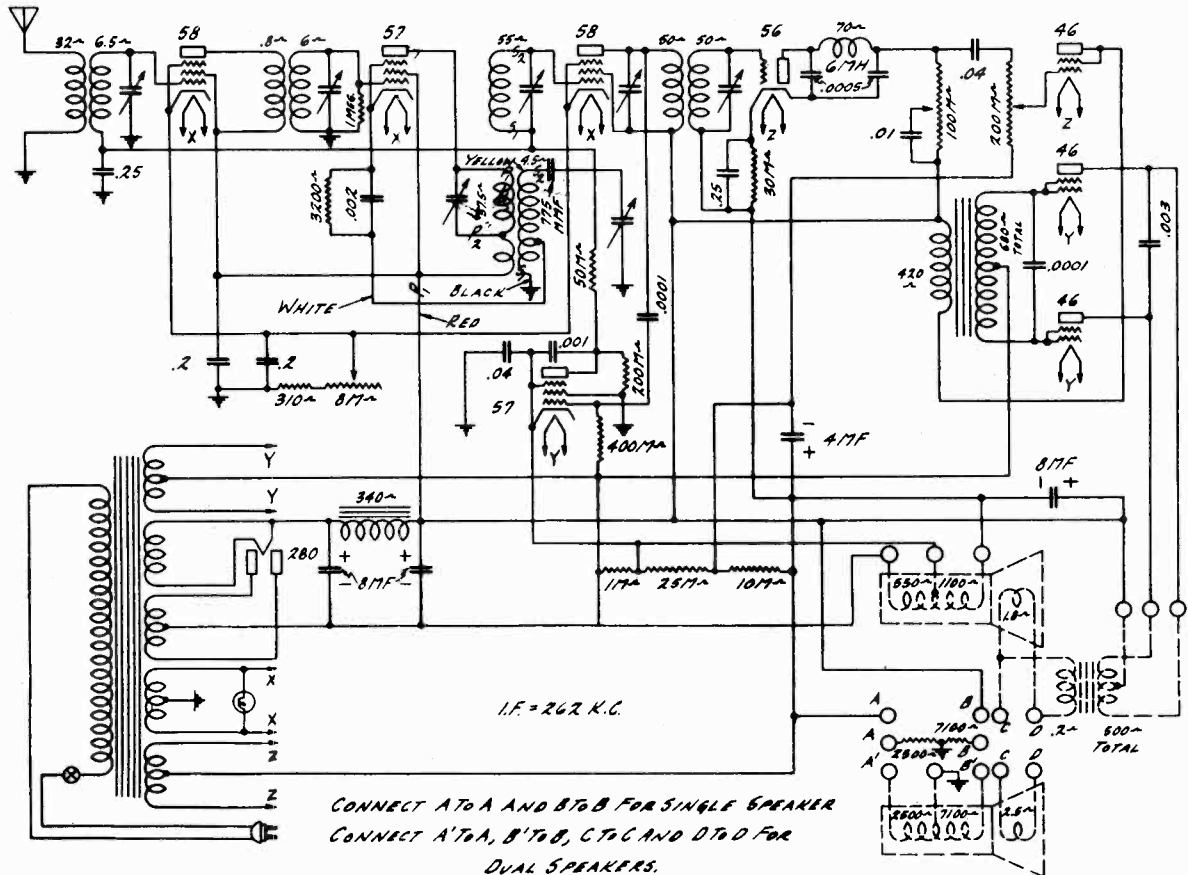
Pilot Lamp: Mazda 47

PARTS LIST

PART No.	DESCRIPTION	PART No.	DESCRIPTION
LA-1014-32	Bulb, dial lamp, Mazda 47	AS-3362	Dial Glass (Calibrated)
AT-1018	Ant. loop	KN-1053	Knob
CI-1049	Oscillator coil	CD-1071-28	Condenser, 250 mmfd., mica
TR-1052	Transformer, 1st I.F.	CD-1071-22	Condenser, 100 mmfd., mica
TR-1051	Transformer, 2nd I.F.	CD-1227-3	Condenser, .002 mfd., 400 volt, tubular
CD-1217	Condenser, variable, two-section	CD-1227-10	Condenser, .02 mfd., 400 volt, tubular
BU-1120	Condenser drive bushing	CD-1227-13	Condenser, .05 mfd., 400 volt, tubular
CX-1025	Condenser drive bushing clip	CD-1227-19	Condenser, .5 mfd., 400 volt, tubular
SW-1060	Phono-radio switch	CD-1227-2	Condenser, .0015 mfd., 400 volt, tubular
RE-1165	Tone control potentiometer	CD-1227-8	Condenser, .01 mfd., 400 volt, tubular
RE-1164	Volume control and switch	CD-1224	Condenser, 10 mfd., 25 volt, electrolytic
SK-1011	Speaker with output transformer	CD-1226	Condenser, 30-40 mfd., 150 volt, tubular electrolytic.
SO-1060	Socket (Tube)	RE-1169	Resistor, 15 ohm.
SO-1064	Socket (pilot lamp)	RE-1168-225	Resistor, 2200 ohm, 1 watt
SE-1033	Tube Shield	RE-1166-516	Resistor, 51 K ohm, 1/2 watt
BE-1048	Tube Shield Base	RE-1166-159	Resistor, 15 megohm, 1/2 watt
SO-1061	Phono input jack	RE-1166-308	Resistor, 3 megohm, 1/2 watt
SO-1059	A.C. outlet (Phono)	RE-1166-507	Resistor, .5 megohm, 1/2 watt
AS-3361	Dial drive cable assembly	RE-1166-206	Resistor, 20 K ohm, 1/2 watt
IN-1024	Dial Pointer	RE-1003-154	Resistor, 150 ohm, 1/2 watt

MONTGOMERY WARD

MODELS 62-49, 62-68,
62-68X, 62-88



In order to adjust the four I.F. trimmer condensers it is necessary to remove the chassis from the cabinet. The I.F. trimmer adjusting screws are located on the underside of the chassis sub-panel and protrude through the porcelain bases of the I.F. transformer. The intermediate frequency in this chassis is 262 kilocycles. In aligning this receiver a "dummy" 57 tube (one which has one filament prong removed) should be inserted in the AVC socket. This will remove any possibility of AVC action. Alignment in this chassis should not be attempted without any tube in the AVC socket as the lack of the tube capacity in the circuit will cause an incorrect alignment to be made. The tube shield should be in position when making any alignment adjustments.

September, 1932

Twenty-Five Cycle Chassis

The 25 cycle chassis uses power transformer No. U4108 instead of power transformer No. U4107.

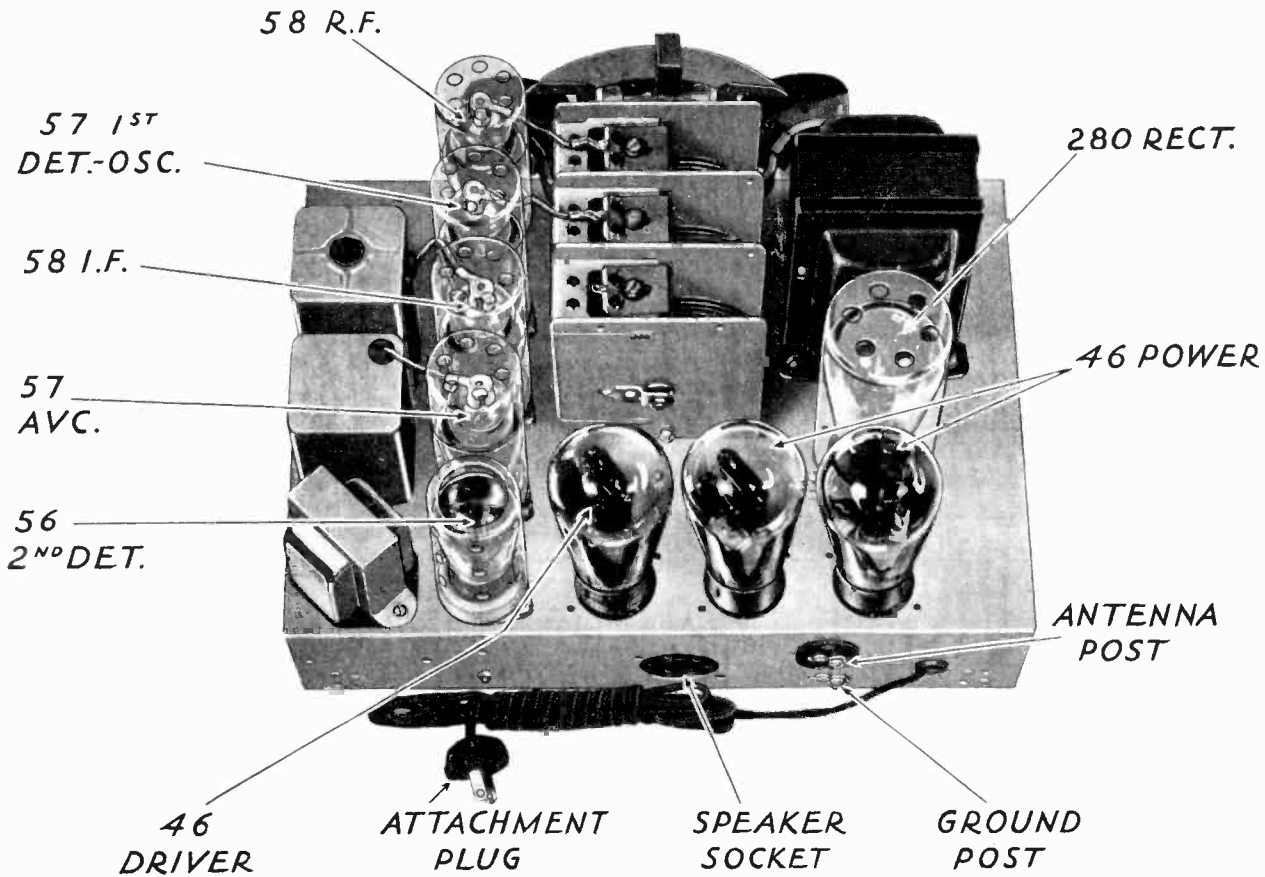
**VOLTAGES AT SOCKETS — LINE VOLTAGE 115 — VOLUME CONTROL AT MAXIMUM
NOISE SUPPRESSOR CONTROL AT MAXIMUM**

Type of Tube	Position of Tube	Function	"A" Volts	"B" Volts	Control Grid "C" Volts	Screen Volts	Screen Current MA	Cathode Volts	Plate MA	Grid Test MA
58	1	R. F.	2.25	125	5.0	125	1.7	5.0	6.0	10.0
57	2	1st Det.	2.25	125	5.0 (2)	125	.3 (2)	5.0 (2)	1.2 (2)	2.0
58	3	I. F.	2.25	125	5.0 (1)	125	1.7	5.0	6.0	10.0
57	4	A.V.C.	2.25	100 (3)	24.0 (4)	145	0	24.0	0	0
56	5	2nd Det.	2.25	150	12.0			12.0	.4	.5
46	6	Driver	2.25	215	19.0 (5)				25.0	30.0
46	7	Power	2.25	320	0				5.0 (6)	13.0
46	8	Power	2.25	320	0				5.0 (6)	13.0
280	9	Rect.	4.8						41	
									Per Plate	

- (1) Measured from movable arm of Noise Suppressor control to ground. Reads 26 volts with Noise suppressor control at minimum.
- (2) Values read with analyzer plug in socket. Actual values different as analyzer prevents oscillator from oscillating.
- (3) Measured with 600,000 Ohm Meter.
- (4) Measured across 1000 Ohm Resistor.
- (5) Measured across 10,000 Ohm Carbon Voltage Divider Resistor.
- (6) Plate current at no signal. At full output, plate current is 60 to 70 MA.

MODELS 62-49, 62-68,
62-68X, 62-88

MONTGOMERY WARD

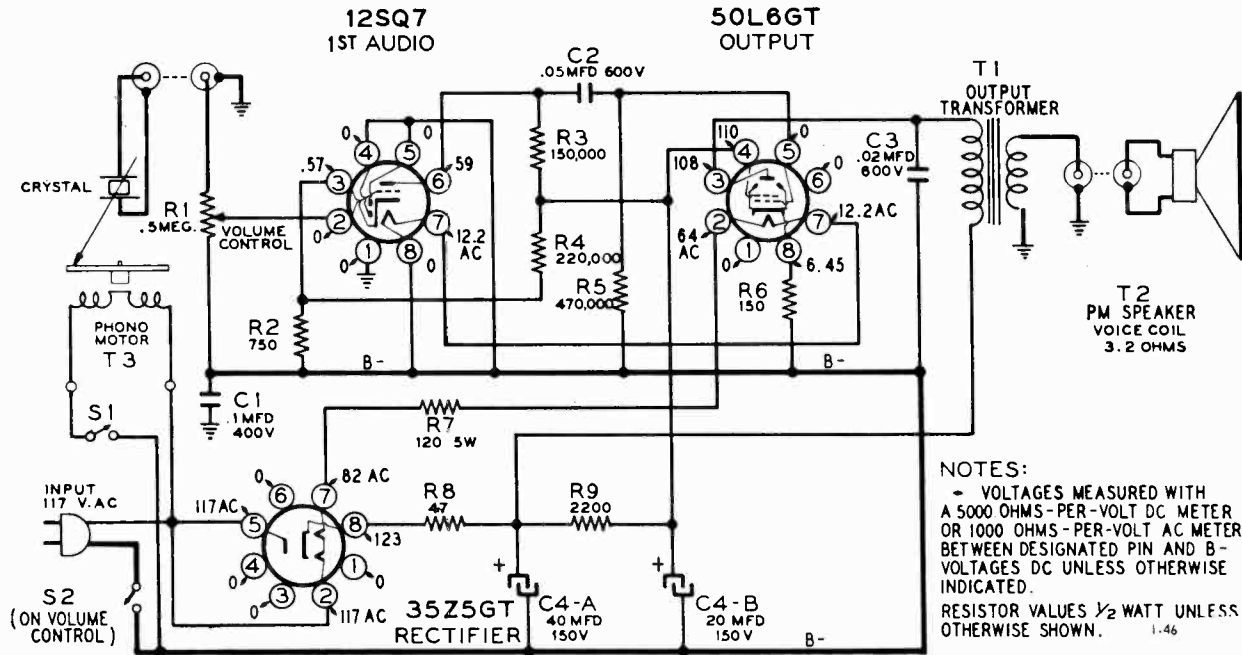


Replacing R.F., Oscillator, or I.F. Transformers

The antenna and first detector transformers are contained in shielding cans under the chassis sub-panel, and it is not necessary to remove these cans in order to replace the transformers. Unscrew and remove the screw holding the transformer mounting bracket to the sub-panel and bring the transformer out as far as the leads will permit. Unsolder the leads to the transformer terminal lugs. Put the new transformer into position and solder the leads to the lugs. Replace the screw holding the transformer mounting bracket to the sub-panel. After the two transformers have been installed, re-align the tuning condensers. To replace the oscillator and first I.F. assembly, unsolder the leads to the lugs on the porcelain base and unsolder the 4 leads extending through the base. Remove the two nuts from the studs extending through the chassis sub-panel, after which the assembly may be removed.

Part No.	Description	No. Used in Set
U 115	Pilot Light Lamp	2
U 678	Ground Binding Post	1
U 701	Tube Socket—280	1
U 705	Resistor, 25,000 Ohm, Carbon, 1 Watt	1
U 861	Attachment Cord and Plug	1
U 962	Grid Cap	4
U1358	Condenser, .04 Mfd. Tubular	1
U1751	Resistor, 200,000 Ohm, Carbon, 1 Watt	1
U2240	Resistor, 400,000 Ohm, Carbon, 1 Watt	1
U2333	Antenna Binding Post	1
U2716	Condenser, .01 Mfd. Tubular	1
U2851	Condenser, .04 Mfd. Tubular	1
U2857	Resistor, 10,000 Ohm, Carbon, 1 Watt	1
U2858	Resistor, 1 Megohm, Carbon, 1/10 Watt	1
U3063	Resistor, 30,000 Ohm, Carbon, 1 Watt	1
U3146	Pilot Lamp Socket, with Bracket and Leads	2
U3358	Vertical Insulated Terminal	3
U3371A	Resistor, 3200 Ohm, Candelohm	1
U3446	Oscillator Series Condenser, 775 Mmfd.	1
U3704	Condenser, .002 Mfd. Bypass	1
U4079	Resistor, 50,000 Ohm, in Insulating Tubing	1
U4107	Power Transformer, 105-125 Volts, 60 Cyc.	1
U4108	Power Transformer, 105-125 Volts, 25 Cyc.	1
U4116	Filter Condenser, Dual 8 Mfd., Electrolytic	1
U4117	Tube Socket—57	2
U4118	Tube Socket—58	2
U4124	Volume Control and Power Switch, 200,000 Ohm	1
U4125	Noise Suppressor Control, 8,000 Ohm	1
U4126	Tone Control, 100,000 Ohm	1
U4128	Dry Electrolytic Condenser Clamp	1
U4129	Tube Socket—46	3
U4130	Tube Socket—56	1
U4131	Speaker Socket	1
U4144	Condenser, 4 Mfd. Dry Electrolytic Bypass	1
U4180	Three-gang Tuning Condenser	1
U4197	Condenser, .25 Mfd. Tubular	2
U4198	Condenser, .2-2 Mfd. Tubular	1
U4492	Tube Shield—56	1
U4524	Detector Plate Choke Assembly	1
U4663	Tuning Condenser Drive Support Bracket	1
U4664	Station Selector Pointer Arm and Bracket	1
U4665	Dial Plate with Dial Charts and Pointers	1
U4666	Dial Drive Shaft Assembly	1
U4667	Dial Drive Disc with Hub and Set Screws	1
U4720	Walnut Knob, Station Selector	1
U4721	Walnut Knob, Tone Control, Noise Suppressor, Volume Control	3
U4793	Antenna Transformer	1
U4795	1st Detector Transformer	1
U4801	I.F. Transformer, Complete with Shield Can	1
U4802	Oscillator-I. F. Assembly, Complete with Shield Can	1

Part No.	Description	No. Used in Set
U4199	Filter Condenser, 8 Mfd. Dry Electrolytic	1
U4230A	Pointer Spring, Tone Control	1
U4231A	Pointer Spring, Noise Suppressor and Volume Control	2
U4246	8" Electrodynamic Speaker, with Input Transformer	1
U4247	8" Electrodynamic Speaker, without Input Transformer	1
U4251	Condenser, 100 Mmfd.	2
U4252	Condenser, 3000 Mmfd.	1
U4254	Condenser, 1000 Mmfd.	1
U4255	Condenser, 500 Mmfd.	2
U4263	Audio Transformer	1
U4271	Pointer "Fish Line," 22" Length	1
U4321	Filter Choke	1
U4340	Collar and Set Screw	3
U4369	Resistor, 1,000 Ohm, Carbon, 1 Watt	1
U4467	Tube Shield Base—280	1
U4468	Tube Shield—280	1
U4471	Tube Shield Base—56, 57 and 58	5
U4472	Tube Shield Can—57 and 58	4
U4473	Tube Shield Cap—57 and 58	4



NOTES:
 - VOLTAGES MEASURED WITH
 A 5000 OHMS-PER-VOLT DC METER
 OR 1000 OHMS-PER-VOLT AC METER
 BETWEEN DESIGNATED PIN AND B-
 VOLTAGES DC UNLESS OTHERWISE
 INDICATED.
 RESISTOR VALUES 1/2 WATT UNLESS
 OTHERWISE SHOWN. L-46

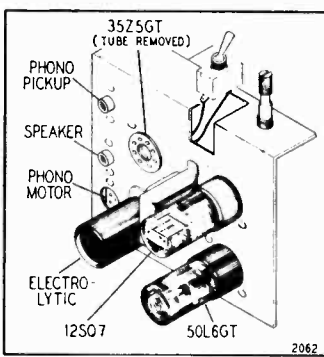
Ref. No.	Part No.	Description	Qty. Used in Set
CAPACITORS			
C1	A-8J-909	.1 mf, 400 volts, 10%	1
C2	A-8J-1995	.05 mf, 600 volts, 20%	1
C3	A-8J-4352	.02 mf, 600 volts, 20%	1
C4-A	11992	Dual electrolytic; 40 mf x 150 volts, 20 mf x 150 volts	1
C4-B			1
RESISTORS			
R1, S2	101230	Volume control (.5 megohm) and amplifier on-off switch	1
R2	A-9B1-6345	750 ohms, 10%, 1/2 watt	1
R3	A-9B1-88	150,000 ohms, 10%, 1/2 watt	1
R4	A-9B1-90	220,000 ohms, 10%, 1/2 watt	1
R5	A-9B1-94	470,000 ohms, 10%, 1/2 watt	1
R6	A-9B1-52	150 ohms, 10%, 1/2 watt	1
R7	A-9C-10925	120 ohms, 10%, 5 watts, wirewound	1
R8	A-9B1-46	47 ohms, 10%, 1/2 watt	1
R9	A-9B1-66	2200 ohms, 10%, 1/2 watt	1

Ref. No.	Part No.	Description	Qty. Used in Set
MISCELLANEOUS			
T2	B-18A-10952	Speaker, 5-inch, P. M.	1
	121210	Socket, octal, for tubes	3
	121216	Socket, for electrolytic capacitor	1
	A-19B-10727	Socket, for motor leads	1
	121282	Socket, for speaker leads	1
	121280	Socket, for pickup leads	1
	A-19A-10947	Plug for motor leads	1
	121285	Plug for speaker leads	1
	10724	Plug for pickup arm leads	1
T1	105128	Output transformer	1
	107266	Line cord and plug	1
S1	A-20C-5945	Switch, on-off, for motor	1
T3	D-2H-10816	Phono motor and turntable	1
	C-48C-10954	Pickup arm, complete (includes rest and crystal pickup (Astatic L-40))	1
	128660-9	Knob	1
	24D-10924	Case	1
	B-2K-10943	Grill screen	1

ELECTRICAL SPECIFICATIONS

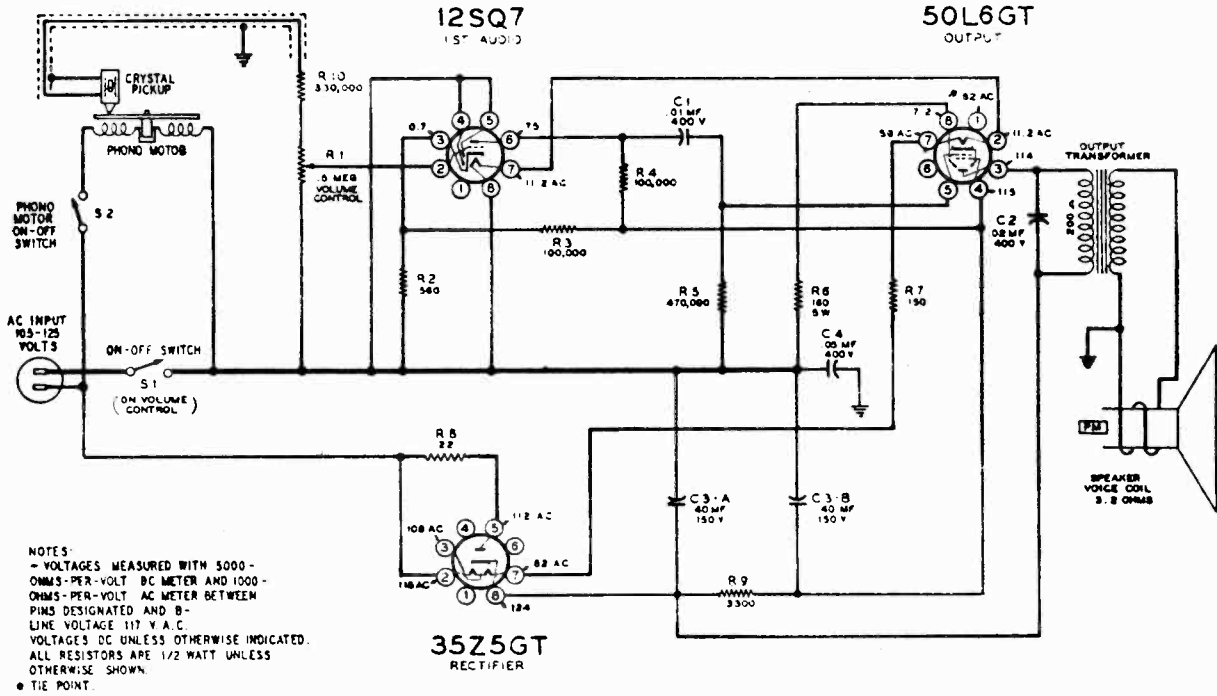
Power supply 105 to 125 volts AC, 60 cycles
 Power output of amplifier 1.5 watts maximum
 Sensitivity (for 1 watt output) 0.25 volts average

*The values of all resistors listed above are based on RMA standards. Due to conditions beyond our control some receivers have been shipped with resistors of pre-standardized values. This receiver will operate equally well with resistors of either group. An illustration of the difference follows:
 Pre-standardized value—50,000 ohms, ±10%, 1/2 watt
 RMA value—47,000 ohms, ±10%, 1/2 watt



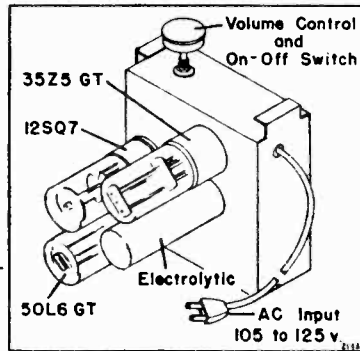
To reach amplifier chassis: Remove turntable, volume control knob, nut on motor toggle switch, and four corner screws. Carefully lift up platform and disconnect phono motor and pickup plugs from amplifier chassis sockets. Platform can then be removed.

Amplifier Chassis



ELECTRICAL SPECIFICATIONS

- 105 to 125 volts AC, 60 cycles, 50 watts.
- 0.75 watt undistorted (0.6 volt input).
- 1.8 watts maximum.
- 5-inch (or 4-inch x 6-inch oval), P. M., voice coil impedance 3.2 ohms.



To reach amplifier chassis, remove four corner screws holding platform to cabinet. Lift platform carefully to avoid breaking connections to speaker. Chassis may be dismounted by removal of volume control knob and two mounting screws.

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

CAPACITORS

C1	BEC-8D-10761	.01 mf, 400 volts, 20%	1
C2	BEC-8D-10774	.02 mf, 400 volts, 20%	1
C3-A, B	BEA-8C-11415-1 or BEA-8C-11119	Electrolytic; 40 mf x 150 volts, 40 mf x 150 volts	1
C4	BEC-8D-10813	.05 mf, 400 volts, 20%	1

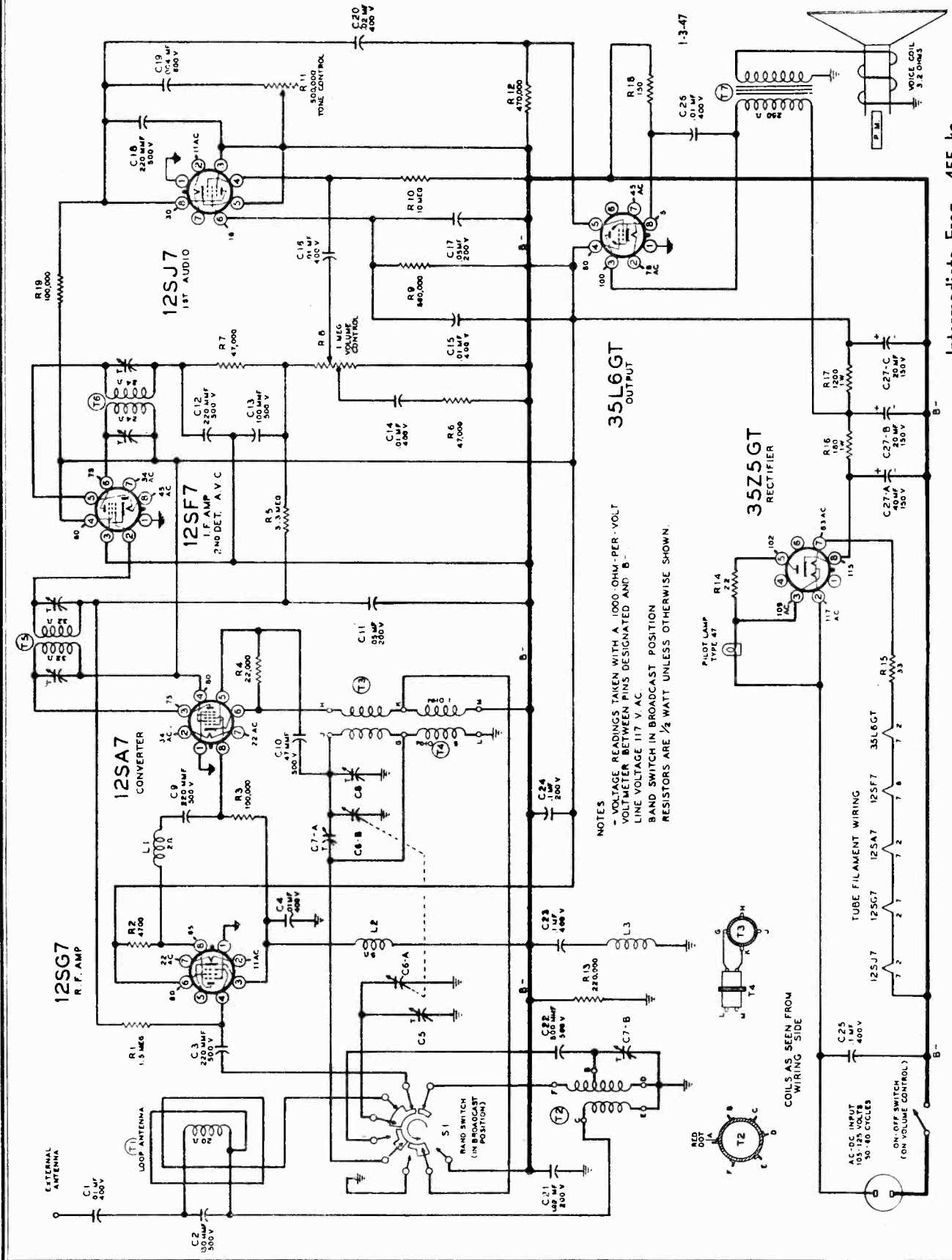
RESISTORS*

R1, S1	3EA-10A-11377	Volume control (500,000 ohms) and on-off switch	1
R2	BEC-9B1-59	560 ohms, 1/2 watt, 10%	1
R3	BEC-9B1-86	100,000 ohms, 1/2 watt, 10%	1
R4	3EC-9B1-25	100,000 ohms, 1/2 watt, 20%	1
R5	BEC-9B1-29	470,000 ohms, 1/2 watt, 20%	1
R6	BEA-9C-11355	160 ohms, 5 watts, 10%, wire-wound	1
R7	BEC-9B1-8	150 ohms, 1/2 watt, 20%	1
R8	BEC-9B1-3	22 ohms, 1/2 watt, 20%	1
R9	BEC-9B1-16	3300 ohms, 1/2 watt, 20%	1
R10	BEC-9B1-28	330,000 ohms, 1/2 watt, 20%	1

MISCELLANEOUS

BEB-12C-10074-3	Output transformer	1
BEB-14M-10088	Line cord and plug	1
BEA-15B-10440	Tube socket	3
BEA-49A-11356	Tube retainer (for 12AT6)	1
BEA-49A-11357	Tube retainer (for 35W4, 50B5)	2
BEB-18A-10952-1 or BEB-18A-11381	Speaker, 5-inch, P. M. Speaker, 4-inch x 6-inch oval, P. M.	1
BED-21H-10816	Phono motor and turntable	1
BE48C-12025	Pickup arm, less crystal cartridge	1
BE8K-12026	Crystal cartridge (Shure P87B)	1
BEA-20C-10317	Phono motor on-off switch	1
BE202-11360-1	Cabinet	1
BEB-2K-11364	Grille	1
BEA-5B-11370-17	Knob	1
BEA-25B-11390	Rubber feet	8

MONTGOMERY WARD MODELS 64BR-1513A, 64BR-1514A, 74BR-1513B, 74BR-1514B

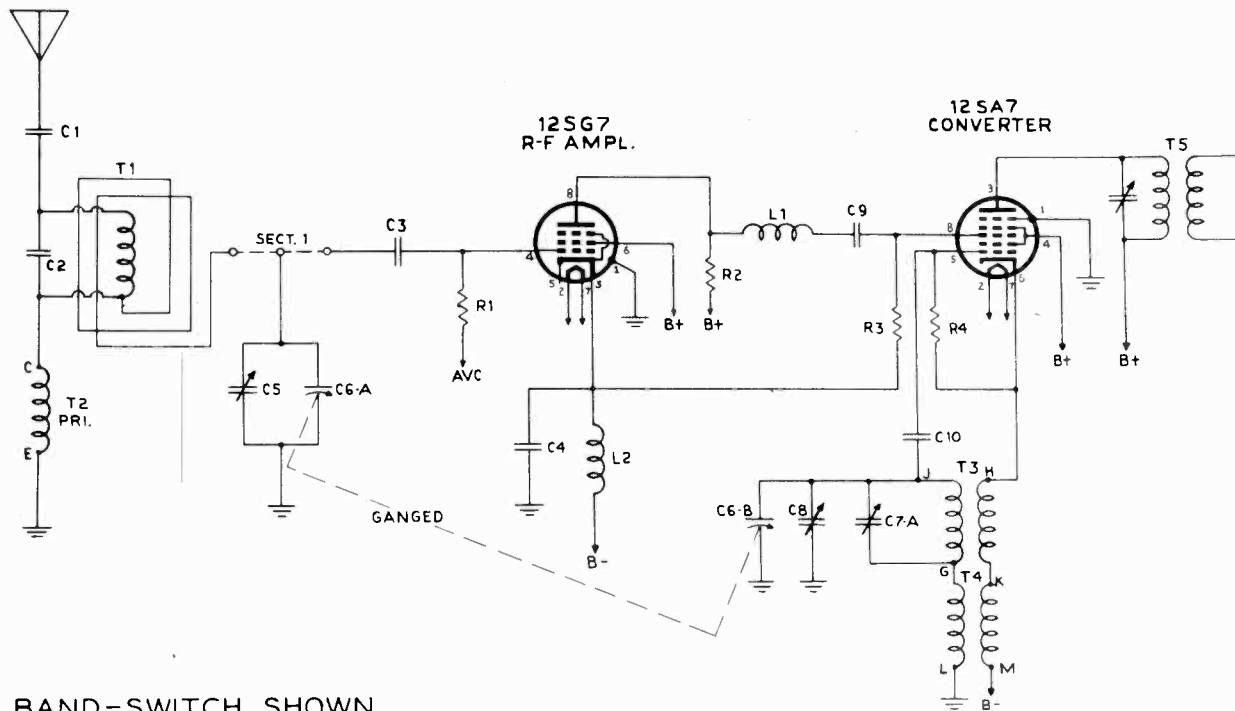


Intermediate Freq. 455 kc.

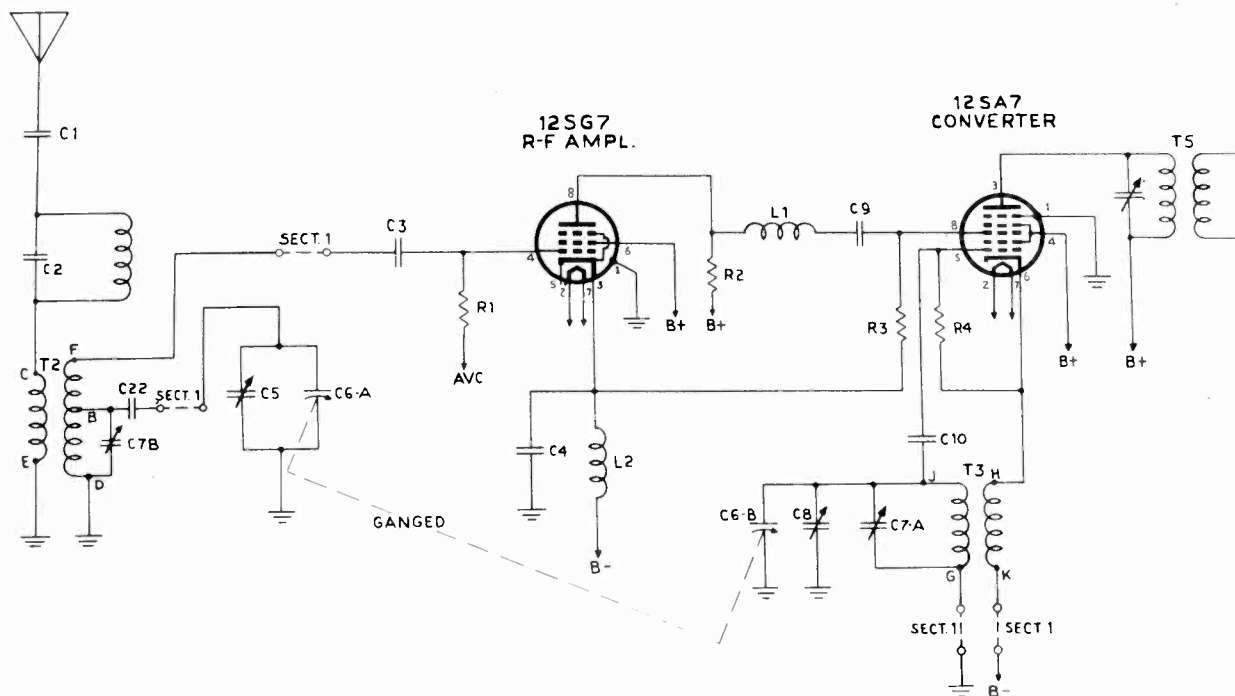
"clarified schematics"

PAGE 17-6 MONT WARD

MODELS 64BR-1513A, 64BR-1514A, MONTGOMERY WARD
74BR-1513B, 74BR-1514B

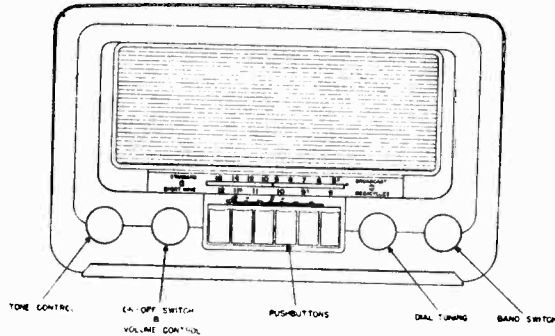


BAND-SWITCH SHOWN
AT 1ST POSITION.
BROADCAST BAND
530 - 1600 KC



BAND-SWITCH SHOWN
AT 2ND POSITION.
SHORT WAVE BAND
9 - 12 MC

MONTGOMERY WARD MODELS 64BR-1513A, 64BR-1514A, 74BR-1513B, 74BR-1514B



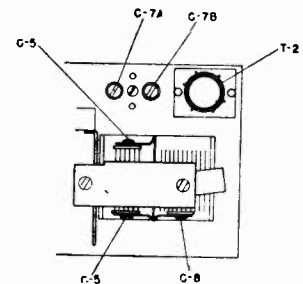
RECEIVER STAGE SENSITIVITIES

The table below lists the sensitivity at the input of each stage. 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 0.4 volts AC across this resistor will be equivalent to a 50-milliwatt output with the speaker connected.

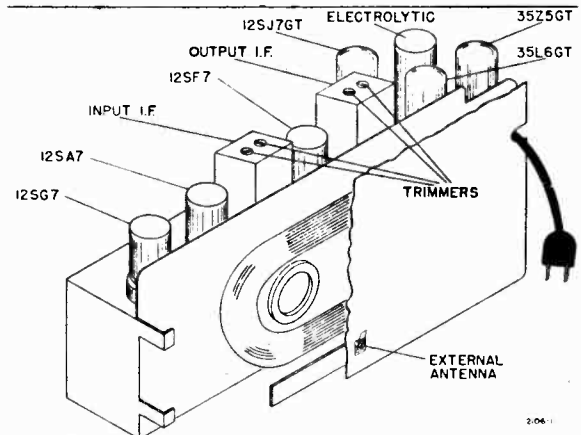
The signal source must be an accurately calibrated signal generator capable of supplying the necessary frequencies modulated 30% with a 400-cycle audio signal. Variations of plus or minus 25% are usually permissible.

The volume control must be set on maximum.

The tone control must be set at maximum high.



NOTE: C-5 should read C-8.
C-8 should read C-5.



Chassis View, Showing Trimmer Location

SIGNAL GENERATOR				INPUT FOR 50-MILLIWATT OUTPUT
Frequency	Coupling Capacitor	Connection to Radio	Ground Connection	
1000 kc	200 mmf or RMA dummy antenna	External antenna clip	Pin 3 of 12SF7 (B-of set)	11 microvolts
1000 kc	0.1 mf	Grid (pin 8) of converter (12SA7)	Pin 3 of 12SF7 (B-of set)	138 microvolts
455 kc	0.1 mf	Grid (pin 8) of converter (12SA7)	Pin 3 of 12SF7 (B-of set)	107 microvolts
455 kc	0.1 mf	Grid (pin 2) of I.F. amp. (12SF7)	Pin 3 of 12SF7 (B-of set)	3200 microvolts
12 mc	200 mmf or RMA dummy antenna	External antenna clip	Pin 3 of 12SF7 (B-of set)	15 microvolts

ALIGNMENT PROCEDURE

- Output meter across 3.2-ohm output load.
- Volume control at maximum for all adjustments.
- Tone control at maximum high.
- Align for maximum output. Reduce input as needed to keep output near 0.4 volts.
- Loop antenna should be connected to receiver and in its proper position when making adjustments.

SIGNAL GENERATOR				TUNER SETTING	ADJUST TRIMMERS TO MAXIMUM OUTPUT (in order shown)
Frequency	Coupling Capacitor	Connection to Radio	Ground Connection		
455 kc	0.1 mf	Grid (pin 2) of 12SF7	Pin 3 of 12SF7 (B-of set)	Capacitor full open (plates out of mesh)	2 trimmers on T6 output IF can
455 kc	0.1 mf	Grid (pin 8) of 12SA7	Pin 3 of 12SF7 (B-of set)	Capacitor full open (plates out of mesh)	2 trimmers on T5 input IF can
1400 kc	200 mmf	External antenna clip	Pin 3 of 12SF7 (B-of set)	Set dial pointer at 1400 kc	Ant. trimmer C5 and oscillator trimmer C8 on gang
12 mc	200 mmf	External antenna clip	Pin 3 of 12SF7 (B-of set)	Set dial pointer at 12 m.c.	Ant. trimmer C7-B and oscillator trimmer C7-A

MODELS 64BR-1513A, 64BR-1514A, MONTGOMERY WARD
74BR-1513B, 74BR-1514B

REPLACEMENT PARTS LIST
Use Only Genuine Factory Replacement Parts
HOW TO ORDER PARTS—When ordering, specify PART number, schematic diagram reference number when applicable, and CHASSIS MODEL number. The model number appears on a label on the chassis.

Ref. No.	Part No.	Description	Qty. Used in Set
CAPACITORS*			
C6-A, C6-B	B-8A-10827	Two gang variable condenser with C5 and C8 trimmers	1
C27-A, C27-B, C27-C	A-8C-10077	Electrolytic filter condenser 40 mfd., 150 volts, 20 mfd., 150 volts, 20 mfd., 150 volts	1
C7-B, C7-A	A-8H-10839	Dual trimmer—for short-wave antenna and oscillator	1
C19	C-8D-10783	.004 mf x 400 volts, tubular	1
C20	C-8D-10774	.02 mf x 400 v., 20%, tubular	1
C23-C25	C-8D-10760	.1 mf x 400 v., 10%, tubular	2
C24	C-8D-10771	.1 mf x 200 v., 10%, tubular	1
C11-17	C-8D-10770	.05 mf x 200 v., 20%, tubular	2
C1-CA-14-15 16-26	C-8D-10761	.01 mf x 400 v., 20%, tubular	6
C21	C-8D-11304	.02 mf x 200 v., 20%, tubular	1
C3-9-12-18	C-8F3-10	220 mfmf, 500 v., 20%, mica	4
C10	C-8E3-109	47 mfmf, 500 v., 10%, mica	1
C22	C-8F3-10910	500 mfmf, 500 v., 3%, silver mica	1
C13	C-8F3-8	100 mfmf, 500 v., 20%, mica	1
C2	C-8F3-115	150 mfmf, 500 v., 10%, mica	1
RESISTORS*			
R8	A-10A-10688	Volume control—1 megohm, and on-off switch	1
R11	A-11B-10690	Tone control—500K ohm	1
R14	C-9B1-42	22 ohm, 1/2 watt, 10%	1
R16	C-9B2-53	180 ohm, 1/2 watt, 10%	1
R18	C-9B1-52	150 ohm, 1/2 watt, 10%	1
R10	C-9B1-37	10 megohm, 1/2 watt, 20%	1
R5	C-9B1-34	3.3 megohm, 1/2 watt, 20%	1
R4	C-9B1-78	22K ohm, 1/2 watt, 10%	1
R12	C-9B1-94	470K ohm, 1/2 watt, 10%	1
R2	C-9B1-70	470K ohm, 1/2 watt, 10%	1
R1	C-9B1-32	1.5 megohm, 1/2 watt, 10%	1
R17	C-9B2-63	1200 ohm, 1 watt, 10%	1
R9	C-9B1-86	100K ohm, 1/2 watt, 10%	1
R9	C-9B1-95	560K ohm, 1/2 watt, 10%	1
R7-R6	C-9B1-82	47K ohm, 1/2 watt, 10%	2
R13	C-9B1-27	220K ohm, 1/2 watt, 20%	1
R3	C-9B1-25	100K ohm, 1/2 watt, 20%	1
R15	C-9B2-44	33 ohm, 1 watt, 10%	1
COILS			
T6	B-13B-10794-1	Output I. F. coil	1
T5	B-13B-10091-2	Input I. F. coil	1
T2	B-13E-10834	S. W. antenna coil	1
T3	B-13D-10833	S. W. oscillator coil	1
T4	A-13D-10838	B. C. oscillator coil	1
L2	A-16A-10835	R. F. choke	1
L3	A-16A-10836	R. F. choke	1
L1	A-16A-10837	R. F. choke	1
T1	C-212-11095	Loop antenna assembly—Walnut—for 62-1513	1
		—or—	
T1	C-212-11095-1	Loop antenna assembly—Ivory—for 62-1514	1

DIAL AND TUNING PARTS

B-6D-10704-1	Dial scale—for 62-1513
B-6D-10704	Dial scale—for 62-1514
A-6A-10687	Diffuser
A-2G-10685	Pointer
B-5B-10710-17	Band switch knob—Walnut
B-5B-10710-8	Band switch knob—Ivory
B-5B-10711-17	Tuning knob—Walnut
B-5B-10711-8	Tuning knob—Ivory
B-5B-10712-17	Volume control knob—Walnut

B-5B-10712-8	Volume control knob—Ivory
B-5B-10713-17	Tone control knob—Walnut
B-5B-10713-8	Tone control—Ivory
B-5B-10041-17	Pushbutton—Walnut
B-5B-10041-8	Pushbutton—Ivory
B-2C-10707	Dial plate
A-23L-10934	Set station call letters
A-6C-10819	Set acetate tabs—(b)
200-10683	Lever assembly—Right hand roller
200-10683-1	Lever assembly—Left hand roller
A-3F-10656	Yoke lock screw
A-2C-10658	Cam
A-2C-10680	Key washer
B-29E-1812	Spring washer
B-3C-11069	Spacer, 1/4" inside x .285 long
B-3C-10698	Spacer, 1/4" inside x .519 long
B-3C-11071	Spacer, 1/4" inside x .754 long
B-3C-11072	Spacer, 1/4" inside x .498 long
B-3C-11073	Spacer, 1/4" inside x .156 long
A-2D-11077	Take-up arm
A-49A-10646	Spring for take-up arm
A-49A-12484	Springs for levers
B-2C-10695	Diffuser plate
A-49A-10887	Spring for dial string and pointer

A-53A-10989	String for dial (30" used) 1 yd.
A-52A-870	Set screw—6/32x1/8 for drum assembly
A-200-10884	Segment gear and bushing
A-3L-7192	Pinion gear—for tuning shaft
A-3A-10675	Manual tuning shaft—less pinion gear
A-2C-10655	Cam yoke
A-2C-10654	Retainer yoke—U shape
OUTPUT TRANSFORMER	
B-12C-10826	Output transformer for speaker
SPEAKER	
B-18A-10260	Speaker—4x6 inch P. M., less output transformer

MISCELLANEOUS

121-171	Tube socket
A-15B-10440	Tube socket
A-23A-7240	Line cord lock
B-14M-10088	Line cord and plug
B-20A-10259	Band change switch
A-47A-10694	Pilot light socket
A-46A-10793	T-47, 6-8 volt, Pilot light bulb
5C-10002-46	Bakelite cabinet—Walnut
5C-10002-9	Bakelite cabinet—Ivory colored
B-2M-7758	Snap-in rivets, to fasten diffuser
B-2M-11205	Stud—(short) for antenna mounting
A-2M-10096	Stud—(long) for antenna mounting

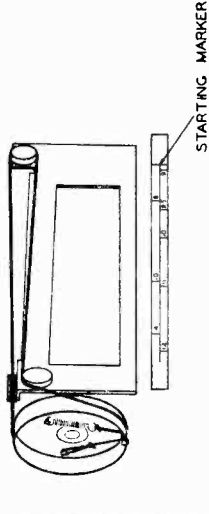
A-2J-10981	Clip—for antenna mounting brackets	4
42A-10874	No. 8-18x3/4 hex. head chassis mounting screw	2
B-2G-10702	Grille escutcheon	1
B-5C-12219	Grille	1
B-23K-12447	Grille cloth	1
B-23J-12448	Baffle	1
C-23J-11328	Back only for loop	1

The values of the resistors and mica capacitors listed above are based on RMA standards. Due to conditions beyond our control some receivers have been shipped with components of pre-standardized values. This receiver will operate equally well with components of either group. An illustration of the differences in both resistors and capacitors follows:

- Pre-standardized value—50,000 ohms, 1/2 watt, 10% RMA value—47,000 ohms, 1/2 watt, 10%
- Pre-standardized value—220 mmf, 500 volts, 20% RMA value—220 mmf, 500 volts, 20%

Dial Stringing Diagram

- REPLACING DIAL STRING
- 1- RESTRING DIAL AS SHOWN
 - 2- TURN TUNING SHAFT CLOCKWISE TO COMPLETELY CLOSE THE GANG
 - 3- FASTEN POINTER TO STRING AT STARTING MARKER ON CALIBRATION SCALE.

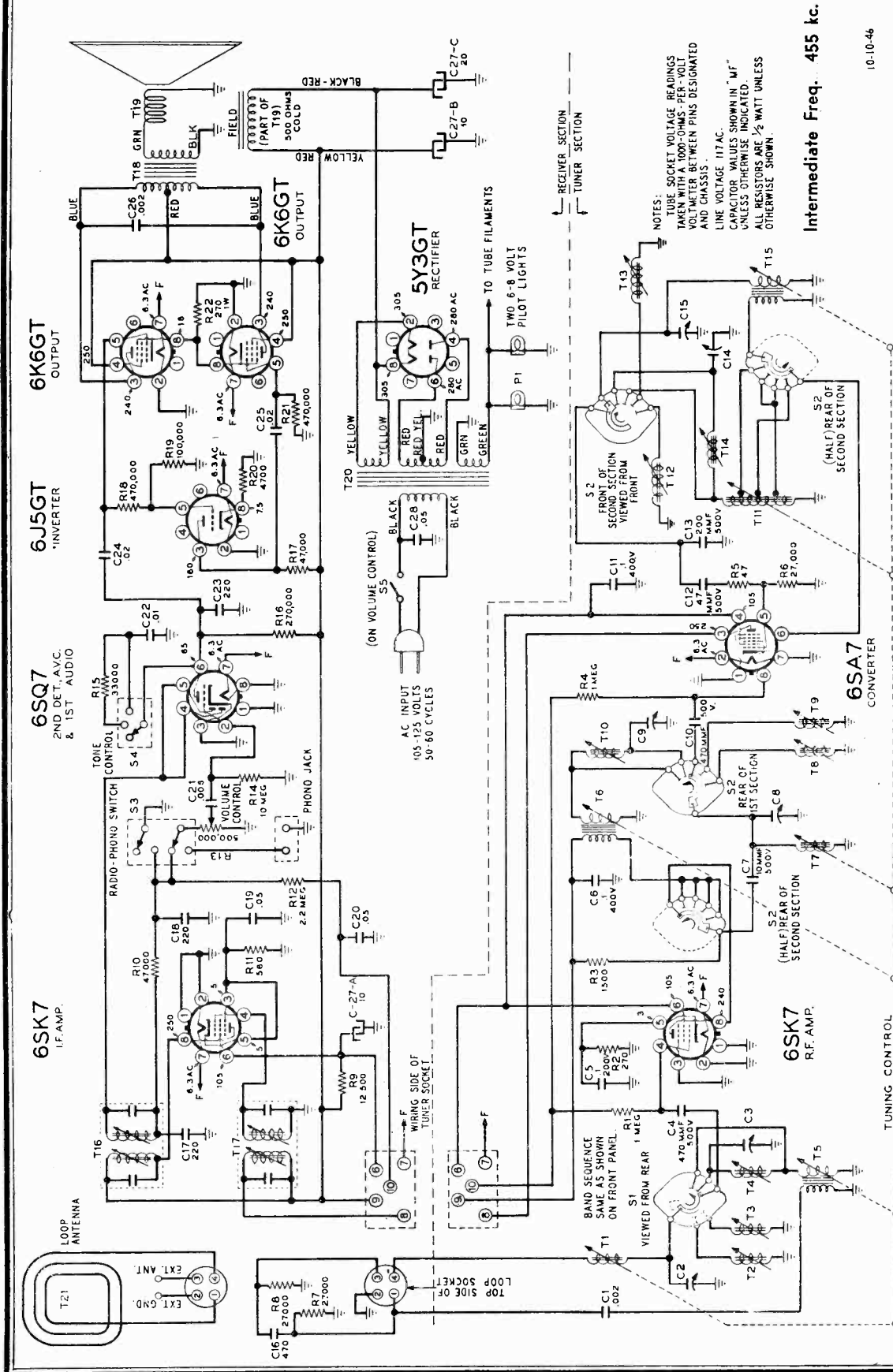


ELECTRICAL SPECIFICATIONS

- Power Supply 105 to 125 volts, DC or 50-60 cycle AC, 25 watts.
- Frequency Range 530 to 1600 kc.; 9 mc to 12 mc.
- Selectivity At 1000 kc, 56 at 1000 x signal. At 10 mc, 85 kc at 1000 x signal.
- Sensitivity 10 microvolts average for .05-watt output on broadcast band. 15 microvolts average for short-wave band.
- Power Output 0.85 watt undistorted, 1.0 watt maximum.
- Loud Speaker 4" x 6" oval, P.M., v.c. impedance 3.2 ohms.

MONTGOMERY WARD

MODEL 64BR-1308A



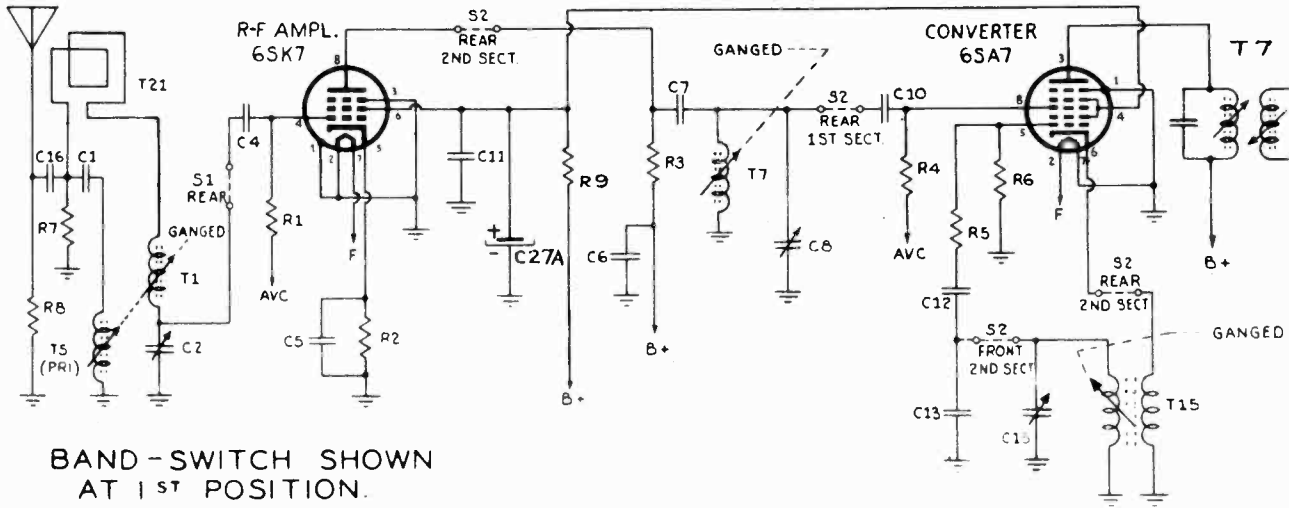
NOTES:
 TUBE SOCKET VOLTAGE READINGS
 TAKEN WITH A 1000-OHMS-PER-VOLT
 VOLTMETER BETWEEN PINS DESIGNATED
 AND CHASSIS.
 LINE VOLTAGE 117 AC.
 CAPACITOR VALUES SHOWN IN "MF"
 UNLESS OTHERWISE INDICATED.
 ALL RESISTORS ARE 1/2 WATT UNLESS
 OTHERWISE SHOWN.

Intermediate Freq. 455 kc.

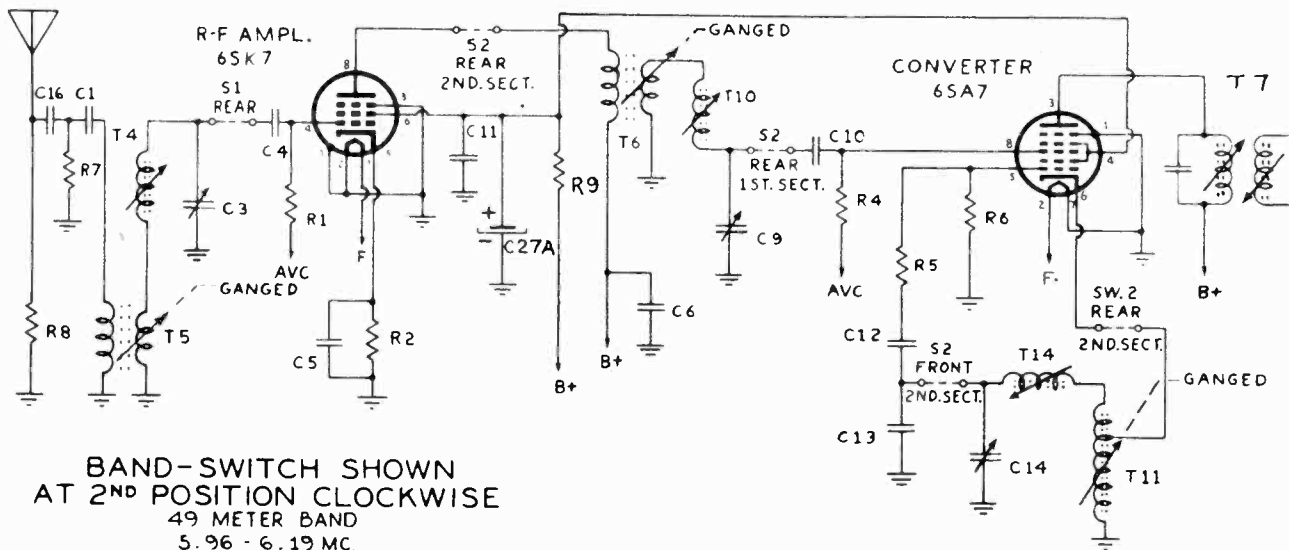
10-10-46

- Power Supply 105 to 125 volts AC, 50-60 cycles, 70 watts. Also made for 25- and 40-cycle AC.
- Frequency Ranges Broadcast band—540 to 1600 kc. 49-meter band—5.96 to 6.19 mc. 31-meter band—9.1 to 10 mc. 25-meter band—11.45 to 12.16 mc. 19-meter band—14.94 to 15.46 mc.
- Selectivity at 1000 kc, 35 kc at 1000 x signal
- Sensitivity 3.75 microvolts average for 1/2 watt output.
- Power Output 5.5 watts undistorted, 7.5 watts maximum.
- Loud Speaker 8" electrodynamic. Voice coil impedance 3.2 ohms.

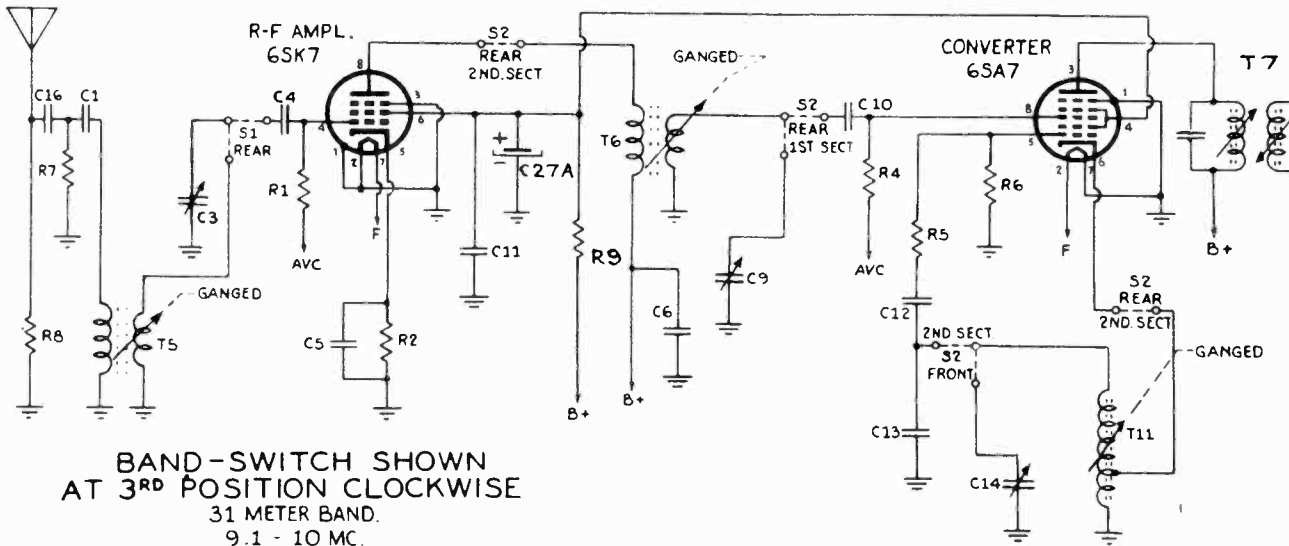
"clarified schematics"



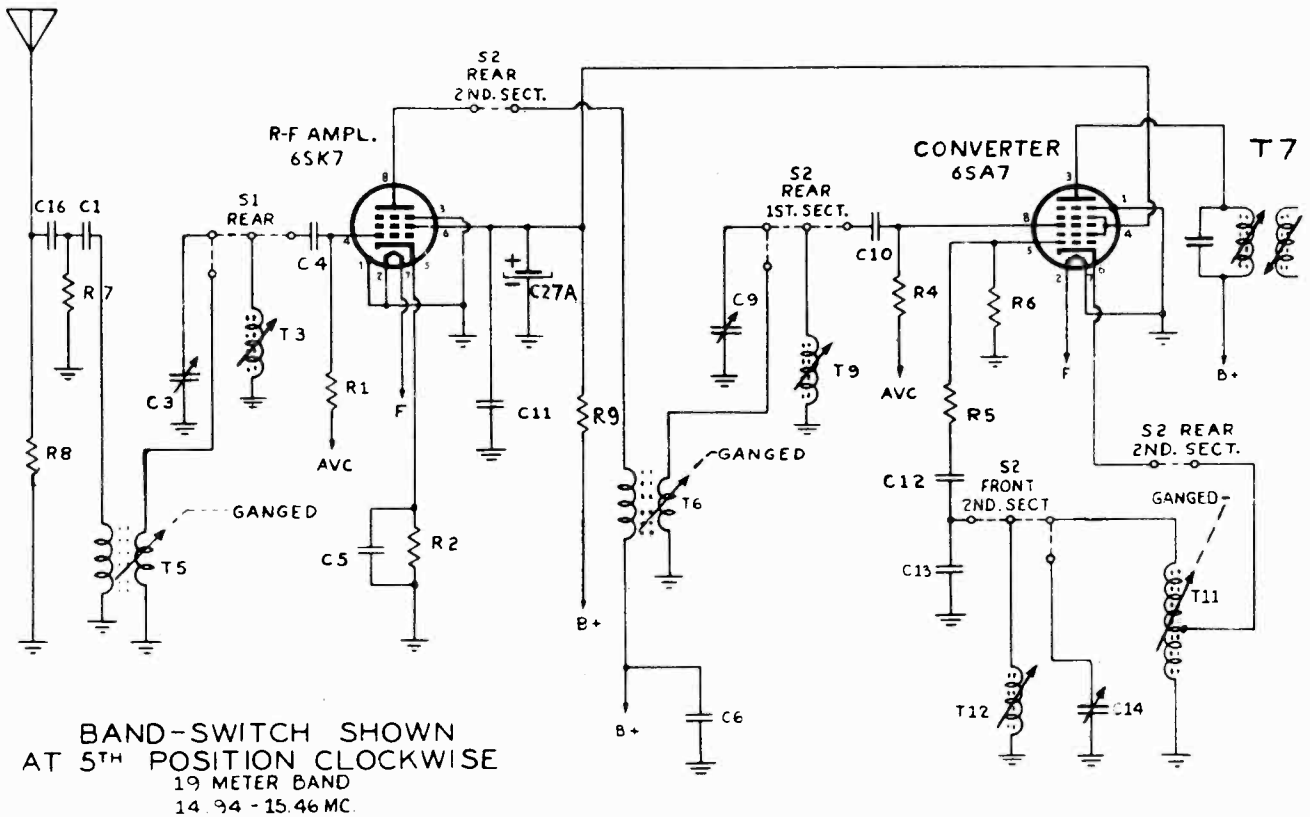
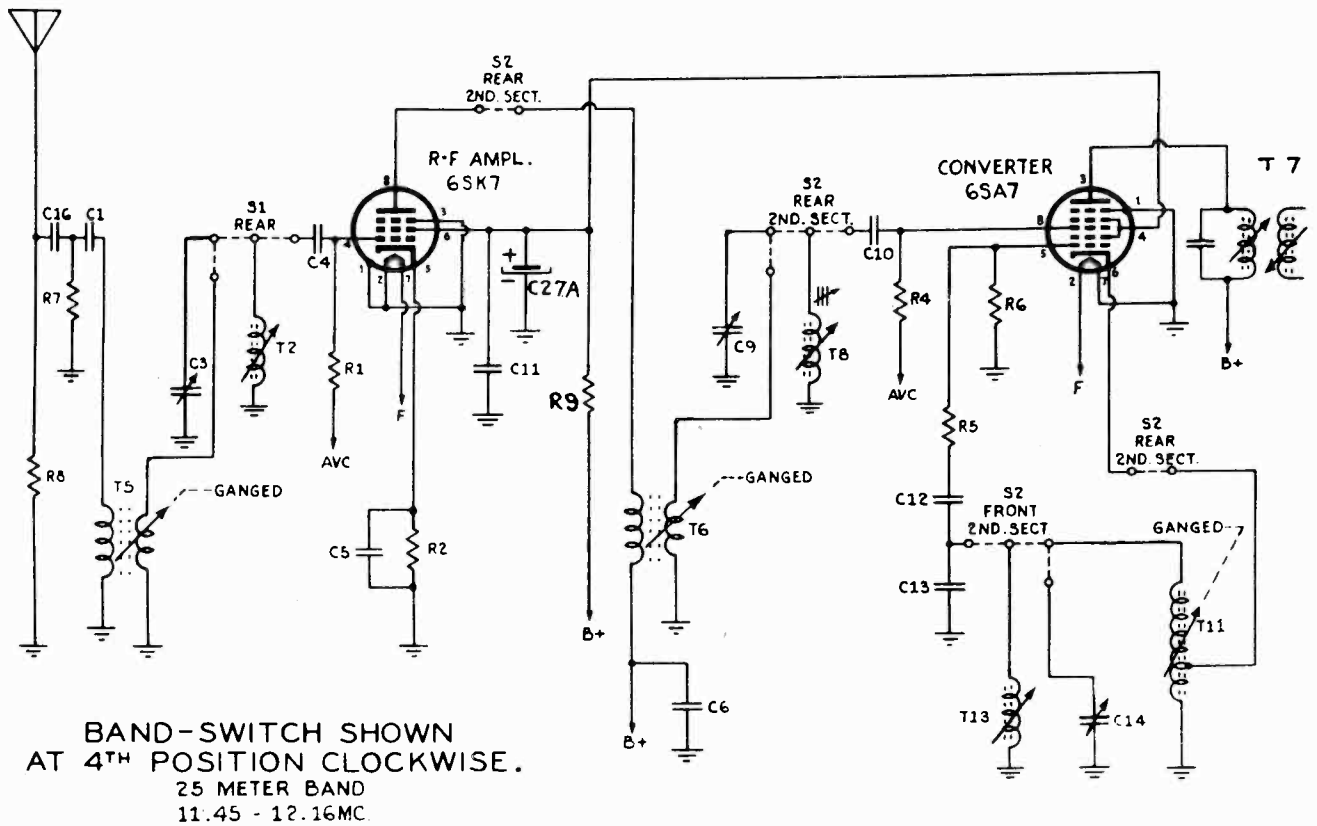
BAND-SWITCH SHOWN
AT 1ST POSITION.
BROADCAST BAND
540-1600 KC



BAND-SWITCH SHOWN
AT 2ND POSITION CLOCKWISE
49 METER BAND
5.96 - 6.19 MC



BAND-SWITCH SHOWN
AT 3RD POSITION CLOCKWISE
31 METER BAND
9.1 - 10 MC



ALIGNMENT PROCEDURE

MECHANICAL ADJUSTMENT—The core tuning bar (see illustration of coils below) and dial pointer must be adjusted mechanically before any electrical alignment is attempted. Rotate the manual tuning control until the core bar is farthest from the coils. For proper adjustment the bar should be approximately 1/32 of an inch from the two rod guide angles.

With the core bar in this position, adjust the dial pointer to coincide with 1600 kc on the dial scale.

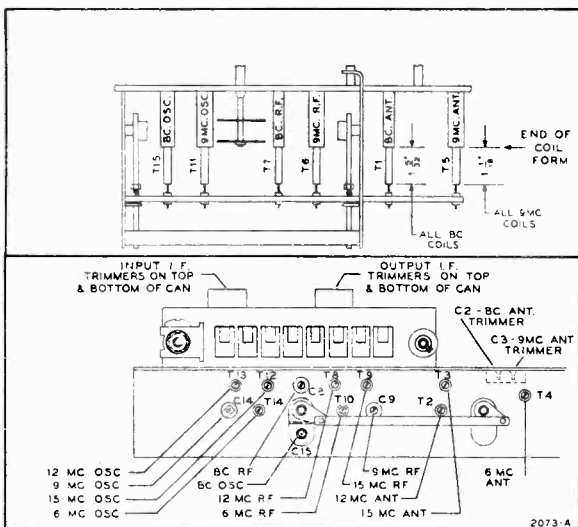
Rotate the cores of each of the three broadcast coils (see illustration) until the end of the core is 1-5/32" from the end of the coil form. Rotate the three 9-mc cores until this dimension is 1-1/8" for these coils. After these adjustments have been made, the unit can be aligned electrically.

ELECTRICAL ADJUSTMENT—To align the set make the following preliminary adjustments: Set the tone pushbutton for treble tone; set the volume control at maximum; connect the ground post of the signal generator to the radio chassis; connect the output meter across a 3.2-ohm output load; and allow the receiver and signal generator to warm up for several minutes.

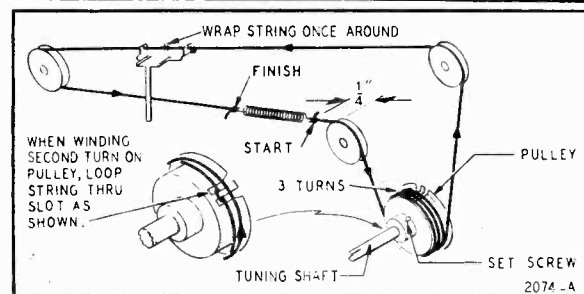
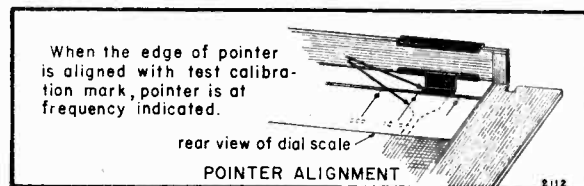
Align the set according to the sequence given in the chart. The indicated coupling capacitor is to be connected in series between the signal generator output lead and the receiver. Adjust the set for maximum output; reduce the input as needed to keep the output near 1.3 volts.

Locations of all the trimmers and coils are shown in the illustrations below. After adjustment, seal the coil cores with collodion or a similar substance (do not use cement).

BAND SWITCH SETTING	SIGNAL GENERATOR			DIAL POINTER SETTING	ADJUST TO MAXIMUM OUTPUT IN ORDER SHOWN
	Frequency	Coupling Capacitor	Connection to Receiver		
Broadcast (for I. F.)	455 kc	.1 mf	Grid (pin 8) of Converter (6SA7)	1600 kc	Trimmers on output and input I. F. cans
Broadcast	1600 kc	200 mmf	Antenna lead	1600 kc	BC Osc. trimmer C15 BC R. F. trimmer C8 BC Ant. trimmer C2
	1400 kc	200 mmf	Antenna lead	1400 kc	Rotate cores of BC R. F. coil T7 and BC Ant. coil T1
31 Meter	9.6 mc	400 ohms	Antenna lead	9.6 mc	9 mc Osc. trimmer C14 9 mc R. F. trimmer C9 9 mc Ant. trimmer C3
49 Meter	6.1 mc	400 ohms	Antenna lead	6.1 mc	6 mc Osc. coil T14 6 mc R. F. coil T10 6 mc Ant. coil T4
25 Meter	11.8 mc	400 ohms	Antenna lead	11.8 mc	12 mc Osc. coil T13 12 mc R. F. coil T8 12 mc Ant. coil T2
19 Meter	15.2 mc	400 ohms	Antenna lead	15.2 mc	15 mc Osc. coil T12 15 mc R. F. coil T9 15 mc Ant. coil T3



View of Trimmers and Tuning Coils



Replacing Dial Pointer Drive Cord

After stringing, spring must be 1/4" from idler when tuning shaft is in extreme counterclockwise position. To do this: Loosen set screw; hold tuning shaft firm and turn pulley by hand until spring is 1/4" from idler; tighten screw.

MONTGOMERY WARD

MODEL 64BR-1808A

REPLACEMENT PARTS LIST

Use Only Genuine Factory Replacement Parts
HOW TO ORDER PARTS—When ordering, specify **PART** number, schematic diagram reference number when applicable, and **CHASSIS MODEL** number. The model number appears on a label on the chassis.

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

REMOVABLE TUNER ASSEMBLY

CAPACITORS*

C1	BEB-8F-10767	.002 mf, 500 volts, 10% mica	1
C2, C3	BE-124143	Dual, broadcast (67-123 mmf) and 9 mc (95-175 mmf) ant. trimmers	1
C4, C10	BEB-8F3-121	470 mmf, 500 volts, 10% mica	2
C5	BEC-8D-10771	.1 mf, 200 volts, +20%—10%	1
C6, C11	BEC-8D-10760	.1 mf, 400 volts, +20%—10%	2
C7	BEB-8F5-101	10 mmf, 500 volts, 10% silver mica	1
C8	BEA-8G-7205	Broadcast RF trimmer (120-220 mmf)	1
C9	BEA-8G-7206	9 mc RF trimmer (60-110 mmf)	1
C12	BEB-8F3-109	47 mmf, 500 volts, 10% mica	1
C13	BEB-8F-10763	200 mmf, 500 volts, 3% silver mica	1
C14	BE-124145	9 mc oscillator trimmer (7-35 mmf)	1
C15	BE-124144	Broadcast oscillator trimmer (15-27 mmf)	1

MAIN CHASSIS

CAPACITORS*

C16	BEC-8F3-12	470 mmf, 20% mica	1
C17, C18, C23	BEC-8F3-10	220 mmf, 20% mica	3
C19, C20	BEC-8D-10770	.05 mf, 200 volts, 20%	2
C21	BEC-8D-10785	.006 mf, 600 volts, 20%	1
C22	BEC-8D-10761	.01 mf, 400 volts, 20%	1
C24, C25	BEC-8D-10774	.02 mf, 400 volts, 20%	2
C26	BEC-8D-10778	.002 mf, 600 volts, +40%—15%	1
C27-A, -B, -C	BEA-8C-10272	Electrolytic, 10 mf-10mf-20 mf, 450 volts	1
C28	BEC-8J-11388	.05 mf, 600 volts, 20%	1

RESISTORS*

R1, R4	BEC-9B1-31	1 megohm, 1/2 watt, 20%	2
R2	BEC-9B1-55	270 ohms, 1/2 watt, 10%	1
R3	BEC-9B1-64	1500 ohms, 1/2 watt, 10%	1
R5	BEC-9B1-46	47 ohms, 1/2 watt, 10%	1
R6	BEC-9B1-79	27,000 ohms, 1/2 watt, 10%	1
R7, R8	BEC-9B1-1987	27,000 ohms, 1/2 watt, 20%	2
R9	BE10662	12,500 ohms, 3 watts, 10%	1
R10	BEC-9B1-23	470-Ω ohms, 1/2 watt, 20%	1
R11	BEC-9B1-59	560 ohms, 1/2 watt, 10%	1
R12	BEC-9B1-33	2.2 megohms, 1/2 watt, 20%	1
R13, S5	BEA-10A-10810	Volume control (500,000 ohms) and on-off switch	1
R14	BEC-9B1-37	10 megohms, 1/2 watt, 20%	1
R15	BEC-9B1-22	33,000 ohms, 1/2 watt, 20%	1
R16	BEC-9B1-2091	270,000 ohms, 1/2 watt, 20%	1

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

MISCELLANEOUS

R17	BEC-9B1-82	47,000 ohms, 1/2 watt, 10%	1
R18	BEC-9B1-94	470,000 ohms, 1/2 watt, 10%	1
R19	BEC-9B1-86	100,000 ohms, 1/2 watt, 10%	1
R20	BEC-9B1-70	4700 ohms, 1/2 watt, 10%	1
R21	BEC-9B1-29	470,000 ohms, 1/2 watt, 20%	1
R22	BEC-9B1-55	270 ohms, 1 watt, 10%	1
T1	BE-111195	Broadcast antenna coil	1
T2	BE-111191	12 mc antenna coil	1
T3	BE-111192	15 mc antenna coil	1
T4	BE-111189	6 mc antenna coil	1
T5	BE-111190	9 mc antenna coil	1
T6	BE-10959	9 mc RF coil	1
T7	BE-10962	Broadcast RF coil	1
T8	BE-10960	12 mc RF coil	1
T9	BE-10961	15 mc RF coil	1
T10	BE-10958	6 mc RF coil	1
T11	BE-110157	9 mc oscillator coil	1
T12	BE-110159	15 mc oscillator coil	1
T13	BE-110158	12 mc oscillator coil	1
T14	BE-110156	6 mc oscillator coil	1
T15	BE-110161	Broadcast oscillator coil	1
T16	BEB-203-1813-3	Output I.F. transformer	1
T17	BEB-203-1813-2	Input I.F. transformer	1
T18	BEB-17C-10234-1	Output transformer	1
T20	BE104202-D	Power transformer	1
T21	BED-212-11429	Loop antenna assembly	1
SOCKETS			
BE121210	Tube socket (all tubes but 6SK7, I.F. amp.)	1	
BE121273	Tube socket, laminated, (for 6SK7, I.F. amp.)	1	
BE121200	Socket, 4-terminal, for loop	1	
BEA-15B-11538	Socket, 4-terminal, for speaker	1	
BEA-55A-7386-1	Socket for phono connection	1	
BE121279	Socket, 5-terminal, for tuner plug	1	
BEB-47A-10808-2	Socket assembly for dial light	1	
MISCELLANEOUS			
BEC-18B-11003	Speaker, 8" electrodynamic	1	
BEA-19A-11539	Plug on speaker leads	1	
BEA-19A-11372	Plug on loop antenna leads	1	
BE1075	Line cord and plug	1	
BEC-6D-10897	Dial scale	1	
BEC-5C-10257-48	Escutcheon for dial scale	1	
BEB-5C-10269-48	Escutcheon for pushbuttons	1	
BEB-2G-10511	Dial pointer	1	
BEB-53A-10989	Cord for dial pointer drive	3	
BE120377	Spring for drive cord	1	
BE10794	Dial light, 6-8 volts, Type 44	2	
BEB-5B-10377-37	Knob, tuning	1	
BEB-5B-10376-37	Knob, volume	1	
BE128683-37	Knob, band switch	1	
BE112961	Station call letters	1 set	
BEB-20A-10526	Band switch, antenna	1	
BEB-20A-11053	Band switch, oscillator and RF	1	
BEB-20A-10527	Band switch, oscillator and RF	1	
BEB-20A-11054	Band switch, oscillator and RF	1	

*The values of the resistors and mica capacitors listed above (except C13) are based on RMA standards. Due to conditions beyond our control some sets have been shipped with components of pre-standardized values. This set will operate equally well with components of either group. An illustration of the differences in both resistors and capacitors follows:

Pre-standardized value—50,000 ohms, 1/2 watt, 10%
 RMA value—47,000 ohms, 1/2 watt, 10%
 Pre-standardized value—200 mmf, 500 volts, 20%
 RMA value—220 mmf, 500 volts, 20%

RECEIVER STAGE SENSITIVITIES

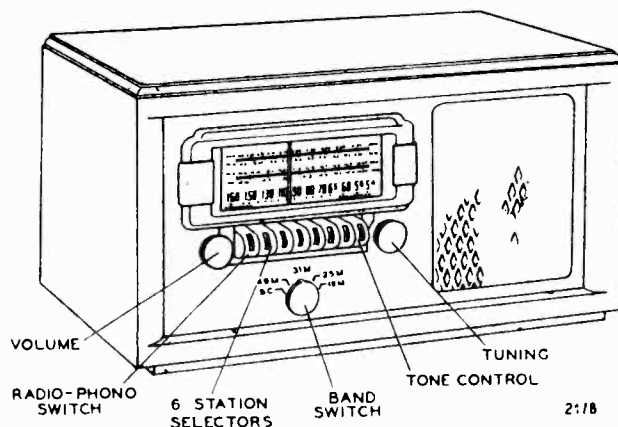
The table below lists the sensitivities at the inputs of various stages. All measurements are based on an output of $\frac{1}{2}$ watt. This may be measured by disconnecting the speaker voice coil and substituting a 3.2-ohm resistor across the secondary winding of the output transformer. A reading of 1.3 volts AC across this resistor will be approximately equivalent to a $\frac{1}{2}$ -watt output with the

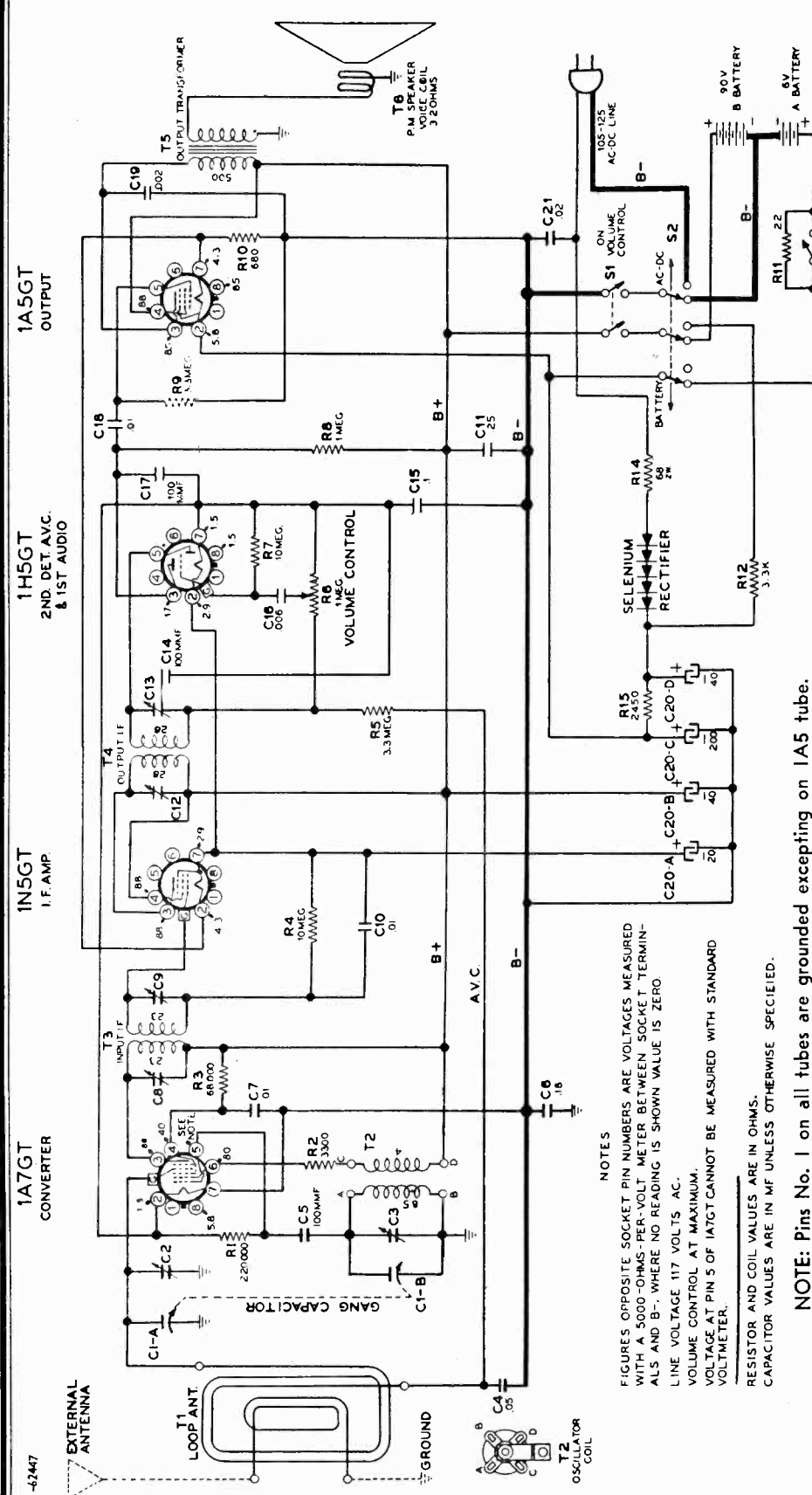
speaker connected. The volume control must be set at maximum.

The signal source must be an accurately calibrated signal generator capable of supplying the frequencies designated, modulated 30% with a 400-cycle audio signal. Variations in sensitivities of plus or minus 25% are usually permissible.

BAND	SIGNAL GENERATOR				INPUT FOR 500-MILLIWATT OUTPUT
	Frequency	Dummy Antenna	Connection to Receiver	Ground Connection	
Broadcast	1000 kc	200 mmf	External Antenna clip	Chassis	3.5 microvolts
	1000 kc	.1 mf	Grid (pin 4) of R. F. amp. (6SK7)	Chassis	8.9 microvolts
	1000 kc	.1 mf	Grid (pin 8) of Converter (6SA7)	Chassis	125 microvolts
	455 kc	.1 mf	Grid (pin 8) of converter (6SA7)	Chassis	100 microvolts
	455 kc	.1 mf	Grid (pin 4) of I. F. amp. (6SK7)	Chassis	4500 microvolts
	400 cycles	.1 mf	Grid (pin 2) of Audio amp. (6SQ7)	Chassis	.1 volt
	400 cycles	.1 mf	Grid (pin 5) of Inverter (6J5GT)	Chassis	4.8 volts
31 meter*	9.6 mc	400 ohms	External Antenna clip	Chassis	1.6 microvolts
49 meter*	6.1 mc	400 ohms	External Antenna clip	Chassis	3.0 microvolts
25 meter*	11.8 mc	400 ohms	External Antenna clip	Chassis	5.0 microvolts
19 meter*	15.2 mc	400 ohms	External Antenna clip	Chassis	9.0 microvolts

*Average sensitivity on short-wave bands at grid (pin 4) of R. F. amplifier is 8.5 microvolts.





GENERAL DESCRIPTION

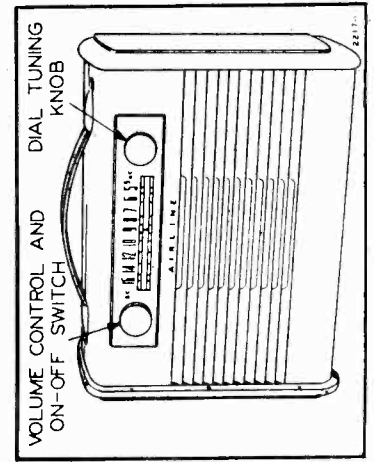
This model is a 3-way portable radio with 4 tubes plus rectifier. It contains a built-in loop antenna and clips for external antenna and ground connections. When battery operation is desired, the line-cord plug is inserted into a socket switch on the chassis; the insertion automatically moves the switch contacts for battery operation. When the line-cord plug is out of the chassis socket and ready for insertion into a 105 to 125 volt outlet, the battery is automatically disconnected.

Power Supply 105-125 volts DC or 50-60 cycle AC, 35 watts.
Battery: Wards Battery Pack No. 62-30
 Size: 10-9/16" by 2 3/4" by 4 1/4".
 "A" — 6 volts, 50 milliamperes.
 "B" — 90 volts, 8.5 milliamperes.

Frequency Range 530 to 1650 kc.
Intermediate Freq. 455 kc.
Selectivity At 1000 kc, 48 kc at 1000 x signal.
Sensitivity 40 microvolts average for .05 watt output.
Power Output 80 milliwatts undistorted.
 180 milliwatts maximum.
Load Speaker 5", P.M., v.c. impedance 3.2 ohms.

NOTES
 FIGURES OPPOSITE SOCKET PIN NUMBERS ARE VOLTAGES MEASURED WITH A 5000-OHMS PER-VOLT METER BETWEEN SOCKET TERMINALS AND B-, WHERE NO READING IS SHOWN VALUE IS ZERO.
 LINE VOLTAGE 117 VOLTS AC.
 VOLUME CONTROL AT MAXIMUM.
 VOLTAGE AT PIN 5 OF 1A7GT CANNOT BE MEASURED WITH STANDARD VOLTMETER.
 RESISTOR AND COIL VALUES ARE IN OHMS.
 CAPACITOR VALUES ARE IN MF UNLESS OTHERWISE SPECIFIED.

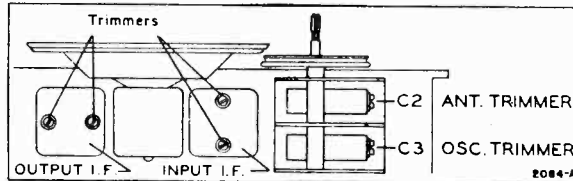
NOTE: Pins No. 1 on all tubes are grounded excepting on 1A5 tube.



ALIGNMENT PROCEDURE

- Output meter across 3.2 ohm output load.
- Volume control at maximum for all adjustments.
- Align for maximum output.
- Reduce input as needed to keep output near 0.4 volts.

NOTE: Temporarily remove middle screw in loop end of cabinet to reach antenna trimmer C2.



SIGNAL GENERATOR				DIAL SETTING	ADJUST TRIMMERS TO MAXIMUM OUTPUT in order shown
Frequency	Coupling Capacitor	Connection to Radio	Ground Connection		
455 kc	.1 mf	1A7GT grid cap*	1A7GT Pin 7	Rotor full open (plates out of mesh)	Input and output trimmers on IF cans
1650 kc	.1 mf	1A7GT grid cap*	1A7GT Pin 7	Rotor full open (plates out of mesh)	Osc. trimmer on gang (see trimmer view)
1400 kc	Chassis installed in cabinet. Lay lead from generator about 1 ft. from loop. Back cover must be snapped shut. Trimmer is reached thru small hole in end of cabinet. Do not move loop leads after alignment.				Set dial to 1400 kc. Ant. trimmer on gang (see trimmer view)

*For these adjustments chassis must be removed from cabinet. Insert a 1 megohm resistor between A.V.C. Buss and 1A7GT grid cap. It is assumed loop is disconnected from chassis.

Ref. No.	Part No.	Description	Qty. Used In Set	Ref. No.	Part No.	Description	Qty. Used In Set	
CAPACITORS				COILS AND TRANSFORMERS				
C1-A, C1-B	BEB-8A-10113	Two-gang variable capacitor	1	R12	BEC-9B1-68	3300 ohms, 10%, 1/2 watt	1	
C2		Antenna trimmer or gang	1	R15	A-9D-12776	2450 ohms, 5%, 6 watts, wire-wound	1	
C3		Oscillator trimmer on gang	1	SPEAKER				
C4	BEC-8D-10770	.055 mf, 20%, 200 volts	1	T1	5EB-13E-13418	Loop antenna assembly	1	
C5, C17	BEC-8F3-8	100 mmf, 20%, mica	2	T2	BEA-13D-10239	Oscillator coils	1	
C6	BEC-8D-11111	180 mf, ±10%, 400 volts	1	T3	BE108-201B	Input IF transformer complete in can with trimmers	1	
C7, C10, C18	BEC-8D-10761	.01 mf, 20%, 400 volts	3	T4	BE108-200B	Output IF transformer complete in can with trimmers and C14	1	
C8		Primary trimmer on input IF transformer, range 53 to 97 mmf	1	T5	BE105-132	Output transformer	1	
C9		Secondary trimmer on input IF transformer, range 53 to 97 mmf	1	SOCKETS				
C11	BEC-8D-10775	.25 mf, 25%, 200 volts	1	T6	BE114-246B	5" P.M. speaker	1	
C12		Primary trimmer on output IF transformer, range 39 to 71 mmf	1	DIAL AND TUNING PARTS				
C13		Secondary trimmer on output IF transformer, range 39 to 71 mmf	1		BEB-6D-13271	Dial scale	1	
C14		100 mmf, +30%, -10%, part of output IF can	1		BEA-2G-13349	Pointer	1	
C15	BEC-8D-10771	.1 mf, 20%, 200 volts	1		BE120-145	Coiled tension spring for dial string	1	
C16	BEC-8D-10785	.006 mf, 20%, 600 volts	1		BE120-9	String for dial	2 1/2' yd.	
C19	BEC-8D-10784	.002 mf, 25%, 600 volts	1		BE117-896	Tuning shaft	1	
C20-A, C20-B, C20-C, C20-D	BE119-126	Dry electrolytic for 50-60 cycles: 20 mf, 150 volts; 40 mf, 150 volts; 200 mf, 10 volts; 40 mf, 150 volts	1		BE131-210	"C" washer	1	
C21	BEC-8D-10774	.07 mf, 20%, 400 volts	1		BEB-5B-13396-57	Knob, "Plain", for tuning	1	
RESISTORS						EEB-5B-13397-57	Knob, "With Dot",	1
R1	BEC-9B1-27	220,000 ohms, 20%, 1/2 watt	1	MISCELLANEOUS				
R2	BEC-9B1-16	3,300 ohms, 20%, 1/2 watt	1	S2	BE125-161	Line-battery socket switch	1	
R3	BEC-9B1-84	68,000 ohms, 10%, 1/2 watt	1	S3	BE125-166	Battery economizer switch	1	
R4, R7	BEC-9B1-37	10 megohms, 20%, 1/2 watt	2		BE120-416	Battery cable switch	1	
R5, R9	BEC-9B1-34	3.3 megohms, 20%, 1/2 watt	2		BE107-370	Line cord and plug	1	
R6, S1	BE101-258	1 megohm volume control with switch	1		BE115-396	Tube shield	2	
R8	BEC-9B1-31	1 megohm, 20%, 1/2 watt	1		BEA-21J-12775	Selenium rectifier	1	
R10	BEC-9B1-60	680 ohms, 10%, 1/2 watt	1		D-2C-13262	Metal front cover	1	
R14	BEC-9B4-48	68 ohms, 10%, 2 watts	1		D-2C-13263	Metal rear cover	1	
R11	BEC-9B1-42	22 ohms, 10%, 1/2 watt	1		D-24D-13265	Wood end piece for cabinet	2	
					B-23A-13270	Handle for cabinet	1	

RECEIVER STAGE SENSITIVITIES

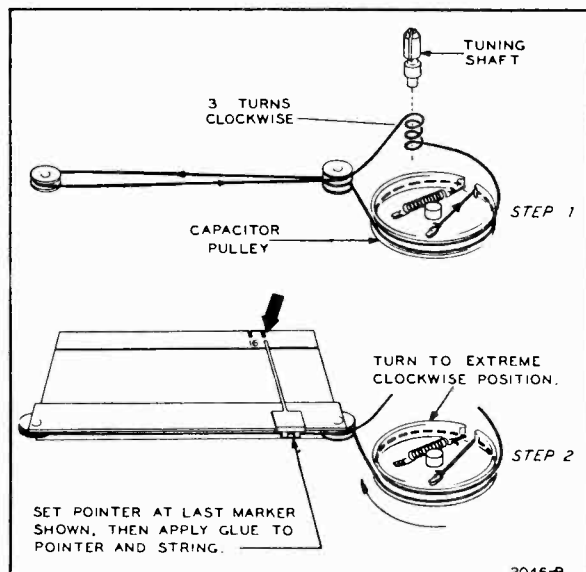
The table below lists the sensitivities at the input of each stage. The receiver should be tuned to 1000 KC for all readings. All measurements are based on an output of 50 milliwatts. This may be measured by disconnecting the speaker voice coil and substituting a 3.2 ohm 5 watt resistor across the secondary winding of the output transformer. A reading of .4 volts AC across this resistor

will be equivalent to a 50 milliwatt output with speaker connected. 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 sensitivities of plus or minus 25% are usually permissible.

SIGNAL GENERATOR				INPUT FOR 50 MILLIWATT OUTPUT
Frequency	Coupling Capacitor	Connection to Radio	Ground Connection	
1000 kc	200 mmf or RMA dummy antenna	External * antenna clip	External ground clip	25 microvolts
1000 kc	.05 mf	Converter (1A7GT) grid cap	1A7GT Pin 7	140 microvolts
455 kc	.05 mf	Converter (1A7GT) grid cap	1A7GT Pin 7	100 microvolts
455 kc	.05 mf	IF amp. (1N5GT) grid cap	1A7GT Pin 7	4500 microvolts
400 cycles	.05 mf	AF amp. (1H5GT) grid cap	1A7GT Pin 7	.06 volts
400 cycles	.05 mf	Power amp. (1A5GT) grid (pin 5)	1A7GT Pin 7	3 volts

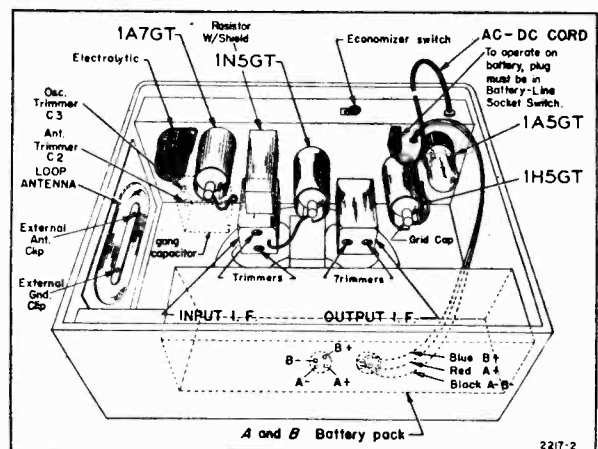
*Back of case must be snapped shut. Run generator leads along with line cord in notch of rear cover.



REPLACING DIAL POINTER DRIVE CORD

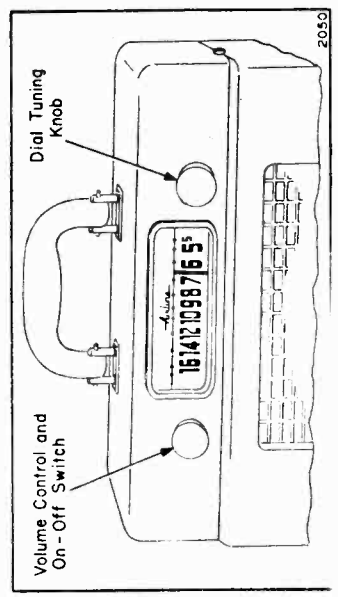
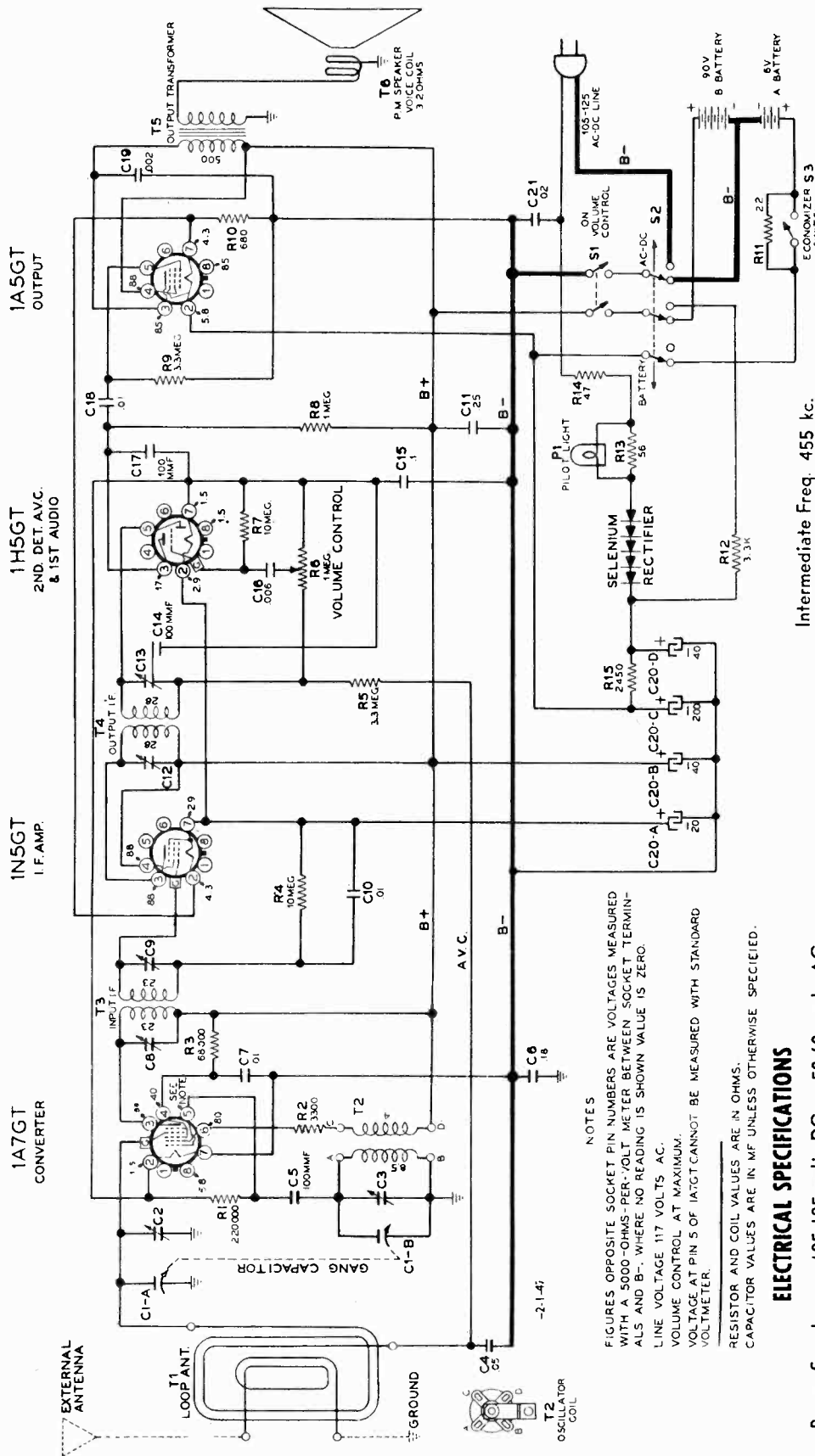
NOTE: Disregard information on setting pointer. 16 is actually on the other end of the calibration scale. Set pointer to end marker next to 16. Gang must be in open position. Procedure is the same otherwise.

NOTE: Antenna trimmer C2 is reached thru hole in side of cabinet.



CHASSIS VIEW

Note: For battery operation, line cord plug must be inserted in battery-line socket switch as shown; switch contacts are automatically moved.



Intermediate Freq. 455 kc.

NOTES
 FIGURES OPPOSITE SOCKET PIN NUMBERS ARE VOLTAGES MEASURED WITH A 5000-OHMS-PER-VOLT METER BETWEEN SOCKET TERMINALS AND B⁻, WHERE NO READING IS SHOWN VALUE IS ZERO.
 LINE VOLTAGE 117 VOLTS AC.
 VOLUME CONTROL AT MAXIMUM.
 VOLTAGE AT PIN 5 OF 1A7GT CANNOT BE MEASURED WITH STANDARD VOLT-METER.

RESISTOR AND COIL VALUES ARE IN OHMS.
 CAPACITOR VALUES ARE IN MF UNLESS OTHERWISE SPECIFIED.

ELECTRICAL SPECIFICATIONS

- Power Supply** 105-125 volts DC or 50-60 cycle AC, 35 watts.
- Battery:** Wards Battery Pack No. 62-30
 Size: 10-9/16" by 2 3/4" by 4 1/4".
 "A"—6 volts, 50 milliamperes.
 "B"—90 volts, 8.5 milliamperes.
- Frequency Range** 530 to 1650 kc.
- Selectivity** At 1000 kc, 48 kc at 1000 x signal.
- Sensitivity** 40 microvolts average for .05 watt output.
- Power Output** 80 milliwatts undistorted.
 180 milliwatts maximum.
- Loud Speaker** 5", P.M., v.c. impedance 3.2 ohms.

RECEIVER STAGE SENSITIVITIES

The table below lists the sensitivities 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 volts AC across this resistor

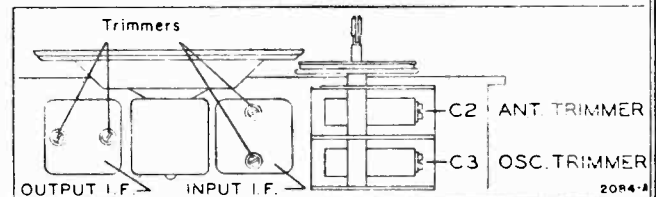
will be equivalent to a 50 milliwatt output with speaker connected. The volume control must be set to maximum.

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 sensitivities of plus or minus 25% are usually permissible.

SIGNAL GENERATOR				INPUT FOR 50 MILLIWATT OUTPUT
Frequency	Coupling Capacitor	Connection to Radio	Ground Connection	
1000 kc	200 mmf or RMA dummy antenna	External antenna clip	External ground clip	25 microvolts
1000 kc	.05 mf	Converter (1A7GT) grid cap	1A7GT Pin 7	140 microvolts
455 kc	.05 mf	Converter (1A7GT) grid cap	1A7GT Pin 7	100 microvolts
455 kc	.05 mf	IF amp. (1N5GT) grid cap	1A7GT Pin 7	4500 microvolts
400 cycles	.05 mf	AF amp. (1H5GT) grid cap	1A7GT Pin 7	.06 volts
400 cycles	.05 mf	Power amp. (1A5GT) grid (pin 5)	1A7GT Pin 7	3 volts

ALIGNMENT PROCEDURE

- Output meter across 3.2 ohm output load.
- Volume control at maximum for all adjustments.
- Align for maximum output.
- Reduce input as needed to keep output near 0.4 volts.



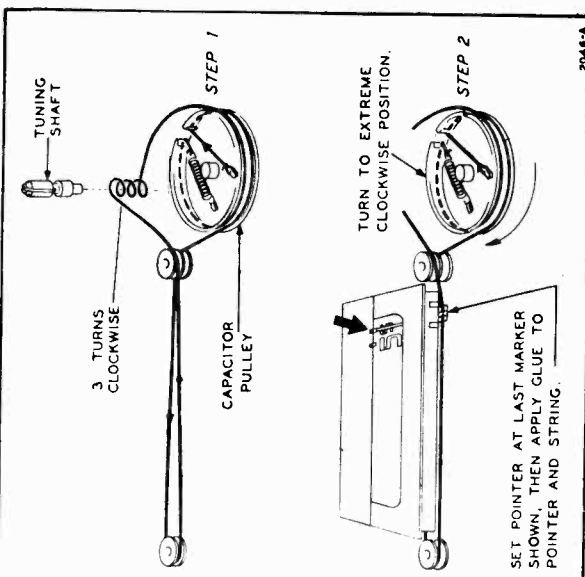
SIGNAL GENERATOR				DIAL SETTING	ADJUST TRIMMERS TO MAXIMUM OUTPUT in order shown
Frequency	Coupling Capacitor	Connection to Radio	Ground Connection		
455 kc	.1 mf	1A7GT grid cap*	1A7GT Pin 7	Rotor full open (plates out of mesh)	Input and output trimmers on IF cans
1650 kc	.1 mf	1A7GT grid cap*	1A7GT Pin 7	Rotor full open (plates out of mesh)	Osc. trimmer on gang (see trimmer view)
1400 kc	200 mmf	External antenna clip	External ground clip	1400 kc	Ant. trimmer on gang (see trimmer view)

*For these adjustments insert a 1 megohm resistor between loop antenna and 1A7GT grid cap.

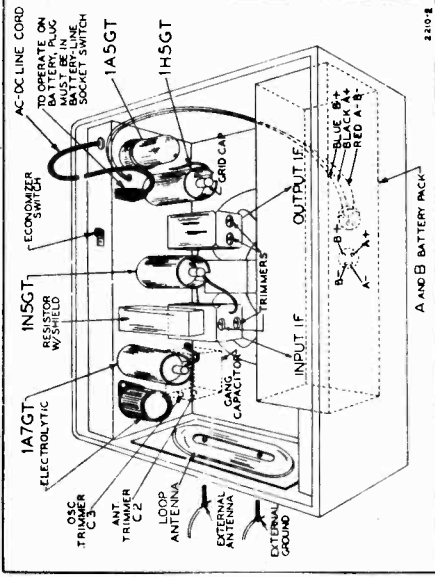
REPLACEMENT PARTS LIST
Use Only Genuine Factory Replacement Parts

Ref. No.	Part No.	Description	Qty. Used in Set
R15	A-9D-12776	2450 ohms, 5%, 6 watts, wire-wound	1
COILS AND TRANSFORMERS			
T1	BEB-13E-10240	Loop antenna assembly	1
T2	BEA-13D-10239	Oscillator coils	1
T3	BEI08-201B	Input IF transformer complete in can with trimmers	1
T4	BEI08-200B	Output IF transformer complete in can with trimmers and C14	1
T5	BEI05-132	Output transformer	1
SPEAKER			
T6	BEI14-246B	5" P.M. speaker	1
SOCKETS			
	BEI21-171	Octal wafer socket	5
	BEI21-243	Bakelite socket base for filter capacitor	1
DIAL AND TUNING PARTS			
	BEB-6D-10115	Dial scale	1
	BEI12-949	Pointer	1
	BEI20-145	Coiled tension spring for dial string	1
	BEI20-9	String for dial	2 1/2
	BEI15-701	Plate for dial, with pulleys	1
	BEI17-896	Tuning shaft	1
	BEI31-210	"C" washer	1
	BEI28-660-39	Knob, "Volume"	1
	BEI28-661-39	Knob, "Tuning"	1
	BEI07-249	Pilot bit, 6-8 volt, No. T-47	1
	BEI07-371	Pilot light socket assembly	1
P1			
MISCELLANEOUS			
S2	BEI25-161	Line-battery socket switch	1
S3	BEI25-166	Battery economizer switch	1
	BEI20-416	Battery cable assembly	1
	BEB-2K-10114	Grill screen	1
	BEI28-673-1	Grill cloth	1
	BEI12-947	Escutcheon for dial	1
	BEI07-370	Line cord and plug	1
	BEI15-396	Tube shield	2
	BEA-21J-12775	Selenium rectifier	1

Ref. No.	Part No.	Description	Qty. Used in Set
CAPACITORS			
C1-A, C1-B	BEB-8A-10113	Two-gang variable capacitor	1
C2		Antenna trimmer on gang	1
C3		Oscillator trimmer on gang	1
C4	BEC-8D-10770	.05 mf, 20%, 200 volts	1
C5, C17	BEC-8E3-8	100 mmf, 20%, mica	2
C6	BEC-8D-11111	.180 mf ±10%, 400 volts	1
C7, C10, C18	BEC-8D-10761	.01 mf, 20%, 400 volts	3
C8		Primary trimmer on input IF transformer, range 53 to 97 mmf	1
C9		Secondary trimmer on input IF transformer, range 53 to 97 mmf	1
C11	BEC-8D-10775	.25 mf, 25%, 200 volts	1
C12		Primary trimmer on output IF transformer, range 39 to 71 mmf	1
C13		Secondary trimmer on output IF transformer, range 39 to 71 mmf	1
C14		100 mmf ±30%—10%, part of output IF can	1
C15	BEC-8D-10771	.1 mf, 20%, 200 volts	1
C16	BEC-8D-10785	.006 mf, 20%, 600 volts	1
C19	BEC-8D-10784	.002 mf, 25%, 600 volts	1
C20-A, C20-B, C20-C, C20-D	BEI19-126	Dry electrolytic for 50-60 cycles; 20 mf, 150 volts; 40 mf, 150 volts; 200 mf, 10 volts; 40 mf, 150 volts	1
C21	BEC-8D-10774	.02 mf, 20%, 400 volts	1
RESISTORS			
R13	BEC-9B2-47	56 ohms, 10%, 1 watt	1
R1	BEC-9B1-27	220,000 ohms, 20%, 1/2 watt	1
R2	BEC-9B1-16	3,300 ohms, 20%, 1/2 watt	1
R3	BEC-9B1-84	68,000 ohms, 10%, 1/2 watt	1
R4, R7	BEC-9B1-37	10 megohms, 20%, 1/2 watt	2
R5, R9	BEC-9B1-34	3.3 megohms, 20%, 1/2 watt	2
R6, S1	BEI01-258	1 megohm volume control with switch	1
R8	BEC-9B1-31	1 megohm, 20%, 1/2 watt	1
R10	BEC-9B1-60	680 ohms, 10%, 1/2 watt	1
R14	BEC-9B2-46	47 ohms, 10%, 1 watt	1
R11	BEC-9B1-42	22 ohms, 10%, 1/2 watt	1
R12	BEC-9B1-68	3300 ohms, 10%, 1/2 watt	1



REPLACING DIAL POINTER DRIVE CORD

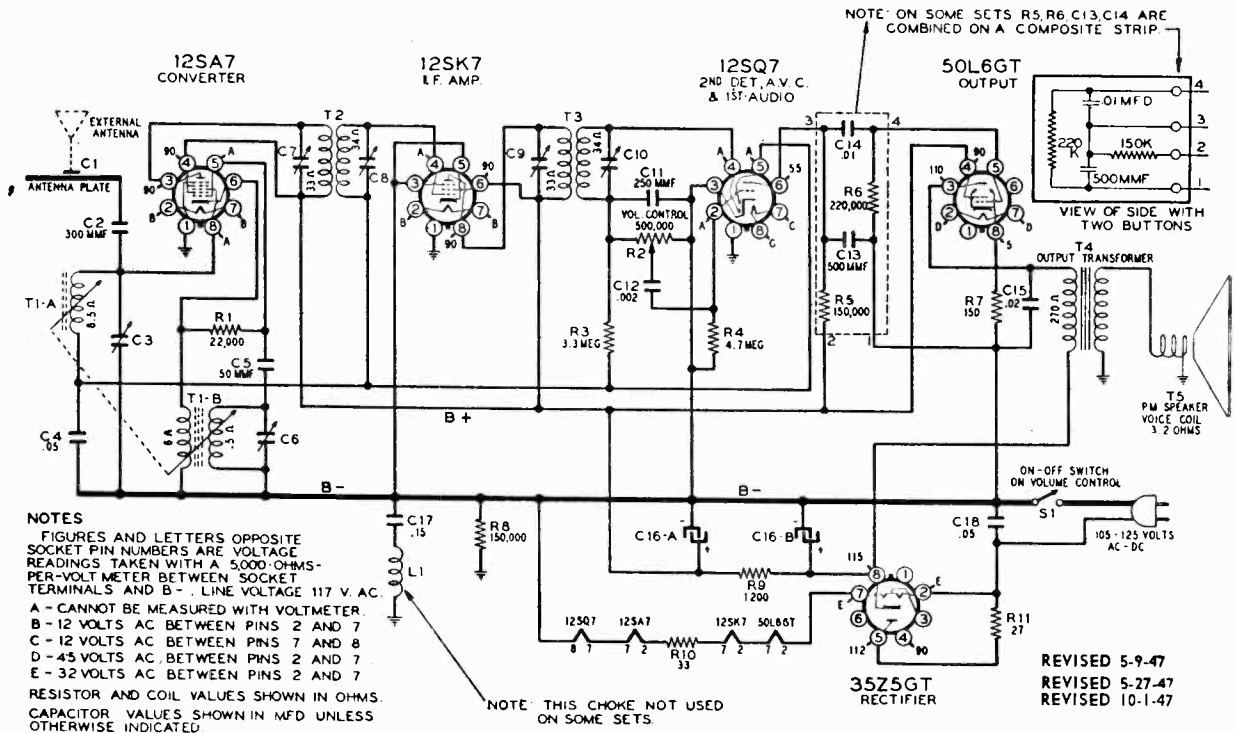


CHASSIS VIEW

Note: For battery operation, line cord plug must be inserted in battery-line socket switch as shown; switch contacts are automatically moved.

MONTGOMERY WARD

MODELS 74BR-1501B,
74BR-1502B



NOTES
FIGURES AND LETTERS OPPOSITE SOCKET PIN NUMBERS ARE VOLTAGE READINGS TAKEN WITH A 5,000-OHMS-PER-VOLT METER BETWEEN SOCKET TERMINALS AND B- . LINE VOLTAGE 117 V. AC
A - CANNOT BE MEASURED WITH VOLTMETER.
B - 12 VOLTS AC BETWEEN PINS 2 AND 7
C - 12 VOLTS AC BETWEEN PINS 7 AND 8
D - 45 VOLTS AC BETWEEN PINS 2 AND 7
E - 32 VOLTS AC BETWEEN PINS 2 AND 7
RESISTOR AND COIL VALUES SHOWN IN OHMS. CAPACITOR VALUES SHOWN IN MFD UNLESS OTHERWISE INDICATED

NOTE: THIS CHOKE NOT USED ON SOME SETS.

NOTES: On some sets dual trimmer C3, C6 is grounded to chassis instead of to B- as shown above.
On some sets R6 is 470K ohms and R5 is 220K ohms. On some sets R10 is not used.

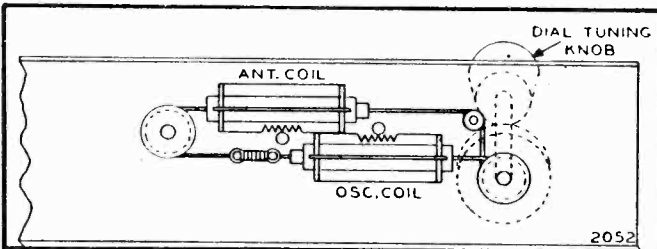
GENERAL DESCRIPTION

This radio is a permeability-tuned, AC-DC set using 4 tubes plus a rectifier. The metal back plate of the cabinet serves as a self-contained antenna. A clip is provided for connection of an external antenna; it is riveted to a washer which is capacity-coupled to the back plate. Simple AVC voltage is applied to the converter and IF-amplifier tubes. The filament string is across the AC line.

ELECTRICAL SPECIFICATIONS

Power Supply 105 to 125 volts, DC or 50-60 cycle AC, 28 watts. Also made for 25-cycles AC.

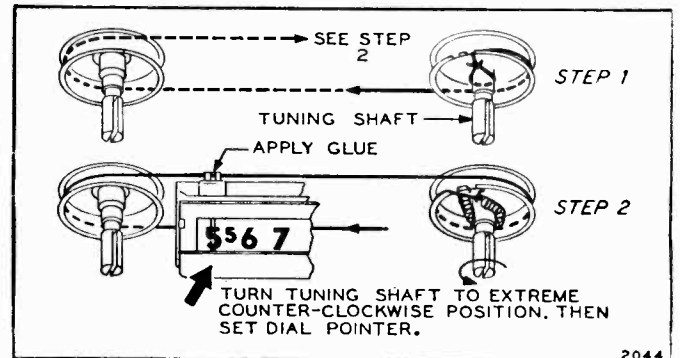
Frequency Range 540 to 1720 kc.
Intermediate Freq. 455 kc.
Selectivity At 1000 kc, 69 kc at 1000 x signal.
Sensitivity 28 microvolts average for .05 watt output.
Power Output 0.96 watts undistorted, 1.58 watts maximum.
Loud Speaker 4", P.M., v.c. impedance 3.2 ohms.
Tube Complement 12SA7, converter
12SK7, I.F. amplifier
12SQ7, detector, AVC, audio amplifier
50L6GT, output amplifier
35Z5GT, rectifier



View of Tuning Coil Assembly

ANTENNA COIL ADJUSTMENT

The antenna coil assembly (see illustration) is made so that it is movable left or right. When making the adjustment as required in the alignment procedure, move the coil assembly very slowly, either by hand or by pivoting one edge of the blade of a screwdriver in the hole and engaging the blade in the gear teeth of the coil form.



NOTES ON DRIVE CORD REPLACEMENT

1. Eighteen inches (18") of cord are required.
2. When tying the string to the tension spring (step 2)), make sure that the spring takes up all slack.

MODELS 74BR-1501B,
74PR-1502B

MONTGOMERY WARD

ALIGNMENT PROCEDURE AND RECEIVER STAGE SENSITIVITIES

The signal source must be an accurately calibrated signal generator capable of supplying R. F. signals modulated 30% with a 400-cycle audio signal. A 400-cycle source is necessary for the audio measurement.

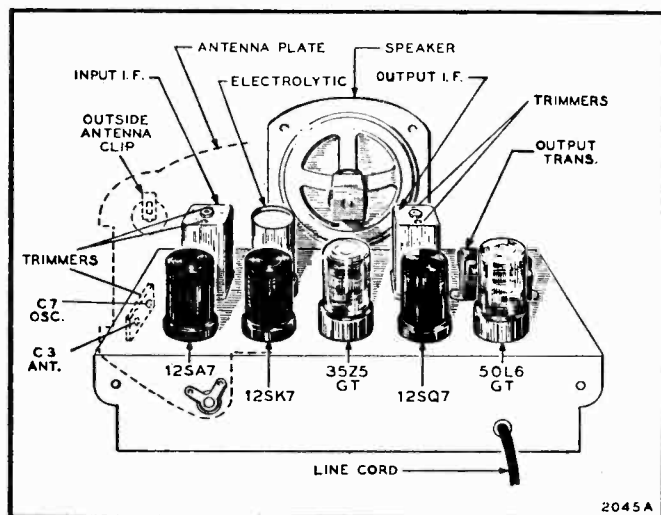
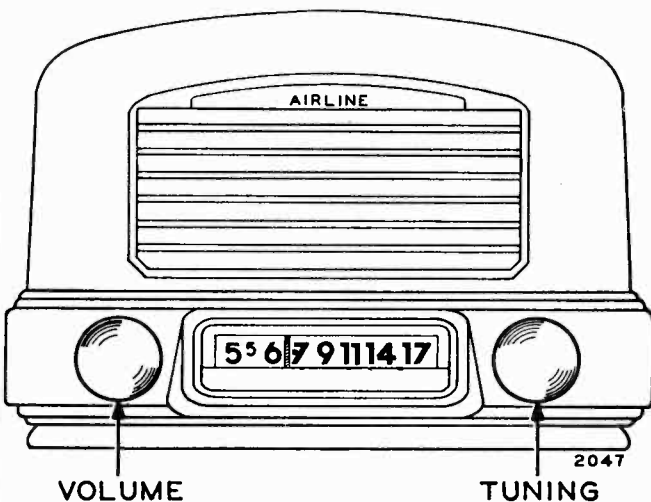
The table below lists the sensitivity at various points. All measurements are based on an output of 50-milliwatts. This may be measured by disconnecting the

speaker voice coil and substituting a 3.2-ohm, 5-watt resistor across the secondary winding of the output transformer. A reading of .4 volts AC across this resistor will be equivalent to a 50-milliwatt output with the speaker connected. Variations of plus or minus 25% are usually permissible. Volume control at maximum for all adjustments.

SIGNAL GENERATOR				TUNER SETTING	ADJUST FOR MAXIMUM OUTPUT	INPUT FOR 50-MILLIWATT OUTPUT
Frequency	Coupling Capacitor	Connection to Radio	Ground Connection			
455 kc	.1 mf	Metal antenna plate	12SQ7 Pin 3	Iron cores all the way out	Trimmers on output and input I.F. cans	_____
1720 kc	.1 mf	Metal antenna plate	12SQ7 Pin 3	Iron cores all the way out	Oscillator trimmer C6	_____
1720 kc	200 mmf	External antenna clip	12SQ7 Pin 3	Iron cores all the way out	Antenna trimmer C3	_____
1400 kc	200 mmf	External antenna clip	12SQ7 Pin 3	1400 kc	Adjust position of ant. coil (see coil illustration view)	31 microvolts
1720 kc	200 mmf	External antenna clip	12SQ7 Pin 3	1720 kc	Antenna trimmer C3*	31 microvolts
1000 kc	200 mmf	External antenna clip	12SQ7 Pin 3	1000 kc	_____	28 microvolts
455 kc	.1 mf	12SA7, Pin 8	12SQ7 Pin 3	Iron cores all the way out	_____	82 microvolts
400 cycles	.1 mf	12SQ7, Pin 2	12SQ7 Pin 3	_____	_____	.05 volts

*After the antenna coil has been tracked at 1400 kc, it is necessary to check the antenna trimmer C3 again at 1720 kc. If no appreciable change in trimmer adjustment is necessary, the coil is in track. If the trimmer

requires considerable change, the position of the antenna coil at 1400 kc must be readjusted. These two adjustments should be made several times, until no trimmer adjustment is required at 1720 kc.



NOTE: C7 SHOULD READ C6

MONTGOMERY WARD

MODELS 74BR-1501B, -1502B
MODELS 74BR-1507A, -1508A

REPLACEMENT PARTS LIST

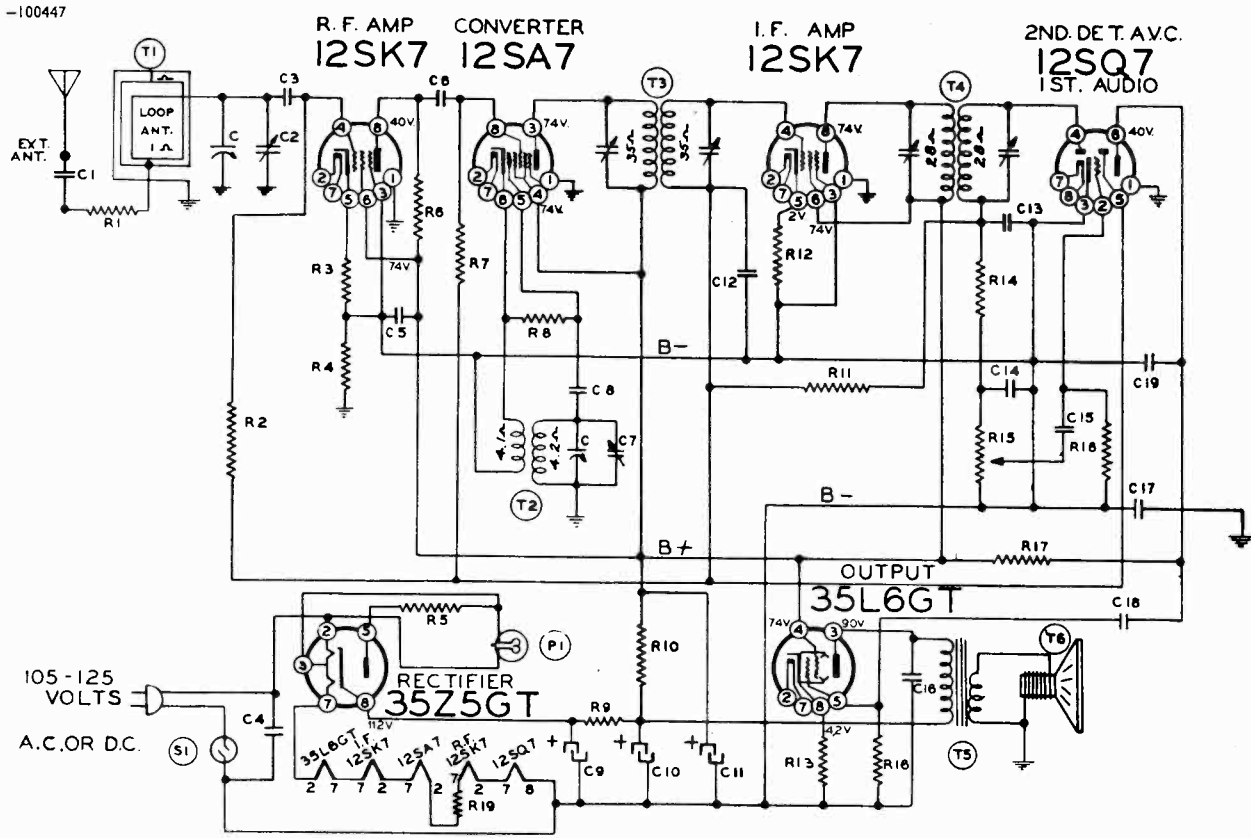
74BR-1501B, 1502B Use Only Genuine Factory Replacement Parts

Ref. No.	Part No.	Description	Qty. Used In Set
CAPACITORS			
C1		Washer capacitor mounted on antenna plate	1
C2	BE129114	300 mmf, 20% mica, 500 volts	1
C3, C6	BE124137	Antenna and oscillator trimmers: dual mounted; C3 (ant.) range is 74 to 136 mmf; C6 (osc.) range is 95 to 175 mmf	1
C4	BE1009	05 mf, 25%, 200 volts	1
C5	BE12939	50 mmf, 20% mica, 500 volts	1
C11	BE12912	250 mf, 20% mica, 500 volts	1
C12	BE10025	002 mf, 25%, 600 volts	1
C13	BE12922	500 mmf, 20% mica, 500 volts	1
C14	BE10011	01 mf, 25%, 400 volts	1
C15	BE10026	02 mf, 25%, 400 volts	1
C16-A, C16-B	BE11992	Dual electrolytic for 50-60 cycle model: 20 mf, 150 volts; 40 mf, 150 volts	1
	or	Dual electrolytic for 25 cycle models: 40 mf, 150 volts; 60 mf, 150 volts	1
	BE11993		1
C17	BE10091	.15 mf, 25%, 400 volts	1
C18	BE10013	.05 mf, 25%, 400 volts	1
RESISTORS			
R1	BEA-9B1-78	22,000 ohms, 10%, 1/2 watt	1
R2, S1	BE101255	500,000-ohm volume control with on-off switch	1
R3	BEA-9B1-34	3.3 megohms, 20%, 1/2 watt	1
R4	BEA-9B1-35	4.7 megohms, 20%, 1/2 watt	1
R5, R8	BEA-9B1-26	150,000 ohms, 20%, 1/2 watt	2
R6	BEA-9B1-27	220,000 ohms, 20%, 1/2 watt	1
R7	BEA-9B1-52	150 ohms, 10%, 1/2 watt	1
R9	BEA-9B2-63	1200 ohms, 10%, 1 watt	1
R10	BEA-9B2-4	33 ohms, 20%, 1 watt	1
R11	BEA-9B1-43	27 ohms, 10%, 1/2 watt	1
	BE-201-13151	Audio coupling assembly (on some sets, this unit replaces R5, R6, C13, C14)	1
COILS AND TRANSFORMERS			
L1	BE105138	RF choke coil	1
T1-A, T1-B	BE13614	Antenna and oscillator coil tuning assembly complete with cores, drive cord, and tuning drive shaft	1
T2, C7, C8	BE108157H	Input IF transformers complete in can with trimmers. (Trimmer range 39 to 73 mmf)	1
T3, C9, C10	BE108157I	Output IF transformers complete in can with trimmers. (Trimmer range 39 to 73 mmf)	1
T4	BE105-128	Output transformer for speaker I	1
	or	BE105128B Output transformer for speaker I	1
	or	BE112C11763-3 Output transformer for speaker I	1
SPEAKER			
T5	BE8-18A-10251	4-inch P. M. speaker	1
SOCKETS			
	BE121171	Tube socket	5
	BE121216	Bakelite socket for electrolytic capacitor	1
DIAL AND TUNING PARTS			
	BEA6D10049-1	Dial scale, ivory	1
	BEA-2D-10050	Dial background	1
	BE15731	Dial bracket	1
	BEA-2G-10051	Dial pointer	1
	BE120214	Dial pointer drive cord 18" yd.	1
	BE120364	Coil spring for drive cord	1
	BE112-788	Idler pulley [fits on volume control shaft]	1
	BE128660-9	Knob, "VOLUME", ivory	1
	B-5B-13091-9	Knob, "VOLUME", walnut	1
	BE128660-46	Knob, "VOLUME", walnut	1
	BE128661-9	Knob, "TUNING", ivory	1
	or	B-5B-13092-9 Knob, "TUNING", walnut	1
	BE128661-46	Knob, "TUNING", walnut	1
NOTE: How to order Ivory knobs to match: 128660-9 and 128661-9 have raised wording. B-5B-13091-9 and B-5B-13092-9 have gold-filled recessed wording.			
MISCELLANEOUS			
	BE115597C	Antenna plate [back plate of cabinet, includes capacitor C1], ivory	1
	BE115597	Antenna plate [back plate of cabinet, includes capacitor C1], walnut	1
	BE131193	Cinch buttons, for fastening antenna plate to cabinet	4
	BE128652-9	Cabinet, bakelite, ivory	1
	BE128652-46	Cabinet, bakelite, walnut	1
	BE10798E	Line cord and plug	1
	BE134103	Rubber washers for mounting chassis	2
	BE131263	Offset washers for mounting chassis	2
	BE13220	Screws, 6-32 x 3/8", for mounting chassis	2 doz
	BEA-2H-11271	Tube shield [for bakelite-base 12SA7GT tube]	2 doz
	BEA-2H-10715	Tube shield [for metal-base 12SA7GT tube]	2 doz

Ref. No.	Part No.	Description
74BR-1507A, 1508A		
CONDENSERS		
C17	C-8D-10953	15 MFD x 400 volts.
C1, C15	C-8D-10778	.002 x 600 volts, ±40%, -15%
C3	C-8F3-12	470 mmfd., mica, ±20%
C4	C-8D-10760	.1 x 400 volts, ±20%
C5	C-8D-10775	.25 x 200 volts, ±20%
C6, C8, C19	C-8F3-8	.001 mica, ±20%
C9, C10, C11	11991-8	Electrolytic [for 50-60 cycle sets], 40 mfd. x 150 volts, 20 mfd. x 150 volts, 20 mid. x 150 volts
	A-8C-10077	.05 x 200 volts, ±20%
C12	C-8D-10770	Dual .0001, mica, ±10%
C13, C14	129161	.02 x 400 volts, ±20%
C16	C-8D-10774	.004 x 600 volts, ±20%
C18	C-8D-10788	
RESISTORS		
R1	C-9B1-13	1000 ohms, 1/2 watt, ±20%
R2	C-9B1-31	1 megohm, 1/2 watt, ±20%
R3	C-9B1-50	100 ohms, 1/2 watt, ±10%
R4	C-9B1-26	150,000 ohms, 1/2 watt, ±20%
R5	C-9B1-42	22 ohms, 1/2 watt, ±10%
R6	C-9B1-70	4700 ohms, 1/2 watt, ±10%
R7	C-9B1-25	100,000 ohms, 1/2 watt, ±20%
R8, R14	C-9B1-23	4700 ohms, 1/2 watt, ±20%
R9	C-9B2-53	180 ohms, 1 watt, ±10%
R10	C-9B2-63	1200 ohms, 1 watt, ±10%
R11	C-9B1-34	3.3 megohms, 1/2 watt, ±20%
R12, R13	C-9B1-52	150 ohms, 1/2 watt, ±10%
R16	C-9B1-29	470,000 ohms, 1/2 watt, ±20%
R17	C-9B1-27	220,000 ohms, 1/2 watt, ±20%
R18	C-9B1-35	4.7 megohms, 1/2 watt, ±20%
R19	C-9B2-44	33 ohms, 1 watt, ±10%
COILS		
T1	C-212-11565-2	Loop antenna assembly, complete on back
T2	A-13D-10215	Oscillator coil
T3	108140H or B-13A-12023	Input I.F. coil in can, 455 Kc.
T4	108145 or B-13B-12022	Output I.F. coil in can, 455 Kc.
	[See note on page 3]	
	121210	
	121171	
	121216	
	107271 or A-47A-11470	
SOCKETS		
	121210	8-prong octal tube sockets, molded
	121171	8-prong socket for 12SK7, laminated
	121216	Socket base, bakelite
	107271 or A-47A-11470	Pilot light socket assembly
SPEAKER		
T6	114197	5-inch P.M. speaker
T5	105104	Output transformer for speaker
DIAL PARTS		
	115448	End plate [right hand bracket]
	115448C	End plate [left hand bracket]
	115146	Cams
	115143	Key washer [13 used on cam shaft]
	117528	Brass spacer [one used on cam shaft]
	117602	Brass spacer [four used on cam shaft]
	131181	Spring washers, for locking collar
	117604	Locking collar
	117600	Level shaft
	115361	Lever with roller
	120283	Return spring for levers
	1154498	Dial bracket assembly
	112785	Pointer
	A-53A-10989	Drive cord, 6 inches used
	A-49A-11087	Spring on tuning shaft, for cord
	A-3N-11086	Spacer under above spring
	120143	Take-up spring for drive cord
	B-6D-10241	Dial scale
	112-659-1	Crystal, clear, for dial scale
	A-2M-7758	Cinch buttons for fastening scale to bracket
	117833	Brass spacer [for spacing pointer from dial]
MISCELLANEOUS		
	10798	Line cord and plug
R15, S1	101218 or A-10A-10626	Volume control and switch, 1 meg.
C, C2, C7	B-8A-10211	2-gang variable condenser
P1	107249	Pilot light bulb, type T-47
	134122	Rubber bumper [bottom of cabinet]
	A-2M-10096	Cinch buttons, for fastening back to cabinet [4 used]
	13141	Cinch buttons, to cover trimmer holes in cabinet
	B-5B-11463-8	Pushbuttons (6 used), ivory
	A-23L-11900	Station call letters, set
	A-6C-11899	Acetate tabs for call letters
	5C-11228-9	Cabinet, bakelite, ivory color
	128-686-8	Knob, volume, ivory color
	A-5B-10994-9	Knob, tuning, ivory color
	A-3F-10995	Locking screw for tuning knob
	120388	Locking spring for tuning knob
	A-2H-10996	Reset key
	5C-11228-36	Cabinet, walnut
	128-686-37	Knob, volume, walnut
	A-5B-10994-36	Knob, tuning, walnut
	B-5B-11463-37	Pushbuttons, walnut

MODELS 74BR-1507A,
74BR-1508A

MONTGOMERY WARD



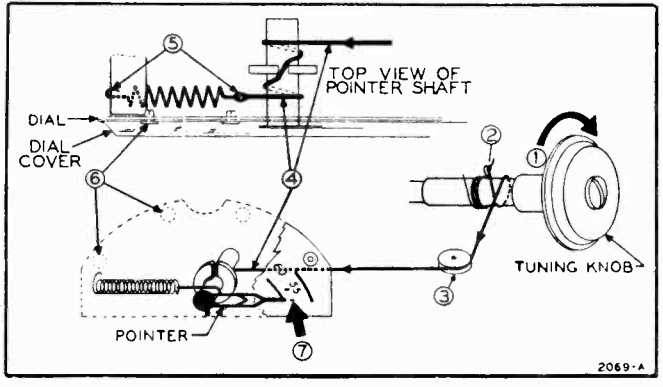
NOTE: On some sets slug tuned I.-F.'s are used instead of trimmer tuned I.-F.'s. 108-140H and 108-145 are trimmer tuned. B-13A-12023 and B-13B-12022 are slug tuned. The slug tuned I.-F.'s

are tuned from the top and bottom (secondary on top, primary on bottom). Slug tuned I.-F.'s cannot be used to substitute trimmer tuned I.-F.'s but trimmer tuned I.-F.'s can be used to substitute slug tuned I.-F.'s.

- Power Supply 105 to 125 volts, DC or 50-60 cycle AC, 35 watts.
- Frequency Range 530 to 1650 kc.
- Intermediate Freq. 455 kc.
- Selectivity At 1000 kc, 55 kc at 1000 x signal.
- Sensitivity 13 microvolts average for .05 watt output.
- Power Output 0.8 watts undistorted, 1 watt maximum.
- Loud Speaker 5" P.M., v.c. impedance 3.2 ohms.

REPLACING DIAL POINTER DRIVE CORD— Six inches of cord are required in the set. Use a piece slightly longer so that knots may be tied at each end. Numbers below correspond to circled numbers in diagram.

1. Rotate tuning knob to extreme clockwise position. This closes tuning condenser. Knob should remain in this position until installation is completed.
2. Tie cord to loop in spring as shown. Wind cord one turn around shaft in direction shown.
3. Pass cord over idler pulley.
4. Pass cord over pointer shaft; wind it one turn around shaft; pass it through key washer; wind it one more turn around shaft.
5. Hook spring over end of dial support. Tie cord to spring. **IMPORTANT:** Before tying knot stretch spring enough so that full contraction of spring will rotate pointer shaft at least one-half turn.
6. Remove dial crystal by removing Cinch buttons.
7. Make sure tuning knob is in extreme clockwise position. Then rotate pointer clockwise, against friction of shaft, until it is in horizontal position, as shown.



ALIGNMENT PROCEDURE AND RECEIVER STAGE SENSITIVITIES

The signal source must be an accurately calibrated speaker voice coil and substituting a 3.2-ohm, 5-watt resistor across the secondary winding of the output transformer. A reading of .4 volts AC across this resistor will be equivalent to a 50-milliwatt output with the speaker connected. Variations of plus or minus 25% are usually permissible. Volume control at maximum for all adjustments.

The table below lists the sensitivity at various points. All measurements are based on an output of 50-milliwatts. This may be measured by disconnecting the

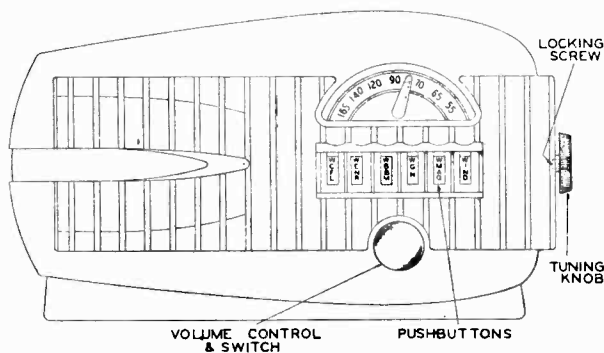
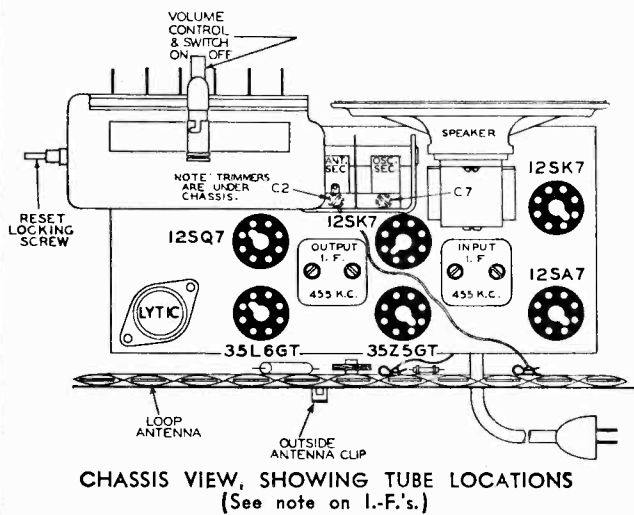
SIGNAL GENERATOR				TUNER SETTING	ADJUST FOR MAXIMUM OUTPUT	INPUT FOR 50-MILLIWATT OUTPUT
Frequency	Coupling Capacitor	Connection to Radio	Ground Connection			
455 kc.	.1 mf.	Pin No. 8 of 12SA7	12SQ7 Pin 3	Rotor full open	Trimmers on output and input I.F. cans	100 microvolts
1650 kc.	.1 mf.	Pin No. 8 of 12SA7	12SQ7 Pin 3	Rotor full open	Oscillator trimmer C7 (on bottom)	_____
1400 kc.	none	See note A	none	Set dial at 1400	Antenna trimmer C2 (on bottom)	_____
1400 kc.	200 mmf.	External antenna clip	12SQ7 Pin 3	1400 kc.	_____	13 microvolts
400 cycles	.1 mf.	12SQ7, Pin 2	12SQ7 Pin 3	_____	_____	.05 volts

Note A: Lay output lead of generator in back of loop antenna.

Turn up generator output. Loop antenna will pick up energy.

SETTING THE PUSHBUTTONS—The pushbuttons may be used, after proper adjustment, for the automatic tuning of any six stations which you select. They can be set up in any order.

1. Turn on the radio. Allow it to warm up for at least one minute.
2. Push out the call letters of the six stations from the call-letter sheets supplied with this manual.
3. Insert one call-letter tab in the rectangular opening in each of the pushbuttons, in any sequence. Press an acetate tab (supplied in small envelope) into each of the pushbuttons.
4. With the screwdriver supplied, check to see that the locking screw in the center of the tuning knob (see illustration) is loose. If it is not, turn it several turns to the left (counterclockwise).
5. Press the first pushbutton down *all the way*. With one hand hold the button down *firmly* and with the other carefully tune in the desired station. Release the pushbutton.
6. Follow this procedure for each of the five other buttons, adjusting each one for a different station.
7. Rotate the tuning knob on the side of the cabinet as far to the right as it will go. Tighten the locking screw in the center of the knob. **IT IS IMPORTANT THAT THIS SCREW BE TIGHTENED VERY FIRMLY.**
8. The pushbuttons are now properly set for automatic tuning. Any of the six stations may now be tuned in simply by pressing the proper button down as far as it will go. If it is desired to reset any of the buttons for a new station, loosen the locking screw in the center of the tuning knob, set the pushbutton as described above, and re-tighten the locking screw.

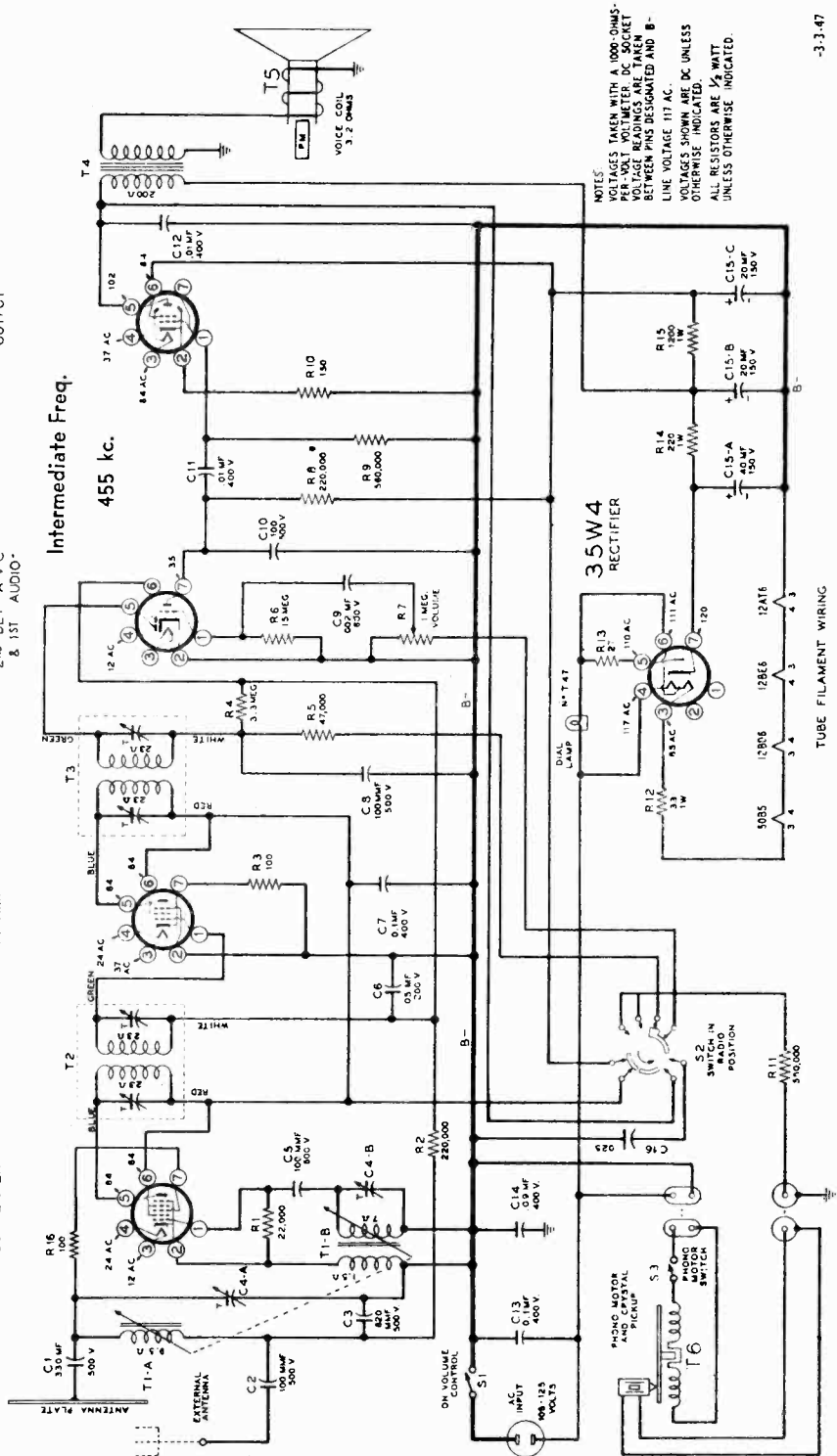


50B5
OUTPUT

12AT6
2ND DET. A.V.C.
& 1ST AUDIO

12BD6
I.F. AMP

12BE6
CONVERTER



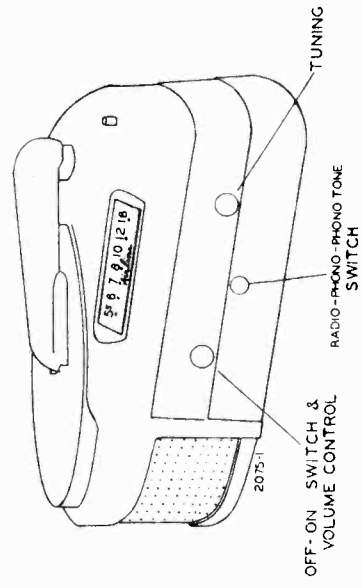
NOTES
VOLTAGES TAKEN WITH A 1000-OHMS-
PER-VOLT VOLTMETER. DC SOCKET
VOLTAGE READINGS ARE TAKEN
BETWEEN PINS DESIGNATED AND B-
LINE VOLTAGE 117 AC.
VOLTAGES SHOWN ARE DC UNLESS
OTHERWISE INDICATED.
ALL RESISTORS ARE 1/2 WATT
UNLESS OTHERWISE INDICATED.

-3-3-47

ELECTRICAL SPECIFICATIONS

- Power Supply 105 to 125 volts, 60 cycles AC, watts.
- Frequency Range 535 to 1690 kc.
- Selectivity At 1000 kc. 52 kc at 1000 x signal.
- Sensitivity 23 microvolts average for .05 watts output.
- Power Output 0.75 watts undistorted, 1.0 watts maximum.
- Loud Speaker 4" x 6" oval, P.M., v.c. impedance 3.2 ohms.

NOTE:—R13 (27 ohms) should be connected between pin no. 7 of the 35W4 tube and junction of R14 and C15-A.



OFF-ON SWITCH & VOLUME CONTROL
RADIO-PHONO-TONE SWITCH
TUNING

ALIGNMENT PROCEDURE
(Trimmer and coil views on next page)

Output meter across 3.2-ohm output load.

Align for maximum output.

Volume control at maximum for all adjustments.

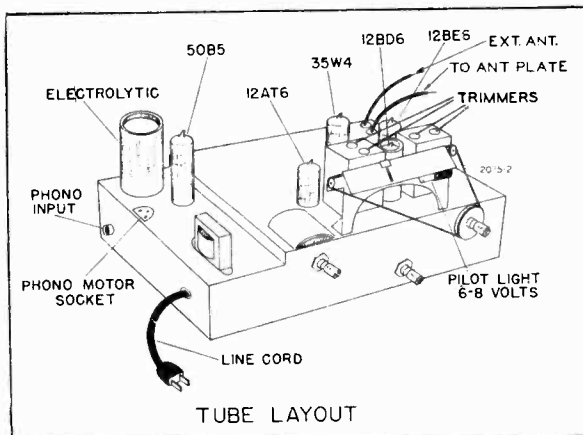
Reduce input as needed to keep output near 0.4 volts.

IMPORTANT: Adjustment of the oscillator and antenna trimmers should be done thru the trimmer holes in the base plate. If the antenna plate is not used while making adjustments, a 20-MMFD. COND. should be connected from the antenna plate lead to chassis to compensate for distributed capacity.

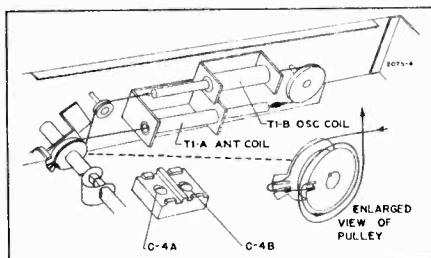
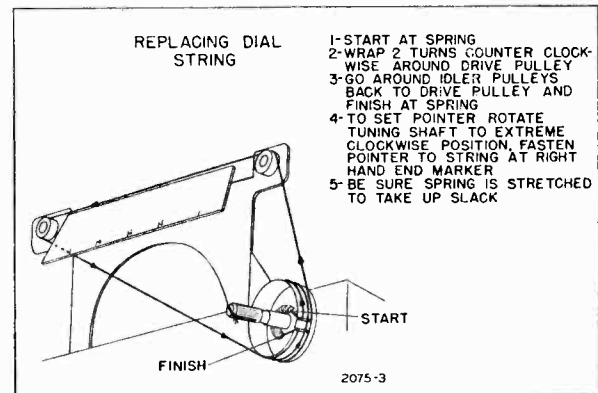
SIGNAL GENERATOR				TUNER SETTING	ADJUST TRIMMERS TO MAXIMUM OUTPUT (in order shown)
Frequency	Coupling Capacitor	Connection to Radio	Ground Connection		
455 kc	.1 mf	Metal antenna plate	12AT6 Pin 2	Iron cores all the way out	Trimmers on output and input I.F. cans
1690 kc	.1 mf	Metal antenna plate	12AT6 Pin 2	Iron cores all the way out	Oscillator trimmer C4-B
1690 kc	200 mmf	External antenna lead	12AT6 Pin 2	Iron cores all the way out	Antenna trimmer C4-A
1400 kc	200 mmf	External antenna lead	12AT6 Pin 2	Turn dial to 1400 kc	Adjust position of ant. coil (See coil assembly view)
1690 kc	200 mmf	External antenna lead	12AT6 Pin 2	Turn dial to 1690 kc	Antenna trimmer C4-A*

*After the antenna coil has been tracked at 1400 kc, it is necessary to check the antenna trimmer C4-A again at 1690 kc. If no appreciable change in trimmer adjustment is necessary, the coil is in track. If the trimmer

requires considerable change, the position of the antenna coil at 1400 kc must be readjusted. These two adjustments should be made several times, until no trimmer adjustment is required at 1690 kc.



Chassis View, Showing Trimmer Location



View of Tuning Coil Assembly

ANTENNA COIL ADJUSTMENT

The antenna coil assembly (see illustration) is made so that it is movable left or right. When making the adjustment as required in the alignment procedure, move the coil assembly very slowly, either by hand or by pivoting one edge of the blade of a screwdriver in the hole and engaging the blade in the gear teeth of the coil form.

REPLACEMENT PARTS LIST

Use Only Genuine Factory Replacement Parts

Ref. No.	Part No.	Description	Qty. Used in Set
CONDENSERS			
C15A, C15B, C15C.	A-8C-10937	Electrolytic, 40-20-20 x 150 volts	1
C7, C13	C-8D-10760	.1 x 400 volts, tubular	2
C4-A, C4-B	A-8E-11240	Dual trimmer—ant. and osc.	1
C11, C12	C-8D-10761	.01 x 400 volts, tubular	2
C9	C-8D-10778	.002 x 600 volts, tubular	1
C6	C-8D-10770	.05 x 200 volts, tubular	1
C14	C-8D-11251	.09 x 400 volts, tubular	1
C2-C5-C8-C10	C-8F3-8	100 mf x 500 volts, 20%, mica	4
C1	C-8F3-119	330 mf x 500 volts, 10%, mica	1
C3	C-8F3-247	820 mf x 500 volts, 5%, mica	1
C16	C-8D-10997	.025 x 400 volts, tubular	1
RESISTORS*			
R7, S1	A-10A-11332	Volume control (1 megohm) and switch	1
R2, R8	C-9B1-27	220K ohms, 1/2 watt, 20%	2
R1	C-9B1-78	22K ohms, 1/2 watt, 10%	1
R9, R11	C-9B1-95	560K ohms, 1/2 watt, 10%	2
R4	C-9B1-34	3.3 megohms, 1/2 watt, 20%	1
R3	C-9B1-50	100 ohms, 1/2 watt, 10%	1
R5	C-9B1-23	47K ohms, 1/2 watt, 20%	1
R6	C-9B1-302	15 megohms, 1/2 watt, 20%	1
R10	C-9B1-52	150 ohms, 1/2 watt, 10%	1
R13	C-9B1-43	27 ohms, 1/2 watt, 10%	1
R14	C-9B2-54	220 ohms, 1 watt, 10%	1
R15	C-9B2-63	1200 ohms, 1 watt, 10%	1
R12	C-9B2-44	33 ohms, 1 watt, 10%	1
R16	C-9B1-7	100 ohms, 1/2 watt, 20%	1
COILS AND TRANSFORMERS			
T1-A, T1-B.	C-211-11222	Antenna and oscillator, permeability tuned coil assembly	1
T2	B-13A-10728-1	Input I. F. coil	1
T3	B-13B-10729	Output I. F. coil	1
T4	B-12C-11230	Output audio transformer (for speaker)	1
SPEAKER			
T5	B-18A-11219	P. M., 4" x 6" oval—less output transformer	1
DIAL AND TUNING PARTS			
	B-6D-11241	Dial scale	1
	A-2G-11123	Pointer	1
	B-53A-11340	String for dial (20" long)	1

Ref. No.	Part No.	Description	Qty. Used in Set
	A-49A-10078	Tension spring for dial string	1
	B-5B-13170-8	Knob, Ivory, "Tuning"	1
	B-5B-13171-8	Knob, Ivory, "Volume"	1
	B-5B-13172-8	Knob, Ivory, "Radio-Phono-Tone"	1
	A-3A-11215	Tuner shaft	1
	A-2C-11120	Drive pulley	1
	B-29C-10393	"C" washer	1
	A-49A-11208	Spring coupling	1
	A-6A-11210	Diffuser plate	2
	B-2M-7758	Snap-in rivets, for diffuser plate	2
	B-2D-11234	Bracket for dial scale	1
PHONO PARTS			
T6	C-201-11406-3	Phono motor and turntable assembly	1
	48C-11884-9	Pick-up arm—ivory color—less mounting base and crystal cartridge	1
	8K-11885	Crystal cartridge only (CR-1)	1
	23B-11886-9	Mounting base (ivory color) for pick-up arm	1
	A-19A-11010	Plug—for pick-up lead	1
	55A-11400	Play-back—needle	1
S3	A-20A-11482	Stop switch	1
	A-3B-11499	Actuator collar	1
	A-2D-11498	Actuator	1
	A-2D-11500	Switch bracket	1
MISCELLANEOUS			
	C-5C-11329-9	Cabinet—ivory color	1
	B-23J-11220	Antenna plate	1
	B-2K-11237	Metal grille	1
	B-2D-11352	Grille band	1
	D-2E-11238	Bottom plate	1
	A-25A-11212	Rubber grommet for bottom plate	5
	A-25F-11407	Rubber bumper—bottom of plate	4
	A-15C-10717	Tube socket	5
	A-2H-10718	Shield base for tube shield	1
	A-2H-10974	Tube shield	1
	A-2M-11428	Tube retainer	4
	B-15B-10076	Mounting base for electrolytic	1
	A-19B-12170	Phono input socket	1
	A-19B-10727	Phono motor socket	1
	A-20A-11114	Radio-phono, phono-tone switch	1
	A-47A-11209	Pilot lite assembly	1
	A-46A-10793	Pilot lite bulb, T-47 (6-8 volts)	1

RECEIVER STAGE SENSITIVITIES

The table below lists the sensitivities 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 volts AC across this resistor

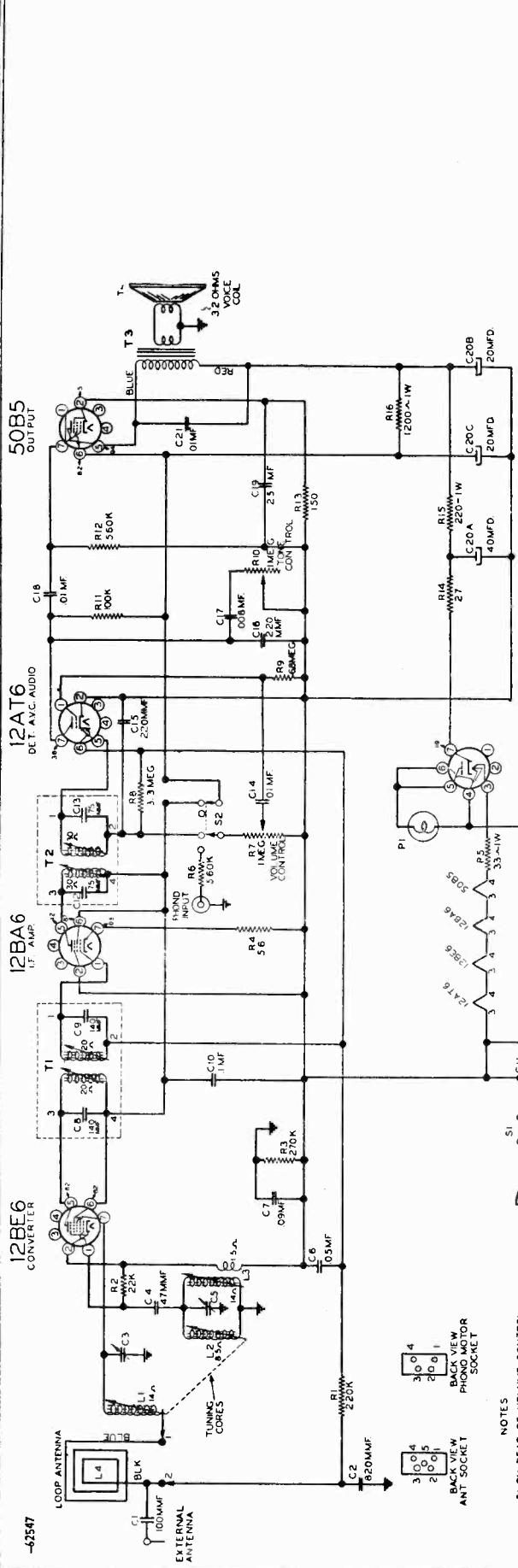
will be equivalent to a 50-milliwatt output with the speaker connected.

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 of plus or minus 25% are usually permissible.

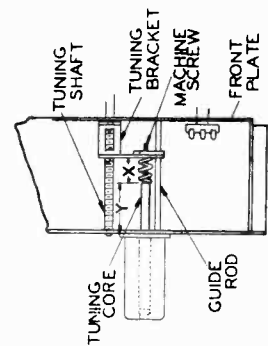
Frequency	Coupling Capacitor	SIGNAL GENERATOR			INPUT FOR 50-MILLIWATT OUTPUT
		Connection to Radio	Ground Connection		
1000 kc	200 mmf or RMA dummy antenna	External antenna lead	12AT6, Pin 2		23 microvolts
1000 kc	.1 mf	Converter 12BE6, pin 7	12AT6, Pin 2		70 microvolts
455 kc	.1 mf	Converter 12BE6, pin 7	12AT6, Pin 2		56 microvolts
455 kc	.1 mf	I. F. amplifier 12BD6, pin 1	12AT6, Pin 2		3400 microvolts
400 cycles	.1 mf	Audio amplifier 12AT6, pin 1	12AT6, Pin 2		.06 volts
400 cycles	.1 mf	Power amplifier 50B5, pin 1	12AT6, Pin 2		2.0 volts

MONTGOMERY WARD

MODELS 74BR-2003A,
74WG-2003B



Note for Model 2003B
On some sets C3 consists of two trimmer plates and two insulators. C3 is then returned to B— instead of to GROUND.
Also C2 is returned to B— instead of to ground.
On some sets R5, Part No. C-9B2-44 is not used.

