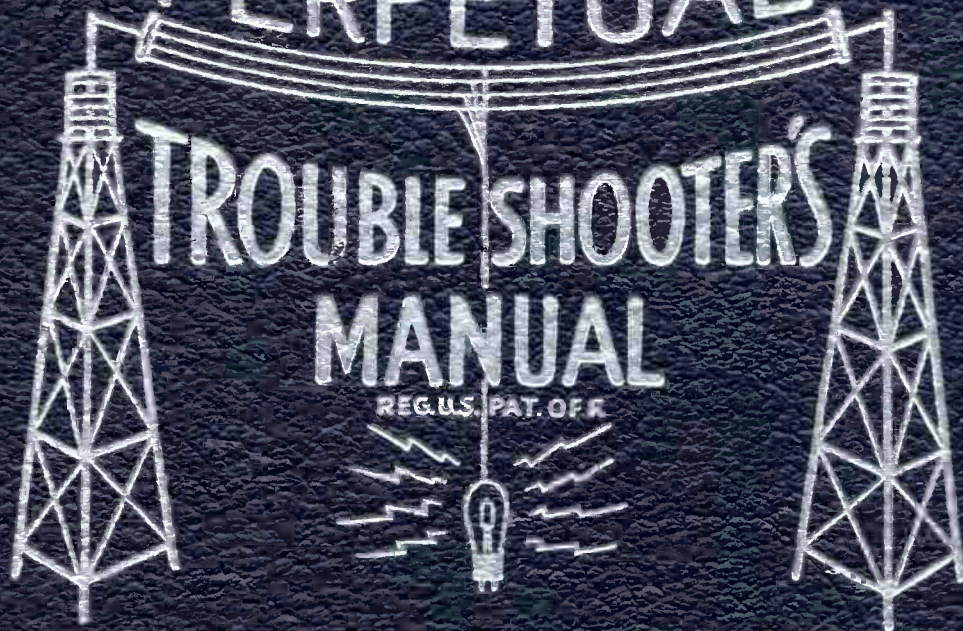


VOLUME XIX

PERPETUAL



JOHN F. RIDER





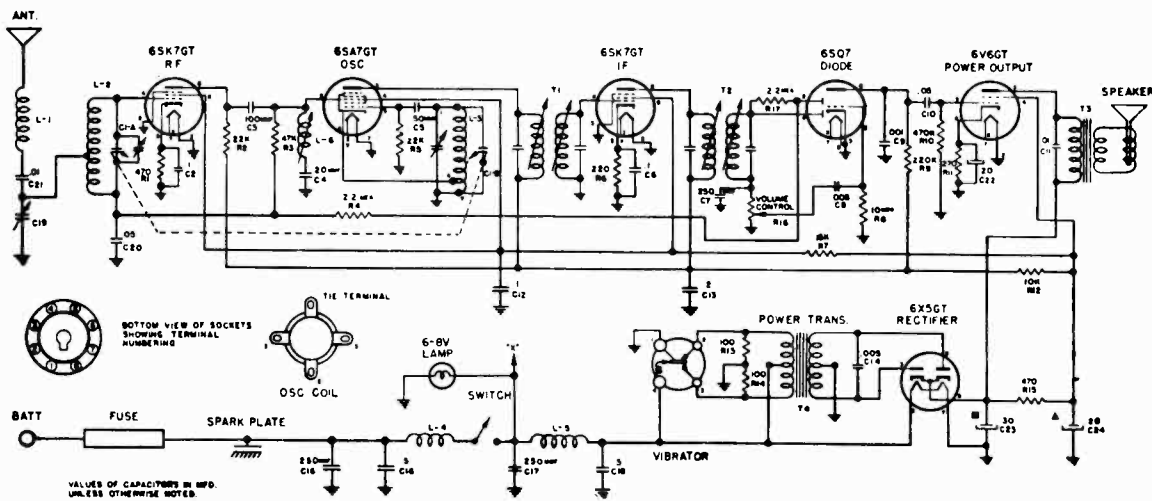


Fig. 3 Schematic Diagram

### ALIGNMENT PROCEDURE

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

- The following equipment is necessary for proper alignment:
- Signal generator that will provide the test frequencies as listed.
- Non-metallic screwdriver.
- Output meter.
- Dummy antennas—.1 MFD., .00025 MFD.

For alignment points refer to Figures 4 and 5.

Dial Setting	Generator Frequency	Dummy Ant.	Generator Connections	Trimmer Reference	Trimmer Adjustment	Trimmer Function
Fully Open	455 KC	.1 MFD.	6SA7 Grid	T2	Maximum	Output I.F.
Fully Open	455 KC	.1 MFD.	6SA7 Grid	T1	Maximum	Input I.F.
Fully Open	455 KC	.00025 MFD.	Ant. lead	L6	Minimum	Wave trap
Fully Open	1600 KC	.00025 MFD	Ant. lead	C18	Maximum	Oscillator
Tune in signal from generator	1400 KC	.00025 MFD.	Ant. lead	C1A	Maximum	Antenna

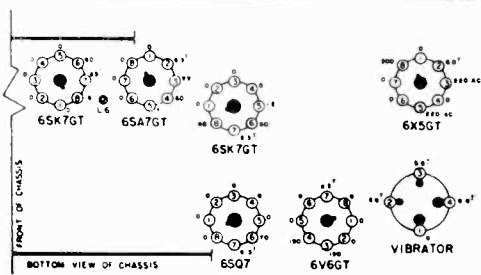


Fig. 4 Socket Voltages

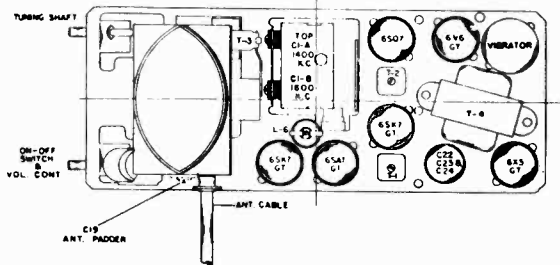


Fig. 5 Tube and Trimmer Locations

## INSTRUCTIONS FOR REMOVING CHASSIS FROM THE CASE

The bottom cover (the one with the speaker louvers) can be removed to permit servicing of major components, such as tubes and vibrator, by removing the eight (8) screws holding it to the top cover. There are three (3) screws on each side, one (1) in the rear, and one (1) in the front.

**CAUTION:** Before attempting to remove the top cover, to service condensers, resistors, etc., the screw connecting the spark plate to the "A" terminal (inside case) must be removed. This is a round head screw, and is located on the rear of the case, close to the mounting stud bolt. It is recessed in a 1/2 inch hole in the case itself, thereby permitting contact with the spark plate.

After removing the spark plate screw, remove the two knobs by pulling forward and remove the eight (8) screws securing the cover to the chassis. Lift the chassis at the rear, at the same time moving it away from the front of the case so that the volume and tuning shafts will clear the holes in the cover.

**NOTE:** When reinstalling the chassis into the case, be sure the screw connecting the spark plate to the "A" terminal (inside case) is tightened very securely, otherwise the receiver will not operate properly.

## SERVICE NOTES

Voltages taken from the different points of the circuit to the chassis are measured with volume control in maximum position, all tubes in their sockets, no signal applied, and with a volt meter having a resistance of 20,000 ohms per volt. These voltages are clearly shown on the voltage chart, (Fig. 4).

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

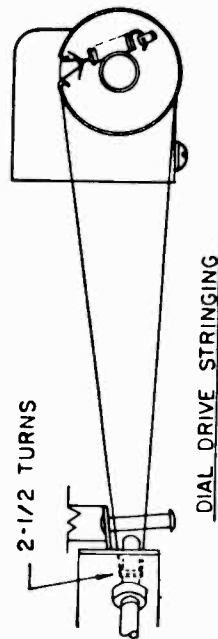
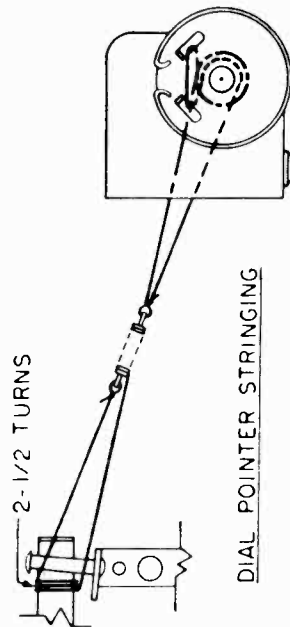
## FINAL ADJUSTMENTS

The input circuit has been especially designed to be used with a low capacity antenna, of the fish pole or whip type.

To adjust the antenna trimmer condenser, carefully tune the receiver to a weak station at approximately 600 kilocycles (K.C.). Remove the snap button covering the antenna trimmer (See Figure 2) and adjust the trimmer for maximum volume. A small screw driver will be needed for this purpose.

## ALIGNING INSTRUCTION

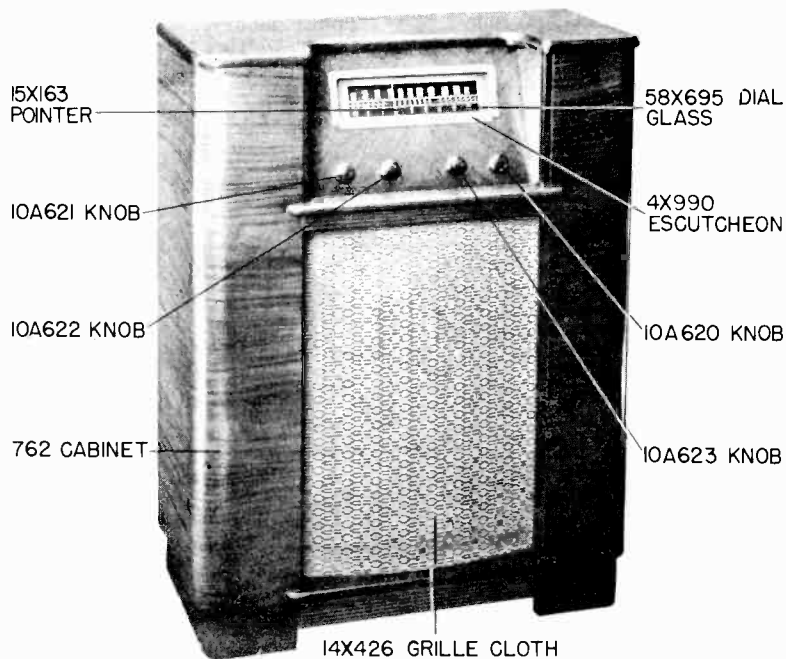
Never attempt any adjustments on this receiver unless it becomes necessary to replace a coil or transformer, or the adjustments have been tampered with in the field. Always make certain that other circuit components, such as tubes, condensers, resistors, etc., are normal before proceeding with realignment.





MODEL 43-5006,

SYMBOL	PART NO.	DESCRIPTION	VALUE	TOL.	RATING
CONDENSERS					
C1A, C1B	B19-196	Variable condenser			
C2, C6, C12	A16-187	Condenser	.1 MFD		400 volt
C3	A15-196	Ceramic condenser	100 MMFD		
C4	A15-202	Ceramic condenser	20 MMFD		
C5	A15-204	Ceramic condenser	50 MMFD		
C7, C15, C17	A15-176	Mica condenser	250 MMFD		
C8	A16-190	Condenser	.005 MFD		600 volt
C9	A16-195	Ceramic condenser	.001 MFD		
C10	A16-193	Condenser	.05 MFD		600 volt
C11, C21	A16-192	Condenser	.01 MFD		400 volt
C13	A16-188	Condenser	.2 MFD		400 volt
C14	A16-185	Oil filled condenser	.005 MFD		1600 volt
C16, C18	A16-184	Condenser	.5 MFD		100 volt
C19	A20-145	Trimmer condenser			
C20	A16-189	Condenser	.05 MFD		400 volt
C22		Electrolytic condenser	20 MFD		25 volt
C23	A18-289	Electrolytic condenser	30 MFD		350 volt
C24		Electrolytic condenser	20 MFD		350 volt
RESISTORS					
R1	A60-722	Resistor	470 ohm	20%	1/2 watt
R13, R14	A60-752	Resistor	100 ohm	10%	1/2 watt
R2, R5	A60-744	Resistor	22K ohm	10%	1/2 watt
R3	A60-685	Resistor	47K ohm	20%	1/2 watt
R4, R17	A60-726	Resistor	2.2 megohm	20%	1/2 watt
R6	A60-753	Resistor	220 ohm	10%	1/2 watt
R7	A60-716	Resistor	15K ohm	10%	1 watt
R8	A60-728	Resistor	10 megohm	20%	1/2 watt
R9	A60-667	Resistor	220K ohm	20%	1/2 watt
R10	A60-731	Resistor	470K ohm	20%	1/2 watt
R11	A60-754	Resistor	270 ohm	10%	1 watt
R12	A60-698	Resistor	1CK ohm	10%	1 watt
R15	A60-694	Resistor	470 ohm	10%	1 watt
R16	A24-177	Volume Control, w/switch	500,000 ohm		
COILS AND TRANSFORMERS					
L1	A10-513	Antenna loading coil			
L2	B10-511	Antenna coil			
L3	A10-512	Oscillator coil			
L4	A33-229	Choke, "A" line			
L5	A33-228	Choke, vibrator hash			
L6	A10-510	I.F. trap coil			
T1	A10-508	1st I.F. transformer			
T2	A10-509	2nd I.F. transformer			
T3	B80-242	Output transformer (part of speaker)			
T4	B80-243	Power transformer			
CABINET, DIAL, AND TUNING PARTS					
	A11-303	Bracket, dial scale			
	A11-304	Bracket, string guide			
	A72-29	Bushing, tuning shaft bearing			
	A70-130	Clip, spring, for tuning shaft			
	D40-141	Dial escutcheon			
	A58-55	Dial pointer			
	B67-522	Dial scale			
	A28-101	Gasket for speaker			
	A52-257	Knob			
	A89-10	Pilot light, type G.E. No. 422			
	A65-37	Rivet, shoulder, for string guide bracket			
	A75-68	Shaft, tuning			
	A75-67	Shaft, for dial pointer			
	A70-132	Spring, for pilot light socket			
	A70-133	Spring, string tension, pointer drive, and tuning			
MISCELLANEOUS					
	A83-421	Clip, I.F. transformer mounting			
	A83-517	Clip, oscillator coil mounting			
	A43-10	Fuse, 15 Amp.			
	A47-112	Grommet, rubber (for mounting speaker and variable condenser)			
	B31-134	Mounting strap, rear			
	A31-139	Mounting plate, front			
	S84-192	Mounting parts kit			
	A87-38	Receptacle, antenna cable			
	B79-362	Speaker, 4" P.M. (includes output transformer)			
	S84-193	Suppression kit assembly			
	A34-105	Vibrator			
	A83-519	Wiper, grounding, for case covers			



## ALIGNMENT PROCEDURE

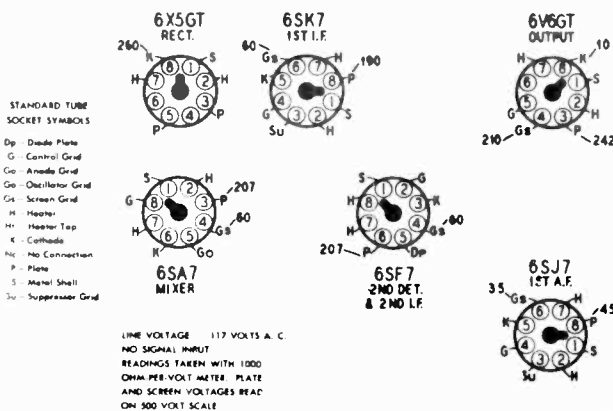
Volume Control—Maximum all adjustments.  
 Connect radio chassis to ground post of signal generator with a short heavy lead.  
 Allow chassis and signal generator to "heat up" for several minutes.  
 The following equipment is required for aligning:

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.

	SIGNAL GENERATOR FREQUENCY SETTING	CONNECTION AT RADIO	DUMMY ANTENNA	BAND SWITCH SETTING	CONDENSER SETTING	ADJUST TRIMMERS TO MAXIMUM
I. F. RANGE B	455 Kc.	Grid of 6SA7 Pin 8	.1 mf.	B Range	Turn Rotor to Full Open	2nd I.F. (Pri.) and (Sec.) 1st I.F. (Pri.) and (Sec.)
	1,620 Kc.	Antenna Lead	50 mmf.	B Range	Turn Rotor to Full Open	Oscillator Range B
	1,400 Kc.	Antenna Lead	60 mmf.	B Range	Tune Rotor to Max. Output Set Pointer to 1,400 Kc. (See Note A)	Antenna Range B
	600 Kc.	Antenna Lead	50 mmf.	B Range	Tune Rotor to Max. Output	Oscillator (600 Kc. Padder) Rock Rotor See Note B
Repeat above steps at 1,620 and 600 Kc. until readjusting the oscillator. Range B Trimmer causes no further improvement of output.						
RANGE D	18.3 Mc.	Antenna Lead	400 ohm	D Range	Turn Rotor to Full Open	Oscillator Range D
	16 Mc.	Antenna Lead	400 ohm	D Range	Tune Rotor to Max. Output	Antenna Range D Rock Rotor—See Note B
LOOP RANGE B	Reassemble chassis in cabinet.					
	1,400 Kc.	Antenna Lead	50 mmf.	B Range	Tune Rotor to Max. Output	Antenna Range B

NOTE A—Set pointer at the 1,400 KC. mark on the dial scale. Attach pointer to drive cord.

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

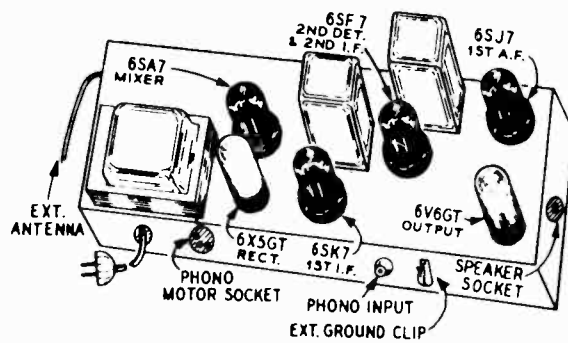
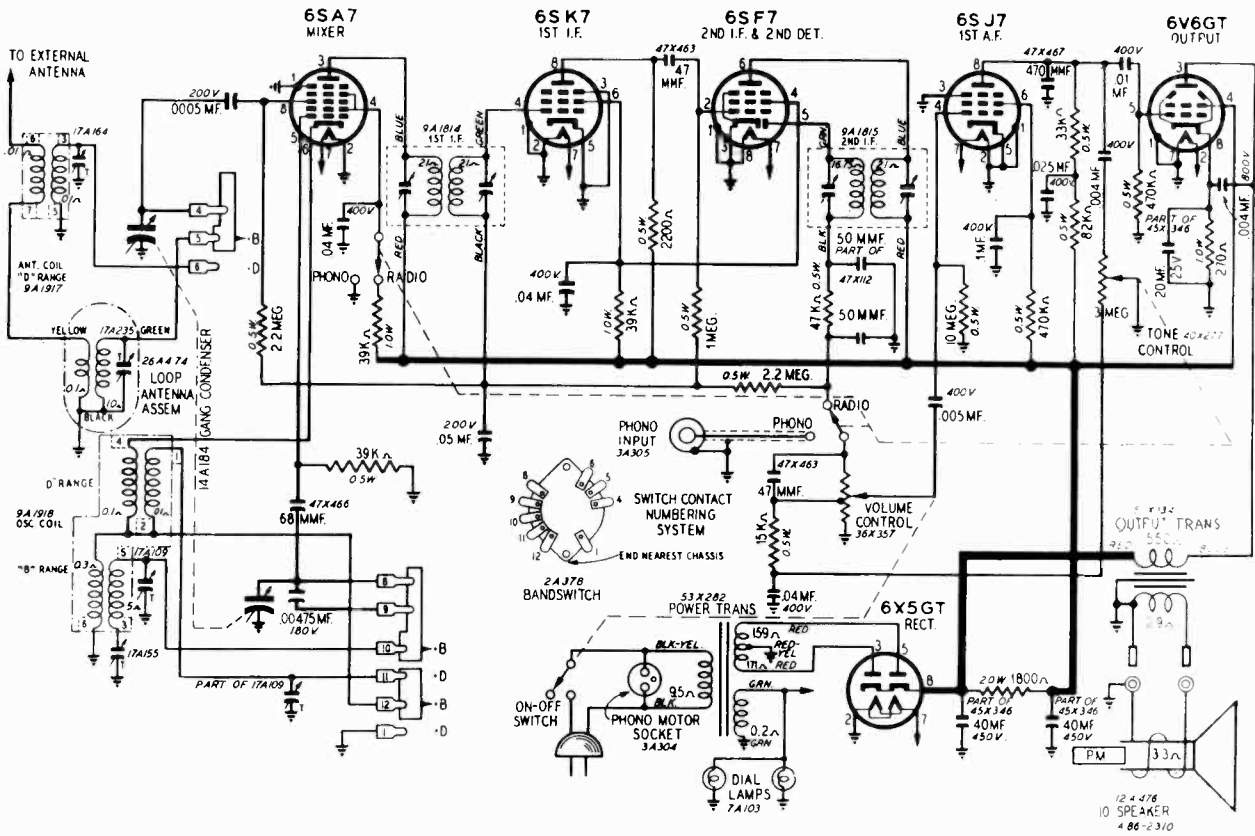




SPECIFICATIONS

6 Tube Superheterodyne, Including Rectifier Tube  
 Speaker.....10" PM Dynamic  
 Intermediate Frequency.....455 KC  
 Selectivity.....40 KC Broad at 1000 Times Signal  
 Sensitivity (For 0.5 Watt Output, with External Ant.  
 B Range.....9 Microvolts Average  
 D Range.....20 Microvolts Average

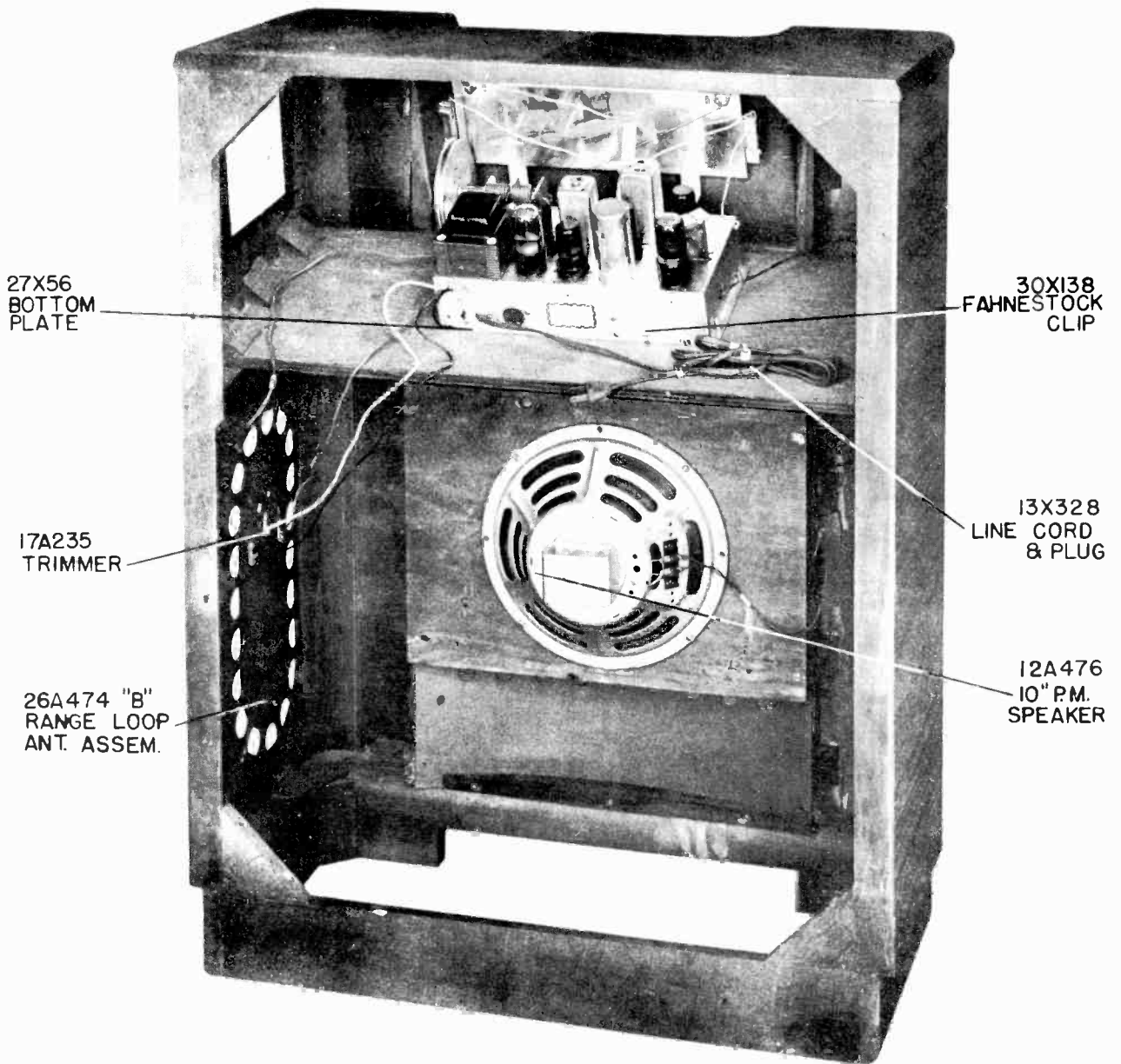
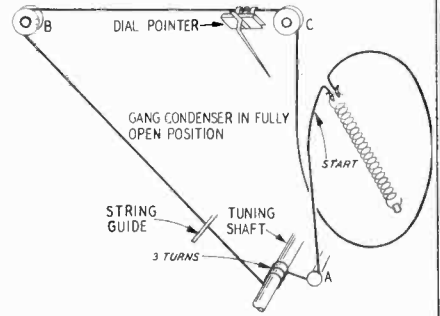
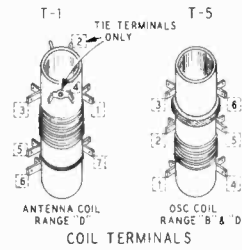
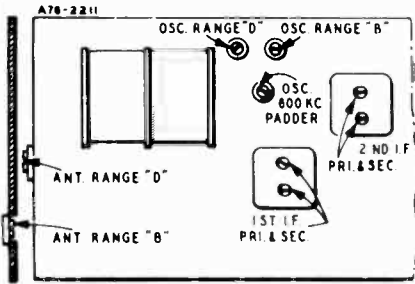
Power Supply.....105-125 Volts, 50 Cycles  
 Power Consumption.....(at 117 Volts AC) 45 Watts  
 Power Output...4 Watts Max. 2.3 Watts, 10% Harmonics  
 Tuning Frequency Range  
 B Range.....540-1600 Kilocycles  
 D Range.....5.75 - 18.3 Megacycles



The Circuit and tube complement of the receiver are as follows:

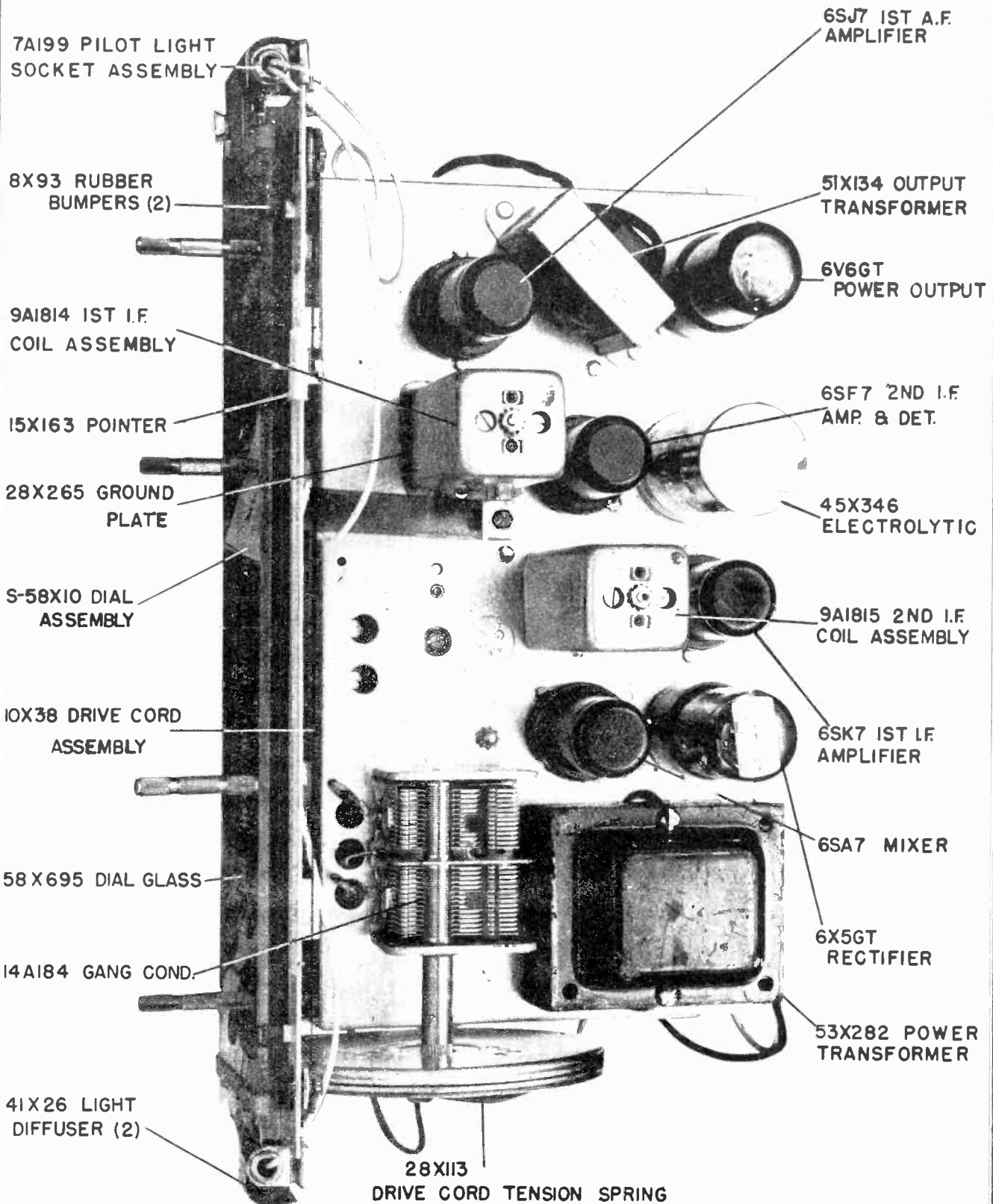
- 1 - 6SA7 1st Detector and Oscillator
  - 1 - 6SK7 1st I-F Amplifier
  - 1 - 6SF7 2nd I-F Amplifier and 2nd Detector
  - 1 - 6SJ7 1st Audio Amplifier
  - 1 - 6V6GT Power Output
  - 1 - 6X5GT Rectifier
- 2 - No. 47 dial lamps are used for dial illumination.

A jack is provided at the rear of the chassis for record player or other special service connections. This jack is switched in and out of the audio circuit with a switch controlled by the tone control knob. This switch also shorts out the R-F signal when it is turned to the phono position.

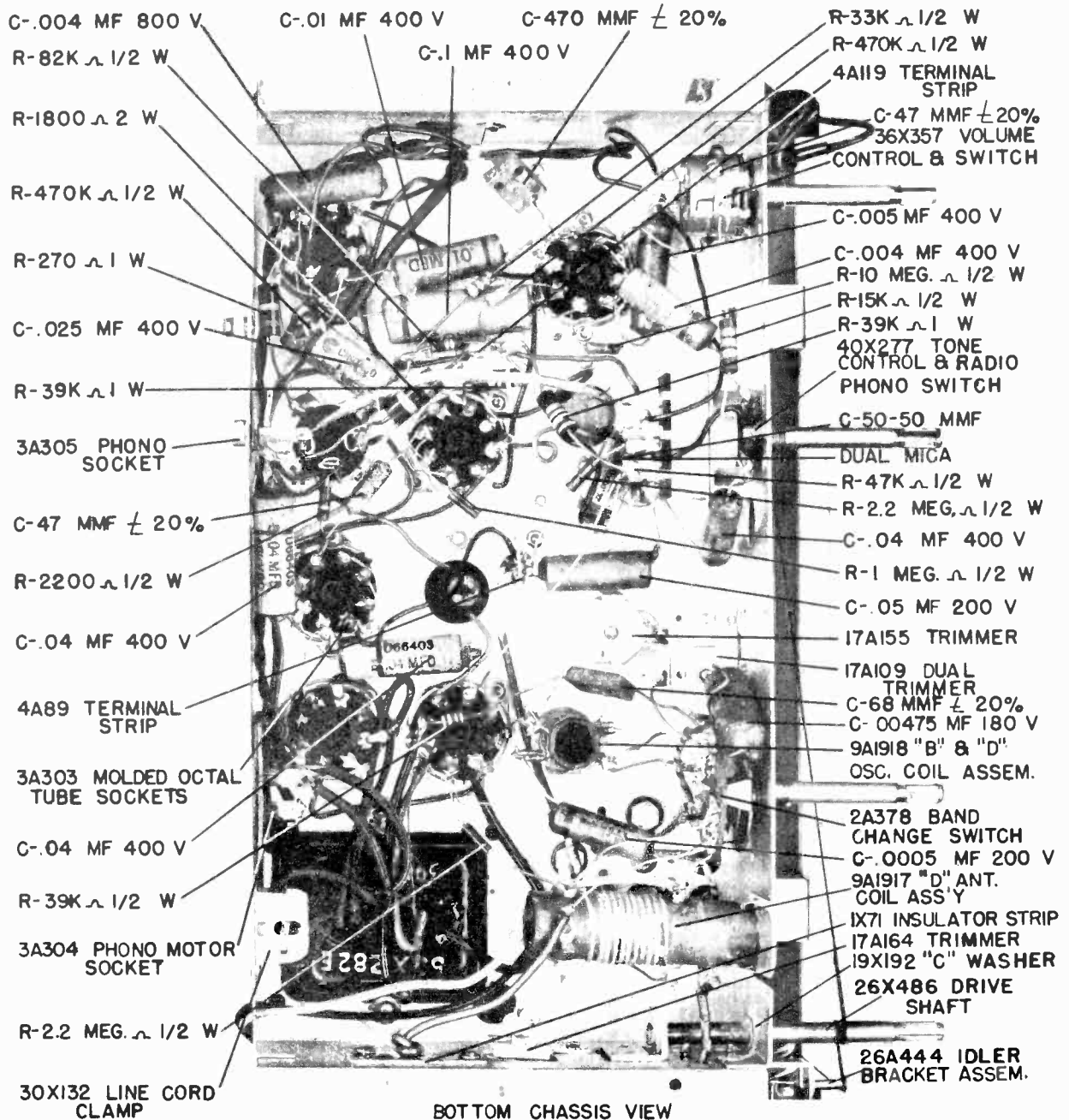


REAR CABINET VIEW





TOP CHASSIS VIEW



BOTTOM CHASSIS VIEW

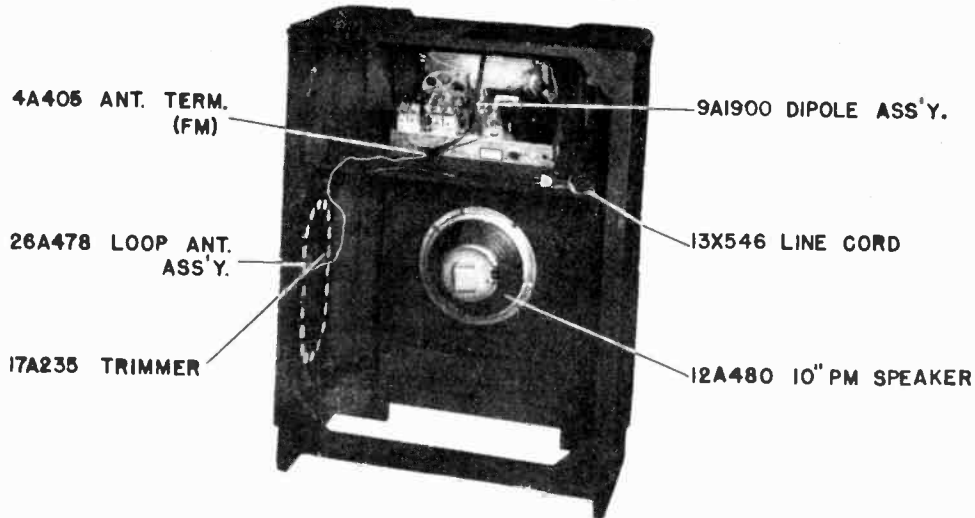
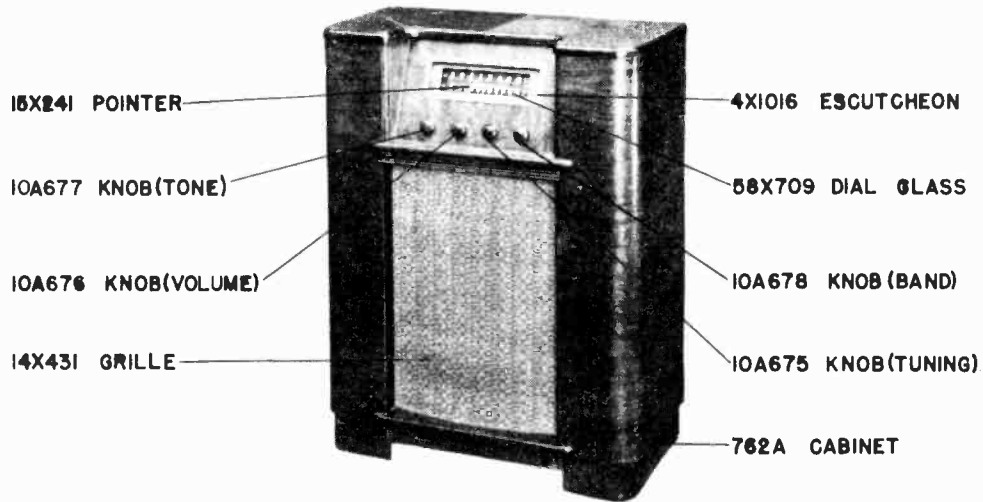
Part No.	Description	Quantity
2A378	Band Change Switch	
3A303	Molded Octal Tube Socket	6
3A304	Phono Motor Socket	
3A304	Phono Socket	
4A89	Terminal Strip	
4A119	Terminal Strip	
7A103	#47 Pilot Light	2
7A199	Pilot Light Socket Assembly	
9A1814	1st i-F Coil Assembly	
9A1815	2nd i-F Coil Assembly	
9A1917	"D" Antenna Coil Assembly	
9A1918	"B" and "D" Oscillator Coil Assembly	
10A620	Knob (Tuning)	
10A621	Knob (Volume)	
10A622	Knob (Tone R.P.)	
10A623	Knob (SW-BC)	
12A476	Speaker, 10" P.M.	
14A184	Gang Condenser	
17A109	Trimmer Condenser, Dual, 2.5-55 mmf	
17A155	Trimmer Condenser, 350-430 mmf	
17A164	Trimmer Condenser, 5-50 mmf	



MODEL 43-6927

GAMBLE-SKOGMO, INC.

26A444	Idler Bracket consisting of: 25X1488 Idler Bracket 20X1450 Rivet	
26A474	"B" Range Loop Antenna Assembly consisting of: 9A1919 "B" Range Loop Antenna 17A235 Trimmer Condenser #1701 Tubular Rivet 3/16"	
S58X10	Dial Assembly consisting of: 7X42 Cardboard Spacer S25X6 Dial Bracket & String Guide Assembly 58X695 Dial Glass 41X26 Light Diffuser 20X268 Rivet	2 2 4
1X71	Insulator Strip	
2X310	Felt Washer	
4X990	Escutcheon	
6X21	Rubber Grommet	3
7X42	Cardboard Spacer	2
8X93	Rubber Bumpers	2
10X38	Drive Cord Assembly	
13X328	Line Cord and Plug Assembly	
15X163	Pointer	
19X8	Flat Washer (Mtg. chassis to cabinet)	4
19X25	Flat Washer	
19X45	#8 Washer (Mtg. power transformer)	2
19X192	"C" Washer (Mtg. drive shaft)	2
20X325	Condenser Cushion Stud	3
20X1449	#6-32 x 1/2 Washer Hd. Machine Screw	
20X1491	Eyelet	
26X486	Drive Shaft	
27X56	Bottom Plate	
28X113	Drive Cord Tension Spring	
28X208	Coil Mounting Spring	
28X265	Ground Plate	
30X128	Solder Lug	
30X132	Line Cord Clamp	
30X138	Fahnestock Clip (External ground)	
30X522	Terminal	
30X523	Terminal	
36X357	Volume Control and Switch	
40X277	Tone Control and Radio Phono Switch	
41X26	Light Diffuser	2
45X346	3 Section Electrolytic Condenser 40 mg, 450V - 40 mf, 450V - 20 mf, 25 V.	
46X289	Capacitor Tubular, .00475-180V	
47X112	50-50 mmf, Dual Mica Condenser	
47X463	Capacitor, Molded Mica, 47 mmf ± 20%	2
47X466	Capacitor, Molded, 68 mmf	
47X467	Capacitor, Molded, 470 mmf ± 20%	
51X134	Output Transformer	
53X282	Power Transformer (60 cycles)	
58X695	Dial Glass	
B66501	Capacitor, Tubular - .0005 mf - 200 V.	
B66503	Capacitor, Tubular - .05 mf 200 V., 25%	
B84153	Resistor, Carbon - 15,000 Ohms 1/2 W	
B84222	Resistor, Carbon - 2200 Ohms 1/2 W	
B84333	Resistor, Carbon - 33,000 ohms 1/2 W	
B84393	Resistor, Carbon - 39,000 ohms 1/2 W	
B84823	Resistor, Carbon - 82,000 ohms 1/2 W	
B85105	Resistor, Carbon - 1 Megohm 1/2 W	
B85106	Resistor, Carbon - 10 Megohm 1/2 W	
B85225	Resistor, Carbon - 2.2 Megohm 1/2 W	2
B85473	Resistor, Carbon - 47,000 ohms 1/2 W	
B85474	Resistor, Carbon - 470,000 ohms 1/2 W	2
C84271	Resistor, Carbon - 270 ohms 1 W	2
C84393	Resistor, Carbon - 39,000 ohms 1 W	2
C64253	Capacitor, Tubular - .025 mf 400 V	
D64403	Capacitor, Tubular - .04 mf 400 V	
D66103	Capacitor, Tubular - .01 mf 400 V	
D66402	Capacitor, Tubular - .004 mf 400 V	
D66403	Capacitor, Tubular - .04 mf 400 V	2
D66502	Capacitor, Tubular - .005 mf 400 V	
D67104	Capacitor, Tubular - .10 mf 400 V	
D84182	Resistor, Carbon - 1800 ohms 210 W	
H66402	Capacitor, Tubular - .004 mf 800 V	
	8-32 Hex Nut, Cad. Pl. Mounting Power Transformer	2
	#8 Lockwasher, E. T. Shakeproof	2
	#6 x 1/4 Slotted Hex Hd. P-K Type "Z" Screw (Mounting Idler Bracket, Dial Bracket and Bottom Plate)	6
	#6 Lockwasher Mounting Oscillator and I-F Coils	5
	#6-32 Hex Nut	5
	3/8" Nut, Type 9N1 (Mtg. Tone Control, Band Switch and Volume Control)	3
	#2 x 3/8" French Oval Hd. Wood Screw, Statuary Bronze (Mounting Escutcheon)	4
	10 x 1/2" Slotted Hex Hd. P-K Type "Z" Screw (Mounting Chassis to Cabinet)	4
	#10 x 3/4" Washer Hd. Wood Screw (Mtg. Speaker)	4
	#16 x 5/8" Flat Hd. Blue Finish Nail (Loop to Cabinet)	4
	#1701 5/32" Tubular Rivet (Mounting Parts)	8



REAR CABINET VIEW

SPECIFICATIONS

7 Tube Superheterodyne.....Including Rectifier Tube	FM Sensitivity.....(For 0.5 Watt Output) 200 mv avg
Power Consumption.....(at 117 Volts AC)...60 Watts	Intermediate Frequency.....AM-455KC; FM-10.7 MC
Selectivity.....AM-50KC Broad at 1000 Times Signal	Tuning Range.....AM-540-1600 KC; FM-88-108 MC
I.F. FM-200KC Broad at 2 Times Down	Speaker.....10" P.M. Dynamic
I.F. FM-800KC Broad at 200 Times Down	Power Output.....4.5 W Max.; 2.5 W 10% Harmonics
AM Sensitivity... (For 0.5 Watt Output, with external Antenna) 20 mv avg	Power Supply.....105-125 Volts, AC 50-60 cycles

REMOVAL OF CHASSIS FROM CABINET

Before the chassis can be removed from the cabinet, it will be necessary to pull off the 4 control knobs, remove the three chassis mounting bolts and disconnect the leads from the chassis to the loop antenna, dipole terminals and speaker.

ALIGNMENT PROCEDURE

AM STAGES

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 is required for aligning.

An All Wave Signal Generator Which Will Provide an Accurately Calibrated Signal at the Test Frequencies as Listed.

Output Indicating Meter, Non-Metallic Screwdriver  
Dummy Antennas - .1 mf, and 50 mmf.



MODEL 43-6951

GAMBLE-SKOGMO, INC.

FREQUENCY SETTING	SIGNAL GENERATOR CONNECTION AT RADIO	GROUND CONNECTION	DUMMY ANTENNA	GANG CONDENSER SETTING	ADJUST TUNING SLUGS (I-F ONLY) GRIMMERS (OSC. & ANT.)
455 KC	Control Grid 1st 6BA6 Pin No.	Chassis Base	.1 mf	Turn Rotor to Full Open	2nd I.F. Pri. & Sec.
455 KC	Control Grid 6BE6 Pin No. 7 1st Det.	Chassis Base	.1 mf	Turn Rotor to Full Open	1st I.F. Pri. & Sec.
1620 KC	Control Grid 6BE6 Pin No. 7	Chassis Base	.1 mf	Turn Rotor to Full Open	Oscillator Trimmer (AM)
1400 KC	External Antenna Lead	Chassis Base	50 mmf	Turn Pointer to 1400 KC See Note A	Antenna Trimmer (AM)

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

FM STAGES

Allow chassis and signal generator to warm up for several minutes. The following equipment is required for aligning:

- An accurately calibrated signal generator providing unmodulated signals at the test frequencies listed below.
- Non-metallic screwdriver.
- Dummy Antennas and I-F Loading Resistor- .01 mf 300 ohms and 100 K ohms.

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

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

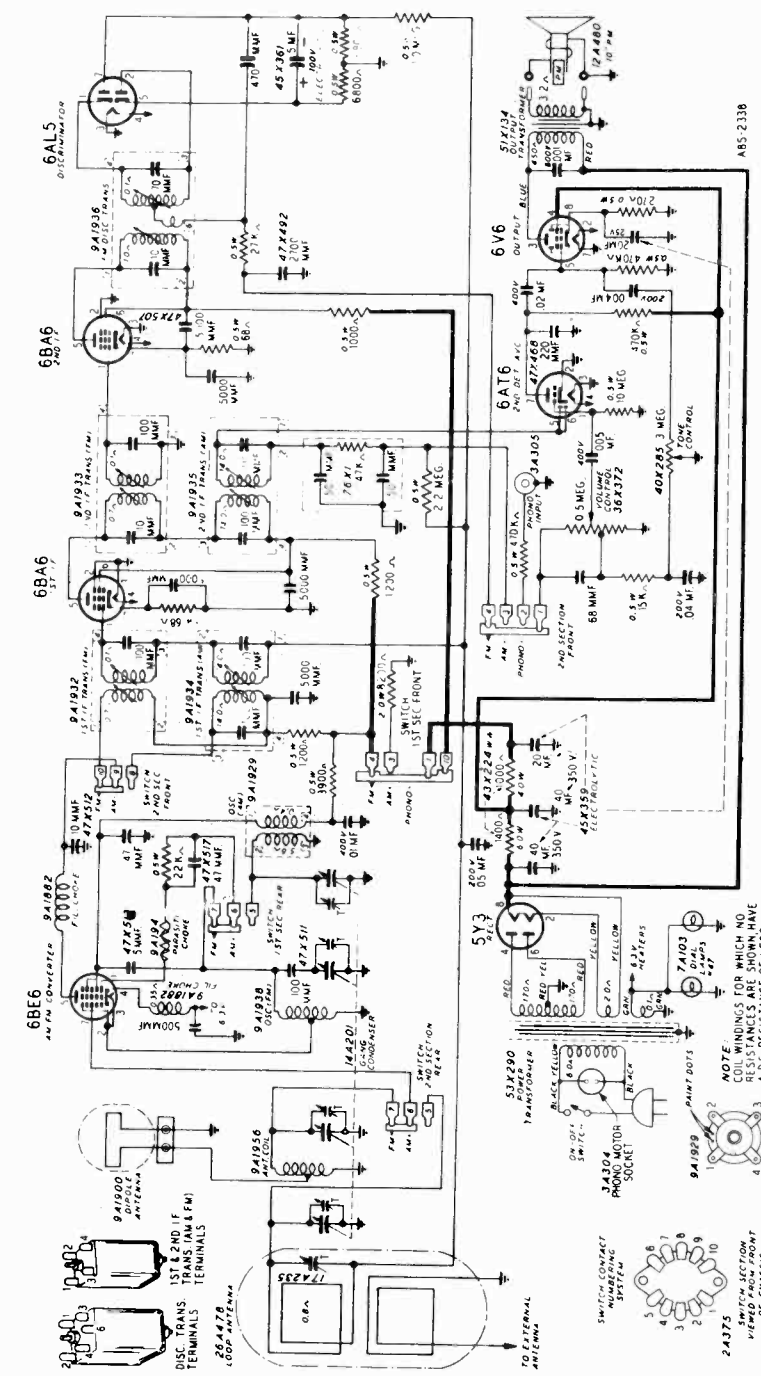
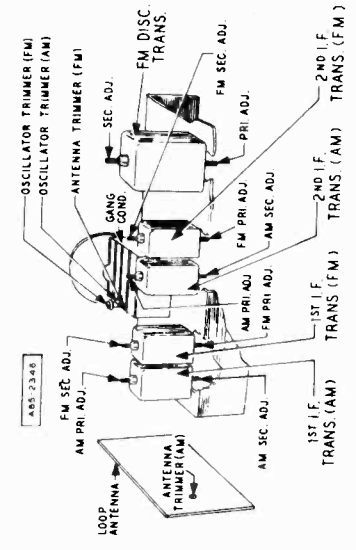
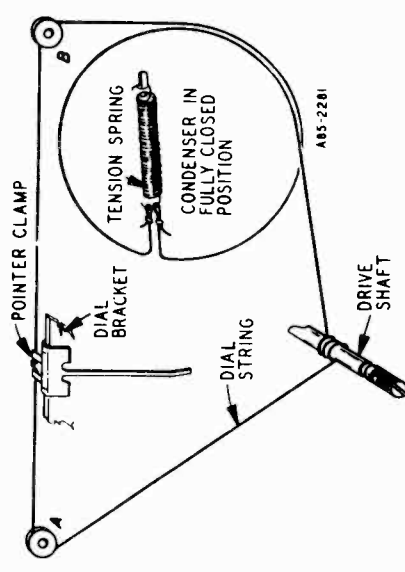
SIGNAL GENERATOR

Discriminator	FREQUENCY SETTING	CONNECTION AT RADIO	DUMMY ANTENNA	BAND SWITCH SETTING	CONDENSER SETTING	ADJUSTMENT FOR MAX. METER DEFLECTION
	10.7 MC	6BA6 2nd I-F Pin 1 & Chassis	.01 mf	FM	Rotor to Full Open	Disc. Pri. Note A
	10.7 MC	6BA6 2nd I-F Pin 1 & Chassis	.01 mf	FM	Rotor to Full Open	Disc. Sec. Note B
	10.7 MC	6BA6 2nd I-F Pin 1 & Chassis	.01 mf	FM	Rotor to Full Open	Disc. Pri. Note A
	10.7 MC	6BA6 2nd I-F Pin 1 & Chassis	.01 mf	FM	Rotor to Full Open	Disc. Sec. Note B
I-F	10.7 MC	6BA6 1st IF Pin 1 & Chassis	.01 mf	FM	Rotor to Full Open	2nd I-F Pri. 2nd I-F Sec. Note C
	10.7 MC	Unsolder lead from Pin 7 to band switch. Insert 100K ohm resistor between Pin 7 & Ground and feed signal into Pin 7 of 6BE6	.01 mf	FM	Rotor to Full Open	1st I-F Pri. 1st I-F Sec. Note C

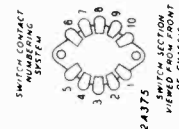
RECHECK I-F ADJUSTMENTS IN ORDER GIVEN

Ant. & Osc.	108.5	Disconnect dipole and connect generator to dipole terminals with resistor in series.	300ohms	FM	Rotor to Full Open	Osc. Trimmer (FM)
Note D	104.5	Same as above	300ohms	FM	Tune rotor for max. AVC voltage	Ant. Trimmer (FM)

RECHECK ANTENNA & OSC. ADJUSTMENTS IN ORDER GIVEN

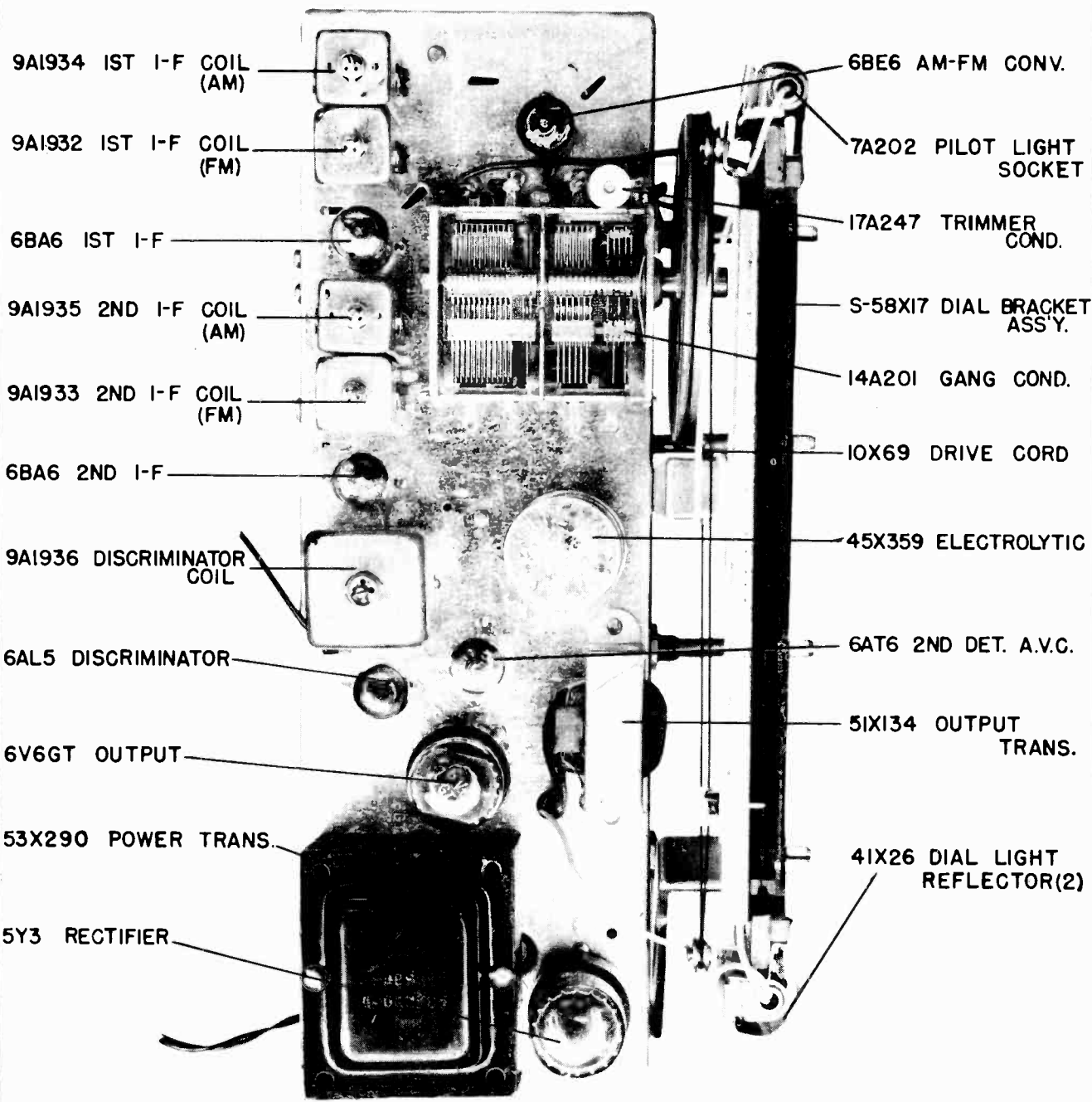
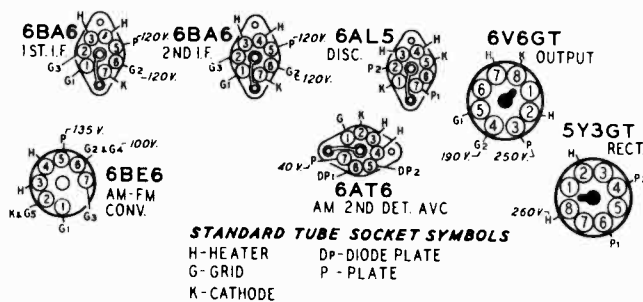
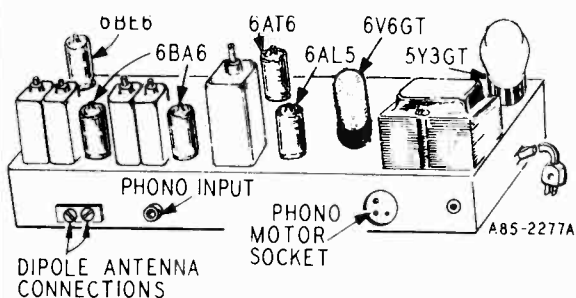


NOTE: COIL WINDINGS FOR WHICH NO RESISTANCES ARE SHOWN HAVE RESISTANCE OF LESS THAN 0.1Ω



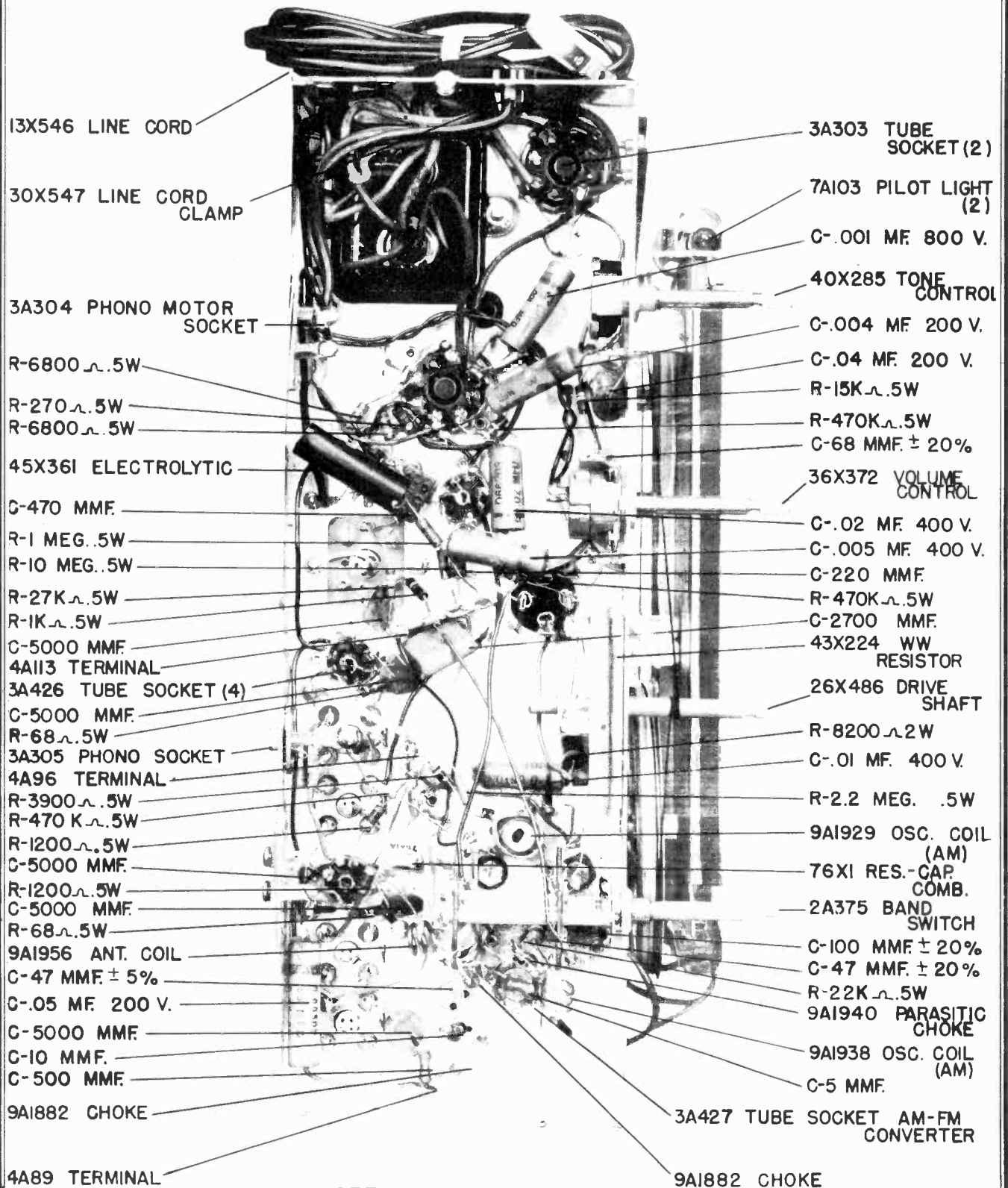
MODEL 43-6951

GAMBLE-SKOGMO, INC.



TOP CHASSIS VIEW





BOTTOM CHASSIS VIEW

PREFIX "C" INDICATES CONDENSER  
 PREFIX "R" INDICATES RESISTOR

MODEL 43-6951

Part No.	Description	Part No.	Description
2A375	Band Change Switch	20X329	Condenser Cushion Stud (3)
3A303	Molded Octal Tube Socket (2)	22X462	Chassis Base (with bracket)
3A304	Phono Motor Socket	26X486	Drive Shaft
3A305	Phono Socket (Single Pin)	25X1488	Idler Bracket
3A426	Tube Socket (miniature) (4)	28X113	Drive Cord Tension Spring
3A427	Tube Socket (Miniature for AM-FM Converter)	28X208	Coil Mounting Spring
4A89	Terminal Strip	30X547	Line Cord Clamp
4A96	Terminal Strip	36X372	Volume Control & Switch
4A113	Terminal Strip	40X285	Tone Control
4A405	Antenna Terminal Strip	41X26	Dial Light Reflector (2)
7A103	#47 Pilot Light (2)	43X224	W. W. Resistor, 1000 ohms 4W-1400 ohms 6W
7A202	Pilot Light Socket Assembly	45X359	4 Section Electrolytic, 40 mf, 350V-40 mf, 350V, 20 mf, 350V-20 mf, 25V
9A1882	Filament Choke (2)	45X361	Dry Electrolytic, 5 mf, 100V
9A1900	Di-Pole Antenna Assembly	47X463	Capacitor, Ceramic; 47 mmf 20%
9A1929	Oscillator Coil Assembly (AM)	47X468	Capacitor, Ceramic; 220 mmf 20%
9A1932	1st I.F. Coil Assembly (FM)	47X471	Capacitor, Molded Mica; 68 mmf 20%
9A1933	2nd I.F. Coil Assembly (FM)	47X492	Capacitor, Molded Mica; 2700 mmf 10%
9A1934	1st I.F. Coil Assembly (AM)	47X507	Capacitor, Silvered Mica; 5000 mmf
9A1935	2nd I.F. Coil Assembly (AM)	47X508	Capacitor, Ceramic; 500 mmf 20%
9A1936	Discriminator Coil Assembly	47X510	Capacitor, Silvered Mica; 470 mmf 5%
9A1938	Oscillator Coil Assembly (FM)	47X511	Capacitor, Ceramic; 100 mmf 5%
9A1940	Parasitic Choke	47X512	Capacitor, Ceramic; 10 mmf 5%
9A1956	Antenna Coil Assembly	47X513	Capacitor, Ceramic; 5.0 mmf 5%
10A675	Knob (Tuning)	47X517	Capacitor, Ceramic; 47 mmf 10%
10A676	Knob (Off-On Volume)	47X518	Capacitor, Ceramic; 100 mmf 20%
10A677	Knob (Tone)	51X134	Output Transformer
10A678	Knob (Ph-BC-FM)	53X290	Power Transformer
12A480	10" P.M. Speaker	57X709	Dial Glass
14A201	Gang Condenser & Pulley	76X1	Resistor Capacitor Combination
17A247	Trimmer Condenser 3-12 mmf	866402	Capacitor Tubular .004 mf 200V 25%
25A478	"B" Range Loop Antenna Ass'y consists of: 9A1939 "B" Range Loop Antenna 17A235 Trimmer Condenser 1701 3/16" Tunular Rivet	866403	Capacitor Tubular .04 mf 200V 25%
S-58X17	Dial Bracket Assembly consisting of: 7X42 Cardboard Spacer (2) 8X185 Rubber Bands (2) 20X268 Rivets (6) 24X446 Idler Pulley (2) 25X1569 Dial Bracket 41X26 Dial Light Reflector (2) 58X709 Dial Glass	866503	Capacitor Tubular .05 mf 200V 25%
4X1016	Escutcheon	883392	Resistor, Carbon; 3900 ohms 1/2W
6X21	Rubber Grommet (4)	883680	Resistor, Carbon; 68 ohms 1/2W
10X69	Drive Cord Assembly	884102	Resistor, Carbon; 1000 ohms 1/2W
13X546	Line Cord and Plug Assembly	884122	Resistor, Carbon; 1200 ohms 1/2W (2)
15X241	Pointer	884153	Resistor, Carbon; 15 K ohms 1/2W
19X107	Flat Washer (Mtg. Speaker) (4)	884223	Resistor, Carbon; 22 K ohms 1/2W
19X145	#8 Flat Washer (Mtg. 53X290) (2)	884271	Resistor, Carbon; 270 ohms 1/2W
19X179	Flat Washer (Mtg. Set to Cabinet) (3)	884273	Resistor, Carbon; 27 K ohms 1/2W
19X192	"C" Washer (drive shaft) (2)	884682	Resistor, Carbon; 6800 ohms 1/2W (2)
		885105	Resistor, Carbon; 1 megohm 1/2W
		885106	Resistor, Carbon; 10 megohms 1/2W
		885225	Resistor, Carbon; 2.2 megohms 1/2W
		885474	Resistor, Carbon; 470 K ohms 1/2W (3)
		D66103	Capacitor, Tubular; .01 mf 400V 25%
		D66203	Capacitor, Tubular; .02 mf 400V 25%
		D66502	Capacitor, Tubular; .005 mf 400V 25%
		D84822	Resistor, Carbon; 8200 ohms 2.0 W
		H66102	Capacitor, Tubular; .001 mf 800V 25%

## FM ALIGNMENT NOTES

Note A - The zero center scale DC vacuum tube voltmeter is to be connected between chassis ground and the A.V.C. line at the 27 K. ohm resistor and its junction with terminal strip. A signal of .1 volt must be fed into the receiver for this adjustment. Note output voltage on the zero center DC vacuum tube voltmeter.

Note B - Disconnect zero center DC vacuum tube voltmeter from A.V.C. and connect it to the audio takeoff point at the 1 megohm resistor and its junction with

the terminal strip. Adjust for zero voltage indication.

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

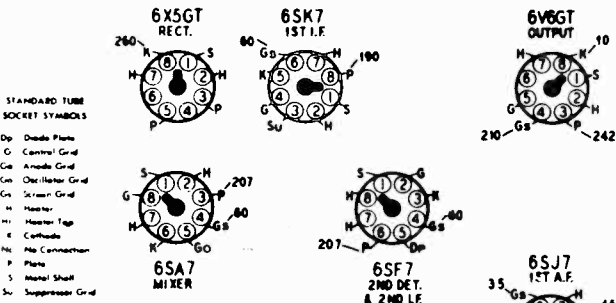
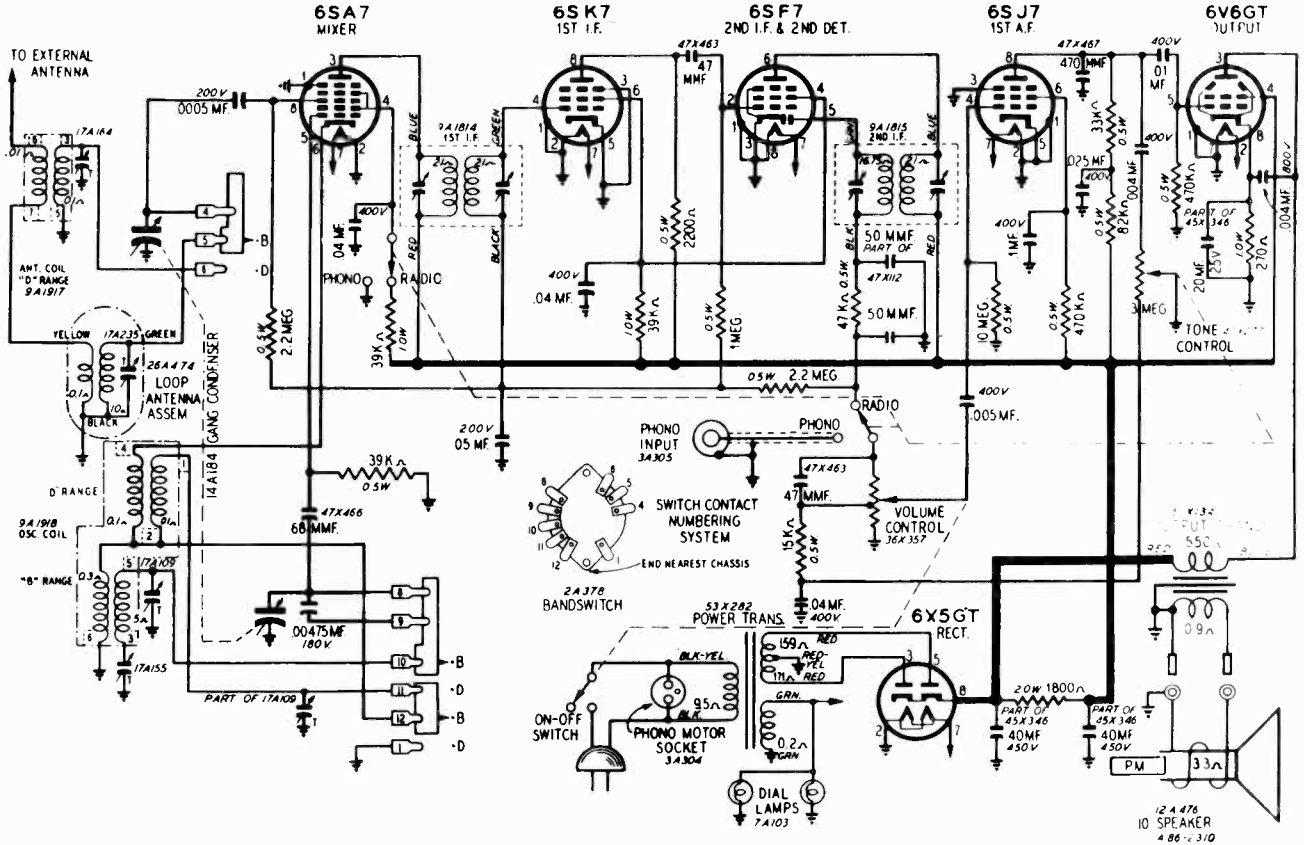
Note D - Remove the 100 K ohm load resistor and solder the lead from pin 7 of 6BE6 tube to the banc switch before attempting to check the antenna and oscillator adjustments.

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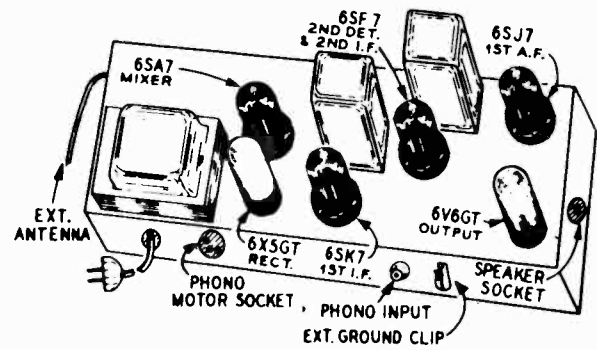
MODELS 43-7603,  
43-7604

SPECIFICATIONS

6 Tube Superheterodyne, Including Rectifier Tube	Power Supply .....	102-125 Volts, 60 cycle
Speaker.....10" PM Dynamic	Power Consumption (at 117 Volts AC)	45 Watts (normal)
Intermediate Frequency.....455 KC		65 Watts (phono)
Selectivity.....40 KC Broad at 1000 Times Signal	Power Output .....	4 Watts Maximum 2.3 Watts
Sensitivity (For 0.5 Watt Output, with External Antenna)		10% Harmonics
B Range .....	Tuning Frequency Range	
D Range .....	B Range .....	540-1600 Kilocycles
	D Range .....	5.75 - 18.3 Megacycles
	Record Changer .....	Plays ten 12" or twelve 10"

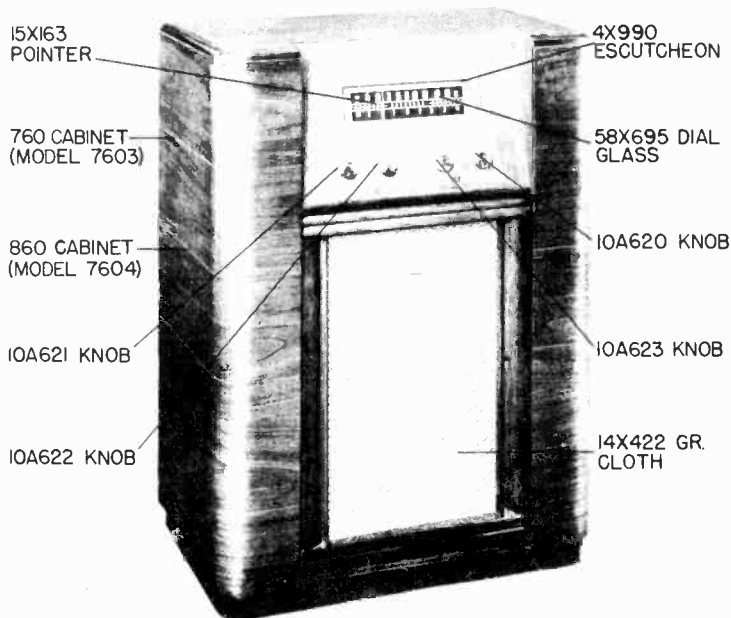


LINE VOLTAGE 117 VOLTS A C  
NO SIGNAL INPUT  
READINGS TAKEN WITH 1000  
OHM PER VOLT METER PLATE  
AND SCREEN VOLTAGES READ  
ON 500 VOLT SCALE



MODELS 43-7603,  
43-7604

GAMBLE-SKOGMO, INC.



The automatic record changer is connected to the rear of the chassis through jacks marked "Phono" and "Phono Motor". The "Phono" jack is switched in or out of the audio circuit by a switch controlled by the tone control knob. This switch also shorts out the r-f signal when it is turned to the phono position

## 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.

	SIGNAL GENERATOR FREQUENCY SETTING	CONNECTION AT RADIO	DUMMY ANTENNA	BAND SWITCH SETTING	CONDENSER SETTING	ADJUST TRIMMERS TO MAXIMUM
I. F.	455 Kc.	Grid of 6SA7 Pin 8	.1 mf.	B Range	Turn Rotor to Full Open	2nd I.F. (Pri.) and (Sec.) 1st I.F. (Pri.) and (Sec.)
RANGE B	1,620 Kc.	Antenna Lead	50 mmf.	B Range	Turn Rotor to Full Open	Oscillator Range B
	1,400 Kc.	Antenna Lead	50 mmf.	B Range	Tune Rotor to Max. Output Set Pointer to 1,400 Kc. (See Note A)	Antenna Range B
	600 Kc.	Antenna Lead	50 mmf.	B Range	Tune Rotor to Max. Output	Oscillator (600 Kc. Padder) Rock Rotor See Note B
Repeat above steps at 1,620 and 600 Kc. until readjusting the oscillator. Range B Trimmer causes no further improvement of output.						
RANGE D	18.3 Mc.	Antenna Lead	400 ohm	D Range	Turn Rotor to Full Open	Oscillator Range D
	16 Mc.	Antenna Lead	400 ohm	D Range	Tune Rotor to Max. Output	Antenna Range D Rock Rotor—See Note B
LOOP RANGE B	Reassemble chassis in cabinet.					
	1,400 Kc.	Antenna Lead	50 mmf.	B Range	Tune Rotor to Max. Output	Antenna Range B

NOTE A—Set pointer at the 1,400 KC. mark on the dial scale. Attach pointer to drive cord.

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

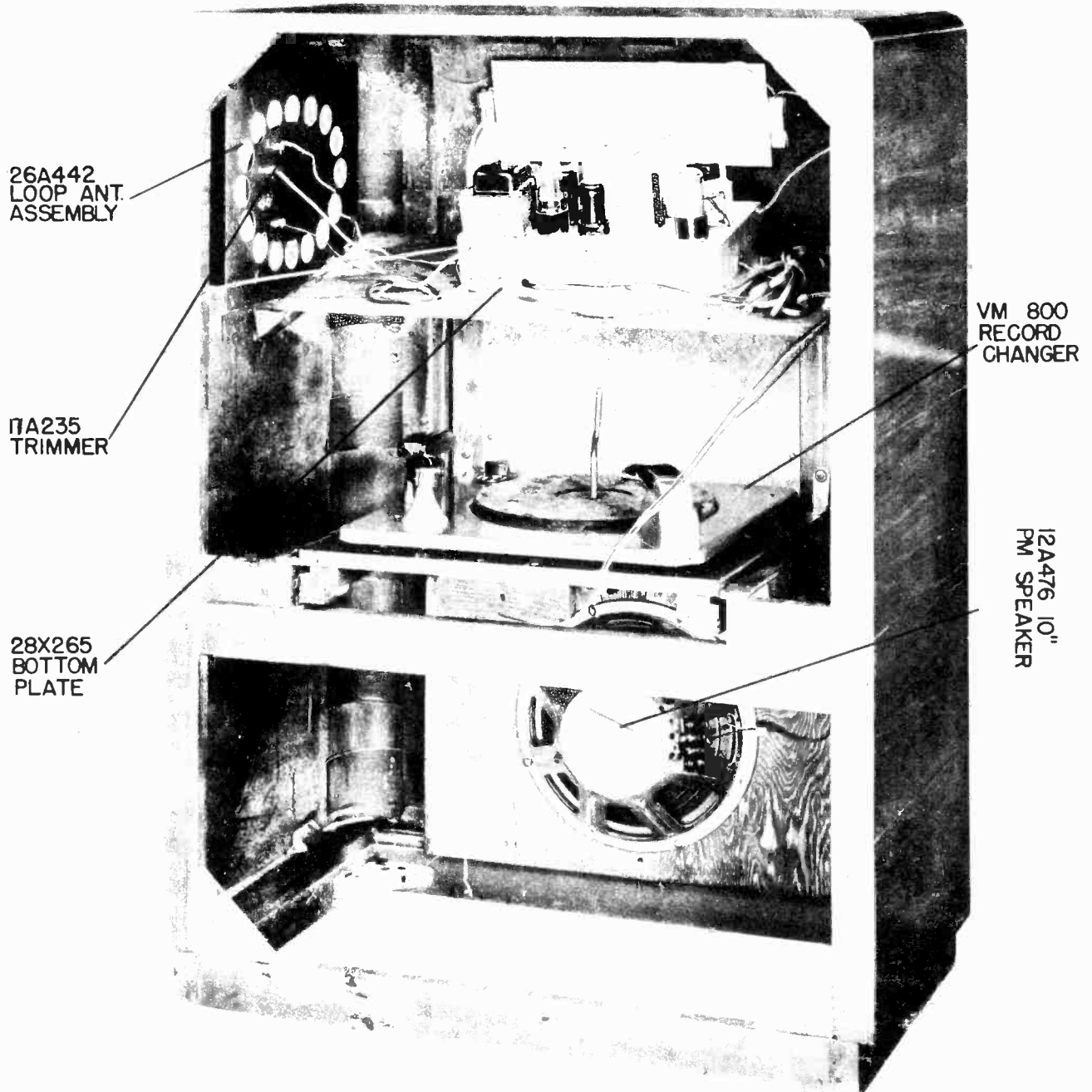


GAMBLE-SKOGMO, INC.

MODELS 43-7603,  
43-7604

The circuit and tube complement of the receiver are as follows:

- 1 - 6SA7 1st Detector and Oscillator
- 1 - 6SK7 1st I-F Amplifier
- 1 - 6SF7 2nd I-F Amplifier and 2nd Detector
- 1 - 6SJ7 1st Audio Amplifier
- 1 - 6V6GT Power Output
- 1 - 6X5GT Rectifier
- 2 - No. 47 lamps are used for dial illumination.



26A442  
LOOP ANT.  
ASSEMBLY

17A235  
TRIMMER

28X265  
BOTTOM  
PLATE

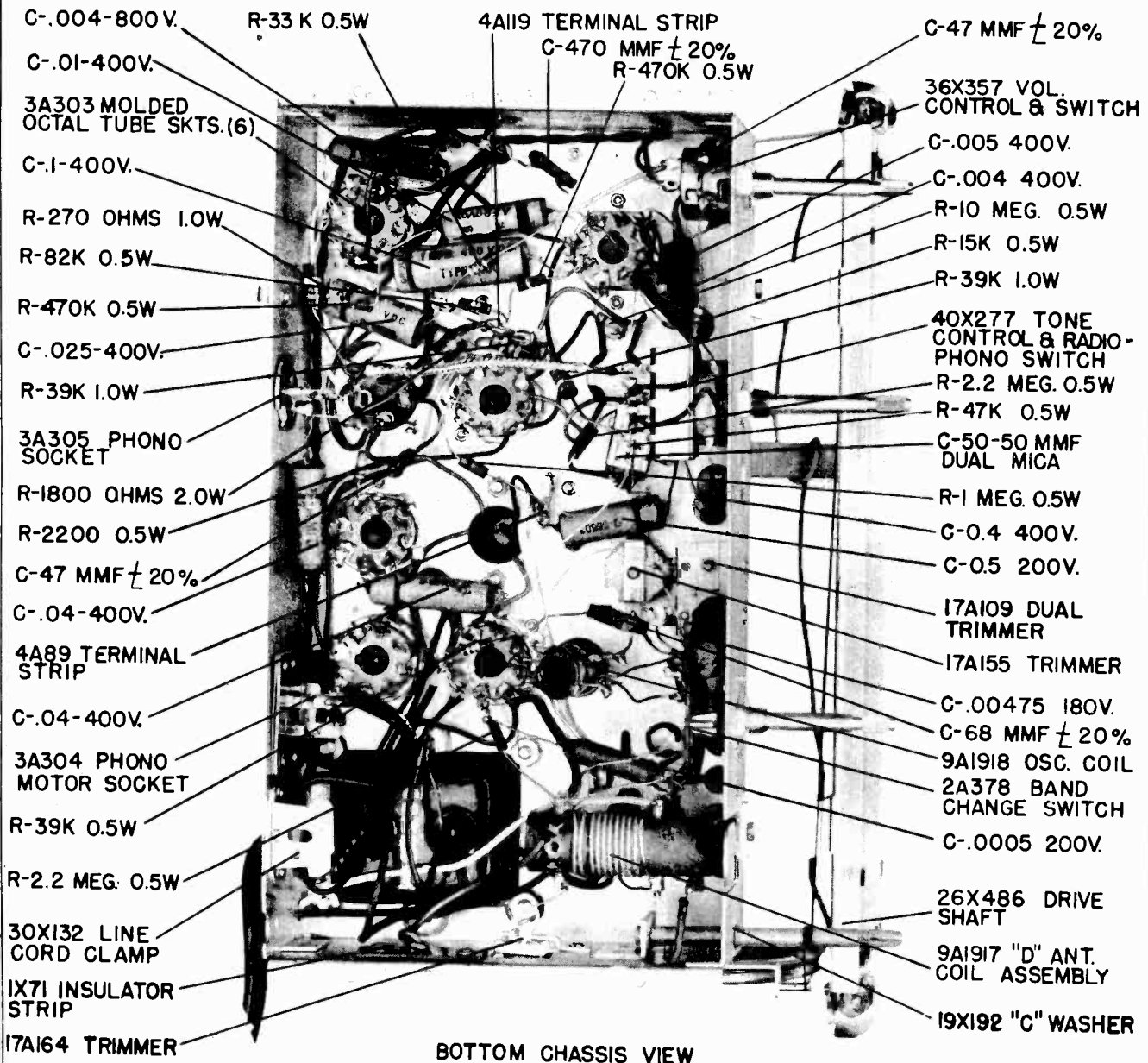
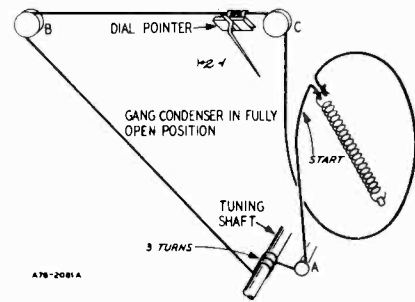
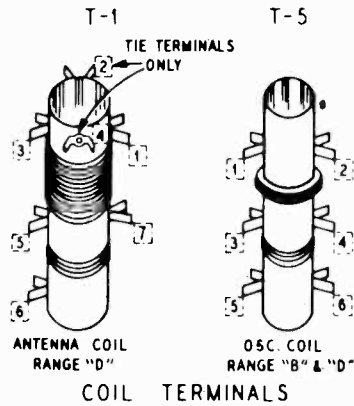
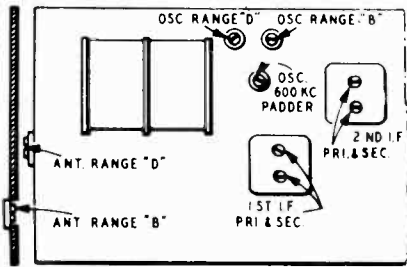
VM 800  
RECORD  
CHANGER

12A476 10"  
PM SPEAKER

REAR CABINET VIEW

MODELS 43-7603,  
43-7604

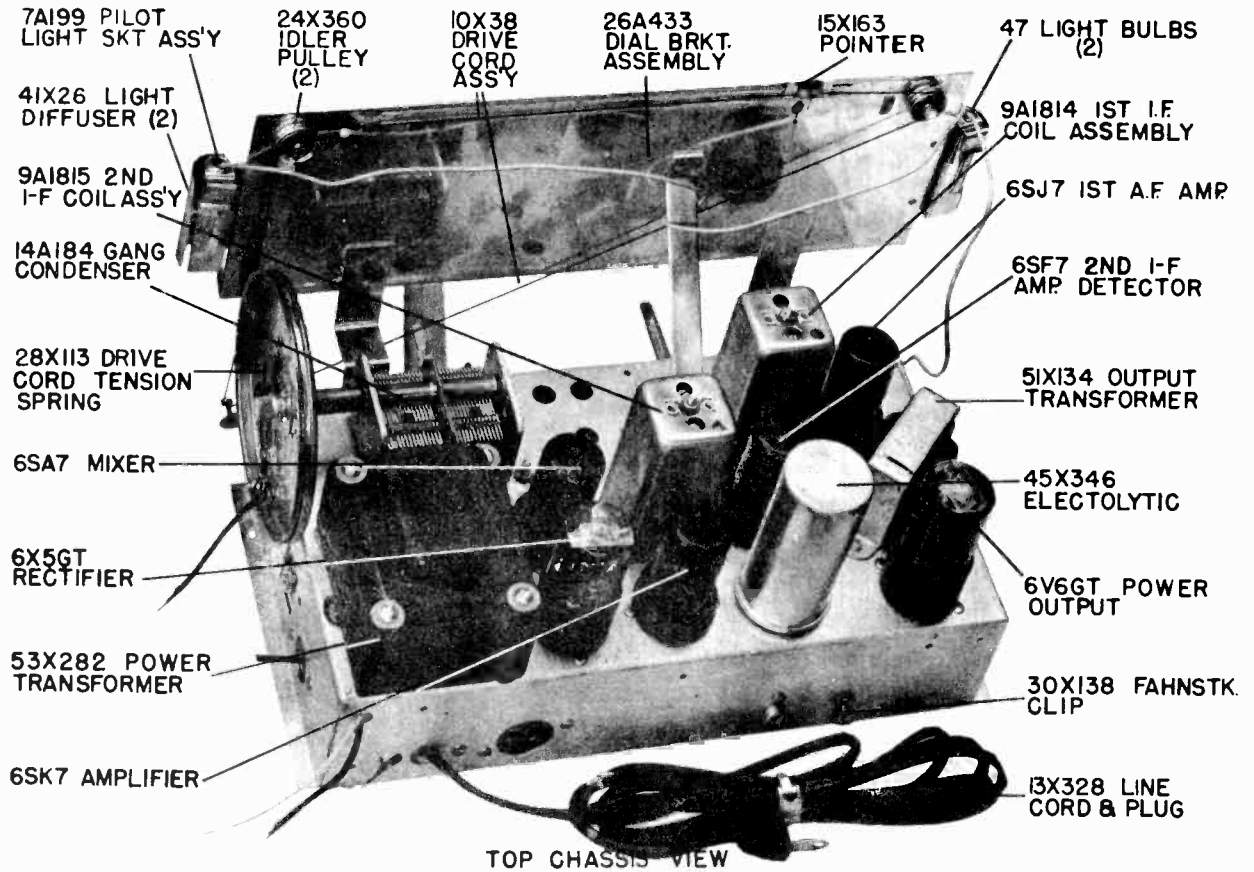
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BOTTOM CHASSIS VIEW

GAMBLE-SKOGMO, INC.

MODELS 43-7603,  
43-7604



7A199 PILOT LIGHT SKT ASS'Y  
4IX26 LIGHT DIFFUSER (2)  
9A1815 2ND I-F COIL ASS'Y  
14A184 GANG CONDENSER  
28XI13 DRIVE CORD TENSION SPRING  
6SA7 MIXER  
6X5GT RECTIFIER  
53X282 POWER TRANSFORMER  
6SK7 AMPLIFIER

24X360 IDLER PULLEY (2)  
10X38 DRIVE CORD ASS'Y

26A433 DIAL BRKT. ASSEMBLY

15XI63 POINTER

47 LIGHT BULBS (2)

9A1814 1ST I-F COIL ASSEMBLY

6SJ7 1ST A.F. AMP

6SF7 2ND I-F AMP DETECTOR

5IX134 OUTPUT TRANSFORMER

45X346 ELECTROLYTIC

6V6GT POWER OUTPUT

30XI38 FAHNSTK. CLIP

13X328 LINE CORD & PLUG

TOP CHASSIS VIEW

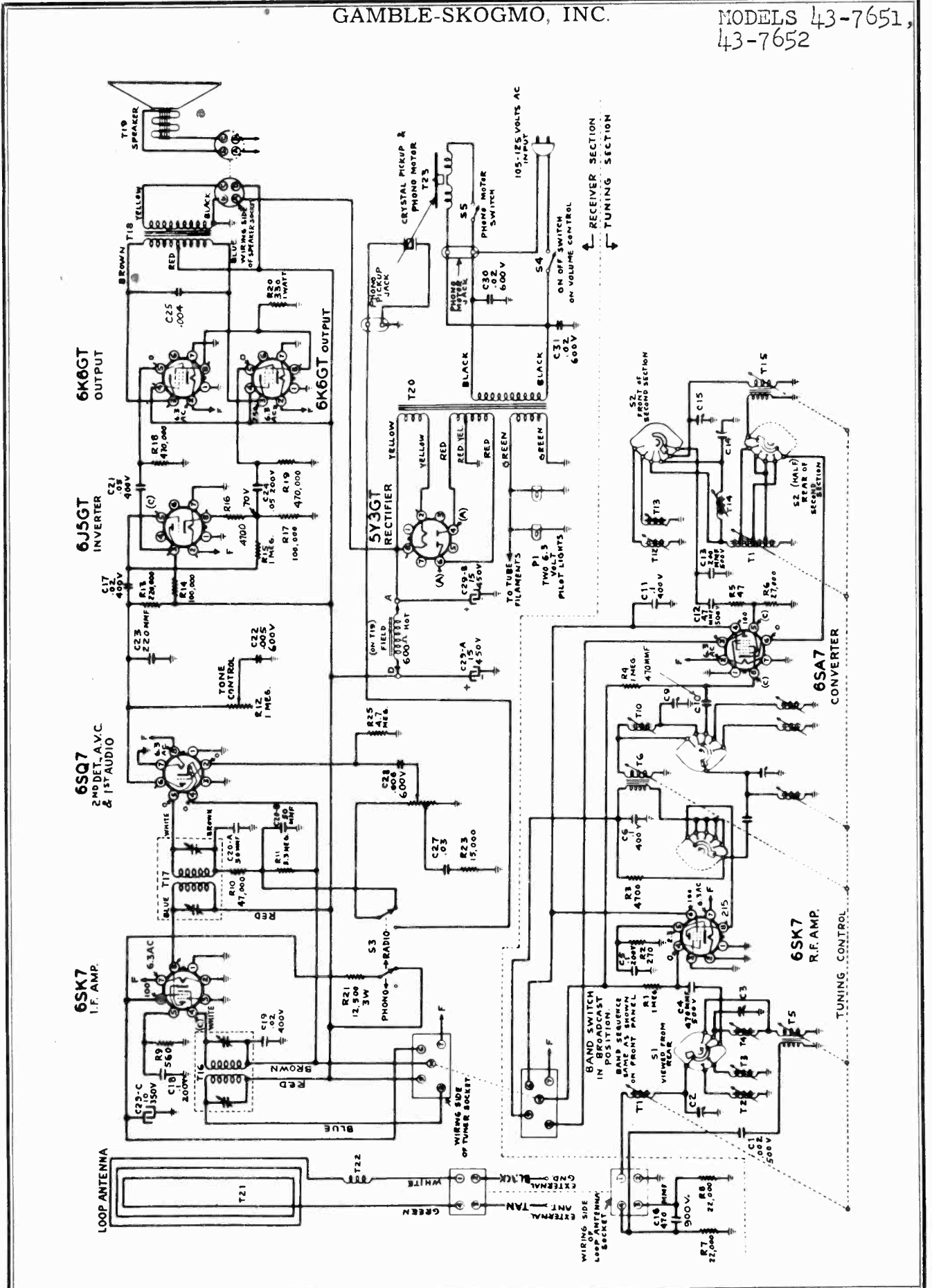
Part No.	Description	Quantity
2A378	Band Change Switch	
3A303	Molded Octal Tube Socket	6
3A304	Phono Motor Socket	
3A305	Single Pin Jack	
4A89	Terminal Strip	
4A119	Terminal Strip	
7A103	#47 Pilot Light	2
7A199	Pilot Light Socket Assembly	
9A1814	1st I-F Coil Assembly	
9A1815	2nd I-F Coil Assembly	
9A1917	"D" Antenna Coil Assembly	
9A1918	"B" & "D" Oscillator Coil Assembly	
10A620	Knob (Tuning)	
10A621	Knob (Volume)	
10A622	Knob (Tone, R.P.)	
10A623	Knob (SW-BC)	
12A476	Speaker, 10" P.M.	
14A184	Gang Condenser	
17A109	Trimmer Condenser (dual) 2.5-35 mmf	
17A155	Trimmer Condenser, 350-430 mmf	
17A164	Trimmer Condenser, 5-50 mmf	
26A442	"B" Range Loop Antenna Ass'y consisting of: 9A1821 "B" Range Loop Antenna 17A235 Trimmer Condenser #1701 Tubular Rivet 3/16"	
26A443	Dial Bracket Assembly 7X42 Cardboard Spacer 58X615 Dial Background 25X1495 Dial Bracket 24X360 Idler Pulley 4IX26 Light Diffuser 20X268 Rivet	2 2 2 6
26A444	Idler Bracket Assembly consisting of: 25X1488 Idler Bracket 20X1450 Rivet	
1X71	Insulator Strip	
2X310	Felt Washer (mtg. 28XI13)	
4X990	Escutcheon	

MODELS 43-7603,  
43-7604

GAMBLE-SKOGMO, INC.

Part No.	Description	Quantity
6X21	Rubber Grommet	3
8X93	Rubber Bumpers	2
10X38	Drive Cord Assembly	
13X328	Line Cord and Plug	
15X163	Pointer	
19X8	Flat Washer (Mtg. chassis to cabinet)	4
19X45	#1 Flat Washer (Mtg. power transformer)	2
19X192	"C" Washer (Mtg. drive shaft)	2
20X329	Condenser Cushion Stud	3
20X1449	6-32 x 1/2" Washer Hd. Machine Screw	
20X1491	Eyelet	
26X486	Drive Shaft	
27X56	Bottom Plate	
25X1488	Idler Bracket	
28X113	Drive Cord Tension Spring	
28X208	Coil Mounting Spring	
28X265	Ground Plate	
30X132	Line Cord Clamp	
30X138	Fahnestock Clip (External Ground)	
30X522	Terminal (connecting 27X56 to chassis)	
30X523	Terminal (connected to 27X56)	
36X357	Volume Control and Switch	
40X277	Tone Control & Radio-Phono Switch	2
41X26	Light Diffuser	
45X346	3 Section Electrolytic Condenser 40mf, 450V. - 40mf, 450V. - 20mf, 25V.	
46X289	Capacitor, Tubular - .00475 mf, 180 V.	
47X112	Capacitor, Dual Mica - 50-50 mmf ± 20%	2
47X463	Capacitor, Molder Mica - 47 mmf ± 20%	
47X466	Capacitor, Molder - 68 mmf ± 10%	
47X467	Capacitor, Molded Mica - mmf ± 20%	
51X134	Output Transformer	
53X282	Power Transformer (60 cycles)	
57X184	Locking Plate	
58X615	Dial Background	
58X695	Dial Glass	
866501	Capacitor, Tubular - .0005 mf 200V, ± 20%	
866503	Capacitor, Tubular - .05 mf 200V, ± 25%	
884153	Resistor, Carbon - 15,000 ohms .5W	
884222	Resistor, Carbon - 2200 ohms .5W	
884333	Resistor, Carbon - 33,000 ohms .5W	
884393	Resistor, Carbon - 39,000 ohms .5W	
884824	Resistor, Carbon - 82,000 ohms .5W	
885105	Resistor, Carbon - 1 megohm .5W	
885106	Resistor, Carbon - 10 megohms .5W	
885225	Resistor, Carbon - 2.2 megohms .5W	2
885473	Resistor, Carbon - 47,000 ohms .5W	
885474	Resistor, Carbon - 470,000 ohms .5W	2
884271	Resistor, Carbon - 270 ohms 1.0W	
884393	Resistor, Carbon - 39,000 ohms 1.0W	2
D64253	Capacitor, Tubular - .025 mf 400V, ± 10%	
D64403	Capacitor, Tubular - .04 mf 400V, ± 10%	
D66103	Capacitor, Tubular - .01 mf 400V, ± 25%	
D66402	Capacitor, Tubular - .004 mf 400V, ± 25%	
D66403	Capacitor, Tubular - .04 mf 400V, ± 25%	2
D66502	Capacitor, Tubular - .005 mf 400V.	
D67104	Capacitor, Tubular - .10 mf 400V. -10% ± 30%	
D84182	Resistor, Carbon - 1800 ohms 2.0W	
H66402	Capacitor, Tubular - .004 mf 800V. ± 25%	
	#1701 3/16" Tubular Rivet (mtg. parts)	2
	#1701 5/32" Tubular Rivet (mtg. parts)	8
	#1701 1/8" Tubular Rivet (mtg. parts)	20
	3/8" Pin Nut (Mtg. tone control band switch, Type 9N1 and volume control)	3
	#8 Lockwasher E. T. } Mtg. Power Transformer	2
	#8 - 32 Hex Nut	2
	#6 x 1/4" Slotted Hex. Hd. P-K Type "X" Screw (Mtg. idler bracket, dial bracket, and bottom plate & S-27X1)	6
	#2 x 3/8" French Oval Hd. Wood Screw Statuary Bronze (mtg. escutcheon)	4
	#6 (1106) Lockwasher, E. T. Shakeproof, Cad. Pl.	6
	#10 x 1/2" Slotted Hex. Hd. P-K Type "Z" Screw (mtg. chassis to cabinet)	4
	#10 x 3/4" Washer Hd. Wood Screw Steel (mtg. speaker)	4
	#16 x 5/8" Flat Hd. Blue Finished Nail (mtg. loop to cabinet)	4
	#10 x 5/8" Washer Hd. Wood Screw, Steel (Mtg. 57X184)	
28A139	Record Changer VM #800	
	#1114 1/4" Lockwasher, E. T. Shakeproof (Mtg. 57X184)	
	1/4-20 x 1 1/4 R.H.M.S. Steel, Cad. Pl. (Mtg. 58X184)	
	#6-32 Hex Nut Cad. Pl.	5
	#6 Split Lockwasher (Mtg. 1X71)	2



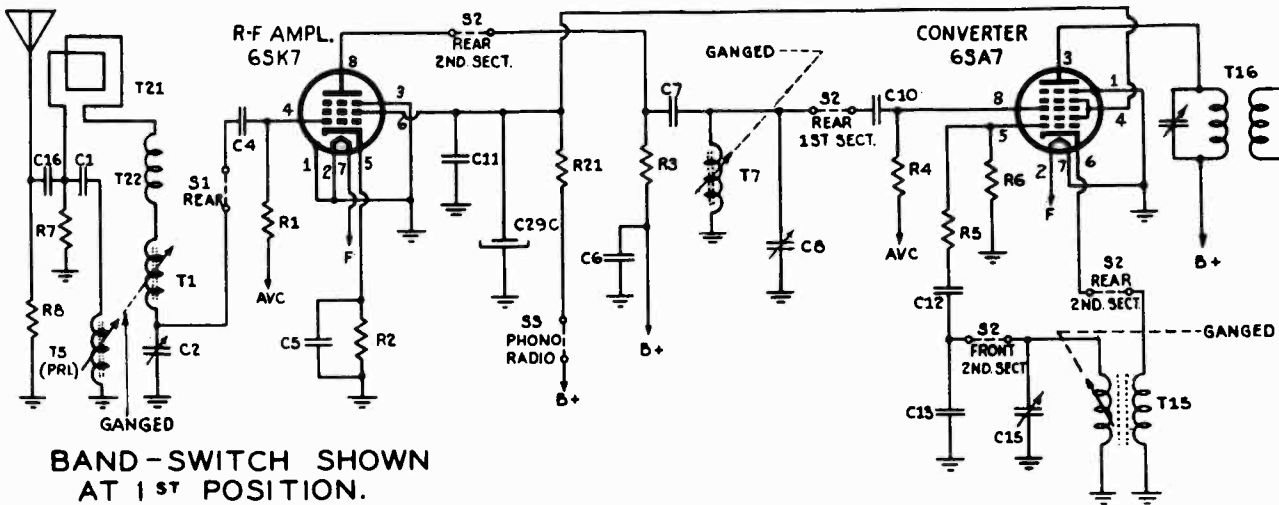


# CLARI-SKEMATIX

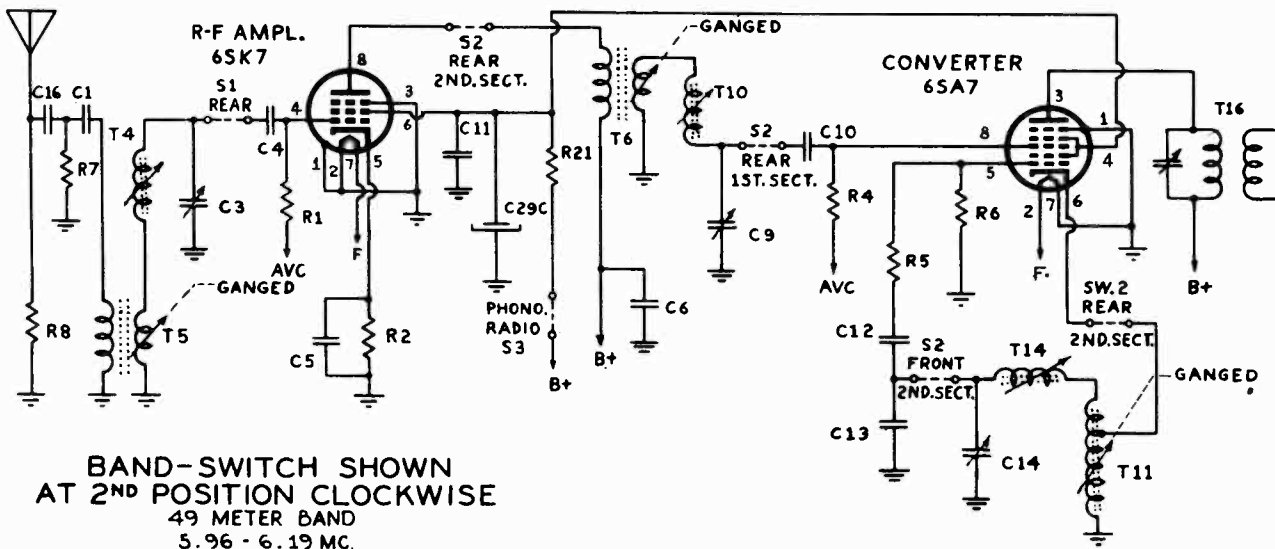
Registered Trademark

MODELS 43-7651,  
43-7652

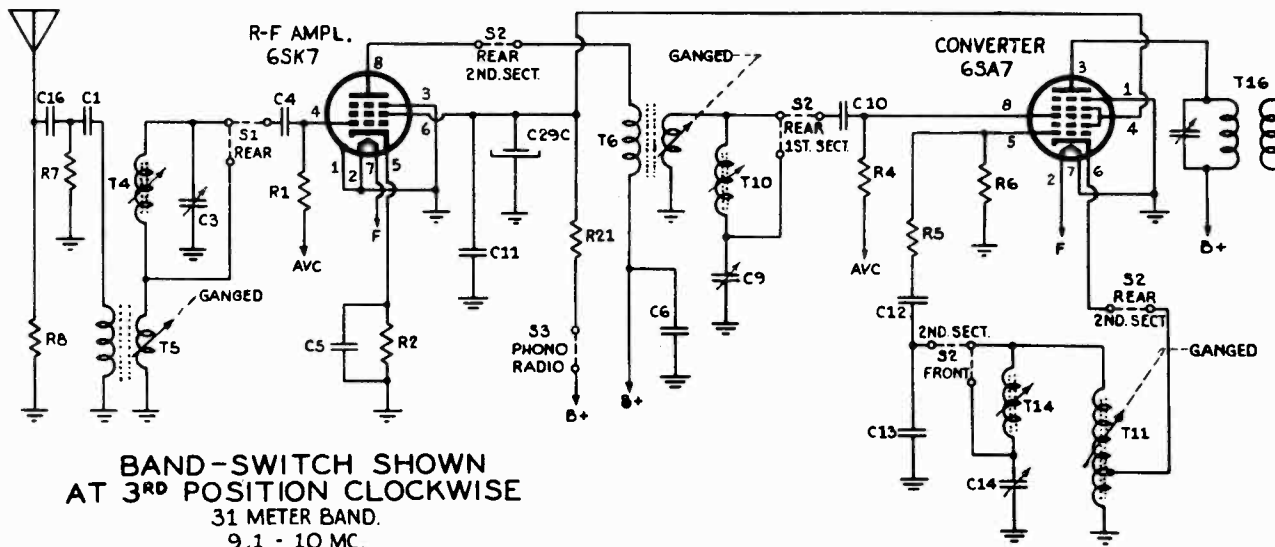
GAMBLE-SKOGMO, INC.



**BAND-SWITCH SHOWN  
AT 1<sup>ST</sup> POSITION.  
BROADCAST BAND  
540-1600 KC**



**BAND-SWITCH SHOWN  
AT 2<sup>ND</sup> POSITION CLOCKWISE  
49 METER BAND  
5.96 - 6.19 MC.**



**BAND-SWITCH SHOWN  
AT 3<sup>RD</sup> POSITION CLOCKWISE  
31 METER BAND.  
9.1 - 10 MC.**



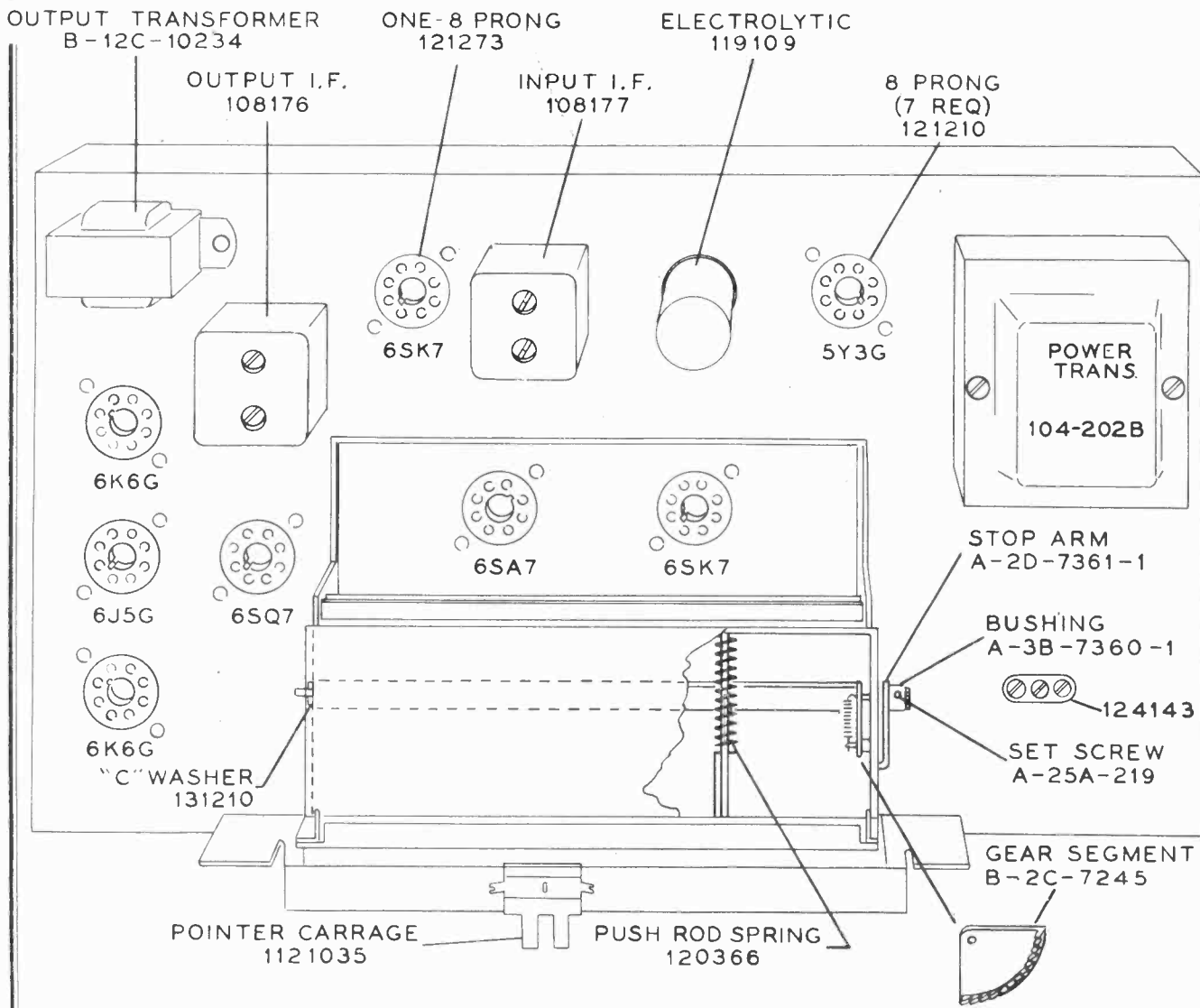
MODELS 43-7651,  
43-7652

GAMBLE-SKOGMO, INC.

MODEL 43-7651



MODEL 43-7652







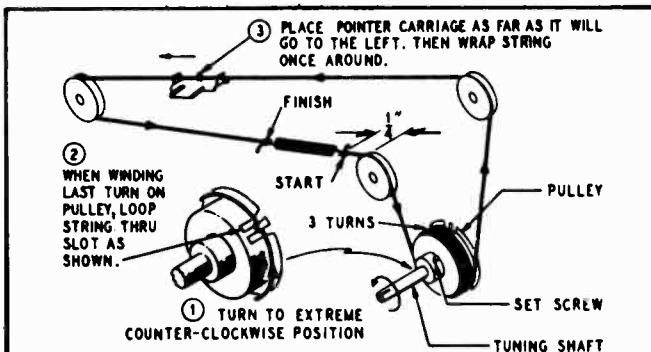
MODELS 43-7651,  
43-7652

### REMOVAL OF CHASSIS FROM CABINET

Before removing chassis, take off escutcheon and pull pointer from pointer carriage.

### SPECIFICATIONS

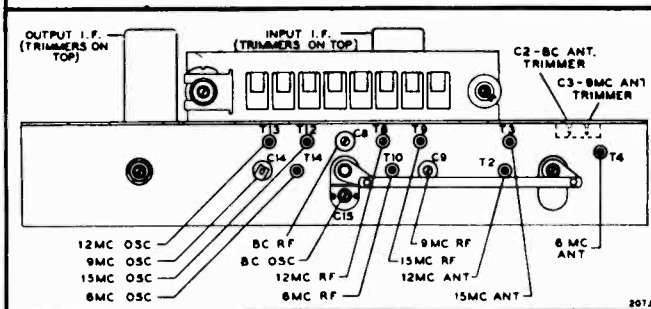
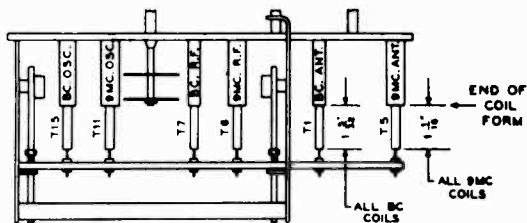
8 Tube Superheterodyne, including rectifier tube  
 Power Output.....7.5 w. max., 5.5 w. undistorted  
 Selectivity.....35 kc. broad at 1,000 times signal at 1,000 kc.  
 Intermediate Frequency.....456 kc.  
 Speaker.....10 inch electrodynamic. Voice coil impedance 3.2 ohms  
 Sensitivity.....4 mv. avg. for 1/2 w. output  
 Power Supply.....105-125 v. A.C. 60 cycles 95 w. (118 w. with phono motor operating)  
 Tuning.....All bands permeability-tuned  
 Frequency Ranges.....Broadcast band 540-1,600 kc.  
 49-meter band 5.96-6.19 mc.  
 31-meter band 9.1-10 mc.  
 25-meter band 11.45-12.16 mc.  
 19-meter band 14.94-15.46 mc.  
 Antenna.....Built-in; provisions also for external antenna and ground.



- ① TURN TO EXTREME COUNTER-CLOCKWISE POSITION
- ② WHEN WINDING LAST TURN ON PULLEY, LOOP STRING THRU SLOT AS SHOWN.
- ③ PLACE POINTER CARRIAGE AS FAR AS IT WILL GO TO THE LEFT, THEN WRAP STRING ONCE AROUND.
- ④ FINISH
- ⑤ WHEN FINISHED WITH STRINGING, SPRING MUST BE 1/4" FROM IDLER AS SHOWN. TO DO THIS:
  - ④ LOOSEN SET SCREW ON PULLEY.
  - ⑤ HOLD TUNING SHAFT FIRM IN POSITION INDICATED AND TURN PULLEY BY HAND UNTIL SPRING IS 1/4" AWAY FROM IDLER.
  - ⑥ TIGHTEN SET SCREW. NOW SPRING SHOULD TRAVEL BACK AND FORTH WITHOUT TOUCHING THE IDLERS.
  - ⑦ REPLACE CHASSIS IN CABINET. REPLACE POINTER ON CARRIAGE. TUNE IN STATION OF KNOWN FREQUENCY. HOLD TUNING SHAFT FIRM AND SLIDE POINTER TO CORRECT POSITION ALONG DIAL.
  - ⑧ GLUE POINTER TO STRING.

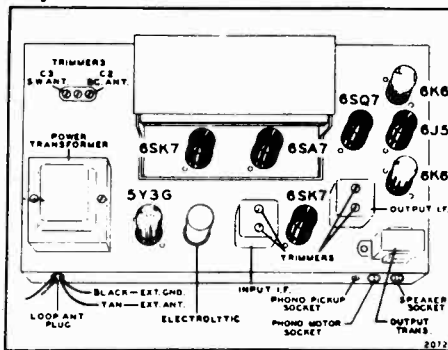
2074

### Coils and Trimmers



2073

### Replacement of Drive Cord



2072A

## ALIGNMENT PROCEDURE CHASSIS VIEW

**Mechanical Adjustment**—The core tuning bar (see illustration of iron cores) 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 1,600 kc. on the dial scale.

Rotate each of the three broadcast coils (see illustration) until the end of the coil is 1-5/32 inches from the end of the coil form. Rotate the three 9-mc. coils until this dimension is 1-1/16 inches from 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 dummy antenna 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.

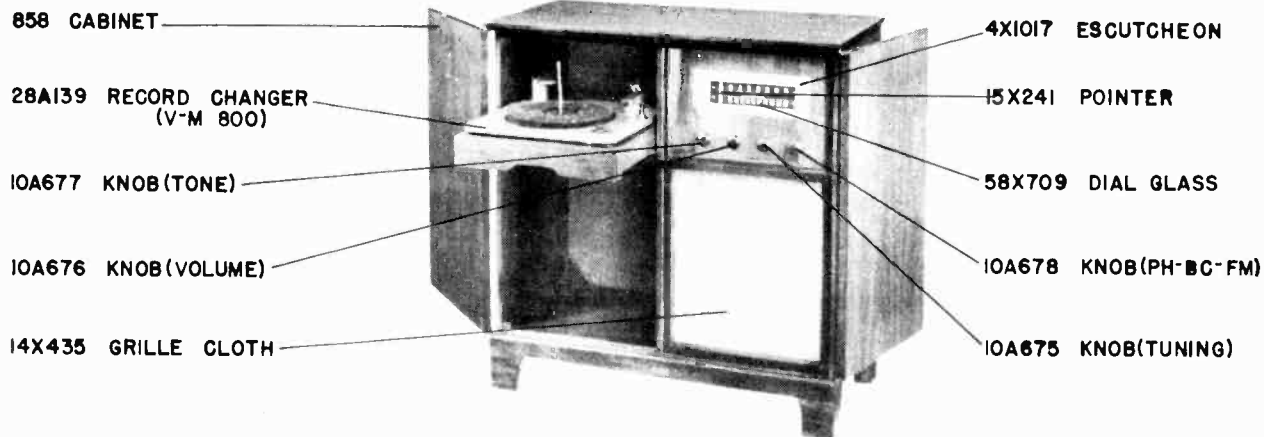
Locations of all the trimmers and coils are shown in the illustrations. After adjustment, seal the coil cores with collodion or a similar substance (do not use cement).

BAND SWITCH SETTING	Frequency	SIGNAL GENERATOR Coupling Capacitor	Connection to Radio	Dial POINTER SETTING	ADJUST TO MAXIMUM OUTPUT (in order shown)
Broadcast (for I.F.)	455 kc.	.1 mf.	Grid (pin 8) of converter (6SA7)	1,600 kc.	Trimmers on output and input I.F. cans
Broadcast	1,600 kc.	200 mmf.	Antenna lead	1,600 kc.	BC Osc. trimmer C15 BC R.F. trimmer C8 BC Ant. trimmer C2
	1,400 kc.	200 mmf.	Antenna lead	1,400 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 C94 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

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
<b>MAIN CHASSIS</b>			T17	108176	Output IF coil complete in can (Range of trimmers: 80-140 mmf)
<b>CAPACITORS*</b>			T18	B-12C-10234	Output transformer
C16	C-8F3-12	470 mmf, 20%, mica	T20	104202B	Power transformer
C17, C19	C-8D-10774	.02 mf, 400 volts, 20%	<b>SOCKETS</b>		
C18	C-8D-10771	.1 mf, 200 volts, +20%—10%	121200		Socket, 4-terminal, for loop antenna
C20-A	129165B	Dual, 50 mmf each section, mica, 20%	121279		Socket, 5-terminal, for tuner
C20-B			A-15B-11538		Socket, 4-terminal, for speaker
C21	C-8D-10813	.05 mf, 400 volts, 20%	121280		Socket, 1-terminal, for phono pick-up
C22	C-8D-10935	.005 mf, 600 volts, +40%—15%	121199		Socket, 2-terminal, for phono motor
C23	C-8F3-10	220 mmf, 20%, mica	121210		Socket, octal, molded (all tubes except 6SK7, IF amp.)
C24	C-8D-10770	.05 mf, 200 volts, 20%	121273		Socket, octal, laminated (for 6SK7, IF amplifier)
C25	C-8D-10788	.004 mf, 600 volts, 20%	B-47A-10808		Socket assembly for dial light
C27	C-8D-10992	.03 mf, 200 volts, 20%	<b>MISCELLANEOUS</b>		
C28	C-8D-10785	.006 mf, 600 volts, 20%	T19	B-18B-10617	Speaker, 10-inch, electrodynamic
C29-A,	119109	Electrolytic, 15 mf x 450 volts, 15		A-19A-11539	Plug on speaker leads
-B, -C		mf x 450 volts, 10 mf x 350 volts	T21	A-14MA-11066-3	Loop antenna (ribbon only)
C30, C31	C-8J-11321	.02 mf, 600 volts, 20%	T22	A-16A-11113	Choke on loop terminal board
<b>RESISTORS*</b>				A-19A-11322	Plug on loop antenna leads
R7, R8	C-9B1-21	22,000 ohms, 1/2 watt, 20%		107401	Phono motor cable assembly
R9	C-9B1-59	560 ohms, 1/2 watt, 10%		10724	Connector, for phono pickup leads
R10	C-9B1-23	47,000 ohms, 1/2 watt, 20%		B-6D-10984	Dial scale
R11	C-9B1-34	3.3 megohms, 1/2 watt, 20%		10794	Dial light, 6-8 volts, type T-44 (2 used)
R12, S3	125180	Tone control (1 megohm) and radio-phono switch		B-2G-10588-1	Dial pointer
R13	C-9B1-27	220,000 ohms, 1/2 watt, 20%		A-2J-11041	Pointer spring
R14, R17	C-9B1-86	100,000 ohms, 1/2 watt, 10%		1121035	Pointer carriage
R15	C-9B1-31	1 megohm, 1/2 watt, 20%		B-53A-10989	String for dial pointer
R16	C-9B1-70	4700 ohms, 1/2 watt, 10%		120377	Spring for dial pointer string
R18, R19	C-9B1-29	470,000 ohms, 1/2 watt, 20%		107266	Line cord and plug (9 feet)
R20	C-9B2-56	350 ohms, 1 watt, 10%		112985-14	Escutcheon (for walnut cabinet)
R21	10662	12,500 ohms, 3 watts, 10%		112985-41	Escutcheon (for mahogany cabinet)
R23	C-9B1-20	15,000 ohms, 1/2 watt, 20%		A-5B-10893-14	Knob, band switch or radio-phonotone (for walnut cabinet)
R24, S4	A-10A-10586	Volume control (500,000 ohms) and on-off switch		A-5B-10893-41	Knob, band switch or radio-phonotone (for mahogany cabinet)
R25	C-9B1-35	4.7 megohms, 1/2 watt, 20%		128523-14	Knob, tuning or volume (for walnut cabinet)
<b>COILS AND TRANSFORMERS</b>				128523-41	Knob, tuning or volume (for mahogany cabinet)
T16	108177	Input IF coil complete in can (Range of trimmers: 110-210 mmf)		A-2L-11293	Bandswitch link
<b>REMOVABLE TUNER ASSEMBLY</b>				112961	Station call letters
<b>CAPACITORS</b>			T6	10959	9-mc RF coil
C1	B-8F-10767	.002 mf, 500 volts, 10%, mica	T7	10962	Broadcast RF coil
C2, C3	124143	Dual, broadcast (67-123 mmf) and 9 mc (95-175 mmf) ant. trimmers	T8	10960	12-mc RF coil
C4, C10	B-8F3-121	470 mmf, 500 volts, 10%, mica	T9	10961	15-mc RF coil
C5	C-8D-10771	.1 mf, 200 volts, +20%—10%	T10	10958	6-mc RF coil
C6, C11	C-8D-10760	.1 mf, 400 volts, +20%—10%	T11	110157	9-mc oscillator coil
C7	B-8F5-101	10 mmf, 500 volts, 10%, silver mica	T12	110159	15-mc oscillator coil
C8	A-8G-7205	Broadcast RF trimmer (120-220 mmf)	T13	110158	12-mc oscillator coil
C9	A-8G-7206	9 mc RF trimmer (60-110 mmf)	T14	110156	6-mc oscillator coil
C12	B-8F3-109	47 mmf, 500 volts, 10%, mica	T15	110161	Broadcast oscillator coil
C13	B-8F-10763	200 mmf, 500 volts, 3%, silver mica	<b>MISCELLANEOUS</b>		
C14	124145	9 mc oscillator trimmer (7-35 mmf)	S1	B-20A-10964	Band switch, antenna
C15	124144	Broadcast oscillator trimmer (15-27 mmf)	S2	B-20A-10965	Band switch, oscillator and RF
<b>RESISTORS</b>				121210	Socket, molded, for 6SA7
R1, R4	C-9B1-31	1 megohm, 1/2 watt, 20%		121171	Socket, laminated, for 6SK7GT
R2	C-9B1-55	270 ohms, 1/2 watt, 10%		117907	Tuning shaft
R3	C-9B1-70	4700 ohms, 1/2 watt, 10%		117798	Pinion gear on tuning shaft
R5	C-9B1-46	47 ohms, 1/2 watt, 10%		120393	Spring, intermediate link, under ends of treadle bar
R6	C-9B1-79	27,000 ohms, 1/2 watt, 10%		131251	Washer, "C", on slug tuning bar
<b>COILS (complete with cores)</b>				B-2C-7245	Gear segment
T1	111195	Broadcast antenna coil		A-2J-7439	Spring clip, for coils
T2	111191	12-mc antenna coil		131316B	Washer "C", for 9-mc coils
T3	111192	15-mc antenna coil		134134	Grommet for core mounting (all broadcast and 9-mc coils)
T4	111189	6-mc antenna coil		134126	Grommet for coil mounting (broadcast RF and antenna coils)
T5	111190	9-mc antenna coil		134125	Grommet for coil mounting (broadcast oscillator coil)
				A-25A-7619	Grommet for all 9-mc coils
				B-202-10475	Pushrod assembly
				120366	Spring, pushrod return
				121281	Plug, 5-prong
				128759-14	Pushbutton, walnut
				128759-41	Pushbutton, mahogany
				131210	Washer, "C", on end plate

MODEL 43-7851

GAMBLE-SKOGMO, INC.