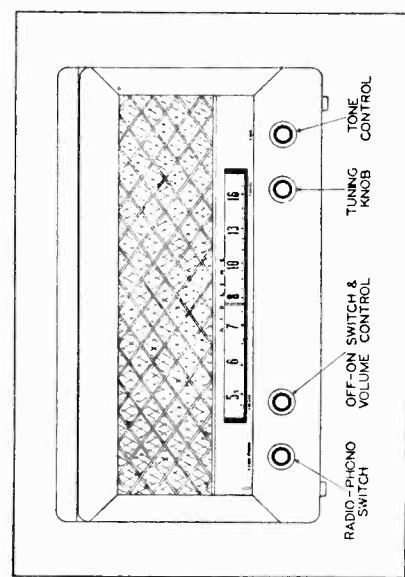


BOTH TUNING CORE S PROTRUDE 1/16" OUT OF BASE OF TUNING COIL ASSEMBLY, WHEN THE TUNING BRACKET IS AGAINST THE FRONT PLATE AS SHOWN IN DRAWING. (DIMENSION Y) IS THE TOTAL LENGTH OF MACHINE SCREW IS 3/4 IN. DIMENSION X APPROX 7/16 IN.

ple AVC voltage is applied to the converter and IF amplifier tubes. The filament string is across the AC line.

ELECTRICAL SPECIFICATIONS

- Power Supply 105 to 125 volts; 60 cycles AC, 60 watts.
- Frequency Range 535 to 1620 kc.
- Intermediate Freq. 455 kc.
- Selectivity At 1000 kc. 50 kc. at 1000 x signal.
- Sensitivity 10 microvolts average for .05 watts output.
- Power Output 0.75 watts undistorted, 1.0 watts maximum.
- Loud Speaker 4" x 6" oval, P.M., v.c. impedance 3.2 ohms.
- Tube Complement 12BE6, converter
12BA6, I.F. amplifier.
12AT6, detector, AVC, audio amplifier
50B5, output amplifier
35W4, rectifier
Pilot lite, 6-8 volts, T-47.
Automatic changer... See manual 5050A.



GENERAL DESCRIPTION

This radio-phonograph is a permeability-tuned, AC set using 4 miniature tubes plus a rectifier. A loop antenna is built into the back of the cabinet. A clip is provided for connection of an external antenna. Sim-

MODELS 74BR-2003A,
74BR-2003B

MONTGOMERY WARD

ALIGNMENT PROCEDURE AND RECEIVER STAGE SENSITIVITIES

The signal source must be an accurately calibrated signal generator capable of supplying R. F. signals modulated 30% with a 400-cycle audio signal. A 400-cycle source is necessary for the audio measurement.

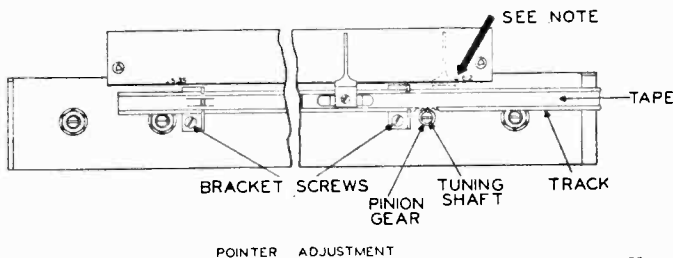
The table below lists the sensitivity at various points. All measurements are based on an output of 50-milliwatts. This may be measured by disconnecting the

speaker voice coil and substituting a 3.2-ohm, 5-watt resistor across the secondary winding of the output transformer. A reading of .04 volts AC across this resistor will be equivalent to a 50-milliwatt output with the speaker connected. Variations of plus or minus 25% are usually permissible. Volume control at maximum for all adjustments. Tone control at maximum treble.

SIGNAL GENERATOR				TUNER SETTING	ADJUST FOR MAXIMUM OUTPUT	INPUT FOR 50-MILLIWATT OUTPUT
Frequency	Coupling Capacitor	Connection to Radio	Ground Connection			
455 kc.	.1 mf	12BE6, Pin 7	12AT6, Pin 2	Iron cores all the way out	Trimmers on output and input I.F. cans	28 microvolts
1620 kc.	.1 mf	12BE6, Pin 7	12AT6, Pin 2	Iron cores all the way out	Oscillator trimmer C5	—————
535 kc.	200 mmf	External antenna clip	12AT6, Pin 2	Iron cores all the way in	Shunt osc. coil L3	11 microvolts
1620 kc.	200 mmf	External antenna clip	12AT6, Pin 2	1620 kc.	Antenna trimmer C3*	8 microvolts
1400 kc.	200 mmf	External antenna clip	12AT6, Pin 2	1400 kc.	Adjust position of ant. core (see coil illustration view)	8 microvolts
400 cycles	.1 mf	12AT6, Pin 1	12AT6, Pin 2	—————	—————	.03 volts

*After the antenna coil has been tracked at 1400 kc, it is necessary to check the antenna trimmer C3 again at 1620 kc. If no appreciable change in trimmer adjustment is necessary, the coil is in track. If the trimmer

requires considerable change, the position of the antenna core at 1400 kc must be readjusted. These two adjustments should be made several times, until no trimmer adjustment is required at 1620 kc.



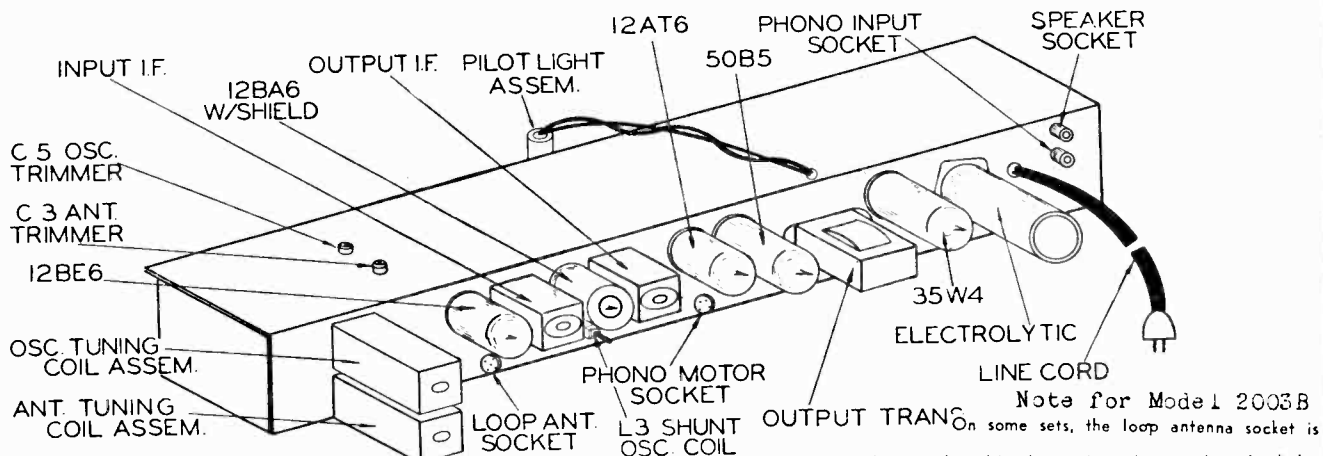
ROTATE TUNING SHAFT FULLY CLOCKWISE SO THAT POINTER IS AT RIGHT SIDE OF DIAL. LOOSEN BRACKET SCREWS AND LIFT UP TRACK. SLIDE POINTER SO THAT RIGHT EDGE OF POINTER SKIRT COINCIDES WITH LEFT EDGE OF 162 KC CALIBRATION MARK.

PULL TRACK DOWN SO THAT TAPE TEETH ENGAGE PINION GEAR AND TIGHTEN BRACKET SCREWS. CAREFULLY ADJUSTMENT OF TAPE PRESSURE ON PINION GEAR TEETH WILL GIVE A SMOOTH MOTION TO THE TUNING SHAFT. IF IT FEELS "GEARY" DECREASE PRESSURE OF TAPE ON GEAR TEETH SLIGHTLY. IF THERE IS LOST MOTION BETWEEN TAPE TEETH AND GEAR TEETH INCREASE PRESSURE SLIGHTLY.

CAUTION: The I.F. transformer construction is such that two resonance peaks occur for each winding, one peak when the slug is above its coil and another peak when the slug is below its coil. Be sure the upper cores are above the top coils and the lower cores are below the bottom coils (see coil drawing).

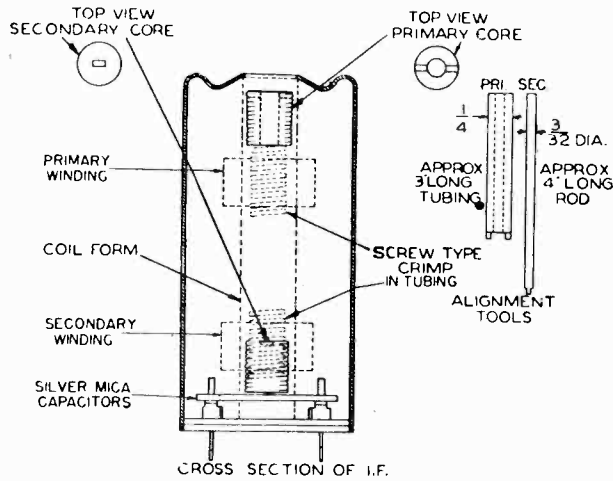
Note for Model 2003B

On some sets, pairs of punch marks on the inside of the tape guide are used as calibration markers. They are in the same relative position as the frequencies shown above. The end of the tape is then used as the indicator line.



MONTGOMERY WARD

MODELS 74BR-2003A,
74BR-2003B



PRIMARY CORE HAS HOLE THRU THE CENTER TO ALLOW SMALL FIBRE TOOL TO PASS THRU AND ADJUST THE SECONDARY CORE. THE PRIMARY CORE HAS A COMPLETE SLOTTED TOP FOR ADJUSTMENT; SECONDARY CORE HAS A SMALL NITCH IN TOP. BOTH WINDINGS ARE TOP TUNED.
THE SECONDARY ALIGNMENT TOOL PASSES THRU THE CENTER OF THE PRIMARY TOOL, FOR SIZE SEE DETAIL DRAWING

Parts list for Model 2003B is the same as for Model 2003A with the following exceptions.

C20A, B, C	A-8C-10077 or A-8C-10937	40 mf; 20 mf; 20 mf; 150 volts Electrolytic filter condenser	1
C3	A-2M-14054	Trimmer plate	1
C3	A-6M-14203	Insulator for trimmer (laminated)	1

DIAL AND TUNING PARTS

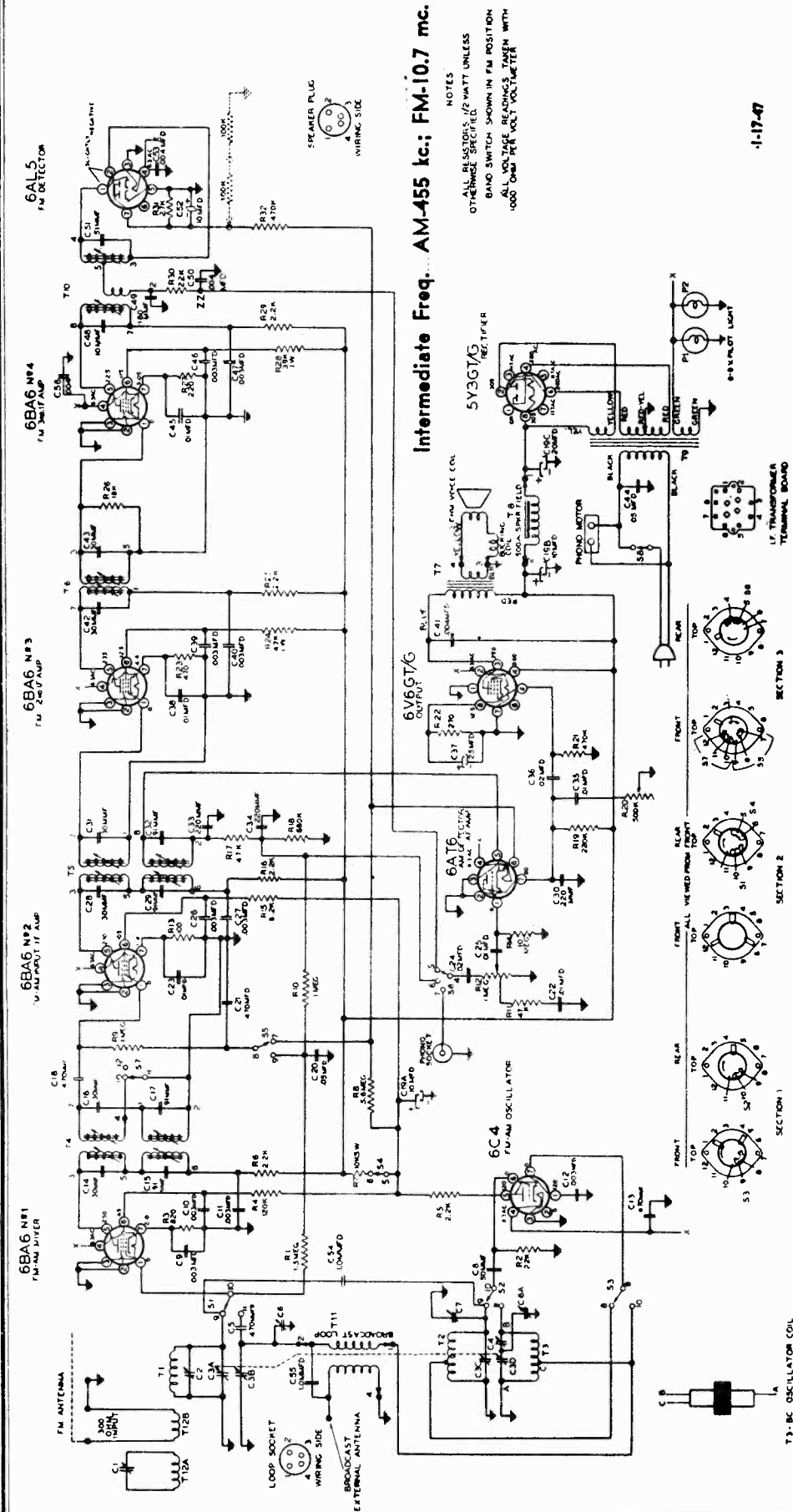
A-6B-13277	Diffuser	1
or		
B-6B-14151	Diffuser	1

PARTS LIST

Ref. No.	Part No.	Description	Qty. Used In Set	Ref. No.	Part No.	Description	Qty. Used In Set
CONDENSERS				L3	B-13D-12371	Osc. shunt coil assembly	1
C20A, B, C	A-8C-10077	40 mf; 20 mf; 20 mf; 150 volts Electrolytic filter condenser	1	L2	A-23D-12667	Osc. tuning coil	1
A-2M-12618	C3, 5	Trimmer plate	2	L1	A-13E-12668	Antenna tuning coil	1
A-6M-12616		Insulator for trimmer	2	T3	B-12C-12356	Output transformer for speaker	1
C10	C-8D-10771	.1 mf x 200 volts, 20%	1	SPEAKER			
C14, 18, 21	C-8D-10761	.01 mf x 400 volts, 20%	3	T4	B-18A-12839-1	4" x 6", P.M. speaker, less output transformer	1
C11	C-8D-10813	.05 mf x 400 volts, 20%	1	PHONO PARTS			
C6	C-8D-10770	.05 mf x 200 volts, 20%	1	D-21H-13293	Record changer	1	
C7	C-8D-11251	.09 mf x 400 volts, 10%	1	P30	Crystal cartridge, with phono needle	1	
C17	C-8D-12243	.006 mf x 600 volts, 10%	1	Phono needle, see manual 62P-5050			
C19	A-8C-11678	Electrolytic condenser, 25 mf x 25 volts	1	DIAL AND TUNING PARTS			
C15, C16	C-8F3-10	220 mmf x 500 volts, 20%, mica	2	C-6D-13315	Dial scale	1	
C2	C-8F3-124	820 mmf x 300 volts, 10%, mica	1	B-5B-13390-58	Knob	4	
C4	C-8G-12198	47 mmf, 10%, ceramic	1	A-2G-13281	Pointer	1	
C1	C-8G-11734	100 mmf, ceramic	1	32F4-10830	Screw, 4-40 x 1/8", to fasten pointer	1	
RESISTORS				B-2J-13282	Rack tape, with teeth	1	
R7, S1	A-10A-12654	Volume (1 megohm) control and switch	1	A-200-13288	Tuning shaft assembly	1	
R10	A-11B-12659	Tone control, 1 megohm	1	A-6B-13277	Diffuser	1	
R3	C-9B1-91	270K ohms, 1/2 watt, 10%	1	B-2M-7758	Snap-pin rivets to fasten diffuser	2 do:	
R4	C-9B1-47	56 ohms, 1/2 watt, 10%	1	A-47A-13360	Pilot lite and bracket assembly	1	
R14	C-9B1-43	27 ohms, 1/2 watt, 10%	1	A-46A-10793	Pilot lite bulb, 6-8 volt, type T-47	1	
R5	C-9B2-44	33 ohms, 1 watt, 10%	1	MISCELLANEOUS			
R11	C-9B1-86	100K ohms, 1/2 watt, 10%	1	A-15C-10717	Miniature 7 prong tube socket	5	
R13	C-9B1-52	150 ohms, 1/2 watt, 10%	1	B-15B-10076	Mounting plate for lytic	1	
R15	C-9B2-54	220 ohms, 1 watt, 10%	1	A-19B-12644	Phono motor socket	1	
R16	C-9B2-63	1200 ohms, 1 watt, 10%	1	A-19B-12645	Loop antenna socket	1	
R2	C-9B1-78	22K ohms, 1/2 watt, 10%	1	A-19B-11044	Pick-up socket	1	
R1	C-9B1-90	220K ohms, 1/2 watt, 10%	1	A-23A-10344	Line cord lock	1	
R6, R12	C-9B1-95	560K ohms, 1/2 watt, 10%	2	A-19B-12170	Speaker socket	1	
R8	C-9B1-34	3.3 megohms, 1/2 watt, 20%	1	A-20A-12653	Radio-phono switch	1	
R9	C-9B1-36	6.8 megohms, 1/2 watt, 20%	1				
COILS AND TRANSFORMERS				S2			
T1, C8, 9	B-13A-13071	Input I.F. coil	1				
T2, C12, 13	B-13B-13072	Output I.F. coil	1				
L4	C-13E-13305	Loop antenna assembly	1				

MODELS 74BR-2702A,
74BR-2702B

MONTGOMERY WARD



Intermediate Freq. AM-455 kc; FM-10.7 mc.

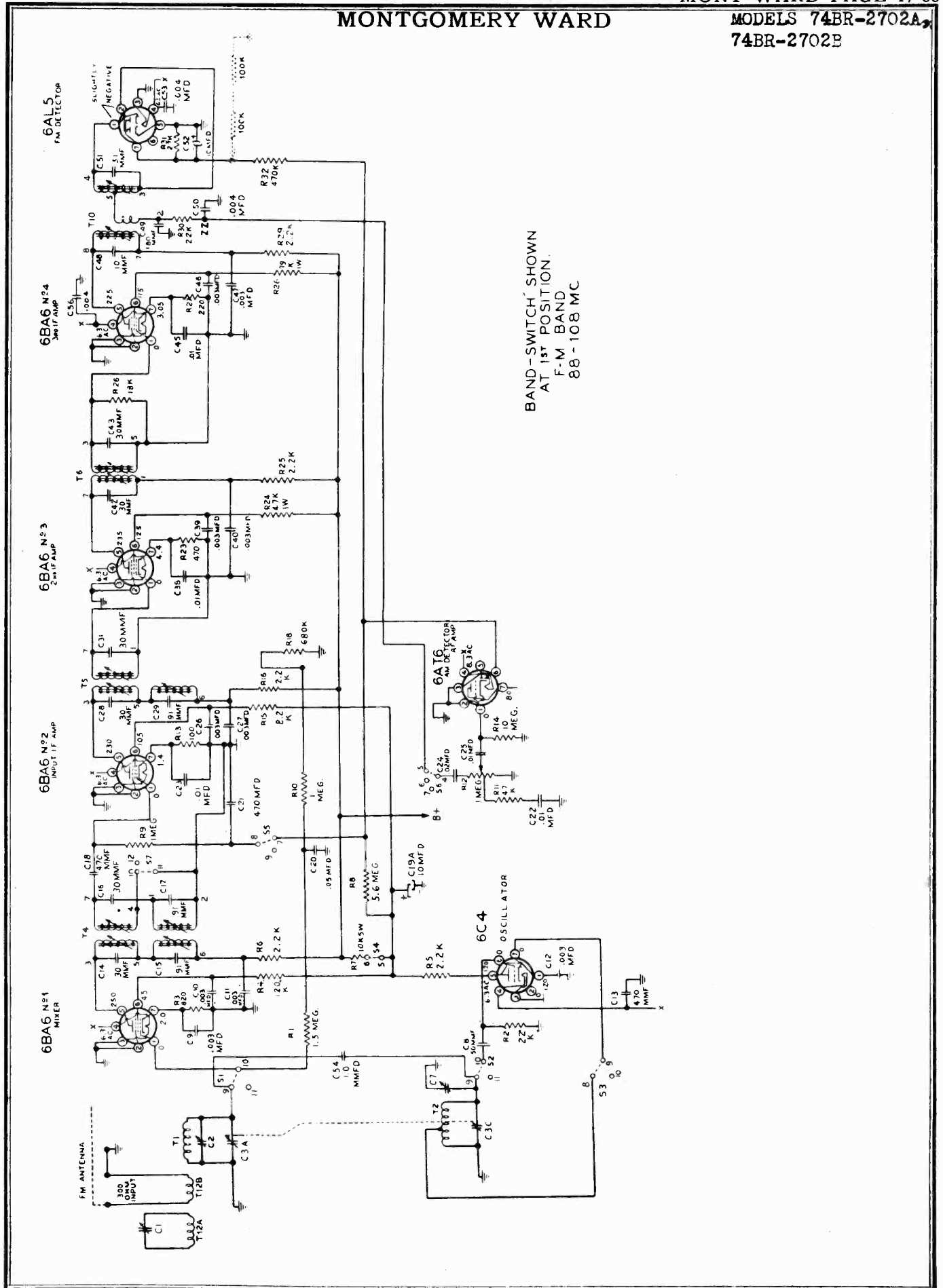
NOTES
ALL RESISTORS, 1/2 WATT UNLESS OTHERWISE SPECIFIED
BAND SWITCH SHOWN IN FM POSITION
ALL VOLTAGE READINGS TAKEN WITH 1000 OHM PER VOLT VOLTMETER

-1-17-47

ELECTRICAL SPECIFICATIONS

Power Supply 105 to 125 volts, AC, 60-cycles;
Chassis only 85 watts. With
phono operation 110 watts.
Broadcast Band—540 to 1600 kc.
F. M. band—88 to 108 mc.
Loud Speaker 10" electrodynamic. Voice coil
impedance 3.2 ohms, 400 cycles.

Selectivity AM-50kc. broad at 1000 times sig-
nal, measured at 1000 kc.
I.F. FM-180 kc. broad at 2 times
down.
I.F. FM-290 kc. broad at 10 times
down.
AM Sensitivity (For .5 watt output with external
antenna)—20 microvolts average
FM Sensitivity (For .5 watt output)—15 micro-
volts average.
Power Output 3.5 watts 10% distortion. 7 watts
maximum.

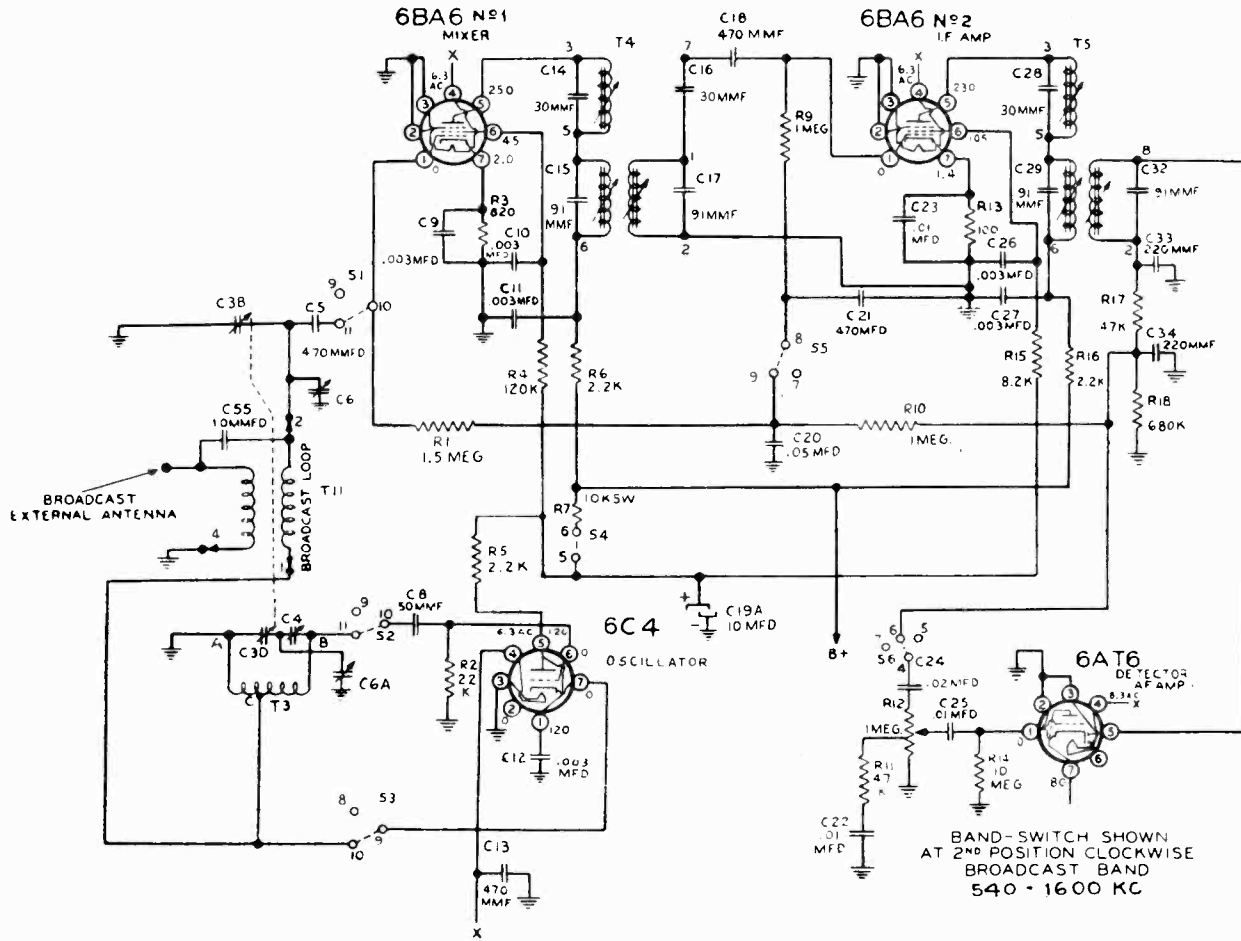


BAND-SWITCH SHOWN
AT 1ST POSITION.
F-M BAND
88-108 MC

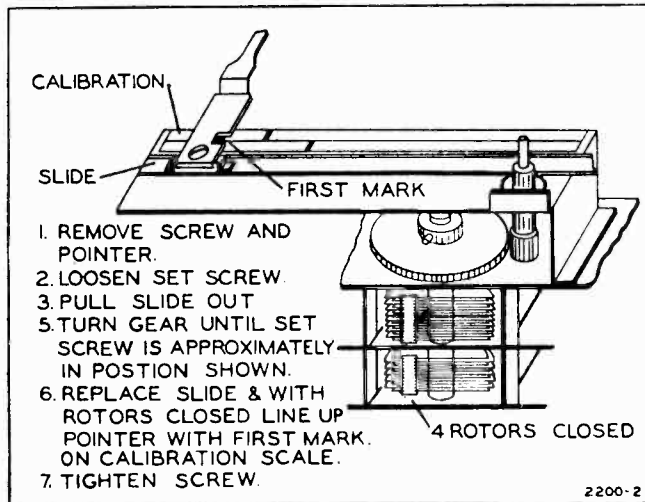
"clarified schematics"

MODELS 74BR-2702A,
74BR-2702B

MONTGOMERY WARD



Procedure for disassembly and assembly of dial mechanism



2200-2

MONTGOMERY WARD

MODELS 74BR-2702A,
74BR-2702B

ALIGNMENT PROCEDURE

Broadcast Band Section I.F. and R.F.

The alignment procedure below includes the sensitivities at the inputs of various stages. All signal input values are based on an output of 1/2 watt. This may be measured by disconnecting the speaker voice coil and substituting a 3.2-ohm resistor across the secondary winding of the output transformer. A reading of 1.3 volts AC across this resistor will be approximately equivalent to a 1/2-watt output with the speaker connected. The volume control

must be set at maximum. The tone control must be set for maximum treble.

The signal source must be an accurately calibrated signal generator capable of supplying the frequencies designated, modulated 30% with a 400-cycle audio signal. A 400 cycle audio signal is required for the audio measurement. Variations in sensitivities of plus or minus 25% are usually permissible.

AM - I. F. ALIGNMENT

Band Switch in AM Position. Tune Set to 1400 Kc. Dummy Antenna .1 Mfd.

SIGNAL GENERATOR FREQUENCY	CONNECTION TO RADIO	ADJUSTMENT TO BE MADE	ADJUST FOR
455 Kc. Use 2100 microvolts	Pin No. 1 of 6BA6 No. 2 and ground	Primary and Secondary of T5 AM windings. See top and bottom views	Maximum output. Should be 1/2 watt
455 Kc. Use 64 microvolts	Pin No. 1 of 6BA6 No. 1 and ground	Primary and Secondary of T4 AM windings. See top and bottom views	Maximum output. Should be 1/2 watt
400 cycles. Use 63 millivolts	Pin No. 1 of 6AT6 and ground	None	Maximum output. Should be 1/2 watt

BROADCAST BAND - R. F. ALIGNMENT

Check Pointer so that it is Exactly Over Calibration Marker to the Extreme Left When Gang is Fully Closed. For Adjustment Loosen Set Screw on Large Gear (see dial mechanism illustration.)

SIGNAL GENERATOR FREQUENCY	CONNECTION TO RADIO	DUMMY ANTENNA	ADJUST
1400 Kc. Use 15 microvolts	Antenna and Ground	200 mmf.	C6A for maximum. 1/2 watt
600 Kc. Use 25 microvolts	Antenna and Ground	200 mmf.	C4 for maximum. 1/2 watt
1400 Kc.	Antenna and Ground	200 mmf.	C6 See Note

NOTE: Recheck first two adjustments after this adjustment because of inter-locking effects.

MODELS 74BR-2702A,
74BR-2702B

MONTGOMERY WARD

ALIGNMENT PROCEDURE

FM Band Section. I.F. and R.F.

IMPORTANT

No alignment of the FM section of this radio should be attempted unless you are positive that the circuits are in need of adjustment and you have the necessary equipment.
All components used in this radio are extremely stable and the tuned circuits should require no adjustment over long periods of time.

NOTE

The following alignment is based on the use of the new Simpson vacuum tube voltmeter which has a "floating ground". In other words, the meter, when used as a vacuum tube voltmeter, can have both the positive and negative sides connected to points above ground and still give true readings.
A standard AM signal generator is required.

FM - I. F. ALIGNMENT

Band Switch in FM Position. Dummy Antenna .1 Mfd.

SIGNAL GENERATOR FREQUENCY	CONNECTION TO RADIO	VACUUM TUBE VOLT METER CONNECTION TO RADIO	ADJUSTMENT TO BE MADE	ADJUST FOR
10.7 Mc. Use about .1 volt	Pin No.1 of 6BA6 no. 4 and ground	Pin no. 7 of 6AL5 and ground	Primary of T10	Resonance should be about 3 volts
10.7 Mc. Use about .1 volt	Pin No.1 of 6BA6 no. 4 and ground	See note "A"	Secondary of T10	Zero. Use zero center scale See note "B"
10.7 Mc. Use about 4000 microvolts	Pin No.1 of 6BA6 no. 3 and ground	Pin no. 7 of 6AL5 and ground	Primary and Secondary of T6	Resonance should be about 3 volts
10.7 Mc. Use about 150 microvolts	Pin No.1 of 6BA6 no. 2 and ground	Pin no. 7 of 6AL5 and ground	Primary and Secondary of 10.7 mc. windings of T5. See top and bottom views	Resonance should be about 3 volts
10.7 Mc. Use 3000 microvolts	FM Antenna input and ground	Pin no. 7 of 6AL5 and ground	Primary and Secondary of 10.7 mc. windings of T4. See top and bottom views	Resonance should be about 3 volts See Note "C"
10.7 Mc.	FM Antenna input and ground	Pin no. 7 of 6AL5 and ground	C1	Minimum response. This is a trap circuit

NOTES ON FM—I.F. ALIGNMENT:

NOTE "A" Connect two resistors, 100K OHMS each, from Pin No. 7 of 6AL5 to ground. These resistors must be matched within 5%. Connect as shown in dotted lines on schematic diagram. Connect vacuum tube voltmeter between the mid point of the resistors and point Σ .
NOTE "B" If T10 has been tampered with, it is possible that no

crossover point will be found at first. Careful adjustment of both primary and secondary is necessary.
GENERAL: Input signals should be adjusted to give approximately 3 volts. The ratio detector is operating at a reasonable level at this point and will give the truest indication of correct alignment with the procedure specified.
NOTE "C" The input microvolts specified is based on the trap circuits being adjusted.

FM - R. F. ALIGNMENT

Check Pointer so that it is Exactly Over Calibration Marker to the Extreme Left When Gang is Fully Closed. For Adjustment Loosen Set Screw on Large Gear (see dial mechanism illustration.)

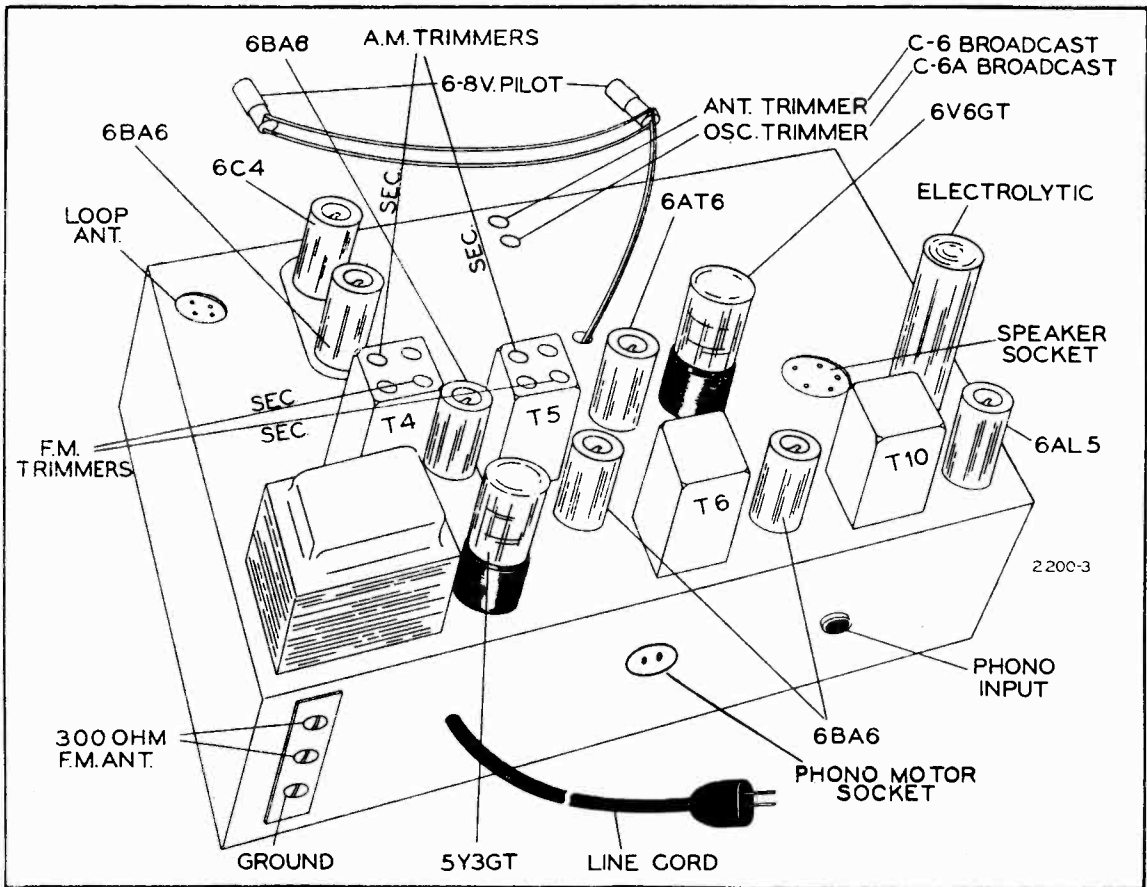
SIGNAL GENERATOR FREQUENCY	CONNECTION TO RADIO	DUMMY ANTENNA	ADJUST	VACUUM TUBE VOLT METER CONNECTION TO RADIO	ADJUST TO
100 Mc. Use about 15 microvolts	FM Antenna lead	300 ohms	C7 Osc. C2 Ant.	Pin No. 7 of 6AL5 and Ground	Resonance about 3 volts

NOTE: If a signal generator with the above fundamental frequency is not available, it is sometimes possible to use harmonics. Use extreme care in picking harmonics. An alternate procedure is

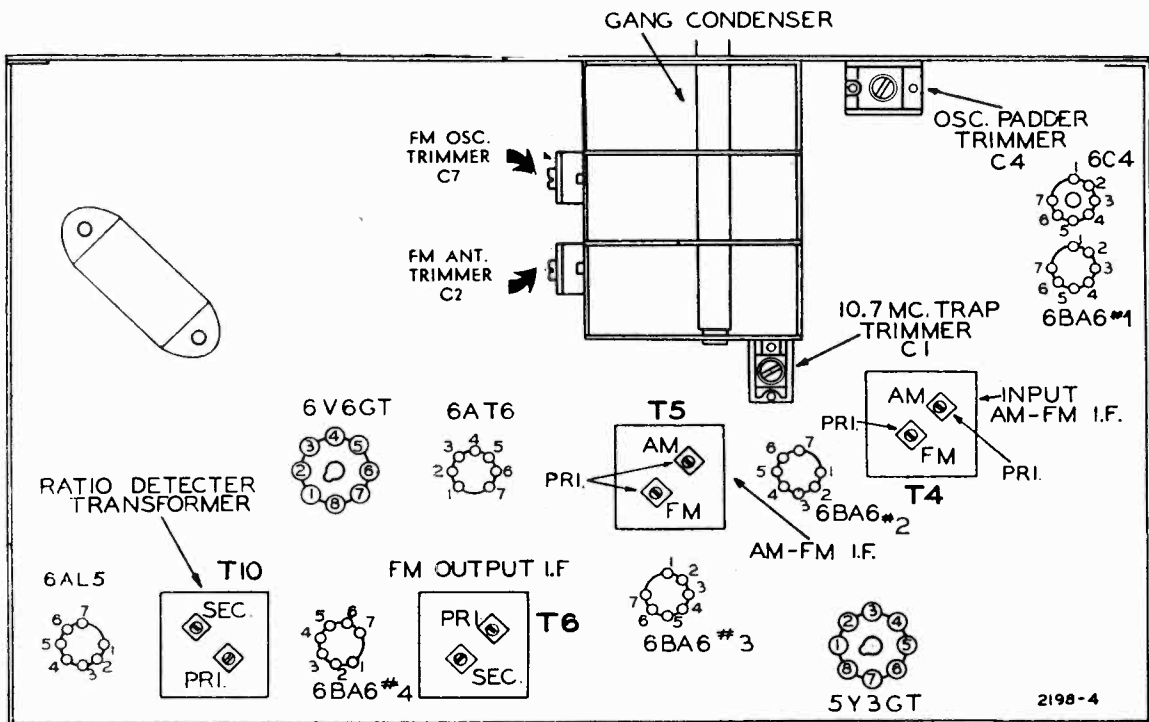
to use a local station carrier of known frequency to align the F.M. Band and to use the vacuum tube volt meter as above for resonance indication. A weak carrier, however will not produce 3 volts.

MONTGOMERY WARD

MODELS 74BR-2702A,
74BR-2702B



Chassis—top view



Chassis—bottom view

MODELS 74BR-2702A,
74BR-2702B

MONTGOMERY WARD

HOW TO ORDER PARTS—When ordering, specify **PART** number, schematic diagram reference number when

applicable, and **CHASSIS MODEL** number. The model number appears on a label on the chassis.

REPLACEMENT PARTS LIST

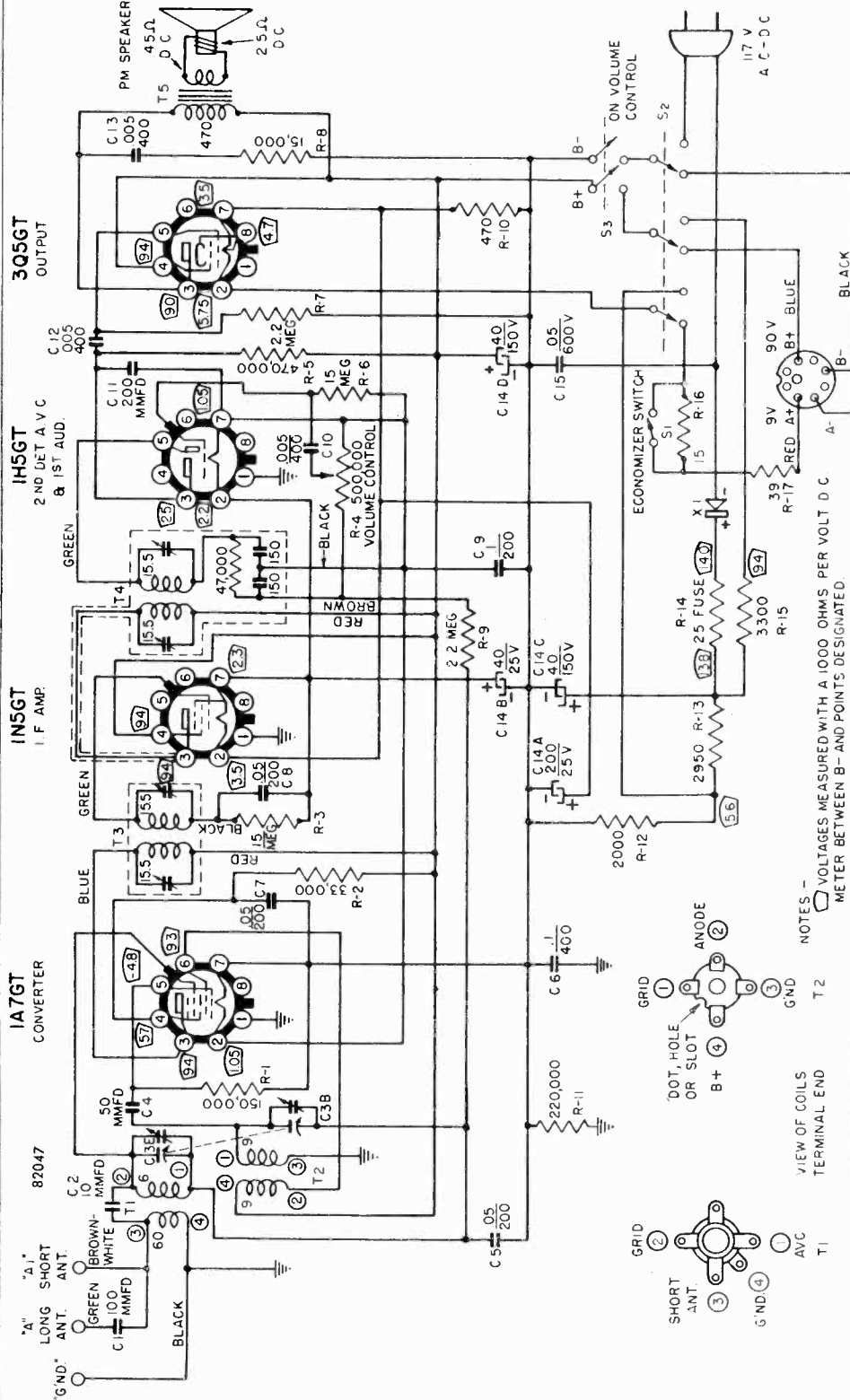
Use Only Genuine Factory Replacement Parts

Ref. No.	Part No.	Description	Qty. Used in Set
R. F. TUNER PARTS			
CONDENSERS			
C3A-B-C-D	B-8A-11275	Two gang split stator variable	1
C2	A-8E-12079	Trimmer cond. F.M. antenna	1
C1	A-8E-11506	Trimmer cond. I.F. trap	1
C7	A-8E-11279	Trimmer cond. F.M. osc. trimmer	1
C6, C6A	A-8E-12557	Trimmer cond. B.C. antenna and oscillator	1
C4	A-8E-12177	Padder cond.—B.C. Band	1
C8	C-8G-11484	50 mmf, ±10%, ceramic	1
C55	C-18G-12408	1.0 mmf, ±2 mmf, ceramic	1
C-9-10-11-12	C-8G-11486	3000 mmf, ±20%, ceramic	4
C5-13	C-8F3-12	470 mmf, 500 volts, ±20% mica	2
RESISTORS			
R3	C-9B1-61	820 ohms, 1/2 watt, 10%	1
R12	A-10B-11263	Volume control (1 megohm)	1
R20, S8	A-11A-11262	Tone control (500M ohms) and switch	1
R5, R6	C-9B1-15	2200 ohms, 1/2 watt, 20%	2
R1	C-9B1-32	1.5 megohm, 1/2 watt, 20%	1
R2	C-9B1-78	22K megohms, 1/2 watt, 10%	1
MISCELLANEOUS			
	A-15C-11491	7-prong miniature tube socket	1
	A-15A-11276	Miniature tube socket, ceramic with base	1
	A-2H-12337	Socket shield base	1
	A-2H-11494	Tube shield	2
	200-12862	Spur gear assembly—consists of two gears, two springs and bushing	1
	A-49A-11673	Spring for above assembly	2
SI-2-3-4-5-6-7	B-20A-11261	Band switch and phono-radio switch	1
	B-2C-11188-1	Dial plate assembly with tape guide, bushing, shaft and pinion gears	1
	A-3J-11182	Pinion gear—inner side of plate	1
	A-3J-11183	Pinion gear—outer side of plate	1
	A-3A-11181	Shaft—for pinion gears	1
	B-2J-11190	Rack tape—with teeth and bracket	1
	A-200-11511	Pointer with bracket	1
	A-49A-12960	Pointer tension spring	1
	32F4-10830	B. H. M. S. 4-40 x 1/8 screw, to fasten pointer and bracket to tape bracket	1
COILS			
T2	A-13D-11282	88-108 mc oscillator coil	1
T1	A-13E-11283	88-108 mc antenna coil secondary	1
T12A, T12B	A-13E-11284	88-108 mc antenna coil primary with trap	1
MAIN CHASSIS PARTS			
C52	A-8C-11495	Electrolytic condenser 10 mfd x 150 volts	1
C37	A-8C-11496	Electrolytic condenser 25 mfd x 25 volts	1
C19A, B, C	A-8C-10272	Electrolytic condenser 10 mfd x 10 mfd x 20 mfd	1
C24, C36	C-8D-10774	.02 mfd x 400 v., 20%, tubular	2
C20	C-8D-10770	.05 mfd x 200 v., 20%, tubular	1
C22	C-8D-11738	.01 mfd x 200 v., 20%, tubular	1
C25, 35	C-8D-10761	.01 mfd x 400 v., 20%, tubular	2
C41, 50, 53, 56	C-8D-10788	.004 mfd x 600 v., 20%, tubular	4
C49	C-8F3-116	180 mmfd x 500 v., 10%, mica	1
C23, 38, 45	C-8F9-20	10K mmfd x 300 v., 20%, mica	3
C21, 18	C-8F3-12	470 mmfd x 500 v., 20%, mica	2
C30, 33, 34	C-8F3-10	220 mmfd x 500 v., 20%, mica	3
C44	C-8J-11388	.05 mfd x 600 v., 20%, molded case paper	1

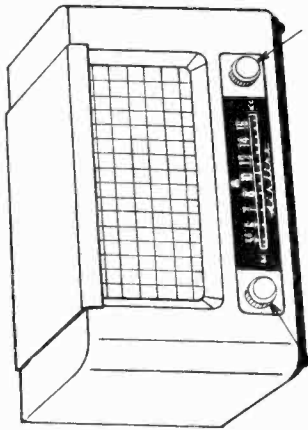
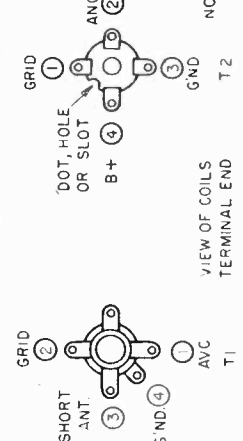
Ref. No.	Part No.	Description	Qty. Used in Set
C26-27-39	C-8G-12449	3000 mmfd, 20%, ceramic-insulated	6
40-46-47			
C14, 16, 28, 31, 42, 43	C-8G-12159	30 mmfd, 500 volts, 5%, ceramic	6
C48	C-8G-11789	10 mmfd, 10%, ceramic	1
C51	C-8G-11891	51 mmfd, 5%, ceramic	1
C15-17	C-8G-12160	91 mmfd, 5%, ceramic	2
C29-32	C-8F5-224	91 mmfd, 5%, silver mica	2
RESISTORS			
R4	C-9B1-87	120K ohms, 1/2 watt, 10%	1
R15	C-9B1-73	8200 ohms, 1/2 watt, 10%	1
R26	C-9B1-77	18K ohms, 1/2 watt, 10%	1
R18	C-9B1-96	680K ohms, 1/2 watt, 10%	1
R24	C-9B2-82	47K ohms, 1 watt, 10%	1
R28	C-9B2-81	39K ohms, 1 watt, 10%	1
R7	B-9C-11489	10K ohms, 5 watts, 10%, wire-wound	1
R30	C-9B1-78	22K ohms, 1/2 watt, 10%	1
R21	C-9B1-29	470K ohms, 1/2 watt, 20%	1
R22	C-9B1-55	270 ohms, 1/2 watt, 10%	1
R16, 25, 29	C-9B1-15	2200 ohms, 1/2 watt, 20%	3
R8	C-9B1-107	5.6 megohms, 1/2 watt, 10%	1
R9, 10	C-9B1-31	1 megohm, 1/2 watt, 20%	2
R13	C-9B1-50	100 ohms, 1/2 watt, 10%	1
R11, R17	C-9B1-23	47K ohms, 1/2 watt, 20%	2
R19	C-9B1-27	220K ohms, 1/2 watt, 20%	1
R14	C-9B1-37	10 megohms, 1/2 watt, 20%	1
R27	C-9B1-54	220 ohms, 1/2 watt, 10%	1
R32	C-9B1-94	470K ohms, 1/2 watt, 10%	1
R31	C-9B1-79	27K ohms, 1/2 watt, 10%	1
R23	C-9B1-58	470 ohms, 1/2 watt, 10%	1
COILS			
T3	A-13D-11285	B.C. oscillator coil	1
T4	C-203-11743	Input I.F. coil combination assembly, 455 kc and 10.7 mc	1
T5	C-203-11746	2nd I.F. coil combination assembly, 455 kc and 10.7 mc	1
T6	C-203-11744	3rd I.F. coil assembly 10.7 mc	1
T10	C-203-11745	Ratio detector I.F. coil assembly 10.7 mc	1
T11, C55	C-13E-12340	Loop antenna assembly with 1.0 mmfd cond. C-8G-12408	1
TRANSFORMERS			
T7	B-12C-11253	Output transformer for speaker	1
T9	B-12A-11259	Power transformer—105-125 volts AC, 60 cycles primary	1
SPEAKER			
T8	B-18B-10617	Electrodynamic speaker, 10-inch, less output transformer	1
MISCELLANEOUS			
	C-6D-12008	Dial scale	1
	D-5C-10006-37	Escutcheon	4
	A-2M-11541	Clip, holds scale to escutcheon	4
	B-5B-10376-37	Knob, "Volume"	1
	B-5B-11672-37	Knob, "Bandswitch"	1
	B-5B-10377-37	Knob, "Tuning"	1
	B-5B-10378-37	Knob, "Tone"	1
	55A-11400	Fidelitone needle	1
	A-23J-12508	Shield (dial)	1
	B-4A-10808-3	Pilot lite assembly	1
P1, P2	A-46A-11739	Pilot lite bulb, 6-8volt, T-44	2
	A-19B-11009	Socket for phono motor	1
	A-15B-11538	Speaker socket	1
	A-19B-12170	Socket for tone arm lead	1
	A-19B-11272	Antenna socket	1
	A-15B-10440	8-prong, octal, tube socket	2
	A-15C-10717	7-prong, miniature tube socket	5
	A-2H-10718	Shield base	5
	A-2H-10974	Shield can	5
	B-14M-11479	A.C. line cord	1
	A-23A-10344	Line cord lock	1
	C-203-11745	Ratio detector I.F. coil assembly 10.7 mc	1
	C-13M-13348		1
	A-16A-13034	Filament choke	1

The parts lists for Models 2702A and 2702B are identical with the following exceptions for Model 2702B:

T10
L1



NOTES -
 VOLTAGES MEASURED WITH A 1000 OHMS PER VOLT D.C. METER BETWEEN B- AND POINTS DESIGNATED.
 SET OPERATED ON 117 V.A.C.
 CAPACITOR VALUES IN MFD UNLESS OTHERWISE SPECIFIED.
 RESISTOR AND COIL VALUE IN OHMS.
 WHERE VALUE OF COILS IS NOT SHOWN, RESISTANCE IS LESS THAN ONE OHM.
 SEE PARTS LIST FOR RESISTOR TOLERANCES.
 SWITCH S2 SHOWN IN BATTERY POSITION.



Sensitivity (for .05 watts output with external antenna) 30 microvolts average.
 Power Output 210 milliwatts maximum, 120 milliwatts at less than 10% distortion.
 Loud Speaker 5" PM dynamic.
 Voice Coil Impedance 3.2 ohms at 400 cycles.
 Battery Pack Wards Battery Pack No. 62-54.

Power Supply 105-125 volts AC or DC.
 12 watts, 90 volts and 9 volt battery pack.
 Frequency Range 540-1620 KC.
 Intermediate Frequency 455 KC.
 Selectivity 42 KC broad at 1000 times signal, 1000 KC.

VOLUME AND OFF & ON
 TUNING

ANTENNA—An antenna of 50 feet or longer should be connected to the long antenna lead "A." An antenna of less than 50 feet should be connected to the antenna lead "A-1."

DIAL CORD REPLACEMENT—Is best accomplished by replacing complete cord assembly No. 26060 which is made up to correct length. In an emergency 30 lb. fish line may be used. See picture of chassis for correct installation.

ALIGNMENT PROCEDURE

VOLUME CONTROL — MAXIMUM FOR ALL ADJUSTMENTS.

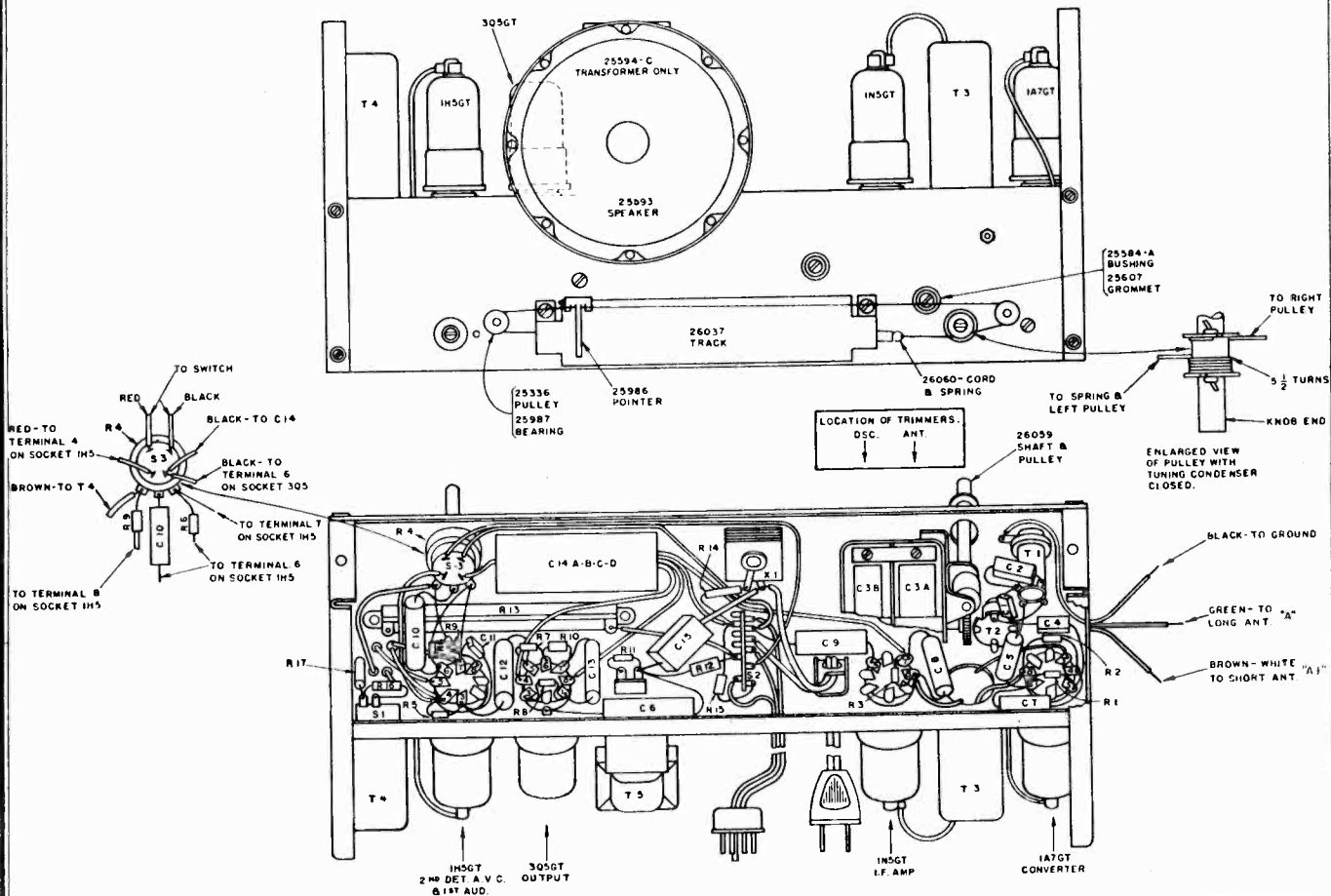
Connect radio to ground connections of Signal Generator. (See Page 1).

Allow the chassis and signal generator to "heat up" for several minutes.

The following equipment is required for aligning:
 A signal generator which will provide an accurately calibrated signal at the test frequencies as listed.
 Output indicating meter; non-metallic screw driver.
 Dummy antennas — .1 mfd., 200 mmfd condensers.

Signal Generator		Connection To Radio	Condenser Setting	Adjust Trimmers To Maximum
Frequency Setting	Dummy Antenna			
455 kc.	.1 Mfd.	1A7, CAP	Turn rotor plates to full open	1st IF Transformer. 2nd IF Transformer.
1620 kc.	200 Mmfd.	Antenna Lead "A"	Turn rotor plates to full open	Osc. trimmer on tuning condenser.
1400 kc.	200 Mmfd.	Antenna Lead "A"	Tune rotor to Maximum output.	Ant. section trimmer on tuning condenser.

The dial pointer may be adjusted to the scale calibration by slipping the pointer on the dial cord.



MONTGOMERY WARD

MODEL 74KR-1210A

BATTERY

Wards Battery #62-54

"A" Section 9 Volts

"B" Section 90 Volts

OPERATING VOLTAGES — This radio is designed for operation on the following power supplies:

POWER LINE

105-125 Volts AC 50-60 Cycles
or 105-125 Volts DC

BATTERY OPERATION—To operate this receiver on battery pack it is necessary to insert the line cord plug in the battery line socket switch, which is located top center of chassis.

RECEIVER STAGE SENSITIVITIES

The following table 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 .05 watts. 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 transform-

er. A reading of .4 volts AC across this resistor will be equivalent to a .05 watt output with the speaker connected. The volume control must be set to maximum. The signal source must be an accurately calibrated signal generator capable of supply both 1000 KC and 455 KC signals modulated 30% with a 400 cycle audio signal. Variations of Plus or Minus 25% are usually permissible.

SIGNAL GENERATOR				INPUT FOR .05 WATT OUTPUT
Frequency	Coupling Capacitor	Connection to Receiver	Ground Connection	
1000 kc.	200 mmf or RMA Dummy Antenna	External Antenna Lead "A"	Chassis	30 Microvolts
1000 kc.	Same as above	1A7GT Top cap	1A7 Pin 7	180 Microvolts
455 kc.	Same as above	1A7GT Top cap	Same as above	480 Microvolts
455 kc.	Same as above	1N5GT Top cap	Same as above	8000 Microvolts
400 cycles	.05 mfd.	C.T. of Volume Control	Same as above	.058 Volts
400 cycles	.05 mfd.	3Q5GT Output Pin 5	Same as above	1.9 Volts

REPLACEMENT PARTS LIST

Ref. No.	Part No.	Description	Quantity Used	Ref. No.	Part No.	Description	Quantity Used
CAPACITORS				TRANSFORMERS AND COILS			
C 1	8872	100 MMFD Mica	1	T 1	25989	Antenna Coil	1
C 2	25997	10 MMFD Mica	1	T 2	25988	Oscillator Coil	1
C 3E-B	26028	Gang Tuning With Trimmers	1	T 3	25621	Transformer I.F. Input	1
C 4	17091	50 MMFD Mica	1	T 4	25622	Transformer I.F. Output	1
C 5-7-8	8661	.05 MFD. 200V. Tubular	3	T 5	25594C	Transformer Output Speaker	1
C 6	17647	.1 MFD. 400V. Tubular	1				
C 9	8582	.1 MFD. 200V. Tubular	1				
C 10-12-13	17646	.005 MFD. 400V. Tubular	3				
C 11	14370	200 MMFD. Mica	1				
C 14 A-B-C-D	25991	Electrolytic 40-40 MFD. 150 V., 40-200 MFD. 25 V	1				
C 15	25996	05 MFD. 600V. Paper	1				
RESISTORS				DRIVE AND DIAL ASSEMBLY			
R 1	14616	150,000 Ohm 1/2 W. Carbon	1	25987	Bearing for Wood Pulleys	2	
R 2	25144	33,000 Ohm 1/2 W Carbon	1	25584	Bushing-Headed	3	
R 3-6	14365	15 Megohm 1/2 W. Carbon	2	25554	Bracket for Tuning Condenser	2	
R 4	25990	Volume Control 500,000 Ohm With Sw. S 3	1	26060	Cord-Dial and Spring	1	
R 5	25042	470,000 Ohm 1/2 W. Carbon	1	25966	Dial Scale-Plastic	1	
R 7-9	25134	2.2 Megohm 1/2 W. Carbon	2	25986	Dial Pointer	1	
R 8	17164	15,000 Ohm 1/2 W Carbon	1	26038	Knob-Volume	1	
R 10	26003	470 Ohm 1/2 W. Carbon	1	26021	Knob-Tuning	1	
R 11	25041	220,000 Ohm 1/2 W. Carbon	1	25336	Pulley-Wood Small	2	
R 12	26004	2000 Ohm 1 W. Carbon	1	26059	Tuning Shaft and Pulley	1	
R 13	26008	2950 Ohm 10W. Wire Wound	1	26113	Tuning Shaft Bushing	1	
R 14	26006	25 Ohm Fuse Wire Wound	1	26037	Track-Dial Pointer	1	
R 15	25385	3300 Ohms 1/2 W. Carbon	1	25607	Rubber Grammets	3	
R 16	26005	15 Ohm 1/2 W. Wire Wound	1	26026	Set Screw for Worm Drive	2	
R 17	26007	39 Ohm 1/2 W. Wire Wound	1	25100	Screws-Dial Scale No. 2	4	
				25033	Spring-Dial Cord	1	
				MISCELLANEOUS			
				25593	Speaker 5" PM With Transformer	1	
				25620	Socket-Octal	4	
				25068	Cord-AC and Plug	1	
				25999	Plug-Battery Cable	1	
			X 1	26002	Rectifier 100MA	1	
				26000	Shell-Battery Cable	1	
			S 1	25319	Switch-Economizer	1	
			S 2	26011	Switch-Change AC To Battery	1	

MONTGOMERY WARD

MODELS 74KR-2706A,
74KR-2706B, 74KR-2713A

RECEIVER STAGE SENSITIVITIES

The following table 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 .5 watts. 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 transform-

er. A reading of 1.26 volts across this resistor will be equivalent to a .5 watt output with the speaker connected. The volume control must be set to maximum. The signal source must be an accurately calibrated signal generator capable of supply both 1000 KC and 455 KC signals modulated 30% with a 400 cycle audio signal. Variations of Plus or Minus 25% are usually permissible.

SIGNAL GENERATOR				INPUT FOR .5 WATT OUTPUT
Frequency	Coupling Capacitor	Connection to Receiver	Ground Connection	
1000 kc	200 mmf or RMA Dummy Antenna	External Antenna Lead	Chassis	5 microvolts
1000 kc	.05 mfd.	6SA7 Mixer, Pin 8	Same as above	175 microvolts
455 kc.	.05 mfd.	6SA7 Mixer, Pin 8	Same as above	160 microvolts
455 kc.	.05 mfd.	6SK7 1-F, Pin 4	Same as above	1600 microvolts
400 cycles	.05 mfd.	6SQ7 1st A-F, Pin 2	Same as above	.12 volts
400 cycles	.05 mfd.	6V6GT Output, Pin 5	Same as above	4.32 volts

ALIGNMENT PROCEDURE

VOLUME CONTROL — MAXIMUM FOR ALL ADJUSTMENTS.

Tone control — In "HIGH" position.

Connect radio chassis to ground connection of Signal Generator.

Allow the chassis and signal generator to "heat up" for several minutes.

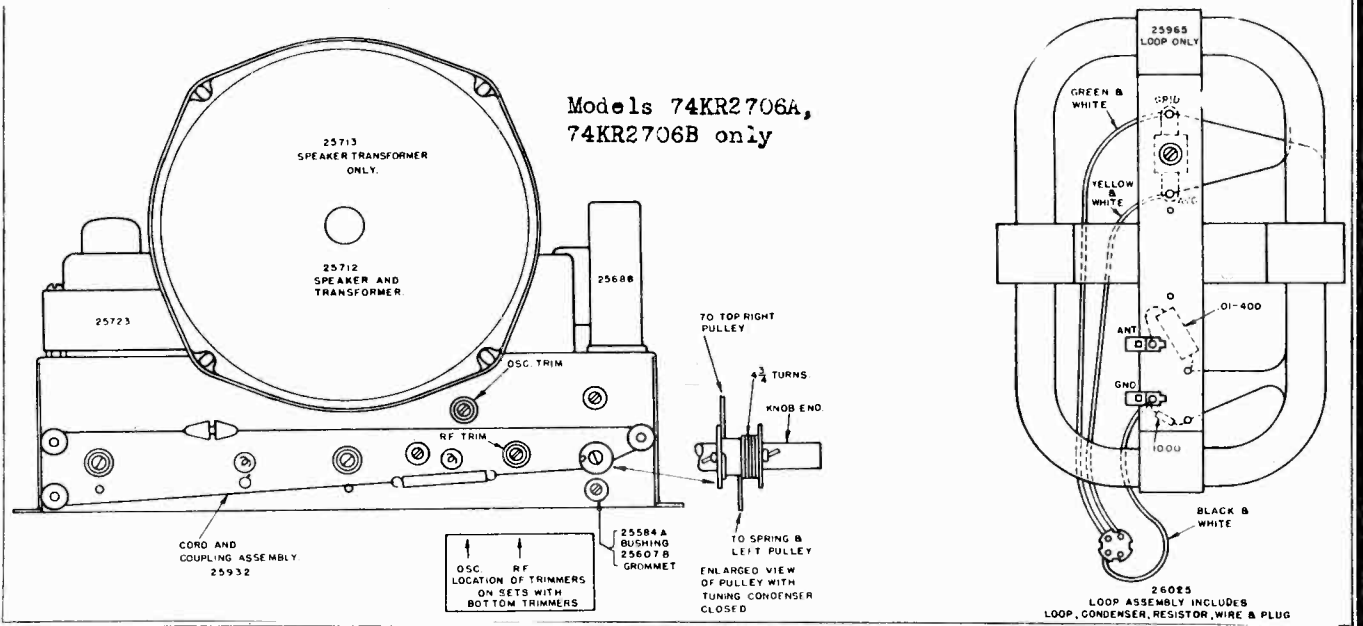
The following equipment is required for aligning: A signal generator which will provide an accurately calibrated signal at the test frequencies as listed. Output indicating meter; non-metallic screw driver. Dummy antennas — .1 mfd., 200 mmfd.

Place loop antenna in its normal relation to the chassis.

Signal Generator		Dummy Antenna	Condenser Setting	Adjust Trimmers To Maximum
Frequency Setting	Connection To Radio			
455 kc	.1 Mfd.	6SA7, Pin 8	Turn rotor plates to full open	1st IF Transformer. 2nd IF Transformer.
1620 kc	200 Mmfd.	Antenna Lead	Turn rotor plates to full open	Osc. trimmer on tuning condenser.
1400 kc	200 Mmfd.	Antenna Lead	Tune rotor to maximum output.	RF Section trimmer on tuning condenser. Antenna trimmer on loop antenna.

The dial pointer may be adjusted to the scale calibration by slipping the pointer coupling on the dial cord.

Trimmer locations for Model 74KR2713A are on page 17-46 Models 74KR2706B, 74KR2713A only



MODELS 74KR-2706A,
74KR-2706B, 74KR-2713A

MONTGOMERY WARD

REPLACEMENT PARTS INFORMATION

HOW TO ORDER PARTS — When ordering, specify PART number, schematic diagram reference, number when applicable, and CHASSIS MODEL NUMBER. The

model number on a label on the chassis. Parts should be ordered from the nearest Wards Mail Order House.

Ref. No.	Part No.	Description	Qty. Used In Set
CAPACITORS			
C 1-2-3	25592	Gang Tuning Capacitor Trimmers	1
	25688	Electrolytic 15-15 Mfd. 450V., 20 Mfd. 25V.	1
	8878	.05 Mfd.—600V. Tubular	1
	8661	.05 Mfd.—200V. Tubular	5
	17646	.005 Mfd.—400V. Tubular	3
	17647	.1 Mfd.—400V. Tubular	1
	8583	.01 Mfd. — 400V Tubular	1
	14370	.0002 Mfd. Mica	1
	8872	.0001 Mfd. Mica	1
	25689	.005 Mfd. 600V. Moulded	2
	25964	70 Mmfd. Mica	1
RESISTORS			
	25414	1000 Ohm ½W. Carbon	1
	25742	330 Ohm 2W. Carbon	1
	25085	470 Ohm ½W. Carbon	2
	25721	22,000 Ohm, 2W. Carbon	1
	25038	22,000 Ohm ½W. Carbon	2
	25144	33,000 Ohm ½W. Carbon	1
	25042	470,000 Ohm ½W. Carbon	1
	8885	100,000 Ohm ½W. Carbon	2
	25041	220,000 Ohm ½W. Carbon	2
	8766	1,000,000 Ohm ½W. Carbon	2
	25134	2.2 Megohm ½W. Carbon	1
	14365	15 Megohm ½W. Carbon	1
	25836	3.3 Ohm ½W. Wire Wound	1
R 1	25690	Volume Control With Switch S2	1
TRANSFORMERS AND COILS			
T 1	25965	Loop Antenna	1
T 2	25724	Coil — Oscillator	1
T 3	25597	Coil — RF	1
T 4	25715	Transformer — IF Input	1
T 5	25714	Transformer — IF Output	1
T 6	25713	Transformer — Output Speaker	1
	25723	Transformer — Power — 60 cycle	1

Ref. No.	Part No.	Description	Qty. Used In Set
DIAL AND DRIVE ASSEMBLY			
	25596	Bearing for Wood Pulleys	3
	25572	Bracket - Tuning Condenser — Front	1
	25573	Bracket - Tuning Condenser — Rear	1
	25932	Cord-Dial (Includes Pointer Coupling)	1
	25947	Dial Scale — Plastic	1
	25578	Dial Pointer	1
	25829	Knob — Tone	1
	25696	Knob - Volume — Tuning	2
	25336	Pulley — Wood — Small	3
	25933	Pulley — Manual Drive With Shaft	1
	25607	Rubber — Grommets	3
	26026	Screw — Set for Worm Gear (Tuning Condenser)	2
	25576	Socket — Dial Lamp	2
	25963	Spring — Dial Cord	1
	25936	Track — Assembly	1
	25952	Washer — Track	2
MISCELLANEOUS			
	25712	8" EM Speaker — With Transformer	1
	25620	Socket — Octal	6
	25700	Receptacle — Phono Motor	1
	25006	Socket - For Loop Antenna	1
	25710	Socket - Phono Pick-up	1
S 1	25562	Switch — Tone	1
	25574	Bracket — Speaker	1*
	25068	Cord — AC and Plug	1
	25693	Plug — For Loop	1
RECORD CHANGER PARTS			
	26034	Motor, 60 cycle, 117 volts	1
	26035	Shure P-30 Crystal Pickup Cartridge and Needle	1
	26036	Replacement Needle Only	1

Parts list for Model 74KR2706A same as above with following exception.

T 1	25692	Loop Antenna	1
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Parts list for Model 74KR2713A same as above with following exceptions.

25951	Track	1
26114	8" EM SPEAKER — With Transformer and Plug	1
26116	Storage Shaft Assembly	1

*In Models 74KR2706A, 74KR2706B only

Power Supply 105-125 volts AC, 60 cycles, 55 watts. (80 watts phono operating).

Frequency Range 540 - 1620 KC.

Intermediate Frequency 455 KC.

Selectivity 40 KC broad at 1000 times signal, 1000 KC.

Sensitivity (for .5 watt output) with external antenna 5 microvolts average.

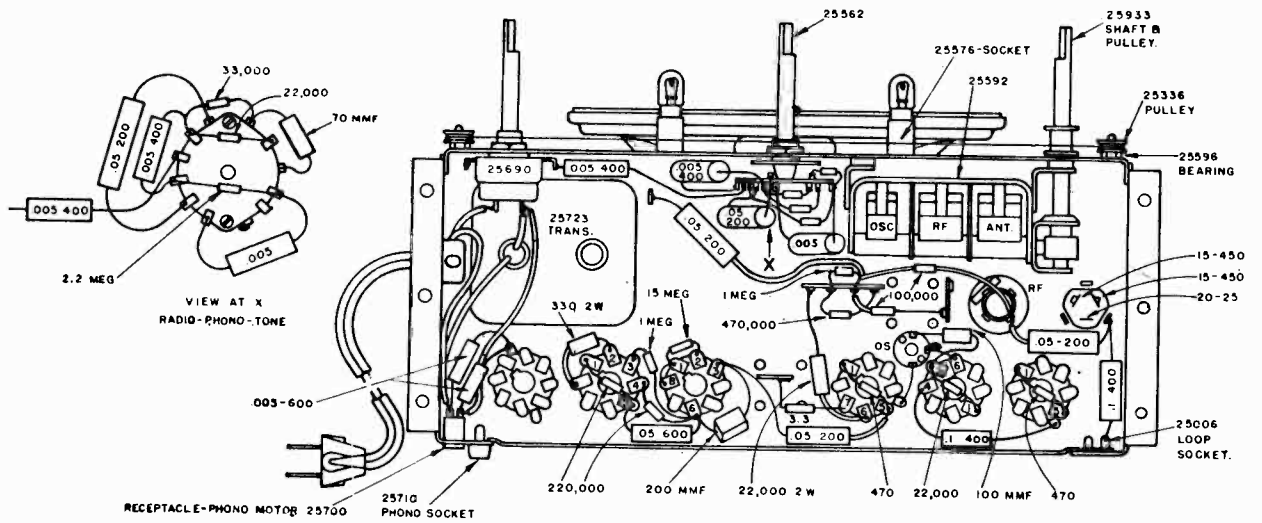
Power Output 6 watts maximum, 3.2 watts 10% distortion.

Loud Speaker 8" EM dynamic, 750 ohms.

Voice Coil Impedance 3.2 ohms at 400 cycles.

MONTGOMERY WARD

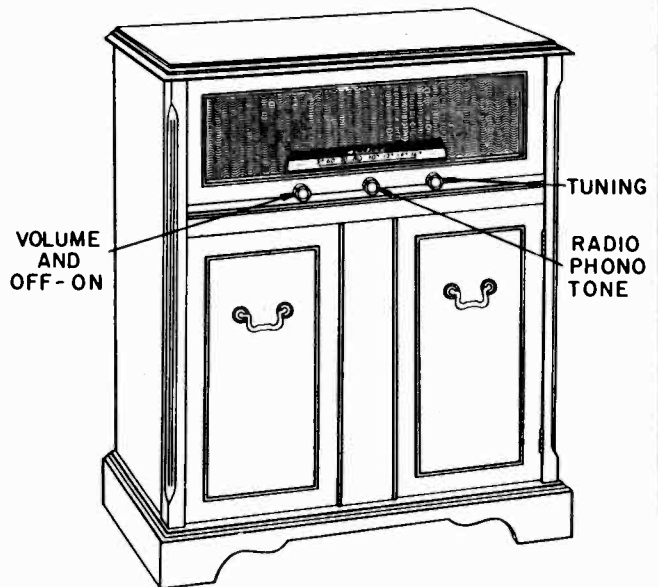
MODELS 74KR-2706A,
74KR-2706B



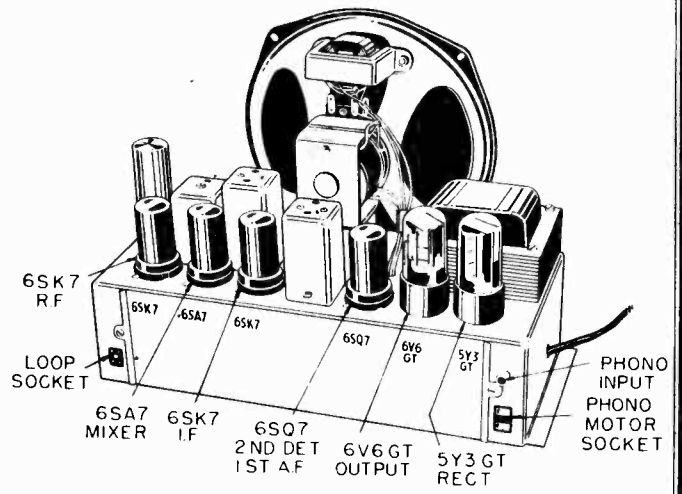
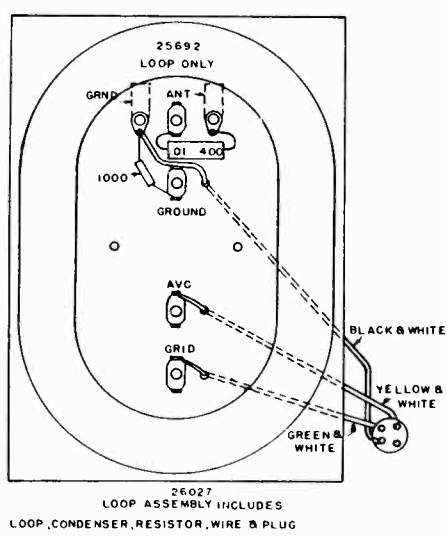
INSTALLING CHASSIS — Replace chassis in cabinet— noting that shafts are approximately centered in holes. Replace screws under mounting board of cabinet, replace loop plug, push knobs on shafts. Hold the pointer, back of dial, near center of scale, with your finger or any small instrument, turn the tuning knob to the right or left until the pointer drive coupling connects itself with the pointer.

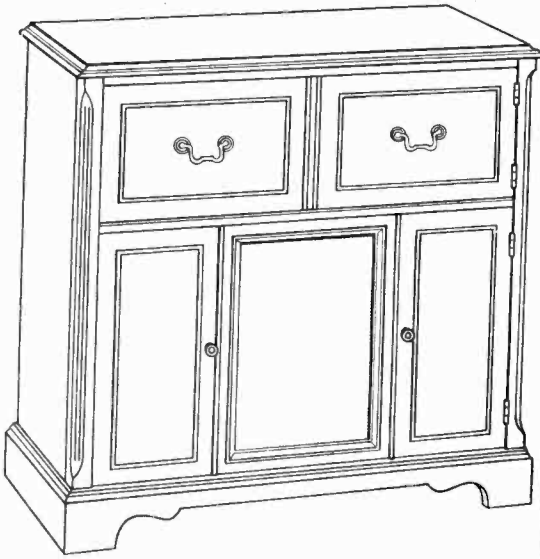
DIAL CORD REPLACEMENT—Is best accomplished by replacing complete cord assembly No. 25932 which is made up to correct length. In an emergency 30 lb. fish line may be used. See picture of chassis for correct installation.

DIAL SCALE REPLACEMENT — The dial scale is held in by means of spring plungers. The dial scale may be lifted out from front of cabinet after slightly loosening the two wood screws which holds the pointer track to cabinet. Remove two wood screws in baffle



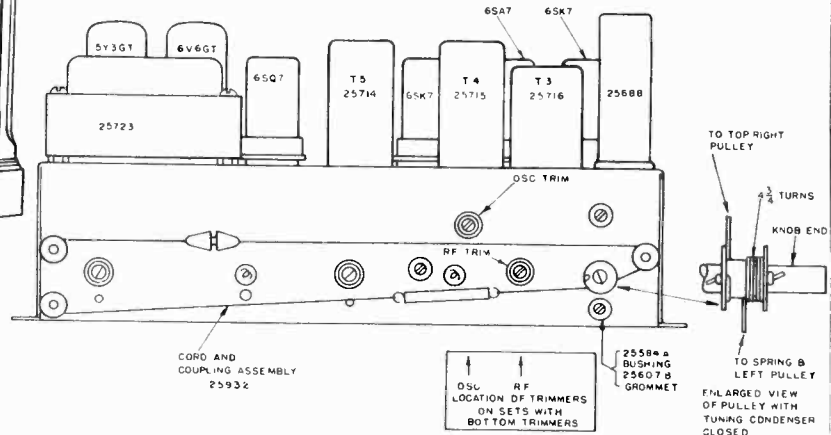
Model 74KR2706A only



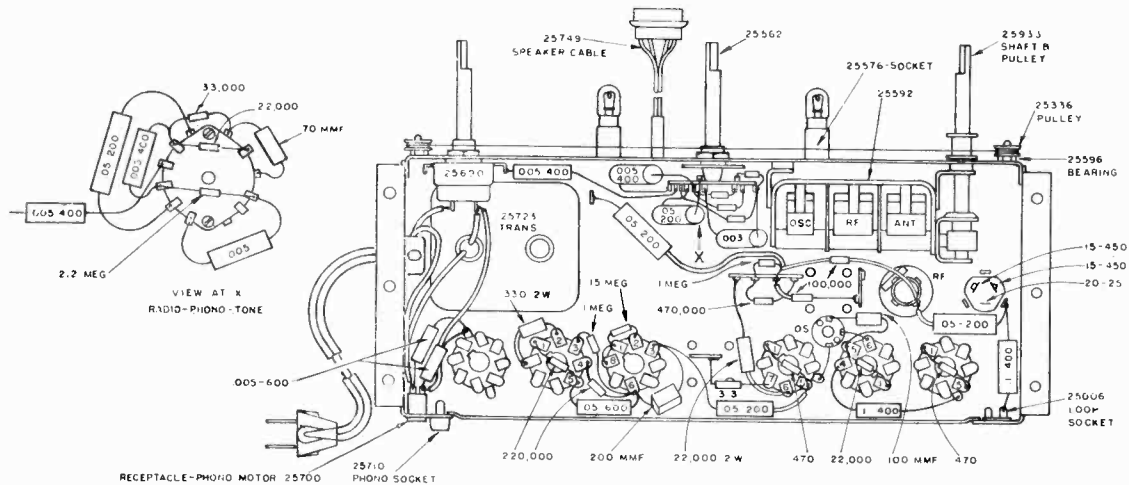
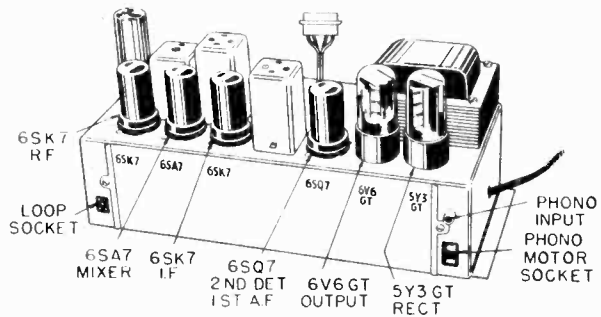


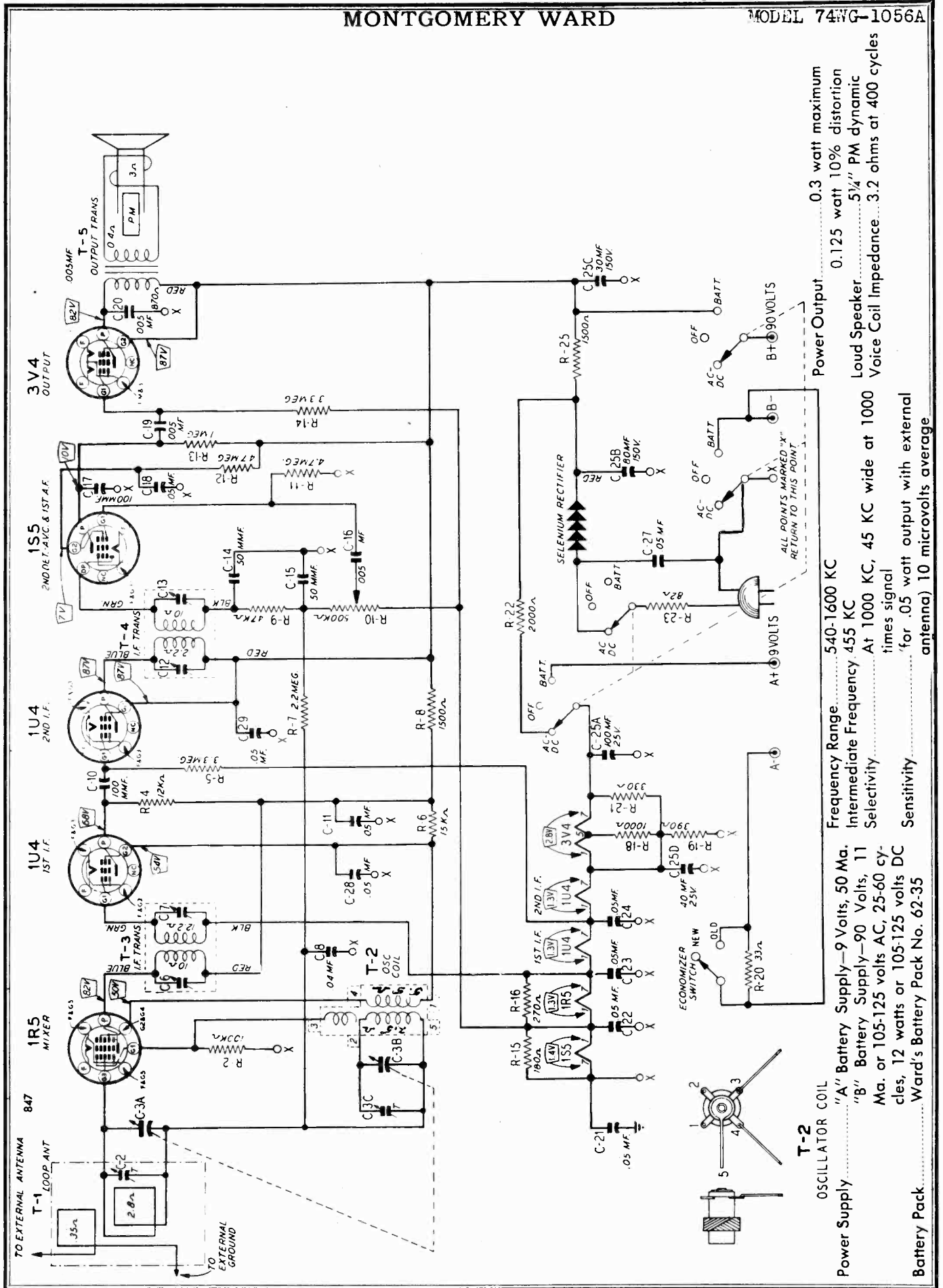
DIAL CORD REPLACEMENT—Is best accomplished by replacing complete cord assembly No. 25932 which is made up to correct length. In an emergency 30 lb. fish line may be used. See picture of chassis for correct installation.

DIAL SCALE REPLACEMENT—The dial scale is held in by means of two wood blocks. To remove wood blocks, remove wood screws from the inside of the cabinet and lift off blocks. The dial scale now may be lifted out of the cabinet.

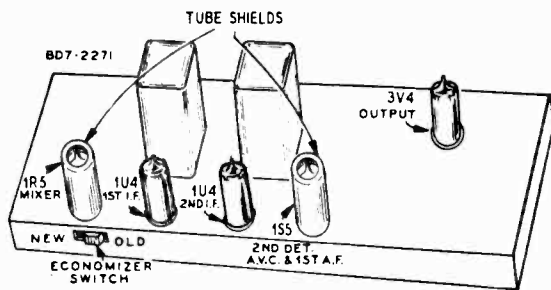


- Power Supply 105-125 volts AC, 60 cycles, 55 watts. (80 watts phono operating).
- Frequency Range 540 - 1620 KC.
- Intermediate Frequency 455 KC.
- Selectivity 40 KC broad at 1000 times signal, 1000 KC.
- Sensitivity (for .5 watt output) with external antenna 5 microvolts average.
- Power Output 6 watts maximum, 3.2 watts 10% distortion.
- Loud Speaker 8" EM dynamic, 750 ohms.
- Voice Coil Impedance 3.2 ohms at 400 cycles.



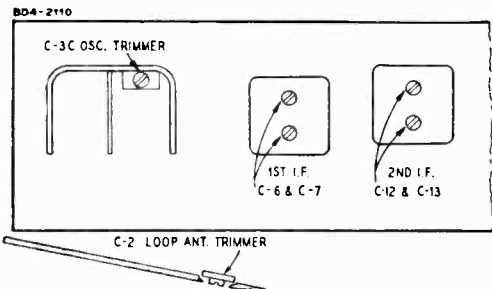


Power Supply..... "A" Battery Supply—9 Volts, 50 Ma.
 "B" Battery Supply—90 Volts, 11 Ma. or 105-125 volts AC, 25-60 cycles, 12 watts or 105-125 volts DC
Battery Pack..... Ward's Battery Pack No. 62-35
Frequency Range..... 540-1600 KC
Intermediate Frequency 455 KC
Selectivity..... At 1000 KC, 45 KC wide at 1000 times signal
 for .05 watt output with external antenna) 10 microvolts average
Sensitivity.....
Power Output..... 0.3 watt maximum
 0.125 watt 10% distortion
Loud Speaker..... 5 1/4" PM dynamic
Voice Coil Impedance..... 3.2 ohms at 400 cycles



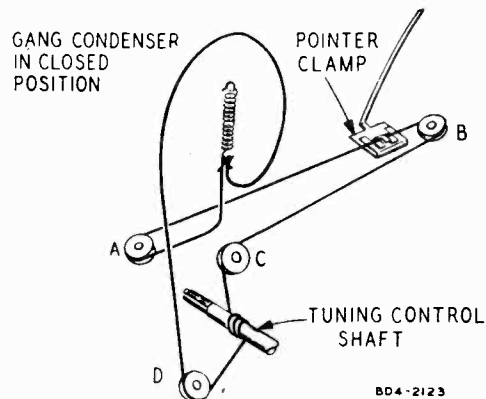
REMOVAL OF CHASSIS FROM CABINET

Pull off the three control knobs and disconnect the battery plug. Unwrap the power cord from the radio at the top of the cabinet if necessary. Remove the four screws that fasten the chassis to the cabinet (2 on the outside at each end of the cabinet). Tip the chassis slightly forward and at the same time withdraw it from the cabinet.



DRIVE CORD REPLACEMENT

Turn the gang condenser to the fully closed position. Use a new 10X52 Drive Cord Assembly and fasten one end to the tension spring. Fasten the other end of the tension spring to the hook on the drive pulley. Pass the cord through the slot in the drive pulley rim and continue around pulley rim 1/4 turn clockwise. Pass cord around pulleys A, B, and C as shown in the illustration. Wind three turns clockwise (viewed from rear of chassis) around tuning control shaft. The turns must progress toward rear of chassis. Pass cord around pulley D and continue 3/4 turn clockwise around large drive pulley. Pass cord through the slot in the pulley rim then stretch the tension spring and fasten free end of cord to it.



ALIGNMENT PROCEDURE

Volume Control—Maximum All Adjustments.

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

The equipment in column at right is required for aligning:

Signal Generator which will provide an accurately calibrated signal at the test frequencies as listed.

Output Indicating Meter; Non-Metallic Screwdriver.

Dummy Antenna—.1 mf., 50 mmf.

SIGNAL GENERATOR

Frequency Setting	Coupling Capacitor	Connection to Radio	Ground Connection	CONDENSER SETTING	ADJUST TRIMMERS TO MAXIMUM See Trimmer Illustration
455 kc	.1 mf	Control Grid 1U4—1st I-F Pin 6	Point "X" At Electrolytic Capacitor Black Lead	Turn Rotor to full open	2nd I-F (C13) & (C12)
455 kc	.1 mf	Control Grid 1R5—Mixer Pin 6	Same as above	Turn Rotor to full open	1st I-F (C7) & (C6)
1620 kc	.1 mf	Control Grid 1R5—Mixer Pin 6	Same as above	Turn Rotor to full open	Oscillator (C3C)
1400 kc	50 mmf	External Antenna Clip on Loop See Note A	External Ground connection on loop	Turn Rotor to Max. Output Set Indicator to 1400 KC See Note B	Antenna (C2)

NOTE A—Re-assemble chassis in cabinet and close the cabinet back before making adjustment.

NOTE B—Tune in a 1400 KC signal. If pointer is not at the 1400 KC mark on the dial scale, move the pointer on the string to the 1400 KC mark.

MONTGOMERY WARD

MODEL 74WG-1056A

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 AC

across this resistor will be equivalent to a 50 milliwatt output with the speaker connected. 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. Output variations of Plus or Minus 25% are usually permissible.

SIGNAL GENERATOR

Frequency	Coupling Capacitor	Connection to Receiver	Ground Connection	INPUT FOR 50 MILLIWATT OUTPUT
1000 kc	200 mmf or RMA Dummy Antenna	Loop Antenna—External antenna clip	Ext. Gnd. Clip	5.0 microvolts
1000 kc	.1 mf.	1R5 Mixer—Pin 6	Point "X" (1S5 Pin 1)	25 microvolts
455 kc	.1 mf.	1R5 Mixer—Pin 6	Same as above	22 microvolts
455 kc	.1 mf.	1U4 1st I-F—Pin 6	Same as above	340 microvolts
455 kc	.1 mf.	1U4 2nd I-F—Pin 6	Same as above	1500 microvolts
400 cycles	.1 mf.	1S5 1st A-F—Pin 6	Same as above	.022 volt
400 cycles	.1 mf.	3V4 Output—Pin 3	Same as above	1.8 volts

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

C-2	17A123	1.5 uuf - 12 uuf	Trimmer	1
C-3A	14A186	Gang Condenser with Drive Pulley		1
C-3B				
C-3C				
C-6				
C-7				
C-8	B66403	.04 uf 200 V	Tubular	1
C-10	47X476	100 uuf	Moulded	2
C-17				
C-11	B66503	.05 uf 200 V	Tubular	8
C-18				
C-21				
C-22				
C-23				
C-24	47X112	50 uuf	Dual Mica	1
C-28				
C-29				
C-12	Part of T-4 (2nd I-F Transformer)			
C-13				
C-14	B66502	.005 uf 200 V	Tubular	2
C-15				
C-16				
C-19	45X356	100 uf 25 V	Dry Elect. Condenser	1
C-20		80 uf 150 V		
C-25A		30 uf 150 V		
C-25B		40 uf 25 V		
C-25D				
C-27	D66503	.05 uf 400 V	Tubular	1

RESISTORS

		Ohms	Watts	
R-2	B84104	100 K	0.5	1
R-4	B84123	12 K	0.5	1
R-5	B85335	3.3 meg	0.5	2
R-14				
R-6	B84153	15 K	0.5	1
R-7	B85225	2.2 meg	0.5	1
R-8	B84152	1500	0.5	2
R-25				
R-9	B85473	47 K	0.5	1
R-10	36X370	500 K	Volume Control	1
R-11	B85475	4.7 meg	0.5	2
R-12				
R-13	B84105	1.0 meg	0.5	1
R-15	B84181	180	0.5	1
R-16	B84271	270	0.5	1
R-18	B84102	1000	0.5	1
R-19	B84391	390	0.5	1
R-20	B85330	33	0.5	1
R-21	B84331	330	0.5	1
R-22	43X221	2000	Shielded Wire Wound	1
R-23	43X223	82	2.0	1

TRANSFORMERS AND COILS

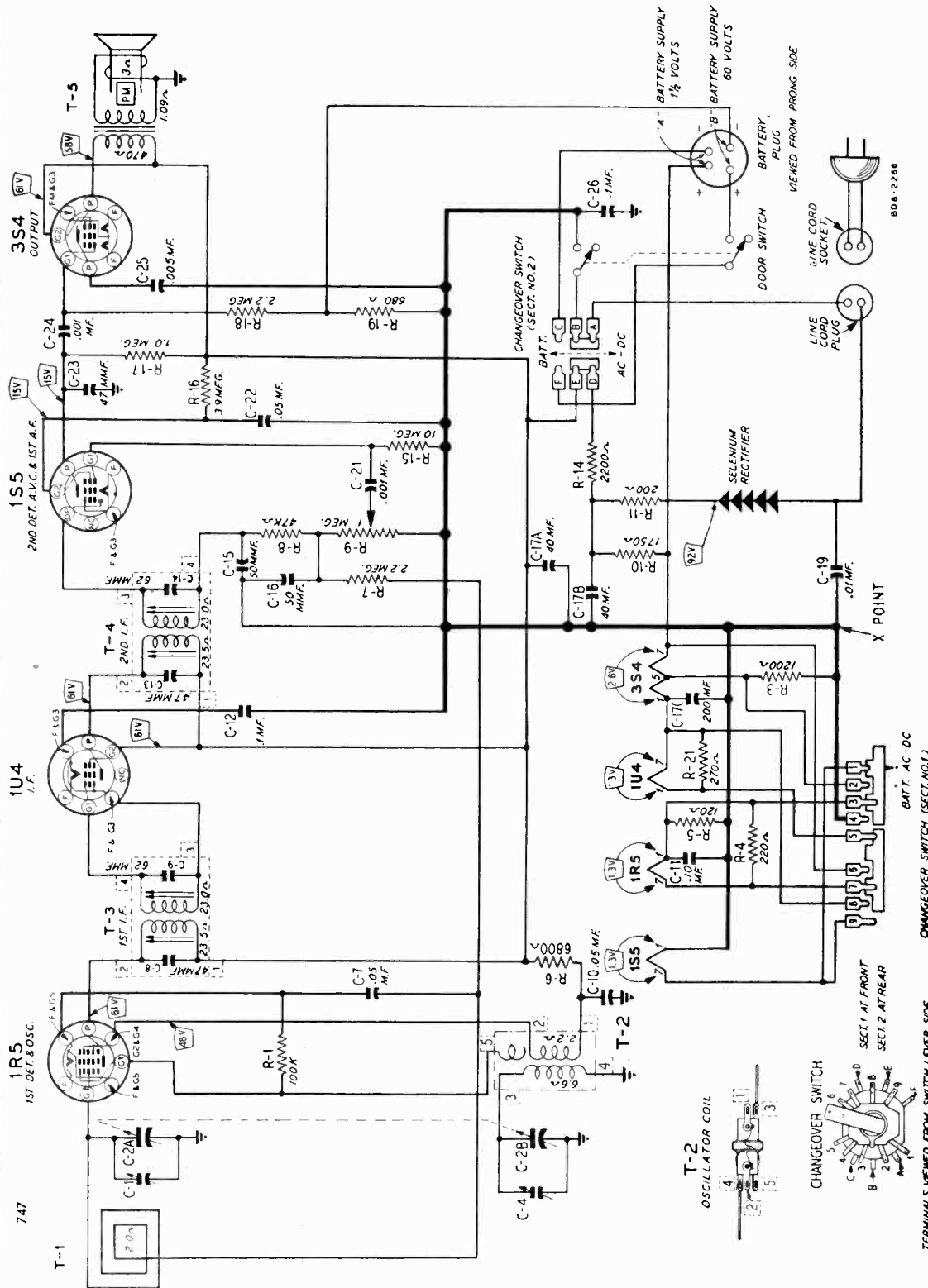
T-1	9A1928	"B" Range Loop Antenna	1
T-2	9A1927	Oscillator Coil Assembly	1
T-3	9A1840	1st I-F Transformer and Can Assembly	1
T-4	9A1841	2nd I-F Transformer and Can Assembly	1
T-5		Output Transformer (see Miscellaneous)	

DIAL AND DRIVE ASSEMBLY

25X1504	Dial Brace Bracket	1
52X693	Dial Scale	1
17X97	Celluloid Crystal	1
15X191	Pointer (For Dial Scale)	1
25X832	Gang Condenser Mounting Bracket	1
6X21	Grommet	3
20X329	Cond. Cushion Stud	Mtg. Gang Condenser 3
28X95	Drive Cord Tension Spring	1
10X52	Drive Cord Assembly	1
4X989	Escutcheon	1
26X505	Drive Shaft	1
19X192	"C" Washer for Drive Shaft	2

MISCELLANEOUS

12A443	5/4" P.M. Speaker complete with Output Transformer	1
3A312	Tube Socket (Miniature)	5
32X221	Tube Shield (1R5 and 1S5)	2
2A175	Battery Saver Switch	1
2A371	AC-DC-Off-Batt. Switch	1
13X429	Battery Cable and Plug Assembly	1
10A626	Knob, Switch	1
10A627	Knob, Tuning	1
10A628	Knob, Volume	1
13X546	Line Card and Plug Assembly	1
11X117	Shield, Volume Control and Switch (Paper)	1
32X368	Shield, Volume Control and Switch (Metal)	1
66X7	Selenium Rectifier	1

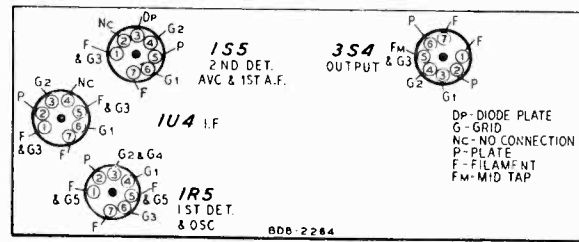
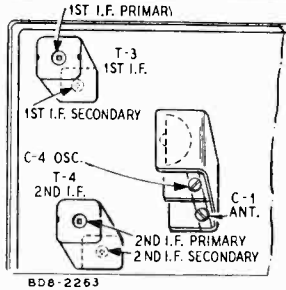
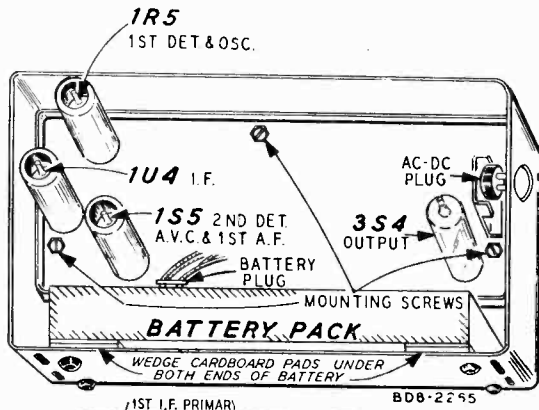


The readings were taken with a 1000 ohm per volt meter and all plate and screen voltages read on a 500 volt scale. Conditions of measurement are:

- Line voltage 117 volts AC
 - Volume control maximum
 - Signal input none
- A variation of $\pm 10\%$ is usually permissible.

TUBE SOCKET VOLTAGES

Socket voltages are shown on the schematic diagram at the tube socket terminals. All voltages except those for the filaments are between the socket terminal and the black or negative lead on C-17.



REMOVAL OF CHASSIS FROM CASE

To remove the chassis from the case it will be necessary to remove the line cord if connected, and the back panel from the case. Open the front cover and carefully remove the two control knobs and the screw on the front panel above the tuning knobs at the side of the ON-OFF switch plunger. Withdraw the battery pack from the case and disconnect the plug connecting to the battery pack. Then remove the 3 chassis mounting screws protruding above the chassis as shown in the tube position illustration. Carefully lift the chassis, and move it over into the battery space. Unsolder the two antenna wires at the door hinges.

ALIGNMENT PROCEDURE

Volume Control — Maximum All Adjustments.
 Allow Chassis and Signal Generator to "Heat Up" for several minutes.
 The following equipment is required for aligning.

A Signal Generator which will provide an accurately calibrated signal at the test frequencies as listed.
 Output Indicating Meter — Non-Metallic Screwdriver.
 Dummy Antenna—.1 mf.

SIGNAL GENERATOR				RECEIVER	
Frequency Setting	Coupling Capacitor	Connection to Radio	Ground Connection	Condenser Setting	Adjust for maximum output. See trimmer illustration.
Remove chassis from case (See paragraph Removal of Chassis From Case) and temporarily solder a 50,000 ohm resistor across the two antenna leads on the chassis.					
455 kc	.1 mf	Control Grid 1R5—Pin 6	"X" Point See Note "B"	Rotor to full open	1st IF Pri. & Sec. 2nd IF Pri. & Sec.
Remove temporary resistor, replace chassis in case and solder antenna leads to hinges.					
1610 kc	.1 mf	Door Hinge Above Tuning Control	"X" Point See Note "B"	Rotor to full open	Oscillator (C-4)
1500 kc	.1 mf	Door Hinge Above Tuning Control	Same as Above	Turn Rotor to Maximum Output	Set Tuning Knob at 1500 kc
1400 kc		Loop See Note A	Loop See Note A	Turn Rotor to Maximum Output	Antenna (C-1)

NOTE A: Connect a loop approximately one foot in diameter across the antenna and ground posts of the signal generator. Place radio approximately 2 feet from loop.

NOTE B: Heavy lines (B-) on circuit diagram designate "X" Point.

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				INPUT FOR 50 MILLIWATT OUTPUT
Freq.	Coupling Capacitor	Connection to Receiver	Ground Connection	
1000 kc	.05 mf	1R5 Mixer Pin 6	C-17 Black Lead	148 microvolts
455 kc	.05 mf	1R5 Mixer Pin 6	Same as above	118 microvolts
455 kc	.05 mf	1U4 IF Amp. Pin 6	Same as above	5000 microvolts
400 cycles	.05 mf	1S5 2nd Det. Pin 6	Same as above	.068 volt
400 cycles	.05 mf	3S4 Output Pin 3	Same as above	4.2 volts

REPLACEMENT PARTS LIST

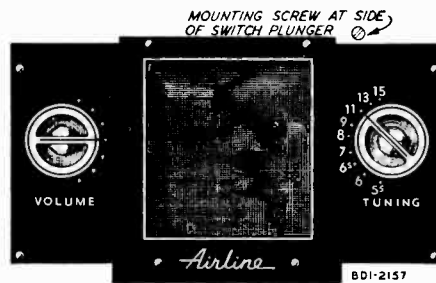
Ref. No.	Part No.	Description	Qty. Used in Set
CAPACITORS			
C-1 } C-4 }		Part of C-2 (Gang Condenser).....	
C-2A } C-2B }	14A197	Gang Condenser.....	1
C-7 } C-10 }	B66503	.05 mf 200 V Tubular.....	2
C-8 } C-9 }		47 mmf (Part of T-3 1st I-F Transformer).....	
C-11	46X390	.10 mf 200 V Tubular.....	1
C-12	46X330	.10 mf 120 V Tubular.....	1
C-13 } C-14 }		47 mmf (Part of T-4 2nd I-F Transformer).....	
C-15 } C-16 }		50-50 mmf (Part of 76X1 Resistor-Capacitor Comb. See "Miscellaneous.").....	
C-17A } C-17B } C-17C }	45X357	40 mf 150 V } 40 mf 150 V } 200 mf 12 V } Dry Electrolytic.....	1
C-19	46X392	.01 mf 400 V Tubular.....	1
C-21	46X334	.001 mf 120 V Tubular.....	1
C-22	46X391	.05 mf 200 V Tubular.....	1
C-23	47X495	47 mmf Ceramic.....	1
C-24	B67102	.001 mf 200 V Tubular.....	1
C-25	B66502	.005 mf 200 V Tubular.....	1
C-26	D67104	.10 mf 400 V Tubular.....	1

RESISTORS			
OHMS WATTS			
R-1	B84104	100 K 0.5 Carbon.....	1
R-3	B84122	1200 0.5 Carbon.....	1
R-4	B84221	220 0.5 Carbon.....	1
R-5	B84121	120 0.5 Carbon.....	1
R-6	B84682	6800 0.5 Carbon.....	1
R-7 } R-18 }	B85225	2.2 meg 0.5 Carbon.....	2
R-8		47 K (Part of 76X1 Resistor-Capacitor Comb. See "Miscellaneous.").....	
R-9	36X305	1.0 meg Volume Control.....	1
R-10	43X107	1750 4.0 Wire wound.....	1
R-11	43X222	200 5.0 Wire wound.....	1
R-14	C84222	2200 1.0 Carbon.....	1
R-15	B85106	10 meg 0.5 Carbon.....	1
R-16	B84395	3.9 meg 0.5 Carbon.....	1
R-17	B85105	1.0 meg 0.5 Carbon.....	1
R-19	B84681	680 0.5 Carbon.....	1
R-21	B84271	270 0.5 Carbon.....	1

TRANSFORMERS AND COILS			
T-1	9A1922	"B" Band Loop Antenna.....	1
T-2	9A1920	"B" Range Oscillator Coil Assembly....	1
T-3 } T-4 }	9A1921	1st I-F Transformer Assembly } 2nd I-F Transformer Assembly }	2
T-5	51X94	Output Transformer.....	1

MISCELLANEOUS			
	76X1	Resistor-Capacitor combination.....	1
	12A447	4" P.M. Dynamic Speaker.....	1
	66X7	Selenium Rectifier.....	1
	3A312	Miniature Tube Socket.....	4
	32X221	Miniature Tube Shield.....	3
	13X453	"A" and "B" Battery Cable & Plug Assembly.....	1

Ref. No.	Part No.	Description	Qty. Used in Set
	2A201	On-Off Switch.....	1
	26A409	Change-Over Switch Assembly.....	1
	13X545	Line Cord and Socket Assembly.....	1
	6A299	Line Plug (on Chassis).....	1
	26A476	Case and Cover Assembly complete with Loop, Loop Cover, and Back, Escutcheon and Speaker Grille.....	1
	26A477	Case Bottom Assembly.....	1
	10A629	Knobs.....	2



GENERAL DESCRIPTION

This model is a 4 tube AC-DC or battery operated portable radio receiver. Controls are provided for tuning, volume, and AC-DC or battery selection. Features include a built-in Airwave Loop Aerial, automatic volume control, PM dynamic speaker and a Selenium rectifier for AC operation. The dial scale is calibrated to cover frequencies between 540-1600 kilocycles. Filament switching is provided to connect the tube filaments in series for AC-DC operation and in parallel for battery operation.

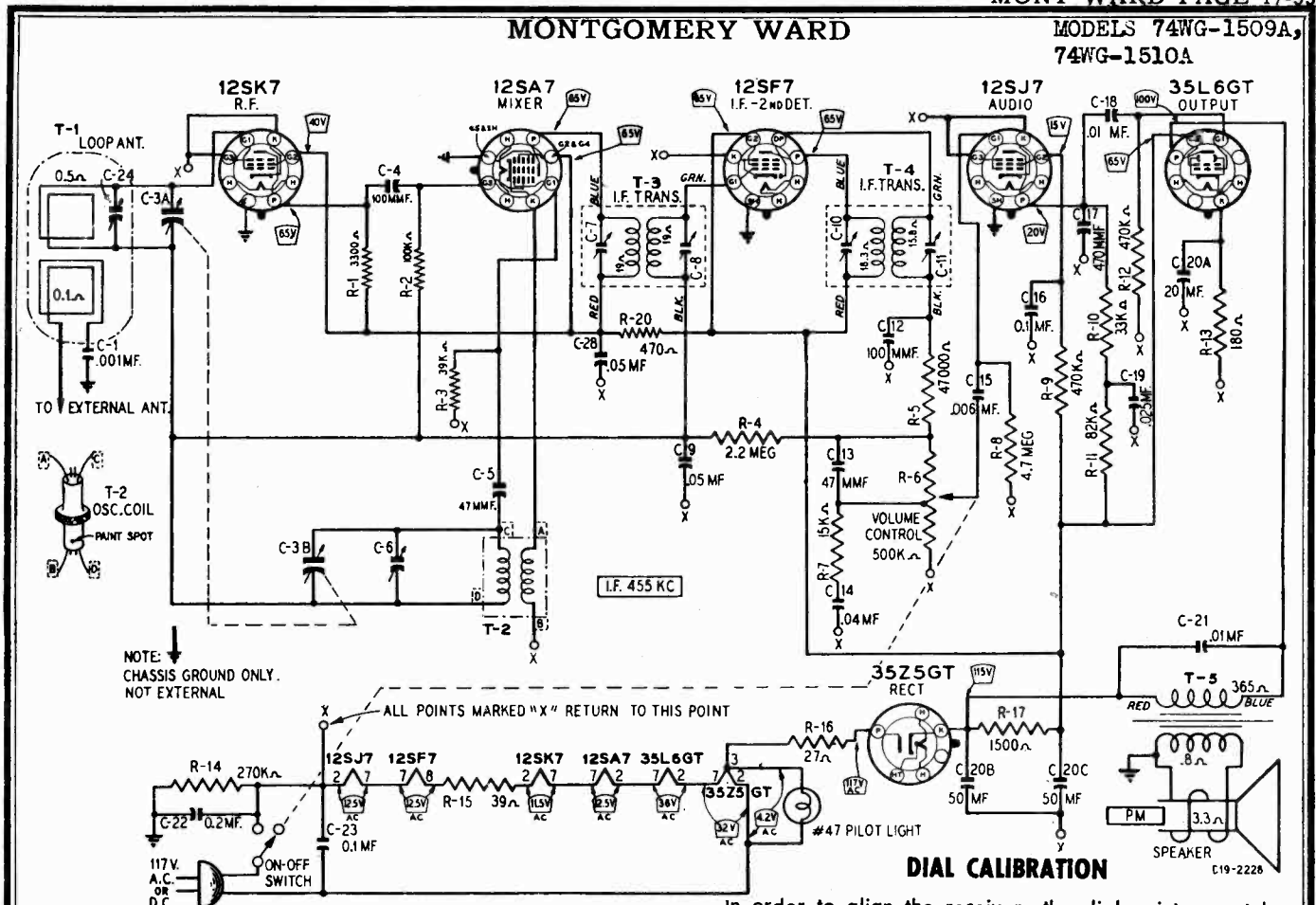
ELECTRICAL SPECIFICATIONS

Power Supply.....	A Battery Supply 1.5 volts, .250 amp. B Battery Supply 60 volts, 8 MA or 105-125 volts AC, 25-60 cycles, 10 watts or 105-125 volts DC
Battery Pack.....	Wards Battery Pack No. 62-32
Frequency Range.....	540-1600 kc
Intermediate Frequency.....	455 kc
Selectivity.....	At 1000 kc, 40 kc wide at 1000 times signal
Sensitivity.....	300 microvolts per meter average (for .05 watt output)
Power Output.....	.130 watt maximum .070 watt 10% distortion
Loud Speaker.....	4" PM Dynamic
Voice Coil Imp.....	3.2 ohms at 400 cycles

Tube Complement	1 1R5 Mixer
	1 1U4 IF Amplifier
	1 1S5 2nd Detector AVC and 1st AF Amplifier
	1 3S4 Output

MONTGOMERY WARD

MODELS 74WG-1509A,
74WG-1510A



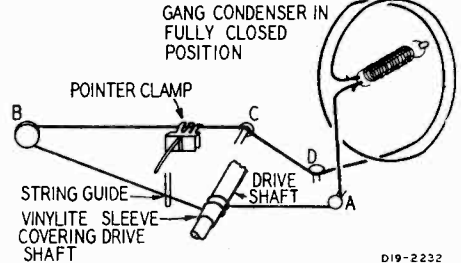
NOTE: CHASSIS GROUND ONLY. NOT EXTERNAL

ALL POINTS MARKED "X" RETURN TO THIS POINT

DRIVE CORD REPLACEMENT

Turn the gang condenser to the fully closed position. Use a new drive cord 42" long and tie one end to the tension spring. Hook the other end of the tension spring over the tab on the drive pulley. Pass the cord through the slot on the drive pulley rim, under stud A and wind two turns clockwise (from front of chassis) around the tuning shaft. Turns must progress away from chassis. Pass cord over pulley B and stud C and under stud D. Pass cord under drive pulley and wind 1 3/4 turns counterclockwise around drive pulley. Stretch tension spring and tie free end of cord to spring. Cut off any excess cord.

Attach the dial pointer to the cord and position as instructed in paragraph DIAL CALIBRATION.

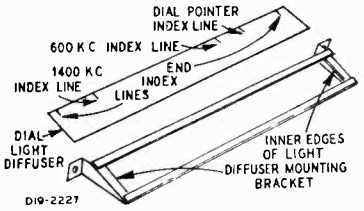


D19-2232

DIAL CALIBRATION

In order to align the receiver, the dial pointer must be positioned on the dial string correctly with reference to the dial. Index lines are provided on the dial light diffuser for this purpose.

Before aligning the receiver (or when replacing the dial light diffuser) check the position of the diffuser strip, making certain that the two end index lines are aligned with the inner edges of the diffuser mounting bracket opening. The bracket should be crimped at one point to prevent movement of the diffuser strip. To position the dial pointer, turn the gang condenser to the fully closed position. The dial pointer should be directly over the dial pointer index line. (See illustration)



D19-2227

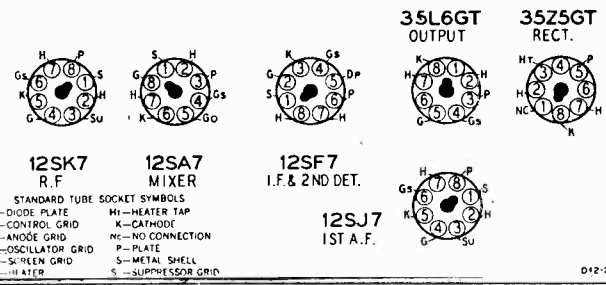
TUBE SOCKET VOLTAGES

Socket voltages are shown on the schematic diagram at the tube socket terminals. All voltages except those for the heater and dial lamp are between the socket terminal and "X" point.

The readings were taken with a 1000 ohm-per-volt meter and all plate and screen voltages read on a 500 volt scale. Conditions of measurement are:

- Line voltage.....117 volts AC
- Volume control.....maximum
- Signal input.....none

A variation of ±10% is usually permissible.



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 AC

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				INPUT FOR 50 MILLIWATT OUTPUT
Frequency	Coupling Capacitor	Connection to Receiver	Ground Connection	
1000 kc	200 mmf or RMA Dummy Antenna	Loop Antenna— External antenna clip	Chassis	19.5 microvolts
1000 kc	.05 mf.	12SA7 Mixer—Pin 8	Point "X" (12SK7 Pin 3)	150 microvolts
455 kc	.05 mf	12SA7 Mixer—Pin 8	Same as above	100 microvolts
455 kc	.05 mf	12SF7 I-F—Pin 2	Same as above	3500 microvolts
400 cycles	.05 mf	12SJ7 1st A-F—Pin 4	Same as above	.042 volt
400 cycles	.05 mf	35L6GT Output—Pin 5	Same as above	1 volt

ALIGNMENT PROCEDURE

Check dial pointer position, see Dial Calibration paragraph.

Volume Control—Maximum All Adjustments.

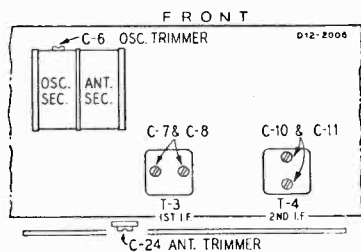
Allow Chassis and Signal Generator to "Heat Up" for several Minutes.

The equipment in column at right is required for aligning:

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., 50 mmf.



NOTE A:—Index line is on dial light diffuser strip. See DIAL CALIBRATION paragraph.

SIGNAL GENERATOR			Coupling Capacitor	DIAL SETTING	ADJUST TRIMMERS TO MAXIMUM OUTPUT IN ORDER SHOWN (See Trimmer Illustration)
Frequency Setting	Connection to Receiver	Ground Connection			
455 kc	Control Grid 12SF7—I-F (Prong No. 2)	Point "X" 12SK7—R-F (Prong No. 3)	.1 mf	Turn Rotor to full open	2nd I-F (C10) & (C11)
455 kc	Control Grid 12SA7—1st Det. (Prong No. 8)	Same as above	.1 mf	Turn Rotor to full open	1st I-F (C7) & (C8)
1620 kc	Control Grid 12SA7—1st Det. (Prong No. 8)	Same as above	.1 mf	Turn Rotor to fully open position	Oscillator (C6)
1400 kc	External Antenna Clip on Loop	Chassis	50 mmf	Turn Rotor to 1400 kc Index Line. See Note A	Antenna (C24)

ELECTRICAL SPECIFICATIONS

Power Supply.....105-125 volts AC, 50-60 cycles, 35 watts or 105-125 volts DC

Frequency Range.....540-1600 KC

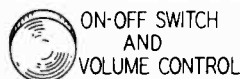
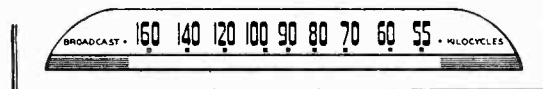
Selectivity.....At 1000 KC, 50 KC wide at 1000 times signal

Sensitivity.....(for .05 watt output with external antenna) 15 microvolts average

Power Output.....1.3 watts maximum
.75 watt 10% distortion

Loud Speaker.....4" x 6" PM dynamic

Voice Coil Impedance...3.2 ohms at 400 cycles



D19-2226

MONTGOMERY WARD

MODELS 74WG-1509A,
74WG-1510A

OPERATING VOLTAGES—Chassis for Models 74WG-1509A and 74WG-1510A are available for operation on the following power supplies: 105-125 volts AC, 50-60 cycles or 105-125 volts DC.

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

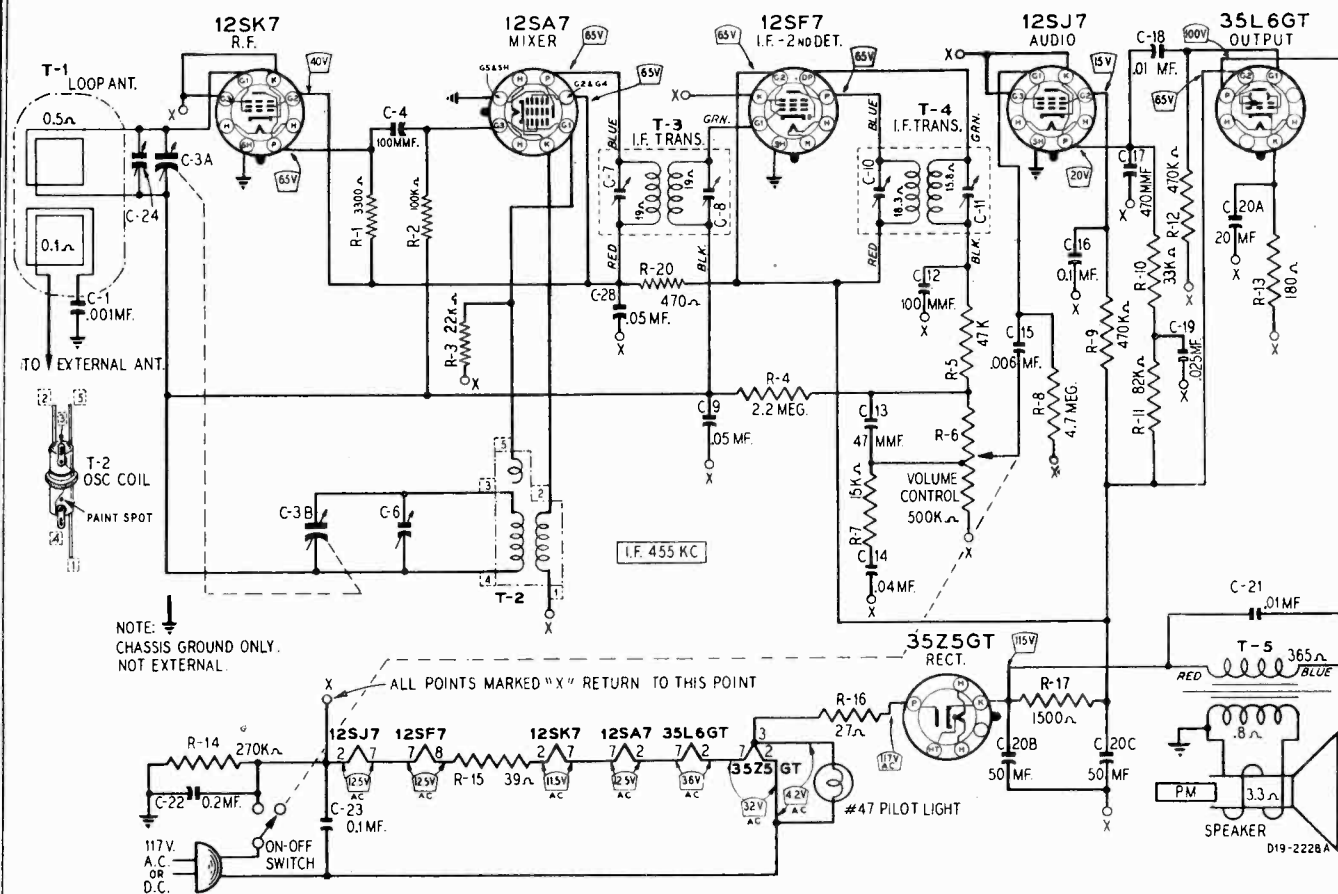
Use only genuine factory tested parts to insure service jobs you can depend on and to obtain original set performance

Ref. No.	Part No.	Description	Qty. Used in Set
CAPACITORS			
C-1	D67102	.001 mf 400 V Tubular.....	1
C-3A } C-3B }	26A402	Gang condenser and pulley assembly	1
C-4 } C-12 }	47X476	100 mmf Molded.....	2
C-5	47X446	47 mmf Molded.....	1
C-6		Part of C-3	
C-7 } C-8 }		Part of T-3, 1st I-F Transformer	
C-9	B66503	.05 mf 200 V Tubular.....	1
C-10 } C-11 }		Part of T-4, 2nd I-F Transformer	
C-13	47X463	47 mmf Molded.....	1
C-14	B67403	.04 mf 200 V Tubular.....	1
C-15	B67602	.006 mf 200 V Tubular.....	1
C-16	B66104	.1 mf 200 V Tubular.....	1
C-17	47X467	470 mmf Molded.....	1
C-18 } C-21 }	B66103	.01 mf 200 V Tubular.....	2
C-19	B67253	.025 mf 200 V Tubular.....	1
C-20A } C-20B } C-20C }	45X344	20 mf 25 V Dry electrolytic 50 mf 150 V condenser.... 50 mf 150 V	1
C-22	B67204	0.2 mf 200 V Tubular.....	1
C-23	D67104	.1 mf 400 V Tubular.....	1
C-24	17A123	1.5-12 mmf Trimmer.....	1
C-28	B67503	.05 mf 200 V Tubular.....	1
RESISTORS			
		Ohms Watts	
R-1	B84332	3300 0.5 Carbon.....	1
R-2	B85104	100,000 0.5 Carbon.....	1
R-3	B84393	39,000 0.5 Carbon.....	1
R-4	B85225	2.2 meg. 0.5 Carbon.....	1
R-5	B85473	47,000 0.5 Carbon.....	1
R-6	36X347	500,000 Volume control and switch	1
R-7	B84153	15,000 0.5 Carbon.....	1
R-8	B85475	4.7 meg. 0.5 Carbon.....	1
R-9	B84474	470,000 0.5 Carbon.....	1
R-10	B84333	33,000 0.5 Carbon.....	1
R-11	B84823	82,000 0.5 Carbon.....	1
R-12	B85474	470,000 0.5 Carbon.....	1
R-13	B83181	180 0.5 Carbon.....	1
R-14	B84274	270,000 0.5 Carbon.....	1
R-15	D84390	39 2.0 Carbon.....	1
R-16	B84270	27 0.5 Carbon.....	1
R-17	C84152	1500 1.0 Carbon.....	1
R-20	B85471	470 0.5 Carbon.....	1

Ref. No.	Part No.	Description	Qty. Used in Set
TRANSFORMERS AND COILS			
T-1	26A448	"B" Range loop antenna assembly (ivory)	1
T-1	26A447	"B" Range loop antenna assembly (walnut)	1
T-2	9A1805	Oscillator coil assembly.....	1
T-3	9A1775	1st I-F Transformer and can assembly	1
T-4	9A1776	2nd I-F Transformer and can assembly	1
T-5	51X116	Output transformer.....	1
DIAL AND DRIVE ASSEMBLY			
	6X21	Rubber grommet	3
	20X329	Cond. cushion stud mtg.....	3
	58X674	Dial (for ivory cabinet)	1
	58X675	Dial (for walnut cabinet).....	1
	26A446	Pointer bracket assembly.....	1
	15X217	Pointer.....	1
	25X1398	Pilot light bracket.....	1
	7A192	Pilot light socket assembly.....	1
		Pilot light No. 47.....	1
		42" drive cord.....	1
	28X95	Drive cord tension spring.....	1
	26X464	Drive shaft	1
	19X192	"C" washer (for drive shaft).....	2
	41X81	Dial light diffuser.....	1
MISCELLANEOUS			
	12A431	4" x 6" speaker with mounting bracket Cone and voice coil assembly (specify part number and letters stamped on speaker).....	1
	3A303	Tube socket—octal (8 prong) molded	5
	3A421	Tube socket with shield	1
	10A297	Knob (walnut) on-off switch, volume control and tuning.....	2
	10A300	Knob (ivory)	2
	28X292	Snap button (mounting loop to cabinet) 6 x 1/4" slotted hex head P-K type "Z" screw (mounting loop to chassis)...	2
	13X328	Line cord and plug assembly.....	1
	55X249	Cabinet, plastic (ivory)	1
	55X264	Cabinet, plastic (walnut).....	1

MODELS 74WG-1509B,
74WG-1510B

MONTGOMERY WARD



Parts list is the same as that for Models 74WG-1509A and 1510A with the following exceptions:

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

CAPACITORS

C-24 Part of C-3

DIAL AND DRIVE ASSEMBLY

- 7A103 Pilot Light 1
- 10X44 Drive Cord Assembly..... 1

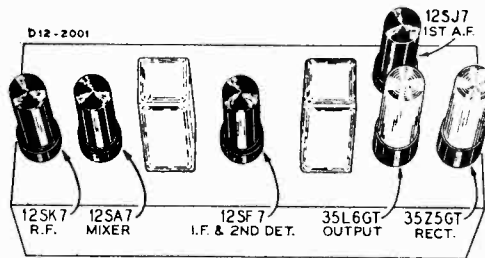
RESISTORS

R-3 B84223 22,000 0.5 Carbon..... 1

TRANSFORMERS AND COILS

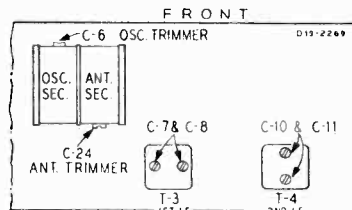
- T-1 9A1925 "B" Range Loop Antenna Assembly (Ivory) 1
- T-1 9A1926 "B" Range Loop Antenna Assembly (Walnut) 1
- T-2 9A1911 Oscillator Coil Assembly..... 1

- Tube and Dial Light Complement**
- 1 12SK7 R-F Amplifier
 - 1 12SA7 Mixer
 - 1 12SF7 I-F and 2nd Detector
 - 1 12SJ7 1st A-F
 - 1 35L6GT Power Output
 - 1 35Z5GT Rectifier
 - 1 47 Dial Lamp



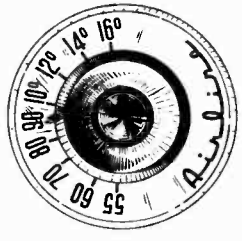
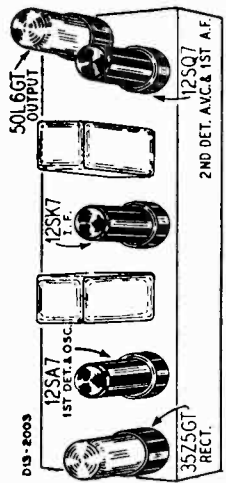
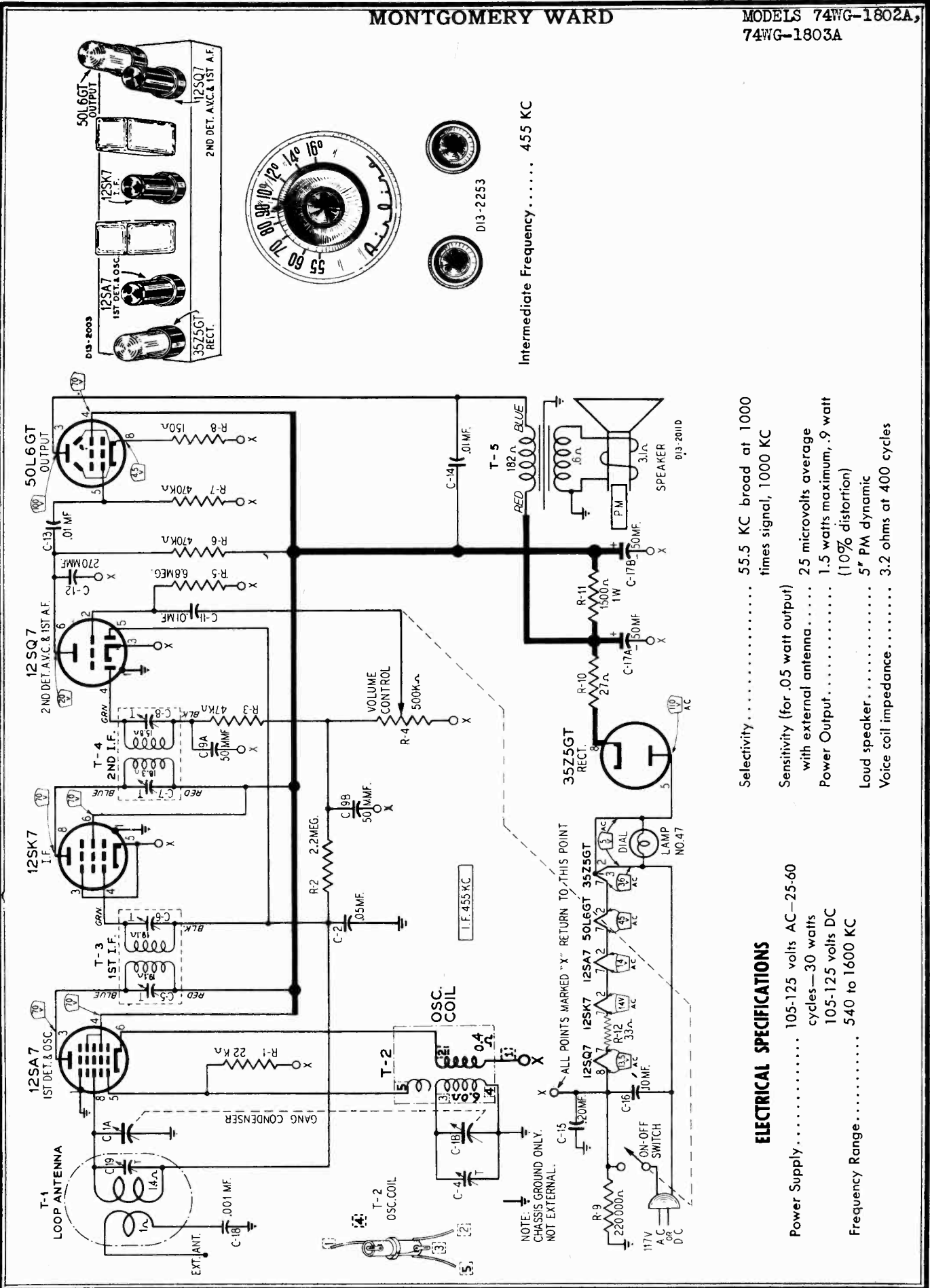
DRIVE CORD REPLACEMENT

Turn the gang condenser to the fully closed position. Use a new 10X44 drive cord assembly and tie one end to the tension spring. Continue as for Models 74WG-1509A and 1510A.



MONTGOMERY WARD

MODELS 74WG-1802A,
74WG-1803A



Intermediate Frequency..... 455 KC

- Selectivity..... 55.5 KC broad at 1000 fimes signal, 1000 KC
- Sensitivity (for .05 watt output) with external antenna..... 25 microvolts average
- Power Output..... 1.5 watts maximum, .9 watt (10% distortion)
- Loud speaker..... 5" PM dynamic
- Voice coil impedance..... 3.2 ohms at 400 cycles

ELECTRICAL SPECIFICATIONS

- Power Supply..... 105-125 volts AC-25-60 cycles-30 watts
- 105-125 volts DC
- Frequency Range..... 540 to 1600 KC

MODELS 74WG-1802A, -1803A
MODEL 74WG-2004A

MONTGOMERY WARD

ALIGNMENT PROCEDURE

Volume Control—Maximum All Adjustments.

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

The equipment in column at right is required for aligning:

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., 50 mmf.

SIGNAL GENERATOR				CONDENSER SETTING	ADJUST TRIMMERS TO MAXIMUM See Trimmer Illustration
Frequency Setting	Coupling Capacitor	Connection to Radio	Ground Connection		
455 kc	.1 mf	Control Grid 12SK7—I-F Prong No. 4	Point "X" 12SK7—I-F Prong No. 3	Turn Rotor to full open	2nd I-F (C7) & (C8)
455 kc	.1 mf	Control Grid 12SA7—1st Det. Prong No. 8	Same as above	Turn Rotor to full open	1st I-F (C5) & (C6)
1620 kc	.1 mf	Control Grid 12SA7—1st Det. Prong No. 8	Same as above	Turn Rotor to full open	Oscillator (C4)
1400 kc	50 mmf	External Antenna Clip on Loop See Note A	Chassis	Turn Rotor to Max. Output Set Indicator 1400 KC— See Note B	Antenna (C19)

NOTE A— Re-assemble chassis in cabinet. Replace back on cabinet.

NOTE B—Tune in a 1400 KC signal. If pointer is not at the 1400 KC mark on the dial scale, pull pointer off shaft. Set pointer at the 1400 KC mark and push back on shaft.

RECEIVER STAGE SENSITIVITIES

The table below lists the sensitivity at the input of each stage. 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

with the speaker connected. 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 of Plus or Minus 25% are usually permissible.

SIGNAL GENERATOR				INPUT FOR 50 MILLIWATT OUTPUT
Frequency	Coupling Capacitor	Connection to Receiver	Ground Connection	
1000 kc	200 mmf or RMA Dummy Antenna	Loop Antenna— external antenna clip	Chassis	24 microvolts
1000 kc	.05 mf	12SA7 1st Detector Pin 8	Point "X" (12SK7 Pin 3)	125 microvolts
455 kc	.05 mf	12SA7 1st Detector Pin 8	Same as above	100 microvolts
455 kc	.05 mf	12SK7, I-F Amp. Pin 4	Same as above	2500 microvolts
400 cycles	.05 mf	12SQ7, 1st A-F, Pin 2	Same as above	.042 volt
400 cycles	.05 mf	50L6GT Output, Pin 5	Same as above	1.9 volts

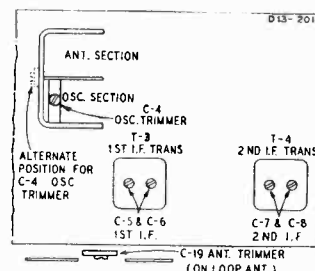
REMOVAL OF CHASSIS FROM CABINET

To remove the chassis from the cabinet it is necessary to pull the two control knobs and the dial pointer from their shafts. Likewise remove the phono-radio knob located inside the record player compartment and disconnect the record player cables from the chassis. Remove the four screws in the bottom of the cabinet and the four snap pins that hold the cabinet back in place.

Care must be taken when removing the dial pointer that it is not damaged in a manner that will make reinstallation impossible.

When reinstalling the pointer, reach inside the cabinet and hold the tuning condenser while pressing the pointer onto the shaft. Damage to the receiver may result if this is not observed.

TRIMMER POSITIONS



MONTGOMERY WARD

MODELS 74WG-1802A, -1803A
MODEL 74WG-2004A

OPERATING VOLTAGES—Chassis for Model 74WG-1802A are available for operation on 105-125 volts AC 60 cycles.

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.

OPERATING VOLTAGES—Chassis for Models 74WG-1802A are available for operation on the following power supplies:

MODEL 74WG-1802A 105-125 volts AC 25-60 cycles or 105-125 volts DC

MODEL 74WG-2004A

Ref. No.	Part No.	Description	Qty. Used in Set	Ref. No.	Part No.	Description	Qty. Used in Set
C-1A	14A176	Gang condenser with pulley	1	C-1A	14A176	Gang Condenser with pulley	1
C-1B	866503	0.5 mf 200 V Tubular	1	C-2	866503	0.5 mf 200 V Tubular	1
C-2	9A1911	Oscillator coil assembly	1	C-4	9A1775	1st I-F Transformer and can assembly	1
C-4	9A1775	1st I-F Transformer and can assembly	1	C-5	9A1783	2nd I-F Transformer and can assembly	1
C-5	9A1783	2nd I-F Transformer and can assembly	1	C-6	51X132	Output Transformer	1
C-6	51X132	Output Transformer	1	C-7		Part of T-1, 1st I-F Transformer	1
C-7		Part of T-1, 1st I-F Transformer	1	C-8		Part of T-4, 2nd I-F Transformer	1
C-8		Part of T-4, 2nd I-F Transformer	1	C-9A	47X112	50 mmf Dual mica	1
C-9A	47X112	50 mmf Dual mica	1	C-9B	866803	.08 mf 200 V Tubular	1
C-9B	866803	.08 mf 200 V Tubular	1	C-10	866103	.01 mf 200 V Tubular	3
C-10	866103	.01 mf 200 V Tubular	3	C-11	47X445	Molded Knob	1
C-11	47X445	Molded Knob	1	C-12	867204	20 mf 200 V Tubular	1
C-12	867204	20 mf 200 V Tubular	1	C-13	10A625	Tube socket—octal (8 prong) molded	5
C-13	10A625	Tube socket—octal (8 prong) molded	5	C-14	28X292	Knob (Phono-Switch)	2
C-14	28X292	Knob (Phono-Switch)	2	C-15	10A526	Knob (Phono-Switch)	1
C-15	10A526	Knob (Phono-Switch)	1	C-16	28X292	Knob (Phono-Switch)	1
C-16	28X292	Knob (Phono-Switch)	1	C-17A	13X546	Line cord and plug assembly	1
C-17A	13X546	Line cord and plug assembly	1	C-17B	13X546	Line cord and plug assembly	1
C-17B	13X546	Line cord and plug assembly	1	C-18	17A123	1.5-12 mmf Trimmer	1
C-18	17A123	1.5-12 mmf Trimmer	1	C-19	17A123	1.5-12 mmf Trimmer	1
C-19	17A123	1.5-12 mmf Trimmer	1				

Ref. No.	Part No.	Description	Qty. Used in Set
T-1	26A467	"8" Band Loop antenna assembly	1
T-2	9A1911	Oscillator coil assembly	1
T-3	9A1775	1st I-F Transformer and can assembly	1
T-4	9A1783	2nd I-F Transformer and can assembly	1
T-5	51X132	Output Transformer	1

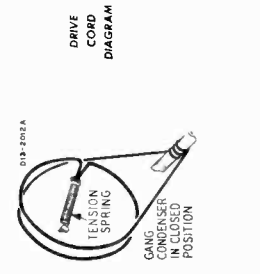
Ref. No.	Part No.	Description	Qty. Used in Set
R-1	884223	22,000 Ohms 0.5 Carbon	1
R-2	885225	2.2 meg 0.5 Carbon	1
R-3	885473	47,000 Ohms 0.5 Carbon	1
R-4	36X368	.5 meg Volume control and switch	1
R-5	885685	6.8 meg 0.5 Carbon	1
R-6	884474	470,000 Ohms 0.5 Carbon	1
R-7	885474	470,000 Ohms 0.5 Carbon	1
R-8	884151	150 Ohms 0.5 Carbon	1
R-9	885224	220,000 Ohms 0.5 Carbon	1
R-10	884270	27 Ohms 0.5 Carbon	1
R-11	885152	1500 Ohms 1.0 Carbon	1
R-12	885105	1 meg 0.5 Carbon	1
R-13	885330	33 Ohms 1.0 Carbon	1

Ref. No.	Part No.	Description	Qty. Used in Set
T-1	26A468	"8" Band Loop Antenna Assembly	1
T-2	9A1911	Oscillator coil assembly	1
T-3	9A1775	1st I-F Transformer and can assembly	1
T-4	9A1783	2nd I-F Transformer and can assembly	1
T-5	51X132	Output Transformer	1

Ref. No.	Part No.	Description	Qty. Used in Set
M-1	12A429	5" P.M. speaker	1
M-2	3A303	Tube socket—octal (8 prong) molded	5
M-3	3A305	Single pin tip socket (Phono)	1
M-4	10A297	Knob	2
M-5	10A526	Knob (Phono-Switch)	1
M-6	28X292	Knob (Phono-Switch)	1
M-7	13X546	Line cord and plug assembly	4
M-8	2A355	Radio phono switch	1
M-9	28A112	Phono-motor assembly	1
M-10	2A170	Phono on-off switch	1
M-11	6A227	Two prong motor plug	1
M-12	AV-101	L75 Crystal cartridge	1
M-13	13X542	Phono motor socket and cable assembly	1

Ref. No.	Part No.	Description	Qty. Used in Set
D-1	25X1559	Gang condenser mounting bracket	1
D-2	58X685	Dial	1
D-3	58X686	Dial Background	1
D-4	15X239	Pointer	1
D-5	26X504	Drive shaft	1
D-6	19X192	"C" washer	2
D-7	7A185	Pilot light cable & socket assembly	1
D-8	28X310	Drive cord tension spring	1
D-9	10X45	Drive cord assembly	1

DRIVE CORD REPLACEMENT
Turn the gang condenser to the fully closed position. Use a new 10X45 drive cord assembly or a piece of cord 18 inches in length and tie one end to the tension spring. Fasten the other end of the tension spring to the hook on the drive pulley. Pass the cord through the slot in the drive pulley rim and continue around pulley one half turn, counterclockwise. Wind 3 1/2 turns counterclockwise (from front of chassis around tuning shaft). Turns should progress toward rear of chassis.



RESISTORS
Ohms Watts
R-1 884223 22,000 0.5 Carbon
R-2 885225 2.2 meg 0.5 Carbon
R-3 885473 47,000 0.5 Carbon
R-4 36X368 .5 meg Volume control and switch
R-5 885685 6.8 meg 0.5 Carbon
R-6 884474 470,000 0.5 Carbon
R-7 885474 470,000 0.5 Carbon
R-8 884151 150 0.5 Carbon
R-9 885224 220,000 0.5 Carbon
R-10 884270 27 0.5 Carbon
R-11 885152 1500 1.0 Carbon
R-12 885105 1 meg 0.5 Carbon
R-13 885330 33 1.0 Carbon

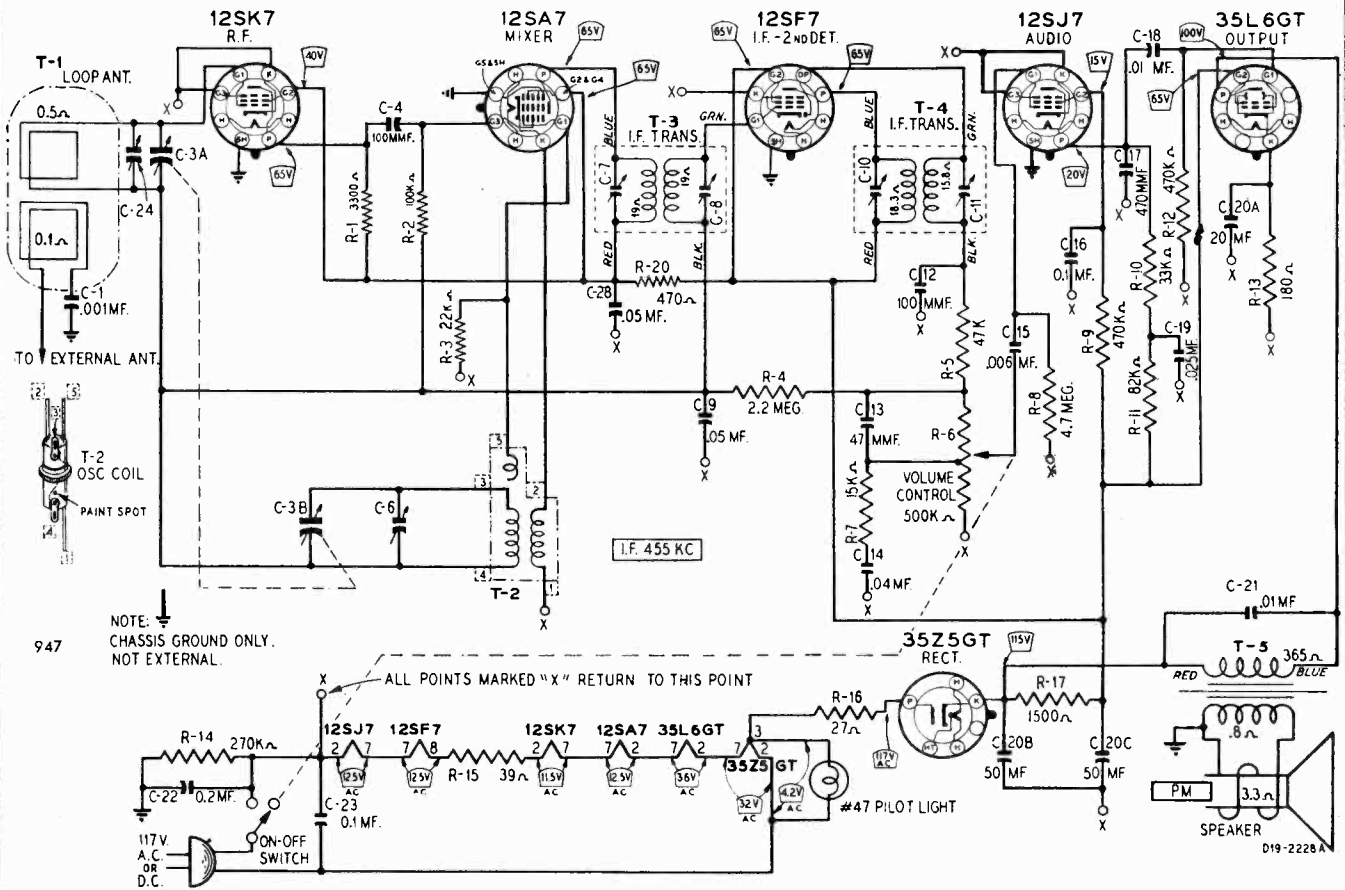
DIAL AND DRIVE ASSEMBLY
Dial condenser mounting bracket
Dial
Dial Background
Pointer
Drive shaft
"C" washer
Pilot light cable & socket assembly
Drive cord tension spring
Drive cord assembly

TUBE SOCKET VOLTAGES
Socket voltages are shown on the schematic diagram at the tube socket terminals. All voltages except those for the heater and dial lamp are between the socket terminal and "X" point.
The readings were taken with a 1000 ohm per volt meter and all plate and screen voltages read on a 500 volt scale. Conditions of measurement are:
Line voltage.....117 volts AC
Volume control.....maximum
Signal input.....none
A variation of ±10% is usually permissible.

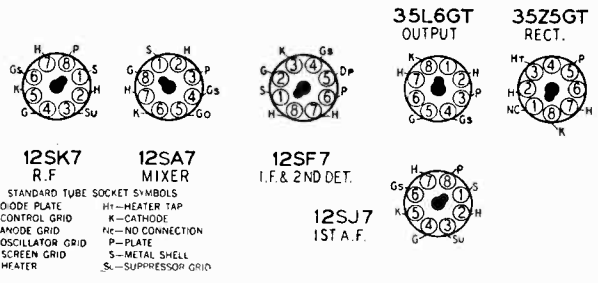
MODEL 74WG-2004A, 74WG-1802A
74WG-1803A

MODELS 74WG-1804D,
74WG-1805A

MONTGOMERY WARD



- Power Supply 105-125 volts AC, 25-60 cycles, 35 watts or 105-125 volts DC
- Frequency Range 540-1600 KC
- Intermediate Frequency . 455 KC
- Selectivity At 1000 KC, 50 KC wide at 1000 times signal
- Sensitivity (for .05 watt output with external antenna) 15 microvolts average
- Power Output 1.3 watts maximum
.75 watt 10% distortion
- Loud Speaker 4" x 6" PM dynamic
- Voice Coil Impedance . . . 3.2 ohms at 400 cycles



STANDARD TUBE SOCKET SYMBOLS
 P—O-ODE PLATE
 G—CONTROL GRID
 Gc—ANODE GRID
 Gs—OSCILLATOR GRID
 Gc—SCREEN GRID
 H—HEATER
 Ht—HEATER TAP
 K—CATHODE
 Kc—NO CONNECTION
 P—PLATE
 S—METAL SHELL
 Su—SUPPRESSOR GRID

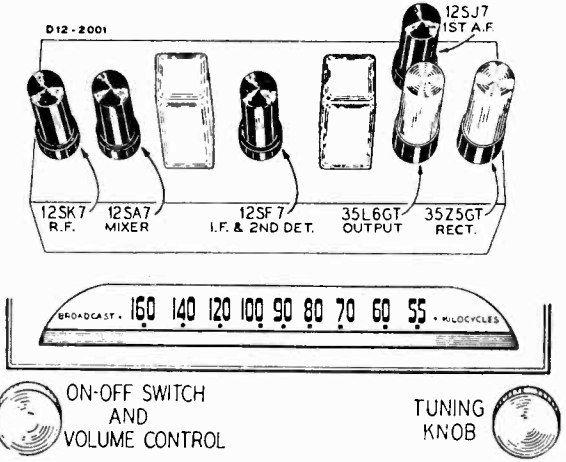
TUBE SOCKET VOLTAGES

Socket voltages are shown on the schematic diagram at the tube socket terminals. All voltages except those for the heater and dial lamp are between the socket terminal and "X" point.

The readings were taken with a 1000 ohm-per-volt meter and all plate and screen voltages read on a 500 volt scale. Conditions of measurement are:

- Line voltage 117 volts AC
- Volume control maximum
- Signal input none

A variation of ±10% is usually permissible.



MONTGOMERY WARD

MODELS 74WG-1804D,
74WG-1805A

ALIGNMENT PROCEDURE

Check dial pointer position, see Dial Calibration paragraph.

Volume Control—Maximum All Adjustments.

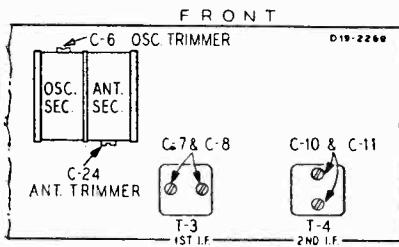
Signal Generator which will provide an accurately calibrated signal at the test frequencies as listed.

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

Output Indicating Meter; Non-Metallic Screwdriver.

The equipment in column at right is required for aligning:

Dummy Antennas—.1 mf., 50 mmf.



NOTE A:—Index line is on dial light diffuser strip. See DIAL CALIBRATION paragraph.

SIGNAL GENERATOR

Frequency Setting	Connection to Receiver	Ground Connection	Coupling Capacitor	DIAL SETTING	ADJUST TRIMMERS TO MAXIMUM OUTPUT IN ORDER SHOWN (See Trimmer Illustration)
455 kc	Control Grid 12SF7—I-F (Prong No. 2)	Point "X" 12SK7—R-F (Prong No. 3)	.1 mf	Turn Rotor to full open	2nd I-F (C10) & (C11)
455 kc	Control Grid 12SA7—1st Det. (Prong No. 8)	Same as above	.1 mf	Turn Rotor to full open	1st I-F (C7) & (C8)
1620 kc	Control Grid 12SA7—1st Det. (Prong No. 8)	Same as above	.1 mf	Turn Rotor to fully open position	Oscillator (C6)
1400 kc	External Antenna Clip on Loop	Chassis	50 mmf	Turn Rotor to 1400 kc Index Line. See Note A	Antenna (C24)

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 AC

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

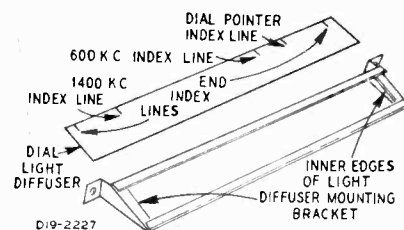
Frequency	Coupling Capacitor	Connection to Receiver	Ground Connection	INPUT FOR 50 MILLIWATT OUTPUT
1000 kc	200 mmf or RMA Dummy Antenna	Loop Antenna— External antenna clip	Chassis	19.5 microvolts
1000 kc	.05 mf.	12SA7 Mixer—Pin 8	Point "X" (12SK7 Pin 3)	150 microvolts
455 kc	.05 mf	12SA7 Mixer—Pin 8	Same as above	100 microvolts
455 kc	.05 mf	12SF7 I-F—Pin 2	Same as above	3500 microvolts
400 cycles	.05 mf	12SJ7 1st A-F—Pin 4	Same as above	.042 volt
400 cycles	.05 mf	35L6GT Output—Pin 5	Same as above	1 volt

DIAL CALIBRATION

In order to align the receiver, the dial pointer must be positioned on the dial string correctly with reference to the dial. Index lines are provided on the dial light diffuser for this purpose.

The 1400 KC index line is for use when aligning the receiver.

Before aligning the receiver (or when replacing the dial light diffuser) check the position of the diffuser strip, making certain that the two end index lines are aligned with the inner edges of the diffuser mounting bracket opening. The bracket should be crimped at one point to prevent movement of the diffuser strip. To position the dial pointer, turn the gang condenser to the fully closed position. The dial pointer should be directly over the dial pointer index line. (See illustration)

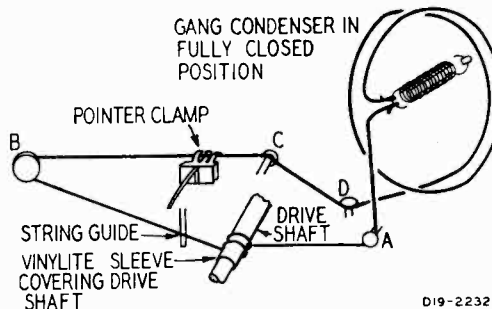


MODELS 74WG-1804D,
74WG-1805A

DRIVE CORD REPLACEMENT

Attach the dial pointer to the cord and position as instructed in paragraph DIAL CALIBRATION.

Turn the gang condenser to the fully closed position. Use a new 10X44 drive cord assembly and fasten one end to the tension spring. Hook the other end of the tension spring over the tab on the drive pulley. Pass the cord through the slot on the drive pulley rim, under stud A and wind two turns clockwise (from front of chassis) around the tuning shaft. Turns must progress away from chassis. Pass cord over pulley B and stud C under stud D. Pass cord under drive pulley and wind 1 3/4 turns counterclockwise around drive pulley. Stretch tension spring and fasten free end of cord to spring.



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

TRANSFORMERS AND COILS

C-1	D67102	.001 mf 400 V Tubular	1
C-3A } C-3B }	14A194	Gang condenser and pulley assembly	1
C-4 } C-12 }	47X476	100 mmf Molded	2
C-6		Part of C-3	
C-7 } C-8 }		Part of T-3, 1st I-F Transformer	
C-9	B66503	.05 mf 200 V Tubular	1
C-10 } C-11 }		Part of T-4, 2nd I-F Transformer	
C-13	47X463	47 mmf Molded	1
C-14	B67403	.04 mf 200 V Tubular	1
C-15	B67602	.006 mf 200 V Tubular	1
C-16	B66104	.1 mf 200 V Tubular	1
C-17	47X467	470 mmf Molded	1
C-18 } C-21 }	B66103	.01 mf 200 V Tubular	2
C-19	B67253	.025 mf 200 V Tubular	1
C-20A } C-20B } C-20C }	45X344	20 mf 25 V Dry electrolytic 50 mf 150 V condenser 50 mf 150 V	1
C-22	B67204	0.2 mf 200 V Tubular	1
C-23	D67104	.1 mf 400 V Tubular	1
C-24		Part of C-3	
C-28	B67503	.05 mf 200 V Tubular	1

T-1	9A1944	"B" Range loop antenna	1
T-2	9A1911	Oscillator coil assembly	1
T-3	9A1775	1st I-F Transformer and can assembly	1
T-4	9A1776	2nd I-F Transformer and can assembly	1
T-5	51X116	Output transformer	1

DIAL AND DRIVE ASSEMBLY

6X21	Rubber grommet	} Gang cond. mtg.	} 3
20X329	Cond. cushion stud		
58X667	Dial (for Walnut Cabinet)		1
58X700	Dial (for Blonde Cabinet)		1
25X1461	Dial bracket		1
26A446	Pointer bracket assembly		1
15X217	Pointer		1
25X1398	Pilot light bracket		1
7A192	Pilot light socket assembly		1
7A103	Pilot light No. 47		1
10X44	Drive cord assembly		1
28X95	Drive cord tension spring		1
26X464	Drive shaft		1
19X192	"C" washer (for drive shaft)		2
41X81	Dial light diffuser		1
4X884	Escutcheon (for Walnut Cabinet)		1
4X1000	Escutcheon (for Blonde Cabinet)		1
25X1460	Escutcheon mounting bracket		2

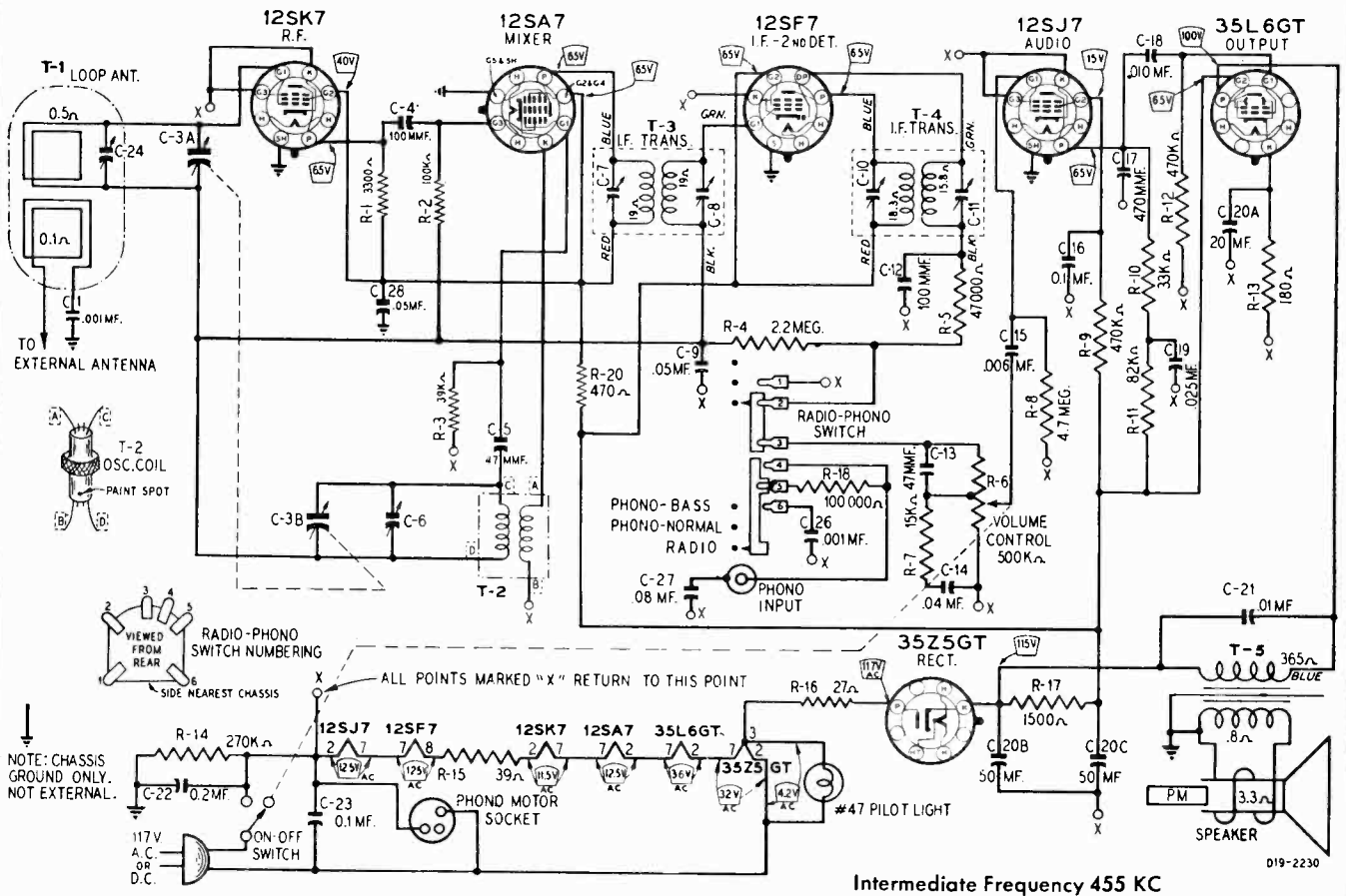
RESISTORS

		Ohms	Watts		
R-1	B84332	3300	0.5	Carbon	1
R-2	B85104	100,000	0.5	Carbon	1
R-3	B85223	22,000	0.5	Carbon	1
R-4	B85225	2.2 meg.	0.5	Carbon	1
R-5	B85473	47,000	0.5	Carbon	1
R-6	36X347	500,000		Volume control and switch	1
R-7	B84153	15,000	0.5	Carbon	1
R-8	B85475	4.7 meg.	0.5	Carbon	1
R-9	B84474	470,000	0.5	Carbon	1
R-10	B84333	33,000	0.5	Carbon	1
R-11	B84823	82,000	0.5	Carbon	1
R-12	B85474	470,000	0.5	Carbon	1
R-13	B83181	180	0.5	Carbon	1
R-14	B84274	270,000	0.5	Carbon	1
R-15	D84390	39	2.0	Carbon	1
R-16	B84270	27	0.5	Carbon	1
R-17	C84152	1,500	1.0	Carbon	1
R-20	B85471	470	0.5	Carbon	1

MISCELLANEOUS

12A431	4" x 6" speaker with mtg. bracket	1
3A303	Tube socket—octal (8 prong) molded	5
3A421	Tube socket with shield	1
10A297	Knob (walnut) on-off switch, volume control and tuning	2
10A649	Knob (Blonde)	2
28X292	Snap button (mtg. loop to cabinet)	2
	6 x 1/4" slotted hex head P-K type "Z" screw mounting loop to chassis	2
13X328	Line cord and plug assembly	1

MONTGOMERY WARD



TUBE SOCKET VOLTAGES

Socket voltages are shown on the schematic diagram at the tube socket terminals. All voltages except those for the heater and dial lamp are between the socket terminal and "X" point.

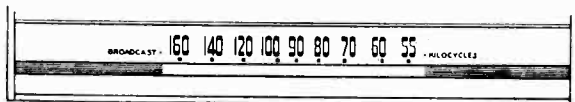
The readings were taken with a 1000 ohm-per-volt meter and all plate and screen voltages read on a 500 volt scale. Conditions of measurement are:

- Line voltage..... 117 volts AC
- Volume control..... maximum
- Signal input..... none

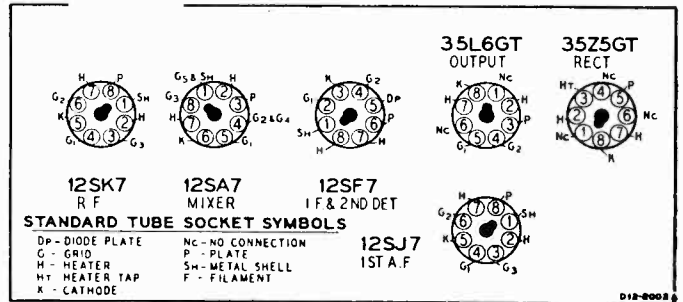
A variation of ±10% is usually permissible.

PHONO MOTOR CONNECTION

If the phono motor plug is ever disconnected from the chassis, it must be reinserted in the chassis socket with the red paint mark on the plug adjacent to the red paint mark on the chassis. If this is not observed the phono motor will not operate.

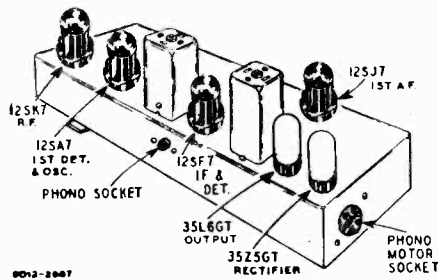


Intermediate Frequency 455 KC



ELECTRICAL SPECIFICATIONS

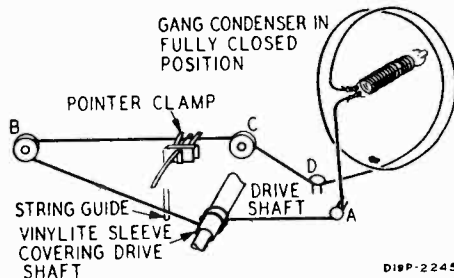
- Power Supply..... 105-125 volts AC, 60 cycles, 35 watts (55 watts phono operating)
- Frequency Range..... 540-1600 KC
- Selectivity..... At 1000 KC, 50 KC wide at 1000 times signal
- Sensitivity..... (for .05 watt output with external antenna) 15 microvolts average
- Power Output..... 1.3 watts maximum
.75 watt 10% distortion
- Loud Speaker..... 4"x6" PM dynamic
- Voice Coil Impedance... 3.2 ohms at 400 cycles
- Record Changer..... See Manual No. 5031A



DRIVE CORD REPLACEMENT

The illustration below shows the method of stringing the drive cord. Use a new drive cord 10X44 or a piece of cord 48" long and fasten one end to the tension spring. Hook the other end of the tension spring over the tab on the drive pulley. Pass the cord through the slot in the pulley rim and continue counterclockwise around the pulley as shown. Three turns must be wound around the tuning shaft in a clockwise direction with the turns progressing away from the chassis. (On sets with a black vinylite sleeve on the tuning shaft, wind only two turns around the shaft.)

Attach the dial pointer to the cord and position, as instructed in paragraph DIAL CALIBRATION.



DIAL CALIBRATION

In order to align the receiver, the dial pointer must be positioned on the dial string correctly with reference to the dial. Index lines are provided on the dial light diffuser for this purpose.

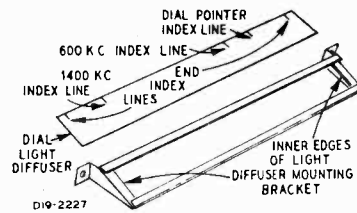
Before aligning the receiver (or when replacing the dial light diffuser) check the position of the diffuser strip, making

ALIGNMENT PROCEDURE

Check dial pointer position, see Dial Calibration paragraph.
 Volume Control—Maximum All Adjustments.
 Allow Chassis and Signal Generator to "Heat Up" for several Minutes.
 The equipment in column at right is required for aligning:

certain that the two end index lines are aligned with the inner edges of the diffuser mounting bracket opening. The bracket should be crimped to prevent movement of the diffuser strip. To position the dial pointer, adjust the radio to the "stop" position at the low frequency end of the dial. The dial pointer should be directly over the dial pointer index line. (See illustration.) If not, move the pointer along the drive cord until it is directly over the index line.

The 1400 KC index line is for use when aligning the receiver.



50 CYCLE OPERATION

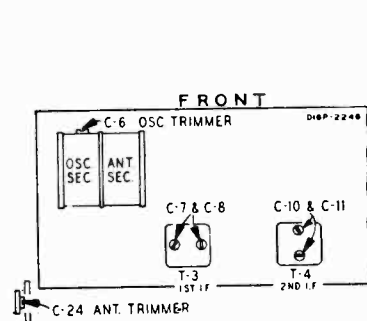
If it is desired to use the radio and record player on a 50 cycle power supply, it will be necessary to install a new bushing on the motor shaft and to wire a 70 ohm, 20 watt resistor in series with the motor and the AC supply.

To install the new bushing, align the upper part of the center spindle with the lower part of the spindle and turn the record shelf to the 12" position. Lift the turntable off the record changer. On record players having a turned metal bushing fastened on with a set screw, loosen the set screw holding the old bushing to the motor shaft, remove the old pulley and install the new bushing No. G-25-72438.

On record players having a spring bushing on the motor shaft, remove the old spring bushing and install a new spring bushing No. G-33-72435.

On record players having no bushing on the motor shaft, install a spring bushing No. G-33-72436.

When replacing the turntable on the record player, make certain that the turntable rim is placed over both of the rubber drive pulleys.



* NOTE A:—Index line is on dial light diffuser strip. See DIAL CALIBRATION paragraph.

SIGNAL GENERATOR			Coupling Capacitor	DIAL SETTING	ADJUST TRIMMERS TO MAXIMUM OUTPUT IN ORDER SHOWN (See Trimmer Illustration)
Frequency Setting	Connection to Receiver	Ground Connection			
455 kc	Control Grid 12SK7—I-F (Prong No. 2)	Point "X" 12SK7—R-F (Prong No. 3)	.1 mf	1600 KC	2nd I-F (C-10) & (C-11)
455 kc	Control Grid 12SA7—1st Det. (Prong No. 8)	Same as above	.1 mf	1600 KC	1st I-F (C-7) & (C-8)
1620 kc	Control Grid 12SA7—1st Det. (Prong No. 8)	Same as above	.1 mf	Turn Rotor to Fully Open Position	Oscillator (C-6)
1400 kc	External Antenna Clip on Loop	Chassis	50 mmf	Turn Rotor to 1400 KC Index Line. See Note A	Antenna (C-24)

MONTGOMERY WARD

MODEL 74WG-2002A

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 AC 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 of Plus or Minus 25% are usually permissible.

SIGNAL GENERATOR				INPUT FOR 50 MILLIWATT OUTPUT
Frequency	Coupling Capacitor	Connection to Receiver	Ground Connection	
1000 kc	200 mmf or RMA Dummy Antenna	Loop Antenna— External antenna clip	Chassis	19.5 microvolts
1000 kc	.05 mf.	12SA7 Mixer—Pin 8	Point "X" (12SK7 Pin 3)	150 microvolts
455 kc	.05 mf.	12SA7 Mixer—Pin 8	Same as above	100 microvolts
455 kc	.05 mf.	12SF7 I-F—Pin 2	Same as above	3500 microvolts
400 cycles	.05 mf.	12SJ7 1st A—Pin 4	Same as above	.042 volt
400 cycles	.05 mf.	35L6GT Output—Pin 5	Same as above	1 volt

Ref. No.	Part No.	Description	Qty. Used in Set
CAPACITORS			
C-1	D67102	.001 mf 400 V Tubular	1
C-3A	26A402	Gang Condenser and Pulley Assembly	1
C-3B			
C-4	47X476	100 mmf Molded	2
C-12			
C-5	47X446	47 mmf Molded	1
C-6	Part of C-3		
C-7	Part of T-3 1st I-F Transformer		
C-8	Part of T-3 1st I-F Transformer		
C-9	B66503	.05 mf 200 V Tubular	1
C-10	Part of T-4 2nd I-F Transformer		
C-11	Part of T-4 2nd I-F Transformer		
C-13	47X463	47 mmf Molded	1
C-14	B67403	.04 mf 200 V Tubular	1
C-15	B67602	.006 mf 200 V Tubular	1
C-16	B66104	.1 mf 200 V Tubular	1
C-17	47X467	470 mmf Molded	1
C-18	B66103	.01 mf 200 V Tubular	1
C-21			
C-19	B67253	.025 200 V Tubular	1
C-20A	45X345	20 mf 25 V } 3 Section	1
C-20B		50 mf 150 V } Dry	
C-20C	50 mf 150 V } Electrolytic	1	
C-22	B67204	.2 mf 200 V Tubular	1
C-23	D67104	.1 mf 400 V Tubular	1
C-24	17A123	1.5-12 mmf Trimmer	1
C-26	B64102	.001 mf 200 V Tubular	1
C-27	B64803	.08 mf 200 V Tubular	1
C-28	B67503	.05 mf 200 V Tubular	1

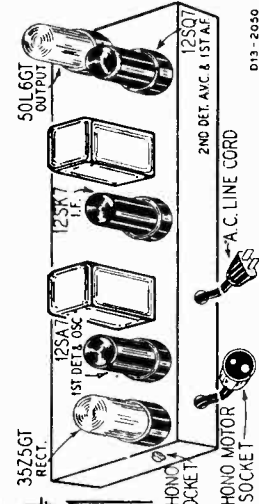
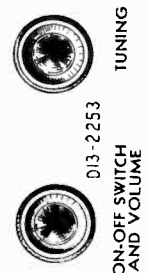
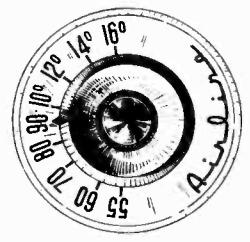
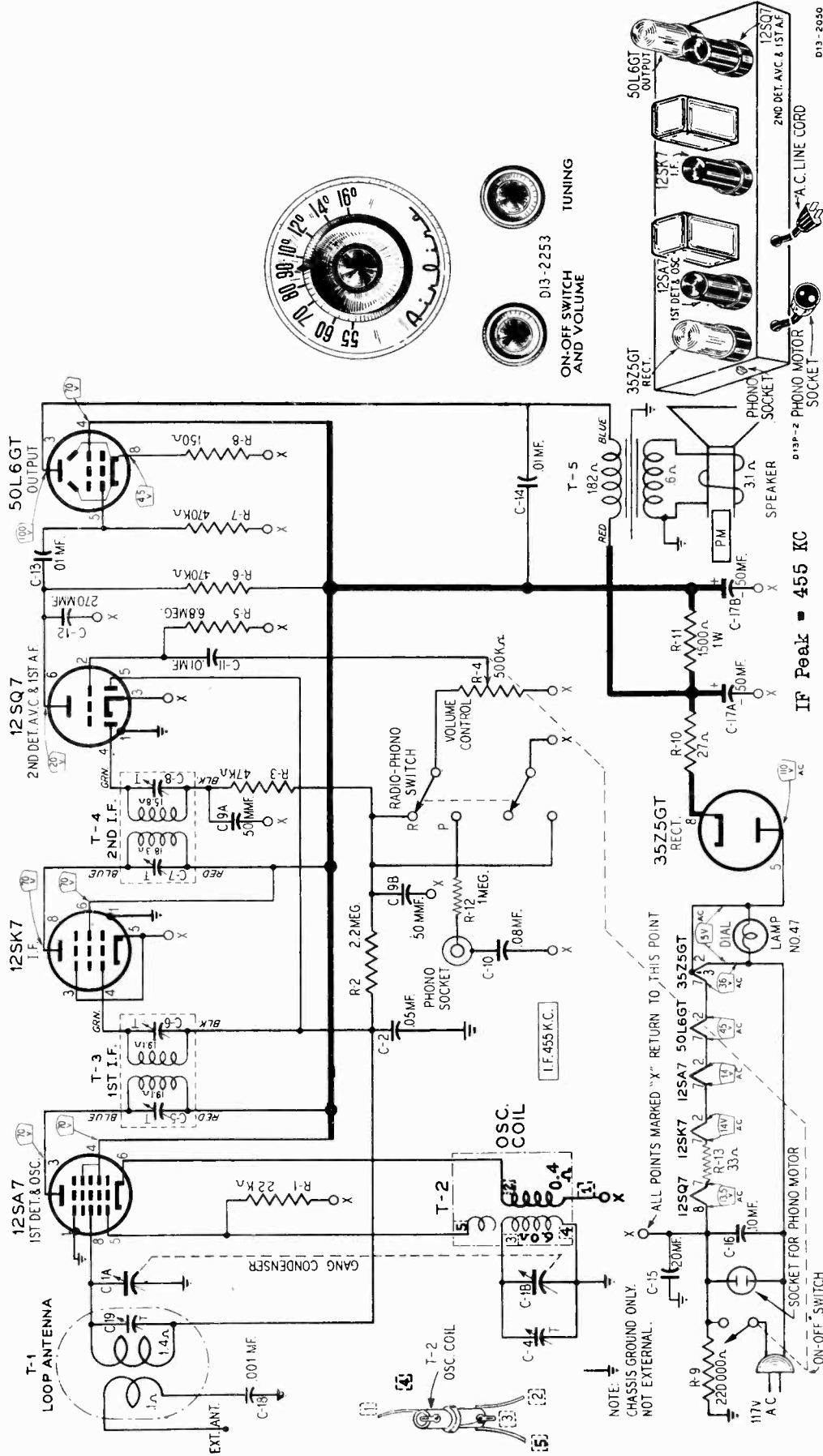
RESISTORS			
		Ohms	Watts
R-1	B84332	3300	0.5 Carbon
R-2	B85104	100 K	0.5 Carbon
R-18			
R-3	B84393	39 K	0.5 Carbon
R-4	B85225	2.2 meg	0.5 Carbon
R-5	B85473	47 K	0.5 Carbon
R-6	36X347	500 K	Volume Control & Switch
R-7	B84153	15 K	0.5 Carbon
R-8	B85475	4.7 meg	0.5 Carbon
R-9	B84474	470 K	0.5 Carbon
R-10	B84333	33 K	0.5 Carbon
R-11	B84823	82 K	0.5 Carbon
R-12	B85474	470 K	0.5 Carbon
R-13	B83181	180	0.5 Carbon
R-14	B84274	270 K	0.5 Carbon
R-15	D84390	39	2.0 Carbon
R-16	B84270	27	0.5 Carbon
R-17	C84152	1500	1.0 Carbon
R-20	B85471	470	0.5 Carbon

Ref. No.	Part No.	Description	Qty. Used in Set
TRANSFORMERS AND COILS			
T-1	26A461	"B" Range Loop Antenna Assembly	1
T-2	9A1805	Oscillator Coil Assembly	1
T-3	9A1775	1st I-F Transformer and Can Assembly	1
T-4	9A1776	2nd I-F Transformer and Can Assembly	1
T-5	51X116	Output Transformer	1

DIAL AND DRIVE ASSEMBLY			
6X21	Rubber Grommet	} Gang Cond. Mtg.	3
20X329	Cond. Cushion Stud		
58X679	Dial		1
30X518	Dial Clamp, Upper		1
30X519	Dial Clamp, Lower		1
26A446	Pointer Bracket Assembly		1
41X81	Dial Light Diffuser		1
15X217	Pointer		1
25X1398	Pilot Light Bracket		1
7A196	Pilot Light Socket Assembly		1
	No. 47 Pilot Light Bulb		1
26X464	Drive Shaft		1
19X192	"C" Washer		2
10X44	Drive Cord		1
28X95	Drive Cord Tension Spring		1

MISCELLANEOUS			
12A437	4" x 6" speaker with mounting bracket		1
	Cone and voice coil assembly (specify part number and letters stamped on speaker)		1
3A303	Tube socket—octal (8 prong) molded		5
3A421	Tube socket with shield		1
3A305	Phono socket—single pin tip		1
3A422	Phono motor socket		1
2A357	Radio-phonograph switch		1
10A297	Knob, volume control and line switch, tuning		2
10A582	Knob, radio-phonograph		1
13X328	Line cord and plug assembly		1

TYPE G-28A115 RECORD CHANGER PARTS			
G-56-72092	Motor, 60 cycle, 117V		
G-56-72096	Motor, 60 cycle, 117V		
Astotic L-75	Crystal cartridge		
G-25-72438	50 cycle adaptor bushing		
G-33-72435	50 cycle adaptor spring bushing		
G-33-72436	50 cycle adaptor spring bushing		



Selectivity.....55.5 KC broad at 1000 times signal, 1000 KC

Sensitivity (for .05 watt output) with external antenna.....25 microvolts average

Power Output.....1.5 watts maximum, .9 watt (10% distortion)

Loud speaker.....5" PM dynamic

Voice coil impedance.....3.2 ohms at 400 cycles

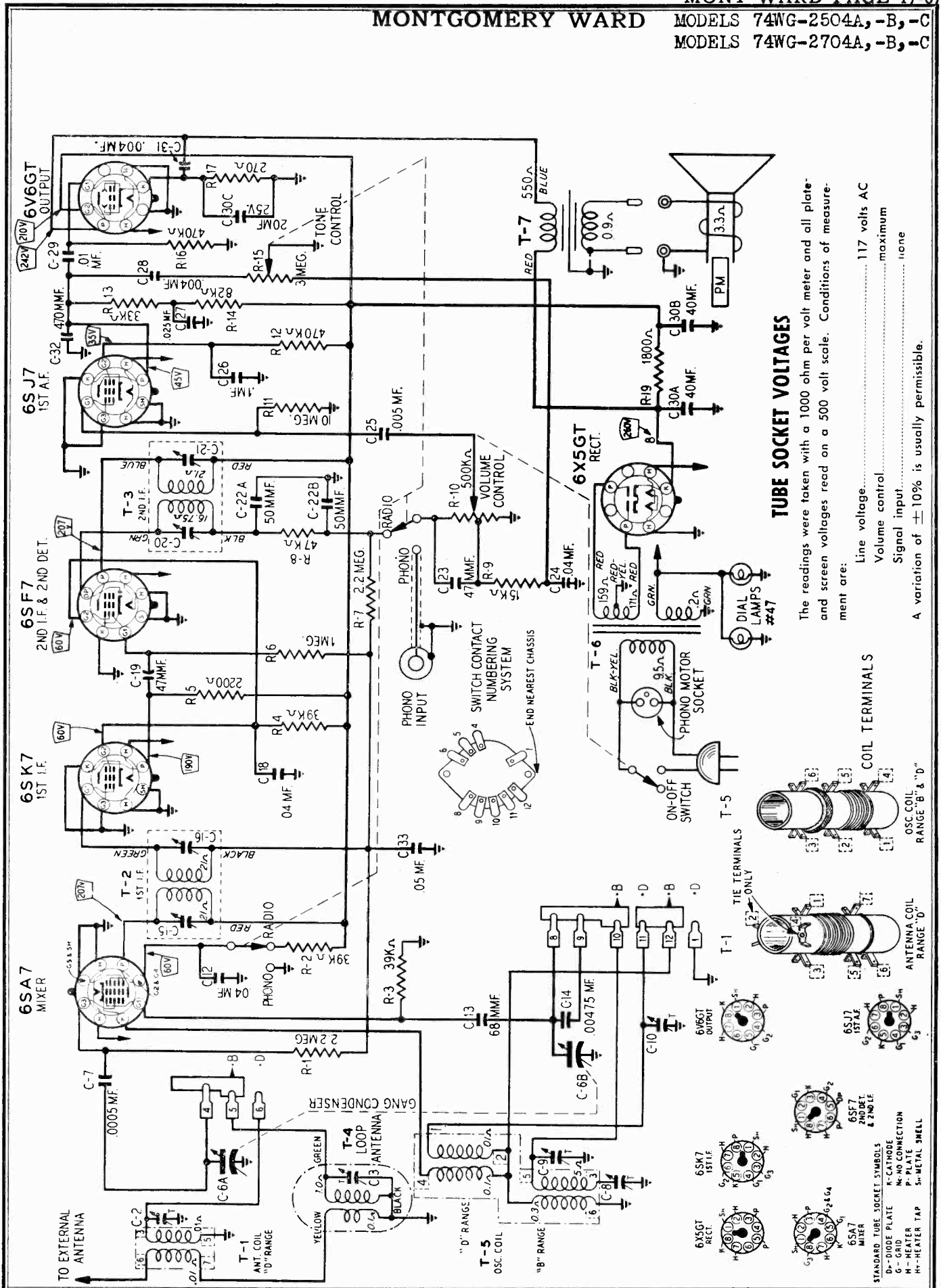
ELECTRICAL SPECIFICATIONS

Power Supply.....105-125 volts AC—60 cycles—30 watts (42 watts Phono Operating)

Frequency Range.....540 to 1600 KC

IF Peak = 455 KC

NOTE: CHASSIS GROUND ONLY. NOT EXTERNAL.

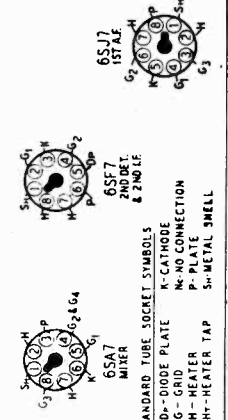
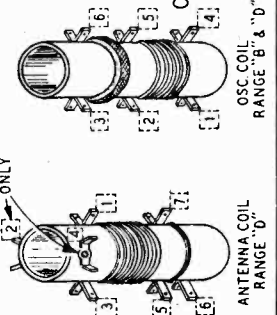


TUBE SOCKET VOLTAGES

The readings were taken with a 1000 ohm per volt meter and all plate and screen voltages read on a 500 volt scale. Conditions of measurement are:

Line voltage.....	117 volts AC
Volume control.....	maximum
Signal input.....	1000 microvolts
A variation of ±10% is usually permissible.	

COIL TERMINALS



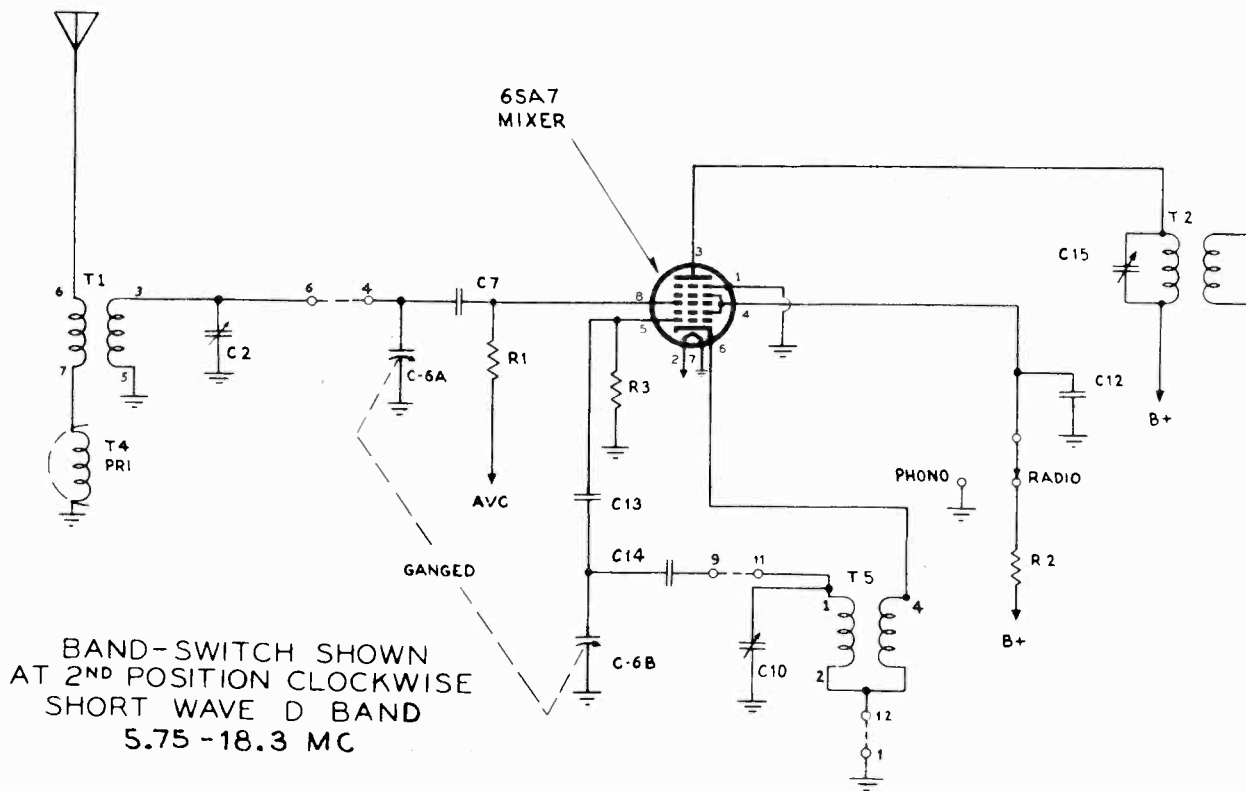
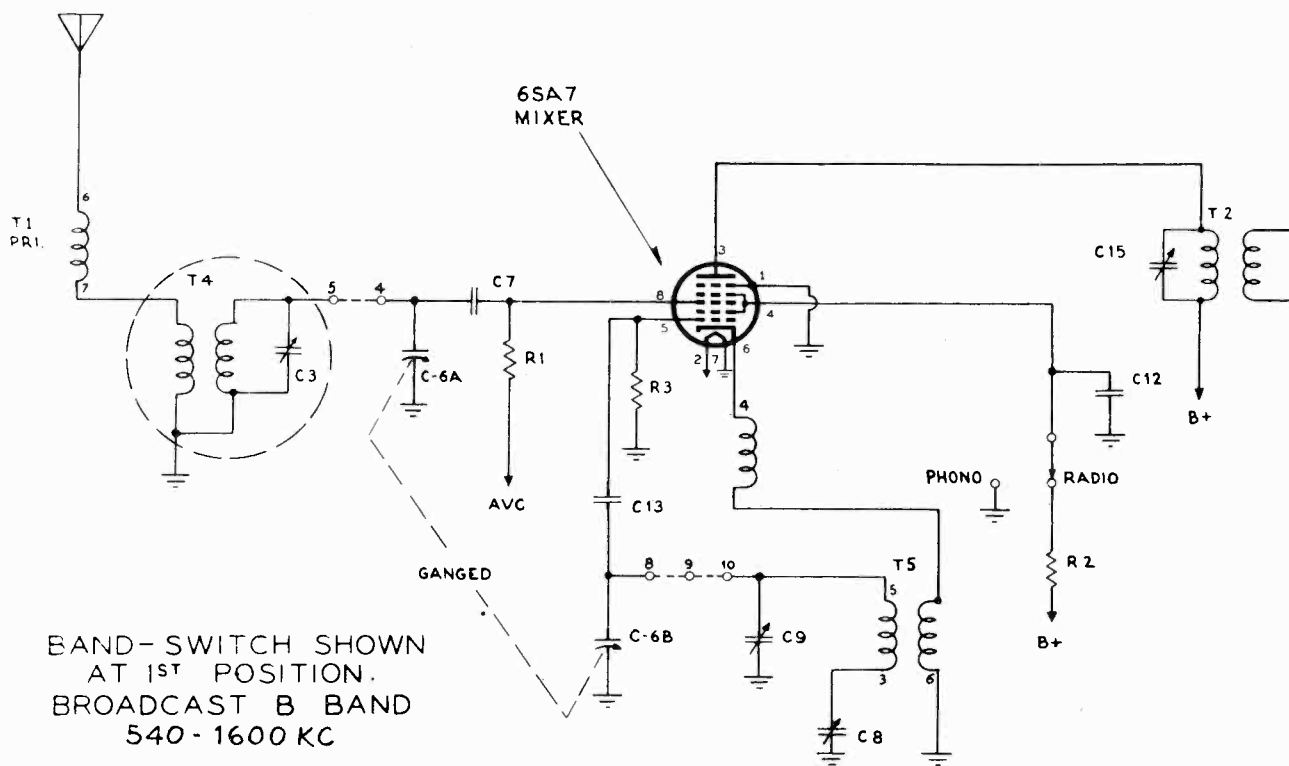
"clarified schematics"

PAGE 17-68 MONT WARD

MODELS 74WG-2504A, -B, -C

MONTGOMERY WARD

MODELS 74WG-2704A, -B, -C

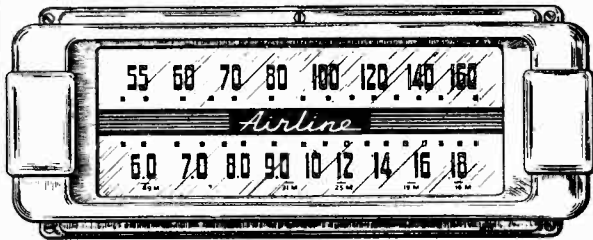


MONTGOMERY WARD

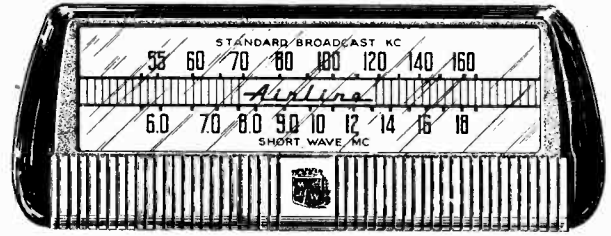
MODELS 74WG-2504A, -B, -C

MODELS 74WG-2704A, -B, -C

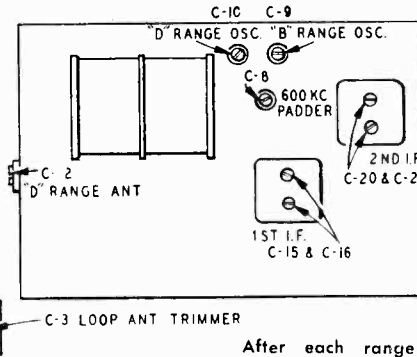
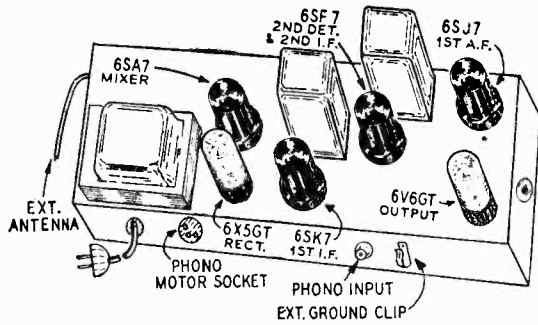
2504A, 2704A



186-2258



2504C, 2704C



ALIGNMENT PROCEDURE

Volume Control—Maximum All Adjustments.

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

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

The following equipment is required for aligning:

An All Wave Signal Generator which will provide an accurately calibrated signal at the test frequencies as listed.

Output Indicating Meter; Non-Metallic Screwdriver.

Dummy Antennas—.1 mf., 50 mmf., and 400 ohms.

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

NOTE A—If the pointer is not at 1400 KC on the dial, re-set pointer at the 1400 KC mark on the dial scale.

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

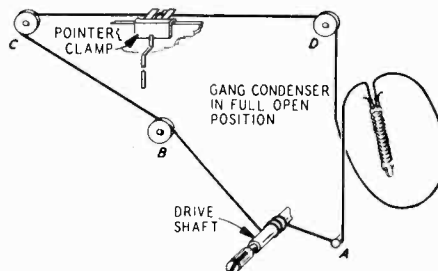
	SIGNAL GENERATOR		Dummy Antenna	Band Switch Setting	CONDENSER SETTING	ADJUST TRIMMERS TO MAXIMUM
	Frequency Setting	Connection at Radio				
I-F	455 kc	6SA7, Pin 8	.1 mf	B Range	Turn Rotor to Full Open	2nd I-F (C-20) & (C-21) 1st I-F (C-15) & (C-16)
RANGE B	1620 kc	Antenna Lead	50 mmf	B Range	Turn Rotor to Full Open	Oscillator Range B (C9)
	1400 kc	Antenna Lead	50 mmf	B Range	Tune Rotor to Max. Output. Set Indicator to 1400 KC. See Note A	Antenna Range B (C3)
	600 kc	Antenna Lead	50 mmf	B Range	Tune Rotor to Max. Output	600 kc (C8) Rock Rotor—See Note B
Repeat above oscillator adjustments at 1620 and 600 KC until readjusting the oscillator Range B Trimmer (C9) causes no further improvement in output.						
RANGE D	18.3 mc	Antenna Lead	400 Ohm	D Range	Turn Rotor to Full Open	Oscillator Range D (C10)
	16 mc	Antenna Lead	400 Ohm	D Range	Tune Rotor to Max. Output	Antenna Range D (C2) Rock Rotor—See Note B
LOOP RANGE B	Reassemble chassis in cabinet.					
	1400 kc	Antenna Lead	50 mmf	B Range	Tune Rotor to Max. Output	Antenna Range B (C3)

MODELS 74WG-2504A,-B,-C
 MODELS 74WG-2704A,-B,-C

MONTGOMERY WARD

Operating Voltages--Chassis for Models 2504C and 2704C are available for operation on the following power supply:

105-125 volts AC, 50-60 cycles.



GENERAL DESCRIPTION

This model is a five tube (plus rectifier tube) AC console receiver with automatic record changer. Controls are provided for tuning, volume, tone, and band selection. The dial scale is calibrated in two bands, the broadcast band in channel numbers to cover frequencies between 540-1600 KC and the short wave band directly in megacycles from 5.75 to 18.3 MC. Other features include a built-in Air Wave Aerial, automatic volume control, beam power audio output stage and a PM dynamic speaker. A switch is provided on the tone control for selection of either radio or phono operation. This applies to Models 2504A, B, and C with the exception that the latter have no record changers.

ELECTRICAL SPECIFICATIONS

- Frequency Range.....B range—540-1600 KC
 D range—5.75 to 18.3 MC
- Intermediate Frequency.....455 KC
- Selectivity.....40 KC broad at 1000 times signal,
 1000 KC
- Sensitivity.....(for .5 watt output) with external antenna
 B range—9 microvolts average
 D range—20 microvolts average
- Power Output.....4 watts maximum
 2.3 watts, 10% distortion
- Loud Speaker.....10" PM dynamic
- Voice Coil Impedance.....3.2 ohms at 400 cycles
- Record Changer.....See Manual No. 5050
- Tube and Dial Light Complement**
 - 1 6SA7 Mixer
 - 1 6SK7 1st I-F Amplifier
 - 1 6SF7 2nd I-F Amplifier & 2nd Det.
 - 1 6SJ7 1st A-F Amplifier
 - 1 6V6GT Power Output
 - 1 6X5GT Rectifier
 - 2 No. 47 Dial Lamps

2504A, 2704A DRIVE CORD REPLACEMENT

Turn the gang condenser to the fully open position. Use a new 10X63 drive cord assembly or a piece of cord 48 inches long and tie one end to the tension spring. Hook the other end of the tension spring to the tab on the drive pulley. Pass the cord through the slot in the drive pulley rim around idler stud A and wind three and one-half turns clockwise around the tuning shaft (turns must progress away from chassis). Then pass cord over idler pulley B and around pulleys C and D. Wrap cord counterclockwise around drive pulley, stretch tension spring and tie free end of cord to spring.

2504C, 2704C DRIVE CORD REPLACEMENT

Turn the gang condenser to the fully open position. Use a new 10X65 drive cord assembly or a piece of cord 48 inches long and tie one end to the tension spring. Hook the other end of the tension spring to the tab on the drive pulley. Pass the cord through the slot in the drive pulley rim around idler stud A and wind three and one-half turns clockwise around the tuning shaft (turns must progress away from chassis). Then pass cord over idler pulleys B and C. Wrap cord counterclockwise around drive pulley, stretch tension spring and fasten free end of cord to spring.

Operating Voltages--Chassis for Models 2504A and 2704A are available for operation on the following power supply:

105-125 volts, AC, 60 cycles

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 .5 watt. 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

1.26 volts across this resistor will be equivalent to a .5 watt output with the speaker connected. 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 of Plus or Minus 25% are usually permissible.

SIGNAL GENERATOR

Frequency	Coupling Capacitor	Connection to Receiver	Ground Connection	INPUT FOR .5 WATT OUTPUT
1000 kc	200 mmf or RMA Dummy Antenna	External antenna lead	Chassis	9 microvolts
1000 kc	.05 mf	6SA7 Mixer, Pin 8	Same as above	42 microvolts
455 kc	.05 mf	6SA7 Mixer, Pin 8	Same as above	40 microvolts
455 kc	.05 mf	6SK7 1st I-F, Pin 4	Same as above	1075 microvolts
455 kc	.05 mf	6SF7 2nd I-F, Pin 2	Same as above	3900 microvolts
400 cycles	.05 mf	6SJ7 1st A-F, Pin 4	Same as above	.08 volt
400 cycles	.05 mf	6V6GT Output, Pin 5	Same as above	3.75 volts

MONTGOMERY WARD

MODELS 74WG-2504A, -B, -C

MODELS 74WG-2704A, -D, -C

2504C, 2704C

2504B,C REPLACEMENT PARTS LIST 2704B,C

Ref. No.	Part No.	Description	Qty. Used in Set	Part No.	Ref. No.	Description	Qty. Used in Set
CAPACITORS							
C-2	17A164	5-50 mmf Trimmer	1	R-10	36X358	500 K	1
C-3	17A235	2-24 mmf Trimmer	1	R-11	885106	10 meg.	1
C-6A	14A196	Gang Condenser with Drive Pulley	1	R-12	885474	470 K	2
C-6B	866501	.0005 mf 200 V Tubular	1	R-13	884333	33 K	1
C-7	17A155	350-430 mmf Trimmer	1	R-14	884823	82 K	1
C-8	17A109	2.5-35 mmf Dual Trimmer	1	R-15	40X276	3.0 meg.	1
C-9	D66403	.04 mf 400 V Tubular	2	R-17	C84271	270	1
C-10	47X466	68 mmf Moulded Tubular	1	R-19	D84182	1800	1
C-13	46X289	.00475 mf Part of T-2 (1st I-F Coil Assy.)	1	TRANSFORMERS AND COILS			
C-14	47X463	47 mmf Moulded	2	T-1	9A1917	"D" Range Antenna Coil Assembly	1
C-15	47X112	50-50 mmf Dual Mica	1	T-2	9A1814	1st I-F Coil Assembly	1
C-16	D64403	.04 mf 400 V Tubular	1	T-3	9A1815	2nd I-F Coil Assembly	1
C-17	D66502	.005 mf 400 V Tubular	1	T-4	26A474	"B" Range Loop Antenna Assembly	1
C-18	D67104	.10 mf 400 V Tubular	1	T-5	9A1918	"B" & "D" Range Oscillator Coil Assembly	1
C-19	D64253	.025 mf 400 V Tubular	1	T-6	53X282	117 Volt, 60 Cycle, Standard Power Transformer	1
C-20	D66402	.004 mf 400 V Tubular	1	T-7	51X134	Output Transformer	1
C-21	D66103	.01 mf 400 V Tubular	1	DIAL AND DRIVE ASSEMBLY			
C-22A	45X346	40 mf 450 V Electrolytic	1	6X21		Rubber Grommet } Mtg. Gang	3
C-22B	20 mf 25 V Electrolytic	1	20X329		Cond. Cushion Stud } Cond.	3	
C-23	H66402	.004 mf 800 V Tubular	1	26X485		Drive Shaft	1
C-30	47X467	.470 mmf Moulded Tubular	1	19X192		"C" Washer (for Drive Shaft)	2
C-30A	866503	.05 mf 200 V Tubular	1	RESISTORS			
C-30B				OHMS			
C-30C				WATTS			
C-31	B85225	2.2 meg.	2	R-1		0.5	Carbon
C-32	C84393	39 K	2	R-2		1.0	Carbon
C-33	B84393	39 K	1	R-3		0.5	Carbon
	B84222	2200	1	R-4		0.5	Carbon
	B85105	1 meg.	1	R-5		0.5	Carbon
	B85473	47 K	1	R-6		0.5	Carbon
	B84153	15 K	1	R-7		0.5	Carbon
				R-8		0.5	Carbon
				R-9		0.5	Carbon
This list applies also to Models 2504A and 2704A with the exception that the description of capacitor C-31 should read: C-31 F66402 .004 mf 600 V Tubular							

DIAL AND DRIVE ASSEMBLY

S-58X13	Dial Bracket Assembly (including Dial Bracket, Idler Pulley, Rivets, and Dial Glass)	1
15X241	Pointer	1
28X113	Drive Cord Tension Spring	1
10X65	Drive Cord Assembly	1
7A199	Pilot Light Socket Assembly	1
7A103	No. 47 Pilot Light Bulb	2
58X696	Dial Glass	1
4X999	Escutcheon	1

MISCELLANEOUS

10A644	Knob (Tuning)	1
10A645	Knob (Off-On Volume)	1
10A646	Knob (SW-BC)	1
10A643	Knob (Tone-R.P.)	1

CAPACITORS 2504A, 2704A

D67204	.2 mf 400 V Tubular	1
C-35		

DIAL AND DRIVE ASSEMBLY

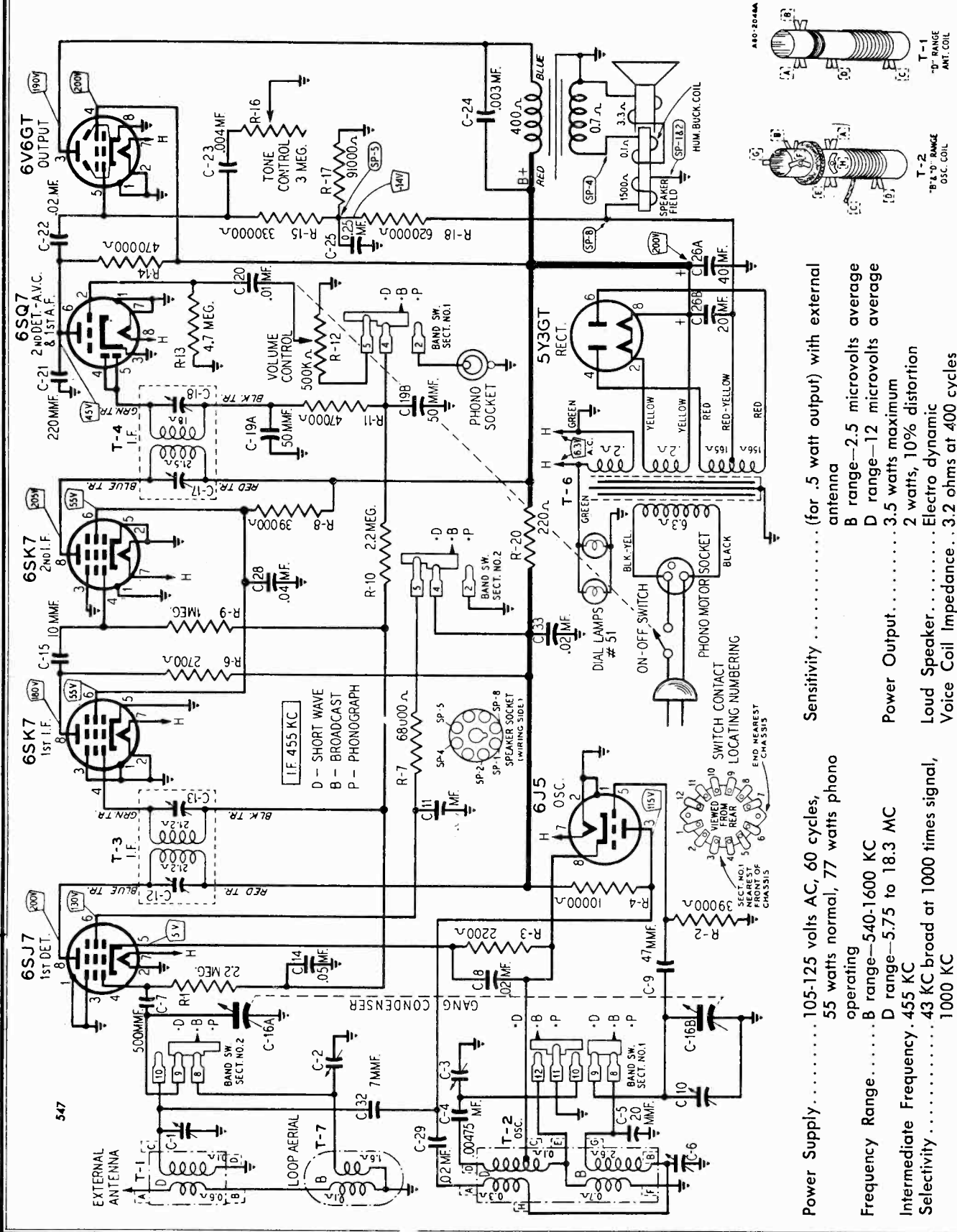
26A473	Dial Bracket Assembly (including Dial Bracket, Idler Pulley, Rivets, and Dial Background)	1
15X190	Pointer	1
28X113	Drive Cord Tension Spring	1
10X63	Drive Cord Assembly	1
7A214	Pilot Light Socket Assembly	1
58X690	No. 51 Pilot Light Bulb	2
4X962	Dial Glass	1
	Escutcheon	1

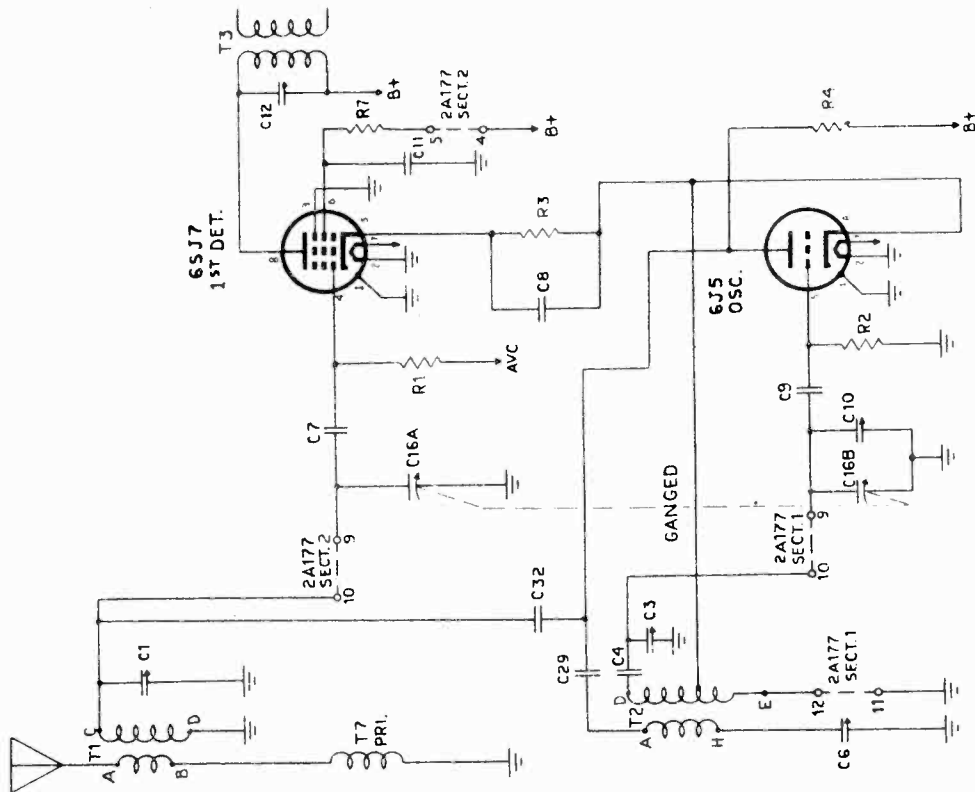
MISCELLANEOUS

10A604	Knob (Tuning)	1
10A605	Knob (Off-On Volume)	1
10A606	Knob (SW-BC)	1
10A581	Knob (Tone-R.P.)	1

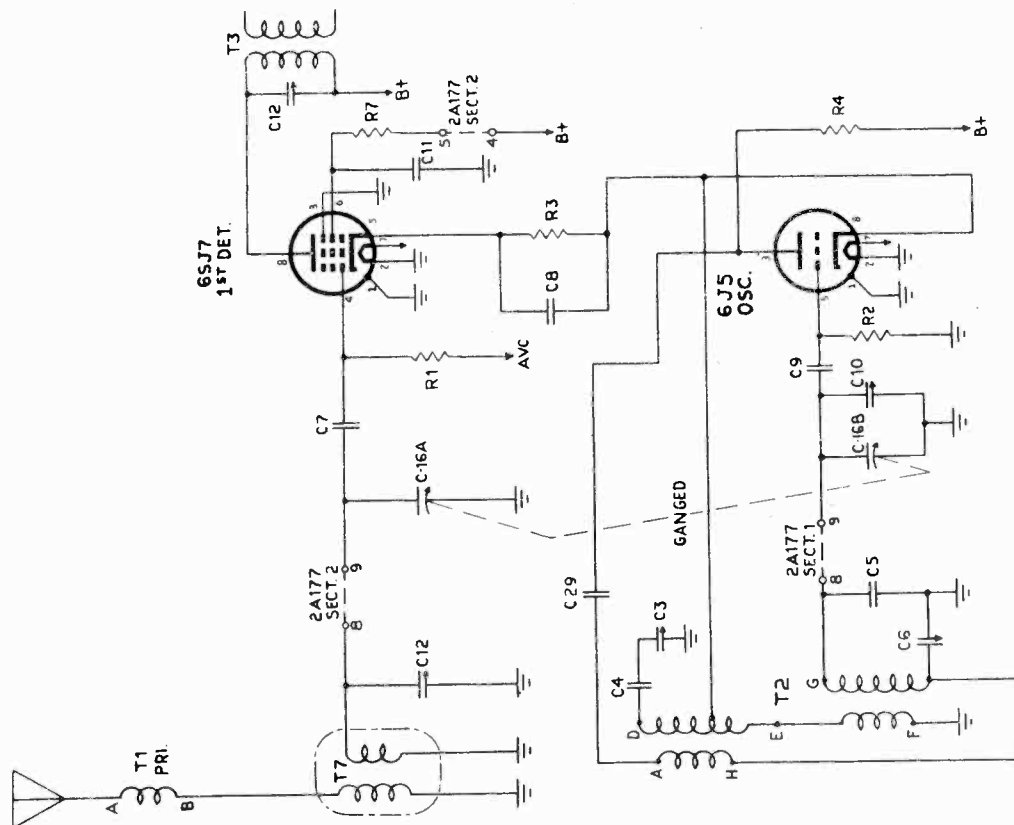
2704A, 2704B, 2704C
TYPE V-28A139 RECORD CHANGER PARTS

V-961-B	Motor Assembly, 60 cycles, 115-120 V	1
Shure P30-1	Crystal Cartridge and Semi-Permanent Needle Assembly	1
	Semi-Permanent Needle	1
	(Specify part number and letters stamped on crystal)	





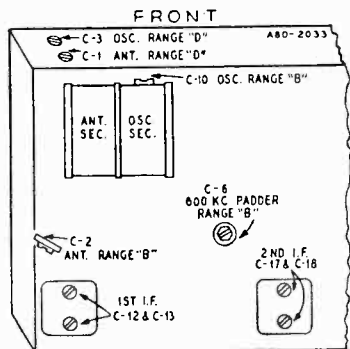
BAND-SWITCH SHOWN AT 2ND POSITION. D RANGE 571 - 18.3 MC



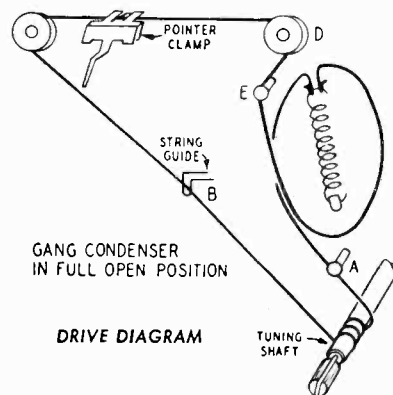
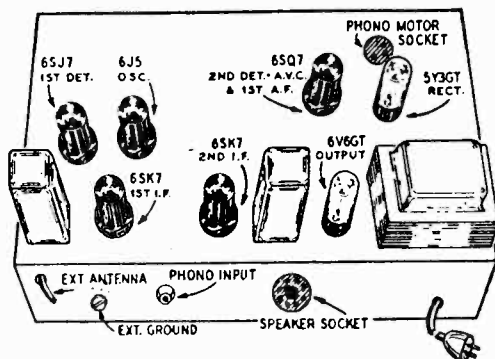
BAND-SWITCH SHOWN AT 1ST POSITION. B RANGE 540 - 1600 KC

DRIVE CORD REPLACEMENT

Turn the gang condenser to the fully open position. Use a new 10X64 drive cord or a piece of cord 46" long and tie one end to the tension spring. Hook the other end of the tension spring to the tab on the drive pulley. Pass the cord through the slot in the drive pulley rim and continue one half turn counterclockwise around the drive pulley. Then pass the cord around idler stud A and wind three turns clockwise around the tuning shaft (turns must progress away from chassis). Pass cord through string guide B, over pulleys C and D and around idler stud E. Wrap 3/4 turn counterclockwise around drive pulley, stretch the tension spring and tie free end of the cord to spring.



TRIMMER POSITIONS



ALIGNMENT PROCEDURE

Volume Control—Maximum All Adjustments.
Connect Radio Chassis to Ground Post of Signal Generator with a Short Heavy Lead.
Allow Chassis and Signal Generator to "Heat Up" for several minutes.

The following equipment is required for aligning:
An All Wave Signal Generator which will provide an accurately calibrated signal at the test frequencies as listed.
Output Indicating Meter; Non-Metallic Screwdriver.
Dummy Antennas—.1 mf., 100 mmf., and 400 ohms.

	SIGNAL GENERATOR		Dummy Antenna	Band Switch Setting	Condenser Setting	ADJUST TRIMMERS TO MAXIMUM
	Frequency Setting	Connection at Radio				
I-F	455 kc	6SJ7, Pin 4	.1 mf	B Range	Turn Rotor to Full Open	2nd I-F (C17) & (C18) 1st I-F (C12) & (C13)
RANGE B	1600 kc	Antenna Lead	100 mmf	B Range	Turn Rotor to Full Open	Oscillator Range B (C10)
	1400 kc	Antenna Lead	100 mmf	B Range	Turn Rotor to Max. Output Set Indicator to 1400 KC See Note A	Antenna Range B (C2)
	600 kc	Antenna Lead	100 mmf	B Range	Turn Rotor to Max. Output	600 kc (C6) Rock Rotor—See Note B

Repeat above oscillator adjustments at 1600 and 600 kc until readjusting the oscillator Range B Trimmer (C10) causes no further improvement in output.

RANGE D	18,300 kc	Antenna Lead	400 Ohm	D Range	Turn Rotor to Full Open	Oscillator Range D (C3)
	17,000 kc	Antenna Lead	400 Ohm	D Range	Turn Rotor to Max. Output	Antenna Range D (C1) Rock Rotor—See Note B
LOOP RANGE B	Reassemble chassis in cabinet. 1400 kc	Antenna Lead	100 mmf	B Range	Turn Rotor to Max. Output	Antenna Range B (C2)

After each range is completed, repeat the procedure as a final check.
NOTE A—If the pointer is not at 1400 KC on the dial, re-set

pointer at the 1400 KC mark on the dial scale.
NOTE B—Turn the rotor back and forth and adjust the trimmer until the peak of greatest intensity is obtained.

MONTGOMERY WARD

MODEL 74WG-2709A

TRANSFORMERS AND COILS

9A1451	Antenna transformer assembly "D" range	1
9A1452	Oscillator coil assembly	1
9A1810	1st I-F Transformer and can assembly	1
9A1811	2nd I-F Transformer and can assembly	1
51X97	Output transformer	1
53X235	117 volt, 60 cycle standard power transformer	1
9A1395	"B" Band loop antenna	1

MISCELLANEOUS

12A455	10" Electro dynamic speaker	1
3A303	Tube Socket—octal (8 prong) molded	7
3A293	Speaker socket—octal (8 prong) molded	1
3A304	Phono motor socket	1
3A305	Single pin-tip socket (phono)	1
10A530	Knob (Volume control)	1
10A531	Knob (Tuning)	1
10A532	Knob (Tone control)	1
10A533	Knob (Band change)	1
13X328	Line cord and plug assembly	1
2A177	Band and phono switch	1
8X99	Rubber chassis cushions (chassis to cabinet)	4

DIAL AND DRIVE ASSEMBLY

25X839	Gang mounting bracket	1
6X26	Rubber grommets } Mounting gang	4
20X347	Con. cushion studs } condenser and	4
19X432	Flat washer } bracket to chassis	4
26A382	Pulley Mtg. Plate Assem. Complete with idler pulleys, idler studs, brace bracket, string guide and dial background	1
58X593	Dial scale glass	1
30X475	Glass clamp	2
4X871	Dial escutcheon	1
15X225	Pointer	1
10X64	Drive cord	1
28X113	Drive cord tension spring	1
26X336	Drive shaft	1
25X580	Drive shaft bracket	1
19X192	"C" washers for drive shaft	2
7A142	Pilot light socket assembly	2
	Dial lamp (No. 51)	2
41X75	Light shield	2

TYPE V-28A139 RECORD CHANGER PARTS

V-961-B Motor Assembly, 60 cycle 115-120 V.
Shure P30-1 Crystal Cartridge and Semi-Permanent Needle Assembly

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 .5 watt. 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 1.26 volts across this resistor will be equivalent to a .5 watt 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 of Plus or Minus 25% are usually permissible.

Frequency	Coupling Capacitor	Connection to Receiver	Ground Connection	INPUT FOR .5 WATT OUTPUT
1000 kc	200 mmf or RMA Dummy Antenna	External antenna lead	Chassis	2.3 microvolts
1000 kc	.05 mf	6SJ7 1st Detector, Pin 4	Same as above	17 microvolts
455 kc	.05 mf	6SJ7 1st Detector, Pin 4	Same as above	13.0 microvolts
455 kc	.05 mf	6SK7 1st I-F, Pin 4	Same as above	1300 microvolts
455 kc	.05 mf	6SK7 2nd I-F, Pin 4	Same as above	3400 microvolts
400 cycles	.05 mf	6SQ7 1st A-F, Pin 2	Same as above	.07 volt
400 cycles'	.05 mf	6V6GT Output, Pin 5	Same as above	3.8 volts

SIGNAL GENERATOR

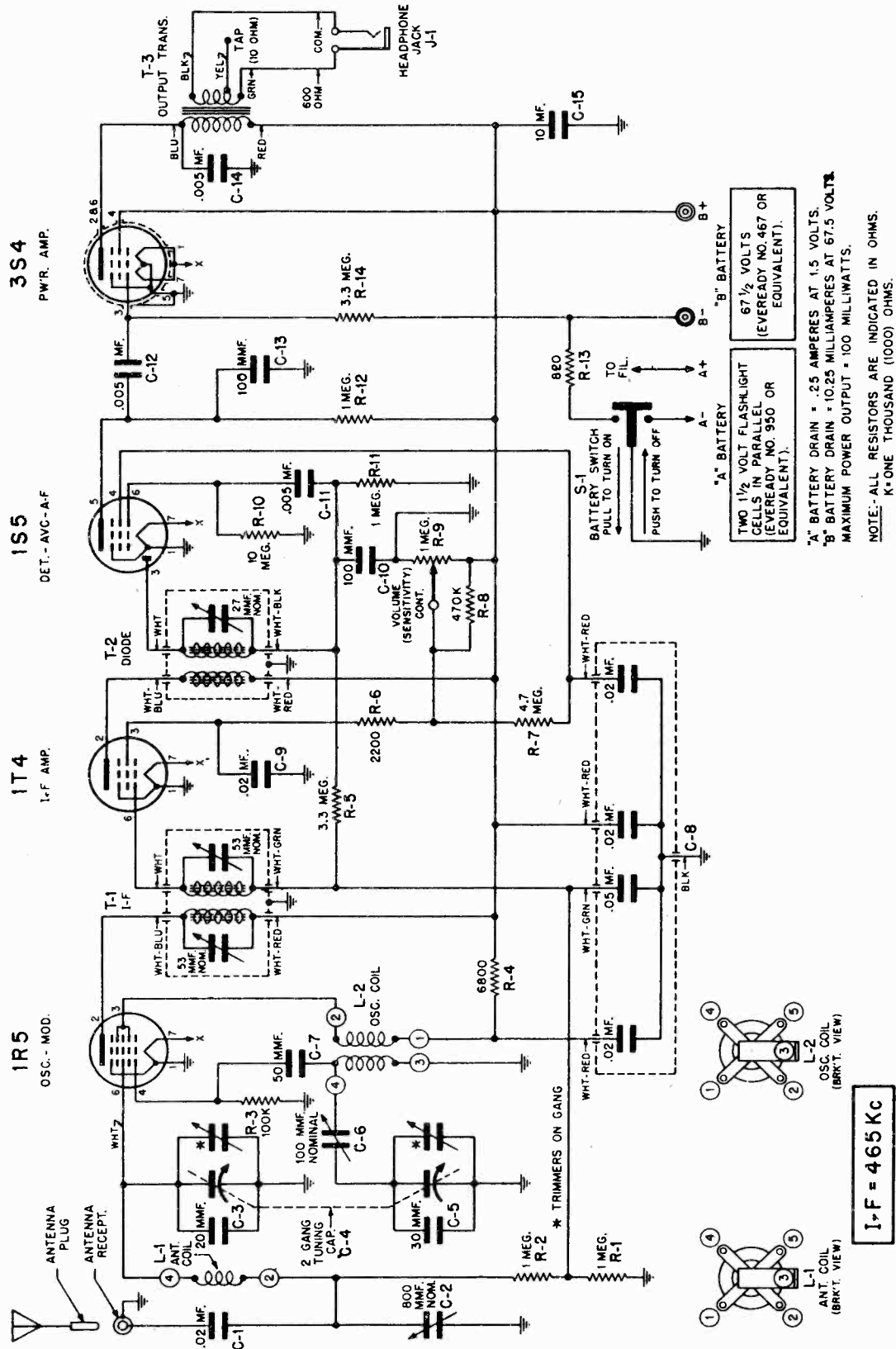
Qty. Used in Set, Ref. No., Part No., Description, Qty. Used in Set

CAPACITORS

C-1	17A163	2-25 mmf Ant. "D" Range Trimmer	1	C-25	B66254	.25 mf	200 V	Tubular	1
C-2	17A149	2-25 mmf Osc. "D" Range Trimmer	1	C-26A	45X277	40 mf	400 V	Dry electrolytic	1
C-3	46X289	1.8-12 mmf Loop aerial trimmer	1	C-26B	45X277	20 mf	450 V		
C-4	47X482	.00475 mf 180 V Tubular	1	C-32	47X182	7 mmf		Ceramic	1
C-5	17A234	20 mmf Molded	1						
C-6	D67501	300-450 mmf 600 kc Padder	1						
C-7	866203	.0005 mf 400 V Tubular	1						
C-8	47X463	.02 mf 200 V Tubular	2						
C-9	D66403	47 mmf Molded	1	R-1	885225	2.2 meg.	0.5	Carbon	2
C-10		Part of gang condenser C-16	1	R-10	884393	39,000	0.5	Carbon	1
C-11		.04 mf 400 V Tubular	2	R-2	884222	2200	0.5	Carbon	1
C-12		Part of 1st I-F Assembly	1	R-3	884103	10,000	1.0	Carbon	1
C-13		.05 mf 200 V Tubular	1	R-4	884272	2700	0.5	Carbon	1
C-14	47X477	10 mmf Molded	1	R-6	884683	68,000	0.5	Carbon	1
C-15	14A150	Gang condenser assembly	1	R-7	884393	39,000	1.0	Carbon	1
C-16		Part of 2nd I-F Assembly	1	R-8	885105	1.0 meg.	0.5	Carbon	1
C-17		50 mmf Dual Mica	1	R-9	885473	47,000	0.5	Carbon	1
C-18		.01 mf 200 V Tubular	1	R-11	36X311	500,000		Volume control, ON-OFF switch	1
C-19A		220 mmf Molded	1	R-12	885475	4.7 meg.	0.5	Carbon	1
C-20		.02 mf 400 V Tubular	2	R-13	885474	470,000	0.5	Carbon	1
C-21		.004 mf 200 V Tubular	1	R-14	885334	330,000	0.5	Carbon	1
C-22		.003 mf 400 V Tubular	1	R-15	40X259	3 meg.		Tone control	1
C-23		.004 mf 200 V Tubular	1	R-16	883913	91,000	0.5	Carbon	1
C-24		.003 mf 400 V Tubular	1	R-17	883624	620,000	0.5	Carbon	1
				R-18	885221	220	0.5	Carbon	1

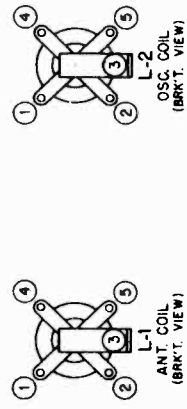
RESISTORS

C-19B	47X112	50 mmf Dual Mica	1	R-19	885475	4.7 meg.	0.5	Carbon	1
C-20	B66103	.01 mf 200 V Tubular	1	R-14	885474	470,000	0.5	Carbon	1
C-21	47X468	220 mmf Molded	1	R-15	885334	330,000	0.5	Carbon	1
C-22	D66203	.02 mf 400 V Tubular	2	R-16	40X259	3 meg.		Tone control	1
C-23	B66402	.004 mf 200 V Tubular	1	R-17	883913	91,000	0.5	Carbon	1
C-24	D66302	.003 mf 400 V Tubular	1	R-18	883624	620,000	0.5	Carbon	1



"A" BATTERY DRAIN = .25 AMPERES AT 1.5 VOLTS
 "B" BATTERY DRAIN = 10.25 MILLIAMPERES AT 67.5 VOLTS
 MAXIMUM POWER OUTPUT = 100 MILLIWATTS.

NOTE: ALL RESISTORS ARE INDICATED IN OHMS.
 K=ONE THOUSAND (1000) OHMS.



I-F = 465 Kc

FREQUENCY RANGE
 200 KC TO 410 KC
 NOTE: ADJUST ANTENNA PADDER (C-2)
 AT APPROX. 220 KC. ON WEAK SIGNAL.

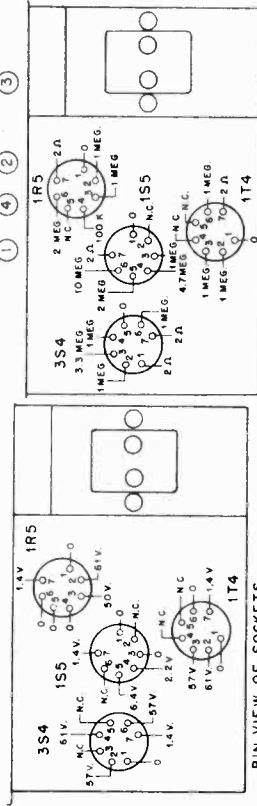
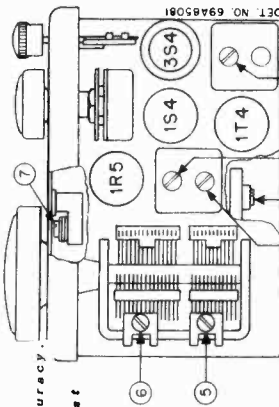
MODEL AR-96-23

ALIGNMENT PROCEDURE

1. Remove chassis from housing.
2. Volume set at maximum for all operations.
3. The adjusting screwdriver or alignment tool should be of the insulated type, such as Motorola Part No. 66A71008.
4. Connect output meter with 600 ohm resistor in parallel across phone jack.

OPERATIONS IN ORDER	GANG CAPACITOR SET AT	DUMMY ANTENNA CONNECTED TO	GENERATOR ANTENNA	ADJUST TRIMMER AT NO.	SET GENERATOR TRIMMER AT	AVERAGE INPUT FOR 5.35V OUTPUT
1	Min.	.1 mf	Osc-Mod Grid	1-2-3	465 Kc	
2	200 Kc	200 mmf	Ant.Recpt.	4	200 Kc	
3	220 Kc	200 mmf	Ant.Recpt.	5	220 Kc	25 uv.
4	400 Kc *	200 mmf	Ant.Recpt.	6	400 Kc	
5	380 Kc	200 mmf	Ant.Recpt.	7	380 Kc	
6	400 Kc *	200 mmf	Ant.Recpt.	6	400 Kc	

Repeat above steps for maximum accuracy.
* Rock gang capacitor until greatest output is obtained.



PIN VIEW OF SOCKETS

PIN VIEW OF SOCKETS

NOTE: VOLTAGE MEASUREMENTS MADE UNDER THE FOLLOWING CONDITIONS:

- 1- 67 1/2 V 'B' BATTERY CONNECTED
- 2- 20/2V 'A' BATTERIES CONNECTED
- 3- VOLUME CONTROL ON FULL
- 4- SWITCH ON
- 5- ANTENNA DISCONNECTED
- 6- USING WESTON MODEL 772 ANALYZER 20,000 OHMS PER VOLT VOLT-METER.

NOTE: VOLTAGE MEASUREMENTS MADE UNDER THE FOLLOWING CONDITIONS:

- 1- BATTERIES DISCONNECTED
- 2- C-15 ELECTROLYTIC DISCONNECTED
- 3- VOLUME CONTROL ON FULL
- 4- SWITCH ON
- 5- USING WESTON MODEL 772 ANALYZER 20,000 OHMS PER VOLT VOLT-METER.
- 6- ANTENNA DISCONNECTED

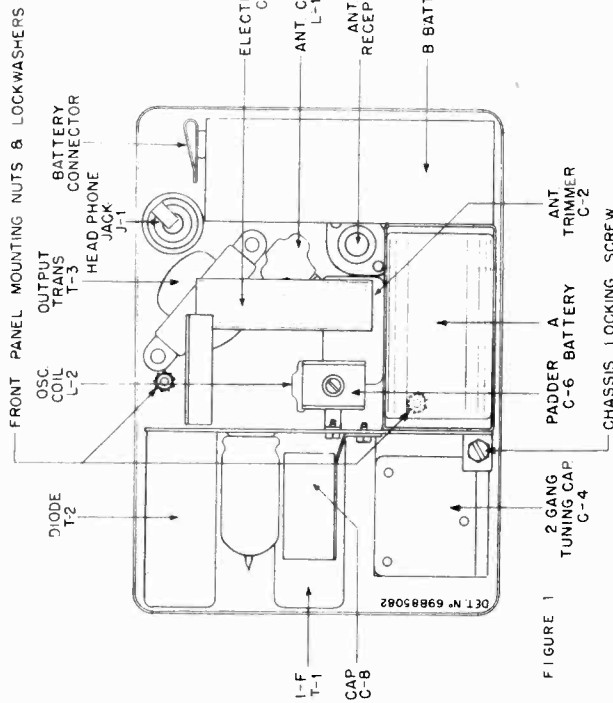


FIGURE 1

REMOVING CHASSIS FROM HOUSING:

1. Unlatch back cover and remove.
 2. Remove 'A' and 'B' batteries.
 3. Remove the three Phillips head screws which fastens the front panel.
 4. Remove chassis locking screw (See figure 1.)
 5. The front panel and chassis may now be removed from the wrap-around housing.
- NOTE:
1. When replacing chassis be sure to place the tube retainer and cardboard packing if removed.
 2. Do not remove tape from housing, as it serves as insulation.

REMOVING CHASSIS FROM FRONT PANEL:

1. The removal of the front panel will ease the replacement of components which are wired to tube sockets.
2. Be sure to make the proper connections when replacing. Refer to the schematic diagram.

REMOVING CHASSIS FROM FRONT PANEL:

1. Remove tuning and volume control knobs; don't lose the two cork washers and spring washer under tuning knob. When replacing, the spring washer is placed between the cork washers.

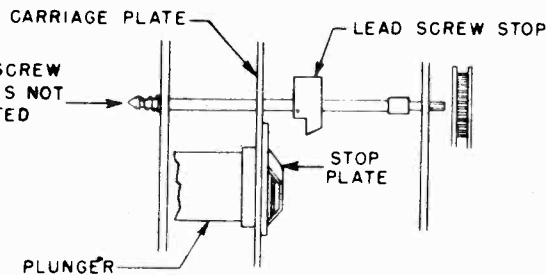
MOTOROLA INC.

MODELS AR-96-23,
AIRBOY

C-1	8A25558	Capacitor, fixed: paper; .02 mf 20% 100 vdc	
C-2	20K61566	Capacitor, variable: mica; 300-800 mmf	
C-3	21K31492	Capacitor, fixed: ceramic; 200 mmf 5% 100 vdc	
C-4	19K54849	Capacitor, variable: 2 gang (tuning)	
C-5	21K63815	Capacitor, fixed: ceramic; 30 mmf 10% 500 vdc	
	or 21K54680		
C-6	20A51567	Capacitor, variable: mica; nominal 100 mmf (osc. padder)	
C-7	21K35392	Capacitor, fixed: ceramic; 50 mmf 10% 500 vdc	
C-8	8K25549	Capacitor, fixed: paper; 4 section (see schematic diagram)	
C-9	8A25558	Capacitor, fixed: paper; .02 mf 20% 100 vdc	
C-10	21R6631	Capacitor, fixed: mica; 100 mmf 20% 300 vdc	
C-11	8A24966	Capacitor, fixed: paper; .005 mf 20% 100 vdc	
C-12	8A24966	Capacitor, fixed: paper; .005 mf 20% 100 vdc	
C-13	21R6631	Capacitor, fixed: mica; 100 mmf 20% 300 vdc	
C-14	8A24966	Capacitor, fixed: paper; .005 mf 20% 100 vdc	
C-15	23A14727	Capacitor, fixed: electrolytic; 10 mf 150 vdc	
J-1	9K54609	Jack, Phone: open circuit; includes washer and nut	
L-1	24A51564	Coil, antenna	
L-2	24A51568	Coil, oscillator	
R-1	6R6004	Resistor, fixed: carbon; 1 megohm 20% 1/2W Ins.	
R-2	6R6004	Resistor, fixed: carbon; 1 megohm 20% 1/2W Ins.	
R-3	6R6031	Resistor, fixed: carbon; 100,000 ohms 10% 1/2W Ins.	or 29K25752
R-4	6R6428	Resistor, fixed: carbon; 6,800 ohms 10% 1/2W Ins.	588469
R-5	6R2118	Resistor, fixed: carbon; 3.3 megohm 20% 1/2W Ins.	587706
R-6	6R6290	Resistor, fixed: carbon, 2,200 ohm 20% 1/2W Ins.	587701
R-7	6R2122	Resistor, fixed: carbon; 4.7 megohm 20% 1/2W Ins.	586823
R-8	6R6032	Resistor, fixed: carbon; 470,000 ohm 20% 1/2W Ins.	or 586847
R-9	18A24918	Resistor, variable; carbon; 1 megohm (volume control)	586811
R-10	6R2109	Resistor, fixed: carbon; 10 megohm 20% 1/2W Ins.	587707
R-11	6R6004	Resistor, fixed: carbon; 1 megohm 20% 1/2W Ins.	587700
R-12	6R6004	Resistor, fixed: carbon; 1 megohm 20% 1/2W Ins.	382679
R-13	6R6059	Resistor, fixed: carbon; 820 ohms 10% 1/2W N.I.	387454
R-14	6R2118	Resistor, fixed: carbon; 3.3 megohms 20% 1/2W Ins.	387506
T-1	1X24889	Coil, I. F. and shield	387107
T-2	1X24886	Coil, Diode and shield	26A24970
T-3	26A51574	Transformer, Output	9A70455
	1X61573	Assembly, Antenna lead-in	9A70489
	1X61663	Assembly, Antenna ferrule and receptacle	31A4677
	1X64552	Assembly, Hank antenna	31A15555
	1X72395	Assembly, tube retainer strip	39A24874
	1X61999	Assembly, Wrap Around (housing)	31A24927
	26A24869	Base, tube shield	40A54549
	1X24876	Bracket, battery assembly	487555
	7A24881	Bracket, capacitor mtg. (C-4)	487557
	7A24940	Bracket, sliding latch (back cover)	4A54759
	7A24872	Bracket, Volume control mtg. (R-9)	4A22908
	38A1738	Button, plug	4A16558
	51B80111	Cord CD-307A (Microphone cord)	487578
	1X64571	Cover, back: includes slide latch and button	
	1X61662	Cover, front: screened, includes jack, switch, output trans. etc.	
	40K60112	Jack, microphone	
	38A54548	Knob, switch	
	38A51604	Knob, tuning, includes setscrew	
	38A51605	Knob, volume	
	887247	Lockscrew: 6-32 x 3/16 S1 HH WS; Cad. Pl. (gang mtg.)	
	487686	Lockwasher, steel: #5 Ext.; Cad. Pl. (C-2 mtg.)	
	487650	Lockwasher, steel: #6 Int; Cad. Pl. (term. strip mtg.)	
	487655	Lockwasher, steel: 3/8 Int; Cad. Pl. (Jack mtg.)	
	487657	Lockwasher, steel: #8 Ext.; Cad. Pl. (Front plate mtg.)	
	29R6207	Lug, soldering: L-6; Hot tin (Batt. brkt. assembly)	
	287051	Nut, Painut: 3/8-32 x 9/16; Cad. Pl. (gang mtg.)	
	287010	Nut, steel: 5-40 x 1/4 hex; Cad. Pl. (C-2 mtg.)	
	287003	Nut, steel: 8-32 x 3/16 hex; Cad. Pl. (Front plate mtg.)	
	29K12867	Plug, Antenna (Ant. lead-in)	
	or 29K25752		
	588469	Rivet, steel: 5/32 x .122; Blk. Nkl. (output trans. mtg.)	
	587706	Rivet, steel: 1/8 x .122; Pol. Nkl. (battery brkt.)	
	587701	Rivet, steel: 3/16 x .122; Pol. Nkl. (latch mtg.)	
	586823	Rivet, steel: 1/8 x .122; Blk. Nkl. (Ant. recept. mtg.)	
	or 586847		
	586811	Rivet, steel: 1/8 x .088; Pol. Nkl. (socket & base mtg.)	
	587707	Rivet, steel: 5/32 x .122; Pol. Nkl. (Vol. cont. brkt. mtg. & term strip mtg.)	
	587700	Rivet, steel: 1/4 x .122; Pol. Nkl. (batt. contact mtg.)	
	382679	Screw, steel: #4 x 1/4 PKA Ph Sv. H; Cad. Pl. (chassis mtg.)	
	387454	Screw, steel: #8 x 1/4 PKZ P1 HH; Cad. Pl. (chassis mtg.)	
	387506	Screw, steel: #6 x 1/4 PKZ P1 HH; Cad. Pl. (C-6, 8 & L-2 mtg.)	
	387107	Setscrew: 8-32 x 1/4 S1 Hdless (tuning knob)	
	26A24970	Shield, tube: midget	
	9A70455	Socket, tube: miniature; molded	
	9A70489	Socket, tube and cushion spring	
	31A4677	Strip, terminal	
	31A15555	Strip, terminal: 2 ins. #3 mtg.	
	39A24874	Strip, battery contact (pos.)	
	31A24927	Strip, "B" battery terminal	
	40A54549	Switch, battery: DPST	
	487555	Washer, steel: 1/4-.128-.033; Cad. Pl. (Output trans. mtg.)	
	487557	Washer, steel: 3/8-11/64-.033; Cad. Pl. (Front plate mtg.)	
	4A54759	Washer, knob: cork (tuning knob)	
	4A22908	Washer, spring (tuning knob)	
	4A16558	Washer, spring (latch mtg.)	
	487578	Washer, brass: 5/16-.130-.025 (latch mtg.)	

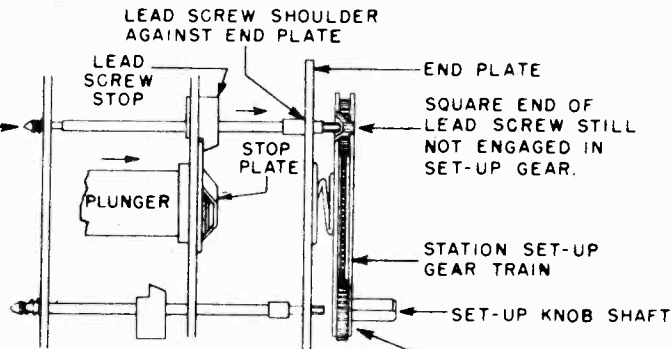
1.

POSITION OF LEAD SCREW WHEN STOP PLATE IS NOT RESTING ON SELECTED LEAD SCREW STOP.



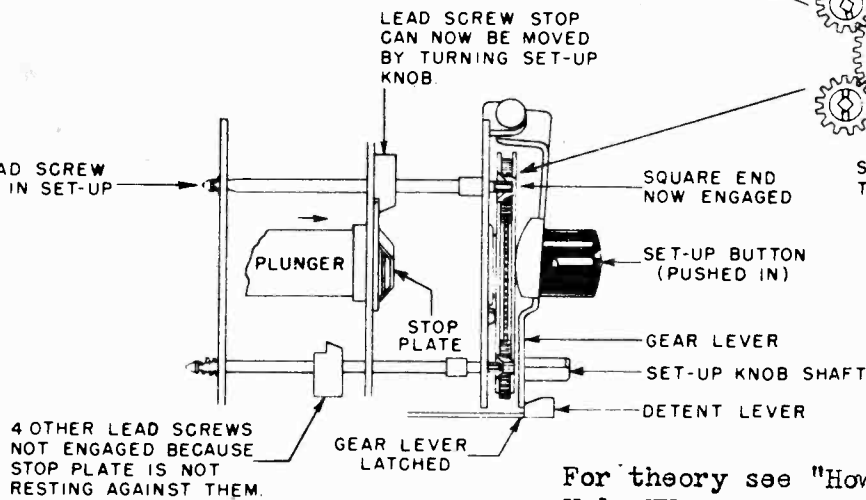
2.

POSITION WHEN STOP PLATE IS RESTING AGAINST LEAD SCREW STOP.



3.

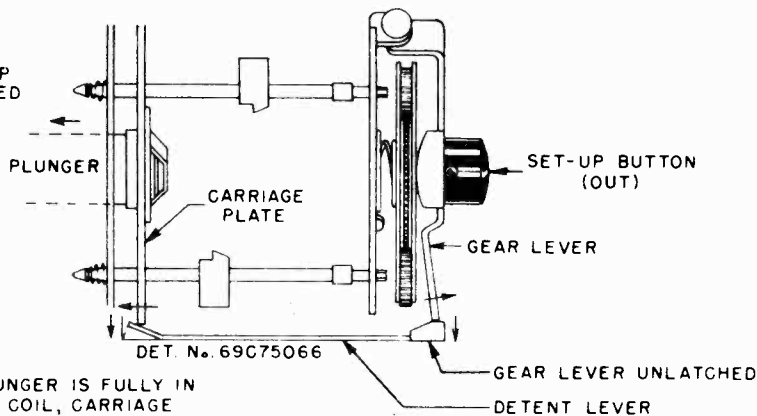
SELECTED LEAD SCREW NOW ENGAGED IN SET-UP GEAR.



For theory see "How It Works", Vol. XV, page 70

4.

AFTER STATION IS SET UP GEAR LEVER IS UNLATCHED BY PRESSING A BUTTON



WHEN PLUNGER IS FULLY IN SOLENOID COIL, CARRIAGE PLATE RELEASES GEAR LEVER AS SHOWN, DISENGAGING LEAD SCREW FROM SET-UP GEAR.

STATION SET-UP MECHANISM

SERVICE NOTES

FAILURE OF SOME LEAD SCREWS TO ENGAGE IN SET-UP GEARS

If some of the lead screws fail to engage in the set-up gears during station setting up procedure, check to see if the gear lever is bent out of shape. When the set-up button is pushed in and the gear lever latches on the detent lever, the set-up gear train should be parallel with the tuner end plate and the bottom of the gear train should be resting on the raised portions of the tuner end plate.

LUBRICATION

Should lubrication ever be required, it is recommended that a very fine grease, commercially called Lubriplate, or its equivalent, be used.

Remove all old and sticky lubricant with a solvent such as carbon tetrachloride and then very sparingly lubricate only the following points:

1. Carriage guide rods.
2. Actuator rod.
3. Manual lead screw.

IMPORTANT:

Do not lubricate or permit lubricant to get on Selector Switch contacts. The friction drag is required for proper operation of tuner.

LEAD DRESSING

Make sure that the selector switch and solenoid coil leads are dressed so that carriage plate does not rub against them. Leads rubbing against the carriage plate may cause the tuner to stick, especially at the high frequency end.

REPLACEMENT OF SOLENOID COIL OR SOLENOID PLUNGER

Should replacement of the solenoid coil or solenoid plunger be required, it will be necessary to replace the entire tuner. A close fit between solenoid plunger and solenoid coil form is required; a proper match can only be secured at the factory. When service of this kind is required, return the tuner to the factory for exchange.

ALIGNMENT

In the event that some part of the R.F. circuit has been changed or the adjustments shifted by mishandling, it is suggested that the receiver be realigned.

The tuner must be in good working order and assembled onto the chassis before attempting alignment of its tuned circuits.

TO REPLACE ANT., R.F., OR OSC. COILS

IMPORTANT: When ordering replacement coils, order by part number and also specify the color coding (paint dots) on old coil. THE REPLACEMENT COIL SHOULD CARRY THE SAME COLOR CODING AS THE ORIGINAL OR THE TUNER WILL NOT TRACK PROPERLY.

1. The top coil is readily accessible and may be replaced while tuner is mounted on receiver chassis. To reach the two bottom coils it will be necessary to remove the tuner from the chassis as outlined under "TO REMOVE TUNER FROM CHASSIS".

2. Unsolder the two lugs by which the coil has been spotted to the tuner plate.

3. Carefully remove the old coil. Save the thin paper washer that is found at the base of the coil.

4. Slip the paper washer over the replacement coil and slip coil into shield can.

5. Orient coil so its lugs are in same position as before and resolder to tuner plate.

6. Reassemble tuner and install in receiver.

7. Realign ANT., R.F. and OSC. stages per instructions on page 7 of this Service Manual.

TO REPLACE ANT., R.F. OR OSC. COIL TUNING CORES.

IMPORTANT: When ordering coil tuning cores, order by part number and also specify the color coding (paint spot) on the old core. ALL 3 TUNING CORES MUST CARRY THE SAME COLOR CODING OR THE TUNER WILL NOT TRACK PROPERLY.

1. The core which tunes the top coil is readily accessible and presents no replacement problem. To readily reach the two bottom coil tuning cores, it will be necessary to remove the tuner from the chassis base as outlined under "TO REMOVE TUNER FROM CHASSIS".

2. Remove the carriage return spring.

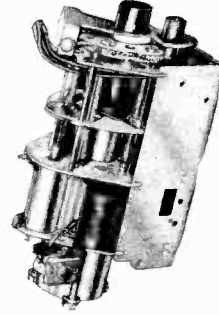
3. Move the carriage plate back as far as it can go. The tuning cores can now be screwed out or in by grasping the portion that sticks out the back of the coil. When installing a new core, make sure that the insulating washer and adjustment clip are replaced properly. The insulating washer goes on the core side; the core adjustment clip has an ear on it and this ear must fit into a hole

in the bakelite insulator on the carriage plate. Refer to Figure 25.

4. Replace the carriage return spring.

5. Install tuner in receiver.

6. Realign ANT., R.F. and OSC. stages per instructions outlined on page 7 of this Service Manual.



SOLENOID TUNER ST-54

PLUNGER RATCHET ADJUSTMENT

The plunger ratchet mechanism is shown in Figure 21. This mechanism rotates the actuator rod which in turn, rotates the carriage stop plate and the selector switch 60° for each inward motion of the plunger.

If this adjustment is incorrect, tuner may operate continuously once current is applied.

Correct ratchet adjustment is indicated when 1/64 to 1/32" clearance is observed between selector switch contacts and the selector switch rotor as shown in Figure 22.

Figure 22. Slowly work the plunger by hand and observe clearance at each contact position. If the average clearance is not 1/64 to 1/32", correction can be made by loosening ratchet adjustment set screw and turning actuator rod by hand until correct clearance is observed.

Before ratchet adjustment set screw is finally tightened, push fixed ratchet 1/32" back into plunger. This increases spring tension against rotating ratchet, thus insuring more positive operation.

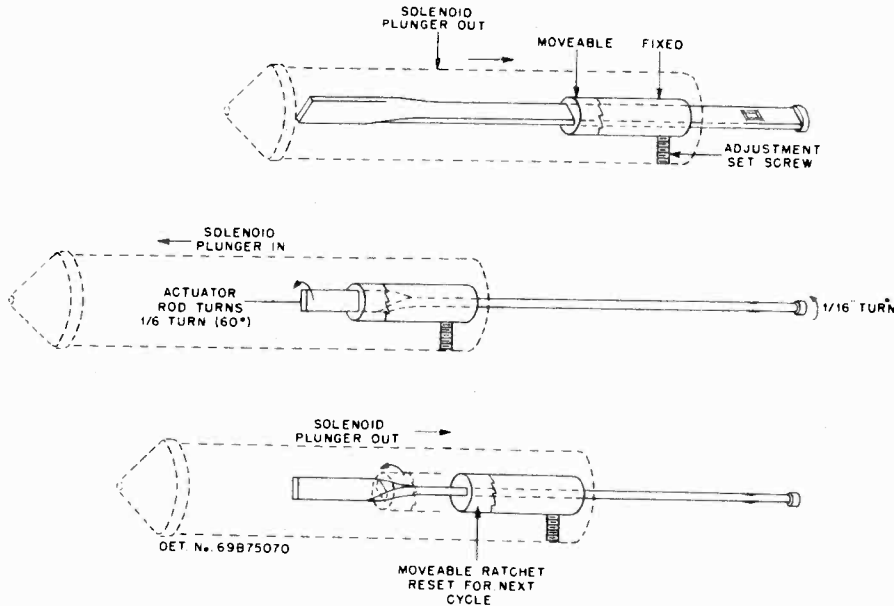


FIGURE 21. PLUNGER RATCHET MECHANISM

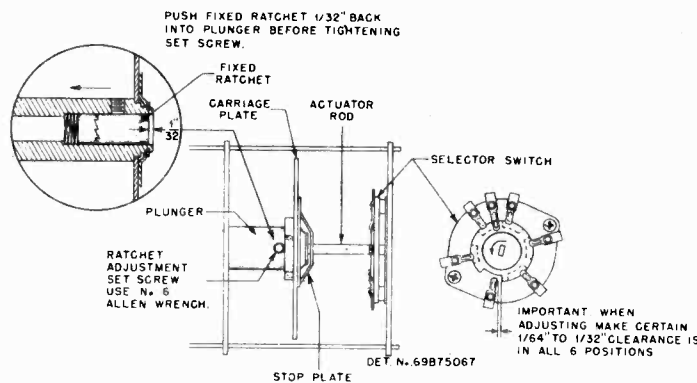


FIGURE 22. PLUNGER RATCHET ADJUSTMENT

ADJUSTMENT OF GEAR LEVER LATCH

The gear lever latch holds the station set-up gear train in position while setting up stations. Failure of latch to engage properly when set-up button is pushed in would result in inability to set up pre-set station positions. Failure of latch to disengage after station is set up, would result in faulty automatic tuning because the lead screws might not seat themselves properly against the tuner end plate. Figure 24 shows the latch detail and adjustment.

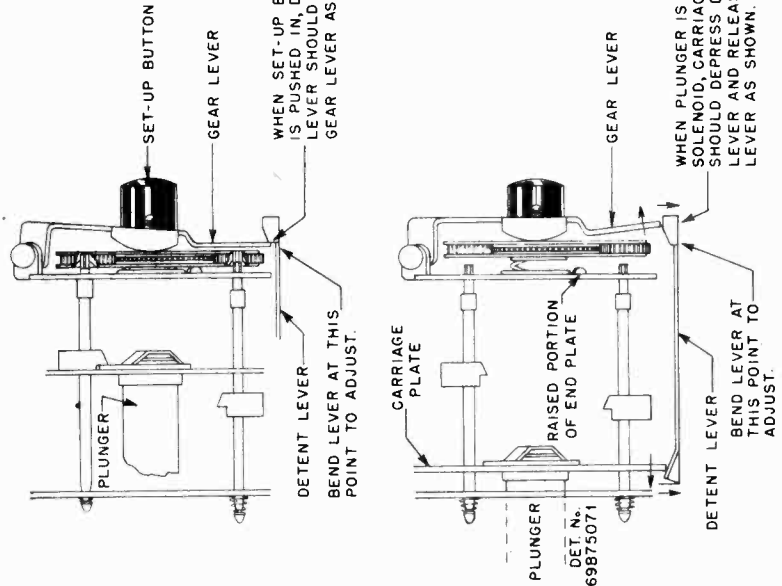


FIGURE 24. GEAR LEVER LATCH ADJUSTMENT

SOLENOID SWITCH TRIP ADJUSTMENT

The solenoid switch tripping mechanism should be adjusted as shown in Figure 23.

If the solenoid switch is tripped too early, the ratchet mechanism may fail to operate; if it trips too late, the plunger may hammer violently or should the solenoid switch fail to trip, the plunger would be held within the solenoid.

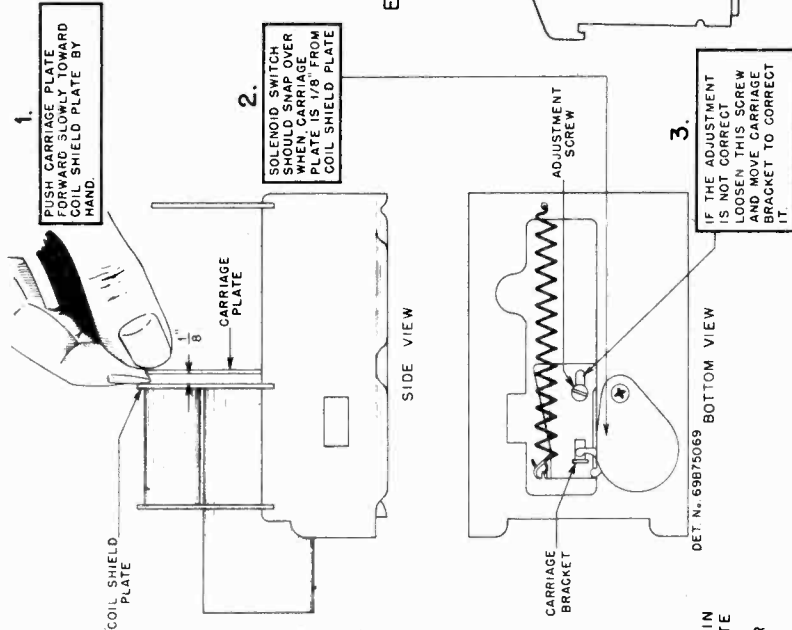


FIGURE 23. SOLENOID SWITCH ADJUSTMENT

AIR RELEASE ADJUSTMENT

The speed at which the tuner operates is governed by dash-pot action of the solenoid plunger within the closed solenoid coil form. The rate at which air is allowed to enter or escape determines the speed of the plunger.

An adjustable air release is provided on all late production tuners. See Figure 20. To adjust loosen the screw and move the eccentric washer which covers the air release hole to expose or cover more of the air release hole.

1. If tuner operates too slowly, open the air release hole. Open it only far enough to secure reliable operation. Too little "dash-pot" action (air release open too much) may cause the plunger to hammer and sometimes even to make the tuner operate continuously due to the selector switch rotor being turned so rapidly as to overshoot its contacts.
2. If the tuner operates too rapidly, increase dash-pot action by closing the air release hole slightly. Close it only enough to eliminate hammering.

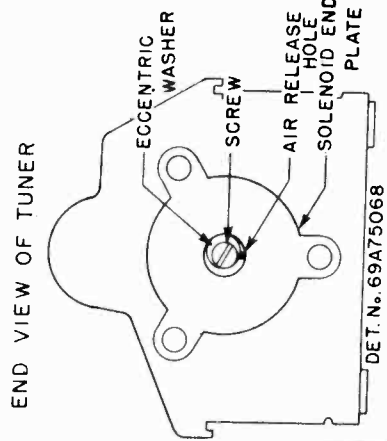
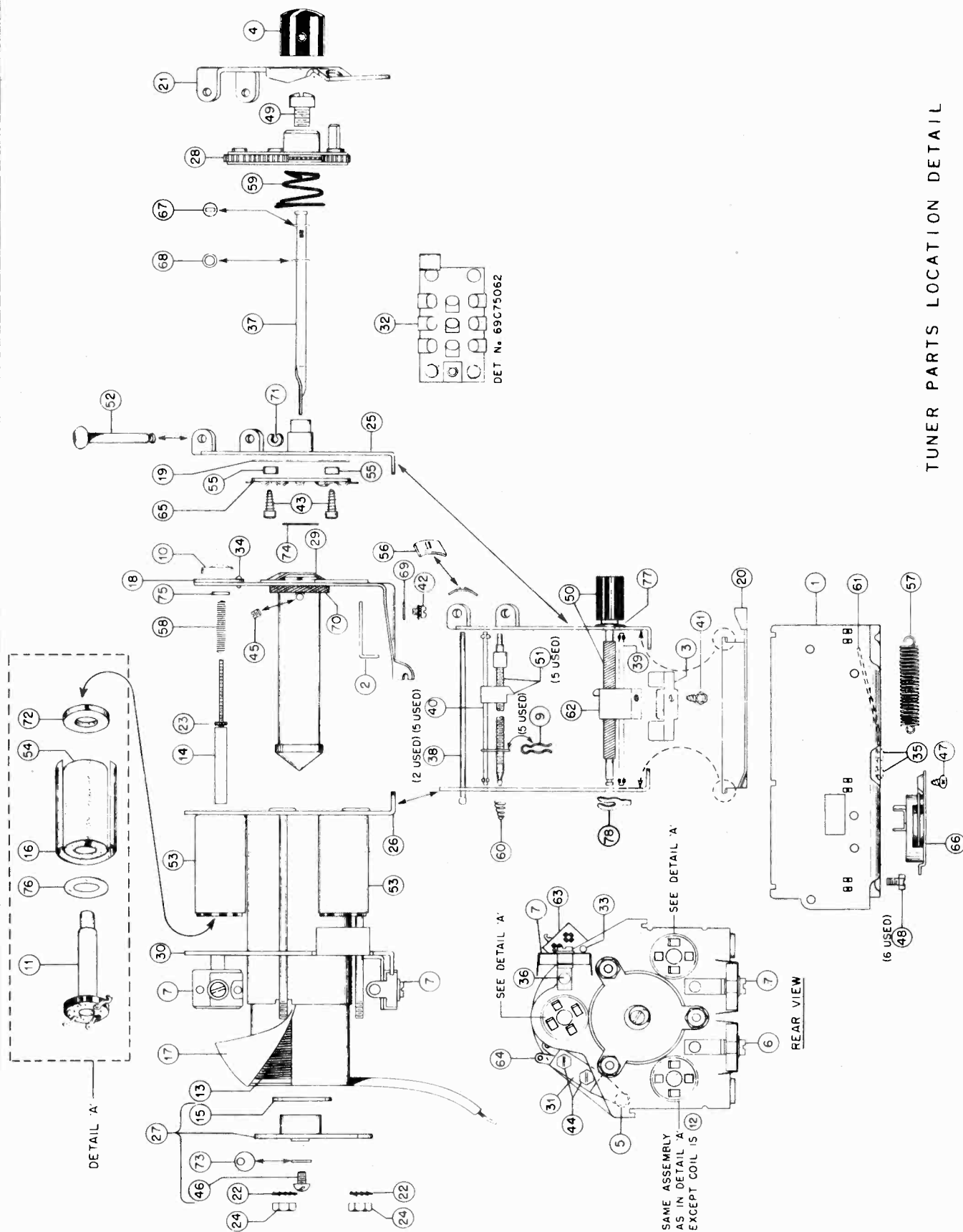


FIGURE 20. AIR RELEASE ADJUSTMENT

as required. Early production tuners did not have a solenoid end plate with an adjustable air release. If such a tuner is slow or sluggish because of too much "dash-pot" action, replace the solenoid end plate with a new end plate having an adjustable air release. Order part Number LX76556.



TUNER PARTS LOCATION DETAIL

MOTOROLA INC.

MODEL ST-54 Tuner

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
1	1X71480	Model ST-54 Solenoid Tuner (complete) Exchange	42	382860	Screw, steel: 4-40 x 1/4 Sl. Lk. BHMS; Cad. Pl. (carriage brkt. mtg.)
2	1X71558	Base & Spring Assembly	43	382681	Screw, steel: 4 x 3/8 Ph. Fil. Hd; Cad. Pl. (selector switch, mtg.)
3	7A70828	Bracket, carriage	44	387327	Screw, steel: 5-40 x 3/8 S1 HH HS; Cad. Pl. (mute sw. mtg.)
4	7A70866	Bracket, lead screw stop	45	387148	Set screw, steel: 6-32 x 1/8 Allen Hd; Nkl. Pl. (ratchet setscrew in plunger)
5	38A70946	Button, lever and gear (set-up button)	46	387200	Screw, steel: 6-32 x 3/16 Sl. Fil. Hd; HS; Cad. Pl. (air release adj. screw)
6	38A70954	Button, mute switch; fibre with mounting bracket	47	382884	Screw, steel: #8 x 1/4 Ph. Fil. Hd; Cad. Pl. (solenoid switch mtg.)
7	20A70214	Capacitor, variable; mica; 30-80 mmf; with mounting bracket	48	387205	Screw (lockscrew): 8-32 x 1/4 Sl. HH; Cad. Pl. (base mtg.)
8	20A70601	Capacitor, variable; mica; 60-180 mmf. with mounting bracket	49	3A74580	Screw, special (rear plate mtg.)
9	8A19133	Capacitor, fixed; paper; .5 mf. 100 vdc per/c	50	58A70902	Screw & Coupling Assembly; manual lead screw with bakelite coupling
10	42A70184	Clip, lead screw	51	1X75015	Screw & Stop Assembly; lead screw with carriage stop
11	1A71881	Coil, core adjustment * doz. Coll. antenna or R.F. (specify color of paint dots on old coil when ordering)	52	47A70834	Shaft, lever
12	1A71879	Coil, oscillator (specify color of paint dots on old coil when ordering)	53	28A70878	Shield, Coil (Ant. R.F. & osc. Coil Shield)
13	58B70889	Coil, solenoid (RETURN entire tuner to factory for exchange when this part requires replacement)	54	43A70881	Sleeve, coil; powdered iron
14	48A70880	Core, powdered iron; with molded-in adj. screw (specify color of paint dot on old core when ordering)	55	45A70853	Spacer, selector switch; fibre
15	32A70872	Gasket, solenoid	56	257988	Speednut, steel; for .083 dia. rod
16	1A70876	Insulator, coil sleeve; armitc	57	41A70941	Spring, carriage
17	1A7A7198	Insulator, magnet winding; armitc	58	41A70958	Spring, coil iron core
18	1A70979	Insulator, slug; bakelite	59	41A70968	Spring, gear plate
19	1A70973	Insulator, switch; armitc	60	41A70949	Spring, lead screw
20	45B70928	Lever, detent	61	41A70871	Spring, lockup
21	45B70830	Lever, gear	62	46A70983	Stop, manual lead
22	487851	Lockwasher, steel; #8 internal; Cad. Pl.	63	31A70948	Strip, Terminal Lug
23	2A78568	Nut, knurled (takes spring pressure off of Iron Cone)	64	40A70821	Switch, mute
24	257003	Nut, Steel: 6-32 x 5/16 Hex; Cad. Pl.	65	40B70852	Switch, selector
			66	1B70844	Switch, solenoid; with mtg. plate
			67	4A70881	Washer, actuator rod; rectangular hole
			68	4A70862	Washer, bearing (actuator rod)
			69	4A75683	Washer, brass; special
			70	4A73378	Washer, bumper
			71	4A70015	Washer, *C*
			72	47A70873	(Lever shaft retainer)
			73	4A76542	Washer, coil spacer; fibre hole adjustable cover
			74	4A70974	Washer, eccentric (air release hole adjustable cover)
			75	4A70956	Washer, insulator (actuator rod)
			76	4A74571	Washer, iron core insulator; Bakelite
			77	4A73821	Washer, paper
			78	4A70832	Washer, spring (manual lead screw) *C* Spring (manual lead screw retainer)

TO REMOVE THE TUNER FROM CHASSIS

- Should it become necessary to remove the solenoid tuner from the receiver chassis, proceed as follows:
 - Remove the top and bottom housings from the set, completely exposing the chassis.
 - Mark all leads connecting tuner to receiver.
 - Disconnect all leads connecting tuner to receiver. The control head connecting receptacle is to be removed by unscrewing the two self-tapping screws; do not unsolder leads from the tuner selector switch. The .5 mf paper capacitor need not be removed.
 - The tuner is held to the chassis by 4 self-tapping screws driven into the sides of the tuner. Do not remove any other screws.

MODEL 5A1
MODEL 5A5

MOTOROLA INC.

ALIGNMENT AND SENSITIVITY CHART

Connect output meter across voice coil (.38V = .05 watt). Set volume control at maximum for all operations. The adjusting screwdriver or alignment tool should be of the insulated type, such as Motorola Part No. 66A71008. Refer to Figure 3 for location of trimmers and padder.

OPERATIONS IN GANG GENERATOR ADJUST GENERATOR SET AT AVERAGE MICROVOLT INPUT
ORDER - ADJUST CAPACITOR DUMMY CONNECTED TRIMMER (400-30% MODULATED) FOR 38V OUTPUT
FOR MAX. SET AT ANTENNA TO NO.

1. Align I.F. and Diode	Minimum	.1 mf.	Osc.-Mod.	1-2-3	455 Kc.	120 μ V
2. Adjust Oscillator to dial scale	1600 Kc.	.1 mf.	Osc.-Mod.	4	1600 Kc	
3. Peak loop antenna trimmer	1400 Kc.	None	Grid (antenna station of gang)	*	1400 Kc.	
4. Adjust Oscillator Padder	600 Kc.	None	Grid (antenna station of gang)	*	600 Kc.	

5. Repeat the above steps for maximum accuracy.

6. Assemble set into housing, tune in weak station around 1400 Kc. and repeat loop antenna trimmer (trimmer #5) for maximum. A hole is provided in the housing for this purpose.

* Connect output of signal generator to a 5" diameter, 3 turn loop. See Figure 2. With the volume on full and the output meter connected across voice coil, bring loop close enough to receiver loop until an output of 50 milliwatts is obtained, (.38 V on output meter). Vary distance between generator and receiver loops to maintain the output during alignment.

** Rock gang capacitor until greatest output is obtained.

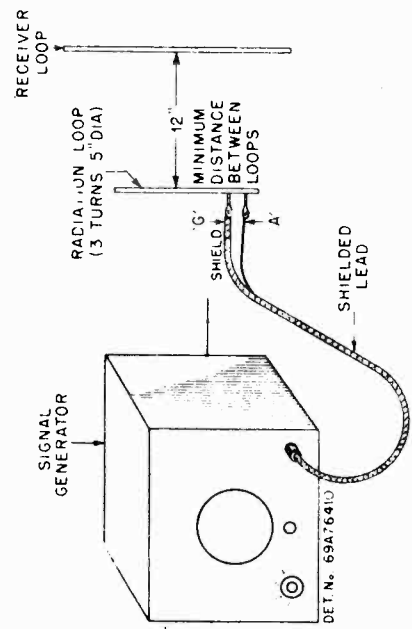
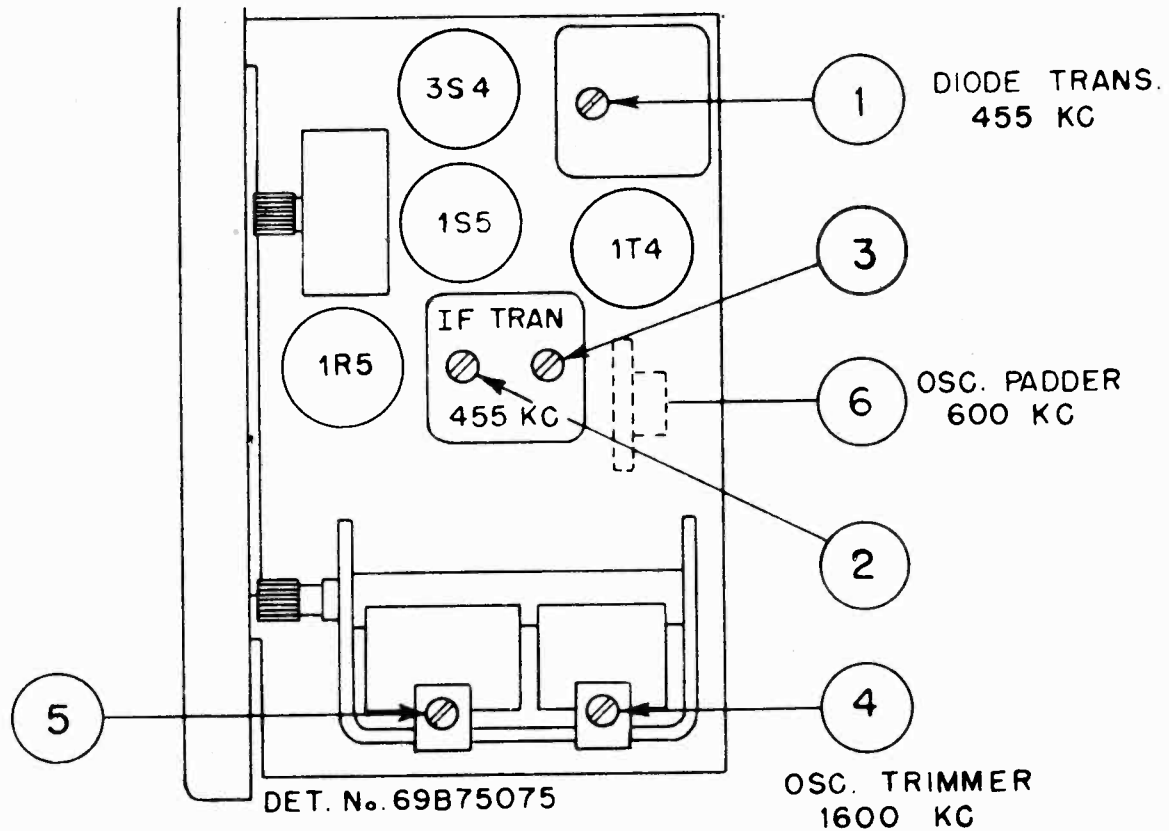


FIGURE 2. METHOD OF RADIATING SIGNAL INTO RECEIVER

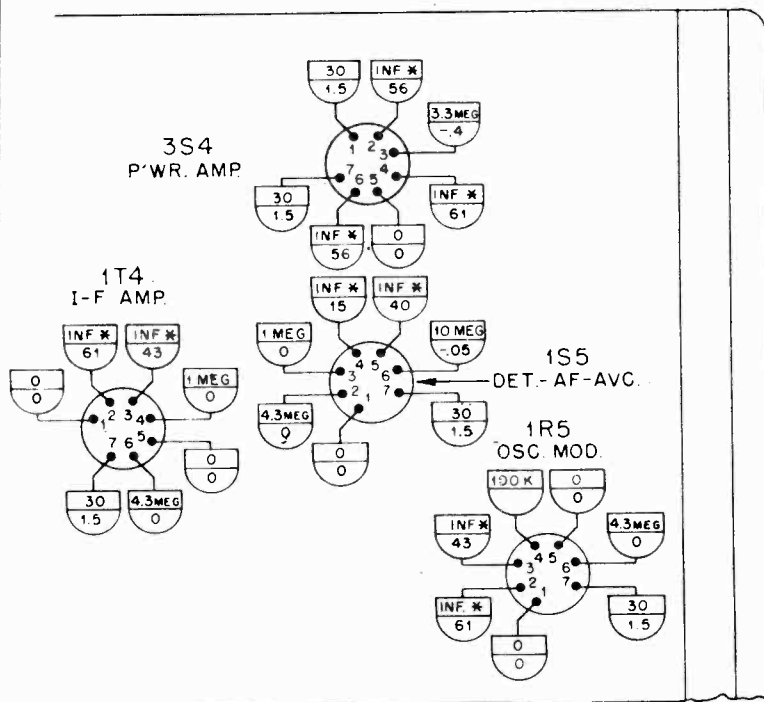
MOTOROLA INC.

MODEL 5A1
Chassis HS-6



ANT. TRIMMER
1400 KC

TUBE AND TRIMMER LOCATION DETAIL



BOTTOM VIEW OF CHASSIS

VOLTAGE AND RESISTANCE DIAGRAM

□ — RESISTANCE MEASUREMENTS.

◐ — VOLTAGE MEASUREMENTS.

* — MAY VARY DUE TO ELECTROLYTIC CAPACITOR IN CIRCUIT.

BATTERIES DISCONNECTED FOR RESISTANCE MEASUREMENTS.

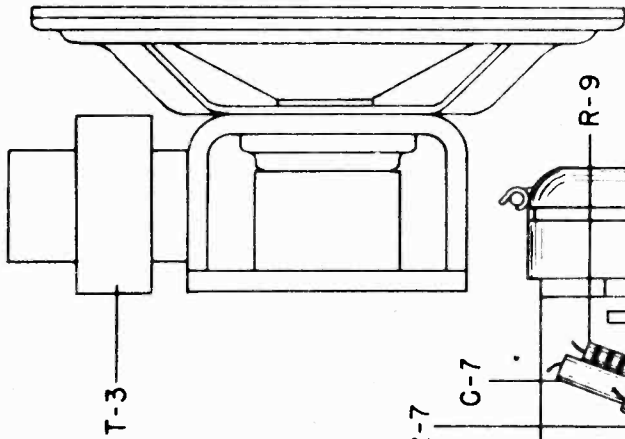
A 20,000 OHM PER VOLT VOLTMETER WAS USED.

MEASUREMENTS MADE BETWEEN CHASSIS AND SOCKET PIN INDICATED.

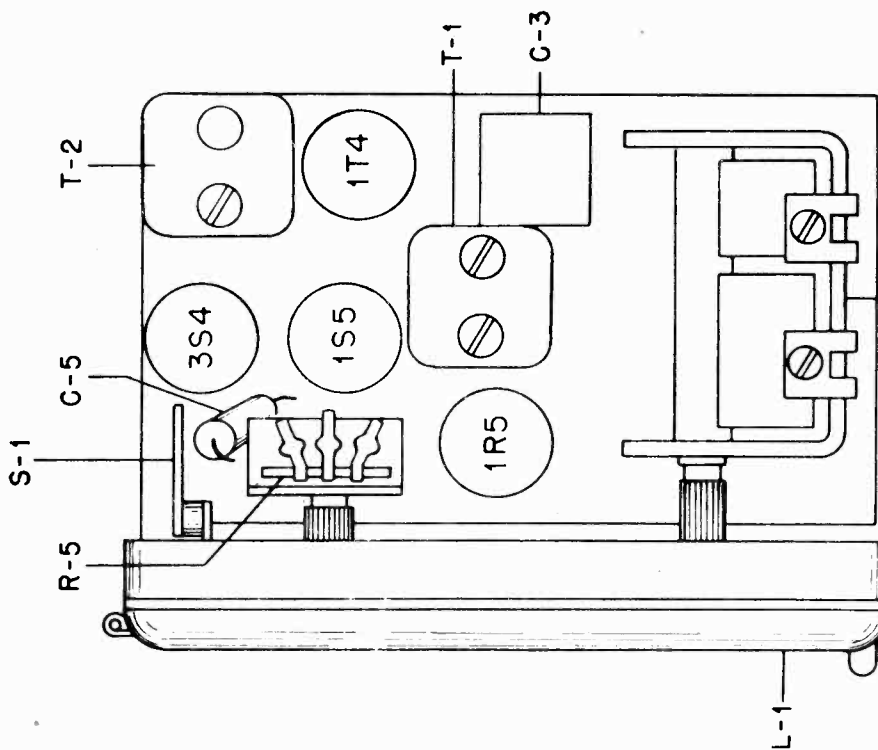
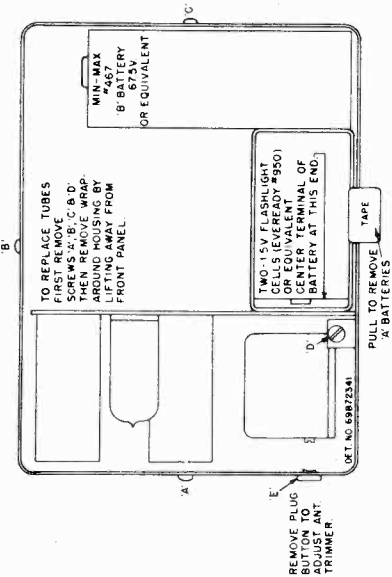
ON-OFF SWITCH IN 'ON' POSITION.

DUE TO COMPONENT TOLERANCES, RESISTANCE VARIATIONS OF 10 TO 20% AND VOLTAGE VARIATIONS OF 20% MAY BE EXPECTED.

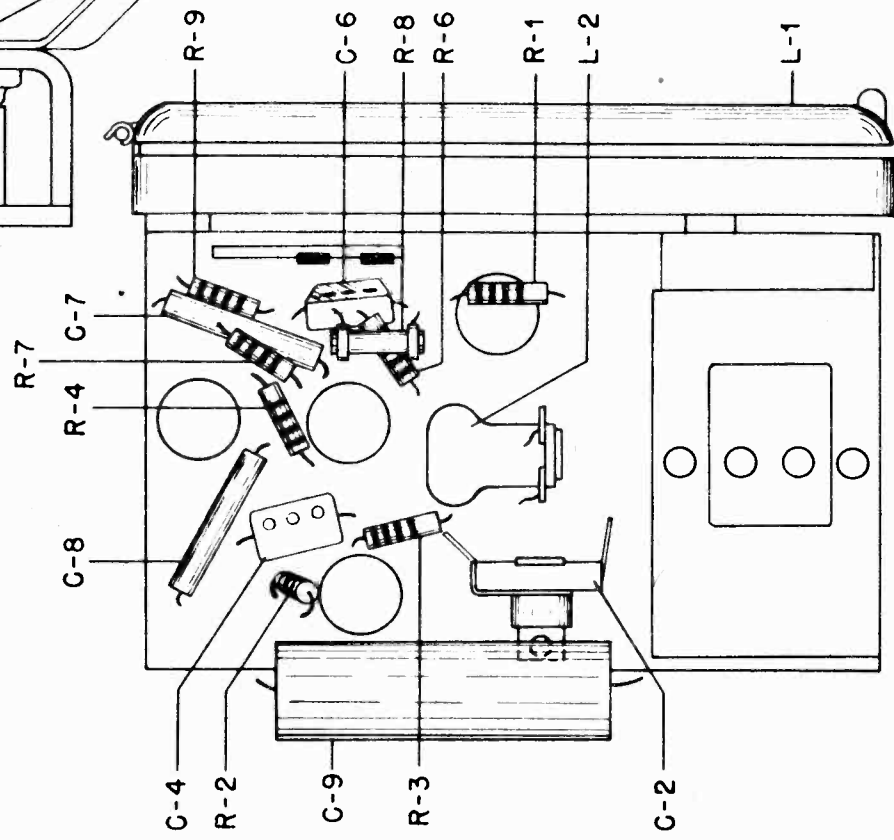
CAUTION: BE CAREFUL WHEN MEASURING FILAMENT CIRCUIT WITH TUBES IN SET. SOME OHMMETERS MAY BURN OUT TUBES



HOUSING REMOVAL DETAIL



DET. No. 69B75077 C-1 TOP VIEW



BOTTOM VIEW

PARTS LOCATION

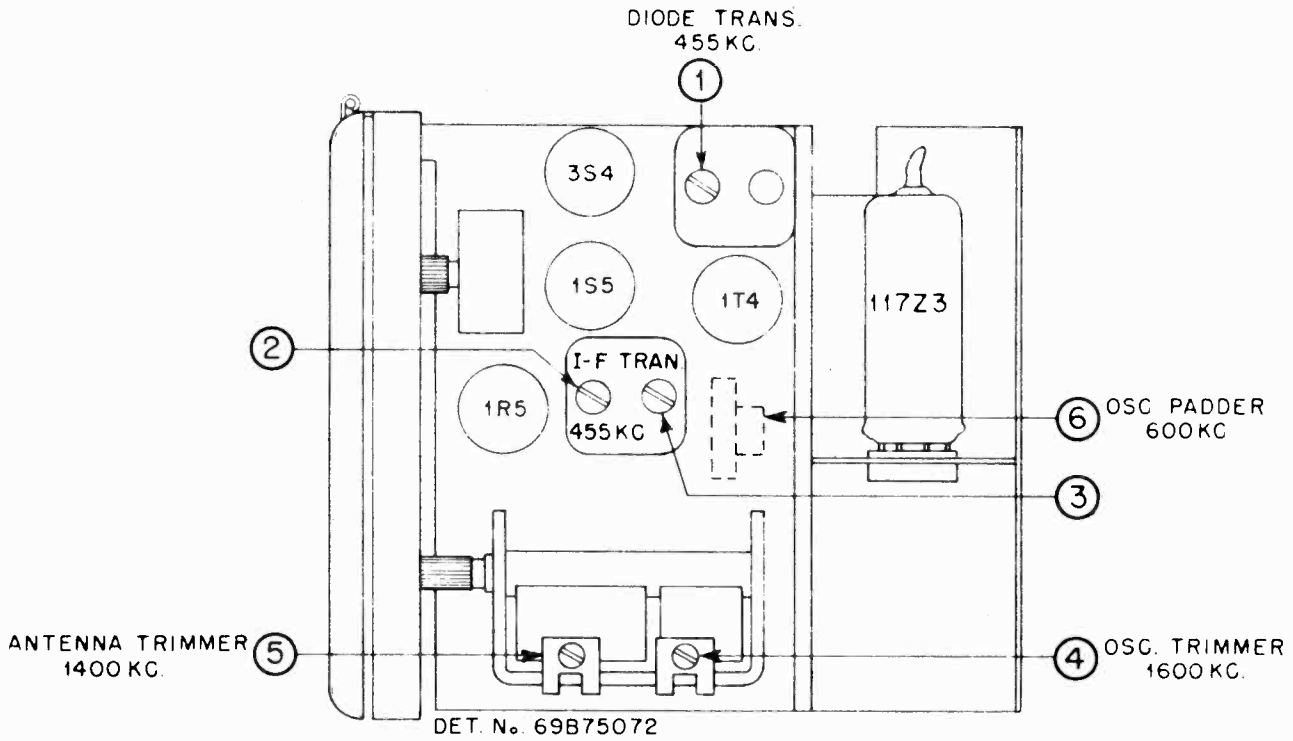
MOTOROLA INC.

MODEL 5A1

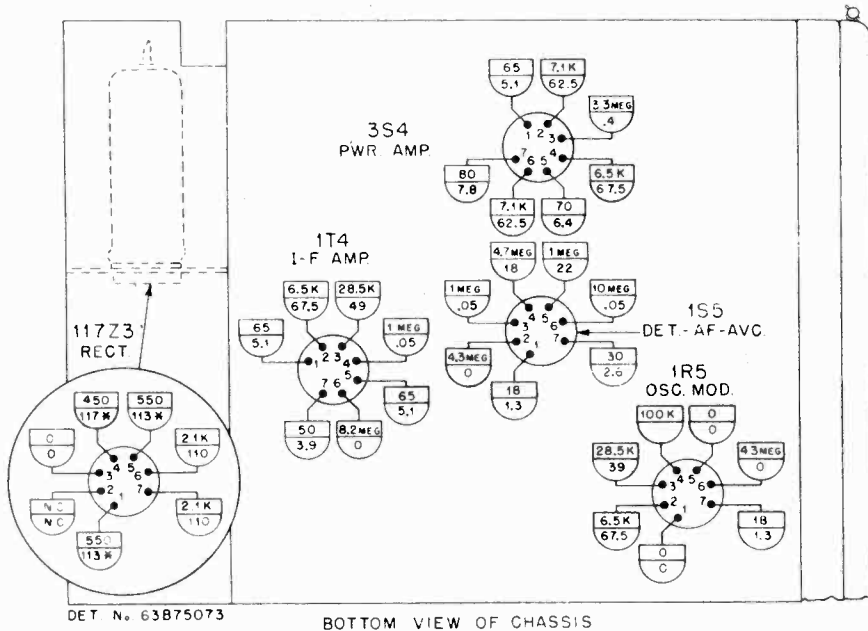
REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
C-1	19824917	Capacitor, variable: 2 gmgs			Insulator, Strip & Wiper Assembly			Spring, latch bar
C-2	20A71206	Capacitor, trimmer: 270 mf. nominal; with "L" mounting bracket (osc. pad).	1124670		(*A* battery negative contact mounted on plastic insulator)	41A24954		Strip, terminal: 2 insulated lugs, #5 mounting
C-3	8K25549	Capacitor, fixed: paper; block-3I .02 & .05 mf. 100 V	36B24988		Knob, control: maroon plastic	31A24973		Strip, terminal: 1 insulated lug, vertical mounting
C-4	21R6631	Capacitor, fixed: mica: 100 mf. 300V	39A24965		Latch, bar: maroon plastic	39A24974		Strip, battery contact (*A* battery, positive contact)
C-5	8A249M6	Capacitor, fixed: paper: .005 mf. 100V	437666		Cad. Pl. (osc. coil mounting)	31A24927		Strip, #8, battery terminal (*B* battery connector)
C-6	21R6631	Capacitor, fixed: mica: 100 mf. 300V	29R5369		Lug, soldering: #2 (loop terminal on loop plate)	14A29832		Support, hinge: brown bakelite; 1-1/2 x 9/32 x 3/32 thick
C-7	8A249M6	Capacitor, fixed: paper: .005 mf. 100V	29R5207		Lug, soldering: #6: R.T.	1X72985		Tube Retainer Strip Assembly: Fibre strip with 3 sponge rubber cushions (for holding tubes in sockets)
C-8	8A249M6	Capacitor, fixed: paper: .005 mf. 100V	297007		Nut, steel: 6-32 x 1/4 hex; cadmium plated (speaker & front plate mounting.)	587713		Rivet, brass: .122 x 1/8; bright mounting
C-9	23A14727	Capacitor, fixed: electrolytic: 10 mf. 150V	297018		Nut, steel: 3/8-32 x 9/16 hex. cadmium plated (volume control etc.)	587707		Rivet, steel: .122 x 5/32; polished nickel (battery bracket mounting; terminal strip mounting)
L-1	2A824975	Antenna, loop: loop coil mounted on maroon painted bakelite plate	1174569		Plate (front) & Housing Assembly: Includes front plate with hinged loop, latch & battery switch	587701		Rivet, steel: .122 x 3/16; polished nickel (gang bracket mounting)
L-2	2A425548	Coil, oscillator	64K71187		Plate, front: includes 3 threaded studs; less all other parts	587772		Rivet, brass: .122 x 3/16; bright mounting
R-1	6R6031	Resistor, fixed: carbon: 100,000 10% 1/2W Ins.	5877191		Retainer, handle	587700		Rivet, steel: .122 x 1/4; polished nickel (*A* battery positive contact mounting)
R-2	6R6428	Resistor, fixed: carbon: 6,900 10% 1/2W Ins.	587725		Rivet, brass: .083 x 3/32; bright mounting	389144		Screw, steel: #2 x 3/16 PKZ Phillips flat head; antique copper (holds loop assembly together)
R-3	6R2118	Resistor, fixed: carbon: 3.3 meg 1/2W Ins.	589497		Rivet, steel: .088 x 1/8; white nickel (tube socket mounting)	387247		Hex head lock screw, cadmium plated (gang mounting)
R-4	6R2122	Resistor, fixed: carbon: 4.7 meg 1/2W Ins.	587771		Rivet, steel: .088 x 1/8; polished nickel (hinge mounting)	387506		Screw, steel: #6 x 1/4 PKZ plain hex head, cadmium plated (by-pass block and oscillator pad & coil mounting)
R-5	18A24918	Resistor, variable: 1 meg 1/2W Ins.	587770		Nickel (switch mounting)	387454		Screw, steel: #8 x 1/4 PKZ plain hex head, cadmium plated (holds back of chassis to housing)
R-6	6R2109	Resistor, fixed: carbon: 10 meg 1/2W Ins.	582915		Rivet, steel: .088 x 7/32; polished nickel (mounting hinge support to front plate)	26A24970		Shield, tube: midget (for 38A)
R-7	6R6004	Resistor, fixed: carbon: 1 meg 1/2W Ins.	587706		Rivet, steel: .122 x 1/8; polished nickel (*A* battery positive contact mounting)	9A70455		Socket, tube: miniature 7 prong (for IR4, 1S5 and 38A)
R-8	6R6059	Resistor, fixed: carbon: 820 1/2W Ins.	T-1	1124689	Transformer, I.F.: 455 kc; com-plate with shield can and trimmers	9A70489		Socket, tube: miniature 7 prong; cushioned type (for IR5)
R-9	6R2118	Resistor, fixed: carbon: 3.3 meg 1/2W Ins.	T-2	1124686	Transformer, output (Purchase with speaker)	14A74531		Spacer, hinge & loop back: bakelite; 1/4 x 3/4 x 1/32 thick
S-1	40A24973	Switch, battery	T-3	25K71182	Transformer, output (Purchase with speaker)	50P71061		Speaker & output transformer: 3-1/2" permanent magnet
	7A24981	Bracket, capacitor mounting (gang etc.)	38A28019		Earfile, speaker: cardboard	487578		Washer, brass: 5/16 x .130 x .025 thick (part of back cover latch assembly)
	7A24972	Bracket, volume control mounting	26A24969		Base, tube shield (for 38A)	14K70715		Washer, extruded: (*A* battery positive contact ins.)
	38A19911	Button, plug (antenna trimmer adjustment cover)	48124982		Battery, *A*: 1-1/2 volt (Eveready #950)	4416556		Washer, spring (part of back cover latch assembly)
	35A28185	Cloth, grille: maroon	48124983		Battery, *B*: 6V-1/2 volt (Eveready #467)			
	1171193	Cover Assembly, back: maroon wrinkle finish; includes sliding latch	1124676		Battery Bracket Assembly (*A* battery holder; with negative contact)			
	56A27113	Foot, felt	1130220		Bracket & Button Assembly (back cover sliding latch)			
	55K30915	Handle, carrying (complete)	488253		Washer, steel: 3/16 x .101 x .018 thick (spacer between hinge support & front plate)			
	51870499	Hinge Assembly (hinges loop to front plate)	487657		Washer, steel: 3/8 x .171-.035 thick, cadmium plated (front plate mounting studs)			
	1171190	Housing Assembly: maroon wrinkle painted; with carrying handle						
	67C24974	Housing, loop: moulded plastic						
	14A76703	Insulator, contact strip: plastic (for *A* battery positive contact)						
	14A29933	Insulator, hinge: bakelite, maroon finish; 1-1/2 x 9/32 x 1/32 thick						

MODEL 5A5
Chassis HS-15

MOTOROLA INC.



TUBE AND TRIMMER LOCATION DETAIL



BOTTOM VIEW OF CHASSIS

VOLTAGE AND RESISTANCE DIAGRAM

— RESISTANCE MEASUREMENTS.

— VOLTAGE MEASUREMENTS.

* — A-C VOLTAGES.

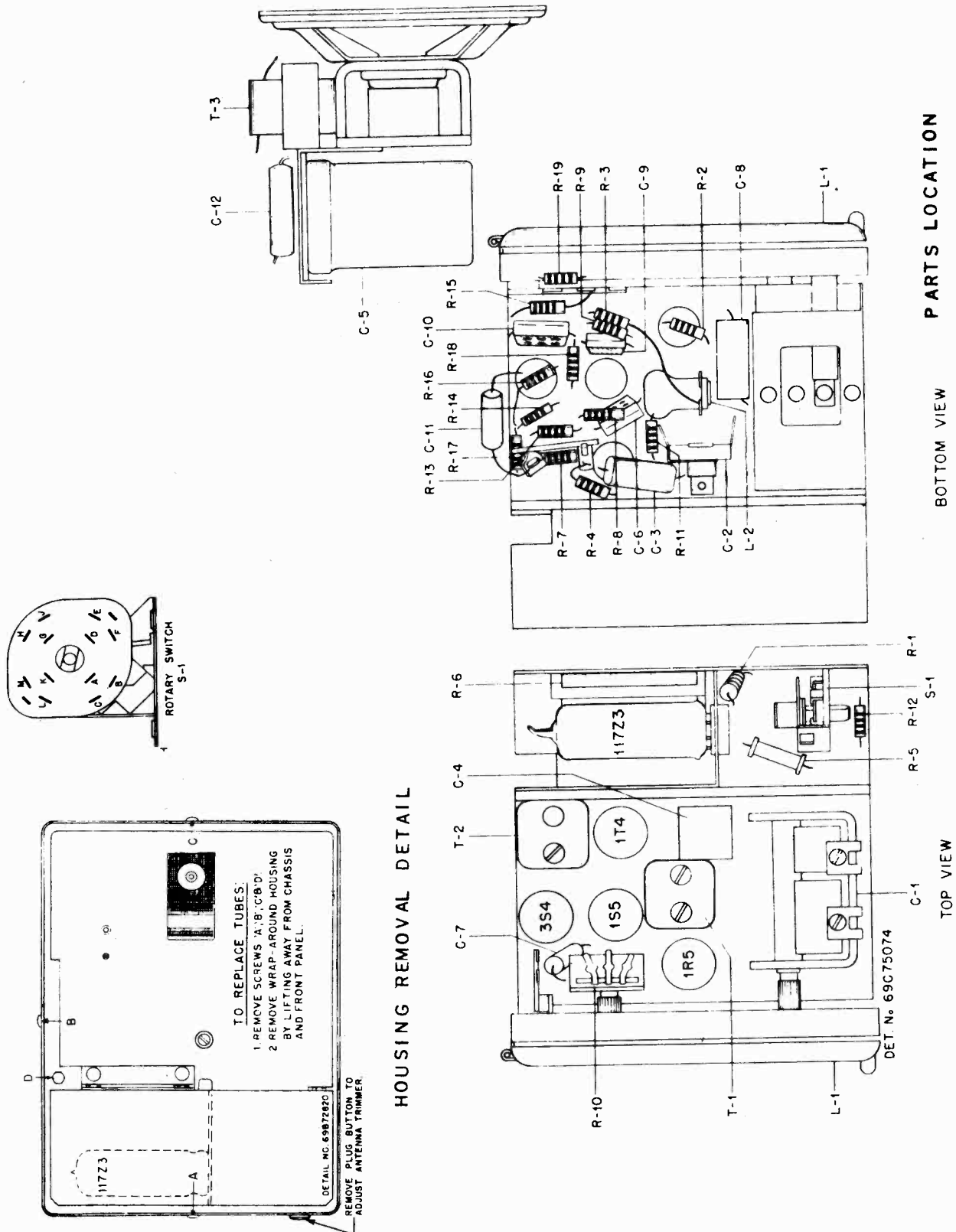
A 20,000 OHM PER VOLT VOLTMETER WAS USED

MEASUREMENTS MADE BETWEEN CHASSIS AND SOCKET PIN INDICATED.

117V LINE CORD REMOVED, BATTERIES DISCONNECTED, ON-OFF SWITCH IN ON POSITION AND A-C D-C BATTERY SWITCH IN A-C D-C POSITION FOR RESISTANCE MEASUREMENTS.

DUE TO COMPONENT TOLERANCES, RESISTANCE VARIATIONS OF 10 TO 20% AND VOLTAGE VARIATIONS OF 20% MAY BE EXPECTED.

CAUTION: BE CAREFUL WHEN MEASURING FILAMENT CIRCUIT WITH TUBES IN SET SOME OHMMETERS MAY BURN OUT TUBES



PARTS LOCATION
BOTTOM VIEW

TOP VIEW

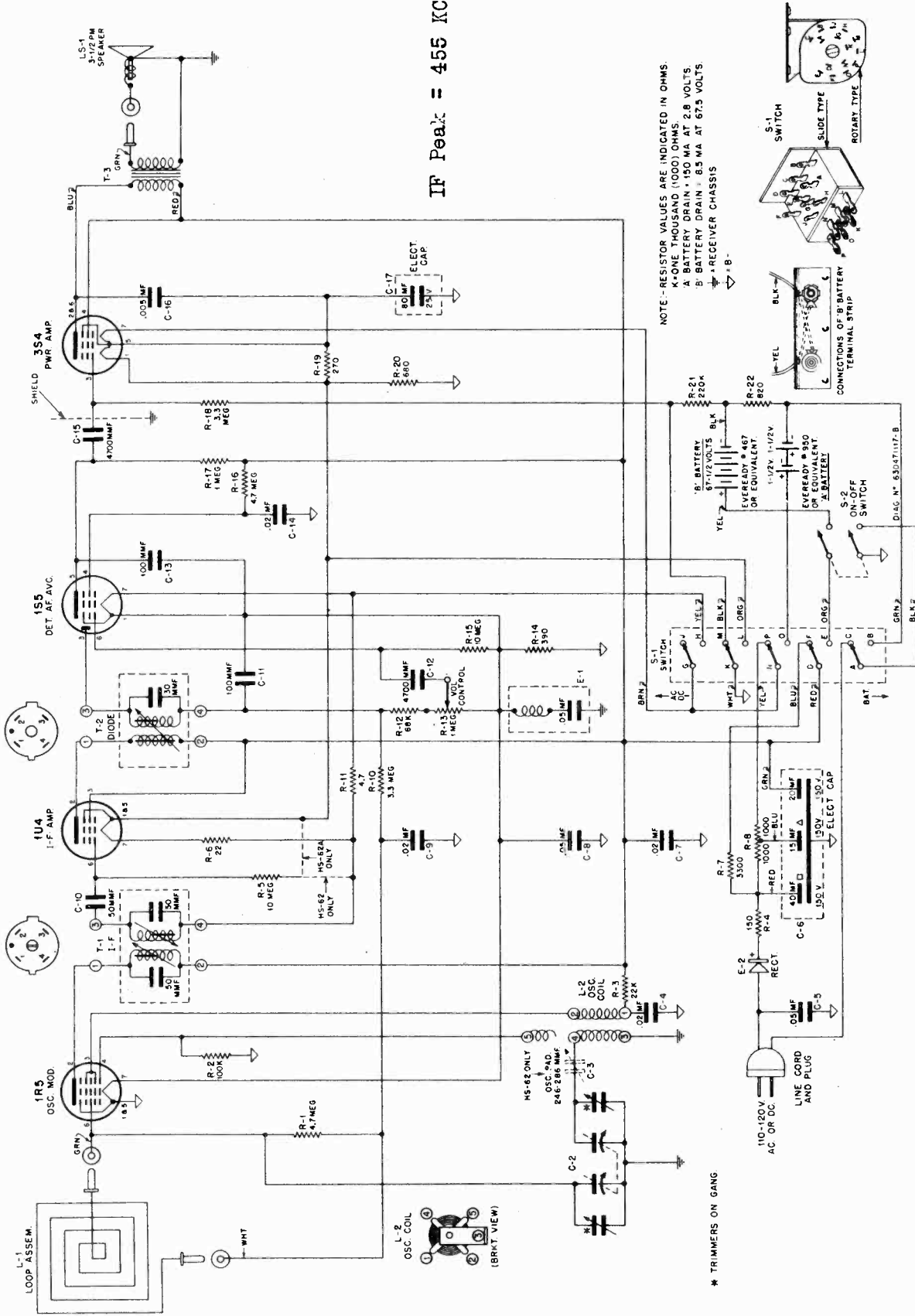
REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
C-1	19B54917	Capacitor, variable: 2 gang			
C-2	20A71206	Capacitor, trimmer: 270 mf. nominal; with "L" mounting bracket (oscillator pad.)			
C-3	8425558	Capacitor, fixed: paper: .02 mf. 100V			
C-4	8427077	Capacitor, fixed: paper: block - 5 X .02 mf., 100V; .05 mf. 100V & .05 mf. 400V			
C-5	23A71212	Capacitor, electrolytic: 40-20-20 mf. 150V. 80 mf. 25V			
C-6	21R6651	Capacitor, fixed: mica; 100 mf. 300V			
C-7	8424966	Capacitor, fixed: paper: .005 mf. 100V			
C-8	8471213	Capacitor, fixed: paper: .05 mf. .00V			
C-9	21R6651	Capacitor, fixed: mica; 100 mf. 300V			
C-10	21R6659	Capacitor, fixed: mica; 500 mf. 500V			
C-11	8424966	Capacitor, fixed: paper: .005 mf. 100V			
C-12	89824	Capacitor, fixed: paper: .002 mf. 400V			
L-1	24B24975	Antenna, loop: loop coil mounted on maroon painted bakelite plate			
L-2	24A25548	Coil, oscillator			
R-1		See Schematic Diagram for Correct Usage			
	6R6241 or	Resistor, fixed: carbon: 27 10% 1/2 W Ins.			
	6R3963	Resistor, fixed: carbon; 100 10% 2 W Ins.			
R-2	6R6031	Resistor, fixed: carbon; 100,000 10% 1/2 W Ins.			
R-3	6R6397	Resistor, fixed: carbon: 25,000 10% 1/2 W Ins.			
R-4	6R3938	Resistor, fixed: carbon; 8.2 meg 1/2W Ins.			
R-5	6R3960	Resistor, fixed: carbon; 2,700 1/2 W N.I. (late models)			
	6R6278	Resistor, fixed: carbon; 3,900 1/2 W N.I. (early models)			
R-6		See Schematic Diagram for Correct Usage			
	17A25977 or	Resistor, fixed: wire wound: 2550 5% 5W			
	17K5249	Resistor, fixed: wire wound: 2060 5% 5W			
R-7	6R6397	Resistor, fixed: carbon; 22,000 10% 1/2 W Ins.			
R-8	6R2118	Resistor, fixed: carbon; 3.3 meg. 1/2 W Ins.			
R-9	6R2109	Resistor, fixed: carbon; 10 meg. 1/2 W Ins.			
R-10	18A24918	Resistor, variable: 1 meg.			
R-11	6R5693	Resistor, fixed: carbon; 27 10% 1/2 W Ins.			
R-12	6R6269	Resistor, fixed: carbon; 820 10% 1/2 W Ins.			
T-1	1371265	Transformer, I.F.: 455 kc. com-plate with shield can and trimmers			
T-2	1324898	Transformer, diode: 455 kc; com-plate with shield can and trimmer			
T-3	25A71182	Transformer, output (purchase with speaker)			
	32A26019	Baffle, speaker: cardboard			
	20A24869	Bass, tube shield (for 35A)			
	1371263	Battery Bracket Assembly: "A" battery retainer bracket with negative contacts and battery reowner tape.			
	1471197	Battery Cover Assembly: nasomite cover with hinge, sponge rubber battery pad, pull tab and catch			
	1330520	Bracket & Button Assembly (back cover sliding latch)			
	7A24681	Bracket, capacitor mtg. (gang capacitor mounting)			
	1371270	Bracket & Insulator Assembly (electrolytic cap mounting)			
	7A27143	Bracket, rectifier unit mounting			
	7A24672	Bracket, volume control mounting			
	38A13911	Button, plug (antenna trimmer adjustment cover)			
	43A27109	Bushing, spacer: brass 7/32 diameter x 9/64 long (part of on-off switch assembly)			
	35A26186	Cloth, grille: maroon			
	30B20329	Cord, line: with plug: 8 feet long			
	1371275	Cover Assembly: back cover with hinges and sliding latch			
	56A27113	Foot, felt			
	5A74868	Grommet, plastic (insulates chassis from front panel and speaker)			
	55K30915	Handle, carrying (complete)			
	51R70499	Hinge Assembly (hinges loop to front plate)			
R-13	6R2122	Resistor, fixed: carbon: 4.7 meg. 1/2 W Ins.			
R-14	6R6256	Resistor, fixed: carbon: 1 meg. 1/2 W Ins.			
R-15	6R2118	Resistor, fixed: carbon: 3.3 meg. 1/2 W Ins.			
R-16	6R6432	Resistor, fixed: carbon: 270 10% 1/2 W Ins.			
R-17	6R6289	Resistor, fixed: carbon: 820 10% 1/2 W Ins.			
R-18	6R6001	Resistor, fixed: carbon; 60000 1/2 W Ins.			
R-19	6R6289	Resistor, fixed: carbon; 820 10% 1/2 W Ins.			
S-1	40A21111 or	Switch, changeover: 4P. D.T.			
	40R76319	Hinge, back cover: brass			
	55K30198	Housing and Back Cover Assembly: complete housing with back cover and handle.			
	67C54974	Housing, loop: molded plastic			
	14A79703	Insulator, contact strip: plastic (for "A" battery positive contact)			
	17A4575	Plate (front) & Housing Assembly: includes front plate with binged loop, latch and power switch.			
	55K71191	Retainer, handle			
	587725	Rivet, brass: .083 X 3/32; bright brass (back cover binged mounting and latch bar spring mounting)			
	58A497	Rivet, steel: .086 X 1/8; nickel plated (socket mounting)			
	587770	Rivet, steel: .088 X 5/32; polished nickel (mounts switch body to front plate)			
	587771	Rivet, steel: .088 X 3/16; polished nickel (loop hinge mounting)			
	582815	Rivet, steel: .088 X 7/32; polished nickel (mounts hinge support to front plate)			
	587775	Rivet, steel: .088 X 9/32; polished nickel (holds on-off switch together)			
	587713	Rivet, brass: .122 X 1/8 (handle mounting)			
	587707	Rivet, steel: .122 X 5/32; nickel plated (terminal strip mounting)			
	587706	Rivet, steel: .122 X 1/8; nickel plated ("A" battery negative contact insulating strip mounting)			
	587772	Rivet, brass: .122 X 3/16 (back cover sliding latch mounting)			
	587701	Rivet, steel: .122 X 3/16 nickel plated (gang capacitor bracket mounting)			
	587700	Rivet, steel: .122 X 1/4; nickel plated (battery contact strip mounting)			
	587708	Rivet, steel: .122 X 9/32; nickel plated (battery contact strip mounting; terminal strip mounting)			
	14A28933	Insulator, binged: bakelite; maroon finish, 1-1/2 X 9/32 X 1/32 thick			
	31A71195	Strip, terminal: 2 insulated lugs, #2 mounting			
	31A71196	Strip, terminal: 3 insulated lugs, #4 mounting			
	14A28932	Support, binged: brown bakelite: 1-1/2 X 9/32 X 3/32 thick			
	40A27111	Switch, body: switch actuating lever and mounting bracket (part of on-off switch)			
	40A27112	Switch plate and contacts: bakelite plate with D.P.S.T. contacts; less actuating lever and mounting bracket (on-off switch)			
	1372595	Tube Retainer Strip Assembly: fibre strip with 3 sponge rubber cushions. (for holding tubes in sockets)			
	9A22056	Wafer, electrolytic mounting: bakelite			

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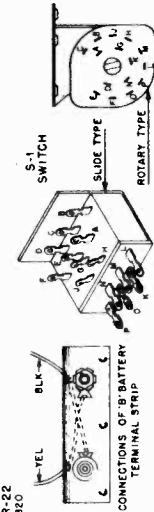
MODEL 5A5
MODEL 55F11

PART	DESCRIPTION	MODEL	DESCRIPTION	PART NO.	MODEL	DESCRIPTION
357162	Screw, steel: 8-32 x 5/16 slotted binder-head machine screw; cadmium plated (electrolytic bracket mounting)	5A5	Nut, steel: 3/8-32 x 9/16 hex; cadmium plated (volume control mounting)	5S7701	55F11	Rivet, steel: .122 x 3/16; nickel plated (electrolytic wafer mounting; tuning shaft bracket mounting; pilot light socket mounting)
26A24970	Shield, tube (for 3S4)		Plate, front: includes 3 unthreaded studs; less all other parts	5S7700		Rivet, steel: .122 x 1/4, nickel plated (loop receptacle mounting)
9S70455	Socket, tube: miniature 7 prong; plain		Washer, brass: 5/16 x .130 x .025 thick (part of back cover latch assembly)	5S7708		Rivet, steel: .122 x 9/32, nickel plated (line cord lock mounting)
9A70489	Socket, tube: miniature 7 prong; cushioned type		Washer, fibre: 9/16 x .190 x .010 thick (insulator on front plate studs)	5A71246		Rivet, shoulder: .187 long (pointer cord guide pulley mounting)
14A74531	Spacer, hinge and loop back: bakelite, 1/4 x 3/4 x 1/32 thick		Washer, spring (part of back cover latch assembly)	5A13696		Rivet, shoulder: .312 long (pointer cord guide pulley mounting)
50B71061	Speaker and Output Transformer: 3-1/2" permanent magnet		Screw, steel: #2 x 3/16 PKZP	47K71725		Rod, dial cord guide: steel; 10-1/16 long x 3/32 diameter
41A24954	Spring, latch bar		Phillips flat head antique copper (holds loop assembly together)	34B71097		Scale, dial: glass
31K27076	Strip, "B" battery terminal ("B" battery connector)		Screw, steel: #4 x 3/16 PKZ slotted hex head; cadmium plated (mounts battery cover hinge to rectifier unit)	3S1317		Screw, steel: #2 x 3/8 Phillips oval head wood screw; bronze finish (dial escutcheon mounting)
39A71210	Strip, battery contact: brass ("A" battery positive contact)		Phillips stove head; bronze plated (front plate to housing mounting)	3S7506		Screw, steel: #6 x 1/4 PKZ plain hex head; cadmium plated (oscillator coil mounting)
31K15026	Strip, terminal: 2 insulated lugs, #2 mounting (line cord tie point)		Screw, steel: 6-32 x 3/16 slotted locking hex head machine screw; cadmium plated (gang mounting)	3S7536		Screw, steel: #6 x 3/8 PKA slotted acorn head; antique copper finish (loop mounting)
1X71264	Insulating Strip & Wipers Assembly: "A" battery negative contacts mounted on plastic insulating strip; includes brass battery connector strap.		Screw, steel: #6 x 3/16 PKZ plain hex head; cadmium plated (holds back of chassis to housing & changeover switch mounting)	3S2294		Screw, steel: 6-32 x 1/2, plain hex head, locking type machine screw; cadmium plated (gang capacitor mounting)
36B24988	Knob, control: maroon plastic		Screw, steel: #6 x 1/4 PKZ plain hex head; cadmium plated (oscillator padder, oscillator coil, by-pass capacitor block and rectifier unit mounting.)	3S2911		Screw, steel: 6-32 x 3/4 Phillips flat head machine screw; cadmium plated (speaker baffle mounting)
38A24965	Latch, bar: maroon plastic		Washer, steel: 3/16 x .101 x .016 thick (spacer between hinge support and front plate)	9A12705		Water, electrolytic capacitor mounting: bakelite
4S7686	Lockwasher, steel: #6 external, cadmium plated (oscillator coil mounting)		Washer, steel: 3/8 x .171 x .033 thick; cadmium plated (front plate mounting studs)	4A70015		Washer, "C"
4S7650	Lockwasher, steel: #6 internal; cadmium plated (battery contact strip mounting)			4S1719		Washer, steel: 3/8 x .140 x .030 thick, cadmium plated
4S7657	Lockwasher, steel: #8 external; cadmium plated (electrolytic bracket mounting)					
29R5368	Lug, soldering: #2 (loop terminals on loop plate)					
29R5399	Lug, soldering: #3 (loop terminals on front plate)					
29R5207	Lug, solder: #6; H.T.					
2S7007	Nut, steel: 8-32 x 1/4 hex. cadmium plated (speaker and chassis mounting)					

IF Peak = 455 KC



NOTE - RESISTOR VALUES ARE INDICATED IN OHMS.
 K - ONE THOUSAND (1000) OHMS.
 A BATTERY DRAIN - 150 MA AT 2.8 VOLTS.
 B BATTERY DRAIN - 85 MA AT 67.5 VOLTS
 * RECEIVER CHASSIS



* TRIMMERS ON GANG

MOTOROLA INC.

MODEL 5A7
MODEL 5A7A**SERVICE NOTES**

Placement of the four tubes (1R5, 1U4, 1S5 and 3S4) is such that they may be easily removed for servicing by opening the back cover of the set. To reduce microphonic howl, rubber shock mounting is provided for the small chassis holding the tubes and coils. A thin piece of braid serves to bond the two chassis. This braid, as well as all leads connecting the small chassis wiring to the large chassis, should be carefully dressed and free in movement to insure a good floating action of the small chassis.

Insulation between the cabinet (front, back and wrap-around) and chassis is provided for by the bakelite bushing mountings on the sides and by a wrap of armitite riveted to the inside of the cabinet.

The chassis itself is isolated from the line and power circuit by a capacitor-choke assembly which eliminates shock hazard. To further guarantee any annoyance from a minor shock the chassis is insulated from the cabinet.

To remove the chassis from the cabinet, remove the two 4-40 screws (one on each side of the cabinet), pull off the tuning knobs, remove the front panel, disconnect the two loop leads from the pin receptacles, and slide the chassis out of the cabinet.

To remove the chassis cover plate, remove the two slotted screws holding the plate to the edge of the large chassis and with the set lying with the speaker cone down, lift the plate up from the chassis.

To remove the gang condenser, the screws holding the small chassis to the large chassis should be removed. This makes it possible to pull the small chassis strip out of the way so that access can be had to the screws holding the gang.

For access to some of the wiring, the "A" battery boxes may have to be removed. To do this, remove the two hex-headed screws over the slide switch leaving the center screw in. The two boxes and the connecting bracket may now be separated from the chassis. The bottom plates of the battery boxes are wired to the set, but the plates may be removed by bending the ears on the boxes outward.

The speaker is held in place by one screw located in the back of the 1S5 tube and a locating ear under the diode coil can. To replace the speaker remove the 8-32 hex-headed screw, disconnect the voice coil lead from the pin receptacle on the speaker and pull the speaker out from the front of the set.

Turning the set on or off is accomplished by opening or closing the front cover which actuates a push rod connected to a switch. Overthrow has been provided in the switch so that the switch is open circuited before the cover is completely closed. This prevents tolerance between the cover and front panel from causing switch failure. Inserting the line cord plug into the two slots between the battery boxes operates a slide switch which changes the circuit wiring to battery operation.

The oscillator coil and tuning capacitor leads should be dressed close to the chassis. This will minimize shifting of oscillator frequency when chassis is installed in its cabinet.

GENERAL INFORMATION

TYPE - Models 5A7 and 5A7A are three power (AC/DC-Battery) portable radio receivers of the personal type. Four miniature type tubes and a selenium rectifier are used in a superheterodyne circuit.

Chassis HS-62 is used in Model 5A7; Chassis HS-62A is used in Model 5A7A.

Models 5A7 (Chassis HS-62) and 5A7A (Chassis HS-62A) differ as follows:

Model 5A7 uses a tuning capacitor having same shaped plates in both sections and an oscillator padding capacitor. Model 5A7A uses a tuning capacitor having a cut plate oscillator tuning section and, therefore, an oscillator padder is not required. The tuning capacitors, oscillator coils, loop antennas, and front panels are, therefore, unique for each model. The front panels differ because of differences in calibration curves between the cut plate and full plate tuning capacitors.

TUNING - 5A7 - 535 to 1600 Kc

5A7A - 535 to 1620 Kc

IF FREQUENCY - 455 Kc

TUBE COMPLEMENT - 1R5 - Oscillator-Modulator

1U4 - IF Amplifier

1S5 - Detector, AVC & 1st AF Amplifier

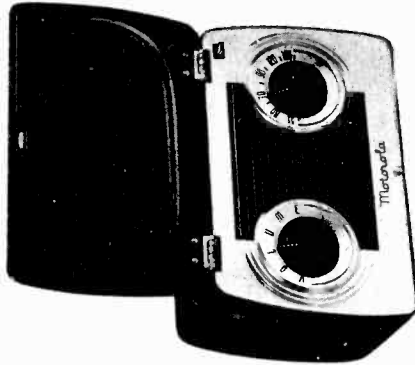
3S4 - Power Amplifier

Rect.- Selenium type - for AC/DC operation

POWER SUPPLY - Operates from 110-120V AC/DC (15 watts) or from the following batteries:

2 - 1-1/2V flashlight cells (Eveready #950 or equivalent)

1 - 67-1/2 "B" battery (Eveready #467 or equivalent)



MODEL 5A7
MODEL 5A7A

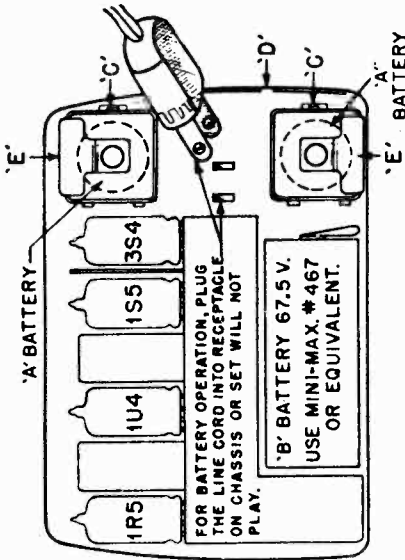


FIGURE 1. BATTERY INSTALLATION DETAIL

'A' Batteries: 1 1/2 V. flashlight cells. Use Eveready No. 950 or equiv. Install with Center Terminal facing back of set. 2 used.
To open 'A' Battery Compartments push Catches 'C' to the right.
When playing from house current, pass Line Cord through Slot 'D' in cabinet.
When line cord is not in use, wind it around Cord Clamps 'E'.

BATTERY REPLACEMENT. When low volume or fuzzy tone is noticed, replace the flashlight cells. Normally, the 67-1/2 "B" battery will last for 3 or 4 changes of the flashlight cells.

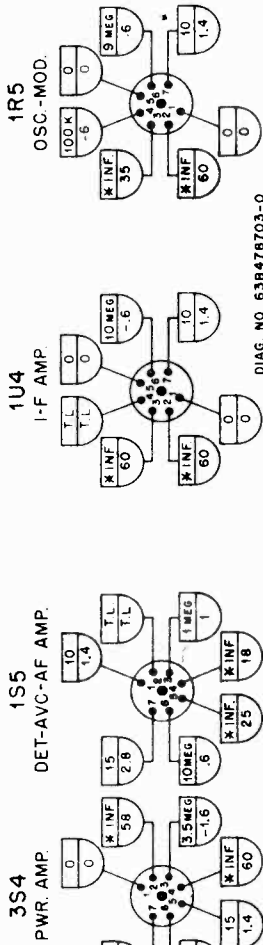
NOTE: The condition of the batteries will not affect operation of receiver from 110-120 volts AC or DC. Complete battery replacement instructions will be found inside the receiver back cover (of see Figure 1).

BOTTOM VIEW OF CHASSIS

- = VOLTAGE MEASUREMENTS.
- = RESISTANCE MEASUREMENTS.
- T.L. = TIE LUG
- * = MEASUREMENTS MAY VARY DEPENDING ON CONDITION OF ELECTROLYTIC CAPACITORS.

CONDITIONS OF MEASUREMENTS.

A VTVM WAS USED TO MAKE ALL VOLTAGE MEASUREMENTS. LOOP IS DISCONNECTED AND NO STATION IS TUNED IN. MEASUREMENTS ARE MADE FROM TUBE BASE PIN TO B-(↔) SET IS OPERATED FROM FRESH BATTERIES DURING VOLTAGE MEASUREMENTS. SET IS IN BATTERY POSITION AND BATTERIES ARE REMOVED DURING RESISTANCE MEASUREMENTS. VOLTAGE TOLERANCE ± 10%. RESISTANCE TOLERANCE ± 20%.



DIAG. NO. 63B478703-0

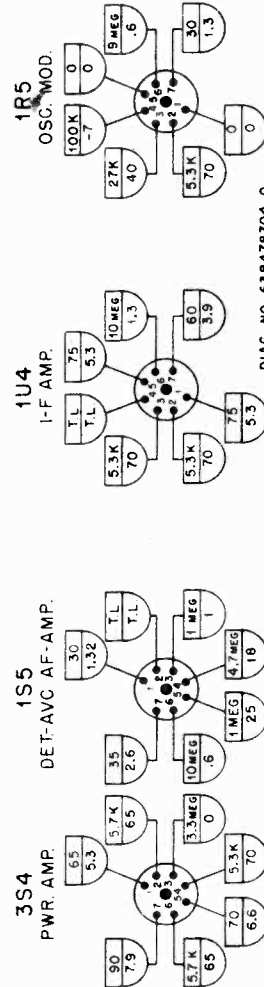
FIGURE 9. VOLTAGE & RESISTANCE DIAGRAM-CHASSIS HS-62 & HS-62A-BATTERY OPERATED

BOTTOM VIEW OF CHASSIS

- = VOLTAGE MEASUREMENTS.
- = RESISTANCE MEASUREMENTS.
- * T.L. = TIE LUG.

CONDITIONS OF MEASUREMENTS

A VTVM WAS USED TO MAKE ALL VOLTAGE MEASUREMENTS. LOOP IS DISCONNECTED AND NO STATION TUNED IN. MEASUREMENTS ARE MADE FROM TUBE BASE PINS TO B-(↔) SET IS OPERATED FROM 117 V. AC DURING VOLTAGE MEASUREMENTS. SET IS IN AC/DC POSITION AND BATTERIES ARE REMOVED DURING RESISTANCE MEASUREMENTS. VOLTAGE TOLERANCE ± 10%. RESISTANCE TOLERANCE ± 20%.



DIAG. NO. 63B478704-0

FIGURE 10. VOLTAGE & RESISTANCE DIAGRAM-CHASSIS HS-62 & 62A-AC OPERATED

MOTOROLA INC.

MODEL 5A7

CHART I. MODEL 5A7 (CHASSIS HS-62) ALIGNMENT PROCEDURE

(Refer to Figure 2 for location of all alignment trimmers and cores)

STEP	DIAL SET TO	DUMMY	SIGNAL GENERATOR CONNECTED TO	SIGNAL GENERATOR SET AT	ADJUST TRIMMER OR CORE	REMARKS
IF ALIGNMENT						
1.	Gang fully opened	.1 mf	Osc-Mod grid & B- *	455 Kc	1, 2 & 3	Adjust for maximum
RF ALIGNMENT						
2.	Gang fully opened	.1 mf	Osc-Mod grid & B- *	1600 Kc	4	This sets oscillator to dial scale
3.	-	-	-	-	-	Install chassis in cabinet, leaving output meter connected to speaker.
4.	1400 Kc	None	Radiation loop**	1400 Kc	5	Tune signal in on receiver, then adjust loop trimmer (5) for maximum. Loop trimmer is reached through hole under plug button on side of cabinet.
5.	600 Kc	None	Radiation loop**	600 Kc	6	Tune signal in on receiver. Adjust osc pad (6) through hole in back of shield plate inside back cover (while rocking gang capacitor) for maximum output.