SPECIFICATIONS

7 Tube Superheterodyne..... Including Rectifier Tube	FM Sensitivity..... (For 0.5 Watt Output) 200 mv avg
Power Consumption (at 117 Volts AC) 60 Watts (normal)	Intermediate Frequency..... AM-455KC; FM-10.7 MC
80 Watts (phono operating)	Tuning Range..... AM-540-1600 KC; FM-88-108 MC
Selectivity..... AM-50KC Broad at 1000 Times Signal	Speaker..... 10" P.M. Dynamic
I.F. FM-200KC Broad at 2 Times Down	Power Output..... 4.5 W Max.; 2.5 W 10% Harmonics
I.F. FM-800KC Broad at 200 Times Down	Power Supply..... 105-125 Volts AC 60 cycles only
AM Sensitivity... (For 0.5 Watt Output, with external	Record Changer..... Plays ten 12" or twelve 10"
Antenna) 20 mv avg	

REMOVAL OF CHASSIS FROM CABINET

Before the chassis can be removed from the cabinet, it will be necessary to pull off the 4 control knobs, remove the three chassis mounting bolts and disconnect the leads from the chassis to the loop antenna, record changer and speaker.

ALIGNMENT PROCEDURE

AM STAGES

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 is required for aligning.

An All Wave Signal Generator Which Will Provide an Accurately Calibrated Signal at the Test Frequencies as Listed.

Output Indicating Meter, Non-Metallic Screwdriver  
Dummy Antennas - .1 mf, and 50 mmf.

GAMBLE-SKOGMO, INC.

MODEL 43-7851

FREQUENCY SETTING	SIGNAL GENERATOR CONNECTION AT RADIO	GROUND CONNECTION	DUMMY ANTENNA	GANG CONDENSER SETTING	ADJUST TUNING SLUGS (I-F ONLY) GRIMMERS (OSC. & ANT.)
455 KC	Control Grid 1st 6BA6 Pin No.	Chassis Base	.1 mf	Turn Rotor to Full Open	2nd I.F. Pri. & Sec.
455 KC	Control Grid 6BE6 Pin No. 7 1st Det.	Chassis Base -	.1 mf	Turn Rotor to Full Open	1st I.F. Pri. & Sec.
1620 KC	Control Grid 6BE6 Pin No. 7	Chassis Base	.1 mf	Turn Rotor to Full Open	Oscillator Trimmer (AM)
1400 KC	External Antenna Lead	Chassis Base	50 mmf	Turn Pointer to 1400 KC See Note A	Antenna Trimmer (AM)

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

FM STAGES

Allow chassis and signal generator to warm up for several minutes. The following equipment is required for aligning:

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

Non-metallic screwdriver

Dummy Antennas and I-F Loading Resistor- .01 mf 300 ohms and 100 K ohms.

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

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

	FREQUENCY SETTING	SIGNAL GENERATOR CONNECTION AT RADIO	DUMMY ANTENNA	BAND SWITCH SETTING	CONDENSER SETTING	ADJUSTMENT FOR MAX. METER DEFLECTION	
Discriminator	10.7 MC	6BA6 2nd I-F Pin 1 & Chassis	.01 mf	FM	Rotor to Full Open	Disc. Pri. Note A	
	10.7 MC	6BA6 2nd I-F Pin 1 & Chassis	.01 mf	FM	Rotor to Full Open	Disc. Sec. Note B	
	10.7 MC	6BA6 2nd I-F Pin 1 & Chassis	.01 mf	FM	Rotor to Full Open	Disc. Pri. Note A	
	10.7 MC	6BA6 2nd I-F Pin 1 & Chassis	.01 mf	FM	Rotor to Full Open	Disc. Sec. Note B	
	I-F	10.7 MC	6BA6 1st IF Pin 1 & Chassis	.01 mf	FM	Rotor to Full Open	2nd I-F Pri. 2nd I-F Sec. Note C
		10.7 MC	Unsolder lead from Pin 7 to band switch. Insert 100K ohm resistor between Pin 7 & Ground and feed signal into Pin 7 of 6BE6	.01 mf	FM	Rotor to Full Open	1st I-F Pri. 1st I-F Sec. Note C

RECHECK I-F ADJUSTMENTS IN ORDER GIVEN

Ant. & Osc.	108.5	Disconnect built-in line antenna and connect generator to dipole terminals with resistor in series	300ohms	FM	Rotor to Full Open	Osc. Trimmer (FM)
Note D	104.5	Same as above	300ohms	FM	Tune rotor for max. AVC voltage	Ant. Trimmer (FM)

RECHECK ANTENNA & OSC. ADJUSTMENTS IN ORDER GIVEN



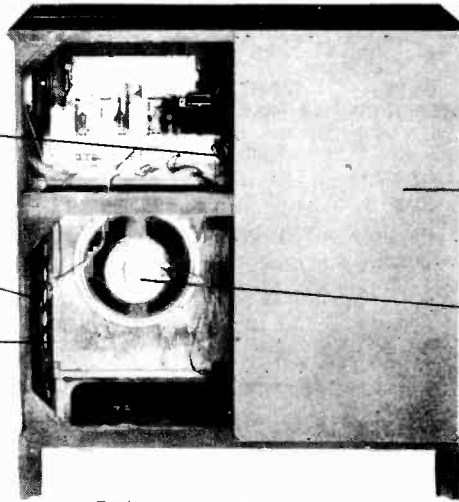
13X546 LINE CORD ASS'Y.

17A235 TRIMMER

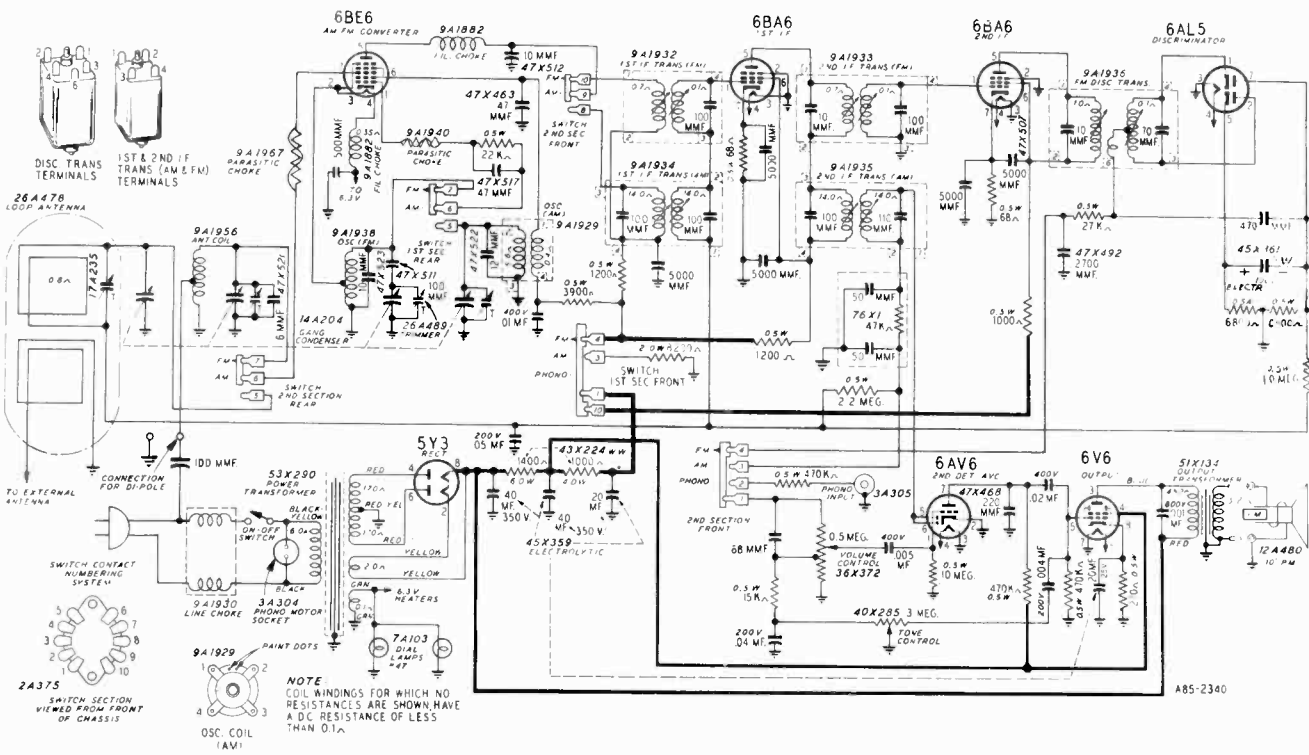
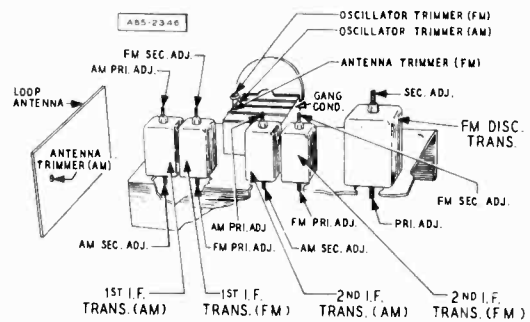
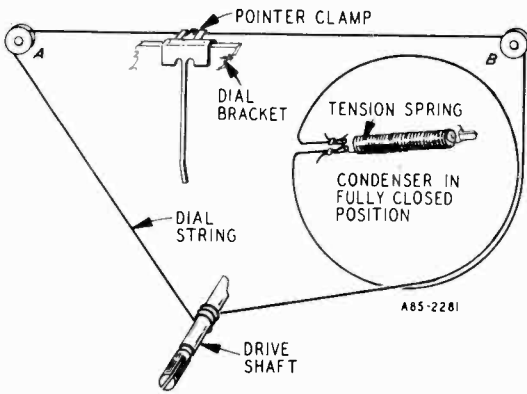
26A478 "B" RANGE LOOP ASS'Y.

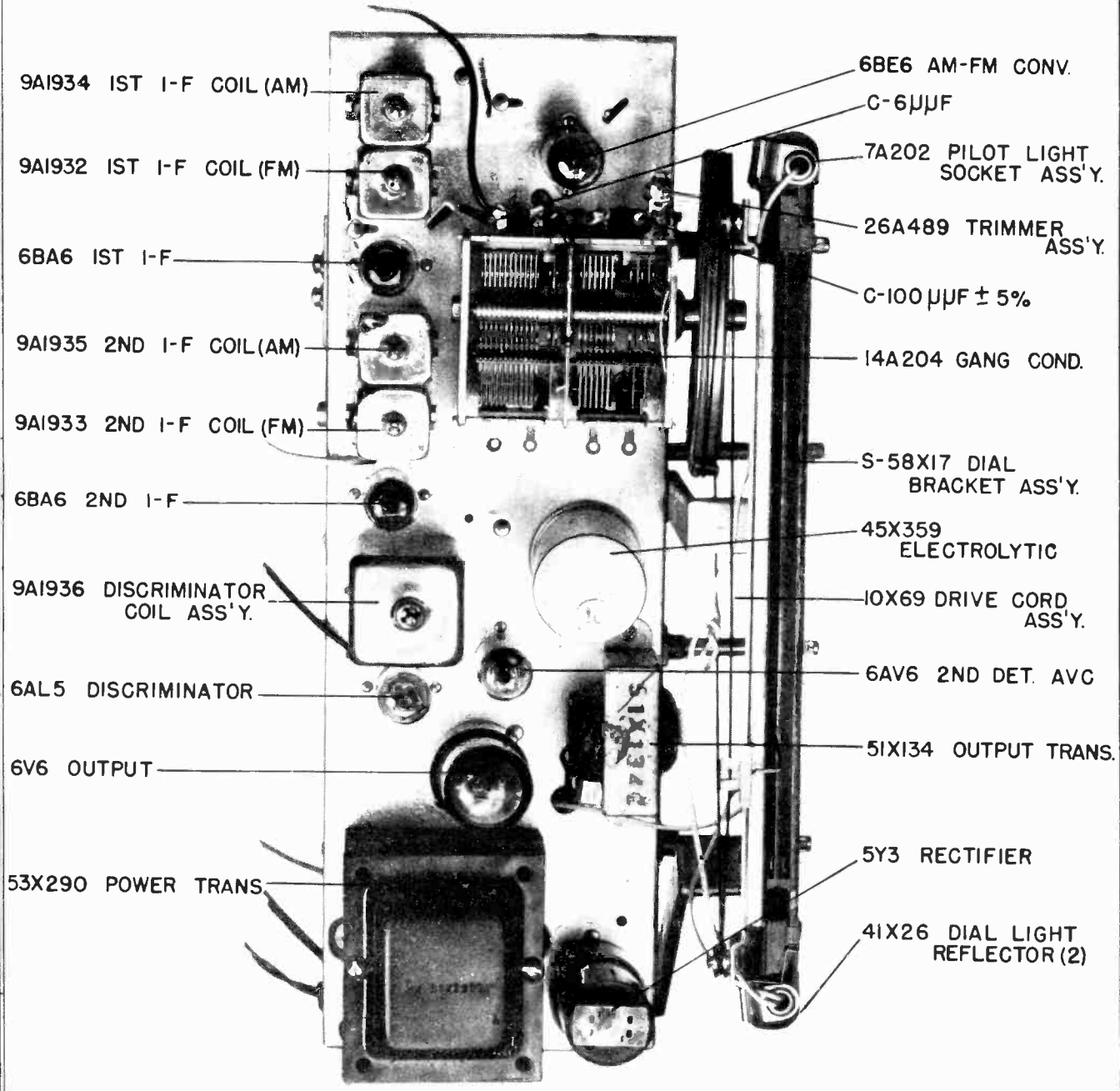
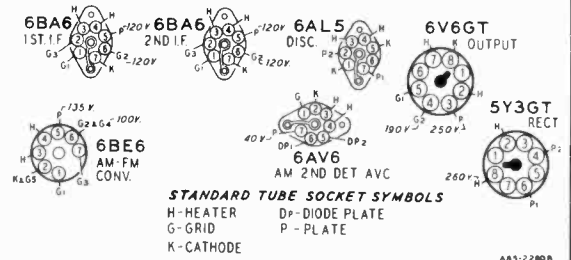
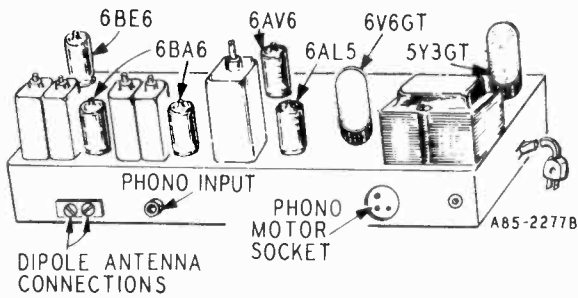
75X12 CABINET BACK

12A480 10" PM SPEAKER



REAR CABINET VIEW

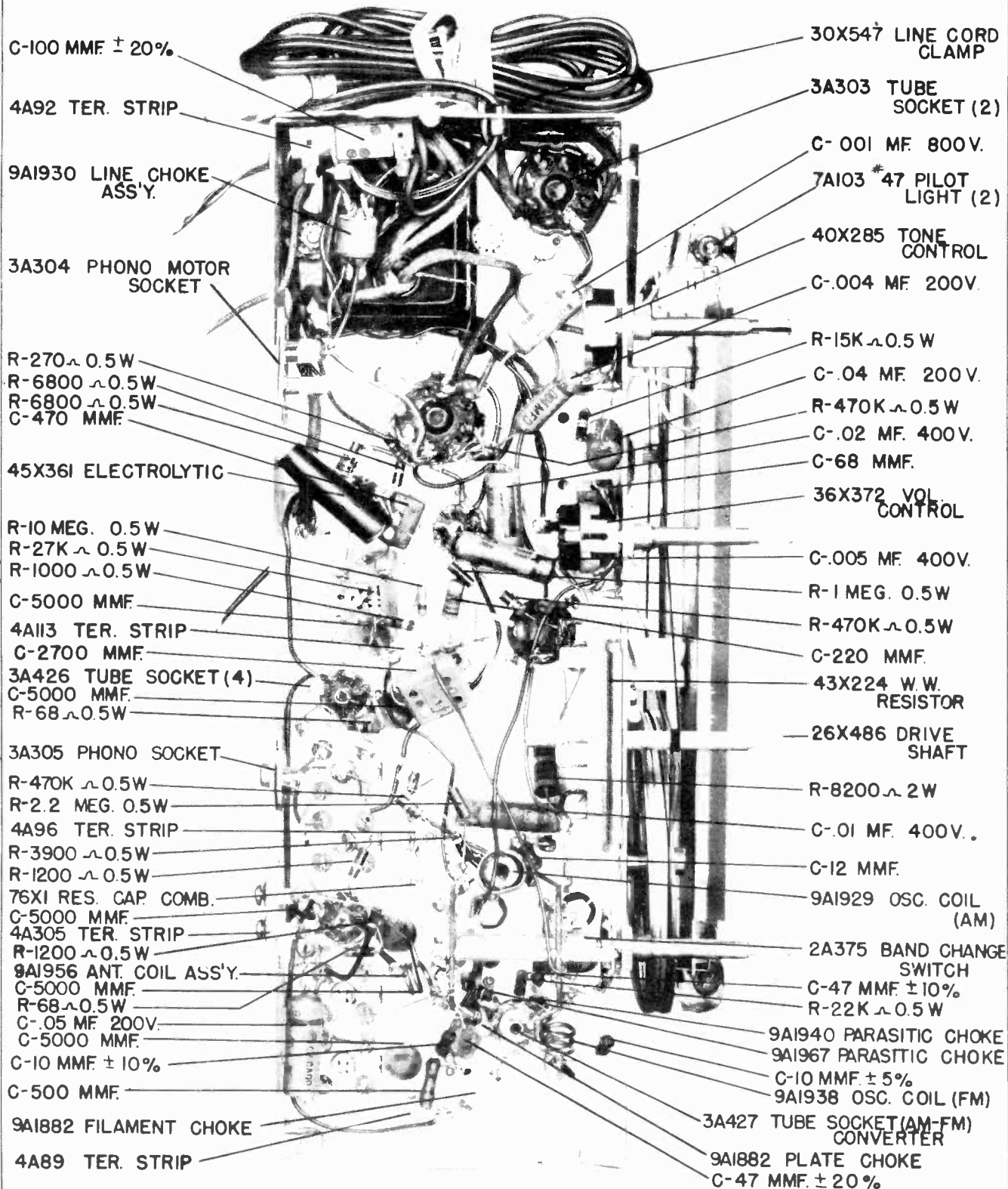




TOP CHASSIS VIEW

MODEL 43-7851

GAMBLE-SKOGMO, INC.



BOTTOM CHASSIS VIEW

PREFIX "C" INDICATES CONDENSER  
 PREFIX "R" INDICATES RESISTOR

GAMBLE-SKOGMO, INC.

MODEL 43-7851

Part No.	Description	Part No.	Description
2A375	Band Change Switch	19X192	"C" Washer (Drive Shaft) (2)
3A303	Molded Octal Tube Socket (2)	19X434	#8 Flat Washer (Mtg. 53X290) (2)
3A304	Phono Motor Socket	20X260	Condenser Cushion Stud (3)
3A305	Phono Socket (Single Pin)	22X472	Chassis Base (with bracket)
3A426	Tube Socket (miniature) (4)	26X486	Drive Shaft
3A427	Tube Socket (miniature for AM-FM converter)	25X1488	Idler Bracket
4A89	Terminal Strip	28X113	Drive Cord Tension Spring
4A92	Terminal Strip	30X547	Line Cord Clamp
4A96	Terminal Strip	36X372	Volume Control & Switch
4A113	Terminal Strip	40X285	Tone Control
4A405	Antenna Terminal Strip	41X26	Dial Light Reflector (2)
7A103	Pilot Light #47 (2)	43X224	W.W. Resistor, 1000 ohms 4 W-1400 ohms 6 W
7A202	Pilot Light Socket Assembly	45X359	4 Section Electrolytic, 40 mf, 350 V - 40 mf 350 V - 20 mf, 350 V - 20 mf, 25 V
9A1882	Choke Assembly (2)	45X361	Dry Electrolytic, 5 mf, 100 V
9A1929	Oscillator Coil Assembly (AM)	47X463	Capacitor, Ceramic; 47 mmf 20%
9A1930	Line Choke Assembly	47X468	Capacitor, Ceramic; 220 mmf 20%
9A1932	1st I.F. Coil Assembly (FM)	47X471	Capacitor, Molded Mica; 68 mmf 20%
9A1933	2nd I.F. Coil Assembly (FM)	47X476	Capacitor, Molded Mica; 100 mmf 20%
9A1934	1st I.F. Coil Assembly (AM)	47X492	Capacitor, Molded Mica; 2700 mmf 10%
9A1935	2nd I.F. Coil Assembly (AM)	47X507	Capacitor, Silvered Mica; 5000 mmf (5)
9A1936	Discriminator Coil Assembly	47X508	Capacitor, Ceramic; 500 mmf 20%
9A1938	Oscillator Coil Assembly (FM)	47X510	Capacitor, Silvered Mica; 470 mmf 5%
9A1940	Parasitic Choke	47X511	Capacitor, Ceramic; 100 mmf 5%
9A1956	Antenna Coil Assembly	47X512	Capacitor, Ceramic; 10 mmf 5%
9A1967	Parasitic Choke Assembly	47X517	Capacitor, Ceramic; 47 mmf 10%
10A675	Knob (Tuning)	47X521	Capacitor, Ceramic; 6 mmf 10%
10A676	Knob (Off-On Volume)	47X522	Capacitor, Ceramic; 12 mmf 10%
10A677	Knob (Tone)	47X523	Capacitor, Ceramic; 10 mmf 10%
10A678	Knob (Ph-BC-FM)	51X134	Output Transformer
12A480	10" P.M. Speaker	53X290	Power Transformer
14A204	Gang Condenser & Pulley	58X709	Dial Glass
28A139	Record Changer V.M. #800	75X12	Cabinet Back
26A478	"B" Range Loop Antenna Assembly made up of: 9A1939 "B" Range Loop Antenna	76X1	Resistor Capacitor Combination
	17A235 Trimmer Condenser	B66402	Capacitor Tubular .004 mf 200 V 25%
	1701 3/16" Tubular Rivet	B66403	Capacitor Tubular .04 mf 200 V 25%
26A489	Trimmer Assembly consisting of: 17A257 Tubular Trimmer Slug	B65503	Capacitor Tubular .05 mf 200 V 25%
	17A258 Tubular Trimmer Sleeve	B83392	Resistor, Carbon; 3900 ohms .5 W
S-58X17	Dial Bracket Assembly consisting of: 7X42 Cardboard Spacer	B83680	Resistor, Carbon; 68 ohms .5 W (2)
	8X185 Rubber Bands	B84102	Resistor, Carbon; 1000 ohms .5 W
	20X268 Rivets	B84122	Resistor, Carbon; 1200 ohms .5 W (2)
	24X446 Idler Pulley	B84153	Resistor, Carbon; 15 K ohms .5 W
	25X1569 Dial Bracket	B84223	Resistor, Carbon; 22 K ohms .5 W
	41X26 Dial Light Reflector	B84271	Resistor, Carbon; 270 ohms .5 W
	58X709 Dial Glass	B84273	Resistor, Carbon; 27 K ohms .5 W
	AS. Req. Brown Lacquer Enamel	B84682	Resistor, Carbon; 6800 ohms .5 W (2)
4X1017	Escutcheon	B85105	Resistor, Carbon; 1 megohm .5 W
5X21	Rubber Grommet (4)	B85106	Resistor, Carbon; 10 megohms .5 W
10X69	Drive Cord Assembly	B85225	Resistor, Carbon; 2.2 megohms .5 W
13X546	Line Cord & Plug Assembly	B85474	Resistor, Carbon; 470 K ohms .5 W (3)
14X435	Grille Cloth	D66103	Capacitor, Tubular; .01 mf 400 V 25%
15X241	Pointer	D66203	Capacitor, Tubular; .02 mf 400 V 25%
19X179	Flat Washer (Mtg. Set to Cabinet) (3)	D66502	Capacitor, Tubular; .005 mf 400 V 25%
		D84822	Resistor, Carbon; 8200 ohms 2.0 W
		H66102	Capacitor, Tubular; .001 mf 800 V 25%

FM ALIGNMENT NOTES

Note A - The zero center scale DC vacuum tube voltmeter is to be connected between chassis ground and the A.V.C. line at the 27 K. ohm resistor and its junction with terminal strip. A signal of .1 volt must be fed into the receiver for this adjustment. Note output voltage on the zero center DC vacuum tube voltmeter.

Note B - Disconnect zero center DC vacuum tube voltmeter from A.V.C. and connect it to the audio takeoff point at the 1 megohm resistor and its junction with

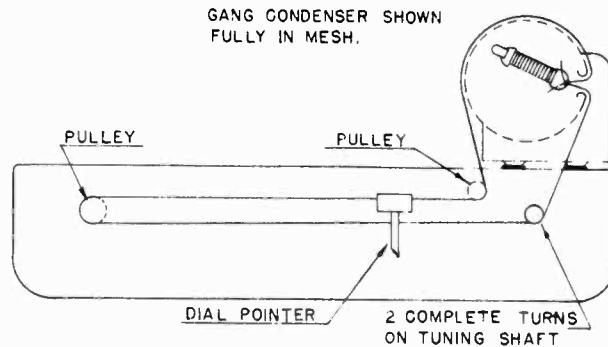
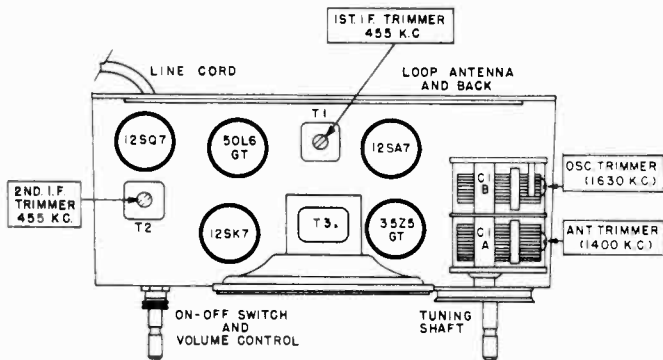
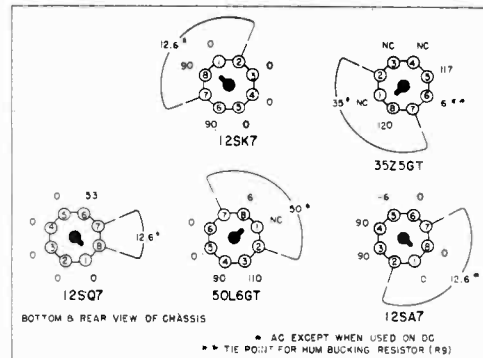
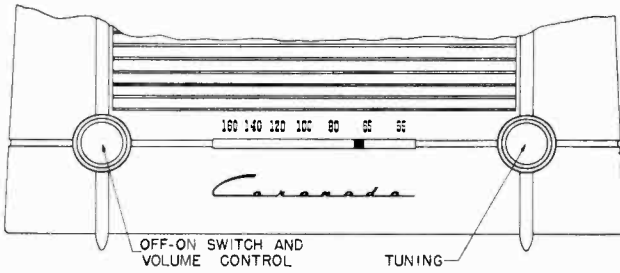
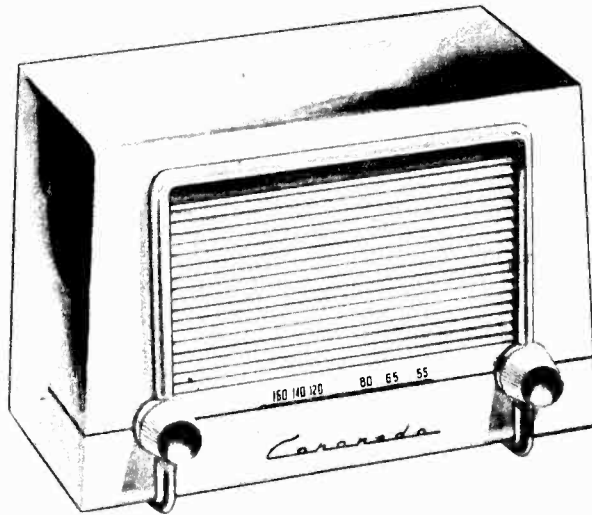
the terminal strip. Adjust for zero voltage indication.

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

Note D - Remove the 100 K ohm load resistor and solder the lead from pin 7 of 6BE6 tube to the band switch before attempting to check the antenna and oscillator adjustments.

MODELS 43-8129A,  
43-8130A, 43-8130B,  
43-8131A, 43-8131B

GAMBLE-SKOGMO, INC.



SPECIFICATIONS

Power Supply	117 volts 60 cycle AC, 117 volts DC, 29 watts
Frequency Range	535 KC to 1630 KC
Intermediate Frequency	455 KC
Antenna	Built-in Loop
Tuning	Variable Capacity
Speaker	4", P.M., voice coil impedance 3.2 ohms
Power Output	0.75 watt undistorted, 1.8 watts maximum
Sensitivity	500 uv/m average for 50 milliwatts output
Selectivity	65 KC broad at 1000 times, signal at 1000 KC

Tubes used are as follows:

12SA7 Oscillator-Converter	50L6GT Power Output
12SQ7 AVC, Detector and Audio	3525GT Power Rectifier
12SK7 I.F. Amplifier	



GAMBLE-SKOGMO, INC.

MODELS 43-8129A,  
43-8130A, 43-8130B,  
43-8131A, 43-8131B

ALIGNMENT PROCEDURE

The following procedure is for use only by competent servicemen having the proper equipment. The alignment should be made with volume control fully on, and the output from the Signal Generator as low as possible, to prevent AVC action from interfering with proper alignment. With the output meter connected across the voice coil of the speaker, the output meter reading for 50 milliwatts is 0.4 volts, using a signal which is modulated 400 c.p.s. Adjust all trimmers for maximum output. Repeat the alignment procedure given below as a final check.

CAUTION: This is an AC/DC receiver and when aligning the set it is necessary to isolate the Signal Generator or the Receiver from the line by use of a transformer, or to place a .2 MFD condenser in each test lead of the Signal Generator.

Frequency	SIGNAL GENERATOR Dummy Antenna	Connection to Radio	POSITION OF VARIABLE	ADJUST FOR MAXIMUM OUTPUT
455 KC	.1 MFD	12SA7 Grid Stator CIA	Fully Open	T1 & T2
1630 KC	.1 MFD	12SA7 Grid Stator CIA	Fully Open	C1B Oscillator
1400 KC		Loosely Coupled To Loop	Tune in Signal Generator	C1A Antenna

Connect low side of Signal Generator to common negative.

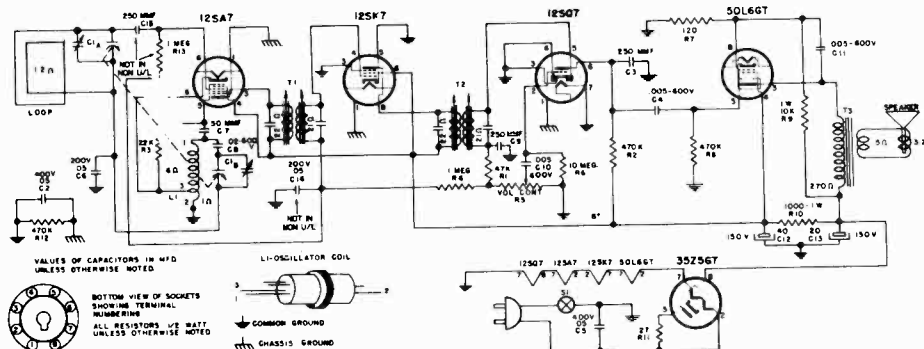
SYMBOL	PART NO.	DESCRIPTION	VALUE	TOL.	RATING
CONDENSERS					
C1A, C1B	B19-198	Condenser, 2 gang			
C2, C5	A16-158	Condenser, paper	.05 MFD	20%	400 volts
C3, C9, C15	A15-176	Condenser, mica	250 MMF	20%	500 volts
C4, C10, C11	A16-153	Condenser, paper	.005 MFD	20%	600 volts
C6, C14	A16-152	Condenser, paper	.05 MFD	20%	200 volts
C7	A15-175	Condenser, mica	50 MMF	20%	500 volts
C8	A16-151	Condenser, paper	.02 MFD	20%	600 volts
C12	A18-280	Electrolytic	40 MFD		150 volts
C13	A18-272	Electrolytic	20 MFD		150 volts
RESISTORS					
R1	A60-685	Resistor	47K ohm	20%	1/2 watt
R2, R8, R12	A60-662	Resistor	470K ohm	20%	1/2 watt
R3,	A60-659	Resistor	22K ohm	20%	1/2 watt
R4, R13	A60-668	Resistor	1 megohm	20%	1/2 watt
R5	A24-180	Volume control and switch			
R6	A60-663	Resistor	1 megohm	20%	1/2 watt
R7	A60-702	Resistor	10 megohm	20%	1/2 watt
R9	A60-698	Resistor	120 ohms	10%	1/2 watt
R10	A60-732	Resistor	10K ohm	10%	1 watt
R11	A60-690	Resistor	1000 ohms	10%	1 watt
		Resistor	27 ohms	10%	1/2 watt
COILS AND TRANSFORMERS					
T1, T2	A10-479	Input and output I.F. transformers			
L1	B10-480	Oscillator coil			

CABINET, DIAL AND TUNING PARTS

PART NO.	DESCRIPTION
A42-453	Cabinet, polystyrene, brown
D42-450	Cabinet, polystyrene, white
A42-452	Cabinet, polystyrene, black
A52-282	Knob, tenite, brown
B52-281	Knob, tenite, white
A51-105	Dial cord
A58-73	Pointer, slide type
A70-122	Spring, dial cord tension

MISCELLANEOUS

PART NO.	DESCRIPTION
A11-187	Clamp, line cord
A23-151	Line cord
A83-421	Clip, I.F. trans. mounting
B79-369	Speaker, 4", P.M. w/output trans.
C21-139	Cover, chassis bottom
SD84-275	Loop and back (for U/L models)
SD84-305	Loop and back (for non U/L models)
68-11	Tube socket





**ALIGNMENT PROCEDURE**

Volume control—Maximum: all adjustments.

Connect ground lead of signal generator to common "B."

Connect dummy antenna in series with output lead of signal generator.

Connect output meter across voice coil of speaker.

For alignment points refer to Figure No. 2.

The following equipment is necessary for proper alignment:

Signal generator that will provide the test frequencies as listed, 30% modulated, 400 c.p.s.

Output meter.

Non-metallic screwdriver.

Dummy antennas—.1 mfd.,

Position of Variable	Generator Frequency	Dummy Ant. Mfd.	Generator Connections	Trimmer Adjustment	Trimmer Function
Fully open	455 KC	.1	*1R5 Grid (Stator of C1A)	T2	Output I.F.
Fully open	455 KC	.1	*1R5 Grid (Stator of C1A)	T1	Input I.F.
Fully open	1600 KC	.1	*1R5 Grid (Stator of C1A)	C1B	Oscillator
Tune in signal from generator	1400 KC	—	Loosely coupled to loop	C1A	Antenna
**Tune in signal from generator	600 KC	—	Loosely coupled to loop	L1	600 KC Padder

\*Connect ground lead of signal generator to chassis.

\*\*When making this adjustment the variable should be rocked back and forth.

SYMBOL	PART NO.	DESCRIPTION	VALUE	RATING
CONDENSERS				
C2, C4, C5, C22	A15-190	Mica condenser	100 MMF	
C1A, C1B	B19-190	Variable condenser		
C3, C7, C8	A16-181	Condenser	.005 MFD	150 volts
C10, C12, C13				
C6	A15-191	Mica condenser	50 MMF	
C11, C17, C21	A16-172	Condenser	.05 MFD	400 volts
C14, C19		Electrolytic condenser	20 MFD	150 volts
C18	A18-282	Electrolytic condenser	40 MFD	150 volts
C20		Electrolytic condenser	100 MFD	25 volts
C15	A16-171	Condenser	.05 MFD	200 volts
C9	A16-182	Condenser	.002 MFD	200 volts
RESISTORS				
R1, R5, R7, R9	A60-726	Resistor	2.2 megohm	1/2 watt
R2	A60-727	Resistor	100K ohm	1/2 watt
R3, R11	A60-728	Resistor	10 megohm	1/2 watt
R4	A60-730	Resistor	47K ohm	1/2 watt
R6	A60-731	Resistor	470K ohm	1/2 watt
R8, R12	A60-729	Resistor	1500 ohm	1/2 watt
R10	A24-172	Volume Control	1 megohm	
R13	A60-723	Resistor	270 ohm	1/2 watt
R14	A60-722	Resistor	470 ohm	1/2 watt
R15	A60-725	Resistor	160 ohm	3 watt
R16, R17	A60-713	Resistor (1000 ohms ea. sec.)	2000 ohm	10 watt
R18	A60-724	Resistor	3300 ohm	1 watt
COILS AND TRANSFORMERS				
T1, T2	C10-475	1st and 2nd I.F. Transformer		
T3	A80-231	Output transformer		
L1	B10-477	Oscillator coil		
MISCELLANEOUS				
	S84-112	Cover assembly for "A" batteries		
	S84-214	Front cover ass'y. for case, with loop		
	S84-217	Rear cover assembly for case		
	S84-111	Hub and Pointer assembly		
	A52-227	Knob, On-Off switch		
	A52-229	Knob, tuning		
	A52-232	Knob, volume control		
	A83-561	Selenium Rectifier		
	B79-353	Speaker, P.M.		
	A69-174	Switch, AC-DC Battery		
	A69-175	Switch, On-Off		
	A75-34	Terminal for "B" battery		
	B23-156	Line cord		
	D21-108	End Cap, for handle		
	A83-494	Handle		











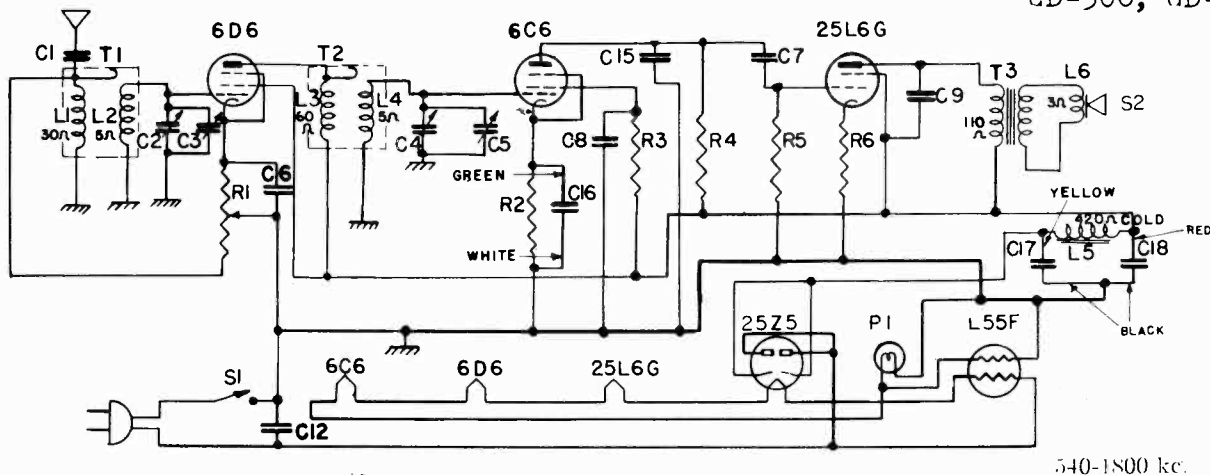
## ALIGNMENT CHART

(Follow Sequence as Indicated)

CIRCUIT ALIGNED	STEP	RCVR. DIAL POINTER	SIGNAL GENERATOR		METER	METER CONNECTIONS	TRIMMER OR CORE ADI.	PROCEDURE
			FREQUENCY	CONNECTIONS				
B.C. I.F.	1	1650 KC. B.C. Band	455 KC. 30% Mod.	Through .1 MFD CAP. TO GRID of 6BE6.	A.C. Output Meter	Across voice coil	Cores on top and bottom of 1st and 2nd I.F. trans.	Adjust for maxi- mum output
F-M I.F.	2	108.5 MC. F-M Band	10.7 MC. unmod.	Through .01 MFD. Cap. to grid of 6BE6.	D.C. VTVM	From Pin 1 limiter grid and ground	Top and bottom cores of 1st, 2nd and 3rd I.F. Trans. F-M	Same as step 1
F-M I.F.	3							Repeat step 2
F-M Disc.	4	108.5 MC. F-M Band	10.7 MC. unmod.	Same as step 2	D.C. VTVM	From junction of 100K disc. load resistor point "A" and ground	Bottom core of 10.7 MC Disc. Trans.	Same as step 1
F-M Disc.	5	108.5 MC. F-M Band	10.7 MC. unmod.	Same as step 2	D.C. VTVM	From Pin 1 6AL5 and ground	Top core of 10.7 Mc Disc. Trans.	Adjust for zero between positive and negative meter reading
F-M Osc. (high Freq. end)	6	108.5 MC. F-M Band	108.5 MC. unmod.	Through balanced 300 ohm dummy ant. to D1, D2 and ground terminals	D.C. VTVM	From Pin 1 limiter grid and ground	C3	Same as step 1
F-M Osc. (low freq. end)	7	87.5 MC. Band 1	87.5 MC. unmod.	Same as #6	D.C. VTVM	Same as #6	Oscillator coil core L3	Same as step 1
F-M Osc.	8	REPEAT STEPS 6 AND 7 AS NECESSARY						
F-M R.F. Circuit	9	105 MC. Band 1	105 MC. unmod.	Same as #6	D.C. VTVM	Same as #6	C2	Same as step 1
F-M ANT. Circuit	10	90 MC. Band 1	90 MC. unmod.	Same as #6	D.C. VTVM	Same as #6	R.F. coil core L2	Same as step 1
	11	REPEAT STEPS 9 AND 10 AS NECESSARY						
	12	95 MC. Band 1	95 MC. unmod.	Same as #6	VTVM D.C.	Same as #6	Antenna coil core L1	Same as step 1
B.C. Osc.	13	1650 KC. Band 2	1650 KC. 30% mod.	Through loop, or coupled to re- ceiver loop by a 2 or 3 turn loop.	Output meter	Across voice coil	C4	Same as step 1
B.C. Osc.	14	540 KC. Band 2	540 KC. 30% mod.	Same as #13	Output meter	Across voice coil	C5	Same as step 1
	15	REPEAT STEP #13						
	16	1500 KC. Band 2	1500 KC. 30% mod.	Same as #13	Output meter	Across voice coil	C6	Same as step 1
B.C.R.F.	17	600 KC. Band 2	600 KC. 30% mod.	Same as #13	Output meter	Across voice coil	C5	Adjust for maxi- mum output while rocking gang
	18	REPEAT STEP 16						
S.W. Osc.	19	18.5 MC. Band 3	18.5 MC. 30% mod.	Through 400 ohm resistor to ant. and gnd. terminals.	Output meter	Across voice coil	C7	Adjust all the way open, then carefully turn in until output is maximum
S.W. R.F.	20	16.0 MC. Band 3	16.0 MC. 30% mod.	Same as #19	Output meter	Across voice coil	C1	Adjust for maxi- mum output while rocking gang

GENERAL ELECTRIC CO.

MODELS GD-50,  
GD-506, GD-550



540-1800 kc.

Symbol	Description	Symbol	Description	Symbol	Description
C-1	Capacitor—.01 Mfd. (GD-41)	C-12	Capacitor—Paper .05 Mfd.	R-5	Resistor—1 Megohm
C-2	Capacitor—Variable	C-15	Capacitor—Mica 100 Mmf.	R-6	Resistor—150 Ohms
C-3	Capacitor—Trimmer on gang	C-16	Capacitor—Elect. 5 Mfd. 25 V.	T-1	Antenna Transformer
C-4	Capacitor—Variable	C-17	Capacitor—Elect. 16 Mfd. 150 V.	T-2	R.F. Transformer
C-5	Capacitor—Trimmer on gang	C-18	Capacitor—Elect. 10 Mfd. 150 V.	T-3	Output Transformer (on speaker)
C-6	Capacitor—Paper .05 Mfd.	R-1	Resistor—25,000 Ohms Volume Control	S-1	Power Switch (Comb. with R-1)
C-7	Capacitor—Paper .01 Mfd.	R-2	Resistor—35,000 Ohms	S-2	Loud-speaker—3-inch
C-8	Capacitor—Paper .01 Mfd.	R-3	Resistor—3 Megohms		
C-9	Capacitor—Paper .02 Mfd.	R-4	Resistor—1 Megohm		

ALIGNMENT

Connect the high side of the signal generator through a 250-mmfd. condenser to the antenna lead. The low side of the signal generator output should be connected to the receiver chassis through a .05-mfd. condenser. Connect a suitable output meter across the voice coil leads; then proceed as follows:

1. With gang condenser plates completely closed, the dial pointer should coincide with the horizontal dial line.
2. Tune receiver to the 1500-ke. point on the dial; then align trimmers (C-3 and C-5) on the gang condenser at 1500 kc. for a maximum output meter reading.

Precaution—One side of the power supply is connected to the chassis—do not connect chassis to any external ground.

Electrical Specifications

Power Supply (Volts)	Frequency (Cycles on AC)	Power Consumption (Watts)
105-125 AC or DC	40-100	48

Electrical Power Output

Undistorted	1.0 watt
Maximum	2.0 watt

Tubes

RF Amplifier	GE-6D6
Detector	GE-6C6
Power Output	GE-25L6G
Rectifier	GE-25Z5
Ballast Tube Resistor	L55F
Dial Lamp	Mazda No. 44

SOCKET VOLTAGES

Tube No.	Plate to -B Volts DC		Screen to -B Volts DC		Cathode to -B Volts DC		Cathode Current M.A. DC		Heater Volts	
	AC	DC	AC	DC	AC	DC	AC	DC	AC	DC
6D6	113	90	113	90	9.0	7.4	0.7	0.6	6.35	6.06
6C6	29 *	16.4 *	45	37	3.1	2.5	0.1	0.08	6.35	6.06
25L6G	108	88	113	90	7.6	6.2	40.5	33.1	25.0	23.5
25Z5	.....	.....	.....	.....	133	108	43.0	35.0	26.0	24.0

Line voltage 115 AC or DC—No signal input—1000 ohms per volt meter.

Dial pointer at 540 kc. Volume control at minimum.

\* Measured on 250-volt scale.



**SPECIFICATIONS**

**CABINET:**

Model .....	XFM-1
Material .....	Wood
Color .....	Walnut
Height .....	10 <sup>3</sup> / <sub>4</sub> in.
Width .....	11 <sup>1</sup> / <sub>2</sub> in.
Depth .....	15 <sup>3</sup> / <sub>4</sub> in.

**ELECTRICAL RATING:**

Nominal Voltage: 110	Range in Volts: 103-117
125	117-133
150	140-160
200	185-213
225	213-234
245	234-260
Frequency .....	50-60 cycles
Wattage .....	65

**OPERATING FREQUENCIES:**

88 mc to 108 mc  
 Antenna Input  
 FM—300-ohm input for folded dipole.

**TUBE COMPLEMENT:**

(V1) R-F Amplifier .....	Type 6AG5
(V2) Oscillator .....	Type 6AK5
(V3) Converter .....	Type 6AK5
(V4) 1st I-F Amplifier .....	Type 6SG7
(V5) 2nd I-F Amplifier .....	Type 6SV7
(V6) Limiter .....	Type 6SH7
(V7) Discriminator and Audio Amplifier .....	Type 6AQ7GT
(V8) Rectifier .....	Type 5Y3GT/G
Dial Lamp (2) .....	Mazda No. 44

**GENERAL INFORMATION**

**INTRODUCTION**

Model XFM-1, Frequency Modulation Translator, is used in conjunction with any radio receiver designed for quality phono operation.

The r-f stage of this translator is unusual in a number of respects. Variable inductance tuning is employed instead of using a conventional tuning capacitor. This design has two distinct advantages. It provides a highly efficient circuit in our range (88 to 108 megacycles) which would not be possible with the more conventional methods of tuning.

Tuning is accomplished by an "elevator" which consists of a rigid plastic horizontal plate (Figure 1-A) raised and lowered by means of a windlass (Figure 1-B) controlled by the tuning knob at the panel. From this plate are suspended three tuning "vanes" (Figure 1-C) which tune three low-inductance circuits. They are called "guillotine" tuners because of their appearance.

**FACTS ABOUT "GUILLOTINE" TUNING**

The "guillotine" tuners are designed for the ultra-high frequency of the FM band where special technique is needed to attain high gain and circuit stability. The efficiency of a tuned circuit with a fixed capacity decreases with the inductance so that for high frequencies demanding very low inductance the circuit will be very inefficient. The stray capacities of every wiring assembly represent shunt capacities which offer only a low resistance at high frequencies. This resistance damps the tuned circuit, causing an appreciable drop in the gain. It is, therefore, imperative to reduce the length of any connecting wire as much as possible. Another disadvantage of standard tuning arrangements at these frequencies is that common coupling is obtained through the shaft of a ganged tuning capacitor unless insulated single sections are used (cumbersome and costly). Common coupling of this type tends to cause oscillation or general instability and preclude high gain per stage. The guillotines make possible short leads, completely isolated sections, stable tuning,

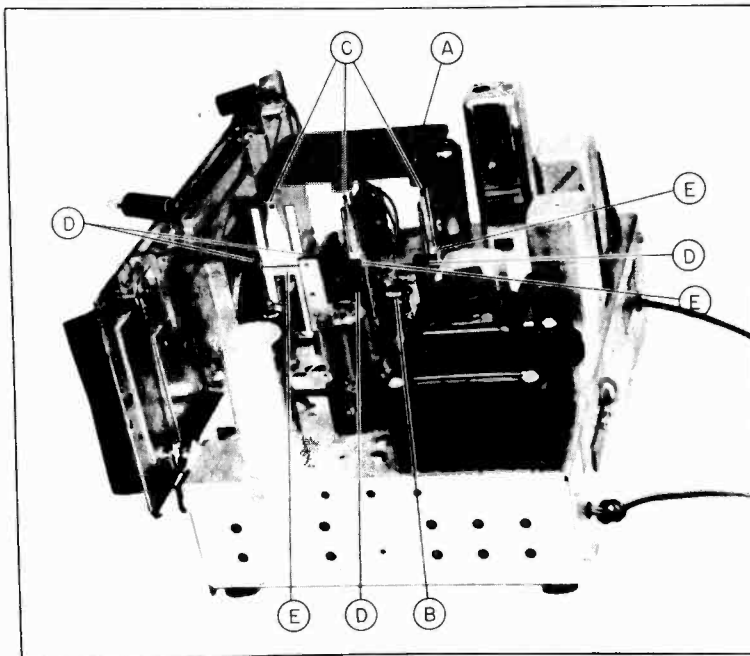


Fig. 1. Chassis with Tuner Assembly



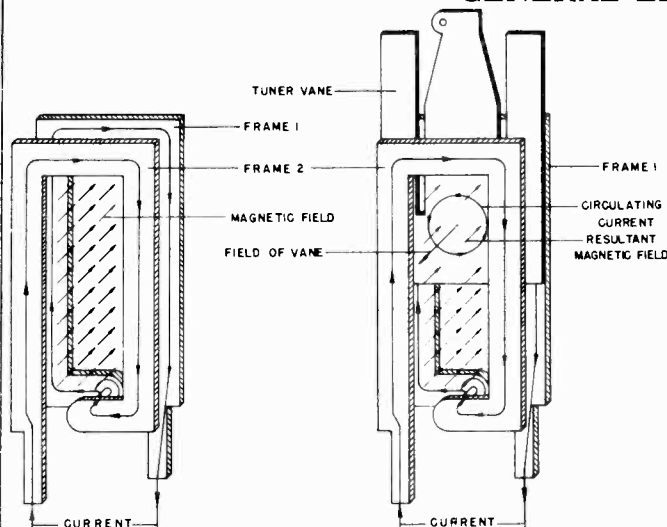


Fig. 2. Principle of Guillotine Tuner

high Q circuits, low shunt capacity, and location of each tuner in the best physical and electrical position in the assembly. Furthermore, since the shunt capacity is small and the inductance is consequently at its highest corresponding value, the additional unavoidable inductance introduced with wiring, band switch, etc., produces a minimum of circuit losses and unbalance.

**GUILLOTINE TUNER**

The guillotine tuner consists of two identical silver-plated brass frames (Figure 1-E) which form a two-turn square coil when connected at their open ends (Figure 2). They are mounted rigidly between two plastic posts (Figure 1-D). The magnetic field of this two-turn inductance is varied by the insertion of a brass blade between the frames (Figure 2). This solid vane slides up and down between the two turns guided in grooves in the plastic posts so that it passes between the two frames of the coil with a constant clearance. The posts are so moulded and the coil so constructed that the whole assembly is held rigidly at a predetermined spacing. The tuning vane is raised and lowered by the tuning elevator (Figure 1-B). When the elevator is all the way up (set tuned to the lowest frequency), the vane is completely above the coil which then acts as a simple two-turn coil. As the set is tuned towards the high frequencies, the vane moves downwards into the magnetic field of the coil unit, finally it is all the way in. The direction of the field is given by the arrows in Figure 2-A. It should be kept in mind that the inductance of the coil is proportional to the intensity of the linked field. If the vane is inserted between the two frames, the magnetic field (which is fluctuating at a rate determined by the FM frequency) induces in it a circulating current whose direction is such that the field produced by it is directed opposite to the original field (arrow in the opposite direction, Figure 2-B). The result is a decrease of field intensity, and subsequently a lower inductance of the coil. A sliding movement of a metal vane accomplishes, therefore, a change of the inductance of the coil.

The vane reduces this inductance through two principles. First, it acts as a shorted turn and thus reduces inductance directly; second—it provides a barrier between the two turns of the coil which reduces the mutual coupling and this, also, the inductance. It is desirable that the increase of the inductance is uniform with the movement of the vanes. To obtain the desired tuning curve, slots are cut in the blade the form of which once calculated can be kept within the required limits throughout production. The entire unit can be mechanically assembled and does not need any adjustment to insure proper tracking. Since the moving vane is ungrounded, there are no sliding contacts to produce noise while tuning in stations.

The tuners described above are identified as T1, T2, and T3 on the schematic diagram, Figure 5.

**STAGE GAIN AND VOLTAGE CHECKS**

Stage gain measurements by vacuum tube voltmeter or similar measuring devices may be used to check circuit performance and isolate trouble. The gain values listed may have tolerances of 20%. Readings taken with low signal so that AVC is not effective.

**(1) R-F AND I-F STAGE GAINS**

Signal applied through 300-ohm resistor, including signal generator impedance (remove 6AG5):  
 Dipole terminals to grid of R-F amplifier 6AG5 ..... 2 at 98 mc  
 This check with oscillator tube 6AK5 removed:  
 Grid of R-F amplifier tube 6AG5 to grid converter tube 6AK5 ..... 9 at 98 mc  
 These checks with oscillator tube 6AK5 removed:  
 Grid of converter tube 6AK5 to grid of 6SG7 ..... 38 at 10.7 mc  
 Grid of 6SG7 to grid of 6SV7 ..... 37 at 10.7 mc  
 (Adjust grid trimmers with VTVM in place.)

**(2) OSCILLATOR GRID BIAS**

D-C voltage developed across R5 ..... 10 volts at 98 mc

**(3) SOCKET PIN VOLTAGES**

Figure 6 shows typical tube pin voltages. All readings should be made from the pins to ground unless otherwise stated.

**REPLACEMENT OF DRIVE CORDS**

**DIAL STRINGING**

Push the tuning elevator all the way down and string the dial as shown in Figure 3. This illustration shows the stringing as viewed from behind the dial scale, as you would see it when working on it. The number and arrows indicate the progression of the dial cord from start to finish. The procedure will be easier if pulley C is by-passed until the rest of the work is finished. After which, the cord can be pulled tight over that pulley. During the procedure, locate the two brass eyelets so that they fall between pulleys A and B. When finished, crimp the eyelets on the cord in the proper position to act as minimum and maximum stops for the tuning mechanism and clip the pointer on the cable halfway between the eyelets.

Separate detail drawing is given to show the method of attaching the ends of the cord. When stringing the mechanism, load the spring by pulling the hook over the projection at the other end of the spring, string the dial and, as a final step, release the hook so that it pulls up the slack in the dial cord.

**ELEVATOR STRINGING**

The step-by-step procedure for stringing the elevator windlass is shown in Figure 4. (The view is from the rear of the mechanism.) This is done with the elevator up. Start by inserting the metallic cord in the slot as shown in 1. Then loop the left-hand free end over (2) and solder it to the lug provided at the bottom of the vertical shaft (3). The other free end is then given two turns around the pulley, first on one side of the first half-turn (4-5) and then on the other side (6-7). In making the two loops, the free end of the cord passes on *this* side of the end which is already secured. Similarly, in view 2, the end of which is to be secured to the bottom of the shaft, passes on *this* side of the right-hand free end of the cord. Observe these relationships. Finally, after completing the seven steps shown, pull the upper end of the cord through the hole in the top of the elevator mechanism and solder it to the spring provided.

**CONCLUDING COMMENTS**

After replacing the dial cord, it may be found that some correction in relative positioning is needed. This can be done by loosening the setscrews in the large drive pulley directly behind the dial scale and repositioning it on the shaft. The object, of course, is to permit the tuning control to drive the elevator through its full tuning range. Slight errors in final settings are not serious since leeway is provided in the location of the dial pointer itself.

**ALIGNMENT**

**EQUIPMENT REQUIRED**

1. Test Oscillator with tone modulation. (See Table.)
2. D-C Voltmeter or Microammeter. (See notes 2 and 3.)
3. A-C Voltmeter, 2 volts. (See note 6.)
4. Insulated hex wrench, 1/4". (See steps 1, 7.)
5. .01 MF Paper Capacitor. (See Steps 1 to 5.)

Important detailed instructions and references in connection with the Alignment Table which follows are keyed in by means of column 7, headed "See Note." The notes are included in numerical order after the table. They are important—refer to them carefully.



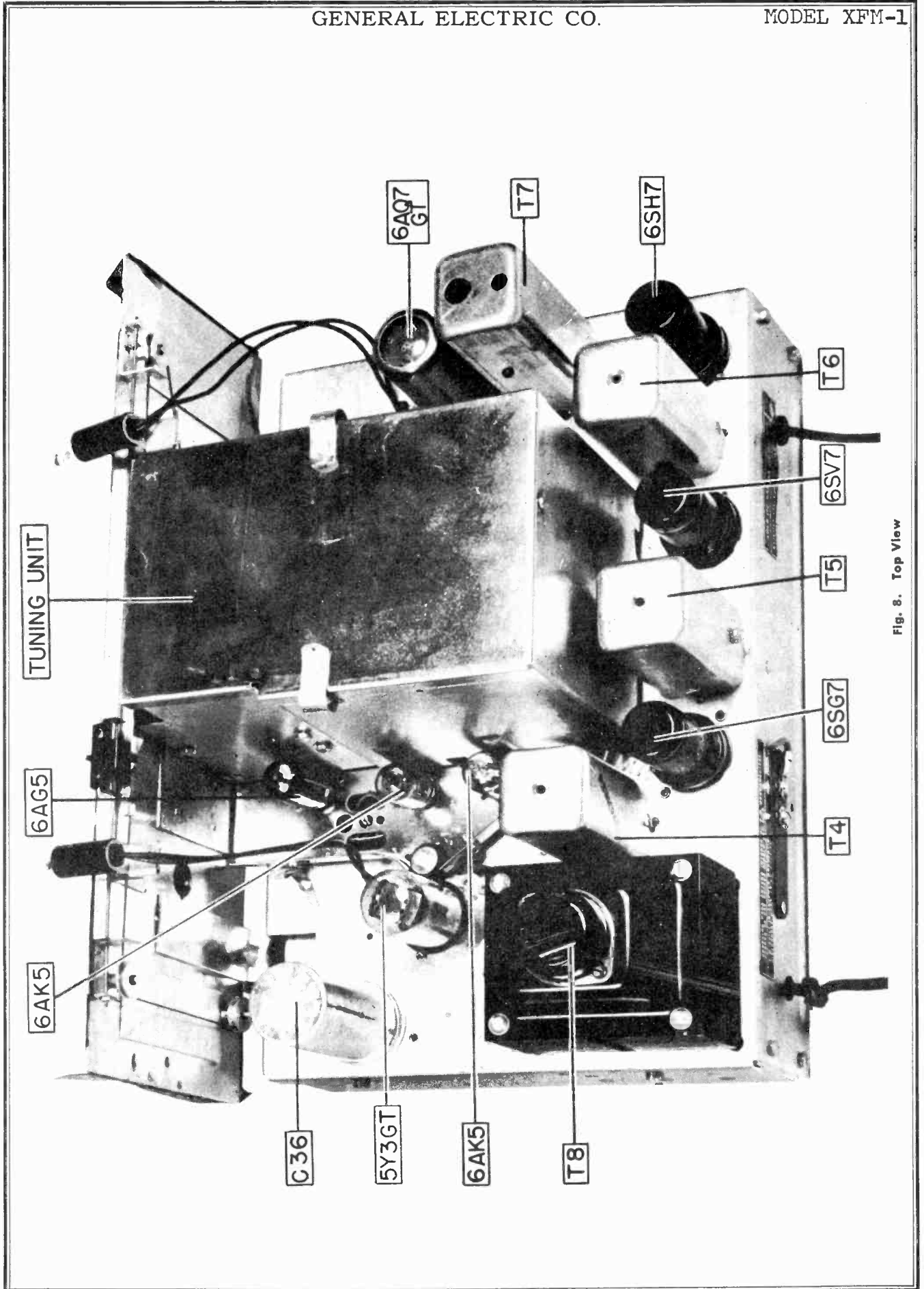


Fig. 8. Top View



GENERAL ELECTRIC CO.

MODEL XFM-1

**ALIGNMENT TABLE**

Step	Signal Generator Frequency	Signal Input Point	Dial Setting	Adjust	Remarks
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**I-F ALIGNMENT**

1	10.7 mc	6SH7 grid thru .01 mf.	.....	C51 for zero**	Adjust C51 for zero meter reading. Apply 1 volt signal input.
2	See last column	6SH7 grid thru .01 mf.	.....	Signal Generator	Detune signal generator to point of max. meter reading.
3	As in Step 2	6SG7 grid thru .01 mf.	.....	Peak C45	1, 2
4	10.7 mc	6SV7 grid thru .01 mf.	.....	Peak C43 and C44	6AQ7GT tube removed from its socket.
5	10.7 mc	6SG7 grid thru .01 mf.	.....	Peak C41 and C42	6AQ7GT tube removed from its socket.
6	10.7 mc	Conv. grid directly	.....	Peak C39 and C40	6AQ7GT tube removed from its socket.

**R-F ALIGNMENT**

7	88 mc	Dipole terminals	88 mc—6, 8 to 6.9 in.*	Peak C50	1, 3, 5 Set dial accurately—then adjust C50.
8	98 mc	Dipole terminals	For max. output	Peak C38	1, 3, 6 Tune dial for max. min. output, then peak C38 while rocking dial.
9	98 mc	Dipole terminals	Do not change	Peak C37	1, 3

\*Important! See Note 7.  
\*\*Use insulated hex wrench, 1/4".

**NOTES IN CONNECTION WITH ALIGNMENT TABLE**

- Use unmodulated signal.
- Connect 20,000-ohm/volt meter from junction of R18 and R16 to chassis. Use ten-volt scale (Steps 1-3).
- Connect 20,000-ohm/volt meter from grid 4 of 6SH7 to chassis with a 200,000-ohm resistor in series. The resistor must be connected directly to the grid so that capacity load-

ing will be negligible and so that the meter is isolated from the i-f signal voltage. Keep signal generator output down so that the meter indicates not more than one volt at the grid (5 microamperes through 200,000 ohms). (Alignment Steps 4 to 6.)

- Connect signal generator directly to the converter grid at some convenient point. The generator lead must be shielded up to this connection so that no more than 1/16 inch of exposed lead exists. Ground the shield solidly by clamping it firmly to the chassis or a shield as close to the connection as possible. (Step 6.)
- Two oscillator settings will give response. The higher frequency response point is the correct one, the other is the image. If in doubt, start with the trimmer screw loosened completely and adjust for the first response.

"Rocking" consists of adjusting the indicated adjuster while turning the dial a small amount back-and-forth through peak output. The object is to find the maximum peak. Rocking is necessary and is permissible only when interlocking circuits are being adjusted.

- Index pointer as follows: Turn pointer to right-hand limit of travel. Mark the dial backplate at a reference edge of the pointer slider. Then, set pointer by turning dial knob until the indicated dimension exists between the reference edge and the mark.

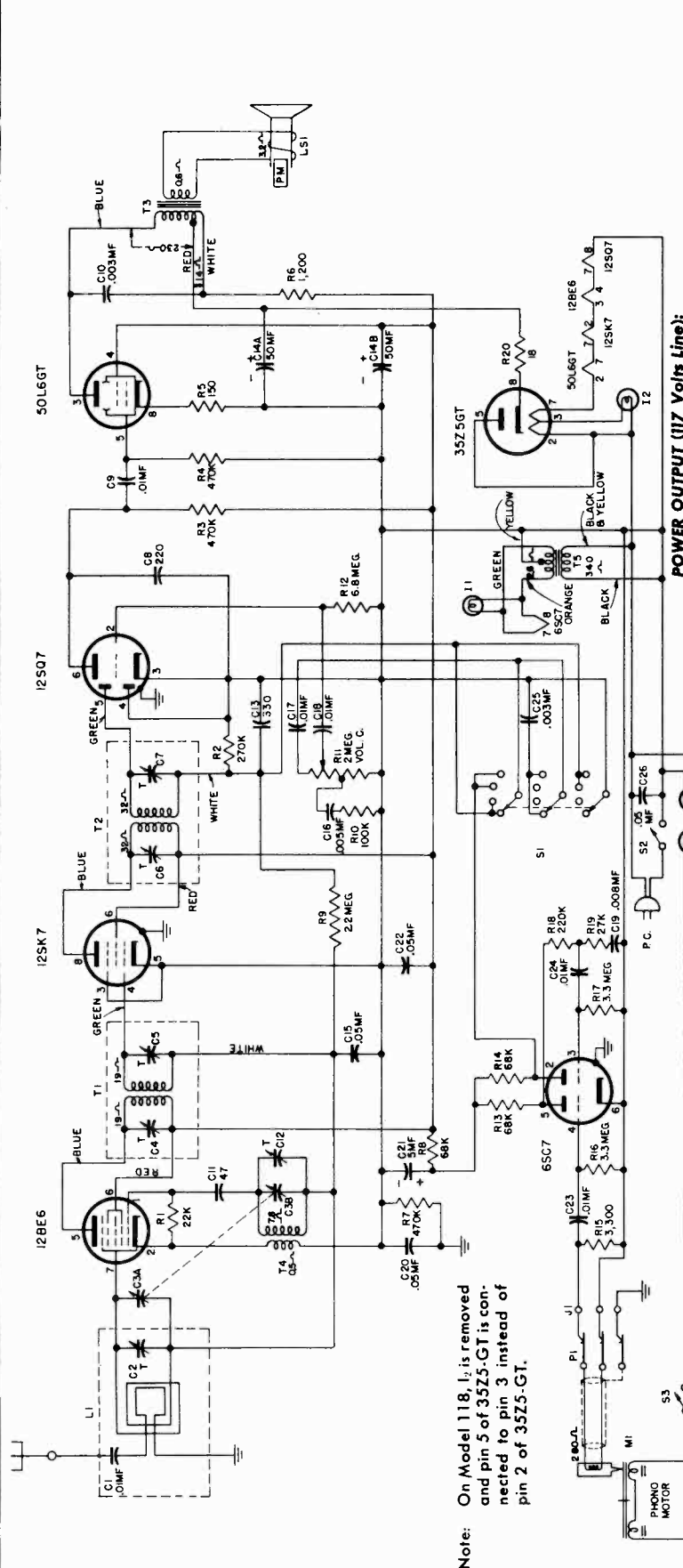
- R4 Resistor—10,000 Ohm; 1/4W.; Carbon
- R10 Resistor—47,000 Ohm; 1/4W.; Carbon
- S1 Switch—A-C Switch for Volume Control

**SPECIALIZED REPLACEMENT PARTS**

C36A, B, C	Back—Cabinet Back Bracket and Roller Fork for Elevator Shaft Capacitor—30 MF, 400V.; 30 MF, 400V.; 15 MF, 400V.; Dry Electrolytic Capacitor—1000 MMF; Mica Capacitor—10 MMF; Ceramic Capacitor—15 MMF; Ceramic Capacitor—1.5 MMF; Ceramic Capacitor—22 MMF; Ceramic Capacitor—100 MMF; Ceramic Capacitor—Air Trimmer 3-40 MMF; Mica Capacitor—Trimmer Strip; 3-30 MMF; Mica Capacitor—Trimmer Strip; 2-20 MMF; Mica Cord—Hoist Cord 6 1/2' Long Cord—Dial Cord 10 Yd. Roll Knob—Black Plain Knob Pointer—Pointer Assembly Scale—Tuning Dial Scale Spring Clip—Holds Coil Assembly Grommet—For Tuning Unit Link—Hoist Link Holding End of Hoist Cord Ring—Retaining Ring for Flywheel Coil Link—Rectangular Coil Link for Coils T1 and T2 Coil Link—Rectangular Coil Link for Coil T3 Post—Insulated Posts for Assembly FM Coils
C19	Plug—Output Plug
C4, 8	Socket—Tube Socket for V5, V6, and V7
C1, 5, 6	Socket—Tube Socket for V4 and V8
C10	Socket—Tube Socket for V1, V2, and V3
C7	Socket—Pilot Light Socket and Leads
C50	Choke—Antenna Choke Core
C37	Choke—Antenna Coil and RF Coil
C38	Choke—Oscillator Cathode Choke
	Choke—RF Plate Choke Coil
	Coil—Oscillator Coil
	Choke—Filament Choke Coil
	Choke—Power Line Choke
	Choke—Oscillator Plate Choke Coil and T2
	Vane—Tuner Vane for FM Coils T1 and T2
	Vane—Tuner Vane for FM Coil T3
	Roller—Hoist Shaft Roller
	Spring—Flat Hoist Pulley Shaft Spring
	Spring—Hoist Pulley Shaft Spring
	Spring—Hoist Cord Tension Spring
	Spring—Guide Wire in Elevator Plate
	Shaft—Tuning Shaft
	Pulley—Small Idler Pulley
	Pulley—Drive Pulley
	Flywheel—Flywheel with Setscrew
	Plate and Shaft—Elevator Top Plate and Vertical Shaft
R25, 26	Resistor—1220 and 6500 Ohms, Wire Wound
T7	Transformer—Discriminator
T4	Transformer—1st I.F. Transformer
T5	Transformer—2nd I.F. Transformer
T6	Transformer—3rd I.F. Transformer
T8	Transformer—Power Transformer
	Wire—Guide Wire on Tuning Unit

**UNIVERSAL REPLACEMENT PARTS**

Cat. No.	Symbol	Description
UCC-040	C23, 26, 30, 31, 34	Capacitor—01 Mfd.; 600V.; Paper
UCC-041	C21, 22, 24, 25, 28, 29	Capacitor—02 Mfd.; 600V.; Paper
UCC-042	C35	Capacitor—03 Mfd.; 600V.; Paper
UCU-512	C27, 32	Capacitor—05 Mfd.; 600V.; Paper
UCU-520	C14	Capacitor—22 MMF; Mica
UCU-528	C15	Capacitor—47 MMF; Mica
UCU-1042	C11, 18	Capacitor—100 MMF; Mica
UCU-1512	C16	Capacitor—300 MMF; Mica
UCU-1544	C12	Capacitor—22 MMF; Mica
UCW-1028	C2, 7	Capacitor—470 MMF; Mica
UIC-001		Capacitor—100 MMF; Ceramic
UIB-014		Cement—Speaker Cone Replacement Cement
URC-034	R30	Terminal—Terminal Board Volume Control 2 Meg. Potentiometer Tapped at 1 Meg.
URD-017	R2	Resistor—47 Ohm; 1/4W.; Carbon
URD-049	R12	Resistor—1000 Ohm; 1/4W.; Carbon
URD-055	R11	Resistor—1800 Ohm; 1/4W.; Carbon
URD-057	R10	Resistor—2200 Ohm; 1/4W.; Carbon
URD-065	R17, 14	Resistor—4700 Ohm; 1/4W.; Carbon
URD-081	R6, 8	Resistor—22,000 Ohm; 1/4W.; Carbon
URD-085	R27	Resistor—32,000 Ohm; 1/4W.; Carbon
URD-085	R3	Resistor—30,000 Ohm; 1/4W.; Carbon
URD-093	R16	Resistor—68,000 Ohm; 1/4W.; Carbon
URD-095	R18	Resistor—82,000 Ohm; 1/4W.; Carbon
URD-099	R9, 15, 19, 20	Resistor—120,000 Ohm; 1/4W.; Carbon
URD-101	R7	Resistor—150,000 Ohm; 1/4W.; Carbon
URD-105	R13, 24	Resistor—220,000 Ohm; 1/4W.; Carbon
URD-125	R1, 5	Resistor—1.5 Meg.; 1/4W.; Carbon
URD-133	R28	Resistor—3.3 Meg.; 1/4W.; Carbon

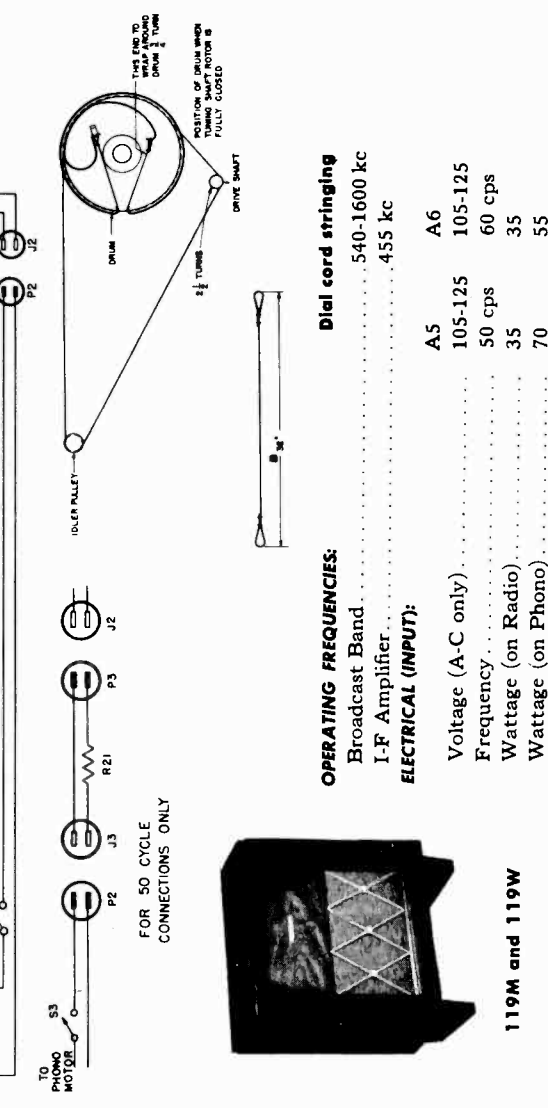


**POWER OUTPUT (117 Volts Line):**  
 Undistorted ..... .95 watts  
 Maximum ..... 2.2 watts

**LOUDSPEAKER:**  
 Model ..... 118 119  
 Type ..... Alnico PM Alnico PM  
 Outside Cone Diameter ..... 5.25 inches 12 inches  
 Voice Coil Impedance at 400 cps ..... 3.2 ohms 3.2 ohms

**PHONOGRAPH PICK-UP:**  
 Type ..... Variable Reluctance  
 D-C Resistance ..... 280 ohms

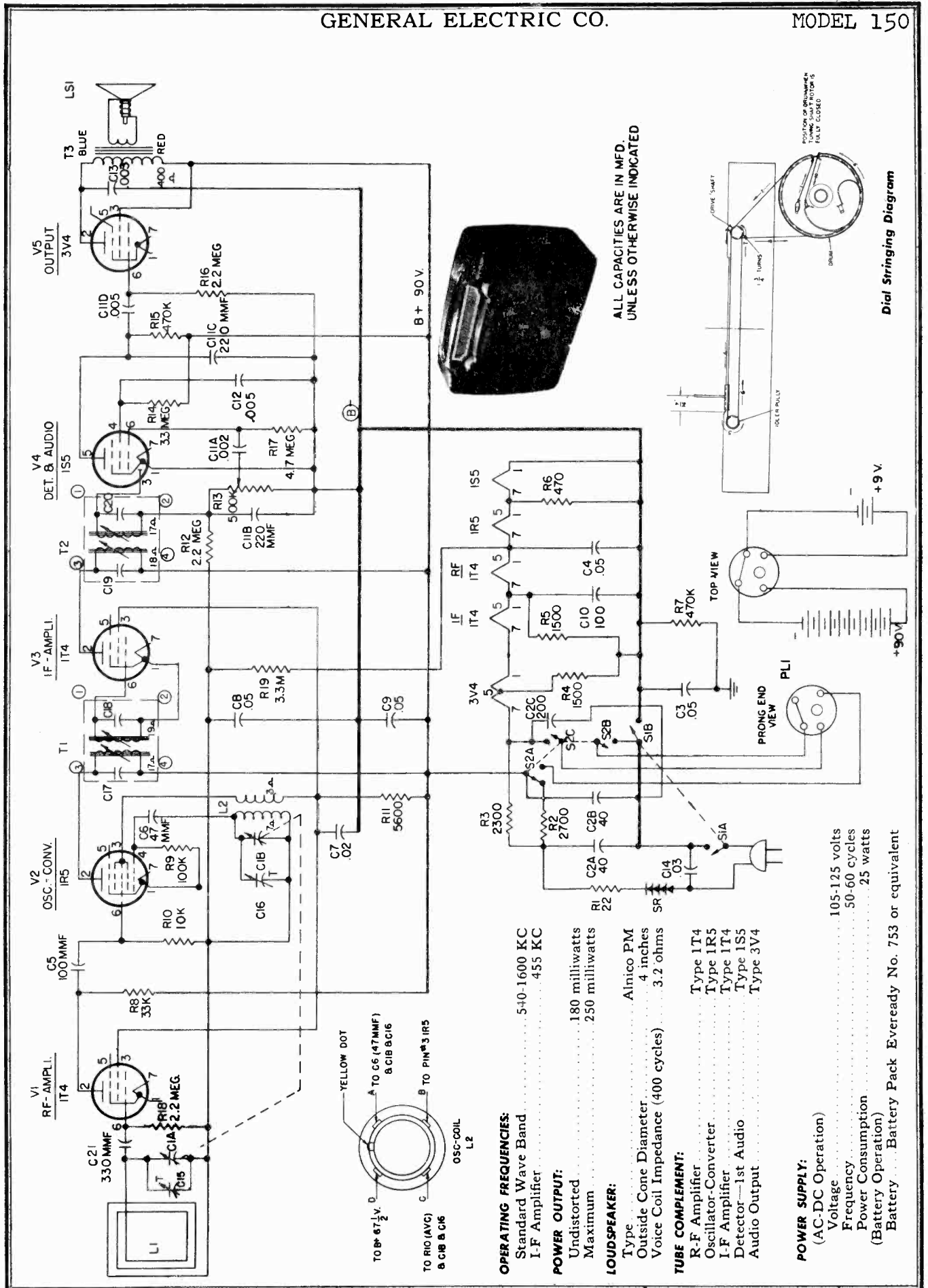
**TUBE COMPLEMENT:**  
 Converter-Oscillator ..... Type 12BE6  
 I-F Amplifier ..... Type 12SK7  
 Detector and Audio Amplifier ..... Type 12SQ7  
 Output ..... Type 50L6  
 Phono Pre-amplifier ..... Type 6SC7  
 Rectifier ..... Type 35Z5  
 Pilot Lamps ..... Mazda No. 47











**GENERAL INFORMATION**

The Model 150 portable radio is a five-tube superheterodyne broadcast receiver with a range of 540 to 1600 kc. The power source may be either 105 to 125 volts, 50 to 60 cycles, or direct current when a power outlet is available. The receiver will also operate from its battery source, thus making it independent of external electric power providing excellent operation in any location where external power is not available.

**BATTERY—AC or DC Operation.**

The left knob turns on the battery provided that the power plug is well inserted into the socket in the chassis. For AC or DC supply (105-125 volts, 50 to 60 cycle operation) the same knob switches on the power when the power plug is pulled out of its socket in the chassis and inserted into the house outlet.

**ELECTRICAL CIRCUIT ALIGNMENT**

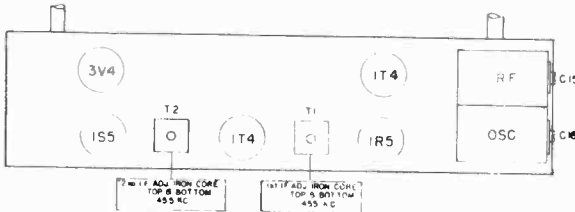
R-F ..... 1500 KC  
 I-F ..... 455 KC

**EQUIPMENT REQUIRED**

1. Test Oscillator with Tone Modulation.
2. AC Output Meter.
3. .05 mf. Paper Capacitor.
4. Insulated Screwdriver.

**PROCEDURE—GENERAL**

The Alignment Chart gives the alignment procedure with correct sequence of trimmer adjustments. The chassis must be removed from the cabinet during i-f alignment.



Tube and Trimmer Location

The test oscillator output signal should be attenuated so that the output meter reading never exceeds 1/2 volt. Connect the capacitor listed in column 2 of the Alignment Chart between the "high side" of the test oscillator and the point of input specified.

The output meter should be connected across the voice coil terminals on the speaker. The "low side" of the test oscillator output should be connected to the chassis ground; the "high side" of the oscillator output should be connected as indicated in the Alignment Chart. During the entire alignment procedure, the volume control should be at its maximum position. For alignment of the oscillator and r-f trimmers, the input signal should be inductively coupled to the radio loop antenna by connecting a 4-turn, 6-inch diameter loop of bell wire across the signal generator output terminals, and locate the loop about one foot from the radio loop antenna. To prevent possible errors in peak readings, the position of the loop with respect to the radio loop antenna should not be changed any one set of adjustments.

**ALIGNMENT CHART**

Step	Test-Osc. Connected to:	Test-Osc. Setting	Pointer Setting	Adjust for Max. Output
1	1T4 I-F grid in series with .05 mfd.	455 KC	550 KC	Iron cores of I-F Transformer T2.
2	1R5 converter grid in series with .05 mfd.	455 KC	550 KC	Iron cores of I-F Transformer T1.
3	Repeat Steps 1 and 2.			
4	Inductively coupled	1500 KC	1500 KC	C15* C16

\* Chassis in cabinet and cabinet back (with loop) closed; remove plug button to adjust C15.

**STAGE GAIN AND VOLTAGE CHECKS**

Stage gain by vacuum tube voltmeter or similar measuring device may be used to check circuit performances and isolate trouble. The gain values listed may have tolerances of 20 per cent. Readings should be taken with low signal input so that the AVC is not effective.

(1) **R-F STAGE GAINS**

- 1T4 R-F Grid (Pin 6) to 1R5 Grid (Pin 6) ... 2.5 @ 1000 KC
- 1R5 Grid (Pin 6) to 1T4 Grid (Pin 6) ... .30 @ 1000 KC
- 1T4 Grid (Pin 6) to 1S5 Diode Plate (Pin 3) ... .50 @ 455 KC

(2) **AUDIO GAIN**

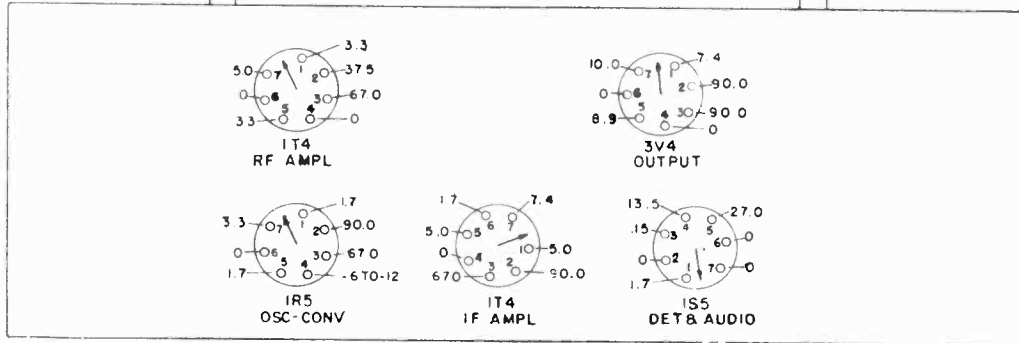
.020 volt at 400 cycles across volume control (R13) with control set at maximum will give approximately .05 watts output across speaker voice coil.

(3) **DC voltage developed across oscillator grid resistor (R9) averages — 8 volts at 1000 kc with respect to B minus.**

(4) **SOCKET PIN VOLTAGES**

Figure 3 shows voltages from all tube pins to B-. Voltage readings much lower than those specified may help localize defective components or tubes.

**BOTTOM VIEW OF CHASSIS**



DC VOLTAGES TO GROUND UNLESS OTHERWISE SPECIFIED  
 ALL RATINGS ARE A C OPERATION MEASURED WITH REFERENCE TO B-  
 RATINGS FOR BATTERY ARE SIMILAR TO AC RATINGS  
 VOLTAGE IS MEASURED WITH 20,000 OHMS PER VOLT METER

Socket Voltages



**SPECIFICATIONS**

**CABINET:**

Height.....	7 <sup>5</sup> / <sub>8</sub> inches
Width.....	10 <sup>5</sup> / <sub>8</sub> inches
Depth.....	2 <sup>3</sup> / <sub>4</sub> inches

**POWER SUPPLY:**

(AC-DC Operation)

Voltage.....	105-120 volts
Frequency on A-C.....	50- 60 cycles
Power Consumption.....	10 watts

(Battery Operation)

- 2— 1<sup>1</sup>/<sub>2</sub> volt "A" Batteries, Eveready No. 950 or equivalent.
- 1—67<sup>1</sup>/<sub>2</sub> volt "B" Battery, Eveready No. 467 or equivalent.

**OPERATING FREQUENCIES:**

Broadcast Band.....	540-1600 KC
I-F Amplifier.....	455 KC

**POWER OUTPUT:**

Undistorted.....	.06 watts
Maximum.....	.12 watts

**LOUDSPEAKER:**

Type.....	Alnico 5 permanent magnet
Size.....	4 inches
Voice Coil Impedance at 400 Cycles.....	3.2 ohms

**TUBE COMPLEMENT:**

Oscillator-Converter.....	1R5
I-F Amplifier.....	1T4
Detector Audio Amplifier.....	1S5
Power Output.....	3V4

**GENERAL INFORMATION**

The Model 145 is a portable superheterodyne receiver designed to operate on the broadcast band range of 540 to 1600 kilocycles. This receiver may be operated from a 105 to 120 volt d-c or 50-60 cycle a-c power source, or it may be operated from its own self-contained batteries by switching to the "Bat." position.

A selector switch (S2) on the front panel is used to switch the radio to battery operation or AC-DC operation. The switch on the volume control will turn on and off either battery or AC-DC power depending on the position of switch S2.

**ELECTRICAL CIRCUIT ALIGNMENT**

**EQUIPMENT REQUIRED:**

1. Test Oscillator with Tone Modulation.
2. A-C Output Meter.
3. .05 mfd. Capacitor.
4. Insulated Screwdriver.

**PROCEDURE:**

1. The alignment procedure is given in table form. All i-f adjustments may be made with the chassis removed from the cabinet. The locations of the i-f and r-f adjustments are shown in Figure 1.

2. The output meter should be connected across the voice coil terminals of the speaker. The low side of the test oscillator should be connected to B minus. The high side of the test oscillator should be connected as indicated in the alignment chart.

**PRECAUTION:** If the signal generator is A-C operated, use an isolating transformer between the power supply and the radio receiver power input. The use of an isolating capacitor is not recommended, as A-C through the capacitor will introduce hum modulation and/or create the possibility of a burned out signal generator attenuator.

3. During the entire alignment procedure the volume control should be rotated fully clockwise in its maximum position. The test oscillator should be attenuated so that the output meter doesn't exceed .4 volt.

4. For alignment of the oscillator and r-f trimmer, the input signal should be inductively coupled to the radio loop antenna by connecting a 4-turn, 6-inch diameter loop of bell wire across the signal generator output terminals, and locate the loop about one foot from the radio loop for alignment. To prevent possible errors in peak readings, the position of the loop with respect to the radio loop should not be changed during any one set of adjustments. The chassis should be installed in the cabinet when the r-f adjustment (step 4) is made.

**ALIGNMENT CHART**

Step	Connect Test Oscillator To:	Test Oscillator Setting	Dial Setting	Adjust for Maximum Output
1	1T4 grid (Pin 6) in series with .05 mfd. cap.	455 KC	550 KC	2nd i-f transformer (T2) primary and secondary cores.
2	1R5 grid (Pin 6) in series with .05 mfd. cap.	455 KC	550 KC	1st i-f transformer (T1) primary and secondary cores.
3	Inductively coupled (see Note 4)	1620 KC	Gang condenser completely open.	C2B for maximum.
4	Inductively coupled (see Note 4)	1500 KC	For max. signal. Set dial pointer at 1500 KC mark on dial scale.	C1B for maximum.

**STAGE GAINS AND VOLTAGE CHECKS**

Stage gain by vacuum tube voltmeter or similar device may be used to check circuit performance and to isolate trouble. The gain values listed may have tolerances of 20 per cent. Readings should be taken with low signal input so that AVC is not effective.

- R-F STAGE GAINS.**  
 1R5 Grid (Pin 6) to 1T4 Grid (Pin 6) . . . . . 27 at 1000 KC  
 1R5 Grid (Pin 6) to 1T4 Grid (Pin 6) . . . . . 33 at 455 KC  
 1T4 Grid (Pin 6) to 1S5 Diode Plate (Pin 3) . . 60 at 455 KC
- AUDIO GAIN.**  
 .05 volt at 400 cycles across the volume control (R6) with volume control set fully clockwise will give approximately .05 watt output or .4 volts across the speaker voice coil.
- D-c voltage developed across oscillator grid resistor R1 averages 18 volts at 1000 kc.**
- SOCKET PIN VOLTAGES.**

Figure 4 shows voltages from all tube pins to B-. Voltage readings much lower than those specified may help localize defective components or tubes.

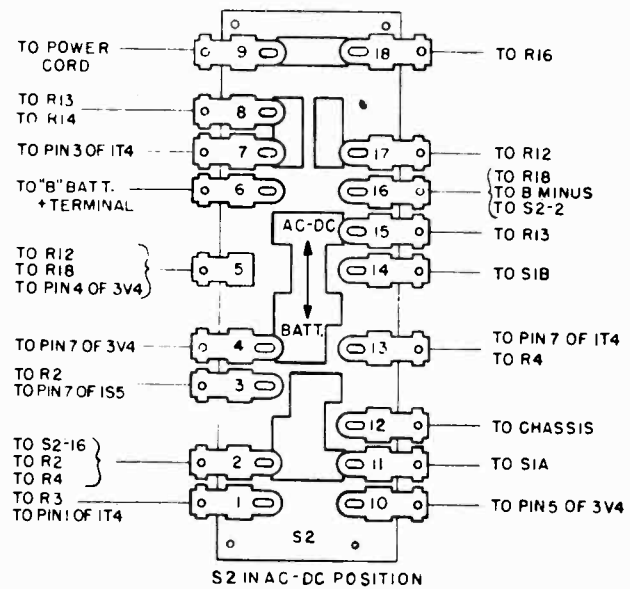


Fig. 2. Switch Connections

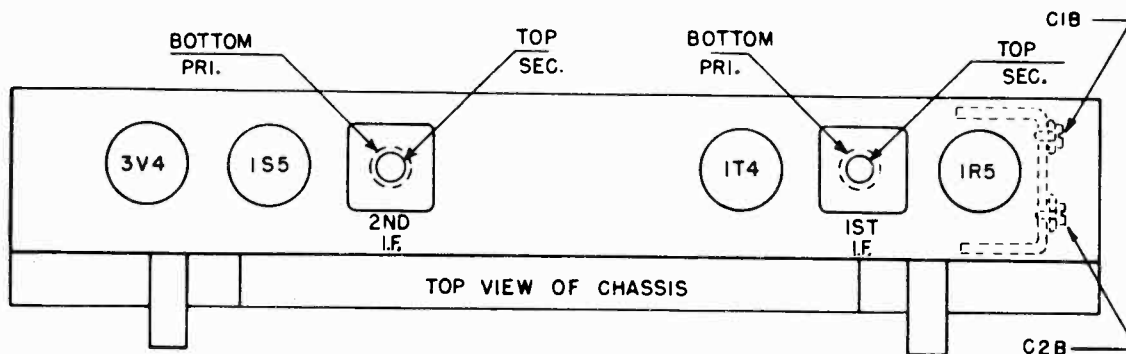


Fig. 1. Tube and Trimmer Location



GENERAL ELECTRIC CO.

MODEL 145

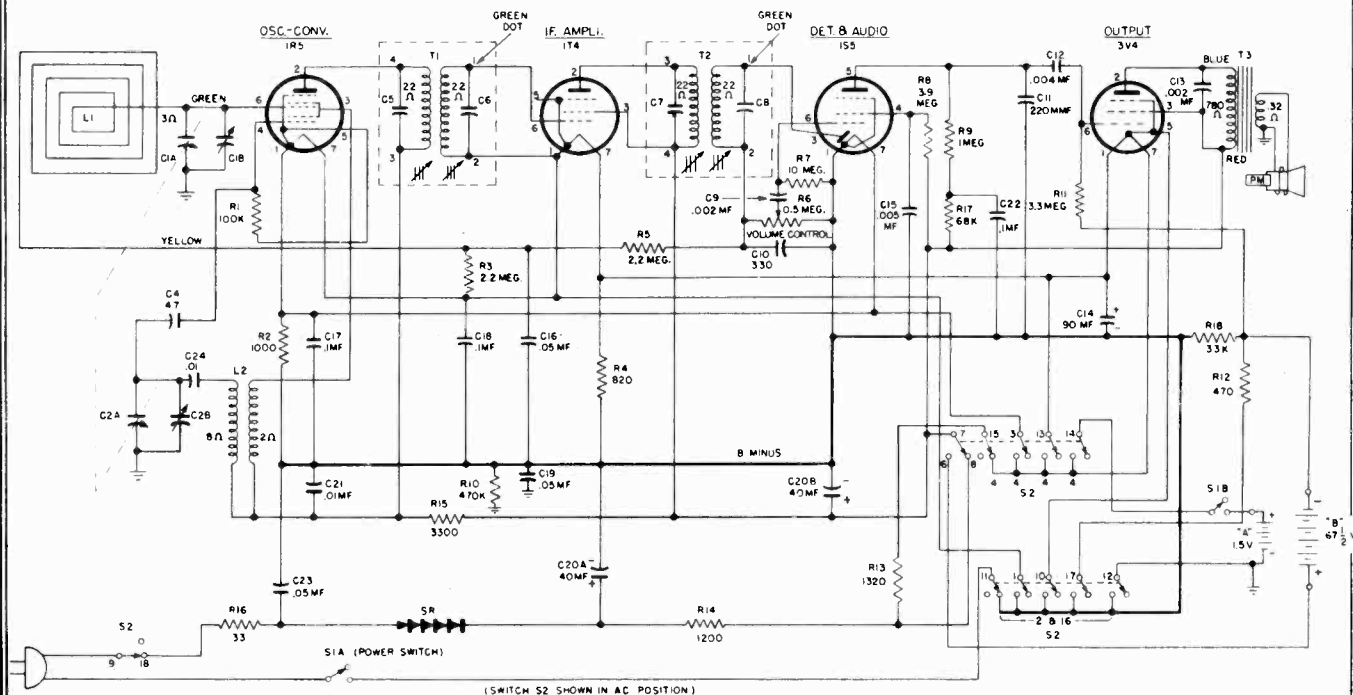
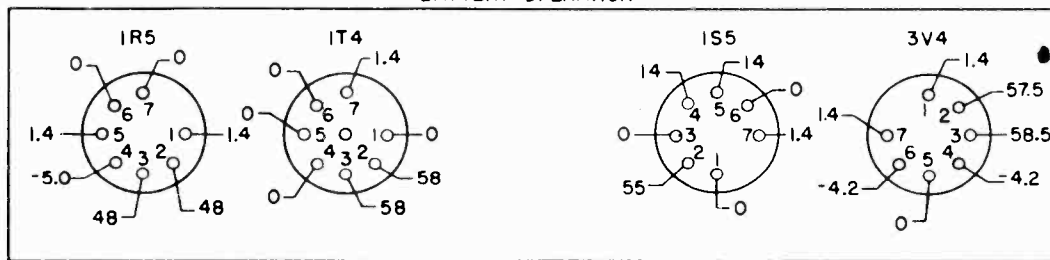


Fig. 3. Schematic Diagram, Model 145

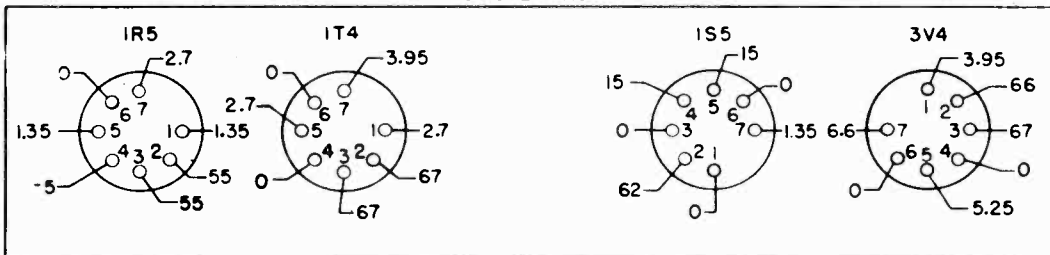
BATTERY OPERATION



CONDITIONS OF TEST: RECEIVER POWERED BY BATTERY SUPPLY MEASURED WITH 20,000 OHMS/VOLT PER METER. ALL VOLTAGES TAKEN FROM B- TO SOCKET PIN.

BOTTOM VIEW OF CHASSIS

AC OPERATION



CONDITIONS OF TEST: RECEIVER POWERED BY AC LINE 117 VOLTS MEASURED WITH 20,000 OHM/VOLT METER. ALL VOLTAGES TAKEN FROM B- TO SOCKET PIN

VOLTAGE ON INPUT SECTION OF ELECTROLYTIC 135 VOLTS

Fig. 4. Socket Voltage Diagram

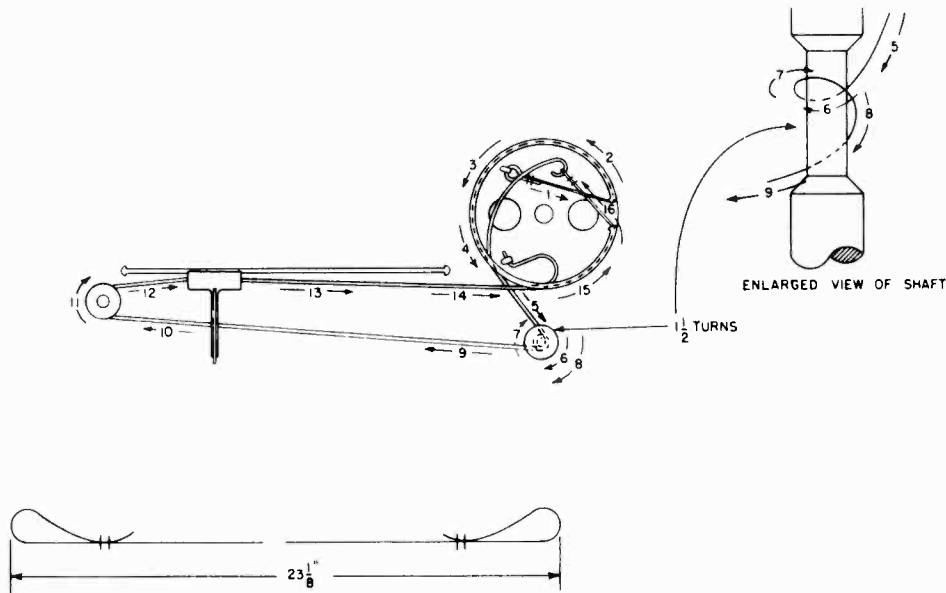


Fig. 5. Dial Stringing Diagram

MODEL 145—REPLACEMENT PARTS LIST

Cat. No.	Symbol	Description	Cat. No.	Symbol	Description
<b>UNIVERSAL REPLACEMENT PARTS</b>			<b>SPECIALIZED REPLACEMENT PARTS (Cont.)</b>		
UCC-028	C23	CAPACITOR—.05 mfd., 400 v.	RDK-149		KNOB and Clip
UCU-020	C4	CAPACITOR—47 mmf. ±20%, mica	RDP-044		POINTER—Dial pointer assembly
UOP-489		SPEAKER	RDS-080		SCALE—Dial scale
URD-041	R12	RESISTOR—470 ohms, 1/2 w., carbon	REC-001		CONNECTOR—For "B" battery
URD-047	R4	RESISTOR—820 ohms, 1/2 w., carbon	REC-004		CONTACT—For "A" battery
URD-049	R2	RESISTOR—1000 ohms, 1/2 w., carbon	REX-005		RECTIFIER—Selenium
URD-061	R15	RESISTOR—3300 ohms, 1/2 w., carbon	RHI-007		HINGE—Front cover hinge
URD-081	R18	RESISTOR—33,000 ohms, 1/2 w., carbon	RHI-008		HINGE—Back cover hinge
URD-093	R17	RESISTOR—68,000 ohms, 1/2 w., carbon	RHJ-009		SPACER—For switch S2 (four req.)
URD-097	R1	RESISTOR—100,000 ohms, 1/2 w., carbon	RHM-055		SPEED NUT—1/2"
URD-113	R10	RESISTOR—470,000 ohms, 1/2 w., carbon	RHR-002		RIVET—.121 dia. x 1/2" long
URD-121	R9	RESISTOR—1 meg., 1/2 w., carbon	RHR-006		RIVET—.121" dia. x 1/4" long for mounting RDE-035
URD-129	R3, 5	RESISTOR—2.2 meg., 1/2 w., carbon	RHS-015		SCREW—Self-tapping screw for mounting loop assembly door
URD-133	R11	RESISTOR—3.3 meg., 1/2 w., carbon	RHS-022		SCREW—Self-tapping for mounting the brass latch plate
URD-135	R8	RESISTOR—3.9 meg., 1/2 w., carbon	RHS-023		SCREW—Self-tapping for mounting hinges
URD-145	R7	RESISTOR—10.0 meg., 1/2 w., carbon	RHY-008		HANDLE
RAB-082		CABINET BACK COVER	RII-019		INSULATOR—For "A" battery contact
RAC-055		CABINET FRONT COVER ASSEMBLY—Includes two hinges (RHI-007) and four screws (RHS-023)	RII-020		BARRIER—Shield around "A" battery
RAC-056		CABINET BODY ASSEMBLY—Includes back cover hinges (RHI-008) and four screws (RHS-023)	RJS-100		SOCKET—For 1R5, 1S5, and 3V4 tube
RAC-057		LOOP COVER	RJS-125		SOCKET—For 1T4 tube
RCC-075	C21	CAPACITOR—.01 mfd., 400 v., paper	RLC-080	L2	COIL—Oscillator coil
RCC-077	C17, 18, 22	CAPACITOR—.1 mfd., 400 v., paper	RLL-037	L1	LOOP
RCC-078	C16, 19	CAPACITOR—.05 mfd., 400 v., paper	RMC-028		KNOB—Catch knob
RCE-051	C20A, B	CAPACITOR—40-40 mfd., 150 v., electrolytic	RMC-029		LATCH PLATE—On front cover, fastened by screws RHS-022
RCE-052	C14	CAPACITOR—90 mfd., 10 v., electrolytic	RMC-031		CATCH—Front cover catch
RCT-035	C1A, B, 2A, B	CAPACITOR—Tuning	RMC-032		CATCH COVER—Front cover, fastened with screws RHS-022
RCW-3018	C13	CAPACITOR—.002 mfd., ceramic	RMC-033		LATCH PLATE—On back cover, fastened with screws RHS-022
RCW-3015	C9, 10, 11, 12, 15	CAPACITOR—Ceramic	RMC-036		LATCH—Back cover latch
RDC-032		CORD—Dial drive cord, 25 yd.	RMC-037		NAMEPLATE AND CATCH
RDE-034		ESCUTCHEON	RMM-085		CLIP—For "A" battery
RDE-035		ESCUTCHEON—Brass for fastening handle to the cabinet	RMS-130		BARRIER
			RMW-042		SPRING—Dial cord tension spring
			RRC-094	R6, S1	PULLEY—1/2-in. pulley for dial cord
			RRW-030	R16	VOLUME CONTROL AND SWITCH
			RRW-031	R13	RESISTOR—33 ohms, 3 w., w.w.
			RRW-032	R14	RESISTOR—1320 ohms, w.w.
			RSW-061	S2	RESISTOR—1200 ohms, w.w.
			RTL-052	T1, T2	SWITCH—AC-DC Batt. switch
			RTO-057	T3	TRANSFORMER—1st and 2nd I-F transformer
			RWL-009		TRANSFORMER—Output transformer
					CORD—Power cord

**SPECIFICATIONS**

**CABINET:**.....Plastic

Height.....	10 1/8 in.
Length.....	12 1/4 in.
Width.....	5 3/4 in.
Weight.....	17 pounds

**ELECTRICAL RATING:**

**Charging from A-C Line:**

Voltage.....	105-125 volts
Frequency.....	50/60 cps
Wattage.....	10 watts

**Operating from Internal Battery.**

Voltage.....	2.1 volts
Current.....	1.7 amp
Wattage.....	3.6 watts
Hours of Operation without Charging Battery.....	Approx. 12-15 hours

**BATTERY REQUIREMENT:**

Willard 2.0 volt No. 25-2 rechargeable battery or equivalent

**OPERATING FREQUENCIES:**

Broadcast Band.....	540-1600 KC
I-F Amplifier.....	455 KC
Power Output (at 2.1 Battery Voltage)	
Undistorted.....	170 milliwatts
Maximum.....	210 milliwatts

**LOUDSPEAKER:**

Type.....	Alnico PM
Outside Cone Diameter.....	5 1/4 in.
Voice Coil Impedance (400 CPS).....	3.2 ohms

**TUBE COMPLEMENT:**

R.F. Amplifier.....	Type 1U4
Oscillator-Converter.....	Type 1R5
I-F Amplifier.....	Type 1U4
Detector—1st Audio.....	Type 1S5
Audio Output.....	Type 3V4

**GENERAL INFORMATION**

The Model 160 Portable Radio is a five-tube superheterodyne broadcast receiver which operates from a built-in rechargeable battery or from 105-125 volts, 50 or 60 cps with a battery in place.

The following paragraphs describe special tests for checking the power supply and the battery of the receiver, and explain some of the special constructional features which will be encountered while servicing the receiver.

**1. POWER SUPPLY**

All power necessary for the operation of the receiver is supplied by the 2-volt rechargeable battery mounted within the radio. Power to the 1.4 volt tube filaments is supplied by the battery through suitable voltage dropping resistors. The high voltage for the screens and plates of the tubes is furnished by a synchronous vibrator used in conjunction with a step-up power transformer and its associated filter circuit. The synchronous vibrator operates directly from the battery.

The receiver power is obtained from the battery at all times in the manner just described, whether the power cord is connected

to a power source or not. When the power cord is connected to a receptacle supplying from 105 to 125 volts, 50 or 60 cps, a-c and the power selector is in either the CHARGE or ON position, the power supplied from the line will be used to charge the battery. The CHARGE position on the three-position power selector switch allows the battery to be charged from the house current when the receiver is not operating. The ON position of the switch permits the radio to be operated with the battery floating on the charger. Under this condition the battery filters the charger's output, maintains the voltage at its proper value and acquires a slow charge, if the voltage is adequate.

The battery charging unit consists of a step-down transformer which converts the line voltage of 117 volts to approximately 5.8 volts center-tapped, and a full wave copper-oxide rectifier which supplies the battery with the d-c charging current.

A charging cable is available which provides an easy means of charging the radio battery from an automobile or a 6-volt storage battery. The cable plug is inserted over the pins provided, see Figure 3, and the plug and socket on the other end of the cable are connected to a 6-volt supply. Complete installation instructions are provided with each cable.

**2. CHARGER CHARACTERISTICS**

**Testing the Operation of the Rectifier Unit**—A 1/4 ampere fuse is used in series with the primary of the charger transformer. If the battery does not show any signs of becoming charged after a reasonable length of time, check the fuse. If it is necessary to replace the fuse, use a 1/4-ampere (G. E. No. 2548 or REF-001) fuse.

If one or more of the copper-oxide discs of the rectifier unit are defective, the charger will not operate properly. To test the rectifier unit operation, remove the battery from the unit and reconnect it in series with a d-c ammeter capable of reading at least two amperes. Plug the power cord into a 105-125 volts, 50 or 60 cps, a-c supply, and turn the power selector switch to the CHARGE position. With the a-c line voltage at 117 volts, the average charging current should read about 1.8 amperes at 2.1 volts battery voltage. Care must be exercised in making this test, as the charging circuit is of extremely low resistance. Very heavy leads must be used, and the use of an ammeter having only 0.05 ohms resistance will introduce considerable error. If the line voltage is greater than 117 volts, or the battery voltage is lower than 2.1 volts, the charging current will be greater. If the current is much less than 1.8 amperes at the rated line voltage of 117 volts, one or more of the copper-oxide discs may be defective.

**Testing the Individual Rectifier Disc**—Two rectifier assemblies are used in the receiver, each assembly consisting of two rectifier discs held together by an eyelet. A cross section of a rectifier as-

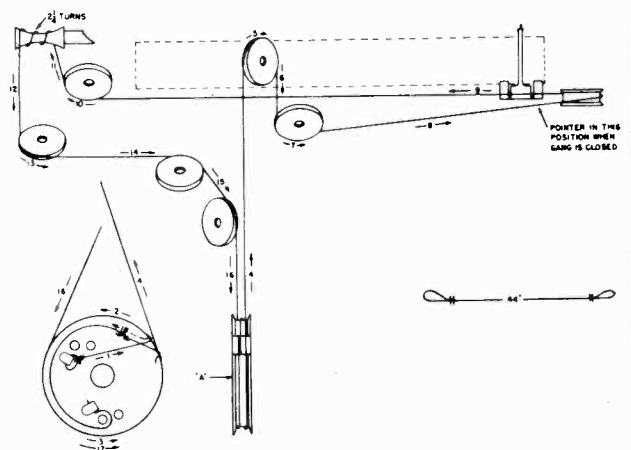


Fig. 1. Dial Stringing Diagram

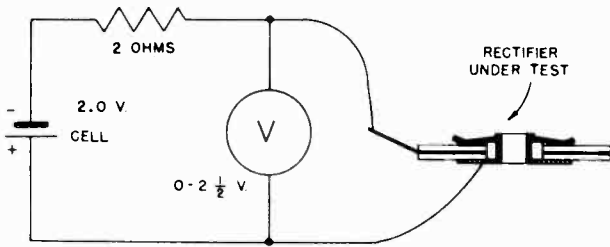


Fig. 2. Rectifier Test Circuit

sembly is shown in Figure 2. The center plate of the assembly is positive and is provided with a soldering tab. A copper-oxide rectifier disc is located on each side of the center plate. The rectifier disc conducts when the proper polarity potential is applied to the copper-oxide surface. The copper oxide is a dark coating which has been plated with nickel to afford a good surface contact to the copper oxide. If either or both of the rectifier discs in an assembly become defective, the entire assembly should be replaced.

To check the rectifier assembly, the following tests are recommended. In the conducting direction, the rectifier assembly should pass 0.5 ampere or more when  $\frac{1}{2}$  volt is impressed across it. If a d-c ammeter is not available for measuring currents as high as 0.65 ampere, the circuit shown in Figure 2 can be used for this check. The 2.0-ohm resistor should be fairly accurate. The voltage across the rectifier assembly should read 0.7 volt or less; if this voltage exceeds 0.7 volt, the assembly is defective and should be replaced.

The reverse current flow is as important as the above test and is made as follows: Reverse the battery polarity in the test circuit described for current check, disconnect the voltmeter, and place a milliammeter that will read 10 ma. in series with a lead to one of the battery terminals. A suitable meter fuse should be used in series with the milliammeter to prevent damage to the meter in case the assembly under test is shorted. The reversed current should not exceed 10 ma. If this current is considerably above this value, the rectifier assembly should be discarded.

If a milliammeter is not available, a rough check may be made by measuring the resistance of the assembly in the non-conducting direction on the low resistance range of an ohmmeter. The resistance should measure at least 300 ohms.

**3. REPLACEMENT OF VIBRATORS**

After many hours of service, the reception might become very noisy or fail due to a faulty vibrator. The type used in this receiver is REU-001.

In order to gain access to the vibrator, proceed as follows:

1. Pull out the pins on the handle of the cabinet (Figure 3).
2. Unscrew the five hex screws which hold the chassis in cabinet (one screw at the bottom of cabinet).

3. Slide the chassis out of the cabinet, being careful not to strain the loop leads.

4. Unscrew the three screws at the bottom and one on the top of the power unit.

5. Lift up the outer shield and then replacement of the vibrator is as easy as changing a normal radio tube.

**BATTERY INFORMATION**

The receiver uses a 2-volt Willard Radio Battery No. 25-2 or equivalent. It has a 25 ampere-hour capacity and should be cared for in the same manner as any storage battery.

**CHARGE INDICATORS**

The degree of charge of the battery can be determined by raising the back cover of the radio and referring to the charge ball indicators visible through the hole in the metal battery case.

If the battery is fully charged, two indicator balls will be visible at the surface of the liquid in the battery. When the battery discharges, these ball indicators will sink and disappear in the following order:

1. Green indicator sinks when approximately 20 per cent of battery capacity has been discharged.
2. The red ball sinks when battery is 80 per cent discharged. On charge, the balls rise or float in the reverse order and the charge may be stopped when both balls appear in the opening.

**TO CHARGE BATTERY**

The battery is charged by merely plugging the receiver power cord in the rated ac power outlet and turning the selector switch to CHARGE. Frequent check should be taken of the charge indicator and when both indicator balls are visible, the battery is adequately charged. Charging the battery after both indicator balls are visible will not harm the battery except it will evaporate the water faster. A completely discharged battery will be restored, usually within 20 to 30 hours.

When operating the receiver from the a-c house current, the battery floats or is being charged at a slow rate. Thus if you wish to operate the receiver even with a fully discharged battery, plug in the power cord in the ac receptacle and turn the power selector switch to the ON position. Prolonged operation in this manner usually will cause the battery potential to stabilize at some voltage determined by the line voltage and the characteristics of the charging circuit components. The degree of charge obtainable with this method of operation likewise is dependent on the line voltage and the characteristics of the charging circuit components.

**BATTERY OPERATING INSTRUCTIONS.**

1. Add distilled or tap water in the filler cap at sufficiently frequent intervals to keep liquid level at indicator mark as viewed through opening in battery case. Do not overfill as this impairs the nonspill feature. Distilled water is to be preferred, as it does not contain any chemical compound which can contaminate the battery.

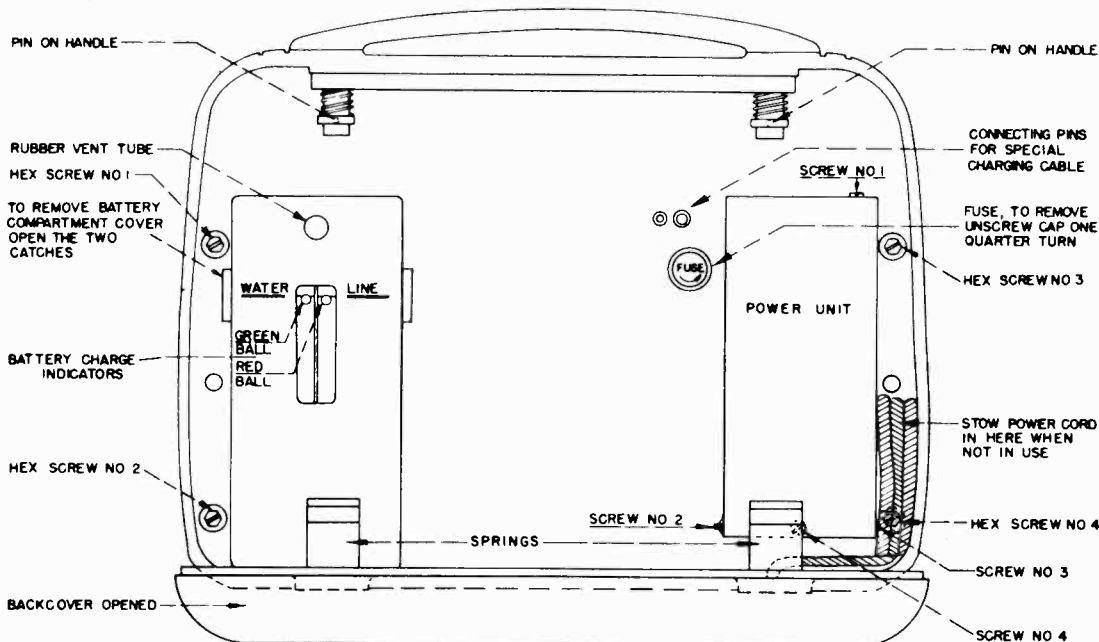


Fig. 3. Rear Compartment Assembly

2. A fully charged battery will operate the radio in the ON position without being connected to an a-c outlet for about 12 to 15 hours before recharging is required. Whenever possible, it is best not to allow the battery to become discharged to the extent that both indicators disappear. However, if both indicators have sunk, the battery should be recharged immediately or within 24 hours.

3. A battery will continually discharge at a slow rate even when not in use. For this reason, monthly checks should be made of the charge condition and the battery placed on charge when necessary. This will prevent damage to the battery, such as freezing during cold weather.

**BATTERY INSTALLATION**

The following instructions should be carefully followed in installing a battery, or replacing an old one:

1. Remove battery from packing carton.
2. If needed, add water to bring liquid level to indicator mark on battery container. Do not overfill.
3. Raise back cover on radio, remove battery case cover. The latter is removed by lifting two catches.
4. Unplug old battery if present, and replace with new battery.
5. Place battery on charge, if necessary, as described in a previous paragraph, until both indicators are showing in the opening in the case cover.

**ELECTRICAL CIRCUIT ALIGNMENT**

**EQUIPMENT REQUIRED**

1. Signal generator with audio tone modulation.
2. A-C output meter, 1 or 1/2 volts full scale, 1000 ohms/volt.
3. Insulated screwdriver.
4. .05 mf. capacitor.
5. Antenna loop.
6. Shorted one turn loop (for "wandering").
7. Powdered iron cores.

**ALIGNMENT PROCEDURE**

1. **General**—The alignment procedure is given in table form for convenience. Reference is made to Figure 5 for the trimmer locations. The low side of the signal generator should be connected to the chassis of the receiver for i-f alignment; the high side should be connected as indicated in the Alignment Chart. A meter or some other suitable indicating device must be connected to the output of the receiver.

When aligning the receiver, the volume control on the receiver should be turned to its maximum position. The output signal of the signal generator should be kept as low as possible at all times, the reading of a meter connected across the voice coil leads of the receiver should be kept below 1/2 volt by changing the signal generator output. If the signal level is too high, the AVC becomes effective and alignment errors might result.

The following paragraphs give greater details regarding the connections of the output meter and the signal generator to the receiver during alignment.

2. **Connecting the Output Meter**—In aligning the receiver some means for indicating differences in the output voltage will be required. A rectifier type a-c meter of 1 or 1 1/2 volts full scale deflection is connected across the speaker voice coil terminals. For alignment of the i-f amplifier, the chassis and the back cover have to be removed from the cabinet (see paragraph 3 of General Information).

In order to be able to tune the i-f amplifier with ease, it is advisable to unsolder the two leads connecting the loop antenna, and solder them together avoiding any undesirable shorting to ground. Now remove the four self-tapping screws holding the speaker mounting plate and slide it out to gain access to the inside of the chassis. Due to the fact that the rectifier discs are mounted

on this mounting plate, it is necessary to ground this plate temporarily to the chassis by means of a metal strip or wire to avoid excessive hum.

For the r-f alignment, the chassis can be left in the cabinet and the output meter connected between the auxiliary green voice coil lead provided and chassis.

3. **Connecting the Signal Generator**—After aligning the i-f transformer T3, the output of the signal generator should be coupled through a 0.05 mf. capacitor to the grid of the 1R5 oscillator-converter tube. This may be accomplished easily by connecting the capacitor to the stator of C2-B, the middle section of the tuning gang, as this stator is connected directly to the converter grid. The low side of the signal generator output should be connected to the chassis ground to complete the circuit.

For aligning the oscillator and r-f coils, the r-f signal should be inductively coupled by connecting a three- or four-turn, 6-inch diameter loop of bell wire across the signal generator output terminals and then locating the loop about one foot from the radio cover. To prevent possible error in peak readings, the position of the loop with respect to the receiver should not be changed during any one set of adjustments. The adjustment of the iron cores must be made with the cover opened, and during the reading of the output meter the loop must be in normal position (the cover of the receiver must be closed).

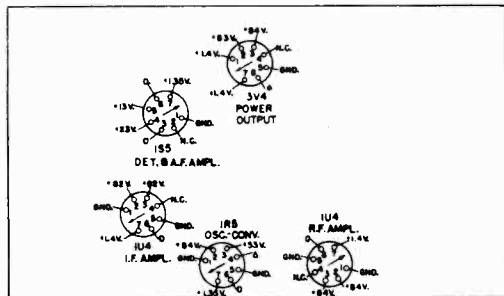
For the oscillator adjustment, it is advisable to use the method of "wandering" the radio loop antenna. "Wandering" is the procedure where more or less gain will be indicated by an increase or decrease in output meter readings when a shorted one-turn loop (approximately 10 in. by 5 in.) is coupled to the radio antenna loop. If a gain is indicated, we have to increase the inductance by screwing in the iron core of the oscillator coil T6. In a similar manner, a field of powdered iron cores may be coupled to the loop. In this case a gain would indicate that the oscillator inductance must be decreased. When no gain is apparent with either the shorted turn wand or the iron field wand, the adjustment of the oscillator iron core is peaked.

After the alignment of the oscillator, the r-f transformer T1 should be aligned as follows:

1. The signal is fed over the loop coupled to the radio antenna loop with cover closed. Note the output meter reading.
2. Open the back cover and turn the tuning slug of T1 approximately 1/2 turn clockwise.
3. Close the back cover and note the new output meter reading. If it has increased, continue to turn the core in the same direction; if it has decreased, reverse the direction. Repeat this procedure until a definite maximum reading is obtained.

**ALIGNMENT CHART**

Step	Test-Oscillator Connected to:	Test-Oscillator Setting	Pointer Setting	Adjust for Maximum Output
1	1U4 (i-f amplifier) grid (Pin 6) in series with 0.5 mf capacitor.	455 KC	1600 KC (gang condenser open)	Iron cores of i-f transformer T3
2	1R5 converter grid (Pin 6) in series with .05 mf capacitor.	455 KC	1600 KC (gang condenser open)	Iron cores of i-f transformer T2
3	1R5 converter grid (Pin 6) in series with .05 mf capacitor.	455 KC	1600 KC (gang condenser open)	Repeak T3 and T2
4	Inductively coupled to loop antenna.	580 KC	580 KC	Iron core of T6*
5	Inductively coupled to loop antenna.	580 KC	580 KC	Iron core of T1**
6	Inductively coupled to loop antenna.	1500 KC	1500 KC	C3B, C2B, and C1B***
7	Repeat Steps 4, 5, and 6 until both peaks reach maximum.			



CONDITIONS OF TEST  
ALL MEASUREMENTS D-C.  
MEASUREMENTS MADE TO GROUND.  
MEASUREMENTS MADE WITH 50,000 OHM/VOLT METER  
BATTERY VOLTAGE - 2.1 VOLTS.

N.C. - NOT CONNECTED TO TUBE.  
\* - 4.5 V., IF MEASURED WITH 1.5 V.A.  
\*\* - READING AFFECTED BY INSTRUMENTS.

Fig. 4. Socket Voltage Diagram

\*Use "Wandering" method described in text.

\*\*See text for details.

\*\*\*Chassis in cabinet and cabinet back (with loop) closed; remove plug buttons to adjust trimmers.





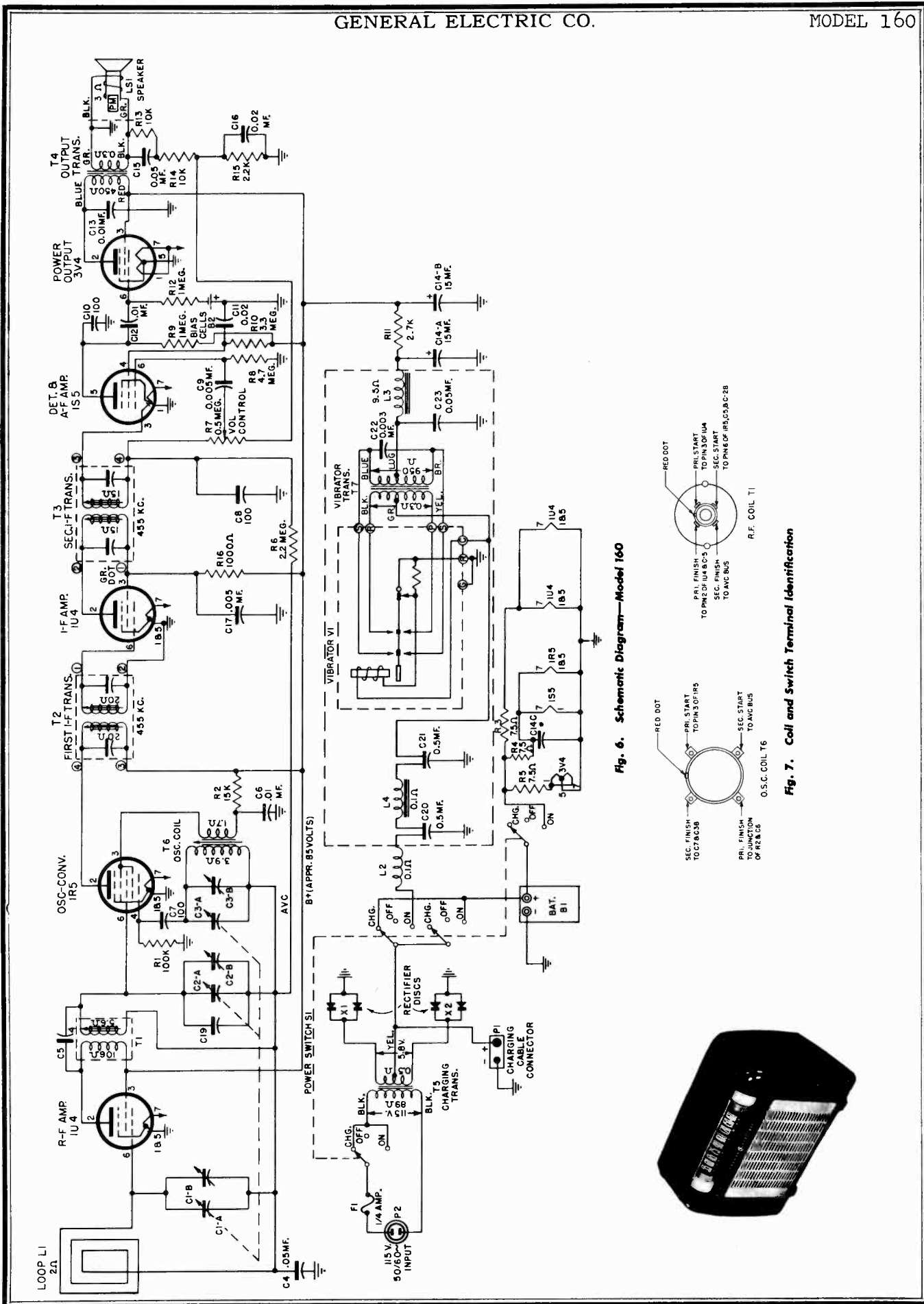


Fig. 6. Schematic Diagram—Model 160



Fig. 7. Coil and Switch Terminal Identification



MODELS 324,  
328

GENERAL ELECTRIC CO.