NOTE: If oscillator padder (6) has been indiscriminately tampered with, it may be necessary to repeat Steps 2, 3, 4 & 5 several times to secure correct tuning range and proper tracking.

* A convenient point for these connections is the stator of the loop section of the tuning capacitor and the rear left hand lug on the power switch. See Figure 2.

** Connect output of signal generator to a 5" diameter, 3 turn loop and bring loop close enough to receiver loop to obtain output of 50 milliwatts (.40 V) on output meter. Vary distance between loops to maintain this output during alignment. Minimum distance between loops should never be less than 12".

ALIGNMENT

Maximum performance can only be obtained if extreme care is exercised during alignment. Follow the procedure carefully.

If the receiver is operated from an AC line during alignment, it is suggested that an isolating transformer be used between receiver and power line.

A low range output meter should be connected to the speaker voice coil terminal and receiver chassis. Set receiver volume control to maximum. For greatest accuracy, keep output of receiver at approximately .05 watt (.05 watt = .40 volt on out-

put meter) throughout alignment by reducing generator output (not receiver volume control) as stages are brought into alignment.

The IF & diode transformer tuning cores are slotted for a small size fibre screwdriver. Do not press hard on the fibre screwdriver during alignment as damage to the coil forms or tuning cores may result.

Chart I gives complete alignment procedure for Model 5A7 (Chassis HS-62). Chart II gives complete alignment procedure for Model 5A7A (Chassis HS-62A).

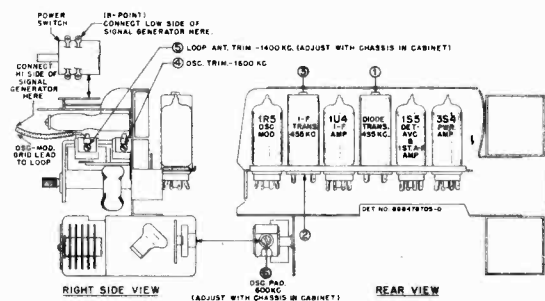


FIGURE 2. CHASSIS HS-62 TUBE & TRIMMER LOCATIONS

CHART II. MODEL 5A7A (CHASSIS HS-62A) ALIGNMENT PROCEDURE

(Refer to Figure 3 for location of all alignment trimmers and cores).

STEP	DIAL SET TO	DUMMY	SIGNAL GENERATOR CONNECTED TO	SIGNAL GENERATOR SET AT	ADJUST TRIMMER OR CORE	REMARKS
IF ALIGNMENT						
1.	Gang fully opened	.1 mf	Osc-Mod grid & B- *	455 Kc	1,2 & 3	Adjust for maximum.
RF ALIGNMENT						
2.	Gang fully opened	.1 mf	Osc-Mod grid & B- *	1620 Kc	4	This sets oscillator to dial scale.
3.	-	-	-	-	-	Install chassis in cabinet, leaving output meter connected to speaker.
4.	1400 Kc	None	Radiation loop **	1400 Kc	5	Tune signal in on receiver, then adjust loop trimmer (5) for maximum. Loop trimmer is reached through hole under plug button on side of cabinet.

* A convenient point for these connections is the stator of the loop section of the tuning capacitor and the rear left hand lug on the power switch. See Figure 3.

** Connect output of signal generator to a 5" diameter, 3 turn loop and bring loop close enough to receiver loop to obtain output of 50 milliwatts (.40 V) on output meter. Vary distance between loops to maintain this output during alignment. Minimum distance between loops should never be less than 12".

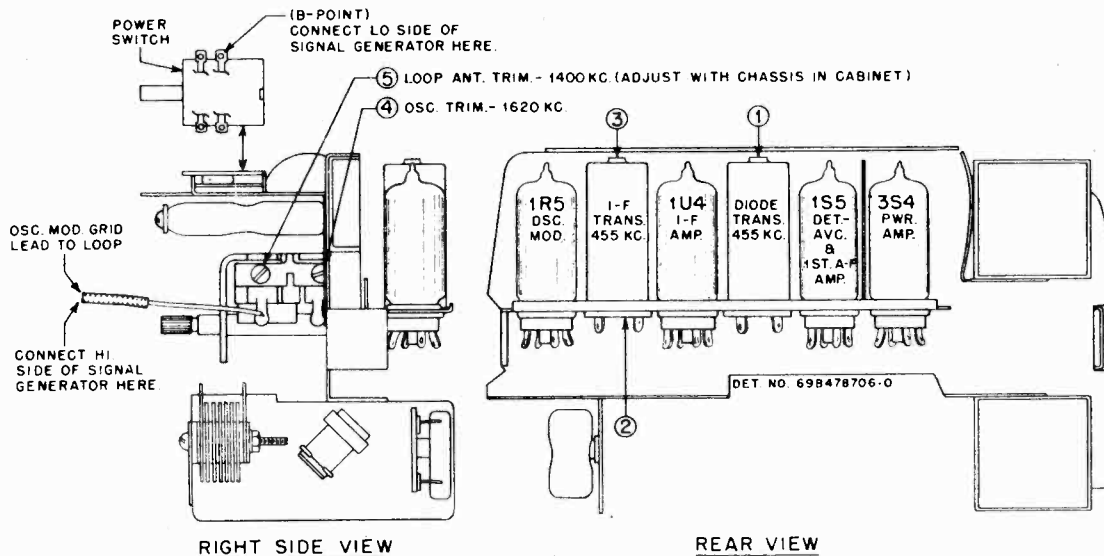


FIGURE 3. CHASSIS HS-62A TUBE & TRIMMER LOCATIONS

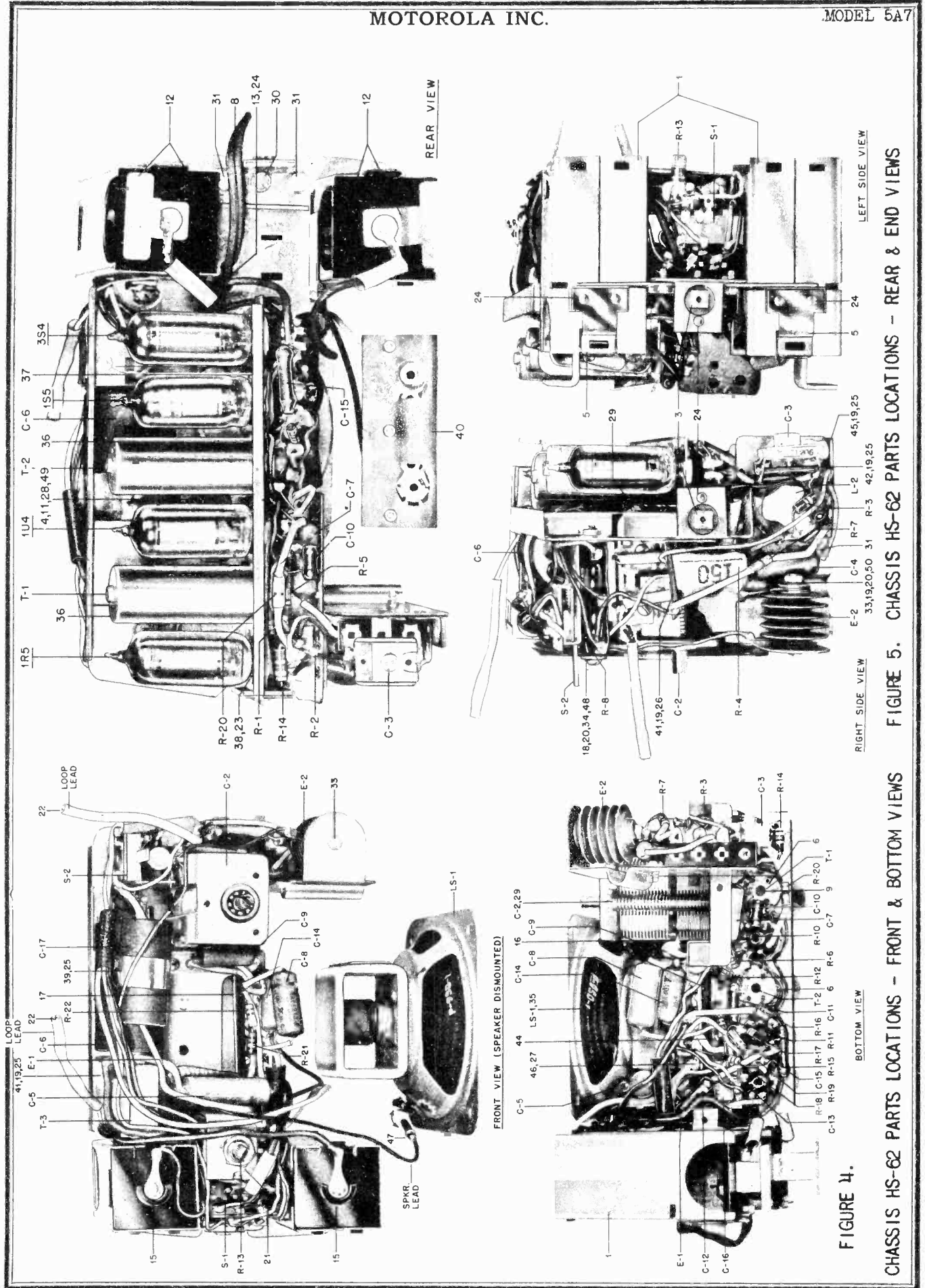


FIGURE 4. CHASSIS HS-62 PARTS LOCATIONS - FRONT & BOTTOM VIEWS

FIGURE 5. CHASSIS HS-62 PARTS LOCATIONS - REAR & END VIEWS

MODEL 5A7A

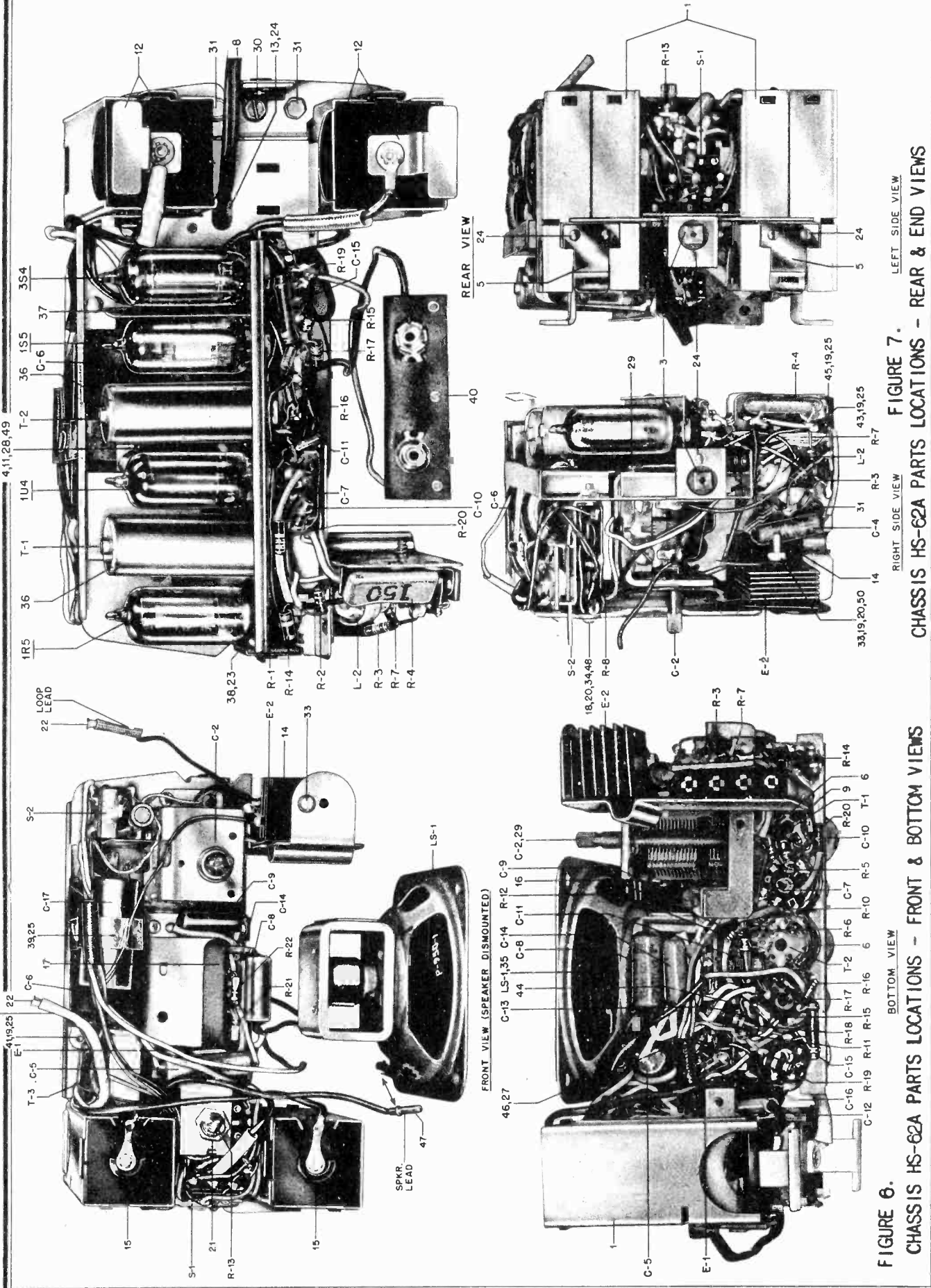


FIGURE 6.
CHASSIS HS-62A PARTS LOCATIONS - FRONT & BOTTOM VIEWS
FIGURE 7.
CHASSIS HS-62A PARTS LOCATIONS - REAR & END VIEWS

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MODEL 5A7
MCDEL 5A7A

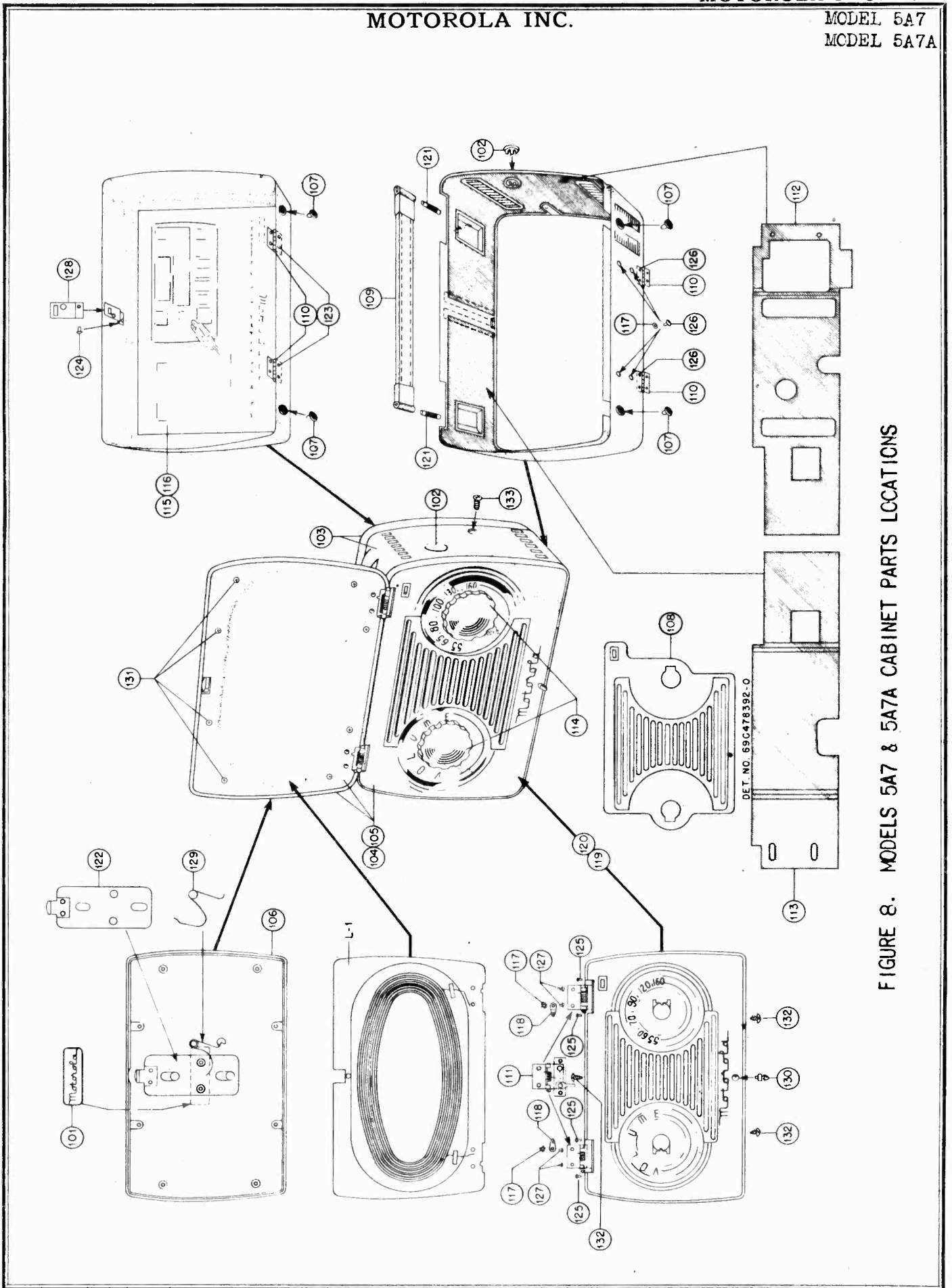


FIGURE 8. MODELS 5A7 & 5A7A CABINET PARTS LOCATIONS

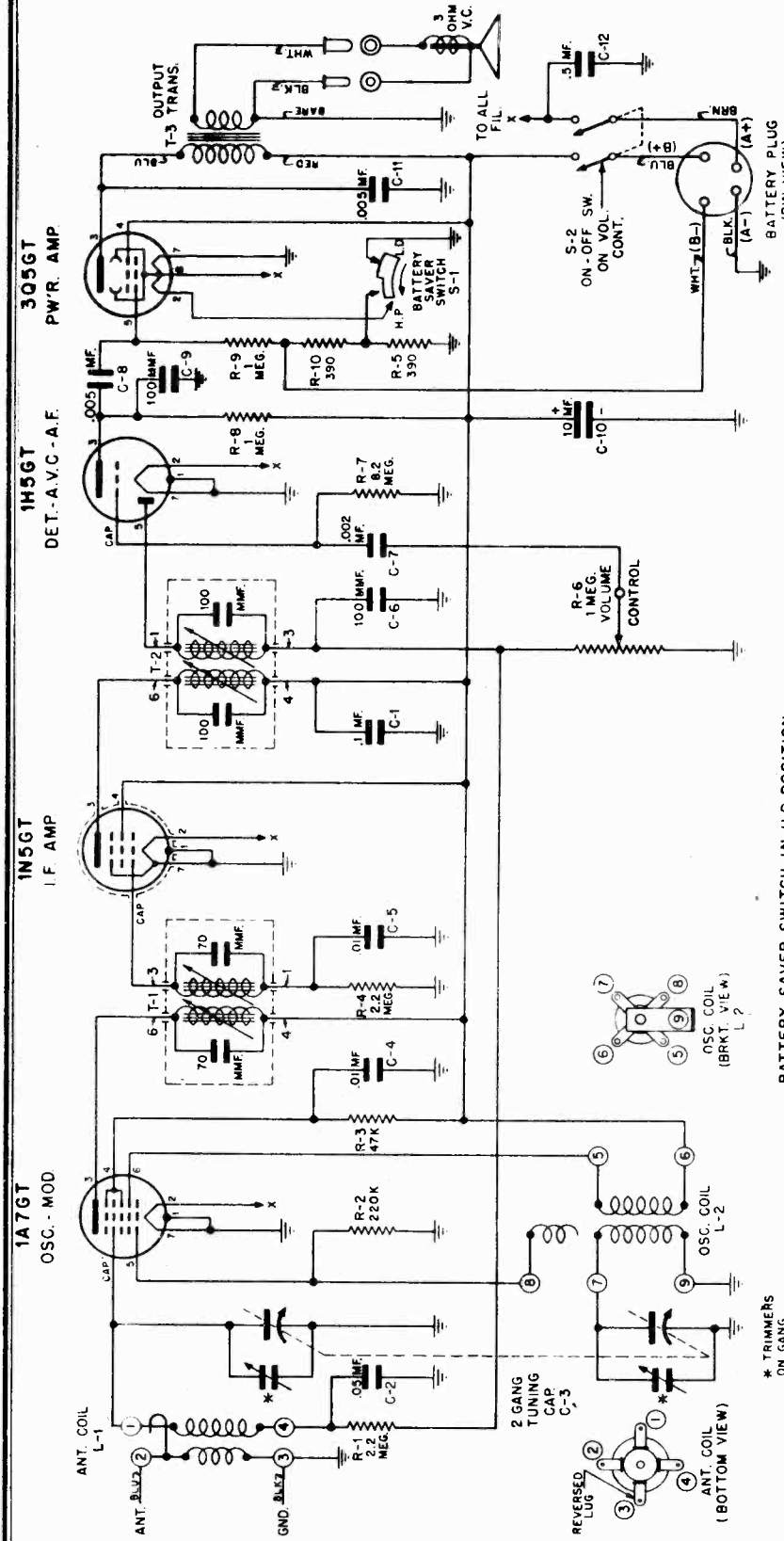
MODEL 5A7
MODEL 5A7A

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REPLACEMENT PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
SWITCHES			24	587770	Rivet: .088 x 5/32 steel; nickel plated (line cord lock battery insulator catch and chassis insulator mg).....	104	1X478227	Cover, Loop & Front Panel Assembly: includes: satin-finished chrome front panel 1, latch retainer stud, two insulator hinges, molded speaker grille, loop antenna and loop cover with latch (for 5A7 only-use only with chassis RS-62)			
3-1	40A470619	Slide switch: SPDT (AC-DC) Battery selector- interchangeable with 40A471827).....	25	587706	Rivet: .822 x 1/8 steel; nickel plated (electrolytic strap mg, etc).....	105	1X478204	Cover, Loop & Front Panel Assembly: same as above except for 5A7A only-use only with chassis RS-62A			
or			26	587707	Rivet: .632 x 3/16 slotted hex head (locking type machine screw; cadmium plated (yng mg)).....						
40A470619			27	587701	Rivet: .632 x 3/16 slotted hex head (locking type machine screw; cadmium plated (yng mg)).....						
3-2	40A470687	Rotary change-over switch: SPDT (AC-DC) Battery Selector- interchangeable with 40A470619).....	28	332881	Screw: #4 x 3/8 Phillips fillister head (thread cutting screw; cadmium plated (sub-chassis mg)).....	106	1X478202	Knob, control: maroon plastic			
			29	357247	Screw: #6-32 x 1/4 Phillips slotted hex head (locking type machine screw; cadmium plated (yng mg)).....	107	55A27113	Foot: felt			
			30	357425	Diode: 4SS: complete with padding capacitor and tuning coil; less shield	108	13C470873	Grille, speaker: maroon plastic			
T-2	24A470892	Diode: 4SS: complete with padding capacitor and tuning coil; less shield	31	357506	NOTE: WHEN USING REPLACEMENT DIODE TRANSFORMER, IT MAY BE NECESSARY TO ENLARGE HOLE IN SHIELD SLIGHTLY.....	109	55A470984	Handle, carrying: complete			
			32	357460	Output.....	110	56X00198	Hinge, back cover			
T-3	25A470622	Output.....	33	339863	Battery Box & Bracket Assembly: two complete; battery boxes assembled together; includes negative contacts and positive contact insulators for catches only.....	111	1X478229	Hinge & Insulator Assembly (front cover)			
1	1X470935	Battery Box & Bracket Assembly: two complete; battery boxes assembled together; includes negative contacts and positive contact insulators for catches only.....	34	331451	Bracket, speaker mounting (used only with 50B478223 speaker only).....	112	14A478014	Insulator, inner housing right hand; amite			
2	7A478012	Bracket, speaker mounting (used only with 50B478223 speaker only).....	35	357205	Brushing, plain; brass (used inside sub-chassis shock mg grommets).....	113	14A478079	Insulator, inner housing left hand; amite			
3	1X470835	Brushing, plain; brass (used inside sub-chassis shock mg grommets).....	36	14A70981	CLIP, tuning core (IF & diode trans.....)	114	36B470987	Label, control: maroon plastic			
4	4A470458	CLIP, tuning core (IF & diode trans.....)	37	28A470808	Core, from: threaded (IF & diode trans.....)	115	54B471078	Label, composer: operating instructions & cover insulator (for 5A7)			
5	55A470913	Core, from: threaded (IF & diode trans.....)	38	94A70506	Cover, classic (bottom chassis cover).....	116	54A471573	Label, composer: operating instructions & cover insulator (for 5A7A)			
6	42A470987	Cover, classic (bottom chassis cover).....	39	42A470687	CLIP, transformer mounting (IF & diode trans, mg).....	117	438406	Lockwasher: #2 internal; cadmium plated (housing insulator mg & loop lug mg).....			
7	42A470981	CLIP, transformer mounting (IF & diode trans, mg).....	40	31A470800	Cord, line & plug: 2 conductor; 6 ft. lg.....	118	28B5399	Wdg, soldering: #5.....			
8	50B470621	Cord, line & plug: 2 conductor; 6 ft. lg.....	41	31A478794	Core, from: threaded (IF & diode trans.....)	119	13C478017	Panel, front: metal; satin chrome finish (5A7A only).....			
9	48A470805	Core, from: threaded (IF & diode trans.....)	42	31A478246	CLIP, tuning core (IF & diode trans.....)	120	15K478000	Pin, handle: retainer (5A7A only).....			
10	15C470642	Cover, classic (bottom chassis cover).....	43	31A485126	Cord, line & plug: 3 conductor; 1/2 in. dia.....	121	46A470987	Plate & latch assembly.....			
11	5K470918	Grommet, insulating: rubber (sub-chassis shock mounting).....	44	31A485111	Cord, line & plug: 3 conductor; 1/2 in. dia.....	122	1X470989	Rivet: .088 x 3/32 steel; black nickel finish (mounts rear cover to hinge).....			
12	1X470633	Insulator, lead & lug assembly; includes cord clamp (A) battery box positive contact).....	45	31A471186	CLIP, tuning core (IF & diode trans.....)	123	55B4847	Rivet: .088 x 3/32 steel; black nickel finish (mounts rear cover to hinge).....			
13	14A470614	Insulator, line cord locks: tube.....	46	31A470612	Grommet, insulating: rubber (sub-chassis shock mounting).....	124	582831	Rivet: .088 x 1/4 steel; stannary bronze finish (mounts hinge to front panel).....			
14	14A478112	Insulator, rectifier: amite.....	47	29A5414	Insulator, lead & lug assembly; includes cord clamp (A) battery box positive contact).....	125	582829	Rivet: .088 x 1/4 steel; stannary bronze finish (mounts hinge to front panel).....			
15	1X470608	Insulator, spring: lead & lug assembly (A) battery box negative contact).....	48	44A70639	Washer, insulating: 3/8 x .136 x .102 (thick amite resistor mounting).....	126	55B4840	Rivet: .088 x 5/32 steel; black nickel finish (mounts hinge to loop cover).....			
16	14A470617	Small.....	49	457854	Washer: 3/8 x 1/8 x .103 thick, steel; cadmium plated (sub-chassis mg).....	127	582827	Rivet: .088 x 5/32 steel; stannary bronze finish (mounts hinge to loop cover).....			
17	14A470615	Large.....	50	457852	Washer: 7/16 x 9/64 x .042 thick, cadmium plated (rectifier mg).....	128	1X470843	Spring & Button Assembly (rear cover catch).....			
18	457866	Lockwasher: #4 external (resistor mg).....	101	36A470978	Button, loop cover: plastic.....	129	41A470909	Spring, loop door catch.....			
19	457865	Lockwasher: #4 internal (term. strip & rectifier mg).....	102	36B470969	Button, plug: wrinkle maroon finish (cover for loop ant. trim, hole).....	130	46A470961	Stud, latch retainer.....			
20	287005	Nut: #8-32 x 1/4 hex; cadmium plated (resistor & rectifier mg).....	103	1X478033	Cabinet: complete; includes: die cast housing, rear cover with catch, felt feet and amite housing insulators; does not include carrying handle; handle does not include carrying handle; retaining pins or front cover and loop assembly.....	131	3539359	Screw: #2 x 1/4 PH Phillips (flat head sheet metal screw; stannary bronze finish (mount loop to loop cover).....			
21	287018	Nut: 3/8-32 x 1/2 hex; cadmium plated (vol. ctrl. mg).....				132	3539390	Screw: #4 x 3/16 PH Phillips (stove head sheet metal screw; stannary bronze finish (mount front panel to housing).....			
22	9A470690	Receptacle, loop lead.....				133	35A76038	Screw: 4-40 x 1/4 Phillips blinderhead machine screw; stannary bronze finish (classis to cabinet mg).....			
23	507769	Rivet: .088 x 3/32 steel; nickel plated (socket mg, etc.).....									

CABINET PARTS - MODELS 5A7 & 5A7A



BATTERY Saver SWITCH IN H.P. POSITION.

A TOLERANCE OF ±10% IS PERMITTED ON VOLTAGE MEASUREMENTS; ±20% ON RESISTANCES.

ALL VOLTAGE MEASUREMENTS ARE MADE WITH A VTVM FROM TUBE BASE PIN TERMINALS TO CHASSIS.

* MAY VARY, DEPENDING ON CONDITION OF ELECTROLYTIC CAPACITOR C-10.

RESISTANCE MEASUREMENTS.

I.F. = 455 KC
FREQUENCY RANGE
538 KC TO 1720 KC

BATTERY PACK
1-1/2 V. 'A' & 90 V. 'B'

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I.F. = 455 KC
FREQUENCY RANGE
538 KC TO 1720 KC

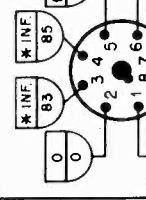
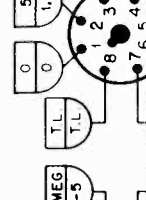
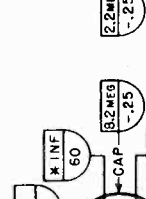
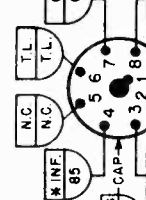
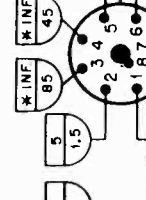
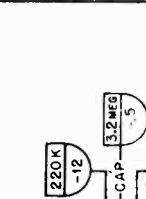
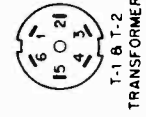
BATTERY PACK
1-1/2 V. 'A' & 90 V. 'B'

A TOLERANCE OF ±10% IS PERMITTED ON VOLTAGE MEASUREMENTS; ±20% ON RESISTANCES.

ALL VOLTAGE MEASUREMENTS ARE MADE WITH A VTVM FROM TUBE BASE PIN TERMINALS TO CHASSIS.

* MAY VARY, DEPENDING ON CONDITION OF ELECTROLYTIC CAPACITOR C-10.

RESISTANCE MEASUREMENTS.



MODEL 47B11

MOTOROLA INC.

Maximum performance can only be obtained if extreme care is exercised during alignment. Follow the procedure carefully.

alignment. (.05 watt = .40 volt on output meter.) The alignment tool should be of an insulated type, such as Motorola Part No. 66A71008.

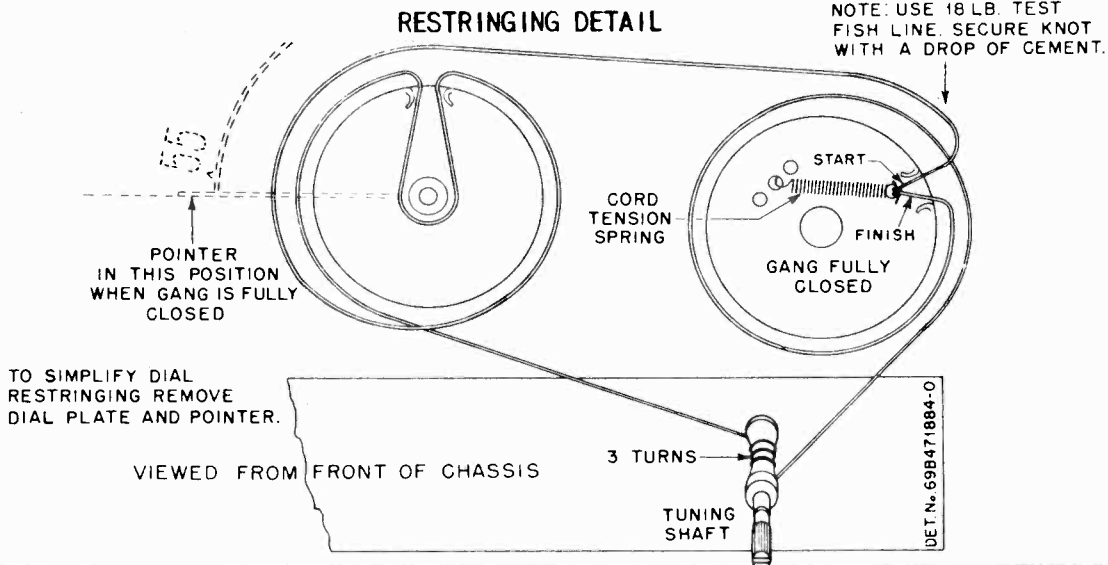
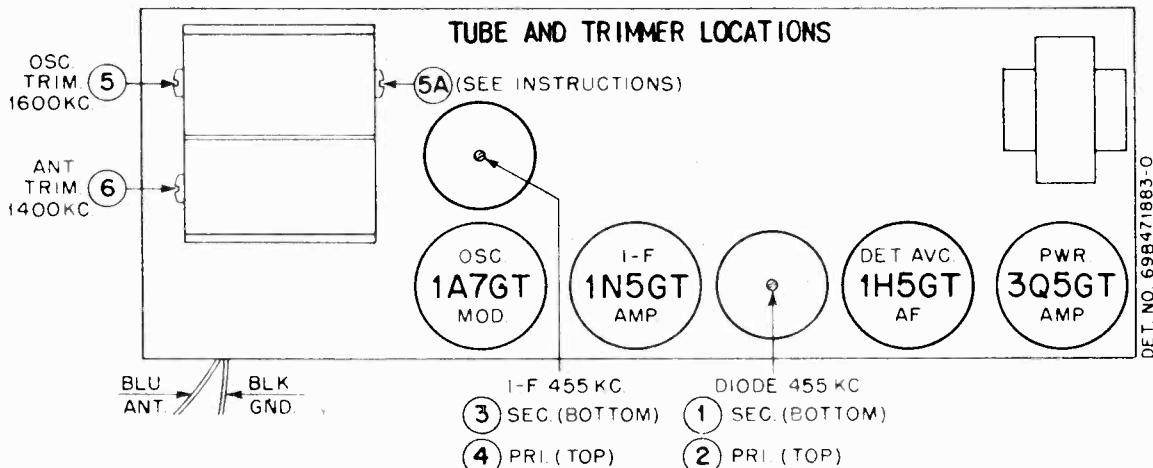
A low range output meter should be connected across the speaker voice coil. Set LO DRAIN-HI POWER switch to HI POWER. Set receiver volume control to maximum; for greatest accuracy keep output of receiver at approximately .05 watt throughout alignment by reducing signal generator output (not receiver volume control) as stages are brought into

Refer to Figure 1 for location of all adjustments.

Normally, oscillator can be set with trimmer 5. However, if setting of trimmer 5A has been tampered with, it may be necessary to increase or decrease setting of 5A before trimmer 5 will peak correctly.

STEP	DIAL SET TO	DUMMY	SIGNAL GENERATOR CONNECTED TO	SIGNAL GENERATOR SET TO	ADJUST TRIMMER OR CORE	REMARKS
ALIGNMENT						
IF ALIGNMENT						
1.	Gang fully opened.	.1 mf.	High side to Osc-Mod grid (cap). Lo side to chassis.	455 Kc.	1,2,3 & 4	Peak for maximum output.
RF ALIGNMENT						
2.	1600 Kc *	200 mmf.	High side to Ant. lead. Lo side to ground lead.	1600 Kc.	5	This sets oscillator to dial scale.
3.	1400 Kc	200 mmf.	"	1400 Kc.	6	Peak for maximum output.

* First check setting of pointer. With gang fully closed, pointer should be parallel with horizontal line on dial scale.



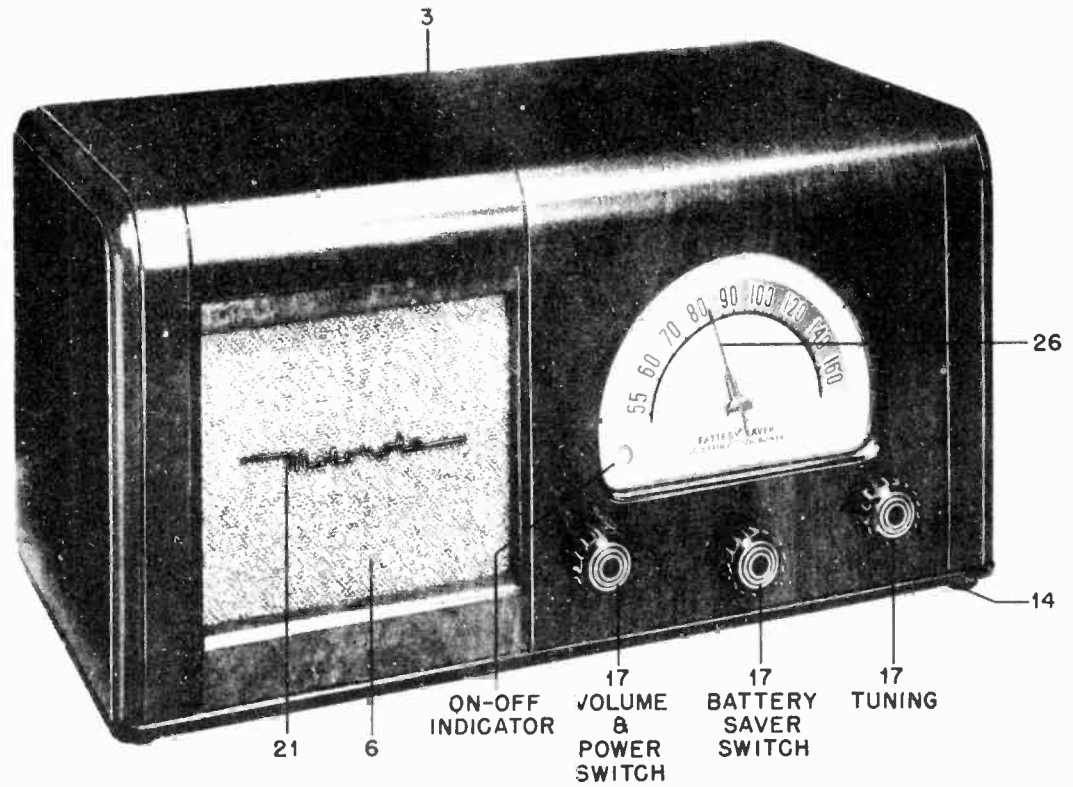


FIGURE 3. PARTS LOCATION - CABINET FRONT

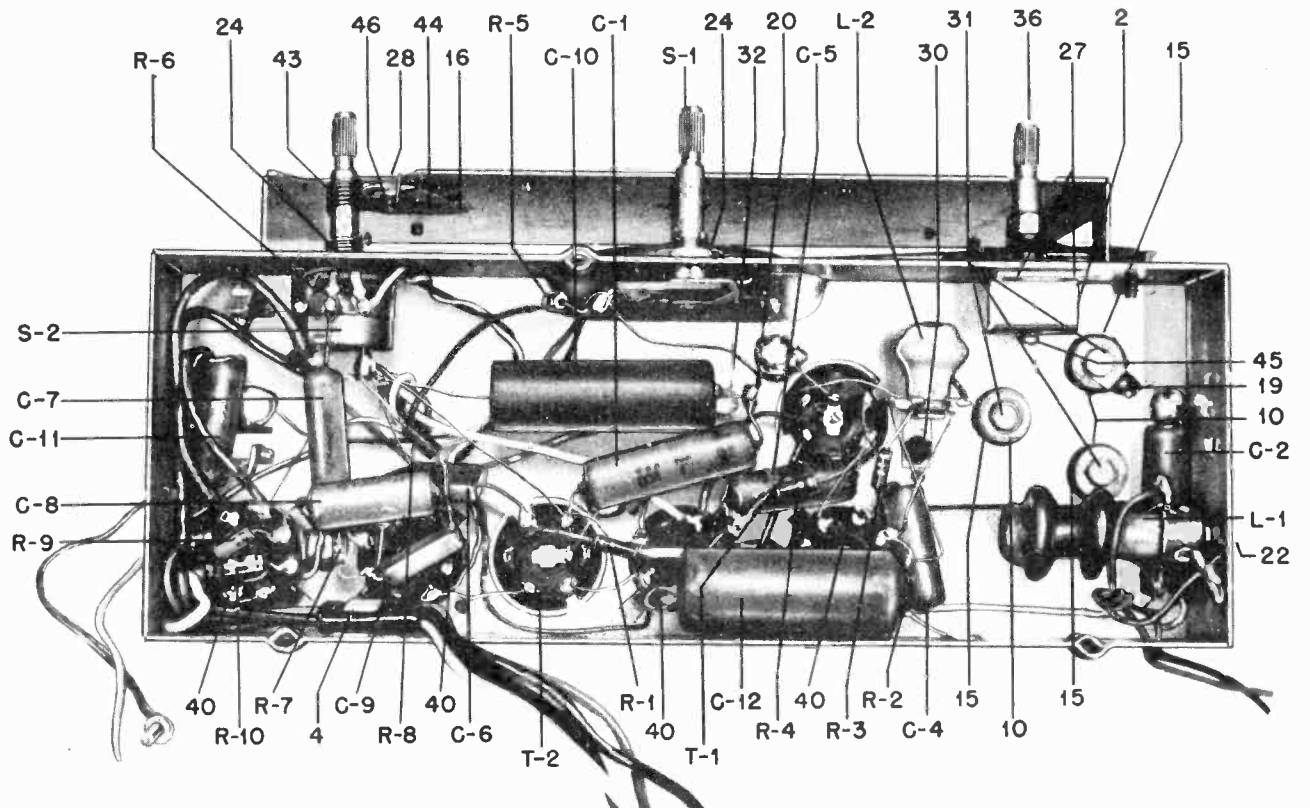


FIGURE 6. PARTS LOCATION - CHASSIS BOTTOM

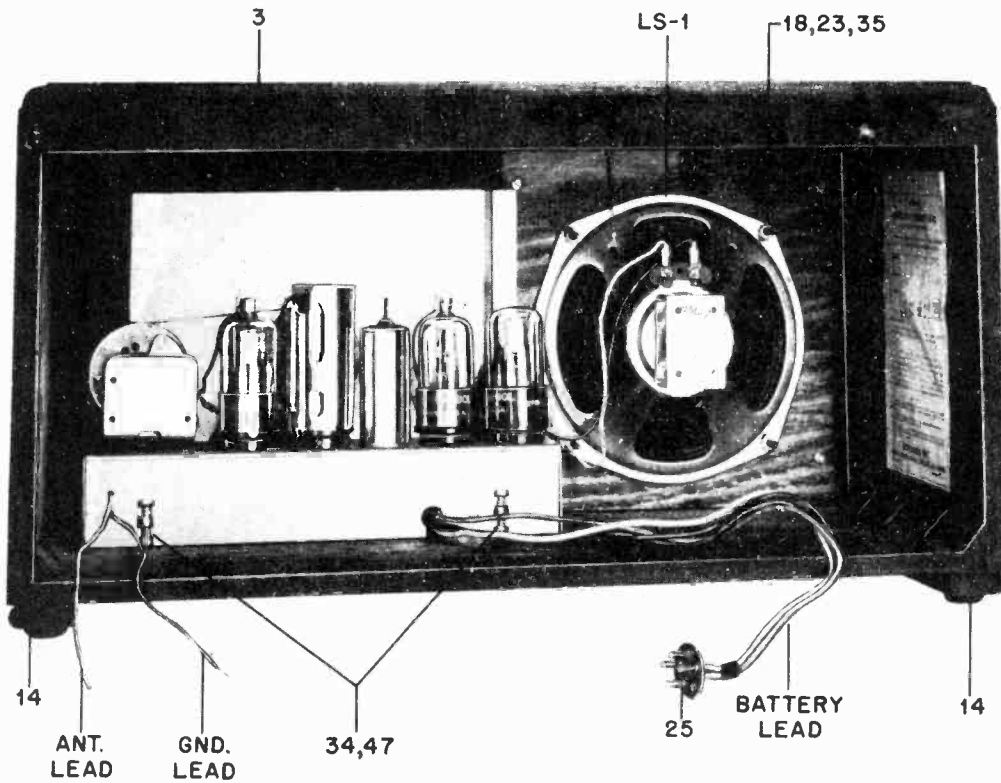
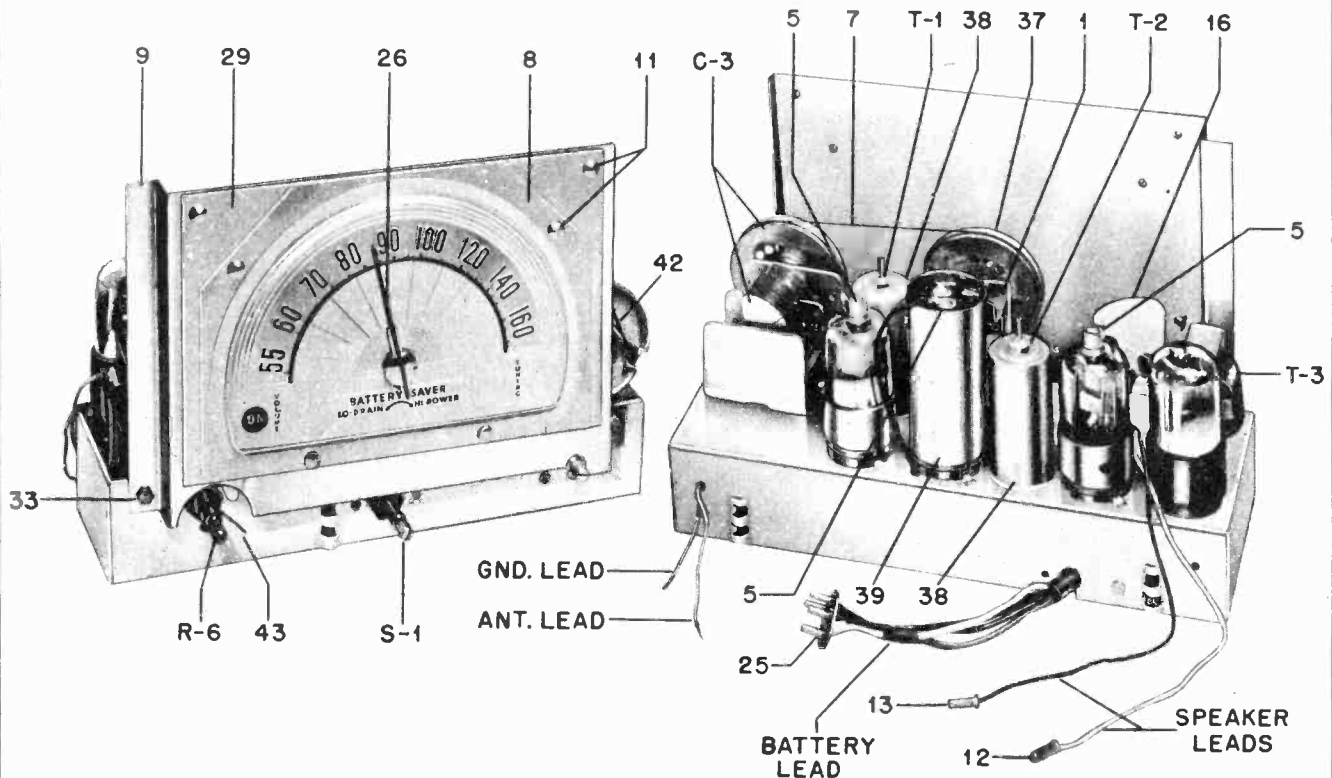


FIGURE 4. PARTS LOCATION - CABINET REAR



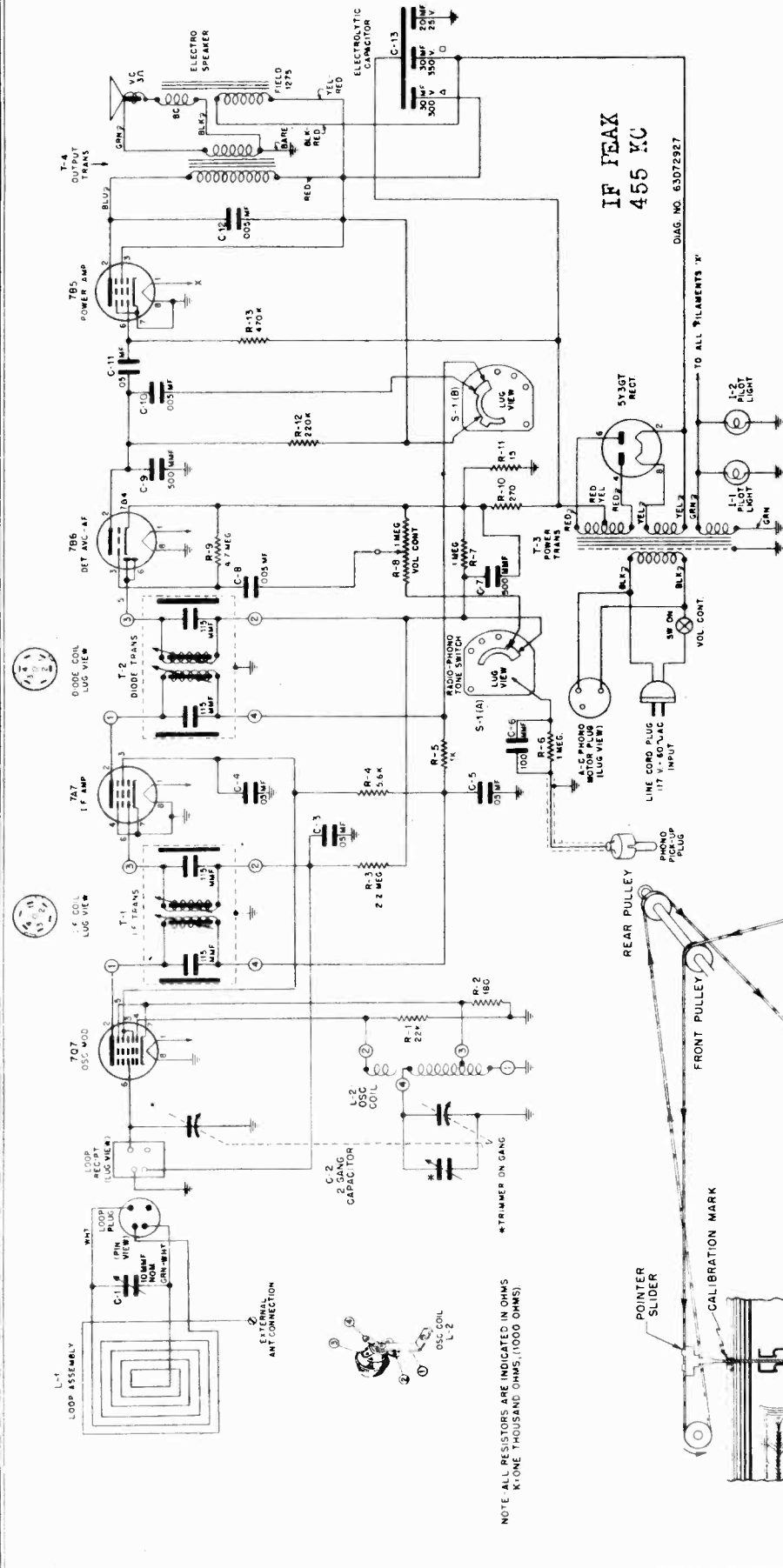
PARTS LOCATION - CHASSIS TOP

MOTOROLA INC.

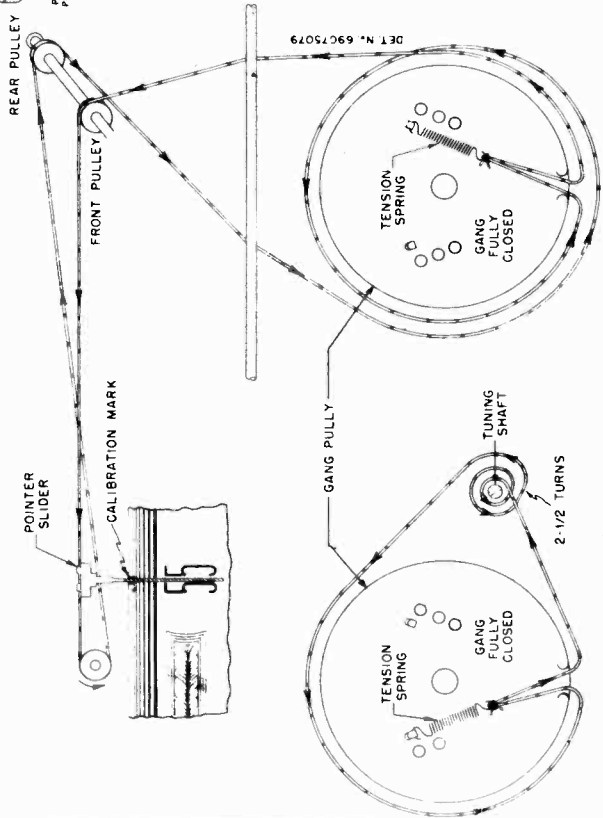
MODEL 47B11

REPLACEMENT PARTS LIST

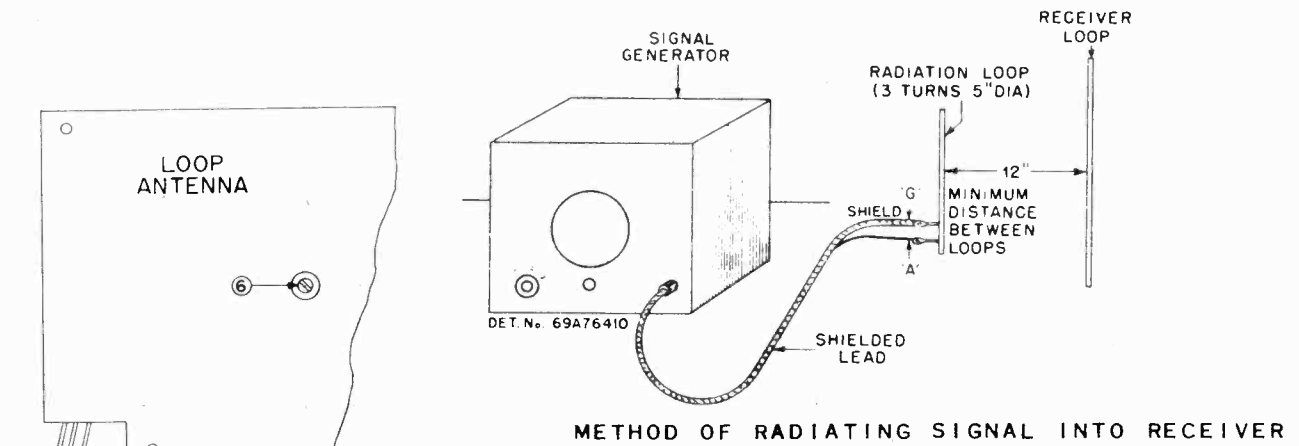
REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
MISCELLANEOUS					
1	71X47007	Bracket Assembly, pointer shaft	42	41A14244	Spring, tension coil
2	7A77337	Bracket, tuning shaft mounting	43	41A77611	Spring, indicator
3	16E77626	Cabinet: wood; walnut finish.....	44	41A72506	Spring, tension (ON-OFF indicator)
4	42K13135	Clamp, cable	45	4A70015	Washer, C
5	42A5480	Clip, grid: small	46	4S7554	Washer: 3/8 x 1/8 x .033 thick; cadmium plated (ON-OFF indicator assem)
6	13K77699	Cloth, grille	47	4S8204	Washer: 1" x .203 x .067 thick (chassis mtg)
7	11M8944	Cord, dial: 18 lb; black	CAPACITORS		
8	61B77625	Crystal, dial	C-1	8S9806	Paper: .1 mf 200V.....
9	1X77696	Dial Scale Mtg. Plate & Indicator Assembly (less dial scale & dial crystal)	C-2	8S9816	Paper: .05 mf 400V.....
10	5A19658	Eyelet (gang mtg)	C-3	1X77683	Variable, 2 gang; includes 2" pulley....
11	5S7805	Eyelet, snap-in (dial scale & crystal mtg)	C-4	8S9809	Paper: .01 mf 400V.....
12	5S7855	Eyelet: .484 long x .156 diameter	C-5	8S9809	Paper: .01 mf 400V.....
13	5S7820	Eyelet: .450 long x .125 diameter	C-6	21R6641	Mica: 100 mmf 500V.....
14	37K15841	Foot, rubber (cabinet foot)	C-7	8S9824	Paper: .002 mf 400V.....
15	5A70404	Grommet, rubber (gang cushions)	C-8	8S9813	Paper: .005 mf 600V.....
16	52A77612	Indicator, ON-OFF	C-9	21R6641	Mica: 100 mmf 500V.....
17	38B77659	Knob, control	C-10	23A14727	Electrolytic: 10 mfd 150V.....
18	4S7680	Lockwasher: #8 external; phosphor bronze (speaker mtg)	C-11	8S9813	Paper: .005 mf 600V.....
19	29K3010	Lug, soldering	C-12	8S9822	Paper: .5 mf 200V.....
20	29R5348	Lug, soldering: #8	COILS		
21	62K76926	Nameplate, Motorola	L-1	24A30442	Antenna: iron core type; incl. mtg. screw
22	2S7070	Nut: 8-32 x 1/4 palnut; cadmium plated (ant. coil mtg)	L-2	24A27349	Oscillator.....
23	2S7003	Nut: 8-32 x 5/16; hex; brass (speaker mtg)	SPEAKER		
24	2S7051	Nut: 3/8-32 x 9/16; hex palnut; cadmium plated (volume cont. mtg)	LS-1	50B71087	PM: 6"; 3.2 ohm voice coil.....
25	28X11368	Plug, 4 prong	RESISTORS		
26	52A77632	Pointer	Note: All resistors are carbon, 20%, insulated type unless otherwise specified.		
27	5S7701	Rivet: .122 x 3/16 steel; polished nickel finish (tuning shaft bracket mtg)....	R-1	6R3927	2.2 meg 1/2W.....
28	5A27875	Rivet, shoulder (ON-OFF indicator mtg)....	R-2	6R6015	220,000 1/2W.....
29	34B77621	Scale, dial	R-3	6R6056	47,000 1/2W.....
30	3S2883	Screw: #8 x 3/16 plain hex head; sheet metal type; black parkerized finish (osc. coil mtg)	R-4	6R3927	2.2 meg 1/2W.....
31	3S2294	Screw: 6-32 x 1/2 plain hex head locking type machine screw; cadmium plated (gang mtg)	R-5	6R5554	390 10% 1/2W.....
32	3S7205	Screw: 8-32 x 1/4 slotted hex head locking type machine screw (pointer shaft bracket mtg)	R-6	18K77615	Volume control: 1 meg; with DPST switch S-2
33	3S7454	Screw: #8 x 1/4 plain hex head sheet metal screw; cadmium plated (dial plate mounting)	R-7	6R5585	8.2 meg 10% 1/2W.....
34	3S7526	Screw: #8 x 1-1/8 slotted hex head sheet metal screw; cadmium plated (chassis mtg)	R-8	6R6004	1 meg 1/2W.....
35	3K653	Screw: speaker mounting	R-9	6R6004	1 meg 1/2W.....
36	1X77694	Shaft, tuning	R-10	6R5554	390 10% 1/2W.....
37	1X77895	Shaft & Drive Pulley Assembly (pointer shaft)	SWITCHES		
38	1A71049	Shield & Iron Core Sleeve Assembly (for T-1 and T-2)	S-1	40K77620	Battery Saver.....
39	26A14760	Shield, tube: bantam	S-2	-	DPDT (part of volume control R-6)
40	9A6790	Socket, tube: molded octal	TRANSFORMERS		
41	9A6788	Socket, tube: (replacement) molded octal (to be used in place of 9A6790 when socket mounting lugs on chassis break off)	T-1	24B77677	IF: 455 Kc; complete with iron cores and padding capacitor, but less shield..
			T-2	24E70531	IF: 455 Kc; complete with iron cores and padding capacitors, but less shield.....
			T-3	25B76952 or 25B76987	Output.....



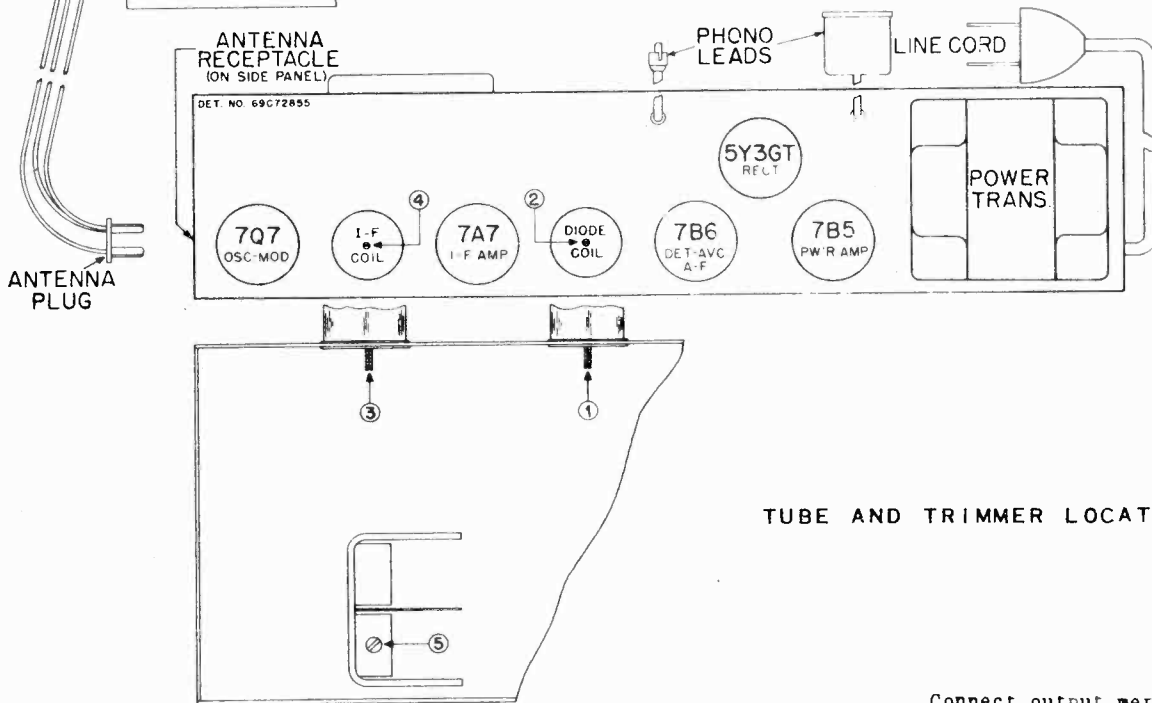
PART NO.	DESCRIPTION
41A14244	Spring, tension coil (pointer and drive cord tension spring)
41A28190	Spring, cushion (top) (record changer mounting)
41A21807	Spring, cushion (bottom) (record changer mounting)
37K70556	Strip, channel: rubber (dial scale mounting)
31K72404	Strip, terminal: 1 insulated lug, #1 mounting (on loop assembly)



NOTE ALL RESISTORS ARE INDICATED IN OHMS
K=ONE THOUSAND OHMS (1,000 OHMS)



METHOD OF RADIATING SIGNAL INTO RECEIVER



TUBE AND TRIMMER LOCATION DETAIL

Connect output meter across the speaker voice coil. (.38V = .05 watt). Volume control set at maximum for all operations. The PHONO-RADIO TONE switch should be set to RADIO treble position. The adjusting screwdriver or alignment tool should be of the insulated type, such as Motorola Part No. 66A71008.

Operations In Order	Gang Capacitor Set At	Dummy Antenna	Generator Connected to	Generator Set At (400~30% modulated)	Adjust Trimmer or Core No.	Average Microvolt Input for .38V output
1. Align I.F. & diode for maximum	Minimum	.1 mf.	OSC-MOD grid (pin 6)	455 Kc.	1, 2, 3 & 4	12 microvolts
2. Set Oscillator trimmer	Minimum	.1 mf.	OSC-MOD grid (pin 6)	1620 Kc.	5	
3. Peak loop antenna	1400 Kc.	None	Radiation loop *	1400 Kc.	6	

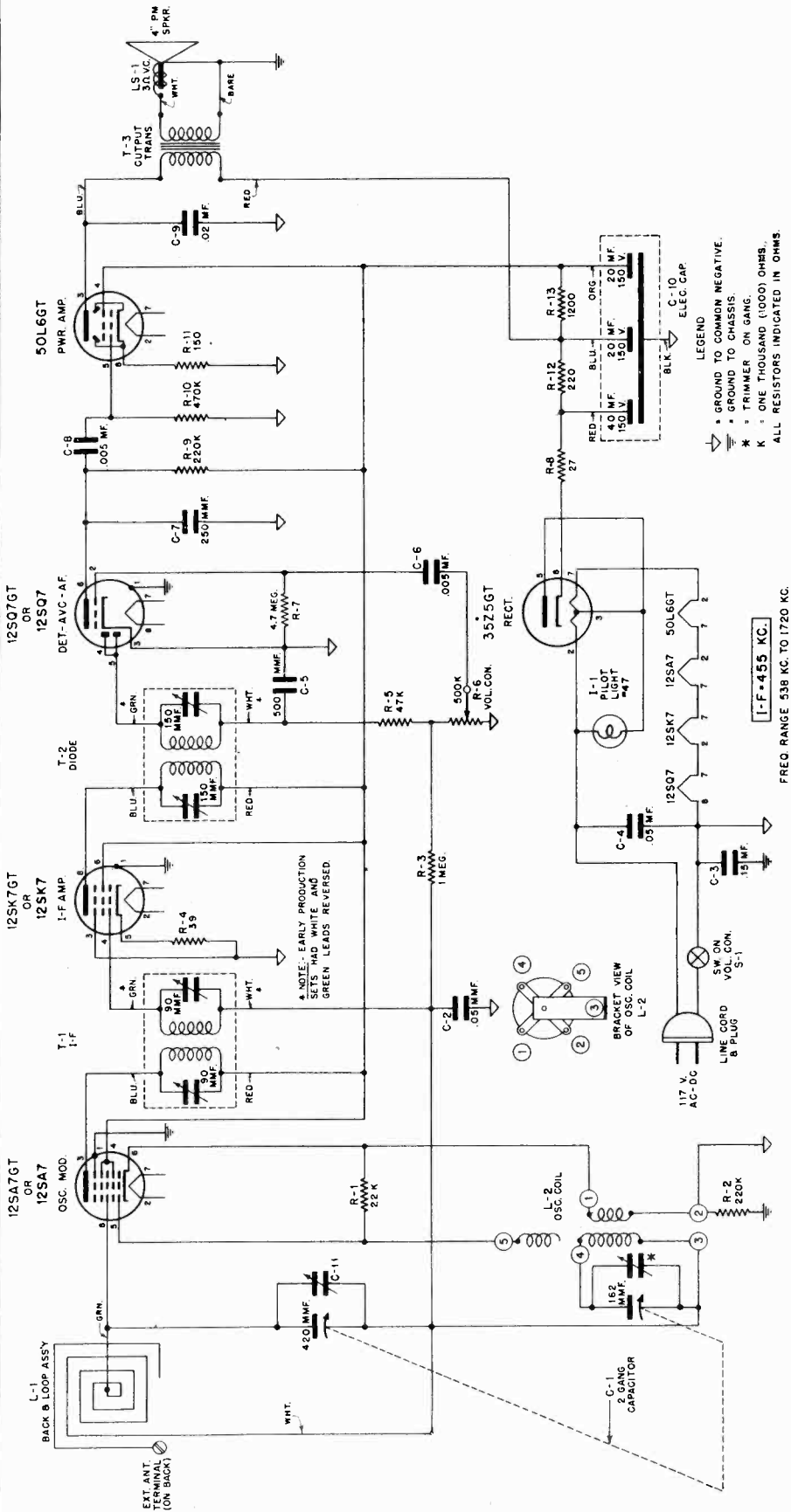
(should be repeaked after loop & set are installed in cabinet.)

* Connect output of signal generator to a 5" diameter 3 turn loop. See Figure 2. With volume control on full, bring loop close enough to receiver loop until an output of 50 milliwatts is obtained (.38V on output meter). The distance between loops should never be less than 12". Vary distance between generator and receiver loops or adjust generator output to maintain .38V during alignment.

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION	
C-1	20A18740	Capacitor, trimmer: 1.5-15 mmf; includes "g" mounting bracket	R-1	6R6028	Resistor, fixed: carbon; 25,000 1/2W Ins.	R-1	6R6028	Resistor, fixed: carbon; 25,000 1/2W Ins.	
C-2	1Y2533	Capacitor, variable: 2 GANG; cut oscillator plates; in-circles pulley.	R-2	6R5660	Resistor, fixed: carbon; 180 10% 1/2 W Ins.	R-2	6R5660	Resistor, fixed: carbon; 180 10% 1/2 W Ins.	
C-3	889616	Capacitor, fixed: paper; .05 mf. 400V	R-3	6R5327	Resistor, fixed: carbon; 2.2 meg 1/2W Ins.	R-3	6R5327	Resistor, fixed: carbon; 2.2 meg 1/2W Ins.	
C-4	889616	Capacitor, fixed: paper; .05 mf. 400V	R-4	6R5322	Resistor, fixed: carbon; 5600 10% 1/2W N.I.	R-4	6R5322	Resistor, fixed: carbon; 5600 10% 1/2W N.I.	
C-5	889616	Capacitor, fixed: paper; .05 mf. 400V	R-5	6R6053	Resistor, fixed: carbon; 1000 1/2W N.I.	R-5	6R6053	Resistor, fixed: carbon; 1000 1/2W N.I.	
C-6	21R6641	Capacitor, fixed: mica; 100 mmf. 500V	R-6	6R6004	Resistor, fixed: carbon; 1 meg 1/2W Ins.	R-6	6R6004	Resistor, fixed: carbon; 1 meg 1/2W Ins.	
C-7	21R6539	Capacitor, fixed: mica; 500 mmf. 500V	R-7	6R6004	Resistor, fixed: carbon; 1 meg 1/2W Ins.	R-7	6R6004	Resistor, fixed: carbon; 1 meg 1/2W Ins.	
C-8	889613	Capacitor, fixed: paper; .005 mf. 800V	R-8	18A70032	Resistor, variable: carbon; 1 meg; with S.P.S.T. switch	R-8	18A70032	Resistor, variable: carbon; 1 meg; with S.P.S.T. switch	
C-9	21R6559	Capacitor, fixed: mica; 500 mmf. 500V	R-9	6R2122	Resistor, fixed: carbon; 4.7 meg 1/2W Ins.	R-9	6R2122	Resistor, fixed: carbon; 4.7 meg 1/2W Ins.	
C-10	889613	Capacitor, fixed: paper; .005 mf. 800V	R-10	6R6035	Resistor, fixed: carbon; 270 10% 1 W N.I.	R-10	6R6035	Resistor, fixed: carbon; 270 10% 1 W N.I.	
C-11	889616	Capacitor, fixed: paper; .05 mf. 400V	R-11	6R2034	Resistor, fixed: carbon; 15 10% 1/2W Ins.	R-11	6R2034	Resistor, fixed: carbon; 15 10% 1/2W Ins.	
C-12	889613	Capacitor, fixed: paper; .005 mf. 800V	R-12	6R6015	Resistor, fixed: carbon; 220,000 1/2W Ins.	R-12	6R6015	Resistor, fixed: carbon; 220,000 1/2W Ins.	
C-13	23A27719 or 23A74627	Capacitor, fixed: electrolytic; 30 mf. 350V, 30 mf. 300V, 20 mf. 25V	R-13	6R6032	Resistor, fixed: carbon; 470,000 1/2W Ins.	R-13	6R6032	Resistor, fixed: carbon; 470,000 1/2W Ins.	
I-1 & I-2	65X10867	Bulb: 6.3V, .25A tubular bayonet; #44	8-1	40A71721	Switch, phono, radio & tone complete but less shield and iron core sleeve	8-1	40A71721	Switch, phono, radio & tone complete but less shield and iron core sleeve	
L-1	24C72605	Loop Assembly: complete with trimmer, connecting leads and plug	T-1	24B70545	Transformer, I.F.: 455 kc: complete but less shield and iron core sleeve	T-1	24B70545	Transformer, I.F.: 455 kc: complete but less shield and iron core sleeve	
L-2	24A72464	Coil, B. C. oscillator	T-2	24B70537	Transformer, diode: 455 kc: complete but less shield and iron core sleeve	T-2	24B70537	Transformer, diode: 455 kc: complete but less shield and iron core sleeve	
T-3	25B21246	Transformer, power	387454	387454	Screw, steel: #8 x 1/4 PKZ plain hex head; cadmium plated (GMR bracket and dial assembly mounting)	387454	387454	Screw, steel: #8 x 1/4 PKZ plain hex head; cadmium plated (GMR bracket and dial assembly mounting)	
T-4	25B21176	Transformer, output	387475	387475	Screw, steel: #8 x 1/4 PKZ slotted acorn head: cadmium plated (power transformer mounting)	387475	387475	Screw, steel: #8 x 1/4 PKZ slotted acorn head: cadmium plated (power transformer mounting)	
			1Y2531	Bracket & Mounting Plate Assembly: "L" shaped steel bracket and bakelite electrolytic mounting plate	387512	387512	Screw, steel: #6 x 1/2 PKZ plain hex head; cadmium plated (speaker mounting)	387512	Screw, steel: #6 x 1/2 PKZ plain hex head; cadmium plated (speaker mounting)
			7B71727	Bracket, gang capacitor mounting	387586	387586	Screw, steel: #8 x 1-1/8 PKZ slotted hex head; cadmium plated (chassis mounting)	387586	Screw, steel: #8 x 1-1/8 PKZ slotted hex head; cadmium plated (chassis mounting)
			7A14684	Bracket, tuning shaft	387596	387596	Screw, steel: 10-32 x 2" slotted hex head machine screw; copper plated (record changer mounting)	387596	Screw, steel: 10-32 x 2" slotted hex head machine screw; copper plated (record changer mounting)
			43A76441	Bushing, felt (used on control shafts, between knobs and cabinet)	287982	287982	Speednut: for 6-32 screw; blue (speaker baffle mounting)	287982	Speednut: for 6-32 screw; blue (speaker baffle mounting)
			18F72566	Cabinet: complete	257087	257087	Speednut: for .083 dia. rod (dial cord guide rod fastener)	257087	Speednut: for .083 dia. rod (dial cord guide rod fastener)
			35K72557	Cloth, grille	47A71722	47A71722	Shaft, tuning	47A71722	Shaft, tuning
			11R9M4	Cord, dial: 18 lb; black					
			30K75570	Cord, line: 6 ft. long; with plug					
			1Y2558	Cord, phono pick-up: complete with one pin plug					
			1Y71047	Core & Palnut Assembly (I.F. & diode transformer top tuning iron core and nut)					

MODEL 56X11
Chassis HS-94

MOTOROLA INC.



LEGEND
 * GROUND TO COMMON NEGATIVE.
 † GROUND TO CHASSIS.
 * TRIMMER ON GANG.
 K = ONE THOUSAND (1000) OHMS.
 ALL RESISTORS INDICATED IN OHMS.
 DIA. NO. 630-471028-A

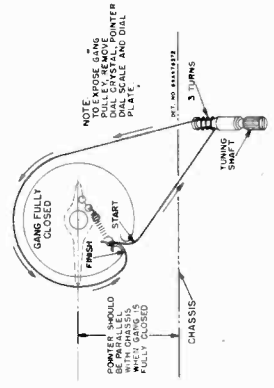


FIGURE 2. STRIKE DRIVE



ALIGNMENT

Maximum performance can only be obtained if extreme care is exercised during alignment. Follow the procedure carefully.

A low range output meter should be connected across the speaker voice coil. Set receiver volume control to maximum; for greatest accuracy, keep output of receiver at approximately .05 watt thru-out alignment by reducing generator output (not receiver volume control) as stages are brought into alignment. (.05 watt = .40 volt on output meter). The alignment tool should be of an insulated type

such as Motorola Part Number 66A71008.

If receiver is operated from AC line during alignment, it is suggested that an isolating transformer be used between receiver and power line. If no isolation transformer is used and hum is encountered during alignment, connect the ground side of the signal generator to B- instead of the receiver chassis.

Refer to Figure 1 for location of all adjustments.

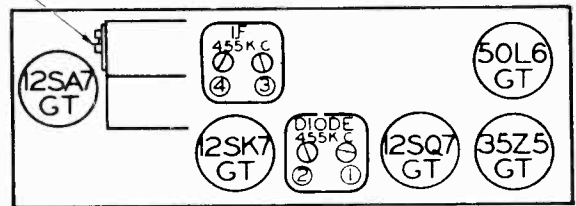
STEP	DIAL SET TO	DUMMY	SIGNAL GENERATOR CONNECTED TO	SIGNAL GENERATOR SET AT	ADJUST TRIMMER	REMARKS
IF ALIGNMENT						
1.	Gang fully opened	.1 mf	Osc-Mod grid*	455 Kc	1,2,3 & 4	Adjust for maximum
RF ALIGNMENT						
2.	Gang fully opened	-	Radiation loop***	1720 Kc	5	This sets osc. to dial scale**
3.	1400 Kc	-	Radiation loop***	1400 Kc	6	Tune signal for max. with receiver tuning knob, then peak trimmer 6. (Repeat this operation after installing chassis & loop in cabinet.

* A convenient point is the stator of the antenna section of the tuning capacitor.

** With gang fully closed, pointer should be parallel with chassis; reset if necessary.

*** Connect output of signal generator to a 5" diameter, 3 turn loop and bring loop close enough to receiver loop to obtain output of 50 milliwatts (.40V) on output meter. Vary distance between loops to maintain this output during alignment. Minimum distance between loops should never be less than 12".

OSC. TRIMMER ADJUST AT 1720 K.C. TUBE & TRIMMER LOCATIONS



DETAIL NO 69A2558B

INPUT TO SET DURING MEASUREMENTS - 117 V. AC.

A VTVM WAS USED TO MAKE ALL MEASUREMENTS.

MEASUREMENTS ARE MADE FROM TUBE BASE PIN TERMINALS TO B-(→)

VOLUME CONTROL IS SET TO MINIMUM AND NO STATION TUNED IN.

VOLTAGE TOLERANCE - ±10%; RESISTANCE TOLERANCE - ±20%.

ALL VOLTAGE MEASUREMENTS ARE DC UNLESS OTHERWISE SPECIFIED.

LOOP ANT. TRIMMER ADJUST AT 1400 K.C.

GND = GROUND TO CHASSIS.

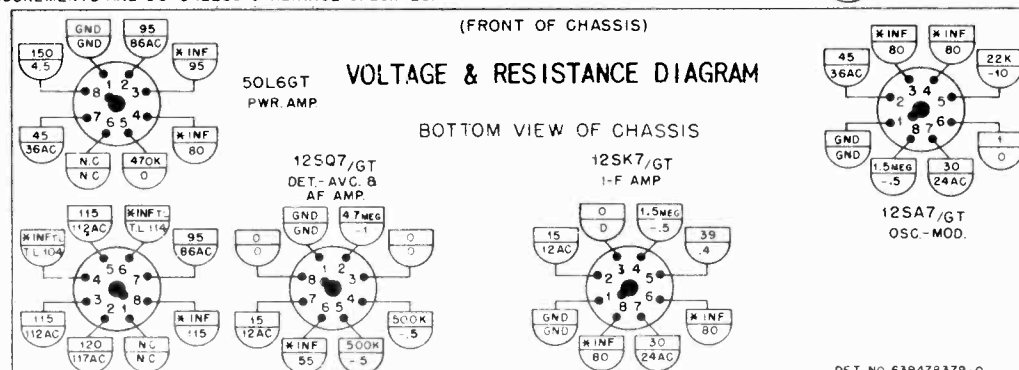
N.C. = NO CONNECTION.

T.L. = LUG USED AS TIE LUG.

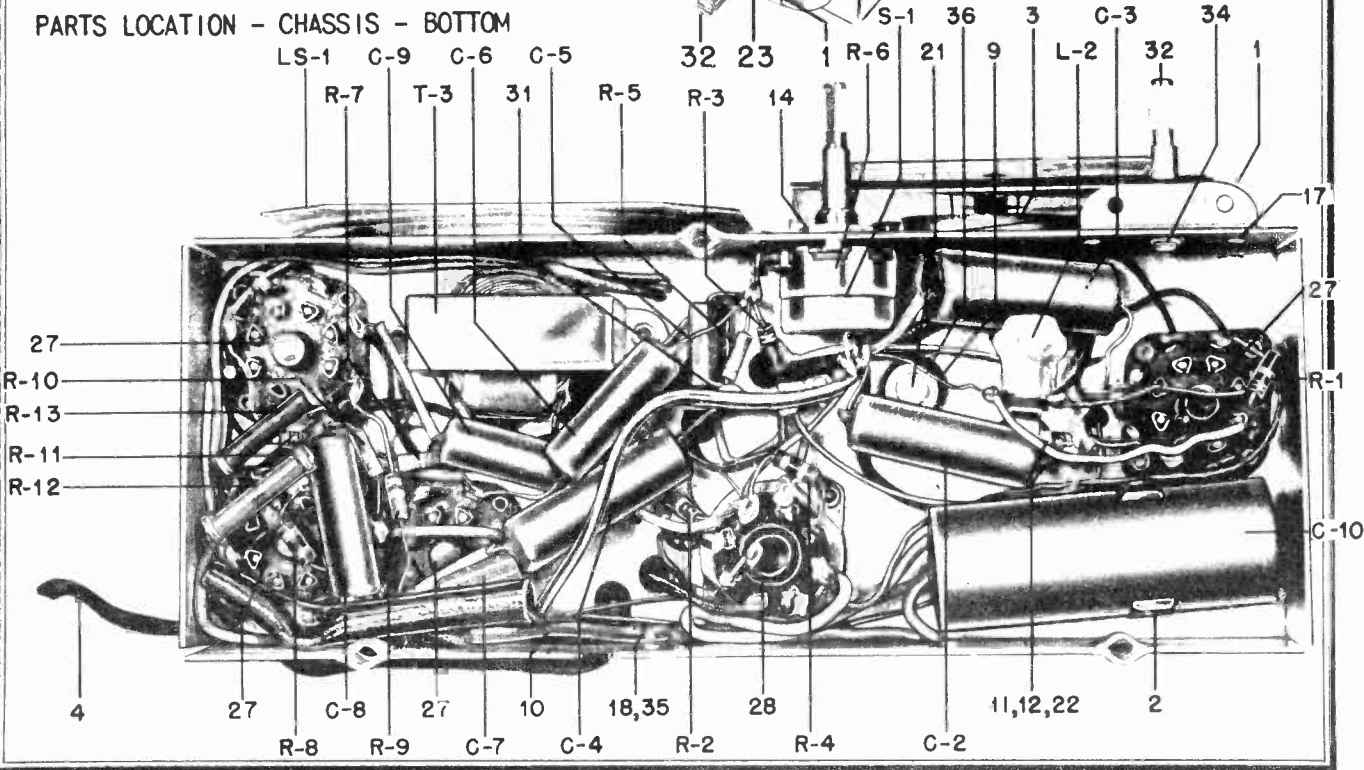
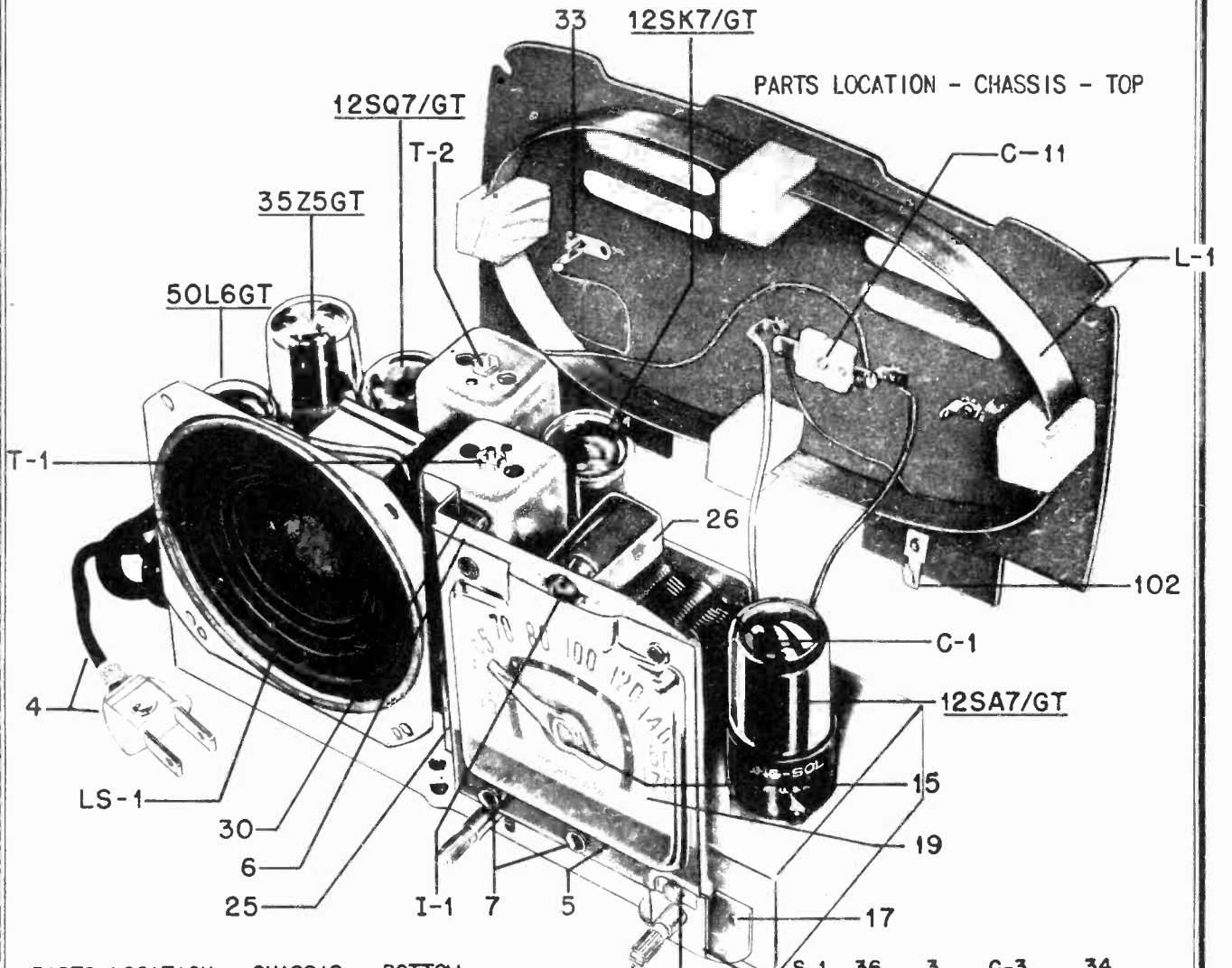
* = MAY VARY DEPENDING ON CONDITION OF ELECTROLYTIC CAPACITORS.

□ = RESISTANCE MEASUREMENTS.

○ = VOLTAGE MEASUREMENTS



DET. NO 638478379-0



MOTOROLA INC.

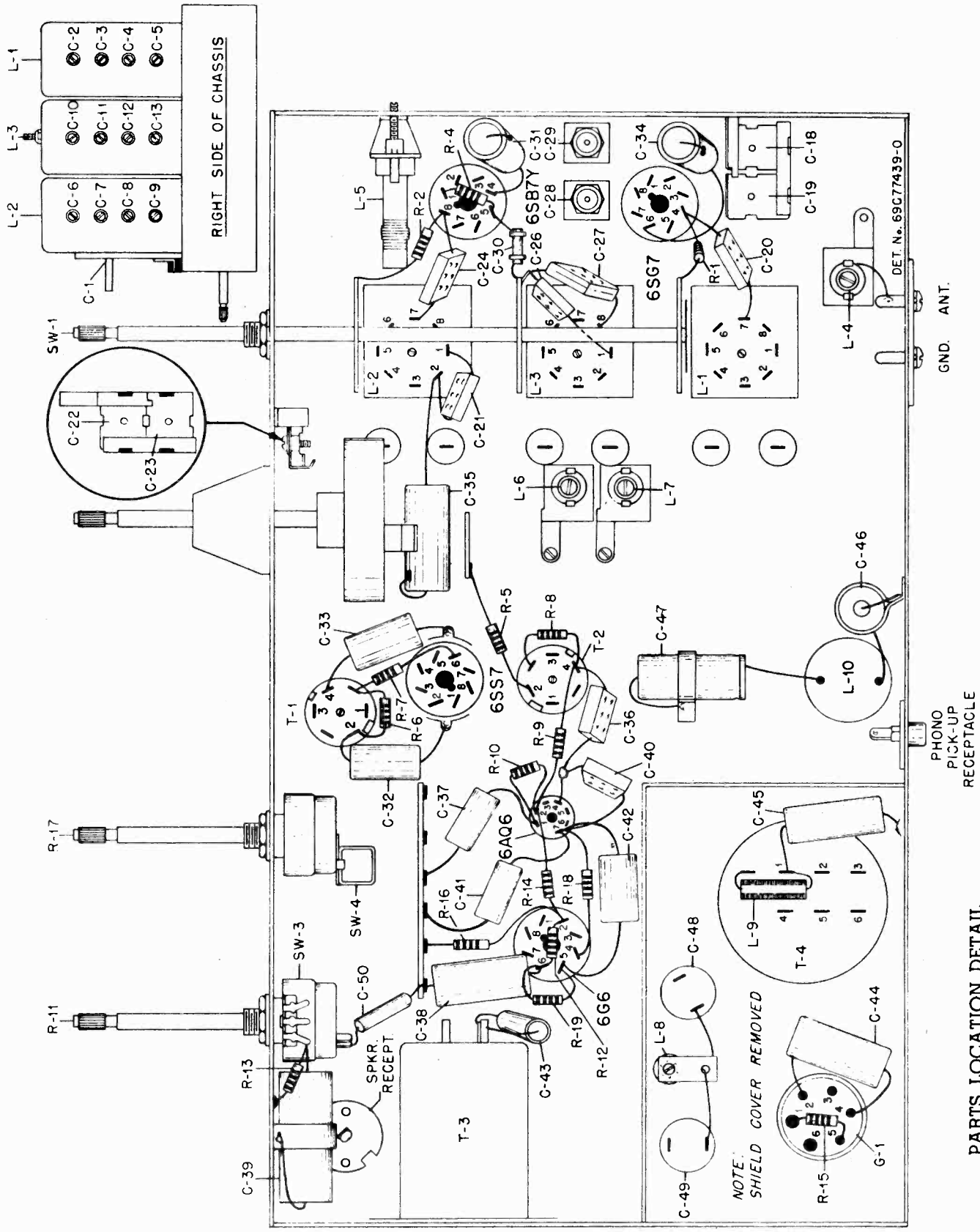
MODEL 56X11

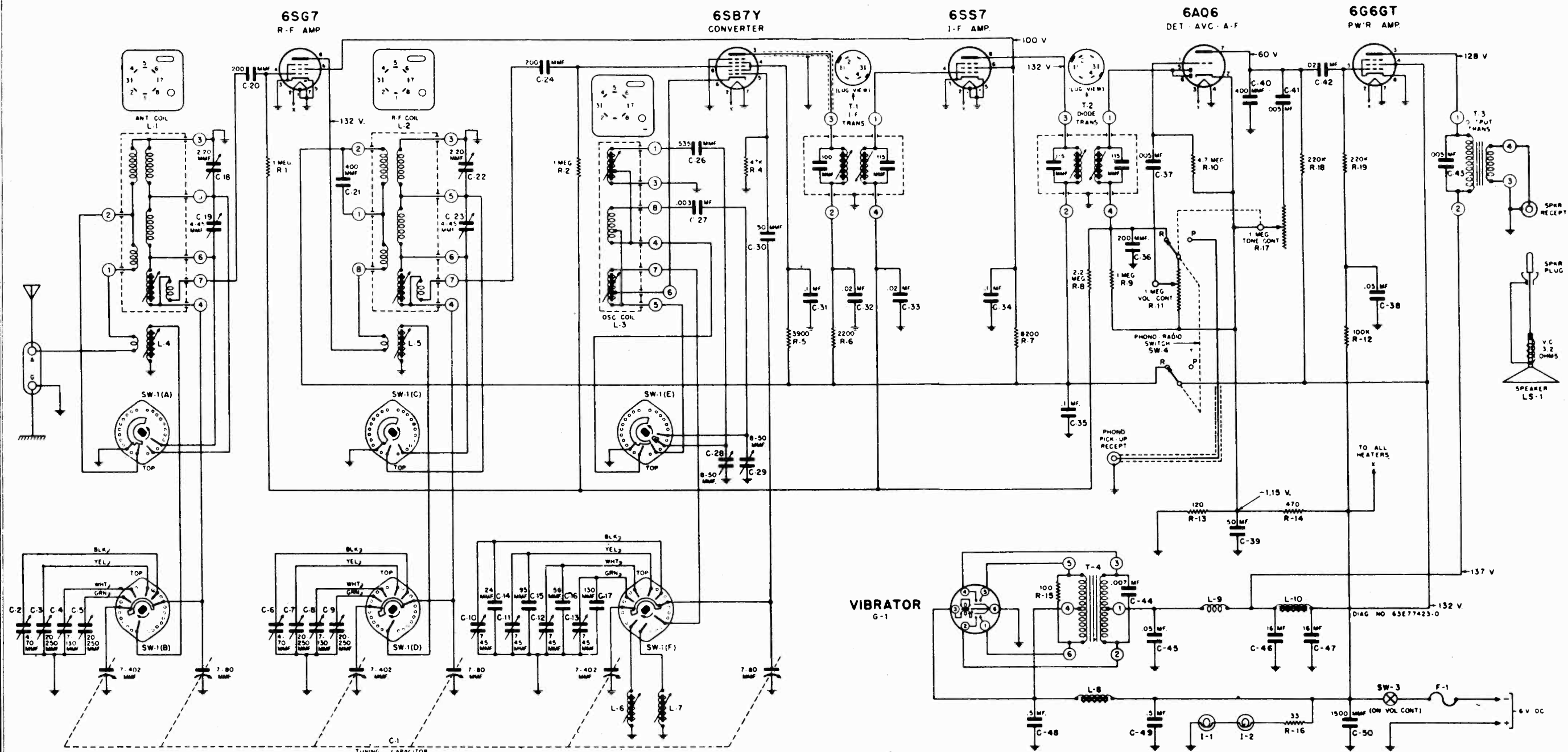
REPLACEMENT PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
CAPACITORS					
C-1	1X20506	Gang Capacitor & Pulley Assembly. 2 gang; cut oscillator plates; with trimmer on oscillator section; drive pulley included	6	1X25530	Dial Plate & Bracket Assembly
			7	5S7805	Eyelet, snap-in (dial scale and crystal mounting)
			8	5A19658	Eyelet, spacer: .296 x .212; copper plated (gang mtg)
C-2	8S9816	Paper: .05 mf 400V	9	37A12691	Grommet, rubber (gang cushion)
C-3	8A72686	Paper: .15 mf 200V	10	32A24815	Lock, line cord: fibre
C-4	8S9816	Paper: .05 mf 400V	11	4S7650	Lockwasher: #6 internal; cadmium plated (Osc. coil mtg)
C-5	21R6839	Mica: 500 mmf 500V	12	29R5248	Lug, soldering: 6L; hot tinned
C-6	8S9813	Paper: .005 mf 600V	13	2S7005	Nut: 6-32 x 1/4 hex; cadmium plated (IF & diode trans. mtg)
C-7	21R6848	Mica: 250 mmf 500V	14	2S7051	Nut: 3/8-32 x 9/16 hex Painut; cadmium plated (volume control mtg)
C-8	8S9813	Paper: .005 mf 600V	15	52B20520	Pointer: red plastic
C-9	8S9802	Paper: .02 mf 400V	16	5S7707	Rivet: .122 x 5/32 steel; nickel plated (term. strip, tube socket mtg)
C-10	23B75808	Electrolytic: 40-20-20 mf 150V	17	5S7701	Rivet: .122 x 3/16 steel; nickel plated (tuning shaft bracket mtg)
C-11	29K28424	Trimmer: 1.5 mmf to 12 mmf (on cabinet back)	18	5S7708	Rivet: .122 x 9/32 steel; nickel plated (line cord lock mtg)
DIAL LIGHT					
I-1	65X11854	Bulb: 6-8V, .15 Amp; tubular bayonet base; #47	19	34E5514	Scale, dial
COILS					
L-1	24B470444	Cabinet Back & Loop Assembly: complete with trimmer	20	3S7506	Screw: #6 x 1/4 PKZ plain hex head sheet metal screw; cadmium plated (diode trans. mtg)
L-2	24A26942	Oscillator	21	3S2294	Screw: 6-32 x 1/2 plain hex head locking type machine screw; cadmium plated (gang mounting)
SPEAKER					
LS-1	50B470442	4" PM; 3.2 ohm voice coil	22	3S7339	Screw: 6-32 x 5/8 plain hex head machine screw; cadmium plated (Osc. coil mtg) ..
RESISTORS					
Note:	All resistors are insulated carbon type, 1/2 watt, 20% less otherwise specified.				
R-1	6R6028	22,000	23	3S7248	Screw: 8-32 x 1/8 plain hex head machine screw; cadmium plated (dial plate mtg).
R-2	6R6015	220,000	24	3S7205	Screw: 8-32 x 1/4 slotted hex head locking type machine screw; cadmium plated (speaker mtg)
R-3	6R6004	1 meg	25	3S7454	Screw: #8 x 1/4 PKZ plain hex head sheet metal screw; cadmium plated (dial plate mtg)
R-4	6R2085	39 10%	26	6CA25505	Socket, dial light, clip & leads
R-5	6R6056	47,000	27	9A6788	Socket, tube: molded octal; plain type ..
R-6	18A14629	or	28	9A70165	Socket, tube: molded octal; shielded type (for IF Amp)
	18A72698	Volume Control: .5 meg; with SPST switch	29	41A14244	Spring, tension coil (drive cord spring)
R-7	6R2122	4.7 meg	30	37K20865	Strip, channel: rubber
R-8	6R5683	27 10%	31	31A15555	Strip, terminal: 2 insulated lugs, #3 mtg
R-9	6R6015	220,000	32	47A14635	Shaft, tuning
R-10	6R6032	470,000	33	29A70422	Terminal, screw (on cabinet back -Ext. Ant. term.)
R-11	6R6373	150 10%	34	4A70015	Washer, "C" (tuning shaft retainer)
R-12	6R6152	220 1 watt, not insulated	35	4S1719	Washer: 3/8 x .140 x .030 thick, steel; cadmium plated (line cord lock mtg) ...
R-13	6R3972	1,200 10% 1 watt, not insulated	36	4S7597	Washer: 7/16 x .171 x .032 thick; cadmium plated (gang mtg)
SWITCH					
S-1	-	Part of volume control R-6			
TRANSFORMERS					
T-1	1X470471	IF, 455 Kc: complete with dual trimmer and shield can			
		20A14619 Trimmer: double; 90 mmf nominal (IF trans. tuning)			
T-2	1X470469	Diode, 455 Kc: complete with dual trimmer and shield can			
		20K20649 Trimmer: double; 155 mmf nominal (diode trans. tuning)			
T-3	25A20503	Output			
MISCELLANEOUS CHASSIS PARTS					
1	7A14610	Bracket, tuning shaft	101	68D25502	Cabinet, table model: walnut plastic ...
2	42K75826	Clip, electrolytic mounting	102	42A18764	Clip, mounting (on cabinet back)
3	11M8944	Cord, dial: 18 lb; black	103	36A470443	Knob, control: walnut plastic
4	30A470651	Cord, line & plug: 2 conductor; 6 ft long	104	38A25507	Plug, split (holds cabinet back to cabinet)
5	61B25515	Crystal, dial: clear plastic	105	3S8117	Screw: #8 x 1 PKZP slotted hex washer head sheet metal screw; antique copper finish (chassis mtg)
			108	32A20575	Washer, paper: 3/8 x .171 x .062 thick (used under chassis mtg screws to prevent cracking cabinet)
CABINET PARTS					

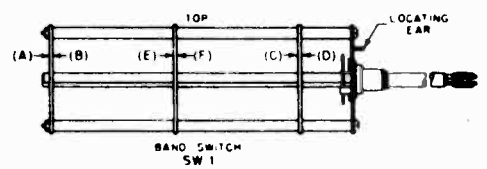
MODEL 57B61V
Chassis ES-77

MOTOROLA INC.





NOTE: BAND SWITCH SW-1 SHOWN IN BAND "A" (BROADCAST) POSITION.



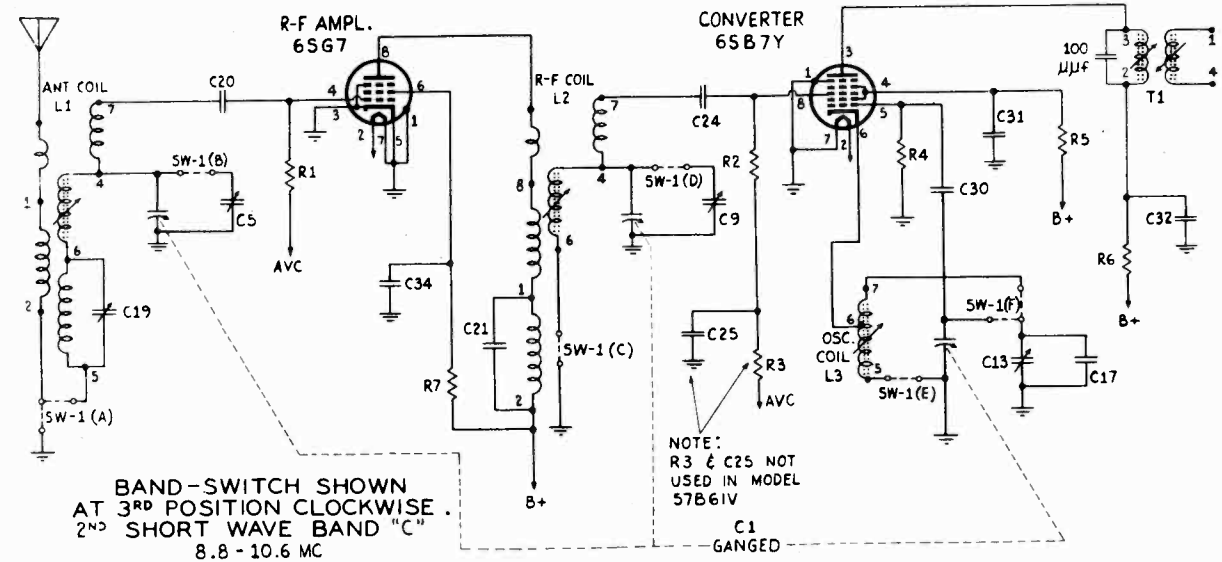
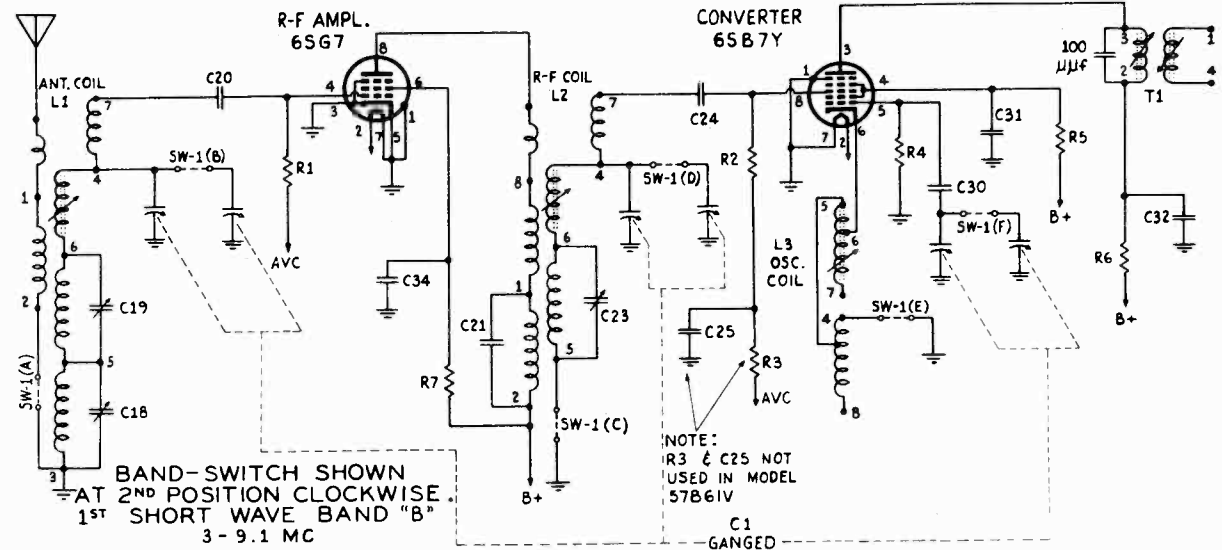
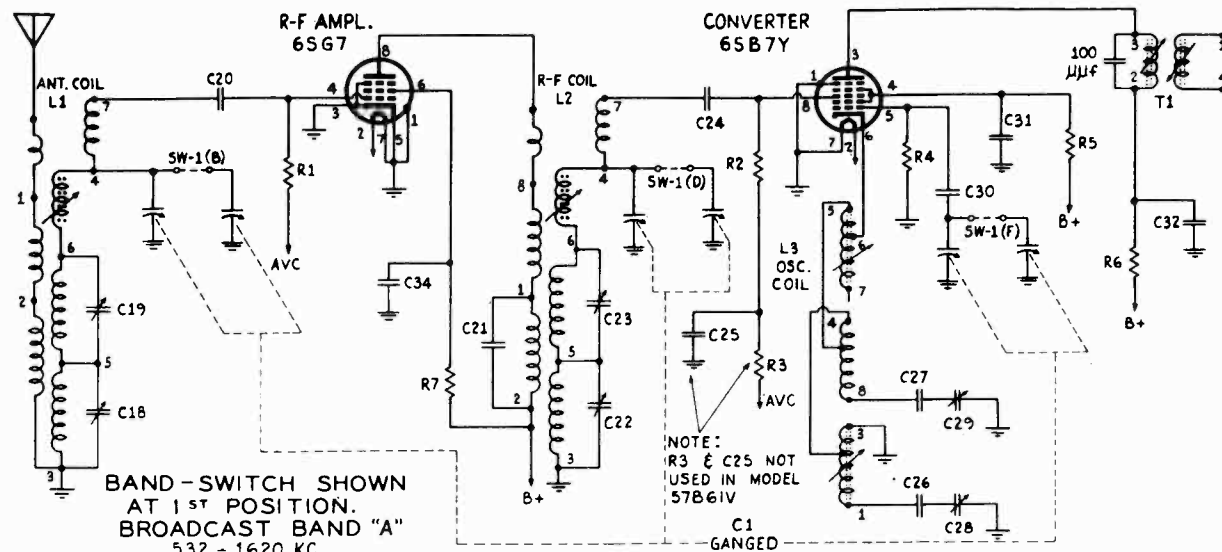
CHASSIS—HS-77

IF PEAK
455 KC

NOTE: ALL RESISTORS ARE INDICATED IN OHMS
R-1 ONE THOUSAND 1,000 OHMS

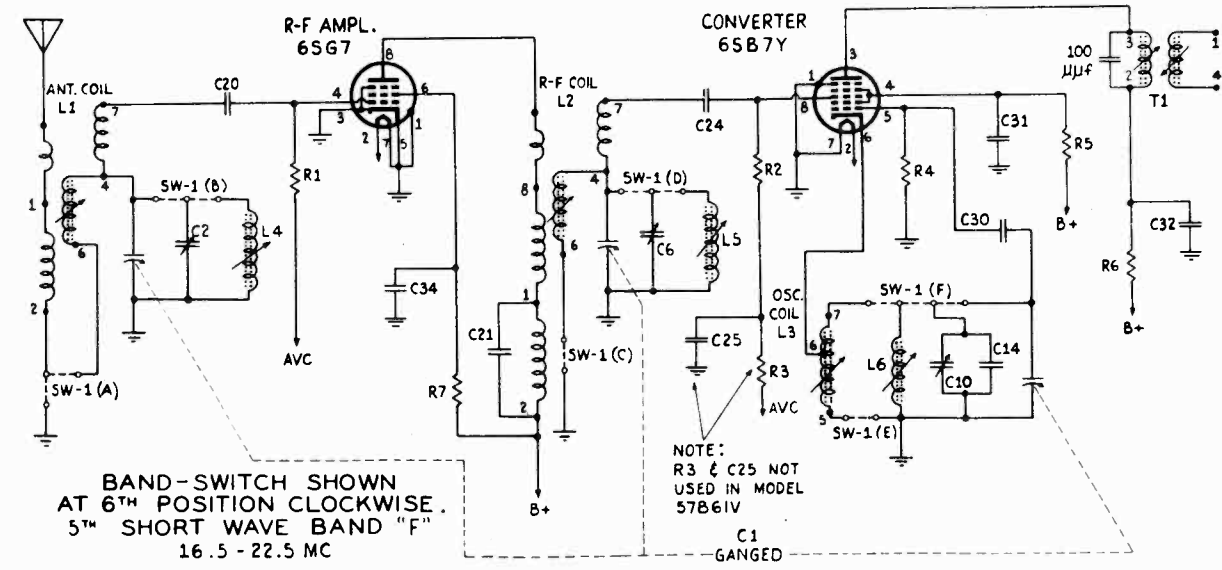
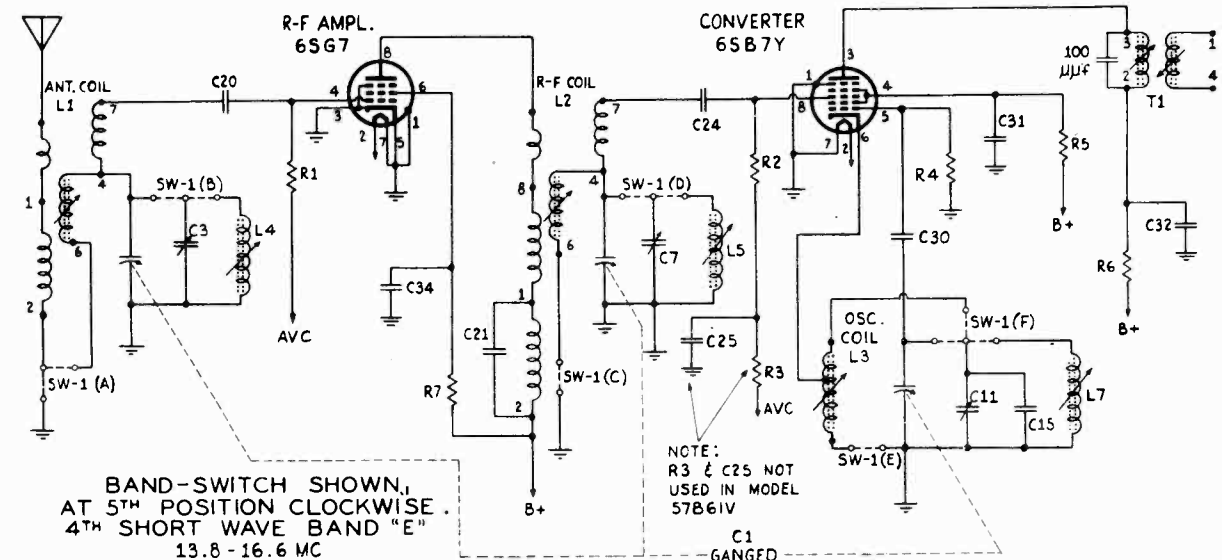
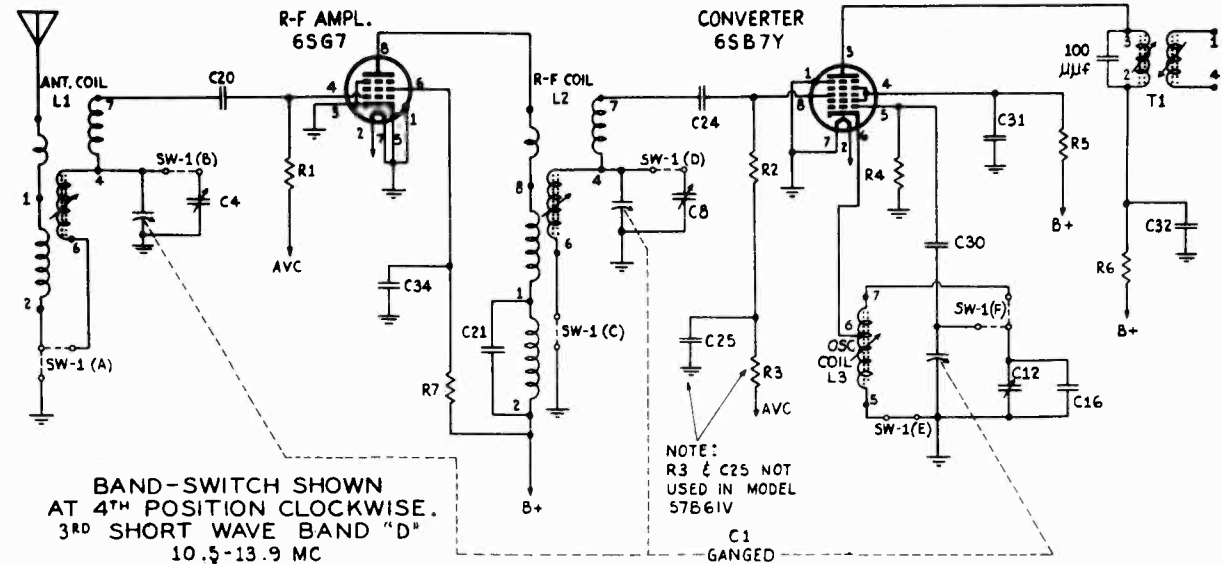
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MODEL 57B61V
MODELS 67F61BN, 67T61BN
MODEL 87T61BN



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MODEL 57B61V
MODELS 67F61BN, 67T61BN
MODEL 87T61BN



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MODEL 57B61V
 MODELS 67F61BN, 67T61BN
 MODEL 87T61BN

ALIGNMENT PROCEDURE

Refer to Figure 6 for location of adjustment trimmers and cores. Connect a low range output meter across speaker voice coil. Volume control should be set at maximum for all operations. The PHONO-RADIO-TONE switch should be set at RADIO position.

The signal generator used, should possess good frequency stability and should be of the modulated type. Its frequency range should be adequate to cover all frequencies indicated in the alignment chart (455 Kc. to 21.5 Mc.) For greatest accuracy, keep the receiver output at approximately 50 milliwatts (.38 V on output meter) during alignment. Vary signal generator output (not receiver volume control) to maintain this output during alignment.

The adjustment screwdriver must be an insulated type.

STEP	DIAL SET TO	BAND SW. SET TO	DUMMY ANTENNA	SIGNAL GENERATOR CONNECTED TO	SIGNAL GENERATOR SET AT	ADJUST TRIMMER OR CORE	REMARKS
I. F. CHANNEL ALIGNMENT							
1.	Gang open	Band "A"	.1 mf	6SB7Y Conv. grid (#5 pin)	455 Kc	1, 2, 3 & 4 (I.F. & Diode trans. cores)	Adjust for maximum
R. F. ALIGNMENT							

Note 1: The bands shall be aligned in the following sequence:

Note 2: Pointer setting: With the gang capacitor fully closed the pointer shall coincide with the low frequency end point of the frequency scales. Pointer must be straight.

BAND D (10.6-13.9 Mc)							
2.	13.8 Mc	Band "D"	400 ohm	Antenna and ground terminals	13.8 Mc	5, 6 & 7	Adjust for maximum in order shown. Make sure oscillator is lower in frequency than the signal by checking image response which should occur with the input signal
3.	10.6 Mc	Band "D"	400 ohm	Antenna and ground terminals.	10.6 Mc	8, 9 & 10	Adjust for maximum in order shown.
4.							Repeat steps 2 and 3 several times until further adjustment does not increase the output. Make step 2 the final adjustment.
BAND C: (8.8-10.6 Mc)							
5.	10.6 Mc	Band "C"	400 ohm	Antenna and ground terminals	10.6 Mc	11, 12 & 13	Adjust for maximum in order shown. Make sure oscillator is lower in frequency than the signal by checking image response which should occur with the input signal at 9.59 Mc. Check calibration at 9.0 Mc.
BAND F: (16.6-22.6 Mc)							
6.	21.5 Mc	Band "F"	400 ohm	Antenna and ground terminals	21.5 Mc	14, 15 & 16	Adjust for maximum in order shown. Make sure oscillator is lower in frequency than the signal by checking image response which should occur with the input signal at 20.59 Mc.
7.	16.6 Mc	Band "F"	400 ohm	Antenna and ground terminals	16.6 Mc	17, 18 & 19	Adjust for maximum in order shown. Use bakelite screwdriver.

MOTOROLA INC.

MODEL 57B61V
 MODELS 67F61BN, 67T61BN
 MODEL 87T61BN

STEP	DIAL SET TO	BAND SW. SET TO	DUMMY ANTENNA	SIGNAL GENERATOR CONNECTED TO	SIGNAL GENERATOR SET AT	ADJUST TRIMMER OR CORE	REMARKS
8.							Repeat steps 6 and 7 several times until further adjustment does not increase the output. Make step 6 the final adjustment.
BAND E: (13.8-16.6 Mc)							
9.	16.5 Mc	Band "E"	400 ohm	Antenna and ground terminals	16.5 Mc	20, 21 & 22	Adjust for maximum in order shown. Make sure oscillator is lower in frequency than the signal by checking image response which should occur with the input signal at 15.59 Mc.
10.	13.8 Mc	Band "E"	400 ohm	Antenna and ground terminals	13.8 Mc	23	Adjust for maximum. Use bakelite screwdriver.
11.							Repeat steps 9 and 10 several times until further adjustment does not increase the output. Make step 9 the final adjustment.
BAND B: (3.0-9.1 Mc)							
12.	9.0 Mc	Band "B"	400 ohm	Antenna and ground terminals	9.0 Mc	24	* Adjust for maximum. Make sure oscillator is higher in frequency than the signal by checking image response which should occur with the input signal at 9.91 Mc
13.	Tune in signal generator at 6.0 Mc	Band "B"	400 ohm	Antenna and ground terminals	6.0 Mc	25 & 26	Adjust for maximum. Check dial calibration at 3.0 Mc.
BAND A: (532-1620 Kc)							
14.	Fully open	Band "A"	200 mmf	Antenna and ground terminals	1620 Kc	27	Adjust for maximum
15.	1400 Kc	Band "A"	200 mmf	Antenna and ground terminals	1400 Kc	28 & 29	Adjust for maximum.
16.	600 Kc	Band "A"	200 mmf	Antenna and ground terminals	600 Kc	30	Adjust for maximum while rocking gang capacitor slightly.
17.	1620 Kc	Band "A"	200 mmf	Antenna and ground terminals	1620 Kc	27	Recheck 1620 osc setting.

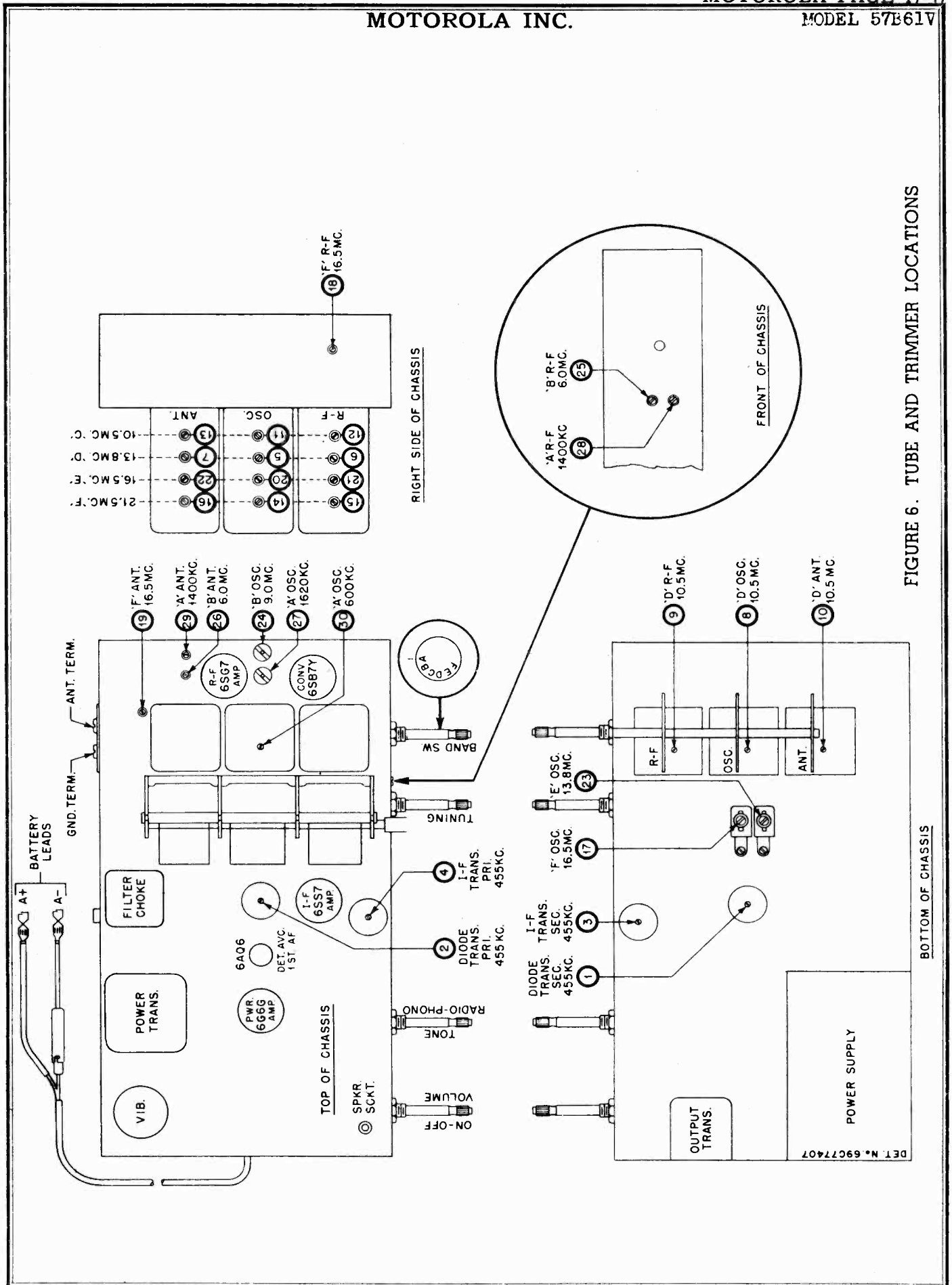


FIGURE 6. TUBE AND TRIMMER LOCATIONS

MOTOROLA INC.

MODEL 57B61V
 MODELS 67F61BN, 67T61BN
 MODEL 87T61BN

REGULADORES

CONTROLS

Los reguladores son como sigue, de izquierda a derecha: (Védse la Figura 3)

From left to right the controls are as follows: (Refer to Figure 3.)

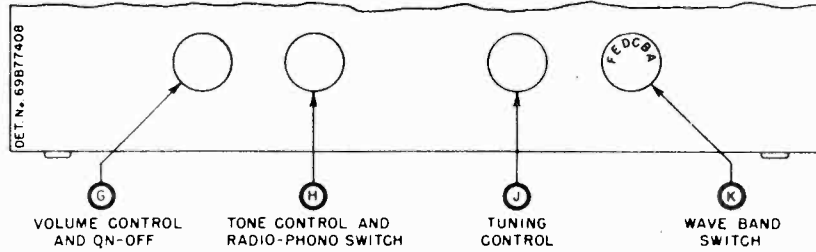


FIGURE 3. CONTROLS

MODEL 67F61BN, 87T61BN, 57B61V

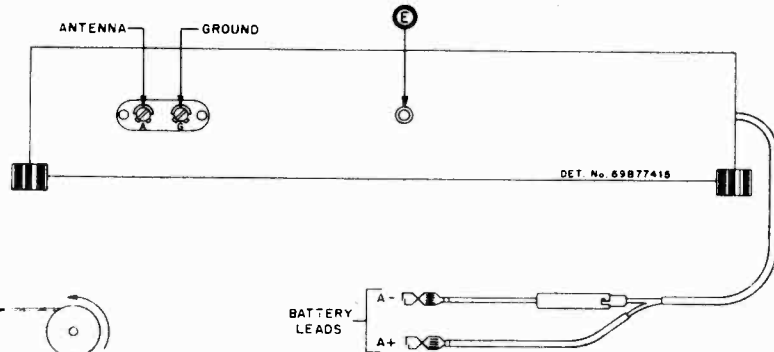
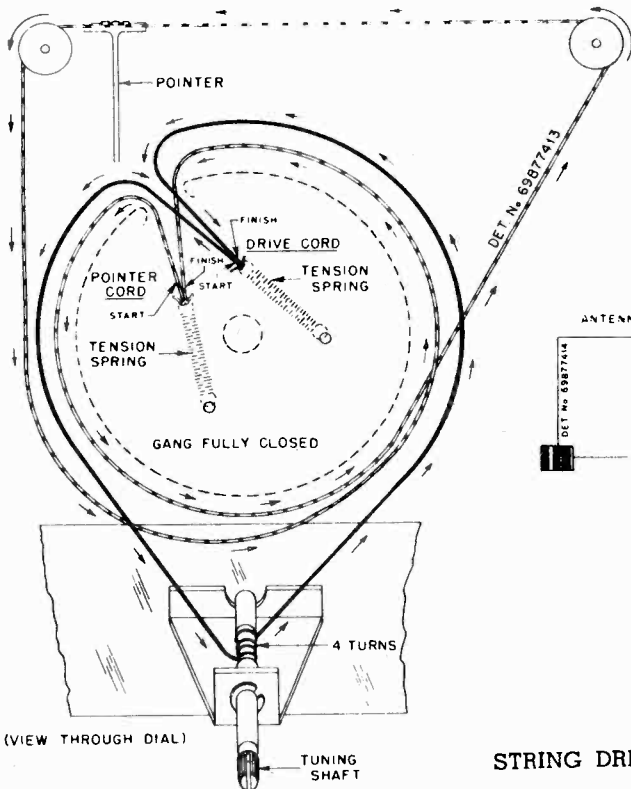


FIGURE 2. CHASSIS REAR VIEW

MODEL 57B61V



STRING DRIVE DETAIL

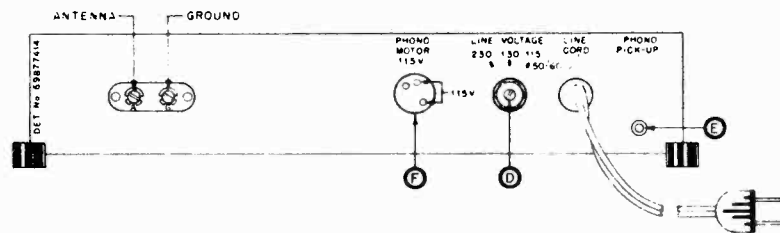


FIGURE 2. CHASSIS REAR VIEW

MODEL 67F61BN, 67T61BN, 87T61BN

MODEL 67F61BN, 67T61BN, 57B61V

MOTOROLA INC.

MODEL 57B61V

MODELS 67F61BN, 67T61BN

MODEL 87T61BN

INSTALACION

Desempaquese el receptor y límpiase el compartimiento del fonógrafo, chasis y gabinete de todo material de empaque, cartones, etc. Asegúrese de que todas las válvulas y el enchufe de la bocina estén firmemente asentados en sus receptáculos.

Las dos tiras de madera que se encuentran debajo del chasis deben quitarse antes de hacer funcionar al receptor. Procedase como sigue: (Véase la Figural.)

1. Quítense y botense los dos tornillos y abrazaderas de empaque (A).
2. Aflójense los cuatro tornillos de retención del chasis. (B)
3. Sáquense y botense las dos tiras de madera. (C)
4. Apriétense los cuatro tornillo de retención del chasis (B) lo suficiente para evitar que las arandelas vibren o hasta que los amortiguadores de caucho estén a punto de ser comprimidos. No los apriete demasiado.

INSTALLATION

Unpack the receiver and remove all packing material, cardboard, etc., from the chassis, phonograph compartment and cabinet. Make sure all tubes and speaker plug are firmly seated in their sockets.

The two wooden shipping strips found under the chassis should be removed before placing receiver in operation. Proceed as follows: (refer to Figure 1.)

1. Remove and discard the two shipping screws and brackets (A).
2. Loosen the four chassis retaining screws (B).
3. Pull out and discard the two wooden shipping strips (C).
4. Tighten the four chassis retaining screws (B) just enough to prevent washers from rattling, or until the rubber cushions are just at the point of being compressed. Do not tighten too tight.

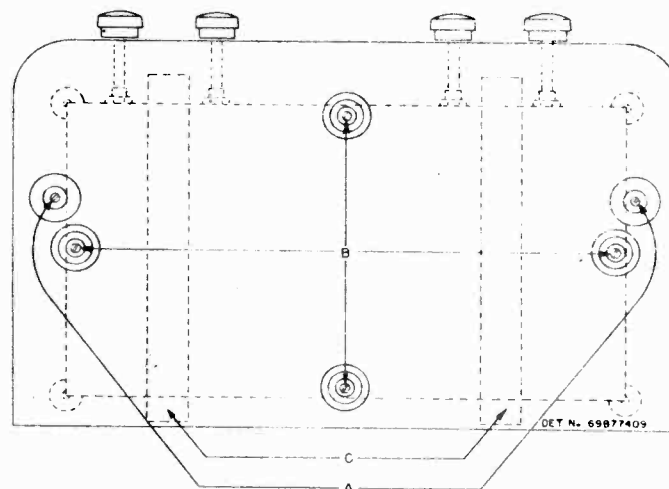


FIGURE 1. SHIPPING STRIP REMOVAL DETAIL

ANTENA

Con este receptor debe usarse una buena antena, especialmente para la recepción de onda corta. Consulte al distribuidor de radio más próximo sobre el tipo de antena que mejor se adapte a su localidad. En la mayoría de los casos un solo alambre de unos 60 pies de largo debe dar buenos resultados. Conecte la antena al terminal marcado "A", en el respaldo del receptor. En el punto en que la antena entra a la casa debe instalarse un pararrayos aprobado. Manténganse bien separados el cable del acumulador y el alambre de entrada de la antena.

CONEXION A TIERRA

Una buena tierra, conectada al terminal "G", en el respaldo del receptor, ayudará a reducir ruidos y mejorará la recepción. Se puede hacer una tierra satisfactoria haciendo conexión a un radiador o tubería de agua. En caso de no haber radiador o tubería de agua, se puede utilizar una varilla o tubo metálico de 5 pies de largo clavándola en tierra húmeda.

CORRIENTE ELECTRICA

Conéctense las dos pinzas de batería a un acumulador de 6 voltios. Fíjese en la polaridad al hacer las conexiones; la pinza marcada "+" debe conectarse al terminal "+" (positivo) del acumulador; y la pinza marcada "-" debe ir al terminal "-" (negativo) del acumulador. En caso de que el receptor no funcione después de 20 segundos, ciérrese el interruptor y verifique la polaridad de las conexiones del acumulador. Puede dañarse el receptor si se le conecta al acumulador incorrectamente y se le deja así conectado por más de unos pocos minutos. Colocando un fusible en el alambre del negativo del acumulador se protege al receptor y al acumulador contra sobrecargas. Nunca utilice un fusible de mayor capacidad que de 5 amperios.

ANTENNA

A good outdoor antenna should be used with this receiver, especially for short wave reception. Consult the radio dealer who serves your territory on the type of antenna best suited for your location. In most cases a single wire about 60 ft long should give good results. Connect the antenna to the terminal marked "A" on the back of the set. An approved lightning arrester should be installed at the point where the antenna enters the house. NOTE: Keep battery cable and antenna lead well separated.

GROUND

A good ground, connected to the terminal "G" on the back of the set will aid in reducing noise and improve reception. A satisfactory ground can be made by connecting to a radiator or water pipe. In the absence of a radiator or water pipe, a 5 foot metal stake or pipe driven into moist earth may be used.

POWER SUPPLY

Connect the two battery clips to a 6 volt storage battery. Observe polarity when connecting; the clip marked "+" goes to the "+" (positive) terminal of the battery and the clip marked "-" goes to the "-" (negative) terminal of the battery. See Figure 2. Should the receiver fail to play after being turned on for about 20 seconds, turn receiver off and recheck polarity of battery connections. The receiver may be damaged if it is incorrectly connected to battery and left turned on for more than a few minutes.

A fuse in the negative battery lead protects the receiver and battery against overloads. Never use a fuse with a higher rating than 5 amperes.

From a fully charged battery, the receiver will draw about 2.6 amperes.

Usando un acumulador plenamente cargado, el receptor consumirá unos 2.6 amperios.

COMUNICADOR DE BANDAS (K)

- Posición "A" - 532 a 1620 Kc. (Onda corriente)
- Posición "B" - 3.0 a 9.1 Mc. (Onda corta)
- Posición "C" - 8.8 a 10.6 Mc. (Onda corta)
- Posición "D" - 10.5 a 13.9 Mc. (Onda corta)
- Posición "E" - 13.8 a 16.6 Mc. (Onda corta)
- Posición "F" - 16.5 a 22.5 Mc. (Onda corta)

CLAVIJA PARA REPRODUCTOR DE FONOGRAFO

Al conectarse un tocadiscos a la clavija para reproductor de fonógrafo (E) al respaldo del receptor, pueden tocarse discos utilizando el amplificador de este radio. Véase la figura 2 para localizar la clavija para reproductor de fonógrafo (E).

Se puede usar cualquier tocadiscos que tenga un buen reproductor de cristal. Para reducir zumbidos y ruidos del reproductor, el alambre que conecta al tocadiscos y el receptáculo para el fonógrafo debe ser blindado.

- 9A6736 Socket, tube: 6 prong; saddle type
- 9A7724 Socket, pilot light: with lead
- 2A7635 Speednut, trimmer lock-in (C-28 & C-29 mounting)
- 31A751 Strip, antenna & ground
- 4A2316 Washer, "C" (tuning shaft retainer)
- T-3 25B76792 Transformer, output
- T-4 25C76712 Transformer, power
- 7A76822 Bracket, tuning shaft
- 1877372 Cabinet, table model
- 5A71092 Grommet, rubber: 5/8 x 3/4 dia. (chassis mounting)

WAVEBAND SWITCH (K)

- "A" position - 532 to 1620 Kc. (standard broadcast)
- "B" position - 3.0 to 9.1 Mc. (short wave)
- "C" position - 8.8 to 10.6 Mc. (short wave)
- "D" position - 10.5 to 13.9 Mc. (short wave)
- "E" position - 13.8 to 16.6 Mc. (short wave)
- "F" position - 16.5 to 22.5 Mc. (short wave)

PHONO PICK-UP JACK

By connecting a record player to the phono pick-up jack (E) on the back of the receiver, you can play records through the amplifier of this radio. See Figure 2 for location of phono pick-up jack (E).

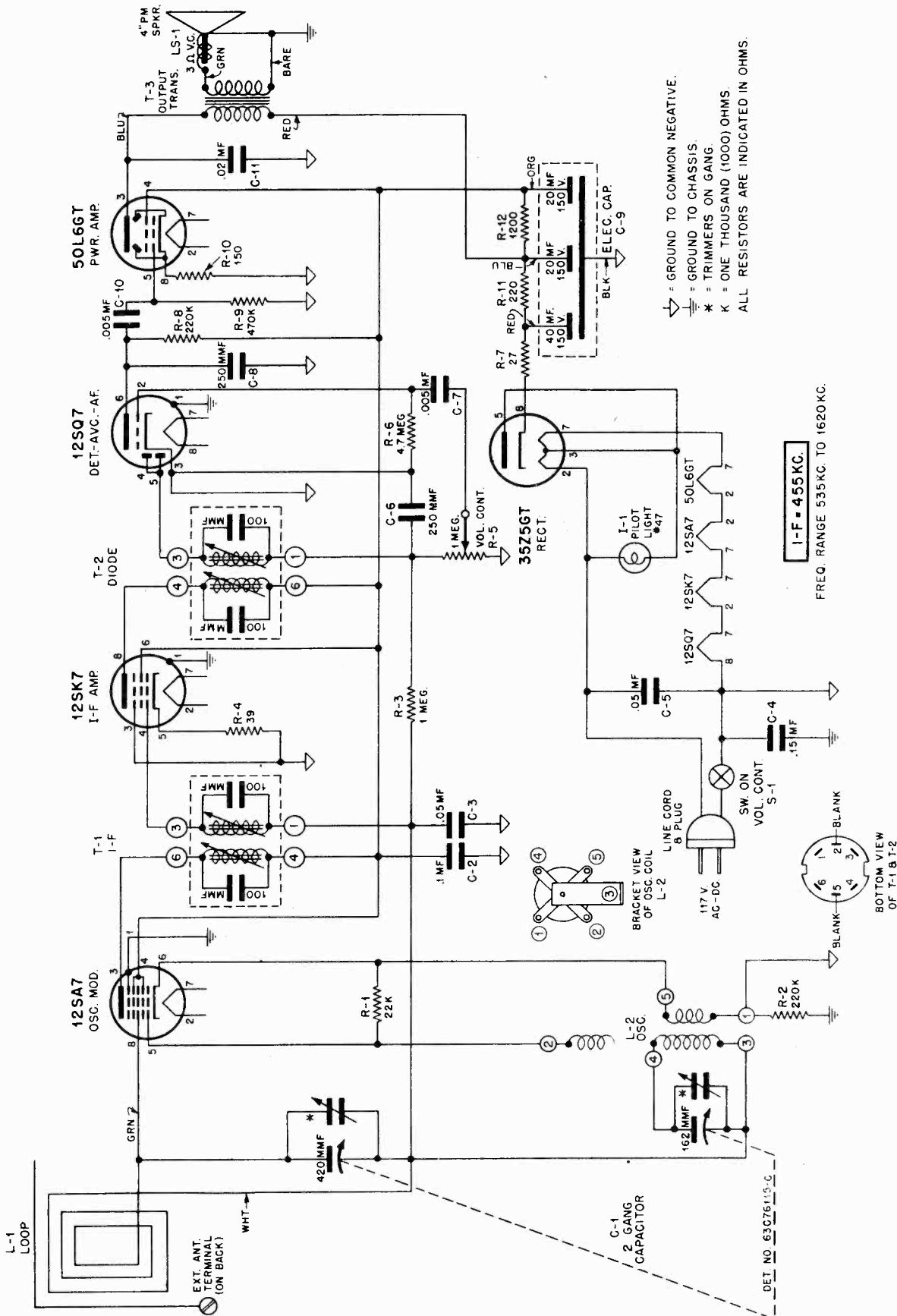
Any record player having a good crystal pickup can be used. To reduce hum and noise pickup, the connecting lead between the record player and radio phono socket should be shielded.

Additional Parts

- 5A71130 Grommet, rubber: 1/4 x 1/2 dia. body: 3/4 dia. head (chassis retainer)
- 5A76628 Grommet: rubber (dial seat cushion)
- 37X15125 Grommet, rubber (gang cushions)
- 5A76960 Grommet, rubber (speaker mounting)
- 2A76795 Knob, control: braided (band switch)
- 36B76794 Knob, control: plain
- 52A76676 Pointer, dial
- 9A22182 Receptacle, plug: 1 prong
- 9A27874 Receptacle, plug: 3 prong
- 3A76705 Scale, dial
- 47A76624 Shaft, tuning
- 1A71049 Shield, & Iron core Sleeve assembly (for I. F. or diode transformer)
- 9A70168 Socket, tube: octal; plain
- 9A77378 Socket, tube: octal; shielded type
- T-1 2A76686 Transformer, I. F.: 455 Kc; complete with iron cores and padding capacitors, but less shield
- T-2 2A76537 Transformer, diode: 465 Kc; complete with iron cores and padding capacitors, but less shield

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REF. NO.	PART NO.	DESCRIPTION.	REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
C-1	19C76476	Capacitor, variable: 3 gang; each gang section consists of 5 plate (7-80) mmf.) and 21 plate (7-402) mmf. sections	C-27	21B2732	Capacitor, fixed: mica; .003 mf 2%	L-5	1X76727	With core and mounting bracket Coil, shunt: bands *E & *F* R.F. shunt; yellow dot coding; complete with tuning core and mounting bracket
C-2	20A76734	Capacitor, trimmer: mica; 4-70 mmf; (20A76689) on same bracket as C-3, C-4 & C-5; not replaceable separately	C-28	20B76642	Capacitor, trimmer: 8-50 mmf	L-6	1X76725	Coil, shunt: band *F* oscillator shunt; red dot coding; complete with tuning core and mounting bracket
C-3	20A76734	Capacitor, trimmer: mica; 20-250 mmf; (20K76671) on same bracket as C-2, C-4 and C-5; not replaceable separately	C-29	20B76642	Capacitor, trimmer: 8-50 mmf	L-7	1X76726	Coil, shunt: band *E* oscillator shunt; green dot coding; complete with tuning core and mounting bracket
C-4	20A76734	Capacitor, trimmer: mica 7-130 mmf; (20K76670) on same bracket as C-2, C-3 & C-5; not replaceable separately	C-30	21K63198	Capacitor, fixed: ceramic; 50 mmf 500V	L-8	24A77239	Choke, *A*
C-5	20A76734	Capacitor, trimmer: mica; 20-250 mmf; (20K76671) on same bracket as C-2, C-3 & C-4; not replaceable separately	C-31	8A76494	Capacitor, fixed: paper; .1 mf 400V; shielded	L-9	24A77240	Choke, *B*
C-6	20A76734	Capacitor, trimmer: mica; 4-70 mmf; (20A76689) on same bracket as C-7, C-8 & C-9; not replaceable separately	C-32	8A76494	Capacitor, fixed: paper; .1 mf 400V; shielded	L-10	25B76711	Choke, filter
C-7	20A76734	Capacitor, trimmer: mica; 20-250 mmf; (20K76671) on same bracket as C-6, C-7 & C-9; not replaceable separately	C-33	8A76495	Capacitor, fixed: paper; .02 mf 400V; shielded	L-11	6R6004	Resistor, fixed: carbon; 1 megohm 1/2 W Ins.
C-8	20A76734	Capacitor, trimmer: mica; 7-130 mmf; (20K76670) on same bracket as C-6, C-7 & C-9; not replaceable separately	C-34	8A76496	Capacitor, fixed: paper; .05 mf 400V; shielded	R-2	6R6004	Resistor, fixed: carbon; 1 megohm 1/2 W Ins.
C-9	20A76734	Capacitor, trimmer: mica; 20-250 mmf; (20K76671) on same bracket as C-6, C-7 & C-8; not replaceable separately	C-35	8A76496	Capacitor, fixed: paper; .05 mf 400V; shielded	R-4	6R6056	Resistor, fixed: carbon; 47,000 ohms 1/2W Ins.
C-10	20K76940	Capacitor, trimmer: ceramic; 7-45 mmf	C-36	21R6697	Capacitor, fixed: mica; 200 mmf 10%	R-5	6R6059	Resistor, fixed: carbon; 3900 ohms 1/2W Ins.
C-11	20K76940	Capacitor, trimmer: ceramic; 7-45 mmf	C-37	8A76496	Capacitor, fixed: paper; .005 mf 600V; shielded	R-6	6R6260	Resistor, fixed: carbon; 220 ohms 1/2W Ins.
C-12	20K76940	Capacitor, trimmer: ceramic; 7-45 mmf	C-38	8A76497	Capacitor, fixed: paper; .06 mf 400V; shielded	R-7	6R6204	Resistor, fixed: carbon; 8200 ohms 10% 1/2 W Ins.
C-13	21A76697	Capacitor, fixed: ceramic; 24 mmf 500V	C-39	8A76498	Capacitor, electrolytic; 50 mf 25V	R-8	6R6327	Resistor, fixed: carbon; 2.2 megohms 1/2W Ins.
C-14	21A76697	Capacitor, fixed: ceramic; 24 mmf 500V	C-40	21R6684	Capacitor, fixed: mica; 400 mmf 10%	R-9	6R6004	Resistor, fixed: carbon; 1 megohm 1/2W Ins.
C-15	21A76688	Capacitor, fixed: ceramic; 95mmf 500V	C-41	8A76498	Capacitor, fixed: paper; .005 mf 600V; shielded	R-10	6R2122	Resistor, fixed: carbon; 4.7 megohms 1/2W Ins.
C-16	21A76688	Capacitor, fixed: ceramic; 56 mmf 500V	C-42	8A76498	Capacitor, fixed: paper; .02 mf 400V; shielded	R-11	16K76685	Resistor, variable: 1 megohm includes on-off switch SW-3
C-17	21A76690	Capacitor, fixed: ceramic; 130 mmf 500V	C-43	8A76498	Capacitor, fixed: paper; .005 mf 600V; shielded	R-12	6R6075	Resistor, fixed: carbon; 100,000 ohms 1/2W Ins.
C-18	20A76613	Capacitor, trimmer: mica; 2-20 mmf; on same bracket as C-19; not replaceable separately	C-44	6K15166	Capacitor, fixed: Paper: .007 mf 1600V; shielded	R-13	6R6561	Resistor, fixed: carbon; 120 ohms 10% 1/2W Ins.
C-19	20A76613	Capacitor, trimmer: mica; 4-45 mmf; on same bracket as C-18; not replaceable separately.	C-45	8A76497	Capacitor, fixed: paper; .05 mf 400V; shielded	R-14	6R6090	Resistor, fixed: carbon; 470 ohms 10% 1/2W Ins.
C-20	21R6697	Capacitor, fixed: mica; 200 mmf 10%	C-46	23B77245	Capacitor, electrolytic; 18 mf 200V	R-15	6R6105	Resistor, fixed: carbon; 100 ohms 10% 1/2 W N.I.
C-21	21R6664	Capacitor, fixed: mica; 400 mmf 10%	C-47	22B77246	Capacitor, electrolytic; 18 mf 200V	R-16	6R3989	Resistor, fixed: carbon; 35 ohms 1/2W Ins.
C-22	20A76614	Capacitor, trimmer: mica; 2-20 mmf; on same bracket as C-23; not replaceable separately	C-48	8A76710	Capacitor, fixed: paper; .5 mf 120V	R-17	16K76686	Resistor, variable; 1 megohm includes phono-radio switch SW-4
C-23	20A76614	Capacitor, trimmer: mica; 4-45 mmf; on same bracket as C-22; not replaceable separately	C-49	8A76710	Capacitor, fixed: paper; .5 mf 120V	R-18	6R6015	Resistor, fixed: carbon; 220,000 ohms 1/2W Ins.
C-24	21R6697	Capacitor, fixed: mica; 200 mmf 10%	C-50	41A76753	Capacitor, fixed: ceramic; 1500 mmf 500V	R-19	6R6016	Resistor, fixed: carbon; 220,000 ohms 1/2W Ins.
C-26	21A2731	Capacitor, fixed; mica; 555 mmf 1%	F-1	65K52293	Fuse; 5 Amp.	SW-1	40B76483	Switch, band; 6 position
			G-1	48B76714	Vibrator, synchronous; 6 volt	SW-3		Switch, S.P.S.T.; part of volume control R-11 (power on-off switch)
			I-1	65K77646	Bulb; 2V; bayonet base; type #49	SW-4		Switch, D.P.D.T.; part of tone control R-17 (radio-phonograph switch)
			F-2	65K77646	Bulb; 2V; bayonet base; type #49			
			L-1	24C76730	Coil, antenna; complete with shield, 4 trimmers (C-2, C-3, C-4 & C-5) and tuning core			
			L-2	24K76731	Coil, R.F.; complete with shield, 4 trimmers (C-6, C-7, C-8 & C-9) and tuning core			
			L-3	24C76732	Coil, oscillator; complete with shield, 4 ceramic trimmers (C-10, C-11, C-12 & C-13), 4 fixed ceramic capacitors (C-14, C-16, C-18 & C-17) and 2 tuning cores			
			L-4	1X76728	Coil, shunt: bands *E & *F* antenna shunt; white dot coding; complete 500V			



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MODELS 57X11,
57X12

ALIGNMENT

Maximum performance can only be obtained if extreme care is exercised during alignment. Follow the procedure carefully.

as Motorola Part Number 66A71008.

A low range output meter should be connected across the speaker voice coil. Set receiver volume control to maximum; for greatest accuracy keep output of receiver at approximately .05 watt throughout alignment by reducing generator output (not receiver volume control) as stages are brought into alignment. (.05 watt = .40 volt on output meter). The alignment tool should be of an insulated type such

If receiver is operated from AC line during alignment, it is suggested that an isolating transformer be used between receiver and power line. If no isolation transformer is used and hum is encountered during alignment, connect the ground side of the signal generator to B- instead of the receiver chassis.

Refer to Figure 1 for location of all adjustments.

STEP	DIAL SET TO	DUMMY	SIGNAL GENERATOR CONNECTED TO	SIGNAL GENERATOR SET TO	ADJUST TRIMMER OR CORE	REMARKS
IF ALIGNMENT						
1.	Gang fully opened	.1 mf.	Osc-Mod grid *	455 Kc	1,2,3 & 4	Adjust for maximum
RF ALIGNMENT						
2.	1800 Kc **	-	Radiation loop ***	1800 Kc	5	This sets osc. to dial scale
3.	1400 Kc	-	Radiation loop ***	1400 Kc	6	Tune signal for max. with receiver tuning knob, then peak trimmer 6.

* A convenient point is the stator of the antenna section of the tuning capacitor.

** Close gang fully and set pointer to calibration mark at left hand side of dial background; then set pointer to 1800 Kc by turning tuning knob till pointer lines up with right hand calibration mark.

*** Connect output of signal generator to a 5" diameter, 3 turn loop and bring loop close enough to receiver loop to obtain output of 50 milliwatts (.40V) on output meter. Vary distance between loops to maintain this output during alignment. Minimum distance between loops should never be less than 12".

TUBE AND TRIMMER LOCATIONS

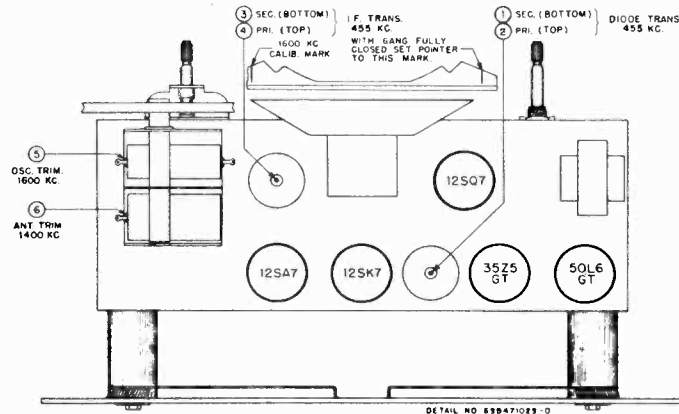
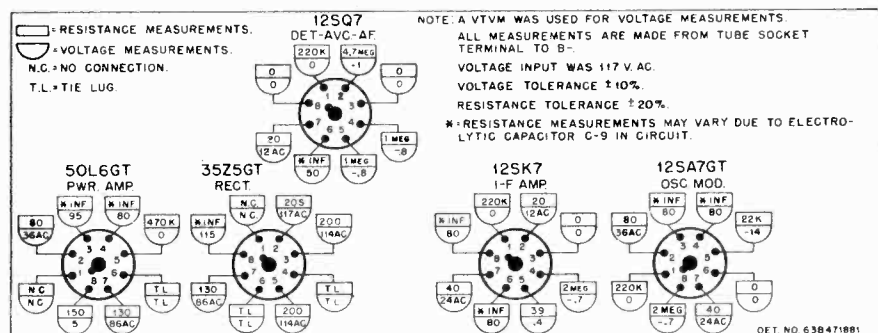


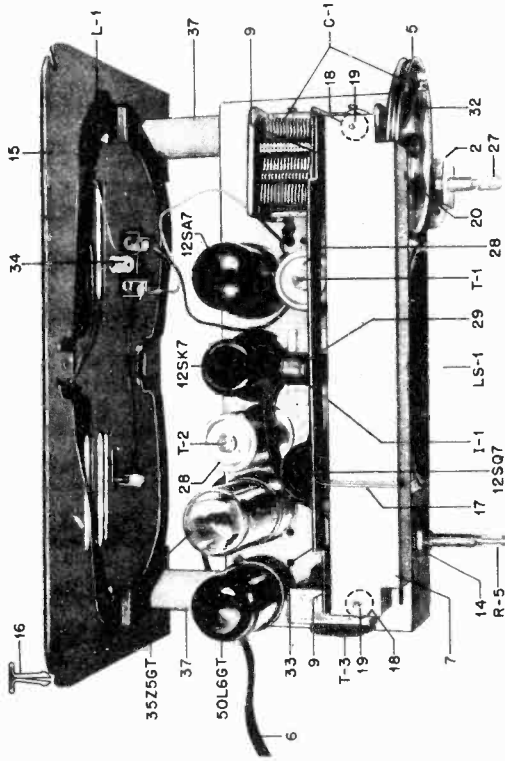
FIGURE 6. VOLTAGE & RESISTANCE DIAGRAM



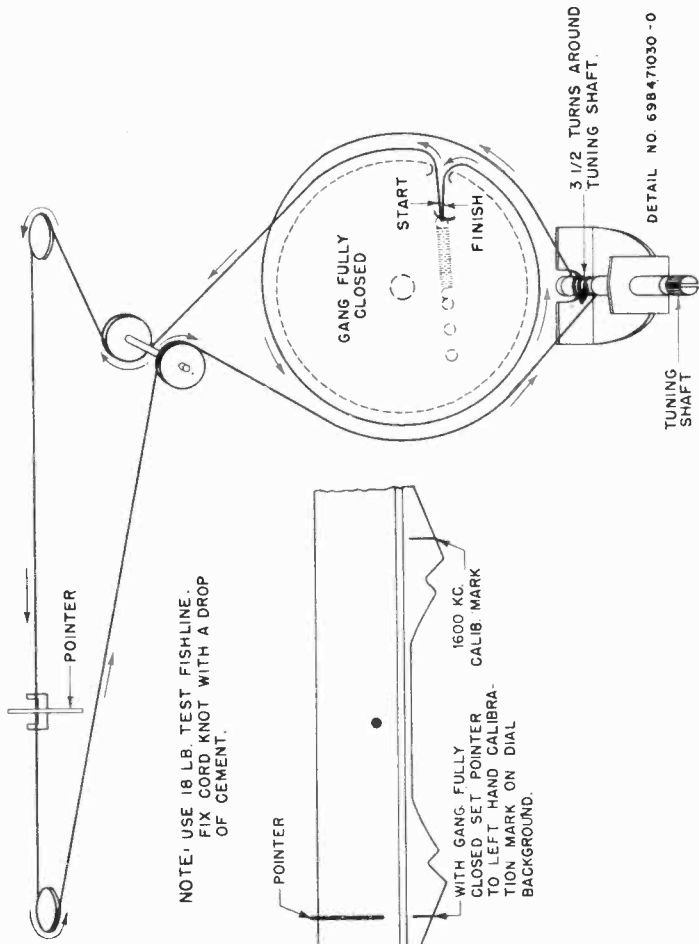
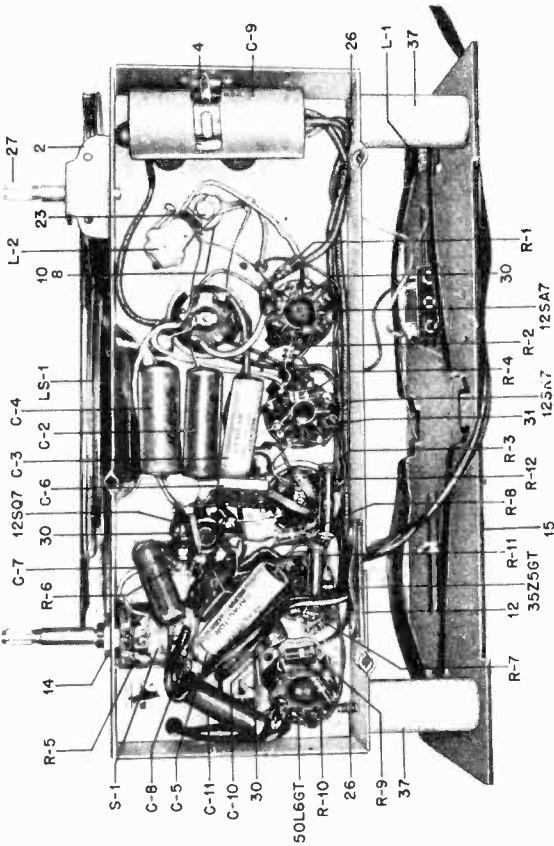
MODELS 57X11,
57X12

MOTOROLA INC.

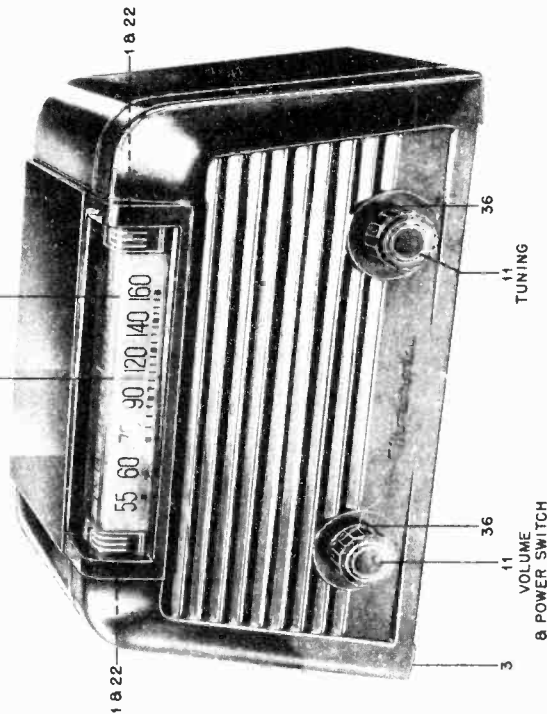
PARTS LOCATION - CHASSIS TOP



PARTS LOCATION - CHASSIS BOTTOM



NOTE: USE 18 LB. TEST FISHLINE.
FIX CORD KNOT WITH A DROP
OF CEMENT.



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MODELS 57X11,
57X12

REPLACEMENT PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
CAPACITORS					
C-1	1X77204	Variable: 2 gang; cut oscillator plates; includes pulley.....	8	5A19658	Eyelet, spacer: 19/64 x .212 I.D. x 1/2 (gang mtg)
C-2	8S9806	Paper: .1 mf 200V	9	5S7805	Eyelet, snap-in; steel (dial background strip mtg)
C-3	8S9816	Paper: .05 mf 400V			
C-4	8A72686	Paper: .15 mf 200V	10	5A70404	Grommet, rubber (gang cushions)
C-5	8S9816	Paper: .05 mf 400V	11	36B77213	Knob, control; plastic; walnut finish (57X11)
C-6	21R6640	Mica: 250 mmf 500V		36K77214	Knob, control; plastic; ivory finish (57X12)
C-7	8S9813	Paper: .005 mf 600V	12	32A24815	Lock, line cord: fibre
C-8	21R6648	Mica: 250 mmf 500V	13	2A70075	Nut, speed: Tinnerman #520 (dial background bracket mtg)
C-9	23B75808	Electrolytic: 40-20-20 mf 150V			
C-10	8S9813	Paper: .005 mf 600V	14	2S7051	Nut, steel: 3/8 x 9/16 hex; cadmium plated (volume control mtg)
C-11	8S9802	Paper: .02 mf 400V	15	1X77210	Panel Assembly, cabinet back: less loop winding
DIAL LIGHT					
I-1	65X11854	Bulb, pilot: 6.3V, .15A; tubular, bayonet base; #47	16	38A25507	Plug, split: 5/8" long (loop panel to cabinet mtg)
COILS					
L-1	24K77096	Loop Winding only - less cabinet back ...	17	52A77089	Pointer, dial
L-2	24A74616	Oscillator	18	49A21552	Pulley, cord: 1/2" groove
			19	5A15045	Rivet, shoulder: 7/16" long; nickel plated (cord pulley mtg)
			20	5A71735	Rivet, shoulder: 1/2" long; nickel plated (cord pulley mtg)
RESISTORS					
NOTE: All resistors are insulated carbon type, ± 20% unless otherwise specified.					
R-1	6R6028	22,000 1/2 W	21	34B77212	Scale, dial: plastic
R-2	6R6015	220,000 1/2 W	22	3S7155	Screw, steel: 6-32 x 3/16 slotted hex head machine screw; cadmium plated (hold dial scale mtg bracket to cabinet)
R-3	6R6004	1 meg 1/2 W	23	3S2294	Screw, steel: 6-32 x 1/2 plain hex head locking type machine screw; cadmium plated (gang mtg)
R-4	6R2085	39 10% 1/2 W			
R-5	18A70032	Volume control: 1 meg; includes switch S-1			
R-6	6R2122	4.7 meg 1/2 W	24	3S7205	Screw, steel: 8-32 x 1/4 slotted hex head locking type machine screw; cadmium plated (speaker mtg)
R-7	6R5683	27 10% 1/2 W			
R-8	6R6015	220,000 1/2 W			
R-9	6R6032	470,000 1/2 W	25	3S8117	Screw, steel: #8 x 1" PKZ slotted hex washer head sheet metal screw; antique copper finish (chassis mtg)
R-10	6R6373	150 10% 1/2 W			
R-11	6R6152	220 1W N.I.	26	3S3383	Screw, steel: #8 x 2" PK2 slotted hex head sheet metal screw, cadmium plated (loop mtg)
R-12	6R3972	1,200 10% 1W N.I.	27	47A77087	Shaft, tuning
SPEAKER					
LS-1	50B76109	Speaker: 4" PM; 3.2 ohms V.C.	28	1A71049	Shield and Iron Core Sleeve Assembly (for T-1 & T-2)
SWITCH					
S-1		Switch (part of volume control R-5)	29	9A77086	Socket, pilot light: with bracket and leads.....
TRANSFORMERS					
T-1	24B70531	IF: 455 Kc; complete with iron cores and padding capacitors, but less shield	30	9A6790 9A6788	Socket, tube: molded octal; plain type .. Socket, tube (replacement) molded octal; plain type (to be used in place of 9A6790 when mounting lugs on chassis break off).....
T-2	24B70533	Diode: 455 Kc; complete with iron cores and padding capacitors, but less shield	31	9A6792	Socket, tube: molded octal; with center shield (for I.F. amp)
T-3	25B76117	Output		9A70165	Socket, tube: (replacement)molded octal; with center shield (to be used in place of 9A6792 when mounting lugs on chassis break off)
1	7A77382	Bracket, dial scale mounting	32	41A14244	Spring, tension coil (drive cord tension)
2	7A14684	Bracket, tuning shaft	33	35B77092	Strip, background
3	16E77220	Cabinet, table model: plastic; walnut finish (57X11).....	34	31K15026	Strip, terminal: 2 insulated lugs, #2 mtg (on loop antenna panel)
	16K77221	Cabinet, table model: plastic; ivory finish (57X12)	35	32A20575	Washer, paper: 3/8 x .171 x .062 thick (used between chassis mtg screws and plastic cabinet to prevent cracking cabinet)
4	42K75826	Clip, electrolytic mounting			
5	11M8944	Cord, dial: 18 lb. black			
6	30A151	Cord, line: 6 ft. long; with plug	36	4K19943	Washer, paper: 11/16 x 17/64 x 1/32 thick (used under control knobs)
7	1X77209	Dial Background Bracket & Pulleys Assembly: background bracket with 4 cord pulleys	37	57A77084	Dowel, back mounting; wood

MODEL 65T21, Chassis ES-32
 MODEL 65T21B, Chassis ES-67

ALIGNMENT AND SENSITIVITY CHART

Connect output meter across speaker voice coil (.38V = .05 watts)
 Volume control set at maximum for all operations.
 The adjusting screwdriver or alignment tool should be of the insulated type, such as Motorola Part No. 66A71008.

Refer to Figure 2 for location of all adjustment trimmers & cores

OPERATION IN ORDER	GANG CAPACITOR SET AT	BAND SWITCH SET AT	DUMMY ANTENNA	GENERATOR CONNECTED TO	ADJUST TRIMMER OR IRON CORE	GENERATOR SET AT (400 μ 30% MODULATED)	AVERAGE INPUT FOR .38V OUTPUT
Adjust I.F.'s for minimum	Minimum	B.C.	.1 mf	Osc. - Mod. grid	1-2-3-4	455 Kc	900 microvolts to I.F. grid 4.5 microvolts to Osc.-Mod. grid (455 Kc)
Set B.C. Oscillator trimmer	1620 Kc	B.C.	None	Radiation loop*	5 B.C. Osc. trimmer C-1	1620 Kc	-----
Adjust B.C. loop trimmer for maximum	1400 Kc	B.C.	None	Radiation loop*	6 B.C. loop trimmer C-4 (on loop) should be adjusted with set in cabinet	1400 Kc	6.5 microvolts to Osc.-Mod. grid through .1 mf dummy
Set S.W. Oscillator trimmer	12.2 Mc	S.W.	50 mmf.	Antenna terminal	7 S.W. Osc. trimmer C-2	12.2 Mc	-----
Adjust S.W.	11.5 Mc	S.W.	50 mmf.	Antenna terminal	8 S.W. Antenna trimmer C-6	11.5 Mc	5 microvolts to Antenna terminal

Repeat above steps for maximum accuracy

.045 volt to 1st A.F. grid (400 μ cycle audio)

Connect output of signal generator to a 5" dia. 3 turn loop. See Fig. 3. With volume control on full, bring loop close enough to receiver loop until an output of 50 milliwatts is obtained. (.38V on output meter). The distance between loops should never be less than 12 inches. Vary distance between generator and receiver loops or adjust generator output to maintain .38V output during alignment.

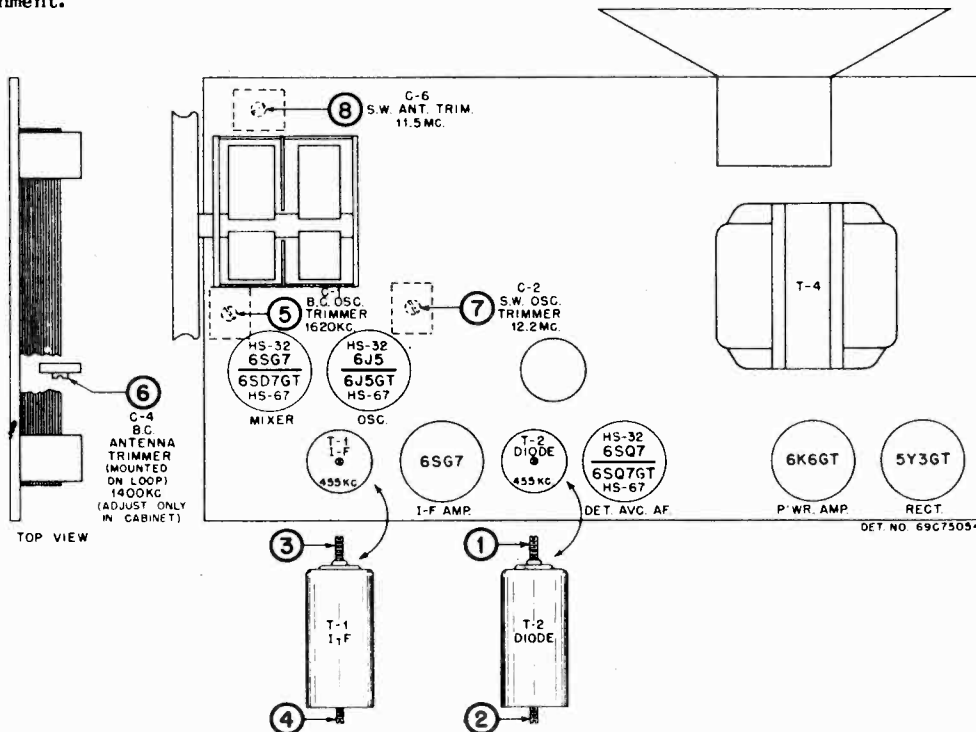
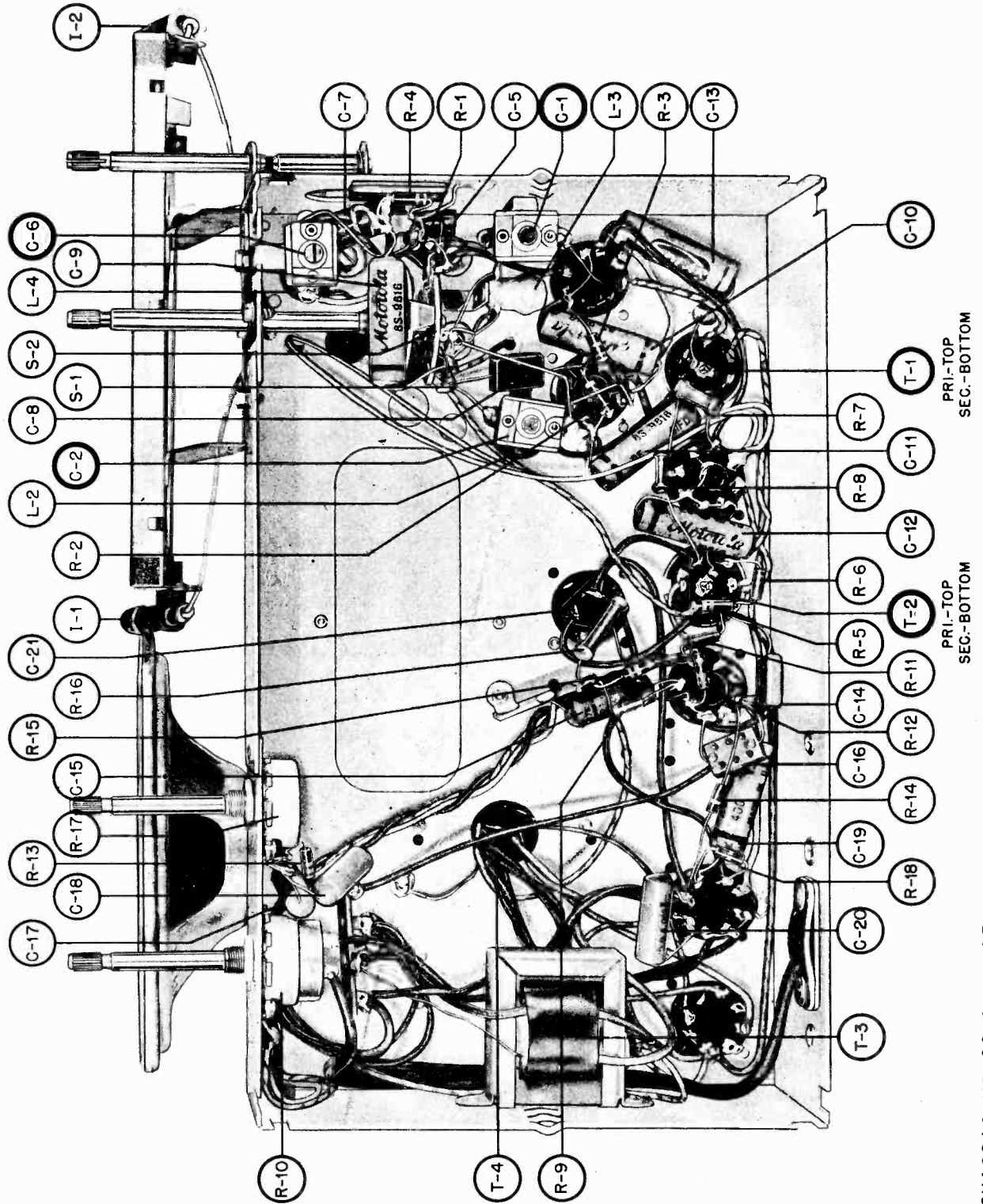


FIGURE 2. TUBE & TRIMMER LOCATION DETAIL

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MODEL 65T21
MODEL 65T21B



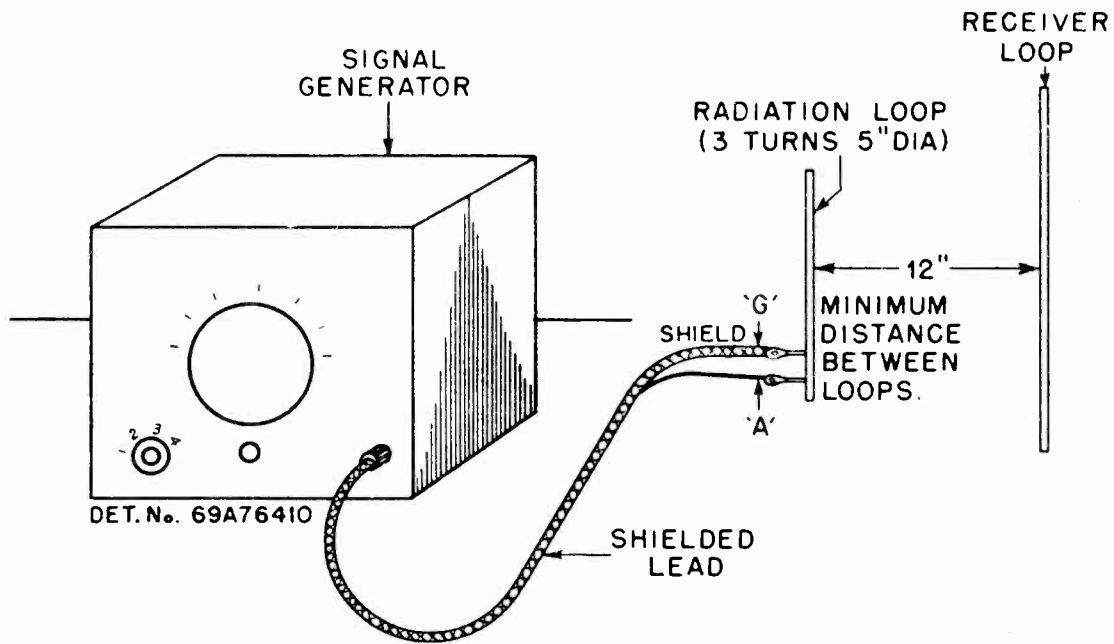
PRI-TOP
SEC-BOTTOM

PRI-TOP
SEC-BOTTOM

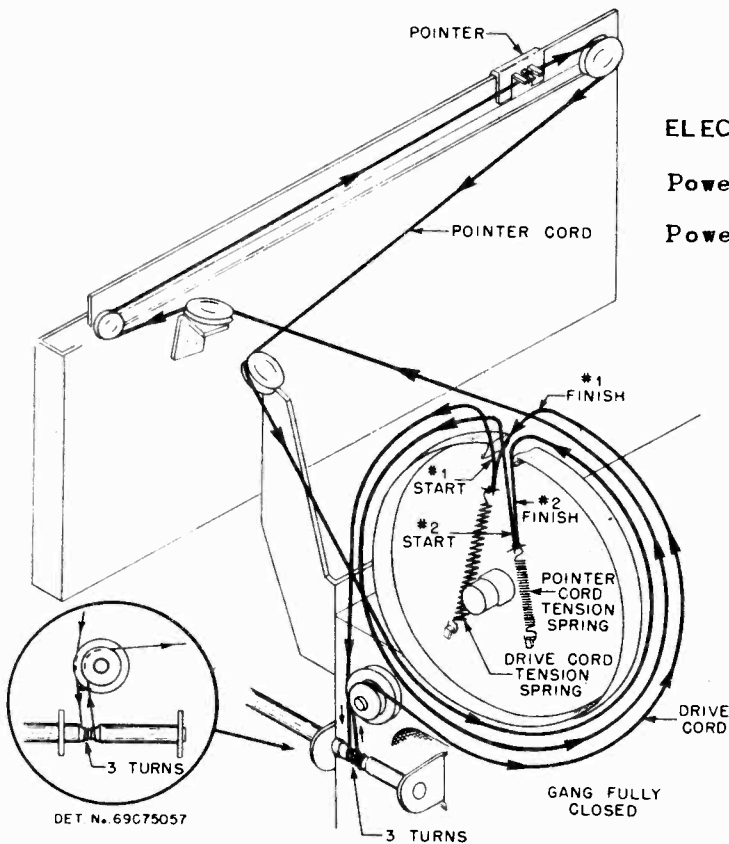
CHASSIS HS-32 & HS-67 - BOTTOM VIEW

MODEL 65T21
MODEL 65T21B

MOTOROLA INC.



METHOD OF RADIATING SIGNAL INTO RECEIVER



STRING DRIVE DETAIL

ELECTRICAL CHARACTERISTICS

Power input: 117V-60 cycles, 65 watts

Power output: 3 watts minimum

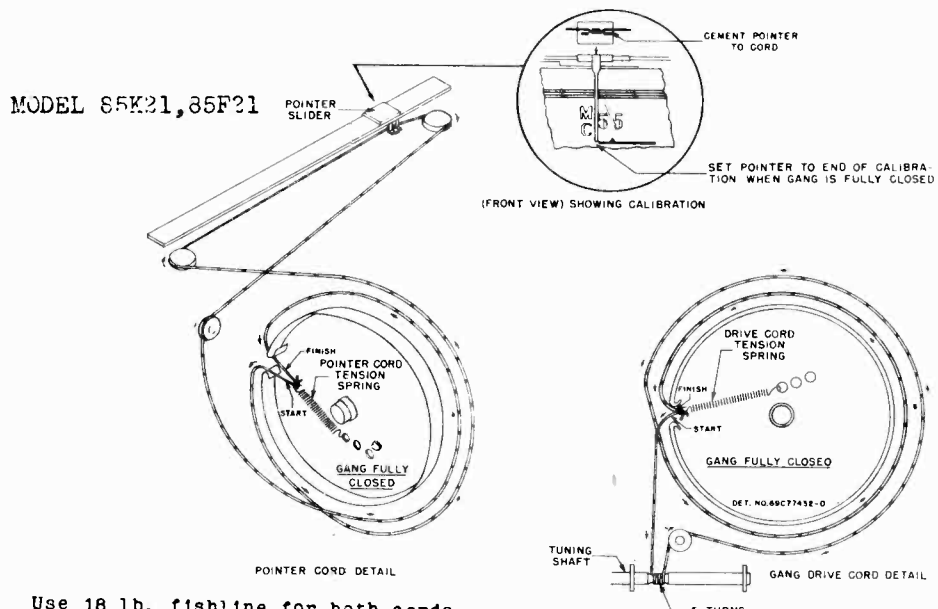
TUNING RANGE

B.C. 535 to 1620 Kc.

S.W. 5.6 to 12.2 Mc.

MOTOROLA INC.

MODEL 65T21
 MODEL 65T21B
 MODEL 85F21
 MODEL 85K21



Use 18 lb. fishline for both cords.

FIGURE 1. POINTER AND DRIVE CORD RESTRINGING DETAIL

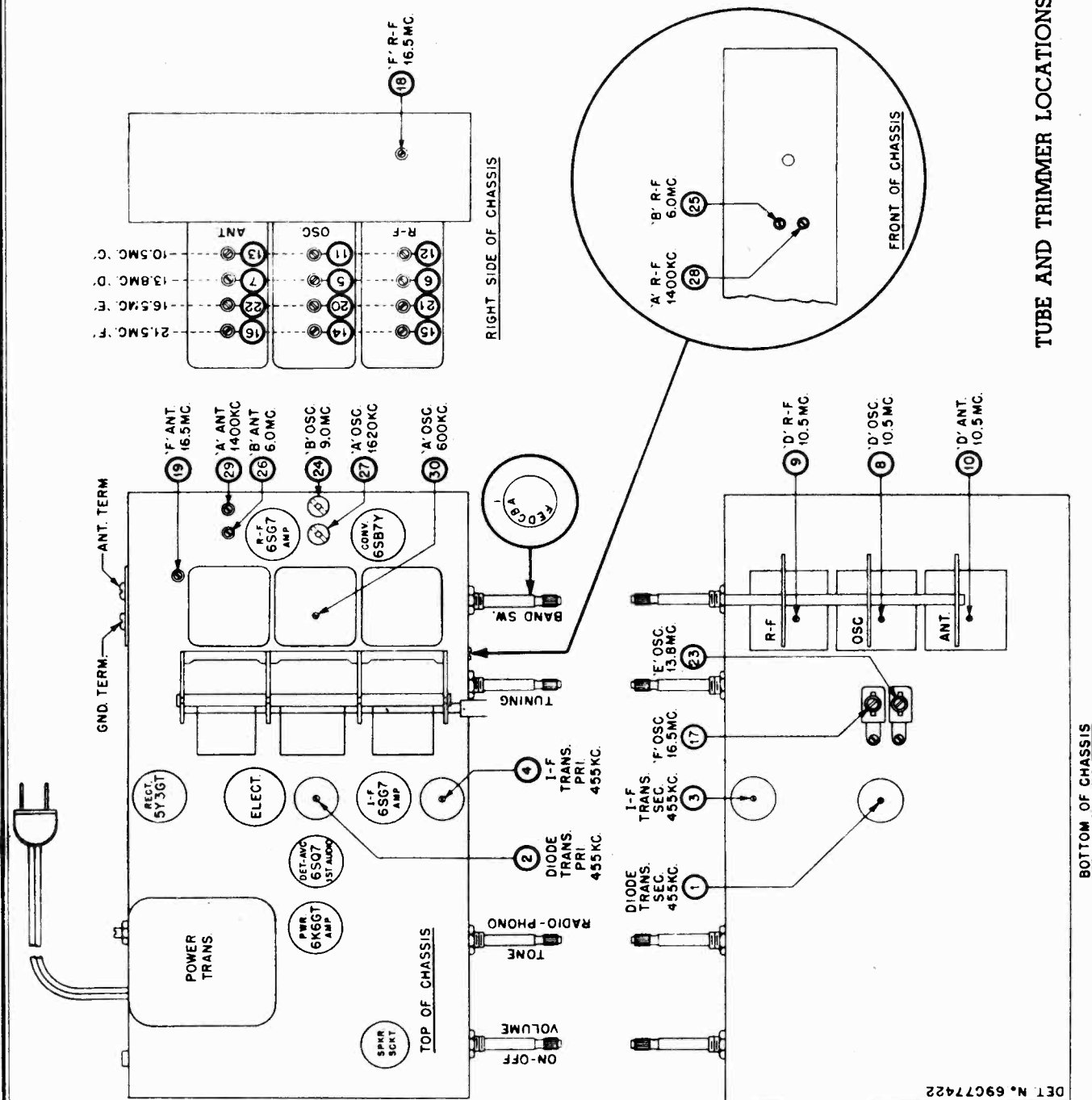
MODEL 65T21, 65T21B

PART NO.	DESCRIPTION	PART NO.	DESCRIPTION
481719	Washer, steel: 3/8 x .140 x .030 thick; cadmium plated (line cord lock mounting)	9A6792	Socket, tube: molded octal; with center shield (for I.F. amp.)
487589	Washer, steel: 7/8 x 9/32 x .027 thick; cadmium plated (used on chassis retainer screws)	9A70165	Socket, tube: replacement; with center shield (to be used only when mounting lugs on chassis break off)
487650	Lockwasher, steel: #6 internal; cadmium plated (output trans. mtg.)	9K72592	Socket, pilot light: with mounting bracket
487655	Lockwasher, steel: 3/8 internal; cadmium plated (band switch)	50B71147	Speaker and bracket: 6" electro
281376	Nut, steel: 3/8-32 x 1/2 hex; cadmium plated (band switch mtg.)	41A14244	Spring, tension coil (drive cord)
387475	Screw, steel: #8 x 1/4 PKZ slotted acorn head; cadmium plated (power trans. & band switch shaft bearing strip mounting)	41A22596	Spring, tension coil (pointer drive)
388011	Screw, steel: 8-32 x 1/2 slotted hex head locking type machine screw; cadmium plated (gang mtg.)	37K70556	Strip, channel: rubber; 1/2" long (dial scale mounting)
387512	Screw, steel: #8 x 1/2 PKZ plain hex head; (cadmium plated)	37K21114	Strip, channel: rubber; 1" long (dial scale mounting)
387534	Screw, steel: #8 x 1-3/8 PKZ slotted hex head; cadmium plated (chassis retainer screws)	32A27678	Strip, shaft bearing: fibre (supports band switch shaft)
1A71049	Shield & Iron Core Sleeve Assembly (I.F. & diode coil shield, and sleeve type iron core)	31A51251	Strip, terminal: 1 insulated lug, #1 ground (on loop)
6A15094	Shield, dial light	5A71130	Grommet, chassis retainer: rubber; 1/4 x 1/2 diameter body; 3/4 diameter head (cushions under chassis retainer screws)
47A71129	Shaft, tuning	5A71092	Grommet, chassis mounting: rubber; 5/8 x 3/4 diameter (used on each corner of chassis)
9A6790	Socket, tube: molded octal; regular type (for all but I.F. amp.)	5A70404	Grommet, rubber (gang and speaker cushions)
9A6788	Socket; tube: replacement (to be used only when mounting lugs on chassis break off)	36K70514	Knob, control: plain; (85T21)
		36K70516	Knob, control: branded (65T21)
		36K72889	Knob, control: plain (85T21B)
		36K72890	Knob, control: branded (65T21B)
		32A24815	Lock, line cord: fibre (Holds line cord to chassis)

MODEL 65T21
MODEL 65T21B

MOTOROLA INC.

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
C-1	20A71140	Capacitor, trimmer: 10-80 muf, with "L" mounting bracket	I-1a			R-15	6R6268	Resistor, fixed: carbon: 39 10K
C-2	20A71141	Capacitor, trimmer: 10-80 muf	I-2	6E110857	Bulb: 6.3V, .25A; tubular bayonet	R-16	6R6036	Resistor, fixed: carbon 270 10K
C-3	1271757	Capacitor, variable: 2 gang; cut	L-1	24C72483	Loop Antenna and Panel (Complete)	R-17	4870087	Resistor, variable: carbon: 1 meg
C-4	20A71051	Oscillator plates: includes pulley	L-2	24A70549	Coil, S.W. oscillator	R-18	6R6015	Resistor, fixed: carbon 220,000
C-5	21R6642	Capacitor, trimmer: 4-20 muf; with "L" mounting bracket (on loop)	L-3	24A70546	Coil, S.W. antenna	S1 & S-2	40A71255	Switch, band: 2 position
C-6	20A71125	Capacitor, trimmer: 10-80; with "L" mounting bracket	R-1	6R6032	Resistor, fixed: carbon: 470,000	T-1	24B70645	Transformer, I.F.: 455 Kc; complete less shield and iron core sleeve (RS-32)
C-7	21R6724	Capacitor, fixed: mica; 1000 muf	R-2	6R6055	Resistor, fixed: carbon: 47,000	T-2	24B70657	Transformer, diode: 455 Kc; complete; less shield and iron core sleeve (RS-34)
C-8	21R6642	Capacitor, fixed: mica; 50 muf 500V	R-3	6R6090	Resistor, fixed: carbon: 470 10K			
C-9	899616	Capacitor, fixed: paper: .05 mf 400V	6R6229		Resistor, fixed: carbon: 1000 10K	24B70653		Transformer, diode: 455 Kc; complete less shield and iron core sleeve (RS-32)
C-10	899616	Capacitor, fixed: paper: .05 mf 400V	R-4	6R2122	Resistor, fixed: carbon: 4.7 meg	24B70633		Transformer, diode: 455 Kc; complete; less shield and iron core sleeve (RS-34)
C-11	899616	Capacitor, fixed: paper: .05 mf 400V	R-5	6R2122	Resistor, fixed: carbon: 4.7 meg	16K71033		Cabinet, table model: blonde mahogany veneer (66721B)
C-12	899616	Capacitor, fixed: paper: .05 mf 400V	R-6	6R3927	Resistor, fixed: carbon: 2.2 meg	4285628		Cl.P., farnesstock: #18; double cloth, grille (65721)
C-13	899616	Capacitor, fixed: paper: .05 mf 400V	R-7	6R6088	Resistor, fixed: carbon: 22,000	35K71099		Cloth, grille (65721B)
C-14	21R6639	Capacitor, fixed: mica; 500 muf	R-8	6R6053	Resistor, fixed: carbon: 1000 1/4W	11H9844		Cord, dial: 18 lb. black
C-15	899613	Capacitor, fixed: paper: .005 mf 600V	R-9	6R2118	N.I.	30A151		Cord, line: 6 ft. long; with plug
C-16	21R6659	Capacitor, fixed: mica; 500 muf	R-10	18A70068	Resistor, variable: carbon: 3.3 meg	1X71048		Core & Clip Assembly (I.F. & diode coil bottom tuning iron core and clip)
C-17	899613	Capacitor, fixed: paper: .005 mf 600V	R-11	6R6004	Resistor, fixed: carbon: 1 meg	1X71047		Core & Palmat Assembly (I.F. & diode coil top tuning iron core and nut)
C-18	899616	Capacitor, fixed: paper: .005 mf 600V	R-12	6R6406	Resistor, fixed: carbon: 22 10K	1X71768		Dial, Bracket & Plate Assembly: includes dial plate, pointer slider rail, 4 cord idler pulleys, 2 pilot light sockets, dial plate mounting bracket, dial background and glass dial scale. Pointer not included.
C-19	899616	Capacitor, fixed: paper: .05 mf 400V	R-13	6R2058	Resistor, fixed: carbon: 39 10K	13970577		Escutcheon, dial
C-20	899613	Capacitor, fixed: paper: .005 mf 600V	R-14	6R6012	Resistor, fixed: carbon: 33,000	5S1611		Eyelet, snap in: .140 x 141; copper oxide (dial background mounting)
C-21	23A27718 or 23A74827	Capacitor, electrolytic: 30-30-20 mf/350-300-25V	R-15	6R6015	Resistor, fixed: carbon: 220,000	5471061		Eyelet, chassis mounting: 1/4 x 1/4 diameter body; 1/2 diameter head (used on each corner of chassis)
		Rivet, shoulder: 1/2 long; nickel plated (mounts 2 idler pulleys to chassis)	287051		Nut, steel: 3/8-32 x 9/16; cadmium mounting	5470098		Eyelet: 25/64 x 7/32 diameter body; 1/2 diameter head (used under chassis retainer screws and gang and speaker mounting)
		Rivet, steel: .122 x 5/32 nickel plated (terminal strip, trimmer, socket & output trans. mounting)	9A12705		Plate, electrolytic capacitor mounting	37K16841		Foot, rubber: 3/4 diameter (cabinet foot)
		Rivet, steel: .122 x 3/16; nickel plated (band switch bracket and electrolytic wafers mounting)	28K19871		Plug, mounting: bakelite	4471133		Washer, spring (used on tuning shaft)
		Rivet, steel: .122 x 1/4; nickel plated (loop receptacle mounting)	52B70519		Plug, 4-prong (loop plug)			
		Rivet, steel: .122 x 9/32; nickel plated (line cord lock mounting)	49A23980		Pulley, cord: 1/4" groove (dial cord idler pulley)			
		Scale, dial: glass	49A21582		Pulley, cord: 1/2" groove (dial cord idler pulley)			
		Screw, steel: #6 x 3/16 PKZ plain hex head; black perkenized finish (B.C. oscillator coil mounting)	9K28049		Receptacle, 4-prong (loop socket)			
		Screw, steel: #8 x 1/4 PKZ plain hex head; cadmium plated (dial tag.)	5A71246		Rivet, shoulder: .187 long; nickel plated (idler pulley shaft)			
			5A12814		Rivet, shoulder: .156 long; nickel plated (idler pulley shaft)			
			31K74933		Strip, terminal: 2 insulated lugs, #3 mounting			
			31A71126		Strip, terminal: 3 insulated lugs, #2 ground			



TUBE AND TRIMMER LOCATIONS

BOTTOM OF CHASSIS

DET. N. 69C77422

AGUJA FONOGRAFICA

El brazo reproductor del fonógrafo está equipado con una aguja de punta de zafiro de duración permanente que tocará varios millares de discos antes que tenga que reemplazarse, a menos de que se dane dejándola caer o por maltrato. Para mejores resultados reemplacela con agujas fonográficas Motorola; ordenando Agujas Fonográficas, Pieza Numero 47X72643.

Para reponer la aguja, es necesario aflojar el pequeño tornillo de ajuste que la mantiene en posición. El tornillo de ajuste es accesible por dentro del pequeño agujero al frente del brazo del reproductor. Utilice un destornillador pequeño para evitar daño al cartucho de cristal o al brazo reproductor.

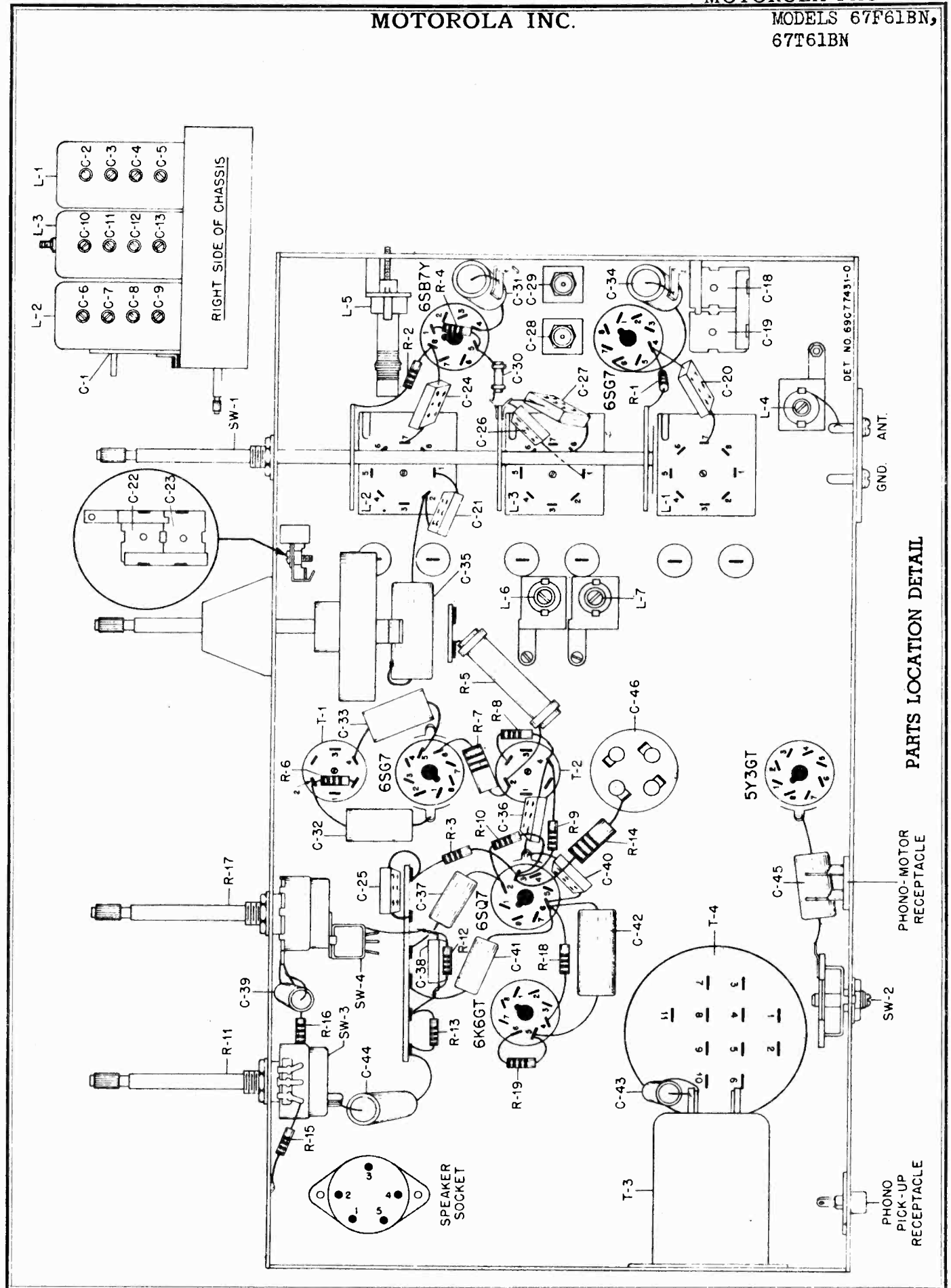
La mesa giratoria del fonógrafo girará a la velocidad correcta solamente si la corriente para el motor fonográfico es de la frecuencia correcta. El motor fonográfico viene de la fábrica con un buje de 60 ciclos instalado en el eje del motor. Si el motor se utiliza con corriente de 50 ciclos, funcionará más despacio y será necesario aumentar el diámetro del buje del eje del motor para compensar la menor velocidad del motor. Se suministra con este receptor un buje adicional de 50 ciclos para reemplazar al buje de 60 ciclos en el eje del motor, cuando se vaya a funcionar el receptor con corriente de 50 ciclos. El buje de 50 ciclos se encontrará dentro de un sobre colocado en el interior del gabinete. Para poder llegar al eje del motor fonográfico, sólo hay que levantar la mesa giratoria. El buje está ajustado al eje del motor con un solo tornillo de ajuste. Una llave No. 6 de cabeza "Allen" se adaptará al tornillo de ajuste.

PHONOGRAPH NEEDLE

The phono pick-up arm is equipped with a long-life permanent point sapphire tipped needle that will play several thousand records before requiring replacement, unless damaged by dropping or other mishandling. For best results replace with Motorola phonograph needles; order Phonograph Needle Part Number 47X72643.

To replace phonograph needle, it is necessary to loosen the small set screw that holds the needle in place. The set screw is accessible through a small hole in the front of the pick-up arm. Use a small screw driver to avoid damaging the crystal cartridge or pick-up arm.

The phono-turntable will turn at the correct speed only if the power supply to the phonomotor is of the correct frequency. The phono-motor comes from the factory with a 60 cycle bushing installed on the phono motor shaft. If the phono-motor is used on a 50 cycle power supply it will run slower and it will be necessary to increase the diameter of the phono-motor shaft bushing to compensate for the slower motor speed. A separate 50 cycle bushing is supplied with this receiver and it replaces the 60 cycle bushing on the phono-motor shaft when receiver is to be operated from 50 cycle power lines. The 50 cycle bushing will be found in an envelope, attached to the inside of the cabinet. To expose phono-motor shaft, just lift up turntable. The bushing is secured to the motor shaft with a single set screw. A #6 Allen head driver wrench will fit the setscrew.



PARTS LOCATION DETAIL

MODEL 67T61BN, 67T61BN

CLAVIJA PARA REPRODUCTOR DE FONOGRAFO Y TOMACORRIENTE PARA MOTOR FONOGRAFICO

Pueden tocarse discos por medio del amplificador de este radio, conectando un tocadiscos a la clavija para reproductor de fonógrafo (E) situada en el respaldo del receptor. Energía para el motor, fonográfico, es también obtenible del receptáculo (F) al respaldo del receptor. Véase la Figura 2 para localizar la clavija (E) y el receptáculo (F). El voltaje en el receptáculo fonomotor es siempre de 115 voltios sin tener en cuenta el voltaje de la línea a que está conectado el receptor; la frecuencia de la corriente en el receptáculo fonomotor será la misma que la frecuencia de la corriente de entrada al receptor. Como la velocidad del motor del fonógrafo es determinada por la frecuencia del voltaje de la línea, asegúrese de que el tocadiscos que utilice se haya diseñado para funcionar correctamente en la frecuencia que proporciona su compañía eléctrica.

PHONO PICK-UP JACK & PHONO MOTOR SOCKET

By connecting a record player to the phono-pick-up jack (E) located on the back of the receiver, you can play records through the amplifier of this radio. Power for the phono-motor is also available at the phono-motor socket (F) on the back of the set. See Figure 2 for location of jack (E) and socket (F). The voltage at the phono-motor socket is always 115 volts, regardless of the input voltage to the set; the frequency of the phono motor supply will be the same as the input power frequency. Since phono-motor speed is determined by the line voltage frequency, make sure the record player you use is designed to run correctly at the frequency your power company supplies.

MODEL 67F61BN, 67T61BN, 87T61BN

CONEXION A TIERRA GROUND

Una buena tierra, conectada al terminal 'G', en el respaldo del receptor, ayudará a reducir ruidos y mejorará la recepción. Se puede hacer una tierra satisfactoria haciendo conexión a un radiador o tubería de agua. En caso de no haber radiador o tubería de agua, se puede utilizar una varilla o tubo metálico de 5 pies de largo clavándolo en tierra húmeda.

A good ground, connected to the terminal 'G' on the back of the set will aid in reducing noise and improve reception. A satisfactory ground can be made by connecting to a radiator or water pipe. In the absence of a radiator or water pipe, a 5 foot metal stake or pipe driven into moist earth may be used.

CORRIENTE ELECTRICA

Antes de conectar el enchufe del cordón al tomacorriente, asegúrese de que el regulador de voltaje de línea (D) del receptor, esté ajustado para corresponder con la línea de voltaje en la cual el receptor ha de funcionar. Véase la figura 2 para localizar el regulador del voltaje de línea. Consulte la compañía eléctrica local, si tiene dudas sobre el voltaje y frecuencia de su corriente.

POWER SUPPLY

Make sure that the receiver line voltage control "D" is adjusted to correspond with the line voltage on which set will be operated before connecting line cord to a power receptacle. Refer to Figure 2 for location of line voltage control. Consult your local power company if you have any doubt as to the voltage and frequency in your locality.

MODEL 67F61BN, 67T61BN, 87T61BN

ANTENA

Con este receptor debe usarse una buena antena, especialmente para la recepción de onda corta. Consulte al distribuidor de radio más próximo sobre el tipo de antena que mejor se adapte a su localidad. En la mayoría de los casos un sólo alambre de unos 60 pies de largo debe dar buenos resultados. Conecte la antena al terminal marcado 'A' en el respaldo del receptor. En el punto en que la antena entra a la casa, debe instalarse un pararrayos aprobado.

ANTENNA

A good outdoor antenna should be used with this receiver, especially for short wave reception. Consult the radio dealer who serves your territory on the type of antenna best suited for your location. In most cases a single wire about 60 ft. long should give good results. Connect the antenna to the terminal marked 'A' on the back of the set. An approved lightning arrester should be installed at the point where the antenna enters the house.

Este receptor puede ajustarse para funcionar con corriente alterna (CA) de 115, 130 o de 230 voltios, de 50 ó de 60 ciclos. Al salir de la fábrica, este receptor está ajustado para trabajar con 230 voltios. Caso de que el voltaje promedio de que se disponga sea de 115 ó 130 voltios (el que más se aproxime), sencillamente gire el regulador del voltaje de línea (D), colocándolo en el voltaje a que vaya a trabajar el receptor.

PRECAUCION: Cuidese de no encharfar el cordón a un tomacorriente de 230 voltios si el regulador de voltaje está ajustado para 115 ó 130 voltios, ya que resultaría en daños para el receptor y para el fonógrafo. El cordón nunca debe ser enchufado a un receptáculo de corriente continua (CC).

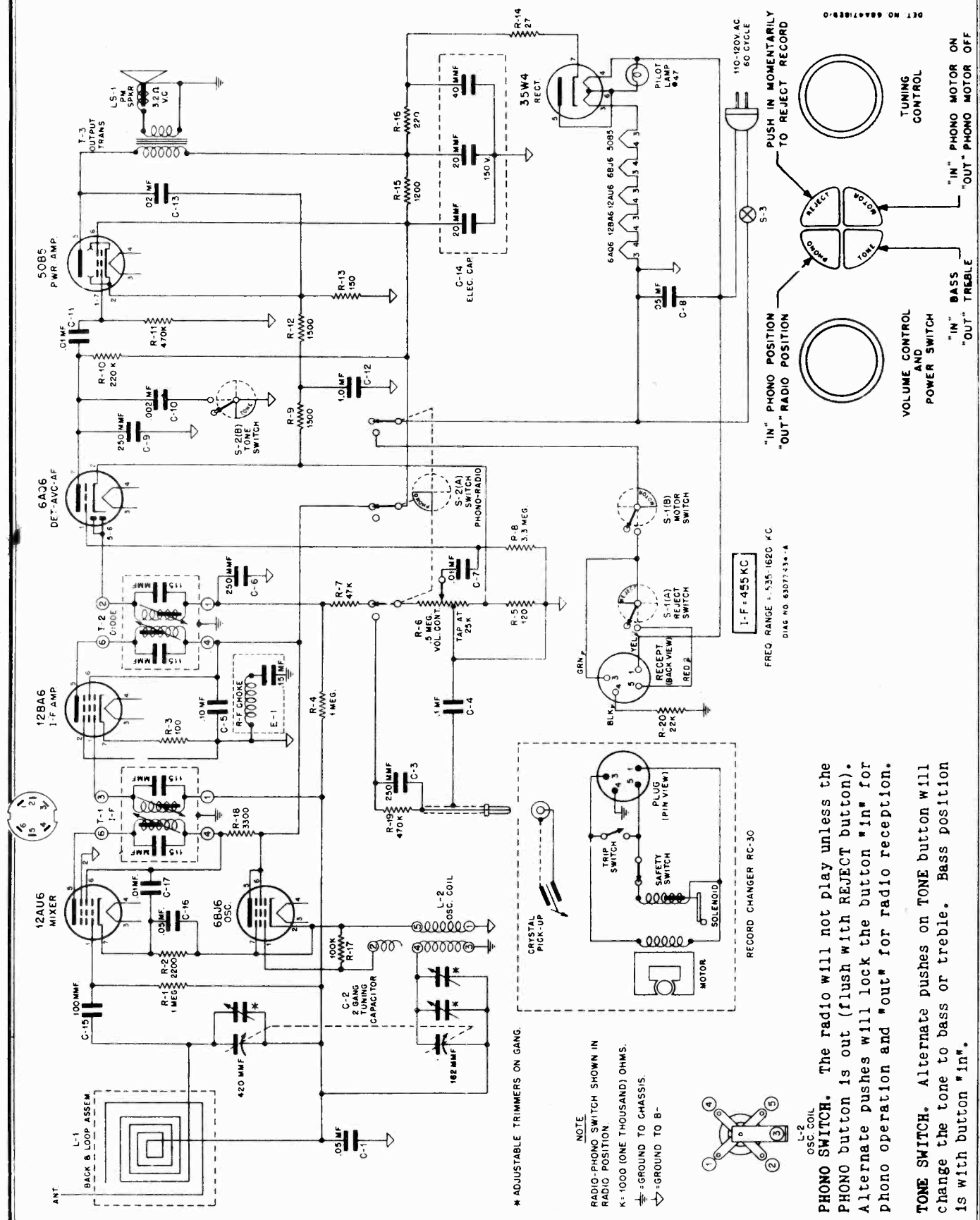
This receiver can be adjusted to operate on 115, 130 or 230 volts alternating current (A.C.) 50 or 60 cycles. When the receiver leaves the factory it is adjusted to operate from 230 volts. In the event your average line voltage is 115 or 130 volts (whichever is closer), simply turn the line voltage control (D) to the voltage on which receiver will be used.

CAUTION: Be careful not to plug the line cord into a 230 volt receptacle with the voltage control set for 115 or 130 volts as damage to the receiver and phonograph will result. The line cord must never be plugged into a direct current (D.C.) receptacle.

MOTOROLA INC.

MODELS 67F61BN,
67T61BN

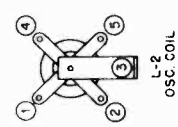
REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
C-1	18C76476	Capacitor, variable; 3 gang; each gang section consists of 5 plate (7-80 muf.) and 21 plate (7-10P muf.) sections	R-1	6R6004	Resistor, fixed; carbon; 1 megohm 1/2W	7A76622	Bracket, tuning shaft	
C-2	20A76734	Capacitor, trimmer; mica; 4-70 muf.; (20K76691) on same bracket as C-3, C-4 & C-5; not replaceable separately	R-2	6R6004	Resistor, fixed; carbon; 1 megohm 1/2W	16C76982	Cabinet, table model	
C-3	20A76734	Capacitor, trimmer; mica; 20-250 muf.; (20K76691) on same bracket as C-2, C-3 & C-4; not replaceable separately	R-3	6R6015	Resistor, fixed; carbon; 220,000 ohms 1/2W	30K21859	Cord, line; 9 ft. long; with plug (chassis mounting)	
C-4	20A76734	Capacitor, trimmer; mica; 7-130 muf.; (20K76670) on same bracket as C-2, C-3 & C-5; not replaceable separately	R-4	6R6058	Resistor, fixed; carbon; 47,000 ohms 1/2W	5A71092	Grommet, rubber; 5/8 x 3/4 dia. (chassis mounting)	
C-5	20A76734	Capacitor, trimmer; mica; 20-250 muf.; (20K76671) on same bracket as C-2, C-3 & C-4; not replaceable separately	R-5	6R6306	Resistor, fixed; carbon; 15,000 ohms 10K 3W N.I.	5A71130	Grommet, rubber; 1/4 x 1/2 dia. body; 3/4 dia. head (chassis retainer)	
C-6	20A76734	Capacitor, trimmer; mica; 4-70 muf.; (20K76691) on same bracket as C-7, C-8 & C-9; not replaceable separately	R-6	6R6390	Resistor, fixed; carbon; 220,000 ohms 1/2W	5A76659	Grommet; rubber (dial scale cushion)	
C-7	20A76734	Capacitor, trimmer; mica; 20-250 muf.; (20K76671) on same bracket as C-6, C-7 & C-9; not replaceable separately	R-7	6R6736	Resistor, fixed; carbon; 47,000 ohms 10K 2W	5A76960	Grommet, rubber (gang cushions)	
C-8	20A76734	Capacitor, trimmer; mica; 7-130 muf.; (20K76670) on same bracket as C-6, C-7 & C-9; not replaceable separately	R-8	6R6367	Resistor, fixed; carbon; 2.2 megohms 1/2W	5K76676	Pointer, dial	
C-9	20A76734	Capacitor, trimmer; mica; 20-250 muf.; (20K76671) on same bracket as C-6, C-7 & C-8; not replaceable separately	R-9	6R6004	Resistor, fixed; carbon; 1 megohm 1/2W	36R76794	Knob, control; branded (band switch)	
C-10	20K7490	Capacitor, trimmer; ceramic; 7-45 muf	R-10	6R2122	Resistor, fixed; carbon; 4.7 megohms 1/2W	36R76795	Knob, control; plain	
C-11	20K7490	Capacitor, trimmer; ceramic; 7-45 muf	R-11	18K76685	Resistor, variable; 1 megohm; tapped at 300,000 ohms; includes on-off switch SW-3	9A22162	Receptacle, plug; 1 prong	
C-12	20K7490	Capacitor, trimmer; ceramic; 7-45 muf	R-12	6R6032	Resistor, fixed; carbon; 470,000 ohms 1/2W	9A27674	Receptacle, plug; 3 prong	
C-13	20K7490	Capacitor, trimmer; ceramic; 7-45 muf	R-13	6R6032	Resistor, fixed; carbon; 470,000 ohms 1/2W	3A76706	Scale, dial	
C-14	21A76687	Capacitor, fixed; ceramic; 24 muf 500V	R-14	6R6396	Resistor, fixed; carbon; 500 ohms 10K 2W	47A76624	Shaft, tuning	
C-15	21A76688	Capacitor, fixed; ceramic; 85 muf 500V	R-15	6R6408	Resistor, fixed; carbon; 22 ohms 10K 1/2W	1A71048	Shield & Iron Core Sleeve Assembly (for I.F. or diode transformer)	
C-16	21A76688	Capacitor, fixed; ceramic; 85 muf 500V	R-16	6R6012	Resistor, fixed; carbon; 33,000 ohms 1/2W	9A70166	Socket, tube; actual; plain	
C-17	21A76890	Capacitor, fixed; ceramic; 130 muf 500V	R-17	18K76686	Resistor, variable; 1 megohm; includes phono-radio switch SW-4	9A76729	Socket, tube; 5 prong; saddle type	
C-18	20A76613	Capacitor, trimmer; mica; 2-20 muf; on same bracket as C-19; not replaceable separately	R-18	6R6015	Resistor, fixed; carbon; 220,000 ohms 1/2W	2A76635	Speednut, trimmer lock-in (C-28 & C-29 mounting)	
C-19	20A76613	Capacitor, trimmer; mica; 4-45 muf; on same bracket as C-18; not replaceable separately	R-19	6R6015	Resistor, fixed; carbon; 220,000 ohms 1/2W	3A17651	Strip, antenna & ground	
C-20	21R6687	Capacitor, fixed; mica; 200 muf 10K 500V	R-20	40B76483	Switch, band; 6 position	4A23164	Washer, .05" (tuning shaft retainer)	
C-21	21R6684	Capacitor, fixed; mica; 400 muf 10K 500V	R-21	40A76637	Switch, line voltage; single pole, 3 position	5A71130	Grommet, rubber; 1/4 x 1/2 dia. body; 3/4 dia. head (chassis retainer)	
C-22	20A76614	Capacitor, trimmer; mica; 2-20 muf; on same bracket as C-23; not replaceable separately	R-22	24B76696	Transformer, I.F.; 455 Kc; complete with iron cores and padding capacitors, but less shield	5A76629	Grommet; rubber (dial scale cushion)	
C-23	20A76614	Capacitor, trimmer; mica; 4-45 muf; on same bracket as C-22; not replaceable separately	R-23	25B76474	Transformer, output	5A76690	Grommet, rubber (gang cushions)	
C-24	21R6687	Capacitor, fixed; mica; 200 muf 10K 500V	R-24	26C76468	Transformer, power	5K76686	Ring	
C-25	21R6684	Capacitor, fixed; mica; 400 muf 10K 500V	R-25	59C77045	Arm, pick-up; complete	14A76688	Insulator, electrolytic capacitor	
C-26	21R2731	Capacitor, fixed; mica; 855 muf 1K 500V	R-26	59K77259	Knob, control; plain	26K77290	Knob, control; branded (band switch)	



DET NO 68A+78E2.0

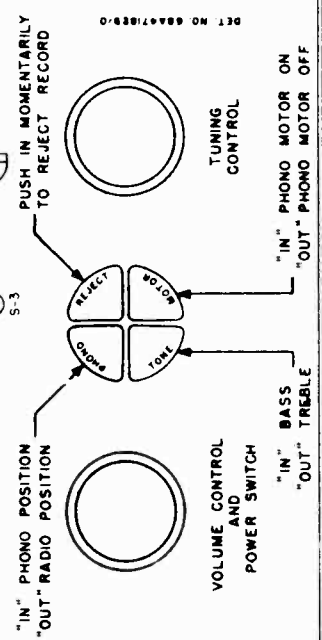
1-F 455 KC
FREQ RANGE 1.535-1620 KC
DIAG NO 63077-51-A

* ADJUSTABLE TRIMMERS ON GANG.
NOTE
RADIO-PHONO SWITCH SHOWN IN RADIO POSITION.
K = 1000 (ONE THOUSAND) OHMS.
⊥ = GROUND TO CHASSIS.



PHONO SWITCH. The radio will not play unless the PHONO button is out (flush with REJECT button). Alternate pushes will lock the button "in" for phono operation and "out" for radio reception.

TONE SWITCH. Alternate pushes on TONE button will change the tone to bass or treble. Bass position is with button "in".



MOTOROLA INC.

MODELS 67F11,
67F12, 67F12B

ALIGNMENT

Maximum performance can only be obtained if extreme care is exercised during alignment. Follow the procedure carefully.

A low range output meter should be connected across the speaker voice coil. Set receiver volume control to maximum. For greatest accuracy, keep output of receiver at approximately .05 watt (.05 watt = .40 volt on output meter) throughout alignment by reducing signal generator output (not receiver volume control) as stages are brought into alignment.

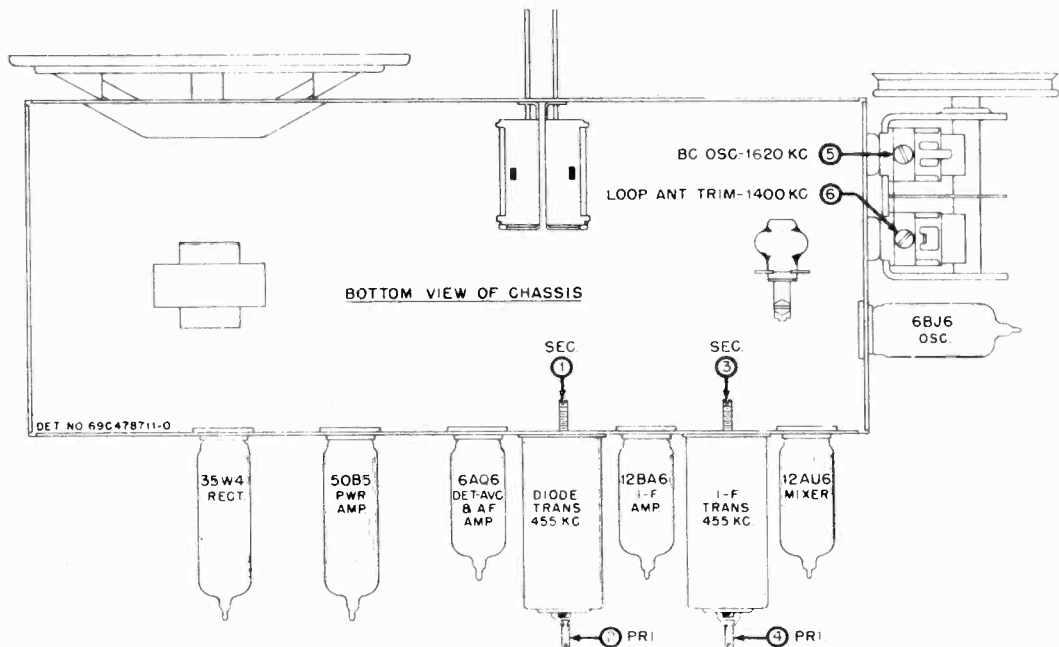
It is suggested that an isolating transformer be used between receiver and power line during alignment.

ALIGNMENT CHART

Refer to Figure 3 for location of all alignment trimmers and cores.

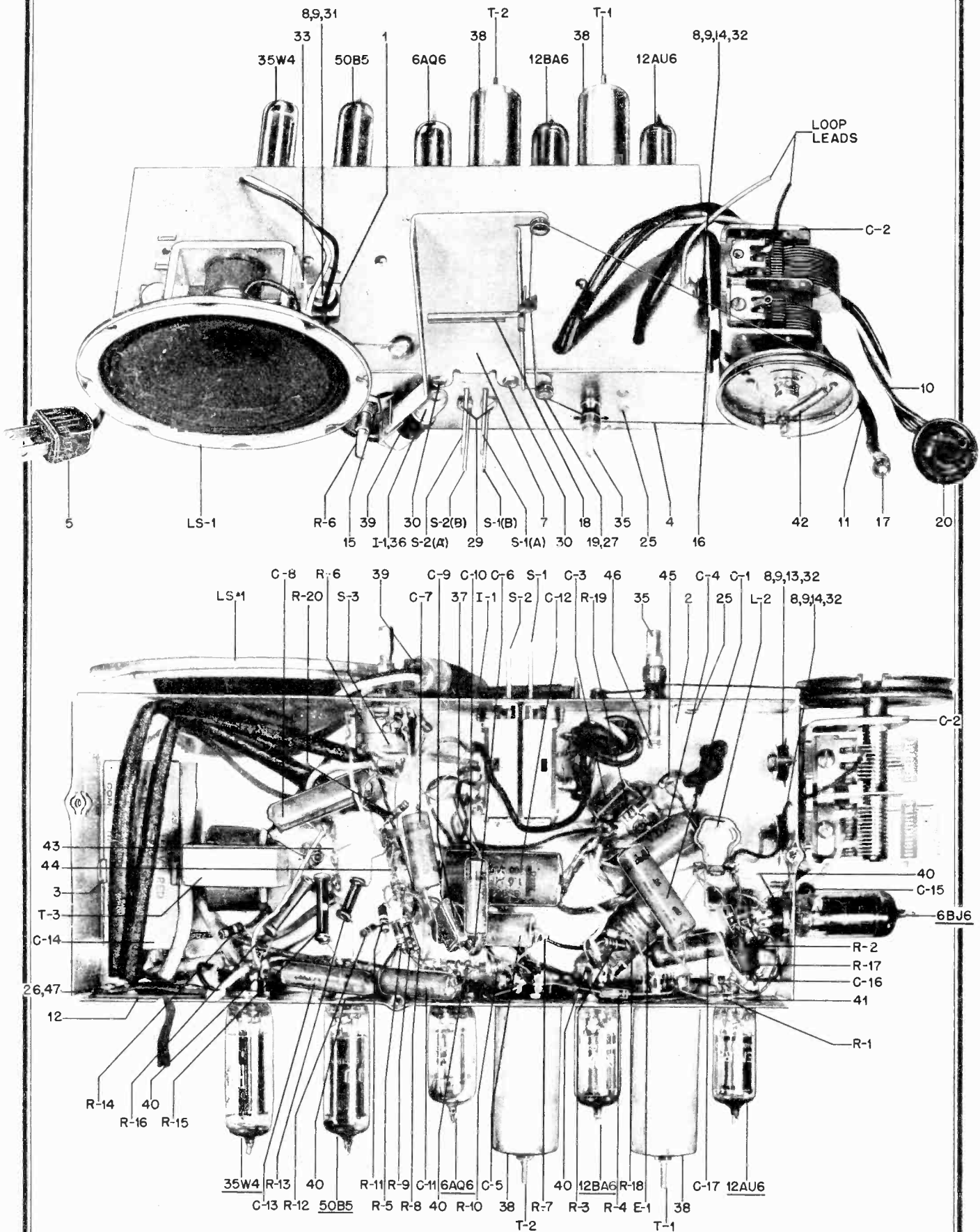
STEP	DIAL SET TO	DUMMY	SIGNAL GENERATOR CONNECTED TO	SIGNAL GENERATOR SET TO	ADJUST TRIMMER OR CORE	REMARKS
IF ALIGNMENT						
1.	Gang fully opened	.1 mf	Mixer Grid (pin #1) & B-	455 Kc	1,2,3 & 4	Adjust for maximum
RF ALIGNMENT						
2.	Gang fully opened	.1 mf	Mixer Grid (pin #1) & B-	1620 Kc	5	This sets oscillator to dial scale. (Check pointer calibration by referring to Figure 4).
3.	1400 Kc	None	Radiation Loop *	1400 Kc	6	Tune signal in on receiver, then adjust trimmer (6) for maximum. After set is assembled in cabinet, repeak this trimmer.

* Connect output of signal generator to a 5" diameter, 3 turn loop and bring loop close enough to receiver loop to obtain output of 50 milliwatts (.40V) on output meter. Vary distance between loops to maintain this output during alignment. Minimum distance between loops should never be less than 12".



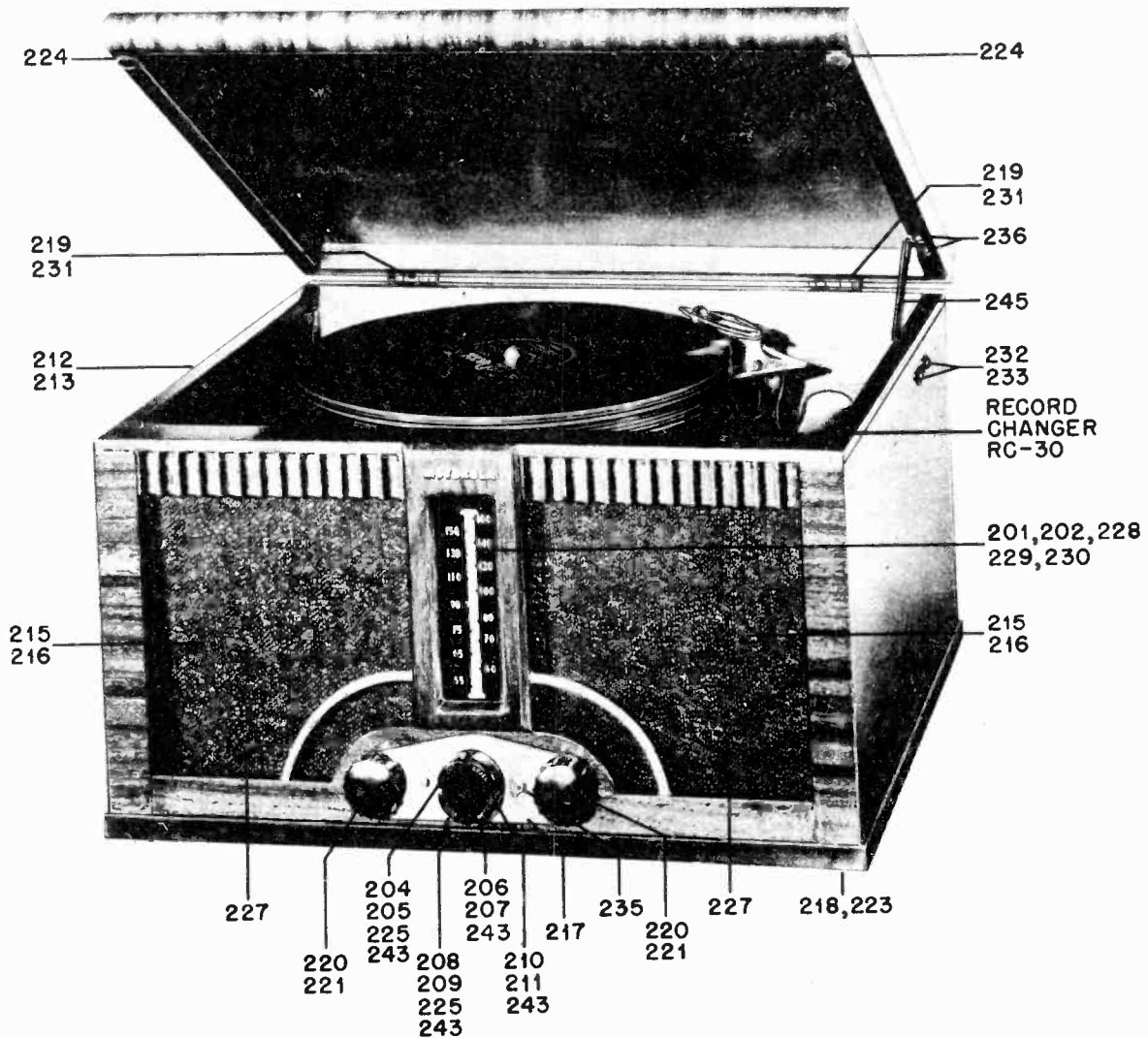
MODELS 67F11,
67F12, 67F12B

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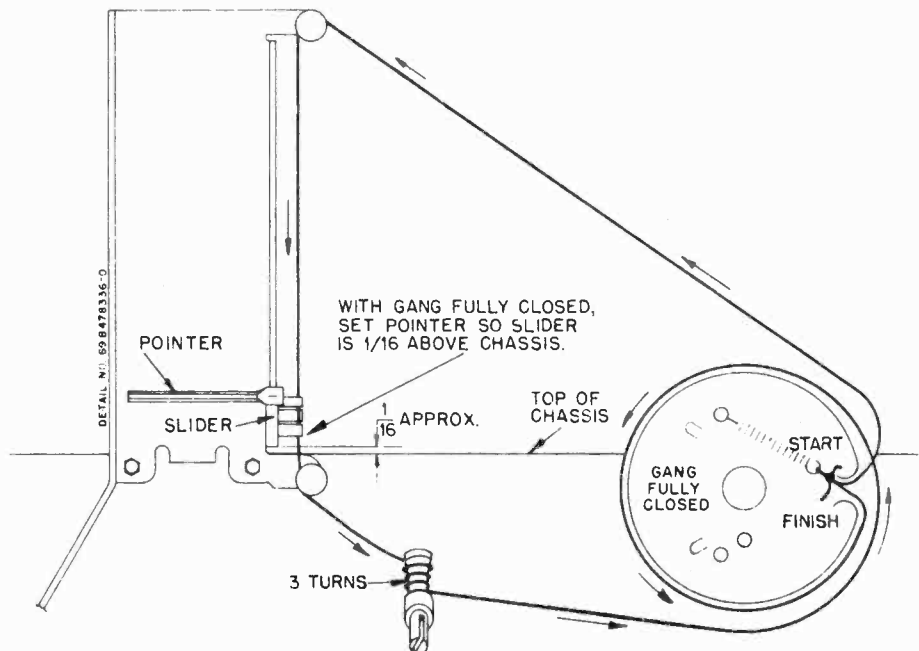


MODELS 67F11,
67F12, 67F12B

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PARTS LOCATION -CABINET- MODELS 67F12 & 12B



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MODELS 67F11,
67F12, 67F12B

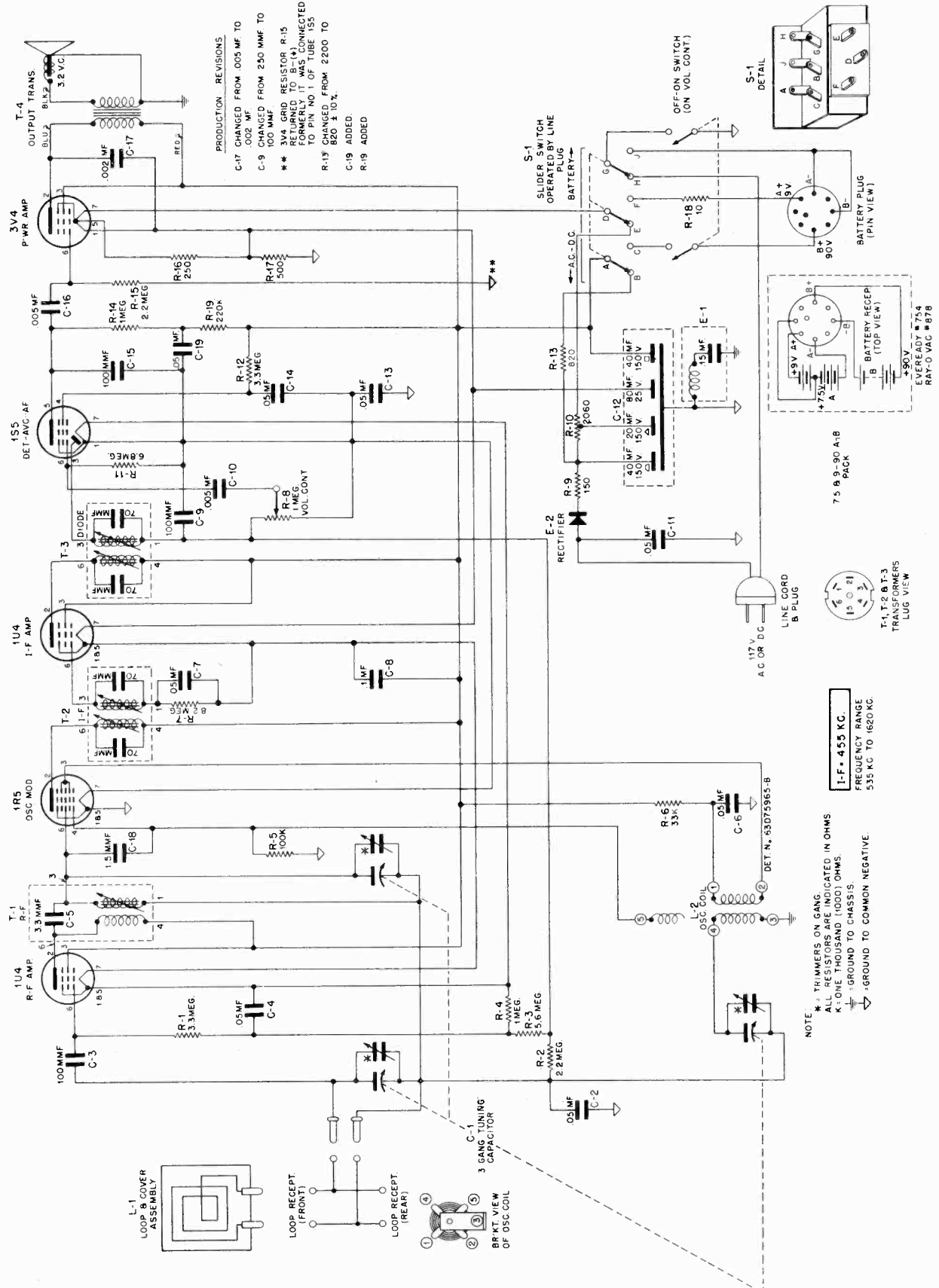
REF. NO.	PART NO.	DESCRIPTION	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
110	36K470205	Button, push: REJECT; walnut plastic; with insert spring	201	37K70069 Band, rubber: 1" (on dial scale)	233	3S476039	Screw: 6-32 x 3/8 Phillips; binderhead machine screw; brass (mounts lid support to cabinet (67F12B))
111	1X470201	Cabinet assembly: walnut plastic; complete with all hardware, dial scale, escutcheon and grille	202	7A470042 Bracket, dial scale retainer	234	3S1348	Screw: #6 x 3/8 Phillips round head wood screw; antique copper finish (perforated plate mounting)
112	16S77697	Cabinet: walnut plastic; less all hardware, dial scale, escutcheon, grille and lid	203	36K470680 Button, plug: 1/4", green (for concealing shipping screw holes in record changer base)	235	3S1341	Screw: #6 x 3/8 Phillips oven head wood screw; brass (escutcheon mtg)
113	42A471546	Clip "C" (loop lead retainer)	204	36K470202 Button, push: PHONO; walnut plastic; with insert spring (67F12)	236	3S7436	Screw: #6 x 1/2 slotted round head wood screw; antique copper finish (mounts lid support to lid)
114	13K471556	Cloth, grille (left side)	205	36K471644 Button, push: PHONO; mottled tan plastic; with insert spring (67F12B)	237	3S3387	Screw: #6 x 1/2 PKA slotted hex head; staturary bronze finish (loop panel mtg)
115	13K471555	Cloth, grille (right side)	206	36K470203 Button, push: MOTOR; walnut plastic; with insert spring (67F12)	238	4S476007	Screw: 8-32 x 7/8 slotted hex head machine screw; cadmium plated (chassis and tube heat shield mtg)
116	37A12748	Foot, cabinet: rubber; includes steel washer	207	36K471645 Button, push: MOTOR; mottled tan plastic; with insert spring (67F12B)	239	3S7396	Screw: 10-32 x 2 slotted hex head machine screw; copper plated (record changer mounting)
117	13C470516	Grille, cabinet: metal (left side)	208	36K470204 Button, push: TONE; walnut plastic; with insert spring (67F12)	240	26C470067	Shield, tube heat
118	13K470517	Grille, cabinet: metal (right side)	209	36K471646 Button, push: TONE; mottled tan plastic; with insert spring (67F12B)	241	41A28190	Spring, cushion: top (record changer mounting)
119	55A470193	Hinge, lid: staturary bronze finish	210	36K470205 Button, push: REJECT; walnut plastic; with insert spring (67F12)	242	41A21807	Spring, cushion: bottom (record changer mounting)
120	36K77681	Knob, control: walnut plastic	211	36K471647 Cabinet, table model: wood, walnut finish (67F12)	243	41A12983	Spring, push button insert
121	16S77698	Lid, cabinet: walnut plastic	212	16A470647 Cabinet, table model: wood, blonde finish (67F12B)	244	22S7904	Staple, insulated: 1/4" (loop lead anchor)
122	29A470186	Lug, soldering: bent (on loop panel)	213	16K471651 Clamp, cable	245	5S470636	Support, lid: staturary bronze finish
123	34B470208	Scale, dial: glass	214	42A470832 Cloth, grille: 7 x 6-1/2 (67F12)	246	2A470641	Teenut, pronged: 8-32; slabbled type
124	3S2982	Screw: 4-40 x 5/16 slotted flat head machine screw cadmium plated (dial scale mounting)	215	13K470648 Cloth, grille: 7 x 6-1/2 (67F12)	247	4A470645	Washer, paper spacer (loop panel spacer)
125	3S2994	Screw: 6-32 x 3/16 slotted binderhead machine screw; staturary bronze finish (hinge mtg)	216	13K471652 Escutcheon, knob and push button: brushed brass finish	248	4S7582	Washer: 7/16 x .187 x .033 thick; cadmium plated (chassis mtg)
126	3S476039	Screw: 6-32 x 3/8 Phillips binderhead machine screw; brass (escutcheon mtg)	217	13K470513 Escutcheon, knob and push button: brushed brass finish	249	4S7611	Washer: 1/2 x 7/32 x .048 thick; antique copper finish (record changer mtg)
127	3S2983	Screw: 6-32 x 3/8 Phillips binderhead machine screw; black nickel plated (baffle board mtg and lid support mtg)	218	37K15941 Foot, cabinet: rubber			
128	3S3365	Screw: #6 x 3/8 PKZ plain hex head sheet metal screw; staturary bronze finish (loop panel mtg)	219	5S470658 Hinge, lid: staturary bronze finish			
129	3A470188	Screw, special: 6-32 internal thread; staturary bronze finish (hinge mtg)	220	36K470646 Knob, control: walnut plastic (67F12)			
130	3S2986	Screw: 6-32 x 7/16 slotted hex head machine screw; cadmium plated (chassis, tube heat shield & cabinet foot mtg)	221	36K471643 Knob, control: mottled tan plastic (67F12B)			
131	3S7396	Screw: 10-32 x 2" slotted hex head machine screw; copper plated (record changer mtg)	222	29A470186 Lug, soldering: bent (on loop panel)			
132	26C470067	Shield, tube heat (Note: Some receivers had tube retainer springs on this shield; these are no longer used or required)	223	22S7963 Pad, felt: 1/2 x 5/8 (cabinet foot mtg)			
133	41A21807	Spring, cushion: bottom (record changer mtg)	224	35K470957 Pad, felt: 1/2 x 1/16 thick (lid cushion)			
134	41A28190	Spring, cushion: top (record changer mtg)	225	35K76759 PHONO & TONE button on (67F12B) to prevent light from showing through			
135	41A12983	Spring, push button insert	226	6A476362 Plate, perforated; painted			
136	55B470509	Support, lid: staturary bronze finish	227	47A470640 Rod, ornamental: brass			
137	4S7582	Washer: 7/16 x .187 x .033 thick; cadmium plated (chassis mtg)	228	34B470208 Scale, dial: glass (67F12)			
138	4S7611	Washer: 1/2 x 7/32 x .048 thick; antique copper finish (record changer mtg)	229	34K471642 Scale, dial: glass (67F12B)			
			230	3S7431 Screw: #2 x 1/4 Phillips round head wood screw; antique copper finish (dial scale mtg)			
			231	3S1336 Screw: #4 x 1/2 slotted flat head wood screw; staturary bronze finish (hinge mounting)			
			232	3S2983 Screw: 6-32 x 3/8 Phillips oval head machine screw; copper oxide finish (mounts lid support to cabinet (67F12))			

CABINET PARTS - MODELS 67F12 & 67F12B

MODELS 67F11,
67F12, 67F12B

MOTOROLA INC.

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
CHASSIS PARTS - HS-63								
CAPACITORS								
C-1	859816	Paper: .05 mf 400V	R-18	6R6036	3,300	28	332683	Screw: #6 x 3/16 PKZ plain hex head sheet metal screw; cadmium plated (oscillator coil mtg)
C-2	1X470181	Variable, 2 gang; includes pulley	R-19	6R6032	470,000	29	357247	Screw: #32 x 3/16 slotted hex head locking type machine screw; cadmium plated (switch mtg)
C-3	21R6648	Mica: 250 mf 500V	S-1	40A470510	Dual Push Switch: reject and motor	30	357506	Screw: #6 x 1/4 PKZ plain hex head sheet metal screw; cadmium plated (tuning gang plate mtg and dial bracket assembly mounting)
C-4	859807	Paper: .1 mf 400V	S-2	40A470511	Dual Push Switch: phono and tone	31	333360	Screw: #6 x 1/2 PKZ plain hex head sheet metal screw; cadmium plated (speaker mounting)
C-5	859806	Paper: .1 mf 200V	S-3		Power switch: part of volume control	32	357339	Screw: #32 x 5/8 slotted hex head machine screw; cadmium plated (tuning gang mounting)
C-6	21R6648	Mica: 250 mf 500V	TRANSFORMERS					
C-7	859809	Paper: .01 mf 400V	T-1	24B470038	IF, 455 Kc: includes padding capacitors and tuning cores but less shield	33	357205	Screw: #32 x 1/4 slotted hex head locking type machine screw; cadmium plated (speaker bracket mtg)
C-8	859816	Paper: .05 mf 400V	T-2	24B76487	Diode, 455 Kc: includes padding capacitors and tuning cores but less shield	34	358153	Screw: #8 x 3/8 PKA plain hex head sheet metal screw; cadmium plated (mounts chassis bottom cover to chassis)
C-9	21R6648	Mica: 250 mf 500V	T-3	25B76117	Output	35	1X470172	Shaft and Pulley Assembly, tuning
C-10	859824	Paper: .002 mf 400V	MISCELLANEOUS CHASSIS PARTS					
C-11	859809	Paper: .01 mf 400V	1	7K470005	Bracket, speaker mtg	36	26A470013	Shield, dial light
C-12	859809	Paper: 1.0 mf 100V	2	7A77337	Bracket, tuning shaft mtg	37	30K14144	Shield, spiral: 3-1/4" long
C-13	859802	Paper: .02 mf 400V	3	4ZK76826	Clip, electrolytic mtg	38	1A71049	Shield and Sleeve Assembly (for IF and Diode transformer)
C-14	23F76908	Electrolytic: 40-20-20/150V	4	11H8944	Cord, dial: 16' black	39	9A470015	Socket, pilot light and leads: with mounting clip
C-15	21R6641	Mica: 100 mf 500V	5	30K21859	Cord, line: 9 ft long; with plug	40	9A470506	Socket, tube: miniature; 7 prong; molded
C-16	859821	Paper: .05 mf 200V	6	1X470184	Cover, chassis bottom: includes grounding wiper	41	9A6776	Socket, tube: miniature; 7 prong; water
C-17	859809	Paper: .01 mf 400V	7	1X470183	Dial Bracket and Pulley Assembly	42	41A14244	Spring, tension coil
CHOKE								
E-1	1A77283	Capacitor and Choke Assembly (includes .15 mf 200V paper capacitor and coil)	8	5A70098	Eyellet, spacer (tuning gang and speaker mounting)	43	31K90044	Strip, terminal: 2 insulated lugs #2 ground
DIAL LIGHT								
L-1	65X11854	Bulb: 6.3V .15A; tubular; bayonet base; clear; #47	9	5A70404	Grommet, rubber (tuning gang and speaker mounting)	44	31A27184	Strip, terminal: 3 insulated lugs #3 mtg
COILS								
L-1	24C470214	Loop & Panel Assembly	10	1X470177	Lead assembly, phono motor & control: four conductors, includes four prong receptacle	45	31A470012	Strip, terminal: 4 insulated lugs #5 ground
L-2	24A74616	Oscillator	11	1X470178	Lead Assembly, phono pick-up: single conductor; includes single pin plug	46	4A70015	Washer "C" (tuning shaft retainer)
SPEAKER								
LS-1	50B470034	PM: 5"; 3.2 ohm VC	12	32A24815	Lock, line cord: fibre	47	431719	Washer: 3/8 x .140 x .030; steel, cadmium plated (line cord lock mtg)
RESISTORS								
Note: All resistors are insulated carbon type 20% 1/2 watt unless otherwise specified.								
R-1	6R6004	1 meg	14	29E5227	Lug, soldering: 6L hot-dipped	48	39K470032	Wiper, grounding: two section (used on chassis bottom cover)
R-2	6R6146	220	15	2S7051	Nut: 3/8-32 x 9/16; Palmut; cadmium plated (volume control mtg)	CABINET PARTS - MODEL 67F11		
R-3	6R6018	100	16	6A4470009	Plate, tuning gang mtg	101	1X470286	Baffle Board and Nut Assembly: left side; with speaker hole
R-4	6R6004	1 meg	17	26K71775	Plug, single pin (on phono pick-up lead)	102	1X470287	Baffle Board and Nut Assembly: right side
R-5	6R5551	120 10%	18	52A470003	Pointer, dial	103	37K470186	Band, rubber: 4" (used on dial scale)
R-6	18K470033	Volume Control: .5 Meg, tapped at 25,000 ohms; includes power switch	19	49A12946	Pulley, cord guide	104	7A470196	Bracket, dial scale retainer
R-7	6R6056	47,000	20	9K470402	Receptacle, 4 prong	105	35A470192	Bumper, rubber (lid cushion)
R-8	6R2118	3.2 meg	21	558497	Rivet: .088 x 1/8; steel, nickel plated (molded tube socket mtg)	106	38K470830	Button, plug: 1/4"; green (for concealing shipping screw holes in record changer base)
R-9	6R6036	1500 10%	22	55E815	Rivet: .088 x 7/32; steel, nickel plated (wafer tube socket mtg)	107	36B470202	Button, push: PHONO; walnut plastic; with insert spring
R-10	6R6015	220,000	23	557706	Rivet: .122 x 1/8; nickel plated (grounding wiper mtg)	108	36K470203	Button, push: MOTOR; walnut plastic; with insert spring
R-11	6R6032	470,000	24	557707	Rivet: .122 x 5/32; steel, nickel plated (terminal strip mtg)	109	36K470204	Button, push: TONE; walnut plastic; with insert spring
R-12	6R6038	1500 10%	25	557701	Rivet: .122 x 3/16; steel, nickel plated (tuning shaft bracket mtg)			
R-13	6R639K	150 10% not insulated	26	557708	Rivet: .122 x 9/32; steel, nickel plated (line cord lock mtg)			
R-14	6R6663	27 10%	27	5A71246	Rivet, shoulder (cord pulley mtg)			
R-15	6R6372	1200 10% 1W not insulated						
R-16	6R6060	220 10% 1W not insulated						
R-17	6R6075	100,000						



ALIGNMENT

Maximum performance can only be obtained if extreme care is exercised during alignment. Follow the procedure carefully.

A low range output meter should be connected across the speaker voice coil. Set receiver volume control to maximum; for greatest accuracy keep output of receiver at approximately .05 watt throughout alignment by reducing generator output (not receiver volume control) as stages are brought into alignment. (.05 watt = .40 volt on output meter.) The alignment tool should be of an insulated type such as Motorola part number 66A71008.

If receiver is operated from AC line during alignment, it is suggested that an isolating transformer be used between receiver and power line. If no isolation transformer is used and hum is encountered during alignment, connect the ground side of the signal generator to B- instead of the receiver chassis.

Refer to Figure 1 for location of all adjustments.

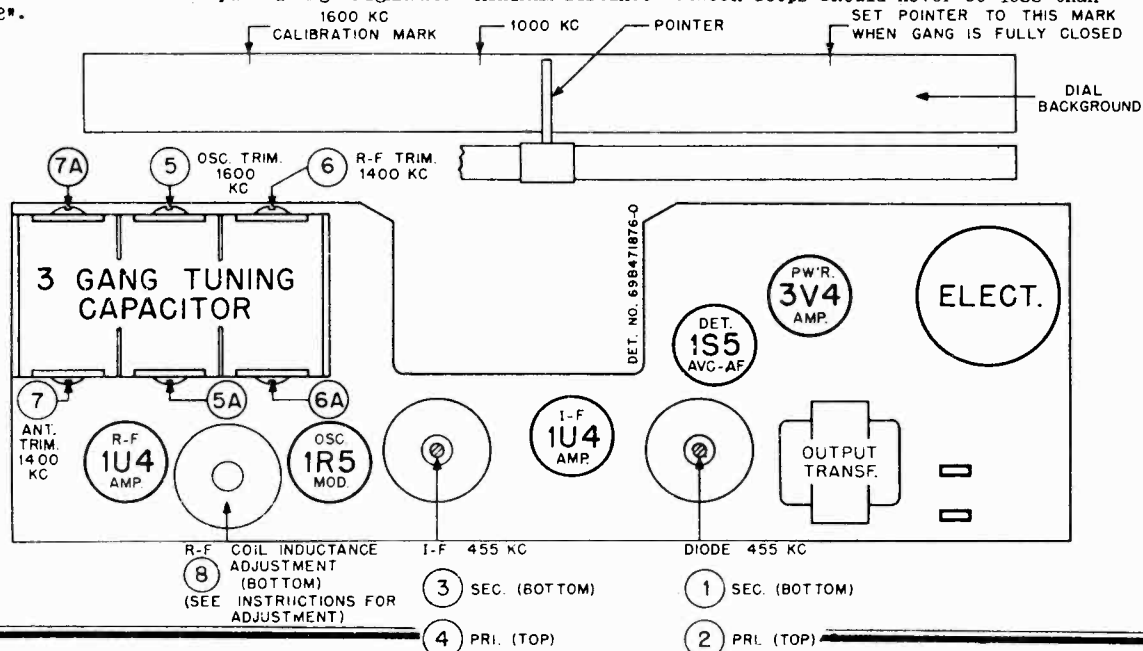
Normally, alignment can be made with trimmers 5, 6 and 7. However, if range of these trimmers is insufficient to obtain peak, adjustment can be made with trimmers 5A, 6A and 7A.

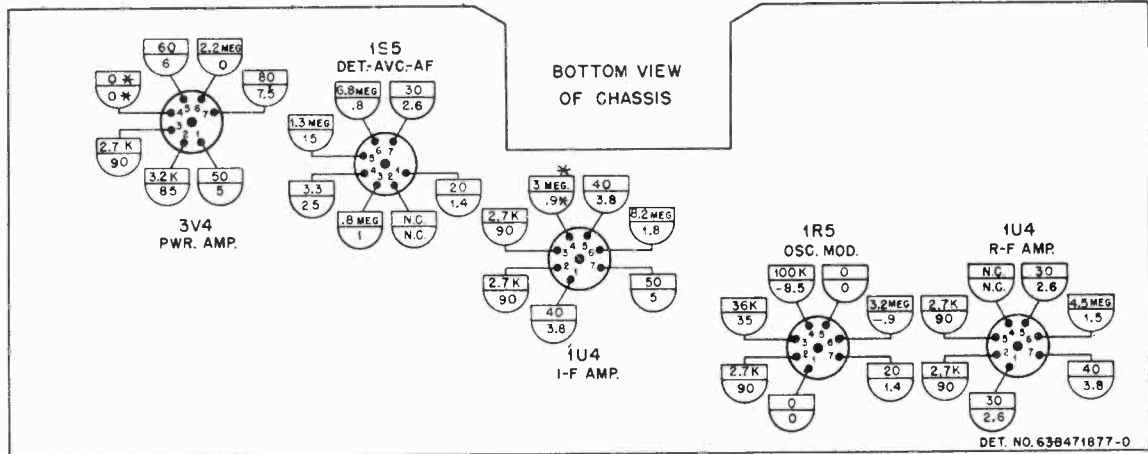
R.F. COIL. The inductance of this coil is set at time of manufacture by adjusting the iron core. No resetting of this core should be made unless it has been tampered with. If so, readjustment can be made by proceeding as follows:

Tune in 600 Kc signal and peak Padder Adj. (8). Next tune in 1400 Kc signal and peak trimmer (6). Repeat both adjustments until maximum response is obtained at both ends; the last adjustment should be trimmer (6).

STEP	DIAL SET TO	DUMMY	SIGNAL GENERATOR CONNECTED TO	SIGNAL GENERATOR SET TO	ADJUST TRIMMER OR CORE	REMARKS
IF ALIGNMENT						
1.	Gang fully opened.	.1 mf	OSC-MOD grid*	455 Kc	1,2,3 & 4	Adjust for maximum output
RF ALIGNMENT						
2.	1600 Kc**	-	Radiation loop***	1600 Kc	5	This sets osc. to dial scale.
3.	1400 Kc	-	Radiation loop***	1400 Kc	6 & 7	Tune signal for max. with receiver tuning knob, then peak trimmers 6 & 7.
4.	1400 Kc	-	Radiation loop***	1400 Kc	7	With chassis assembled into cabinet, repeak antenna trimmer. Loop should be in upright position.

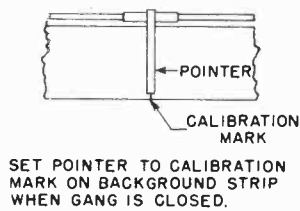
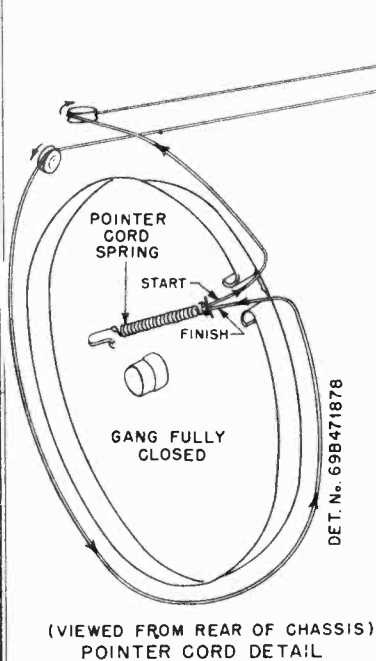
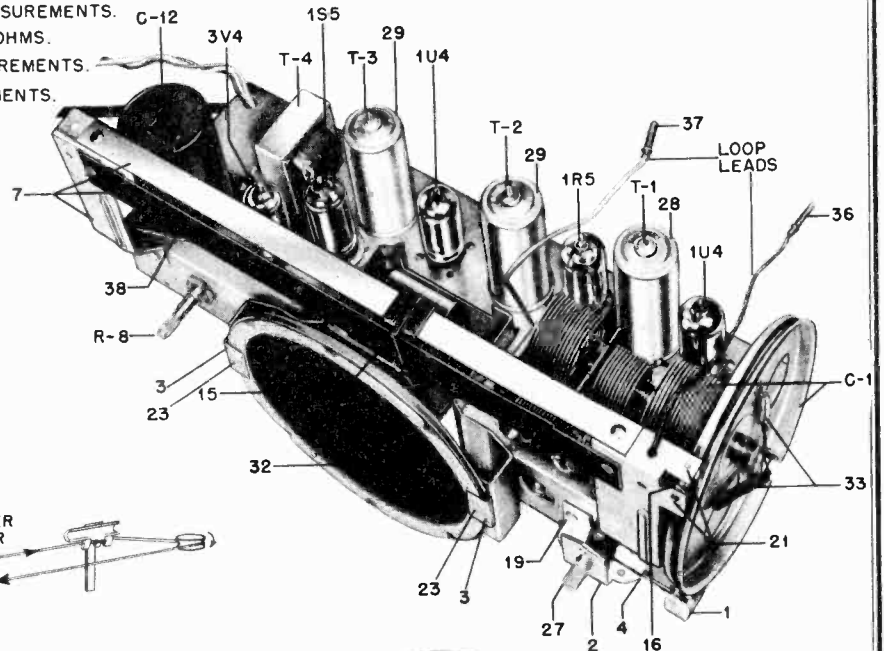
- * A convenient point is the stator of the tuning capacitor.
- ** Close gang fully and set pointer to calibration mark at left hand side of dial background, then set to 1600 Kc by setting pointer at right hand calibration mark.
- *** Connect output of signal generator to a 5" diameter, 3 turn loop and bring loop close enough to receiver loop to obtain output of 50 milliwatts (.40V) on output meter. Vary distance between loops to maintain this output during alignment. Minimum distance between loops should never be less than 12".



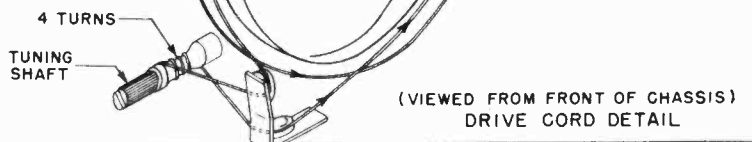


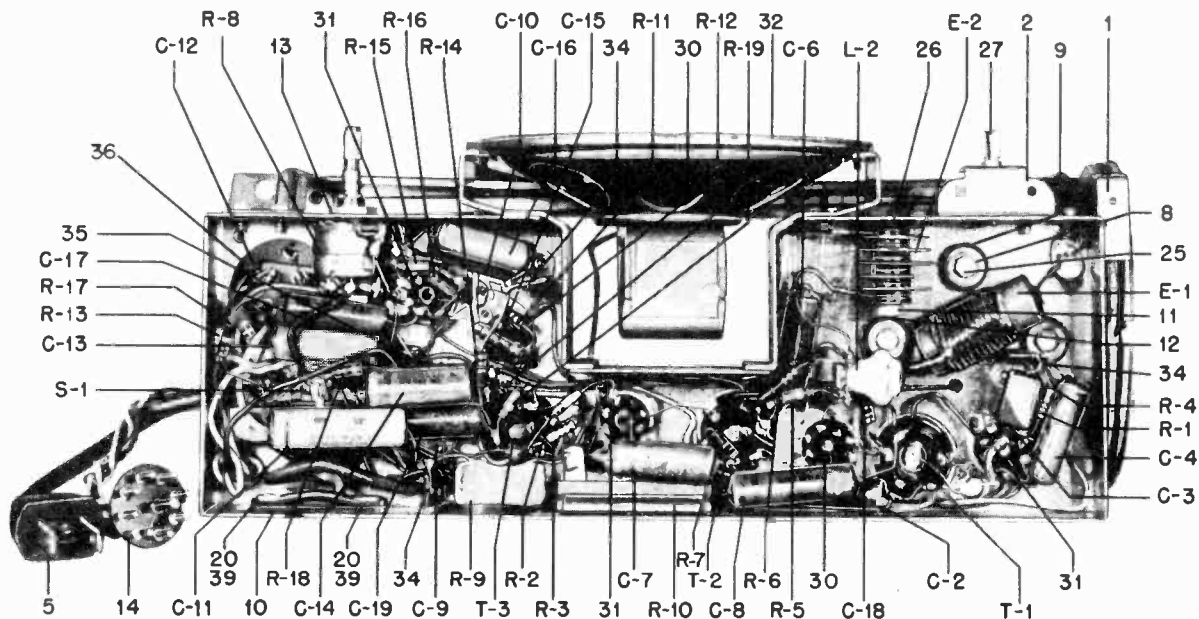
NOTE: A VTVM WAS USED TO MAKE MEASUREMENTS.
 MEASUREMENTS ARE MADE FROM TUBE BASE PIN TO B- (↔)
 SET WAS OPERATED FROM 117 V. AC LINE FOR VOLTAGE MEASUREMENTS.
 SET WAS IN AC POSITION AND POWER SWITCH WAS 'ON' FOR RESISTANCE MEASUREMENTS.
 K = 1000 (ONE THOUSAND) OHMS.
 □ = RESISTANCE MEASUREMENTS.
 ◐ = VOLTAGE MEASUREMENTS.

VOLTAGE TOLERANCE = ±10%.
 RESISTANCE TOLERANCE = ±20%.
 * = TIE LUG.



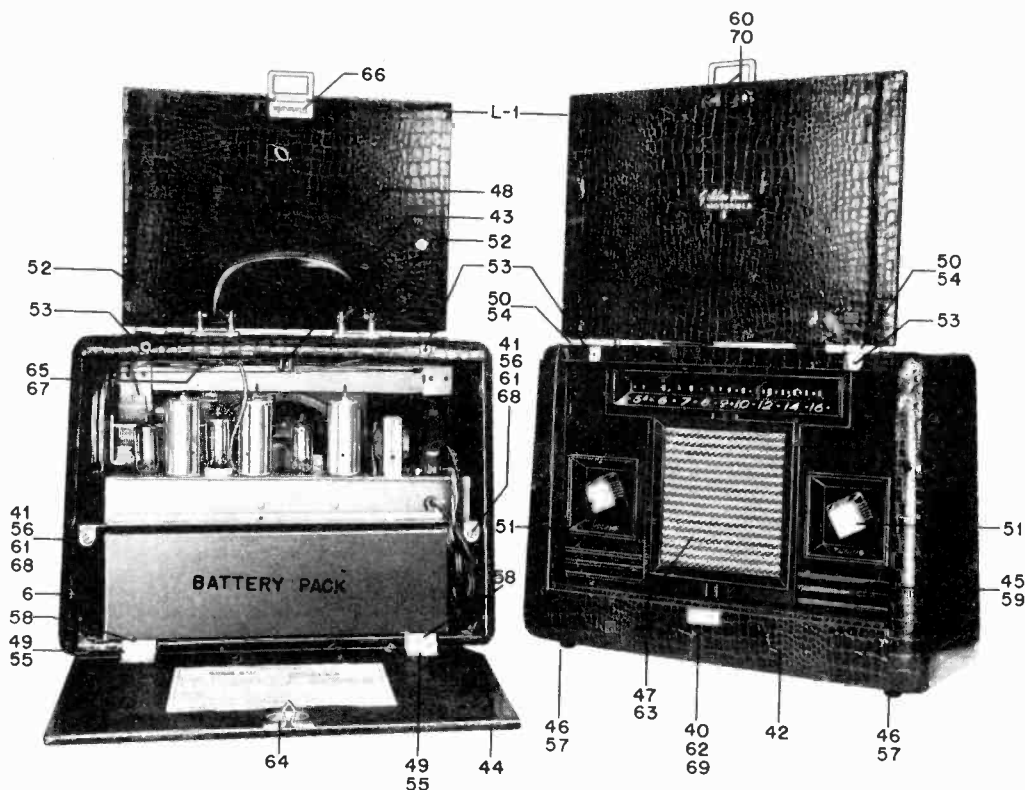
NOTE: USE 18 LB TEST FISH LINE. SECURE KNOT WITH A DROP OF CEMENT.





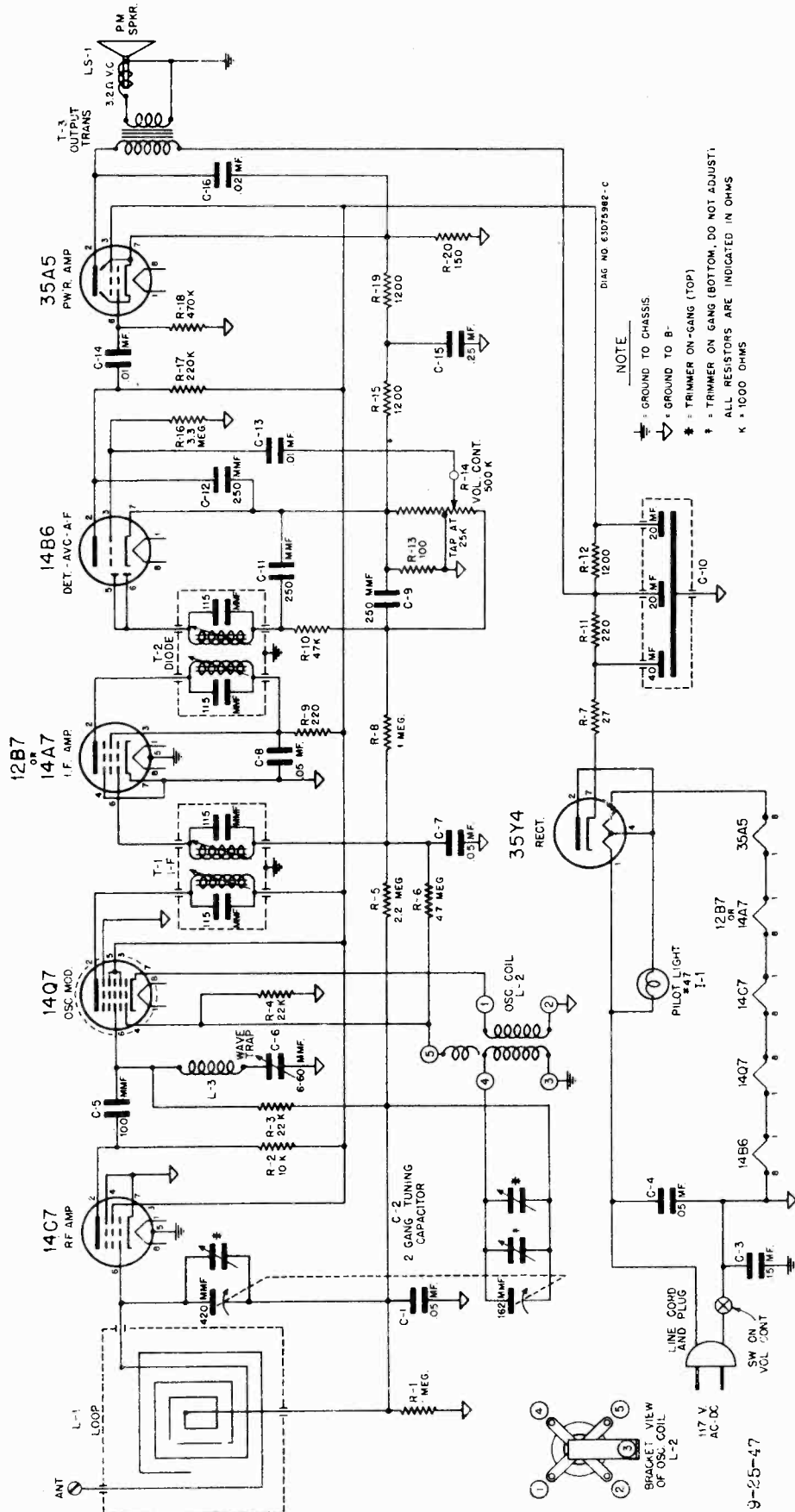
TYPE- 5 tube, three power portable, with a selenium rectifier for house current operation. Loop antenna is housed in detachable front cover.

POWER SUPPLY - Operates from 117V AC or DC (15 watts), or self-contained battery pack. Use Eveready No. 754 or Ray-O-Vac No. AB-878 Battery Pack.



MOTOROLA INC.

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
CHASSIS PARTS					
CAPACITORS					
C-1	1X77263	Variable, 3 gang; Includes pulley ..	T-2	24B76980	IF: 455 Kc; complete with iron tuning cores and padding capacitors, but less shield
C-2	858905	Paper: .05 mf 100V	T-3	24B77264	Diode: 455 Kc; complete with iron tuning cores and padding capacitors but less shield can
C-3	2116648	Mica: 250 mmf 500V	T-4	25B76982	Output
C-4	858905	Paper: .05 mf 100V	1	71X477010	Bracket & Pulley Assembly (cord guide)
C-5	21K77268	Molded 3.3 mmf	2	74A16894	Bracket, tuning shaft mfg
C-6	858905	Paper: .05 mf 100V	3	7476939	Bracket, speaker plate
C-7	869605	Paper: .1 mf 200V	4	1146944	Cord, dial; 154 black
C-8	858905	Mica: 100 mmf 500V	5	30B2029	Cord: 6 ft. line cord with plug
C-9	866641	Paper: .005 mf 600V	6	15C76984	Cover, chassis bottom
C-10	858913	Paper: .05 mf 400V	7	1X77281	Dial Background, Rail and Bracket Assembly; Includes pointer, slider & pulleys
C-11	859816	Paper: .05 mf 400V	8	5419858	Eyellet, spacer (gang mfg)
C-12	23X76985	Electrolytic: 40-40-20-80 mfd. (includes black fibre cover)	9	5470404	Grommet, Rubber (gang mfg)
C-13	858905	Paper: .05 mf 100V	10	49A12646	Lock, line cord; fibre
C-14	858905	Paper: .05 mf 100V	11	497650	Lockwasher, steel; #6 internal; cadmium plated (rectifier mfg)
C-15	21B77286	Ceramic: 100 mmf 500V	12	257002	Nut, steel; 6-32 x 5/16 hex; cadmium plated (rectifier mfg)
C-16	858913	Paper: .005 mf 600V	13	257051	Nut, steel; 3/8-32 x 9/16 hex; palmut; cadmium plated (volume control mfg)
C-17	858964	Paper: .002 mf 400V	14	28K77272	Plug, 9 pin (on battery cable)
C-18	21B77287	Molded: 1.5 mmf	15	1X76949	Pointer and Slider Assembly
C-19	858905	Paper: .05 100V	16	49A12646	Pulley, drive cord guide
CAPACITOR & CHOKE ASSEMBLY					
E-1	1A72283	Capacitor and Choke Assembly (includes .15 mf 800V paper capacitor and coil)	17	588497	Rivet: .088 x 1/2; nickel plated (tube socket mfg)
RECTIFIER					
E-2	48B76986	Rectifier, selenium	18	587707	Rivet: .122 x 5/32; nickel plated (terminal strip mfg)
COILS					
L-1	15C77054	Loop & Cover Assembly; Includes front cover, loop, catch & hinges	19	587701	Rivet: .122 x 3/16; nickel plated (electrolytic mfg & tuning shaft mfg)
L-2	24A76943	Oscillator	20	587708	Rivet: .122 x 9/32; nickel plated (line cord lock mfg)
RESISTORS					
Note: All resistors 20% insulated carbon type unless specified otherwise.					
R-1	6R218	3.5 meg 1/2W	21	5A71248	Rivet, shoulder: .187" lg (pulley mfg)
R-2	6R3927	2.2 meg 1/2W	22	5A13896	Rivet, shoulder: .312" lg (pulley mfg)
R-3	6R3988	5.6 meg 1/2W	23	352974	Screw: 4-40 x 5/16 (flat Phillips head); cadmium plated (speaker mfg)
R-4	6R6004	1 meg 1/2W	24	357506	Screw: #6 x 1/4 PKZ plain hex head; cadmium plated (slider switch mfg and dial background mfg)
R-5	6R6075	100,000 1/2W	25	352294	Screw: 6-32 x 1/2 plain hex head, locking type machine screw; cadmium plated (gang mfg)
R-6	6R6012	33,000 1/2W	26	359883	Screw: 6-32 x 1-1/8 slotted round head machine screw; cadmium plated (rectifier mfg)
R-7	6R5585	8.2 meg 1/2W	27	47A76887	Shaft, tuning control
R-8	18A76948	Volume control: 1 meg; with DPST switch. Wirewound: 150, 10K 2-1/2W	28	26B70107	Shield, (RF coil)
R-9	17A76986	Wirewound: 2060 5W	29	1A71049	Shield and Sleeve Assembly (IF and Diode shield can)
R-10	17B73249	6.8 meg 1/2W	30	9A77086	Socket, tube: miniature; 7 prong; cushioned
R-11	6R3957	3.3 meg 1/2W	31	9A70455	Socket, tube: miniature; 7 prong plain
R-12	6R218	820 10K 1/2W	32	50C76953	Speaker, PH: 5"; 3.2 ohms V.C.
R-13	6R2659	2.2 meg 1/2W	33	41A14244	Spring, tension coil
R-14	6R6004	1 meg 1/2W	34	31A84785	Strip, terminal: 2 insulated lugs, 1 mfg.
R-15	6R3927	2.2 meg 1/2W	35	31A87686	Strip, terminal: 3 insulated lugs, 1 mfg.
R-16	6R2098	250 10K 1/2W	36	29A5400	Terminal, plain pin: .125 diam.
R-17	6R5632	500 10K 1/2W	37	29A5401	Terminal, plain pin: .156 diam.
R-18	6R5621	10 10K 1/2W	38	9A22056	Water, bakelite (electrolytic mfg)
R-19	6R8015	220,000 1/2W			
SWITCHES					
S-1	40A27114	Switch, changeover: triple pole, double throw			
TRANSFORMERS					
T-1	24B76988	RF: broadcast band; complete with iron tuning core and C-5 (3.3 mmf) coupling capacitor; less shield can			



NOTE
 ⚡ = GROUND TO CHASSIS
 ↗ = GROUND TO B-
 * = TRIMMER ON-GANG (TOP)
 † = TRIMMER ON GANG (BOTTOM, DO NOT ADJUST)
 ALL RESISTORS ARE INDICATED IN OHMS
 K = 1000 OHMS

DIAG NO 6307588-C

I-F = 455 KC

FREQUENCY RANGE: 535 KC - 1620 KC

CAUTION: Never connect antenna or chassis to water pipe, radiator or other ground.

SPEAKER
 LS-1 50B76118 P.M.: 5"; 3.2 ohm V.C. Exchange

TRANSFORMERS
 T-1 24B470038 I.F.: 455 Kc; includes cores and padding capacitors but less shield ..
 T-2 24B75487 Diode: 455 Kc; includes cores and padding capacitors but less shield
 T-3 25B76117
 or
 25B76118 Output

COILS
 L-1 24K77323 Loop: winding only
 L-2 24A76192 Oscillator
 L-3 24A77336 Wave Trap
DIAL LIGHT
 I-1 65X11854 Bulb: 6.3V .15A; tubular; bayonet base

MOTOROLA INC.

MODELS 67X11,
67X12, 67X13

Maximum performance can only be obtained if extreme care is exercised during alignment. Follow the procedure carefully.

such as Motorola part number 66A71008.

A low range output meter should be connected across the speaker voice coil. Set receiver volume control to maximum; for greatest accuracy keep output of receiver at approximately .05 watt throughout alignment by reducing generator output (not receiver volume control) as stages are brought into alignment. (.05 watt = .40 volt on output meter) The alignment tool should be of an insulated type

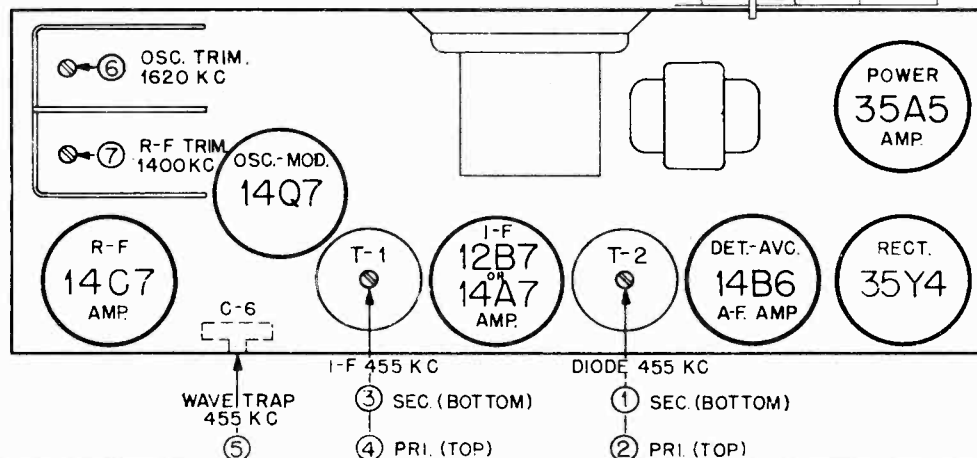
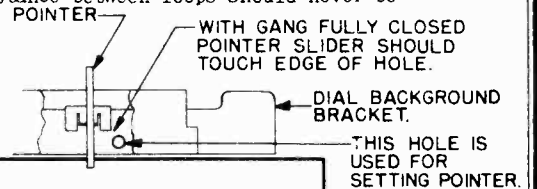
If receiver is operated from AC line during alignment, it is suggested that an isolation transformer be used between receiver and power line. If no isolation transformer is used and hum is encountered during alignment, connect the ground side of the signal generator output to receiver B- instead of the receiver chassis.

STEP	DIAL SET TO	DUMMY	SIGNAL GENERATOR CONNECTED TO	SIGNAL GENERATOR SET TO	ADJUST TRIMMER OR CORE	REMARKS
IF ALIGNMENT						
1.	Gang fully opened	.1 mf	RF Amp. grid*	455 Kc	1,2,3 & 4	Adjust for maximum output.
WAVE TRAP ADJUSTMENT						
2.	Gang fully opened	.1 mf	RF Amp. grid*	455 Kc	5	Adjust for minimum response.
3.**	Gang fully opened	.1 mf	RF Amp. grid*	1620 Kc	6	Adjust for maximum output; this sets osc. to dial scale
4.	1400 Kc		Radiation loop***	1400 Kc	7	Tune signal for max. with receiver tuning knob, then peak trimmer 7.

* A convenient point for this connection is the stator of the RF section of the tuning capacitor.

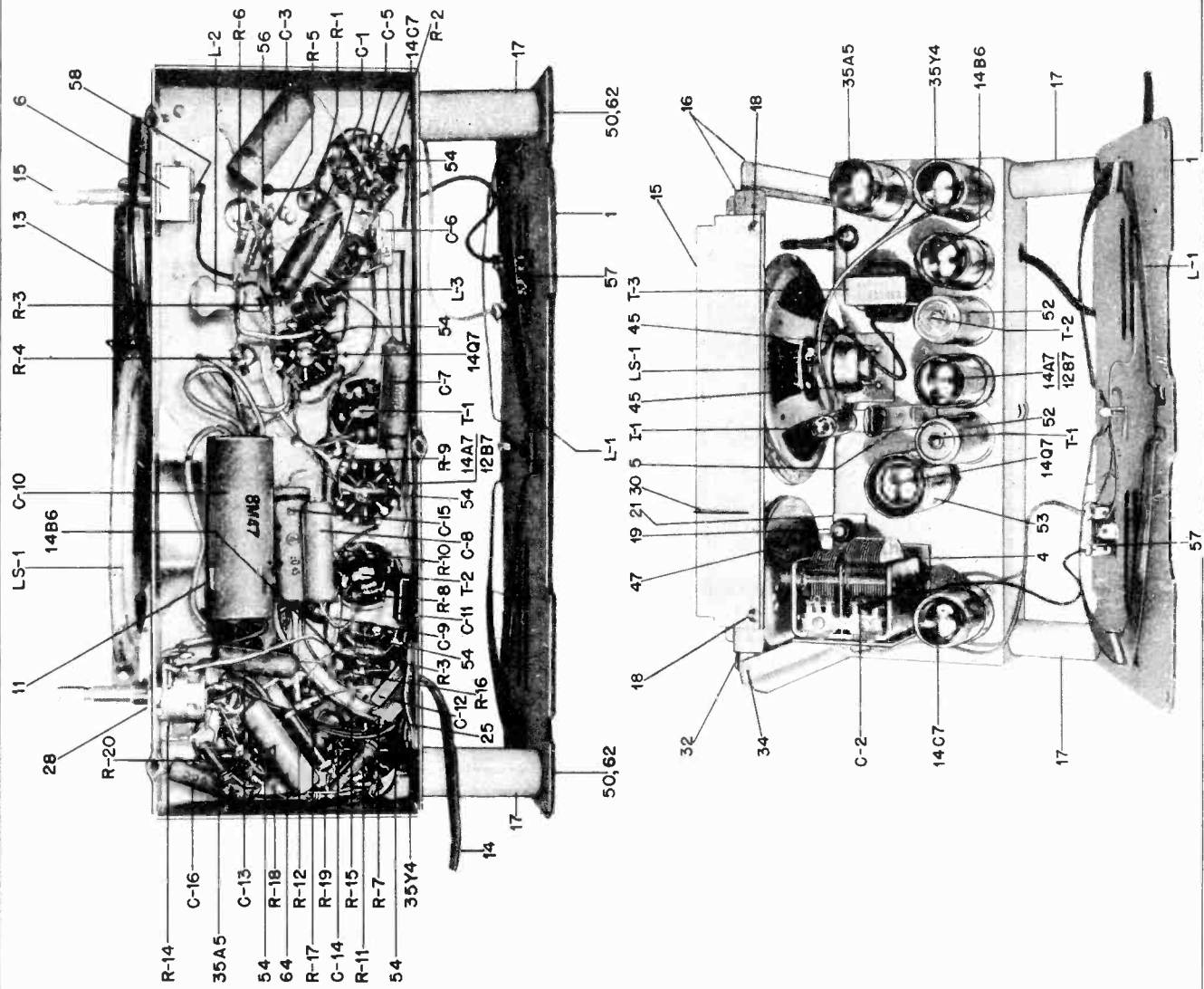
** First close gang fully and set pointer to calibration mark as shown in Figure 1, then proceed with Step 3.

*** Connect output of signal generator to a 5" diameter, 3 turn loop and bring close enough to receiver loop to obtain output of .50 milliwatts (.40V) on output meter. Vary distance between loops to maintain this output during alignment. Minimum distance between loops should never be less than 12".

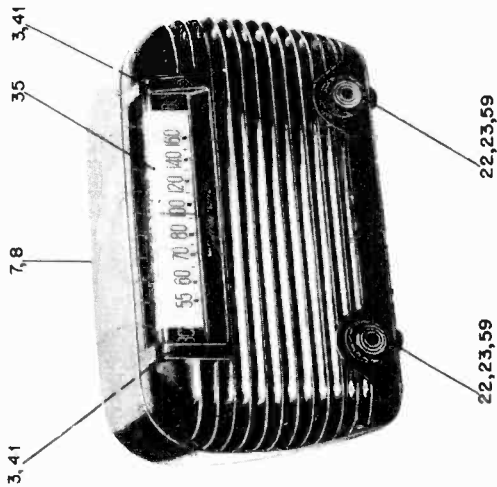


MODELS 67X11,
67X12, 67X13

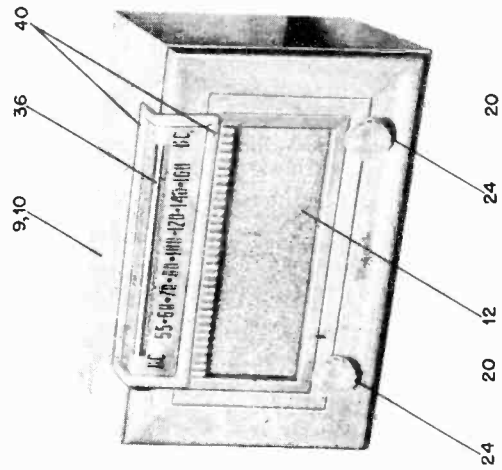
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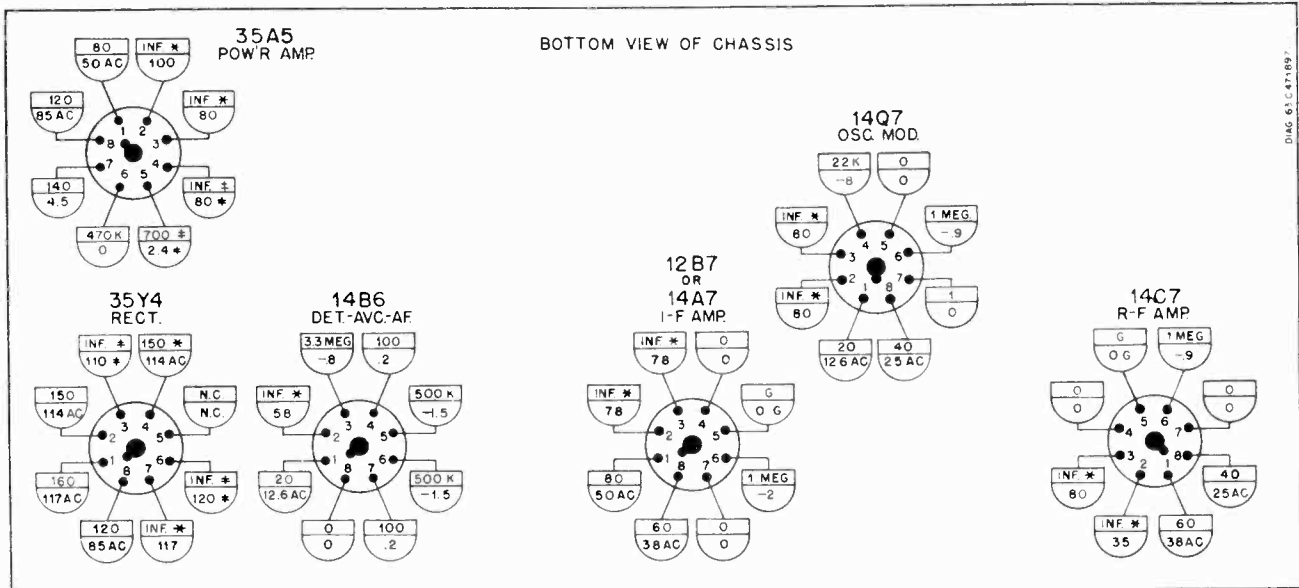


67X11 Walnut, 67X12 Ivory



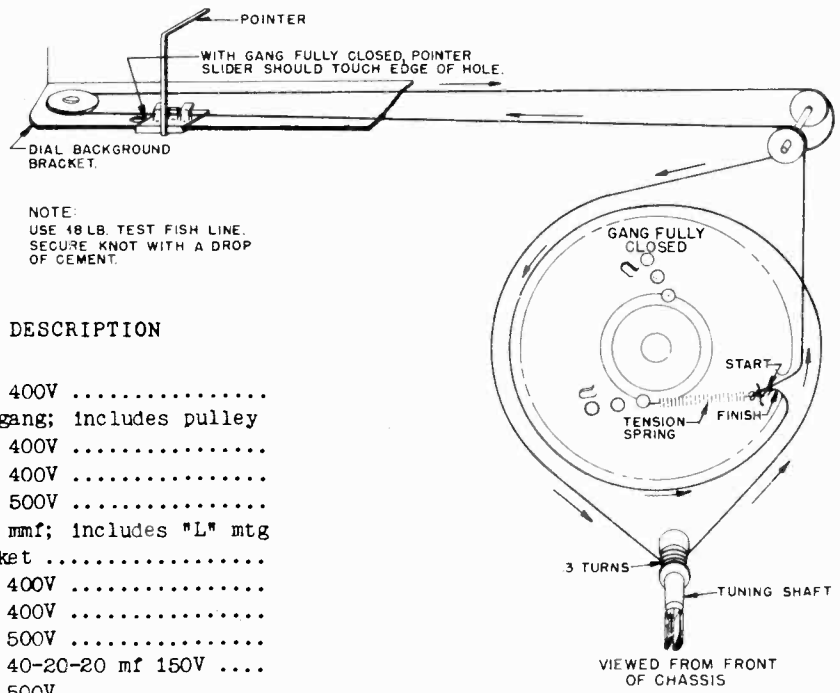
67X13 Blonde or Toast





□ = RESISTANCE READINGS.
 ◐ = VOLTAGE READINGS.
 G=GROUND TO CHASSIS.
 N.C.=NO CONNECTION.
 * = MAY VARY, DEPENDING ON CONDITION OF ELECTROLYTIC CAPACITORS.
 † = TIE POINT.

NOTE: A VTVM WAS USED TO MAKE VOLTAGE MEASUREMENTS. VOLUME CONTROL SET AT MINIMUM AND NO SIGNAL TUNED IN. MEASUREMENTS TAKEN FROM TUBE SOCKET TERMINALS INDICATED TO B-(◁). ALL VOLTAGE MEASUREMENTS TAKEN WITH 117V.AC INPUT TO SET. ALL VOLTAGE MEASUREMENTS DC UNLESS OTHERWISE SPECIFIED. ALL MEASUREMENTS ± 10%.



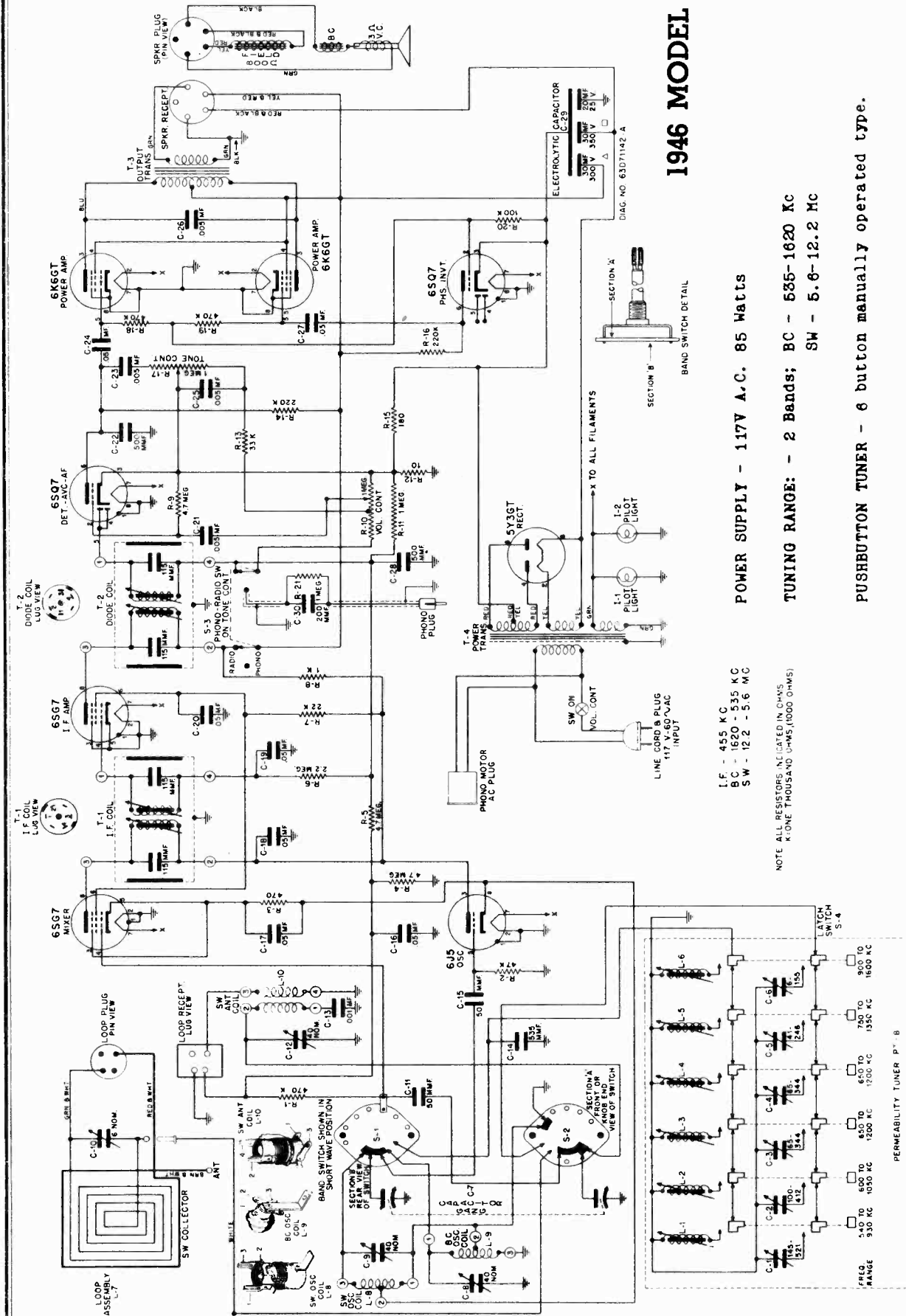
REF. NO.	PART NO.	DESCRIPTION
CAPACITORS		
C-1	8S9816	Paper: .05 mf 400V
C-2	1X77339	Variable: 2 gang; includes pulley
C-3	8A75566	Paper: .15 mf 400V
C-4	8S9816	Paper: .05 mf 400V
C-5	21R6641	Mica: 100 mmf 500V
C-6	20A26941	Trimmer: 6-60 mmf; includes "L" mtg bracket
C-7	8S9816	Paper: .05 mf 400V
C-8	8S9816	Paper: .05 mf 400V
C-9	21R6648	Mica: 250 mmf 500V
C-10	23B75808	Electrolytic: 40-20-20 mf 150V
C-11	21R6648	Mica: 250 mmf 500V
C-12	21R6648	Mica: 250 mmf 500V
C-13	8S9809	Paper: .01 mf 400V
C-14	8S9809	Paper: .01 mf 400V
C-15	8S9810	Paper: .25 mf 100V
C-16	8S9802	Paper: .02 mf 400V

MOTOROLA INC.

MODELS 67X11,
67X12, 67X13

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
RESISTORS					
All resistors carbon -20%-insulated unless specified otherwise					
R-1	6R6004	1 meg 1/2 W		or	
R-2	6R6054	10,000 1/2 W	34K478005		Scale, dial and escutcheon (toast color) (67X13 only)
R-3	6R6028	22,000 1/2 W			
R-4	6R6028	22,000 1/2 W	37	5S7707	Rivet: .122 x 5/32; nickel plated (pilot light mounting bracket mounting, trimmer mounting and terminal strip mounting)
R-5	6R3927	2.2 meg 1/2 W			
R-6	6R2122	4.7 meg 1/2 W			
R-7	6R5683	27 10% 1/2 W			
R-8	6R6004	1 meg 1/2 W	38	5S7701	Rivet: .122 x 3/16; nickel plated (tuning shaft mounting bracket mounting)
R-9	6R3933	220 1/2 W			
R-10	6R6056	47,000 1/2 W	39	5S7708	Rivet: .122 x 9/32; nickel plated (line cord lock mounting)
R-11	6R6152	220 1W NI			
R-12	6R3972	1200 1W NI	40	3S1328	Screw: #2 x 3/8 Phillips ovalhead wood screw; brass plated (67X13 dial scale and escutcheon mounting)...
R-13	6R6326	100 10% 1/2 W	41	3S7155	Screw: 6-32 x 3/16 slotted hex head; cadmium plated (dial mounting) (67X11 and 67X12 only)
R-14	18A76191	Volume Control: 500,000 ohms; includes on-off switch			
R-15	6R6393	1200 10% 1/2 W	42	3S7506	Screw: #8 x 1/4 PKZ plain hex head sheet metal screw; cadmium plated (oscillator coil mounting)
R-16	6R2118	3.3 meg 1/2 W			
R-17	6R6015	220,000 1/2 W			
R-18	6R6032	470,000 1/2 W	43	3S7350	Screw: 6-32 x 1/4 slotted hex head; locking type machine screw; cadmium plated (lug mtg)
R-19	6R6393	1200 10% 1/2 W			
R-20	6R6392	150 10% 1/2 W NI	44	3S1339	Screw: #6 x 5/8 flat head wood screw; (baffle mtg) (67X13, only)
1	1X77347	Back Assembly: cabinet back with antenna terminal and terminal strip; less loop	45	3S7205	Screw: 8-32 x 1/4 slotted hex head locking type machine screw; cadmium plated (speaker mtg) ..
2	32A471517	Baffle, speaker (67X13 only)			
3	7A77362	Bracket, dial mounting (67X11 & 67X12) ..	46	3S7454	Screw: #8 x 1/4 PKZ plain hex head cadmium plated (dial background bracket assembly mtg)
4	7B18748	Bracket, gang mounting			
5	7A77303	Bracket, pilot light mounting.....doz			
6	7A77337	Bracket, tuning shaft mounting			
7	16E77648	Cabinet, table model: plastic walnut (67X11 only)	47	3S7507	Screw: #8 x 5/8 PKZ plain hex head sheet metal screw; cadmium plated (gang mtg).....
8	16K77649	Cabinet, table model: plastic ivory			
9	16D470664	Cabinet, table model: wood; blonde finish (67X13 only)	48	3S8117	Screw: #8 x 1" PKZ slotted hex head sheet metal screw; antique copper finish (chassis mtg) (67X11 and 67X12 only)
10	16K478003	Cabinet, table model: wood; toast finish (67X13 only)			
11	42K75826	Clip, electrolytic mounting	49	3S7526	Screw: #8 x 1-1/8 PKA slotted hex head; cadmium plated (chassis mtg) (67X13 only)
12	13K470665	Cloth, grille (67X13 only)			
13	1M8944	Cord, dial: 18"; black	50	3S3384	Screw: #8 x 2-1/4 PKZ slotted hex head sheet metal screw cadmium plated (back mtg)
14	3A470651	Cord, line: 6 ft. long; with plug ..			
15	35B77311	Dial Background			
16	1X77344	Dial Background Bracket and Support Assembly: includes shoulder rivets and pulleys	51	1X77363	Shaft Assembly, tuning
17	37K77085	Dowel, wood (loop antenna mounting) ..	52	1X71049	Shield and Iron Core Sleeve Assembly (IF and Diode shield can).....
18	5S7805	Eyelet, snap-in (dial background mounting)	53	26A72635	Shield, tube
19	5A19658	Eyelet, spacer (gang mounting)	54	9A76185	Socket, tube: loctal
20	37K15841	Foot, rubber: 1/2 diameter (cabinet foot) (67X13 only)		or 9A72549	Socket, tube: loctal; mounts with rivets (Use this socket to replace 9A76185 socket when mounting ears on chassis; break off)
21	37A12691	Grommet, rubber (gang mounting)			
22	36B77659	Knob, control: Walnut (67X11 only)			
23	36K77660	Knob, control: Ivory (67X12 only)	55	41A14244	Spring, tension coil
24	36K478004	Knob, control: Tan (67X13 only)	56	31A76184	Strip, terminal: #1 ground 2 insulated.
25	32A24815	Lock, line cord: fibre	57	31K15026	Strip, terminal: 2 insulated lugs, center mtg (on cabinet back)
26	4S7666	Lockwasher: #8 external; cadmium plated (oscillator coil mounting)			
27	29R5227	Lug, soldering: #6	58	4A70015	Washer "C" (tuning shaft mtg)
28	2S7051	Nut: 3/8-32x9/16; Palnut; cadmium plated (volume control mounting)	59	4K19943	Washer, paper (used between control knobs and cabinet 67X11 & 12 only) ...
29	38A25507	Plug, split (cabinet back mounting)	60	32A20575	Washer: 3/8 x .171 x .062 (chassis mtg) 67X11 & 12 only
30	32A77307	Pointer and Slider Assembly			
31	49A12646	Pulley, cord: idler (cord guide)	61	4S1719	Washer: 3/8 x .140 x .030; nickel plated (line cord lock mtg)
32	49A71078	Pulley, cord: 1/2" groove (cord guide) .			
33	5A71246	Rivet, shoulder: .187" long	62	4S7563	Washer: 5/8 x .203 x .033; cadmium plated (cabinet back mtg)
34	5A75045	Rivet, shoulder: .437" long			
35	34D77647	Scale, dial (67X11 and 67X12 only)	63	4S8204	Washer: 1" x .203 x .067; copper plated (chassis mtg) 67X13 only
36	34D470662	Scale, dial and escutcheon (tan color) (67X13 only)			

1946 MODEL



POWER SUPPLY - 117V A.C. 85 Watts
 TUNING RANGE: - 2 Bands; BC - 535-1620 Kc
 SW - 5.6-12.2 Mc

PUSHBUTTON TUNER - 6 button manually operated type.

I.F. - 455 Kc
 BC - 1620 - 535 Kc
 SW - 12.2 - 5.6 Mc

NOTE: ALL RESISTORS INDICATED IN OHMS
 K - ONE THOUSAND OHMS (1000 OHMS)

TYPE - 8 tube phonograph-radio with loop antenna in upright console type cabinet.

TUBE COMPLEMENT - 6S97 Mixer, 6J5 Oscillator, 6SQ7 I.F. Amplifier, 6SQ7 Detector, AVC and 1st

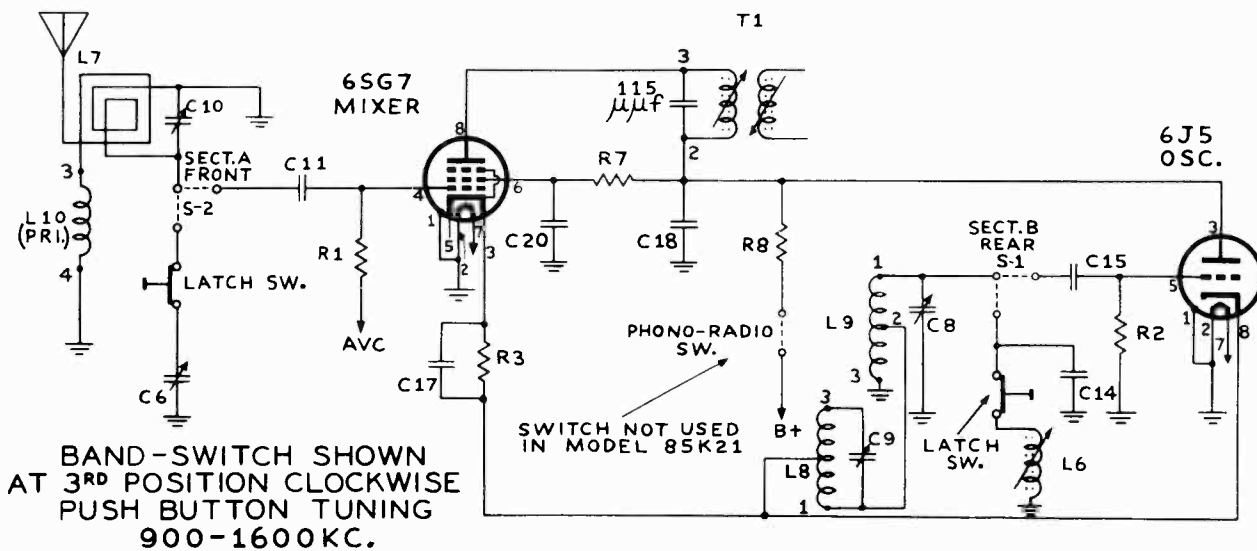
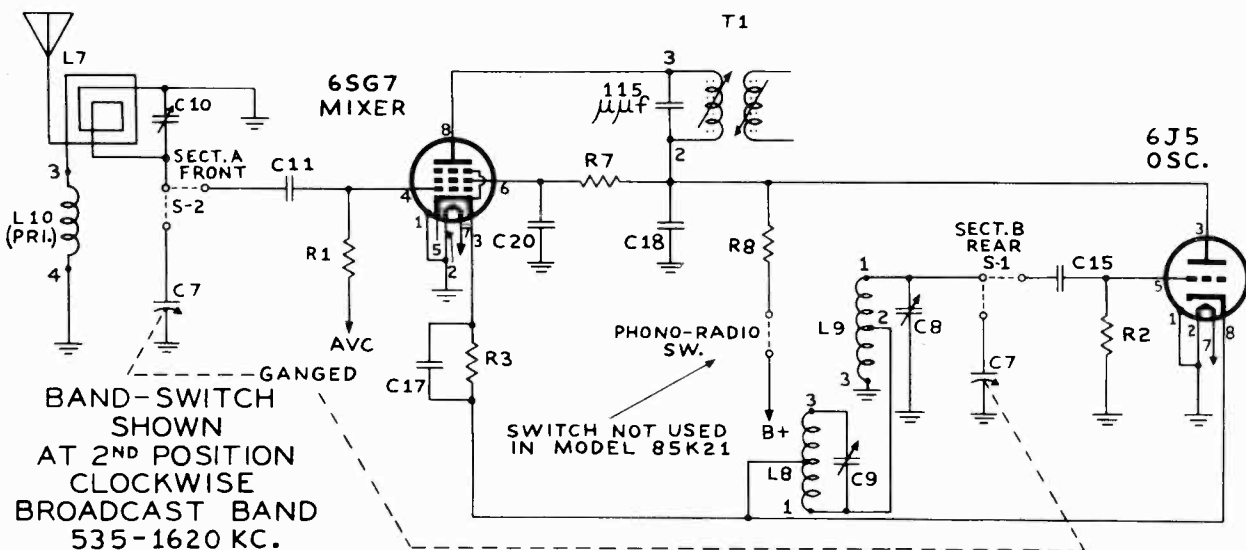
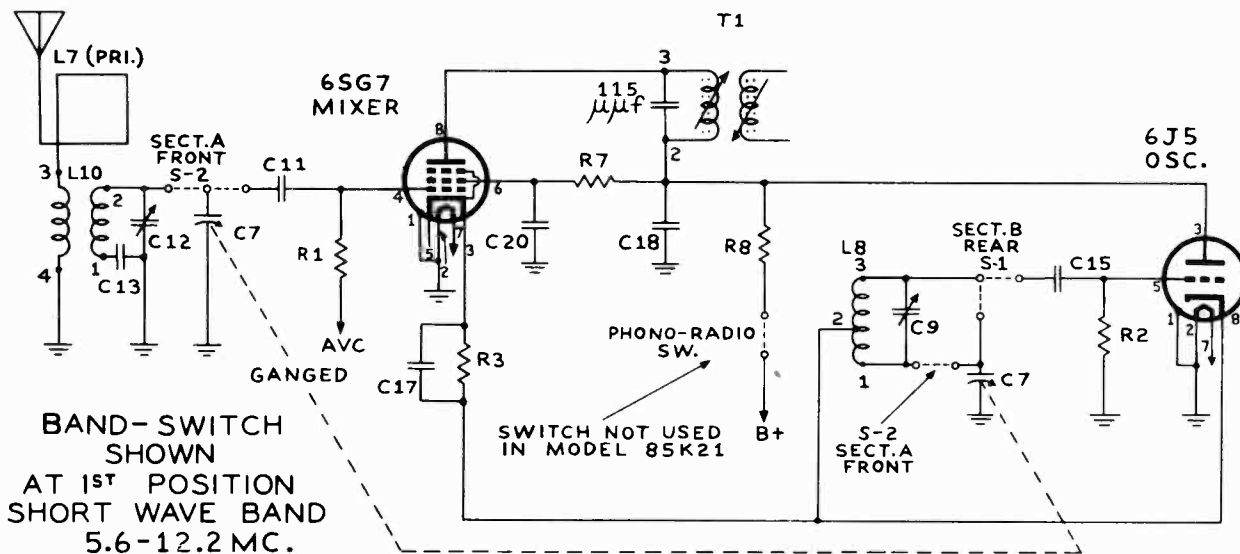
A.F. Amplifier, 6S97 Phase Inverter, 2- 6K6GT Power Amplifiers and 5Y3GT Rectifier.

"clarified schematics"

MOTOROLA INC.

MODEL 85F21

MODEL 85K21



ALIGNMENT

Refer to Figure 2 for location of adjustment trimmers and cores. Connect a low range output meter across speaker voice coil. Volume control should be set at maximum for all operations.

The signal generator used, should possess good frequency stability and should be of the modulated type. For greatest accuracy, keep the receiver output at approximately 50 milliwatts (.38V on output meter) during alignment. Vary signal generator output (not receiver volume control) to maintain this output during alignment.

Step	Gang Setting	Band	Dummy	Generator Connected to	Generator Frequency	Trimmer or Core	Remarks
1	Fully opened	B. C	.1mf	Mixer grid & chassis	455 kc	1, 2, 3, & 4	Adjust I. F. & Diode trans. for maximum
2	Fully opened	B. C	-	Radiation loop*	1620 kc	5	Set oscillator to dial scale
3	1400 KC	B. C	-	Radiation loop*	1400 kc	6 †	Tune signal generator for max. on output meter, then peak trimmer.
4	12.2 MC	SW	50mmf	Short wave antenna terminal	12.2 Mc	7	Set osc. to dial scale.
5	11.5 MC	SW	50mmf	Short wave antenna terminal	11.5 Mc	8	Tune signal generator for max. on output meter, then peak trimmer.

† Repeak after chassis and loop are installed in cabinet.

* Connect output of signal generator to a 5" diameter, 3 turn loop. With volume on full, bring loop close enough to receiver until output of 50 milliwatts is obtained (.38V on output meter). Vary distance between generator and receiver loops to maintain this output during alignment. Minimum distance between loops should never be less than 12".

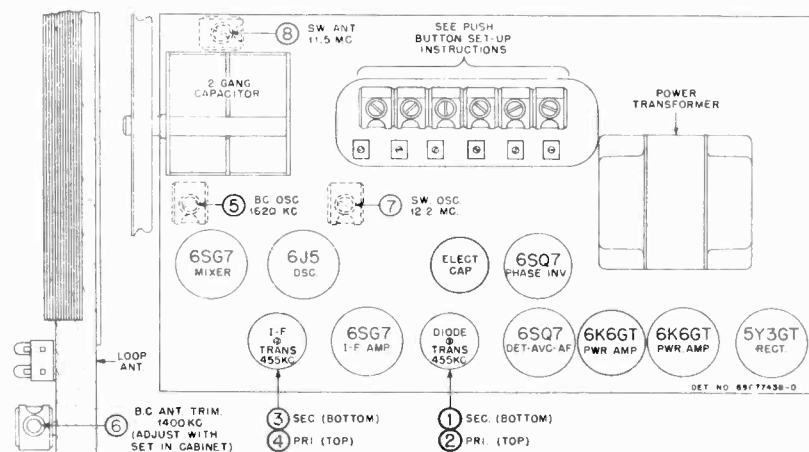


FIGURE 2. TUBE & TRIMMER LOCATIONS

MODEL 85F21
MODEL 85K21

MOTOROLA INC.

INSTRUCTIONS FOR SETTING PUSH BUTTONS

1. Turn the radio "on" and allow it to warm up for a period of at least fifteen minutes.
2. Make a list of the frequencies of the nearby stations you wish to tune in automatically. It is recommended that you select the most powerful stations.
3. Turn the band switch to "BC" position and carefully tune in the first station to be set up.
4. Adjust a signal generator to zero beat with this station. NOTE: While it is advisable to use a signal generator for accuracy, it is not an absolute necessity.
5. Turn the band switch to "PB" position.
6. Push the button to be set up, making sure to select a button having the proper frequency range to include the station you are setting. See Figure 3.
7. The tuner adjustment screws are accessible from the back of the radio. (See Figure 2).
8. Adjust the oscillator screw until the signal from the generator, or station is heard. Carefully adjust the screw to maximum volume.
9. Now adjust the antenna trimmer screw for maximum volume.
10. Follow the same procedure for the remaining buttons.
11. It is advisable, after all buttons are set up, to repeat steps 8, 8 and 9 for maximum performance

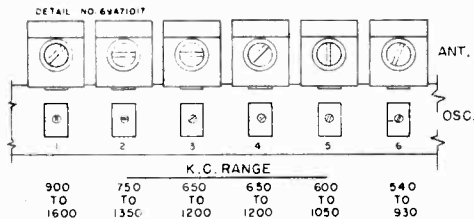


FIGURE 3. PUSH BUTTON SET-UP DETAIL

NOTE: - A V.T.V.M. WAS USED TO MAKE MEASUREMENTS. IF A 20,000 OHM PER VOLT METER IS USED ALL GRID & AVC VOLTAGES WILL READ LOWER.

MEASUREMENTS ARE MADE FROM TUBE BASE PIN TERMINALS TO CHASSIS.

VOLUME CONTROL ON FULL

VOLTAGE TOLERANCE ±10%

RESISTANCE TOLERANCE ±20%

BAND SWITCH IN BC POSITION.

PHONO RADIO SWITCH IN RADIO POSITION

* MEASUREMENTS MAY VARY DUE TO ELECTROLYTIC CAPACITOR C-29 IN CIRCUIT.

□ = RESISTANCE MEASUREMENTS.

○ = VOLTAGE MEASUREMENTS

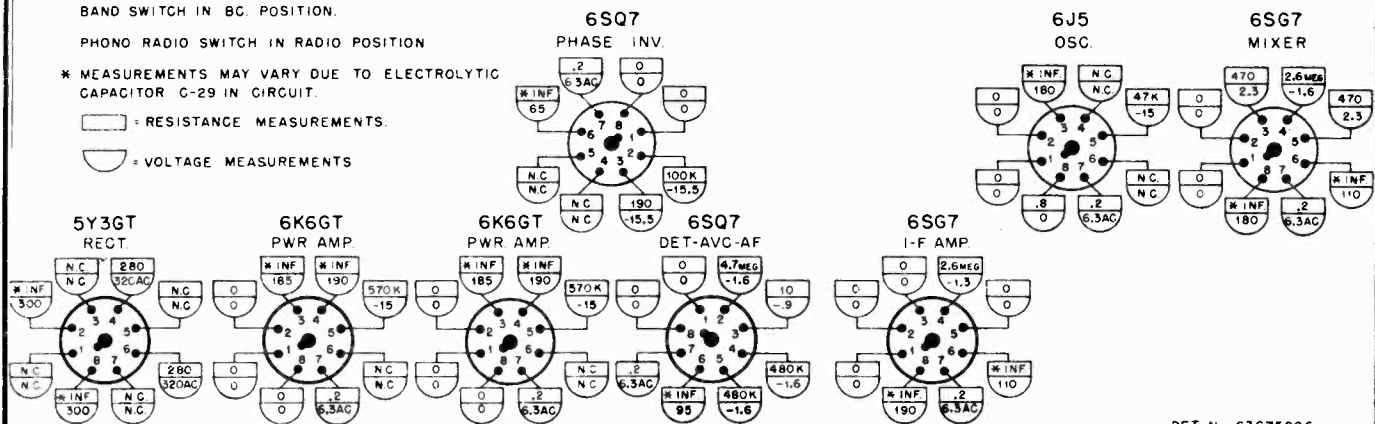


FIGURE 4. VOLTAGE & RESISTANCE DIAGRAM

DET No. 63G75996

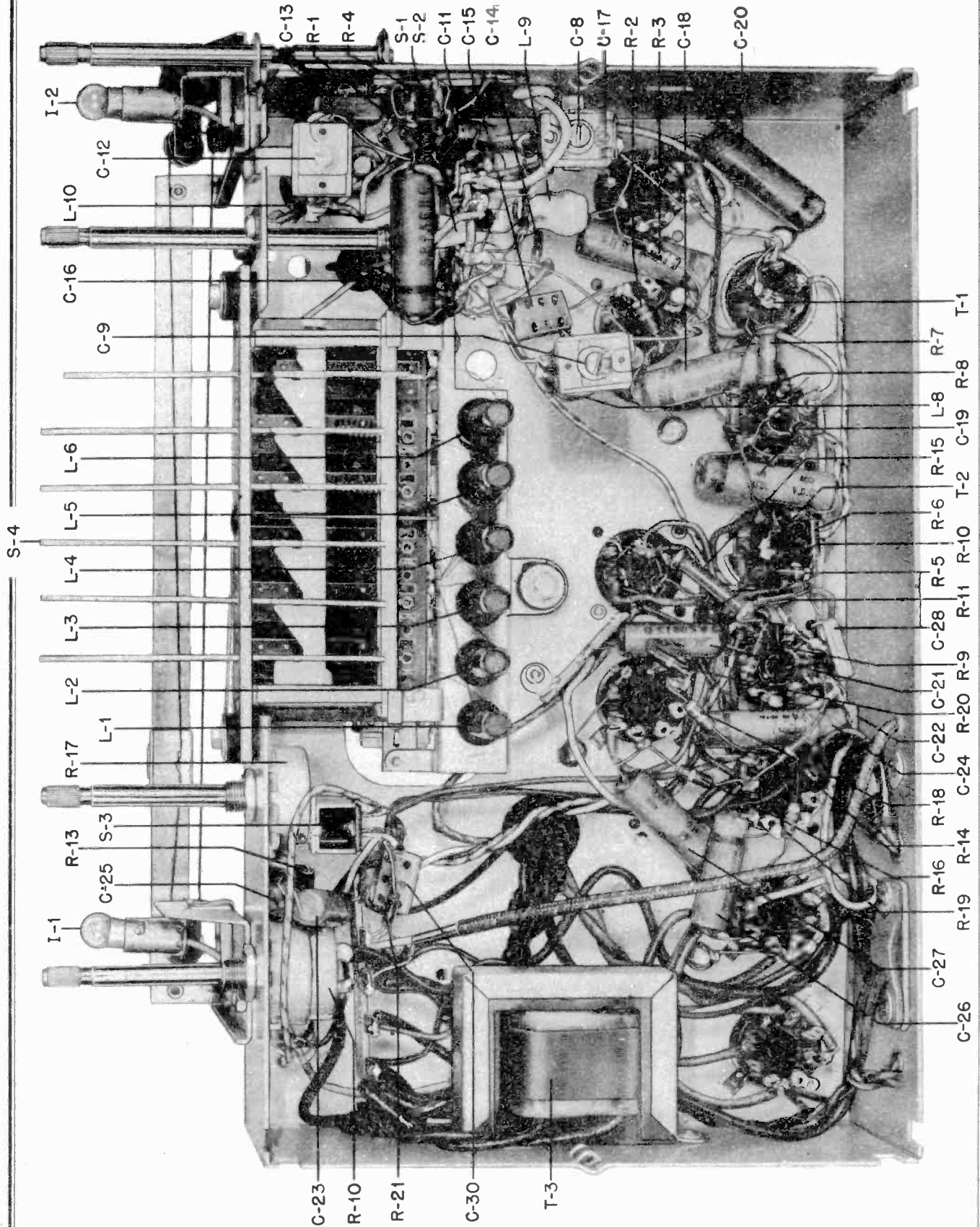


FIGURE 5. PARTS LOCATION, BOTTOM VIEW

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
<u>CAPACITORS</u>			<u>SWITCHES</u>		
C-1			S-1		
C-6		Capacitor and Mounting Strip Assembly, push button tuning: See Permeability Tuner Parts List	S-2	40A71127	Band selector: three position
C-7	1X72383	Variable: 2 gang; with pulley	S-3		Phono-Radio: (on tone control R-17)
C-8	20A71140	Mica trimmer: 10-80 mmf; includes "L" mtg. bracket	S-4		Switch Assembly, push button: See Permeability Tuner Parts List
C-9	20A71141	Mica trimmer: 10-80 mmf	<u>TRANSFORMERS</u>		
C-10	20A71226	Mica trimmer: 2-12 mmf; includes mtg bracket	T-1	24B70646	I. F.: 455 kc; complete with iron cores and padding capacitor, but less shield
C-11	21R6642	Mica: 50 mmf 500V	T-2	24B70637	Diode: 455 KC; complete with iron cores and padding capacitor, but less shield
C-12	20A71125	Mica trimmer: 10-80 mmf; includes "L" mtg bracket	T-3	25B27661	Output
C-13	21R2724	Mica: .001 mf 5% 500V	T-4	25B26035	Power
C-14	21A28020	Silver mica: 535 mmf 3%	<u>MISCELLANEOUS</u>		
C-15	21R6642	Mica: 50 mmf 500V	38B71139		Button, push: plastic (includes insert spring 41A12893)
C-16	8S9816	Paper: .05 mf 400V	1X72423		Cabinet Assembly: console type
C-17	8S9816	Paper: .05 mf 400V	35K72310		Cloth grille
C-18	8S9816	Paper: .05 mf 400V	1M8944		Cord, dial: 18 lb. black
C-19	8S9816	Paper: .05 mf 400V	30K21859		Cord, line: 9 ft. long; with plug
C-20	8S9816	Paper: .05 mf 400V	1X72349		Dial Bracket & Slider Assembly: complete; includes dial brackets, pulleys, pulley mounting brackets, slider rail and pointer slider (does not include dial scale and pointer)
C-21	8S9813	Paper: .005 mf 800V	13C71752		Escutcheon, dial (lower) wood
C-22	21R6639	Mica: 500 mmf 500V	13B71753		Escutcheon, dial (upper) wood
C-23	8S9813	Paper: .005 mf 400V	13B70494		Escutcheon, push button: plastic
C-24	8S9816	Paper: .05 mf 400V	5A71081		Eyelet, chassis mounting: 1/4" x 1/4" diameter body; 1/4" diameter head
C-25	8S9813	Paper: .005 mf 800V	5A72771		Grommet, rubber: 1-1/8" O.D. x 3/4" I.D. x 3/8" thick (light shield)
C-26	8S9813	Paper: .005 mf 800V	5A71092		Grommet, rubber, 5/8" x 3/4" diameter (chassis mounting)
C-27	8S9816	Paper: .05 mf 400V	5A70404		Grommet, rubber: gang cushion
C-28	21R6639	Mica: 500 mmf 500V	5A71130		Grommet, rubber: 1/4" x 1/2" diameter body: 3/4" diameter head (chassis retainer)
C-29	23A27718	Electrolytic: 30-30-20 mf/350-300-25V	36K70511		Knob, control: plain
C-30	21R6640	Mica: 200 mmf 500V	36K70513		Knob, control: branded
<u>DIAL LIGHTS</u>			1X76402		Lead Assembly, phono-pick-up: includes plug: 42" long
J-1			1X72505		Lead Assembly, speaker: four conductor: with receptacle
J-2	65X4151	6-8V; bayonet base; type #51	32A24816		Lock, line cord: fibre
<u>COILS</u>			4S7855		Lockwasher, steel: 3/8 internal; cadmium plated (band switch mounting)
L-1			4S1376		Nut, steel: 3/8-32 x 1/2" hex; cadmium plated (band switch mounting)
L-6		Coil Assembly, P.B. Oscillator: See Permeability Tuner Parts List	287051		Nut, steel: 3/8-32 x 9/16" hex; palnut; cadmium plated (volume & tone control mounting)
L-7	24K72495	Loop Assembly, antenna: complete; includes loop, trimmer and lead assembly	9A12705		Plate, electrolytic capacitor mounting: bakelite
L-8	24A70549	S.W. oscillator	28K71775		Plug, 1 pin (on phono pick-up lead)
L-9	24A70548	B.C. oscillator	28K19871		Plug, 4 pin (antenna loop)
L-10	24A70548	S.W. antenna	52A71280		Pointer, dial
<u>RESISTORS</u>			49A23980		Pulley, cord: 1/4" groove (cord guide)
Note:	All resistors are 1/2w insulated type unless otherwise specified.		49A21741		Pulley, cord: 3/8" groove (cord guide)
R-1	6R6032	470,000 1/2w	9A30P80		Receptacle, 3 prong (on phono motor leads)
R-2	6R6056	47,000 1/2w	9K28049		Receptacle, 4 prong: bakelite (loop antenna receptacle)
R-3	6R6090	470 1/2w	5A71246		Rivet, shoulder: 3/8" long; nickel plated (pulley mtg.)
R-4	6R2122	4.7 meg 1/2w	1X72769		Scale, dial: glass; with dial light housing covers and light shields
R-5	6R2122	4.7 meg 1/2w	3S8301		Screw, steel: #2 x 1/2" Phillips' oval head wood screw; antique bronze finish (escutcheon mounting)
R-6	6R3927	2.2 meg 1/2w	3S1312		Screw, steel: #4 x 1-1/8" Phillips oval head wood screw; bronze finish (escutcheon mtg.)
R-7	6R6088	22,000 1/2w N.I.			
R-8	6R6053	1000 1/3w N.I.			
R-9	6R2122	4.7 meg 1/2w			
R-10	18A70068	Volume control: carbon; 1 meg with SPST switch; tapped at 300,000 ohms			
R-11	6R6004	1 meg 1/2w			
R-12	6R5621	10 1/2w			
R-13	6R6012	33,000 1/2w			
R-14	6R6015	220,000 1/2w			
R-15	6R6115	180 1w N.I.			
R-16	6R6015	220,000 1/2w			
R-17	18A70068	Tone control: carbon; 1 meg; with DPDT switch			
R-18	6R6032	470,000 1/2w			
R-19	6R6032	470,000 1/2w			
R-20	6R6075	100,000 1/2w			
R-21	6R6004	1 meg 1/2w			
<u>SPEAKER</u>					
50B72379		Electrodynamic; 10"; 800 ohm field; 3.2 ohm V.C.			

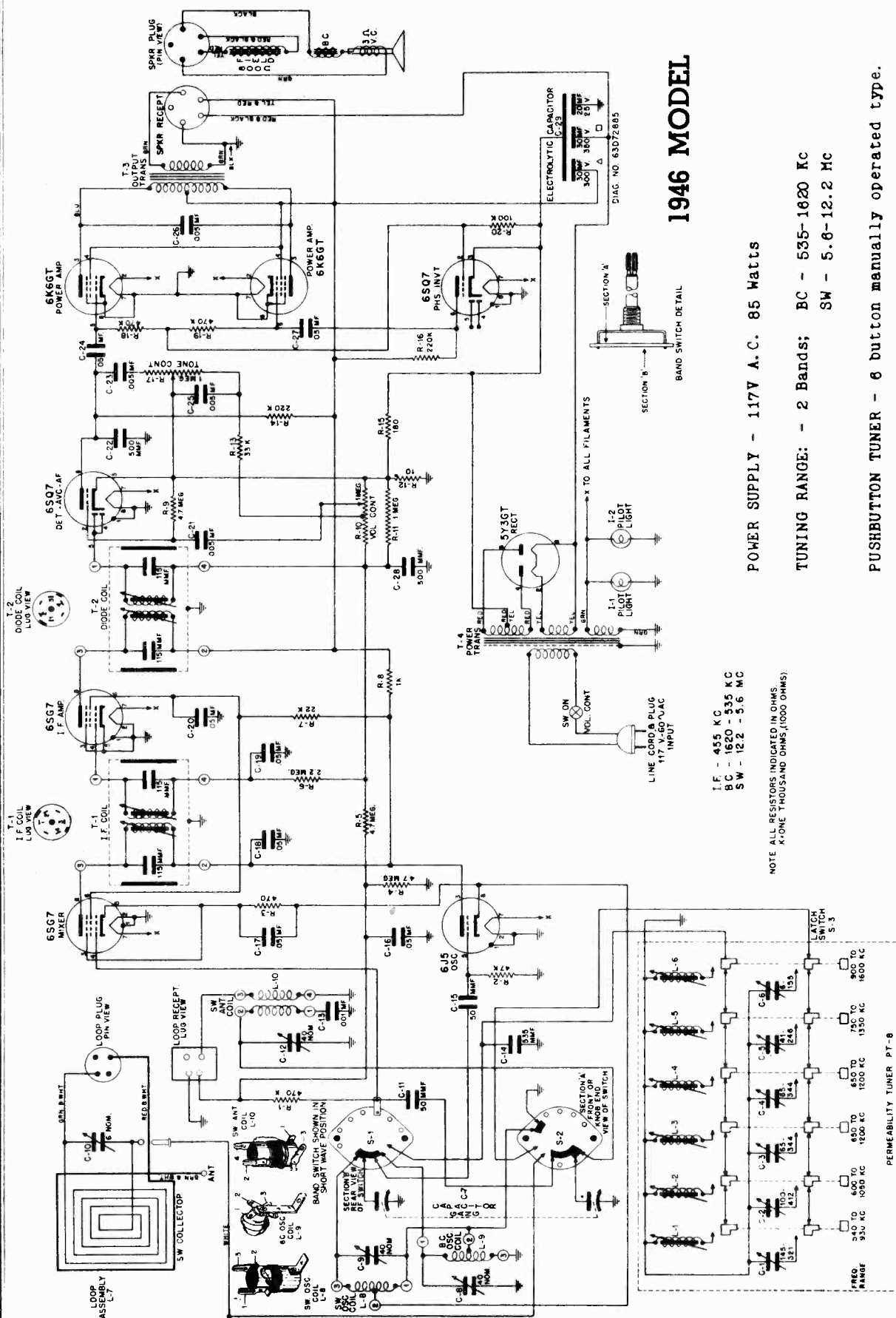
MOTOROLA INC.

MODEL 85F21
MODEL 85K21

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
MISCELLANEOUS (continued)					
3S7534		Screw, steel: #8 x1-3/8" PKA slotted sheet metal screw; cadmium plated (chassis mounting)	C-1 to C-8	20A72336	Capacitor and Mounting Strip Assembly: capacitors not replaceable separately; consist of - C-1, 145-521 mmf; C-2, 100-412 mmf; C-3, 65-344 mmf; C-4, 65-344 mmf; C-5, 41-248 mmf; C-6, 6-155 mmf.
3S7396		Screw, steel: 10-32 x2" slotted hex head machine screw; copper plated (record changer mounting)			
47A71129		Shaft, tuning			
1A71049		Shield & Iron Core Sleeve Assembly (for I.F. or diode transformer)			
9A71290		Socket, pilot light: with bracket			
9A6790		Socket, tube: molded octal; plain type (for all but I.F. amp)			
9A6788		Socket, tube: (replacement) molded octal; plain type (to be used in place of 9A6790 when mounting lugs on chassis break off.			
9A6792		Socket, tube: molded octal; with center shield (for I.F. amp)			
9A70165		Socket, tube: (replacement) molded octal; with center shield (to be used in place of 9A6792 when mounting lugs on chassis break off.)			
41A28190		Spring, cushion: top (record changer mounting)			
41A21807		Spring, cushion: bottom (record changer mounting)			
41A14244		Spring, tension coil (pointer cord)			
41A14111		Spring, tension coil (drive cord)			
31A12847		Strip, terminal: 2 insulated lugs: #3 mounting			
31A22190		Strip, terminal: 4 insulated lugs: #3 ground			
32A27678		Strip, shaft bearing: fibre (for band switch shaft)			
38C70588		Tabs, call letter			
4A21577		Washer, "C" (used on tuning shaft)			
4A71133		Washer, spring (used on tuning shaft)			
PERMEABILITY TUNER					
1X71110		Permeability Tuner PT-8: complete: with 1-7/8" push button shaft (for plastic escutcheon)			
1X72490		Permeability Tuner PT-8: complete: with 2-1/8" push button shaft (for wood escutcheon)			
85K21					
9A70165		Socket, tube: (replacement) molded octal; with center shield (to be used in place of 9A6792 when mounting lugs on chassis break off)			
41A14244		Spring, tension coil (pointer cord)			
41A14111		Spring, tension coil (drive cord)			
31K74933		Strip, terminal: 2 insulated lugs: #3 mounting			
31A71126		Strip, terminal: 3 insulated lugs: #2 ground			
32A27678		Strip, shaft bearing: fibre (for band switch shaft)			
38C70588		Tabs, call letter			
4A21577		Washer, "C" (used on tuning shaft)			
4A71133		Washer, spring (used on tuning shaft)			
PERMEABILITY TUNER					
1X71110		Permeability Tuner PT-8: complete: with 1-7/8" push button shaft			
CAPACITORS					
C-1 to C-8	20A72336	Capacitor and Mounting Strip Assembly: capacitors not replaceable separately; consist of - C-1, 145-521 mmf; C-2, 100-412 mmf; C-3, 65-344 mmf; C-4, 65-344 mmf; C-5, 41-248 mmf; C-6, 6-155 mmf.			
COILS					
L-1	1X72416	Coil Assembly, P.B. Oscillator: 540-930 kc; includes core and clip (brown)			
L-2	1X72417	Coil Assembly, P.B. Oscillator: 600-1050 kc; includes core and clip (red)			
L-3	1X72418	Coil Assembly, P.B. Oscillator: 650-1200 kc; includes core and clip (orange)			
L-4	1X72418	Coil Assembly, P.B. Oscillator: 650-1200 kc; includes core and clip (orange)			
L-5	1X72419	Coil Assembly, P.B. Oscillator: 730-1350 kc; includes core and clip (yellow)			
L-6	1X72420	Coil Assembly, P.B. Oscillator: 900-1600 kc; includes core and clip (green)			
SWITCH					
S-3	40K72342	Switch Assembly, push button: with 2-1/8" push button shaft (for wood escutcheon)			
S-3	40B71105	Switch Assembly, push button: with 1-7/8" push button shaft (for plastic escutcheon)			
MISCELLANEOUS					
	5A70098	Eyelet, steel: 23/64" thick x7/32" I.D. x 1/2" diameter head (tuner mounting)			
	5A70404	Grommet, rubber (tuner mounting)			
	3S8176	Screw, steel: #4 x3/16" PKZ slotted hex head sheet metal screw; cadmium plated (trimmer mounting)			
MISCELLANEOUS					
	5A70098	Eyelet, steel: 23/64" thick x7/32" I.D. x 1/2" diameter head (tuner mounting)			
	5A70404	Grommet, rubber (tuner mounting)			
	3S8176	Screw, steel: #4 x3/16" PKZ slotted hex head; sheet metal screw; cadmium plated (trimmer mounting)			

Prices Subject to Change Without Notice

MODEL 85X21



1946 MODEL

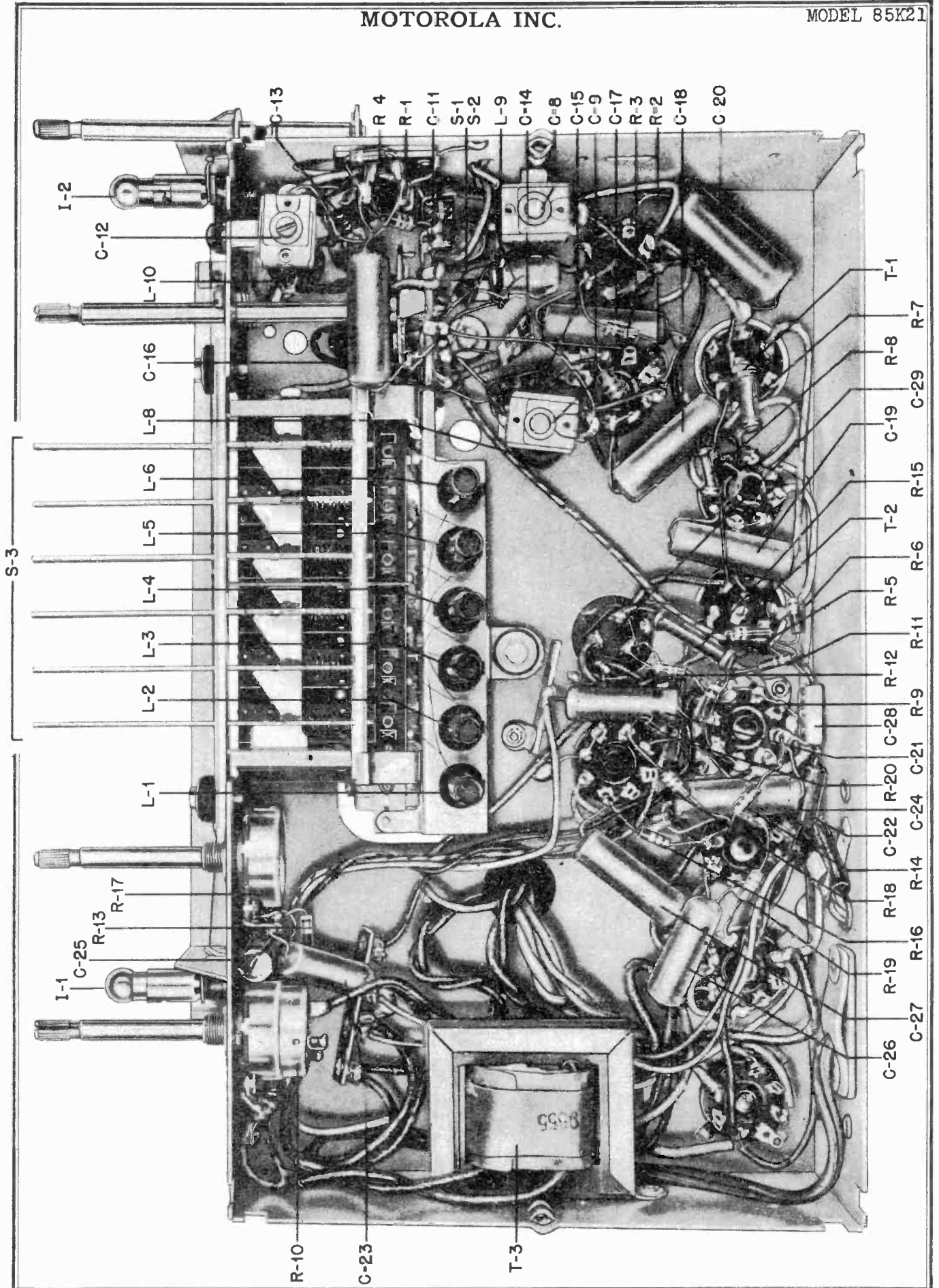
POWER SUPPLY - 117V A.C. 85 Watts
 TUNING RANGE: - 2 Bands; BC - 535-1620 KC
 SW - 5.0-12.2 MC
 PUSHBUTTON TUNER - 6 button manually operated type.