MODEL 324



MODEL 328

**SPECIFICATIONS**

**CABINET**

Model	324	328
Material	Wood	Wood
Color	Mahogany	Blonde
Height	32 1/2 in.	32 1/2 in.
Width	31 5/8 in.	31 5/8 in.
Depth	16 1/8 in.	16 1/8 in.

**ELECTRICAL**

Voltage	105-125
Frequency	.60 c.p.s
Wattage (Radio)	65 watts
Wattage (Phono)	80 watts

**OPERATING FREQUENCIES**

AM	540-1620 kc
FM	88-108 mc

**INTERMEDIATE FREQUENCIES**

AM	455 kc
FM	10.7 mc

**POWER OUTPUT**

Undistorted	3.0 watts
Maximum	5.0 watts

**LOUDSPEAKER**

Type	Alnico permanent magnet
Outside Diameter of Cone	12 inches
Voice Coil Impedance at 400 Cycles	3.2 ohms

**TUBE COMPLEMENT**

(V1) Converter	6BE6
(V2) R-F and 1st FM-IF Amplifier	6BA6
(V3) Second FM and 1st AM-IF Amplifier	6BA6
(V4) FM Limiter	6AU6
(V5) AM Detector, FM Discriminator, and Audio Amplifier	6T8
(V6) Power Output	6V6
(V7) Rectifier	5Y3GT
(V8) Phono Preampfier	6SC7

**PHONOGRAPH PICK-UP**

Type	Variable reluctance
D-c Resistance	250 ohms

**ANTENNA**

AM	Built-in loop or outside antenna
FM	Power cord antenna, or 300 ohm FM dipole antenna

**GENERAL**

Models 324 and 328 are alike except for cabinet. For service information on the record changer, refer to General Electric publication ER-S-P6.

These models are designed to operate either from built-in antennas or from an external AM antenna or FM dipole antenna. On AM it is merely necessary to connect an external antenna to the terminal screw marked "Antenna." On FM, to operate the receiver from the built-in power line antenna, it is necessary to connect the green wire coming out of the rear of the chassis, to the left-hand terminal screw of the antenna terminal strip. For operation from a 300-ohm FM dipole (G.E. Cat. No. UKA-006 or UKR-006), remove this green wire from the terminal and connect the 300-ohm transmission line (G.E. Cat. No. UWT-002) to the terminals marked "DIPOLE."

On AM operation, the set operates as a five-tube set with the signal being fed directly into the converter grid.

On FM, the set uses a reflex circuit, the Armstrong type discriminator, and a special limiter circuit.

In the reflex circuit, V2 (6BA6) acts both as an r-f amplifier and as the 1st i-f amplifier. The r-f signal is fed into the grid of V2 through the secondary of T1. It is amplified by V2 and tuned at the converter grid by L4, C1B, and trimmer C6. In the converter, the r-f is changed to 10.7 mc i-f, and fed into the primary of T1 and again inserted into the grid of V2, which now acts as an i-f amplifier. The i-f signal is fed from the plate of V2 through choke L9 into the second i-f transformer.

L1 and C3 form a 10.7 mc wave trap to eliminate any i-f signal from the antenna circuit to prevent interference. C4 and L2 are designed to peak at 98 mc with strays to increase the FM r-f sensitivity. At the FM r-f frequencies, the capacitor C46 offers little series impedance to the r-f signal. L9 and C7 form a high-pass filter to pass the FM r-f signal into the converter grid and to shunt the FM i-f frequency into the primary of the second FM i-f transformer.

It should be noted that the FM oscillator coil L8 is a section of 300-ohm line shorted at one end to form a one-turn loop. C11 and C10 are tapped in at each side of the shorted end.

L13 and C27 in the cathode circuit of the limiter tube are series tuned to 10.7 mc. This effectively grounds the cathode for IF. The presence of R21, however, provides a highly degenerative condition for any amplitude modulation applied to the limiter grid. The cathode bias developed by R21 is approximately 85 volts, which makes it necessary to insert onto the grid of V4 from B+80 volts through R38.

In late models of 324 and 328, the variable reluctance pick-up with replaceable stylus was used. When this pick-up was used, the resistor R49 was changed to 15,000 ohms, 1/2 watt from 6800 ohms, 1/2 watt.

**STAGE GAIN AND VOLTAGE CHECKS**

Stage gain measurements by a vacuum tube voltmeter or similar measuring device may be used to check circuit performance and isolate trouble. The gain values listed may have tolerances of ±20 per cent. Readings should be taken with low signal voltage so that AVC is not effective.

**1. R-F AND I-F STAGE GAINS**

Signal applied through IRE dummy antenna:	
Antenna Post to V2 Grid	4 at 1000 kc
V2 Grid to V3 Grid	60 at 455 kc
Dipole Terminals to V2 Grid	1.3 at 98 mc
V2 to V1 Grid	5 at 98 mc
V1 to V2 Grid	2.6 at 10.7 mc
V2 to V3 Grid	18 at 10.7 mc
V3 to V4 Grid	54 at 10.7 mc

**2. AUDIO GAIN**

0.05 volts at 400 cps across volume control with volume control set at maximum will give approximately 1/2 watt output across the speaker voice coil.

**3. OSCILLATOR GRID BIAS**

D-c voltage developed across R3:  
6.5 volts at 1000 kc. (Use 220 K resistor to isolate V.T.V.M.)  
4.5 volts at 98 mc. (Use 220 K resistor to isolate V.T.V. M.)

**4. SOCKET PIN VOLTAGES**

Fig. 3 shows typical tube pin voltages. All readings should be made from the pins to ground, unless otherwise indicated.

**5. HUM MEASUREMENT**

Hum measured across the voice coil of the speaker with volume control at minimum and Band switch on AM should not exceed 7 millivolts.

On FM, ground limiter grid and measure hum across voice coil with volume control at maximum. Hum should not exceed 15 millivolts.

**ALIGNMENT**

Two methods of alignment are given: (1) The regular meter alignment as previously used; and (2) Visual alignment, which allows for more precision in aligning the i-f transformers and particularly the discriminator alignment where it is necessary that the negative and positive half cycles of the output wave have equal amplitude and symmetry.

**EQUIPMENT REQUIRED FOR METER ALIGNMENT**

1. Test oscillator with tone modulation.
2. 20,000 ohm-per-volt voltmeter or microammeter.
3. A-c voltmeter, 2 volts.
4. .01 mfd., paper capacitor.
5. 200,000-ohm resistor, 1/2 watt.

**NOTES IN CONNECTION WITH METER ALIGNMENT CHART**

1. Use unmodulated signal.
2. Connect 20,000 ohm-per-volt meter from junction of R26 and R48 to chassis. Use 10-volt scale. Steps 4 and 5.
3. Connect 20,000 ohm-per-volt meter from junction of C40 and R38 to cathode of limiter (Pin 7 of V4) in series with a 200,000-ohm resistor. The resistor must be connected directly to the cathode pin to minimize capacity loading and to isolate the i-f signal from the meter. Keep signal generator down so that meter indicates not more than 1 volt (5 microamps through 200,000 ohms).
4. Use 400-cycle modulation.
5. Connect a standard output meter across speaker voice coil. Turn volume control full on. Keep signal generator output down so that output meter indicates not more than 1/2 watt output during alignment.
6. For alignment of the AM oscillator and R-F trimmer, the signal should be inductively coupled to the loop antenna by connecting a four-turn, six-inch diameter loop of bell wire across the signal generator terminals, and then locate the loop about one foot from the radio loop antenna. To prevent possible errors in peak readings, the position of the loop in respect to the radio loop should not be changed during any one set of adjustments.
7. To align the first FM i-f transformer T1, it is necessary to disconnect the copper strap from the band switch to Pin 7 of V1 (6BE6) by unsoldering the strap from the tube pin connection. Resolder the strap after T1 is aligned.
8. When tuning the secondary of T6 three minimum points will be obtained. The center one is the correct setting. As the transformer is tuned either side of 10.7 mc, the meter reading should increase.
9. Termination impedance of signal generator should be 300 ohms.
10. When detuning the signal generator in Step (4), two maximum meter readings will be obtained, one on each side of 10.7 mc. The primary of T6 should be aligned to maximum when the signal generator is tuned to the smaller of these two peaks.

**METER ALIGNMENT CHART**

Step No.	Signal Generator Frequency	Signal Input Point	Band Switch	Dial Setting	Adjust	See Note
<b>AM-IF ALIGNMENT</b>						
1	455 KC	6BE6 grid (Pin 7 of V1) through .01 mfd.	AM	550 KC	Primary and secondary cores of T5 for maximum	4, 5
2	455 KC	6BE6 grid (Pin 7 of V1) through .01 mfd.	AM	550 KC	Primary and secondary cores of T2 for maximum	4, 5
<b>FM DISCRIMINATOR AND I-F ALIGNMENT</b>						
3	10.7 MC	6BA6 grid (Pin 1 of V3)	FM	.....	T6 secondary core for minimum	4, 5, 8
4	See Note 10	6BA6 grid (Pin 1 of V3)	FM	.....	Detune signal generator to point of maximum meter reading	1, 2, 10
5	See Note 10	6BA6 grid (Pin 1 of V3)	FM	.....	T6 primary for maximum	1, 2
6	Repeat Step 3.					
7	10.7 MC	6BA6 grid (Pin 1 of V3)	FM	.....	Primary and secondary cores of T4 for maximum	1, 3
8	10.7 MC	6BA6 grid (Pin 1 of V2)	FM	.....	Primary and secondary cores of T3 for maximum	1, 3
9	10.7 MC	6BE6 grid (Pin 7 of V1)	FM	.....	Primary and secondary cores of T1 for maximum	1, 3, 7
<b>AM-RF ALIGNMENT</b>						
10	1620 KC	Inductively coupled	AM	C1 completely open	Adjust C9 for maximum	4, 5, 6
11	1500 KC	Inductively coupled	AM	For maximum output	Adjust C5 for maximum while rocking generator. Set pointer to 1500 KC or 161 mark on scale on backplate.	4, 5, 6

MODELS 324,  
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GENERAL ELECTRIC CO.

FM-RF ALIGNMENT

12	108 MC	Dipole terminals	FM	C1 completely open	Adjust C12 for maximum	1, 3, 9
13	108 MC	Dipole terminals	FM	For maximum output	Adjust C6 for maximum while rocking generator	1, 3, 9
14	10.7 MC	Dipole terminals	FM	.....	Adjust C3 for minimum.	1, 3

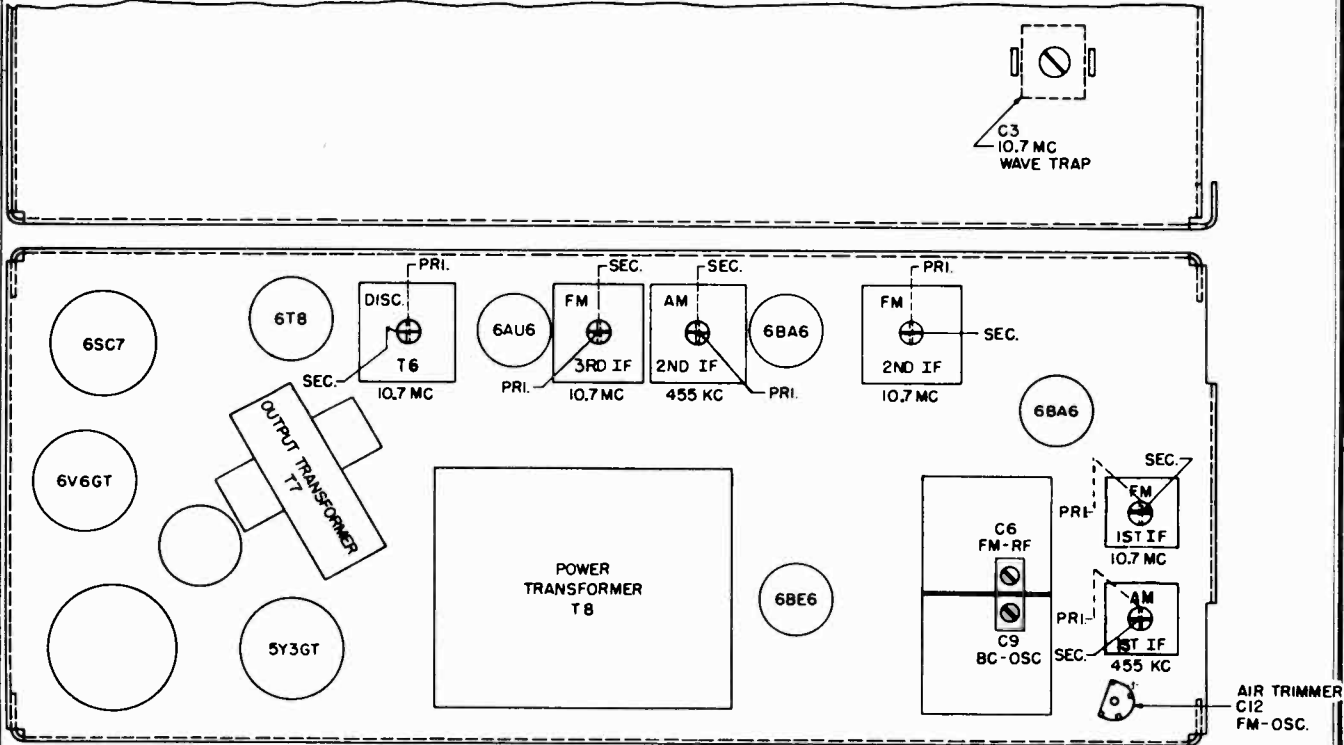


Fig. 1 Tube and Trimmer Location

EQUIPMENT REQUIRED FOR VISUAL ALIGNMENT:

1. General Electric YGS-3 AM and FM signal generator, or equivalent.
2. General Electric CRO-5A oscilloscope, or equivalent.
3. 200,000 ohm, 1/2 watt resistor.
4. 20,000 ohm-per-volt meter.
5. .01 mfd. paper capacitor.
6. 8 to 10 mfd. Pyranol capacitor.

NOTES IN CONNECTION WITH METER ALIGNMENT CHART

1. Connect vertical plates of scope to the limiter cathode (Pins 2 or 7 of V4) through a 200,000-ohm resistor and chassis. Connect an 8 to 10 mfd. pyranol capacitor between junction of C40 and R38 and ground.
2. Connect vertical plates of scope at junction of R18 and C28 and chassis.
3. Use a 60-cycle, amplitude-modulated signal.
4. In some cases tuning of the converter grid will cause "pulling" of the oscillator and will change the oscillator frequency. After centering the response curve, if peaking of C5 or

C6 causes the curve to move off the scope screen, it is necessary to recalibrate the oscillator as in Steps 10 and 12.

5. The termination impedance of the signal generator 300 ohms to properly match the input impedance of this receiver.

6. To align the 1st i-f transformer T1, it is necessary to disconnect the copper strap from Pin 7 of V1 (6BE6) by unsoldering it. Resolder after alignment.

7. For alignment of the AM oscillator and r-f trimmers, the signal should be inductively coupled to the loop antenna by connecting a four-turn six-inch diameter loop of bell wire across the signal generator terminals, and then locate this loop about one foot from the radio loop antenna. To prevent possible errors in peak readings, the position of the loop with respect to the radio loop should not be changed during any one set of adjustments.

8. When using a sweep signal, it is necessary to apply the same sweep voltage to the horizontal plates of the scope as is used to sweep the r-f frequency. It may be necessary to use an RC phase shift network. This may be done by putting a .005 mfd. capacitor across the horizontal plate terminals of the scope and a 1/2-megohm potentiometer in series with the high side of the horizontal sweep voltage line. The potentiometer should be adjusted for a single trace.

**VISUAL ALIGNMENT CHART**

Step No.	Signal Generator Frequency	Signal Input Point	Band Switch	Dial Setting	Adjust	See Note
<b>AM-IF VISUAL ALIGNMENT</b>						
1	455 KC ±20 KC at 60-cycle sweep rate	6BE6 grid (Pin 7 of V1) through .01 mfd.	AM	.....	Two slugs of T5 for maximum amplitude and symmetry.	2
2	455 KC ±20 KC at 60-cycle sweep rate	6BE6 grid (Pin 7 of V1) through .01 mfd.	AM	.....	Two slugs of T2 for maximum amplitude and symmetry.	2
<b>FM-IF AND DISCRIMINATOR VISUAL ALIGNMENT</b>						
3	10.7 MC ±300 KC at 60-cycle rate	6BA6 grid (Pin 1 of V2)	FM	.....	Two slugs of T4 for maximum amplitude of wave and symmetry.	1
4	10.7 MC ±300 KC at 60-cycle rate	6BA6 grid (Pin 1 of V2)	FM	.....	Two slugs of T3 for maximum amplitude symmetry of wave.	1
5	10.7 MC ±300 KC at 60-cycle rate	6BE6 grid (Pin 7 of V1). (See Note 7.)	FM	.....	Tuning slugs of T1 for maximum amplitude and symmetry of wave.	1, 6
6	10.7 MC ±300 KC at 60-cycle rate	6BA6 grid (Pin 1 of V3)	FM	.....	Primary of T6 for maximum amplitude.	2
7	10.7 MC ±300 KC at 60-cycle rate	6BA6 grid (Pin 1 of V3)	FM	.....	Secondary of T6 for vertical symmetry with respect to the midpoint horizontal trace.	2
8	10.7 MC ±300 KC at 60-cycle sweep rate	6BA6 grid (Pin 1 of V3)	FM	.....	Primary of T6 for straightest line between positive and negative peaks.	2
9	Recheck Step 7					
<b>AM-RF VISUAL ALIGNMENT</b>						
10	1620 KC	Inductively coupled	AM	C1 completely open	C9 for steepest slope of straight-line trace on scope.	2, 3, 7
11	1500 KC ±20 KC at 60 cps sweep rate	Inductively coupled	AM	For maximum output	C5 for maximum amplitude. Set pointer to 1500 KC or 161 mark on scale on backplate.	2, 3, 7
<b>FM-RF VISUAL ALIGNMENT</b>						
12	108 MC	Dipole terminals	FM	C1 completely open	C12 for steepest slope of straight line trace on scope.	1, 3, 5
13	98 MC ±300 KC at 60 cps sweep rate	Dipole terminals	FM	For maximum output	C6 for maximum amplitude and minimum distortion.	1, 5
14	10.7 MC ±300 KC at 60 cps rate	Dipole terminals	FM	.....	C3 for minimum amplitude.	1, 5

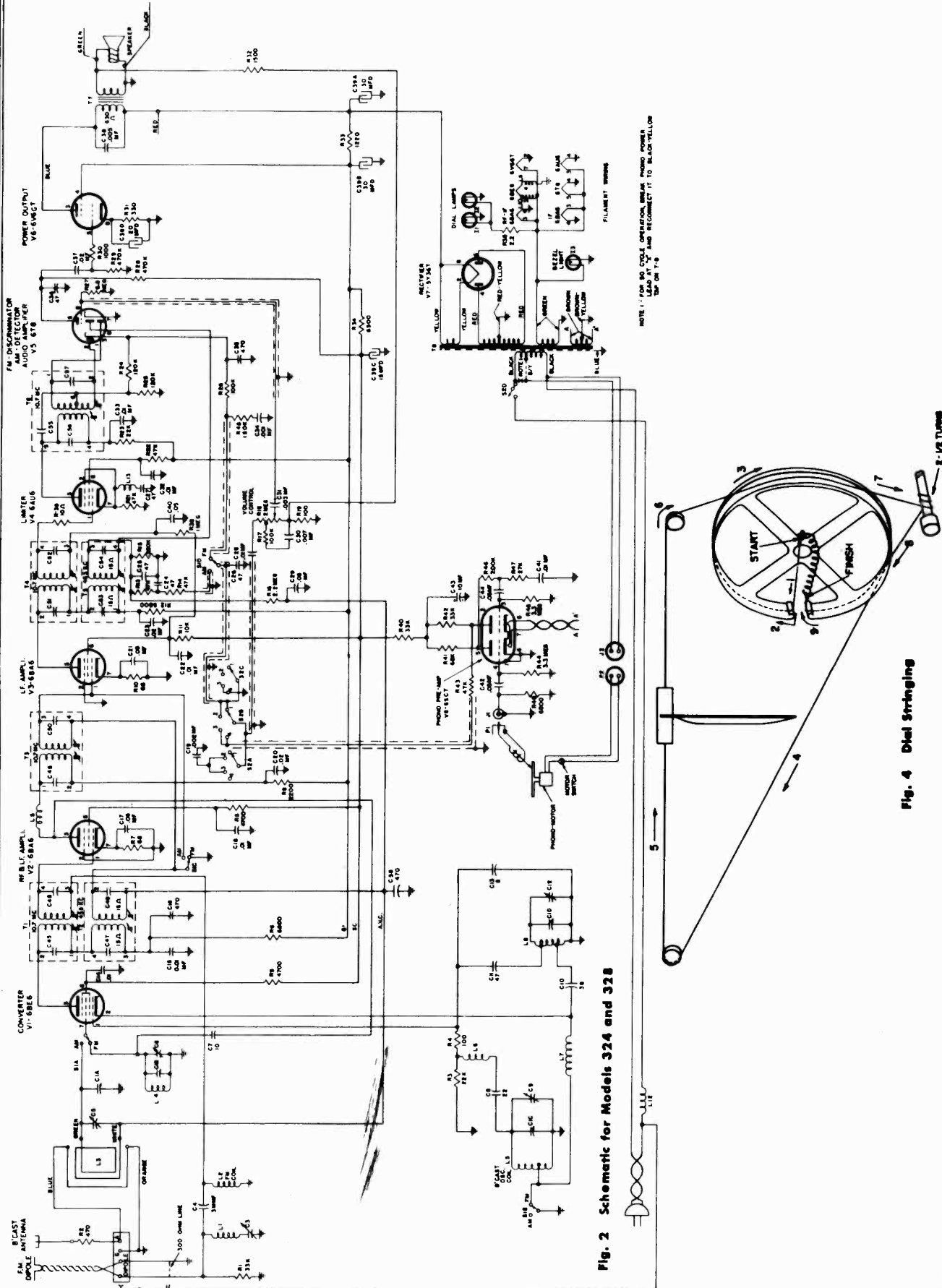
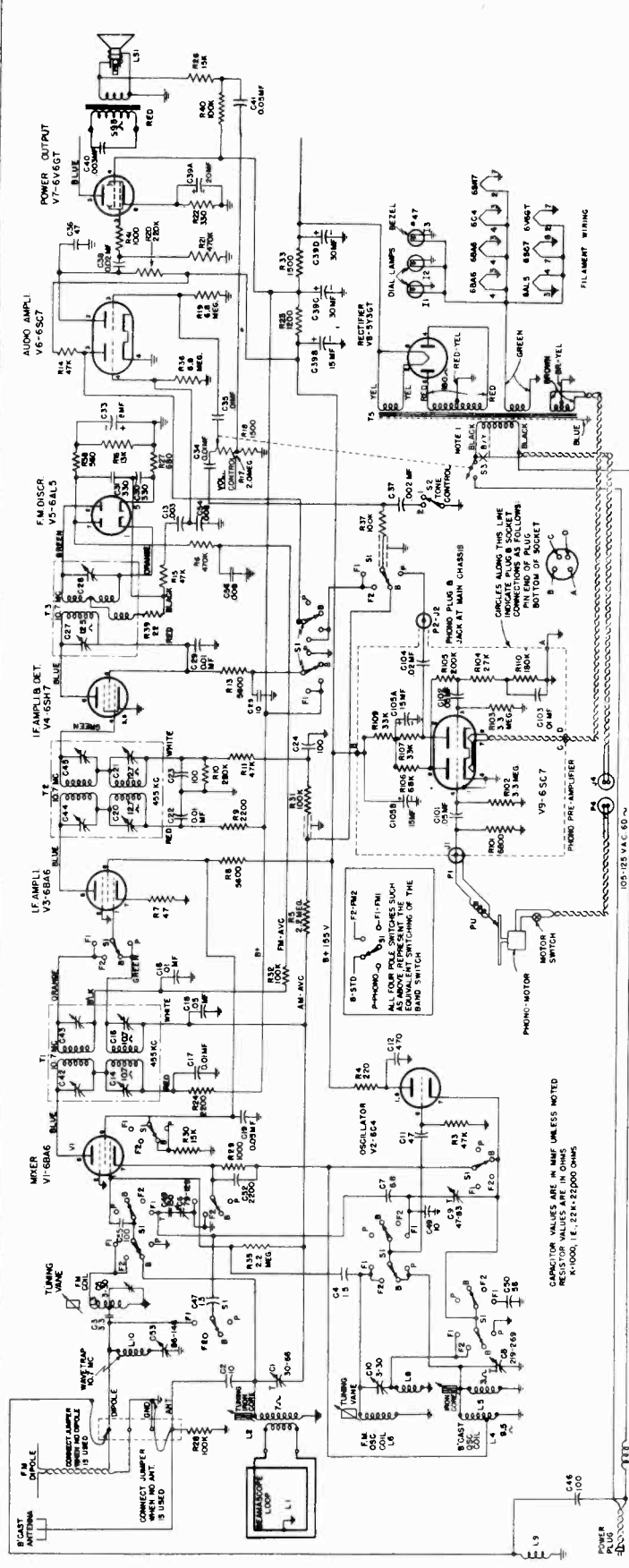


Fig. 2 Schematic for Models 324 and 328

Fig. 4 Dial stringing







NOTE 1  
FOR 30-CYCLE OPERATOR BREAK POWER LEAD AT 'X' AND RECONNECT IT TO BLACK-YELLOW TAP LEAD ON T5.

105-125 V.A.C. 60 ~

CONNECTOR VALUES ARE IN MUF UNLESS NOTED  
RESISTOR VALUES ARE IN OHMS  
K=1000, I.E., 22K=22,000 OHMS

**ELECTRICAL RATING:**

Rating	A5	A6
Voltage	105-125	105-125
Frequency	50	60
Wattage	85	85

**OPERATING FREQUENCIES**

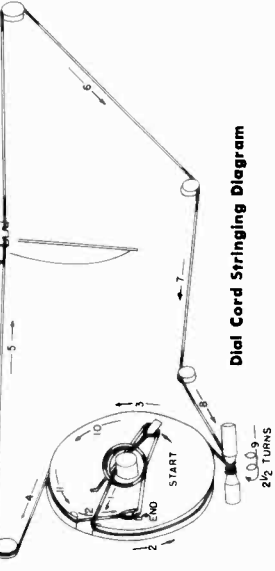
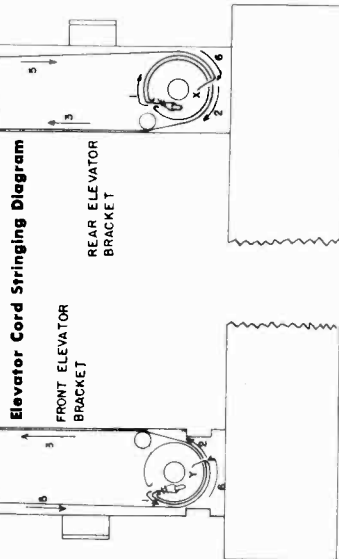
Standard Band	540 to 1600 kc
Frequency Modulation 1	42 to 49 mc
Frequency Modulation 2	88 to 108 mc

**POWER OUTPUT (117 Volts Line):**

Undistorted	3 watts
Maximum	5 watts

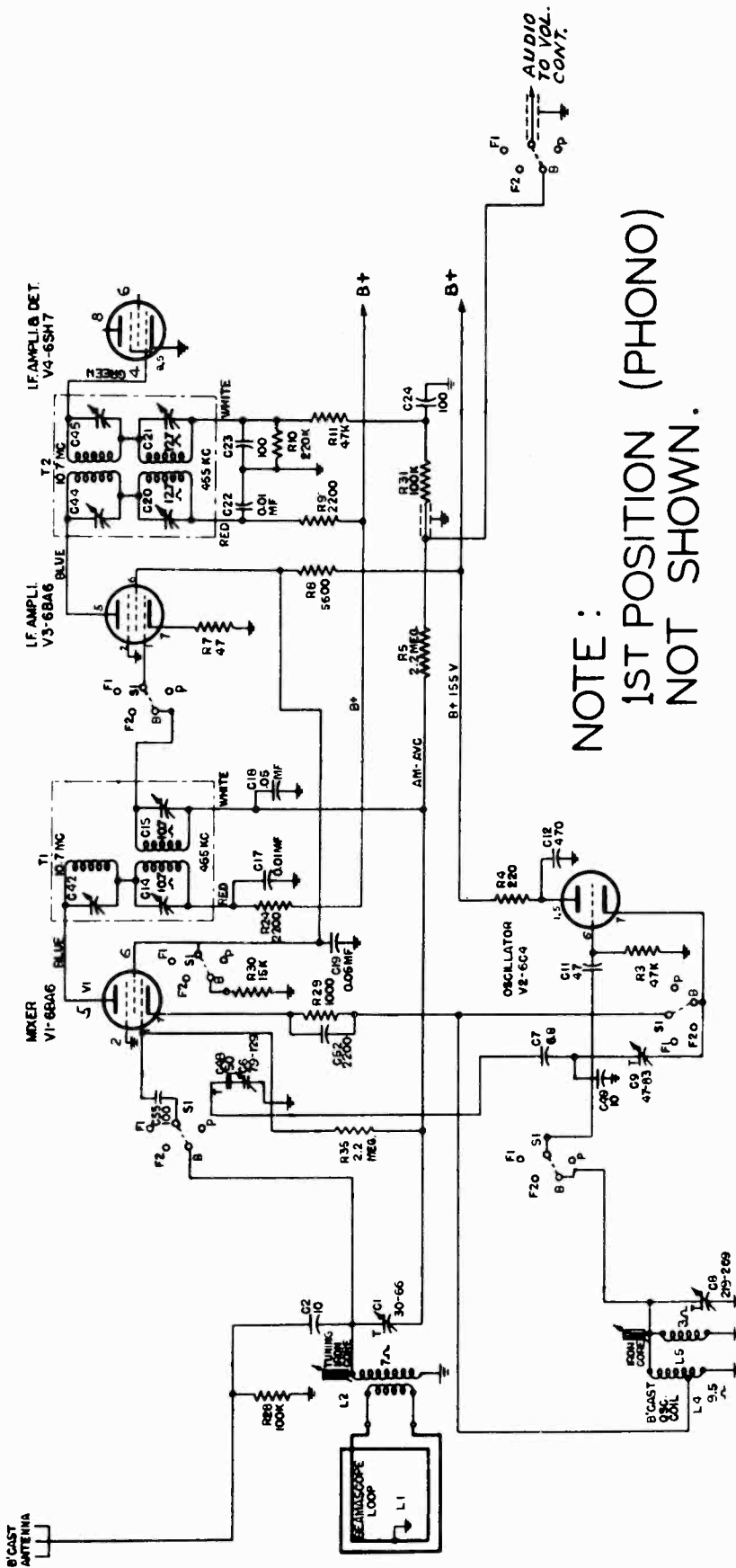
**PHONOGRAPH PICK-UP:**  
Type ..... Variable reluctance  
D-C Resistance ..... 250 ohms

**LOUD-SPEAKER:**  
Type ..... Alnico P. M.  
Size ..... 12 inches  
Voice coil impedance at 400 C.P.S. .... 3.2 ohms



**TUBE COMPLEMENT:**

- (V1) Converter ..... 6BA6
- (V2) Oscillator ..... 6C4
- (V3) 1st I-F Amplifier ..... 6BA6
- (V4) 2nd I-F and AM Detector ..... 6SH7
- (V5) FM Ratio Detector ..... 6AL5
- (V6) Audio Amplifier ..... 6SC7
- (V7) Power Output ..... 6V6GT
- (V8) Rectifier ..... 5Y3GT
- (V9) Phono Pre-amplifier ..... 6SC7
- I1, I2, I3 Pilot Lights ..... Mazda No. 47



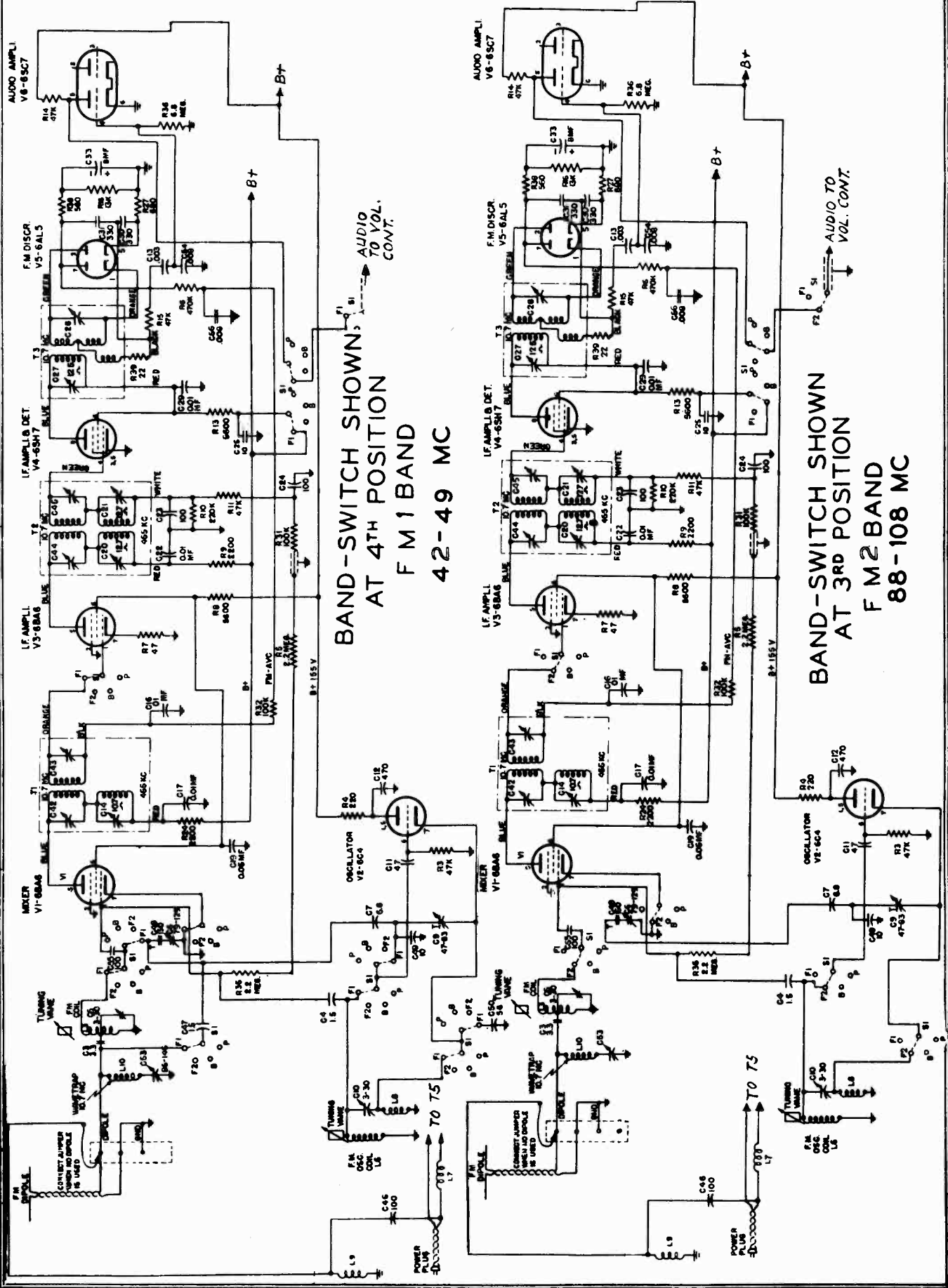
**NOTE :**  
 1ST POSITION (PHONO)  
 BAND-SWITCH SHOWN  
 AT 2ND POSITION  
 BROADCAST BAND  
 540-1600 KC

# CLARI-SKEMATIX

Registered Trademark

GENERAL ELECTRIC CO.

MODELS 354, 355



**THE TUNING SYSTEM:**

Variable inductance tuning is employed instead of using a conventional tuning capacitor. It provides a high efficiency FM circuit in the 88-108 megacycle range which would not be possible with the more conventional methods of tuning. Other advantages are also gained but the one mentioned above is the most important.

Tuning is accomplished by an "elevator" which consists of two rigid metal elevator support bars raised and lowered by means of a windlass controlled by the tuning knob at the panel. From these elevator bars are suspended two powdered iron cores which tune the broadcast converter and oscillator coils; and two tuning "vanes" which tune two low-inductance circuits. These latter circuits are employed in both FM bands. They are called "guillotine" tuners because of their appearance.

**FACTS ABOUT "GUILLOTINE TUNING":**

The "guillotine" tuners are designed primarily for the 88-108 megacycle FM band where special technique is needed to realize high gain and circuit stability. Ordinary coils, tuned by a variable capacitor are inefficient at these frequencies, first because of the low inductances required to reach these frequencies when a variable tuning capacitor is used and, second, because shunt capacity reduces the gain of the amplifier circuit; shunt capacity must be kept very low. Another disadvantage of standard tuning arrangements at these frequencies is that common coupling is obtained through the shaft of a ganged tuning capacitor unless insulated single sections are used which are cumbersome and costly. Common coupling of this type tends to cause oscillations or general instability and precludes high gain per stage. The guillotines make possible short leads, completely isolated sections, stable tuning high Q circuits, low shunt capacity, and location of each tuner in the best physical and electrical position in the assembly. Furthermore, since the shunt capacity is small and the inductance is consequently at its highest corresponding value, the additional unavoidable inductance introduced in the wiring, bandswitch, etc., produces a minimum of circuit losses and unbalance.

The guillotine tuner consists of a heavy, silver-plated, two-turned square coil, rigidly supported between two plastic posts. A flat, solid vane slides up and down between the two turns. It is guided in grooves in the plastic posts so that it passes between the two sections of the coil without touching them. The posts are so moulded and the coil so constructed that the whole assembly is held rigidly at a predetermined spacing. The tuning vane is raised and lowered by the tuning elevator. When the elevator is all the way up (set tuned to the lowest frequency), the vane is completely above the coil which then acts as a simple, two-turn coil. As the set is tuned toward the higher frequencies, the vane moves downward into the field of the coil until, finally, it is all the way in.

The vane reduces the inductance of the coil through two principles. First, it acts as a shorted turn, and thus reduces inductance directly; second, it provides a barrier between the two turns of the coil which reduces the mutual coupling and thus reduces the inductance.

The tuners described above are L3 and L6.

**FM BANDS:**

Guillotine tuners L3 and L6 are used as the tuned circuits for the converter and local oscillator respectively, in both FM bands. In the higher frequency band, the tuner is used with only a small shunt trimmer for adjusting distributed capacity. In the lower band, a higher value shunt trimmer is used to reduce the frequency. The layout of the band switch tuners and tube sockets is arranged to give the shortest possible leads when the FM bands are in use. The lead lengths in the other band are not nearly so critical.

**STANDARD BROADCAST BAND:**

This receiver employs a converter and an oscillator which are tuned by iron slugs suspended from the tuning elevator. These tuners are L2 and L5 respectively.

**I-F AMPLIFIER:**

The i-f amplifier consists of a composite 455 kc and 10.7 mc circuit. The electrical changes required to transfer AM and FM service are made by the band switch. When the switch is in either the FM-1 or FM-2 position, the amplifier operates at 10.7 megacycles and delivers the i-f signal into an FM discriminator circuit. When the switch is in the broadcast position, the amplifier operates at 455 kc. Screen and plate voltage is removed from the 6SH7 amplifier and the tube acts as an AM diode detector. Thus, the AM audio signal appears across R10 while the FM audio signal appears across C54. A section of the band switch switches the audio input circuit from one to the other.

**RATIO DETECTOR:**

In the ratio detector as used in this set the a-c voltages as applied to the diodes of a ratio detector are the same as the a-c voltages applied to the diodes in a conventional discriminator circuit. The method of obtaining audio from the FM carrier distinguishes the ratio detector from the conventional discriminator.

At resonant frequency the d-c voltage to which C31 and C30 are charged are equal and additive. When the frequency of the FM carrier goes above the center frequency the d-c voltage to which C30 is charged increases and the d-c voltage to which C31 is charged decreases proportional to the increase in frequency. The sum of the voltage of C30 and C31, however, remains the same. When the frequency goes below the center frequency the ratio of the charge on C30 and C31 reverses. The d-c charge of C30 decreases below its charge at center frequency and the d-c charge of C31 increases above its charge at center frequency. The increase and decrease of d-c charge is proportional to the change in frequency while the sum of the two remains constant at all times. The audio is tapped off between C30 and C31 to ground. The d-c voltage across C30 has been shown to vary proportionately to the change in frequency applied to the diodes of the detector tube 6AL5.

The ratio detector is also different from the discriminator in that it needs no limiter stage before it. The large condenser C33—8 mfd. combined with the resistor R16, has a long time constant and serves to limit any sudden change in d-c charge across C30 and C31, which might result from noise impulses.

**REPLACEMENT OF DRIVE CORDS****DIAL STRINGING**

The dial pointer should be strung as shown in Figure 1. The tuning elevators should be strung, as shown in Figure 2, with the dial pointer at the extreme right of the dial. The front drum and stringing procedure is shown viewed from the rear of the chassis and the rear drum and stringing procedure is shown viewed from the front of the chassis. Ends X and Y at the conclusion of step 6, in stringing the front and rear elevators, should be connected at opposite ends of spring RMS-004 (not shown) after making one-half turn each around the shaft in opposite directions.

To position the elevator bar for the FM tuner, turn the dial pointer to the extreme right. Loop the elevator strings through the two notches at the end of the elevator bars and

adjust the elevator bar above the FM coils to be 2 5/8 inches from the top of the chassis to the top of the elevator bar and cement to the cord with Glyptal. With the guillotine tuning vanes at the bottom, the adjusting screws set at their midpoints on the elevator bar and with spring and guide wires in place, solder guide wire to tuning vane.

To position the elevator bar for the AM slug tuner, turn the dial pointer to the extreme left and set the elevator bar 2 5/8 inches from the top of the chassis to top of the elevator bar. Loop the elevator cord through the notches at the ends of the bar and cement to cord with Glyptal. Then turn the dial pointer to extreme right and with the adjusting screws at their midpoints on the elevator bar, position the tuning slugs in the antenna and oscillator coils 3 9/16 inches from the top of the chassis to the top of the slug and solder the guide wire to the top of the adjusting screw.

**STAGE GAINS AND VOLTAGE CHECKS**

Stage gain measurements by vacuum tube voltmeter or similar measuring devices may be used to check circuit performance and isolate trouble. The gain values listed may have tolerances of 20%. Readings should be taken at low signal input so that AVC is not effective.

**1. R-F AND I-F STAGE GAINS.**

Signal applied through IRE dummy antenna:  
Antenna Post to V1 Grid ..... 3 at 1000 KC  
These checks with oscillator tube V2 removed:  
V1 Grid to V3 Grid ..... 78 at 455 KC  
V1 Grid to V3 Grid ..... 38 at 10.7 MC  
V3 Grid to V4 Grid ..... 22.5 at 10.7 MC

**2. AUDIO GAIN.**

.01 volts at pin 4 of V6 with volume control full clockwise will give approximately 1/2 watt output across the speaker voice coil.

**3. OSCILLATOR GRID BIAS.**

D-c voltage developed across R.3  
11.5 Volts at 1000 KC  
3.0 Volts at 45 MC  
3.9 Volts at 98 MC

**4. SOCKET PIN VOLTAGES.**

Figure 4 shows typical tube pin voltages. All readings should be made from the pins to ground unless otherwise indicated.

**EQUIPMENT FOR VISUAL ALIGNMENT:**

- |   |                                    |
|---|------------------------------------|
| 1. General Electric YGS-3 AM and FM signal generator or equivalent. | 3. 330,000-ohm resistor, 1/2 watt. |
| 2. General Electric CRO5A oscilloscope or equivalent.               | 4. .01 mf. capacitor.              |
|   | 5. 20,000 ohms-per-volt meter.     |

**NOTES IN CONNECTION WITH VISUAL ALIGNMENT TABLE:**

- |   |   |
|---|---|
| 1. Connect scope to pin 4 of V4 (6SH7) through resistor 330,000 ohms.   | 3. The output curve when aligning the discriminator transformer should have symmetry and the curve should extend an equal distance above and below the horizontal reference axis. |
| 2. The over-all i-f curve on FM with sufficient signal input should have fairly steep skirts, a relatively flat top and symmetry of form. | 4. Connect scope to V6 (6SC7) pin 4 through 330,000 ohms.   |

**VISUAL ALIGNMENT CHART**

STEP	SIGNAL GENERATOR FREQUENCY	SIGNAL INPUT POINT	BAND SWITCH SETTING	DIAL SETTING	ADJUST	SEE NOTE	REMARKS
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**I-F VISUAL ALIGNMENT (AM)**

1	455 kc ±20 kc at 60-cycle sweep	6BA6 (V3) grid thru .01 mfd.	STD	.....	Adjust C20 and C21 for maximum amplitude and symmetry of curve.	1	
2	455 kc ±20 kc at 60-cycle sweep	6BA6 (V1) grid thru .01 mfd.	STD	.....	Adjust C14 and C15 for maximum amplitude and symmetry of curve.	1	

**I-F VISUAL ALIGNMENT (FM)**

3	10.7 mc ±300 kc at 60-cycle sweep	6BA6 (V3) grid thru .01 mfd.	FM2	.....	Adjust C44 and C45 for maximum amplitude and symmetry.	1	
4	10.7 mc ±300 kc at 60-cycle sweep	6BA6 (V1) grid thru .01 mfd.	FM2	.....	Adjust C42 and C43 for maximum amplitude of wave and symmetry of curve.	1, 2	

**VISUAL ALIGNMENT OF RATIO DETECTOR**

5	10.7 mc ±300 kc at 60-cycle sweep	6SH7 (V4) pin 4 (grid)	FM2	.....	Adjust C27 to maximum amplitude.	4	
6	10.7 mc ±300 kc at 60-cycle sweep	Same as Step 5	FM2	.....	Adjust C28 for symmetry of curve on scope*	3, 4	*Negative and positive half cycles of curve should have equal amplitude.
7	10.7 mc ±300 kc at 60-cycle sweep	6BA6 (V1) grid thru .01 mfd.	FM2	.....	Adjust C44, C45, C42, and C43 for maximum amplitude	1, 2	
8	10.7 mc ±300 kc at 60-cycle sweep	6BA6 (V1) grid thru .01 mfd.	FM2	.....	Readjust C27 and C28 as in steps 5 and 6	4	



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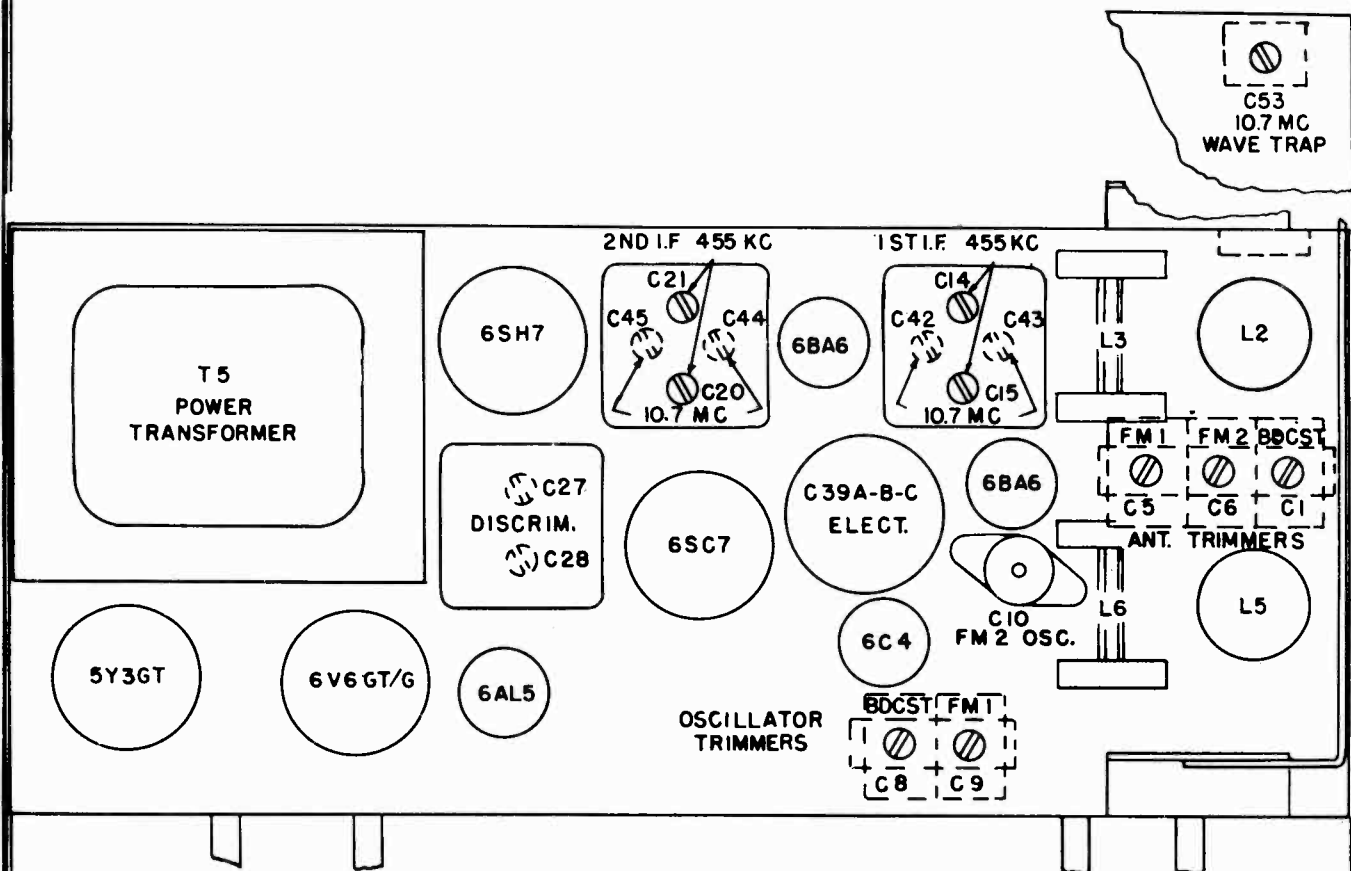
MODELS 354, 355

METER ALIGNMENT CHART

STEP	SIGNAL GENERATOR FREQUENCY	SIGNAL INPUT POINT	BAND SWITCH	DIAL SETTING	ADJUST	SEE NOTE	REMARKS
<b>I-F ALIGNMENT (A-M)</b>							
1	455 kc	6BA6 (V3) grid thru .01 mfd.	STD	.....	C20 and C21 for maximum	4, 5	
2	455 kc	6BA6 (V1) grid thru .01 mfd.	STD	.....	C14 and C15 for maximum	4, 5	
<b>I-F ALIGNMENT (F-M)</b>							
3	10.7 mc	6SH7 grid thru .01 mfd.	FM2	.....	C27 for maximum	1, 2	Sufficient i-f input to give approx. 0.8 volt across C33.
4	10.7 mc	6SH7 grid thru .01 mfd.	FM2	.....	Peak C28 for minimum audio output	4, 5	Use insulated screwdriver for alignment.
5	10.7 mc	6BA6 (V3) grid thru .01 mfd.	FM2	.....	C44 and C45 for maximum	1, 2	
6	10.7 mc	6BA6 (V1) grid thru .01 mfd.	FM2	.....	C42 and C43 for maximum. Retrim C27, C44 and C45 for maximum.	1, 2	
<b>R-F ALIGNMENT—FM2 BAND</b>							
7	Align dial pointer with dots at extreme right of scale when tuning knob is turned full clockwise.						
8	98 mc	Dipole terminal	FM2	98 mc	Adjust C10 for maximum	1, 2	
9	98 mc	Dipole terminal	FM2	98 mc	Adjust C5 for maximum*	1, 2	*Rock tuning knob during alignment.
<b>R-F ALIGNMENT—FM1 BAND</b>							
10	46 mc	Dipole terminal	FM1	46 mc	Adjust C9 for maximum	1, 2	
11	46 mc	Dipole terminal	FM1	46 mc	Adjust C6 for maximum*	1, 2	*Rock tuning knob during alignment.
<b>R-F ALIGNMENT—BROADCAST</b>							
12	1620 kc	Antenna Post**	STD	Note 6	Adjust C8 and C1 for maximum	4, 5, 6	**Remove green lead from Ant. term. board. Beam-a-scope loop L1 must be connected to chassis.
13	1000 kc	Antenna Post	STD	1000 kc	Adjust iron core in L5 for maximum	4, 5	
14	1000 kc	Antenna Post	STD	1000 kc	Adjust iron core in L2 for maximum	4, 5	
15	Recheck step 12						

**ALIGNMENT NOTES**

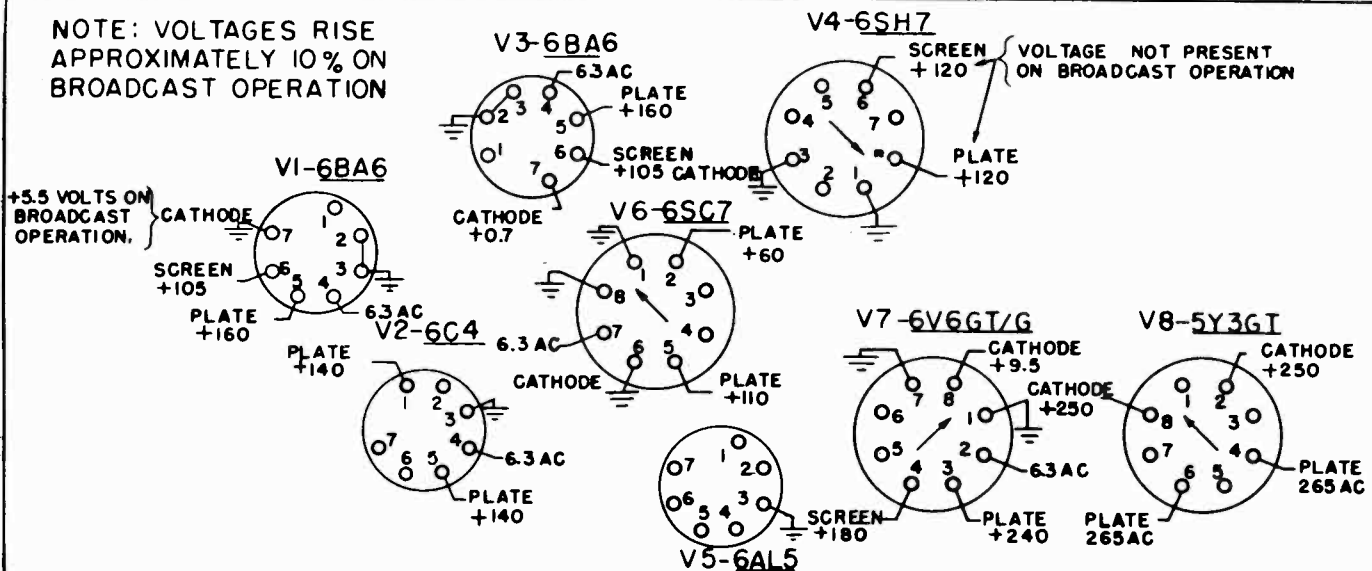
1. Use *unmodulated* signal.
2. Connect 20,000 ohms-per-volt meter across C33.
3. Connect 20,000 ohms-per-volt meter from junction of R15 and C13 to chassis.
4. Use 400-cycle modulation.
5. Connect a standard output meter across the speaker voice coil. Turn volume control fully on. Keep signal generator output down so that the meter indicates not more than 1/2-watt output during alignment.
6. Turn the tuning knob clockwise until the dial pointer is at extreme right of dial scale.



Tube and Trimmer Location

BOTTOM VIEW OF CHASSIS

NOTE: VOLTAGES RISE APPROXIMATELY 10% ON BROADCAST OPERATION



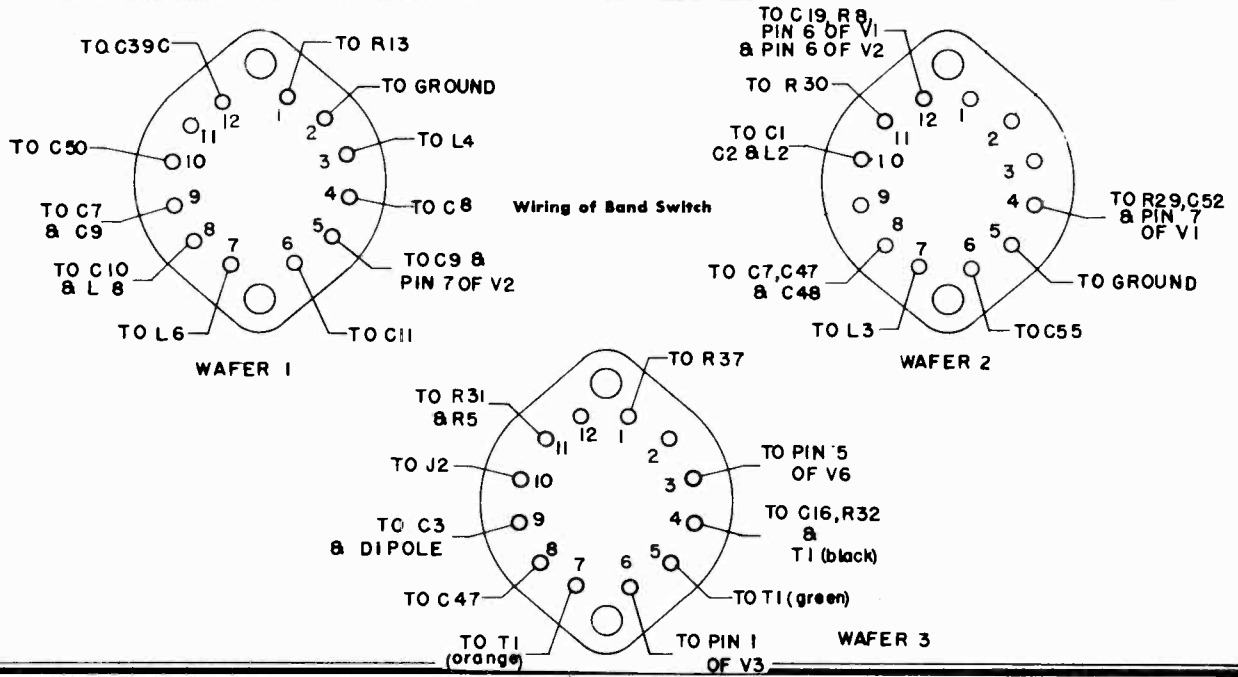
ALL VOLTAGES MEASURED TO CHASSIS USING A 20,000 OHM PER VOLT METER

Socket Voltage Diagram

Cat. No.	Symbol	Description	Cat. No.	Symbol	Description
<b>UNIVERSAL REPLACEMENT PARTS</b>			<b>SPECIALIZED REPLACEMENT PARTS (Cont'd)</b>		
UCC-011	C41	CAPACITOR—.05 mf., paper 200 v.	RCW-1028	C55	CAPACITOR—100 mmf., ceramic
UCC-020	C13	CAPACITOR—.003 mf., paper 400 v.	F.CY-017	C10	CAPACITOR—Air trimmer
UCC-024	C54, 56	CAPACITOR—.008 mf., paper 400 v.	RCY-018	C1, 5, 6	CAPACITOR—Trimmer, 3-30 mmf., 30-60 mmf., 79-129 mmf.
UCC-028	C18	CAPACITOR—.05 mf., paper 400 v.	RCY-019	C8, 9	CAPACITOR—Trimmer, 219-269 mmf., 47-83 mmf.
UCC-036	C37	CAPACITOR—.002 mf., paper 600 v.	RCY-020	C53	CAPACITOR—Trimmer, 86-146 mmf.
UCC-040	C16, 17, 22, 34, 35	CAPACITOR—.01 mf., paper 600 v.	RDC-032		CORD—Elevator drive cord, NF28
UCF-041	C38	CAPACITOR—.02 mf., paper 600 v.	RDC-033		CORD—Dial drive cord, NF40
UCF-045	C19	CAPACITOR—.05 mf., paper 600 v.	RDE-022		ESCUTCHEON—Dial scale
UCN-504	C3	CAPACITOR—3.3 mmf., ceramic	RDK-061		KNOB—Inner knob (black)
UCN-1506	C7	CAPACITOR—6.8 mmf., ceramic	RDK-110		KNOB—Outer knob (black)
UCU-004	C2	CAPACITOR—10 mmf., mica	RDP-020		POINTER—Dial scale pointer assembly
UCU-020	C23, 24, 46	CAPACITOR—100 mmf., mica	RDS-033		SCALE—Dial scale
UCU-044	C12	CAPACITOR—470 mmf., mica	RDX-026		PLATE—Backplate spring
UCU-060	C52	CAPACITOR—2200 mmf., mica	RHC-010		CLIP—Insulator spring clip
UCU-1032	C48	CAPACITOR—150 mmf., mica	RHM-016		CLIP—Oscillator coil clip
UCU-1040	C30, 31	CAPACITOR—330 mmf., mica	RHM-026	L3	COIL—Antenna tuner coil (two-turn frame)
UCW-1022	C50	CAPACITOR—56 mmf., ceramic	RHW-027	L6	COIL—Oscillator tuner coil (two-turn frame)
UPF-1206		SPEAKER—12-inch speaker	RII-001		WASHER—(Two required on guide wire of tuner vane)
URD-017	R7	RESISTOR—47 ohms, 1/2 w., carbon	RJS-049	J4	SOCKET—Phono-power
URD-033	R4	RESISTOR—200 ohms, 1/2 w., carbon	RJS-055	J2	SOCKET—Miniature for V2
URD-049	R29, 41	RESISTOR—1000 ohms, 1/2 w., carbon	RJS-056		SOCKET—Dial light
URD-053	R18	RESISTOR—1500 ohms, 1/2 w., carbon	RLA-013	L2	COIL—B-C antenna
URD-057	R9, 24	RESISTOR—2200 ohms, 1/2 w., carbon	RLC-022	L4	PADDER—B-C oscillator
URD-077	R26	RESISTOR—15,000 ohms, 1/2 w., carbon	RLC-023	L5	COIL—B-C oscillator
URD-089	R3, 11, 14, 15	RESISTOR—47,000 ohms, 1/2 w., carbon	RLI-004	L7	CHOKE—Power line choke
URD-097	R40, 28, 31, 32, 37	RESISTOR—100,000 ohms, 1/2 w., carbon	RLI-005	L8, L9, L10	CHOKE—Oscillator and FM antenna
URD-105	R10, 20	RESISTOR—220,000 ohms, 1/2 w., carbon	RLL-013		LOOP—Assembly
URD-113	R6, 21	RESISTOR—470,000 ohms, 1/2 w., carbon	RMM-050		VANE—Antenna tuner vane for coil L3
URD-133	R5, 35	RESISTOR—2.2 meg., 1/2 w., carbon	RMM-051		VANE—Oscillator tuner vane for coil L6
URD-141	R19, 36	RESISTOR—6.8 meg., 1/2 w., carbon	RMM-052		GUIDE WIRE—Connects vanes to elevator bar
URD-1043	R38	RESISTOR—56 ohms, 1/2 w., carbon	RMS-043		ADJUSTING SCREW—On elevator bar
URD-1045	R27	RESISTOR—680 ohms, 1/2 w., carbon	RMS-115		SPRING—Spring on tuning vane guide wires
URD-1076	R16	RESISTOR—13,000 ohms, 1/2 w., carbon	RPX-010	R17, S3	PICKUP—Variable reluctance
URE-037	R22	RESISTOR—330 ohms, 1 w., carbon	RRC-033	S1	VOLUME—Control, 2 meg. and switch
URF-051	R23	RESISTOR—1200 ohms, 2 w., carbon	RSW-024	S2	SWITCH—Band
URF-067	R8, 13	RESISTOR—5600 ohms, 2 w., carbon	RSW-025	T3	SWITCH—Tone control
URF-077	R30	RESISTOR—15,000 ohms, 2 w., carbon	RTD-004	T1	TRANSFORMER—Discriminator
			RTL-031	T2	TRANSFORMER—1st I-F transformer
			RTL-032	T5	TRANSFORMER—2nd I-F transformer
			RTP-028	T5	TRANSFORMER—Power transformer (60 cycles)
			RTP-033		TRANSFORMER—Power transformer (50 cycles)
			RWL-004		CORD—Power cord

**SPECIALIZED REPLACEMENT PARTS**

RAA-006		ARM—Band switch
RAA-007		ARM—Tone switch
RAB-038		BACK—Cabinet
RAL-001		BEZEL—on cabinet front
RAV-031		CABINET—Model 355
RAV-034		CABINET—Model 354
RCC-014	C40	CAPACITOR—.005 mfd., paper
RCC-040	C33	CAPACITOR—.01 mfd., oil
RCE-038	C33	CAPACITOR—.8 mfd., 25 v., electrolytic
RCE-039	C39A, C39B, C39C, D	CAPACITOR—20 mfd., 25 v.
	C11	CAPACITOR—15 mfd., 300 v.
RCW-001	C49	CAPACITOR—30 mfd., 350 v.
RCW-013	C11	CAPACITOR—ceramic
RCW-017	C4, 47	CAPACITOR—10 mmf., ceramic
		CAPACITOR—1.5 mmf., ceramic



MODELS 376,  
377, 378

## GENERAL ELECTRIC CO.

**ELECTRICAL RATING (INPUT):**

Voltage	105-125 volts
Frequency	50 cycles, 60 cycles
Wattage (Radio)	75 watts
Wattage (Phono)	105 watts

**OPERATING FREQUENCIES:**

Standard Band	540 to 1600 KC
FM Band	88 to 108 MC

**POWER OUTPUT:**

Undistorted	3 watts
Maximum	5.5 watts

**LOUDSPEAKER:**

Type	Alnico PM
Size	12 inches
Voice Coil Impedance	3.2 ohms

**INTERMEDIATE FREQUENCY:**

Standard Band	455 KC
FM Band	10.7 MC

**ANTENNA INPUT:**

Standard Band	Conventional antenna
FM Band	300-ohm input for folded dipole

**PHONOGRAPH PICK-UP:**

Type	Variable reluctance
D-C Resistance	250 ohms

**TUBE COMPLEMENT:**

(V1) R-F Amplifier	6AG5
(V2) Converter	6BE6
(V3) 1st I-F Amplifier	6BA6
(V4) 2nd I-F Amplifier	6AU6
(V5) FM Limiter	6AU6
(V6) FM Discriminator, AM Detector, and Audio Amplifier	6S8GT
(V7) Power Output	6V6GT
(V8) Rectifier	5Y3GT
(V9) Phono-preamplifier	6SC7
(I1, I2) Dial Lamps	Mazda No. 47
(I3) Bezel Lamp	Mazda No. 47

**STAGE GAIN AND VOLTAGE CHECKS:**

Stage gain measurements by vacuum tube voltmeter or similar measuring devices may be used to check circuit performance and isolate trouble. The gain values listed may have tolerances of  $\pm 20\%$ . Readings should be taken with low signal voltage so that AVC is not effective.