I.F. - 455 KC
 BC - 1620 - 535 KC
 SW - 12.2 - 5.6 MC
 NOTE ALL RESISTORS INDICATED IN OHMS
 K=ONE THOUSAND OHMS, (1000 OHMS)

TYPE - 8 tube phonograph-radio with loop antenna in upright console type cabinet.

TUBE COMPLEMENT - 6S77 Mixer, 6J5 Oscillator, 6S77 I.F. Amplifier, 6S77 Detector, AVC and 1st

A.F. Amplifier, 6S77 Phase Inverter, 2- 6K6GT Power Amplifier and 5Y3GT Rectifier.



MODEL 85K21

REF. NO.	PART NO.	DESCRIPTION
<u>CAPACITORS</u>		
C-1 to C-6		Capacitor and Mounting Strip Assembly, push button tuning; See Permeability Tuner PT-8 Parts List
C-7	1X72363	Variable: 2 gang; with pulley
C-8	20A71140	Mica trimmer: 10-80 mmf
C-9	20A71141	Mica trimmer: 10-80 mmf; includes "L" mtg. bracket
C-10	20A71226	Mica trimmer: 2-12 mmf; includes mtg. bracket
C-11	21R6642	Mica: 50 mmf 500V
C-12	20A71125	Mica trimmer: 10-80 mmf; includes "L" mtg. bracket
C-13	21R2724	Mica: .001 mmf 5% 500V
C-14	21A29020	Silver mica: 535 mmf 3%
C-15	21R6642	Mica: 50 mmf 500V
C-16	8S9816	Paper: .05 mf 400V
C-17	8S9816	Paper: .05 mf 400V
C-18	8S9816	Paper: .05 mf 400V
C-19	8S9816	Paper: .05 mf 400V
C-20	8S9816	Paper: .05 mf 400V
C-21	8S9813	Paper: .005 mf 600V
C-22	21R6639	Mica: 500 mmf 500V
C-23	8S9813	Paper: .005 mf 600V
C-24	8S9816	Paper: .05 mf 400V
C-25	8S9813	Paper: .005 mf 600V
C-26	8S9813	Paper: .005 mf 600V
C-27	8S9816	Paper: .05 mf 400V
C-28	8S9839	Mica: 500 mmf 500V
C-29	23A27718	Electrolytic: 30-30-20 mf/350-300-25V

DIAL LIGHTS

I-1 & I-2	65X4151	6-8V; bayonet base; type #51
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COILS

L-1 to L-6		Coil Assembly, P. B. oscillator; See Permeability Tuner PT-8 Parts List
L-7	24K71287	Loop Assembly, antenna: complete; includes loop, trimmer and lead assembly
L-8	24A70549	S. W. oscillator
L-9	24A70546	B. C. oscillator
L-10	24A70548	S. W. antenna

RESISTORS

Note: All resistors are 1/2w 20% insulated type unless otherwise specified

R-1	6R6032	470,000 1/2w
R-2	6R6056	47,000 1/2w
R-3	6R6090	470 1/2w
R-4	6R2122	4.7 meg 1/2w
R-5	6R2122	4.7 meg 1/2w
R-6	6R3927	2.2 meg 1/2w
R-7	6R6088	22,000 1/2w N. I.
R-8	6R6053	1000 1/3w N. I.
R-9	6R2122	4.7 meg 1/2w
R-10	18A70068	Volume control: carbon; 1 meg; with SPST switch; tapped at 300,000 ohms
R-11	6R6004	1 meg 1/2w
R-12	6R5821	10 1/2w
R-13	6R6012	33,000 1/2w
R-14	6R6015	220,000 1/2w
R-15	6R6116	180 1w N. I.
R-16	6R6015	220,000 1/2w
R-17	18A70087	Tone control: carbon; 1 meg.
R-18	6R6032	470,000 1/2w
R-19	6R6032	470,000 1/2w
R-20	6R6075	100,000 1/2w

SPEAKER

50B72379	Electrodynamic; 10"; 800 ohm field; 3.2 ohm V. C.
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SWITCHES

S-1 & S-2	40A71127	Band selector: three position
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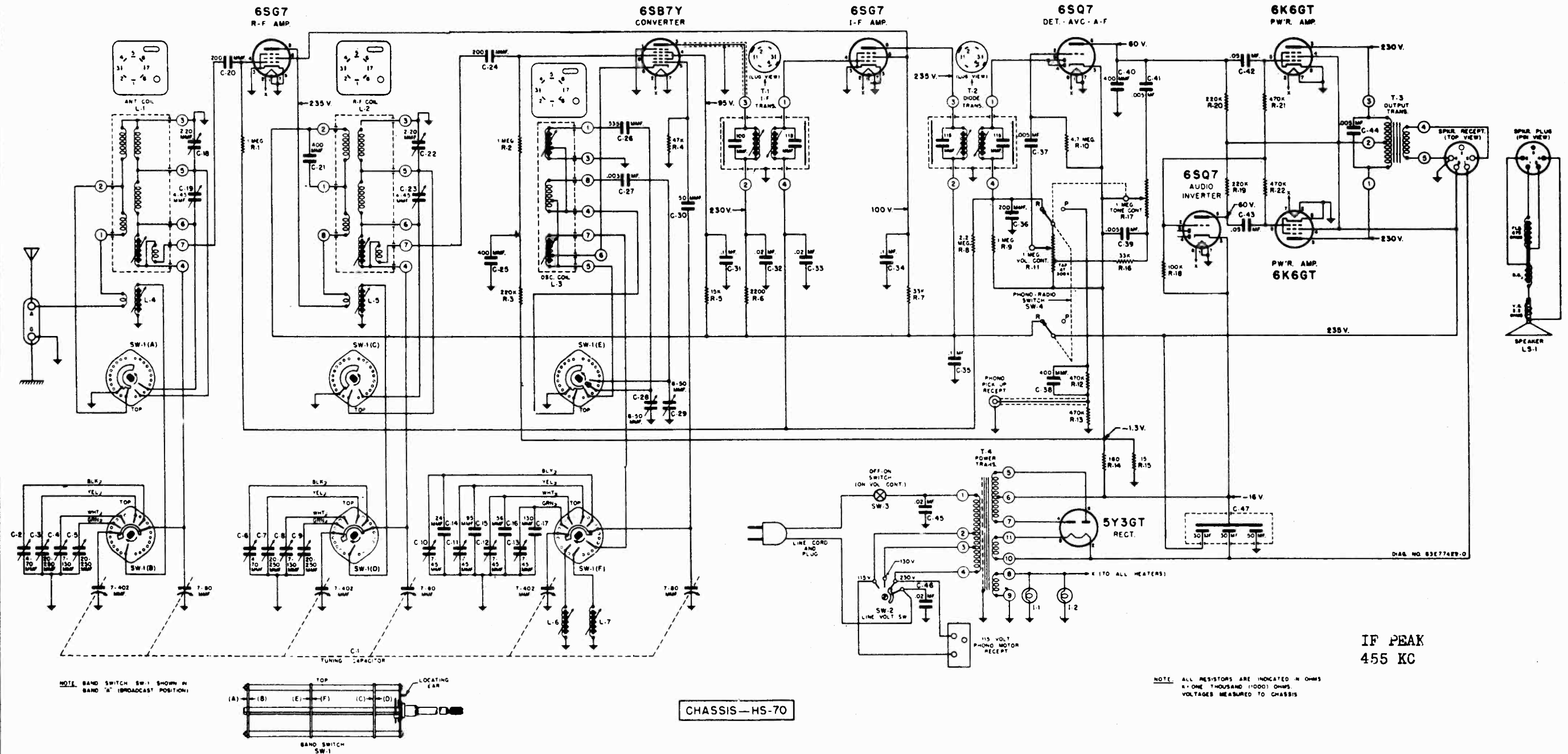
REF. NO.	PART NO.	DESCRIPTION
S-3	--	Switch Assembly, push button: See Permeability Tuner PT-8 Parts List

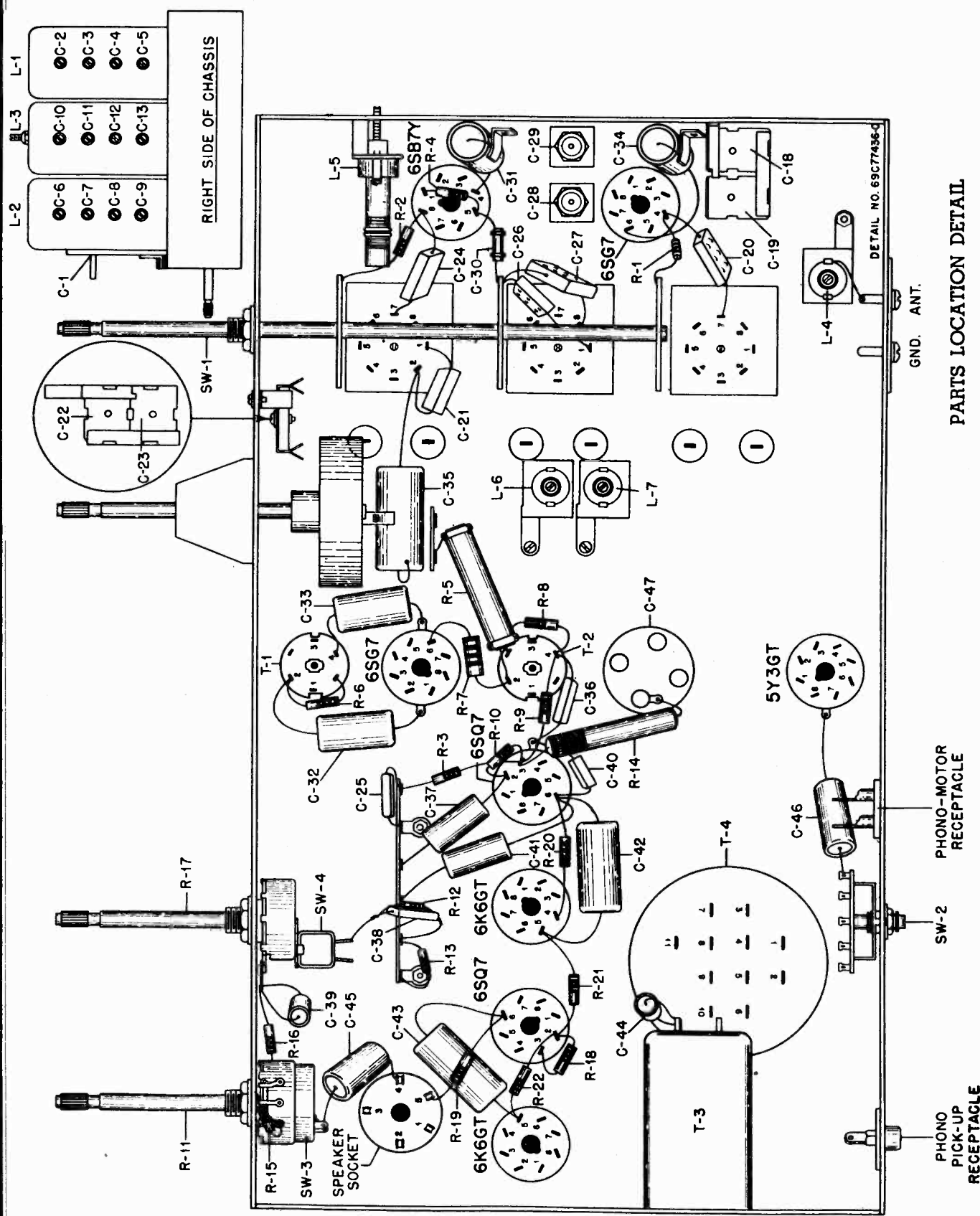
TRANSFORMERS

T-1	24B70545	I. F.: 455 kc; complete with iron cores and padding capacitors, but less shield
T-2	24B70537	Diode: 455 kc; complete with iron cores and padding capacitors, but less shield
T-3	25B27661	Output
T-4	25B28035	Power

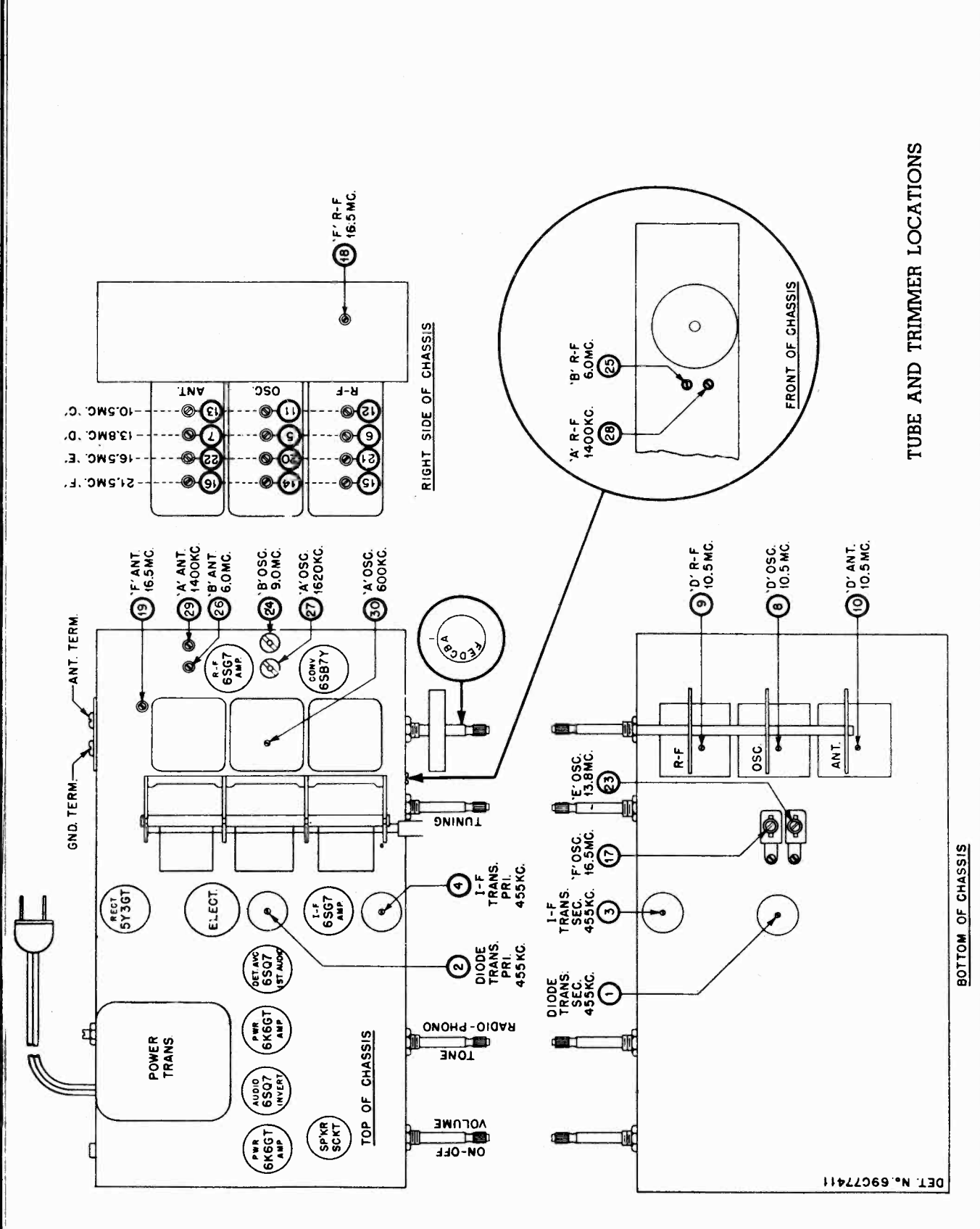
MISCELLANEOUS

36B71139	Button, push: plastic (includes insert spring 41A12993)
16E72317	Cabinet Assembly; console type
35K71223	Cloth grille
11M8944	Cord, dial: 18 lb. black
30K21859	Cord, line: 9 ft. long; with plug
1X72349	Dial Bracket & Slider Assembly: complete; includes dial brackets, pulleys, pulley mounting brackets, slider rail and pointer slider (does not include dial scale and pointer.
13C72362	Escutcheon, dial (lower) plastic
13B72361	Escutcheon, dial (upper) plastic
5A71061	Eyelet, chassis mounting: 1/4" x 1/4" diameter body; 1/4 diameter head doz.
5A72771	Grommet, rubber: 1-1/8" O. D. x 3/4" I. D. x 3/8" thick (light shield)
5A71092	Grommet, rubber: 5/8" x 3/4" diameter (chassis mounting)
5A70404	Grommet, rubber: gang cushion
5A71130	Grommet, rubber: 1/4" x 1/2" diameter body; 3/4" diameter head (chassis retainer)
36K72889	Knob, control: plain
36K72890	Knob, control: branded
1X72364	Lead Assembly, speaker: four conductor; with receptacle
32A24815	Lock, line cord: fibre
4S7855	Lockwasher, steel: 3/8 internal; cadmium plated (band switch mounting)
4S1376	Nut, steel: 3/8-32 x 1/2" hex; cadmium plated (band switch mounting)
2S7051	Nut, steel: 3/8-32 x 9/16" hex; palnut; cadmium plated (volume & tone control mounting)
9A12705	Plate, electrolytic capacitor mounting: bakelite
28K19871	Plug, 4 pin (antenna loop)
52A71280	Pointer, dial
49A21741	Pulley, cord: 3/8" groove (cord guide)
9K28049	Receptacle, 4 prong: bakelite (loop antenna receptacle)
5A71246	Rivet, shoulder: 3/8" long; nickel plated (pulley mtg.)
1X72769	Scale, dial: glass; with dial light housing covers and light shields
3S1312	Screw, steel: #4 x 1-1/8 Phillips oval head wood screw; bronze finish (escutcheon mtg.)
3S7534	Screw, steel: #8 x 1-3/8" PKA slotted sheet metal screw; cadmium plated (chassis mounting)
47A71126	Shaft, tuning
1A71049	Shield & Iron Core Sleeve Assembly (for I. F. or diode transformer)
9A71290	Socket, pilot light: with bracket
9A6790	Socket, tube: molded octal; plain type (for all but I. F. amp)
9A6788	Socket, tube: (replacement) molded octal; plain type (to be used in place of 9A6790 when mounting lugs on chassis break off)
9A6792	Socket, tube: molded octal; with center shield (for I. F. amp)

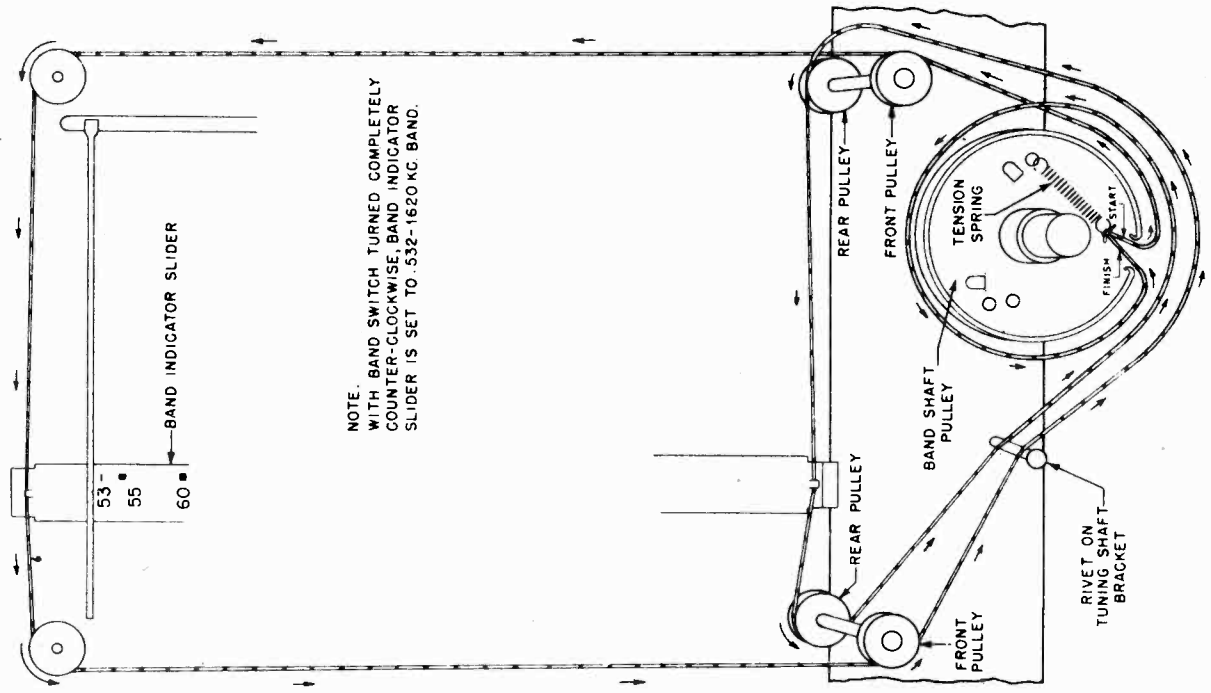




PARTS LOCATION DETAIL



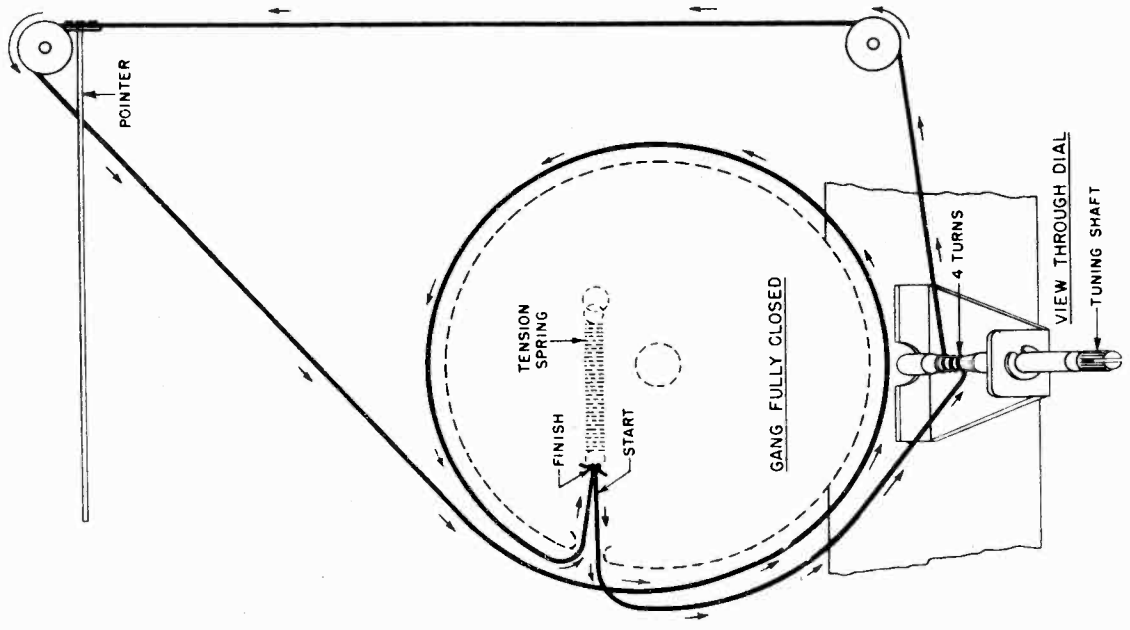
TUBE AND TRIMMER LOCATIONS



NOTE.
 WITH BAND SWITCH TURNED COMPLETELY
 COUNTER-CLOCKWISE, BAND INDICATOR
 SLIDER IS SET TO .532-1620 KC. BAND.

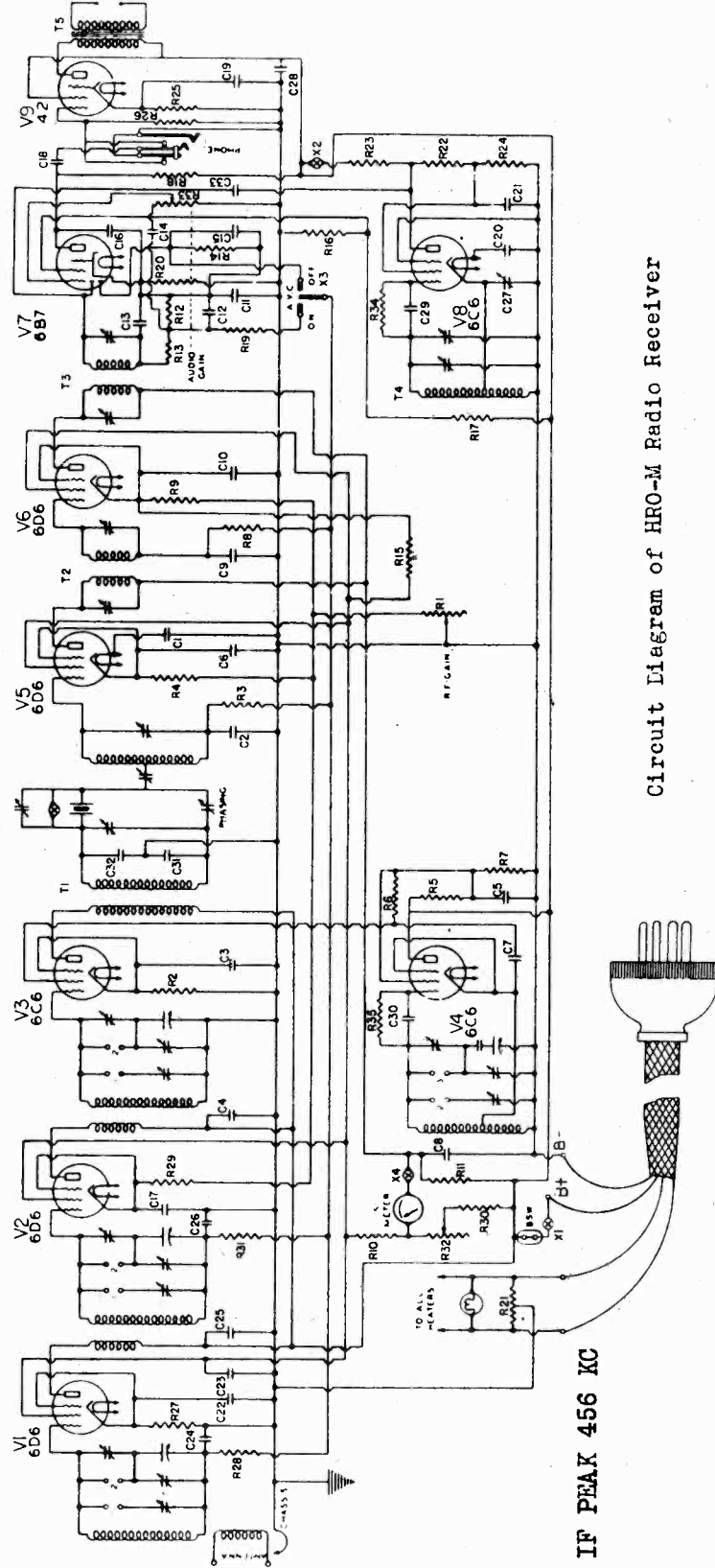
STRING DRIVE DETAIL

BAND INDICATOR SLIDER CORD DETAIL



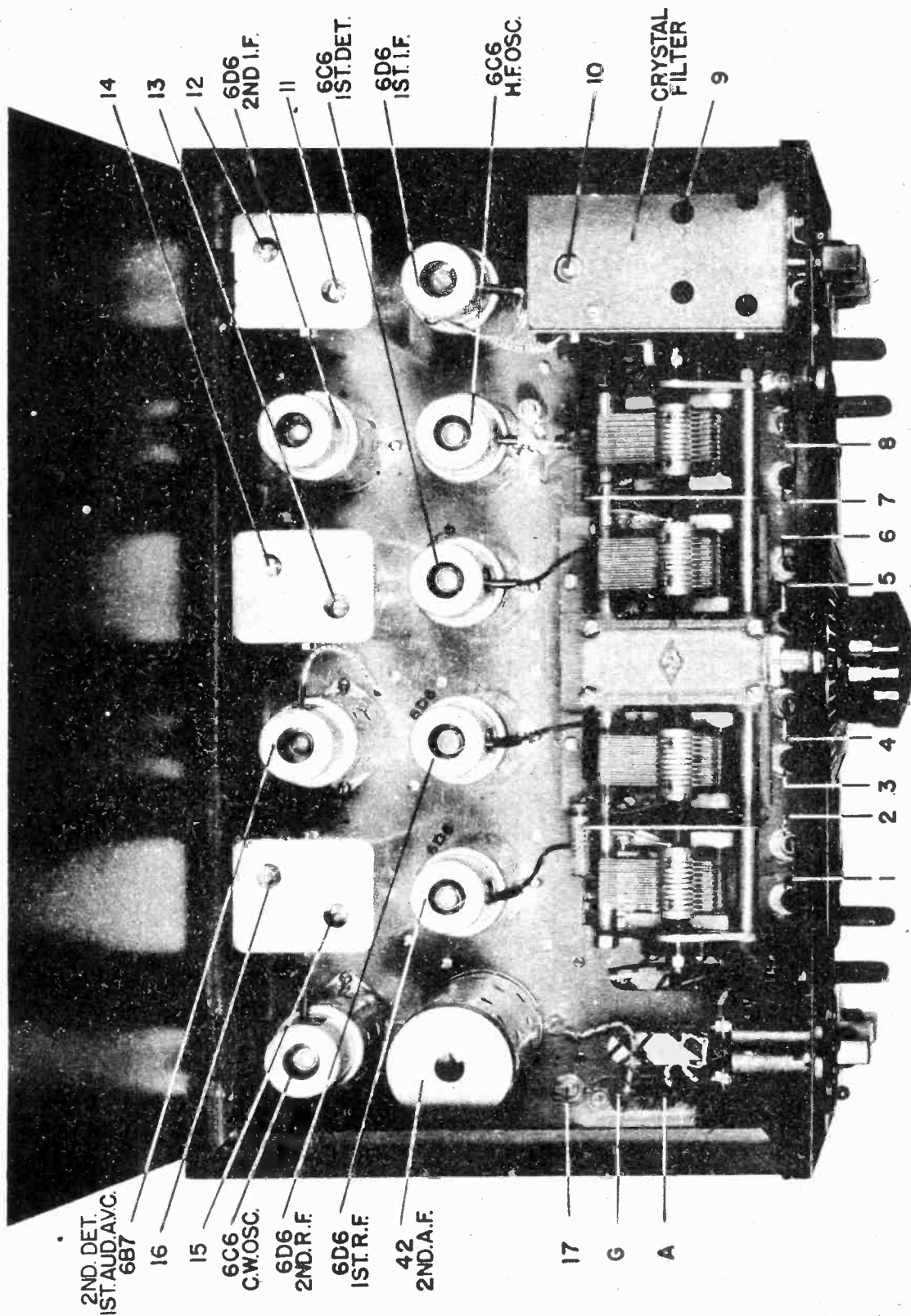
POINTER AND DRIVE CORD DETAIL

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
C-1	20A76478	Capacitor, variable: 3 gms; each gang section consists of 4 plate (7-80 mfr.) and 21 plate (7-402 mfr.) sections	L-5	1X76727	mounting bracket	8W-2	40A76621 or 40A76637	Switch, line voltage; single pole, 3 position
C-2	20A76734	Capacitor, trimmer: mica; 4-70 mfr. (20A7668) on same bracket as C-3, C-4 & C-5; not replaceable separately	L-6	1X76728	Coll. shunt: red dot coding; complete with tuning core and mounting bracket	8W-3		Switch, S.P.S.T.; part of volume control R-11 (power on-off switch)
C-3	20A76734	Capacitor, trimmer: mica; 20-260 mfr. (20A76671) on same bracket as C-2, C-4 and C-5; not replaceable separately	L-7	1X76728	Coll. shunt: band #5 oscillators; green dot coding; complete with tuning core and mounting bracket	8W-4		Switch, D.P.D.T.; part of tone control R-17 (radio-telephone switch)
C-4	20A76734	Capacitor, trimmer: mica; 7-130 mfr. (20A76669) on same bracket as C-2, C-3 & C-5; not replaceable separately	R-1	6R6004	Resistor, fixed: carbon; 1 megohm 1/2w ins.	T-1	24B76695	Transformer, I.F.: 455 Kc; complete with iron cores and padding capacitors, but less shield
C-5	20A76734	Capacitor, trimmer: mica; 20-260 mfr. (20A76671) on same bracket as C-2, C-3 & C-4; not replaceable separately	R-2	6R6004	Resistor, fixed: carbon; 1 megohm 1/2w ins.	T-2	24B76657	Transformer, diode; 455 Kc; complete with iron cores and padding capacitors, but less shield
C-6	20A76734	Capacitor, trimmer: mica; 7-130 mfr. (20A76669) on same bracket as C-2, C-3 & C-5; not replaceable separately	R-3	6R6015	Resistor, fixed: carbon; 220,000 ohms 1/2w ins.	T-3	25B76785	Transformer, output
C-7	20A76734	Capacitor, trimmer: mica; 20-260 mfr. (20A76671) on same bracket as C-2, C-3 & C-4; not replaceable separately	R-4	6R6056	Resistor, fixed: carbon; 47,000 ohms 1/2w ins.	T-4	25C76665	Transformer, power
C-8	20A76734	Capacitor, trimmer: mica; 7-130 mfr. (20A76669) on same bracket as C-2, C-3 & C-5; not replaceable separately	R-5	6R6308	Resistor, fixed: carbon; 15,000 ohms 10% 3/4 W.I.		7476983	Bracket, tuning shaft: with cord guiding shoulder rivet
C-9	20A76734	Capacitor, trimmer: mica; 20-260 mfr. (20A76671) on same bracket as C-2, C-3 & C-4; not replaceable separately	R-6	6R6280	Resistor, fixed: carbon; 2200 ohms 1/2w ins.		16A77287	Cabinet, table model
C-10	20A76490	Capacitor, trimmer: mica; 7-45 mfr.	R-7	6R5788	Resistor, fixed: carbon; 33,000 ohms 10% 24 ins.		30K21859	Cord, line: 9 ft. long; with plug
C-11	20A76490	Capacitor, trimmer: mica; 7-45 mfr.	R-8	6R5927	Resistor, fixed: carbon; 2.2 megohms 1/2w ins.		5471092	Grommet, rubber; 5/8 x 3/4 dia. (chassis mounting)
C-12	20K76940	Capacitor, trimmer: ceramic; 7-45 mfr.	R-9	6R6004	Resistor, fixed: carbon; 1 megohm 1/2w ins.		5471130	Grommet, rubber; 1/4 x 1/2 dia. body; 3/4 dia. head (chassis retainer)
C-13	20K74940	Capacitor, trimmer: ceramic; 7-45 mfr.	R-10	6R2122	Resistor, fixed: carbon; 4.7 megohms 1/2w ins.		5476629	Grommet, rubber (dial scale cushion)
C-14	21A76687	Capacitor, fixed: ceramic; 24 mfr 500V	R-11	18K76685	Resistor, variable: 1 megohm; tapped at 300,000 ohms; includes on-off switch 9w-3		37K15125	Grommet, rubber (6mm cushions)
C-15	21A76689	Capacitor, fixed: ceramic; 95 mfr 500V	R-12	6R6377	Resistor, fixed: carbon; 470,000 ohms 10% 1/2w ins.		5476980	Grommet, rubber (speaker mounting)
C-16	21A76688	Capacitor, fixed: ceramic; 55 mfr 500V	R-13	6R6377	Resistor, fixed: carbon; 470,000 ohms 10% 1/2w ins.		1476979	Indicator, band: with slider at each end
C-17	21A76680	Capacitor, fixed: ceramic; 130 mfr 500V	R-14	6R3986	Resistor, fixed: carbon; 160 ohms 10% 1/2w ins.		14476898	Insulator, electrolytic capacitor
C-18	20A76613	Capacitor, trimmer: mica; 2-20 mfr; on same bracket as C-19; not replaceable separately	R-15	6R2034	Resistor, fixed: carbon; 15 ohms 10% 1/2w ins.		36K76796	Knob, control; plain
C-19	20A76613	Capacitor, trimmer: mica; 4-46 mfr; on same bracket as C-18; not replaceable separately	R-16	6R6012	Resistor, fixed: carbon; 33,000 ohms 1/2w ins.		62A76916	Pointer, dial
C-20	20A6997	Capacitor, fixed: mica; 200 mfr 10% 500V	R-17	18K76686	Resistor, variable: 1 megohm; includes phone-radio switch 9w-4		9A22182	Receptacle, plug: 1 prong
C-21	21R6664	Capacitor, fixed: mica; 400 mfr 10% 500V	R-18	6R6031	Resistor, fixed: carbon; 100,000 ohms 10% 1/2w ins.		9A27674	Receptacle, plug: 3 prong
C-22	20A76614	Capacitor, trimmer: mica; 2-20 mfr; on same bracket as C-25; not replaceable separately	R-19	6R6015	Resistor, fixed: carbon; 220,000 ohms 1/2w ins.		34D76915	Scale, dial: glass



Circuit Diagram of HRO-M Radio Receiver

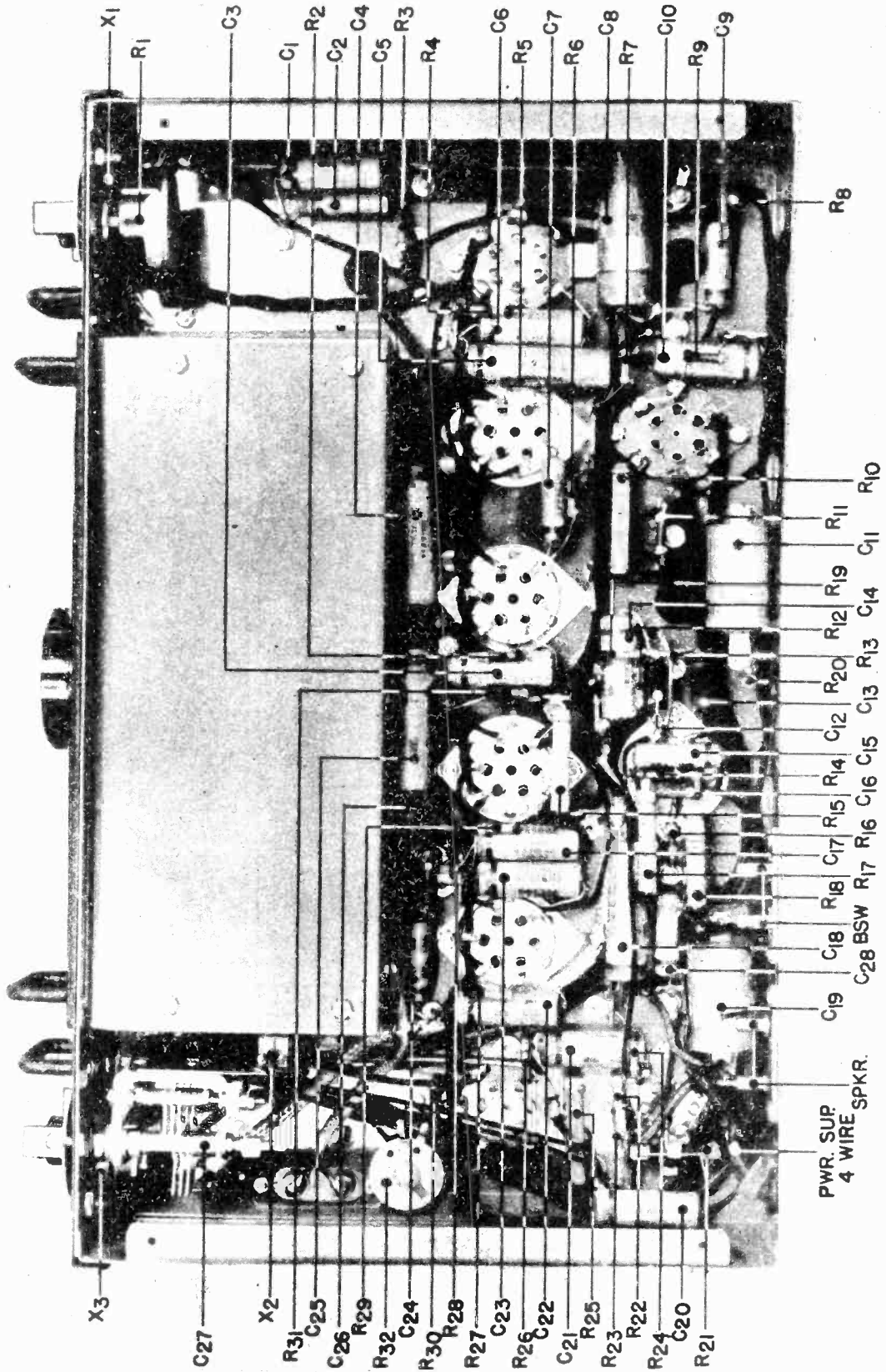
IF PEAK 456 KC



Top View of HRO-M Radio Receiver

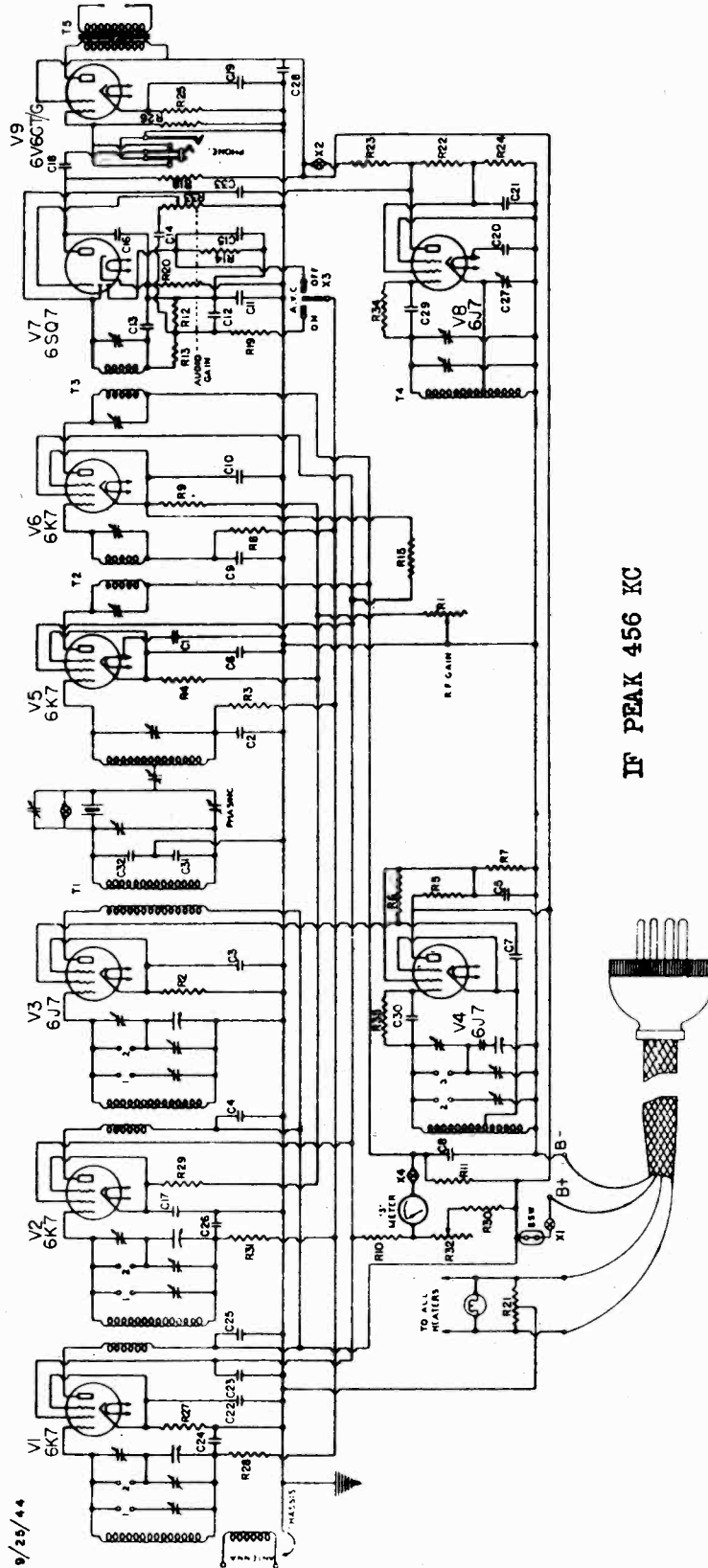
NATIONAL COMPANY, INC.

MODELS HRO-M, HRO-MX,
HRO-M-RR, HRO-M-TM



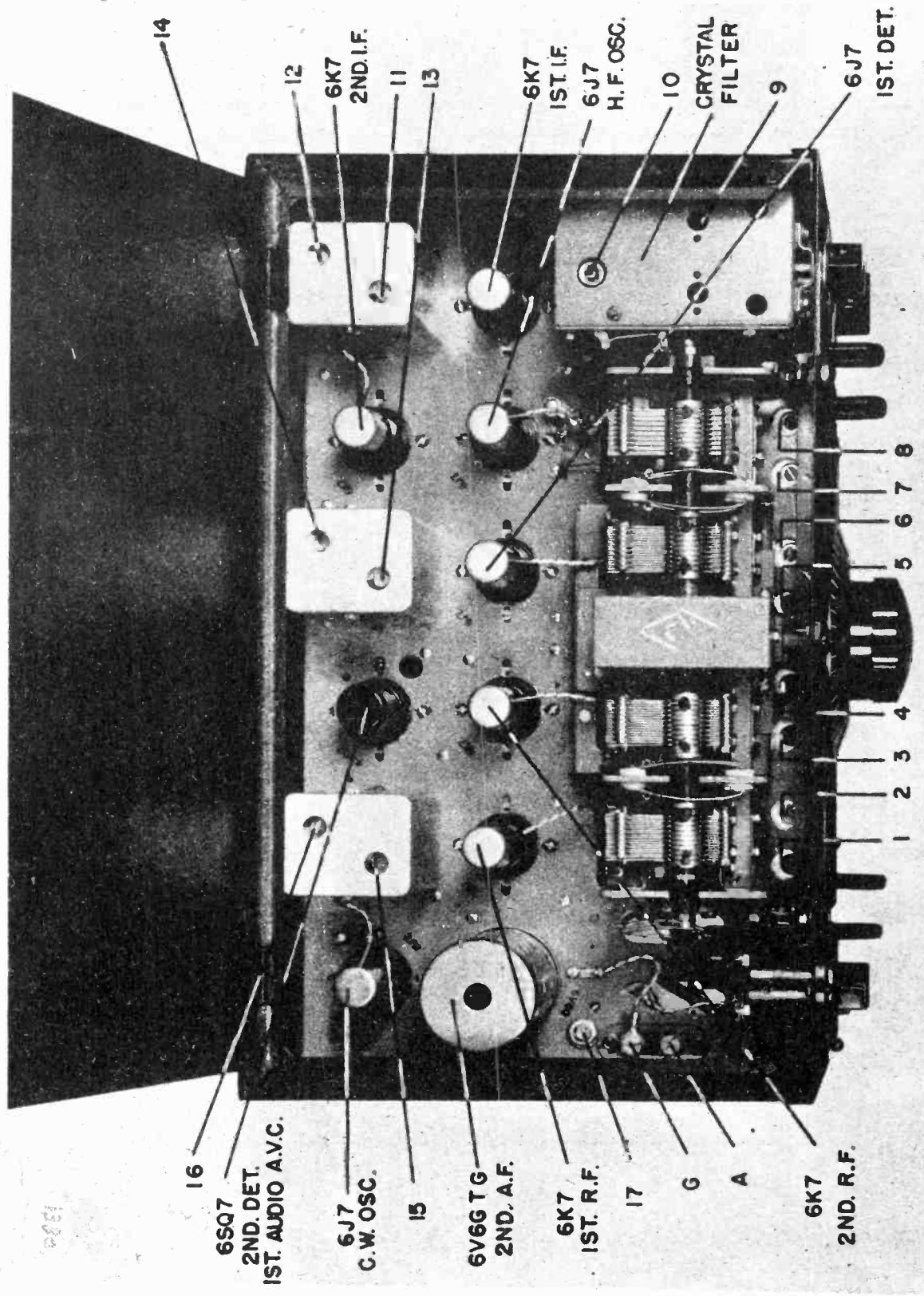
Bottom View of HRO-M Radio Receiver

SCHEMATIC DIAGRAM FOR HRO-5 RADIO RECEIVER

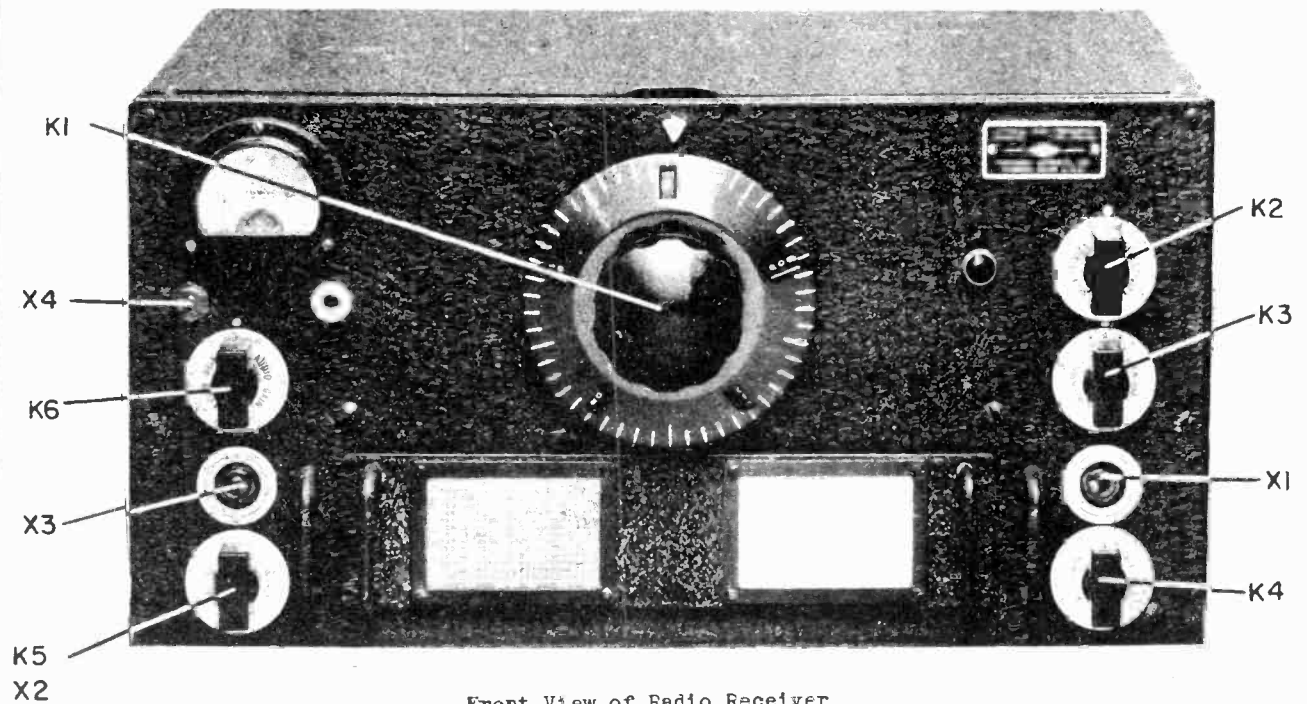


IF PEAK 456 KC

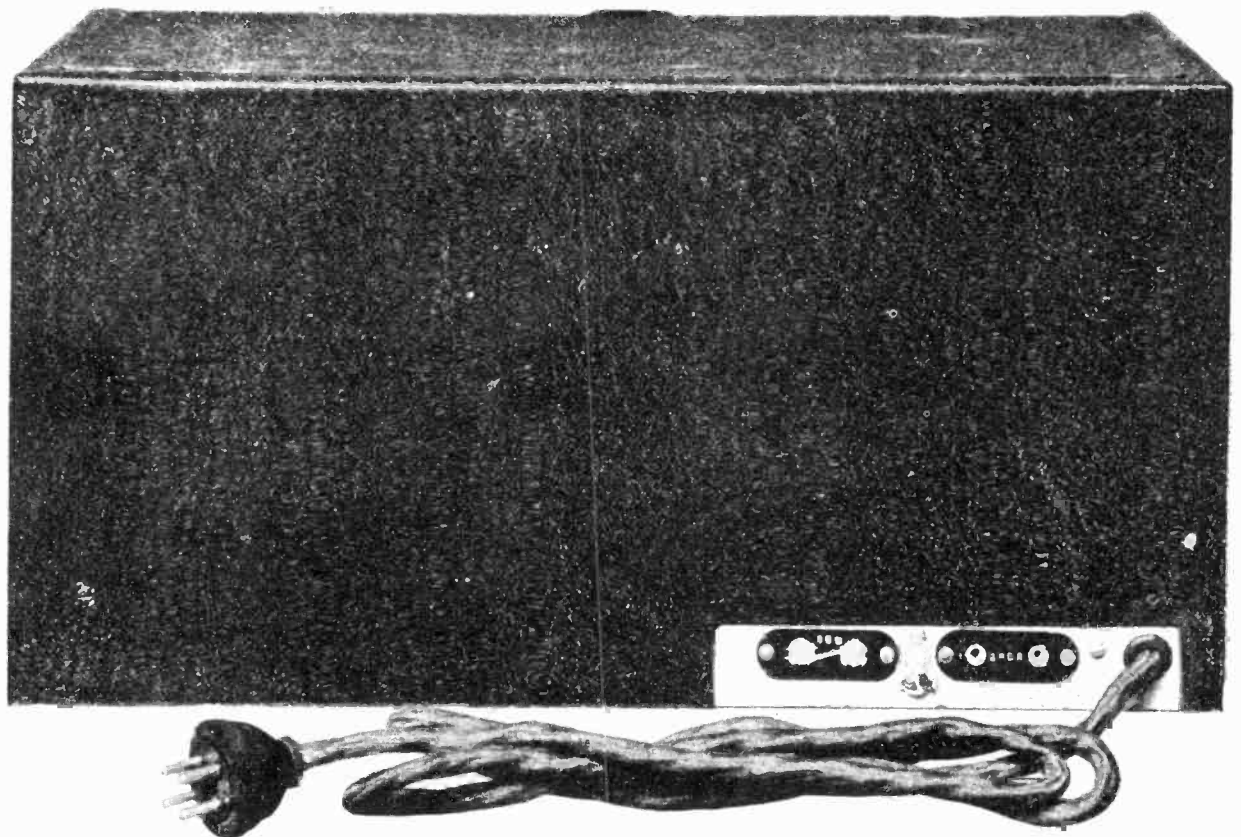




Top View of HRO-5 Radio Receiver



Front View of Radio Receiver



Rear View of Radio Receiver

RECEIVER

The HRO-5 Radio Receiver is a high-frequency superheterodyne suitable for C.W. and left-hand side of the receiver. Normally, the plate circuit of the output tube is M.C.W. reception throughout the frequency range of 50 to 430 Kcs., and 480 to 30,000 brought directly to these tip jacks and a separate permanent magnet type loud speaker Kcs. This range of frequencies is covered in nine bands as follows:

- 50 - 100 KC. Band. Type J Coil Set
- 100 - 200 KC. Band. Type H Coil Set
- 180 - 430 KC. Band. Type G Coil Set
- 480 - 960 KC. Band. Type F Coil Set
- 900 - 2050 KC. Band. Type E Coil Set
- 1.7 - 4.0 MC. Band. Type JD Coil Set
- 3.5 - 7.3 MC. Band. Type JC Coil Set
- 7.0 - 14.4 MC. Band. Type JB Coil Set
- 14.0 - 30.0 MC. Band. Type JA Coil Set

The receiver may be obtained in either table or rack mounting models. Plug-in coil set Types JA, JB, JC, and JD are normally supplied with the receiver, and coil set Types E, F, G, H, and J may be obtained in addition, as desired. The receiver is designed for use with an external power unit capable of supplying 240 volts D. C. at 70 milliamperes and 6.2 volts A. C. at 3.4 amperes, although lower plate supply voltages down to 135 volts may be used with some sacrifice in performance.

The circuit employed on all bands comprises two tuned stages of radio frequency amplification, a tuned first detector stage, a high frequency oscillator employing a tube separate from the first detector tube, a first intermediate frequency amplifier stage employing a crystal filter, a conventional second intermediate frequency amplifier stage operating at 456 kilocycles, a combined second detector - automatic volume control - first audio stage, an audio output stage, and a beat frequency oscillator coupled to the second detector to provide for C.W. reception.

The antenna input circuit is suitable for use with a transmission line, a doublet antenna, or a single wire antenna. The antenna input impedance averages approximately 500 ohms at frequencies higher than 1700 Kc.

Two audio output circuits are provided:

- (1) Loud speaker terminals, in the form of tip jacks, are located at the rear

(2) A phone jack is mounted on the front panel. This jack is wired into the output of the first audio stage. When the phones are plugged in, the signal input to the last tube is completely disconnected.

The crystal filter located in the first intermediate amplifier stage provides a convenient means of obtaining adjustable selectivity when receiving any frequency in the tuning range of the receiver. The PHASING control associated with the crystal filter enables the operator to easily suppress interfering signals which may produce objectionable heterodynes. The crystal filter may be used advantageously in either C.W. or M.C.W. reception.

Automatic volume control and an associated signal strength meter are provided for use in M.C.W. reception.

The tubes employed in the HRO- Radio Receiver are located in the circuit as follows:

	HRO-M	HRO-5
First R.F.	6D6	6K7
Second R.F.	6D6	6K7
First Detector	6C6	6J7
High Frequency Oscillator	6C6	6J7
First I.F.	6D6	6K7
Second I.F.	6D6	6K7
Diode Detector, AVC, First Audio	6B7	6SQ7
Second Audio	42	6V6GT/G
Beat Frequency Oscillator	6C6	6J7

B. POWER UNIT.

Power units for operation from 230 A.C., 115 volts A.C., 6 volts D.C., or 12 volts D.C. are available for use with the HRO-5 Receiver.

These power units may be obtained in either rack or table mounting styles.

Special connections in the vacuum tube heater circuits located within the receiver are required for operation from a 12 volt D.C. source.

In all cases the circuit of the power unit consists of a transformer (with vibrator for D.C. models), a rectifier, and filter circuits.

C. LOUD SPEAKER

Loud Speakers in rack or table mounting styles can be supplied for use with the HRO-5 Radio Receiver. Normally the speaker is of the permanent magnet type and the transformer should have an input impedance of 5000 to 7000 ohms. The speaker transformer carries the plate current of the Receiver output tube. In installations where an output transformer is included within the Receiver, the speaker transformer must of course match the Receiver output impedance. A dynamic speaker may be used, although a means for the speaker field excitation must be provided.

INSTALLATION.

The receiver, power unit, and loud speaker may be arranged in any desired positions although it is not recommended that the loud speaker be placed on top of the receiver as in some cases undesirable microphonic noises may result.

The audio power output terminals are located at the rear left-hand side of the receiver. Phone tips on the loudspeaker cable and tip jacks mounted on the receiver chassis provide a convenient means for connecting the loud speaker to the receiver. Connect the loud speaker to these terminals, or if no speaker is to be used, insert a jumper in the tip jacks to connect them together. If this precaution is neglected, the output tube may be damaged due to excessive screen current.

Insert the receiver power plug in the power socket of the power unit. Connect the power unit to the proper supply source.

The radio frequency input circuit of the HRO-5 Receiver is arranged for operation with either single-wire or doublet type of antenna. There are two R.F. input binding posts located at the left-hand end of the receiver. When using a single-

wire antenna, connect the lead-in to the binding post nearest the front panel and clamp the short flexible lead, which is connected to the chassis, under the remaining binding post. An external ground connection may or may not be necessary, depending upon the particular installation. When a doublet antenna is used, connect the antenna feeders or a balanced transmission line directly to the input terminals and do not use the flexible ground connection mentioned above.

The radio frequency upon which reception is desired will determine the coil set to employ, in accordance with the individual charts on each coil set panel. Select the proper coil set and plug it into the opening in the front of the receiver.

The receiver is now ready for use. Turn the receiver on by means of the toggle switch located on the power unit. Complete the receiver B+ circuits by means of the toggle switch located on the receiver front panel directly above the R.F. GAIN control. A pair of terminals at the rear of the receiver chassis is wired to the B+ switch on the front panel. These terminals provide a convenient means of connecting a relay or switch for remote control of the B+ circuits.

For further instructions refer to the section of this book entitled Operating Instructions.

CIRCUIT DESCRIPTION.**A. SPECIAL FEATURES.**

Several special features have been included in the HRO-5 Radio Receiver which result in high quality performance. These special features provide receiver characteristics which enable the operator to adjust the receiver for optimum reception under a variety of receiving conditions.

The radio frequency amplifier stages are so designed that the receiver gain is essentially uniform throughout the tuning range of the receiver. The impedance of a typical R.F. tuned secondary circuit decreases as the L/C ratio decreases, thus tending to reduce stage gain as the low frequency end of the tuning band is approached. Compensation for this effect is obtained by the use of high inductance primary coils in the interstage R.F. transformers. The high inductance primary is designed so that the primary circuit, as a whole, resonates broadly at a frequency outside the low frequency limit of the coil set tuning range. The primary circuit will, therefore, show increasing impedance as the tuning of the receiver approaches the low frequency end of the band. This resonant characteristic of the primary increases gain

at low frequencies, over-compensating for the decreasing impedance of the secondary. In order to obtain the proper amount of compensation, a small coupling capacity is placed between the plate of the preceding tube and the grid of the following tube. This capacity is most effective at the higher frequency end of the band and combined with the resonant characteristic of the primary provides uniform gain throughout the band.

A slightly different arrangement for gain compensation is employed in the 14-30 Mc. band. The interstage R.F. coupling transformers have three windings all closely coupled together. The primary winding connected in the plate circuit of the first R.F. tube is interwound with the tuned secondary winding and both have approximately the same number of turns. A third winding which feeds the control grid of the following R.F. amplifier tube is so designed that its natural period (or resonant frequency) falls just outside the low frequency end of the frequency band covered by the coil set. The impedance of this resonant secondary increases as the low frequency end of the tuning band is approached, thus tending to compensate for the unfavorable L/C ratio of the tuned secondary in much the same manner as the resonant primary system used in other coil sets. The self resonant secondary arrangement is preferable, in the 14-30 Mc. band, as the resonant primary system is inadequate in its levelling action. It is not practical to include any gain compensation system in the coil sets for the 50 to 100 Kc. band.

The plug-in coil sets regularly supplied with the HRO-5 Radio Receiver do not have any provision for band spread. Coil sets can be supplied which include the band spread feature, if desired. Band spread is accomplished by switching small capacitors in series with each section of the main tuning capacitor thus reducing its effective range of capacity change. This system provides band spread of the frequencies received at the high frequency end of each coil set tuning range. The frequency bands chosen for band spread are those of the 10, 20, 40, and 80 meter amateur bands. Coil sets which contain the band spread feature are designated as Type A, B, C and D rather than JA, JB, JC and JD.

The receiver is compensated for frequency drift due to temperature changes occurring in circuits which may detune the receiver from the desired signal. While variations in room temperature are usually so gradual that drift resulting from this source is not objectionable, it is minimized through the use of air dielectric trimmer and tuning condensers, and the use of coil form material which has a small temperature coefficient. The cause of most objectionable frequency drift is the change of inductance

of the high frequency oscillator coil as the interior of the receiver is heated by the tubes. To minimize heating the R.F. coils, the receiver is designed so that the coil sets are plugged into the very bottom of the receiver, underneath the chassis in a separate shielded compartment. The heat from the tubes will of course rise toward the top of the receiver and the R.F. coils will remain nearly at room temperature.

A Crystal Filter is included in the HRO-5 Radio Receiver as a means of providing adjustable selectivity. The use of the Crystal Filter also enables the operator to easily suppress an interfering signal by means of the PHASING control. With the Crystal Filter switch in the off position the receiver band width is approximately 3 Kc., at two times down. Switching the Crystal Filter into the circuit gives a band width of approximately 2.5 Kc. in the broad position and about 200 cycles in the sharp position of the SELECTIVITY control. The PHASING control can be adjusted to suppress interfering signal frequencies differing from the desired signal frequency by 300 cycles or more. The Crystal Filter employs a bridge type circuit which makes use of the high rate of reactance change with changes in frequency provided by a crystal to give the desired sharpness of selectivity. The reactance vs. frequency characteristic of the crystal is modified by damping, or loading the crystal by means of the tuned input circuit. When the input circuit is detuned, its effective resistance decreases and damping is greatly reduced, producing maximum selectivity. Detuning the input circuit does not materially affect the amplification of the receiver at the resonant frequency of the crystal since the series impedance of the circuit becomes very low when damping is reduced.

Automatic volume control is provided for use only with M.C.W. reception. When the beat oscillator is turned on for C.W. reception it provides sufficient signal to operate the A.V.C. system and renders the receiver extremely insensitive.

A beat oscillator, which operates at or near the intermediate frequency is coupled to the second detector. The signal from this oscillator and the desired C.W. signal heterodyne at the second detector and produce an audio beat note thus providing a means for C.W. reception.

The main tuning dial located at the center of the front panel permits swift, accurate tuning and precise logging. This type of dial has an effective scale length of twelve feet and is direct reading to one part in 500. The dial drives the four-band main tuning capacitor through a worm drive having a reduction ratio of 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.

OPERATING INSTRUCTIONS

A. CONTROLS.

The main tuning dial is located at the center of the front panel. The dial is so arranged that the frequency to which the receiver tunes increases as the dial reading increases. Each coil set is fitted with a calibration chart showing the relationship between dial reading and frequency. An additional chart for band spread calibration is provided on coil sets which include the band spread feature. Observation of each coil set tuning chart will show that the calibration is very nearly linear which characteristic eliminates considerable reference to the coil charts.

The R.F. GAIN control is located at the lower right-hand corner of the front panel and 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, or 10, on its circular scale. In this position all tubes are operating at maximum gain with minimum bias. As the control is turned counter-clockwise, increasing bias is applied to the second R.F., the first I.F., and the second I.F. tubes, thus reducing their amplification.

Directly above the R.F. GAIN control is a two position toggle switch. This switch is connected in the positive lead of the power supply circuit and its purpose is to shut off the receiver during periods of transmission OR WHEN CHANGING COIL SETS. This last function is important. The B+ circuits are complete when this switch is pushed to the right. Series connected 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.

Immediately above the B+ switch is the PHASING control and the Crystal Filter switch. When this control is rotated to 0, the Crystal Filter is disconnected. When the control is at any other setting between 1 and 10, it acts as a PHASING control with the Crystal Filter connected in the circuit. The PHASING control is used to balance the crystal bridge circuit in eliminating interfering signals.

The SELECTIVITY control is located above the PHASING control. With the Crystal Filter in use, minimum selectivity will be found with the pointer nearly vertical where receiver background noise is a maximum. Rotating the knob in either direc-

tion from this point will progressively increase selectivity. When the filter is not in use, this knob acts as an ordinary I.F. trimmer and should be set at the point giving maximum volume and sensitivity.

The C.W. OSC. switch and vernier tuning control is located at the lower left-hand side of the front panel. The C.W. oscillator is used to obtain an audible beat note when receiving C.W. signals or to locate the carrier of a weak M.C.W. station. Rotating the C.W. OSC. knob in a clockwise direction switches B+ voltage to the plate and screen of the C.W. oscillator tube. Further rotation of the knob from 0 on the scale to 10 varies the frequency over a range of approximately 3 kc. The C.W. oscillator tunes to the intermediate frequency at 9 on the scale.

The automatic volume control switch is located above the C.W., OSC. control. The automatic volume control circuits are in operation when the toggle switch is pushed to the left.

The AUDIO GAIN control is located directly above the AVC-MVC switch. Clockwise rotation of this control increases the signal applied to the triode section of the first audio tube. This control adjusts the volume level of the signal at both phone jack and loudspeaker terminals.

The S-meter for indicating carrier intensity or signal strength is in the upper left-hand corner. Just below it, and to the left, is a switch which connects the S-meter in the circuit.

The phone jack is located just below and slightly to the right of the S-meter. When a phone plug is inserted into the phone jack, the loud speaker is automatically silenced.

Inspection of the coil set terminal panels which include the band spread feature will show several small rectangular metal pieces. There are two of these pieces or terminal blocks on each coil which will accommodate a small flat-head machine screw. With the screws in the left-hand positions, the coil range will be that shown in the left-hand, or general coverage chart. If it is desired to change the calibration to band spread, as shown on the right-hand chart, it is only necessary to move each of the four screws to the right-hand terminal block of each coil.

B. C.W. RECEPTION.

After the HRO-5 Receiver is properly installed it is put in operation by turning both the Power Unit switch and the Receiver B+ switch to the on position. The C.W. OSC. control should be turned on and the A.V.C. switch must be pushed to the

right to render the A.V.C. circuits inoperative. If the A.V.C. switch is turned on with the C.W. oscillator in operation, the receiver will block and become extremely insensitive. The Receiver is now adjusted for C.W. reception and will tune in accordance with the frequency calibration of the coil set in use.

Although the settings of the R.F. GAIN and A.F. GAIN controls will depend to some extent upon operating conditions, it is recommended that the A.F. GAIN control be set about 5 and the R.F. GAIN control advanced as may be required to provide a satisfactory audio signal. Advancing the R.F. GAIN control too much may cause I.F. or second detector overload. Such overload is indicated by a change in pitch of the C.W. beat note over the duration of a code character, or by excessive "chumping".

The best setting of the C.W. OSC. control will also depend upon operating conditions. When the received signal is free from interference and is sufficiently strong to override static and circuit noise, it is recommended that the C.W. OSC. control be set at the position which tunes the C.W. oscillator to the intermediate frequency of the receiver. This setting will normally be between 8 and 10 on the C.W. OSC. dial. As the control is turned toward 0, the C.W. oscillator is progressively detuned from the intermediate frequency of the receiver.

The operator can determine the extent of this deviation by listening to the characteristic pitch of background and circuit noises. When this pitch is 2000 or 3000 cycles per second, it will be found that the receiver has definite "single signal" properties such that on one side of the carrier, the audio beat note of a received signal will be considerably louder than that of the other side. This characteristic is helpful in receiving weak signals through interference and utilizes the maximum available sensitivity of the receiver.

C. M.C.W. RECEPTION

The initial adjustment of the HRO-5 Receiver for M.C.W. reception is the same as for C.W. reception except that the C.W. oscillator control should be turned off. In M.C.W. reception the C.W. oscillator may be useful in locating the carrier of a weak phone or broadcast station. After the phone carrier has been found the C.W. oscillator is, of course, turned off.

With A.V.C. off the settings of the A.F. GAIN and R.F. GAIN controls will depend to some extent upon operating conditions. It is recommended that the A.F. GAIN control be set at about 5 and the R.F. GAIN control advanced as may be required to provide a satisfactory audio signal. When receiving weak signals, best signal-to-noise

ratio will be obtained by retarding the A.F. GAIN control and advancing the R.F. GAIN control to a point as near maximum as receiving conditions permit. The operator must be careful to avoid overloading the I.F. or second detector stages under these conditions. Overload will be indicated by excessive audio distortion.

To receive M.C.W. signals with automatic volume control, the A.V.C. switch must be pushed to the left, i.e., the on position. The R.F. GAIN control should be advanced to a point as near maximum as receiving conditions permit. Audio output should be controlled entirely by means of the A.F. GAIN control. When the noise level is high, the R.F. GAIN control may be retarded to limit the overall sensitivity to a definite maximum. The operator should remember, however, that the full range of A.V.C. action cannot be obtained unless the R.F. GAIN control is fully advanced.

D. RECEPTION WITH THE CRYSTAL FILTER.

The crystal filter may be used advantageously in both C.W. and M.C.W. reception to adjust the selectivity of the receiver and also to suppress interfering signals.

For M.C.W. reception the crystal filter is switched into the circuit by turning the PHASING control knob from 0 to 1 as indicated by its dial. The insertion of the crystal filter reduces the receiver gain slightly and as a result it will be necessary to advance both A.F. and R.F. GAIN controls to compensate for this loss in gain. The PHASING control should then be turned to the center of its range which effectively removes its action from the band of frequencies being received. The SELECTIVITY control may be adjusted for minimum selectivity by turning it to a position (near the center of its range) where background noise is the loudest. The receiver may now be tuned to M.C.W. signals in the usual manner, but it will be found that the selectivity is very high, with the result that all audio frequency tones above a few hundred cycles are comparatively weak when the receiver is tuned exactly to the M.C.W. carrier. Normally this loss of high frequency audio tones would result in low intelligibility of received signal, but since the background noise, static, etc., have been reduced much more, the net result is usually an improvement. Selectivity may be increased for use in extreme cases of interference by turning the SELECTIVITY control in either direction from the minimum selectivity position. Under these conditions, tuning is very critical and care must be exercised to assure proper tuning.

An interfering signal which produces undesirable heterodynes may be greatly suppressed by means of the crystal filter PHASING control. It will be found that the point of maximum attenuation for signals with a frequency near the desired frequency

ALIGNMENT

will occur near one extreme or the other of the PHASING control rotation depending on whether the frequency of the undesired signal is above or below the frequency of the desired signal. Undesired signals with frequencies further removed from the desired signal frequency can be suppressed with settings of the PHASING control which occur nearer the center of its range.

Crystal Filter operation for C.W. reception is similar to that for M.C.W. with the exception that maximum selectivity may be employed without the loss of intelligibility experienced in M.C.W. reception. When maximum selectivity is employed, tuning is very critical and care must be exercised to assure proper tuning. When the receiver is slowly tuned across the carrier of a 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. OSC. must provide a beat note peak well within the audible range so that receiver peak response may be readily observed. A C.W. OSC. dial setting near 7 is recommended. After the receiver has been correctly tuned, the pitch of the beat note may be adjusted by means of the C.W. OSC. 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 dial to the other side of "zero beat" so that the pitch is the same as before and observing the marked reduction in output. This dial setting is not recommended for use other than to demonstrate the single signal properties of the receiver. The operation of the PHASING control in suppressing an undesired signal is the same for either C.W. or M.C.W. reception.

F. MEASUREMENT OF SIGNAL STRENGTH.

The S-meter can be used to measure the strength of received signals when the receiver is adjusted for M.C.W. reception employing automatic volume control. With no signal input the S-meter should read zero with the R.F. GAIN control set at about 9.5. The setting of the AUDIO GAIN control is unimportant when measuring signal strength. The Crystal Filter should be disconnected from the circuit and the SELECTIVITY control set for maximum S-meter reading. The S-meter may be used to measure the strength of either C.W. or M.C.W. signals provided that the beat oscillator is not used.

Should realignment of the HRO-5 Radio Receiver become necessary the following alignment data should be carefully studied before making any circuit adjustments. It is important that the operator understands the function of each circuit element so that correct alignment may be obtained quickly and accurately. Adjustments referred to by number are shown in the various receiver photographs.

The complete alignment of the Receiver may be divided into five steps:

- (A) Intermediate Frequency Amplifier alignment including Crystal Filter adjustments.
- (B) High Frequency Oscillator alignment.
- (C) Radio Frequency Amplifier alignment.
- (D) Tracking of High Frequency Oscillator and Radio Frequency Amplifier circuits.
- (E) Band Spread adjustments.

A. INTERMEDIATE FREQUENCY AMPLIFIER ALIGNMENT.

A-1 The operator is cautioned against making any adjustments indiscriminately, and he should not realign any circuit unless tests definitely indicate that realignment is necessary.

A-2. The alignment of the Intermediate Frequency Amplifier may be easily checked in the following manner. The receiver should be adjusted for normal operation with no antennas, AVC off, R.F. GAIN at 9, Crystal Filter on, PHASING control at 5, SELECTIVITY maximum, and the C.W. OSC. turned on. The setting of the A.F. GAIN control does not affect the measurement and may be adjusted to provide sufficient output to make the required observations. The C.W. OSC. control should then be turned until a point is found where the predominant pitch of the background noise is lowest and a crystal ring is heard. This setting of the C.W. OSC. control should occur near 9 on the C.W. OSC. scale and the exact setting should be noted. The Crystal Filter should then be disconnected from the circuit by turning the PHASING control to 0 on its scale and the SELECTIVITY control adjusted for maximum background noise. The C.W. OSC. control should again be adjusted for the lowest predominant pitch of background noise and this new setting noted. If the I.F. Amplifier is properly aligned, the setting of the C.W. OSC. control should be the same for both tests outlined above. The I.F. Amplifier should not be realigned, however, unless the test shows appreciable misadjustment of the I.F. Amplifier.

(b) Adjust an accurately calibrated test oscillator, frequency meter, or signal generator to provide a signal which should be tuned in near 490 on the receiver dial according to the General coverage calibration chart for the coil set in use.

(c) Tune the Receiver to the test signal and compare the dial reading with the calibration chart.

(d) When the Receiver dial reading is too low, more circuit capacity is required and is supplied by adjustment of trimmer, number 8; When the Receiver dial reading is too high, less circuit capacity is required and is removed by adjustment of trimmer, number 8.

B-3. It is particularly important that the High Frequency Oscillator circuits operate at a higher frequency than that of the R.F. Amplifier circuits. This can be checked by tuning in the test signal, as an image which is normally 912 kilocycles lower on the Receiver dial. The image signal should be considerably weaker if the R.F. Amplifier is correctly aligned and a stronger test signal may be required before the image can be found. If the image signal appears at a higher dial setting rather than a lower setting, the H.F. oscillator circuit is incorrectly adjusted and the capacity of trimmer, number 8, must be decreased until the real signal and image signal appear at the proper points on the dial.

C. R.F. AMPLIFIER ALIGNMENT.

C-1. The term R.F. Amplifier alignment, as used in this section, includes alignment of both R.F. Amplifier and First Detector circuits.

C-2. The R.F. Amplifier may be aligned in the following manner:

(a) Adjust the receiver as explained in (a) of paragraph B-2. No antenna is needed.

(b) Turn the Receiver dial to 490.

(c) Adjust trimmers, numbers 2, 4 and 6, for maximum background noise, which is the setting for maximum gain.

D. TRACKING OF THE H. F. OSCILLATOR AND R. F. AMPLIFIER CIRCUITS.

D-1. Tracking of the H. F. Oscillator and R. F. Amplifier circuits may be readily checked by observing the background noise while tuning throughout the range of the coil set in use. The background noise should not vary greatly as the dial is turned toward the low frequency limit of the coil set tuning range. The actual tracking of each stage near the low frequency limit of the tuning range may be checked by press-

A-3. When it is found necessary to realign the I.F. Amplifier, the following procedure should be used:

(a) Adjust the receiver as explained in paragraph A-2, with the Crystal Filter connected into the circuit and set for maximum selectivity.

(b) Connect an antenna to the receiver and tune in a steady C.W. signal so that it is tuned exactly on the crystal peak response frequency.

(c) Adjust the C.W. OSC. to provide a beat note well within the audio range.

(d) Adjust I.F. Amplifier trimmers, numbers 10, 11, 12, 13, and 14, for maximum response. Avoid second detector or audio overload by reducing the signal input to the receiver as required. Such overload makes various I.F. Amplifier adjustments appear considerably less critical than they actually are. Do not reduce signal level by retarding the R.F. GAIN control but rather by reducing the input to the antenna terminals.

(e) Check the alignment of the I.F. Amplifier as explained in paragraph A-2 to assure that it has been properly aligned to the crystal frequency.

A-4. After the I.F. Amplifier has been properly aligned, the tuning of the C.W. OSC. should be checked. This may be readily accomplished by repeating the test of paragraph A-2 with the Crystal Filter disconnected from the circuit and the SELECTIVITY control adjusted for maximum background noise. If the setting of the C.W. OSC. control does not occur at or near 9, with this test, turn the C.W. OSC. control to 9 and adjust trimmer number 15 or 16, or both, for the lowest pitch of background noise.

B. HIGH FREQUENCY OSCILLATOR ALIGNMENT.

B-1. The need for realignment of the High Frequency Oscillator of any band is indicated when the frequency calibration of the receiver dial is in error by more than 3% (plus or minus) at the high frequency end of the band in question. If there is doubt concerning the necessity for High Frequency Oscillator realignment, this portion of the circuit should not be adjusted as correction can be made by R.F. Amplifier trimmer adjustments.

B-2. If the frequency calibration of a coil set is in error by more than 3%, it should be corrected in the following manner:

(a) Adjust the receiver for normal operation as follows: R.F. GAIN at 9, C.W. OSC. off, A.V.C. off, Crystal Filter off, (PHASING control at 0), SELECTIVITY control at the position of maximum background noise, and the A.F. GAIN set to provide a suitable signal level for the required observations.

ing the outside rotor plates of the main tuning condenser section toward or away from the stator, but not far enough to short the condenser or permanently bend the rotor plates. Any change in capacity should decrease the background noise indicating decreased sensitivity, if the stage is tracking properly. Coil sets which may require precise adjustment of circuit elements are provided with adjustable series padders in the High Frequency Oscillator portion of the coil set, which can be adjusted to track with the average adjustment of the R. F. Amplifier coils. This series padder is mounted inside the coil and is adjustable from the rear by means of a screw driver. It should be remembered that the series padders found in the coils of coil set Types A, B, C and D are Band Spread series padders and should not be adjusted except during Band Spread alignment.

D-2. After calibration and alignment at the high frequency end of the coil set have been adjusted as explained in paragraphs B-2 and C-2, the tracking may be adjusted as follows:

- (a) With the Receiver adjusted as in part (c) of paragraph C-2, turn the Receiver dial to 20.
- (b) Test the tracking of each stage in turn by bending the outside rotor plate of each section of the main tuning capacitor and note any misadjustment. DO NOT bend the rotor plate of any section to such an extent that it will not spring back to its original position.
- (c) Adjust the High Frequency Oscillator series padder to its optimum tracking position when step b (above) gives indication of poor tracking.
- (d) Turn the Receiver dial to 490 and adjust trimmer number 8 to give the proper calibration with the new value of series padder.
- (e) Repeat a, b, c, and d until best tracking is obtained.
- (f) Note any slight tracking errors occurring in the R. F. Amplifier stages so that if the same error occurs in a majority of the coil sets, the outside rotor plate may be permanently bent to provide the best tracking for the stage involved.

E. BAND SPREAD ALIGNMENT.

E-1. The Band Spread feature may or may not be included in the particular coil sets supplied depending on the type of coil set purchased for the receiver. The following alignment data applies only to coil sets which include the Band Spread feature.

E-2. Adjustments made for general coverage will affect the Band Spread adjustments, but the separate Band Spread adjustments may be made without changing the general coverage alignment.

E-3. The four screws used to switch from general coverage to Band Spread, as explained under Operating Instructions, must be shifted to the right-hand terminal blocks before any Band Spread alignment adjustments are made.

E-4. The need for realignment of the High Frequency Oscillator section of any coil set is indicated when the frequency calibration of the Receiver dial is in error by more than 30 divisions (plus or minus) at the high frequency end of the band in question.

E-5. If the frequency calibration of a coil set is in error it should be corrected in the following manner.

- (a) Repeat the procedure of Paragraph B-2 with the exceptions that a test oscillator frequency is chosen which should be tuned in at 450 on the Receiver dial as indicated by the Band Spread tuning chart and correction for calibration error is made by adjustment of trimmer number 7.

E-6. The alignment of the R. F. Amplifier for Band Spread operation is similar to that for general coverage so the procedure of Paragraph C-2 should be repeated with the exception that the Receiver dial should be turned to 450 and trimmers, numbers 1, 3, and 5 should be adjusted for maximum background noise.

E-7. The adjustment of and method of checking Band Spread tracking is not similar to that for general coverage. The following procedure should be used for Band Spread tracking adjustments.

- (a) With the receiver adjusted as in Paragraph E-6, turn the Receiver dial to 50.
- (b) Check the receiver calibration at 50 against an accurate test oscillator.
- (c) Adjust the High Frequency Oscillator series padder located inside the High Frequency Oscillator coil shield to provide the correct dial calibration.
- (d) Turn the dial to 450 and adjust trimmer number 7 to give the proper calibration.
- (e) Turn the dial to 50 and check the calibration. Repeat c and d if necessary.
- (f) With the Receiver dial at 50 check the settings of trimmers, numbers 1, 3 and 5, for the position of maximum background noise.
- (g) If it is found that increasing or decreasing the capacity of trimmer 1, 3 or 5 increases the background noise, adjust the associated series padder located inside the coil shields to provide the desired capacity.
- (h) Turn the Receiver dial to 450 and adjust trimmers 1, 3 and 5 for maximum background noise.
- (i) Repeat f and h, also g, if necessary.

E-8. The alignment of the R. F. Amplifier for Band Spread operation is similar to that for general coverage so the procedure of Paragraph C-2 should be repeated with the exception that the Receiver dial should be turned to 450 and trimmers, numbers 1, 3, and 5 should be adjusted for maximum background noise.

E-9. The adjustment of and method of checking Band Spread tracking is not similar to that for general coverage. The following procedure should be used for Band Spread tracking adjustments.

- (a) With the receiver adjusted as in Paragraph E-6, turn the Receiver dial to 50.
- (b) Check the receiver calibration at 50 against an accurate test oscillator.
- (c) Adjust the High Frequency Oscillator series padder located inside the High Frequency Oscillator coil shield to provide the correct dial calibration.
- (d) Turn the dial to 450 and adjust trimmer number 7 to give the proper calibration.
- (e) Turn the dial to 50 and check the calibration. Repeat c and d if necessary.
- (f) With the Receiver dial at 50 check the settings of trimmers, numbers 1, 3 and 5, for the position of maximum background noise.
- (g) If it is found that increasing or decreasing the capacity of trimmer 1, 3 or 5 increases the background noise, adjust the associated series padder located inside the coil shields to provide the desired capacity.
- (h) Turn the Receiver dial to 450 and adjust trimmers 1, 3 and 5 for maximum background noise.
- (i) Repeat f and h, also g, if necessary.

SUPPLEMENT FOR THE HRO-5TA & HRO-5RA

The HRO-5A Series of Receivers are equipped with bandspread coil sets, namely the A, B, C and D coil sets. The frequency and dial coverage of these coil sets are as follows:

COIL SET	GENERAL COVERAGE	BANDSPREAD	
		Frequency	Dial
A	14.0 - 30.0	28 - 29.7 MC;	50 - 450
B	7.0 - 14.4	14 - 14.4 MC;	50 - 450
C	3.5 - 7.3	7.0 - 7.3 MC;	50 - 450
D	1.7 - 4.0	3.5 - 4.0 MC;	50 - 450

These coil sets are aligned in the Receiver at the National Laboratories using crystal controlled test oscillators assuring precision calibration. The frequency tolerance for the calibration of the amateur bands adhered to at the National Laboratories is $\pm 0.03\%$.

The National Company wishes to caution those owners of HRO Receivers who intend to purchase the now available bandspread coil sets. These coil sets can be properly aligned in the individual receivers only by using crystal controlled test signals. If the purchaser does not have available suitable test equipment, the National Company is prepared to align these coil sets providing the receiver is shipped to the factory. In the past, the National Company has manufactured models of the HRO employing both glass and metal type tubes. The bandspread coil sets are different for these two models of the HRO Receiver and when ordering it should be stated which model is to be used with the bandspread coil sets.

HRO-5-1 SERIES SUPPLEMENT
Addition of Noise Limiter

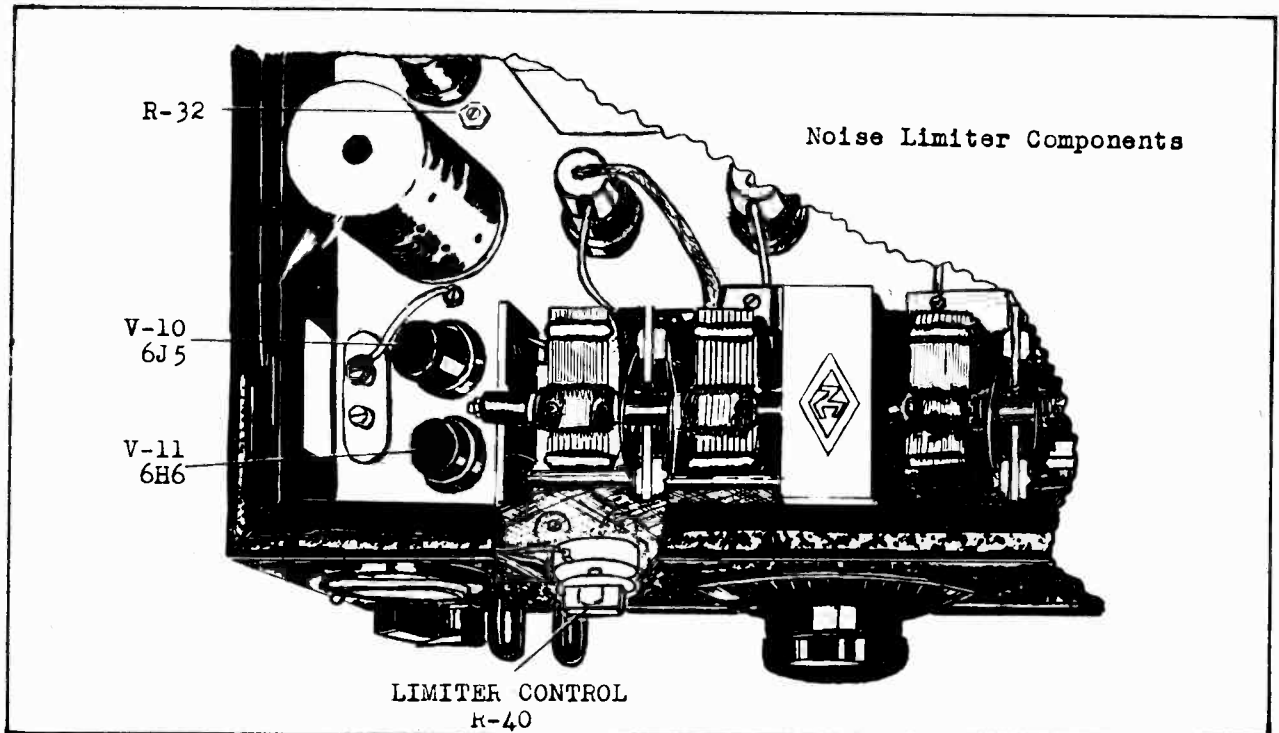
To further improve the performance standards of the HRO Receiver, a noise limiter has been added to the circuit. The design and operation of this new noise limiter has been thoroughly tested in the National Laboratories and has proven its worth in minimizing the effects of undesirable noise pulses of high intensity and short duration. A Limiter control, front panel mounted to the left of the main tuning dial, is provided to adjust the threshold level at which limiting action starts. With the Limiter control set at 0, the limiter circuits will pass all but the strongest audio peak voltages; when the control is set at 10 limiting action is at its maximum, i.e. threshold level at its lowest point. When receiving voice or music, care should be taken not to advance the control too far as distortion will result due to suppression of the positive and negative peaks. The limiter control may be advanced farther during radiotelegraph reception as distortion is then less important.

The new components used in the noise limiter assembly, with their respective symbol numbers are as follows:

C45	0.1 mfd., 400 VDCW	R39	50,000 ohms, 1/2 watt
C46	8 mfd., 250 VDCW	R40	10,000 ohms, Variable
C47	0.01 mfd., 300 VDCW	R41	50,000 ohms, 2 watt
R36	1 megohm, 1/2 watt	R42	250,000 ohms, 1/2 watt
R37	5,000 ohms, 1/2 watt	V10	6J5
R38	50,000 ohms, 1/2 watt	V11	6H6

C21 - Changed from 0.1 mfd. to 0.01 mfd.

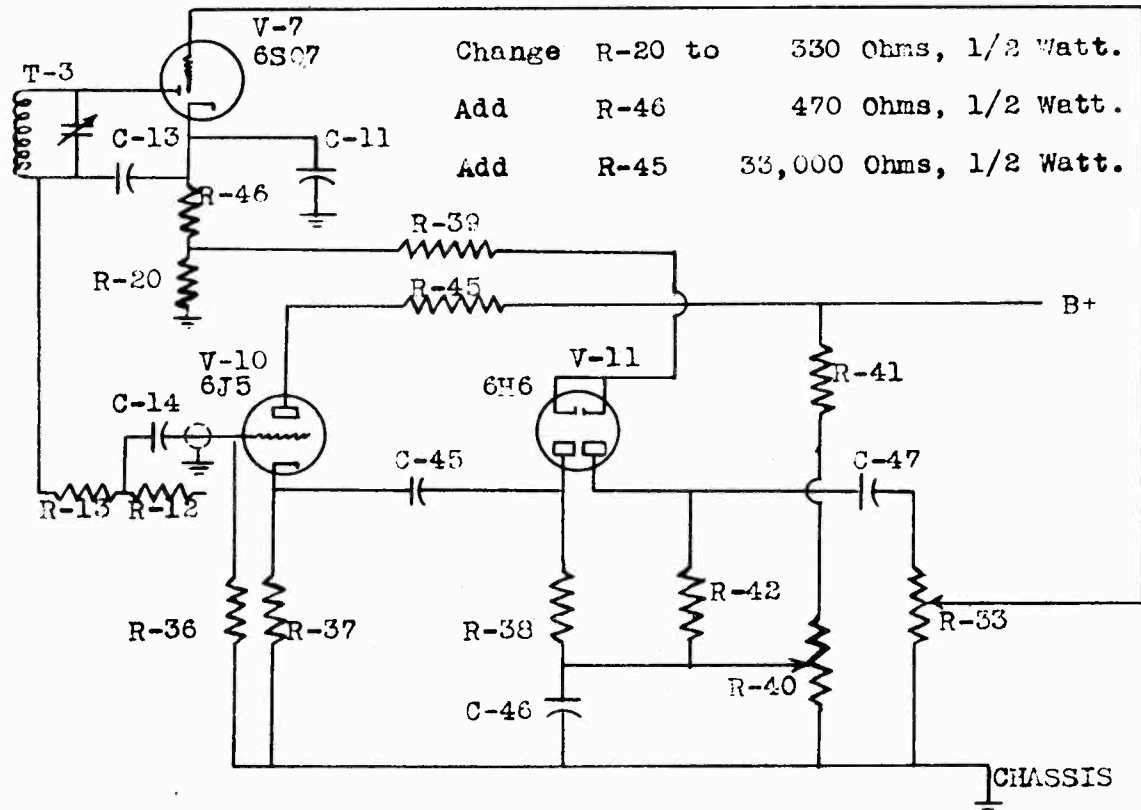
Drawn on the following page is the schematic diagram illustrating the noise limiter section of the circuit and a pictorial view showing the locations of the two new tubes and Limiter control.



Cut-away top view of HRO Receiver

SCHEMATIC DETAIL
(Noise Limiter Components)

FOR HRO-5-1



MODELS HRO Series

NATIONAL COMPANY, INC.

TABULATION OF PARTS

Part Symbol Number	Function	Description	Mfr. Type Number	Mfr. Type Number	Part Symbol Number	Function	Description	Mfr. Type Number
CONDENSERS								
C1	V5 Heater Bypass	.1 Mfd., 400 VDC W	G	Sprague	C32	Crystal Filter Bridge	.001 Mfd., 500 VDC W	Class C Centralab
C2	V5 G-16 Filter	.01 Mfd., 600 VDC W	G	Sprague	C33	V8 to V7 Coupling	2. Mnf., 400 VDC W	B-22 NationalCo
C3	V3 Cathode Bypass	.1 Mfd., 400 VDC W	G	Sprague	C34	Coil JA-1 or A-1 Antenna Coupling	.0004 Mfd., 500 VDC W	Class D Centralab
C4	V2 B+ Bypass	.1 Mfd., 600 VDC W	G	Sprague	C35	Coil JA-1 or A-1 Series Padder	.0012 Mfd., 500 VDC W	1467 Aerovox
C5	V4 Screen Bypass	.1 Mfd., 600 VDC W	G	Sprague	C36	Coil JA-4 or A-4 Series Padder	.00085 Mfd., 500 VDC W	1467 Aerovox
C6	V5 Cathode Bypass	.01 Mfd., 600 VDC W	G	Sprague	C37	Coil JB-4 or B-4 Series Padder	.0026 Mfd., 500 VDC W	1467 Aerovox
C7	V4 Cathode to V2 Screen	.25 Mfd., 600 VDC W	G	Sprague	C38	Coil JC-4 or C-4 Series Padder	.0016 Mfd., 500 VDC W	1467 Aerovox
C8	V5 and V6 Plate Filter	.01 Mfd., 600 VDC W	G	Sprague	C39	Coil JD-4 or D-4 Series Padder	.00088 Mfd., 500 VDC W	1467 Aerovox
C9	V6 Grid Filter	.1 Mfd., 400 VDC W	G	Sprague	C40	Coil E-4 Series Padder	.00045 Mfd., 500 VDC W	Dual C Centralab
C10	V6 Cathode Bypass	.1 Mfd., 400 VDC W	G	Sprague	C41	Coil F-4 Series Padder	.00035 Mfd., 500 VDC W	Dual C Centralab
C11	V7 Cathode Bypass	10. Mfd., 50 VDC W	D 9765	Sprague	C42	Coil G-4 Series Padder	.0001 Mfd., 500 VDC W	Class C Centralab
C12	V7 Diode Filter	.0001 Mfd., 500 VDC W	Class C Centralab	Sprague	C43	Coil J-4 Fixed Trimmer	.00005 Mfd., 500 VDC W	Class D Centralab
C13	V7 Diode Filter	.00025 Mfd., 500 VDC W	Class C Centralab	Sprague	C44	H.F. Osc. Temperature Compensator	10. Mnf., 500 VDC W	Class D Centralab
C14	V7 Diode to Pentode Coupling	.1 Mfd., 400 VDC W	G	Sprague	KNOBBS AND DIALS			
C15	V7 Diode Bypass	.01 Mfd., 600 VDC W	G	Sprague	K1	Main Tuning Dial	5/16" Bushing	SA-6L5 NationalCo
C16	V7 Plate Bypass	.0005 Mfd., 500 VDC W	Dual C Centralab	Sprague	K2	Selectivity Knob	1/4" Bushing	SA-1273 NationalCo
C17	V2 Cathode Bypass	.1 Mfd., 400 VDC W	G	Sprague	K3	Phasing Knob	1/4" Bushing	SA-7 NationalCo
C18	V7 to V9 Coupling	.1 Mfd., 600 VDC W	G	Sprague	K4	R.F. Gain Knob	1/4" Bushing	SA-5 NationalCo
C19	V9 Cathode Bypass	10. Mfd., 50 VDC W	D 9765	Sprague	K5	C.W. OSC. Knob	1/4" Bushing	SA-6 NationalCo
C20	V8 Heater Bypass	.1 Mfd., 400 VDC W	G	Sprague	K6	Audio Gain Knob	1/4" bushing	SA-4 NationalCo
C21	V8 Screen Bypass	.1 Mfd., 400 VDC W	G	Sprague	RESISTORS			
C22	V1 Cathode Bypass	.1 Mfd., 400 VDC W	G	Sprague	R1	R.F. Gain Control	10,000 OHM, 1.5 Watt, Var.	G-60 Clarostat
C23	V1, V2, V5 and V6 Screen Bypass	.1 Mfd., 400 VDC W	G	Sprague	R2	V-3 Cathode	5,000 OHM, 1/2 Watt	SCI-1/2 Speer
C24	V1 Grid Filter	.01 Mfd., 600 VDC W	G	Sprague	R3	V5 Grid Filter	500,000 OHM, 1/2 Watt	SCI-1/2 Speer
C25	V1 B+ Bypass	.1 Mfd., 600 VDC W	G	Sprague	R4	V5 Cathode	300 OHM, 1/2 Watt	SCI-1/2 Speer
C26	V2 Grid Filter	.01 Mfd., 600 VDC W	G	Sprague	R5	V4 Screen Filter	50,000 OHM, 1/2 Watt	SCI-1/2 Speer
C27	C.W. OSC. Tuning	30 Mnf.,	SA-13 NationalCo	Sprague	R6	V2 Screen Filter	100,000 OHM, 1/2 Watt	SCI-1/2 Speer
C28	V7 B+ Bypass	.01 Mfd., 600 VDC W	G	Sprague				
C29	V8 Grid Coupling	.001 Mfd., 500 VDC W	1467	Aerovox				
C30	V4 Grid Coupling	.0001 Mfd., 500 VDC W	Class C Centralab	Sprague				
C31	Crystal Filter Bridge	.0001 Mfd., 500 VDC W	Class C Centralab	Sprague				

NATIONAL COMPANY, INC.

MODELS HRO Series

Part Symbol Number	Function	Description	Mfr. Type Number	Mfr.	Part Symbol Number	Function	Description	HRO-5	HRO-4	Mfr. Type Number	Mfr.
RESISTORS											
R7	V4 Screen Bleeder	100,000 OHM, 1/2 Watt	SCI-1/2	Speer	T1	Crystal Filter	TRANSFORMERS	HRO-5	HRO-4	SA-81	NationalCo
R8	V6 Grid Filter	500,000 OHM, 1/2 Watt	SCI-1/2	Speer	T2	Second I.F. Transformer	456. Kc.	Sr-2491	SA-11F	NationalCo	
R9	V6 Cathode	1000/5000 OHM, 1/2 Watt	SCI-1/2	Speer	T3	Second Detector Trans.	456. Kc.	SA-2492	SA-41G	NationalCo	
R10	V1,V2,V5 & V6 Screen Filter	15,000 OHM, 2 Watt	SCI-2	Speer	T4	C.W.Oscillator Trans.	456. Kc.	SA-2493	SA-41H	NationalCo	
R11	S Meter Bridge	2500 OHM, 1/2 Watt	SCI-1/2	Speer	*T5	Output Trans.	Specify			NationalCo	
R12	V7 Diode Load	500,000 OHM, 1/2 Watt	SCI-1/2	Speer	**T6	First I.F. Trans.	456. Kc.		SA-1320	NationalCo	
R13	V7 Diode Filter	50,000 OHM, 1/2 Watt	SCI-1/2	Speer							
R14	V7 Diode Equalizing	250,000 OHM, 1/2 Watt	SCI-1/2	Speer							
R15	V1,V2,V5 & V6 Screen Bleeder	30,000 OHM, 2 Watt	SCI-2	Speer	V1	First R.F.	VACUUM TUBES	HRO-5	HRO-4	6D6	RCA
R16	V7 Screen Bleeder	20,000 OHM, 1/2 Watt	SCI-1/2	Speer	V2	Second R.F.	R.F.Pentode	6K7	6D6	6D6	RCA
R17	V7 Screen	100,000 OHM, 2 Watt	SCI-2	Speer	V3	First Detector	R.F.Pentode	6K7	6C6	6C6	RCA
R18	V7 Plate	50,000 OHM, 1 Watt	SCI-1	Speer	V4	H.F.Oscillator	R.F.Pentode	6J7	6C6	6C6	RCA
R18	V7 Plate	100,000 OHM, 2 Watt	SCI-2	Speer	V5	First I.F.	R.F.Pentode	6K7	6D6	6D6	RCA
R19	AVC Filter	500,000 OHM, 1/2 Watt	SCI-1/2	Speer	V6	Second I.F.	R.F.Pentode	6K7	6D6	6D6	RCA
R20	V7 Cathode	800 OHM, 1/2 Watt	SCI-1/2	Speer	V7	Second Detector	Diode-Pentode	6SQ7	6B7	6B7	RCA
R21	Heater Center Tap	64 OHM, 3 Watt	864C	Mallory	V8	C.W.Oscillator	R.F.Pentode	6J7	6C6	6C6	RCA
R22	V8 Screen Filter	100,000 OHM, 1/2 Watt	SCI-1/2	Speer	V9	Audio Output	A.F.Pentode	6V6GT/G	42	42	RCA
R23	V8 Plate	250,000 OHM, 1/2 Watt	SCI-1/2	Speer							
R24	V8 Screen Bleeder	100,000 OHM, 1/2 Watt	SCI-1/2	Speer							
R25	V9 Cathode	300 OHM, 2 Watt	SCI-2	Speer	W1	Power Cable and Plug	CABLES AND PLUGS			C-627	NationalCo
R25	V9 Cathode	500 OHM, 2 Watt	SCI-2	Speer							
R26	V9 Grid	500,000 OHM, 1/2 Watt	SCI-1/2	Speer							
R27	V1 Cathode	300 OHM, 1/2 Watt	SCI-1/2	Speer	X1	B+ Switch	SWITCHES			80994	A.H.+H.
R28	V1 Grid Filter	500,000 OHM, 1/2 Watt	SCI-1/2	Speer	X2	C.W.Oscillator Switch	S.P.S.T.Toggle, 3A., 250 V.			20994L	A.H.+H.
R29	V2 Cathode	300 OHM, 1/2 Watt	SCI-1/2	Speer	X3	A.V.C. Switch	S.P.D.T.Toggle, 3A., 250 V.			21350E	A.H.+H.
R30	S Meter Bridge	2000 OHM, 1/2 Watt	SCI-1/2	Speer	X4	S Meter Switch	S.P.S.T.Toggle, 3A., 250 V.			80994	A.H.+H.
R31	V2 Grid Filter	500,000 OHM, 1/2 Watt	SCI-1/2	Speer							
R32	S Meter Zero Adjusting	1000 OHM, 1 Watt, Var.	E-9029A	Ciarostat							
R33	Audio Gain Control	500,000 OHM, 1 Watt, Var.	10101655	Centralab							
R34	V8 Grid	50,000 OHM, 1/2 Watt	SCI-1/2	Speer							
R35	V4 Grid	20,000 OHM, 1/2 Watt	SCI-1/2	Speer							

This Parts List indicates suitable types, but equivalent alternate types may be employed.

* Specify Output Impedance When An Output Transformer is Desired.

** May be used in place of T-1.

Used only on HRO-5 Series

o Used only on HRO-4 Series

FIXED COMPOSITION RESISTORS (CONTINUED)

OR17	0.10 Megohm, 2 Watt	RC41BF104K
#R18	47,000 Ohm, 1 Watt	RC31BF473K
OR18	0.10 Megohm, 2 Watt	RC41BF104K
R19	0.47 Megohm, 1/2 Watt	RC21BF474K
R20	820 Ohm, 1/2 Watt	RC21BF821K
R22	0.10 Megohm, 1/2 Watt	RC21BF124K
R23	0.22 Megohm, 1/2 Watt	RC21BF224K
R24	0.10 Megohm, 1/2 Watt	RC21BF104K
#R25	330 Ohm, 2 Watt	RC41BF331K
OR25	470 Ohm, 2 Watt	RC41BF471K
R26	0.47 Megohm, 1/2 Watt	RC21BF474K
R27	330 Ohm, 1/2 Watt	RC21BF331K
R28	0.47 Megohm, 1/2 Watt	RC21BF474K
R29	330 Ohm, 1/2 Watt	RC21BF331K
R30	2,200 Ohm, 1/2 Watt	RC21BF222K
R31	0.47 Megohm, 1/2 Watt	RC21BF474K
R34	47,000 Ohm, 1/2 Watt	RC21BF473K
R35	22,000 Ohm, 1/2 Watt	RC21BF222K

VARIABLE WIRE-WOUND RESISTORS
(LOW OPERATING TEMPERATURE)

R1	10,000 Ohm, 3 Watt	RA25ALR103FK
R32	1,000 Ohm, 2 Watt	RA15ALSAL024K

Used only on HRO-5 Series
0 Used only on HRO-M Series

Power Unit and Loud Speaker Types

POWER UNITS

Table Model	6 Volt DC Vibrapack	Type 686-S
Table Model	AC Power Unit 50/60 Cycle (Specify 115V or 230V)	Type 697
Rack Mounting	6 Volt DC Vibrapack	Type SFU-686-S
Rack Mounting	AC Power Unit 50/60 Cycle (Specify 115V or 230V)	Type SFU-697

LOUD SPEAKERS

Table Mounting	Loud Speaker	Type MCS
Rack Mounting	Loud Speaker	Type RFSH

MISCELLANEOUS

Rack Mounting	Combined Power Unit, Loud Speaker, and Five Compartment Coil Storage Container (Panel Height 15 3/4")	Type SPC
Rack Mounting	Five Compartment Coil Storage Container	Type RCRP

FIXED CAPACITORS, CERAMIC-DIELECTRIC

C12	100 Mmfd., 500 V DC W	CC35SL101K
C13	270 Mmfd., 500 V DC W	CC35SL271K
C16	540 Mmfd., 500 V DC W	Dual CC35SL271K
C30	100 Mmfd., 500 V DC W	CC35SL101K
C31	100 Mmfd., 500 V DC W	CC35SL101K
C32	100 Mmfd., 500 V DC W	CC35SL101K
C34	43 Mmfd., 500 V DC W	CC21SL430K
C40	450 Mmfd., 500 V DC W	Dual CC35SL331J and CC35SL121J
C41	350 Mmfd., 500 V DC W	CC35SL351J
C42	100 Mmfd., 500 V DC W	CC35SL101J
C43	51 Mmfd., 500 V DC W	CC21SL510K
C44	10 Mmfd., 500 V DC W	CC21UJ100F

FIXED MICA-DIELECTRIC CAPACITORS

C35	1,200 Mmfd., 500 V DC W	CM35C122J
C36	850 Mmfd., 500 V DC W	CM35C851J
C37	2,600 Mmfd., 500 V DC W	CM35C262J
C38	1,600 Mmfd., 500 V DC W	CM35C162J
C39	880 Mmfd., 500 V DC W	CM35C881J

FIXED COMPOSITION RESISTORS

R2	4,700 Ohm, 1/2 Watt	RC21BF472K
R3	0.47 Megohm, 1/2 Watt	RC21BF474K
R4	330 Ohm, 1/2 Watt	RC21BF331K
R5	47,000 Ohm, 1/2 Watt	RC21BF473K
R6	0.10 Megohm, 1/2 Watt	RC21BF104K
R7	0.10 Megohm, 1/2 Watt	RC21BF104K
R8	0.47 Megohm, 1/2 Watt	RC21BF474K
#R9	1,000 Ohm, 1/2 Watt	RC21BF102K
#R9	1,500 Ohm, 1/2 Watt	RC21BF152K
#R9	2,200 Ohm, 1/2 Watt	RC21BF222K
#R9	3,300 Ohm, 1/2 Watt	RC21BF332K
#R9	4,700 Ohm, 1/2 Watt	RC21BF472K
R10	15,000 Ohm, 2 Watt	RC41BF153K
R11	2,200 Ohm, 1/2 Watt	RC21BF222K
R12	0.47 Megohm, 1/2 Watt	RC21BF474K
R13	47,000 Ohm, 1/2 Watt	RC21BF473K
R14	0.22 Megohm, 1/2 Watt	RC21BF224K
R15	33,000 Ohm, 2 Watt	RC41BF333K

OR16 #Varies with Individual Receivers

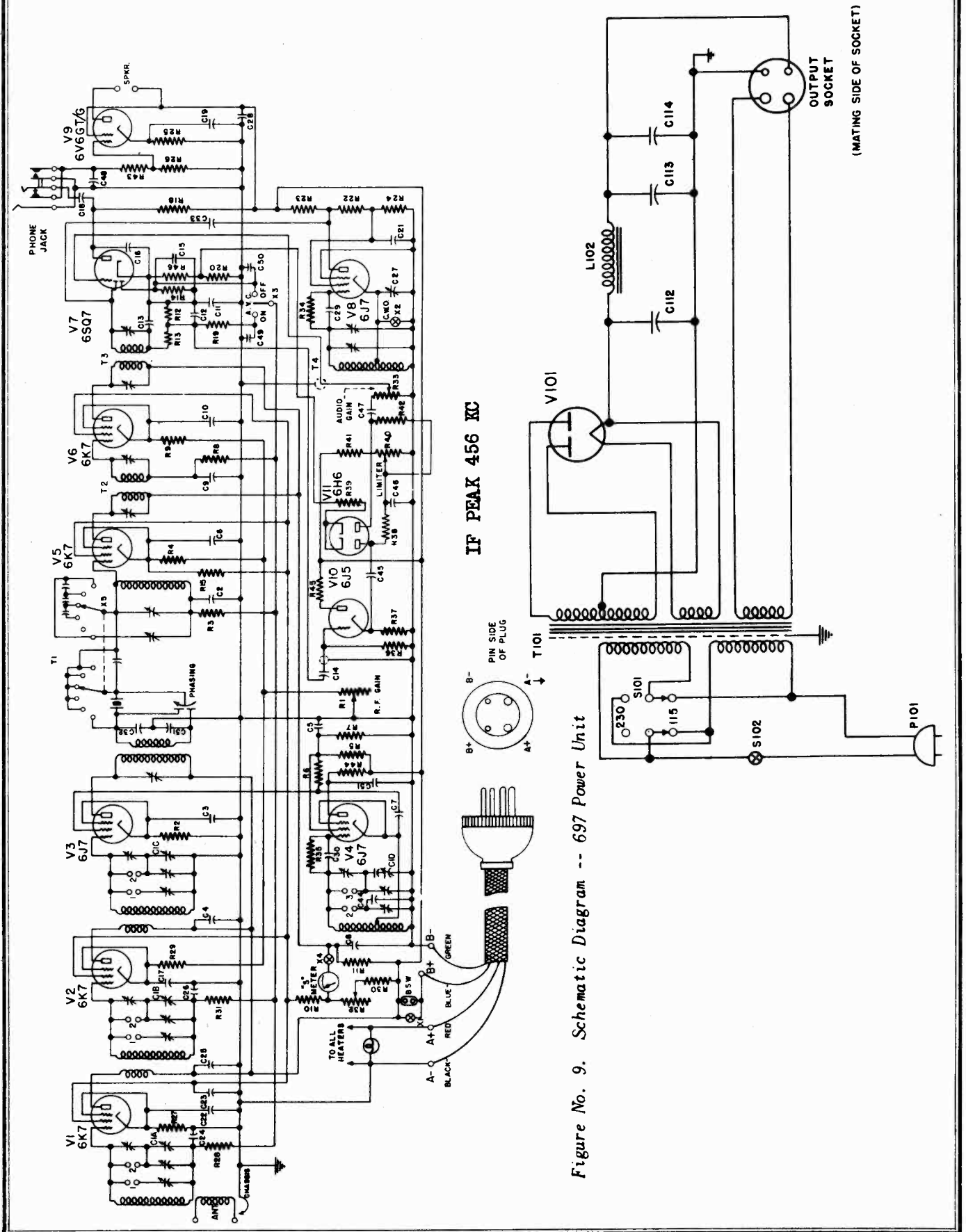


Figure No. 9. Schematic Diagram -- 697 Power Unit

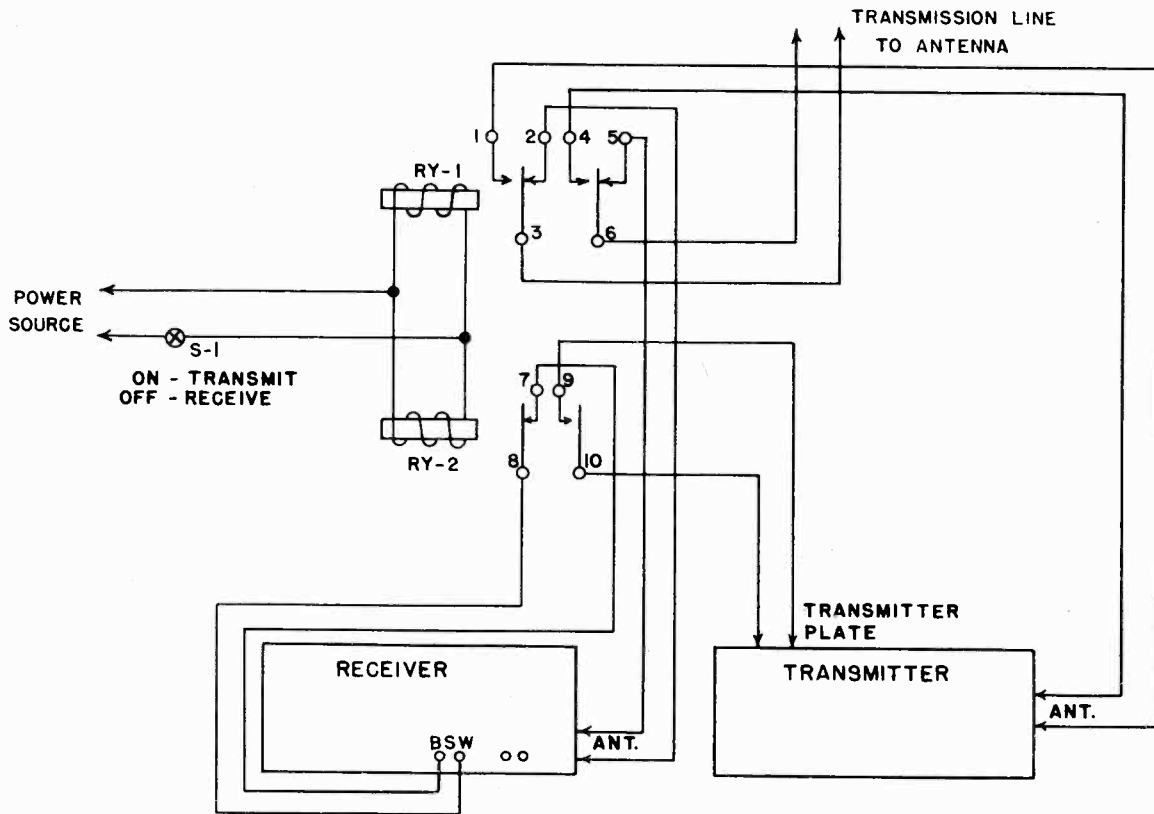


Figure No. 3. Typical Antenna Switching System

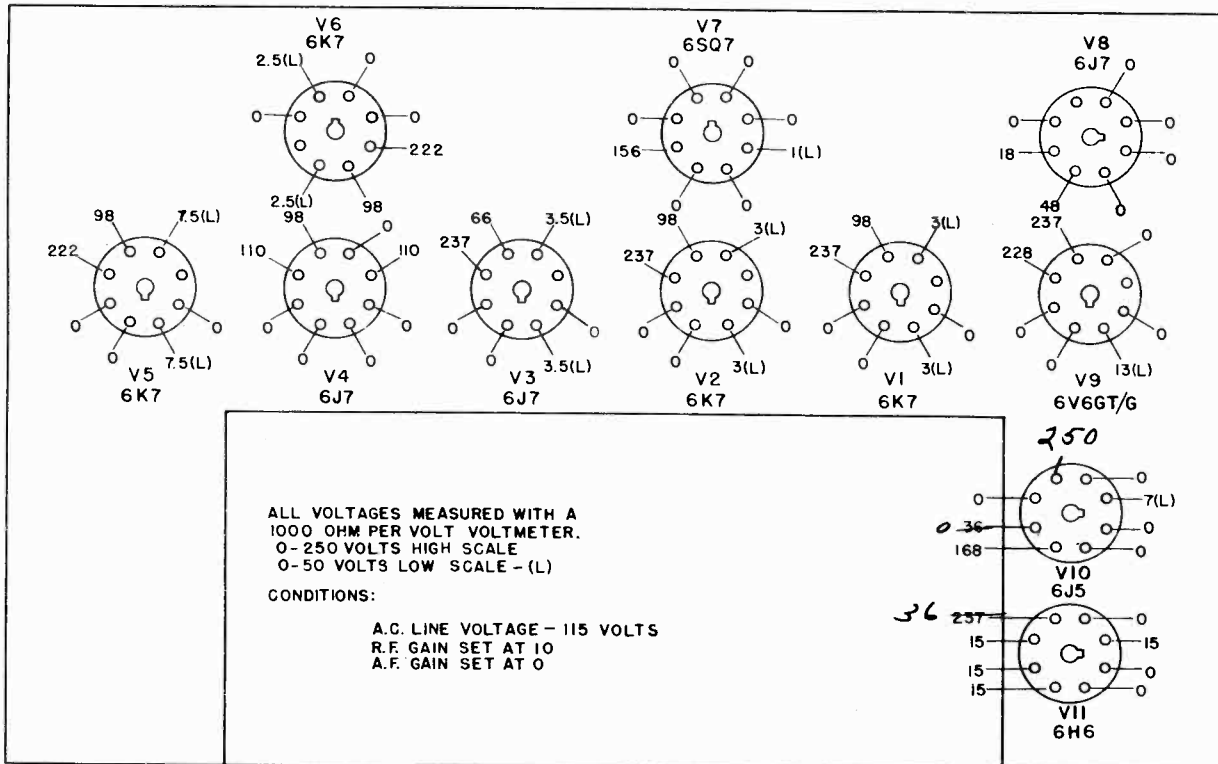


Figure No. 6. Tube Socket Voltages

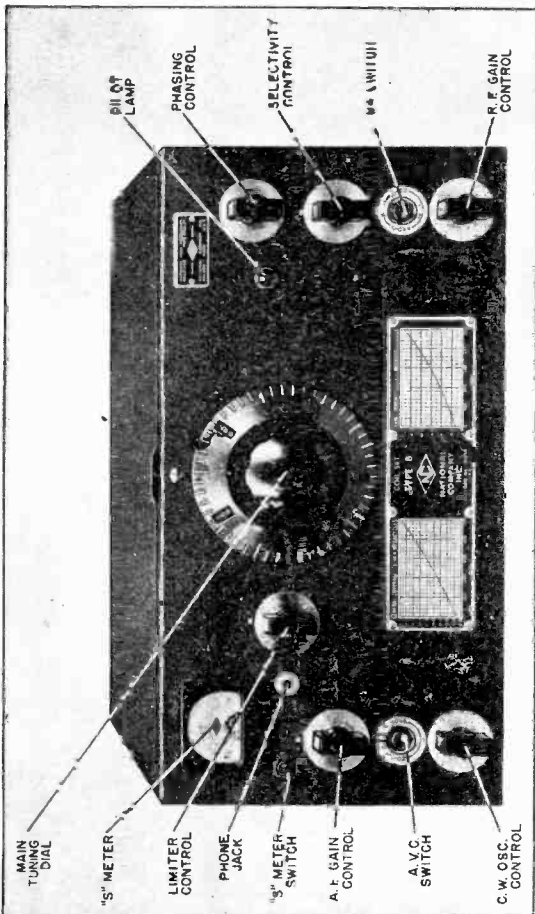


Figure No. 4. Front View of Receiver

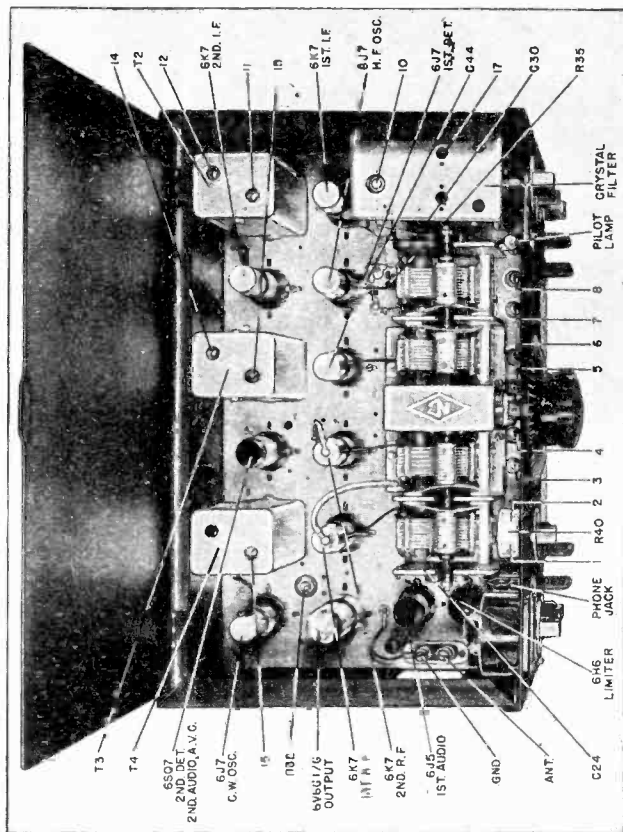


Figure No. 5. Top View of Receiver

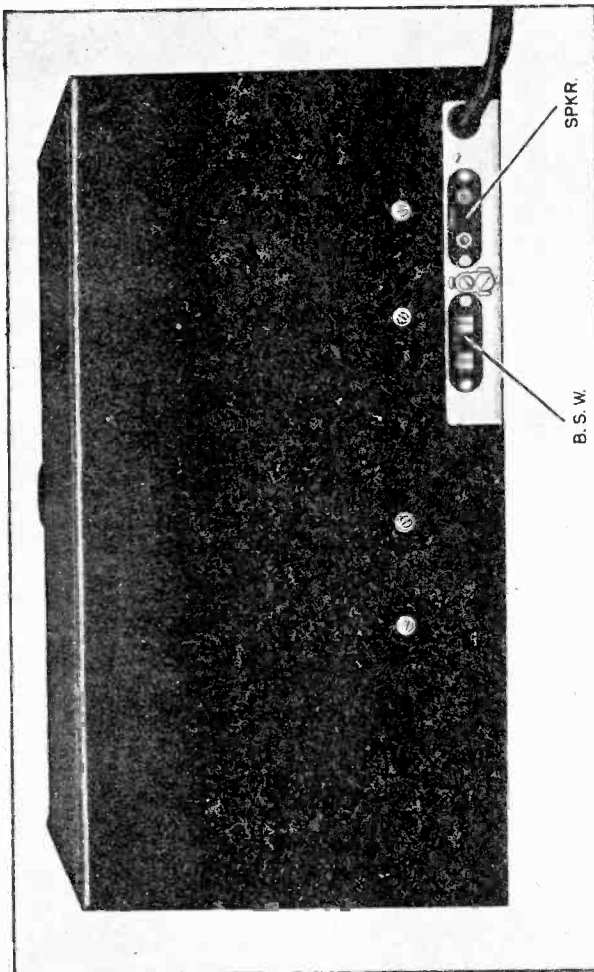


Figure No. 2. Rear View of Receiver

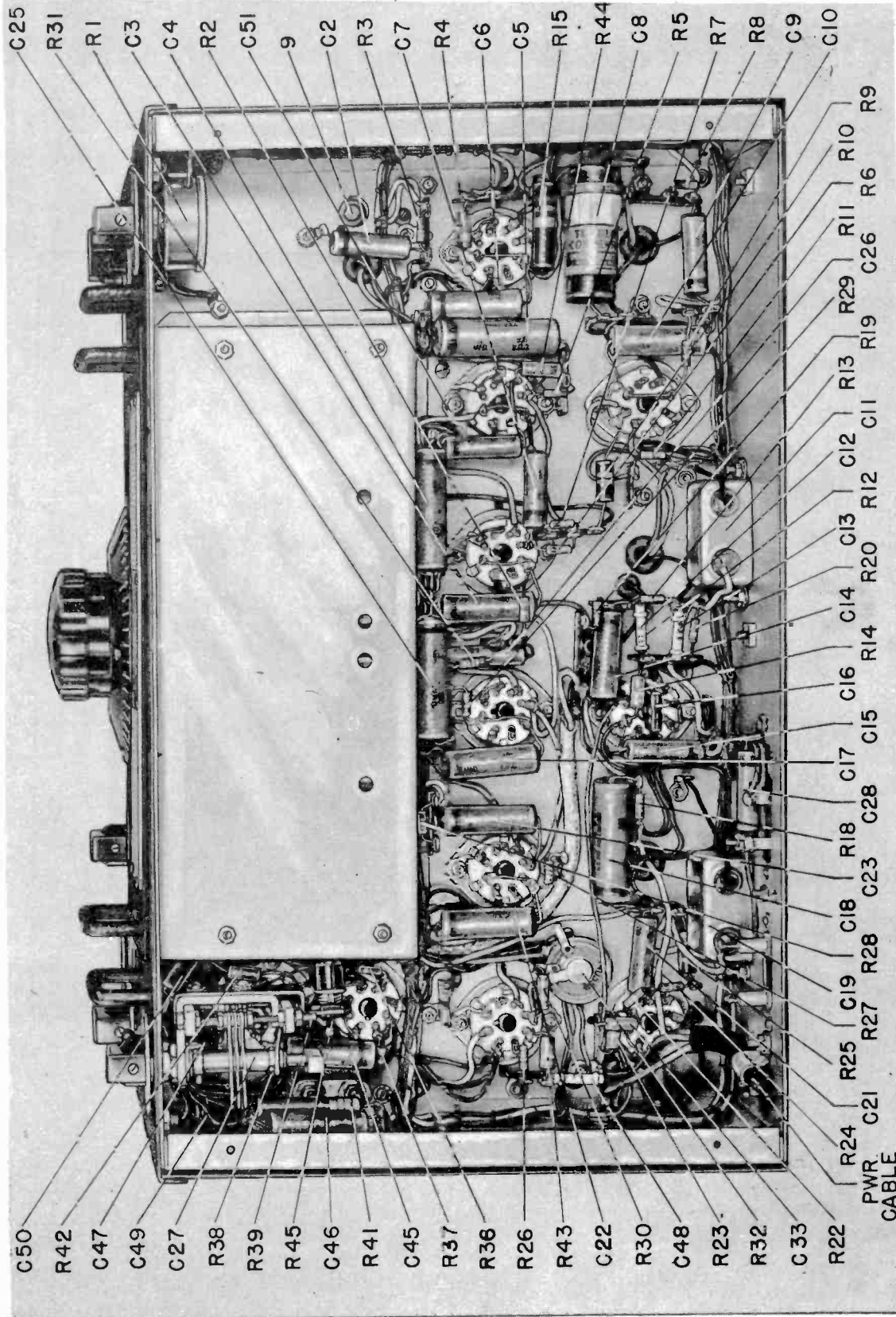


Figure No. 7. Bottom View of Receiver

DESCRIPTION

General

The HRO-5A1 Radio Receiver is an eleven tube high-frequency superheterodyne suitable for C.W. and M.C.W. reception throughout the frequency range of 50 to 430 Kcs., and 480 Kcs. to 30,000 Kcs. This range is covered in nine bands as follows:

COIL SET	GENERAL COVERAGE	BANDSPREAD
A	14.0 - 30 Mc.	27.0-30.0Mc.
B	7.0 - 14.4 Mc.	14.0-14.4Mc.
C	3.5 - 7.3 Mc.	7.0- 7.3Mc.
D	1.7 - 4.0 Mc.	3.5- 4.0Mc.
E	900 - 2050 Kc.	
F	480 - 960 Kc.	
G	180 - 430 Kc.	
H	100 - 200 Kc.	
J	50 - 100 Kc.	

The Receiver may be obtained in either table or rack mounting models. Plug-in coil set Types A,B,C and D are normally supplied with the receiver, and coil set Types E,F,G,H and J may be obtained in addition, as desired. Coil set types A,B,C and D provide bandspread for the 10-11, 20, 40 and 80 meter amateur bands and each of these bands is spread over approximately 400 dial divisions on the main 500 division tuning dial. Coil set Types JA, JB, JC, and JD, which do not provide the bandspread feature, are available as may be desired.

Circuit

The circuit employed on all bands comprises two tuned stages of radio frequency amplification, a tuned first detector, a high-frequency oscillator employing a tube separate from the first detector tube, a first intermediate frequency amplifier stage employing a variable-selectivity crystal filter, a conventional second intermediate frequency amplifier stage operating at 456 kilocycles, a combined second detector-automatic volume control - second audio stage, a first audio amplifier stage, an adjustable threshold series valve noise limiter, an audio output stage and a beat frequency oscillator coupled to the second

Crystal Filter

The crystal filter, located in the first intermediate frequency amplifier stage, is extremely flexible and of most efficient design. A six-position selectivity control and a crystal phasing control are front-panel mounted for adjustment of the crystal filter. Figure No. 1 shows the selectivity characteristics of the Receiver for each of the six positions of the selectivity control. The crystal filter may be used for either C.W. or M.C.W. reception; any degree of selectivity from true single-signal to broadcast reception being available. Operation of the phasing control provides for easy suppression of interfering signals which may produce objectionable heterodynes.

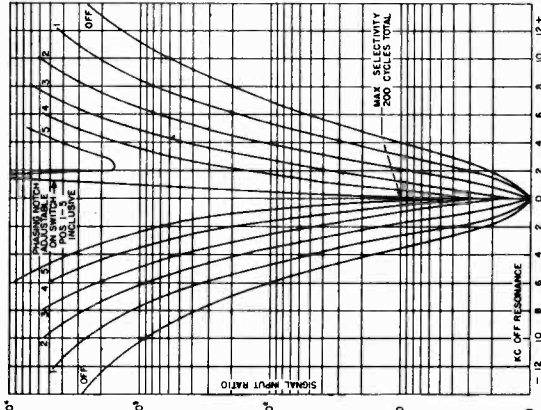


Figure No. 1. Crystal Filter Selectivity Curves.

Signal Strength Meter

Signal input readings are indicated in "S" units from 1 to 9 in 5 db. steps and in db. above S-9 from 0 db. to 40 db. on the

panel mounted signal strength meter. A reading of S-9 is obtained with an antenna input of approximately 50 microvolts. Accurate signal input readings from 0.5 microvolts to 5000 microvolts are possible. The meter employs a 0-1 milliamperer movement and is connected in a bridge circuit.

Audio Output

Two audio output circuits are provided. Loud-speaker terminals in the form of tip jacks, are located at the rear left-hand side of the receiver and a phone jack is mounted on the front panel. Normally, the plate circuit of the output tube is brought directly to the tip jacks and a separate permanent-magnet loud-speaker is connected to the tip jacks. The loud-speaker must have an impedance of from 5000 to 7000 ohms to properly load the output tube. The output transformer in this case is mounted on the loud-speaker and its primary carries the plate current of the output tube.

Power Supply

The Receiver can be used with the 697 Power Unit for 115 or 230 volt, 50 to 60 cycle A.C. operation or the 686S Power Unit for 6 volt D.C. operation. The Power Units are conservatively rated for use with the Receiver and will give long, trouble-free life.

Loud Speaker

RFSH or MCS Loud-speakers in rack or table mounting styles respectively can be used with the Receiver. These are permanent magnet type loud-speakers and have an output transformer which provides a proper impedance match for the output tube to the loud-speaker voice coil. This matching transformer has a primary impedance of 5000 ohms. In special models of the Receiver, an output transformer is mounted within the Receiver itself. In this case, the loud-speaker matching transformer must have a primary impedance which matches the Receiver output transformer secondary impedance. External means for supplying field excitation will be necessary if a dynamic speaker is to be used with the Receiver.

detector to provide for C.W. reception.

Antenna Input

The Receiver is designed for operation with a single wire antenna or antennae employing transmission lines having impedances of 70 ohms or more. The actual antenna input impedance is between 300 and 600 ohms depending on the received frequency.

Tube Complement

The HRO-5A1 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.....6K7
 - Second R.F. Amplifier.....6K7
 - First Detector.....6J7
 - High Frequency Oscillator.....6J7
 - First I.F. Amplifier.....6K7
 - Second I.F. Amplifier.....6K7
 - First A.F. Amplifier.....6X5
 - Diode Detector, AVC, Second Audio.....6X7
 - Audio Output.....6V6GT/6
 - Beat Frequency Oscillator.....6J7
 - Noise Limiter.....6H6

Noise Limiter

The addition of a new, highly effective series valve noise limiter to the HRO-5A1 greatly improves the Receiver's capabilities under adverse receiving conditions. Its usefulness is most appreciated on the higher frequency bands of the receiver where automobile ignition noise and other high frequency disturbances are effectively suppressed. A front panel threshold control permits adjustment of the level at which limiting action starts. Since distortion effects are relatively unimportant in C.W. reception, the noise limiter may be advanced to a greater degree than would normally be employed on M.C.W. signals. In this operating condition there is provided a simulation of A.V.C. action for the reception of C.W. signals, a highly desirable feature. The noise limiter is of the double-acting type - limiting noise on both positive and negative peaks.

INSTALLATION**Antenna Recommendations**

The radio frequency input of the Receiver is arranged for operation from either a single-wire antenna, a doublet antenna, or other types employing transmission lines having impedances of 70 ohms or more. There are two R.F. input binding posts at the left-hand end of the Receiver. A short, flexible, grounded lead is provided for grounding one input binding post in installations where a ground is required at the point of antenna input 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 antenna binding posts; the flexible grounding lead 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 post nearest the front panel of the Receiver, grounding the other binding post by means of the flexible lead. 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 binding post nearest the front panel of the receiver; the other binding post should be grounded by means of the flexible lead.

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, direction-

al type since the same antenna gain is available for both receiving and transmitting - a very desirable condition. Any transmission line of 70 ohms impedance or more may be used. 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 for controlling the transmitter plate supply and the Receiver B+ circuit may be used to achieve single-switch control of the station. This second relay should be a double pole, single throw type having one normally open pair of contacts and one normally closed pair of contacts. The schematic diagram of this type of control circuit is shown in Figure 3. The relay contacts are shown in the normal or non-energized position. With S-1 OPEN (receive position) the antenna transmission line is connected to the Receiver by contacts 2 and 3 and contacts 5 and 6 on relay RY-1; contacts 7 and 8 on relay RY-2 are closed and complete the B+ circuit of the Receiver. With the switch S-1 closed (transmit position) RY-1 contacts 1 and 3 and 4 and 6 are closed transferring the antenna transmission line to the transmitter; contacts 9 and 10 of relay RY-2 close to complete the plate supply circuit to the transmitter. Contacts 9 and 10 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 OPEN and in the transmitting condition with switch S-1 CLOSED. The power source for the relays RY-1 and RY-2 will be either 6 volts or 115 volts A.C. or D.C. depending on the power source available and the types of relays used.

When a doublet antenna is used, the antenna feeders or balanced transmission line are connected to the antenna binding posts. The flexible lead is not used.

The inner conductor of a concentric transmission line should be connected to the antenna binding post nearest the front panel of the Receiver. The outer conductor and the flexible grounding lead should be connected to the other binding post.

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 5-7 describes this procedure.

Installation Procedure

After unpacking the Receiver and associated equipment, proceed as follows:

- (1) Make sure all tubes are seated firmly in their sockets.
- (2) Insert the Receiver power plug into the Power Unit output socket.
- (3) Connect Power Unit cord to proper source of voltage.
- (4) Connect antenna as recommended in Section 2-2.
- (5) Connect the loud-speaker to the tip jacks marked "SPKR" at the rear of the Receiver. If a loud-speaker is NOT going to be used a jumper MUST be connected between the "SPKR" tip jacks. If this precaution is neglected the output tube may be damaged due to excessive screen current.

The frequency at which reception is desired will determine the coil set used, in accordance with the calibration charts on the front panel of each coil set. If Bandspread coverage of one of the amateur bands is desired, as indicated by the calibration chart at the right-hand side of the front panel of coil sets A, B, C and D, the screws in each coil terminal panel should be in the right-hand position. If General coverage is desired, the terminal panel screws should be in the left-hand position and calibration will be in accordance with the chart on the left-hand side of the coil set front panel. (See Section 4 concerning bandspread switching.) After selecting the proper coil set and adjusting for either Bandspread or General coverage, plug the coil set into the opening at the front of the Receiver. To avoid damage to the contacts it is important that the Receiver B+ switch be in the OFF position whenever coil sets are changed.

The Receiver is now ready for operation, and is turned on by means of the toggle switch mounted on the panel of the Power Unit. After allowing the tubes to reach operating temperature, the B+ circuit is completed by means of the toggle switch on the front panel of the Receiver, located directly above the R.F. GAIN control. This is a convenient stand-by switch.

A pair of terminals (BSW) at the rear of the Receiver provide a convenient means for connecting a relay or switch for remote control of the Receiver B+ circuits.

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.

Battery Operation

The Receiver is readily adaptable to emergency or portable operation, or operation in locations where 115 or 230 volt A.C. power is not available. It may be operated directly from batteries or a National Type 686S Power Unit may be used for operation from a 6 volt storage battery. The Type 686S Power Unit draws 7.5 amperes at 6 volts when furnishing power to the Receiver. Battery drain may be decreased for emergency operation by removing the 6V6GT/G output tube from its socket. In this case, the Type 686S Power Unit draws 6 amperes at 6 volts.

The Schematic Diagram, Figure 8, shows a pin view of the Receiver power plug, thus providing the information necessary for wiring batteries to an auxiliary four-prong socket. The regular Receiver power plug may be inserted into this auxiliary socket to complete the power circuit. The normal B voltage required for operation of the Receiver is 240 volts at which voltage the receiver draws 70 milliamperes. Satisfactory headphone operation will result with a B voltage as low as 180 volts. The B battery life may be increased in this instance by removing the 6V6GT/G output tube from its socket as it is not used for headphone operation. With the output tube removed from its socket, the Receiver will draw 36 milliamperes at 180 volts. With the output

tube in operation the B battery drain is 65 milliamperes at 180 volts. To conserve battery power the Receiver power plug should be removed from the auxiliary battery socket when the Receiver is not being used. If greater convenience is desired, a single pole, single throw switch may be wired in series with the A+ lead to the battery to turn off the heater supply. If an A battery switch is used it is important that both the external A+ switch and Receiver B+ switch be turned OFF to conserve battery power when the Receiver is not being operated. The Receiver B+ switch will serve as a stand-by switch during transmission periods the same as for A.C. operation.

position, the nominal bandwidth is 8.0 Kc. at ten times down. Switching the Crystal Filter SELECTIVITY switch to position 1 gives a bandwidth of approximately 3.6 Kc., while with the SELECTIVITY switch in position 5 the bandwidth is about 1700 cycles. The PHASING control can be adjusted to suppress interfering signal frequencies differing from the desired signal by 300 cycles or more. The Crystal Filter employs a bridge type circuit which makes use of the high rate of reactance change with changes in frequency provided by a crystal to give the desired sharpness of selectivity. The reactance vs. frequency characteristic of the crystal is modified by damping, or loading the crystal by means of the tuned input circuit. When the input circuit is detuned, its effective resistance decreases and damping is greatly reduced, producing maximum selectivity. Detuning the input circuit does not materially affect the amplification of the receiver at the resonant frequency of the crystal since the series impedance of the circuit becomes very low when damping is reduced.

R.F. Amplifier Stages

The radio frequency amplifier stages are so designed that the receiver gain is essentially uniform throughout the entire tuning range of the Receiver. The impedance of a typical R.F. tuned secondary circuit decreases as the L/C ratio decreases, thus tending to reduce stage gain as the low frequency end of the tuning band is approached. Compensation for this effect is obtained by the use of high inductance primary coils in the interstage R.F. transformers. The high inductance primary is designed so that the primary circuit, as a whole, resonates broadly at a frequency outside the low frequency limit of the coil set tuning range. The primary circuit will, therefore, show increasing impedance as the tuning of the receiver approaches the low frequency end of the band. This resonant characteristic of the primary increases gain at low frequencies, overcompensating for the decreasing impedance of the secondary. In order to obtain the proper amount of compensation, a small coupling capacity is placed between the plate of the preceding tube, and the grid of the following tube. This capacity is most effective at the high frequency end of the band and combined with the resonant characteristic of the primary provides uniform

CIRCUIT FEATURES

gain throughout the band. A slightly different arrangement is employed for gain compensation in the 14 to 30 megacycle band. The interstage R.F. coupling transformers have three windings all closely coupled together. The primary winding connected in the plate circuit of the first R.F. tube is interwound with the tuned secondary winding and both have approximately the same number of turns. A third winding which feeds the control grid of the following R.F. amplifier tube is so designed that its natural period (or resonant frequency) falls just outside the low frequency end of the frequency band covered by the coil set. The impedance of this resonant secondary increases as the low frequency end of the tuning range is approached, thus tending to compensate for the unfavorable L/C ratio of the tuned secondary in much the same manner as the resonant primary system used in other coil sets. The self-resonant secondary arrangement is preferable, in the 14 to 30 Mc. band, as the resonant primary system is inadequate in its levelling action. It is not practical to include any gain compensation system in the coil sets for the 50 to 100 Kc. band.

Band-Spread

The plug-in coil sets regularly sup-

Temperature Compensation

The receiver is compensated for frequency drift due to temperature changes occurring in circuits which may detune the receiver from the desired signal. While variations in room temperature are usually so gradual that drift resulting from this source is not objectionable, it is minimized through the use of air dielectric trimmer condensers, and the use of coil form material which has a small temperature coefficient. The cause of most objectionable 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. To minimize heating of the R.F. coils, the receiver is designed so that the coil sets are plugged into the very bottom of the receiver, underneath the chassis in a separate shielded compartment. The heat from the tubes will of course rise toward the top of the receiver and the R.F. coils will remain nearly at room temperature.

Crystal Filter

A Crystal Filter affords six positions of selectivity in the HRO Receiver, ranging from broad-band selectivity for reception of broadcast signals to single signal selectivity for C.W. reception. The use of the Crystal Filter enables the operator to easily suppress an interfering signal by means of the PHASING control. With the SELECTIVITY switch in the OFF position, the PHASING control has little effect on receiver performance. In this

Beat Frequency Oscillator

A beat frequency oscillator, which operates at or near the intermediate frequency is coupled to the second detector. The signal from this oscillator and the desired C.W. signal heterodyne at the second detector and produce an audio beat note thus providing a means for C.W. reception.

Automatic Volume Control

Automatic Volume Control is provided for use only for M.C.W. reception. When the Beat Frequency Oscillator is turned on for C.W. reception it provides sufficient signal to operate the A.V.C. system and thus render the receiver extremely insensitive for C.W. reception, therefore, the A.V.C. switch should be in the OFF position. However, the noise limiter, due to its peak limiting action, will provide A.V.C. action for the reception of C.W. signals. The limiter control may be advanced as desired to produce this A.V.C. action and may even be fully advanced to good advantage since the distortion is not detrimental to the reception of C.W. signals.

above the C.W. OSC. control. The automatic volume control circuits are operative when the toggle switch is pushed to the left.

The AUDIO GAIN control is located directly above the A.V.C. switch. Clockwise rotation of this control increases the signal applied to the triode section of the second audio tube. This control adjusts the volume level of the signal at both phone jack and loud-speaker terminals.

The LIMITER control, located just to the left of the MAIN TUNING dial, serves to adjust the D.C. potential applied to the elements of the series valve noise limiter tube. The limiter circuit is thus provided with an adjustable threshold at which limiting starts. Any audio voltages or noise peaks in excess of this threshold are prevented from reaching the audio amplifier. With the LIMITER control set at zero, the limiter circuits will pass all but the strongest audio peak voltages; when the control is set at ten, the threshold is lowered to a point where the audio signal will be distorted due to the suppression of the positive and negative peaks.

The S-METER for indicating carrier intensity or signal strength is on the upper left-hand corner of the front panel. Just below it and to the left, is a switch which connects the S-METER in the circuit.

The PHONE JACK is located just below and slightly to the right of the S-METER. When a phone plug is inserted into the PHONE JACK, the loud-speaker is automatically silenced.

The BANDSPREAD switch for each of the four bandspread coil sets is located on each coil set. Inspection of the coil set terminal panels will show several small rectangular metal pieces. There are two of these metal pieces or terminal blocks on each coil which are tapped and countersunk for a flat-head machine screw. With the screws in the left-hand position, the coil range will be that shown in the left-hand or general coverage chart. It is only necessary to move each of the four screws to the right-hand terminal block of each coil to change the calibration from general coverage to BANDSPREAD as shown on the right-hand chart.

through a worm drive having a reduction ratio of 20 to 1. Back-lash is eliminated by the use of a spring-loaded split worm wheel which assures positive drive in either direction at all times.

OPERATION

Controls

The MAIN TUNING dial is located at the center of the front panel. The dial is so arranged that the frequency to which the receiver tunes increases as the dial reading increases. Each coil set is provided with a calibration chart showing the periods of transmission and frequency COIL SETS. This last function is very important. The B+ circuits are completed include the band-spread feature. Observation of each coil set tuning chart will show that the calibration is very nearly linear which eliminates considerable reference to the coil charts.

The R.F. GAIN control is located at the lower right-hand corner of the front panel and 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 on the receiver performance. With the SELECTIVITY control knob set at any point between 1 and 5, inclusive, the crystal filter is in operation, selectivity increasing as the knob is progressively advanced to position 5. The PHASING control is then used to balance the crystal bridge circuit and eliminate interfering signals or heterodynes.

The C.W. OSC. switch and vernier tuning control is located at the lower left-hand side of the front panel. The C.W. oscillator is used to produce an audible beat note when receiving C.W. signals or to locate the carrier of a weak M.C.W. station. Rotating the C.W. OSC. knob in a clockwise direction from OFF removes the ground from the cathode of the C.W. Oscillator, thus permitting it to oscillate. Further rotation of the knob from 0 on the scale to 10 varies the frequency of oscillation over a range of approximately 3 kilocycles. The C.W. Oscillator tunes to the receiver intermediate frequency at 9 on the graduated scale.

The A.V.C. switch is located directly

Noise Limiter
An adjustable threshold, series valve noise limiter provides very useful suppression of static peaks, automobile ignition noise and other high-frequency electrical noise fed to the receiver via the antenna. The degree of suppression and level at which noise limiter action occurs is adjustable by means of the limiter control on the front panel. When receiving M.C.W. signals, care in setting this control must be exercised since too much limiting action will cause audio distortion. However, when receiving C.W. signals the operator may take full advantage of the limiting action and provide AVC action as well as noise suppression, since distortion is not serious in this case. The 6H6 in the noise limiter stage is a duo-diode providing suppression of both the positive and negative peaks of noise.

Main Tuning Dial

The main tuning dial at the center of the front panel permits swift, accurate tuning and precise logging. This type of dial has an effective scale length of approximately twelve feet and is direct reading to one part in five-hundred. The dial drives the four-gang main tuning capacitor

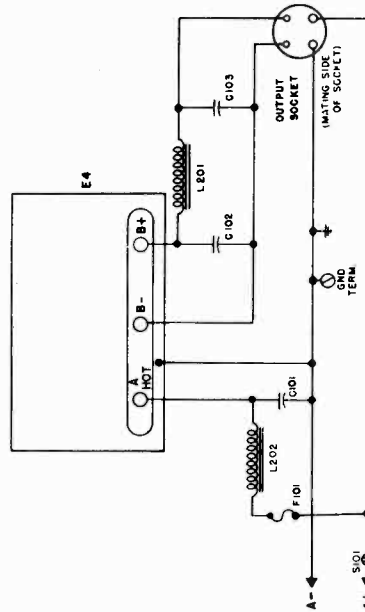


Figure No. 40. Schematic Diagram -- 686S Power Unit
TYPE 686S AND TYPE 1286S POWER UNITS

NATIONAL COMPANY, INC.

C.W. Reception

After the HRO-5A1 is properly installed it is put in operation by turning both the Power Unit switch and the Receiver B switch to the ON position. The LIMITER control should be set at 0. The C.W. OSC. control should be turned on and the A.V.C. switch must be pushed to the right to render the A.V.C. circuits inoperative. If the A.V.C. switch is turned on with the C.W. oscillator in operation, the Receiver will block and become extremely insensitive. The Receiver is now adjusted for C.W. reception and will tune in accordance with the frequency calibration of the coil set in use.

Although the settings of the R.F. GAIN and A.F. GAIN controls will depend to some extent upon operating conditions, it is recommended that the A.F. GAIN control be set at 5 and the R.F. GAIN control advanced as may be required to provide a satisfactory audio signal. Advancing the R.F. GAIN control too much may cause I.F. or second detector overload. Such overload is indicated by a change in pitch of the C.W. beat note over the duration of a code character, or by excessive "thumping".

The best setting of the C.W. OSC. control will also depend upon operating conditions. When the received signal is free from interference and is sufficiently strong to override static and circuit noise, it is recommended that the C.W. OSC. control be set at the position which tunes the C.W. oscillator to the intermediate frequency of the receiver. This setting will normally be between 8 and 10 on the C.W. OSC. dial. As the control is turned toward 0, the C.W. oscillator is progressively detuned from the intermediate frequency of the receiver.

The operator can tell the extent of this deviation by listening to the characteristic pitch of background and circuit noises. When this pitch is 2000 or 3000 cycles per second, it will be found that the receiver has definite single-signal properties such that on one side of the carrier, the audio beat note of a received signal will be considerably louder than that of the other side. This characteris-

tic is helpful in receiving weak signals through interference and utilizes the maximum available sensitivity of the receiver.

If receiving conditions are such that static peaks or noise pulses of high intensity and short duration are present, the best signal-to-noise ratio is obtained by advancing the LIMITER CONTROL toward 10. Maximum limiter action is possible for reception of C.W. signals since audio distortion is not important. At the same time using strong limiter action has the further advantage of providing A.V.C. action for C.W. reception.

Phone Reception

The initial adjustment of the HRO-5A1 Receiver for reception of M.C.W. signals is the same as for C.W. reception except that the C.W. OSC. control should be turned off. For M.C.W. reception, the C.W. oscillator may be useful in locating the carrier of a weak phone or broadcast station. After the phone carrier has been located, the C.W. oscillator is turned off. With the A.V.C. OFF the setting of the A.F. GAIN and R.F. GAIN controls will depend to some extent upon operating conditions. It is recommended that the A.F. GAIN control be set at about 5 and the R.F. GAIN control advanced as may be required to provide a satisfactory audio signal. When receiving weak signals, best signal-to-noise ratio will be obtained by retarding the A.F. GAIN control and advancing the R.F. GAIN control to a point as near maximum as receiving conditions will permit. Care must be exercised to prevent overloading the I.F. or second detector stages under these conditions. Overload will be indicated by excessive audio distortion.

To receive M.C.W. signals with automatic volume control, the A.V.C. switch must be placed in the ON position. The R.F. GAIN control should be advanced to a point as near maximum as receiving conditions will permit. Audio output should be controlled entirely by means of the A.F. GAIN control. When the noise level is high, the R.F. GAIN control may be retarded to limit the overall sensitivity of the receiver to a definite maximum. It should be remembered, however, that the

full range of A.V.C. action cannot be obtained unless the R.F. GAIN control is fully advanced.

The action of the LIMITER control is similar to that described under Section 4-2. The best setting of the LIMITER control will be determined by trial since too much limiting action will cause distortion of the audio output. If the noise pulses and static peaks are of large amplitude or of long duration the best signal-to-noise ratio will be obtained with the A.V.C. switch in the OFF position. In this operating condition, the optimum signal-to-noise ratio must be obtained by careful adjustment of both the R.F. GAIN and LIMITER controls.

Reception with Crystal Filter

The crystal filter may be used advantageously in the reception of both C.W. and M.C.W. signals to adjust the selectivity of the receiver and also to suppress interfering signals or heterodynes.

For M.C.W. reception the normal setting of the SELECTIVITY control is at one of the positions affording broad selectivity. Positions 1 and 2 are recommended. Selectivity may be progressively increased by turning the SELECTIVITY control to positions 3, 4 and 5 although too sharp selectivity for M.C.W. reception will render phone signals unintelligible due to excessive side-band cutting. The PHASING control is used to attenuate, or eliminate, if possible, interfering signals. The PHASING control is normally set at 0 on the scale for reception of M.C.W. signals. If, after tuning in a signal, an interfering signal causes a heterodyne or whistle, the PHASING control should be adjusted until the interfering signal is reduced to a minimum. The setting of the PHASING control which gives maximum attenuation of the heterodyne will depend on the pitch of the heterodyne whistle. If the beat-note is above 1,000 cycles, the optimum PHASING control setting will be zero; if the beat-note is 300 or 400 cycles, the optimum PHASING control setting will be near one end of the scale or the other, depending upon whether the interfering signal is higher or lower in frequency than the desired signal.

For the reception of C.W. signals the action of the crystal filter is similar to that for M.C.W. reception except that full use of the sharp selectivity position may be used without the loss of intelligibility experienced in M.C.W. reception. When maximum selectivity is used, (SELECTIVITY control at position 5), care must be exercised since the tuning is very critical. When the receiver is slowly tuned across the carrier of a 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. OSC. 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. OSC. dial setting near 7 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. OSC. 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.

Measurement of Signal Strength

To measure the strength or intensity of a signal, the R.F. GAIN control must be advanced to 9.5 and the A.V.C. switch turned to the ON position. The crystal filter should be turned OFF by means of the SELECTIVITY control, and the PHASING control set at 0. The LIMITER and A.F. GAIN controls do not affect the S-METER reading.

Tuning the receiver to a signal will cause the meter to read, indicating the signal input in S-units or in decibels a-

above the S-9 level.
 With no R.F. input to the receiver, or with the antenna disconnected, the S-meter should read 0, plus or minus 1 S-unit. If it does not, the S-meter circuit requires adjustment. See Section 6.
 Measurement of the signal strength of C.W. signals cannot be made with the C.W. oscillator in operation.

ALIGNMENT DATA

General

Should realignment of the HRO-5A1 Radio Receiver become necessary the following alignment data should be carefully studied before making any circuit adjustments. It is important that the function of each circuit element is understood so that correct alignment may be obtained quickly and accurately. Adjustments referred to by number are shown in Figures 5 and 7.

- (a) The complete alignment of the receiver may be divided into five steps:
- (a) Intermediate Frequency Amplifier alignment including crystal filter adjustments.
- (b) High Frequency Oscillator alignment.
- (c) Radio Frequency Amplifier alignment.
- (d) Tracking of High Frequency Oscillator and Radio Frequency Amplifier circuits.
- (e) Bandsread Adjustments.

I.F. Amplifier Alignment

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. The receiver should be adjusted for normal operation with no antenna, AVC OFF, R.F. GAIN at 9, crystal Filter SELECTIVITY switch at 5, PHASING control at 0, and C.W. OSC. turned ON. The setting of the A.F. GAIN control does not affect the meas-

signal generator output should be reduced now in order to avoid I.F. or audio overload and the C.W. OSC. should be adjusted to give an audio beat-note at some frequency between 400 and 1000 cycles per second.

The I.F. amplifier trimmer capacitors, numbers 9,11,12,13 and 14, should be carefully tuned to produce a maximum reading on the output meter. The order of adjustment is not important. While tuning the I.F. amplifier trimmer capacitors it will be necessary to reduce the signal generator output if the I.F. amplifier gain increases to the overload point.

The crystal filter SELECTIVITY control should be set at 1 and the signal generator detuned between 3 and 4 kilocycles to one side of the crystal frequency, crystal filter trimmer capacitor Number 10 should be tuned for maximum output meter indication. After making this adjustment, the SELECTIVITY control should be set at off and the signal generator returned to exact crystal frequency. Compensator trimmer capacitor Number 17 should then be tuned for maximum reading on the output meter.

After the I.F. amplifier has been aligned, the tuning of the C.W. OSC. should be checked. This may be easily accomplished by repeating the test previously described with the crystal filter off. If the setting of the C.W. OSC. control does not occur at or near 9, with this test, turn the C.W. OSC. control to 9 and carefully adjust trimmer Number 15 by ear for the lowest pitch of background noise.

High Frequency Oscillator Alignment

The need for realignment of the high frequency oscillator of any band is indicated when the frequency calibration of the receiver dial is in error by more than 3% at the high frequency end of the band in question. If there is doubt concerning the necessity for high frequency oscillator realignment, this portion of the circuit should not be adjusted as correction can be made by R.F. amplifier trimmer adjustments.

If the frequency calibration of a coil set is in error by more than 3%, it should be corrected in the following manner:

(a) Adjust the receiver for normal operation as follows: R.F. GAIN at 9, C.W. OSC. off, A.V.C. off, Crystal Filter off, A.F. GAIN set to provide a suitable signal level.

(b) Adjust an accurately calibrated signal generator to provide a signal which should be tuned in near 490 on the receiver dial according to the general coverage calibration chart for the coil set in use.

(c) Tune the receiver to the test signal and compare the dial reading with the calibration chart.

(d) When the receiver dial reading is too low, more circuit capacity is required and is supplied by adjustment of trimmer Number 8. When the receiver dial reading is too high, less circuit capacity is required and is removed by adjustment of trimmer Number 8.

It is particularly important that the high frequency oscillator operates above the R.F. amplifier frequency and not below. This can be checked by tuning in the test signal as an image which is normally 912 kilocycles lower on the receiver dial. The image signal should be much weaker if the R.F. amplifier is correctly aligned and a stronger test signal may be required in order to hear the image. If the image signal appears at a higher dial setting rather than a lower dial setting, the high frequency oscillator is incorrectly adjusted and the capacity of trimmer, Number 8, must be decreased until the real signal and image signal each appear at the proper points on the dial.

R.F. Amplifier Alignment

The term R.F. amplifier alignment, as used in this section, includes alignment of both R.F. Amplifier and First Detector circuits.

The receiver should be adjusted as in paragraph (a) 5-3. No Antenna is required. Turn the receiver dial to 490 and adjust trimmers, Numbers 2,4, and 6, for maximum background noise, which is the setting for maximum gain.

Tracking of the H.F. Oscillator and I.F. Amplifier Circuits

Tracking of the H.F. Oscillator and R.F. Amplifier circuits may be readily

checked by observing the background noise while tuning over the range of the coil-set in use. The background noise should not vary greatly as the dial is turned toward the low frequency limit of the coil set tuning range. The actual tracking of each stage near the low frequency limit of the tuning range may be checked by pressing the outside rotor plates of the main tuning condenser section toward or away from the stator, but not far enough to short the condenser or permanently bend the rotor plates. Any change in capacity should decrease the background noise indicating detuning properly. Coil sets which may require precise adjustment of circuit elements are provided with adjustable series padders in the high frequency oscillator position of the coil set, which can be adjusted to track with the average adjustment of the R.F. amplifier coils. This series padder is mounted inside the coil and is adjustable from the rear by means of a screw-driver. It should be remembered that the series padders found in the coils of coil-sets types A, B, C and D are bandspread series padders and should not be adjusted except during bandspread alignment.