**1. R-F AND I-F STAGE GAINS.**

Signal applied through IRE dummy antenna:

Antenna Post to V1 Grid	3.0 at 1000 kc
Dipole Terminals to V1 Grid	0.7 at 98 mc
V1 Grid to V2 Grid	8.5 at 1000 kc
V1 Grid to V2 Grid	10 at 98 mc
V2 Grid to V3 Grid	22 at 455 kc
V2 Grid to V3 Grid	3.0 at 10.7 mc
V3 Grid to V4 Grid	2.0 at 455 kc
V3 Grid to V4 Grid	57 at 10.7 mc
V4 Grid to V5 Grid	40 at 10.7 mc

**2. AUDIO GAIN.**

.07 volts at 400 cps across volume control with control set at maximum will give approximately  $\frac{1}{2}$  watt output across the speaker voice coil.

**3. OSCILLATOR GRID BIAS.**

D-c Voltage Developed Across R5:
8.5 volts at 1000 kc.
3.5 volts at 98 mc.

**4. SOCKET PIN VOLTAGES.**

Figure 3 shows typical tube pin voltages. All readings should be made from the pins to chassis unless otherwise indicated.

**ALIGNMENT**

Two methods of alignment, (1) the regular meter alignment method as previously used on AM sets, and (2) the visual alignment which allows for much more precision in aligning the i-f transformers and, particularly the discriminator where you can check the output wave shape for distortion, oscillations, and to see that the negative and positive half cycles of the wave have equal amplitude and are symmetrical.

**EQUIPMENT REQUIRED FOR METER ALIGNMENT:**

1. Test Oscillator with tone modulation.
2. D-C Voltmeter or Microammeter.
3. A-C Voltmeter, 2 volts.
4. .01 mf. paper capacitor.
5.  $\frac{1}{2}$  watt resistor of required resistance (note 9).
6. 200 mmf. mica capacitor.

**EQUIPMENT REQUIRED FOR VISUAL ALIGNMENT:**

1. General Electric YGS-3 AM and FM signal generator, or equivalent.
2. General Electric CRO-5A oscilloscope, or equivalent.
3. 330,000 ohm resistor,  $\frac{1}{2}$  watt.
4. 20,000 ohm per volt meter.

**NOTES IN CONNECTION WITH METER ALIGNMENT:**

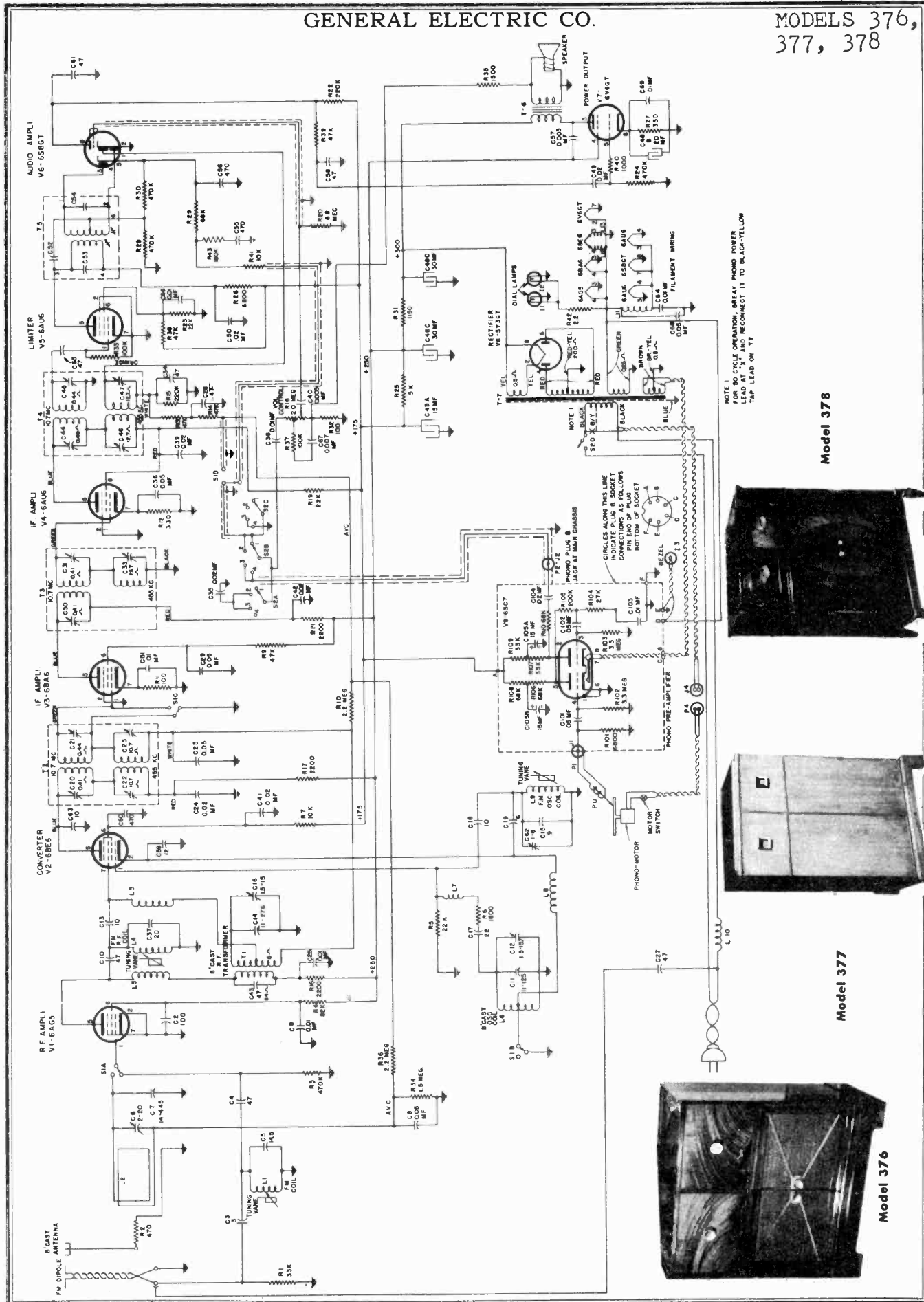
- (1) Use unmodulated signal.
- (2) Connect 20,000 ohm-per-volt meter from junction of R29 and R41.
- (3) Connect 20,000 ohm-per-volt meter from grid pin 1 of (V5) 6AU6 limiter to chassis with a 200,000-ohm resistor in series. The resistor must be connected directly to the grid to minimize capacity loading and to isolate the meter from the i-f voltage. Keep signal generator output down so that meter indicates not more than one volt at the grid (5 microamperes through 200,000 ohms) (Alignment Steps 7 through 13).
- (4) Use 400-cycle modulation (Steps 1, 2, 3, 15, 16, 17, and 18).
- (5) Connect a standard output-meter across speaker voice coil. Turn volume control full on. Keep signal generator output down so that meter indicates not more than  $\frac{1}{2}$  watt output (1.26 volts) during alignment. (Steps 1, 2, 3, 15, 16, 17 and 18.)
- (6) Two oscillator settings will give response. The higher frequency response is the correct one; the other is the image response. If in doubt, start with the trimmer screw loosened completely and adjust for the first response.
- (7) For alignment of the standard band oscillator and r-f trimmers, the input signal should be inductively coupled to the radio loop antenna by connecting a 4-turn, 6-inch diameter loop of bell wire across the signal generator terminals, and then locate the loop about one foot from the radio loop antenna to prevent possible errors in peak readings. The position of the loop in respect to the radio loop antenna should not be changed during any one set of adjustments. Steps 15, 16, 17 and 18.
- (8) The lead from the signal generator must be kept as short as possible and it must be kept away from later stages to prevent regeneration. The signal may also be fed in to the tube pin connection from the top of the chassis to prevent regeneration.
- (9) A dummy antenna is a resistor in series with the hot lead of the signal generator. The resistance of the resistor plus the termination impedance of the signal generator should equal 300 ohms.
- (10) If a dial scale is not available, index the dial pointer as follows: Turn the pointer to the left-hand limit of travel and mark the dial plate at a reference edge of the pointer slide. Then set the pointer by turning the dial knob until the indicated dimension exists between the reference edge and the mark.

**NOTES IN CONNECTION WITH VISUAL ALIGNMENT TABLE:**

- (1) Use FM signal modulated at 60 cps  $\approx$  300 kc.
- (2) Connect vertical plates of scope to the limiter grid (pin 1 of V5) (6AU6) through 200,000 ohm resistor.
- (3) Connect vertical plates of scope to the junction of R29 and R41 (FM audio) through 200,000 ohms.
- (4) Connect vertical plates of scope at junction of R13 and C28 (AM audio output) through 200,000 ohms.
- (5) Use FM signal modulated at 60 cps  $\approx$  20 kc.
- (6) Use a 60 cycle amplitude modulated signal.
- (7) If a dial scale is not available, index the dial pointer as follows: Turn the pointer to the left-hand limit of travel and mark the dial plate at a reference edge of the pointer slide. Then set the pointer by turning dial knob until the indicated dimension exists between the reference edge and the mark.
- (8) Two oscillator settings will give a response. The higher frequency response is the correct one, the other response is the image. If in doubt, start with the trimmer screw loosened completely and adjust for the first response.
- (9) In some cases tuning of the converter grid will cause "pulling" of oscillator which will change the oscillator frequency. After centering the response curve on the scope, if peaking of L4 causes the response curve to move off of the screen it is necessary to realign the oscillator for calibration.
- (10) A dummy antenna is a resistor in series with the hot lead of the signal generator. The resistance of the resistor plus the termination impedance of the signal generator should equal 300 ohms.
- (11) Leads from the signal generator must be kept as short as possible and away from later stages to prevent regeneration. The signal may also be fed to the tube pin connection from the top of the chassis to prevent regeneration.

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MODELS 376,  
377, 378



NOTE 1  
FOR 50 CYCLE OPERATION, BREAK PHONO POWER  
LEAD FROM SOCKET AND RECONNECT IT TO BLACK-YELLOW  
TAP LEAD ON T1.

Model 378

Model 377

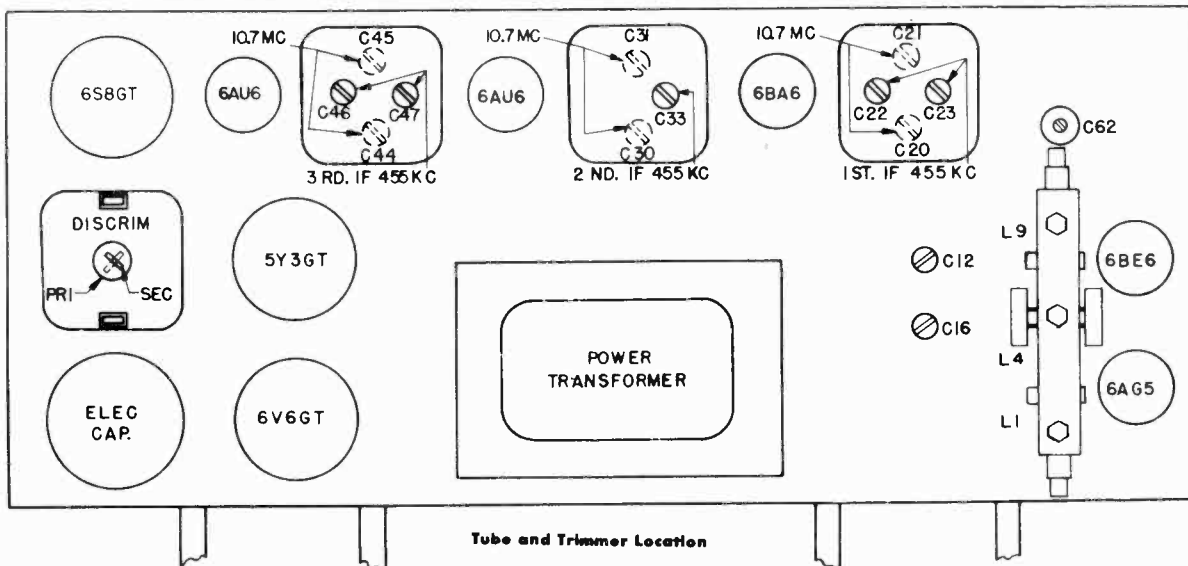
Model 376

MODELS 376,  
377, 378

GENERAL ELECTRIC CO.

ALIGNMENT CHART

STEP	SIGNAL GENERATOR FREQUENCY	SIGNAL INPUT POINT	BAND SWITCH	DIAL SETTING	ADJUST	SEE NOTE	REMARKS
<b>AM I-F METER ALIGNMENT</b>							
1	455 kc	Conv. grid directly thru .01 mfd	STD	.....	Peak C47 and C46	4, 5	Adjust for max.
2	455 kc	Conv. grid directly thru .01 mfd	STD	.....	Peak C33	4, 5	Adjust for max.
3	455 kc	Conv. grid directly thru .01 mfd	STD	.....	Peak C23 and C22	4, 5	Adjust for max.
<b>FM DISCRIMINATOR AND I-F METER ALIGNMENT</b>							
4	10.7 mc	Pin 1 of V5 (6AU6) thru .01 mf	FM	.....	Discrim. Secondary for zero meter	1, 2	Apply 1 volt signal input.
5	Detune signal generator	Pin 1 of V5 (6AU6) thru .01 mf	FM	.....	*Signal Generator	1, 2	*Detune signal generator to point of maximum meter reading.
6	As in Step 5	Pin 1 of V5 (6AU6) thru .01 mf	FM	.....	Peak discr. primary	1, 2	Adjust for max.
7	10.7 mc	Pin 1 of V4 (6AU6) thru .01 mf	FM	.....	Peak C45 and C44	1, 3	Adjust for max.
8	10.7 mc	Pin 1 of V3 (6BA6) thru .01 mf	FM	.....	C31 and C30	1, 3	Adjust for max.
9	10.7 mc	Pin 7 of V2 (6BE6) thru .01 mf	FM	.....	C21 and C20	1, 3, 8	Adjust for max.
<b>FM R-F METER ALIGNMENT</b>							
10	98 mc	Dipole terminals thru dummy antenna	FM	98 mc or 3 1/4 inches	Peak C62	1, 3, 6, 9, 10	
11	98 mc	Dipole terminals thru dummy antenna	FM	For max. output	Peak L4 vane	1, 3, 9	
12	Repeat steps 10 and 11 until no further improvement in sensitivity.						
13	98 mc	Dipole terminals thru dummy antenna	FM	98 mc	Peak L1 vane	1, 3, 9	
14	Repeat steps 10, 11, and 12.						
<b>AM R-F METER ALIGNMENT</b>							
15	1500 kc	Inductively coupled	STD	1500 kc or 5 inches	Peak C12	4, 5, 7, 10	
16	1500 kc	Inductively coupled	STD	For max. output	Peak C16	4, 5, 7	
17	Repeat steps 15 and 16 until no further improvement in sensitivity.						
18	1500 kc	Inductively coupled	STD	Do not change from Step 16	Peak C6	4, 5, 7	





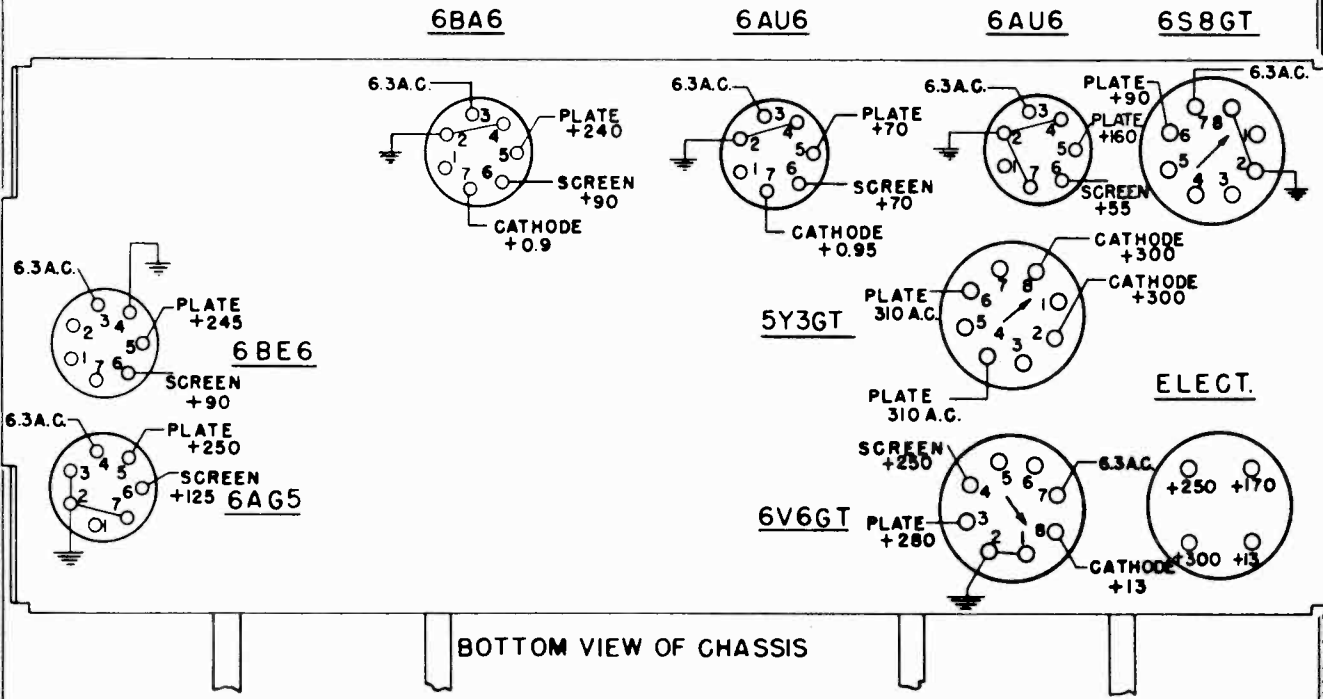
GENERAL ELECTRIC CO.

MODELS 376,  
377, 378

STEP	SIGNAL GENERATOR FREQUENCY	SIGNAL INPUT POINT	BAND SWITCH	DIAL SETTING	ADJUST	SEE NOTE	REMARKS
<b>AM I-F VISUAL ALIGNMENT</b>							
1	455 kc ± 20 kc at 60-cycle sweep	Conv. grid directly pin 7 V2 (6BE6) thru .01 mf	AM	.....	C47 and C46*	4, 5	*Adjust for max. amplitude and min. distortion of curve on scope screen.
2	Same as Step 1	Same as Step 1	AM	.....	C33	4, 5	Same as Step 1.
3	Same as Step 1 and 2	Same as Step 1 and 2	AM	.....	C23 and C22	4, 5	Same as Steps 1 and 2.
<b>FM I-F VISUAL ALIGNMENT</b>							
4	10.7 mc ± .3 mc at 60-cycle sweep	Conv. grid directly pin 7 V2 (6BE6) thru .01 mf	FM	.....	C45 and C44	1, 2, 11	Adjust for max. amplitude and min. distortion.
5	Same as Step 4	Same as Step 4	FM	.....	C31 and C30	1, 2, 11	Same as Step 4.
6	Same as Steps 4 and 5	Same as Steps 4 and 5	FM	.....	C21 and C20	1, 2, 11	Same as Steps 4 and 5.
<b>DISCRIMINATOR VISUAL ALIGNMENT</b>							
7	10.7 mc ± .3 mc at 60-cycle rate	Conv. grid directly pin 7 V2 (6BE6) thru .01 mf	FM	.....	Primary of T5 discrim. transformer	1, 3, 11	Adjust primary for max. amplitude.
8	Same as Step 7	Same as Step 7	FM	.....	Secondary of T5	1, 3, 11	Adjust secondary for vertical symmetry with respect to mid-point horizontal traces.
9	Same as Step 7	Same as Step 7	FM	.....	Primary of T5	1, 3, 11	Adjust for straightest possible slope of straight line trace.
<b>FM R-F VISUAL ALIGNMENT</b>							
10	98 mc Note 6	Dipole terminals thru dummy antenna	FM	98 mc or 3 1/4 in.	Adjust C62*	2, 6, 7, 8, 10	*Set dial pointer accurately, then adjust for steepest slope of straight line trace on scope.
11	98 mc Note 1	Dipole terminals thru dummy antenna	FM	98 mc	Peak L4 vane	1, 2, 9, 10	Center response curve on scope, then peak for max. amplitude.
12	98 mc Note 1	Dipole terminals thru dummy antenna	FM	98 mc	Peak L1 tuning vane	1, 2, 10	Peak for max. amplitude.
<b>AM R-F VISUAL ALIGNMENT</b>							
13	1500 kc Note 6	Antenna thru 200 mmf	STD	1500 kc or 5 in.	Adjust C12	4, 6, 7	Adjust C12 for steepest slope of straight line trace on scope.
14	1500 kc Note 5	Antenna thru 200 mmf	STD	1500 kc	Adjust C16	4, 5, 7, 9	Adjust C16 for max. amplitude.
15	1500 kc Note 5	Antenna thru 200 mmf	STD	1500 kc	Adjust C6	4, 5, 7	Adjust C6 for max. amplitude.

MODELS 376,  
377, 378

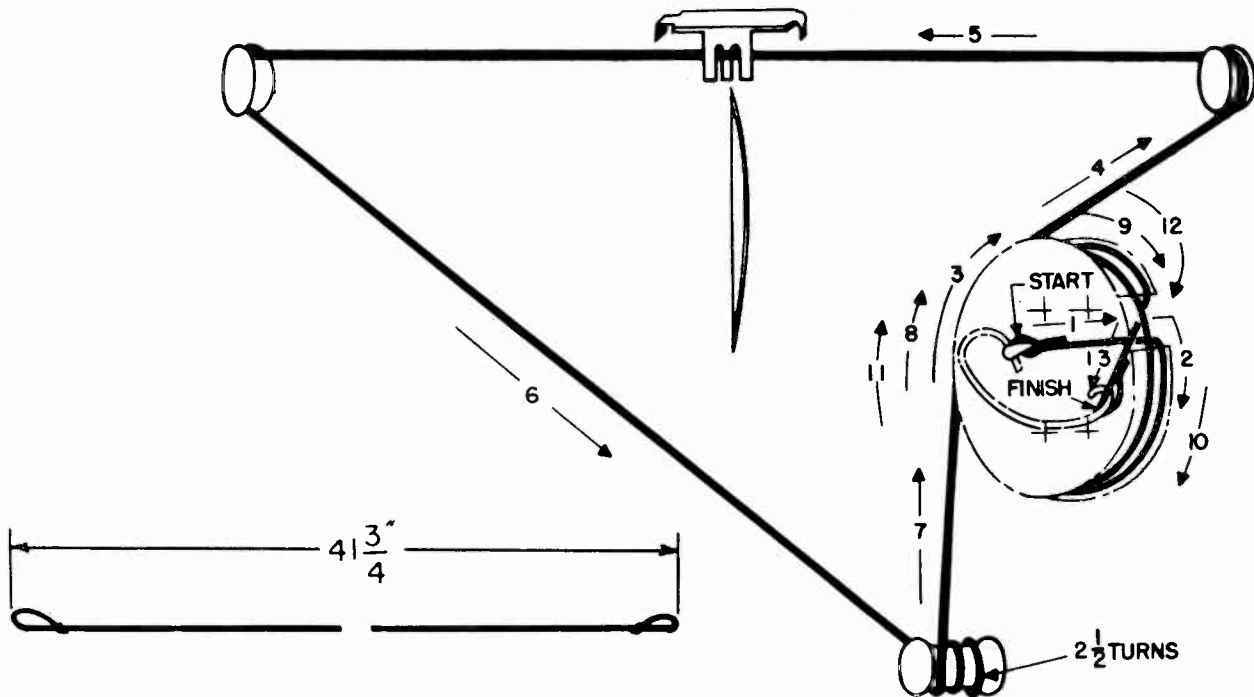
GENERAL ELECTRIC CO.



ALL VOLTAGES ARE +DC UNLESS OTHERWISE SPECIFIED

ALL VOLTAGES MEASURED TO CHASSIS USING A 20,000 OHM PER VOLT METER

Socket Voltage Diagram



Dial String Diagram

GENERAL ELECTRIC CO.

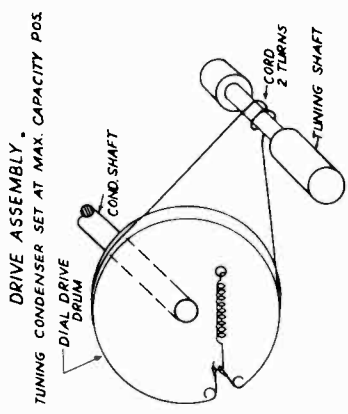
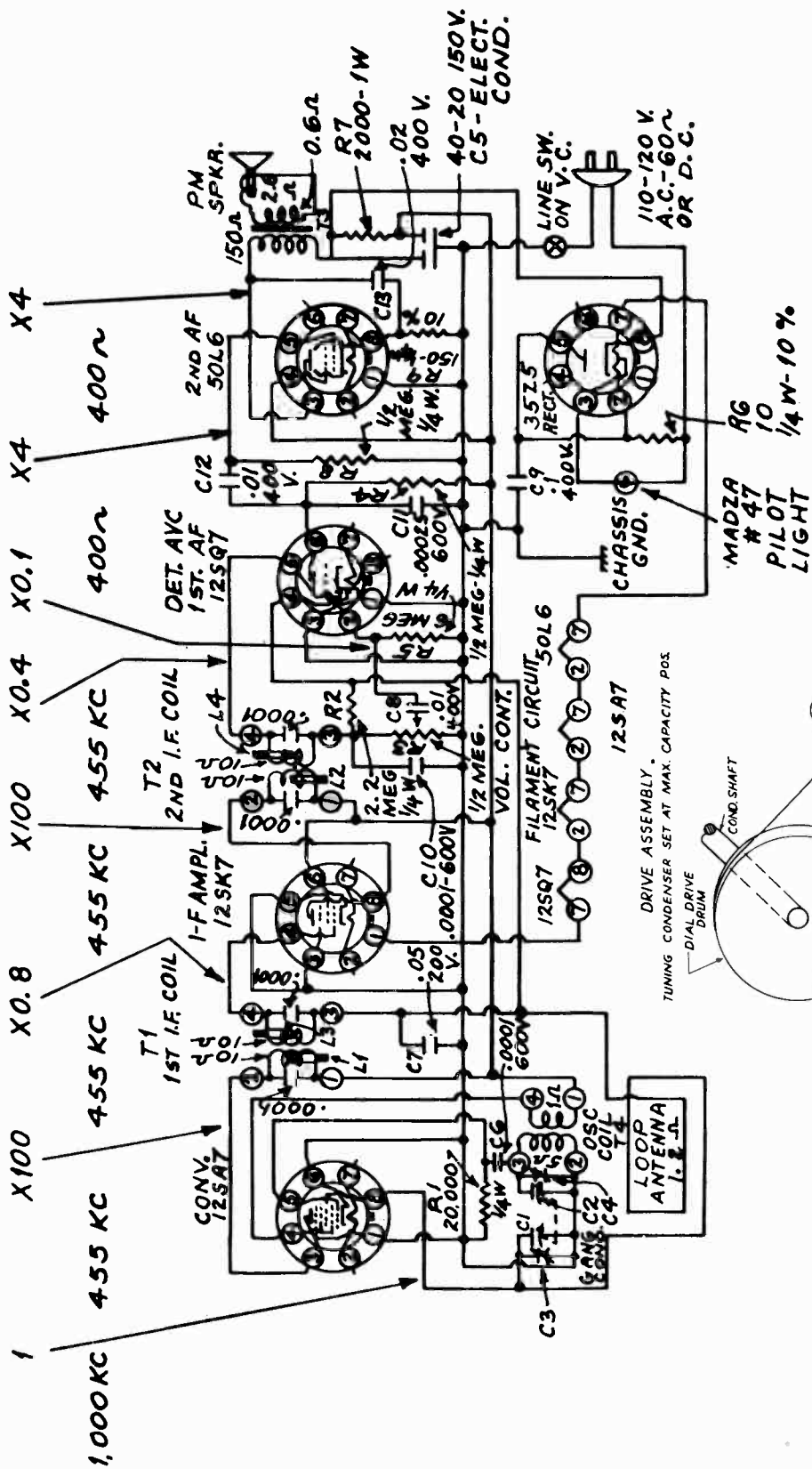
MODELS 376,  
377, 378

MODELS 376, 377, 378 REPLACEMENT PARTS LIST

Cat. No.	Symbol	Description	Cat. No.	Symbol	Description
<b>UNIVERSAL REPLACEMENT PARTS</b>			<b>SPECIALIZED REPLACEMENT PARTS (Cont'd)</b>		
UCC-621	C35	CAPACITOR—.002 mf., 600 v., paper	RCW-1048	C3	CAPACITOR—3 mmf., ceramic
UCC-623	C40	CAPACITOR—.003 mf., 600 v., paper	RCW-1049	C5	CAPACITOR—14.5 mmf., ceramic
UCC-630	C38, 51, 69, 64, 66, 9, 26, 103	CAPACITOR—.01 mf., 600 v., paper	RCW-1050	C19	CAPACITOR—6 mmf., ceramic
UCC-631	C24, 41, 42, 49, 50, 39, 104	CAPACITOR—.02 mf., 600 v., paper	RCW-1051	C15	CAPACITOR—9 mmf., ceramic
UCC-635	C29, 101, 102, 8, 25, 68	CAPACITOR—.05 mf., 600 v., paper	RCW-1052	C4, 10	CAPACITOR—47 mmf., ceramic
UCU-020	C27, 28, 34, 58	CAPACITOR—47 mmf., mica	RCW-1053	C17	CAPACITOR—22 mmf., ceramic
UCU-028	C2	CAPACITOR—100 mmf., mica	RCY-037	C6	CAPACITOR—Trimmer, 2-20 mmf.
UCU-044	C56, 55	CAPACITOR—470 mmf., mica	RCY-038	C62	CAPACITOR—Trimmer, 1-8 mmf.
UCU-520	C61	CAPACITOR—47 mmf., mica	RDC-033		CORD—Dial drive cord, 10 yard length
UCU-1034	C55	CAPACITOR—180 mmf., mica	RDD-009		DRUM
UCW-044	C60	CAPACITOR—470 mmf., ceramic	RDE-005		ESCUTCHEON
UCW-1020	C43	CAPACITOR—47 mmf., ceramic	RDE-030		KNOB—With Arrow
UCW-2004	C18	CAPACITOR—10 mmf., ceramic	RDE-031		KNOB—Plain
UCW-2006	C59	CAPACITOR—12 mmf., ceramic	RDE-079		KNOB—Plain, for Model 377
UCW-2011	C37	CAPACITOR—20 mmf., ceramic	RDE-116		KNOB—With Arrow, for Model 377
UOP-1206		SPEAKER—12-inch PM speaker same as S1200D-7	RDM-007		BUSHING—For tuning shaft
UOX-005		SPEAKER REPAIR KIT—Cone, voice coil and spider assembly, dust cap and gasket	RDS-058		SCALE—Dial scale
URD-009	R5, 19, 23	RESISTOR—22,000 ohms, 1/2 w., carbon	RDX-035		POINTER—Dial pointer assembly
URD-013	R1, 107, 109	RESISTOR—33,000 ohms, 1/2 w., carbon	RHM-010		GROMMET—Rubber grommet for mounting tube socket on preamplifier
URD-017	R9, 13, 14, 38, 39	RESISTOR—47,000 ohms, 1/2 w., carbon	RHJ-006		SPACER—For mounting tuner assembly
URD-021	R11	RESISTOR—68 ohms, 1/2 w., carbon	RHM-038	L1, 4, 9	COIL—For guillotine tuner, 2 required per coil
URD-025	R32	RESISTOR—100 ohms, 1/2 w., carbon	RHM-039		CLIP (For pilot lights)
URD-033	R12	RESISTOR—220 ohms, 1/2 w., carbon	RHX-011		GROMMET (Tuner mounting grommet)
URD-041	R2	RESISTOR—470 ohms, 1/2 w., carbon	RII-010		INSULATOR—Mounting insulator for guillotine tuner
URD-049	R40	RESISTOR—1000 ohms, 1/2 w., carbon	RJJ-004	J3	SOCKET—Preamplifier power socket
URD-053	R35	RESISTOR—1500 ohms, 1/2 w., carbon	RJP-003	P1	PLUG—Phono motor power
URD-055	R6	RESISTOR—1300 ohms, 1/2 w., carbon	RJP-004	P2	PLUG—Pick-up output plug
URD-057	R16, 17, 21	RESISTOR—2200 ohms, 1/2 w., carbon	RJP-010	P3, 4	PLUG—Preamplifier output plug
URD-069	R26, 101	RESISTOR—6800 ohms, 1/2 w., carbon	RJP-018	J2	SOCKET—Preamplifier power plug
URD-073	R7, 41	RESISTOR—10,000 ohms, 1/2 w., carbon	RJS-003	J1	SOCKET—Preamplifier output socket
URD-083	R104	RESISTOR—27,000 ohms, 1/2 w., carbon	RJS-049	J4	SOCKET—Phono input to preamplifier
URD-093	R29, 106, 108, 110	RESISTOR—68,000 ohms, 1/2 w., carbon	RJS-085		SOCKET—Tube socket for V6
URD-095	R4	RESISTOR—82,000 ohms, 1/2 w., carbon	RJS-106		SOCKET—Phono power socket
URD-097	R33, 37	RESISTOR—100,000 ohms, 1/2 w., carbon	RLA-012	L3, 5, 7	SOCKET—Octal socket for preamplifier
URD-103	R43	RESISTOR—180,000 ohms, 1/2 w., carbon	RLB-024	T1	SOCKET—Pilot light
URD-105	R15, 22	RESISTOR—220,000 ohms, 1/2 w., carbon	RLC-060	L6	COIL—FM choke coil
URD-113	R3, 24, 28, 30	RESISTOR—470,000 ohms, 1/2 w., carbon	RLF-007	L11, 8	COIL—FM oscillator choke and filament choke coil
URD-125	R34	RESISTOR—1.5 meg., 1/2 w., carbon	RLI-005	L12, 13	COIL—Filament choke
URD-129	R10, 36	RESISTOR—2.2 meg., 1/2 w., carbon	RLI-044	L10	COIL—FM power line choke coil
URD-133	R102, 103	RESISTOR—3.3 meg., 1/2 w., carbon	RLL-027	L2	LOOP—Broadcast loop
URD-141	R20	RESISTOR—6.8 meg., 1/2 w., carbon	RMM-006		SHIELD—Pilot light
URD-1104	R105	RESISTOR—200,000 ohms, 1/2 w., carbon	RMM-055		HOOD—Lamp hood
URE-037	R27	RESISTOR—330 ohms, 1 w., carbon	RMS-044		SPRING—Vane holder spring
			RMS-130		SPRING—Dial cord tension spring
			RMS-125		SPRING—Lever plate spring
			RMS-126		SPRING—Vane holder
			RMW-042		PULLEY—Dial cord idler
			RMX-108	L1, 4	TUNER VANE AND GUIDE WIRE ASSEMBLY
			RMX-109		TUNING SHAFT ASSEMBLY
			RMX-110	L9	TUNER VANE AND GUIDE WIRE ASSEMBLY
			RRC-074	R13	VOLUME CONTROL
			RRN-006	R42	RESISTOR—2.2 ohms, 1/2 w.
			RRW-010	R25, 31	RESISTOR—5000 ohms, wirewound
			RSW-047	S1	SWITCH—Bandchange switch
			RSW-048	S2	SWITCH—Radio, phono and tone control
			RTD-006	T5	TRANSFORMER—Discriminator transformer
			RTL-062	T2	TRANSFORMER—1st I-F transformer
			RTL-063	T3	TRANSFORMER—2nd I-F transformer
			KTL-064	T4	TRANSFORMER—3rd I-F transformer
			RTO-040	T6	TRANSFORMER—Output transformer
			RTP-058	T7	TRANSFORMER—Power transformer (60 cycles)
			RTP-059	T7	TRANSFORMER—Power transformer (50 cycles)
			RWL-004		CORD—Power cord
<b>SPECIALIZED REPLACEMENT PARTS</b>					
RAL-001		BRZEL—Pilot light			
RAV-047		CABINET—For Model 376			
RAV-048		CABINET—For Model 377			
RAV-049		CABINET—For Model 378			
RCC-001	C67	CAPACITOR—.007 mf., 200 v., paper			
RCC-014	C57	CAPACITOR—.003 mf., 1000 v., paper			
RCC-086	C36	CAPACITOR—.05 mf., paper			
RCE-029	C48A, B, C, D	CAPACITOR—Electrolytic			
RCE-030	C105A, B	CAPACITOR—Electrolytic for preamp			
RCT-028	C7, 11, 14	CAPACITOR—Tuning			
RCW-020	C13, 63	CAPACITOR—10 mmf., ceramic			



NOTE: APPROX. GAIN PER STAGE USING CHANALYST & WITH A FIXED BIAS OF -3 V.





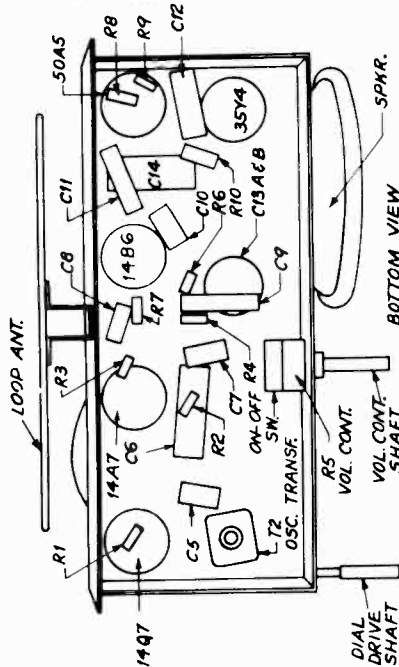
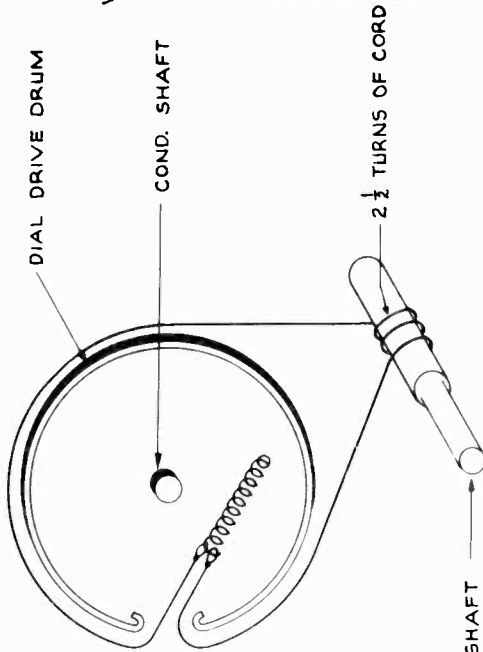




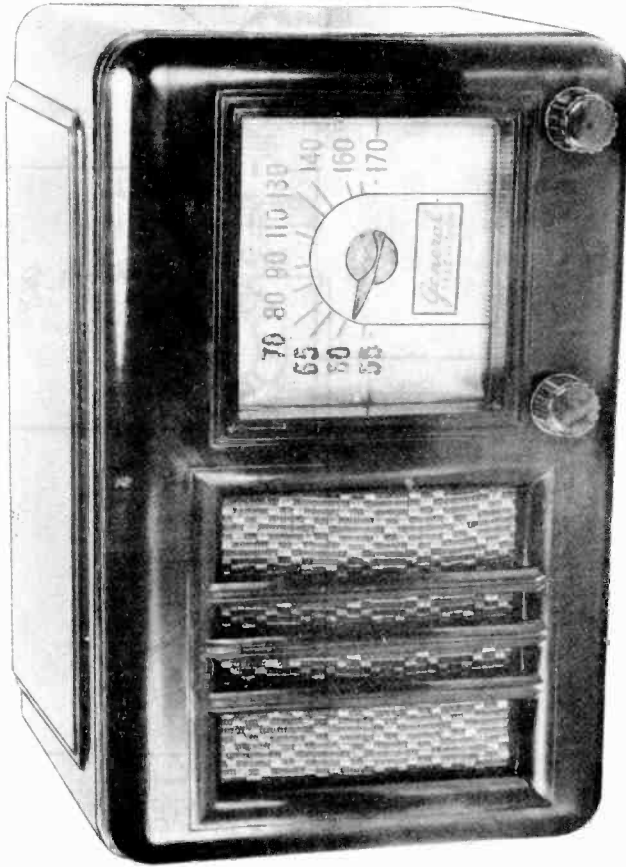
MODEL 6C5

GENERAL TELEV. AND RADIO CORP.

DIAL DRIVE ASSEMBLY



NOTE: TUNING COND. IN MAX. CAPACITY POSITION



TUBE	PIN	V.T.W.	1,000 OHM/V	RESISTANCE
14A7 converter	1	A.C.	35 ohm	over 500K
	2	80	over 500K	6.8K
	3	80	GND.	2.5 meg.
	4	GND. 4	-0.3	1.4 ohm
	5	-1	0	50 ohm
	6	0	A.C.	18 ohm
	7	0	A.C.	22
	8	A.C.	80	over 500K
14B6 DET. A.V.C. 1st audio AMPL.	1	A.C.	24	over 500K
	2	80	GND.	GND.
	3	80	GND.	GND.
	4	GND.	-0.3	2.5 meg.
	5	GND.	-0.3	GND.
	6	-1	GND.	35 ohm
	7	GND.	GND.	GND.
	8	A.C.	12	over 500K
50A5 audio output	1	GND.	12	over 500K
	2	46	-0.3	10 meg's
	3	-1	-0.3	500K
	4	-1	-0.3	500K
	5	GND.	GND.	18 ohm
	6	A.C.	A.C.	100 ohm
	7	A.C.	120	over 500K
	8	80	80	over 500K
35Y4 rectifier	1	A.C.	0	1.2 meg.
	2	A.C.	5	150 ohm
	3	-0.5	5	40 ohm
	4	A.C.	A.C.	135 ohm
	5	A.C.	A.C.	135 ohm
	6	GND. through	GND. through	GND. through
	7	On-off SW.	125	over 500K
	8	A.C.	A.C.	100 ohm

ALL VOLTAGE AND RESISTANCE MEASUREMENTS MADE WITH RESPECT TO CHASSIS GROUND. AND WITH A LINE VOLTAGE OF 116 V. A. C.

ALIGNMENT PROCEDURE.

Connect output meter across voice coil.

Connect the signal generator to the standard Haseltine Loop Model 1150 and couple it loosely to the receiver loop. Set the volume control at maximum, and fully mesh the tuning capacitor.

The output of the signal generator should be just sufficient to give a readable deflection on the output meter.

Set the signal generator to 456 kc and adjust i-f alugs for maximum output in the following order: R2, R1. Repeat sequence if trimmers were badly maladjusted.

Set the signal generator and receiver to 1600 kc and adjust the oscillator trimmer C2 for maximum output.

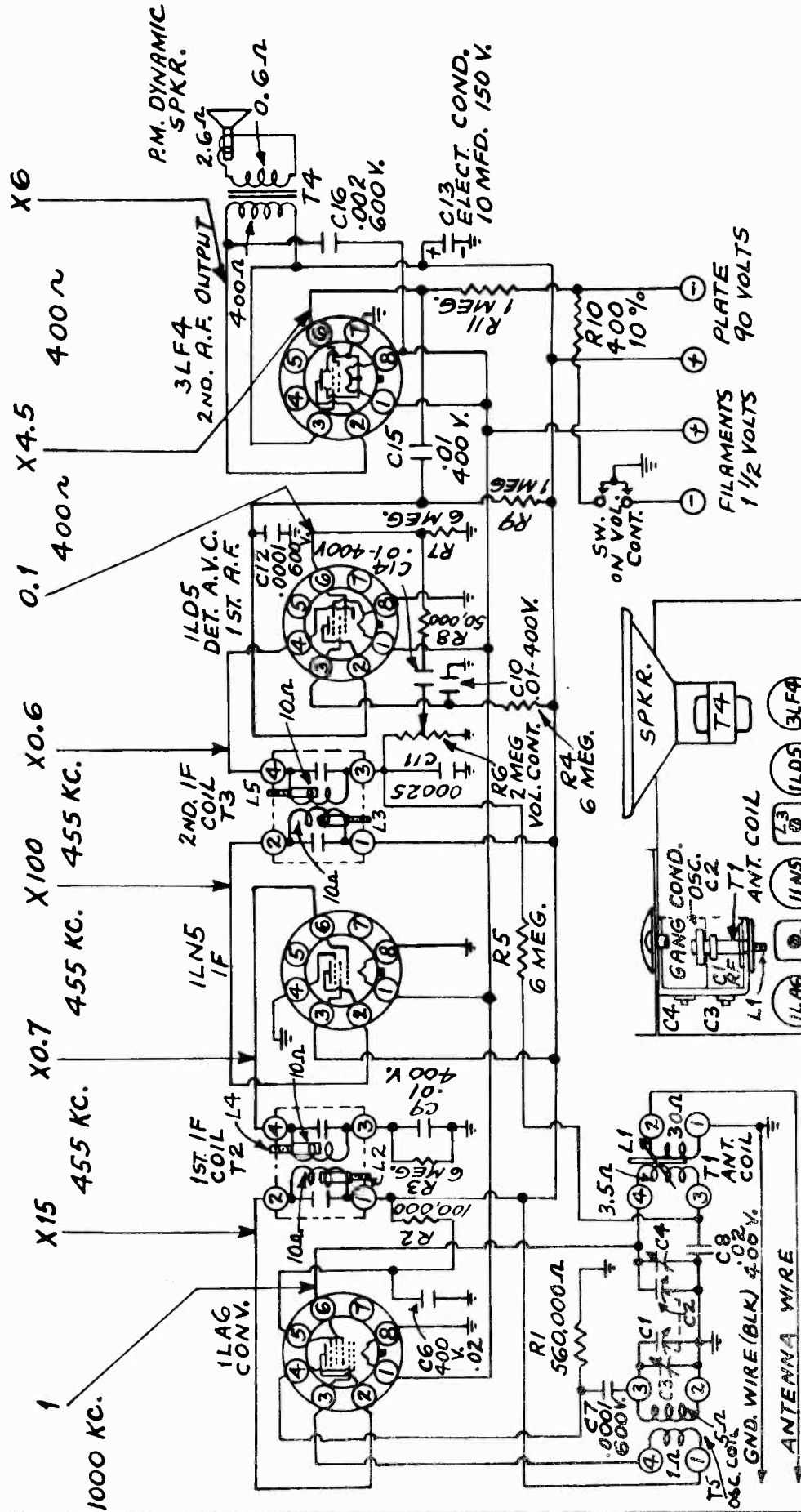
Set the signal generator and receiver to 1400 kc and adjust the antenna trimmer C4 for maximum output.

Set the signal generator and receiver to 1600 kc and readjust oscillator trimmer C2 for maximum output.

GENERAL TELEV. AND RADIO CORP.

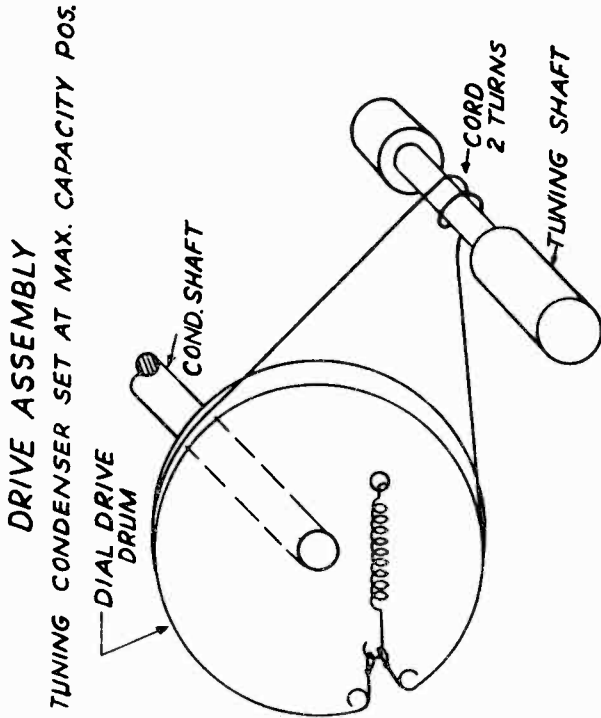
MODEL 14A4F

APPROX. GAIN PER STAGE USING CHANALYST & WITH A FIXED BIAS OF -3 VOLTS.

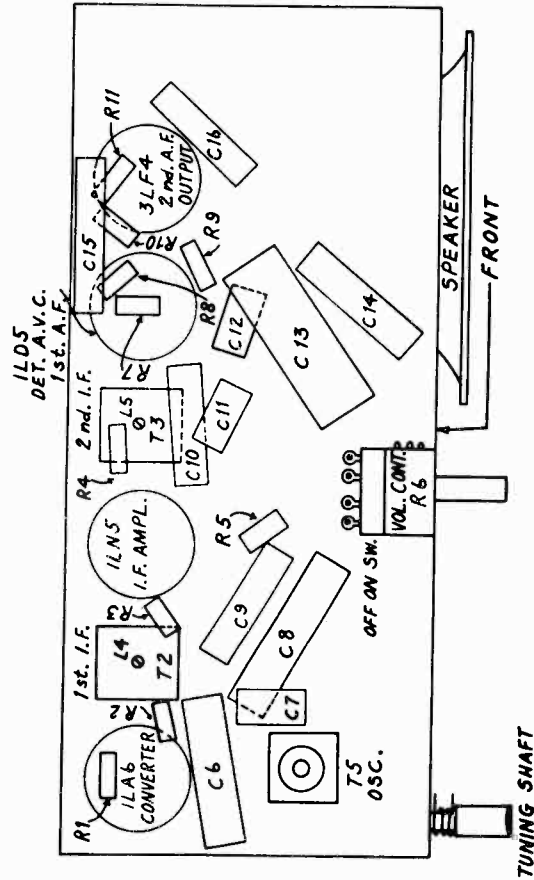


NOTE: ALL RESISTORS ARE 1/4 W. 20% UNLESS OTHERWISE SPECIFIED.

TUBE LAYOUT



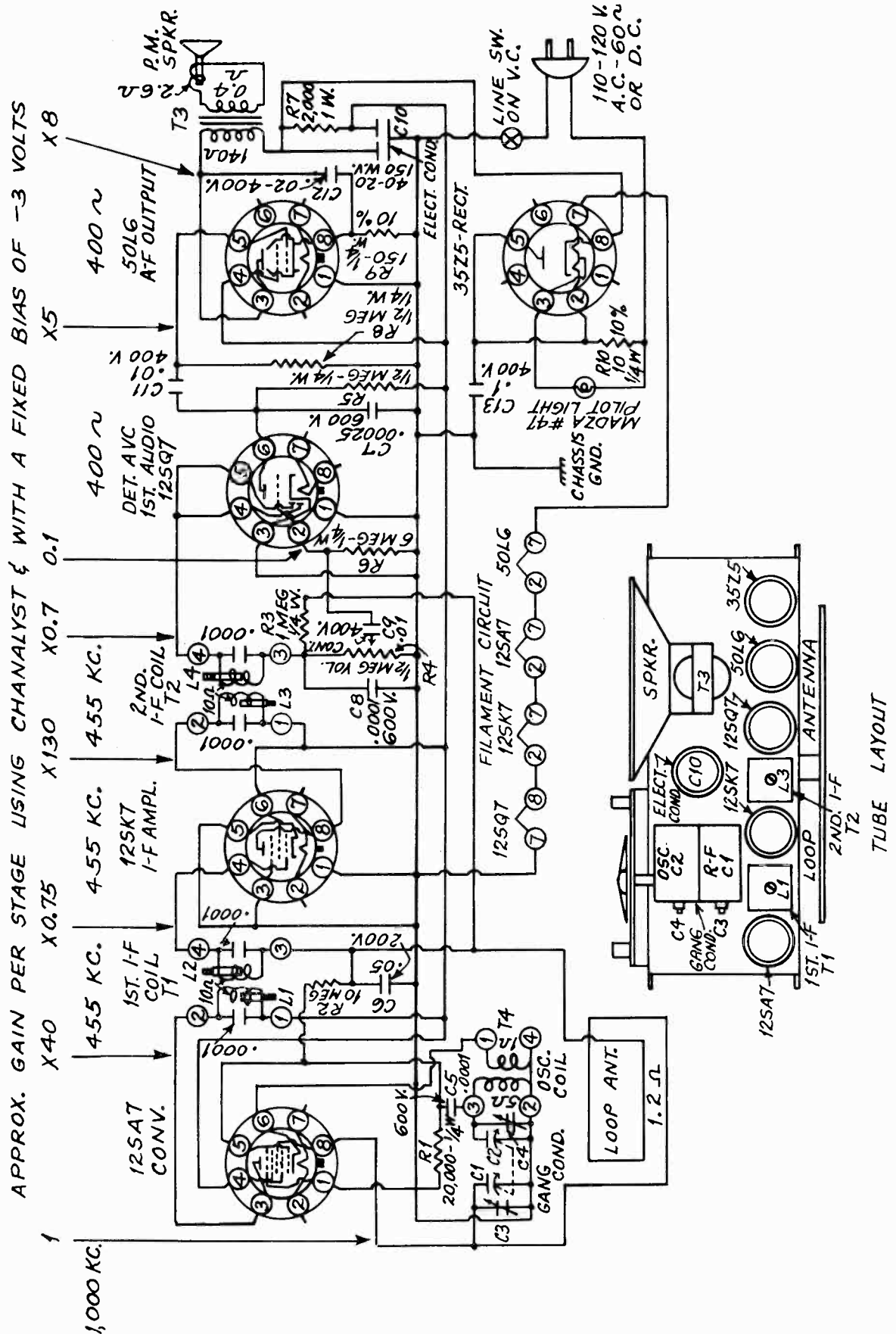
BOTTOM VIEW



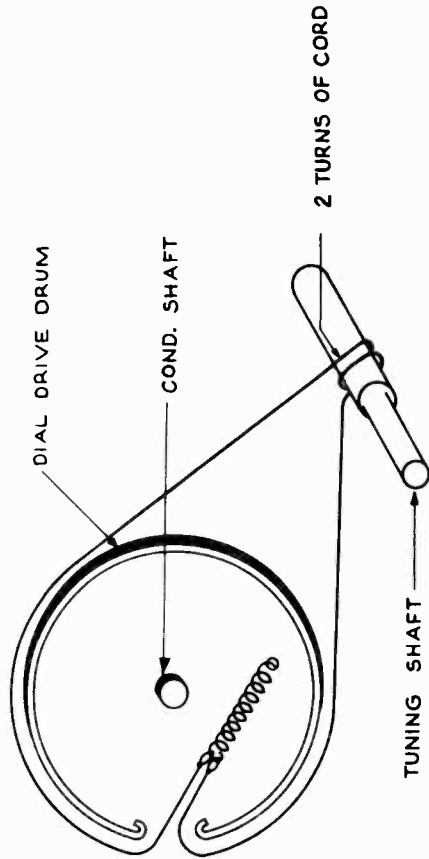
Tube	Pin	D-C Voltage VTVM	20000 ohms/ volt	1000 ohms/ volt	Resistance
1LA6	1	+1.5	+1.4	+1.4	4
	2	+90	+90	+88	Infinite
	3	+90	+90	+88	Infinite
	4	-3.4	-0.5	0	600,000
	5	+3.4	+3.3	+26	Infinite
	6	-0.3	-0.1	0	7,000,000
	7	0	0	0	Infinite
	8	0	0	0	0
1LN5	1	+1.5	+1.4	+1.4	4
	2	+90	+90	+98	Infinite
	3	+90	+90	+88	Infinite
	4	0	0	0	0
	5	0	0	0	Infinite
	6	-0.3	-0.1	0	Infinite
	7	-0.3	-0.1	0	Infinite
	8	0	0	0	7,000,000
1LD5	1	+1.5	+1.4	+1.4	4
	2	+26	+20	+20	Infinite
	3	+21	+16	+10	Infinite
	4	-0.4	-0.2	0	2,000,000
	5	0	0	0	Infinite
	6	-0.2	0	0	7,500,000
	7	-0.2	0	0	Infinite
	8	0	0	0	7,700,000
3LF4	1	+1.5	+1.4	+1.4	4
	2	+86	+86	+84	Infinite
	3	+90	+90	+83	Infinite
	4	0	0	0	0
	5	-5.4	-5	-5	450
	6	-5	-1	0	1,700,000
	7	0	0	0	0
	8	+1.5	+1.4	+1.4	4

GENERAL TELEV. AND RADIO CORP.