After calibration and alignment at the high-frequency end of the coil set have been accomplished, as explained in Section 5-3, the tracking may be adjusted as follows:

- (a) With the receiver adjusted as in Section 5-4, turn the receiver dial to 20.
- (b) Test the tracking of each stage in turn by bending the outside rotor plate of each section of the main tuning capacitor. DO NOT BEND the rotor plate of any section to such an extent that it will not spring back to its original position.
- (c) Adjust the H.F. oscillator series padder to its optimum tracking position when step (b) above gives indication of poor tracking.
- (d) Turn the receiver dial to 490 and adjust trimmer Number 8 to give the proper calibration with the new series padder adjustment.
- (e) Repeat (a), (b), (c) and (d) until best tracking is obtained.
- (f) Note any slight tracking errors occurring in the R.F. Amplifier stages so

that if the same error occurs in a majority of the coil sets, the outside rotor plate may be permanently bent to provide the best tracking for the stage involved.

Bandspread Alignment

The following data applies only to coil sets which include the bandspread feature; coil-set Types A, B, C and D. Adjustments made for general coverage will affect the bandspread adjustments, but the separate bandspread adjustments may be made without changing the general coverage alignment. The four screws used to switch from general coverage to bandspread must be shifted to the right-hand terminal blocks before any bandspread alignment adjustments are made.

The need for realignment of the H.F. oscillator section of any coil set is indicated when the frequency calibration of the main tuning dial is in error by more than 30 divisions at the high frequency end of the band in question.

(a) If the frequency calibration of a coil set is in error, realignment may be accomplished in the following manner:

- (1) Repeat the procedure of Section 5-3 with the exceptions that the test oscillator frequency is chosen so as to be tuned in at 450 on the receiver dial as indicated by the bandspread tuning chart and correction for calibration error is made by adjustment of trimmer number 7.
- (b) The alignment of the R.F. amplifier for bandspread operation is similar to that for general coverage so the procedure of Section 5-4 should be repeated with the exception that the receiver dial should be turned to 450 and trimmer Numbers 1, 3 and 5 should be adjusted for maximum background noise.
- (c) The adjustment and method of checking bandspread tracking is not similar to that for general coverage. The following procedure should be used for bandspread tracking adjustments.
 - (1) With the receiver adjusted as in paragraph (a) above turn the receiver dial to 50.
 - (2) Check the receiver calibration at dial reading 50 against an accurate test oscillator.
 - (3) Adjust the H.F. oscillator ser-

ies padder located inside the H.F.O. coil shield to provide the correct dial calibration.

(4) Turn the dial to 450 and adjust trimmer Number 7 to give the proper calibration.

(5) Turn the dial to 50 and check the calibration. Repeat (3) and (4) if necessary.

(6) With the receiver dial at 50 check the settings of trimmers, Numbers 1, 3 and 5 for the position of maximum background noise.

(7) If it is found that increasing or decreasing the capacity of trimmer 1, 3 or 5 increases the background noise, adjust the associated series padder located inside the coil shields to provide the required capacity.

(8) Turn the receiver dial to 450 and adjust trimmers 1, 3 and 5 for maximum background noise.

(9) Repeat (6) and (8), also (7) if necessary.

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 end of each band. The general coverage adjustments affect the bandspread adjustments and should be performed first. The following procedure should be adhered to:

- (a) General Coverage:
 - (1) With the four screws used for switching from general coverage to bandspread in the left-hand (general coverage) position, adjust the receiver for normal operation as follows: R.F. GAIN at 9, C.W. OSC. off, A.V.C. off, CRYSTAL FILTER off, A.F. GAIN set to provide a suitable signal.
 - (2) Connect the antenna feeders to the Receiver antenna binding posts and tune the receiver to a Signal at approximately 490 on the Receiver dial. Adjust trimmer Number 2 for maximum signal output. If no signal can be received, the trimmer should be adjusted for maximum background noise.
- (b) Bandspread:
 - (1) With the receiver adjusted the same as for general coverage, shift the

four screws on the coil terminal panels to the right-hand position (bandspread position).

(2) Connect the antenna feeders to the Receiver antenna binding posts and tune the receiver to a signal at approximately 450 on the Receiver dial. Adjust trimmer Number 1 for maximum signal output. If no signal can be received the trimmer should be adjusted for maximum background noise.

S-Meter Adjustment

The S-meter balancing resistor R-32, is used to obtain zero meter reading in the absence of signal input to the receiver. The adjustment is as follows: Set the R.F. GAIN control at 9.5, AVC ON, and disconnect the antenna. R-32 should now be adjusted until the S-meter reads zero.

Main Tuning Dial

The main tuning dial should normally give no trouble. If, however, the dial should become removed from the receiver it should NOT be operated until mounted on the condenser 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 condenser, limit stops protect the dial provided the assembly is properly done. The procedure for re-mounting the dial is as follows:

- (a) Place dial on condenser shaft, tighten set-screws and turn dial counter-clockwise to fully mesh condenser 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 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 should be flush with the edge of the stator plates at zero. 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 condenser 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 pointer's equidistant 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 trials may be required before the correct mesh is found.

POWER UNITS

Type 697 Table Model Power Unit

The National Type 697 Table Model Power Unit operates from 115 or 230 volts A.C., 50 or 60 cycles, to provide 240 volts at 70 milliamperes D.C. and 6.2 volts at 3.2 amperes A.C. The circuit diagram of this unit is shown in Figure 9. Output voltages for both A and B supply are available at a four prong socket for convenient connection of the receiver power plug. Section 7-3 shows typical operating voltages and currents when used with the

HRO-5A1 Radio Receiver. The Type 697 Power Unit consists of a power transformer, glass Type 5Y3GT/G rectifier tube, and a single section condenser-input filter. B- is connected to the Power Unit Chassis. The Power Unit for rack mounting is designated as SPU-697.

Type 686S Table Model Power Unit

The National Type 686S Table Model Power Unit operates from a 6 volt D.C. supply to provide approximately 165 volts at 45 milliamperes D.C. Battery clips are provided for convenient connection to a 6 volt storage battery or similar source of power. Output voltages for both A and B supply are available at a four prong socket for convenient connection of the receiver power plug. Figure 10 shows the schematic wiring diagram. Section 7-3 shows typical operating voltages and currents when used with the HRO-5A1 Radio Receiver. The 686S Power Unit consists of a vibrapack and a single section condenser-input filter. The vibrapack uses a 6X5 (or 0Z4) type rectifier tube and a vibrator. It should be noted that B- is not connected to the Power Unit chassis; A- is connected to the chassis. The National Type SPU-686S Power Unit is the rack-mounted model.

Typical Operating Conditions for Power Units

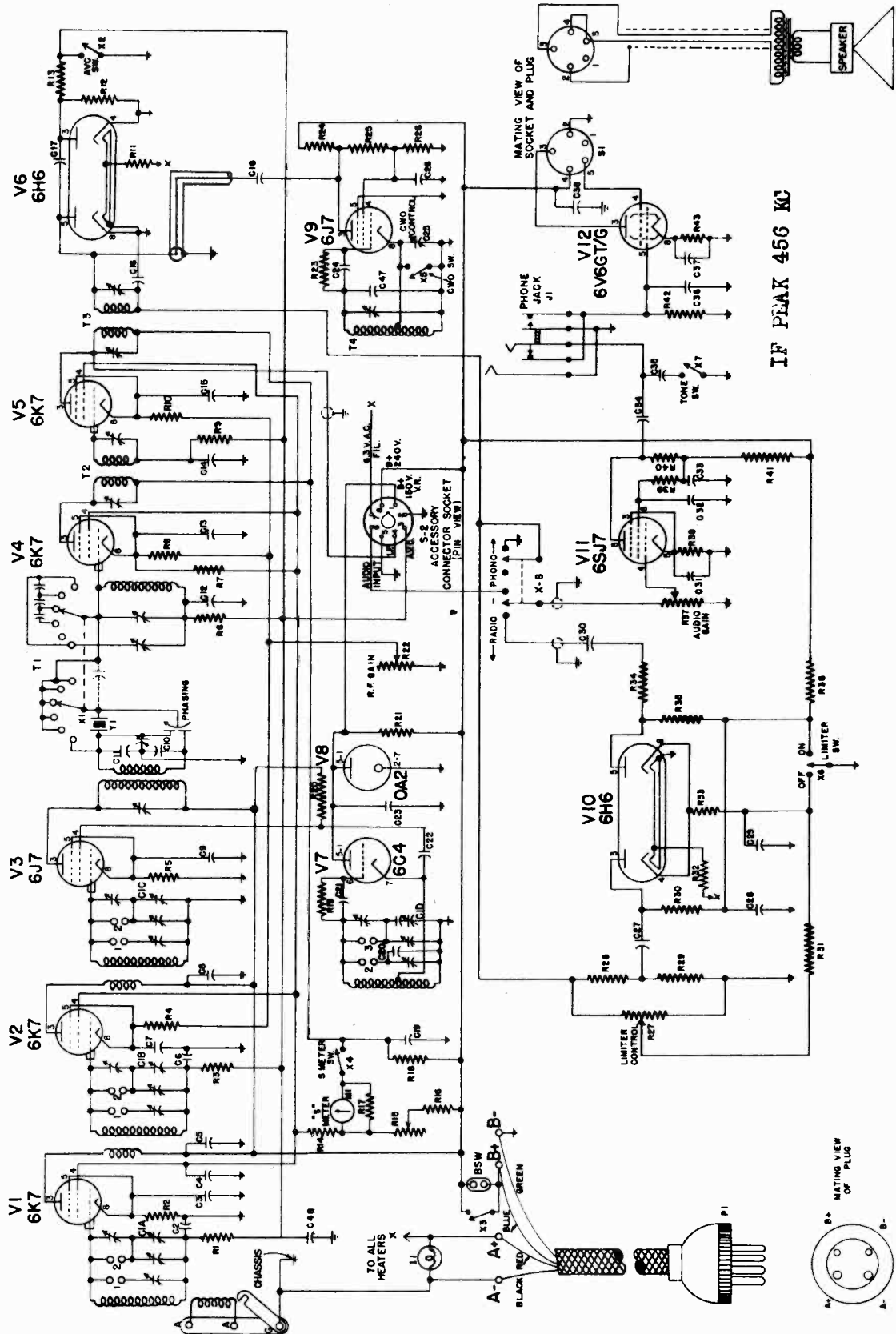
The following table shows typical operating currents and voltages of the 697, 686S Power Units when used with HRO Series Receivers:

VARIABLE	697	686S
Primary Voltage	115 or 230 VAC	6V DC
Frequency	50/60 cps	0
Heater Voltage	6.2 VAC	6V DC
Heater Current	3.4 Amp. AC	3 Amp.
B Voltage	240 VDC	165V DC
B Milliamperes	70 DC	45 DC
Line Current	.65 Amp.	6.3 Amp.
Power Consumption	70 Watts	38 Watts

PARTS LIST

Symbol	Function	Type	Rating
CAPACITORS			
C-1A	First R.F. Amplifier Tuning	Air	225 mmf. max.
C-1B	Second R.F. Amplifier Tuning	Air	225 mmf. max.
C-1C	First Detector Tuning	Air	225 mmf. max.
C-1D	H.F. Oscillator Tuning	Air	225 mmf. max.
C-2	First I.F. Grid Filter	Paper	.01 mfd., 600 VDCW
C-3	First Detector Cathode Bypass	Paper	.1 mfd., 400 VDCW
C-4	Second R.F. Plate Bypass	Paper	.1 mfd., 600 VDCW
C-5	H.F. Oscillator Screen Bypass	Paper	.1 mfd., 600 VDCW
C-6	First I.F. Cathode Bypass	Paper	.1 mfd., 400 VDCW
C-7	H.F. Oscillator Coupling	Paper	.01 mfd., 600 VDCW
C-8	First & Second I.F. Plate Bypass	Paper	.25 mfd., 600 VDCW
C-9	Second I.F. Grid Filter	Paper	.01 mfd., 600 VDCW
C-10	Second I.F. Cathode Bypass	Paper	.1 mfd., 400 VDCW
C-11	Second Detector Cathode Bypass	Elec.	10 mfd., 50 VDCW
C-12	Second Detector Filter	Ceramic	100 mmf., 500 VDCW
C-13	Second Detector Filter	Ceramic	270 mmf., 500 VDCW
C-14	V-7 to V-10 Coupling	Paper	.1 mfd., 400 VDCW
C-15	Second Detector Bypass	Paper	.01 mfd., 600 VDCW
C-16	Second Audio Plate Bypass	Mica	470 mmf., 500 VDCW
C-17	Second R.F. Cathode Bypass	Paper	.1 mfd., 400 VDCW
C-18	V-7 to V-9 Coupling	Paper	.1 mfd., 600 VDCW
C-19	Audio Output Cathode Bypass	Elec.	10 mfd., 50 VDCW
C-20	Not Used		
C-21	C.W. Oscillator Screen Bypass	Paper	.01 mfd., 600 VDCW
C-22	First R.F. Cathode Bypass	Paper	.1 mfd., 400 VDCW
C-23	V-1, V-2, V-5 and V-6 Screen Bypass	Paper	.1 mfd., 400 VDCW
C-24	First R.F. Grid Filter	Paper	.01 mfd., 600 VDCW
C-25	First R.F. Plate Bypass	Paper	.1 mfd., 600 VDCW
C-26	Second R.F. Grid Filter	Paper	.01 mfd., 600 VDCW
C-27	C.W. Oscillator Tuning	Air	30 mmf.
C-28	Audio Output Screen Bypass	Paper	.01 mfd., 600 VDCW
C-29	C.W. Oscillator Grid Coupling	Mica	.001 mfd., 500 VDCW
C-30	H.F. Oscillator Grid Coupling	Ceramic	100 mmf., 500 VDCW
C-31	Crystal Filter Bridge	Ceramic	100 mmf., 500 VDCW
C-32	Crystal Filter Bridge	Ceramic	100 mmf., 500 VDCW
C-33	V-8 to V-7 Coupling	Ceramic	2 mmf., 500 VDCW
C-34	Coil A-1 Antenna Coupling	Ceramic	39 mmf., 500 VDCW
C-35	Coil A-1 Series Padder	Mica	.0012 mfd., 500 VDCW
C-36	Coil A-4 Series Padder	Mica	.001 mfd., 500 VDCW
C-37	Coil B-4 Series Padder	Mica	.0026 mfd., 500 VDCW
C-38	Coil C-4 Series Padder	Mica	.0016 mfd., 500 VDCW
C-39	Coil D-4 Series Padder	Mica	900 mmf., 500 VDCW
C-40	Coil E-4 Series Padder	Ceramic	500 mmf., 500 VDCW
C-41	Coil F-4 Series Padder	Ceramic	350 mmf., 500 VDCW
C-42	Coil G-4 Series Padder	Ceramic	100 mmf., 500 VDCW
C-43	Coil J-4 Series Padder	Ceramic	50 mmf., 500 VDCW
C-44	H.F. Oscillator Temp. Compensating (Minus .00077 mmf./mmf./°C)	Ceramic	10 mmf., 500 VDCW
C-45	V-10 to V-11 Coupling	Paper	.1 mfd., 400 VDCW
C-46	Limiter Filter	Elec.	8 mfd., 250 VDCW
C-47	Limiter Output Coupling	Paper	.01 mfd., 600 VDCW
C-48	Audio Output Grid Filter	Ceramic	160 mmf., 500 VDCW
C-49	A.V.C. Filter	Mica	.001 mfd., 500 VDCW
C-50	A.V.C. Filter	Mica	.001 mfd., 500 VDCW
C-51	H.F. Oscillator Plate Bypass	Paper	.01 mfd., 600 VDCW

Symbol	Function	Type	Rating
RESISTORS			
R-1	R.F. Gain Control	W.W. Var.	10,000 Ohms, 1.5 W.
R-2	First Detector Cathode	Fixed	4,700 Ohms, 1/2 W.
R-3	First I.F. Grid Filter	Fixed	470,000 Ohms, 1/2 W.
R-4	First I.F. Cathode	Fixed	330/1000 Ohms, 1/2 W.
R-5	H.F. Oscillator Screen Filter	Fixed	47,000 Ohms, 1/2 W.
R-6	H.F. Oscillator Screen Bleeder	Fixed	100,000 Ohms, 1/2 W.
R-7	H.F. Oscillator Screen Bleeder	Fixed	100,000 Ohms, 1/2 W.
R-8	Second I.F. Grid Filter	Fixed	470,000 Ohms, 1/2 W.
R-9	Second I.F. Cathode	Fixed	330 Ohms, 1/2 W.
R-10	V-1, V-2, V-5, and V-6 Screen Filter	Fixed	15,000 Ohms, 2 W.
R-11	S-Meter Bridge	Fixed	2,200 Ohms, 1/2 W.
R-12	Second Detector Load	Fixed	470,000 Ohms, 1/2 W.
R-13	Second Detector Filter	Fixed	47,000 Ohms, 1/2 W.
R-14	Second Detector Equalizing	Fixed	220,000 Ohms, 1/2 W.
R-15	V-1, V-2, V-5, and V-6 Screen Bleeder	Fixed	27,000 Ohms, 2 W.
R-16	Not Used		
R-17	Not Used		
R-18	Second Audio Plate Load	Fixed	47,000 Ohms, 1/2 W.
R-19	A.V.C. Filter	Fixed	470,000 Ohms, 1/2 W.
R-20	Second Detector Cathode	Fixed	330 Ohms, 1/2 W.
R-21	Not Used		
R-22	C.W. Oscillator Screen Filter	Fixed	100,000 Ohms, 1/2 W.
R-23	C.W. Oscillator Plate	Fixed	220,000 Ohms, 1/2 W.
R-24	C.W. Oscillator Screen Bleeder	Fixed	100,000 Ohms, 1/2 W.
R-25	Audio Output Cathode	Fixed	330 Ohms, 2 W.
R-26	Audio Output Grid	Fixed	470,000 Ohms, 1/2 W.
R-27	First R.F. Cathode	Fixed	330 Ohms, 1/2 W.
R-28	First R.F. Grid Filter	Fixed	470,000 Ohms, 1/2 W.
R-29	Second R.F. Cathode	Fixed	330 Ohms, 1/2 W.
R-30	S-Meter Bridge	Fixed	1,800 Ohms, 1/2 W.
R-31	Second R.F. Grid Filter	Fixed	470,000 Ohms, 1/2 W.
R-32	S-Meter Zero Adjusting	W.W. Var.	1,000 Ohms, 1 W.
R-33	Audio Gain Control	Comp. Var.	500,000 Ohms, 1 W.
R-34	C.W. Oscillator Grid	Fixed	47,000 Ohms, 1/2 W.
R-35	H.F. Oscillator Grid	Fixed	22,000 Ohms, 1/2 W.
R-36	First Audio Grid	Fixed	1,000,000 Ohms, 1/2 W.
R-37	First Audio Cathode	Fixed	4,700 Ohms, 1/2 W.
R-38	Limiter Plate	Fixed	47,000 Ohms, 1/2 W.
R-39	Limiter Cathode	Fixed	47,000 Ohms, 1/2 W.
R-40	Limiter Threshold Control	W.W. Var.	10,000 Ohms, 1 W.
R-41	First Audio Plate	Fixed	47,000 Ohms, 2 W.
R-42	Limiter Plate	Fixed	220,000 Ohms, 1/2 W.
R-43	Audio Output Grid	Fixed	220,000 Ohms, 1/2 W.
R-44	H.F. Oscillator Plate	Fixed	22,000 Ohms, 1 W.
R-45	First Audio Plate Dropping	Fixed	33,000 Ohms, 1/2 W.
R-46	Second Detector Cathode	Fixed	470 Ohms, 1/2 W.
TRANSFORMERS			
T-1	Crystal Filter		456 K.C.
T-2	Second I.F. Transformer	Air Tuned	456 K.C.
T-3	Second Detector Transformer	Air Tuned	456 K.C.
T-4	C.W. Oscillator Transformer	Air Tuned	456 K.C.
VACUUM TUBES			
V-1	First P.F. Amplifier	6K7	
V-2	Second R.F. Amplifier	6K7	
V-3	First Detector	6J7	
V-4	High Frequency Oscillator	6J7	
V-5	First I.F. Amplifier	6K7	
V-6	Second I.F. Amplifier	6K7	
V-7	Second Detector, A.V.C., Second Audio	6SQ7	
V-8	C.W. Oscillator	6J7	
V-9	Audio Output	6V6GT/G	
V-10	First Audio Amplifier	6J5	
V-11	Noise Limiter	6H6	
SWITCHES			
X-1	B+ Switch	Toggle	S.P.S.T.
X-2	C.W. Oscillator Switch	Toggle	S.P.S.T.
X-3	A.V.C. Switch	Toggle	S.P.D.T.
X-4	S-Meter Switch	Toggle	S.P.S.T.
X-5	Crystal Selectivity Switch	Rotary	Two Gang 6 Position
TYPE 697 POWER UNIT			
C-112	Filter Capacitor	Elec.	8-898 Mfd., 475 VDCW
C-113			
C-114			
L-102	Filter Choke	Potted	17 Henry
P-101	Power Cord and Plug	Toggle	D.P.D.T.
S-101	115-230 Volt Switch	Toggle	S.P.S.T.
S-102	Power Switch	Potted	
T-101	Power Transformer	5Y3CT/G	
V-101	Rectifier Tube		
TYPE 6885 POWER UNIT			
C-101	Filter Capacitor	Mica	500 Mfd., 15 VDCW
C-102	Filter Capacitor	Elec.	8-8 Mfd., 475 VDCW
C-103	Filter Capacitor		6.3 VDC Input
E-101	Vibrapack	3AG	10 Amperes
F-101	Fuse	Potted	17 Henry
L-201	Filter Choke	Potted	
L-202	Hash Choke	Toggle	
S-101	Power Switch	Toggle	S.P.S.T.
V-101	Rectifier Tube	6X5	



IF PEAK 456 KC

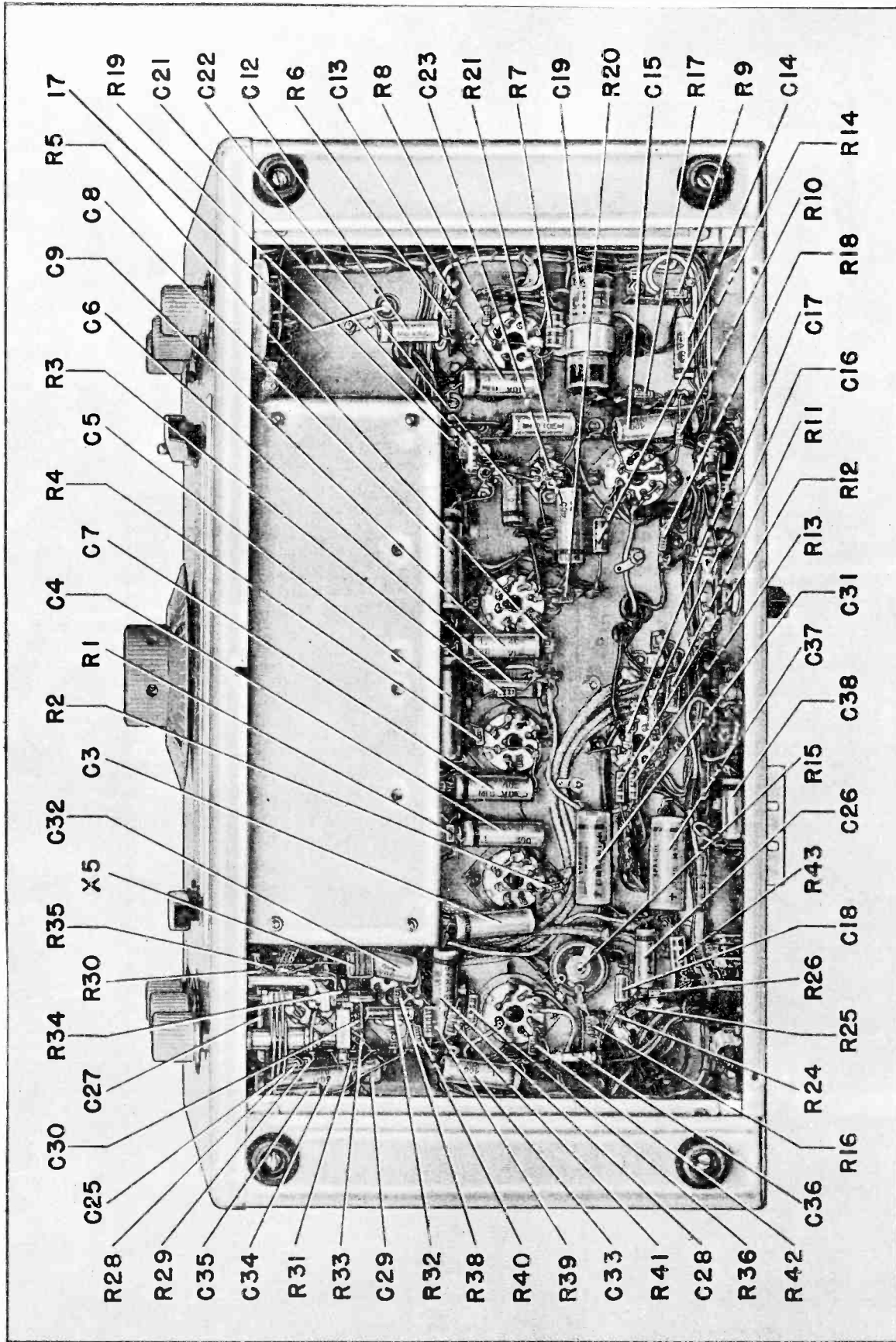


Figure No. 8. Bottom View of Receiver

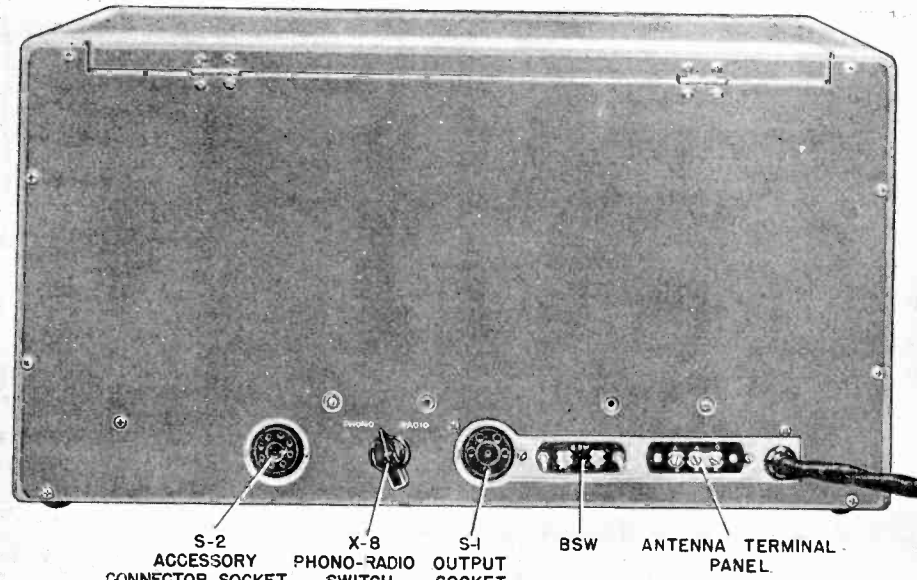


Figure No. 2. Rear View of Receiver (BSW Shield Removed)

Figure No. 3. Typical Antenna Switching System

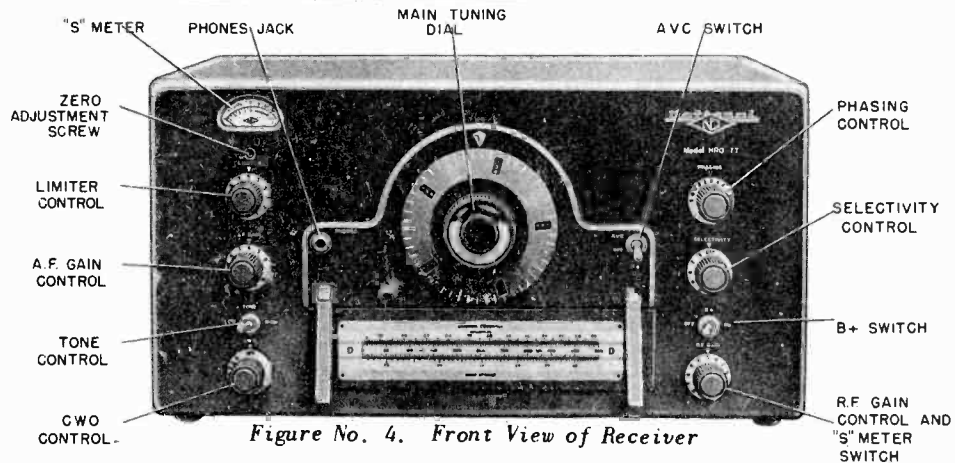
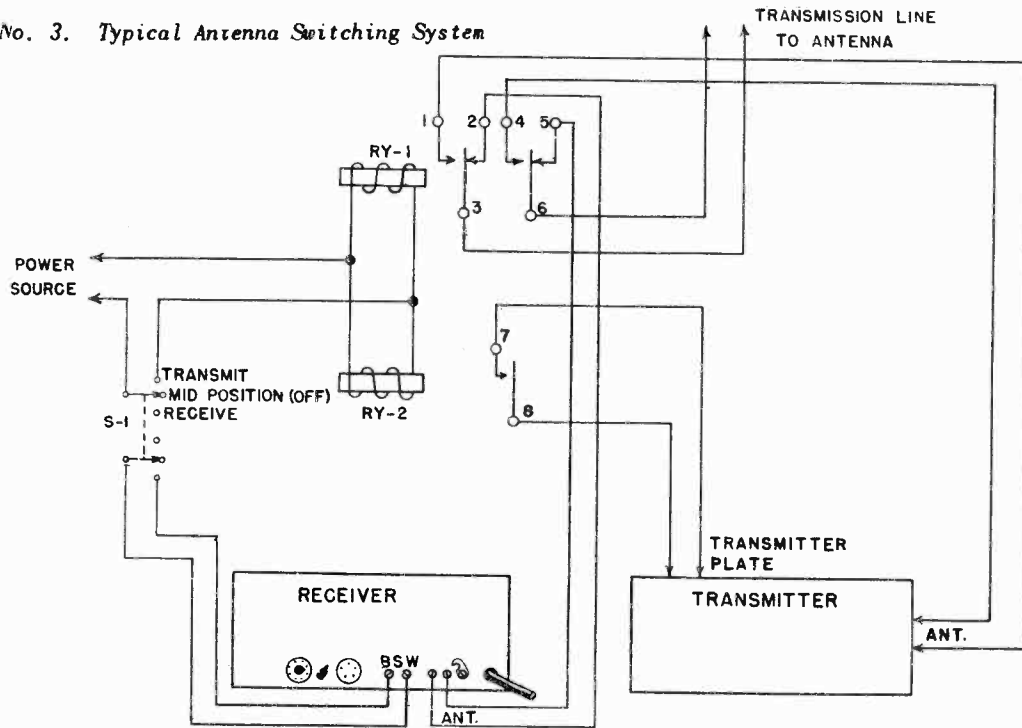
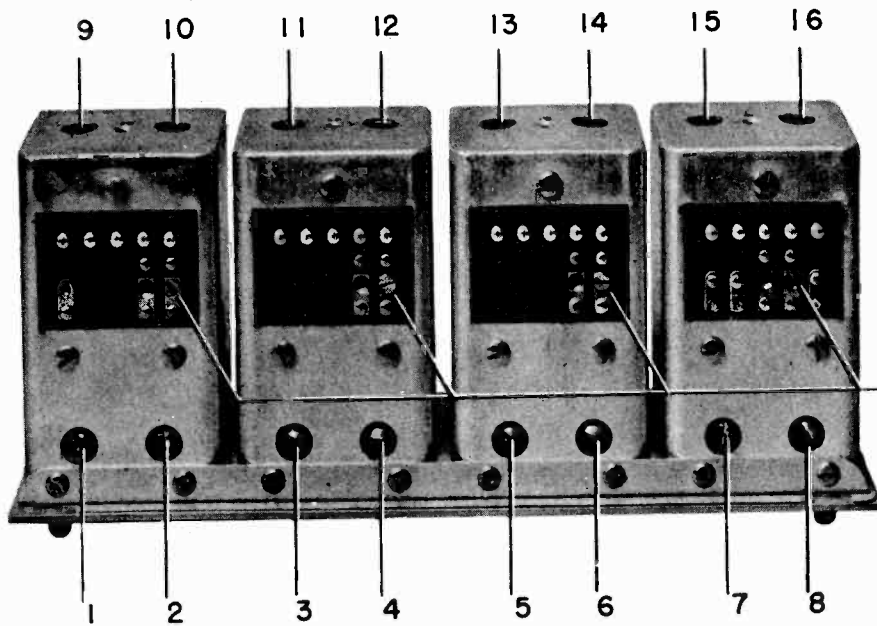


Figure No. 4. Front View of Receiver



BANDSWITCHING SCREWS SHOWN IN BANDSPREAD POSITION.

NOTE: Inductance Adjustments at Position No. 16 are as follows:

1. A, B and 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 and F coil set -- 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 and 13 of coil sets A, B, C and D is a loop of wire inside coil form -- bending the loop one way or the other varies the inductance.

Figure No. 6. Typical Coil Set Showing Alignment Adjustment Locations

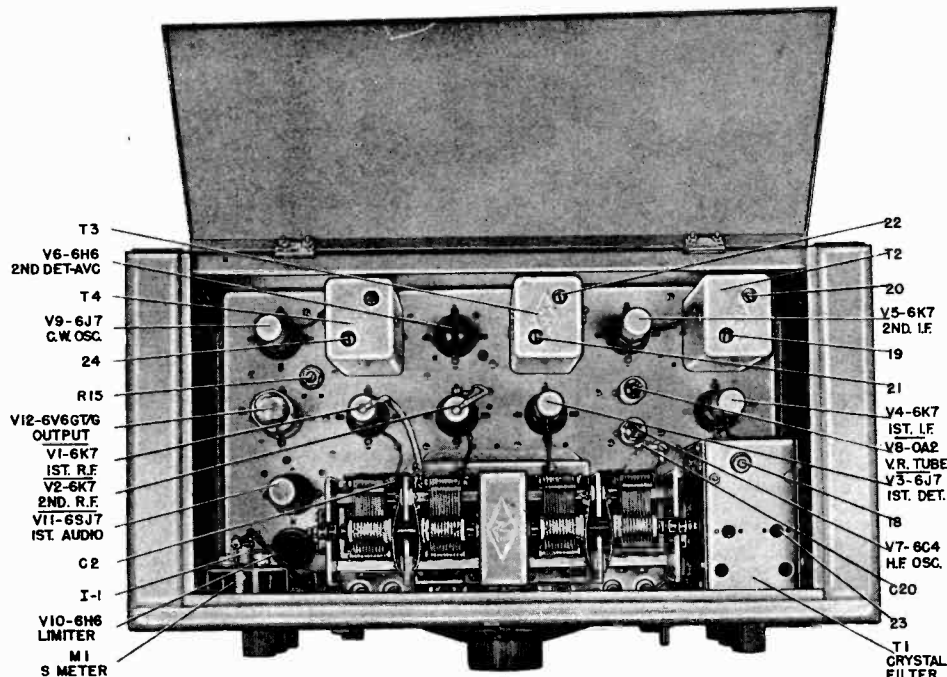


Figure No. 5. Top View of Receiver

General

The HRO-7 Radio Receiver is a twelve tube high-frequency superheterodyne for the reception of code and phone signals throughout its frequency range of 50 to 430 Kcs., and 480 to 30,000 Kcs. Long an outstanding and proven performer in Communication and Amateur services, this new series of HRO-7 Receivers features many new refinements emanating from the latest advances in receiver circuitry and design. A new automatic, adjustable threshold, double action noise limiter effectively reduces interference caused by external noise pulses. Two new miniature type tubes, a 6C4 high-frequency oscillator and an OA2 voltage regulator, are employed to give a high order of oscillator stability. The addition of an Accessory Connector Socket, Tune Control, plus other electrical and mechanical revisions give this new HRO greater flexibility and adaptability. A 6 position crystal filter, maximum bandspreading of the Amateur Bands, and an excellent signal-to-noise ratio continue to make the HRO a dependable Receiver, capable of maintaining communications despite the most adverse conditions. The HRO-7 is housed in a new cabinet styled in a modern manner with an attractive gray finish.

A complete equipment consists of a receiver, power supply, loud-speaker and plug-in coil set types A, B, C and D. Coil set types E, F, G, H and J may be obtained in addition, as desired.

Circuit

The circuit employed on all bands comprises two tuned stages of radio frequency amplification, a tuned first detector, a high-frequency oscillator employing a tube separate from the first detector tube, a first intermediate frequency amplifier stage employing a variable-selectivity crystal filter and a conventional second intermediate frequency amplifier stage both operating at 456 kilocycles, a combined second detector - automatic volume control stage, an automatic adjustable-threshold series valve noise limiter, a first audio amplifier stage, an audio output stage and a beat frequency oscillator coupled to the second detector to provide for C.W. reception. A voltage regulator tube is used to regulate the plate supply to the high frequency oscillator tube.

Tube Complement

The HRO-7 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.....6K7
 - Second R.F. Amplifier.....6K7
 - First Detector.....6J7
 - High Frequency Oscillator.....6C4
 - First I.F. Amplifier.....6K7
 - Second I.F. Amplifier.....6K7
 - Diode Detector, A.V.C.....6B6
 - Noise Limiter.....6H6
 - First A.F. Amplifier.....6SJ7
 - Audio Output.....6V6GT/G
 - Beat Frequency Oscillator.....6J7
 - Voltage Regulator.....OA2

Tuning System

The frequency coverage of the HRO-7 is covered in nine bands as follows:

COIL SET GENERAL COVERAGE BANDSPREAD

- A 14.0 - 30 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.

As shown above plug-in coil set types A, B, C and D provide bandspread coverage of the 10-11, 20, 40 and 80 meter amateur bands. The 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 small capacitors in series with each section of the main tuning capacitor, thus reducing its effective capacity range. All coil sets are aligned in the Receiver using crystal controlled test oscillators assuring precise calibration.

The micrometer type MAIN TUNING dial drives the four gang 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

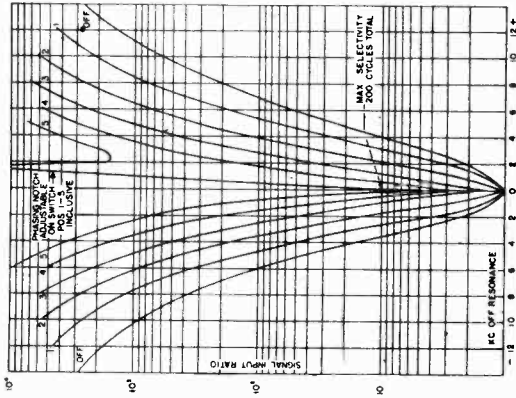


Figure No. 1. Crystal Filter Selectivity Curves.

and is calibrated from zero to 500. The chart appearing on the front of each plug-in coil set is fitted with a linear scale corresponding to the dial markings and a parallel frequency scale which enables the operator to readily determine the frequency of any particular dial setting. Lever type handles are mounted on the front panel at each end of the plug-in coil set enclosure to facilitate the changing of coil sets. These handles make coil set changing effortless and sure; when the handles are depressed to their maximum vertical position positive contact is made between the coil set and the Receiver brushboard.

Noise Limiter

The new noise limiter in the HRO-7 is the automatic, adjustable-threshold, series valve type. This limiter is double acting -- limiting noise on both positive and negative peaks, and is equally effective on both C.W. and phone reception. Its usefulness is most appreciated on the higher frequency bands of the Receiver where automobile ignition noise and other high frequency disturbances are effectively suppressed.

Crystal Filter

The crystal filter, located in the first intermediate frequency amplifier stage, is extremely flexible and of most efficient design. A six-position selectivity control and a crystal phasing control are front-panel mounted for adjustment of the crystal filter. Figure No. 1 shows the selectivity characteristics of the Receiver for each of the six positions of the selectivity control. The crystal filter may be used for either C.W. or M.C.W. reception; any degree of selectivity from true single-signal to broadcast reception being available. Operation of the phasing control provides for easy suppression of interfering signals which may produce objectionable heterodynes.

Tune Control

A two position TUNE control (High-Low) is provided to select the desired frequency characteristic of the audio output. The "Low" setting of this control will aid the operator in receiving weak signals through interference.

INSTALLATION**Arrangement**

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 B should be grounded by means of the link.

The Receiver, Power Unit and Loud speaker may be arranged in any desired position although it is not recommended that the loud-speaker be placed on top of the Receiver as undesirable microphonics may result. Neither Power Unit nor Loud-speaker should be placed near the antenna terminals.

Antenna Recommendations

The radio frequency input of the Receiver is arranged for operation from either a single-wire antenna, a doublet 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 lines 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

sorted. The headphone output load impedance is not critical and varying types of headphones may be used including crystal types, as no direct current flows through the phones.

Temperature Compensation

The HRO-7 is compensated for frequency drift due to temperature changes occurring in circuits which may detune the receiver from the desired signal. The cause of most objectionable 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 of the R.F. coils is minimized by the position of the plug-in coil sets in that they plug in at the bottom of the Receiver underneath the chassis in a separate shielded compartment. A further safeguard against frequency drift is provided for on bandspread operation. The heat dissipated in the high frequency oscillator tube 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.

Loud-speaker

RFSH or MCR Loud-speakers in rack or table mounting styles respectively can be used with the Receiver. These are permanent magnet type loud-speakers and have an output transformer which provides a proper impedance match for the output tube to the loud-speaker voice coil. This matching transformer has a primary impedance of 5000 ohms. In special models of the Receiver, an output transformer is mounted within the Receiver itself. In this case, the loud-speaker matching transformer must have a primary impedance which matches the Receiver output transformer secondary impedance. External means for supplying field excitation will be necessary if a dynamic speaker is to be used with the Receiver.

Accessory Connector Socket

A socket, S-2, of the standard octal type is mounted at the rear of the Receiver to permit external connection of various accessories such as a narrow-band F.M. adaptor, crystal calibrator, phonograph, two-position switch, X-8, is mounted adjacent to this socket marked PHONO-RADIO. In the RADIO position all Receiver circuits function normally and connection to the Accessory Connector Socket of equipment such as a crystal calibrator or high-frequency converter may be made. In the PHONO position the second detector portion of the Receiver circuit is rendered inoperative. The PHONO position can be used for the connection of an F.M. adaptor, or phonograph. The input circuit for connection of a phonograph is high-impedance and feeds into the high gain 6SJ7 first audio amplifier stage. The AUDIO GAIN and TUNE controls are operative with this connection.

The drawing of the Accessory Connector Socket on the Schematic Diagram shows the various connections made to the pins of this socket and the voltages available. An octal plug termination on the accessory, wired to mate with the proper pins on the Accessory Connector Socket, makes an ideal arrangement for quick and sure connection to the Receiver.

Audio Output

Two audio output circuits are provided. Loud-speaker terminals in the form of a five prong socket are located at the rear of the Receiver and a phone jack is mounted on the front panel. Normally, the plate circuit of the output tube is brought directly to the output socket for connection to a separate permanent-magnet loud-speaker. The loud-speaker must have an impedance of from 5000 to 7000 ohms to properly load the output tube. The output transformer in this case is mounted on the loud-speaker and its primary carries the plate current of the output tube. The phone jack is wired so as to silence the loud-speaker when the phone plug is in-

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 B should be grounded by means of the link.

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. Any transmission line of 70 ohms impedance or more may be used. 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 RV-1; the B+ circuit of the Receiver is completed by the switch. (The B+ switch on the Receiver should be at B position.) With the switch in the transmit position RV-1 contacts 1, 3, 4 and 6 are closed transferring the antenna transmission line to the transmitter; contacts 7 and 8 of relay RV-2 close to complete the plate supply circuit to the transmitter. Contacts 7 and 8 of relay RV-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.

When a doublet antenna 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 4-5 describes this procedure.

AC Operation

After unpacking the HRO-7 Receiver and associated equipment, proceed as follows:

- (1) Make sure all tubes are firmly seated in their sockets and that all grid grips are securely in position.
- (2) Make sure the plug-in coil set 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 the RADIO-PHONO switch at the rear of the Receiver is set at the RADIO position (right-hand).
- (4) Connect antenna as recommended in Section 2-2.
- (5) Insert the Receiver power plug into the output socket on the Power Unit.
- (6) Insert the five prong loudspeaker plug into the audio output socket at the rear of the Receiver.

- (7) Connect Power Unit line cord to milliamperes at 180 volts. With the output tube in operation the B battery drain is 60 milliamperes at 180 volts. To conserve battery power the Receiver power plug should be removed from the auxiliary battery socket when the Receiver is not being used. If greater convenience is desired, a single pole, single throw switch may be wired in series with the A+ lead to the battery to turn off the heater supply. If an A battery switch is used it is important that both the external A+ switch and Receiver B+ switch be turned Off to conserve battery power when the Receiver is not being operated. The Receiver B+ switch will serve as a stand-by switch during transmission periods the same as for A.C. operation.

- (8) Set controls as recommended in Section 3 for the 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.

Battery Operation

The Receiver is readily adaptable to emergency or portable operation, or operation in locations where 115 or 230 volt A.C. power is not available. It may be operated directly from batteries or a National Type 686S Power Unit may be used for operation from a 6 volt storage battery. Type 686S Power Unit draws 6.5 amperes at 6 volts when furnishing power to the Receiver. Battery drain may be decreased for headphone operation by removing the 6V6GT/G output tube from its socket. In this case, the Type 686S Power Unit draws 5.5 amperes at 6 volts.

The Schematic Diagram, Figure 8, shows a pin view of the Receiver power plug, thus providing the information necessary for wiring batteries to an auxiliary four-prong socket. The regular Receiver power plug may be inserted into this auxiliary socket to complete the power circuit. The normal B voltage required for operation of the Receiver is 240 volts at which voltage the Receiver draws 85 milliamperes. Satisfactory headphone operation will result with a B voltage as low as 180 volts. The B battery life may be increased in this instance by removing the 6V6GT/G output tube from its socket as it is not used for headphone operation. With the output tube removed

from its socket, the Receiver will draw 32 milliamperes at 180 volts. With the output tube in operation the B battery drain is 60 milliamperes at 180 volts. To conserve battery power the Receiver power plug should be removed from the auxiliary battery socket when the Receiver is not being used. If greater convenience is desired, a single pole, single throw switch may be wired in series with the A+ lead to the battery to turn off the heater supply. If an A battery switch is used it is important that both the external A+ switch and Receiver B+ switch be turned Off to conserve battery power when the Receiver is not being operated. The Receiver B+ switch will serve as a stand-by switch during transmission periods the same as for A.C. operation.

OPERATION

Controls
The MAIN TUNING dial is arranged so that the frequency to which the Receiver tunes increases as the dial reading increases. Each coil set is provided with a calibration chart showing the relationship between dial reading and frequency. An additional scale for bandspread calibration is provided on the calibration chart of coil sets which include the bandspread feature. Observation of each coil set tuning chart will show that the calibration is very nearly linear which eliminates considerable reference to the coil charts.

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, or 10, on its circular scale. At this setting the Meter switch is closed connecting the Meter into the circuit. At this position (10) all tubes are operating at maximum gain with minimum bias. As the control is turned counter-clockwise, increasing bias is applied to the second R.F., the first I.F. and the second I.F. tubes, thus reducing their amplification.

The B+ ON-OFF switch is connected

in the positive lead of the power supply circuit and its purpose is to shut off the Receiver during periods of transmission or WHEN CHANGING COIL SETS. This last function is important. The B+ circuits are completed when this switch is pushed to the right. Connected in parallel with the B+ switch and mounted at the rear of the chassis is a pair of contacts, marked R.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 R.S.W. shield.

The PHASING and SELECTIVITY controls are a part of the crystal filter. When the SELECTIVITY control is set at OFF, the crystal is switched out of the circuit. With the crystal switched out, the PHASING control has little influence on the Receiver performance. With the SELECTIVITY control knob set at any point between 1 and 5, inclusive, the crystal filter is in operation, selectivity increasing as the knob is progressively advanced to position 5. The PHASING control is then used to balance the crystal bridge circuit and eliminate interfering signals or heterodynes.

The C.W.O. switch and vernier tuning adjustments control the action of the C.W. Oscillator transformer. The C.W. Oscillator is used to produce an audible beat note when receiving C.W. signals or to locate the carrier of a weak M.C.W. station. Rotating the C.W.O. knob in a clockwise direction from Off removes the ground from the cathode of the C.W. Oscillator, thus permitting it to oscillate. Further rotation of the knob from 0 on the scale to 10 varies the frequency of oscillation over a range of approximately 3 kilocycles. The C.W. Oscillator tunes to the Receiver intermediate frequency at 9 on the graduated scale.

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 phone jack and loud-speaker terminals. Clockwise rotation of this control increases the signal applied to the grid of the first audio amplifier tube.

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 suppression of both positive and negative peaks.

The S-METER for indicating carrier intensity or signal strength is turned on by rotating the R. F. GAIN control to 10. At this setting the S-Meter switch on back of the control is closed connecting the S-Meter into the circuit.

The TUNE control is a two-position switch serving to select the desired audio output frequency characteristic. The "Low" position attenuates the higher audio frequencies while the "high" position provides an audio output response equivalent to normal Receiver reproduction.

The BANDSPREAD switch for each of the four bandspread coil sets is located on each coil set. Inspection of the coil set terminal panels will show several small rectangular metal pieces. There are two of these metal pieces or terminal blocks on each coil which are tapped and countersunk for a flat-head machine screw. With the screws in the left-hand position, the coil range will be that shown on the top scale of the calibration chart. It is only necessary to move each of the four screws to the right-hand terminal block of each coil to change the calibration from General Coverage to bandspread as shown on the bottom scale of the calibration chart. See Figure No. 6.

Phase Reception

After the HRO-7 is properly installed as outlined in Section 2, it is placed in operation by the following adjustments:

1. Set the Power Unit switch at ON.
2. Set the Receiver B+ switch at ON. It is recommended that the operator allow approximately one minute warm-up time before the B+ switch is turned ON. This delay is necessary to permit the Voltage Regulator tube to function efficiently directly after the B+ switch is turned ON.
3. Turn the R. F. GAIN control to 10.
4. Set the A. V. C. switch at A. V. C.
5. Turn the C. W. O. control to the OFF position.
6. Turn the SELECTIVITY control to OFF.
7. Turn the PHASING control to 0.
8. Turn the LIMITER control to OFF.
9. Set the TONE control at the position giving the desired audio output tone.
10. Turn the A. F. GAIN control to the position giving the desired audio volume.

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. The position of the four screws on the coil set in use, as previously mentioned 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 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. Audio output should be controlled entirely by means of

the A. F. GAIN control. Very weak signals are best received with the R. F. GAIN control fully advanced. If the level of background noise in the Receiver proves objectionable, such as might be the case when receiving local broadcast stations, the R. F. GAIN control may be retarded to reduce the high level of noise as desired. However, when operating with the R. F. GAIN control well retarded, the full range of A. V. C. action will not be realized.

Operating the Receiver with A. V. C. off will result in an increase in sensitivity in some cases, depending on the incoming signal. With A. V. C. off, however, greater care should be taken in the setting of the A. F. and R. F. GAIN controls. Generally, the A. F. GAIN control can be advanced to some point near 10 and the R. F. GAIN control used to adjust the audio output volume. Overload, as indicated by excessive distortion, will result if the R. F. GAIN control is advanced too far.

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, when receiving weak signals through interference, by setting the TUNE control at LOW.

SELECTIVITY and PHASING -- For M. C. W. reception the normal setting of the SELECTIVITY control is at one of the positions affording broad selectivity.

Positions 1 and 2 are recommended. Selectivity may be progressively increased by turning the SELECTIVITY control to positions 3, 4 and 5 although too sharp selectivity for M. C. W. reception will render phone signals unintelligible due to excessive side-band cutting. The PHASING control is used to attenuate, or eliminate, if possible, interfering signals. The PHASING control is normally set at 0 on the scale for reception of M. C. W. signals. If, after tuning in a signal, an interfering signal causes a heterodyne or whistle, the PHASING control should be adjusted until the interfering signal is reduced to a minimum. The setting of the PHASING control which gives maximum attenuation of the heterodyne will depend on the pitch of the heterodyne whistle. If the beat-note is above 1,000 cycles, the optimum PHASING control setting will be zero; if the beat-note is 300 or 400 cycles, the optimum PHASING control setting will be near one end of the scale or the other, depending upon whether the interfering signal is higher or lower in frequency than the desired signal.

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. Turn the C. W. O. control to ON.
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 M. C. W. reception except that full use of the sharp selectivity position may be used without the loss of intelligibility experienced in M. C. W. reception. When maximum selectivity is used, (SELECTIVITY control at position 5), care must be exercised since the tuning is very critical. When the Receiver is slowly tuned across the carrier of a 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 7 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.

Measurement of Signal Strength

To measure the strength or intensity of a signal, the R.F. GAIN control must be advanced to 10, the A.V.C. switch set ON and the C.W.O. control turned OFF. The crystal filter should be turned OFF by means of the SELECTIVITY control, and the PHASING control set at 0. The LIMITER, TONE and A.F. GAIN controls do not affect the S-Meter reading.

Tuning the Receiver to a signal will cause the meter to read, indicating the signal input in S-units or in decibels above the S-9 level.

With no R.F. input to the Receiver, or with the antenna disconnected, the S-Meter should read 0, plus or minus 1 S-unit. If it does not, the S-Meter circuit requires adjustment. See Section 5.

Measurement of the signal strength of C.W. signals cannot be made with the C.W. oscillator in operation.

ALIGNMENT DATA

General

Should realignment of the HRO-7 Radio Receiver become necessary the following alignment data should be carefully studied before making any circuit adjustments. It is important that the function of each circuit element is understood so that correct alignment may be obtained quickly and accurately. Adjustments referred to by number are shown in Figures 5, 6 and 8.

The complete alignment of the Receiver may be divided into three steps:

- (a) Intermediate Frequency Amplifier alignment including crystal filter adjustments.
- (b) General Coverage Alignment.
- (c) Bandsread Alignment.

I.F. Amplifier Alignment

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. The Receiver should be adjusted for normal operation with no antenna, A.V.C. OFF, R.F. GAIN at 9, Crystal Filter SELECTIVITY switch at 5, PHASING control at 0, and C.W.O. control ON. The setting of the A.F. GAIN control does not affect the measurement and may be adjusted to provide sufficient output to make the required observations. The C.W.O. control should then be turned until a point is found where the predominant pitch of the background noise is lowest and a crystal ring is heard. This setting of the C.W.O. control should occur near 9 on the C.W.O. scale and the exact setting should be noted. The crystal filter should

then be disconnected from the circuit by turning the SELECTIVITY control to the OFF position. The C.W.O. control should again be adjusted for the lowest predominant pitch of background noise and this new setting noted. If the I.F. Amplifier alignment is correct, the setting of the C.W.O. control should be the same for both tests outlined above. The I.F. Amplifier should not be realigned, however, unless the test shows appreciable misalignment.

The intermediate frequency of the HRO-7 is 456 kilocycles, plus or minus 2 kilocycles. The exact frequency is determined by the quartz crystal resonator in the crystal filter.

Trimmer capacitors are provided on the crystal filter and on each I.F. transformer. These capacitors are numbered 17, 18, 19, 20, 21, 22, 23 on Figure Nos. 5 and 6.

The high output lead of an accurately calibrated signal generator should be connected to the grid terminal of the first detector tube and the ground lead to any convenient point on the chassis. The flexible lead need not be disconnected from the grid of the tube. A dummy antenna is not used. The C.W.O. should be turned on and the modulation of the signal generator turned off to provide a steady C.W. test signal. Set the PHASING control at 0, the SELECTIVITY control at 5, and the A.F. GAIN control at maximum or fully advanced. An output meter with a 5000 ohm resistive load should be connected to the output of the Receiver. Output terminals are available at two convenient locations: the two input terminals on the output transformer mounted on the MCR and RFSH Loudspeakers or the five prong output socket, X-1, at the rear of the Receiver. If the output socket on the Receiver is used for connection of an output meter a five prong plug, wired in the same manner as the loudspeaker plug shown on the Schematic Diagram, may be used for convenience in connecting the output meter to the Receiver.

The signal generator should be tuned to approximately 456 kilocycles and its output adjusted to give a convenient reading on the output meter. Tune the signal generator to the frequency producing maximum reading on the output meter; a definite

sharply peaked response will be noted. The signal generator output should be reduced now in order to avoid I.F. or audio overload and the C.W.O. should be adjusted to give an audio beat-note at some frequency between 400 and 1000 cycles per second.

The I.F. amplifier trimmer capacitors, numbers 17, 19, 20, 21 and 22, should be carefully tuned to produce a maximum reading on the output meter. The order of adjustment is not important. While tuning the I.F. amplifier trimmer capacitors it will be necessary to reduce the signal generator output if the I.F. amplifier gain increases to the overload point.

The crystal filter SELECTIVITY control should be set at 1 and the signal generator detuned between 3 and 4 kilocycles to one side of the crystal frequency, crystal filter trimmer capacitor Number 18 should be tuned for maximum output meter indication. After making this adjustment, the SELECTIVITY control should be set at off and the signal generator returned to exact crystal frequency. Compensator trimmer capacitor Number 23 should then be tuned for maximum reading on the output meter.

After the I.F. amplifier has been aligned, the tuning of the C.W.O. should be checked. This may be readily accomplished by repeating the test previously described with the crystal filter off. If the setting of the C.W.O. control does not occur at or near 9, with this test, turn the C.W.O. control to 9 and carefully adjust trimmer Number 24 by ear for the lowest pitch of background noise.

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 coil sets A, B, C, D, E and F. The original alignment at 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 Bandsread alignment the cali-

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 end of each band. The general coverage adjustments affect the bandspread adjustments and should be performed first. The following procedure should be adhered to:

(a) General Coverage:
(1) With the four screws used for switching from General Coverage to Bandspread in the left-hand (General Coverage) position, adjust the Receiver for normal operation as follows: R.F. GAIN at 9, C.W.O. off; A.V.C. off, CRYSTAL FILTER off, A.F. GAIN set to provide a suitable signal.

(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 being aligned. Adjust trimmer at position Number 2 on Figure Number 6 for maximum signal output. If no signal can be received, the trimmer should be adjusted for maximum background noise.

(b) Bandspread:
(1) With the Receiver adjusted the same as for general coverage, shift the four screws on the coil terminal panels to the right-hand position (bandspread position).

(2) Connect the antenna feeders to the Receiver antenna terminals and tune the Receiver to the signal shown in step 1 on the Bandspread Alignment Chart for the coil set being aligned. Adjust trimmer at position Number 1 on Figure Number 6 for maximum signal output. If no signal can be received the trimmer should be adjusted for maximum background noise.

S-Meter Adjustment

The S-Meter balancing resistor R-15, is used to obtain zero meter reading in the absence of signal input to the Receiver. The adjustment is as follows: Set the R.F. GAIN control at 10, A.V.C. ON, and disconnect the antenna. R-15 should now be adjusted until the S-Meter reads zero.

It is important that the high frequency oscillator 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 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 in this section and on the Alignment Chart are shown on Figure Number 6.

Bandspread Alignment

The data given in this section applies to the Bandspread Alignment of the H.F. oscillator and R.F. amplifier 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. 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 +20 divisions. To effect alignment the Receiver controls are adjusted the same as outlined in Section 4-3, except that the four Bandswitching screws must be in the right-hand positions.

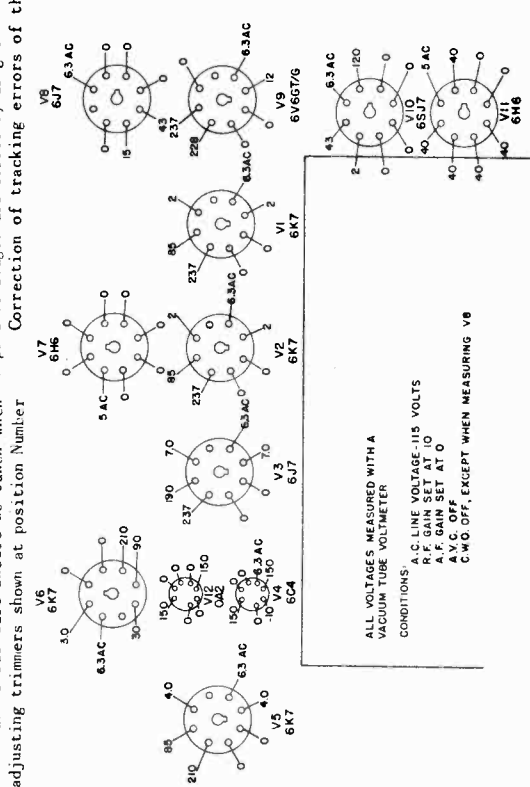
The procedure in effecting Bandspread alignment is accomplished by adhering to the instructions given in the Bandspread Alignment Chart. The procedure is similar to that for General Coverage except for the method followed in checking tracking errors of the R.F. amplifier stages at the low frequency limit of each coil set. To secure an indication of proper tracking check the settings of trimmers at position Numbers 1, 3 and 5 for the position of maximum Receiver gain. Any change in capacity should decrease the Receiver gain indicating proper tracking. The use of trimmers 1, 3 and 5 for a tracking check may destroy their proper setting and this should be carefully checked at the high frequency limit of the coil set.

The locations of the adjustments referred to in this section and on the Alignment Chart are shown on Figure Number 6.

General Coverage Alignment

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 should be noted that General Coverage alignment affects Bandspread alignment, but that adjustment of Bandspread alignment does not affect General Coverage.

Particular care should be taken when adjusting trimmers shown at position Number



NATIONAL COMPANY, INC.

MODEL HRO-7

NOTE: Do not effect Bandsread Alignment until after completion of General Coverage

Bandsread Alignment Chart

Step	Coil Set	Adjust Signal Source To:	Set Dial At	Adjust To Receive Test Signal	Adjust For Maximum Output
1	A	30.0 Mc.	450	Trimmer at Pos. No. 7	Trimmer at Pos. Nos. 1, 3, 5.
2	A	27.2 Mc.	61	Padder at Pos. No. 15	Padder at Pos. Nos. 10, 12, 14.
3	A	30.0 Mc.	450		Check Step 1. Repeat Steps 1 and 2 if necessary. Check Step 1.
1	B	14.4 Mc.	450	Trimmer at Pos. No. 7	Trimmer at Pos. Nos. 1, 3, 5.
2	B	14.0 Mc.	50	Padder at Pos. No. 15	Padder at Pos. Nos. 10, 12, 14.
3	B	14.4 Mc.	450		Check Step 1. Repeat Steps 1 and 2 if necessary. Check Step 1.
1	C	7.3 Mc.	450	Trimmer at Pos. No. 7	Trimmer at Pos. Nos. 1, 3, 5.
2	C	7.0 Mc.	50	Padder at Pos. No. 15	Padder at Pos. Nos. 10, 12, 14.
3	C	7.3 Mc.	450		Check Step 1. Repeat Steps 1 and 2 if necessary. Check Step 1.
1	D	4.0 Mc.	450	Trimmer at Pos. No. 7	Trimmer at Pos. Nos. 1, 3, 5.
2	D	3.5 Mc.	50	Padder at Pos. No. 15	Padder at Pos. Nos. 10, 12, 14.
3	D	4.0 Mc.	450		Check Step 1. Repeat Steps 1 and 2 if necessary. Check Step 1.

Typical Operating Conditions for Power Units

The following table shows typical operating currents and voltages of the 697, 686S Power Units when used with HRO-7 Receivers:

VARIABLE	697	686S
Primary Voltage	115 or 230 VAC	16V DC
Frequency	50/60 cps	0
Heater Voltage	6.2 VAC	6V DC
Heater Current	3.3 Amp. AC	3 Amp. DC
B Voltage	240 VDC	165V DC
B Milliamperes	85 DC	55 DC
Line Current	.65 or .32 Amp.	6.5 Amp.
Power Consumption	7.4 Watts	39 Watts

General Coverage Alignment Chart

Step	Coil Set	Adjust Signal Source To:	Set Dial At	Adjust To Receive Test Signal	Adjust For Maximum Output
1	A	30.0 Mc.	485	Trimmer at Pos. No. 8	Trimmer at Pos. Nos. 2, 4, 6.
2	A	14.4 Mc.	54	Inductance at Pos. No. 16	Inductance at Pos. Nos. 9, 11, 13.
3	A	30.0 Mc.	485		Check step 1. Repeat steps 1 and 2 if necessary.
1	B	14.4 Mc.	485	Trimmer at Pos. No. 8	Trimmer at Pos. Nos. 2, 4, 6.
2	B	7.0 Mc.	28	Inductance at Pos. No. 16	Inductance at Pos. Nos. 9, 11, 13.
3	B	14.4 Mc.	485		Check step 1. Repeat steps 1 and 2 if necessary.
1	C	7.3 Mc.	490	Trimmer at Pos. No. 8	Trimmer at Pos. Nos. 2, 4, 6.
2	C	3.5 Mc.	23	Inductance at Pos. No. 16	Inductance at Pos. Nos. 9, 11, 13.
3	C	7.3 Mc.	490		Check step 1. Repeat Steps 1 and 2 if necessary.
1	D	4.0 Mc.	490	Trimmer at Pos. No. 8	Trimmer at Pos. Nos. 2, 4, 6.
2	D	1.8 Mc.	36	Inductance at Pos. No. 16	Inductance at Pos. Nos. 9, 11, 13.
3	D	4.0 Mc.	490		Check step 1. Repeat Steps 1 and 2 if necessary.
1	E	2.0 Mc.	470	Trimmer at Pos. No. 8	Trimmer at Pos. Nos. 2, 4, 6.
2	E	1.0 Mc.	68	Padder at Pos. No. 7	Inductance at Pos. No. 16
3	E	1.4 Mc.	245		Check Step 1. Repeat steps 1, 2 and 3 if necessary.
4	E	2.0 Mc.	470		
1	F	0.9 Mc.	430	Trimmer at Pos. No. 8	Trimmer at Pos. Nos. 2, 4, 6.
2	F	0.5 Mc.	30	Padder at Pos. No. 7	Inductance at Pos. No. 16
3	F	0.7 Mc.	230		Check Step 1. Repeat Steps 1, 2 and 3 if necessary.
4	F	0.9 Mc.	430		

MODEL HRO-7

NATIONAL COMPANY, INC.

Main Tuning Dial

The main tuning dial should normally give no trouble. If, however, the dial should become removed from the Receiver it should NOT be operated until mounted on the condenser 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 condenser, limit stops protect the dial provided the assembly is properly done. The procedure for re-mounting the dial is as follows:

(a) Place dial on condenser shaft, tighten set-screws and turn dial counter-clockwise to fully mesh condenser 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 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 should be flush with the edge of the stator plates at zero. 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 condenser 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 equidistant 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 trials may be required before the correct mesh is found.

POWER UNITS**Type 686S Power Unit**

connection of the Receiver power plug. Section 6-3 shows typical operating voltages and currents when used with the HRO-7 Radio Receiver. The Type 697 Power Unit consists of a power transformer, glass Type 5Y3GT/G rectifier tube, and a single section condenser-input filter. B- is connected to the Power Unit Chassis. The Power Unit for rack mounting is designated as SPU-697.

Type 686S Power Unit

The National Type 686S Table Model Power Unit operates from a 6 volt D.C. supply to provide approximately 165 volts at 55 milliamperes D.C. Battery clips are provided for convenient connection to a 6 volt storage battery or similar source of power. Output voltages for both A and B supply are available at a four prong socket for convenient connection of the Receiver power plug. Figure 10 shows the schematic wiring diagram. Section 6-3 shows typical operating voltages and currents when used with the HRO-7 Radio Receiver. The 686S Power Unit consists of a vibrapack and a single section condenser-input filter. The vibrapack uses a 6X5 (or 0Z4) type rectifier tube and a vibrator. It should be noted that B- is not connected to the Power Unit chassis; A- is connected to the chassis. The National Type SPU-686S Power Unit is the rack-mounted model.

The National Type 697 Table Model Power Unit operates from 115 or 230 volts A.C., 50 or 60 cycles, to provide 240 volts at 85 milliamperes D.C. and 6.2 volts at 3.3 amperes A.C. The circuit diagram of this unit is shown in Figure 9. Output voltages for both A and B supply are available at a four prong socket for convenient

PARTS LIST

Symbol	Function	Type	Rating
C-43	A Band, First Detector Bandsread Padder	Ceramic	21 mmf., 500 VDCW
	B Band, First Detector Bandsread Padder	Ceramic	5 mmf., 500 VDCW
	C Band, First Detector Bandsread Padder	Ceramic	12 mmf., 500 VDCW
	D Band, First Detector Bandsread Padder	Ceramic	25.7 mmf., 500 VDCW
C-44	A Band, H.F. Osc. Gen. Cov. Padder	Mica	.001 mfd., 500 VDCW
	B Band, H.F. Osc. Gen. Cov. Padder	Mica	2600 mmf., 500 VDCW
	C Band, H.F. Osc. Gen. Cov. Padder	Mica	1600 mmf., 500 VDCW
	D Band, H.F. Osc. Gen. Cov. Padder	Mica	900 mmf., 500 VDCW
	E Band, H.F. Osc. Gen. Cov. Feather	Mica	510 mmf., 500 VDCW
	F Band, H.F. Osc. Gen. Cov. Padder	Mica	350 mmf., 500 VDCW
C-45	A Band, H.F. Osc. Bandsread Trimmer	Ceramic	10 mmf., 500 VDCW
	B Band, H.F. Osc. Bandsread Trimmer	Ceramic	10 mmf., 500 VDCW
	C Band, H.F. Osc. Bandsread Trimmer	Ceramic	10 mmf., 500 VDCW
	D Band, H.F. Osc. Bandsread Trimmer	Ceramic	10 mmf., 500 VDCW
C-46	A Band, H.F. Osc. Gen. Cov. Trimmer	Ceramic	10 mmf., 500 VDCW
	B Band, H.F. Osc. Gen. Cov. Trimmer	Ceramic	10 mmf., 500 VDCW
C-47	C.W. Oscillator Trimmer	Ceramic	100 mmf., 500 VDCW
C-48	AVC Filter	Mica	0.01 mfd., 500 VDCW

MISCELLANEOUS

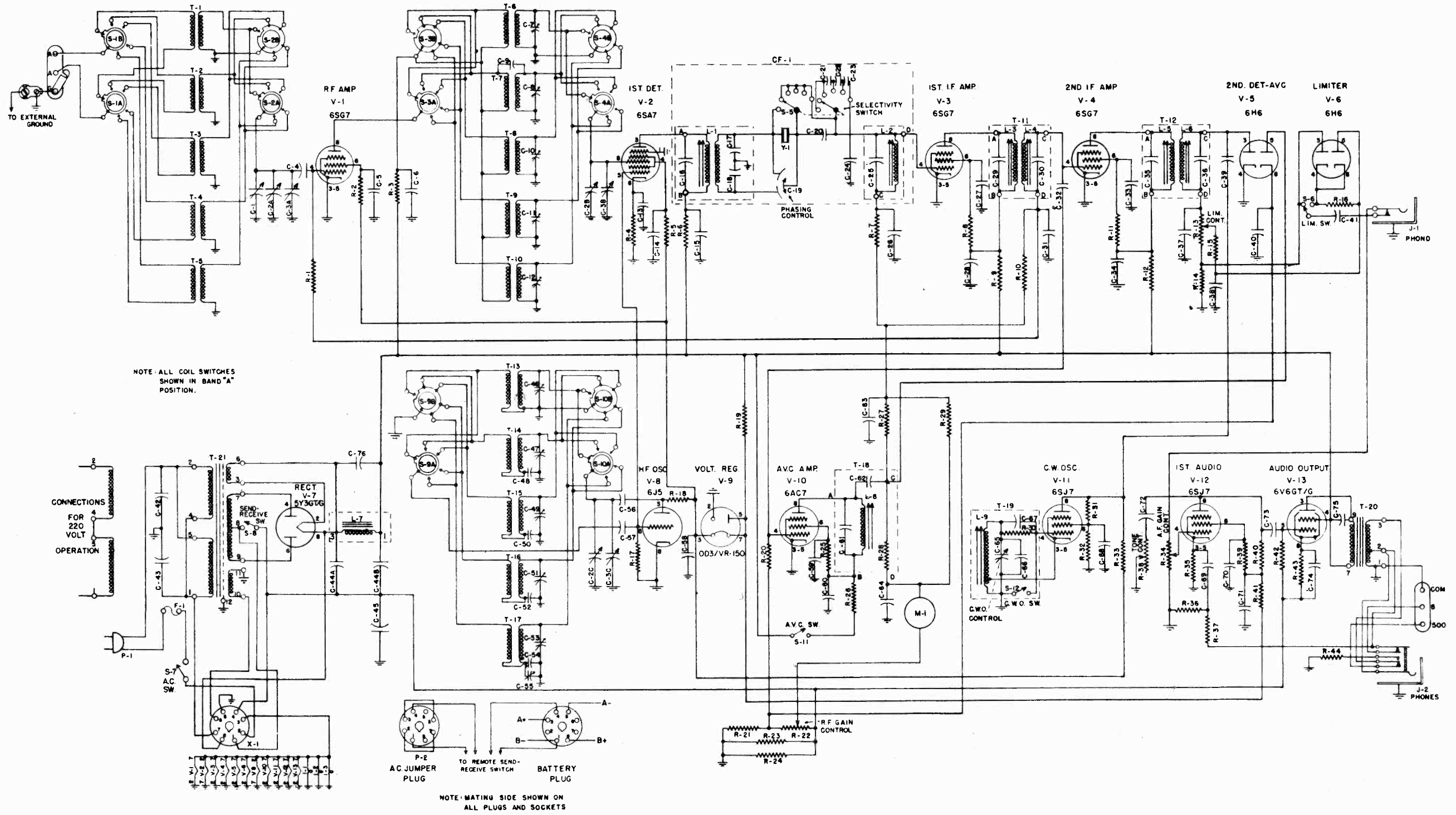
Symbol	Function	Type	Rating
I-1	S-Meter Lamp	Multi-Okt.	6-8 V., 0.15 Amp.
J-1	Phones Jack	S Scale	0-1 M.A. D.C.
M-1	S-Meter		
P-1	Power Cable and Plug		
S-1	Output Socket	Five-Frong	
S-2	Accessory Connector Socket	Octal	
T-1	First I.F. Transformer	Crys. Fil.	456 Kc.
T-2	Second I.F. Transformer	Air Tuned	456 Kc.
T-3	Second Detector Transformer	Air Tuned	456 Kc.
T-4	C.W. Oscillator Transformer	Air Tuned	456 Kc.
V-1	First R.F. Amplifier	6K7	
V-2	Second R.F. Amplifier	6K7	
V-3	First Detector	6J7	
V-4	First I.F. Amplifier	6K7	
V-5	Second I.F. Amplifier	6K7	
V-6	Second Detector, A.V.C.	6H6	
V-7	High Frequency Oscillator	6C4	
V-8	Voltage Regulator	0A2	
V-9	C.W. Oscillator	6J7	
V-10	Noise Limiter	6H6	
V-11	First Audio Amplifier	6SJ7	
V-12	Audio Output	6V6GT/G	
X-1	Crystal Selectivity Switch	Rotary	Two gang, 6 Position
X-2	A.V.C. Switch	Toggle	S.P.S.T.
X-3	B+ Switch	Toggle	S.P.S.T.
X-4	S-Meter Switch	Part of R-22	S.P.S.T.
X-5	C.W. Oscillator Switch	Part of C-25	S.P.S.T.
X-6	Limiter Switch	Part of R-27	S.P.D.T.
X-7	Tone Switch	Toggle	S.P.S.T.
X-8	Radio-Phono Switch	Rotary	D.P.D.T.
Y-1	Crystal Resonator	Quartz	456 kc.

CAPACITORS

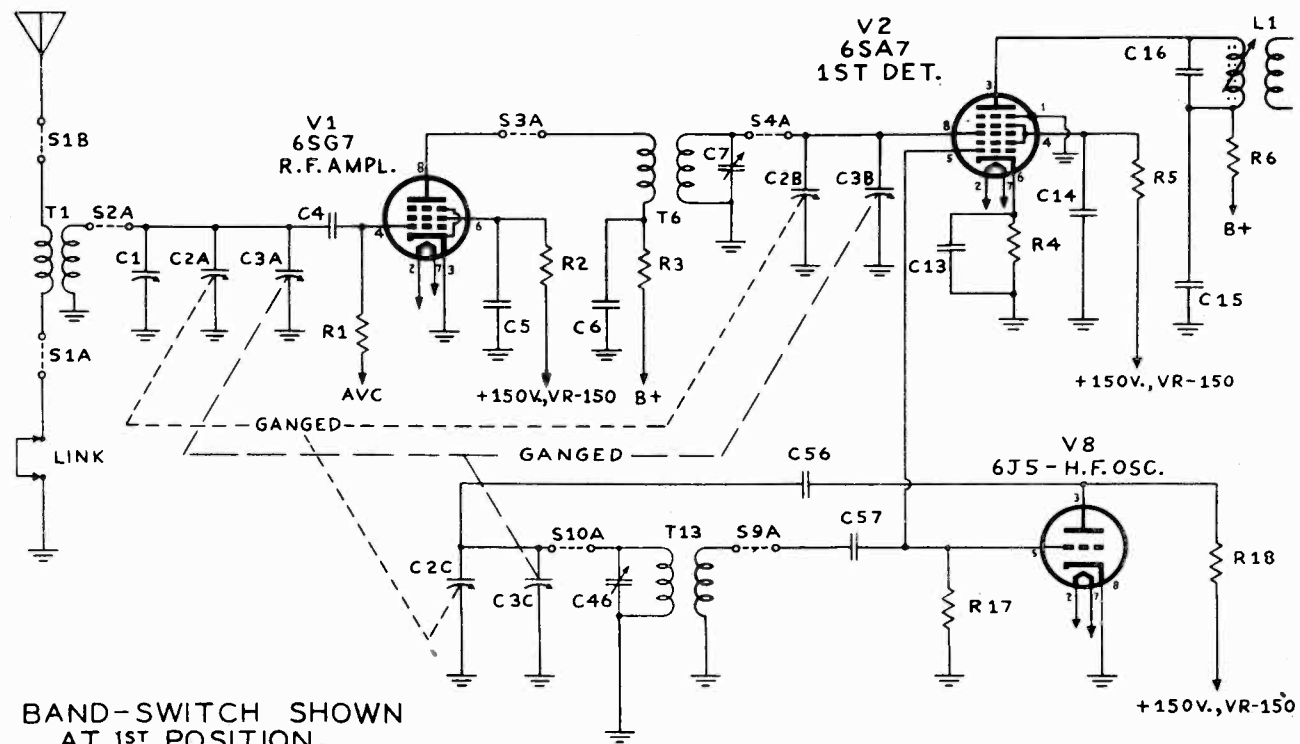
Sym.	Function	Type	Rating
C-1	Main Tuning	Air	4-section variable
C-1A	First R.F. Tuning	Air	225 mmf., max.
C-1B	Second R.F. Tuning	Air	225 mmf., max.
C-1C	First Det. Tuning	Air	225 mmf., max.
C-1D	H.F. Oscillator Tuning	Air	225 mmf., max.
C-2	First R.F. Grid Filter	Paper	.01 mfd., 600 VDCW
C-3	First R.F. Cathode Bypass	Paper	.1 mfd., 400 VDCW
C-4	V-1, V-2, V-4 & V-5 Screen Bypass	Paper	.1 mfd., 400 VDCW
C-5	First R.F. Plate Filter	Paper	.1 mfd., 600 VDCW
C-6	Second R.F. Grid Filter	Paper	.1 mfd., 600 VDCW
C-7	Second R.F. Cathode Bypass	Paper	.1 mfd., 400 VDCW
C-8	Second R.F. Plate Bypass	Paper	.1 mfd., 600 VDCW
C-9	First Detector Cathode Bypass	Paper	.1 mfd., 400 VDCW
C-10	Crystal Filter Bridge	Ceramic	47 mmf., 500 VDCW
C-11	Crystal Filter Bridge	Ceramic	62 mmf., 500 VDCW
C-12	First I.F. Grid Filter	Paper	.01 mfd., 600 VDCW
C-13	First I.F. Cathode Bypass	Paper	.1 mfd., 400 VDCW
C-14	Second I.F. Grid Filter	Paper	.1 mfd., 600 VDCW
C-15	Second I.F. Cathode Bypass	Paper	.1 mfd., 400 VDCW
C-16	Second Detector Load	Ceramic	270 mmf., 500 VDCW
C-17	T-3 to A.V.C. Rectifier Coupling	Ceramic	100 mmf., 500 VDCW
C-18	V-9 to V-6 Coupling	Ceramic	.3 mmf., 500 VDCW
C-19	First and Second I.F. Plate Filter	Paper	.25 mfd., 600 VDCW
C-20	H.F. Oscillator Temp. Compensating (gains .00077 mmf./mmf./°C)	Ceramic	10 mmf., 500 VDCW
C-21	H.F. Oscillator Grid Coupling	Ceramic	100 mmf., 500 VDCW
C-22	V-7 to V-3 Coupling	Paper	.01 mfd., 600 VDCW
C-23	H.F. Oscillator Plate Bypass	Paper	.1 mfd., 400 VDCW
C-24	C.W. Oscillator Grid Coupling	Mica	.001 mfd., 500 VDCW
C-25	C.W. Oscillator Tuning	Air	30 mmf.
C-26	C.W. Oscillator Screen Bypass	Paper	.01 mfd., 600 VDCW
C-27	V-6 to V-10 Coupling	Paper	.1 mfd., 400 VDCW
C-28	Limiter Plate Filter	Paper	.1 mfd., 400 VDCW
C-29	Limiter Threshold Filter	Paper	.1 mfd., 400 VDCW
C-30	V-10 to V-11 Coupling	Paper	.01 mfd., 600 VDCW
C-31	First Audio Cathode Bypass	Elec.	25 mfd., 50 VDCW
C-32	First Audio Screen Bypass	Paper	.1 mfd., 400 VDCW
C-33	First Audio Plate Filter	Paper	.1 mfd., 400 VDCW
C-34	V-11 to V-12 Coupling	Paper	.1 mfd., 400 VDCW
C-35	Tone	Mica	.003 mfd., 600 VDCW
C-36	Audio Output Grid Bypass	Ceramic	160 mmf., 500 VDCW
C-37	Audio Output Cathode Bypass	Elec.	10 mfd., 50 VDCW
C-38	Audio Output Screen Bypass	Paper	.01 mfd., 600 VDCW
C-39	First R.F. Gen. Cov. Padder A Band	Mica	1200 mmf., 500 VDCW
C-40	A Band, First R.F. Bandsread Padder	Ceramic	12 mmf., 500 VDCW
	B Band, First R.F. Bandsread Padder	Ceramic	5 mmf., 500 VDCW
	C Band, First R.F. Bandsread Padder	Ceramic	12 mmf., 500 VDCW
	D Band, First R.F. Bandsread Padder	Ceramic	25.7 mmf., 500 VDCW
C-41	A Band, Antenna Coupling	Ceramic	40 mmf., 500 VDCW
C-42	A Band, Second R.F. Bandsread Padder	Ceramic	21 mmf., 500 VDCW
	B Band, Second R.F. Bandsread Padder	Ceramic	5 mmf., 500 VDCW
	C Band, Second R.F. Bandsread Padder	Ceramic	12 mmf., 500 VDCW
	D Band, Second R.F. Bandsread Padder	Ceramic	25.7 mmf., 500 VDCW

PARTS LIST (Continued)

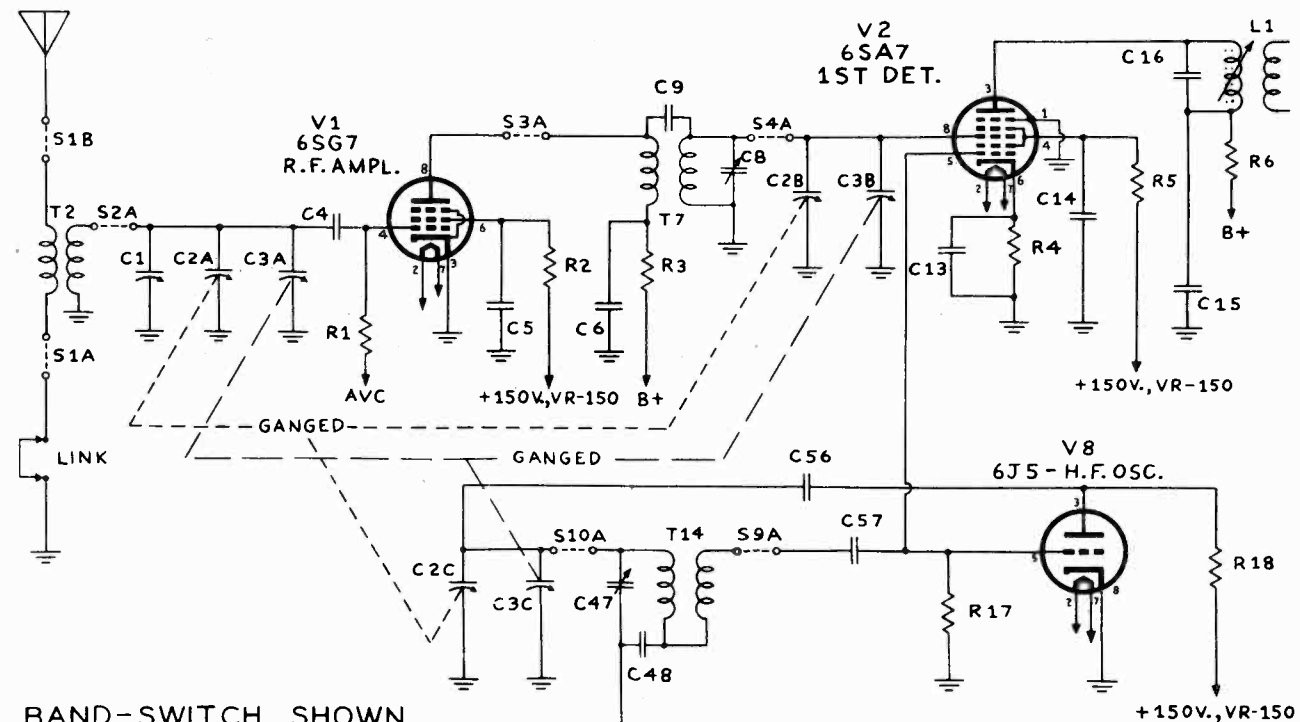
Symbol	Function	Type	Rating
RESISTORS			
R-1	First R.F. Grid Filter	Fixed	470,000 Ohms, 1/2 W.
R-2	First R.F. Cathode	Fixed	330 Ohms, 1/2 W.
R-3	Second R.F. Grid Filter	Fixed	470,000 Ohms, 1/2 W.
R-4	Second R.F. Cathode	Fixed	330 Ohms, 1/2 W.
R-5	First Detector Cathode	Fixed	4,700 Ohms, 1/2 W.
R-6	First R.F. Grid Filter	Fixed	470,000 Ohms, 1/2 W.
R-7	V-1, V-2, V-4 & V-5 Screen Bleeder	Fixed	27,000 Ohms, 2 W.
R-8	First I.F. Cathode	Fixed	330/1,000 Ohms, 1/2 W.
R-9	Second I.F. Grid Filter	Fixed	470,000 Ohms, 1/2 W.
R-10	Second I.F. Cathode	Fixed	330 Ohms, 1/2 W.
R-11	V-6, Filament Dropping	Fixed	4.3 Ohms, 1 W.
R-12	A.V.C. Plate Load	Fixed	1,500,000 Ohms, 1/2 W.
R-13	A.V.C. Filter	Fixed	1,500,000 Ohms, 1/2 W.
R-14	V-1, V-2, V-4 & V-5 Screen Filter	Fixed	15,000 Ohms, 2 W.
R-15	S-Meter, zero adjusting	W.W. Var.	1,000 Ohms, 1 W.
R-16	S-Meter Bridge	Fixed	1,800 Ohms, 1/2 W.
R-17	S-Meter Shunt	Fixed	270 Ohms, 1/2 W.
R-18	S-Meter Bridge	Fixed	2,200 Ohms, 1/2 W.
R-19	H.F. Oscillator Grid	Fixed	22,000 Ohms, 1/2 W.
R-20	First Detector Screen	Fixed	100,000 Ohms, 1/2 W.
R-21	V-8 Dropping	Fixed	5,000 Ohms, 5 W.
R-22	R.F. Gain Control	W.W. Var.	10,000 Ohms, 1.5 W.
R-23	C.W. Oscillator Grid	Fixed	47,000 Ohms, 1/2 W.
R-24	C.W. Oscillator Plate	Fixed	220,000 Ohms, 1/2 W.
R-25	C.W. Oscillator Screen Filter	Fixed	100,000 Ohms, 1/2 W.
R-26	C.W. Oscillator Screen Bleeder	Fixed	100,000 Ohms, 1/2 W.
R-27	Limiter Threshold Control	Comp. Var.	500,000 Ohms, 1 W.
R-28	Second Detector Load	Fixed	22,000 Ohms, 1/2 W.
R-29	Second Detector Load	Fixed	470,000 Ohms, 1/2 W.
R-30	Limiter Plate	Fixed	220,000 Ohms, 1/2 W.
R-31	Limiter Threshold Filter	Fixed	220,000 Ohms, 1/2 W.
R-32	Limiter Filament Dropping	Fixed	4.3 Ohms, 1 W.
R-33	Limiter Cathode	Fixed	220,000 Ohms, 1/2 W.
R-34	Limiter Output Divider	Fixed	220,000 Ohms, 1/2 W.
R-35	Limiter Plate Load	Fixed	470,000 Ohms, 1/2 W.
R-36	Limiter Plate Filter	Fixed	820,000 Ohms, 1/2 W.
R-37	Audio Gain Control	Comp. Var.	500,000 Ohms, 1 W.
R-38	First Audio Cathode	Fixed	2,200 Ohms, 1/2 W.
R-39	First Audio Screen	Fixed	820,000 Ohms, 1/2 W.
R-40	First Audio Plate	Fixed	100,000 Ohms, 1/2 W.
R-41	First Audio Plate Filter	Fixed	47,000 Ohms, 1/2 W.
R-42	Audio Output Grid	Fixed	470,000 Ohms, 1/2 W.
R-43	Audio Output Cathode	Fixed	330 Ohms, 2 W.



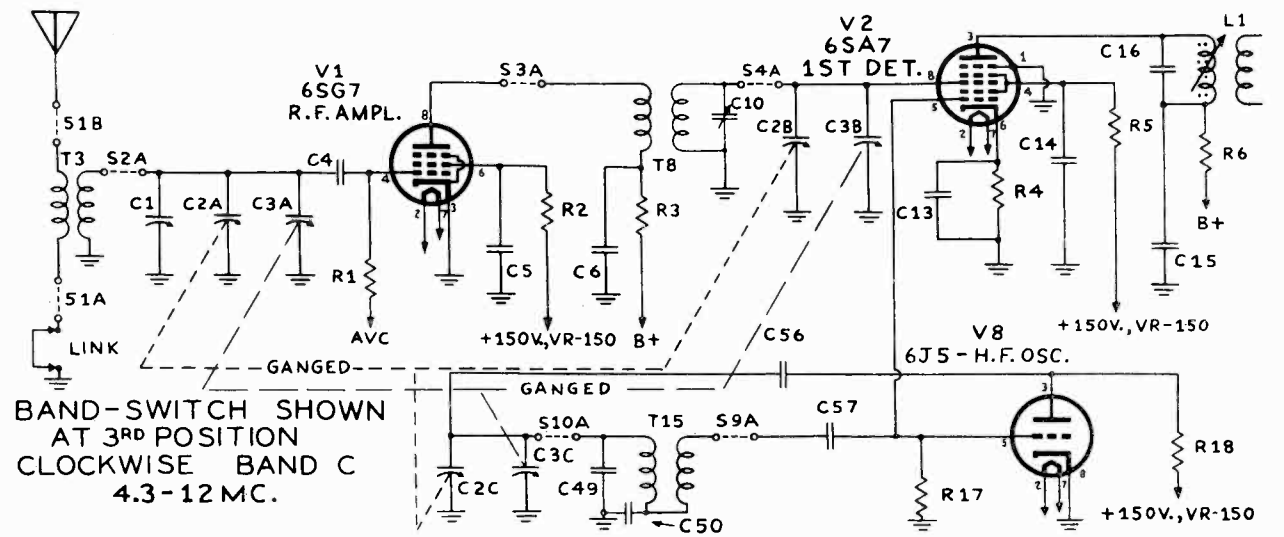
IF PEAK 455 KC



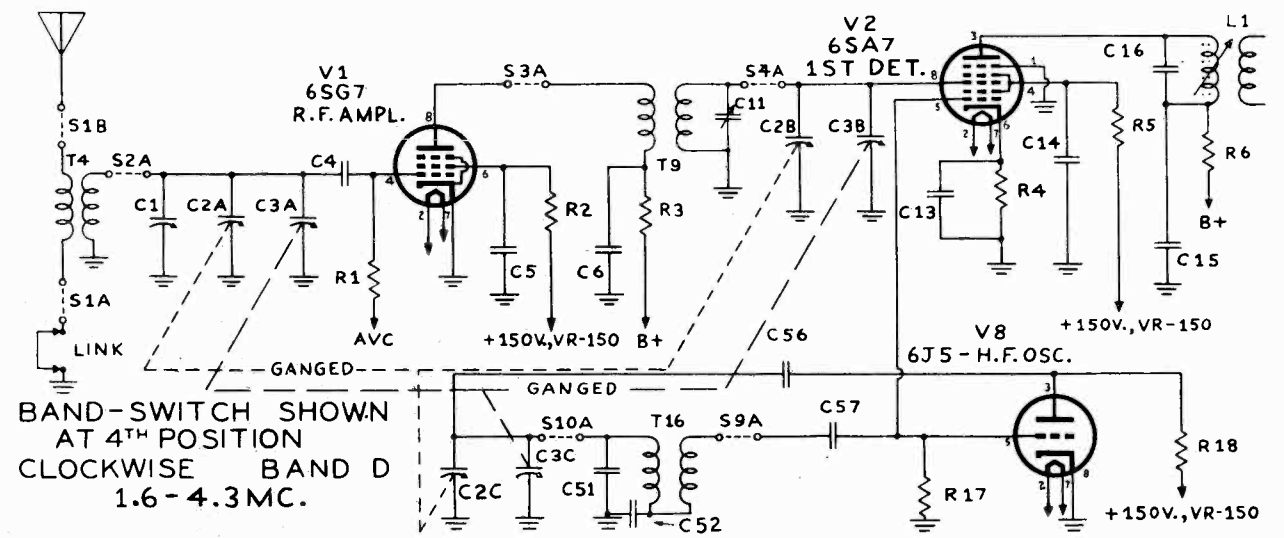
BAND-SWITCH SHOWN AT 1ST POSITION.
BAND A
48-56 MC.



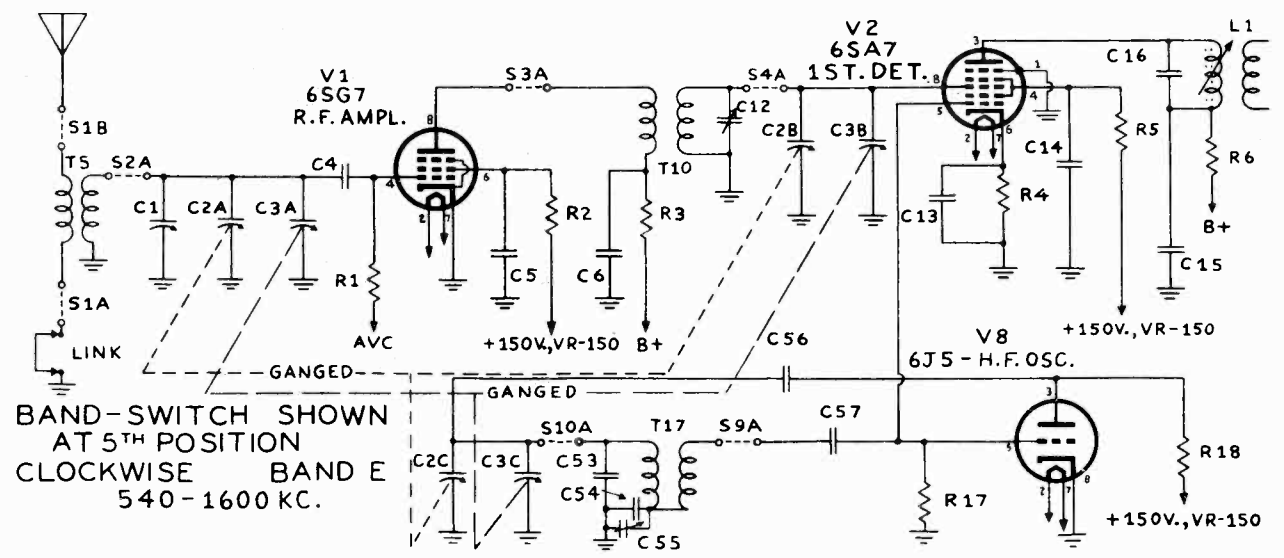
BAND-SWITCH SHOWN AT 2ND POSITION CLOCKWISE
BAND B
12-31 MC



BAND-SWITCH SHOWN AT 3RD POSITION
CLOCKWISE BAND C
4.3-12 MC.



BAND-SWITCH SHOWN AT 4TH POSITION
CLOCKWISE BAND D
1.6-4.3 MC.



BAND-SWITCH SHOWN AT 5TH POSITION
CLOCKWISE BAND E
540-1600 KC.

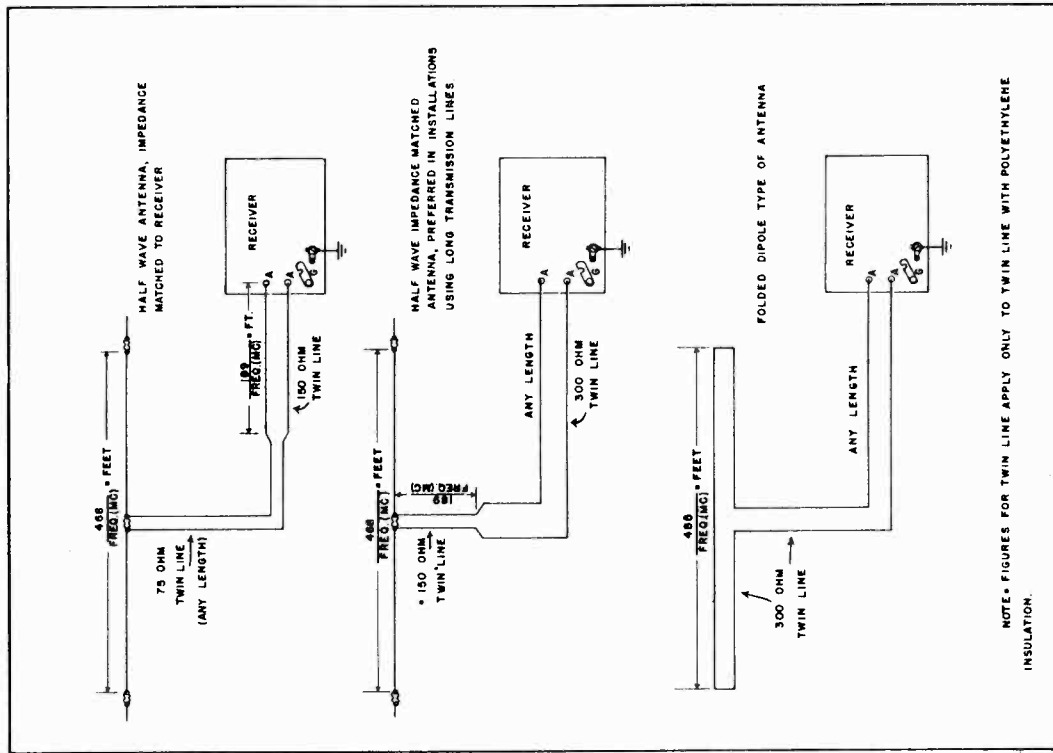


Figure No. 2. Typical Antenna Installations

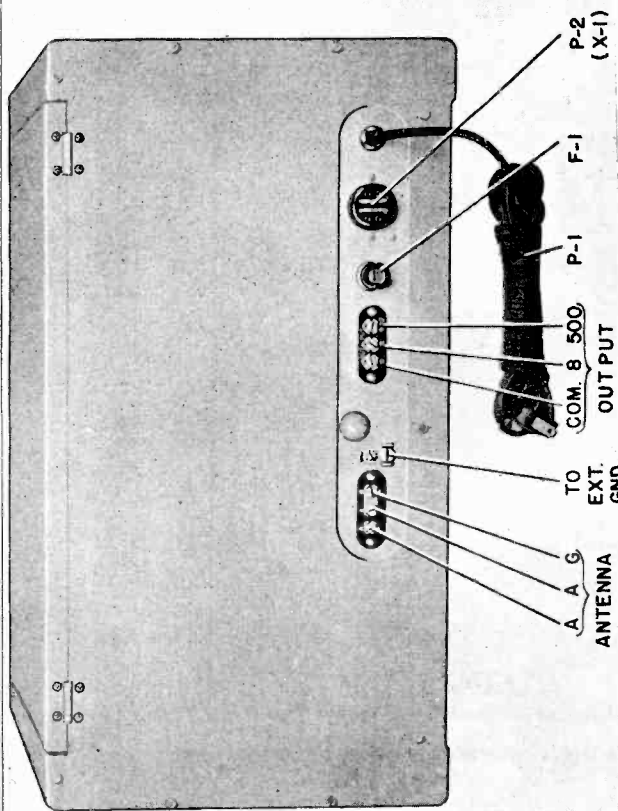


Figure No. 1. Rear View of Receiver

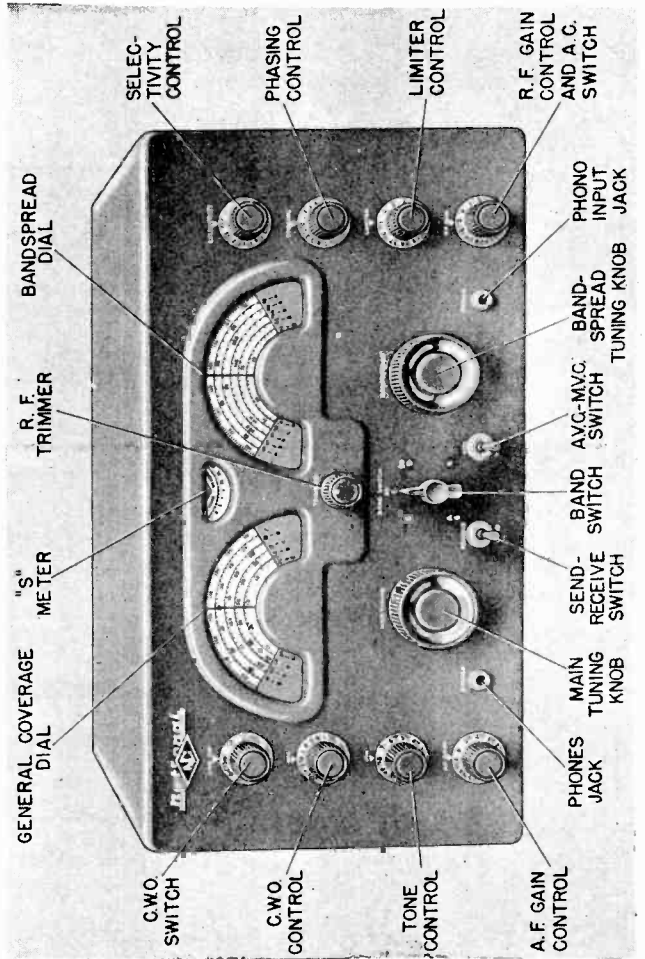
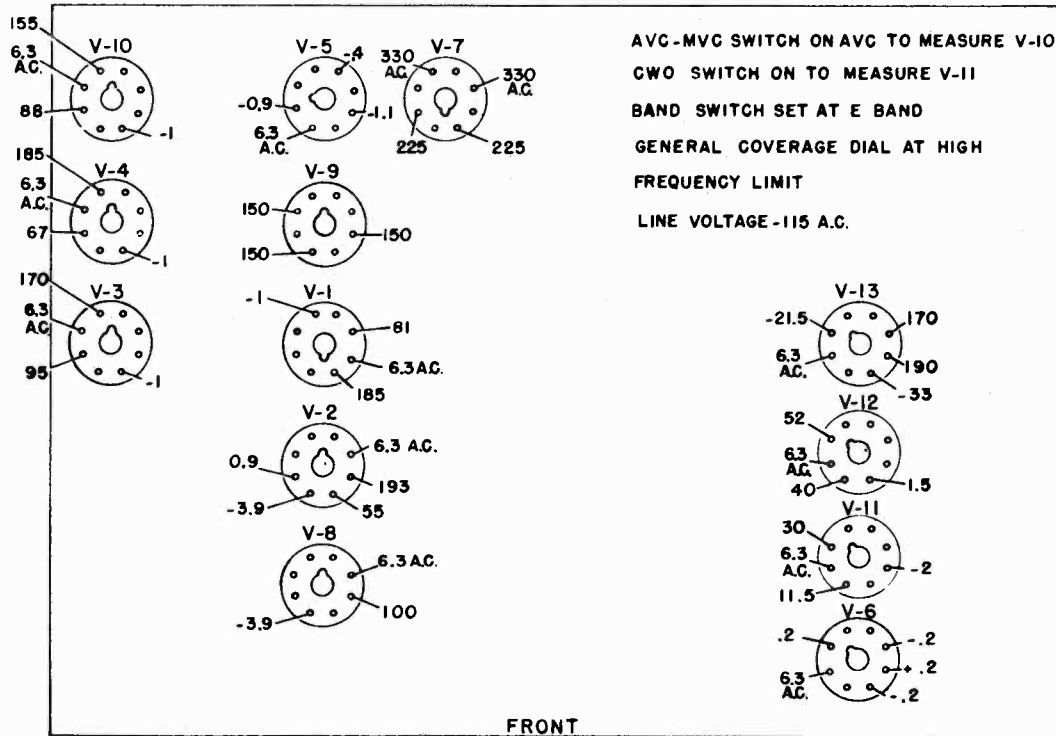


Figure No. 3. Front View of Receiver



FRONT

Figure No. 4. Tube Socket Voltages

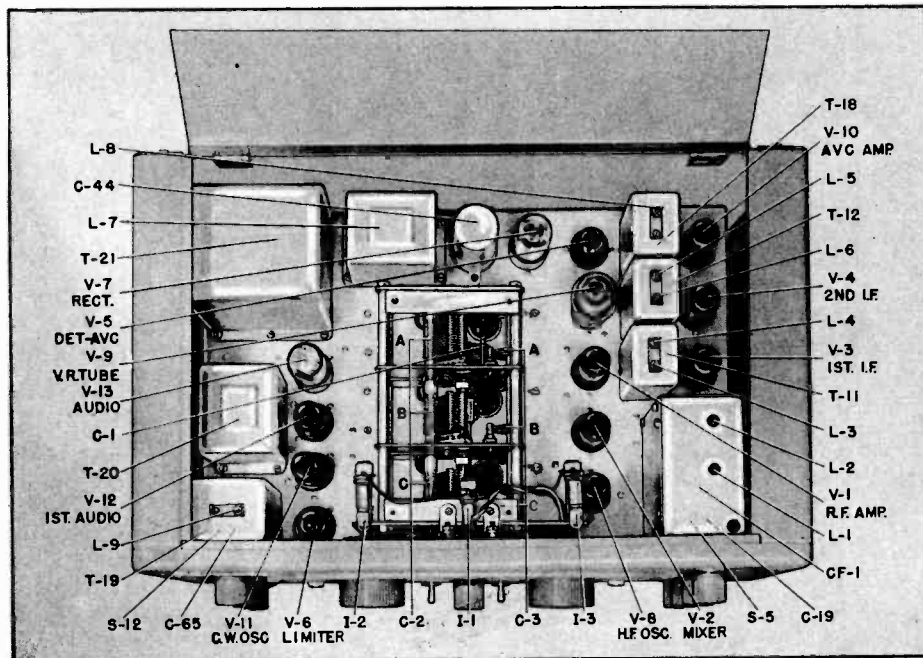


Figure No. 5. Top View of Receiver (Tuning Capacitor Cover Removed)

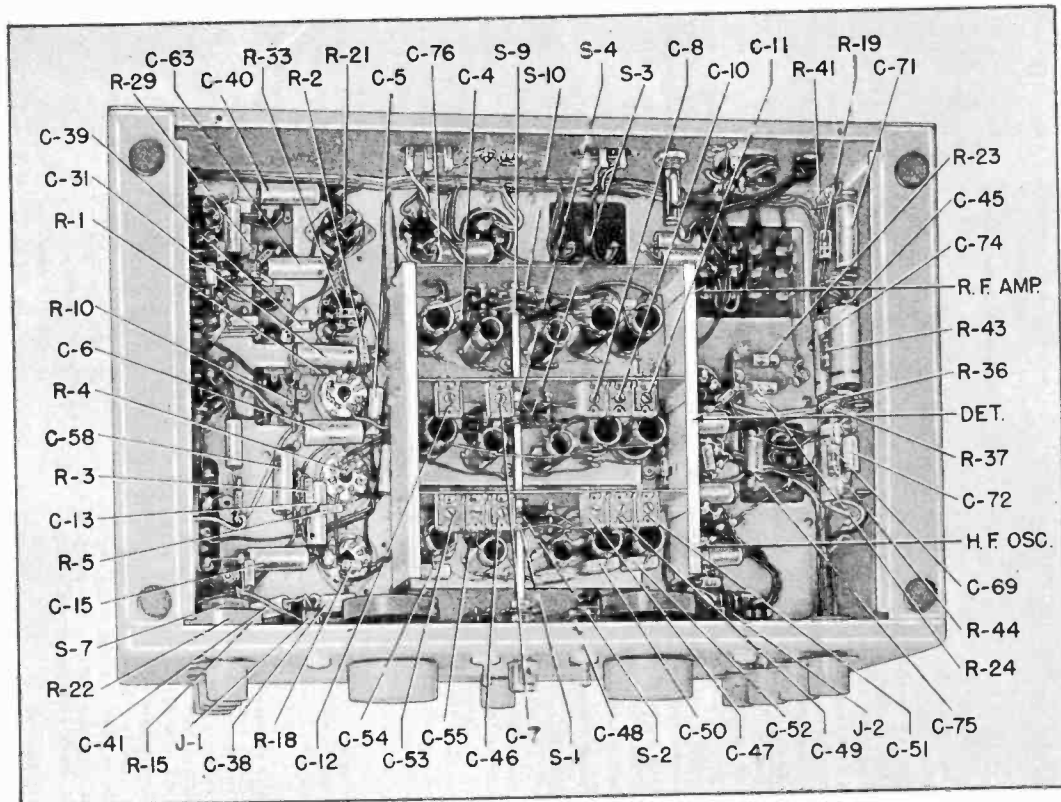


Figure No. 6. Bottom View of Receiver

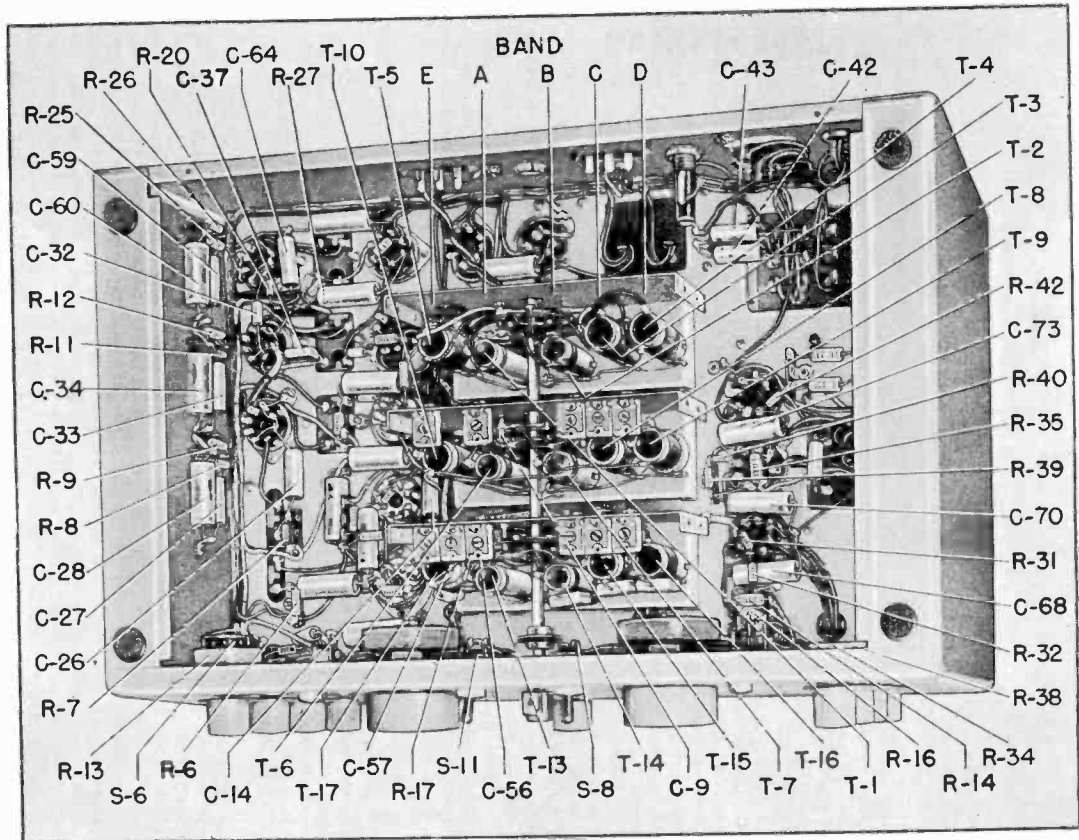


Figure No. 7. Bottom View of Receiver, Coil Compartment Side Plates Removed.

tiometer functioning to adjust the tonal output of the audio amplifier. The control is helpful when receiving weak signals through interference.

Signal Strength Meter

A signal strength meter is associated with the AVC circuit. The S-Meter scale is calibrated in S units from 1 to 9 with approximately 4 db per S unit and in db above S-9 from 0 to 40 db. The "no signal" S-Meter reading does not require adjustment. If it is necessary to compare strong signals which cause the S-Meter to read off scale, the S-Meter sensitivity may be reduced by retarding the RF Gain control.

Antenna Input

Antenna input terminals are located at the rear of the receiver chassis near the center. The input circuit is suitable for use with a single wire antenna, a balanced feed line or a low impedance (70 ohm) concentric transmission line. The average input impedance is roughly 500 ohms.

Audio Output

Two audio output circuits are provided:

- (1) A headphone jack is front-panel mounted and is wired so as to silence the loud-speaker on the insertion of the phone plug. The headphone load impedance is not critical allowing a wide range of headphone types to be used. Greater audio output at the headphone jack may be obtained, if desired. This is accomplished by unsoldering the headphone jack connection at terminal No. 2, the 8 ohm tap, on the audio output transformer and resoldering it to terminal No. 3, the 500 ohm tap.
- (2) An output terminal strip is mounted at the rear of the Receiver having both 8 and 500 ohm terminals and a common ground terminal. The 8 ohm terminal is suitable for connection to the loud-speaker supplied with the NC-173 Receiver and the 500 ohm terminal may be used for connection to a 500 ohm line.

Power Supply

The NC-173 Receiver is designed for operation from a 110/120 volt or 220/240 volt 50/60 cycle power source. The Receiver

AMATEUR BAND GEN. COV. DIAL SETTING
198 on Linear Scale

6	10-11
20	30.0 Mc.
40	14.4 Mc.
80	7.3 Mc.
	4.0 Mc.

The flexibility of this tuning system should be noted. If bandspread coverage is desired on any band in the 540 kc. to 31 mc. range, the main tuning dial can be set at the high frequency end of the band to be spread and the Bandsread dial used for tuning. Stations may be logged and bandspread tuning calibrated by means of the 0 to 200 numerical scale on the Bandsread dial. In the 48 to 56 mc. range the Bandsread tuning dial only is used for tuning. Band changing is accomplished by means of a highly efficient band switch.

Tuning of the first RF stage on all bands can be readily adjusted to compensate for a wide range of antenna loading conditions by means of the panel mounted antenna compensating capacitor.

Crystal Filter

Adjustable selectivity is obtained in the NC-173 by means of a crystal filter. This crystal filter is newly designed and incorporates features which make it highly flexible in its adjustments and superior in performance. The crystal filter provides uniform selectivity variation from the broad Off position to the sharp No. 5 position as well as phasing action for the attenuation of interfering signals. The broader selectivity positions are used during phone reception; the sharper selectivity positions are used during code reception.

Noise Limiter

A new concept in noise limiter design is introduced in the NC-173 Receiver. This new limiter could be termed "double action plus" and the noise limiting action is equally effective whether receiving phone or code signals (that is with the CW Oscillator On or Off). A threshold control on the front panel permits adjustment of the level at which limiting action starts.

Tone Control

The Tone control is a variable poten-

Tube Complement

The NC-173 is supplied complete with tubes which are tested in the receiver at the time of alignment.

The tubes employed are as follows:

R. F. Amplifier.....	6S7
First Detector.....	6S7
H. F. Oscillator.....	6J5
First I. F. Amplifier.....	6S7
Second I. F. Amplifier.....	6S7
Second Det. - AVC Det.....	6H6
AVC Amplifier.....	6AC7
Beat Frequency Oscillator.....	6H6
Limiter.....	6H6
1st. Audio.....	6S7
Audio Output.....	6V6GT/G
Voltage Regulator.....	OD3/VR-150
Rectifier.....	5Y3GT/G

Tuning System

The main tuning capacitor C-2 and the bandsread tuning capacitor C-3 are connected in parallel on all bands. Separate knobs with associated dial scales are used to operate these two capacitors to tune the frequency range of the Receiver in five bands as follows:

BAND	GENERAL COVERAGE	BANDSPREAD
A	12 - 31 Mc.	48 - 56 Mc.
B	4.3 - 12 Mc.	27 - 30 Mc.
C	1.6 - 4.3 Mc.	14.0 - 14.4Mc.
D	0.54 - 1.6 Mc.	7.0 - 7.3Mc.
E		3.5 - 4.0Mc.

This tuning system requires that the bandsread dial be set at the proper point when using the general coverage dial and vice versa. The accuracy of the dial calibration will not be maintained unless these settings are properly observed. The correct setting of the Bandsread dial for general coverage tuning is at 180 on the linear scale. The following table lists the dial settings for bandsread tuning of the various amateur bands.

General

The new NC-173 Receiver features a wide frequency coverage which includes the conventional 540 to 31 mc. range and in addition encompasses the Amateur six meter band in its 48 to 56 mc. range. The tuning system employs separate directly-calibrated dial scales for general coverage and bandsread tuning. Calibrated bandsread tuning is provided for the main amateur bands i.e.: 6, 10-11, 20, 40 and 80. The NC-173 selectivity characteristic is adjustable over a wide range from broad band broadcast requirements to sharp amateur signal CW reception. The adjustable selectivity plus high sensitivity assures the operator of optimum Receiver performance at all times.

The NC-173 also employs a voltage regulator tube to minimize frequency drift in the high frequency oscillator and also in the beat frequency oscillator. This assures a minimum of frequency drift for both phone and code reception.

These stabilized circuits plus a very effective new noise limiter enables the operator to cope with the most adverse receiving conditions.

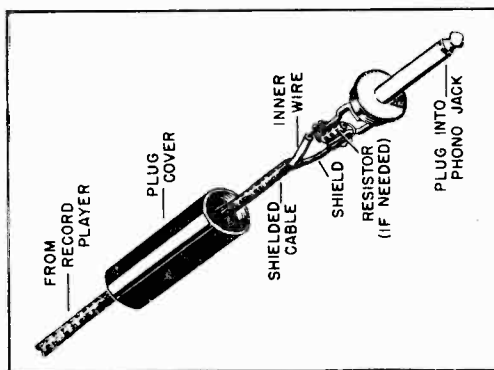
Circuit

The NC-173 utilizes 13 tubes in a superheterodyne circuit, featuring such circuit refinements as an RF amplifier stage, a separate AVC amplifier, a voltage regulator for circuit stabilization and a double diode noise limiter.

The circuit employed on all bands consists of one stage of radio frequency amplification, a first detector and separate stabilized high frequency oscillator, two intermediate frequency amplifier stages, a diode type second detector, an audio limiter, a high gain audio stage and an audio output stage. The remainder of the Receiver includes automatic volume control, beat frequency oscillator, voltage regulator and rectifier circuits. The crystal filter is connected between the first detector and first IF stages.

er is shipped from the factory with the power transformer wired for 110/120 volt operation only. A few simple wiring changes in the dual primary of the power transformer are necessary to adapt the NC-173 Receiver for 220/240 volt operation. These changes are made directly on the power transformer terminal panel and are as follows:

- (a) Remove the jumper between terminals 1 and 4 and between 2 and 5.
 - (b) Connect a jumper between terminals 4 and 5.
- A drawing of both possible primary circuits is shown on the Schematic Diagram. Normal power consumption is approximately 83 volt-amps. The built-in power unit supplies all voltages required by the heater and B supply circuits - 4.1 amperes at 6.3 volts and 92 milliamperes at 225 volts, respectively. A 2 ampere fuse is connected in one side of the AC input line to protect the receiver circuits against any voltage surges in the power line or short circuits in the Receiver. This fuse is mounted in an extractor post at the rear of the receiver and is easily removed for examination or replacement.



INSTALLATION

Antenna Recommendations

The antenna input circuit of the Receiver is arranged for operation from either a single-wire antenna, a doublet antenna or other types having impedances of 70 ohms or more. The antenna terminal

strip, at the rear of the Receiver, has three terminals, two are for antenna connections and the other for a ground. The ground terminal has connected to it a metal link which is used to ground one antenna lead as necessary. With balanced antenna systems, such as the doublet type, the metal link is not used. With an unbalanced system, such as the single-wire antenna, it is desirable to ground the unused antenna terminal by means of the metal link. For an unbalanced system of the concentric transmission line type, it is recommended that the outside of the concentric line be grounded directly to the ground lug below the antenna terminal strip. The external ground connection to the ground lug below the antenna terminal strip should be maintained at all times.

For best impedance matching to the antenna input circuit, an antenna with a 300 to 600 ohm transmission line is recommended. If a doublet type with a 300 to 600 ohm balanced transmission line is used the metal grounding link should not be used. For optimum results the antenna should be cut to the proper length corresponding to the desired operating frequency. See Fig. No. 1. It must be remembered that an antenna installation of this type will have maximum efficiency over a narrow band of frequencies near the frequency for which the antenna was designed and will be most useful in installations where the Receiver is tuned to one frequency or narrow band of frequencies. For other frequencies it would be desirable to connect the two transmission line leads together at one antenna post and the metal link used to ground the other post. 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 one antenna post and the metal link used to ground the other post. In an installation where the Receiver is to be used as the receiving unit in a transmitting station, the most efficient

operation will usually result from use of the transmitting antenna as a receiving antenna also. This is especially true if the transmitting antenna is of the multi-element, directional type as the same antenna gain is available for both receiving and transmitting--a very desirable condition. For switching the antenna from transmitter to receiver, an antenna change-over relay with good high-frequency insulation is recommended. A second relay for controlling the transmitter plate supply and the Receiver B+ circuit may be used to achieve single-switch control of the station. This second relay should be a double pole, single throw type having one normally open pair of contacts and one normally closed pair of contacts.

Installation Procedure

After unpacking the Receiver and Speaker proceed as follows:

- (1) Seat A.C. jumper plug and all tubes firmly in their sockets.
- (2) Connect the loud-speaker to the 8 ohm output terminals at the rear of the Receiver.
- (3) Connect a good external ground to the screw-type lug located at the rear of the Receiver below the antenna terminal strip.
- (4) Connect the antenna as recommended in paragraph 2-2.
- (5) Connect the power cord to a 115 volt, 50/60 cycle AC source of supply.
- (6) Set controls as recommended in Section 3 for reception of signals.

NOTE

Where the Receiver is located in the field of a relatively powerful transmitter, it is advisable to provide some means of preventing damage to the Receiver antenna coil. If a separate receiving antenna is used, a means for disconnecting or grounding the antenna during transmission periods should be provided.

Battery Operation

The NC-173 may be operated in portable or emergency service by connecting batteries to the terminals of the power socket located at the rear of the receiver. The AC jumper plug may be required for battery connection or if changeover operation is desired any octal plug or octal tube base may be used. In any of the above circumstances the battery plug used should be wired according to the drawing shown on the schematic diagram. A 6 volt heater supply (storage battery) should be connected to terminals 3 and 5 and 135 to 250 volt "B" supply connected to terminals 1 and 8. The recommended "B" voltage supply for battery economy is between 135 and 180 volts. The voltage regulator tube will not imitate with this recommended "B" supply but regulation is not required for battery operation. A suggested refinement is to include a switch in the A+ 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 battery socket. The Receiver's "B" switch may be used to silence the receiver with battery operation the same as for AC operation.

The recommendations of Section 3, Operation apply to the battery powered NC-173 Receiver.

Loud Speaker

If the installation is such that the loud-speaker will be placed close to the receiver, the most desirable position is at the side.

OPERATION

Control.

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 five positions of the Band Switch are marked with identifying band letters plus the Amateur bands covered in each band corresponding to the band designations on the dial escutcheons. The Band Switch does not have any limit stops so that band changing may be accomplished with a minimum of Band Switch turning.

The General Coverage dial knob operates the main tuning capacitor and turns the main dial scale through a combination pinch drive and anti-backlash gear train. The main dial scale is calibrated directly in frequency for each band covered and also carries a 0-200 linear scale for auxiliary logging purposes. The main dial escutcheon is marked with the frequency band limits in megacycles and also with band letter designations which correspond to the Band Switch markings.

The Bandspread tuning dial knob operates the bandspread tuning capacitor and bandspread dial scale through a combination pinch drive and anti-backlash gear train which is similar to that used for general coverage tuning. The bandspread dial scale is marked directly in frequency for the amateur 6, 10-11, 20, 40 and 80 meter bands and also has a 0-200 linear scale for bandspread logging on other than the frequency calibrated bandspread frequencies.

The RF Trimmer control operates a tuning capacitor trimmer which is connected across the first RF Amplifier main tuning capacitor section. The RF Trimmer can be used to tune the first RF Amplifier stage properly under a wide variety of antenna loading conditions.

The RF Gain control adjusts the amplification of the RF and IF Amplifier stages. Clockwise rotation of the control increases Receiver gain. The AC Power switch is associated with the RF Gain control and AC power is turned On as the RF Gain control is advanced from AC Off to 0 on the scale.

The AF Gain control adjusts the amount of audio voltage applied to the first audio tube. Clockwise rotation of the control increases the Receiver audio power output. The AF Gain control is operative when an audio signal is applied to the Phono input jack.

The Limiter control is used both to switch the limiter into the circuit and also to adjust the threshold at which limiting action starts. The limiter is turned on as the Limiter control is advanced from Off to 0 and the threshold is lowered as the control is advanced toward 10. Any noise peak voltages in excess of this adjustable threshold are prevented from reaching the audio amplifier. The limiter circuit is of the double diode type and is equally effective for either phone or CW reception.

The Tone control is used to vary the frequency characteristic of the audio portion of the Receiver. Turning this control toward 10 on its scale increasingly attenuates the lower frequencies.

The CW Switch and CWO control are used for radiotelegraph code reception. The CW Switch is used to turn the CW Oscillator On and the CWO control is used to adjust the pitch of the CW note. At zero on the CWO scale, the CW Oscillator is tuned to the Receiver's intermediate frequency.

The Phasing and Selectivity controls

adjust the operation of the crystal filter. Receiver selectivity is made progressively sharper as the Selectivity control is turned from Off toward 5 on its scale. The Phasing control is inoperative with the Selectivity control in the Off position. The Phasing control is used to attenuate interfering signals and is connected in a bridge circuit so that the bridge can be balanced to reject the undesired signal frequency.

The Send-Receive switch is used to quiet the Receiver during transmission periods or other times when it is desirable to be able to turn on the Receiver immediately after a period of silence (i.e. not having to wait for the tubes to warm up). The Send-Receive switch is connected in the B-circuit and functions when the Receiver operates from batteries as well as during normal AC operation. The Send-Receive switch should not be used to silence the Receiver after the completion of an operating period. The Receiver should be turned Off by turning the RF Gain control to the AC Off position.

External (remote) stand-by control of the Receiver may be accomplished by connecting a switch or relay to terminals 1 and 4 of the AC jumper plug as shown on the Schematic Diagram. This is a parallel arrangement thus permitting the Send-Receive switch to remain operative with the external switch or relay in the circuit.

The AVC-MVC switch is used to adjust the Receiver for either Automatic Volume Control or for Manual Volume Control operation. Automatic Volume Control can be used for either phone or code reception. The AVC time constants have been adjusted so that Receiver gain does not change appreci-

ably during average code speed reception.

Phone Reception

After the equipment is properly installed, as outlined in Section 2, it is placed in operation by adjusting the receiver controls as follows:

1. Advance the *RF Gain* to a point between 8 and 10.
2. Set the *Send-Receive* switch at *Receive*.
3. Set the *AVC-MVC* switch at *AVC*.
4. Turn the *CWO* switch to *Off*.
5. Set the *Selectivity Control* at *Off*.
6. Set the *Phasing* control at 0.
7. Set the *Limiter* control at *Off*.
8. Set the *AF Gain* control to the point providing the audio volume desired by the operator.
9. Adjust the *Tone* control to give the desired audio characteristic.

The Receiver is now adjusted for the reception of phone signals and will tune to the frequency indicated by the tuning dial and band switch settings. Set the *RF Trimmer* control for maximum S-Meter reading after the desired station has been selected, or alternately in the absence of a signal the *RF Trimmer* may be set for maximum Receiver background noise.

The tuning system in the NC-173 is arranged for ease of operation and accuracy of calibration. However, it is necessary that the proper settings of the *General Coverage* and *Bandspread* dials be observed for tuning of signals. For general coverage tuning the *Bandspread* dial must be set at 180 on its linear scale; for *Bandspread* tuning the *General Coverage* dial must be set at the proper point corresponding to the *Amateur* band being tuned. The *General Coverage* dial settings for *Bandspread* tuning of the various amateur bands are listed in Section 1. The various "set points" are marked directly on the *General Coverage* dial scale at the upper frequency limit of the amateur band being tuned and are easily located by the identifying circular markers. As stated in Section 1, tuning of the 6 meter band is accomplished by use of the *Bandspread* dial entirely. The correct setting of the *General Coverage* dial for 6 meter band operation is at the scale marker position located at approximately 198 on

the linear scale. The *Band Switch* setting determines the band of frequencies which the Receiver will tune at any one time. The dial scale in use is indicated by the identifying markers on the dial escutcheons which correspond to the markings on the *Band Switch* control.

With the *AVC-MVC* switch set in the *AVC* position, the *RF Gain* control should be advanced as far as receiving conditions permit, or until background noise becomes objectionably loud. Audio output should be adjusted entirely by means of the *AF Gain* control. The operator must remember that automatic volume control action will be restricted unless the *RF Gain* control is fully advanced.

The *AVC-MVC* switch may be set at the manual volume control position, in which case the operator must be careful not to advance the *RF Gain* control to a point where *IF* or audio amplifier overload occurs. Such overload is indicated by distortion. In general, the *AF Gain* control may be set at a fixed position and the *RF Gain* control used to adjust the volume of the audio output.

If a signal is weak and partially obscured by background noise and static, best signal-to-noise ratio will be obtained by turning the *Tone* control towards 0 on its scale. The most effective setting must be determined by trial as too much attenuation of the higher audio frequencies will impair the intelligibility of speech.

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 advancing the *Limiter* control clockwise from the *Off* position. The best setting must be determined by trial as too much limiter action will impair the audio quality.

The selectivity of the receiver is adjusted by means of the crystal filter *Selectivity* control. The normal setting of the *Selectivity* control in phone 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* control to positions 3, 4 or 5. The evidences of increasing selectivity will be the attenuation of the higher frequency audio tones of the signal as well as sharper

tuning. Increasing selectivity too much will attenuate these higher tones to such an extent that phone signals will become unintelligible.

The *Phasing* control is used to eliminate or attenuate interfering heterodynes. The normal setting of the *Phasing* control with the crystal filter *On* for phone reception is at 0 on the scale. If, after a signal has been tuned in, an interfering signal causes a heterodyne or whistle the *Phasing* control should be adjusted until interference is reduced to a minimum. The setting of the *Phasing* control which provides maximum attenuation of the heterodyne will depend on the pitch of the heterodyne whistle. If the beat note is above 1000 cycles, the optimum *Phasing* control setting will be near one end of the scale or the other, depending upon whether the interfering signal has a higher or lower frequency than the desired signal. The *Phasing* control is inoperative with the *Selectivity* control in the *Off* position, but the *Phasing* control is operative at all other *Selectivity* control settings.

C.W. Reception

The Receiver is placed in operation for the reception of CW signals in the same manner as that outlined for phone reception, (Section 3-2), except that the *CWO* switch should be set at *On* and the *CWO* control set at mid-scale. The CW code characters are made audible by the heterodyning action of the CW Oscillator with the incoming signal. The frequency of the CW Oscillator can be varied by rotation of the *CWO* control.

The sensitivity of the receiver should be adjusted by means of the *RF Gain* control and the audio volume by means of the *AF Gain* control. When receiving CW characters with slow keying or long pauses during keying it may be desirable to set the *AVC-MVC* switch at *MVC* so that the receiver gain does not change during keying pauses. In this case, the *AF Gain* control should be set at a fixed position and the audio volume adjusted by means of the *RF Gain* control. In either of the above cases, care should be taken not to advance the *RF Gain* to a point where *IF* or audio amplifier overload will occur.

The action of the *Tone* and *Limiter*

controls will be similar to that described under Section 3-2. However, in CW reception it will be possible to advance these controls considerably further than is desirable in phone reception since audio distortion is relatively unimportant.

Turning the *CWO* control to either side of zero will change the characteristic pitch of the receiver background noise thus providing a means of adjusting the audio beat note to the operator's preference. The pitch will become higher as the *CWO* oscillator is detuned from the *IF Amplifier*.

A distinct advantage in the reception of weak signals through interference can be realized by the use of the "single-signal" properties of the NC-173 Receiver. The CW oscillator should be detuned until the pitch of the receiver background noise is roughly 2000 cycles. Under this condition the audio beat note of any CW code signal will show a broad peak in output at approximately 2000 cycles. This peak is easily found by rotating the tuning dial slowly through the carrier of a received signal. This peak will appear on one side of "zero beat" only and on the other side of "zero beat" the 2000 cycle note will be considerably weaker. It should be noted that depending on the frequency of the interfering signal better receiving conditions will be obtained by detuning the *CWO* on one side of zero than on the other. The best setting of the *CWO* can only be determined by trial settings on either side of zero until optimum results are obtained.

Crystal filter operation for CW reception is similar to that described in Section 3-2 with the exception that it is possible to utilize maximum selectivity without the loss of intelligibility experienced in phone reception. When maximum selectivity is employed, i.e. *Selectivity* control at 5, tuning is very critical and care must be taken to assure proper tuning. At this setting the "single-signal" effect, previously described, is very pronounced. When tuning across the carrier of a received signal the audio beat note is very sharply peaked at a definite audio frequency. The maximum response indicates the proper dial setting. The pitch of the beat note peak may be adjusted by use of the *CWO* control to provide an audio tone

a particular incoming signal. The CWO Tone, Limiter and AF Gain control settings do not affect meter readings.

Tuning the Receiver to a signal will cause a meter deflection indicating the signal strength in S-units or in decibels above the S-9 level.

In instances where a strong signal causes the S-Meter to read off scale the S-Meter sensitivity may be reduced by retarding the RF Gain control until an on scale reading is obtained. Without disturbing the setting of the RF Gain control the comparative strength of this strong signal may be compared with other signals.

SERVICE AND TEST DATA

Tube Failures

The partial or complete failure of a vacuum tube in the Receiver may reduce the sensitivity, produce intermittent operation, or cause the equipment to be completely inoperative. If tube failure is suspected all tubes should be checked in suitable tube testing equipment, or by replacement with tubes of proven quality. Care should be taken that any tubes removed for checking purposes be returned to their original sockets thereby reducing the necessity for realignment.

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 high frequency oscillator and I.F. tubes should be chosen with care to select a replacement which most nearly approaches the characteristics of the original tube. A replacement high frequency oscillator tube can be readily checked by noting any change in dial calibration, particularly in the amateur broadcast bands. Substitution of new I.F. amplifier tubes may possibly alter overall gain and selectivity characteristics. Instructions for realignment are given in detail in Section 5-2.

Circuit Failures

All components parts in the NC-173 Receiver have been carefully selected to assure an ample factor of safety yet failure

terminals the test signal should be within the limits specified below. It is important that the proper output impedance matching be observed, i.e., 8 or 500 ohms depending upon which terminal is used, when making these tests.

The Band Switch must be set at the mid-position between the A and E bands.

TERMINAL	TEST SIGNAL
Mixer Grid	13 ± 3 Microvolts
First IF Grid	170 ± 30 Microvolts
Sec. Det. Grid	33,000 ± 6,000 Microvolts

Voltage Tabulation

All voltage measurements are made with the Receiver controls adjusted for normal operation as outlined in Section 3-2 except that the AVC-MVC switch should be set at #VC and the AF Gain control at 10, except as noted on Figure No. 4. A high-impedance vacuum tube voltmeter should be used to make these measurements. Readings taken with any other type of instrument will differ greatly from those shown on Figure No. 4. All voltages are measured between specified terminal and chassis.

ALIGNMENT DATA

General

All circuits in the NC-173 Receiver are carefully aligned, before shipment, using precision crystal controlled oscillators which insure close conformability to the dial calibration. No realignment of the various adjustments will be required, therefore, unless the receiver is tampered with or damaged in transit.

The necessity for any realignment can be determined by checking the performance of the Receiver against its normal operation as outlined in Section 3. In no case should realignment be attempted unless tests indicate that such realignment is necessary. Even then, it must be remembered that the NC-173 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 a similar type of receiver.

The HF coil groups are mounted in an

aluminum compartment which is directly below the main tuning capacitor. The HF oscillator coils are nearest the front panel, the first detector coils are in the center of the compartment and the RF coil group is nearest the rear of the Receiver.

All HF oscillator and first detector coils have individual general coverage trimmer capacitors. The E band has also a general coverage variable series padding capacitor. These capacitors are identified in Figure No. 6.

The IF transformers, crystal filter, AVC amplifier and CW oscillator transformers all have individual permeability-tuned iron core inductors with screw-adjustments for alignment purposes. These adjustments are identified on Figure No. 5.

Before proceeding with the alignment of any circuit of the Receiver, the equipment must be set up as specified in Section 2-3, except that the antenna lead-in must be disconnected. An output meter having an 8 or 500 ohm resistive load should be connected to the matching terminal on the Receiver's output terminal strip. If it is so desired a high impedance AC voltmeter having a resistive load of over 8 ohms may be connected to the phone output jack and used in place of the output meter. The RF Gain control should be set at 10 and the Tone control at 0.

Alignment of the equipment may be divided into two major steps:

- (1) IF and AVC Amplifier Alignment.
- (2) General Coverage Alignment.
 - (a) HF Oscillator.
 - (b) First Detector.

The circuits must be tuned in the above order when complete alignment is necessary.

5-2IF and AVC Amplifier Alignment

The intermediate frequency of the NC-173 Receiver is 455 kilocycles, plus or minus 2 kilocycles. The exact frequency is determined by the quartz crystal resonator Y-1.

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 detector section of the main tuning capacitor, C-2f, and the grounded lead to any convenient grounded

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MODEL NC-173

PARTS LIST

Symbol	Function	Type	Rating
CAPACITORS			
C-1	RF Trimmer	Air	Variable
C-2	Main Tuning	Air	Variable
C-2A	RF Amp. Tuning	Air	Part of C-2
C-2B	1st Det. Tuning	Air	Part of C-2
C-2C	HF Osc. Tuning	Air	Part of C-2
C-3	Bandspread Tuning	Air	Variable
C-3A	HF Amp. Bandspread Tuning	Air	Part of C-3
C-3B	1st Det. Bandspread Tuning	Air	Part of C-3
C-4	HF Osc. Grid Coupling	Mica	0.001 mfd., 300 VDC
C-5	RF Amp. Screen Bypass	Paper	0.01 mfd., 600 VDC
C-6	RF Amp. Plate Filter	Paper	0.05 mfd., 600 VDC
C-7	A Band 1st Det. Trimmer	Mica	Variable
C-8	F Band 1st Det. Trimmer	Mica	Variable
C-9	F Band 1st Det. Pri. to Sec. Coupling	Ceramic	10 mmf., 500 VDC
C-10	C Band 1st Det. Trimmer	Mica	Variable
C-11	I Band 1st Det. Trimmer	Mica	Variable
C-12	F Band 1st Det. Trimmer	Mica	Variable
C-13	Mixer Cathode Bypass	Paper	0.1 mfd., 400 VDC
C-14	Mixer Screen Bypass	Paper	0.01 mfd., 600 VDC
C-15	Mixer Plate Filter	Paper	0.05 mfd., 600 VDC
C-16	Crystal Filter Input Tuning	Mica	510 mmf., 500 VDC
C-17	Crystal Filter Bridge	Ceramic	85 mmf., 500 VDC
C-18	Crystal Filter Fringe	Ceramic	50 mmf., 500 VDC
C-19	Crystal Filter Phasing	Air	Variable
C-20	Crystal Filter Coupling	Ceramic	10 mmf., 500 VDC
C-21	Selectivity Adjusting	Ceramic	25 mmf., 500 VDC
C-22	Selectivity Adjusting	Ceramic	100 mmf., 500 VDC
C-23	Selectivity Adjusting	Ceramic	100 mmf., 500 VDC
C-24	Selectivity Adjusting	Ceramic	50 mmf., 500 VDC
C-25	Crystal Filter Output Tuning	Mica	510 mmf., 500 VDC
C-26	1st IF Grid Filter	Paper	0.01 mfd., 600 VDC
C-27	1st IF Screen Bypass	Paper	0.01 mfd., 600 VDC
C-28	1st IF Plate Filter	Paper	0.05 mfd., 600 VDC
C-29	T-11 Primary Tuning	Mica	510 mmf., 500 VDC
C-30	T-11 Secondary Tuning	Mica	510 mmf., 500 VDC
C-31	2nd IF Grid Filter	Paper	0.1 mfd., 400 VDC
C-32	2nd IF Grid to AVC Grid Coupling	Ceramic	47 mmf., 500 VDC
C-33	2nd IF Screen Bypass	Paper	0.01 mfd., 600 VDC
C-34	2nd IF Plate Filter	Paper	0.05 mfd., 600 VDC
C-35	T-12 Primary Tuning	Mica	510 mmf., 500 VDC
C-36	T-12 Secondary Tuning	Mica	510 mmf., 500 VDC

ment are as outlined in Section 3-2 except that the AVC-WVC switch should be at WVC. Throughout the alignment procedure outlined below it is important that the *bandspread* dial is set at 180 on the linear scale.

- (a) HF Oscillator
- Alignment is effected as follows: Set the *Band Switch* at the position indicating the band to be aligned. Set the *General Coverage* tuning dial near the high frequency end of the band. Connect a signal generator to the antenna input terminals through a standard dummy antenna and accurately tune the signal generator to deliver a signal of the same frequency as that indicated by the receiver dial setting. If, when this signal is tuned in, the dial reading is too high, decrease the capacity of the HF oscillator circuit trimmer until the signal appears at the proper point on the dial. Conversely low dial readings are corrected by increasing the capacity of this trimmer to make correction. Care should be taken to insure that the HF oscillator is tuned to the fundamental frequency and not the image. This can be checked by tuning to the image frequency which should appear 910 kilocycles below the fundamental frequency and be considerably weaker. If the image does not appear at the lower dial setting the HF oscillator trimmer capacity must be decreased until the fundamental and image frequencies appear at the proper points on the dial.
- (i) First Detector
- Adjust the signal generator to deliver a modulated signal near the high frequency limit of the band to be checked, tune the receiver to give maximum output, as indicated on the output meter. Adjust the first detector trimmer capacitor until the output reading shows maximum. If these trimmers require considerable realignment, it may be necessary to readjust the high frequency oscillator trimmer in order to maintain correct calibration.
- An alternate method of aligning the first detector stage in the event a signal generator is not available is to set the first detector trimmer capacitors for maximum background noise. It will be found that trimmer settings under this method are sufficiently sharp to provide good alignment, although the adjustment must be made with care to avoid alignment to the image.

point on the chassis. This is a direct connection no dummy antenna being required.

- (2) Set the CWO switch at On.
- (3) Set the AVC-WVC switch at WVC.
- (4) Set the Phasing control at 0.
- (5) Set the Selectivity control at 5.
- (6) Set the AF Gain control at 10.
- (7) Turn the modulation of the signal generator off to provide a steady CW test signal.

Adjust the output attenuator of the signal generator to provide a signal of approximately 100 microvolts and vary the tuning control of the signal generator slowly between the frequencies of 453 and 457 kilocycles. At some frequency between these limits the IF amplifier of the receiver will show a very sharply peaked response, as indicated on the output meter. The absence of such a sharply peaked response will serve to indicate that the crystal resonator, Y-1, is defective. The CWO control must be set to provide an audible beat note at all times.

While making IF amplifier adjustments, it will be necessary to retard the attenuator of the signal generator if the readjustment increases IF amplifier gain to a point where overload occurs. Without altering the frequency setting of the signal generator set the *Selectivity* and CWO switches at *Off*, and turn the modulation of the signal generator *On*. The IF tuned inductors L-1 through L-6 should each be carefully adjusted to give a maximum reading on the output meter. The order in which these adjustments are made is not important.

To align the AVC amplifier turn the AVC-WVC switch to AVC. Adjust L-8 of transformer T-18 until a well-defined dip is observed in the output meter readings. The setting of L-8 where this dip occurs will provide maximum AVC action.

Turn the modulation of the signal generator *Off* and turn the CWO switch *On* and set the CWO control at 0 at which setting the CW oscillator should be at zero beat with the test signal. If zero beat does not occur at 0, readjust the tuneable inductor L-9 of transformer T-19 for the correct setting.

General Coverage Alignment

The control settings used for align-

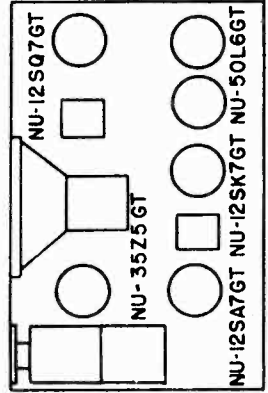
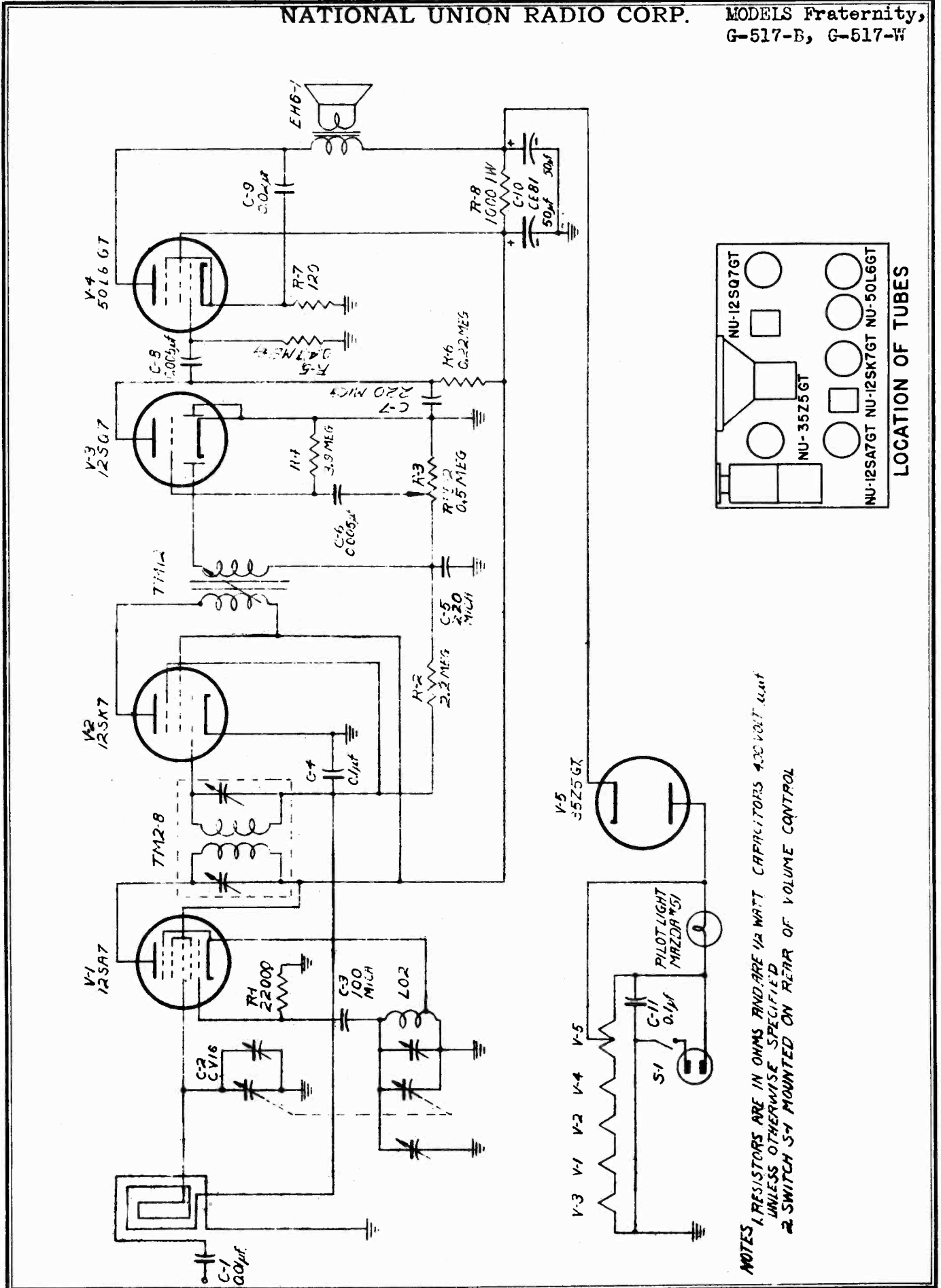
Symbol	Function	Type	Rating
CAPACITORS (Continued)			
C-37	2nd Det. Load	Mica	270 mfd., 500 VDCW
C-38	Limiter Plate Filter	Paper	0.1 mfd., 400 VDCW
C-39	Det. Plate to IFO Plate Coupling	Ceramic	10 mfd., 500 VDCW
C-40	AVC Cathode Bypass	Paper	0.1 mfd., 400 VDCW
C-41	1st Audio Coupling	Paper	0.01 mfd., 600 VDCW
C-42	AC Line Bypass	Paper	0.01 mfd., 600 VDCW
C-43	AC Line Bypass	Paper	0.01 mfd., 600 VDCW
C-44	Power Supply Filter	Elec.	848 mfd., 475 VDCW
C-44A	Power Supply Filter	Elec.	Part of C-44
C-44B	Power Supply Filter	Elec.	Part of C-44
C-45	B Minus Bypass	Elec.	25 mfd., 50 VDCW
C-46	A Band HF Osc. Trimmer	Mica	Variable
C-47	H Band HF Osc. Trimmer	Mica	Variable
C-48	E Band HF Osc. Padder	Mica	0.0085 mfd., 300 VDCW
C-49	C Band HF Osc. Trimmer	Mica	Variable
C-50	C Band HF Osc. Padder	Mica	0.0042 mfd., 300 VDCW
C-51	D Band HF Osc. Trimmer	Mica	Variable
C-52	D Band HF Osc. Padder	Mica	1250 mfd., 500 VDCW
C-53	E Band HF Osc. Trimmer	Mica	Variable
C-54	E Band HF Osc. Padder	Mica	420 mfd., 500 VDCW
C-55	E Band HF Osc. Padder	Mica	Variable
C-56	HF Osc. Plate Coupling	Mica	0.001 mfd., 300 VDCW
C-57	HF Osc. Grid Coupling	Ceramic	100 mfd., 500 VDCW
C-58	B Supply Filter	Paper	0.1 mfd., 400 VDCW
C-59	AVC Amp. Screen Bypass	Paper	0.01 mfd., 600 VDCW
C-60	AVC Amp. Plate Filter	Paper	0.05 mfd., 600 VDCW
C-61	T-18 Tuning	Mica	510 mfd., 500 VDCW
C-62	AVC Amp. to AVC Coupling	Mica	0.001 mfd., 300 VDCW
C-63	AVC Bus Filter	Paper	0.1 mfd., 400 VDCW
C-64	S-Meter Bypass	Paper	0.01 mfd., 600 VDCW
C-65	T-19 Tuning	Air	Variable
C-66	OMO Tuning	Mica	270 mfd., 500 VDCW
C-67	OMO Grid Coupling	Mica	270 mfd., 500 VDCW
C-68	OMO Osc. Screen Bypass	Elec.	0.1 mfd., 400 VDCW
C-69	1st Audio Cathode Bypass	Elec.	25 mfd., 50 VDCW
C-70	1st Audio Screen Bypass	Paper	0.1 mfd., 400 VDCW
C-71	1st Audio Plate Filter	Paper	0.1 mfd., 400 VDCW
C-72	Tone Adjusting	Paper	0.005 mfd., 500 VDCW
C-73	2nd Audio Grid Coupling	Paper	0.1 mfd., 400 VDCW
C-74	2nd Audio Cathode Bypass	Elec.	25 mfd., 50 VDCW
C-75	2nd Audio Tone	Paper	0.005 mfd., 500 VDCW
C-76	Power Supply Filter	Paper	0.1 mfd., 400 VDCW

Symbol	Function	Type	Rating
RESISTORS (Continued)			
R-41	1st Audio Plate Filter	Fixed	47,000 Ohms, 1/2 W.
R-42	2nd Audio Grid	Fixed	470,000 Ohms, 1/2 W.
R-43	2nd Audio Cathode	Fixed	270 Ohms, 2 W.
R-44	Headphone Load	Fixed	470 Ohms, 2 W.

Symbol	Function	Type	Rating
MISCELLANEOUS			
CF-1	Crystal Filter		455 Kc.
F-1	AC Line Fuse	Cart.	2 Amp., 250 V.
I-1	S-Meter Lamp	No. 47	0.15 Amp., 6-8 V.
I-2	Dial Lamp	No. 47	0.15 Amp., 6-8 V.
I-3	Dial Lamp	No. 47	0.15 Amp., 6-8 V.
J-1	Phono Jack		Multi-Circuit
J-2	Phones Jack		Multi-Circuit
L-1	CF-1 Input Tuning	Variable	Iron-Core Inductor
L-2	CF-1 Output Tuning	Variable	Iron-Core Inductor
L-3	T-11 Input Tuning	Variable	Iron-Core Inductor
L-4	T-11 Output Tuning	Variable	Iron-Core Inductor
L-5	T-12 Input Tuning	Variable	Iron-Core Inductor
L-6	T-12 Output Tuning	Variable	Iron-Core Inductor
L-7	Filter Choke	No. 80	17 Henries
L-8	T-18 Tuning	Variable	Iron-Core Inductor
L-9	T-19 Tuning	Variable	Iron-Core Inductor
M-1	Signal Strength Meter		
P-1	AC Line Plug and Cord		2 Contact
P-2	AC Jumper Plug	Octal	
S-1	HF Trans. Switch	Rotary	IP 5 Position
S-1A			Part of S-1
S-1E			IP 5 Position
S-2	HF Trans. Band Switch	Rotary	Part of S-2
S-2A			Part of S-2
S-2B			IP 5 Position
S-3	1st Det. Trans. Band Switch	Rotary	Part of S-3
S-3A			Part of S-3
S-3B			Part of S-3
S-4	1st Det. Trans. Band Switch	Rotary	IP 5 Position
S-4A			Part of S-4
S-4B			Part of S-4
S-5	Selectivity Control Switch	Rotary	IP 6 Position
S-6	Limiter Switch		S.P.D.T.
S-7	AC Line Switch		S.P.S.T.
S-8	Send - Receive Switch	Toggle	S.P.S.T.
S-9	HF Osc. Band Switch	Rotary	IP 5 Position
S-9A			Part of S-9
S-9B			Part of S-9
S-10	HF Osc. Band Switch	Rotary	IP 5 Position
S-10A			Part of S-10
S-10B			Part of S-10
S-11	AVC Switch	Toggle	S.P.S.T.
S-12	OM Osc. Switch	Rotary	S.P.D.T.
T-1	RF Amp. Trans.	A Band	
T-2	RF Amp. Trans.	B Band	
T-3	RF Amp. Trans.	C Band	
T-4	RF Amp. Trans.	D Band	
T-5	RF Amp. Trans.	E Band	
T-6	1st Det. Trans.	A Band	
T-7	1st Det. Trans.	B Band	
T-8	1st Det. Trans.	C Band	
T-9	1st Det. Trans.	D Band	
T-10	1st Det. Trans.	E Band	
T-11	2nd IF Trans.		455 Kc.
T-12	Det. Input Trans.		455 Kc.
T-13	HF Osc. Trans.	A Band	
T-14	HF Osc. Trans.	B Band	
T-15	HF Osc. Trans.	C Band	
T-16	HF Osc. Trans.	D Band	
T-17	HF Osc. Trans.	E Band	
T-18	AVC Amp. Trans.		
T-19	OM Osc. Trans.		455 Kc.
T-20	Audio Output Trans.		
T-21	Power Transformer		
V-1	HF Amplifier	6SG7	
V-2	Mixer	6SA7	
V-3	1st IF Amp.	6SG7	
V-4	2nd IF Amp.	6SG7	
V-5	2nd Det.-AVC	6H6	
V-6	Limiter	6H6	
V-7	Rectifier	5Y3GT/G	
V-8	HF Osc.	6J5	
V-9	Voltage Regulator	OD3/VR-150	
V-10	AVC Amp.	6AC7	
V-11	OM Osc.	6SJ7	
V-12	1st Audio	6SJ7	
V-13	Audio Output	6VE6T/G	
X-1	Lattery Socket	Octal	
Y-1	Crystal Resonator		455 Kc.

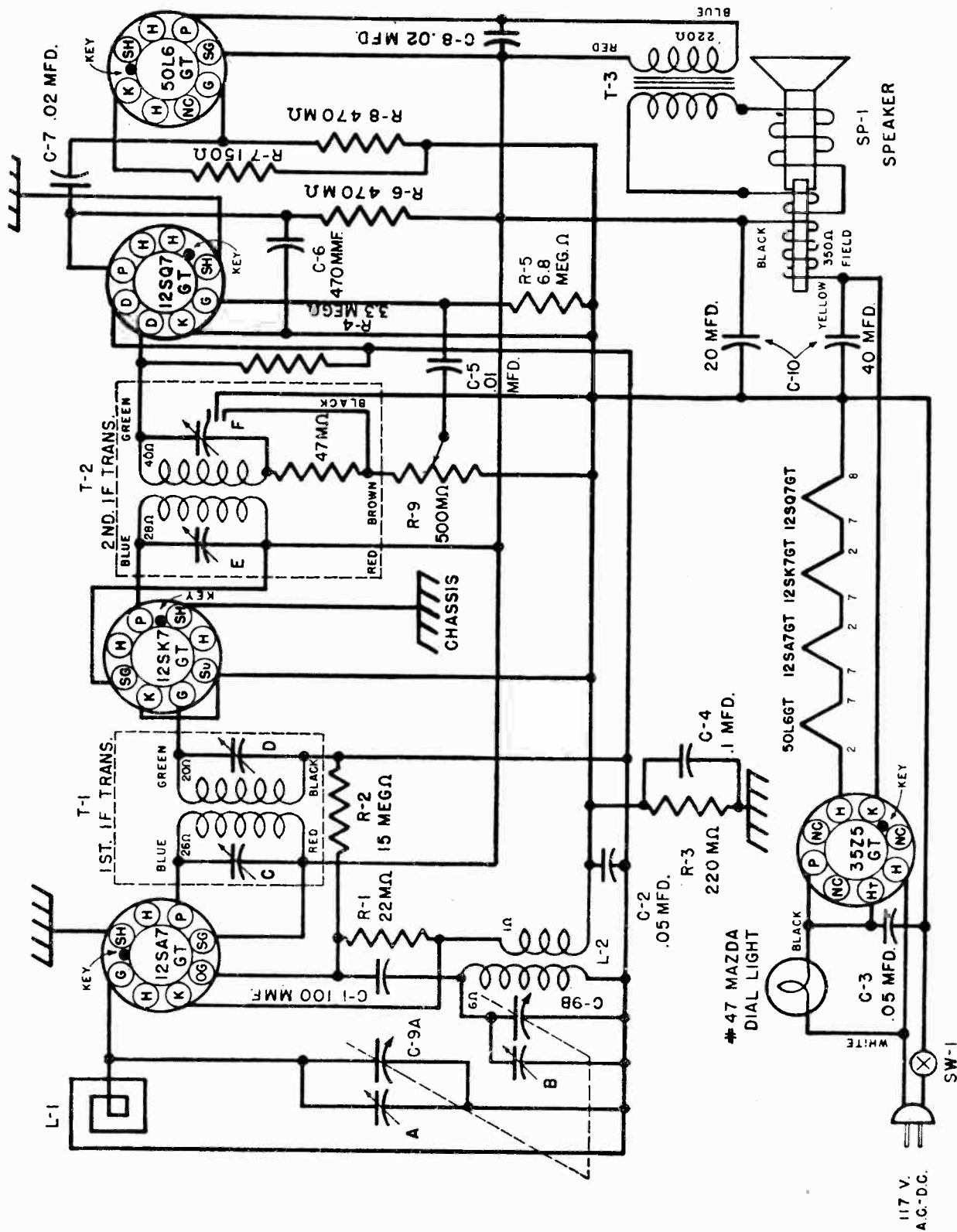
RESISTORS

R-1	RF Amp. Grid	Fixed	100,000 Ohms, 1/2 W.
R-2	RF Amp. Screen Filter	Fixed	33,000 Ohms, 1/2 W.
R-3	RF Amp. Plate Filter	Fixed	2,200 Ohms, 1/2 W.
R-4	Mixer Cathode	Fixed	220 Ohms, 1/2 W.
R-5	Mixer Screen Filter	Fixed	33,000 Ohms, 1/2 W.
R-6	Mixer Plate Filter	Fixed	2,200 Ohms, 1/2 W.
R-7	1st IF Grid Filter	Fixed	470,000 Ohms, 1/2 W.
R-8	1st IF Screen Filter	Fixed	33,000 Ohms, 1/2 W.
R-9	1st IF Plate Filter	Fixed	2,200 Ohms, 1/2 W.
R-10	2nd IF Grid Filter	Fixed	470,000 Ohms, 1/2 W.
R-11	2nd IF Screen Filter	Fixed	100,000 Ohms, 1/2 W.
R-12	2nd IF Plate Filter	Fixed	2,200 Ohms, 1/2 W.
R-13	Limiter Control	Variable	100,000 Ohms, 1 W.
R-14	Limiter Plate	Fixed	68,000 Ohms, 1/2 W.
R-15	Limiter Plate Filter	Fixed	270,000 Ohms, 1/2 W.
R-16	Limiter Load	Fixed	270,000 Ohms, 1/2 W.
R-17	HF Osc. Grid	Fixed	22,000 Ohms, 1/2 W.
R-18	HF Osc. Plate	Fixed	47,000 Ohms, 1/2 W.
R-19	VR Dropping	Fixed	2,200 Ohms, 2 W.
R-20	AVC Amp. Grid	Fixed	470,000 Ohms, 1/2 W.
R-21	Voltage Divider	Fixed	330 Ohms, 1/2 W.
R-22	RF Gain Control	Variable	10,000 Ohms, 1.5 W.
P-23	Voltage Divider	Fixed	1,800 Ohms, 2 W.
P-24	Voltage Divider	Fixed	1,800 Ohms, 2 W.
P-25	AVC Amp. Screen Filter	Fixed	33,000 Ohms, 1/2 W.
P-26	AVC Amp. Plate Filter	Fixed	2,200 Ohms, 1/2 W.
P-27	AVC Filter	Fixed	470,000 Ohms, 1/2 W.
F-28	AVC Load	Fixed	33,000 Ohms, 1/2 W.
F-29	AVC Filter	Fixed	100,000 Ohms, 1/2 W.
H-30	OM Osc. Grid Bias	Fixed	47,000 Ohms, 1/2 W.
H-31	OM Osc. Screen Filter	Fixed	100,000 Ohms, 1/2 W.
H-32	OM Osc. Screen Bleeder	Fixed	100,000 Ohms, 1/2 W.
H-33	OM Osc. Plate	Fixed	220,000 Ohms, 1/2 W.
R-34	AF Gain Control	Variable	500,000 Ohms, 1 W.
R-35	1st Audio Cathode	Fixed	2,200 Ohms, 1/2 W.
R-36	Inverse Feedback Voltage Divider	Fixed	100 Ohms, 1/2 W.
R-37	Inverse Feedback Voltage Divider	Fixed	10,000 Ohms, 1/2 W.
H-38	Tone Control	Variable	500,000 Ohms, 1 W.
I-39	1st Audio Screen Filter	Fixed	470,000 Ohms, 1/2 W.
H-40	1st Audio Plate	Fixed	100,000 Ohms, 1/2 W.



LOCATION OF TUBES

NOTES
 1. RESISTORS ARE IN OHMS AND ARE 1/2 WATT CAPACITORS 400 VOLT UNLESS OTHERWISE SPECIFIED
 2. SWITCH S-1 MOUNTED ON REAR OF VOLUME CONTROL



ALL TUBE SOCKETS SHOWN FROM PIN END VIEW.