MODEL 17A5

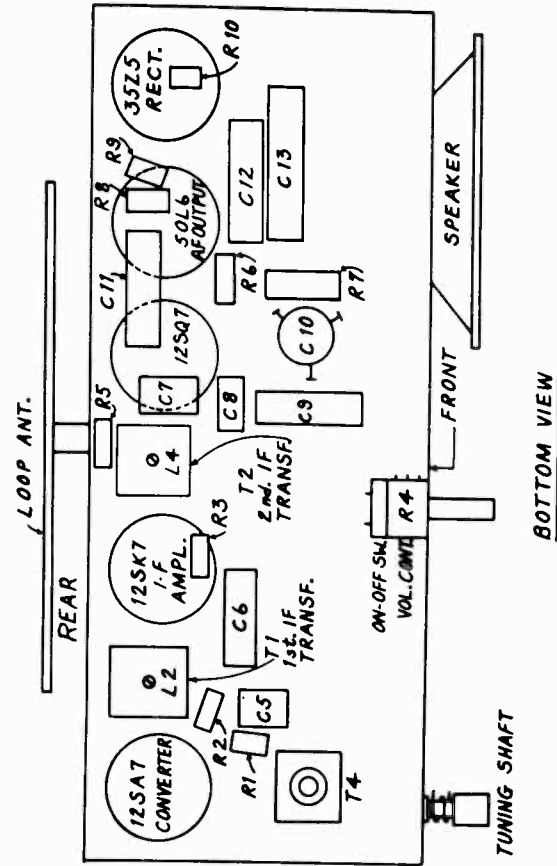


DIAL DRIVE ASSEMBLY

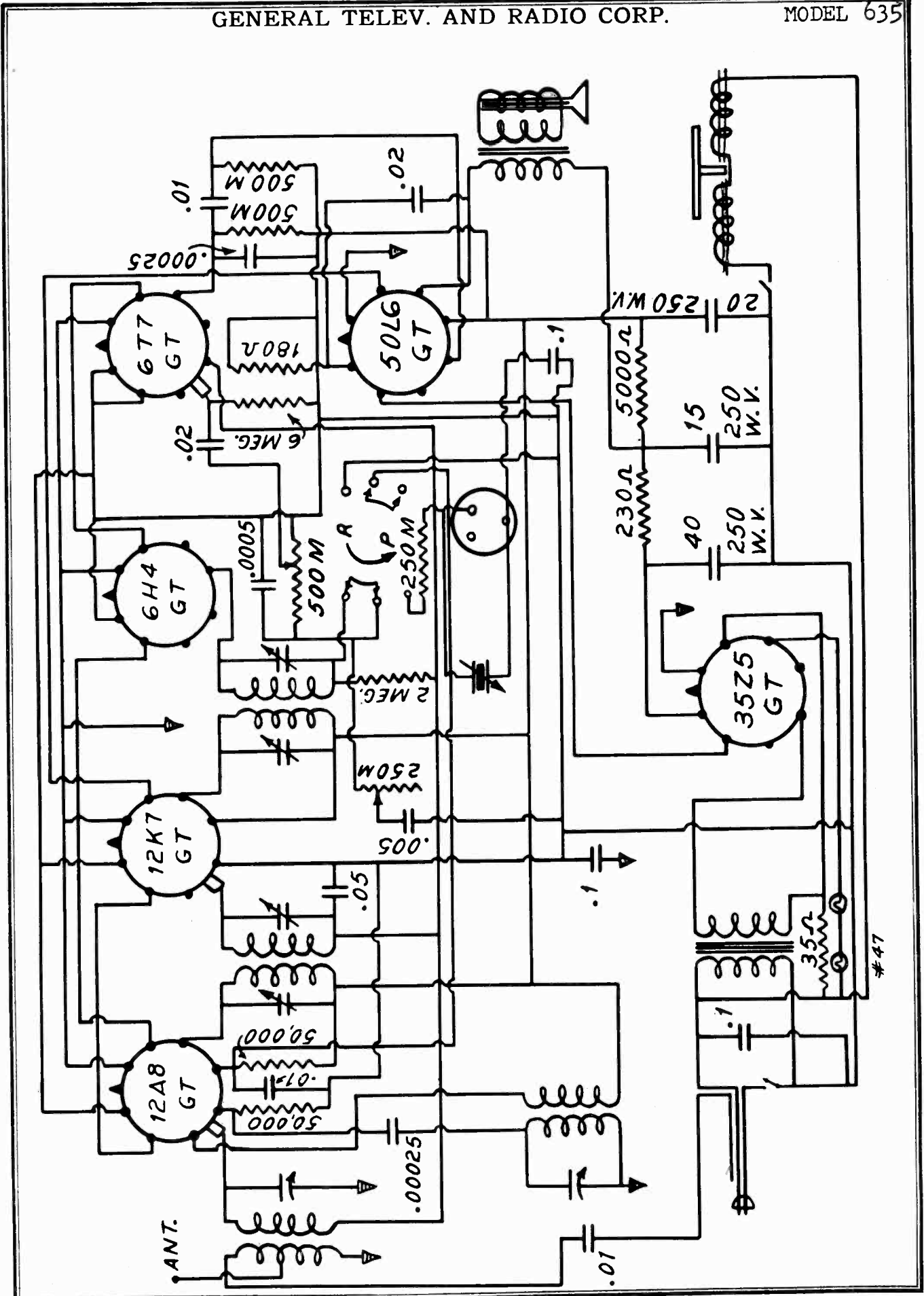


NOTE: TUNING COND. IN MAX. CAPACITY POSITION

Tube	Pin	D-C Voltage VTVM	20000 ohms/ volt	1000 ohms/ volt	Resistance
12SA7	1	0	0	0	0
	2	0	0	0	2 $\mu$
	3	+80	+80	+78	Infinite
	4	+80	+80	+78	Infinite
	5	-10	-9.5	-4.8	20,000
	6	0	0	0	1
	7	0	0	0	40
	8	-1.5	-0.8	-0.2	1,200,000
12SK7	1	0	0	0	0
	2	0	0	0	12
	3	0	0	0	0
	4	-1.5	-0.6	-0.2	1,200,000
	5	0	0	0	0
	6	+80	+80	+78	Infinite
	7	0	0	0	26
	8	+80	+50	+78	Infinite
12SQ7	1	0	0	0	0
	2	-0.5	-0.4	-0.2	6,000,000
	3	0	0	0	0
	4	-0.5	-0.4	-0.2	400,000
	5	-0.5	-0.4	-0.2	400,000
	6	+4.5	+4.2	+4.0	Infinite
	7	0	0	0	14
	8	0	0	0	0
50L6	1	0	0	0	0
	2	+120	+120	+120	Infinite
	3	+30	+80	+78	Infinite
	4	0	0	0	460,000
	5	0	0	0	Infinite
	6	0	0	0	Infinite
	7	0	0	0	90
	8	+4.5	+4.5	+4.5	150
35Z5	1	0	0	0	Infinite
	2	0	0	0	120
	3	0	0	0	120
	4	0	0	0	Infinite
	5	0	0	0	120
	6	0	0	0	120
	7	0	0	0	90
	8	+120	+120	+120	Infinite

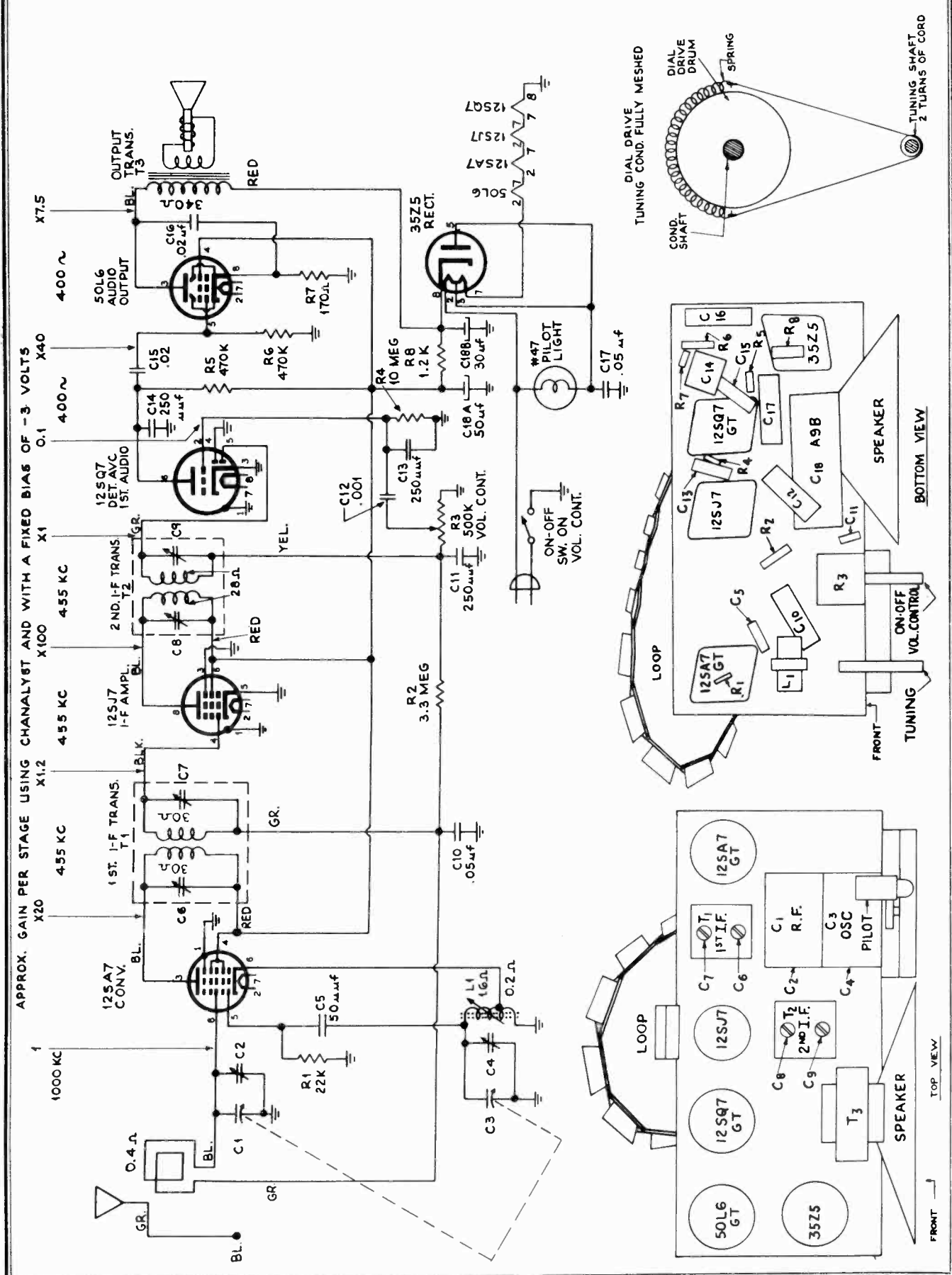


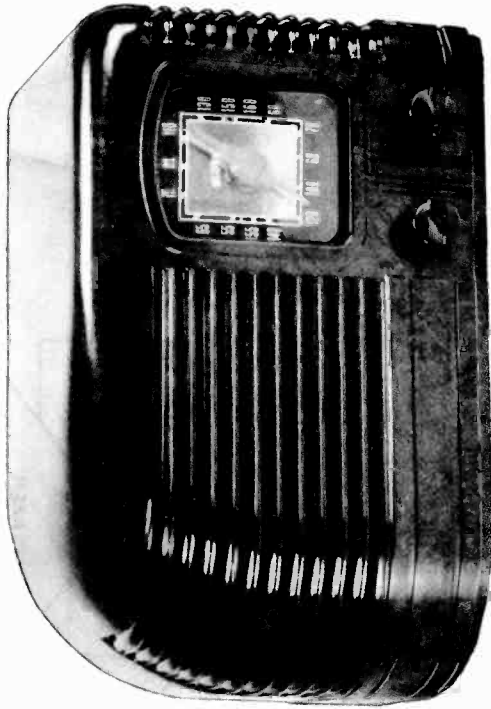
BOTTOM VIEW











TUBE	PIN	VTRM	20,000Ω/V	1,000Ω/V	RESISTANCE
12SA7 CCNV.	1	0	0	0	0
	2	AC	AC	AC	34Ω
	3	82V	82V	82V	2.0 Meg
	4	82V	82V	82V	2.0 Meg
	5	-8.6V	-4.0	-4.0	22K
	6	-9.8V	-5.4	-5.4	22K
	7	0	0	0	0.2Ω
	8	AC	AC	AC	22Ω
12SJ7 IF AMPL.	1	-1.1V	-0.24V	-0.05	5 Meg
	2	0	0	0	0
	3	AC	AC	AC	22Ω
	4	0	0	0	0
	5	-1.1V	-0.24V	-0.08	5 Meg
	6	82V	82V	82V	2.0 Meg
	7	AC	AC	AC	12Ω
	8	82V	82V	82V	2.0 Meg
12SQ7 DET. AVC 1st AUDIO	1	0	0	0	0
	2	-1.44	-0.72	-0.25	10 Meg
	3	0	0	0	0
	4	0	0	0	0
	5	-0.8V	-0.44	-0.06V	500K
	6	54V	50V	14V	2 Meg
	7	AC	AC	AC	10Ω
	8	0	0	0	0
50L6 AUDIO OUTPUT	1	--	--	--	--
	2	AC	AC	AC	75Ω
	3	92V	92V	92V	2 Meg
	4	82V	82V	82V	2 Meg
	5	0	0	0	500K
	6	--	--	--	--
	7	AC	AC	AC	30Ω
	8	0	0	0	0

ALIGNMENT PROCEDURE

Connect output meter across the voice coil.

Connect the signal generator to the standard Hazeltine loop Model 1150 and couple it loosely to the receiver loop. Set the volume control at maximum, and fully mesh the tuning capacitor.

The output of the signal generator should be just sufficient to give a readable deflection on the output meter.

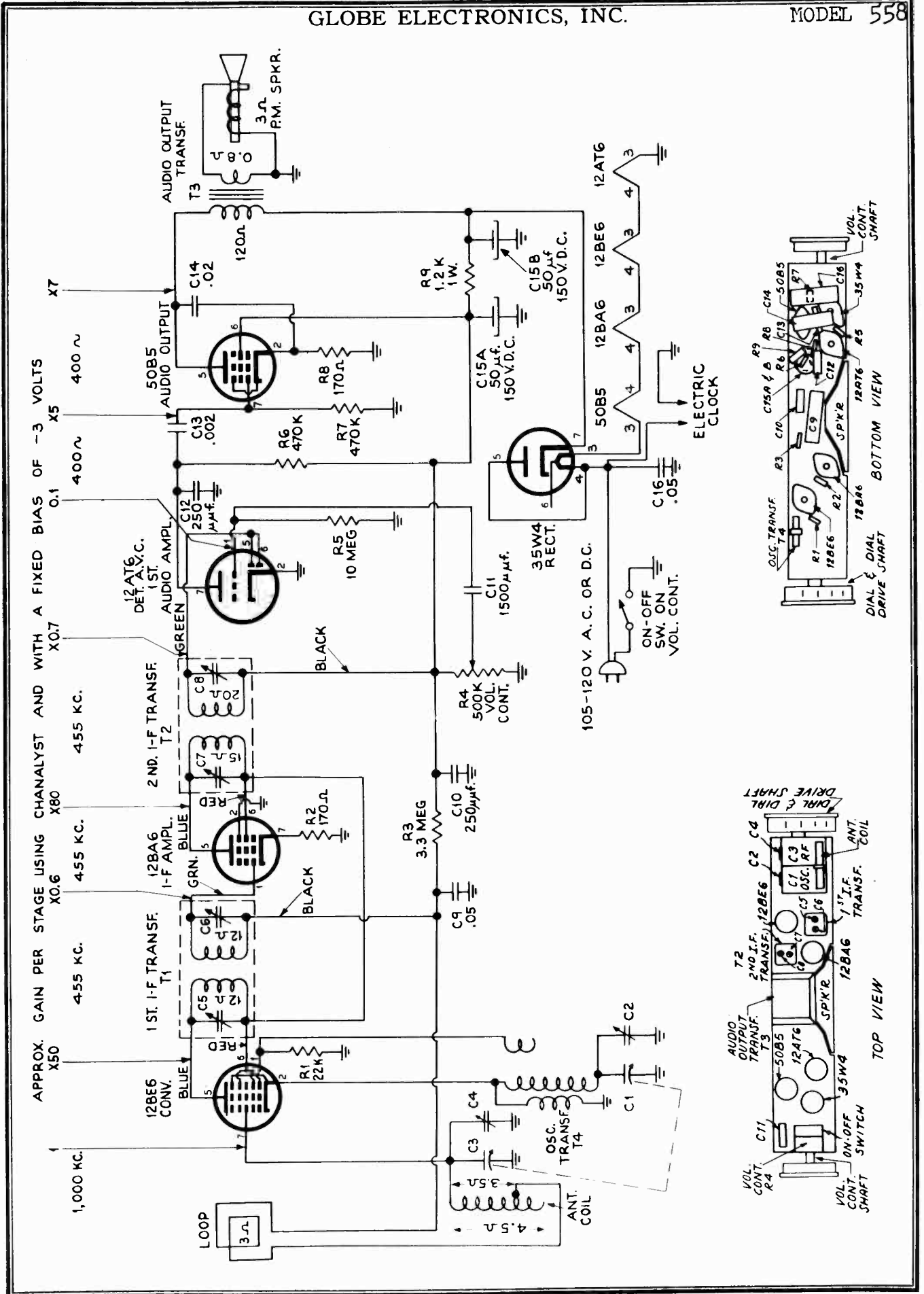
Set the signal generator to 455 kc and adjust i-f trimmers for maximum output in the following order: C9, C8, C7, C6. Repeat sequence if trimmers were badly maladjusted.

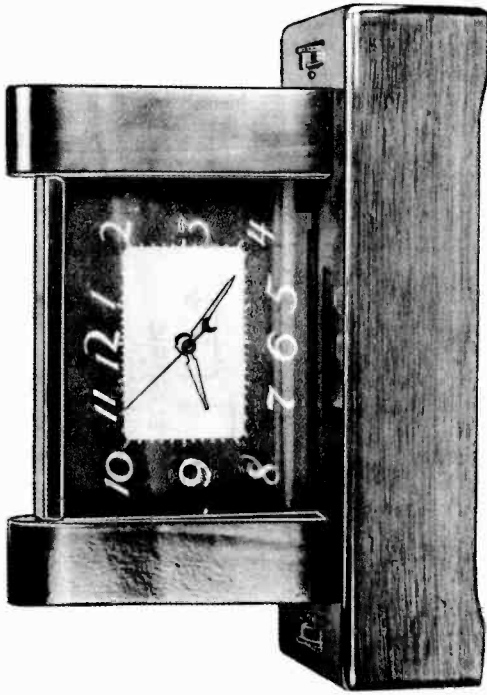
Set the signal generator and receiver to 1550 kc and adjust the oscillator trimmer C4 for maximum output.

Set the signal generator and receiver to 1400 kc and adjust the antenna trimmer C2 for maximum output.

Set the signal generator and receiver to 600 kc and adjust the oscillator padder L1 for maximum output while rocking the tuning capacitor.

Set the signal generator and receiver to 1550 kc and readjust oscillator trimmer C4 for maximum output.





ALIGNMENT PROCEDURE

Connect output meter across voice coil.

Connect the signal generation to the standard Haseltine Loop Model 1150 and couple it loosely to the receiver loop. Set the volume control at maximum, and fully mesh the tuning capacitor.

The output of the signal generator should be just sufficient to give a readable deflection on the output meter.

Set the signal generator to 455 kc and adjust i-f trimmers for maximum output in the following order: C3, C7, C8, C5. Repeat sequence if trimmers were badly maladjusted.

Set the signal generator and receiver to 1600 kc and adjust the oscillator trimmer C2 for maximum output.

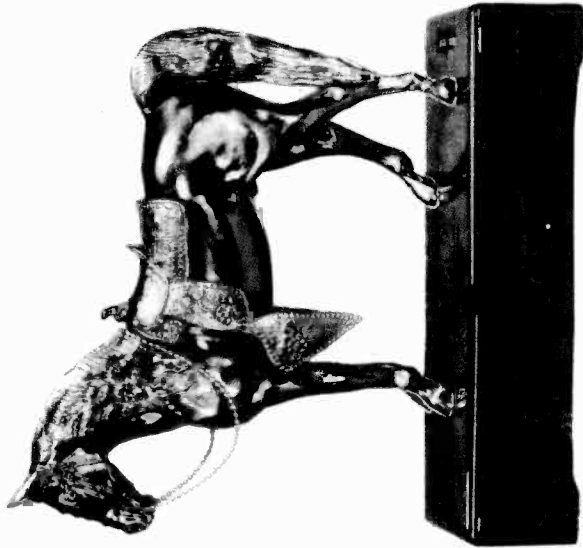
Set the signal generator and receiver to 1400 kc and adjust the antenna trimmer C4 for maximum output.

Set the signal generator and receiver to 1600 kc and readjust oscillator trimmer C2 for maximum output.

TUBE	PIN	VTVM	1,000 OHM/V	RESISTANCE
12BE6 conv.	1	-8	-4	22K
	2	0	0	0.6 ohm
	3	A.C.	A.C.	15 ohm
	4	A.C.	A.C.	30 ohm
	5	95	95	over 500K
	6	95	95	over 500K
	7	-0.8	0	2.5 megs
12BA6 1.-F. AMPL.	1	-0.8	0	2 megs
	2	GND.	GND.	GND.
	3	A.C.	A.C.	30 ohm
	4	A.C.	A.C.	40 ohm
	5	95	95	over 500K
	6	9	95	over 500K
	7	1.6	1.6	170 ohm
12AU6 DET. A.V.C. 1st audio AMPL.	1	-1.3	-0.5	10 meg's
	2	GND.	GND.	GND.
	3	GND.	GND.	GND.
	4	A.C.	A.C.	15 ohm
	5	-0.9	-0.3	600K
	6	-0.9	-0.3	600K
	7	45	18	over 500K
50B5 audio output	1	6.5	6.5	470K
	2	A.C.	A.C.	170 ohm
	3	A.C.	A.C.	100 ohm
	4	A.C.	A.C.	40 ohm
	5	125	125	over 500K
	6	95	95	over 500K
	7	0	0	470K
35W4 rect.	1	6.5 tie point	6.5 tie point	170 ohm
	2	—	—	—
	3	A.C.	A.C.	100 ohm
	4	A.C.	A.C.	135 ohm
	5	A.C.	A.C.	135 ohm
	6	A.C.	A.C.	130 ohm
	7	130	130	over 500K

ALL VOLTAGE AND RESISTANCE MEASUREMENTS MADE WITH RESPECT TO CHASSIS GROUND. AND WITH A LINE VOLTAGE OF 116 V.A.C.





TUBE	PLN	VTRM	1,000 OHM/V	RESISTANCE
12BE6 conv.	1	-8	-4	22K
	2	0	0	0.6 ohm
	3	A.C.	A.C.	15 ohm
	4	A.C.	A.C.	30 ohm
	5	95	95	over 500K
	6	95	95	over 500K
	7	-0.6	0	2.5 meg's
12BA6 1-F AMPL.	1	-0.6	0	2 meg's
	2	GND.	GND.	GND.
	3	A.C.	A.C.	30 ohm
	4	A.C.	A.C.	40 ohm
	5	95	95	over 500K
	6	95	95	over 500K
	7	1.6	1.6	170 ohm
12AT6 DET. A.V.C. 1st audio AMPL.	1	-1	-0.3	10 meg's
	2	GND.	GND.	GND.
	3	GND.	GND.	GND.
	4	A.C.	A.C.	15 ohm
	5	-0.7	-0.2	600K
	6	-0.7	-0.2	600K
	7	45	18	over 500K
50B5 audio output	1	6.5	6.5	470K
	2	A.C.	A.C.	170 ohm
	3	A.C.	A.C.	100 ohm
	4	A.C.	A.C.	40 ohm
	5	125	125	over 500K
	6	95	95	over 500K
	7	0	0	470K
35W4 rect.	1	6.5 tie point	6.5 tie point	170 ohm
	2	A.C.	A.C.	100 ohm
	3	A.C.	A.C.	135 ohm
	4	A.C.	A.C.	135 ohm
	5	A.C.	A.C.	130 ohm
	6	A.C. -	A.C. -	130 ohm
	7	130	130	over 500K

ALIGNMENT PROCEDURE

Connect output meter across voice coil.

Connect the signal generator to the standard Hazeltine Loop model 1150 and couple it loosely to the receiver loop. Set the volume control at maximum, and fully mesh the tuning capacitor.

The output of the signal generator should be just sufficient to give a readable deflection on the output meter.

Set the signal generator to 450 kc and adjust i-f trimmers for maximum output in the following order: C10, C9, C8, C7. Repeat sequence if trimmers were badly miscalibrated.

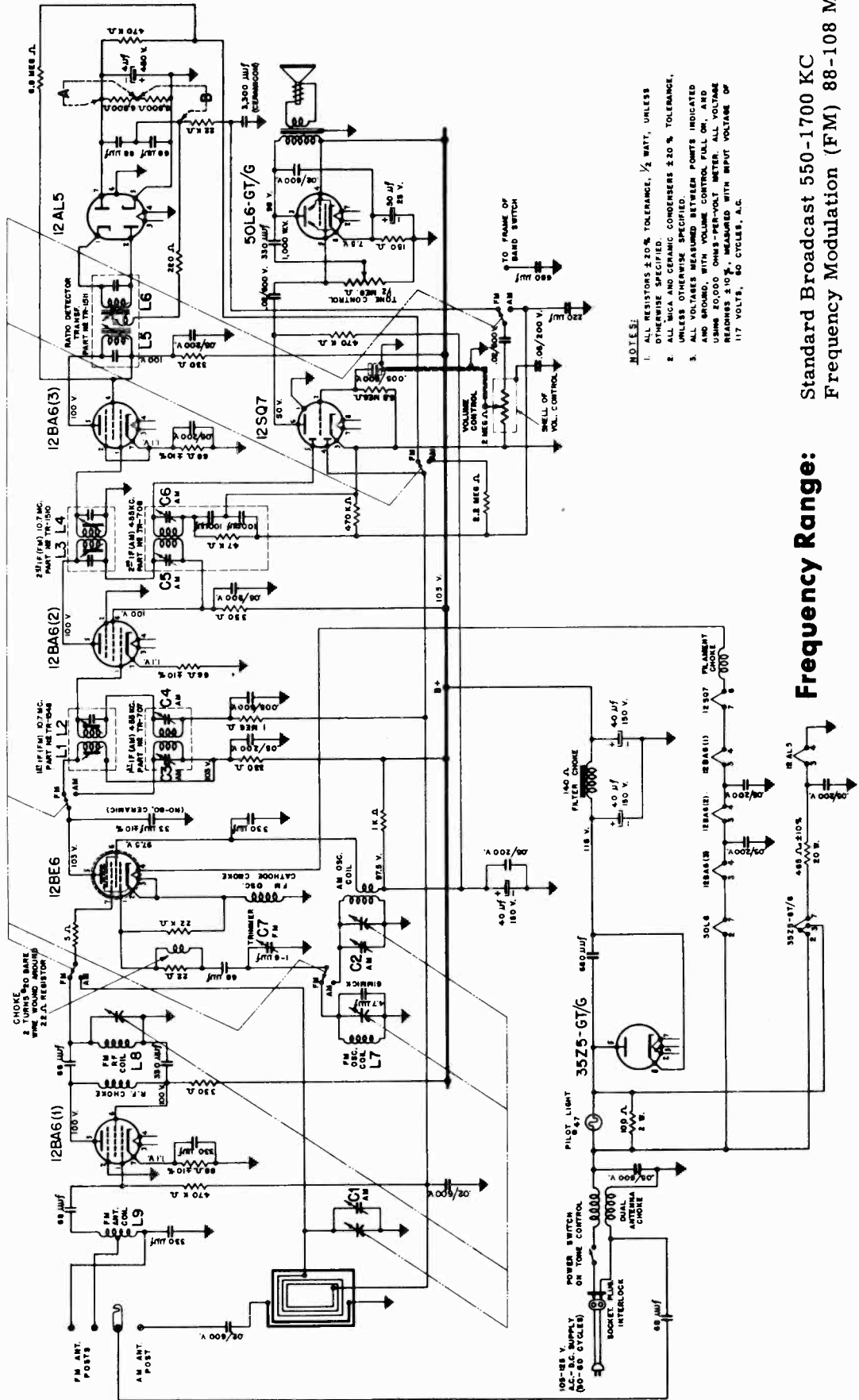
Set the signal generator and receiver to 1600 kc and adjust the oscillator trimmer C2 for maximum output.

Set the signal generator and receiver to 1400 kc and adjust the antenna trimmer C4 for maximum output.

Set the signal generator and receiver to 1600 kc and readjust oscillator trimmer C2 for maximum output.

ALL VOLTAGE AND RESISTANCE MEASUREMENTS MADE WITH RESPECT TO CHASSIS GROUND, AND WITH A LINE VOLTAGE OF 116 V.A.C.

CIRCUIT DIAGRAM



- NOTES:
1. ALL RESISTORS ± 20% TOLERANCE, 1/2 WATT, UNLESS OTHERWISE SPECIFIED.
  2. ALL MIC AND CERAMIC CONDENSERS ± 20% TOLERANCE, UNLESS OTHERWISE SPECIFIED.
  3. ALL VOLTAGES MEASURED BETWEEN POINTS INDICATED UNLESS OTHERWISE SPECIFIED. ALL VOLTAGE MEASUREMENTS MADE WITH 20,000 OHM-RES-VOLT METER. ALL VOLTAGE READINGS ± 10%, MEASURED WITH INPUT VOLTAGE OF 117 VOLTS, 60 CYCLES, A.C.

**Frequency Range:** Standard Broadcast 550-1700 KC  
Frequency Modulation (FM) 88-108 MC

**Power Requirement:** 105-125 volts ac 50-60 cycles  
or 105-125 volts dc

**Power Consumption:** 50 watts



**REPLACEMENT PARTS LIST**

**Condensers**

- CCA332M 3300 mmfd ±20% ceramicon
- CCAL300K 30 mmfd ±10% ceramicon
- CO-111 40+40/150 W.V. and 50/25 W.V. electrolytic
- CO-1056 4 mmfd/450 W.V. electrolytic
- CO-1083 4.7 mfd ±20% condenser
- CO-1248 40 mfd/150 W.V. electrolytic
- CT-1036-1 1-8 mmfd trimmer
- CV-1461 2 gang A.M.-F.M. variable condenser
- RCM20A221M 220 mmfd ±20% mica
- RCM20A331M 330 mmfd ±20% mica
- RCM20A680M 68 mmfd ±20% mica
- RCM30A681M 330 mmfd ±20% mica
- RCM40A331M 330 mmfd ±20% mica
- RCP10W2503A .05/200 W.V. paper tubular
- RCP10W6203A .02/600 W.V. paper tubular
- RCP10W6502A .005/600 W.V. paper tubular
- RCP10W6503A .05/600 W.V. paper tubular

**Resistors**

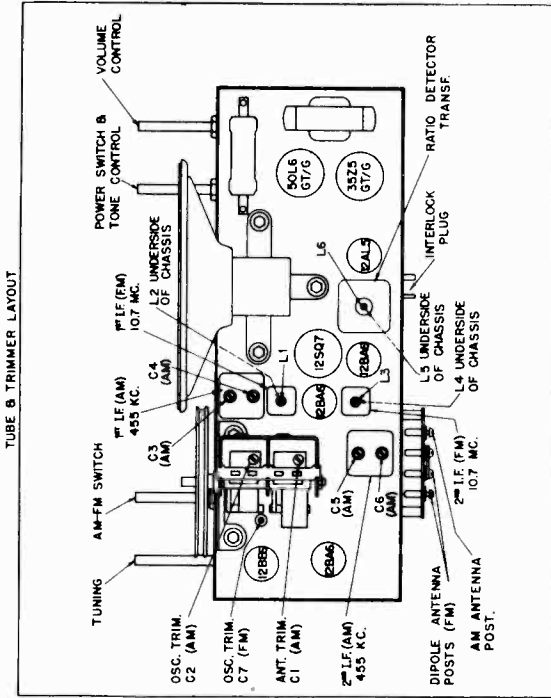
- RE-1464 465 ohms ±10% 20 watt
- REB100M 10 ohms ±20% 1/2 watt
- REB102M two used in parallel
- REB105M 1000 ohms ±20% 1/2 watt
- REB105M 1 megohm ±20% 1/2 watt
- REB151K 150 ohms ±10% 1/2 watt
- REB220M 22 ohms ±20% 1/2 watt
- REB221M wire over resistor
- REB223M 220 ohms ±20% 1/2 watt
- REB225M 22,000 ohms ±20% 1/2 watt
- REB331M 2.2 megohm ±20% 1/2 watt
- REB474M 330 ohms ±20% 1/2 watt
- REB680K 470,000 ohms ±20% 1/2 watt
- REB682M 68 ohms ±10% 1/2 watt
- REB685M 6800 ohms ±20% 1/2 watt
- RED101M 100 ohms ±20% 2 watt

**Transformers and Coils**

- CK-114 85 mils-140 ohm choke
- CK-1058 filament choke
- CK-1109 dual antenna choke
- CK-1127 r-f choke
- CL-1452 f-m oscillator cathode choke
- CL-1457 f-m antenna coil
- CL-1458 f-m oscillator coil
- CL-1459 f-m r-f coil
- CL-1466 a-m oscillator coil
- TR-707 455 kc input I.F. transformer
- TR-708 455 kc output I.F. transformer
- TR-904 output transformer
- TR-1510 10.7 mc f-m output I.F. transformer
- TR-1511 ratio detector transformer
- TR-1548 10.7 mc f-m input I.F. transformer

**Miscellaneous**

- BU-187 #47 pilot light bulb
- CA-154-1W walnut bakelite cabinet
- CA-154-1V ivory bakelite cabinet
- DL-1444 dial scale
- KN-671 walnut knob marked "Volume"
- KN-672 walnut knob marked "Off-On-Tone"
- KN-673 walnut knob marked "Tuning"
- KN-1117 walnut knob marked "AM-FM"
- KN-675 ivory knob marked "Volume"
- KN-676 ivory knob marked "Off-On-Tone"
- KN-677 ivory knob marked "Tuning"
- KN-1118 ivory knob marked "AM-FM" loop
- LP-1463 dial pointer
- PO-334 2 megohm volume control
- PT-105 1/2 megohm tone control
- PT-106 miniature tube shield
- SK-855 6" PM speaker
- SK-792 insulated pilot light socket assembly
- SO-313 pointer drive spring
- SP-218 masonite back
- ST-1450 light diffuser
- ST-1465 band switch
- SW-1435 C washer for drive shaft
- WA-302



**SERVICE AND ALIGNMENT INSTRUCTIONS**

**CAUTION:** The chassis of this receiver is directly connected to one side of the line. When servicing this receiver do not place chassis on a grounded metallic bench.

**ALIGNMENT:**

Equipment Required: Vacuum tube voltmeter; modulated A-M and F-M signal generator; output meter radiation loop; one .1/400 WV condenser; one 300 ohm resistor; one insulated screw driver. To insure proper alignment on A-M, the use of a radiation loop is recommended. To radiate a signal connect a loop of about 6" to 8" diameter one 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".

**FOR COMPLETE ALIGNMENT INSTRUCTIONS ON AM AND FM BANDS SEE 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.

**CAUTION:** The diffuser plate is assembled to the chassis with two P.K. screws. The one at the left is fastened down tight. The one at the right should be backed off about two turns from the tight position in order to permit free expansion of the plate and thereby avoid warpage which may interfere with proper movement of the pointer.

Before aligning close the variable condenser fully counter-clockwise (plates fully closed) and check that pointer coincides with the reference dot (extreme left dot) on diffuser plate.

**ALIGNMENT PROCEDURE CHART**

STEP	SET BAND SWITCH ON SIGNAL GENERATOR TO-	CONNECT HIGH SIDE OF SIGNAL GENERATOR TO-	SET SIGNAL GENERATOR TO-	TURN POINTER TO-	READ OUTPUT ON -	ADJUST THE FOLLOWING -KEEP SIGNAL FROM SIGNAL GENERATOR AS LOW AS POSSIBLE
BEFORE ALIGNING CLOSE VARIABLE CONDENSER FULLY COUNTERCLOCKWISE (PLATES FULLY CLOSED) AND ADJUST POINTER TO COINCIDE WITH THE REFERENCE DOT (EXTREME LEFT DOT) ON CALIBRATION STRIP.						
1	FM	PIN NO. 1 OF 12BA6 (3) TUBE FOR 1 VOLT SIGNAL	10.7 MC UNMODULATED SIGNAL	EXTREME RIGHT HAND POSITION (CONDENSER FULLY OPEN).	VACUUM TUBE VOLTMETER (SHOWN AS "A" ON CIRCUIT DIAGRAM.)	(RATIO DETECTOR PRIMARY) L6, FOR MAXIMUM READING (SLUG ON UNDER-SIDE OF CHASSIS).
2	FM				VACUUM TUBE VOLTMETER ACROSS "B" ON CIRCUIT DIAGRAM.	L6 (RATIO DETECTOR SECONDARY) (SLUG ON TOP OF CHASSIS).
3	FM	PIN NO. 7 OF 12BE6 TUBE IN SERIES WITH A.1/400 VOLT COND.			VACUUM TUBE VOLTMETER ACROSS 6800 OHM RESISTOR AS SHOWN AS "A" ON CIRCUIT DIAGRAM.	L4 (UNDER-SIDE OF CHASSIS) L3 (TOP OF CHASSIS) AND I.F. TRANSFORMER FOR MAXIMUM READING.
4	FM					L5 (UNDER-SIDE OF CHASSIS) L1 (TOP OF CHASSIS) L2 (TOP OF CHASSIS) I.F. TRANSFORMER FOR MAXIMUM READING.
5	AM	R.F. SECTION OF VARIABLE CONDENSER OR PIN NO. 7 OF 12BE6 TUBE IN SERIES WITH A.1/400 VOLT COND.	455 KC		OUTPUT METER ACROSS SPEAKER-VOICE-COIL	C5 AND C6 (2ND I.F. TRANSFORMER) FOR MAXIMUM READING.
6	AM					C3 AND C4 (1ST I.F. TRANSFORMER) FOR MAXIMUM READING.
7	FM			<b>REPEAT STEPS 3 AND 4</b>		
8	FM	CONNECT FM SIGNAL GENERATOR TO DIPOLE TERMINAL POST USING A 300 OHM RESISTOR IN SERIES WITH THE HIGH SIDE LEAD. USE A 30% MODULATED FM SIGNAL	88 MC	88 MC ON CALIBRATION STRIP	OUTPUT METER ACROSS SPEAKER-VOICE-COIL	OSCILLATOR COIL #17 UNDER-SIDE OF CHASSIS ADJUST BY COMPRESSING OR EXPANDING COIL SLIGHTLY FOR MAXIMUM OUTPUT INCLUDING WITH 88 MC ON CALIBRATION STRIP.
9	FM		108 MC	108 MC ON CALIBRATION STRIP		C7 (OSCILLATOR TRIMMER) FOR MAXIMUM OUTPUT
10	FM		<b>REPEAT STEPS 8 AND 9 UNTIL OSCILLATOR RANGE IS 88 MC ON CALIBRATION STRIP</b>			
11	FM		98 MC	RESONANCE APPROXIMATELY 98 MC ON CALIBRATION STRIP	OUTPUT METER ACROSS SPEAKER-VOICE-COIL	#18 AND #19 UNDER-SIDE OF CHASSIS ADJUST BY COMPRESSING OR EXPANDING COIL SLIGHTLY FOR MAXIMUM OUTPUT
12	AM	USE RADIATED SIGNAL CONNECT BOTH SIDES OF SIGNAL GENERATOR TO RADIATION LOOP	1700 KC	EXTREME RIGHT HAND POSITION, CONDENSER FULLY OPEN		C2 (OSCILLATOR TRIMMER) FOR MAXIMUM OUTPUT
13	AM		1500 KC	RESONANCE APPROXIMATELY 1500 KC ON CALIBRATION STRIP		C1 (R.F. TRIMMER) FOR MAXIMUM OUTPUT
14	AM		600 KC	RESONANCE APPROXIMATELY 600 KC ON CALIBRATION STRIP		CHECK THAT 600 KC RESONANCE CORRESPONDS WITH 600 KC POINT ON CALIBRATION STRIP

\* THESE ADJUSTMENTS ARE PERMANENTLY SET AT THE FACTORY AND NORMALLY DO NOT REQUIRE RE-ADJUSTMENT UNLESS THEY ARE DISPLACED OR REPLACED IN SERVICING

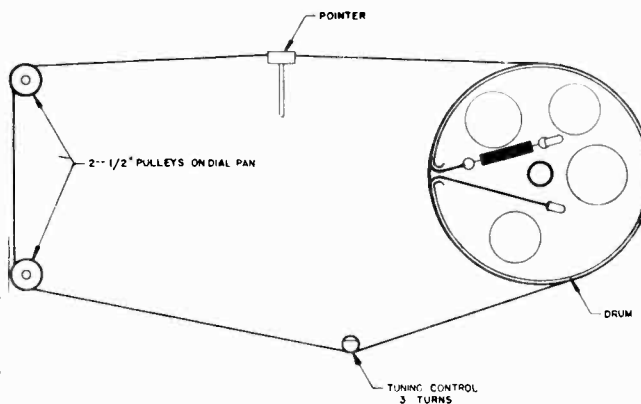
MODELS 93-104,  
93-105, 93-106

THE B. F. GOODRICH COMPANY

**ELECTRICAL AND MECHANICAL DATA**

Frequency Range ..... (AM) 535 KC to 1620 KC  
 Intermediate ..... (FM) 87.25 MC to 108.75 MC  
 Frequency ..... (AM) 455 KC (FM) 10.7 MC  
 Power Supply ..... 117 volts AC, 60 cycles

Speaker ..... 10-inch PM  
 V.C. Impedance ..... 3.2 ohms at 400 cycles  
 Power Output (Undistorted) ..... 3.5 watts  
 Power Output (Maximum) ..... 5 watts



**TUBE COMPLEMENT**

1	6BA6	RF Amplifier	1	6AT6	AM Detector—AVC—1st Audio (AM-FM)
1	6BE6	Oscillator-Converter	1	6H6	FM Detector
1	6BA6	1st IF Amplifier	1	6V6GT	Power Output
1	6BA6	2nd IF Amplifier	1	5Y3GT	Rectifier

**DIAL STRINGING**

**SOCKET VOLTAGES**

TUBE	POSITION	1	2	3	4	5	6	7	8
6BA6	RF Amplifier	—2	0	0	6.3 AC	130	90	.75	.....
6BE6	Oscillator-Converter	—2.5	0	6.3 AC	0	140	95	0	.....
6BA6	1st IF. Amplifier	—5	0	6.3 AC	0	120	90	.75	.....
6BA6	2nd IF. Amplifier	0	0	0	6.3 AC	90	90	.75	.....
6AT6	AM Detector—AVC— 1st Audio (AM-FM)	—3	0	0	6.3 AC	—3	0	55	.....
6H6	FM Detector	0	0	8	8	8	8	6.3 AC	8
6V6GT	Power Output	0	0	210	175	0	8	6.3 AC	0
5Y3GT	Rectifier	0	5V AC To Pin 8	NC	235	NC	235 AC	NC	225

NOTE: All DC voltages measured with RCA Voltomyst from B— to socket contact indicated. All voltages are positive DC unless otherwise marked.  
 Volume control full on. Zero signal input.

Tone control in clockwise position.  
 Band switch in "AM" position.  
 Line voltage 117 volts, 60 cycle AC.

**Reference Notes to Alignment Chart**

Note 1—Either spread or compress the R.F. section gang plates for maximum output.

Note 2.—The FM section of this receiver operates with delayed A.V.C. This delay must be removed for the alignment procedure, this is accomplished by shorting pin No. 6 on the 6V6. The A.V.C. point is on terminal board at end of

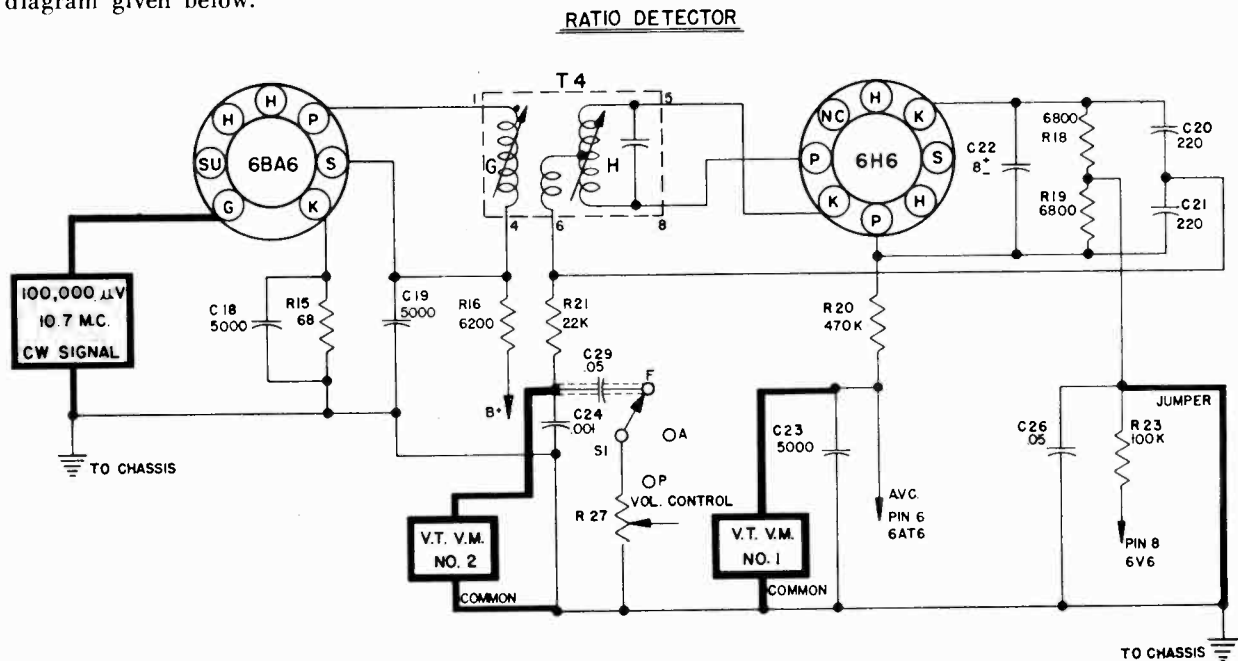
2.2 meg. resistor coming from pin 1 of 6BA6 1st I.F. amplifier. Audio point is on high end of volume control.

Note 3—The F.M. R.F. and osc. coils are air coils constructed of stiff wire. To adjust these coils for band coverage and tracking, move turns of coil together or apart as required.

**RATIO DETECTOR**

Proper operation of the ratio detector stage is extremely important for best performance on the FM band of this receiver.

The performance of the ratio detector stage may be checked by closely following the procedure and diagram given below.



1. After setting up the S.G. and V.T.V.M., turn the trimmer adjustment screws G & H counter clockwise until the slugs are in the extreme outward position. Trimmer adjustment screw G is located at the underside of the chassis. Trimmer adjustment screw H is located on top of the chassis. For exact locations of these adjustment screws see trimmer location diagram.

2. Now turn adjustment "G" clockwise until VTVM in No. 1 position indicates maximum voltage. This maximum value should be from 1 to 2 volts with input as indicated in above diagram. Then slowly turn adjustment "H" in a clockwise direction, observing VTVM in No. 2 position. It will approach a maximum value and then rapidly drop to zero. If adjustment "H" is turned beyond this point, VTVM in No. 2 position will indicate a polarity change. The proper adjustment of "H" is at the point where the VTVM indicates zero volts between the polarity change.

3. Shift the 10.7 mc. signal to 10.725 mc. (10.7 mc. + 25 kc.). VTVM in No. 2 position should now indicate a minus .25 volts minimum.

4. Change the 10.725 mc. signal to 10.675 mc. (10.7 mc. — 25 kc.). VTVM in No. 2 position should indicate a plus .25 volts minimum. STEPS 3 and 4 constitute a sensitivity check on the ratio detector transformer.

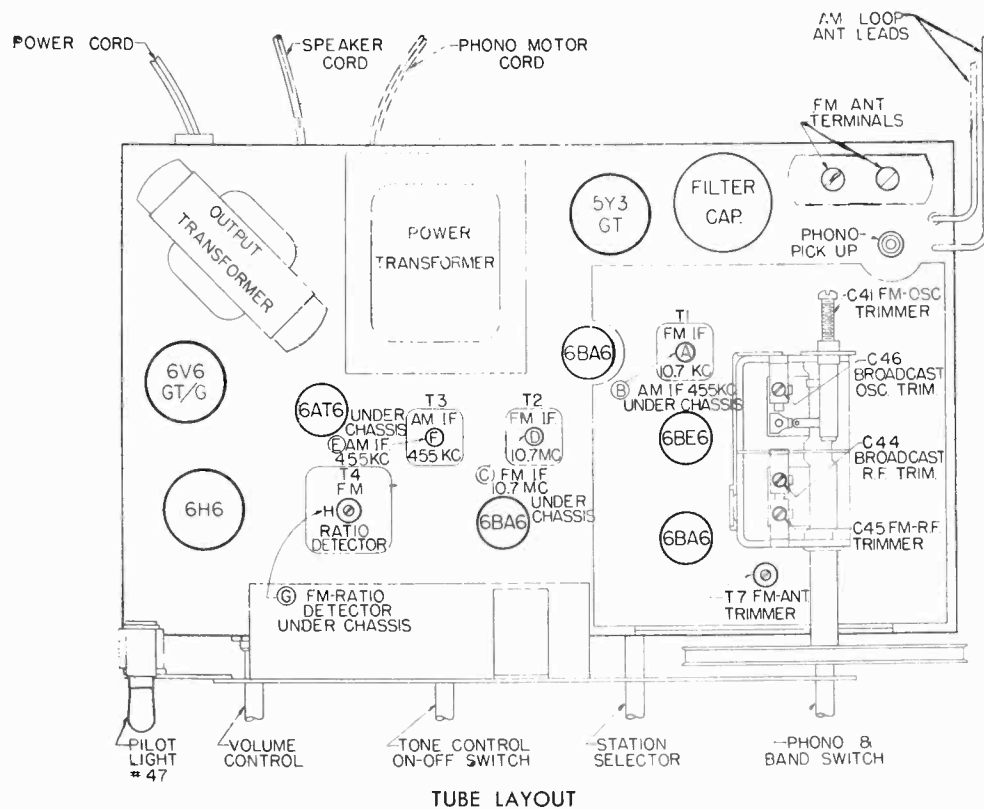
5. Place the polarity switch of VTVM in No. 2 position to "minus" position and observe VTVM as the frequency of the signal generator is increased above 10.7 mc. It should indicate an increasing positive voltage. Continue increasing the frequency until the meter indicates a peak and begins to decrease. Reduce the generator frequency slightly until the peak is obtained. Record the generator frequency.

6. Set the polarity switch of VTVM to "plus" position. Repeat STEP 5, reducing the generator frequency from 10.7 mc. instead of increasing. Record the generator frequency when VTVM in No. 2 position indicates a peak.

7. The difference between the generator frequencies noted in STEPS 5 and 6 is the "Static Band Width" of the Ratio Detector transformer. This should be approximately 285 kc.



## THE B. F. GOODRICH COMPANY

MODELS 93-104,  
93-105, 93-106

**GENERAL**—Operate this receiver on 117 volt, 60 cycle alternating current (AC). Do not connect this equipment to any other source.

**ANTENNA**—A built-in loop and folded dipole antennae are provided for reception of AM and FM stations, which eliminate the need for external antennae in the average installation.

If this receiver is installed where AM reception is poor, attach an external antenna to the lead at the back of the built-in loop antenna.

To connect an external FM antenna, first remove the two dipole wires from the "FM" terminals on the top of the radio chassis. Connect the two wires from the external FM antenna to the terminals marked "FM" as shown in above illustration.

**GROUND**—A ground connection is not required for installation of this receiver.



MODELS 93-104,  
93-105, 93-106

THE B. F. GOODRICH COMPANY

**ALIGNMENT CHART**

Step No.	Band Switch Position	Signal Generator	Connection at Receiver	Dummy Antenna	Dial Setting	Adjust Trimmer	Remarks
1	AM	Mod. 455 kc.	6BE6 Conv. Grid Pin 7	0.1 Mfd.	Mid Band	B, E, F	Adjust for Maximum Output
2	AM	1500	Receiver Loop	Radiating Loop	1500	C-46 BC osc. Trim	Adjust for Maximum Output
3	AM	1500 kc.	Receiver Loop	Radiating Loop	1500	C-44 BC RF Trim	Adjust for Maximum Output
4	AM	1000 kc.	Receiver Loop	Radiating Loop	1000	See Note 1	See Note 1.
5	AM	600 kc.	Receiver Loop	Radiating Loop	600	See Note 1	See Note 1
6	FM	10.7 mc. CW	FM Antenna Terminals	0.1 Mfd.	Mid Band	A, C, D, G See Note 2	Adjust for Maximum AVC using VTVM at Terminal Board.
7	FM	10.7 mc. CW	FM Antenna Terminals	0.1 Mfd.	Mid Band	H See Note 2	Adjust for Zero Audio Volts using VTVM. No. 2
8	FM	108.5 mc. FM	FM Antenna Terminals	300 ohms Carbon Res.	HF end	C-41 FM osc. Trim	Adjust for Maximum Output.
9	FM	87.5 mc. FM	FM Antenna Terminals	300 ohms Carbon Res.	LF end	Adjust FM osc. coil See Note 3	Adjust for Maximum Output.
10	FM	103 mc. FM	FM Antenna Terminals	300 ohms Carbon Res.	103 mc.	C-45 FM RF Trim	Adjust for Maximum Output.
11	FM	100 mc. FM	FM Antenna Terminals	300 ohms Carbon Res.	100 mc.	T7 FM Ant. Trim	Adjust for Maximum Output.
12	FM	88 mc. FM	FM Antenna Terminals	300 ohms Carbon Res.	88 mc.	Adjust FM RF Coil See Note 3	Adjust for Maximum Output.

Before starting alignment, pointer must be set to 87.5 MC. mark with gang fully closed.

**ALIGNMENT PROCEDURE**

The following equipment is necessary to properly align this receiver:

1. AM signal generator with frequency coverage from 4. 455 kc. to 1700 kc. Output meter—to match 4 ohms, 5 watts maximum.
2. FM or CW signal generator covering the FM band from 87.25 mc. to 108.75 mc. and the 10.7 mc. frequency for FM IF alignment.
3. Vacuum Tube Voltmeter (VTVM).
4. Insulated alignment screwdriver.
5. Dummy antenna—0.1 mfd. capacitor, 300 ohm carbon resistor and inductive loop (fashioned from several turns of wire).

NOTE: Oscilloscope equipment not required if aligned according to the following procedure:





MODELS 93-104,  
93-105, 93-106

THE B. F. GOODRICH COMPANY

## SERVICE PARTS LIST

Symbol	Part No.	Description	Symbol	Part No.	Description
		Cabinet, Mahogany .....		39184-1	Knob, Mahogany (selector) .....
		Cabinet, Blonde .....		39183-1	Knob, Mahogany (volume, tone, tuning)
		Cabinet, Walnut .....		39183-2	Knob, Walnut (volume, tone, tuning)
CI	1698	Capacitor, variable .....		39184-2	Knob, Walnut (selector) ..
C5		Capacitor, ceramic 18 mmf G.P. ....		39184-3	Knob, White (selector) ...
C10		Capacitor, ceramic 25 mmf G.P. ....		39183-3	Knob, White (volume, tone, tuning)
C6, C7		Capacitor, ceramic 50 mmf G.P. ....	L1	28243	Loop, antenna .....
C3		Capacitor, ceramic 100 mmf G.P. ....		41111	Pointer, dial .....
C2		Capacitor, ceramic 1000 mmf G.P. ....	R1		Resistor 1 meg ohm 1/4 w.
C4, C8, C9		Capacitor, ceramic 5000 mmf G.P. ....	R5, R20,		Resistor
C13, C14, C15,			R30		470,000 ohms 1/4 w. ....
C18, C19, C23,			R6, R13,		Resistor
C39, C43			R21, R25		22,000 ohms 1/4 w. 10%
C12		Capacitor, ceramic 500 mmf G.P. ....	R7		Resistor 27,000 ohms 1/4 w. 10%
C42		Capacitor, ceramic 5mmf (-750 P.M.) ...	R10, R14		Resistor 2.2 meg ohms 1/4 w.
C20, C21,		Capacitor, Mica 220 mmf	R4		Resistor 10 ohms 1/4 w. 10%
C28			R2, R11,		Resistor 68 ohms 1/4 w. ...
C16, C17,		Capacitor, Mica 100 mmf ..	R15		
C31			R18, R19		Resistor 6800 ohms 1/4 w. 10% ..
C29, C26,		Capacitor, Paper .05 MFD 400 V. ....	R3, R8		Resistor 4700 ohms 1/4 w.
C33, C32			R28		Resistor 10 meg ohms 1/4 w.
C40, C30,		Capacitor, paper .01 MFD 400 v. ....	R29		Resistor 390 ohms 1 w. 10% ....
C34, C25			R17		Resistor 220,000 ohms 1/4 w. ....
C35		Capacitor, paper .005 mfd 400 v. ....	R12		Resistor 8200 ohms 1/2 w.
C22		Capacitor, electrolytic 8 mfd 50 v. ....	R24		Resistor 15,000 ohms 1 w.
C38a, 20120		Capacitor, electrolytic 10,	R23		Resistor 100,000 ohms 1/4 w.
C38b, C38c, C38d		40, 40 mfd 300 v. 25 mfd	R32		Resistor 1100 ohms 7 w. 10%
		25 v. ....	R22		Resistor 47,000 ohms 1/4 w.
C11	1985	Capacitor, mica 500 mmf	R26		Resistor 1.5 meg ohms 1/4 w.
C24		Capacitor, paper .001 mfd 400 v. ....	R16		Resistor 6800 ohms 1 w. ....
C27		Capacitor, paper .02 mfd 400 v. ....	R9		Resistor 3300 ohms 1/4 w.
C37		Capacitor, oil .05 mfd 400 v. ....		54523	Shaft, dial drive .....
L2, L9,	28229	Choke, filament .....		18149	Socket, dial light .....
L7, L8				18150	Socket, miniature .....
L3	28242	Choke, plate .....	P1	18104	Socket, octal .....
L6	28244	Coil, B.C. Osc. ....		58112	Socket, Phono .....
L5	28221	Coil, F.M. Osc. ....		54335	Speaker, 10" P.M. ....
L4	28222	Coil, F.M. R.F. ....	S1	3797	Spring, dial cable .....
R-27	2494	Control, volume 1/2 meg ...	T1	3382	Switch, band .....
R-31	2522	Control, tone, w/switch .25 meg .....			Transformer, A.M., F.M. I.F. ....
	5592	Cord, power .....	T2	3381	Transformer, F.M. I.F. ....
	4278	Dial crystal .....	T3	3383	Transformer, A.M. I.F. ....
	54503	Holder, dial crystal .....	T7	28239	Transformer, antenna .....
			T4	3539	Transformer, Discriminator .....
			T5	1349	Transformer, output .....
			T6	1092	Transformer, power .....
			C41		Trimmer, F.M. ....

THE B. F. GOODRICH COMPANY

MODELS 93-107,  
93-108

## TUBE LOCATION

**ANTENNA**—A built-in loop and folded dipole antennas are provided for reception of AM and FM stations, which eliminate the need for external antennas in the average installation.

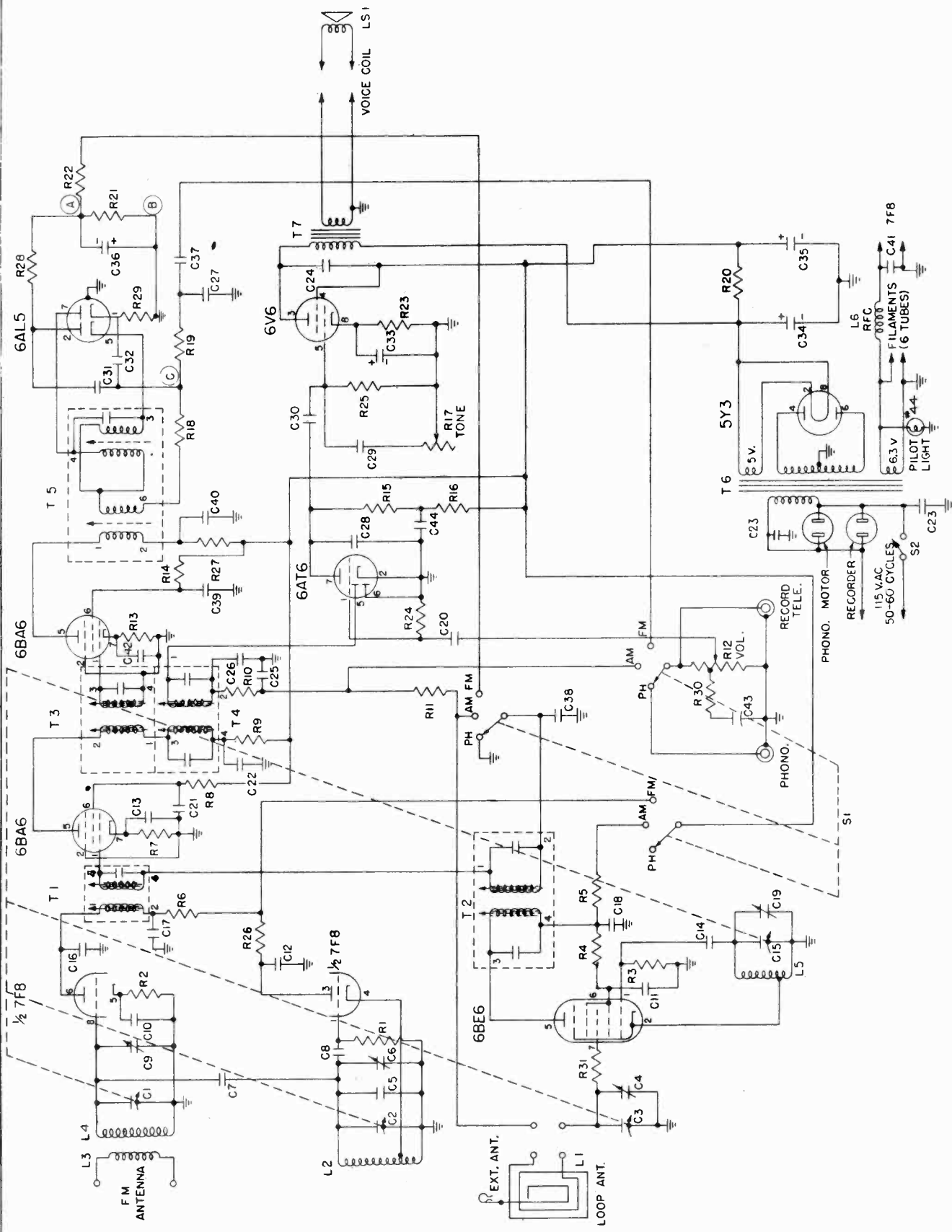
If this receiver is installed where reception is poor, separate antennas may be desirable for AM and/or FM reception. For AM reception, a single wire antenna 25 to 100 feet long can be attached to the external antenna clip located near the center of the AM antenna loop fastened to the center panel of the radio compartment. For FM reception, an external dipole antenna can be connected to the right-hand pair of antenna terminals located on the back of the radio chassis (after removing the leads from the cabinet dipole antenna).

**GROUND**—A ground connection is not required for installation of this receiver.

## INSTALLATION

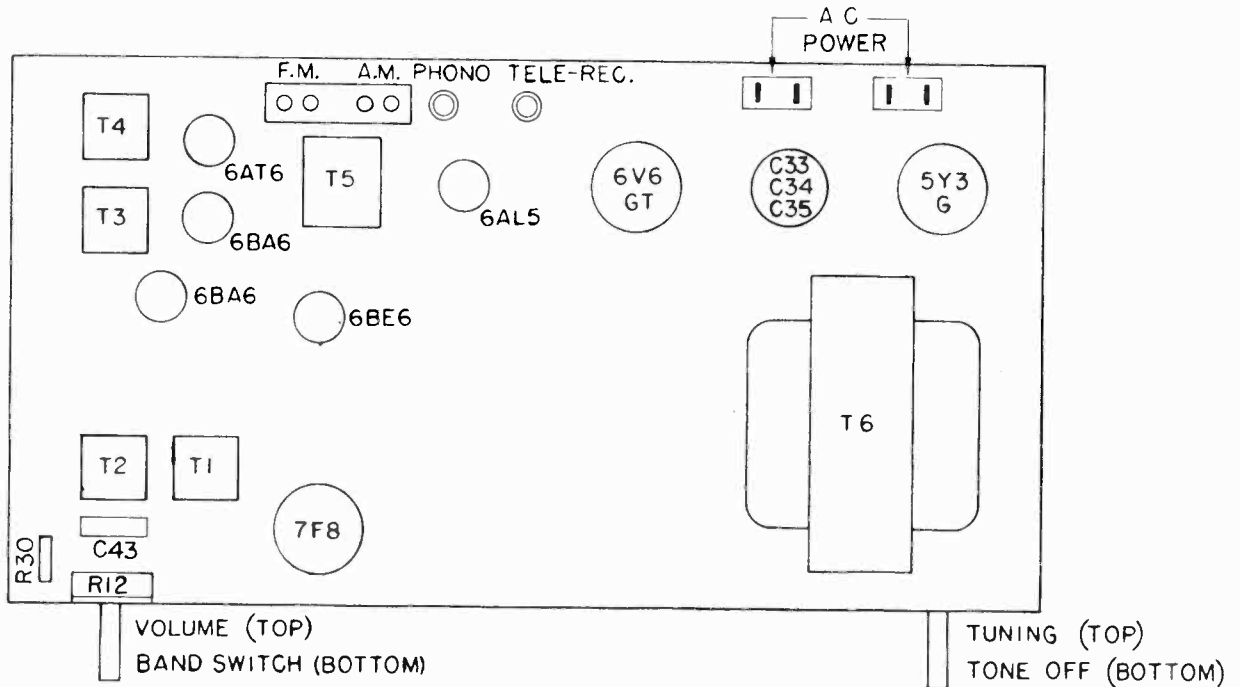
**GENERAL**—Operate this receiver on 117 volt, moved from the set. See that the record changer is floating freely on its mountings. 60 cycle alternating current (AC) only.