455 KC IF

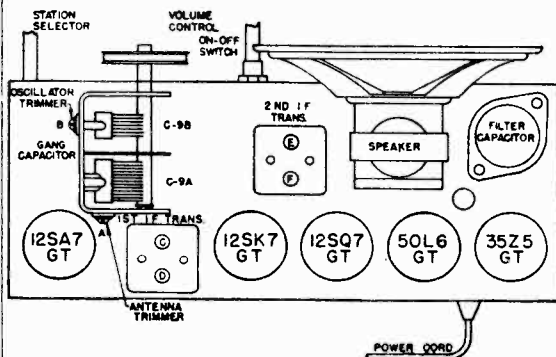
ALIGNMENT PROCEDURE

The following equipment is necessary to properly align this chassis:

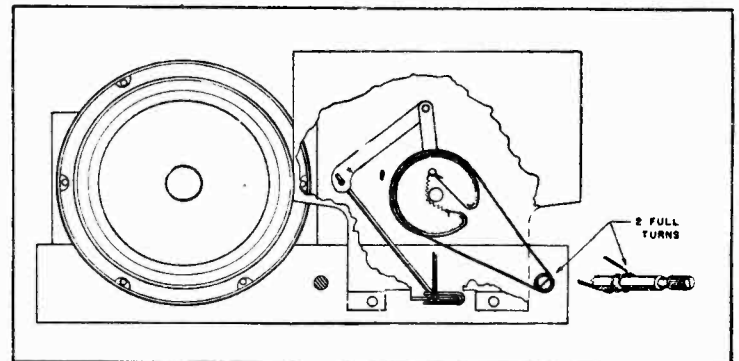
1. A signal generator which will provide an accurately calibrated signal at the frequencies listed.
2. An output meter.
3. A non-metallic screwdriver.
4. Dummy antenna: — .1 mfd., — RMA loop.

NOTE: Intermediate Frequency and Oscillator adjustments may be made with the loop disconnected provided a resistor of 10,000 to 50,000 ohms is substituted to close the 12SA7GT grid circuit. The loop alignment must be done with the loop and chassis mounted in operating position in the cabinet. A single turn loosely coupled to loop may be substituted for RMA loop.

GENERATOR	CONNECTION AT RADIO	DUMMY ANTENNA	DIAL	TO TUNE TRIMMERS	REMARKS
IF 455 kc.	12SA7GT grid	.1 mfd.	HF end	IF trimmer's C D E F	Tune to max.
1620 kc.	Through loop	RMA loop	HF end	Osc. trimmer B	Set limit of band
1400 kc.	Through loop	RMA loop	1400 kc.	Ant. trimmer A	Tune to max.



Tube Layout



Dial Mechanism

TUBE COMPLEMENT

- 1—12SA7GT Oscillator and Mixer tube
- 1—50L6GT Power Output tube
- 1—12SK7GT IF Amplifier tube
- 1—35Z5GT Rectifier tube
- 1—12SQ7GT Second Detector and First Audio tube

NOTE: The above glass tubes are interchangeable with their metal equivalent.

Electrical and Mechanical Specifications

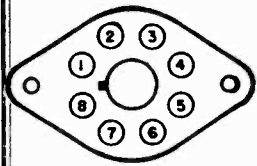
Frequency Range	540-1600 kc.	Power Output (Undistorted) ...	.75 watts
Intermediate Frequency	455 kc.	Power Output (Maximum).....	1.5 watts
Power Supply.....	105-125 volts AC-DC	Tuning Drive Ratio.....	3 to 1
Loudspeaker	Dynamic		
V.C. Impedance.....	3.5 ohms at 400 cycles		

MODEL 571

NATIONAL UNION RADIO CORP.

SOCKET VOLTAGES

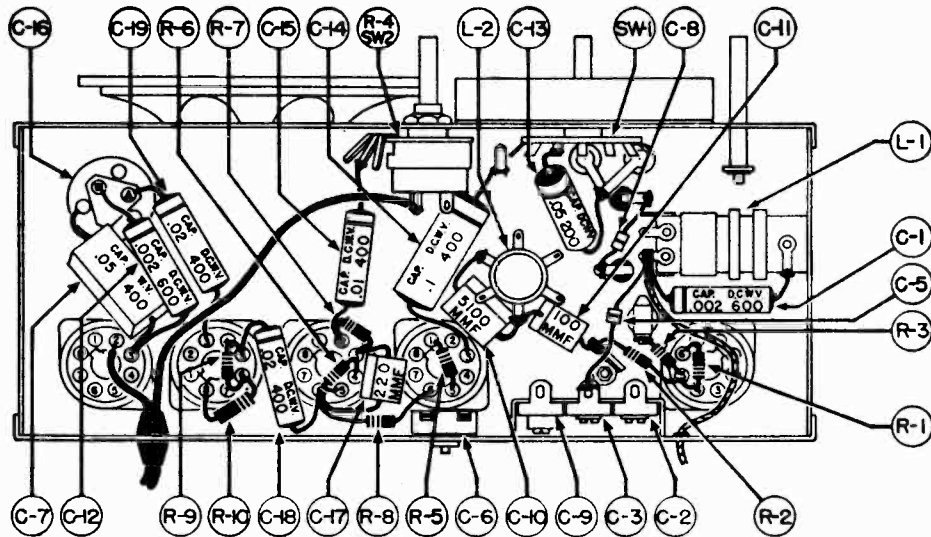
TUBE	POSITION	1	2	3	4	5	6	7	8
12SA7GT	Oscillator and Mixer	0	37.5 AC	99	99	-4.2	0	24.5 AC	0
12SK7GT	IF Amplifier	0	24.5 AC	0	0	0	99	12.5 AC	99
12SQ7GT	2nd Det.—1st Audio	0	0	0	0	0	16	12.5 AC	0
50L6GT	Power Output	0	85 AC	91.5	99	0	0	37.5 AC	5.9
35Z5GT	Rectifier	0	117 AC	112 AC	0	112 AC	0	85 AC	112



NOTE: All DC voltages measured with a 1000 ohm-per-volt meter from ON-OFF switch (—B) to socket contact indicated. All voltages are positive DC unless otherwise marked.

Volume control full on. No signal.

Line Voltage 117 volts AC.

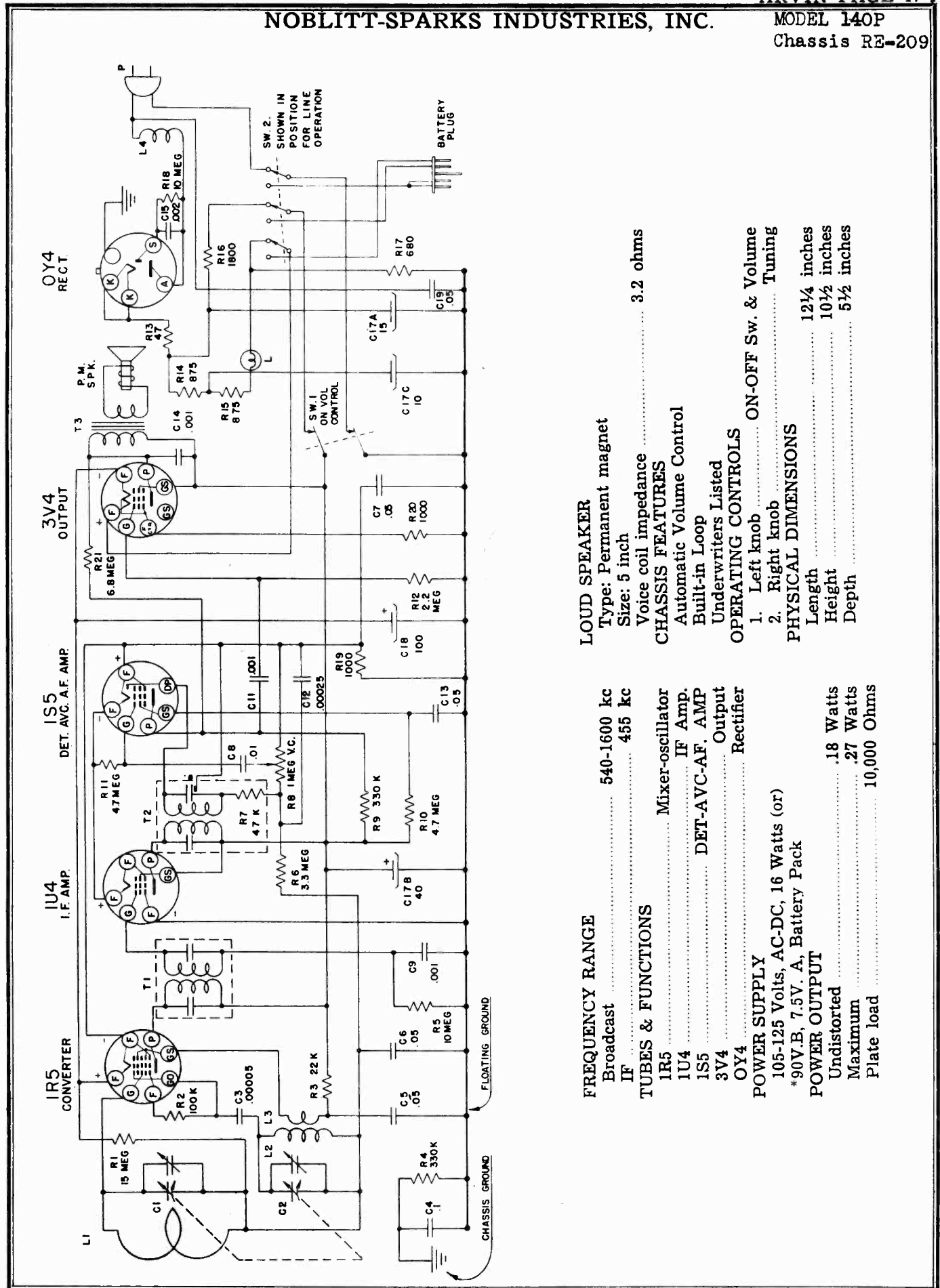


Parts Layout
Chassis Model 568

SERVICE PARTS LIST

Symbol	Part No.	Description	Symbol	Part No.	Description
C-7	BC31B503	Cap., Molded Paper, .05 mfd.	C-16	A-8948	Cap., Electrolytic, 40-20 mfd.
C-13	BD210503	Cap., Paper, .05 mfd., 200 v.	R-4	B-9051-5	Control, Vol & Sw. 500,000 ohm
C-15	BD410103	Cap., Paper, .01 mfd., 400 v.	T-1	B-51010-1	Transformer Assembly, 1st IF
C-14	BD410104	Cap., Paper, .1 mfd., 400 v.	T-2	B-51011-1	Transformer Assembly, 2nd IF
C-18, 19	BD410203	Cap., Paper, .02 mfd., 400 v.	C-51014		Speaker, 5-inch Dynamic
C-1, 12	BD610202	Cap., Paper, .002 mfd., 600 v.	A-51160-1		Cord, Power, 6 ft.
C-10	BM58D512	Cap., Mica, 5100 mmf.	A-51163		Clip, Spring
C-11	BM78A101	Cap., Mica, 100 mmf.	C-6	B-51428-5	Capacitor, Padder
C-17	BM78A221	Cap., Mica, 220 mmf.	B-51591		Spring, Dial Bracket
R-10	BR16C151	Resistor, 150 ohm, 1/2 w.	SW-1	B-51764-1	Switch, Band
R-2	BR17B151	Resistor, 150 ohm, 1/3 w.	A-51787		Spring, Cable. Music Wire
R-3	BR17B156	Resistor, 15 meg., 1/3 w.	L-1	B-51828	Coil Assembly, BC & SW Ant.
R-1	BR17B223	Resistor, 22,000 ohm, 1/3 w.	C-2, 3, 9	A-51834	Capacitor, Trimmer, 3-section
R-5	BR17B224	Resistor, 220,000 ohm, 1/3 w.	L-2	B-51836	Coil Assembly, Osc.
R-6	BR17B335	Resistor, 3.3 meg., 1/3 w.	C-4	C-51837-1	Capacitor, Variable
R-8, 9	BR17B474	Resistor, 470,000 ohm, 1/3 w.	C-8	B-51839-2	Capacitor, 1 mmf.
R-7	BR17B685	Resistor, 6.8 meg., 1/3 w.	C-5	B-51839-4	Capacitor, 2.2 mmf.
A-2163		Cable, Drive	A-51869		Antenna Reel Assembly
A-6158		Lamp, Pilot, No. 47, Mazda, 6.3 v.			

Order parts not listed by specifying (1) Part Name and (2) Model Number (include number following dash)



LOUD SPEAKER
Type: Permanent magnet
Size: 5 inch
Voice coil impedance 3.2 ohms

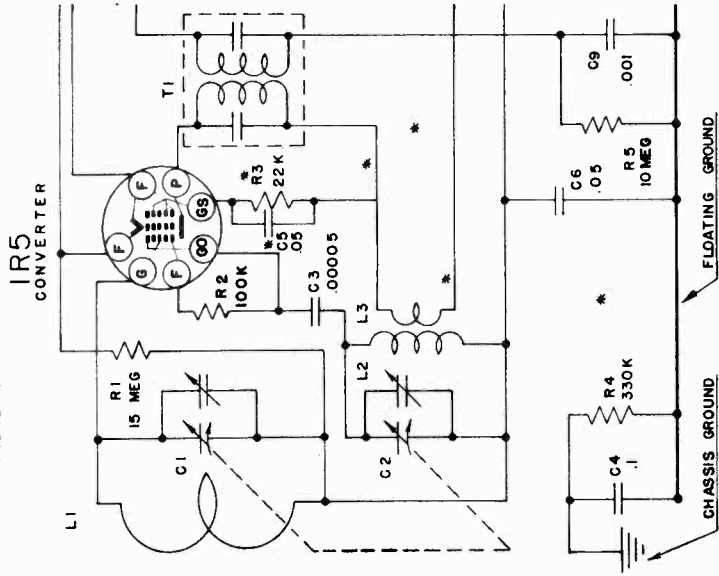
CHASSIS FEATURES
Automatic Volume Control
Built-in Loop
Underwriters Listed
OPERATING CONTROLS
1. Left knob ON-OFF Sw. & Volume
2. Right knob Tuning
PHYSICAL DIMENSIONS
Length 12¼ inches
Height 10½ inches
Depth 5½ inches

FREQUENCY RANGE
Broadcast 540-1600 kc
IF 455 kc

TUBES & FUNCTIONS
IR5 Mixer-oscillator
IU4 IF Amp.
IS5 DET-AVC-AF. AMP
3V4 Output
OY4 Rectifier

POWER SUPPLY
105-125 Volts, AC-DC, 16 Watts (or)
*90V.B, 7.5V. A, Battery Pack
POWER OUTPUT
Undistorted18 Watts
Maximum27 Watts
Plate load 10,000 Ohms

OSCILLATOR CIRCUIT CHANGE
USED ON SETS BUILT AFTER JUNE 1947 TO
INCREASE SENSITIVITY.



* INDICATES POINTS WHERE CHANGES WERE MADE
1 C5 AND R3 RELOCATED IN SCREEN GRID CIRCUIT, 2. PLATE
CURRENT OF CONVERTER TUBE PASSES THROUGH L3

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
R1	C20060-156	Resistor, 15 megohm 1/4 W	E21155		Cabinet top cover Assy.
R2	C20060-104	Resistor, 100,000 ohms 1/4 W	AD21338-1		Cabinet bottom cover and grille
R3	C20060-223	Resistor, 22,000 ohm 1/4 W	AC21460-1		assy. (includes 3 mtg. eyelets, grille cloth, 1 spkr baffle).
R4, R9	C20060-334	Resistor, 330,000 ohms 1/4 W	AC21459-1		Rear door Assy (includes rear door shaft, torque spring, grille cloth, 2 lugs, 6 eyelets).
R5, R18	C20060-106	Resistor, 10 megohm 1/4 W	D21207		Battery cradle
R6	C20060-335	Resistor, 3.3 megohm 1/4 W	D21143		Chassis bottom cover
R7	C20060-473	Resistor, 47,000 ohms 1/4 W	AD21456-1		Cabinet wrap-around Assy (includes cabinet front cover, grille Assy, & rear door Assy).
R8	C21050	Volume Control and Switch 1 M	E21131		Cabinet wrap-around
R10, R11	C20060-475	Resistor, 4.7 megohm 1/4 W	C21159		Handle
R12	C20060-225	Resistor, 2.2 megohm 1/4 W	A21190		Control knob
R13	C20070-470	Resistor, 47 ohm 1 W	C21210		Dial crystal
R14, R15, A21348	Resistor, 1750 ohm 10W, tpd 875		A21183		Handle mtg. "U" stud
R16	C20070-182	Resistor, 1800 ohm 1 W	A21209		Grille cloth, spkr grille
R17	C20060-681	Resistor, 680 ohm 1/4 W	A21341		Grille cloth, rear door
R19, R20	C20060-102	Resistor, 1000 ohm 1/4 W	C21364		Speaker baffle
R21	C20060-685	Resistor, 6.8 megohm 1/4 W	C21136		Battery pack
C1, C2	C19822	Variable Cond.-2 gang. Include 1 A20077-3 grommet and 1 spacer eyelet.	A21211		Battery, complete with filters
		or	C21146		Battery plug
			C21148		Dial scale
			A19361		Dial pointer
			A19132		Tuning shaft
			A19295		Hairpin clip
			A21343		Dial drive cord
			A21344		Spring, dial drive cord
			B21123-2		Tube, shield
			A19344-1		Tube shield base
			A19205-4		Tube shield spring
			A16695		Tube retainer spring
			A21347		Idle pulley
			A19139		Idle pulley stud
			A19138-1		Cam
			A20077-3		Spring, ON-OFF indicator
			A19328-2		Terminal strip, single
					Spacer eyelet (mtg. either variable condenser)
					Grommet (mtg. either variable cond)
					Grommet (for mtg. variable condenser C21153).
C3	C20065-500	Variable Cond.-2 gang. Include 2-A 19328-2 grommet.			
C4	C20068-104	Cond., .00005 uf 500V Mica			
C5,6,7,13	C20068-103	Cond., .1 uf 400 VPT.			
C8	C20068-103	Cond., .05 uf 400 VPT.			
C9,11,14	C20065-102	Cond., .01 uf 400 VPT.			
C10	C20065-251	Cond., .001 uf 500V Mica			
C12	C20065-251	Cond., .00025 uf 500V Mica			
C15	C20069-202	Cond., .002 uf 600 VPT.			
C17A, C17B, C17C	A21163	Electrolytic condenser, 15, 40, 10 uf, 150V			
C18	A21164	Electrolytic cond. 100uf 10V.			
C19	C20068-503	Cond., .05 uf 400 VPT.			
L1	AC21054-1	Antenna loop assembly			
L2, L3,	AC21055-1	Oscillator coil Assy.			
L4	AC21152-1	Hash filter			
T1	AC21052-1	1st I. F. coil			
T2	AC21053-1	2nd I. F. coil			
T3	AC21057-1	Output transformer			
C	AC21056-1	Battery plug and cable Assy.			
L	A21172	Dial light bulb - Mazda No. 49			
P	B20169-1	Line cord and plug Assy.			
Spk	C21113	Speaker			
	A21032-1	Socket, tube, miniature, wafer			
	A21032-2	Socket, tube, miniature, wafer, center pin shielded			
	A18254-1	Socket, tube, plain wafer			
	A21346-1	Socket, dial light with leads			

NOBLITT-SPARKS INDUSTRIES, INC.

MODEL 140P

ALIGNMENT PROCEDURE

PRELIMINARY:

Output meter connection	.....	Across loudspeaker voice coil
Output meter reading to indicate 50 milliwatts (standard output)	.....	4 volts
Dummy antenna value to be used in series with generator output	.....	See chart below
Connection of generator output lead	.....	See Chart Below
Connection of generator ground lead	.....	Floating ground
Generator modulation	.....	30% 400 cycles
Position of volume control	.....	Fully clockwise
Position of dial pointer with variable fully closed	.....	Last mark at left end of dial

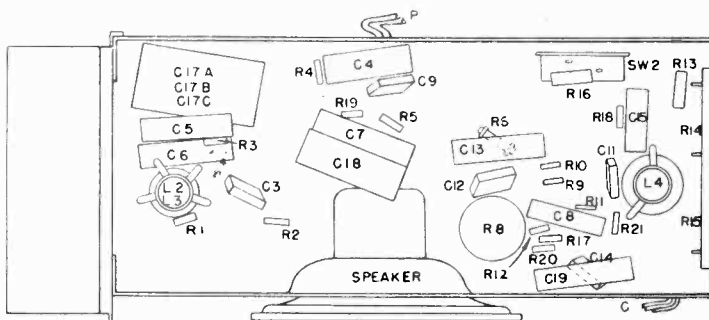
Position of Variable	Frequency of Generator	Dummy Antenna	Generator Output Connection	Trimmers Adjusted in Order Shown for Maximum Output	Function of Trimmer
Open	455	.05 mfd.	IR5 grid (Stator of C1)	Top of 2nd & 1st IF trans. T2 & T1	IF
1400	1400		*Test Loop	C2; C1, Trimmers on Variable Condenser	Osc. Ant.
600	600		*Test Loop	**Check Point	

*Standard Hazeltine Test Loop Model 1150 or 3 turns of wire about 6" in diameter, placed about one foot from the set loop.

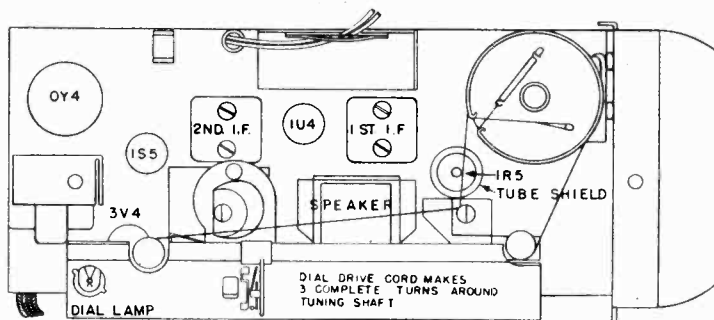
The alignment procedure should be repeated in the original order for greatest accuracy. Always keep the output from the signal generator at its lowest possible value to make the AVC action of the receiver ineffective.

CAUTION: While handling the set out of the cabinet, be careful not to bend the loop because any change in its spacing in respect to the aluminum plate will change the tracking of the antennae circuit with the oscillator.

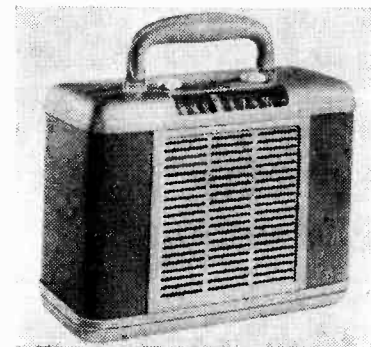
**If the antenna stage does not track with the oscillator at 600 Kc, check to see if the loop is parallel with the aluminum plate. If it is necessary to straighten the loop to track the set at 600 kc, it will be necessary to retune the set to 1400 kc and repeat the alignment procedure in its original order until the correct spacing has been obtained. In some few cases, due to variations in the parts and wiring of the set, the loop may have to be bent slightly out or in to track the set, but usually the best tracking is obtained with the loop straight.



LOCATION OF PARTS UNDER CHASSIS



TUBE LAYOUT



VOLTAGE & RESISTANCE MEASUREMENTS FROM SOCKET TERMINALS TO FLOATING GROUND

V O L T A G E R E S I S T A N C E

WITH SLIDE SWITCH IN ELECTRIC POSITION

TUBE	1	2	3	4	5	6	7	8
1R5	2.8	95	48	**	2.8	*1.8	4.2	
1U4	0	95	95	*1.8	0	0	1.4	
1S5	2.8	0	*2	*20	*50	*1	1.4	
3V4	4.2	95	95	7	5.6	0	7	
OY4	0	0	+DC	117AC	117AC	0	120	120

WITH SLIDE SWITCH IN BATTERY POSITION

TUBE	1	2	3	4	5	6	7	8
1R5	3.0	90	48	**	3.0	*1.8	4.5	
1U4	0	90	90	*1.8	0	0	1.5	
1S5	3.0	0	*2	*20	*50	*1	1.5	
3V4	4.5	90	90	0	6.0	0	7.5	
OY4	0	0	0	0	0	0	0	0

All voltage measurements are made with a line voltage of 117V AC or a battery having 90 VB and 7.5 VA; with no signal using a 1000 ohm per volt voltmeter and are +DC unless otherwise indicated. * Measured with a vacuum tube voltmeter. **The oscillator voltage measured with a vacuum tube voltmeter from the oscillator grid to floating ground will vary from approx. -6V with the variable condenser closed to -12V with the condenser open. The true oscillator voltage measured from the grid to the negative filament lug should be from -10 to -20V.

Approximate Resistance of Coils:
 T1 Primary - 34 ohms
 Secondary - 22 ohms
 Revised
 T1 Primary - 25 ohms
 Secondary - 25 ohms

T2 Primary - 22 ohms
 Secondary - 34 ohms
 has 47,000 ohm resistor in series inside can
 Revised
 T2 Primary - 23 ohms
 Secondary - 35 ohms
 has 47,000 ohm resistor in series inside can.

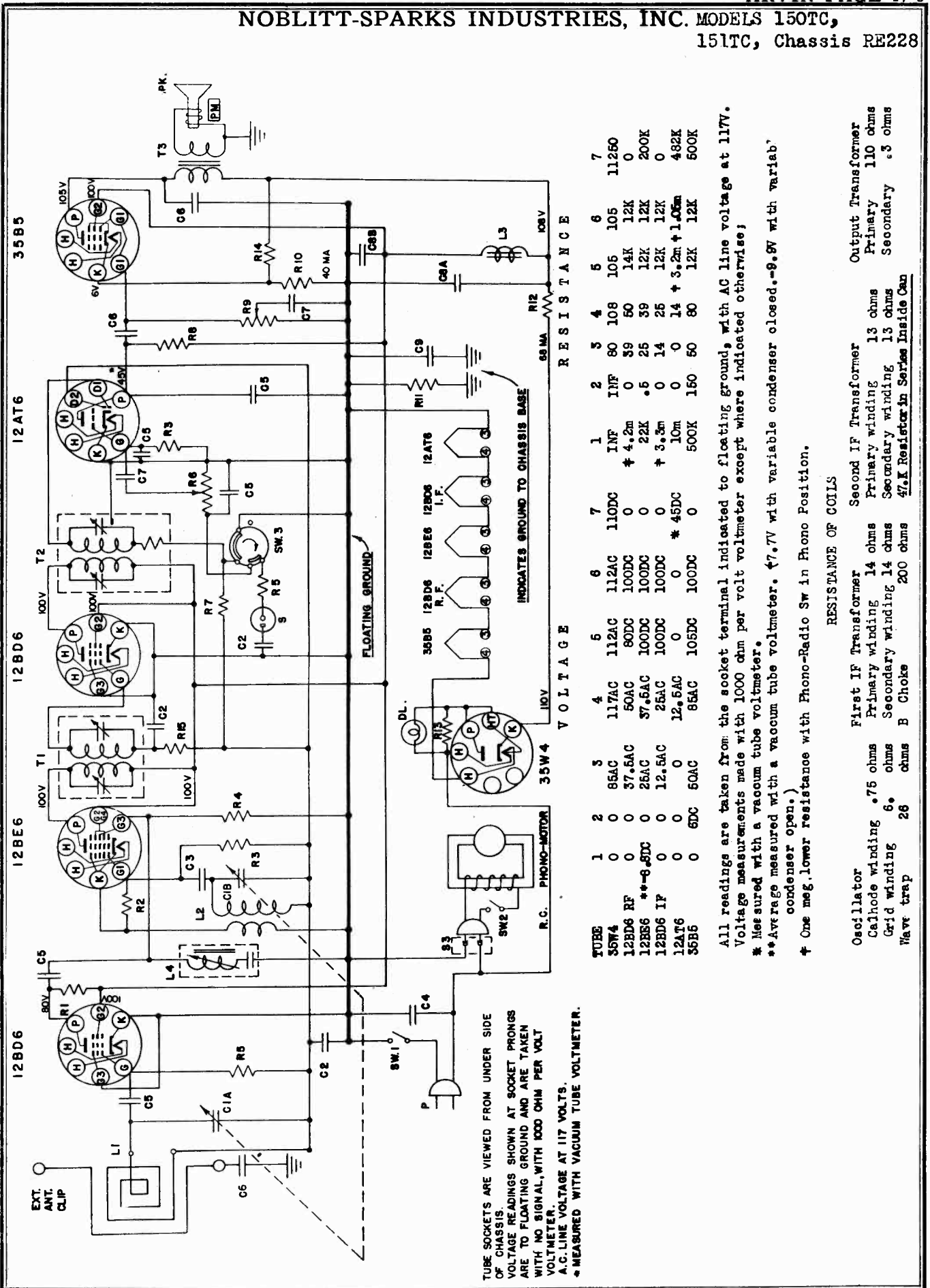
T3 Primary - 250 ohms
 Secondary - 4 ohms

SERVICE HINTS AND CIRCUITS CHANGES:

* Any of the following battery packs can be used: General 60A-6F6-5; Eveready 753; Ray-O-Vac AB994; Burgess F6A60.

- NOTE: 1. The dial light operates only when the set is connected to the power line. The set will not operate on the power line if the dial light is burned out. (The tubes will have no filament voltage).
2. Since there have been changes made in the IF Coils in the course of production, all IF Coil replacements should be made in matched pairs to assure satisfactory performance. All coils supplied for replacement will be the revised coils. Replacement of either IF Coil alone may result in oscillation or poor performance.

NOBLITT-SPARKS INDUSTRIES, INC. MODELS 150TC,
151TC, Chassis RE228



©John F. Rider

RECORD CHANGER: GI Model 205, RCD. CH. 15-5

R E S I S T A N C E

TUBE	1	2	3	4	5	6	7	8	9	10
35W4	0	0	85AC	117AC	112AC	112AC	110DC	INF	80	108
12BD6 RF	0	0	37.5AC	50AC	80DC	100DC	0	# 4.2m	39	50
12BE6 **-6-8DC	0	0	26AC	37.5AC	100DC	100DC	0	22K	25	39
12BD6 IP	0	0	12.5AC	25AC	100DC	100DC	0	# 3.3m	14	25
12AT6	0	0	0	12.5AC	0	0	* 45DC	10m	0	14
35B5	0	6DC	50AC	85AC	105DC	100DC	0	500K	150	50

V O L T A G E

TUBE	1	2	3	4	5	6	7	8	9	10
35W4	0	0	85AC	117AC	112AC	112AC	110DC	INF	80	108
12BD6 RF	0	0	37.5AC	50AC	80DC	100DC	0	# 4.2m	39	50
12BE6 **-6-8DC	0	0	26AC	37.5AC	100DC	100DC	0	22K	25	39
12BD6 IP	0	0	12.5AC	25AC	100DC	100DC	0	# 3.3m	14	25
12AT6	0	0	0	12.5AC	0	0	* 45DC	10m	0	14
35B5	0	6DC	50AC	85AC	105DC	100DC	0	500K	150	50

R E S I S T A N C E

TUBE	1	2	3	4	5	6	7	8	9	10
35W4	0	0	85AC	117AC	112AC	112AC	110DC	INF	80	108
12BD6 RF	0	0	37.5AC	50AC	80DC	100DC	0	# 4.2m	39	50
12BE6 **-6-8DC	0	0	26AC	37.5AC	100DC	100DC	0	22K	25	39
12BD6 IP	0	0	12.5AC	25AC	100DC	100DC	0	# 3.3m	14	25
12AT6	0	0	0	12.5AC	0	0	* 45DC	10m	0	14
35B5	0	6DC	50AC	85AC	105DC	100DC	0	500K	150	50

All readings are taken from the socket terminal indicated to floating ground, with AC line voltage at 117V. Voltage measurements made with 1000 ohm per volt voltmeter except where indicated otherwise;
 * Measured with a vacuum tube voltmeter.
 ** Average measured with a vacuum tube voltmeter. † 7.7V with variable condenser closed, -9.9V with variable condenser open.)
 † One meg. lower resistance with Phono-Radio Sw in Phono Position.

R E S I S T A N C E OF COILS

Coil	Resistance (ohms)	Notes
Oscillator	26 ohms	One meg. lower resistance with Phono-Radio Sw in Phono Position.
Calhode winding	.75 ohms	
Grid winding	6. ohms	
Wave trap	200 ohms	
First IF Transformer	14 ohms	
Primary winding	13 ohms	
Secondary winding	13 ohms	
Choke	200 ohms	
Second IF Transformer	13 ohms	
Primary winding	13 ohms	
Secondary winding	13 ohms	
Output Transformer	110 ohms	
Primary	110 ohms	
Secondary	.3 ohms	

TUBE SOCKETS ARE VIEWED FROM UNDER SIDE OF CHASSIS.
 VOLTAGE READINGS SHOWN AT SOCKET PRONGS ARE TO FLOATING GROUND AND ARE TAKEN WITH NO SIGNAL, WITH 1000 OHM PER VOLT VOLTMETER.
 * A.C. LINE VOLTAGE AT 117 VOLTS.
 † MEASURED WITH VACUUM TUBE VOLTMETER.

ALIGNMENT PROCEDURE

Complete alignment can be accomplished with the chassis mounted in the cabinet. It is necessary to: (1) Remove the screws from the compartment shield loop assembly and lay it back to make the trimmers accessible; (2) Remove the bottom plate from the chassis to make the necessary output meter and generator connections.

NOTE: Adjust the antenna trimmer C 1A through hole in the loop assembly with the loop in its normal operating position.
 ** Connect generator to a standard Hazeltine test loop, placed two (2) feet from set loop (10-3/4" from back of cabinet) or three (3) turns of wire six (6) inches in diameter placed near the back of the cabinet or about one (1) foot in front of the cabinet.

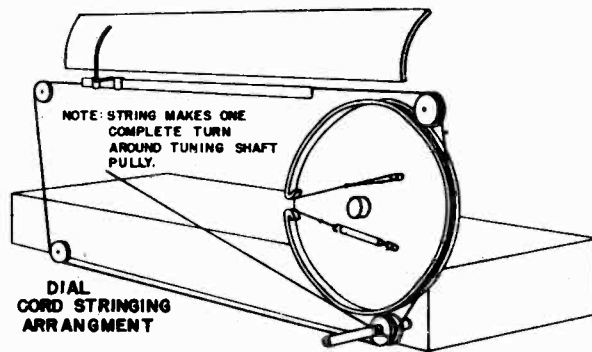
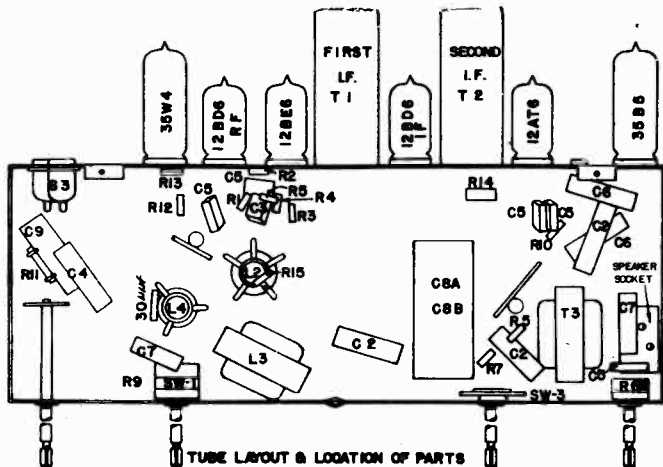
Output meter connection Across loudspeaker voice coil
 Output meter reading to indicate 200 milliwatts (standard output)8 volts
 Dummy antenna value to be used in series with generator output See chart below
 Connection of generator output lead See chart below
 Connection of generator ground lead Floating ground
 Generator modulation 30% 400 cycles
 Position of volume control Fully clockwise
 Position of dial pointer with variable fully closed.....Last round mark at left edge of dial

Position of Variable	Frequency of Generator	Dummy Antenna	Generator Output Connection	Trimmers adjusted in Order Shown for Max. Output	Function of Trimmer
Open	455	.05 mfd.	12BE6 Grid	Top of 2nd & 1st IF Trans.	IF
Open	455	.05 mfd.	RF Grid	*Adj. L4 for Min. Output	Wave Trap
1400	1400		** Test Loop	C1B, C1A Trimmers on Variable Condenser	Osc. Ant.

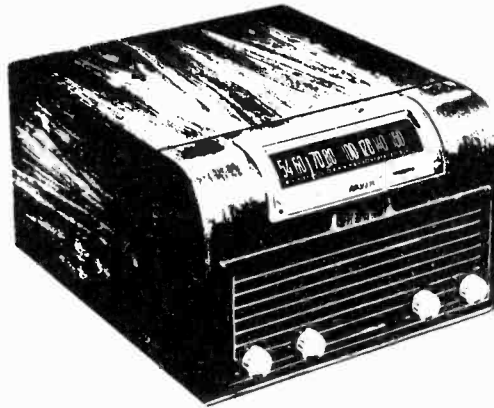
The alignment procedure should be repeated in the original order for greatest accuracy. Always keep the output from the signal generator at its lowest possible value to make the AVC action of the receiver ineffective.

If a standard test loop is used with the signal generator for alignment of the receiver, the approximate sensitivities should be 150 uv/m and 120 uv/m 600 Kc and 1400 Kc, respectively.

Approximate stage by stage sensitivities for 200 Milliwatt Output:
 .05 uf. cond. in series with generator lead 50 uf cond. in series with generator lead
 IF Grid - 455 Kc. 5000 uv Mixer Grid 1000 Kc.....250 uv
 Mixer Grid - 455 Kc. 100 uv RF Grid - 1000 Kc 80 uv
 Antenna - 1000 Kc 15 uv



NOBLITT-SPARKS INDUSTRIES, INC.

MODELS 150TC,
151TC

FREQUENCY RANGE

Broadcast 540-1600 kc
 IF 455 kc

TUBES & FUNCTIONS

12BD6 RF Amp.
 12BE6 Mixer-oscillator
 12BD6 IF Amp.
 12AT6 DET-AVC-AP
 35B5 Output
 35W4 Rectifier

LOUD SPEAKER

Type: Permanent magnet
 Size: 5-1/4 inch
 Voice coil impedance 3.2 ohms

POWER SUPPLY

105-125 Volts AC , 55 Watts

POWER OUTPUT

Undistorted 1 Watt
 Maximum 1.9 Watts
 Plate load 2000 ohms

150-TC has a mahogany cabinet
 151-TC has a walnut cabinet

SERVICE HINTS

On AC, the power cord plug should be tried in both its possible positions in the receptacle, and left in the position that gives least hum. Do not attempt to operate the record changer on DC.

For service information on the Record changer see "Automatic Record Changer Service Instructions, Model 205", which should be filed with this bulletin.

Alignment, trouble shooting and many parts changes can be accomplished without removing the chassis from the cabinet. It is necessary in most cases, only to remove the bottom plate and the compartment shield loop assembly.

"TO REMOVE THE CHASSIS FROM THE CABINET"

1. Remove the line cord plug from the electric outlet; turn the tuning knob until the pointer is at 54 on the dial so that the variable condenser is closed, and fasten the pickup to its rest with string or a rubber band.
2. Remove the seven (7) screws which hold the compartment shield and loop assembly in the inside front of the cabinet. Tilt the loop back. Remove the three plug on wires from the terminal strip on the loop and remove the blue lead from the clip inside the bottom of the cabinet on right side. Remove the loop from the cabinet.
3. Remove the two (2) nuts, lock washers and flat washers from the studs on inside front of the cabinet, above the speaker, to release the dial assembly from the cabinet., and remove the speaker plug from its socket on top of the chassis.
4. Pull off the four (4) control knobs.
5. Stand cabinet on end, remove the changer AC plug and Phono pickup plug from back of the chassis; remove the three (3) screws from the bottom plate, and lift off the bottom plate.
6. Remove the three (3) brass screws which hold the chassis base to the under side of the changer platform.
7. Slide the chassis back until the dial mechanism clears the studs.
8. Pull back of chassis away from changer platform to allow the variable condenser to clear the changer platform at the notch provided for it.
9. Pull the chassis back until the control shafts clear the front of the cabinet.
10. Straighten the chassis up and pull it straight out the bottom of the cabinet.

"TO REMOVE RECORD CHANGER"

- a. Remove the chassis as above.
- b. Remove the two "c" washers from the changer mounting bolts. These are located under the changer platform.
- c. Lift changer out of cabinet.

NOTE: When changer is in operation, see that the mounting screws are turned all the way down (clockwise) so that the changer floats on its springs.

MODELS 150TC,
151TC

NOBLITT-SPARKS INDUSTRIES, INC.

PARTS LIST

REF.	PART NO.	DESCRIPTION	PART NO.	DESCRIPTION
R1	C20060-222	Resistor, 2200 ohm 1/4 W	C21075	Knob, Volume
R2	C20060-223	Resistor, 22,000 ohm 1/4 W	021076	Knob, Tuning
R3	C20060-10.6	Resistor, 10 megohm 1/4 W	C21077	Knob, Phono-Radio Switch
R4	C20060-224	Resistor, .22 megohm 1/4 W	C21078	Knob, Tone Control & Switch
R5	C20060-105	Resistor, .22 megohm 1/4 W	A20040-12	Felt Washer (Behind Knobs) (10)
R6	C19927	Volume Control, 1 megohm	A20185-7	Lockwasher, Countersunk Mtg. Chgr. (10)
R7	C20060-225	Resistor, 2.2 megohm 1/4 W	A21124	"C" Washer
R8	C20060-474	Resistor, .47 megohm 1/4 W	A21121	Screw, Changer Mtg.
R9	C19928	Tone Control & Switch, .5 megohm	A21168	Double Fahnestock Connector (For Outside Antenna)
R10	C20060-151	Resistor, 150 ohm 1/4 W	A21307	Carton Complete with Fillers (Model 151-TC)
R11	C20060-334	Resistor, .33 megohm 1/4 W	A21083	Carton Complete with Fillers (Model 150-TC)
R12	C20060-220	Resistor, 22 ohm 1/4 W	B19931	Variable Condenser Mtg. Bracket
R13	C20060-331	Resistor, 330 ohm 1/4 W	D21087	Dial Backing Plate
R14	C20070-123	Resistor, 12,000 ohm 1/4 W	C21106	Dial Support Bracket
C1A-C1B	AD21111-1	Variable Condenser & Pulley Assy.	D21089	Dial Plate Mounting Bracket
O2	C20067-503	Condenser, .05 us 200 V, Paper	A19923	Tuning Shaft Bracket
C3	C20065-500	Condenser, .00005 uf 500 V, Mica	A18995	Idler Pulley Stud
C4	C20068-503	Condenser, .05 uf 400 V, Paper	A21093	Dial Pointer
C5	C20065-251	Condenser, .00025 uf 500 V, Mica	D21091	Dial Glass
C6	C20068-103	Condenser, .01 uf 400 V, Paper	A21170	Dial Scale Background, Paper
C7	C20068-502	Condenser, .005 uf 400 V, Paper	A19361	Hairpin Clip (On Tuning Shaft)
C8A-C8B	A21349	Electrolytic Condenser, 50-30 uf., LEW	A19132	Cord, Dial Drive
C9	AD21169-1	Antenna Loop & Compartment Cover Assy.	A19295	Capacitor Mtg. Clip
L1	AD21187-1	Oscillator Coil Assembly	A19141	Terminal Strip, Double
L2	AC21107-1	Filter Choke Assembly	A19800	Terminal Strip, Triple, R. H.
L3	AC21107-1	I. F. Trap	A21189	Female Terminal (On Leads to Antenna Loop)
L4	AC21158	1st I. F. Coil	A20077-3	Rubber Grommet (For Mounting Rubber Channel)
T1	AC21097-1	2nd I. F. Coil	A19616-2	Rubber Channel (For Mounting Dial Glass)
T2	AC21098-1	Output Transformer	A19138-1	Spacer Eyelet (For Mounting Variable Condenser)
T3	AC21099-1	Dial Lamp, Mazda 47	B21123-2	Tube Retainer Spring, Medium
DL	A19351	Line Cord & Plug Assembly	B21123-1	Tube Retainer Spring, Long
P	B20064-10	Record Changer (General Instrument Model 205)	A20132-1	Tube Socket, Miniature, Molded
RC	A819934	Socket, 1-Prong (Phono Pickup)	A20132-2	Tube Socket, Miniature, Laminated
S	A19552	Socket, Phono Motor	A19553	Socket, Insulator (For 1-Prong Socket)
S3	C21064	Speaker Assembly	A19579	Socket, Speaker
Spk. SWS	C19930	Phono-Radio Switch	A19628-2	Socket, Dial Lamp, with Leads
	R21071	Cabinet Assembly, Mahogany Veneer (Model 150-TC)	A19234	Socket, Antenna Loop
	R21071-1	Cabinet Assembly, Walnut Veneer (Model 151-TC)	AA21100-1	Tuning Shaft & Pulley Assembly
	A19850	Needle, Semi-permanent	A19554	Plug, One Prong
	E21074	Dial Escutcheon		
	E21102	Speaker Grille		
	A19933	Grille Cloth		
	A19556	Plug, A. C. (On Record Changer)		
	E21068	Chassis Bottom Cover		

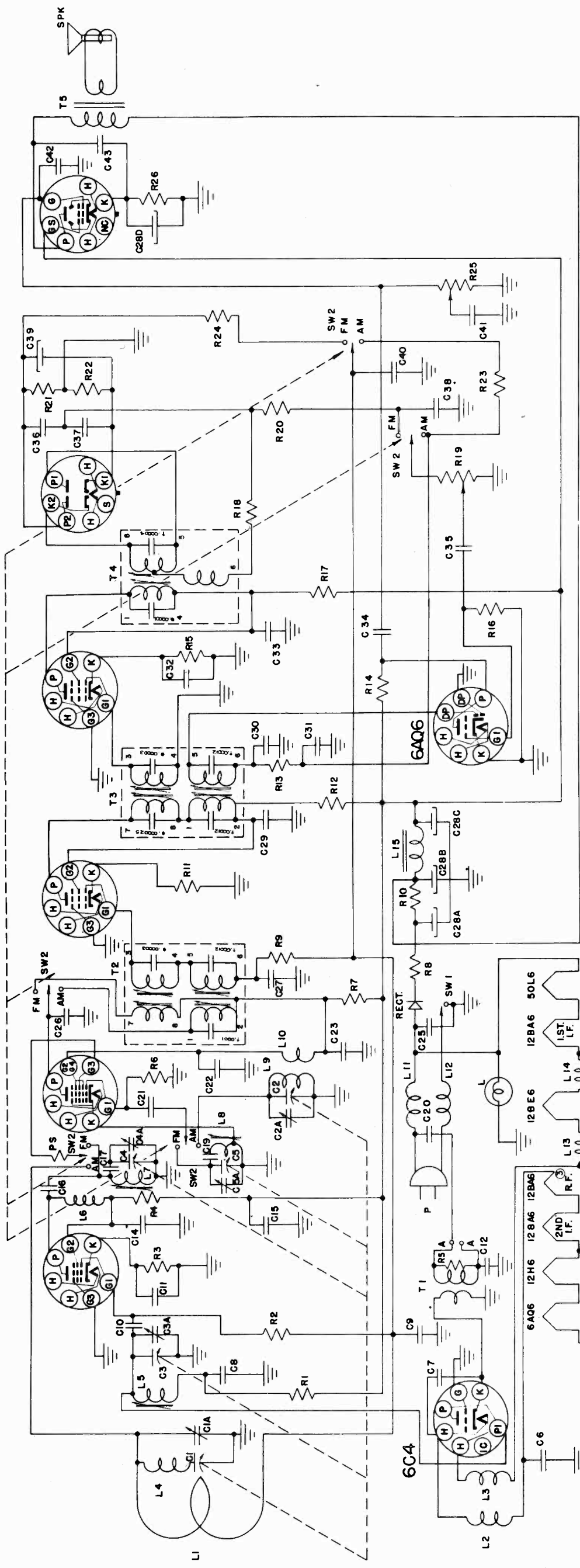
NOBLITT-SPARKS INDUSTRIES, INC.
12BA6 12BA6

MODEL 182TFM
Chassis RE237

12BE6 12BA6

12H6

50L6GT



C—RF ALIGNMENT—AM

1. Turn band switch to AM (To the left).
2. Connect signal generator to a standard Hazeltine test loop, Model 1150, placed 2' from the set loop, or three turns of wire about six inches in diameter placed about one foot from the set loop.
3. Tune the generator to 1620 KC and tune the receiver to the high frequency end of the dial.
4. Connect output meter across the speaker voice coil.
5. Adjust oscillator trimmer (11) on variable condenser for maximum output.
6. Tune signal generator to 1400 KC, and tune receiver to pick up this signal.
7. Adjust antenna trimmer (12) on variable condenser for maximum output.
8. Check tracking at 1000 KC and 600 KC.

D—RF ALIGNMENT—FM

1. Turn band switch to FM (To the right).
2. Connect FM signal generator to FM antenna terminals through a 220 ohm dummy.
3. Set signal generator to 88 megacycles, using 23 KC deviation.
4. Set receiver dial to 88 megacycles.
5. Adjust FM oscillator slug (13) for maximum signal.
6. Set signal generator to 108 M. C.
7. Set receiver dial to 108 M. C.
8. Adjust the FM oscillator trimmer (14) for maximum signal.
9. Repeat 3 to 8; check and recheck until proper coverage is obtained.
10. Set signal generator to 91 M. C., and adjust RF slugs (15) & (16) for maximum signal.
11. Set signal generator to 105 M. C. and adjust RF trimmers (17) & (18) for maximum signal.
12. Repeat 10 & 11 until proper tracking is obtained.

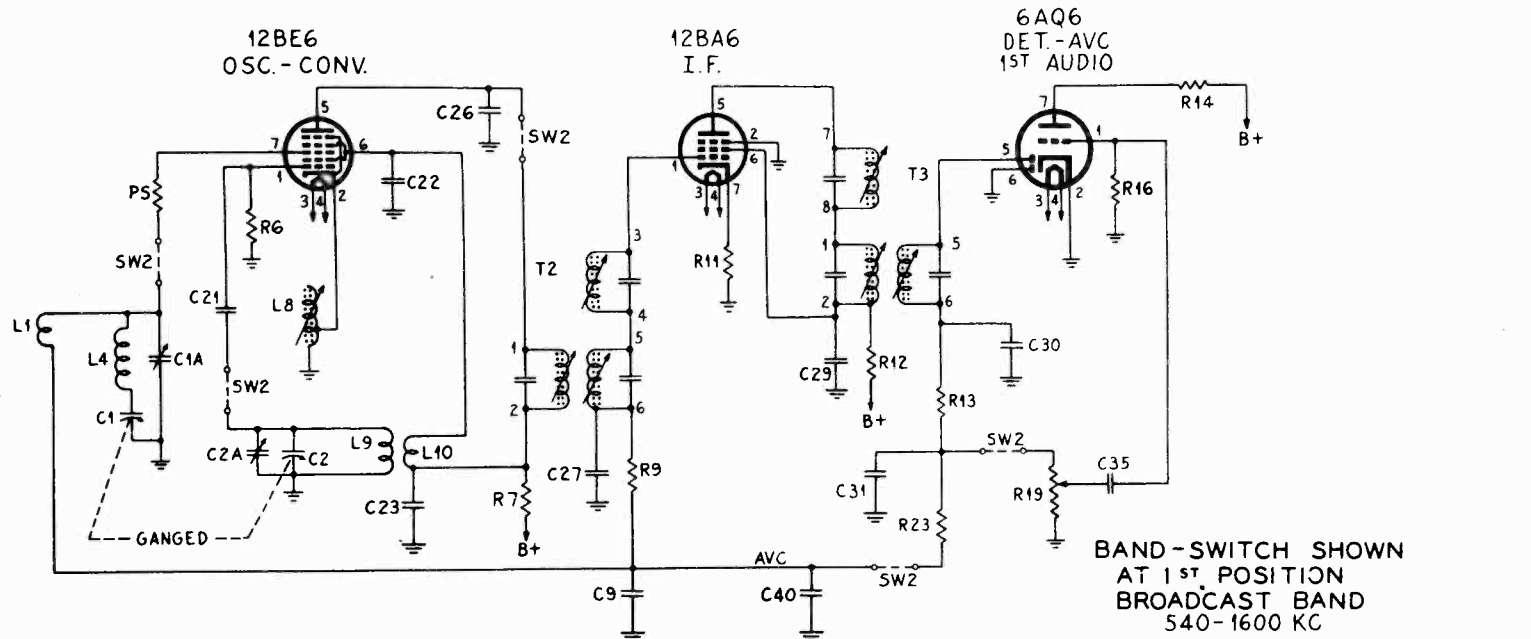
A—IF ALIGNMENT—AM

1. Turn the band switch to AM (To the left).
2. Connect the signal generator output lead to the converter grid, with an .05 uf. dummy and the generator ground lead to the receiver chassis.
3. Connect output meter across the speaker voice coil.
4. Tune the signal generator to 455 KC and adjust 455 KC IF slugs (1)-(2)-(3)-(4) for maximum output.

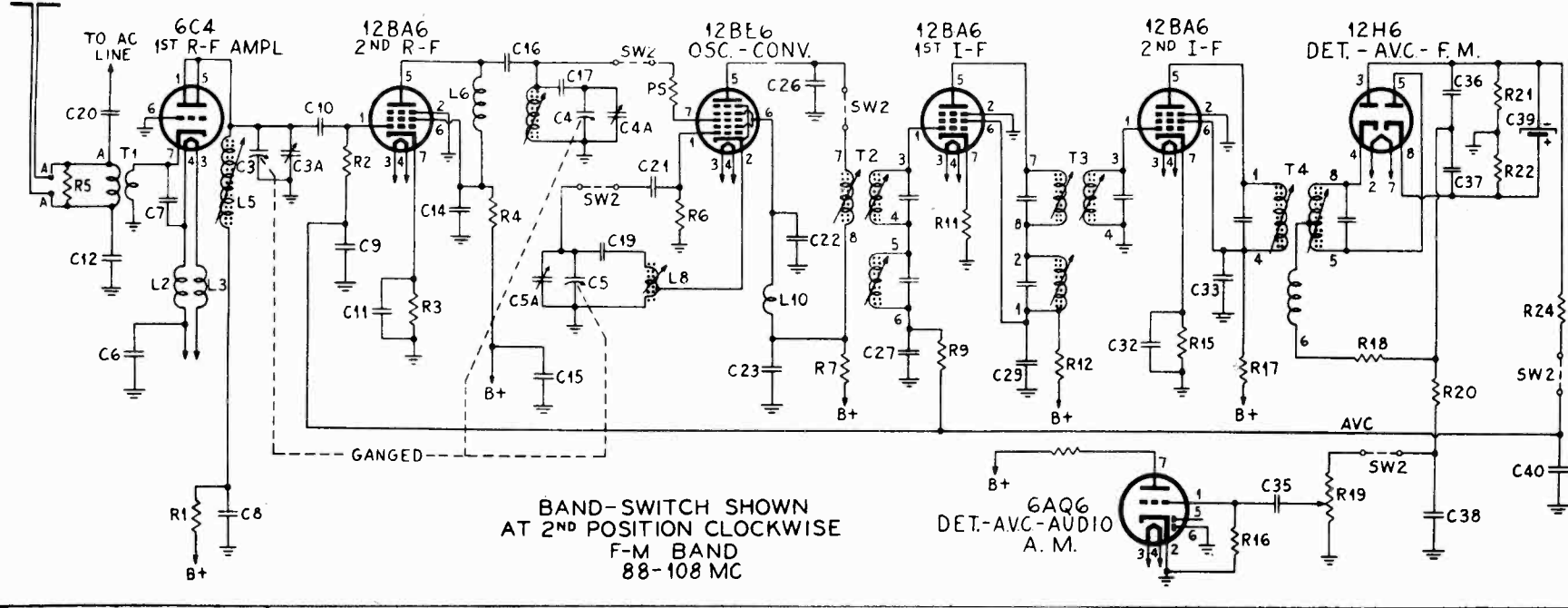
B—IF ALIGNMENT—FM

1. Turn the band switch to FM (To the right).
- *2. Connect 10.7 megacycle FM signal generator output lead to 2nd IF grid and the generator ground lead to receiver chassis.
3. Connect a D. C. vacuum tube volt meter to the A. V. C. line and adjust slug no. (5) (primary, bottom of detector transformer) for maximum A. V. C. Voltage.
4. Connect the D. C. V. T. V. M. to the audio output of detector (high side of volume control) and adjust slug no. (6) (secondary, top of detector transformer), for zero voltage.
5. Connect 10.7 megacycle FM signal generator to the converter grid.
6. Connect D. C. V. T. V. M. to the A. V. C. line and adjust the 10.7 IF slugs (7)-(8)-(9)-(10) for maximum A. V. C. voltage.

*If a 10.7 MC.-F. M. generator is not available, an unmodulated signal of 10.7 M. C. from an accurately calibrated conventional AM type generator may be used.



BAND-SWITCH SHOWN AT 1ST POSITION BROADCAST BAND 540-1600 KC



BAND-SWITCH SHOWN AT 2ND POSITION CLOCKWISE F-M BAND 88-108 MC

APPROXIMATE VOLTAGE AND RESISTANCE MEASUREMENTS
TUBE SOCKET LUGS TO CHASSIS GROUND

Tube	Function	VOLTAGE				RESISTANCE							
		Band Switch	Plate	Screen	Cath. Grid	1	2	3	4	5	6	7	8
6C4	1st RF Amp	FM-AM 95	—	0	0	•	Inf.	51	46	•	0	0	0
12BA6	2nd RF Amp	FM	100	100	.9	0	2meg	0	45	35	•	•	68
12BE6	Oscillator Converter	FM	100	100	.9	0	4meg	0	45	35	•	•	68
12BA6	1st IF Amp	AM	100	100	0	••	22 K	0	52	62	•	•	0
12BA6	2nd IF Amp	AM	100	100	0	•••	22 K	0	52	62	•	•	3meg
6AQ6	AF Amp	FM	92	92	.9	0	1meg	0	62	72	•	•	68
12BA6	2nd I-F	AM	92	92	.9	0	3.2meg	0	62	72	•	•	68
6AQ6	AF Amp	FM-AM	92	92	.9	0	.9	0	35	24	•	•	68
12H6	Det. AVC	FM	42	—	0	0	0.6	68meg	0	0	10	Imeg	0
12H6	Det. AVC	FM	—	—	—	—	—	0	24	6800	Imeg	Imeg	•
50L6	AF Output	AM	—	—	—	—	—	0	24	6800	Inf.	Inf.	•
50L6	AF Output	FM-AM	115	105	7.5	0	Inf.	72	•	•	500K	Imeg	100
50L6	AF Output	FM-AM	115	105	7.5	0	Inf.	72	•	•	500K	Imeg	100
50L6	AF Output	FM-AM	115	105	7.5	0	Inf.	72	•	•	500K	Imeg	100

All voltage readings are positive unless otherwise indicated.
All voltage measurements are made with an electronic voltmeter with a line voltage of 117V. AC.
*No reading given here, due to the wide variations in readings which would be obtained, due to the electrolytic condensers in the B+ circuit.
**G3.0: G1 Varies from approx. -1.5V to -4V, depending on the setting of the variable condenser, variations in tubes, coils, etc.
***G3.0: G1. Voltage varies from approx. -5V with variable condenser closed to approx. -7.5V with variable condenser open.

APPROXIMATE DC RESISTANCE OF COILS AND TRANSFORMERS

Label	Description	Resistance
L1	Loop Antenna	6 ohms
L2,3,4	RF Chokes	.6 ohms
6.1,3,14	RF Chokes	2 ohms
L9,10	AM Osc Coil	L9 5 ohms L10 220 ohms
L15	B+ Filter Choke	220 ohms
T5	Output Transformer (Pri)	110 ohms
	(Sec.)	3 ohms

All resistance measurements of coils were made with the coils wired in the circuit.
All coils and transformers not listed have a resistance too low to be measured with an ohmmeter.

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	QTY	DESCRIPTION
R1-12-17	C20060-102	Resistor, 1000 ohm, 1/4 W	C5A	D21409 Variable Condenser (Less Trimmers)
R2-24	C20060-105	Resistor, 1 megohm, 1/4 W	C3A-4A	A21440 Trimmer Condenser, 1.6-18 uuf.
R3-11-15	C20060-680	Resistor, 68 ohm, 1/4 W	C5A	A21439 Trimmer Condenser, 1.8 uuf.
R4-7	C20060-381	Resistor, 380ohm, 1/4 W	C6-11	C20201-500 Condenser, .00005 uf, 500V, Glass
R5	C20060-100	Resistor, 10 ohm, 1/4 W	C7-20	C20201-101 Condenser, .0001 uf, 500V, Ceramic
R6-13-20	C20060-223	Resistor, 22,000 ohm, 1/4 W	C8-10	C20226-501 Condenser, .0005 uf, 350V, Ceramic
R8	C20060-220	Resistor, 22 ohm, 1/4 W	C8-10	C20226-501 Condenser, .0005 uf, 350V, Ceramic
R9	C20060-104	Resistor, 100,000 ohm, 1/4 W	C9-12	C20226-102 Condenser, .001 uf, 350V, Ceramic
R10	C20103-101	Resistor, 100 ohm, 1 W	C13-14-22	C20226-502 Condenser, .005 uf, 350V, Ceramic
R14	C20060-334	Resistor, 300,000 ohm, 1/4 W	C15-23	C20204-100 Condenser, .00001 uf, 500V, Ceramic
R16	C20060-685	Resistor, 68 megohm, 1/4 W	C16	C20204-100 Condenser, .00001 uf, 500V, Ceramic
R18	C20060-101	Resistor, 100 ohm, 1/4 W	C17	C20206-201 Condenser, .0002 uf, 500V, Mica
R-19	C21401-1	Volume Control, 1 megohm	C19	C20205-2 Condenser, .0001 uf, 500V, Ceramic
R21-22	C20120-682	Resistor, 6800 ohm, 1/4 W	C21	C20204-270 Condenser, .000027 uf, 500V, Ceramic
R23	C20060-225	Resistor, 2.2 megohm, 1/4 W	C25-34	C20068-503 Condenser, .05 uf, 400 V, P. T.
R25	C21405-1	Tone Control and Switch, 500,000 ohm	C26	C20205-3 Condenser, .00002 uf, 500 V, Ceramic
R26	C20060-221	Resistor, 220 ohm, 1/4 W		
C1-C1A	AC21401-1	Variable Condenser (With Trimmers)		
C2-C2A				
C3-C3A				
C4-C4A				

NOBLITT-SPARKS INDUSTRIES, INC.

MODEL 182TFM

REF. NO.	PART NO.	DESCRIPTION	
C28,A,B, C.D	A21402	Condenser, Electrolytic, 40-40-80 uf, 150V, 20 uf., 25V	A20217 Socket, Antenna Loop
C35	C20068-103	Condenser, .01 uf, 400V, P. T.	D21372 Dial Scale Backing Plate
C36-37	C20205-5	Condenser, .00005 uf, 500V, Ceramic 10% N750	A21382 Tuning Shaft Insulator (Rear Phenolic) (Quantity of 5)
C38	C20203-202	Condenser, .002 uf, 350V, Ceramic	A20196-2 Rivet, Tubular Shoulder (For Mtg. Idler Pulley) (Quantity of 5)
C39	A21403	Condenser, Electrolytic, 8 uf, 50V	A20196-4 Rivet, Tubular Shoulder (For Mtg. Idler Pulley) (Quantity of 5)
C40	C20067-503	Condenser, .05 uf, 200V, P. T.	A20202-2 Idler Pulley, 3/8" x 1/8" x 1/2", (Quantity of 5)
C41	C20067-502	Condenser, .005 uf, 200V, P. T.	A21422 Tuning Shaft
C42	C20065-251	Condenser, .00025 uf, 500V, Mica	D21389 Dial Scale, .050 Clear Acetate
C43	C20069-502	Condenser, .005 uf, 600V, P. T.	A19132 Cord, Dial Drive
L1	AE21395-1	Antenna Loop, Rear Cover, and Line Cord Assy.	A19361 Hairpin Clip (On Tuning Shaft)
L2-3-4 6-13-14	AA21445-1	High Frequency Choke	A19295 Spring, Dial Drive Cord
L5	AC21399-1	1st R. F. Coil (FM)	A21384 Terminal Strip, Double, L. H.
L7	AC21400-1	2nd R. F. Coil (FM)	A19141 Terminal Strip, Double, Center Mtg.
L8	AC21397-1	Oscillator Coil (FM)	A19140 Terminal Strip, Single, L. H.
L9-10	AC21396-1	Oscillator Coil (AM)	A21385 Terminal Strip, Triple with Center Mtg. Lug Grounded
L11-12	AA21444-1	High Frequency Choke	A19236 Terminal Strip, Triple with Separate Mtg. Lug
L15	AC21394-1	B+ Filter Choke	A21457 Insulator (Chassis Fibre, Mtg. Screw)
T1	AA21398-1	Antenna Coupling Transformer	A20077-3 Grommet, Rubber (Under Variable Cond.)
T2	AC21390-1	1st I. F. Coil	A19138-1 Eyelet, Spacer (Under Variable Cond.)
T3	AD21391-1	2nd I. F. Coil	A20218 Plug, 2-Prong (Chassis Back Flange-Interlock Plug)
T4	AD21392-1	Detector Transformer	A21189 Terminal, Female (Quantity of 10)
T5	AC21393-1	Output Transformer	A21388 Control Shaft Insulator, Phenolic
Sw2	C21406	Band Switch	A21443 Tuning Shaft Insulator, Front, Phenolic (Quantity of 5)
Spk	C21331	Speaker, 5/4" P. M.	A21225 Antenna Lead Insulator, Phenolic (Quantity of 5)
Rect	A20207-3	Rectifier, Selenium, 150 MA	A20118-1 Socket, Tube, Miniature, Molded (Black)
P	B20064-5	Line Cord & Plug Assy	A20197-1 Socket, Tube, Miniature, Molded (Low Loss Bakelite)
L	A19135	Dial Lamp, Mazda C7	A18254-1 Socket, Tube, Plain, Wafer
	R21379	Cabinet Assy., Complete	A19579 Socket, Speaker
	A21330	Name Plate, Brass	A19134-4 Socket, Dial Lamp
	D21365	Escutcheon, Clear Lucite	A21408 Washer, Insulating, 3/8" I. D. x 3/4" O.D., Phenolic (Quantity of 5)
	C21428	Knob, Tuning	AC21377-1 Dial Pointer Assy.
	C21427	Knob, Volume	
	C21430	Knob, Tone	
	C21429	Knob, A.M.-F.A. Switch	
	A21431	Carton Complete with Fillers	
	C21426	Speaker Grille	
	C21498	Grille Felt, on Front Cabinet Baffle	

Fading

If fading occurs, check the shielded audio leads. One lead should be connected from the center lug of the volume control to the audio coupling condenser on stand-off insulator. The other one should be connected from the right hand terminal of the control to the band change switch. If these two leads are reversed, the A.V.C. will be ineffective.

Antenna

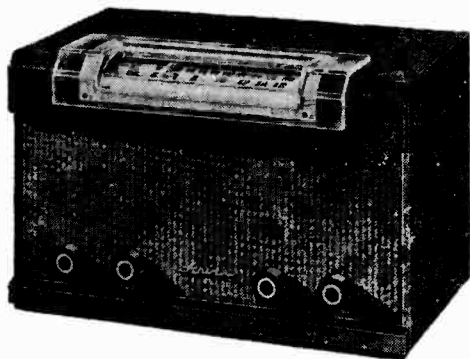
On some of the first sets produced, the primary and secondary windings of the antenna coupling transformer T1, were shorted together. This would cause the antenna terminals on the back of the set to be grounded to the chassis. This should be carefully checked before connecting an external antenna to the set, because one position of the A.C. plug in the electric outlet would place 110 volt A.C. between the antenna and any grounded object. This would be a shock hazard, and if the antenna became grounded, would burn out the R.F. choke in the AC leads in the set.

Oscillation

If oscillation is encountered, try dressing the yellow filament leads, in the IF section of the set, down against the chassis and away from the tube sockets.

Regeneration

Some cases of regeneration in the FM - IF circuit have been encountered. This can be detected by a high discriminator voltage, and also a high A.V.C. voltage, with no input signal. Replacing the .005 mfd. 2nd IF cathode bypass condenser, C32, with a .002 mfd., 350 volt, ceramic condenser will correct this in most cases.



SPECIFICATIONS & SERVICE NOTES

FREQUENCY RANGE

Broadcast Band	540-1600 KC
AM-IF	455 KC
FM Band	88-108 MC
FM-IF	10.7 MC

TUBES & FUNCTIONS

6C4	1st RF Amp FM
12BA6	2nd RF Amp FM
12BE6	Oscillator Converter AM-FM
12BA6	1st IF Amp AM-FM
12BA6	2nd IF Amp FM
6AQ6	Det. AVC. AF Amp AM
.....	AF Amp FM
12H6	Detector, AVC. FM
50L6	AF Output AM-FM

POWER OUTPUT

Undistorted	1.4 Watts
Maximum	2.5 Watts
Plate Load	2000 Ohms

POWER SUPPLY

105-125 Volts, AC-DC	45 Watts
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THE ANTENNA

This set has a loop antenna for AM Broadcast reception. For local FM reception, a built-in (line cord) antenna is provided. An external antenna connection is provided for areas where reception is difficult. To connect the external antenna, remove the green wire from the antenna terminal on the back of the set, and connect a dipole antenna to the antenna terminals. When the line cord antenna is used, the green wire must be connected to the outside terminal on the antenna terminal board.

GROUND

This set is designed to operate without a ground connection and no attempt should be made to use one.

CAUTION

The chassis of this receiver is connected to one side of the power line. Therefore, to prevent a shock hazard, all control shafts, mounting screws and exposed rivets have been insulated from the chassis. When servicing this set and replacing parts, be sure all the necessary insulators are in place to isolate the chassis from all exposed metal parts.

IF & DETECTOR TRANSFORMER REPLACEMENTS

To insure properly matched units for best performance, it is recommended that the IF transformers and FM detector transformer be replaced as complete assemblies, rather than attempt to repair or replace parts of these assemblies.

SPEAKER

Cone Size	5 1/4"
Cone Resonance in Air-Approx.	197 Cycles
Type	Permanent Magnet
Magnet Size	1.47 oz. Alnico V
Voice Coil Impedance	3.2 Ohms

OPERATING CONTROLS

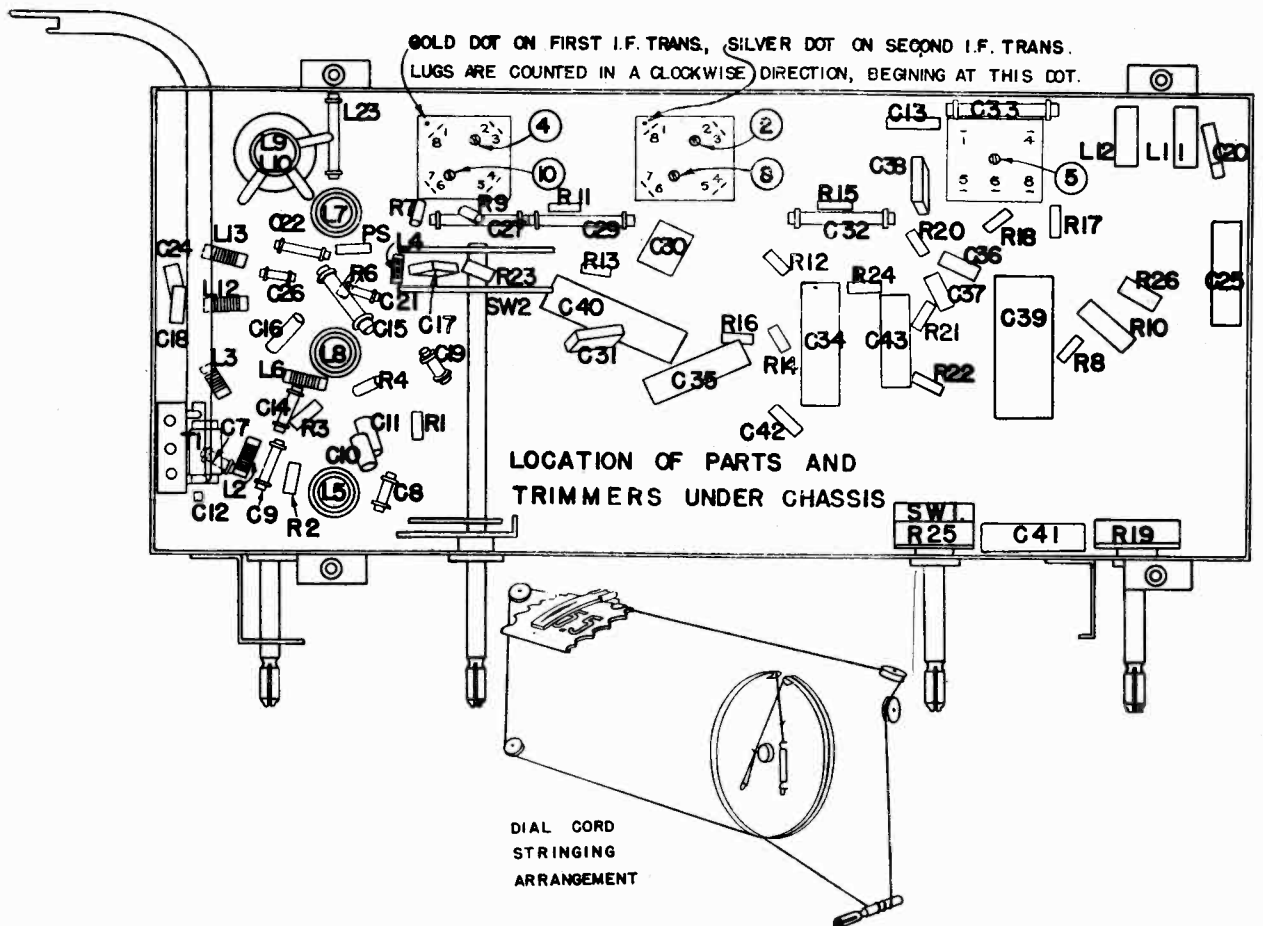
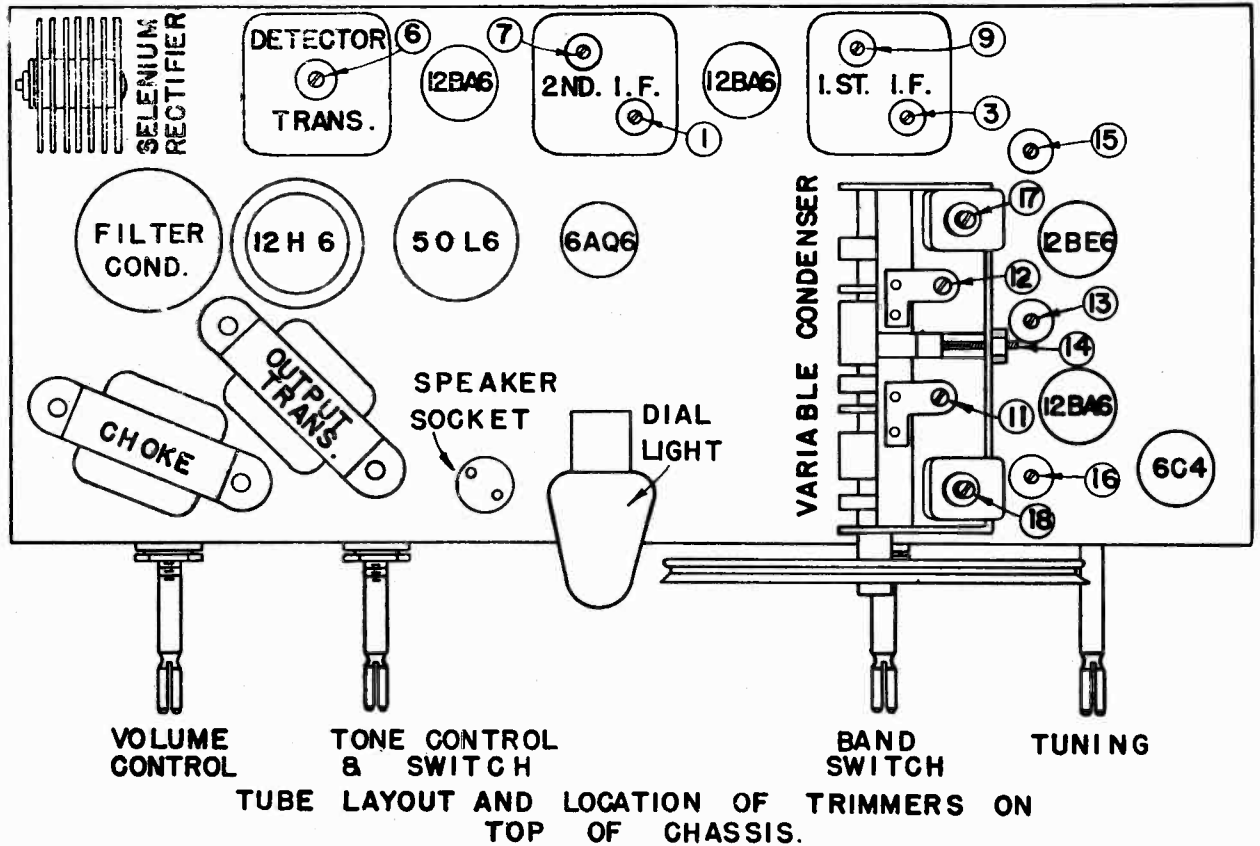
Extreme Left Knob	Volume
Left Center	On-Off Switch, Tone Control
Right Center	AM-FM Band Switch
Extreme Right	Tuning

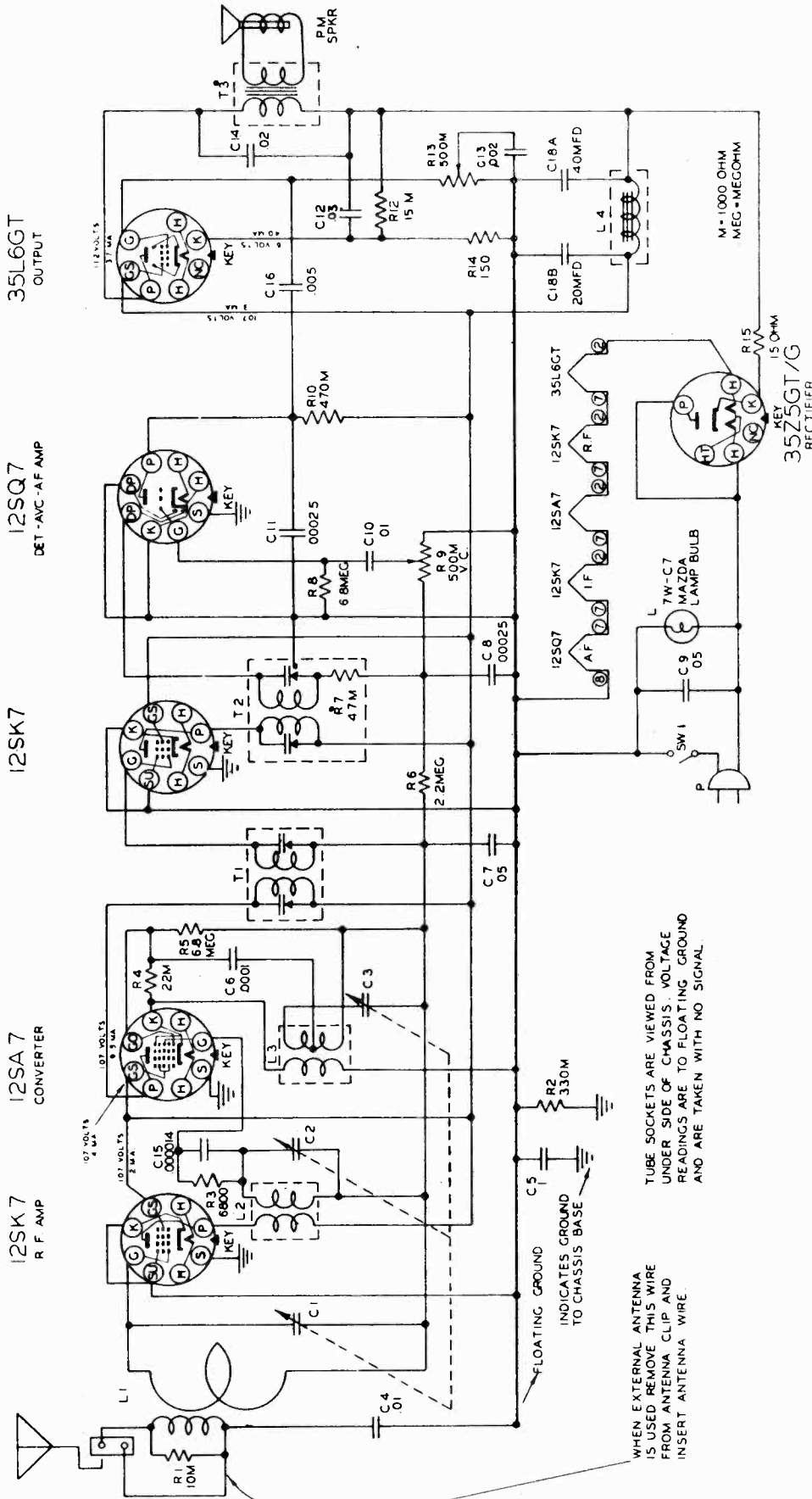
PHYSICAL DIMENSIONS

Length	14"
Height	8 1/2"
Depth	8 5/16"

APPROX. SENSITIVITIES

FM Converter Grid 10.7 M. C.	300 uv
FM Antenna Terminals 105 MC	40 uv
(23KC Deviation)	
AM Converter Grid 455 KC	150 uv
AM Loop 1400 KC	240 uv/m





WHEN EXTERNAL ANTENNA IS USED REMOVE THIS WIRE FROM ANTENNA CLIP AND INSERT ANTENNA WIRE.

TUBE SOCKETS ARE VIEWED FROM UNDER SIDE OF CHASSIS. VOLTAGE READINGS ARE TO FLOATING GROUND AND ARE TAKEN WITH NO SIGNAL.

NOTE:
The chassis RE-206-2 is identical with chassis RE-206-1 used in the Model 664, with exception of the loop assembly.

NOBLITT-SPARKS INDUSTRIES, INC.

MODEL 6640

ALIGNMENT PROCEDURE

PRELIMINARY.

Output meter connection	Across loudspeaker voice coil
Output meter reading to indicate 200 milliwatts (standard output)	8 volts
Dummy antenna value to be used in series with generator output	See chart below
Connection of generator output lead	See chart below
Connection of generator ground lead	Floating ground
Generator modulation	30% 400 cycles
Position of Volume Control	Fully clockwise
Position of dial pointer with variable fully closed	Vertical

Place the set loop in the same position with respect to the rear of the chassis, and the same distance from the chassis, as it would be with the set mounted in the cabinet. This distance is 1-11/32" from the back of the chassis to the front of the loop. If the position of the loop is not correct while adjustments are made on the antenna circuit, the antenna circuit will not track and the set will be weak, when placed in the cabinet.

Position of Variable	Frequency of Generator	Dummy Antenna	Generator Output Connection	Trimmers adjusted in Order Shown for Max. Output	Function of Trimmer
Open	455	.01 mfd.	12SA7 Grid or (Stator of center section of variable condenser)	Top of 2nd & 1st IF Trans.	IF
1400	1400	.00005 mfd.	Antenna Clip (With black wire removed)	*C3, C2, C1, trimmers on Variable Condenser	Osc. RF Ant.
600	600	.00005 mfd.	Antenna Clip (With black wire removed)	**Adj. plates of variable cond. for Max. output.	Osc. RF Ant.

If a standard test loop is used with the signal generator for alignment of the receiver, the black wire will be left in the antenna clip, and the approximate sensitivities should be 250 uv/m and 150 uv/m or less at 600 Kc and 1400 Kc respectively. Sets using glass 12SA7 tube may have slightly weaker sensitivities.

Approximate stage by stage sensitivities for 200 Milliwatt output.

IF. - 455 Kc.	10,000 uv	Antenna 1000 Kc	15 uv
Mixer 455 Kc.	150 uv	Antenna 1400 Kc	15 uv
Mixer 1000 Kc.	170 uv	Antenna 600 Kc	25 uv

The alignment procedure should be repeated in the original order for greatest accuracy. Always keep the output from the signal generator at its lowest possible value to make the AVC action of the receiver ineffective.

*Trimmer C3 (oscillator) is located either on the top or bottom of the variable condenser, depending on the type variable used on any particular set.

CAUTION:

****AS THE CONDENSERS ARE ALL TRACKED BEFORE LEAVING THE FACTORY IT IS NOT PROBABLE THAT THE PLATES WILL NEED TO BE ADJUSTED UNLESS WIDE VARIATIONS IN TUBES ARE ENCOUNTERED OR THE CONDENSER HAS BEEN DAMAGED. PLATE BENDING SHOULD NOT BE ATTEMPTED WITHOUT THE PROPER EQUIPMENT, OR BY ANYONE NOT EXPERIENCED AT TRACKING CONDENSERS.**

The outside plates on the antenna & RF sections of the variable condenser are cut, so they can be bent in or out to give more or less capacity at any given position of the rotor, after the trimmers on the variable have been adjusted at 1400 Kc. A disc type tuning wand affords a quick method of determining whether more or less capacity is needed in antenna circuit. If the output increases when the Iron end of the wand is placed near the loop, the plates should be bent in to give more capacity. If the output increases when the brass or aluminum end of the wand is placed near the loop the plates should be spread out. If the wand indicates that the plates should go closer, but cannot go closer without shorting, the oscillator section plates can be spread, or vice versa, but the calibration should be checked after adjusting the oscillator section. Also the band coverage should be checked to see that 540 Kc can be received.

Since the osc. section has much less capacity than the RF & antenna sections, plate bending will be much more effective in the osc. circuit, and a small change in or out in the plates of this section will have the same effect as a large change in the opposite direction in the other sections.

If the receiver is weak at 1000 Kc the same procedure can be followed at 1000 Kc as outlined above for 600 Kc but this will change the tracking at 600 Kc and may affect 1400 Kc so that all points should be rechecked in the original order.

The condenser should be checked for any possible shorting of the plates after the alignment is completed.

MODEL 6640

NOBLITT-SPARKS INDUSTRIES, INC.

FREQUENCY RANGE

Broadcast 540-1600 kc
 IF 455 kc

LOUD SPEAKER

Type: Permanent magnet
 Size: 5 1/4 inch
 Voice coil impedance 3.2 ohms

TUBES & FUNCTIONS

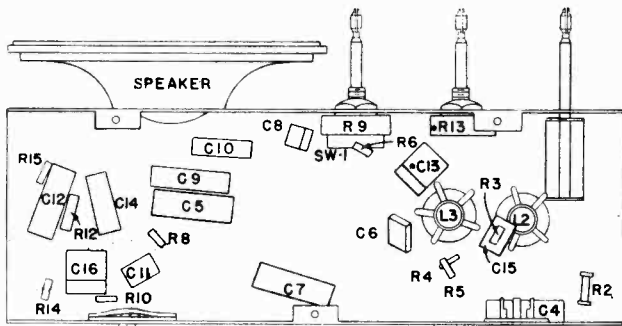
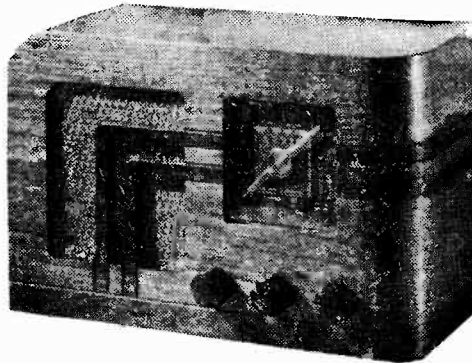
12SK7 RF Amp.
 12SA7 Mixer-oscillator
 12SK7 IF Amp.
 12SQ7 DET-AVC AF Amp.
 35L6 Output
 35Z5GT Rectifier

POWER SUPPLY

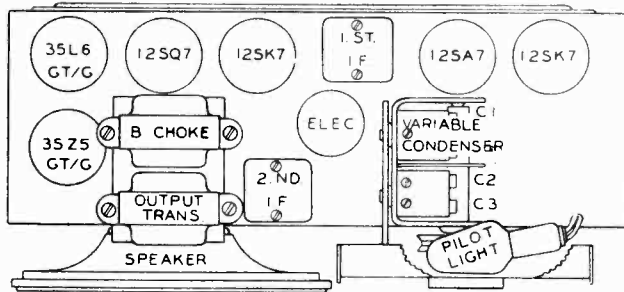
105-125 Volts AC-DC, 45 Watts

POWER OUTPUT

Undistorted8 Watts
 Maximum 2.5 Watts
 Plate load 2000 Ohms



LOCATION OF PARTS UNDER CHASSIS



TUBE LAYOUT

PARTS LIST

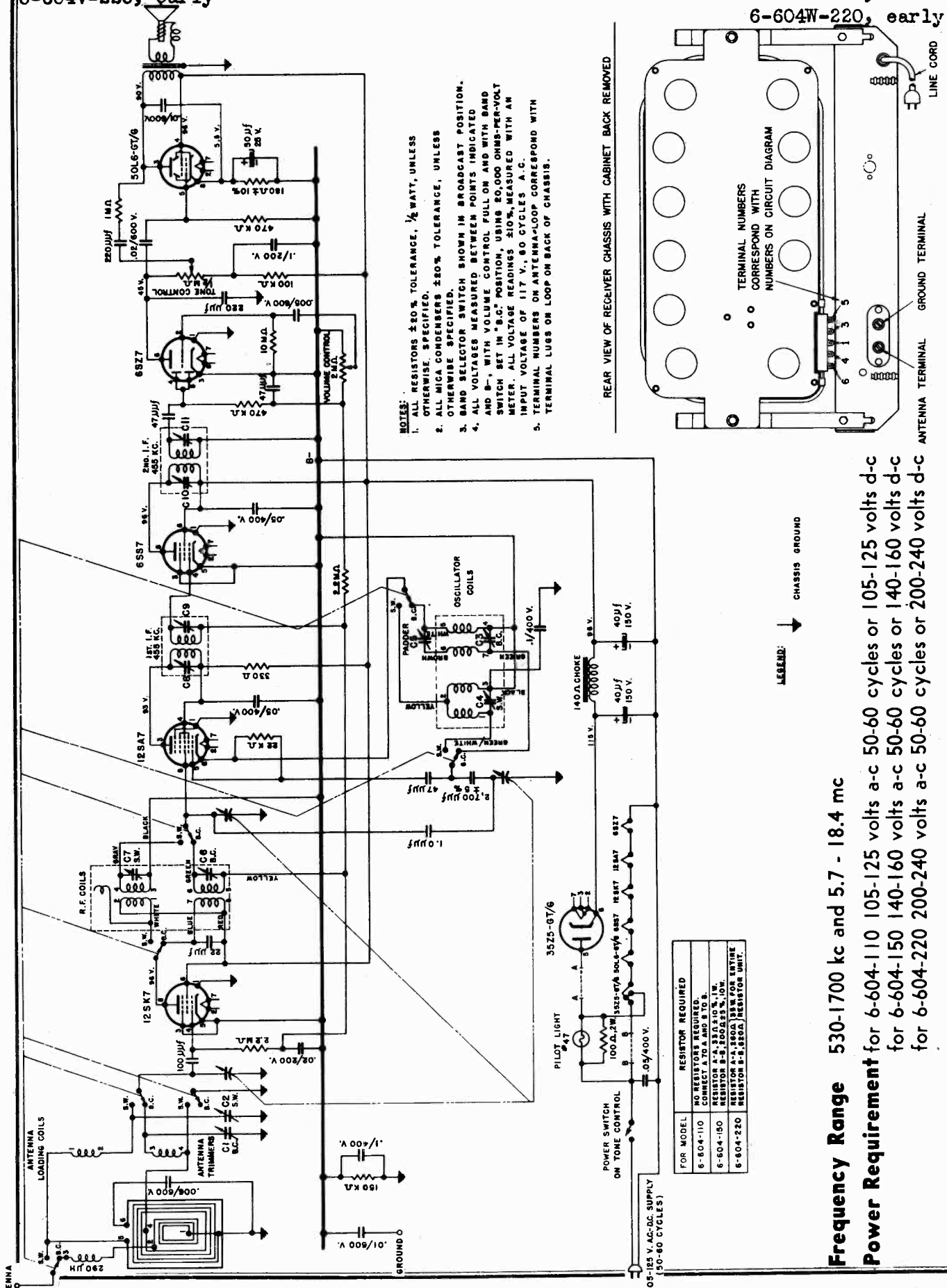
REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
R1	C20060-103	Resistor, 10,000 ohm 1/4W	A19138-1	Spacer Eyelet for Mtg. Var. Cond.	
R2	C20060-334	Resistor, 330,000 ohm 1/4W	E21410	Cabinet, Wood, Walnut	
R3	C20060-332	Resistor, 6800 ohm 1/4 W	A18272	Dial Crystal	
R4	C20060-223	Resistor, 22,000 ohm 1/4 W	A19783-1	Knobs, Walnut	
R5, R8	C20060-685	Resistor, 6.8 megohm 1/4 W	L1	AD21423-1 Antenna Loop & Rear Cover Assy.	
R6	C20060-225	Resistor, 2.2 megohm 1/4 W	L2	AC19860-1 R. F. Coil	
R7	C20060-473	Resistor, 47,000 ohm 1/4 W	L3	AC18580-1 Oscillator Coil	
R9	C19244	Vol. Cont. & Sw. 500,000 ohms	L4	AC18583-1 Iron Core Choke	
R10	C20060-474	Resistor, 470,000 ohm 1/4 W	T1	AC21009-1 1st I. F. Coil	
R12	C20070-153	Resistor, 15,000 ohms 1 W	T2	AC18578-1 2nd I. F. Coil	
R13	C19965	Tone Control, 500,000 ohm	T3	AC18582-1 Output Transformer	
R14	C20060-151	Resistor, 150 ohm 1/4 W	Spk.	AC19872-1 Speaker Assy. (Spk with Trans. Mtg. Brkt.)	
R15	C20060-150	Resistor, 15 ohm 1/4 W	Spk.	C18550 Speaker only	
C1	B18564	**Variable Condenser, 3 gang	A19293	Tuning Shaft	
C2	or		C18432-D	Dial Scale	
C3	C19853		A21173	Dial Pointer	
C4, C10	C20068-103	Cond., .01 uf. 400 VPT	A19132	Dial Drive Cord	
C5	C20068-104	Cond., .1 uf. 400 VPT	A18254-1	Socket, Tube, Wafer Type	
C6	C20065-101	Cond., .0001 uf. 500 V Mica	A16668	Elect. Mtg. Wafer	
C7, C9	C20068-503	Cond., .05 uf. 400 VPT	A19234	Antenna Socket	
C8, C11	C20065-251	Cond., .00025 uf. 500 V Mica	A19134-2	Dial Light Socket	
C12	C20068-303	Cond., .03 uf. 400 VPT	A19135	Dial Light Bulb, Mazda C7 Night Light, 7W	
C13	C20069-202	Cond., .002 uf. 600 V	B20064-8	Line Cord and Plug Assy.	
C14	C20068-203	Cond., .02 uf. 400 VPT.	A20077-3	Rubber Grommet for Mtg. Var. Cond. B18564 & 19853	
C15	A19182	Cond., 14 mmf. 600V Mica	A19328-2	Rubber Grommet for Mtg. Var. Cond. C19583 Only	
C16	C20069-502	Cond., .005 uf. 600 VPT.	A21422	Carton with Fillers	
C18A	A19239	Cond., Electrolytic 40-20 uf 150V			
C18B	A19674	Terminal Strip			

** When ordering a replacement Variable Condenser, be sure to use the part number which is stamped on the back of the original Condenser.

MODELS 6-604V-110,
6-604V-220, early

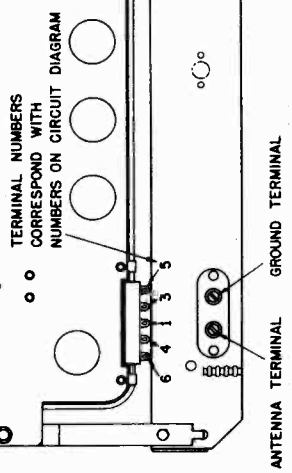
OLYMPIC RADIO & TELEV. INC.

MODELS 6-604W-110,
6-604W-150,
6-604W-220, early



- NOTES:
1. ALL RESISTORS $\pm 20\%$ TOLERANCE, $\frac{1}{2}$ WATT, UNLESS OTHERWISE SPECIFIED.
 2. ALL MICA CONDENSERS $\pm 20\%$ TOLERANCE, UNLESS OTHERWISE SPECIFIED.
 3. BAND SELECTOR SWITCH SHOWN IN BROADCAST POSITION.
 4. ALL VOLTAGES MEASURED BETWEEN POINTS INDICATED AND B-₁ WITH VOLUME CONTROL FULL ON AND WITH BAND SWITCH SET IN "B.C." POSITION, USING 50,000 OHMS-PER-VOLT METER. ALL VOLTAGE READINGS $\pm 10\%$, MEASURED WITH AN INPUT VOLTAGE OF 117 V., 60 CYCLES A.C.
 5. TERMINAL LUGS ON LOOP ON BACK OF CHASSIS.

REAR VIEW OF RECEIVER CHASSIS WITH CABINET BACK REMOVED



FOR MODEL	RESISTOR REQUIRED
6-604-110	NO RESISTORS REQUIRED.
6-604-150	RESISTOR A-A, 230.0 $\pm 10\%$, 1W.
6-604-220	RESISTOR B-B, 200.0 $\pm 25\%$, 10W.
	RESISTOR C-C, 100.0 $\pm 25\%$, 10W.
	RESISTOR D-D, 100.0 $\pm 25\%$, 10W.

Frequency Range 530-1700 kc and 5.7 - 18.4 mc

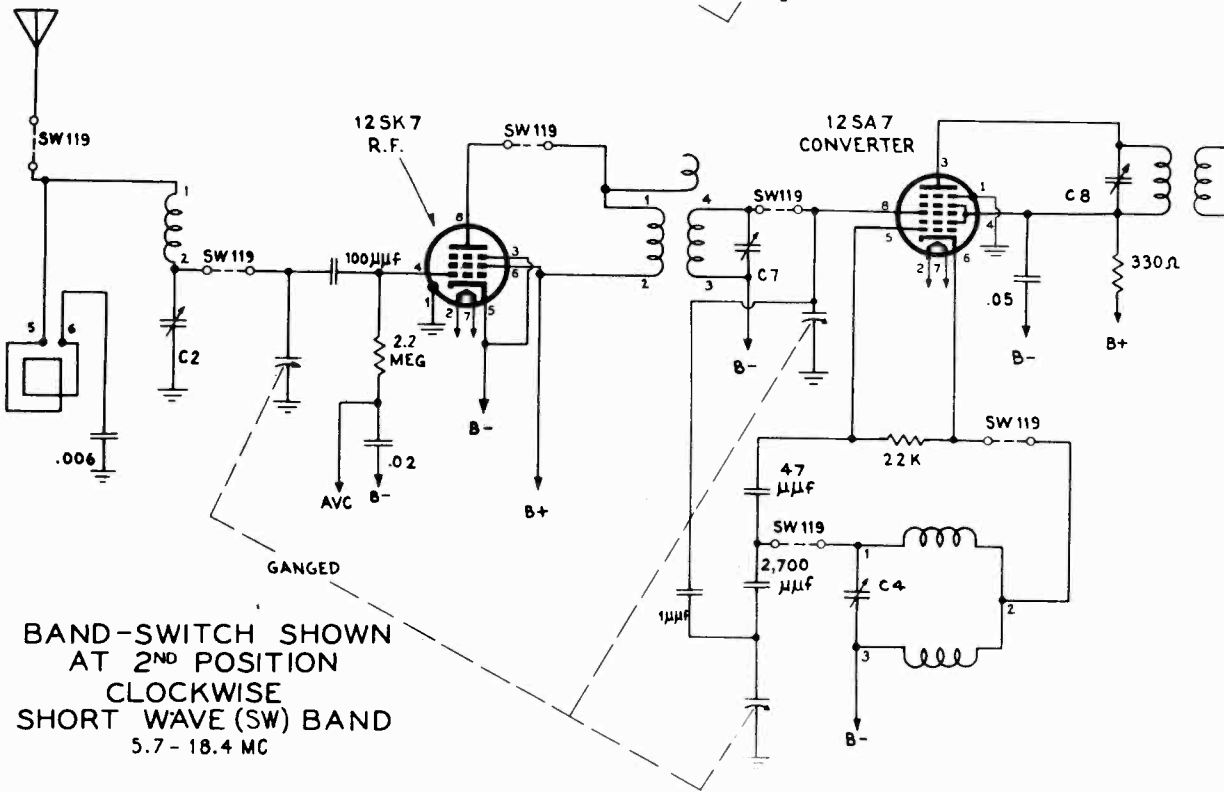
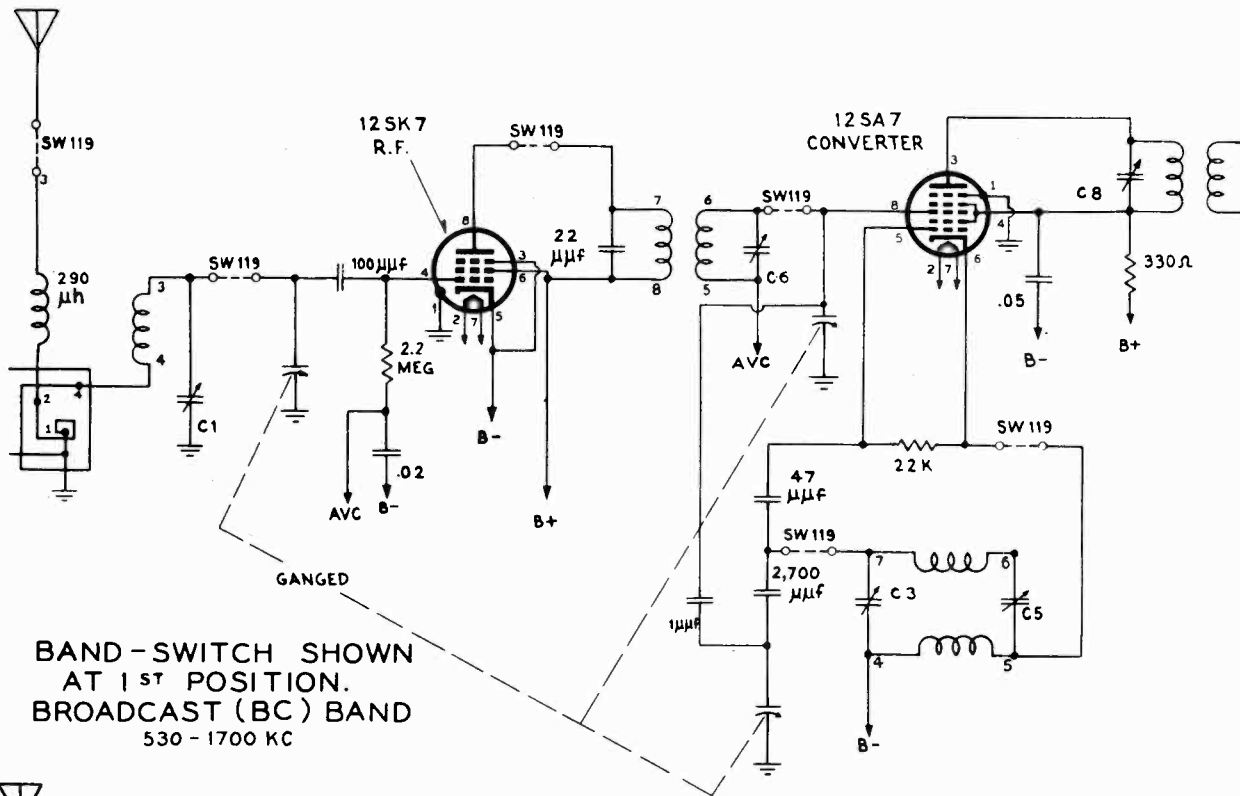
Power Requirement for 6-604-110 105-125 volts a-c 50-60 cycles or 105-125 volts d-c

for 6-604-150 140-160 volts a-c 50-60 cycles or 140-160 volts d-c

for 6-604-220 200-240 volts a-c 50-60 cycles or 200-240 volts d-c

"clarified schematics"

MODELS 6-604W-110, early, OLYMPIC RADIO & TELEV. INC.
 6-604W-150, early,
 6-604W-220, early
 MODELS 6-604V-110, early,
 6-604V-220, early



SERVICE AND ALIGNMENT INSTRUCTIONS

In this receiver the B-voltage is not returned directly to ground but to a common B-return. To avoid hum modulation and to insure proper alignment it is therefore recommended to use a radiated signal for alignment. To radiate the signal connect a loop of about 6" to 8" diameter 1 turn of #14 or #12 wire across the output of the signal generator and place this loop parallel to the loop of the receiver to be aligned at a distance of 8" or 10".

ALIGNMENT:

Equipment required: Modulated r-f signal generator, output meter, insulated screw driver, two .1 mfd 400 volts condensers.

With the receiver removed from the cabinet connect output meter across voice coil. Connect ground side of the signal generator in series with a .1/400 volt condenser to the common B-; turn volume control fully on, and keeping the output of the signal generator as low as possible, proceed in the sequence as shown on the alignment chart.

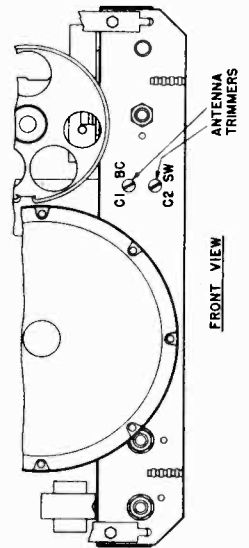
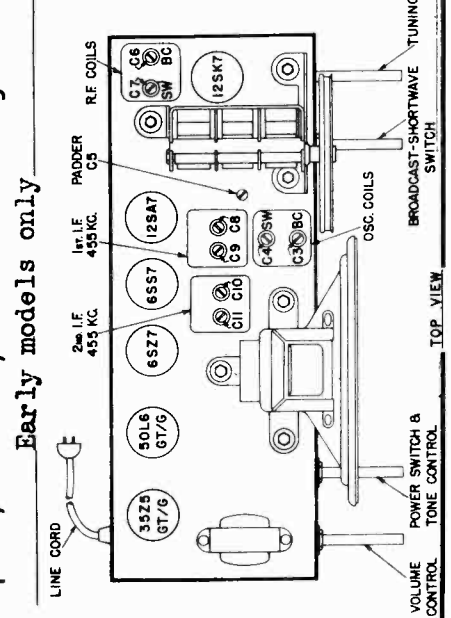
To facilitate alignment of the receiver when removed from cabinet, calibration points are provided on the light diffuser plate, which is mounted to the chassis.

Before aligning, close the variable condenser fully counterclockwise (plates fully closed) and check that pointer coincides with the reference dot (extreme left dot) on the diffuser plate.

NOTE:

In order to adjust the short wave oscillator trimmer and the short wave r-f trimmer accurately to the fundamental frequency and not to the image signal, turn the trimmers first to the maximum capacity position (fully tight). From this position loosen the trimmer through one peak indication on the output meter until a second peak is obtained. Adjust for maximum output on this second peak.

To check whether this procedure has been accurately performed, ascertain that an image signal can be received (much weaker) by tuning the signal generator to a frequency 910 kilocycles above the alignment frequency.



MODELS 6-604W series, OLYMPIC RADIO & TELEV. INC.

early and late

MODELS 6-604V series,

early and late

For the 604 series late production, step 2 should read:

R.F. section of variable condenser or pin 7 of the 12BE6 tube in series with a .1mfd, 400 volt condenser.

ALIGNMENT PROCEDURE CHART						
STEP	BET BAND SWITCH ON	CONNECT HIGH SIDE OF SIGNAL GENERATOR TO-	SET SIGNAL GENERATOR TO-	TURN POINTER TO-	ADJUST THE FOLLOWING FOR MAXIMUM OUTPUT. (KEEP SIGNAL FROM SIGNAL GENERATOR AS LOW AS POSSIBLE).	
1	B.C.	R.F. SECTION OF VARIABLE CONDENSER OR PIN 4 OF THE 6S87 TUBE IN SERIES WITH A .1MFD, 400 VOLT CONDENSER.	466 KC.	EXTREME RIGHT HAND POSITION. (CONDENSER PLATES FULLY OPEN).	C11 AND C10 (Sec. I.F. TRANSFORMER)	
2	B.C.	R.F. SECTION OF VARIABLE CONDENSER OR PIN 8 OF THE 6S87 TUBE IN SERIES WITH A .1MFD, 400 VOLT CONDENSER.	466 KC.	EXTREME RIGHT HAND POSITION. (CONDENSER PLATES FULLY OPEN).	C9 AND C8 (1st. I.F. TRANSFORMER)	
3	B.C.	REPEAT STEPS 1 AND 2				
4	B.C.	USE RADIATED SIGNAL (CONNECT BOTH SIDES OF SIGNAL GENERATOR TO RADIATION LOOP).	1700 KC.	1700 KC. CALIBRATION POINT ON DIFFUSER PLATE.	C3 (OSCILLATOR TRIMMER)	
5	B.C.		1400 KC.	RESONANCE, APPROXIMATELY 1400 KC. CALIBRATION POINT ON DIFFUSER PLATE.	C8 AND C1 (R.F. AND ANTENNA TRIMMERS)	
6	B.C.		900 KC.	RESONANCE, APPROXIMATELY 900 KC. CALIBRATION POINT ON DIFFUSER PLATE.	C5 (PADDER) ROCK VARIABLE FOR MAXIMUM SIGNAL	
7	B.C.		REPEAT STEPS 4, 5 AND 6			
8	S.W.		18 MC.	18 MC. CALIBRATION POINT ON DIFFUSER PLATE	C4 (OSCILLATOR TRIMMER) SECOND PEAK FROM TIGHT POSITION. C7 (R.F. TRIMMER)	
9	S.W.	8 MC.	RESONANCE	C2 (ANTENNA TRIMMER)		
10	S.W.	REPEAT STEPS 8 AND 9				

NOTE: In order to adjust the short wave oscillator trimmer and the short wave r-f trimmer accurately to the fundamental frequency and not to the image signal, turn the trimmers first to the maximum capacity position (fully tight). From this position loosen the trimmer through one peak indication on the outputmeter until a second peak is obtained. Adjust for maximum output on this second peak. To check whether this procedure has been accurately performed, ascertain that an image signal can be received (much weaker) by tuning the signal generator to a frequency 910 kilocycles above the alignment frequency.

REPLACEMENT PARTS

Part No.	Description
BU 187	Bulb—#47 Mazda 6.3V pilot light bulb
CA 154W	Cabinet—walnut bakelite cabinet
CA 154V	Cabinet—ivory bakelite cabinet
CK 114	Choke—140 ohms 85 mils filter choke
CL 211	Coil—antenna loading coil
CL 212	Coil—shielded oscillator coil
CL 224	Coil—shielded R.F. coil (BC&SW)
CO 111	Condenser—40/40/150W.V.&50/25W.V. electrolytic condenser
CO 311	Condenser—1.0 mmfd ±20% fixed condenser
CT 389	Condenser—dual 3-35 mmfd trimmer condenser
CT 440	Condenser—350-780 mmfd padder condenser
CV 144	Condenser—3 gang variable condenser
DL 454	Dial—glass dial scale
KN 671	Knob—walnut knob marked "VOLUME"
KN 672	Knob—walnut knob marked "OFF-ON TONE"
KN 673	Knob—walnut knob marked "TUNING"
KN 674	Knob—walnut knob marked "BC-SW"
KN 675	Knob—ivory knob marked "VOLUME"
KN 676	Knob—ivory knob marked "OFF-ON TONE"
KN 677	Knob—ivory knob marked "TUNING"
KN 678	Knob—ivory knob marked "BC-SW"
LP 213	Loop—Antenna
PO 334	Pointer
PT 105	Control—2 megohm volume control
PT 106	Control—1/2 megohm tone control (with S.P.S.T. Switch)
RCM20A101M	Condenser—100 mmfd ±20% mica condenser
RCM20A220M	Condenser—22 mmfd ±20% mica condenser
RCM20A221M	Condenser—220 mmfd ±20% mica condenser
RCM20A470M	Condenser—47 mmfd ±20% mica condenser
RCM30B272J	Condenser—2700 mmfd ±5% mica condenser
RCPI0W2104A	Condenser—.1/200 W.V. tubular paper condenser
RCPI0W2203A	Condenser—.02/200 W.V. tubular paper condenser
RCPI0W4104L	Condenser—.1/400 W.V. tubular paper condenser
RCPI0W4503A	Condenser—.05/400 W.V. tubular paper condenser
RCPI0W6103A	Condenser—.01/600 W.V. tubular paper condenser
RCPI0W6203A	Condenser—.02/600 W.V. tubular paper condenser
RCPI0W6502A	Condenser—.005/600 W.V. tubular paper condenser
RCPI0W6602K	Condenser—.006/600 W.V. tubular paper condenser
RE 802	Resistor—200 ohms ±5% 10 watt resistor
RE 804	Resistor—880 ohms 35 watt resistor unit tapped at 260 ohms
REB 104M	Resistor—100,000 ohms ±20% 1/2 watt resistor
REB 105M	Resistor—1 megohm ±20% 1/2 watt resistor
REB 106M	Resistor—10 megohms ±20% 1/2 watt resistor
REB 154M	Resistor—150,000 ohms ±20% 1/2 watt resistor
REB 181K	Resistor—180 ohms ±10% 1/2 watt resistor
REB 223M	Resistor—22,000 ohms ±20% 1/2 watt resistor
REB 225M	Resistor—2.2 megohms ±20% 1/2 watt resistor
REB 331M	Resistor—330 ohms ±20% 1/2 watt resistor
REB 474M	Resistor—470,000 ohms ±20% 1/2 watt resistor
REC 330K	Resistor—33 ohms ±10% 1 watt resistor
RED 101M	Resistor—100 ohms ±20% 2 watt resistor
SK 115	Speaker—6 1/2" P.M. speaker with 2000 ohm output transformer
SO 313	Socket—insulated "U" pilot light socket assembly
SP 191	Spring—dial drive lock spring
ST 412	Back—printed cardboard back
ST 459	Light Diffuser
SW 119	Switch—3 wafer 2 position band switch
TR 118	Transformer—1st & 2nd I.F. transformer 455KC

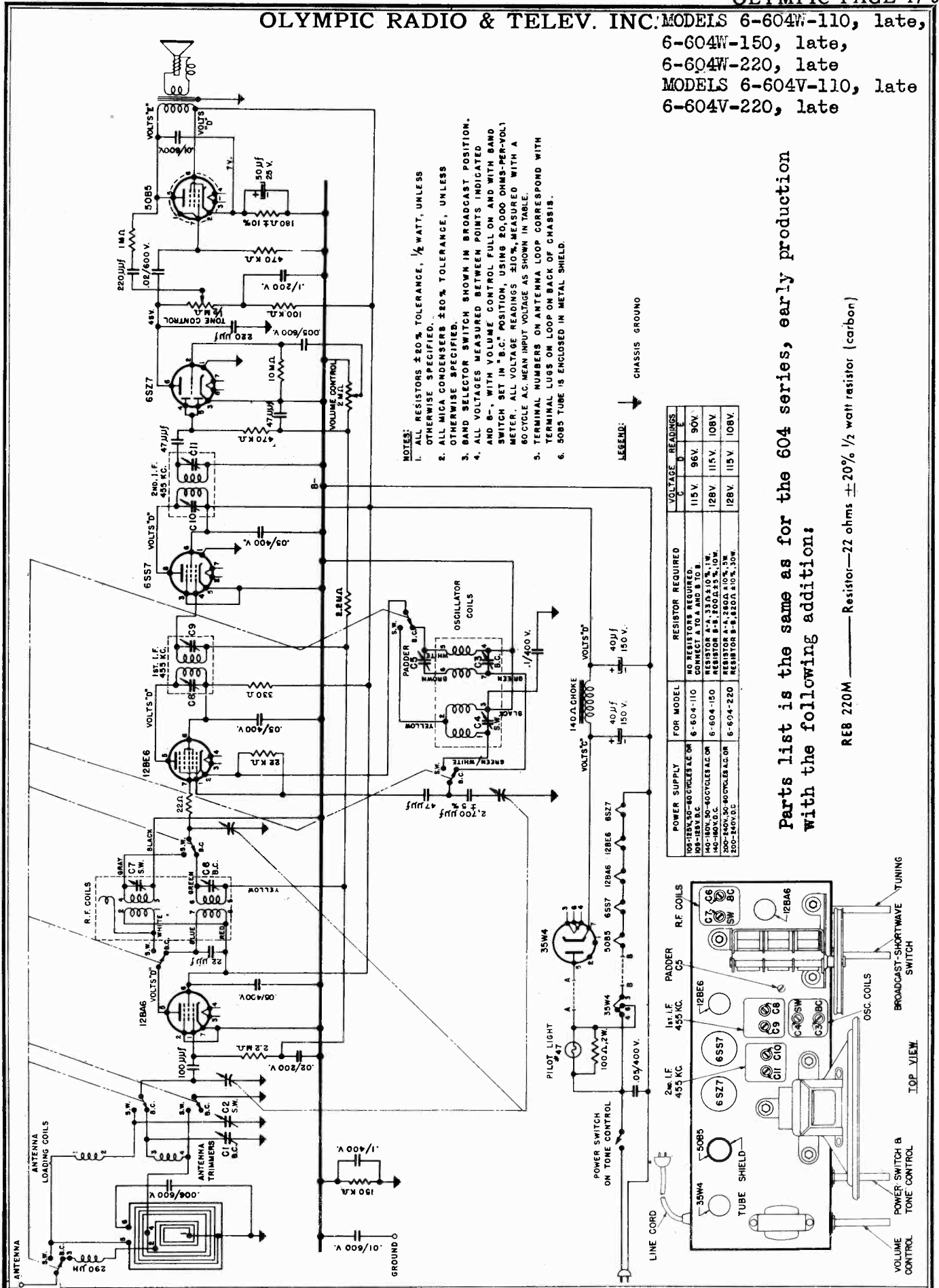
OLYMPIC RADIO & TELEV. INC. MODELS 6-604W-110, late,

6-604W-150, late,

6-604W-220, late

MODELS 6-604V-110, late

6-604V-220, late



- NOTES:
1. ALL RESISTORS ±20% TOLERANCE, 1/2 WATT, UNLESS OTHERWISE SPECIFIED.
 2. ALL MICA CONDENSERS ±20% TOLERANCE, UNLESS OTHERWISE SPECIFIED.
 3. BAND SELECTOR SWITCH SHOWN IN BROADCAST POSITION.
 4. ALL VOLTAGES MEASURED BETWEEN POINTS INDICATED AND B-, WITH VOLUME CONTROL FULL ON AND WITH BAND SWITCH SET IN "B.C." POSITION, USING 20,000 OHMS-PER-VOLT METER. ALL VOLTAGE READINGS ±10%, MEASURED WITH A 60 CYCLE A.C. MEAN INPUT VOLTAGE AS SHOWN IN TABLE.
 5. TERMINAL NUMBERS ON ANTENNA LOOP CORRESPOND WITH 6.
 6. 50B5 TUBE IS ENCLOSED IN METAL SHIELD.

LEGEND: CHASSIS GROUND

POWER SUPPLY	FOR MODEL	RESISTOR REQUIRED	VOLTAGE READINGS		
			C	D	E
120-180V, 50-80 CYCLES A.C. OR 100-180V D.C.	6-604-110	115 REACTOR REQUIRED CONNECT A TO A AND B TO B	115 V.	96 V.	90 V.
140-180V, 50-80 CYCLES A.C. OR 140-180V D.C.	6-604-150	RESISTOR A-A, 33.0Ω±10%, 1W. RESISTOR B-B, 200Ω±5%, 10W.	128 V.	115 V.	108 V.
200-240V, 50-80 CYCLES A.C. OR 200-240V D.C.	6-604-220	RESISTOR A-A, 2.00Ω±10%, 3W. RESISTOR B-B, 5.00Ω±10%, 30W.	128 V.	115 V.	108 V.

Parts list is the same as for the 604 series, early production with the following addition:

REB 220M — Resistor—22 ohms ±20% 1/2 watt resistor (carbon)

"clarified schematics"

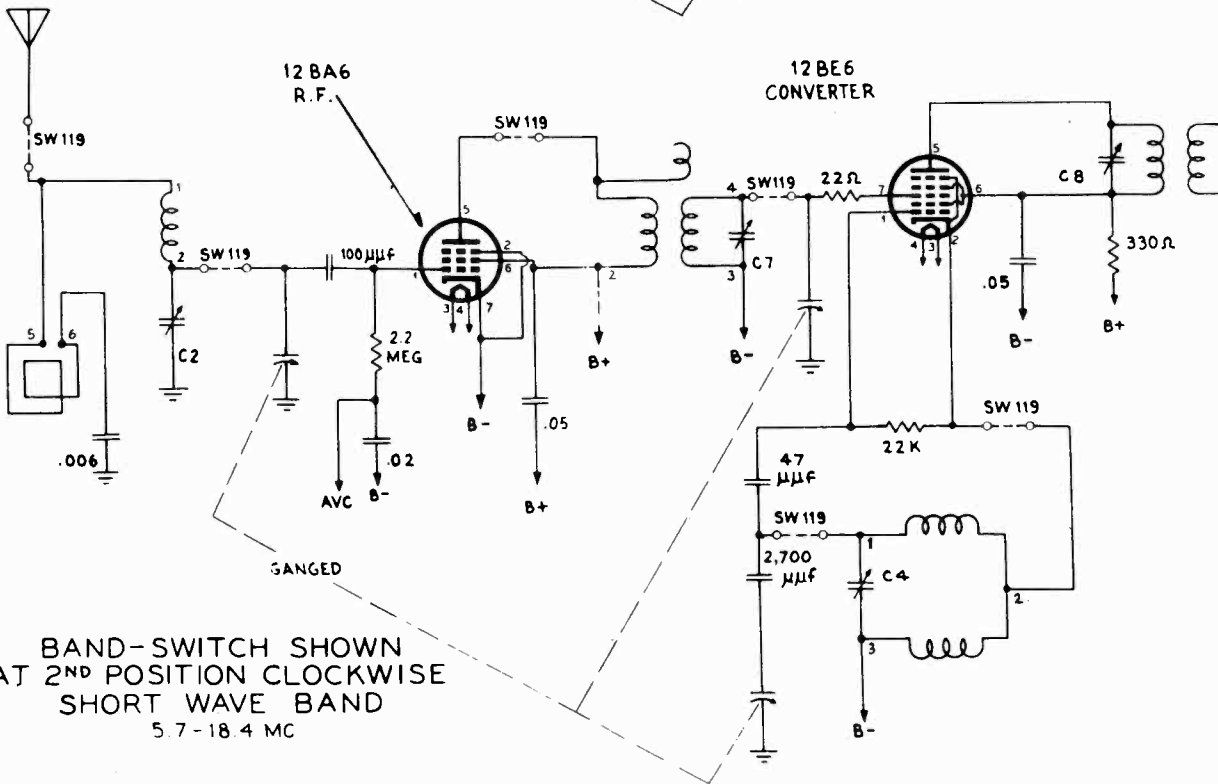
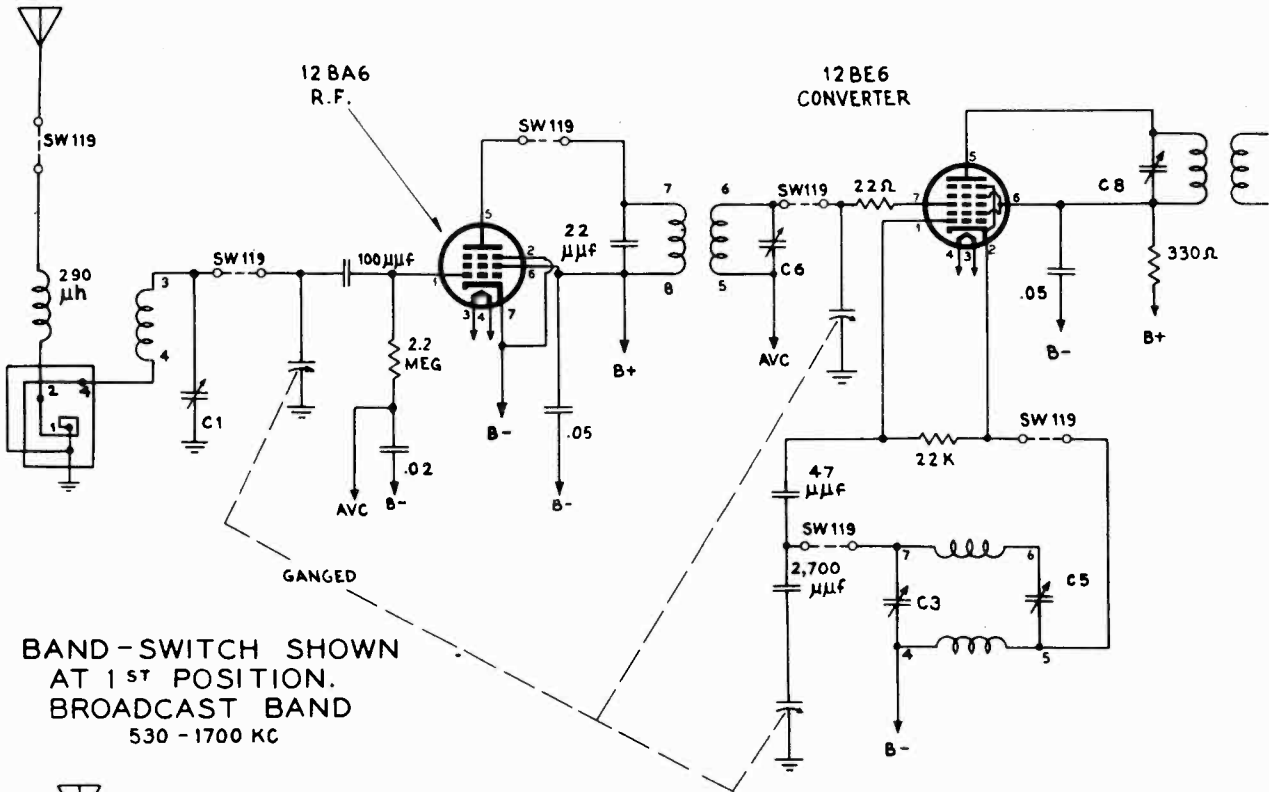
MODELS 6-604W-110, late, OLYMPIC RADIO & TELEV. INC.

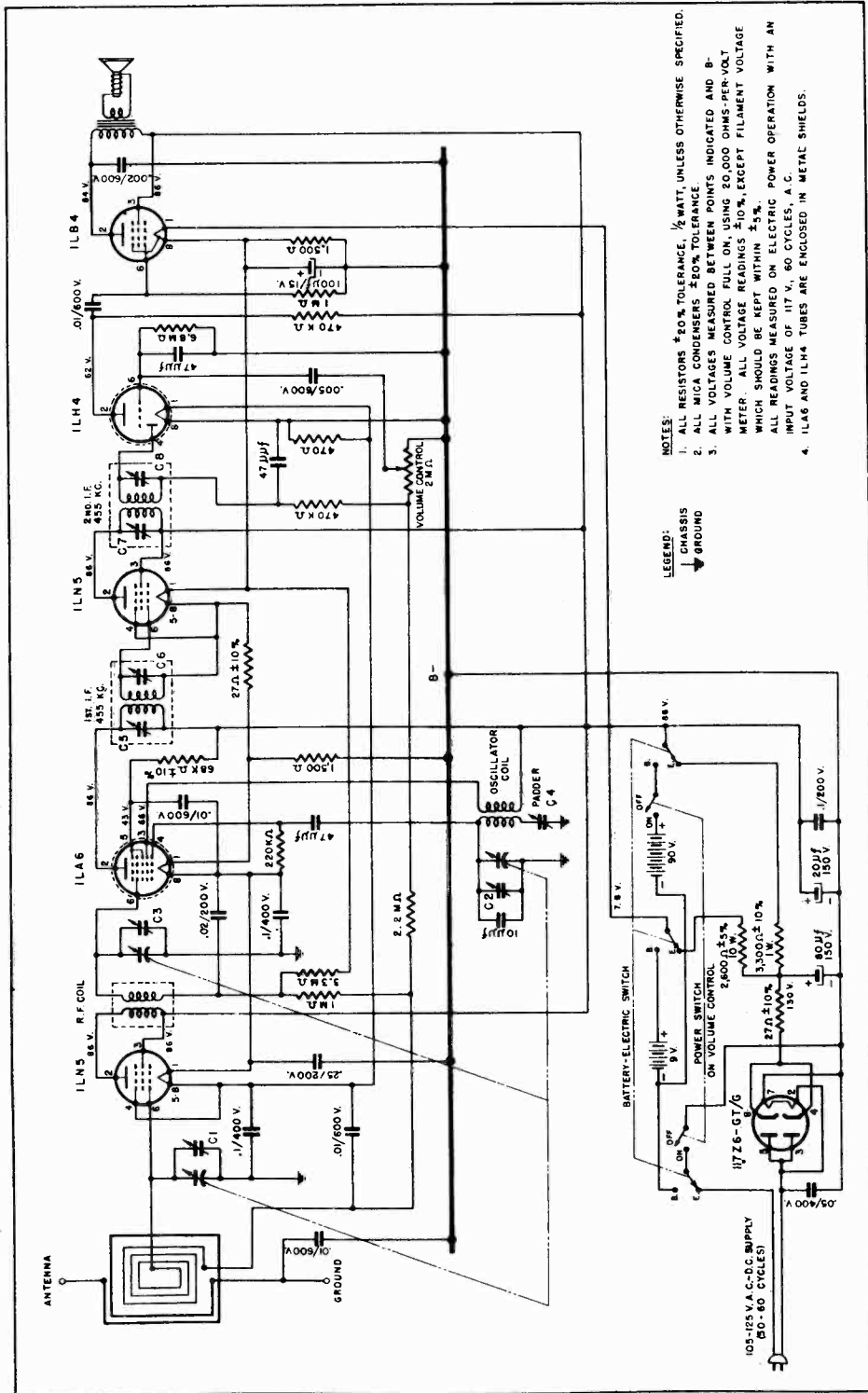
6-604W-150, late,

6-604W-220, late

MODELS 6-604V-110, late,

6-604V-220, late





- LEGEND:
 CHASSIS
 GROUND
- NOTES:
 1. ALL RESISTORS $\pm 20\%$ TOLERANCE, $\frac{1}{2}$ WATT, UNLESS OTHERWISE SPECIFIED.
 2. ALL MICA CONDENSERS $\pm 20\%$ TOLERANCE.
 3. ALL VOLTAGES MEASURED BETWEEN POINTS INDICATED AND B-METER WITH VOLUME CONTROL FULL ON, USING 20,000 OHMS-PER-VOLT WHICH SHOULD BE KEPT WITHIN $\pm 5\%$.
 ALL READINGS MEASURED ON ELECTRIC POWER OPERATION WITH AN INPUT VOLTAGE OF 117 V., 60 CYCLES, A.C. ALL TUBES ARE ENCLOSED IN METAL SHIELDS.

ALIGNMENT PROCEDURE CHART

STEP	CONNECT HIGH SIDE OF SIGNAL GENERATOR TO -	SET SIGNAL GENERATOR TO -	SET POINTER TO -	ADJUST THE FOLLOWING FOR MAXIMUM OUTPUT (KEEP SIGNAL FROM SIGNAL GENERATOR AS LOW AS POSSIBLE.)
1	R.F. SECTION OF VARIABLE CONDENSER IN SERIES WITH 1 MF.D. COND.	455 KC.	EXTREME RIGHT HAND POSITION. (CONDENSER PLATES FULLY OPEN)	C 8, C 7, C 6, C 5 AND REPEAT IN SAME ORDER (1ST. AND 2ND. I.F. TRANSFORMERS)
2	ANTENNA TERMINAL OF ANTENNA LOOP IN SERIES WITH 50 MMFD. COND.	1500 KC.	1500 KC. (150 ON. DIAL)	C 2, C 3, C 1 (OSCILLATOR, R.F. AND ANTENNA TRIMMERS)
3		600 KC.	600 KC. (APPROX. 60 ON DIAL)	C 4 (PADDER)
4				ROCK DIAL FOR MAXIMUM SIGNAL
				REPEAT STEPS 2 AND 3

MODEL 6-606-U
MODEL 6A-606-U

OLYMPIC RADIO & TELEV. INC.

- Frequency Range** 530 - 1700 kc.
- Power Requirement** 105 - 125 volts a-c, 50 to 60 cycles, or 105 - 125 volts d-c, or 9 volts "A" and 90 volts "B" battery supply.
- Power Consumption on electric operation** — 20 watts

Model 6-606 is a portable six tube superheterodyne receiver designed for operation on a-c and d-c, as well as on self contained batteries. It will operate on 105-125 volts a-c, 50 to 60 cycles; 105-125 volts d-c or on 9 volts "A" and 90 volts "B" batteries.

BATTERIES

The batteries recommended for this receiver are two #746 "Eveready" 4½ volt batteries (National Carbon Co.) and two #482 "Eveready" 45 volt batteries (National Carbon Co.) or replacement types of equal size and voltage. To replace batteries, remove back of cabinet by pulling at top of back. Batteries are accessible without removing chassis or loop. Consult layout drawing for correct placement and connections of batteries.

For tube replacement it is not necessary to remove the chassis from the cabinet. Access to the tubes may be made by removing the center screw on the loop holding same to the bracket, and then lifting loop carefully off the bracket so as to avoid breaking of wires connecting same.

For ALIGNMENT the chassis must be removed from case. Remove first batteries and then the three screws holding chassis to the bottom of the shelf.

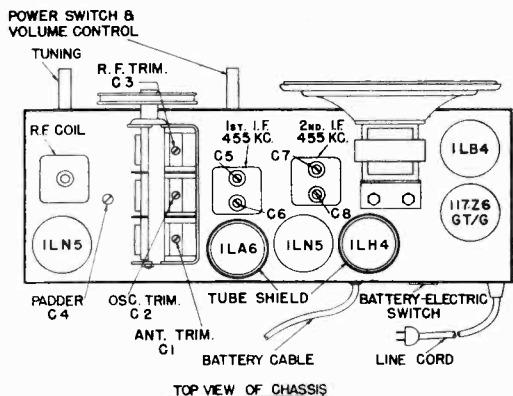
ALIGNMENT

Equipment Required: Modulated r-f signal generator; output meter; insulated screw driver; two .1 mfd 400 volt and one 50 mmfd 400 volt condensers.

Turn variable condenser fully counterclockwise (plates fully closed) and check that pointer coincides with the first thin calibration mark on the dial. Connect the output meter and signal generator as follows:

Output meter: Connect across voice coil and turn volume control to maximum.

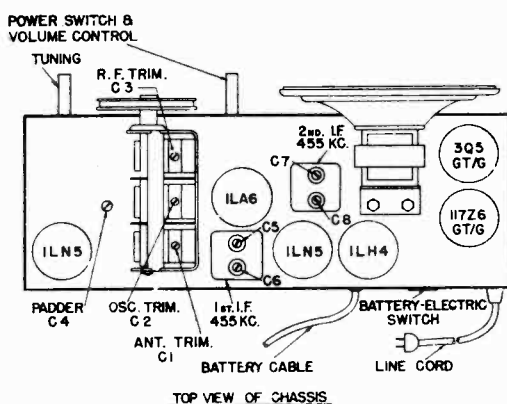
Signal generator: Connect the low side of the signal generator to the receiver chassis thru a .1 mfd condenser and keep output as low as possible, then proceed in the sequence shown on the alignment chart.



TOP VIEW OF CHASSIS

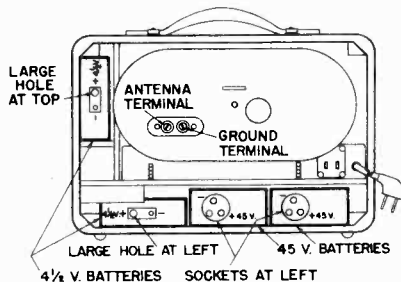
NOTE:
1LA6 AND 1LH4 TUBES ARE ENCLOSED IN METAL SHIELDS.

MODEL 6-606-U



TOP VIEW OF CHASSIS

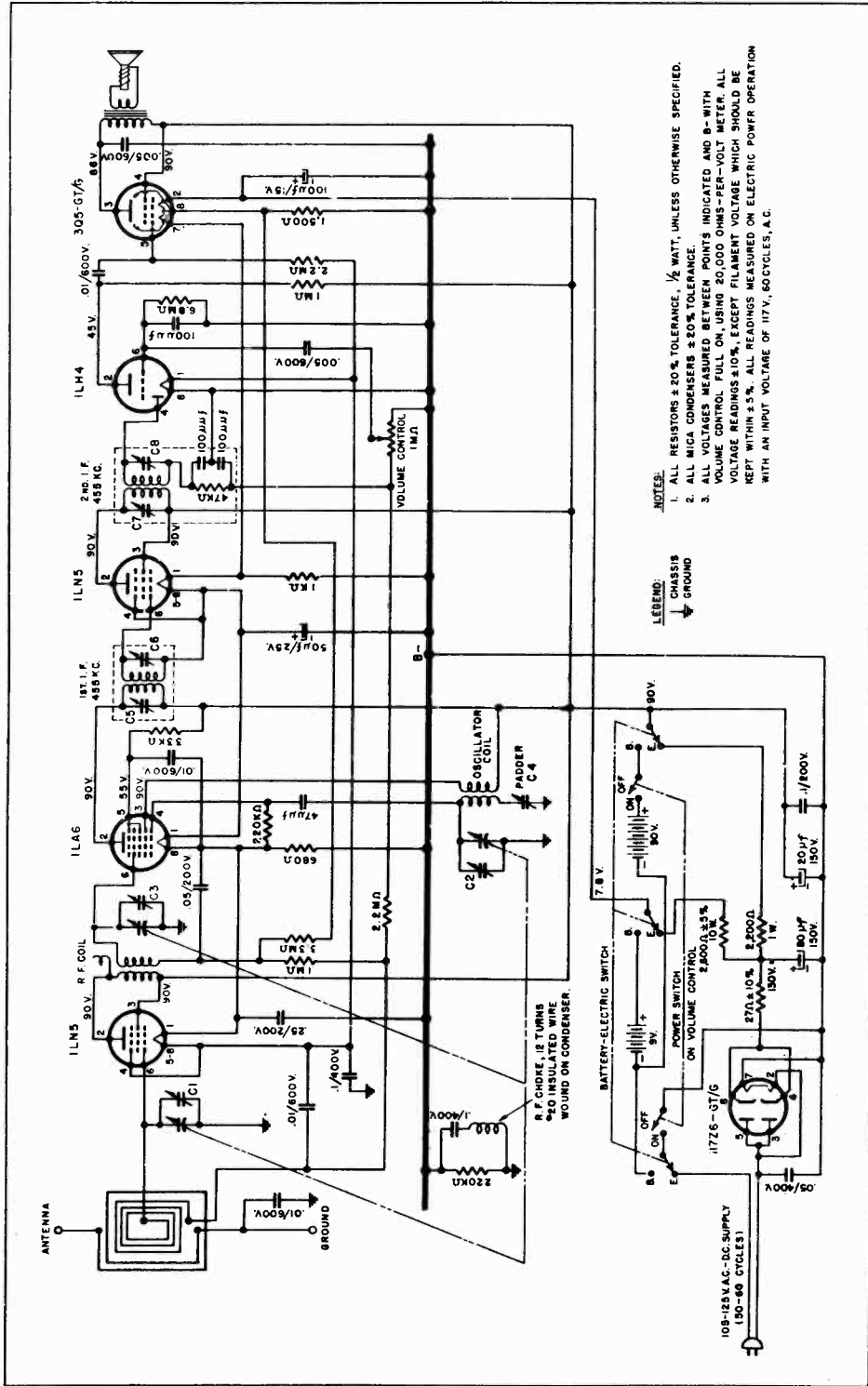
MODEL 6A-606-U



REAR VIEW OF CABINET
SHOWING PLACEMENT OF BATTERIES

REPLACEMENT PARTS

Part No.	Description	Part No.	Description
BK-405	Bracket-Resistor mounting bracket	RCPI0W6202M	Condenser-.002/600W.V. paper tubular condenser
CA-229	Cabinet-portable cabinet	RCPI0W6502A	Condenser-.005/600W.V. paper tubular condenser
CB-335	Cable-battery cable	RE-407	Resistor-2600 ohms $\pm 5\%$ 10 watt resistor
CL-176	Coil-R.F. coil, shielded	REB105M	Resistor-1 megohm $\pm 20\%$ 1/2 watt resistor
CL-177	Coil-oscillator coil	REB152M	Resistor-1500 ohms $\pm 20\%$ 1/2 watt resistor
CO-182	Condenser-80/20/150W.V. & 100/15W.V. electrolytic condenser	REB224M	Resistor-220,000 ohms $\pm 20\%$ 1/2 watt resistor
CR-299	Crystal-dial crystal	REB225M	Resistor-2.2 megohms $\pm 20\%$ 1/2 watt resistor
CT-388	Condenser-220-680 mmfd padder condenser	REB270K	Resistor-27 ohms $\pm 10\%$ 1/2 watt resistor
CV-146	Condenser-3 gang variable condenser (with pulley)	REB335M	Resistor-3.3 megohms $\pm 20\%$ 1/2 watt resistor
DL-391	Dial-metal dial scale	REB471M	Resistor-470 ohms $\pm 20\%$ 1/2 watt resistor
ES-274-1	Escutcheon-moulded escutcheon	REB474M	Resistor-470,000 ohms $\pm 20\%$ 1/2 watt resistor
KN-260	Knob-walnut knob	REB683K	Resistor-68,000 ohms $\pm 10\%$ 1/2 watt resistor
KN-261	Knob-walnut knob with dot	REB685M	Resistor-6.8 megohms $\pm 20\%$ 1/2 watt resistor
LC-223	Line Cord	REC332K	Resistor-3300 ohms $\pm 10\%$ 1 watt resistor
LP-178	Loop-Antenna	SD-607	Shield-Tube Shield
PO-395	Pointer-dial pointer	SK-156	Speaker-5" P.M. Speaker with output transformer
PT-383	Control-volume control 2 megohms with D.P.S.T. switch	SP-191	Spring-Drive shaft retaining spring
RCM20A100M	Condenser-10 mmfd $\pm 20\%$ mica condenser	SW-193	Switch-battery-electric T.P.D.T. slide switch
RCM20A470M	Condenser-47 mmfd $\pm 20\%$ mica condenser	TR-186	Transformer-I.F. 455 K.C. Transformer
RCPI0W2104A	Condenser-.1/200W.V. paper tubular condenser		
RCPI0W2203A	Condenser-.02/200W.V. paper tubular condenser		
RCPI0W2254A	Condenser-.25/200W.V. paper tubular condenser		
RCPI0W4104L	Condenser-.1/400W.V. paper tubular condenser		
RCPI0W4503A	Condenser-.05/400W.V. paper tubular condenser		
RCPI0W6103A	Condenser-.01/600W.V. paper tubular condenser		

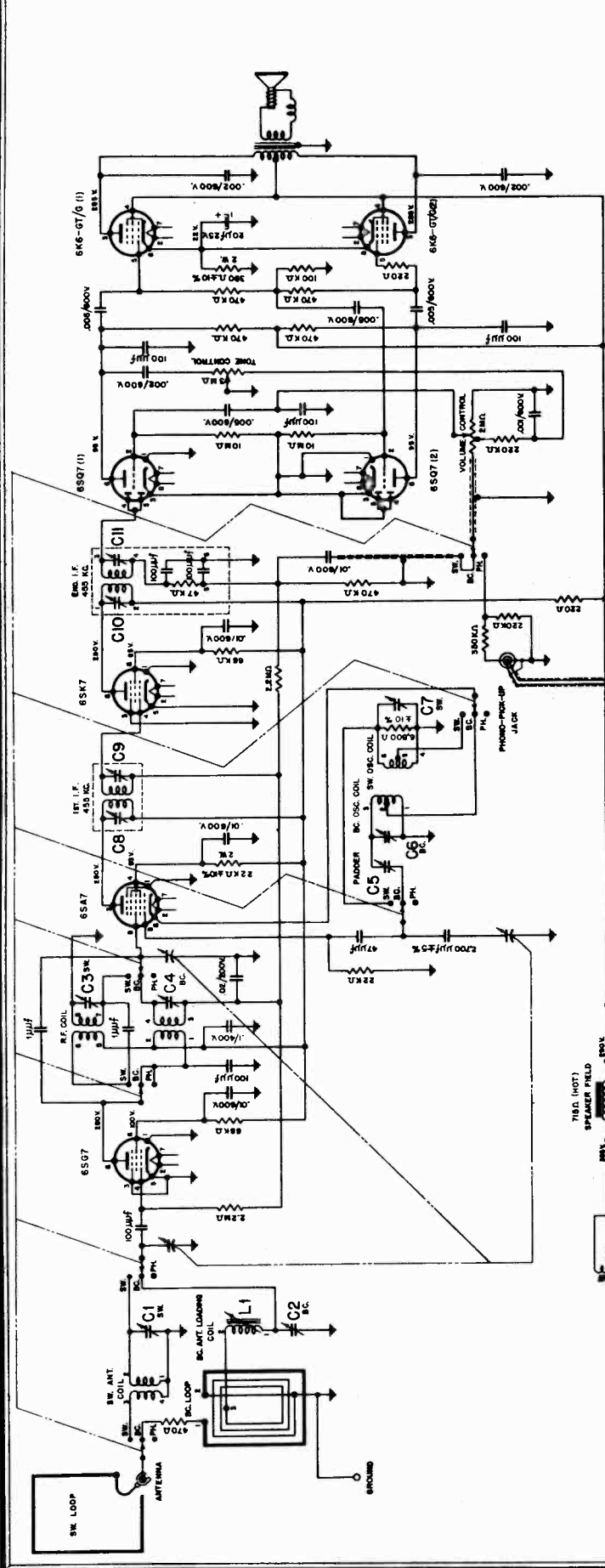


ALIGNMENT PROCEDURE CHART

STEP	CONNECT HIGH SIDE OF SIGNAL GENERATOR TO -	SET SIGNAL GENERATOR TO -	SET POINTER TO -	ADJUST THE FOLLOWING FOR MAXIMUM OUTPUT: (KEEP SIGNAL FROM SIGNAL GENERATOR AS LOW AS POSSIBLE.)
1	R.F. SECTION OF VARIABLE CONDENSER IN SERIES WITH .1 MFD COND.	455 KC.	EXTREME RIGHT HAND POSITION. (CONDENSER PLATES FULLY OPEN)	C 8, C 7, C 6, C 5 AND REPEAT IN SAME ORDER (1ST AND 2ND I.F. TRANSFORMERS)
2	ANTENNA TERMINAL OF ANTENNA LOOP IN SERIES WITH 50 MMFD. COND.	1500 KC.	1500 KC. (150 ON DIAL)	C 2, C 3, C 1 (OSCILLATOR, R.F. AND ANTENNA TRIMMERS)
3		600 KC.	600 KC. (APPROX. 60 ON DIAL)	C 4 (PADDER)
4				ROCK DIAL FOR MAXIMUM SIGNAL
REPEAT STEPS 2 AND 3				

REPLACEMENT PARTS

Part No.	Description	Part No.	Description
BK-405	Bracket-Resistor mounting bracket	RCPI0W6502A	Condenser-.005/600WV paper tubular condenser
CA-229	Cabinet-portable cabinet	RE-407	Resistor-2600 ohms $\pm 5\%$ 10 watt resistor
CB-335	Cable-battery cable	REB102M	Resistor-1000 ohms $\pm 20\%$ 1/2 watt resistor
CL-177	Coil-oscillator coil	REB105M	Resistor-1 megohm $\pm 20\%$ 1/2 watt resistor
CL-630	Coil-R.F. coil	REB152M	Resistor-1500 ohms $\pm 20\%$ 1/2 watt resistor
CO-182	Condenser-80/20/150WV & 100/15WV electrolytic condenser	REB224M	Resistor-220,000 ohms $\pm 20\%$ 1/2 watt resistor
CO 808	Condenser-50 mfd /25 W.V. electrolytic condenser	REB225M	Resistor-2.2 megohms $\pm 20\%$ 1/2 watt resistor
CR-299	Crystal-dial crystal	REB270K	Resistor-27 ohms $\pm 10\%$ 1/2 watt resistor
CT-388	Condenser-220-680 mmfd paddercap condenser	REB333M	Resistor-33,000 ohms $\pm 20\%$ 1/2 watt resistor
CV-146	Condenser-3 gang variable condenser (with pulley)	REB335M	Resistor-3.3 megohms $\pm 20\%$ 1/2 watt resistor
DL-391	Dial-metal dial scale	REB 681M	Resistor-680 Ohms $\pm 20\%$ 1/2 watt resistor
ES-274-1	Escutcheon-moulded escutcheon	REB685M	Resistor-6.8 megohms $\pm 20\%$ 1/2 watt resistor
KN-260	Knob-walnut knob	REC 222M	Resistor-2200 ohms $\pm 20\%$ 1 watt resistor
KN-261	Knob-walnut knob with dot	SK-476	Speaker-5" P.M. Speaker with output transformer
LP-178	Loop-Antenna	SP-191	Spring-Drive shaft retaining spring
PO-395	Pointer-dial pointer	SW-193	Switch-battery-electric T.P.D.T. slide switch
PT-576	Control-volume control 1 megohm with D.P.S.T. switch	TR-707	Transformer-I.F. 455 K.C. input-Transformer
RCM20A101M	Condenser-100 mmf $\pm 20\%$ mica condenser	TR-708	Transformer-Output I.F. 455 K.C. Transformer with built-in I.F. filter
RCM20A470M	Condenser-47 mmfd $\pm 20\%$ mica condenser		
RCP10W2254A	Condenser-.25/200W.V. paper tubular condenser		
RCP10W4104L	Condenser-.1/400W.V. paper tubular condenser		
RCP10W4503A	Condenser-.05/400WV paper tubular condenser		
RCP10W6103A	Condenser-.01/600WV paper tubular condenser		

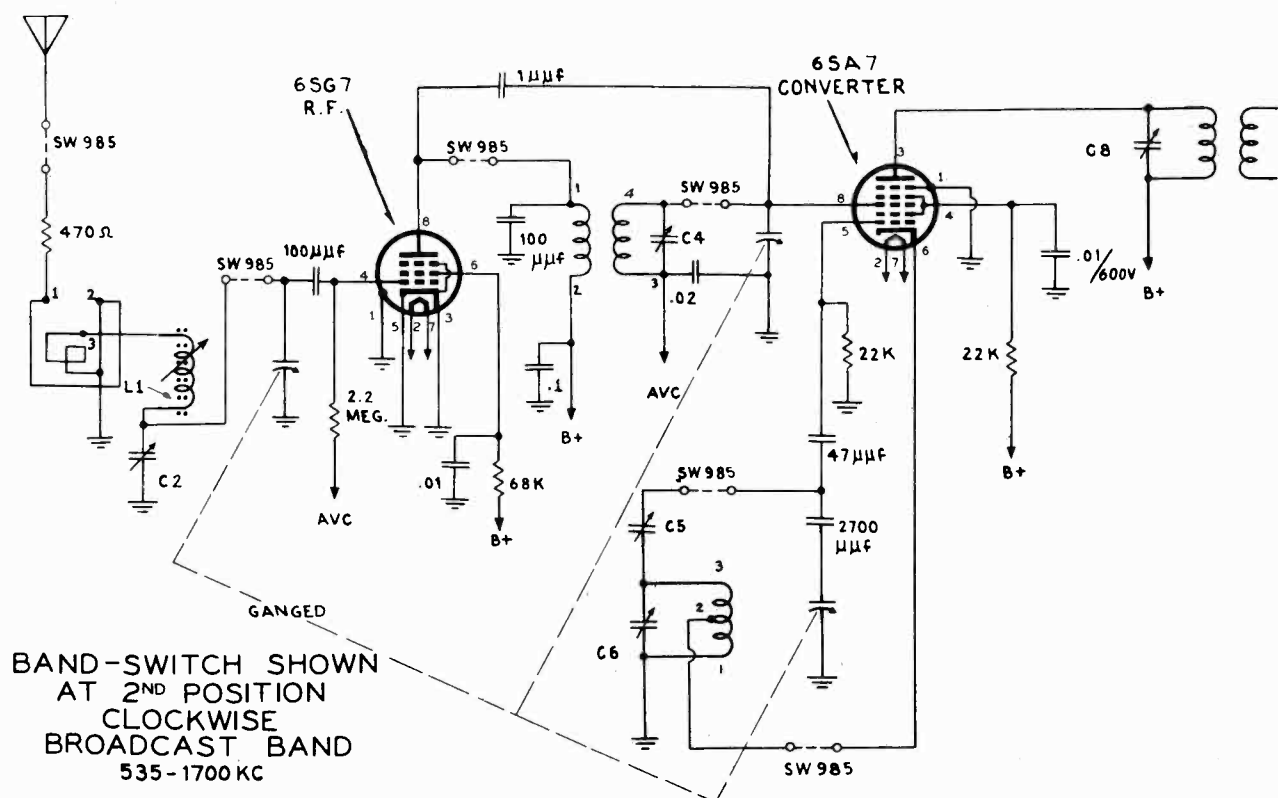
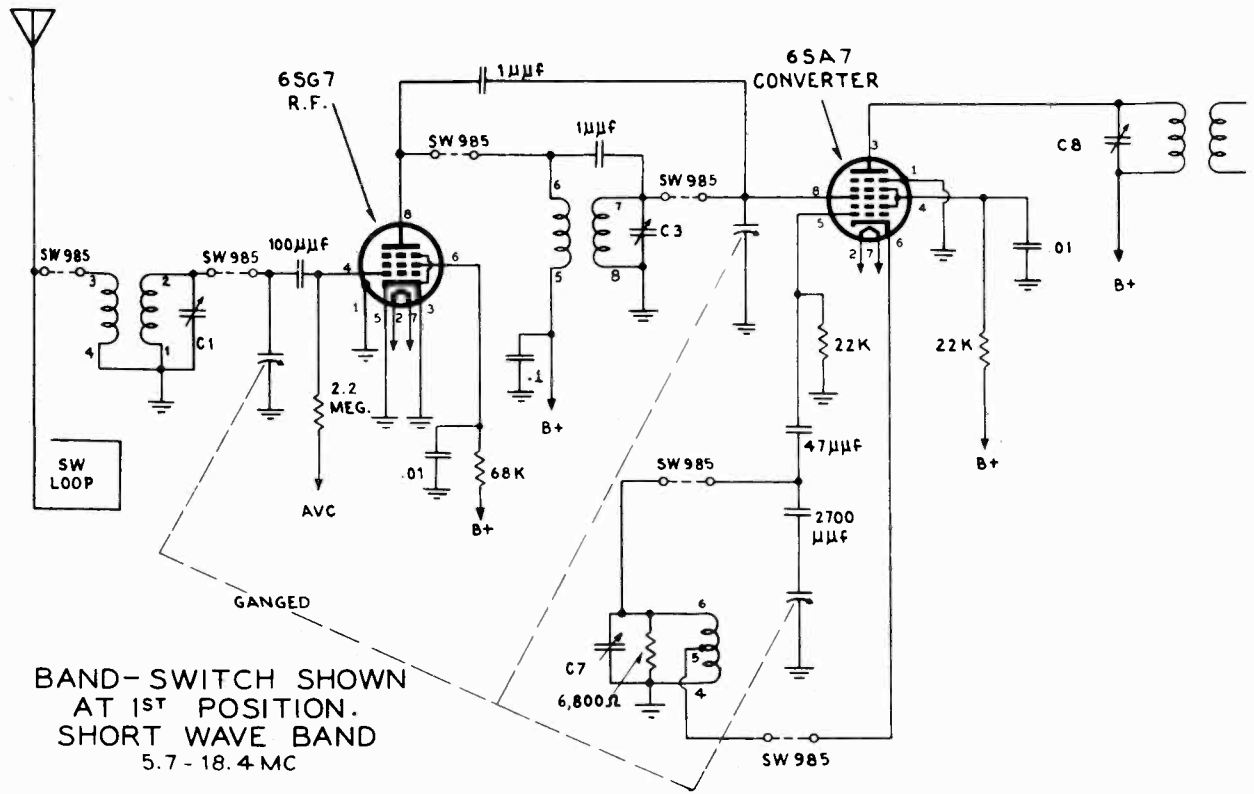


- NOTES:**
- 1. ALL RESISTORS $\pm 20\%$ TOLERANCE, $1/2$ WATT, UNLESS OTHERWISE SPECIFIED.
 - 2. ALL MICA CAPACITORS $\pm 20\%$ TOLERANCE, UNLESS OTHERWISE SPECIFIED.
 - 3. BAND SELECTOR SWITCH SHOWN IN WINDUZZ POSITION.
 - 4. ALL VOLTAGES MEASURED BETWEEN POINTS INDICATED AND GROUND, WITH VOLUME CONTROL FULL ON AND BAND SWITCH SET IN "BC" POSITION, UNLESS OTHERWISE SPECIFIED.

- REB 223M Resistor—22,000 ohms $\pm 20\%$ $1/2$ watt resistor
- REB 224M Resistor—220,000 ohms $\pm 20\%$ $1/2$ watt resistor
- REB 225M Resistor—2.2 megohms $\pm 20\%$ $1/2$ watt resistor
- REB 334M Resistor—330,000 ohms $\pm 20\%$ $1/2$ watt resistor
- REB 471M Resistor—470 ohms $\pm 20\%$ $1/2$ watt resistor
- REB 474M Resistor—470,000 ohms $\pm 20\%$ $1/2$ watt resistor
- REB 682K Resistor—6,800 ohms $\pm 10\%$ $1/2$ watt resistor
- REB 683K Resistor—68,000 ohms $\pm 10\%$ $1/2$ watt resistor
- REB 223K Resistor—22,000 ohms $\pm 10\%$ $1/2$ watt resistor
- REB 391K Resistor—390 ohms $\pm 10\%$ $1/2$ watt resistor
- REB 473M Resistor—47,000 ohms $\pm 20\%$ $1/2$ watt resistor
- SK 384 Speaker—12" dynamic speaker 715 ohms (12,000 ohms transformer)
- SP 191 Spring—lock spring (for dial drive)
- SP 218 Spring—pointer drive spring
- SW 985 Switch—3 wafers—3 position band switch
- TR 781 Transformer—input I.F. transformer—shielded
- TR 782 Transformer—output I.F. transformer—shielded
- TR 981 Transformer—power transformer

- KN 423 Knob—walnut "off-on tone" knob
- KN 425 Knob—walnut "tuning" knob
- KN 430 Knob—walnut "SW-BC-PH" knob
- LP 1008 Loop—antenna loop
- NE 322 Needle—permanent needle
- PO 1011 Pointer—dial-pointer
- PT 568 Control—2 megohms tapped volume control
- PT 567 Control—3 megohms tone control (S.P.S.T.)
- RCM20A101M Condenser—100 MMFD. 20% mica condenser
- RCM20A470M Condenser—47 MMFD. 20% mica condenser
- RCM30B272J Condenser—2700 MMFD. 5% mica condenser
- RCPI0W2203A Condenser—.02/200 W.V. paper tubular condenser
- RCPI0W4104L Condenser—.1/400 W.V. paper tubular condenser
- RCPI0W4503A Condenser—.05/400 W.V. paper tubular condenser
- RCPI0W6107A Condenser—.001/600 W.V. paper tubular condenser
- RCPI0W6103A Condenser—.01/600 W.V. paper tubular condenser
- RCPI0W6207M Condenser—.002/600 W.V. paper tubular condenser
- RCPI0W6502A Condenser—.005/600 W.V. paper tubular condenser
- REB 104M Resistor—100,000 ohms $\pm 20\%$ $1/2$ watt resistor
- REB 106M Resistor—10 megohms $\pm 20\%$ $1/2$ watt resistor
- REB 221M Resistor—220 ohms $\pm 20\%$ $1/2$ watt resistor

- | Part No. | Description |
|----------|--|
| BU 187 | Bulb—#47 pilot light bulb |
| CB 1070 | Cable—speaker cable assembly |
| CL 998 | Coil—antenna loading coil (BC) |
| CL 999 | Coil—antenna transformer coil (SW) |
| CL 1000 | Coil—R.F. coil (BC & SW) |
| CL 1001 | Coil—oscillator coil (BC & SW) |
| CO 768 | Condenser—30/20/450 W.V. & 20/25 W.V. electrolytic condenser |
| CO 311 | Condenser—1.0 MMFD. 20% fixed condenser |
| CT 389 | Condenser—dual 3-35 MMFD. trimmer condenser |
| CT 440 | Condenser—350-780 MMFD. paddler condenser |
| CT 1002 | Condenser—1.6-18 MMFD. trimmer condenser |
| CV 144 | Condenser—3 gang variable condenser |
| DL 1003 | Dial—glass dial scale |
| IC 1015 | Core—iron core |
| KN 422 | Knob—walnut "volume" knob |



MODEL 7-724

ALIGNMENT

Equipment Required: Modulated r-f signal generator; output meter; insulated screw driver; one .1 mfd 400 volts and one 400 ohm resistor.

With the receiver removed from the cabinet, connect output meter across voice coil. Connect ground side of the signal generator to chassis; turn volume control fully on, and keeping the output of the signal generator as low as possible, proceed in the sequence as shown on the alignment chart.

Before aligning, close the variable condenser fully counterclockwise (plates fully closed) and check that pointer coincides with the "reference line" on the dial scale. THIS IS THE LINE DIRECTLY UNDERNEATH THE LETTERS SW ON UPPER SCALE. To insure proper alignment, it is suggested to use a radiated signal. To radiate a signal connect the loop of about 6" to 8" diameter 1 turn of #14 or #12 wire across the output of the signal generator and place this loop parallel to the loop of the receiver to be aligned at a distance of about 8" or 10".

To remove this receiver from the console it is first necessary to disconnect the connector plugs for the loop; speaker; phono input and phono motor from the chassis, and the female connector plug from the speaker. Then remove the four knobs and the four screws holding the chassis to its mounting panel. CAUTION: WHEN REMOVING THE CHANGER BE SURE TO PLACE IT IN A POSITION WHEREBY THE CHANGER MECHANISM WILL NOT BE DAMAGED.

ALIGNMENT PROCEDURE CHART			ADJUST THE FOLLOWING FOR MAXIMUM OUTPUT. (KEEP SIGNAL FROM SIGNAL GENERATOR AS LOW AS POSSIBLE.)
SET BAND SWITCH ON	CONNECT HIGH SIDE OF SIGNAL GENERATOR TO—	TURN POINTER TO—	
1 B C	R.F. SECTION OF VARIABLE CONDENSER OR PIN B OF THE 6SA7 TUBE IN SERIES WITH A .1MFD. 400 VOLT CONDENSER.	EXTREME RIGHT HAND POSITION (CONDENSER PLATES FULLY OPEN).	C 11 AND C 10 (2nd I.F. TRANSFORMER)
2 B C			C 9 AND C 8 (1st. I.F. TRANSFORMER)
3 B C		REPEAT STEPS 1 AND 2	
4 B C	ANTENNA SECTION OF VARIABLE CONDENSER	1700 KC. CALIBRATION POINT	C 6 (OSCILLATOR TRIMMER)
5 B C	RESONANCE, APPROXIMATELY 1500 KC.	RESONANCE, APPROXIMATELY 1500 KC. CALIBRATION POINT	C 4 (R.F. TRIMMER)
6 B C	RESONANCE, APPROXIMATELY 600 KC.	RESONANCE, APPROXIMATELY 600 KC. CALIBRATION POINT.	C 5 (PADDER)
7 B C		REPEAT STEPS 4, 5, AND 6	
8 B C	USE RADIATED SIGNAL (CONNECT BOTH SIDES TO RADIATION LOOP).	RESONANCE, APPROXIMATELY 600 KC.	L 1 (ANTENNA LOADING COIL) ROCK VARIABLE FOR MAXIMUM SIGNAL
9 B C		RESONANCE, APPROXIMATELY 1500 KC.	C 2 (ANTENNA TRIMMER)
10 B C		REPEAT STEPS 8 AND 9	
11 S W	ANTENNA POST IN SERIES WITH 400 OHM RESISTOR	18 MC. CALIBRATION POINT	C 7 (OSCILLATOR TRIMMER) SECOND PEAK FROM TIGHT POSITION C 3 (I.F. TRIMMER) FIRST PEAK FROM TIGHT POSITION C 1 (ANTENNA TRIMMER) FIRST PEAK FROM TIGHT POSITION
12 S W		6 MC. RESONANCE	ROCK VARIABLE FOR MAXIMUM SIGNAL. CHECK THAT POINTER (AT RESONANCE) COINCIDES WITH 6 MC. CALIBRATION POINT. IF NOT, REPEAT STEP 11.
13 S W		REPEAT STEPS 11 AND 12	

NOTE: In order to adjust the short wave oscillator trimmer accurately to the fundamental frequency and not to the image signal, turn the trimmer first to the maximum capacity position (fully tight). From this position loosen the trimmer through one peak indication on the output meter until a second peak is obtained. Adjust for maximum output on this second peak. To check whether this procedure has been accurately performed, ascertain that an image signal can be received (much weaker) by tuning the signal generator to a frequency 910 kilocycles above the alignment frequency.