Before connecting the plug to an electrical outlet, be sure that all tubes are firmly seated in their sockets as shown in the tube layout illustration. Be sure that all the packing material is re-



THE B. F. GOODRICH COMPANY

MODELS 93-107,  
93-108



TOP VIEW OF CHASSIS

ELECTRICAL AND MECHANICAL DATA

Frequency Range (AM) 535 KC to 1650 KC	Speaker ..... 10-inch PM
Intermediate (FM) 88 MC to 108 MC	V.C. Impedance ..... 3.2 ohms at 400 cycles
Frequency ..... (AM) 455 KC, (FM) 10.7 MC	Power output (Undistorted) ..... 3.5 watts
Power Supply ..... 117 volts*AC, 60 cycles	Power output (Maximum) ..... 5 watts

TUBE COMPLEMENT

1 7F8	FM Oscillator—Converter	1 6AL5	FM Detector
1 6BF6	AM Oscillator—Conv.	1 6AT6	AM Detector—AVC
1 6BA6	AM-FM 1st IF Amplifier		1st Audio (AM-FM)
1 6BA6	FM 2nd IF Amplifier	1 6V6GT	Power Output
		1 5Y3GT	Rectifier

SOCKET VOLTAGES

Tube	Position	1	2	3	4	5	6	7	8	Band Switch
7F8	FM Osc.—Conv.	-2*	0	230	0	4	240	6.3 AC	0	FM
6BF6	AM Osc.—Conv.	-12*	0	0	6.3 AC	230	120	0	—	AM
6BA6	FM-AM IF	-0.8*	0	0	6.3 AC	230	95	1	—	FM
6BA6	FM 2nd IF	0	0	0	6.3 AC	230	85	1	—	FM, AM
6AT6	AM Det.- 1st AF	-1.5*	0	0	6.3 AC	-2.7*	0	100	—	AM
6AL5	FM Disc.	0	-1*	0	6.3 AC	-0.5*	NC	-0.5*	—	FM
6V6GT	AF Output	0	0	280	250	0	NC	6.3 AC	14	FM, AM
5Y3GT	Rect.	—	5V AC to pin 8	NC	260 AC	NC	260 AC	NC	300	FM, AM

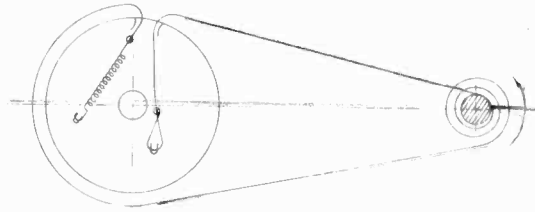
All voltages measured to chassis unless otherwise noted.  
DC voltages measured with 20,000 ohm/volt meter.  
All voltages DC unless otherwise noted.

All measurements made with no signal input to receiver.  
\* Must be measured with VTVM with 100,000 ohm composition resistor in series with probe.

**CHASSIS REMOVAL**—Remove the receiver power cord from the electrical outlet before starting to remove the chassis.

1. Close the tuning condenser by setting to the low end of the band.
2. Remove the four knobs by pulling.
3. Disconnect loop and dipole leads from their respective chassis terminals.
4. Pull the phono-motor plug from the chassis socket.
5. Pull out the phono-pickup plug.
6. Unsolder the speaker leads at the speaker.
7. Remove the four long chassis bolts and slide the chassis out.

**NOTE:** When reinstalling the chassis, hold the wooden chassis blocks against the chassis and slide the chassis and blocks into the cabinet. The tuning condenser should also be kept closed when handling the chassis.

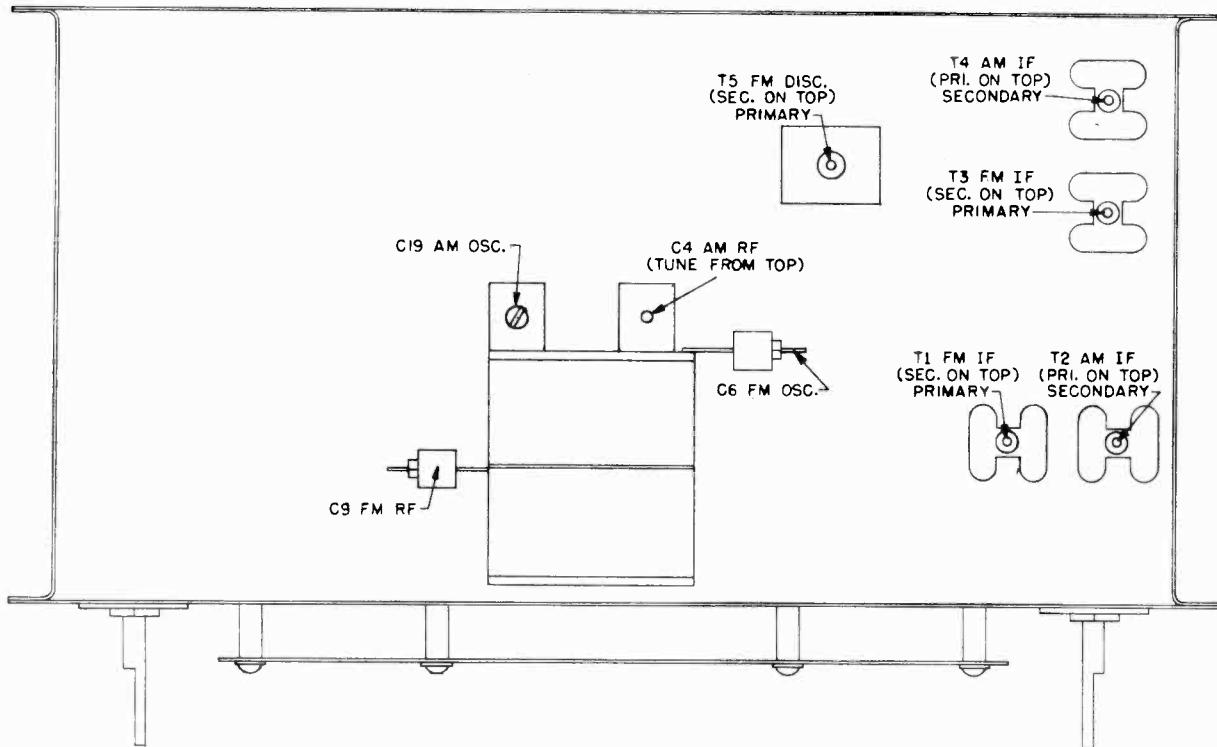


DIAL STRINGING

**ALIGNMENT PROCEDURE**

The following equipment is necessary to properly align this receiver.

1. AM signal generator, 455 kc to 1650 kc.
2. FM or CW signal generator covering the FM band from 88 mc. to 108 mc. and 10.7 mc. for FM IF.
3. Vacuum Tube Voltmeter (VTVM).
4. Output meter.
5. Insulated alignment screwdriver.
6. Dummy antennas—0.1 mfd. capacitor and two 150 ohm composition resistors.
7. Two 100,000 ohm  $\pm 10\%$  composition resistors for ratio detector alignment.



TRIMMER LOCATION—BOTTOM VIEW

## Notes on Alignment

- 1—Before beginning alignment, the pointer must be set at the highest mark on the dial with the tuning condenser fully open.
- 2—The AM section should be completely aligned before beginning the FM alignment.
- 3—The set should be allowed to warm up 15 minutes before aligning.
- 4—An output meter should be connected across the speaker voice coil for AM alignment. Keep the volume control at maximum on AM and use as low a signal input as possible for AM and FM.
- 5—For AM and FM tracking, bend plates of the variable (RF Section) as required.
- 6—In FM alignment, care must be taken to set the receiver oscillator frequency 10.7 MC *above* the incoming signal frequency.
- 7—The dummy antenna for FM alignment is two 150 ohm composition resistors; one in series with each generator lead.

## RATIO DETECTOR ALIGNMENT

(T1 and T3 should be tuned before tuning T5.)

## TUNING T5 PRIMARY

Locate the ratio detector test points A, B, and C on the schematic diagram. Solder two 100,000 ohm composition resistors in series from point "A" to chassis. Connect a VTVM from point "A" to chassis and feed 10.7 MC CW into the FM antenna terminals. Adjust T5 primary (bottom slug) for maximum reading, setting the generator output to give about one volt meter reading. (An insulated aligning tool should be used for this adjustment.)

## TUNING T5 SECONDARY

Connect the VTVM probe to point "C" and the VTVM common or ground lead to the junc-

tion of the two 100,000 ohm resistors. Tune T5 secondary until the meter reading reverses polarity. Set the slug at this zero point.

## CHECKING BAND WIDTH

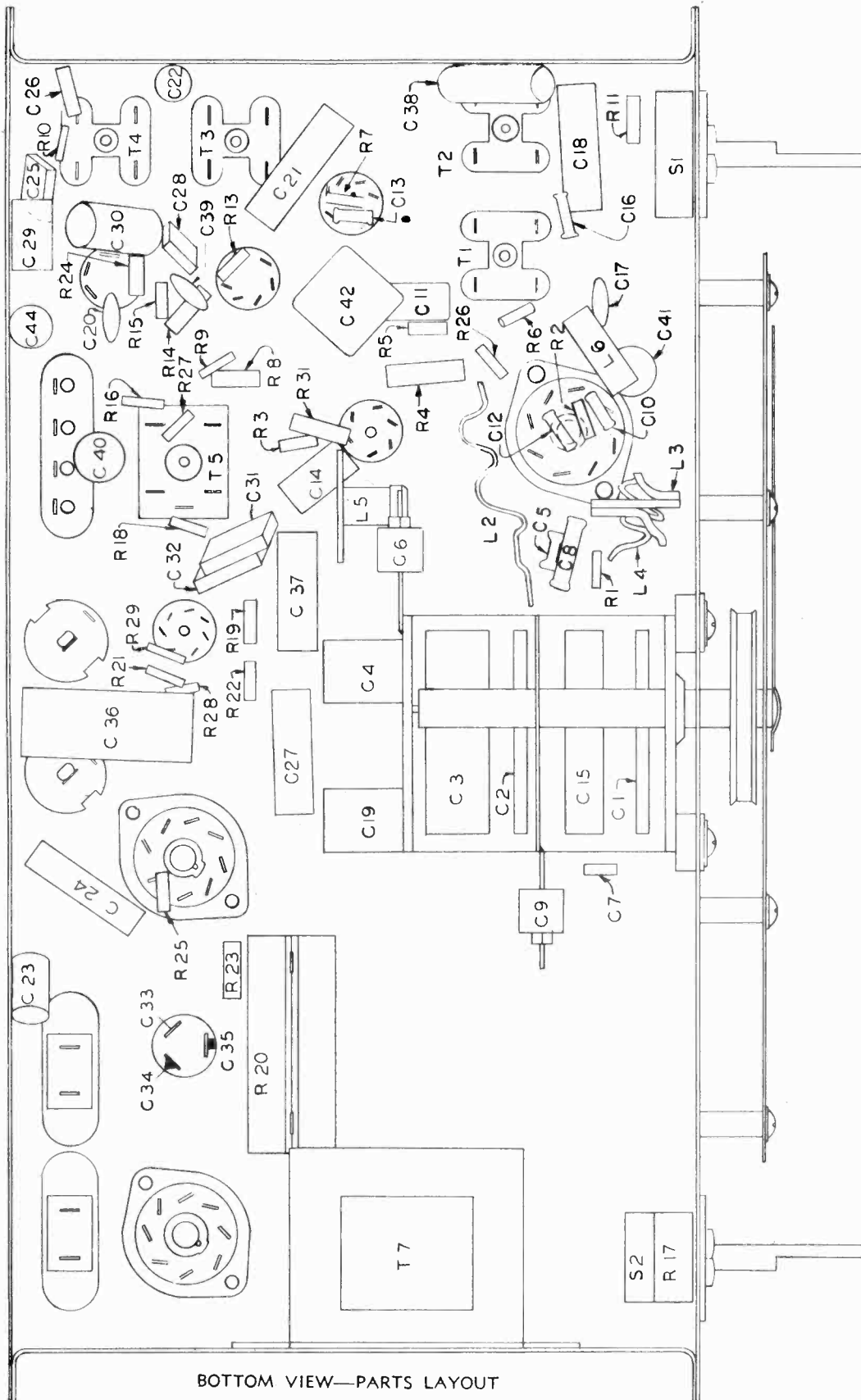
Connect the signal generator to the grid of the 2nd FM IF tube. Set the generator to 100,000 microvolts at 10.7 MC CW. Shift the generator frequency above and below 10.7 MC and record the frequencies at which the maximum positive and negative meter readings are obtained. The difference between these two readings is the bandwidth of the ratio detector and should be 250 to 300 KC.

Remove the two 100,000 ohm resistors before beginning the FM RF alignment.

## ALIGNMENT CHART

STEP NO.	BAND SWITCH POSITION	SIGNAL GENERATOR	CONNECTION TO RECEIVER	DUMMY ANTENNA	DIAL SETTING	ADJUST	REMARKS
1	AM	455 KC Mod.	6BE6 Conv. Grid Pin 7	0.1 mfd	1600 KC	T2 Pri., Sec., T4 Pri., Sec.	Adjust for Max. output
2	AM	1600 KC Mod.	Ext. Antenna Clip	0.1 mfd	1600 KC	C19 BC Osc. Trimmer	Adjust for Max. output
3	AM	1400 KC Mod.	Ext. Antenna Clip	0.1 mfd	1400 KC	C4 BC RF Trimmer	Adjust for Max. output
4	AM	600 KC Mod.	Ext. Antenna Clip	0.1 mfd	600 KC	See Note 5	See Note 5
5	FM	10.7 MC CW	FM Ant. Terminals	0.1 mfd	107 MC	T1 Pri. & Sec., T3 Pri. & Sec., T5 Pri. only	Tune for Max. reading, VTVM from point A to chassis. See Ratio Detector Alignment.
6	FM	10.7 MC CW	FM Ant. Terminals	0.1 mfd	107 MC	T5 Sec.	Tune for Zero reading, VTVM from resistor junction to point C. See Ratio Detector Alignment
7	FM	107 MC CW	FM Ant. Terminals	300 ohms See Note 7	107 MC	C6 FM Osc. Trimmer	Adjust for Max. with VTVM from point A to chassis. See Note 6.
8	FM	107 MC CW	FM Ant. Terminals	300 ohms	107 MC	C9 FM RF Trimmer	Adjust for Max. with VTVM from Point A to chassis.
9	FM	98 MC CW	FM Ant. Terminals	300 ohms	98 MC	See Note 5	Adjust for Max. with VTVM from Point A to chassis.
10	FM	88 MC CW	FM Ant. Terminals	300 ohms	88 MC	See Note 5	Adjust for Max. with VTVM from Point A to chassis.





BOTTOM VIEW—PARTS LAYOUT

## THE B. F. GOODRICH COMPANY

MODELS 93-107,  
93-108

## SERVICE PARTS LIST

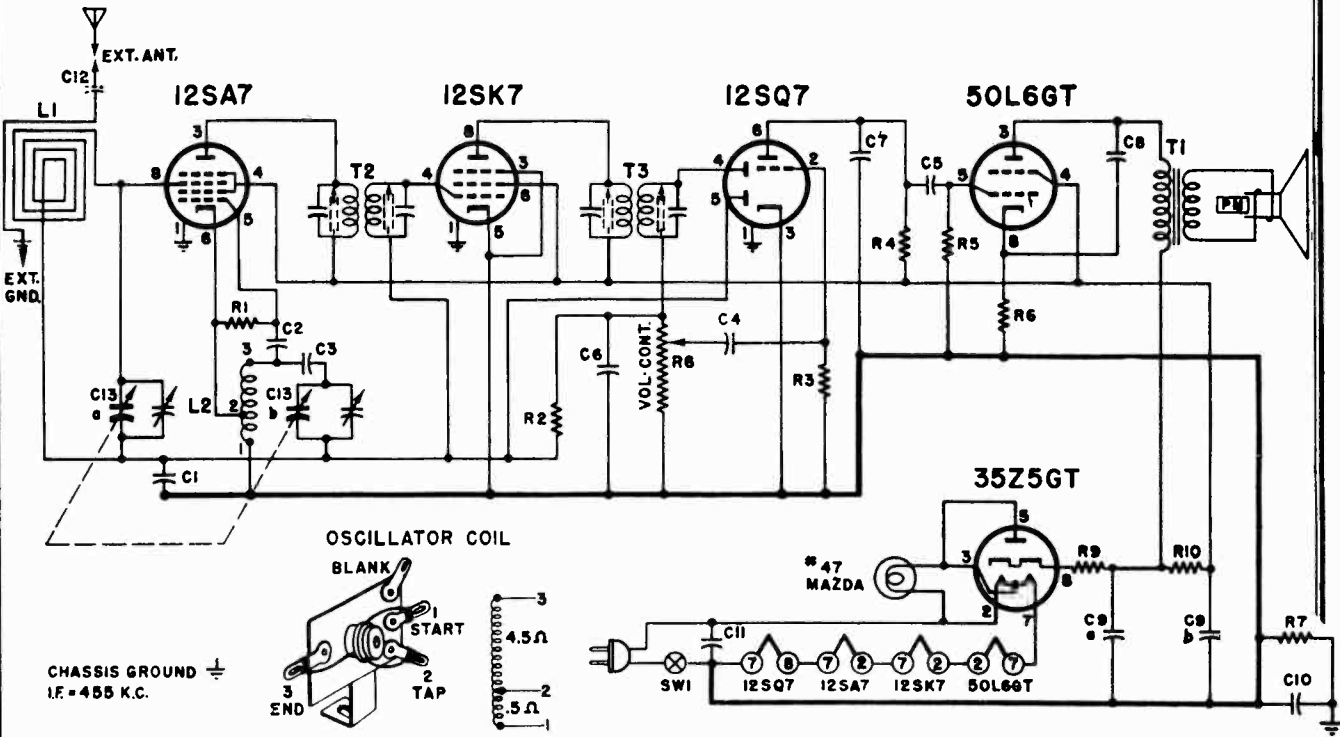
Symbol	Description	Part Number	Symbol	Description	Part Number
C1, C2, C3, C15	Capacitor, 4 Section Variable	4410	R12	Resistor, .5 MEG. Tapped Potentiometer (Vol.)	4814
C4, C19	Capacitor, Trimmer (A.M. Section)	4313	R15, R16, R22	Resistor, .22 MEG. $\pm 20\%$ Composition $\frac{1}{2}$ WATT	4500
C6, C9	Capacitor, Trimmer (F.M. Section)	4318	R17	Resistor, .5 MEG. Potentiometer w/switch (Tone)	4812
C5	Capacitor, 5 MMF. $\pm 10\%$ N750 Ceramic	4028	R18	Resistor, 120 OHM $\pm 10\%$ Composition $\frac{1}{2}$ WATT	4546
C7	Capacitor, 1.5 MMF $\pm 10\%$ Mica	4024	R20	Resistor, 1500 OHM $\pm 5\%$ w.w. $6\frac{1}{2}$ WATT	4701
C8	Capacitor, 22 MMF. $\pm 10\%$ N150 Ceramic	4021	R21	Resistor, 15,000 OHM $\pm 20\%$ Composition $\frac{1}{2}$ WATT	4521
C10, C12, C13, C42	Capacitor, 1000 MMF. Ceramic Hi-K	4025	R23	Resistor, 400 OHM $\pm 10\%$ Composition 1 WATT	4587
C11, C18, C21, C22, C23	Capacitor, .01 MFD. 400V Paper	4112	R24	Resistor, 4.7 MEG. $\pm 20\%$ $\frac{1}{2}$ WATT	4544
C14, C26	Capacitor, 100 MMF. $\pm 20\%$ Mica	4000	R25	Resistor, .47 MEG. $\pm 20\%$ $\frac{1}{2}$ WATT	4506
C16	Capacitor, 10 MMF. $\pm 10\%$ Ceramic	4027	R28, R29	Resistor, 560 OHM $\pm 10\%$ $\frac{1}{2}$ WATT	4507
C17, C20, C39, C40, C41	Capacitor, 5000 MMF. Ceramic Hi-K	4029	R30	Resistor, 6800 OHM $\pm 10\%$ $\frac{1}{2}$ WATT	4557
C25	Capacitor, 470 MMF. $\pm 20\%$ Mica	4003	L1	Loop Antenna (A.M.)	5279
C27, C24	Capacitor, .002 MFD. 600V. Paper	4118	L2	Oscillator Coil (F.M.)	5247
C28, C31, C32	Capacitor, 270 MMF. $\pm 20\%$ Mica	4001	L3	Antenna Primary (F.M.)	5258
C29	Capacitor, .005 MFD. 600V. Paper	4102	L4	Antenna Secondary (F.M.)	5248
C30, C44	Capacitor, .05 MFD. 400V. Paper	4101	L5	Oscillator Coil (A.M.)	5282
C33	Capacitor, 20 MFD. 25V. Electrolytic	4200	L6	Filament Choke	5266
C34, C35	Capacitor, 20 MFD. 450V. Electrolytic	4200	LS1	Loudspeaker 10" (P.M.)	9054
C36	Capacitor, 5 MFD. 50V. Electrolytic	4209	T1	1st F.M. I.F. Transformer	5284
C37, C43	Capacitor, .02 MFD. 400V. Paper	4106	T2	1st A.F. I.F. Transformer	5286
C38	Capacitor, .05 MFD. 200V. Paper	4100	T3	2nd F.M. I.F. Transformer	5285
R1, R3	Resistor, 22,000 OHM $\pm 20\%$ Composition $\frac{1}{2}$ WATT	4501	T4	2nd A.F. I.F. Transformer	5287
R2	Resistor, 1200 OHM $\pm 10\%$ Composition $\frac{1}{2}$ WATT	4553	T5	Discriminator Ratio Detector	5288
R4	Resistor, 15,000 OHM $\pm 20\%$ Composition 1 WATT	4539	T6	Power Transformer	5012
R5, R6, R9, R26, R27	Resistor, 1500 OHM $\pm 20\%$ Composition $\frac{1}{2}$ WATT	4534	T7	Output Transformer	5122
R7, R13	Resistor, 68 OHM $\pm 20\%$ Composition $\frac{1}{2}$ WATT	4524	S2	On-Off Switch (Part of R17)	6002
R8, R14	Resistor, 33,000 OHM $\pm 20\%$ Composition 1 WATT	4556	S1	Band Switch	7529
R10, R19	Resistor, 47,000 OHM $\pm 20\%$ Composition $\frac{1}{2}$ WATT	4504		Cabinet, Blonde	Blonde
R11	Resistor, 2.2 MEG. $\pm 20\%$ Composition $\frac{1}{2}$ WATT	4502		Cabinet, Mahogany	7529 Mahog.
				Dial	2217B
				Escutcheon (with crystal attached)	8084
				Knob, Blonde	3585B
				Knob, Mahogany	3585M
				Plug, Phono	6203
				Pointer, dial	518
				Socket, octal	6105
				Socket, miniature	6118
				Socket, octal	6103
				Socket, phono	6121
				Socket, pilot lamp	6110
				Socket, AC power	6108
				Spring, dial cable	9507
				Strip, antenna terminal	424

NOTE: In some cases the following substitutions have been made:  
 C24 is two .001 MFD. 600V in parallel.  
 C27 is two .001 MFD. 600V in parallel.

C42 is 1050 MMF.  $\pm 5\%$  Mica.  
 R8 and R14 are each 47,000 ohm  $\pm 20\%$  1 Watt.  
 R23 is two 820 ohm  $\pm 10\%$   $\frac{1}{2}$  Watt in parallel.

MODELS 92503,  
92504

THE B. F. GOODRICH COMPANY



REPLACEMENT PARTS

RESISTORS

Symbol	Part No.
R1... 22,000 Ohms, 1/2 Watt	60B 8-223
R2... 1 Megohm, 1/2 Watt	60B 8-105
R3... 47 Megohms, 1/2 Watt	60B 8-475
R4... 220,000 Ohms, 1/2 Watt	60B 8-224
R5... 470,000 Ohms, 1/2 Watt	60B 8-474
R6... 150 Ohms, 1/2 Watt	60B 8-151
R7... 150,000 Ohms, 1/2 Watt	60B 8-154
R8... 1 Megohm, Volume Control and Switch SW1	75B 1-6
R9... 33 Ohms, 1 Watt	60B 28-3
R10... 1,000 Ohms, 1 Watt	60B 28-2

CONDENSERS

Symbol	Part No.
C1... .1 mfd., 200 Volts, Paper	64B 1-30
C2... 50 mmfd., Mica	65B 7-11
C3... .02 mfd., 400 Volts, Paper	64B 1-24
C4... .01 mfd., 400 Volts, Paper	64B 1-25
C5... .01 mfd., 400 Volts, Paper	64B 1-25
C6... 250 mmfd., Mica	65B 7-22
C7... 500 mmfd., Mica	65B 7-27

C8... .02 mfd., 400 Volts, Paper	64B 1-24
C9a... 50 mfd., 150 Volts, Elect.	67A 10
C9b... 30 mfd., 150 Volts, Elect.	67A 10
C10... .18 mfd., 200 Volts, Paper	64A 2-2
C11... .05 mfd., 400 Volts, Paper	64B 1-22
C12... .005 mfd., 600 Volts, Paper	64B 1-12
(Used in early production only)	
C13a. 0 to 420 mmfd., R.F. Section	Gang... 68A 18
C13b. 0 to 108 mmfd., Osc. Section	

COILS & TRANSFORMERS

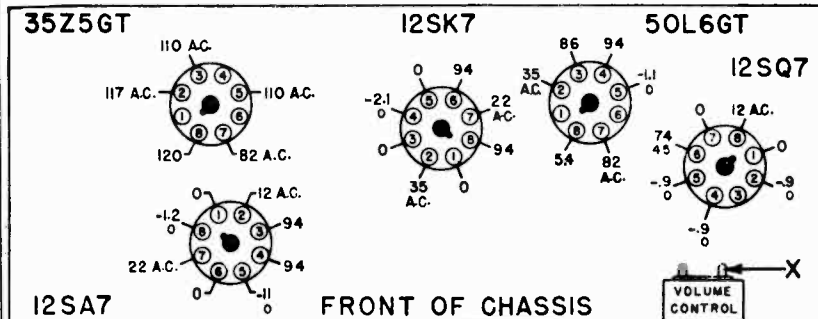
L1... Loop Antenna	69C 44
L2... Oscillator Coil	69A 43
T1... Transformer, Output	98A 4
T2... Transformer, 1st I.F.	72B 50
T3... Transformer, 2nd I.F.	72B 51

MISCELLANEOUS

Description	Part No.
Background, Dial	X22C 3-1

Bracket, Loop Retainer	15A 14
Cabinet, Ivory (Model 92503)	34D 5-1
Cabinet, Mahogany (Model 92504)	34D 5-2
Clip, Dial Glass Mounting	18A 2
Cord, Dial (62")	50A 1-3
Cover, Back and Loop Antenna	69C 44
Dial Scale, Glass	21B 8-2
Drum and Hub Assembly, Dial	A1012
Knob, Ivory (Model 92503)	33A 7-1
Knob, Mahogany (Model 92504)	33A 7-2
Pilot Light No 47	81A 1-8
Pilot Light Socket and Leads	82A 2-4
Pointer, Metal Dial	25A 4-1
Pulley, Fibre Dial	17A 1-3
Shaft, Tuning	28A 1-1
Socket, Laminated Octal Tube	87A 10-2
Speaker (5" PM) and Output Trans.	78B 4-4
Spring, Dial Cord Tension	19B 1-7
Washer, Fibre Flat	5A 1-6
Washer, Fibre Offset	5A 2-5
Washer, C.	4A 4-8
Washer, Spring	4A 6-3-0

VOLTAGE DATA

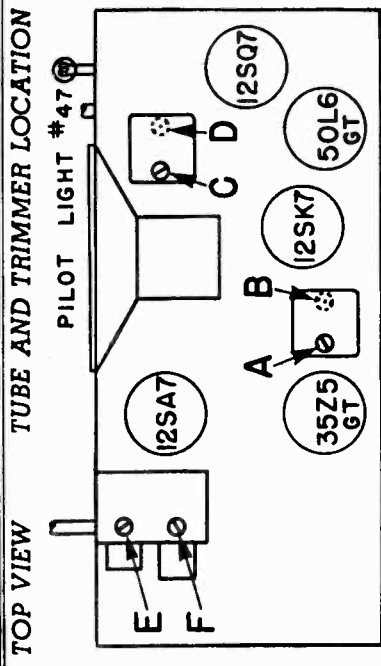


Bottom View of Chassis, Showing Voltages

- Readings made between point indicated and Volume Control Lug (Point "X" on drawing).
- Measured on a 117 Volt A.C. line.
- Dial turned to low frequency end, no signal.
- Measured with vacuum tube voltmeter. A second voltage reading is shown made with a 1000 ohm - per-volt meter when use of this instrument would result in appreciably lower readings.

**ALIGNMENT PROCEDURE**

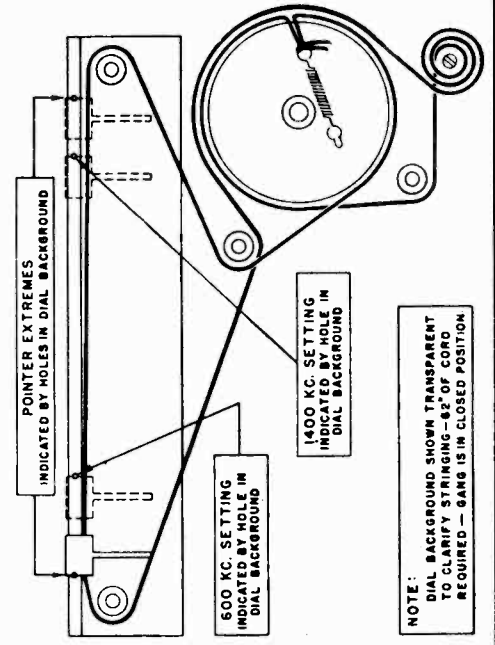
- Check setting of Pointer Extremes and note correct 600 K.C. and 1400 K.C. positions on Dial Background. (See Dial Diagram.)
- Connect the signal generator ground lead through a .1 mfd. condenser to B— (point "X" on voltage chart).
- Connect Output Meter across Voice Coil of Speaker.
- Turn Receiver Volume Control full on.
- Use lowest Output setting of Signal Generator capable of producing adequate Output Meter indication and then proceed as outlined in chart below.
- Repeat adjustments to insure good results.



**BACK OF CHASSIS**

Connect Signal Generator to—	Dummy Antenna Between Radio and Generator	Set Generator Frequency to—	Set Receiver Dial Frequency to—	Adjust Following Trimmers	Type of Adjustment
Tuning Condenser Antenna Stator	250 mmfd. Condenser	455 KC.	High frequency end of Dial	C—D 2nd I. F. A—B 1st I. F. (See note below)	Adjust to maximum Output
Tuning Condenser Antenna Stator	250 mmfd. Condenser	1630 KC.	High frequency end of Dial	E—Oscillator	Adjust to maximum Output
Loop radiator (or place pickup lead from generator close to loop of set to obtain adequate signal).	No actual connection between set and generator.	1400 KC.	Tune in generator signal	F—Antenna	Adjust to maximum Output

NOTE: The B and D adjustments are made from the underside of the chassis.



**POWER SUPPLY**

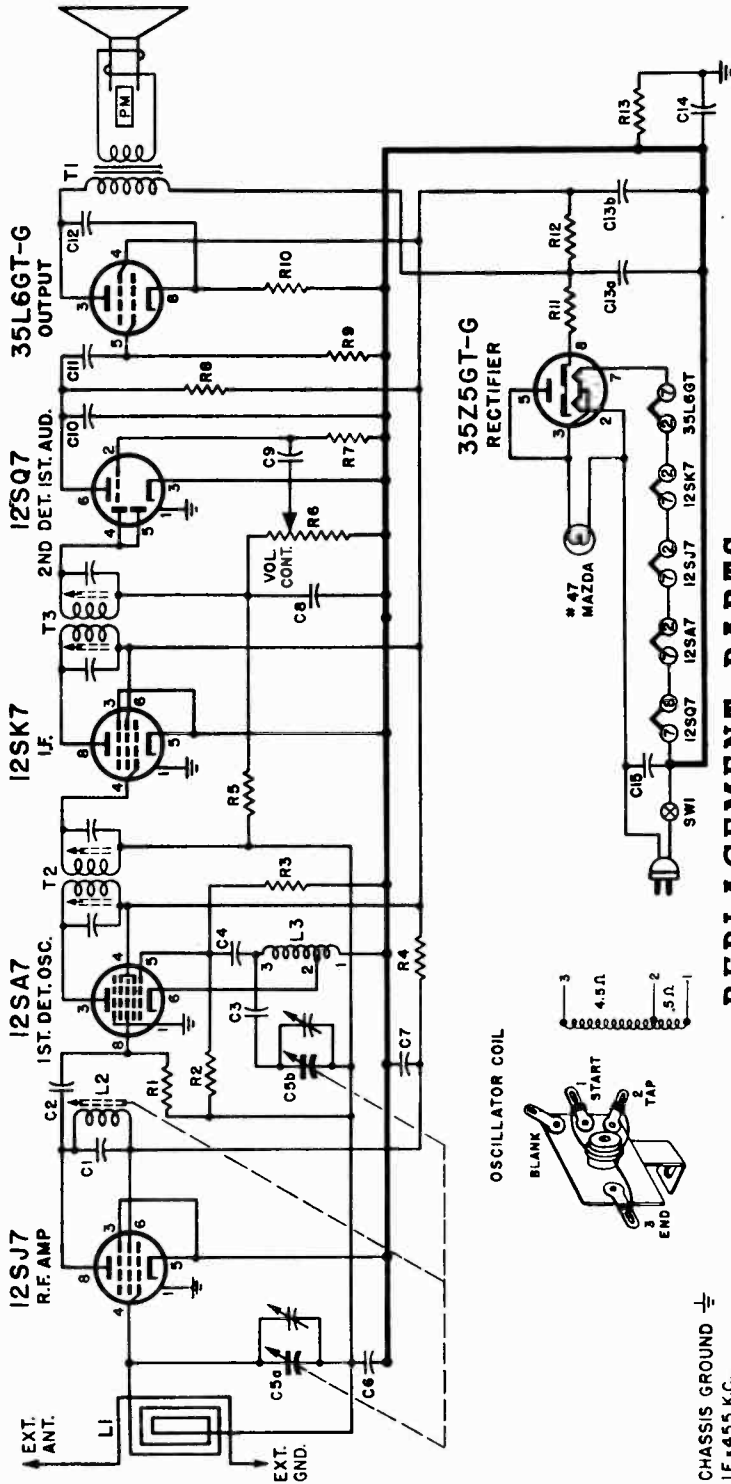
This receiver is designed to operate from any AC (Alternating Current) power supply main of 110-120 volts, 50-60 cycles or DC (Direct Current) power supply main of 110-120 volts. If the receiver fails to operate on DC (Direct Current), reverse the power line plug.  
On AC only the line plug should be tried both ways and left in the position that gives minimum hum.

**DIAL STRINGING AND POINTER SETTINGS**

NOTE:  
DIAL BACKGROUND SHOWN TRANSPARENT TO CLARIFY STRINGING—62° OF CORD REQUIRED — GANG IS IN CLOSED POSITION

MODELS 92505,  
92506

THE B. F. GOODRICH COMPANY



**REPLACEMENT PARTS**

C6... 1 mid., 200 Volts, Paper	64B 1-30
C7... .05 mfd., 400 Volts, Paper	64B 1-22
C8... 250 mmfd., Mica	65B 7-22
C9... .01 mfd., 400 Volts, Paper	64B 1-25
C10... 500 mmfd., Mica	65B 7-27
C11... .01 mfd., 400 Volts, Paper	64B 1-25
C12... .02 mfd., 400 Volts, Paper	64B 1-24
C13a 50 mfd., 150 Volts	Elect. 67A 10
C13b 30 mfd., 150 Volts	Elect. 64A 2-2
C14... .18 mfd., 200 Volts, Paper	64A 2-2
C15... .05 mfd., 400 Volts, Paper	64B 1-22

L1... Loop Antenna	69C 44
L2... R.F. Coil and Mounting	A1052
L3... Oscillator Coil	69A 43
T1... Transformer, Output	98A 4
T2... Transformer, 1st I.F.	72B 50
T3... Transformer, 2nd I.F.	72B 51

Part No.	Description	Part No.
64B 1-30	Background, Dial	X22C3-1
64B 1-22	Bracket Plate, Loop Retainer	15A 14

Buttons, Snap (for R.F. Coil)	13A 1-2-2
Cabinet, Ivory (Model 92505)	34D 8-1
Cabinet, Mahogany (Model 92506)	34D 8-2
Clip, Dial Glass	18A 2
Cord, Dial	50A 1-3
Cover, Back (incl. Loop Antenna)	69C 44
Dial Scale, Glass	21B 10-2
Drum and Cam Assembly	A1049
Knob, Mahogany (Model 92506)	33A 7-2
Knob, Ivory (Model 92505)	33A 7-1
Lever Arm Assembly (R.F.)	A1050
Pilot Light, No. 47	81A 1-8
Pilot Light Socket and Leads	82A 2-3
Pointer, Fibre; 1/4x1/4" OD	17A 1-3
Pulley, Set; 8/32x1/2" (Dial Drum)	1A 5-58
Shaft, Tuning	28A 1-1
Slug, R.F. Iron Core (with wire)	71B 1-2
Socket, Octal Tube	87A 10-2
Speaker (5" PM) and Transformer	78B 4-4
Spring, Tension (Dial)	19B 1-3
Spring, Lever Arm (R.F.)	19A 4
Spacer, T (R.F.)	29A 2-3-21
Stud, Slug Adj. (R.F.)	27A 4
Washer, C (Tuning Shaft)	4A 4-8
Washer, Spring (Tuning Shaft)	4A 6-3-0

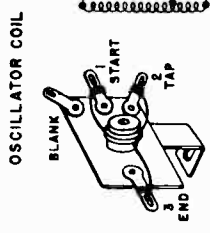
**COILS & TRANSFORMERS**

**MISCELLANEOUS**

Symbol	Part No.
R1... 10,000 Ohms, 1/2 Watt	60B 8-103
R2... 10,000 Ohms, 1/2 Watt	60B 8-106
R3... 22,000 Ohms, 1/2 Watt	60B 8-223
R4... 100 Ohms, 1/2 Watt	60B 8-101
R5... 1 Megohm, 1/2 Watt	60B 8-105
R6... 1/2 Megohm, Volume Control	75B 1-9
R7... 4.7 Megohms, 1/2 Watt	60B 8-475
R8... 270,000 Ohms, 1/2 Watt	60B 8-274
R9... 470,000 Ohms, 1/2 Watt	60B 8-474
R10... 150 Ohms, 1/2 Watt	60B 8-151
R11... 33 Ohms, 1 Watt	60B 28-3
R12... 1,000 Ohms, 1 Watt	60B 28-2
R13... 150,000 Ohms, 1/2 Watt	60B 8-154

Symbol	Part No.
C1... 785 mmfd., ±5%, Silver Mica	65B 1-8
C2... 250 mmfd., Mica	65B 7-22
C3... .02 mfd., 400 Volts, Paper	64B 1-24
C4... 50 mmfd., Mica	65B 7-11
C5a 0 to 420 mmfd.	Gang
C5b 0 to 108 mmfd.	



CHASSIS GROUND  
I.F. +455 KC.

TOP VIEW

TUBE & TRIMMER LOCATION

**ALIGNMENT PROCEDURE**

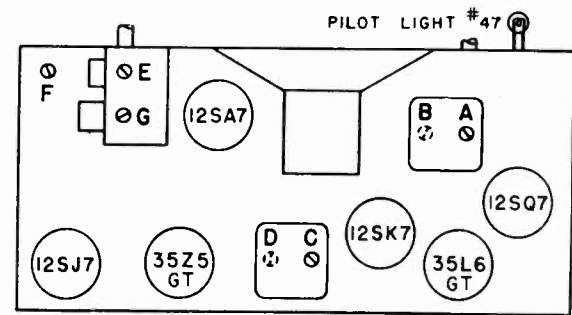
Check setting of Pointer Extremes and note correct 600 K.C. and 1400 K.C. positions on Dial Background. (See Dial Diagram.)

Connect Output Meter across Voice Coil of Speaker.

Turn Receiver Volume Control full on.

Use lowest Output setting of Signal Generator capable of producing adequate Output Meter indication and then proceed as outlined in chart below.

Repeat adjustments to insure good results.

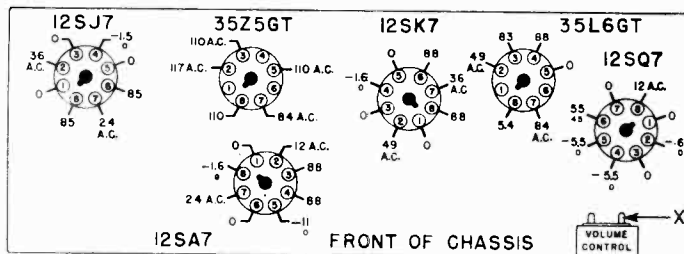


Connect Signal Generator To—	Dummy Antenna Between Radio and Generator	Set Generator Frequency To—	Set Receiver Dial Frequency To—	Adjust Following Trimmers	Type of Adjustment
12SA7 Control Grid	250 mmfd. Mica Condenser	455 KC.	High frequency end of Dial	A and B—2nd I. F. C and D—1st I. F. (See Note 1 below)	Adjust to maximum Output
External Antenna Wire on Loop	250 mmfd. Mica Condenser	1630 KC.	High frequency end of Dial	E—Osc.	Adjust to maximum Output
External Antenna Wire on Loop	250 mmfd. Mica Condenser	1400 KC.	Tune in Generator signal	F—R. F. (Iron Core)	See Note 2 Below
Loop radiator (or place lead from generator close to loop of set to obtain adequate signal).	No actual connection between set and generator.	1400 KC.	Tune in Generator signal	G—Ant.	Adjust to maximum Output

NOTE 1: The B and D adjustments are made from the underside of the chassis.

NOTE 2: Adjustment F is the threaded stud at the top end of the slug wire. Screw stud up or down in the bakelite for maximum output. Alignment is correct if the output is reduced when the position of the lever arm is changed slightly in either direction (up or down).

**VOLTAGE DATA**



Bottom View of Chassis, Showing Voltages

- Readings made between point indicated and Volume Control Lug (Point "X" on drawing).
- Measured on a 117 Volt A.C. line.
- Dial turned to low frequency end, no signal.
- Measured with Vacuum Tube voltmeter.
- A second voltage reading is shown made with a 1000 ohm-per-volt meter when use of this instrument would result in appreciably lower readings.

**DIAL DRUM POSITION**

If the dial drum position is disturbed, it should be carefully re-positioned to insure correct tuning of the permeability tuned coil. With the gang fully meshed, the drum will be properly positioned if the center of the condenser shaft and the dial cable hole on the drum are in a straight line parallel to the chassis base. Note that the dial cable hole should be on the right side (looking at front) of the chassis.

**R.F. SLUG POSITION**

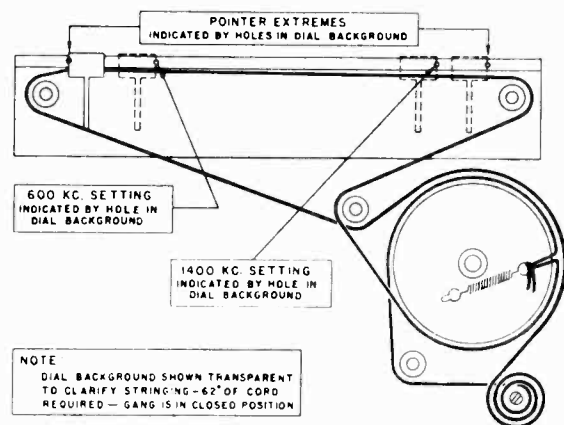
If the tuned coil slug needs replacing or re-positioning, first see that the dial drum is in its proper position. Then with the gang condenser fully meshed and the threaded stud half-way through the bakelite, note that the top of the slug is flush with the top of coil form. Then re-align.

**POWER SUPPLY**

This receiver is designed to operate from any AC (Alternating Current) power supply main of 110-120 volts, 50-60 cycles or DC (Direct Current) power supply main of 110-120 volts. If the receiver fails to operate on DC (Direct Current), reverse the power line plug.

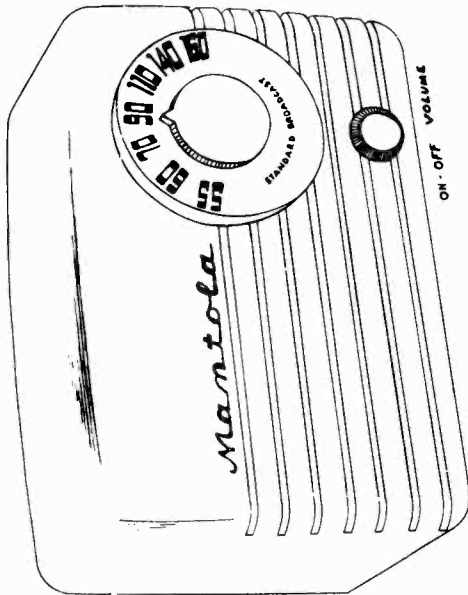
On AC only the line plug should be tried both ways and left in the position that gives minimum hum.

**DIAL STRINGING AND POINTER SETTINGS**



MODELS 92514,  
92515, CHASSIS AG

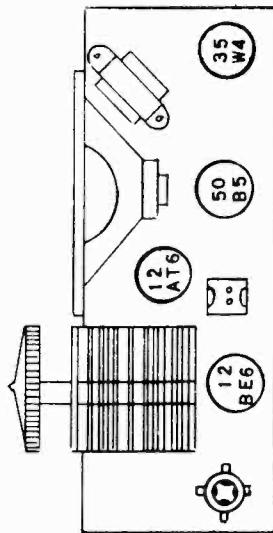
THE B. F. GOODRICH COMPANY



**POWER SUPPLY**

This receiver is designed to operate on either an A.C. or D.C. power supply. The following operation ratings should be observed:

Voltages ..... 105-125 Volts, A.C. or D.C.  
Frequency ..... 50 to 60 cycles on A.C.



Remove back to replace tubes

**ALIGNMENT PROCEDURE**

- Output meter across 3.5 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.

Frequency	SIGNAL GENERATOR			SETTING TUNER	ADJUST TRIMMERS TO MAXIMUM OUTPUT (in order shown)
	Coupling Factor	Connection to Receiver	Ground Connection		
455 kc	.1 mfd	12BE6 Grid	B—	Rotor full open (Plates out of mesh)	Input and output trimmers on IF cans
1620 kc	.1 mfd	12BE6 Grid	B—	Rotor full open (Plates out of mesh)	Oscillator trimmer T2
1400 kc	75 mmf	Hank	B—	1400 kc	Antenna trimmer T1

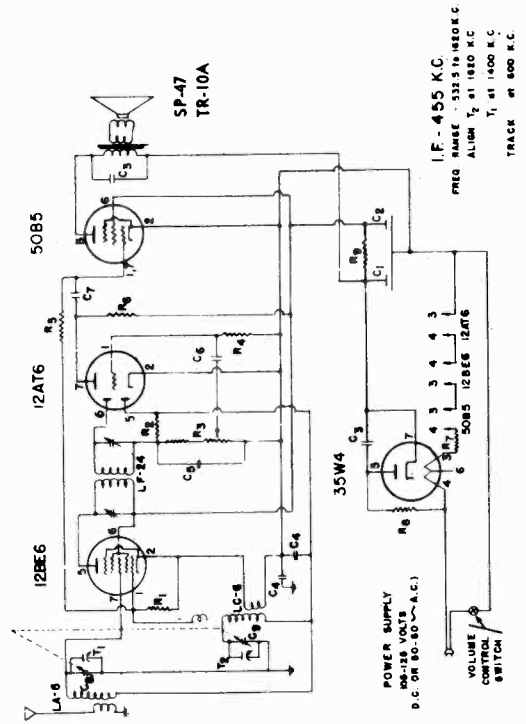


# REPLACEMENT PARTS LIST

Ref. No.	Part No.	Description
<b>CAPACITORS</b>		
C1, C2	CE-15	2 x 40 mfd 150V. Elect.
C3	CP203-1	.02 mfd 400V paper cond.
C4	CP503-4	.05 mfd 200V paper cond.
C5	CM151-1	.00015 mfd 500V paper cond.
C6	CP202-2	.002 mfd 400V paper cond.
C7	CP502-3	.005 mfd 200V paper cond.
C8, C9	CV-14	Variable Condenser (2 gang)
<b>RESISTORS</b>		
R1	RC183-2	18,000 ohms 1/2 W 10%
R2	RC475-1	4.7 megohms 1/2 W 20%
R3	VC-11	2 meg. vol. cont., 100 K Stop
R4	RC106-1	10 megohms 1/2 W 20%
R5	RC334-1	330,000 ohms 1/2 W 20%
R6	RC224-1	220,000 ohms 1/2 W 20%
R7	RW390-5	39 ohms 1 W 10%
R8	RC180-1	18 ohms 1/2 W 20%
R9	RC222-5	2200 ohms 1 W 10%
<b>COILS &amp; TRANSFORMERS</b>		
	LA-5	Antenna Coil
	LC-6	Oscillator Coil
	LF-24	I.F. Transformer
	TR-10A	Output Transformer
<b>MISCELLANEOUS</b>		
	CB-116	Cabinet (specify Ivory or Mahogany)
	KN-20-2	Knob
	KN-25-2	Pointer Knob
	SP-47	4" PM Speaker

## ELECTRICAL SPECIFICATIONS

- Power Supply** ..... 105-125 Volts D.C. or 50-60 Cycles A.C. 30 Watts
- Frequency Range** ..... 532.5 to 1620 kc.
- Intermediate Freq.** ..... 455 kc.
- Tuning** ..... Two gang capacitor
- Speaker** ..... 4 inch PM 3.5 ohm voice coil impedance
- Power Output** ..... 1 watt undistorted  
1.5 watt maximum
- Sensitivity** ..... 800 Microvolts at 50 milli-watts Output
- Selectivity** ..... 120 kc broad at 1000 times signal at 1000 kc.



MODELS 92516,  
92517

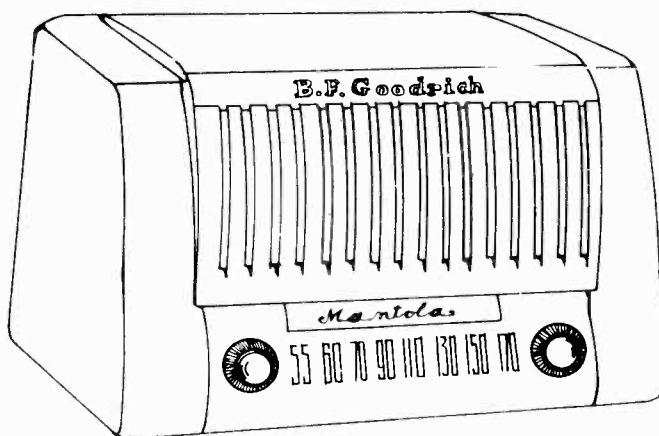
THE B. F. GOODRICH COMPANY

### POWER SUPPLY

This receiver is designed to operate on either an A.C. or D.C. power supply. The following operation ratings should be observed:

Voltages.....105 - 125 Volts, A.C. or D.C.

Frequency..... 50 to 60 cycles on A.C.



VOLUME CONTROL AND ON-OFF SWITCH

DIAL TUNING KNOB

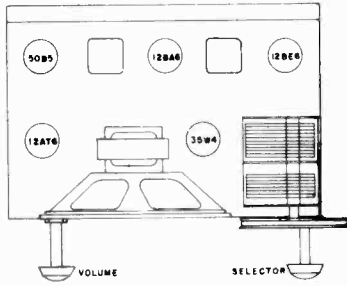
### ALIGNMENT PROCEDURE

- Output meter across 3.5 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				SETTING TUNER	ADJUST TRIMMERS TO MAXIMUM OUTPUT (in order shown)
Frequency	Coupling Factor	Connection to Receiver	Ground Connection		
455 kc	.1 mfd	12BE6 Grid	B—	Rotor full open (Plates out of mesh)	Input and output trimmers on IF cans
1700 kc	.1 mfd	12BE6 Grid	B—	Rotor full open (Plates out of mesh)	Oscillator trimmer T2
1500 kc		Radiating Loop		1500 kc	Antenna trimmer T1

THE B. F. GOODRICH COMPANY

MODELS 92516,  
92517

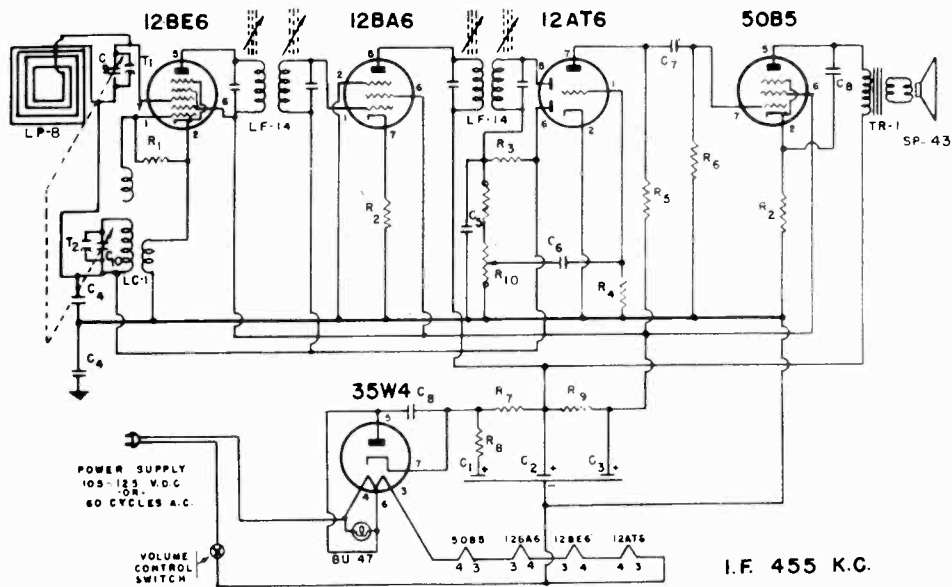


ELECTRICAL SPECIFICATIONS

- Frequency Range ..... 530 to 1700 kc.
- Intermediate Freq. .... 455 kc.
- Tuning ..... Two-gang capacitor
- Antenna ..... Built-in loop
- Speaker ..... 4 inch PM; voice coil Impedance
- Power Output ..... .75 Watt Undistorted  
1.2 Watt Maximum
- Sensitivity ..... 300 microvolts per meter for  
50 milliwatt output
- Selectivity ..... 60 KC broad at 1000 times  
signal at 1000 KC.

REPLACEMENT PARTS LIST

Ref. No.	Part No.	Description
<b>CAPACITORS</b>		
C1, C2, C3	CE-11	3x20 mfd. 150V. Elect.
C4	CP-503-3	.05 mfd. 200 V. paper cond.
C5	CM-151-1	.00015 mfd. 500V. Mica cond.
C6	CP-202-4	.002 mfd. 200V. paper cond.
C7	CP-103-3	.01 mfd. 200V. paper cond.
C8	CP-203-1	.02 mfd. 400V. paper cond.
C9, C10	CV-13	Variable condenser (2-gang)
<b>RESISTORS</b>		
R1	RC-223-1	22,000 ohms 1/2W 20%
R2	RC-151-1	150 ohms 1/2W 20%
R3	RC-225-1	2.2 megohms 1/2W 20%
R4	RC-106-1	10 megohms 1/2W 20%
R5	RC-224-1	220,000 ohms 1/2W 20%
R6	RC-474-1	470,000 ohms 1/2W 20%
R7	RC-151-4	150 ohms 1W 20%
R8	RC-180-2	18 ohms 1/2W 10%
R9	RC-152-1	1,500 ohms 1/2W 20%
R10	VC-10	1 meg. vol. control, 100K Stop
<b>COILS &amp; TRANSFORMERS</b>		
LP-8		Loop Antenna
LC-1		Oscillator Coil
LF-14		I.F. Transformer
TR-1		Output Transformer
<b>MISCELLANEOUS</b>		
SP-43		4" P.M. Speaker
PN-12		Pointer
CR-2		Drive Cord
SG-1		Spring for drive cord
CB-115M		Cabinet (Mahogany)
CB-115I		Cabinet (Ivory)
KN-20		Knob (Specify Ivory or Mahogany)
BK-27		Cardboard back



CHASSIS SERIES "AB"

MODEL 92752,  
CHASSIS W

THE B. F. GOODRICH COMPANY

### TUBES

Be sure each of the tubes is in place and inserted firmly in its socket.

The tube location of each tube is shown on the card attached to the back of the cabinet. Your receiver is equipped and tested at the factory with the tubes that are shipped with it.

### POWER SUPPLY

This receiver is designed to operate on either an A.C. or D.C. power supply. The following operation ratings should be observed:

Voltages ..... 105 - 125 Volts, A.C. or D.C.

Frequency ..... 50 to 60 cycles on A.C.

If in doubt as to the voltage and frequency supplied to your home, telephone your local Power Company.

When operating on a D.C. source, it is necessary to insert the power plug with the proper polarity. If the set fails to function after an interval sufficient for the tubes to reach their operating temperature, reverse the power plug in the outlet.

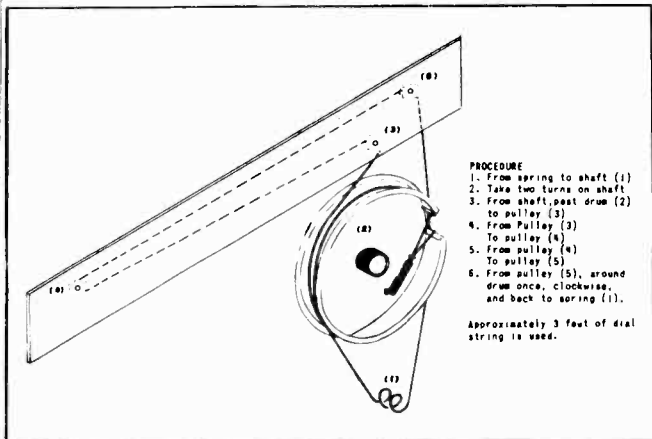
The battery supply to be used with this receiver is as follows:

"A" supply ..... 7½ volts.  
Use five type "D" flashlight cells.

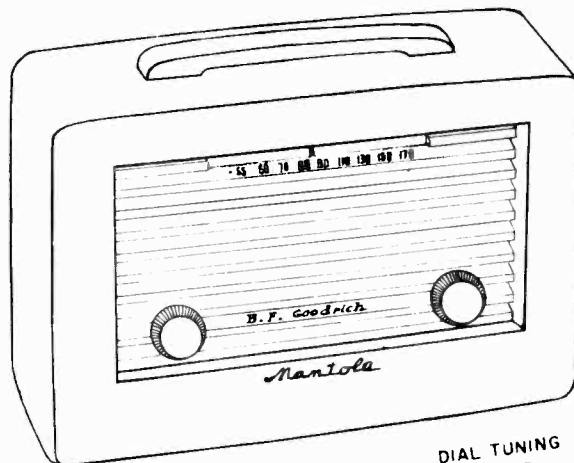
"B" supply ..... 67½ volts.  
Use B.F. Goodrich No. R35, Ray-O-Vac No. 4367 or equivalent.

### ANTENNA SYSTEM

This receiver is equipped with a loop antenna system, which obviates the necessity of using an antenna connection for receiving most local and some distant stations.



Replacement of Drive Cord



VOLUME CONTROL  
AND  
ON-OFF SWITCH

DIAL TUNING  
KNOB

When tuning Broadcast Stations, it may be found advisable to rotate the radio about its position of rest until the most distant station regularly enjoyed is heard the clearest. In some vicinities where there is a localized noise interference prevalent, it is best to rotate the radio cabinet to a position which gives a minimum of noise.

### OPERATION

#### TO OPERATE ON AC OR DC

Switch to electric on the slide switch located at the back of the set.

Plug the line cord into the nearest convenient wall outlet through the opening provided in the back.

#### TO OPERATE ON BATTERIES

To operate on batteries switch to batteries on the slide switch and store the line cord in the space provided.

THE B. F. GOODRICH COMPANY

MODEL 92752,  
CHASSIS W**VOLUME CONTROL and POWER SWITCH**

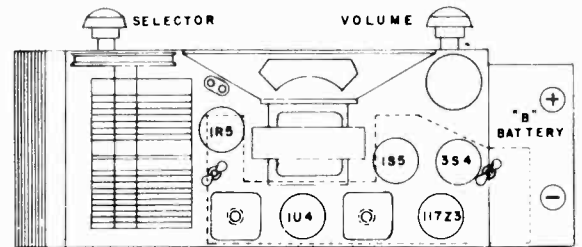
The volume control and power switch are operated by a common control knob at the left of the cabinet. When the control is in extreme counter-clockwise position, the receiver power is off. From this position a slight clockwise rotation will turn the power on and by further clockwise rotation, volume may be increased until the full output of the receiver is obtained. To conserve batteries and tubes, be sure that the receiver is turned off when it is not in use.

**TUNING CONTROL**

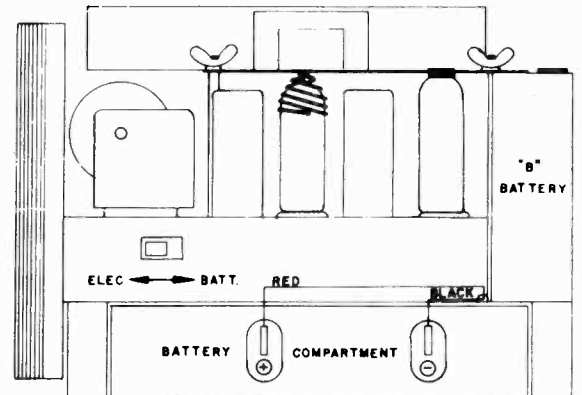
The knob at the right is the tuning control. Stations are tuned manually by turning this tuning control. The dial calibration numbers are in tenths of the actual kilocycle readings. To convert these calibrations to kilocycles, as is shown in most radio log books, add a "0" to the end of each number. After the desired station is heard, adjust this knob to the point of maximum volume and most realistic reproduction. This position of exact tune is very important as it is only when the receiver is in this position that the full, rich tone is available. The volume control may now be set to give the desired volume.

**MAINTENANCE****CAUTION**

Always remove the power cord from its receptacle before starting to replace tubes or batteries.



TO REPLACE TUBES, UNSCREW WING NUTS, AND REMOVE TUBE SPRING PLATE



Do not allow cells which have become too weak to operate the set properly to remain in the set for any length of time.

**REPLACEMENT OF TUBES**

To replace tubes, remove the two wing nuts which hold the tube spring plate and lift off the plate. Replace the plate and wing nuts after removal of old tubes.

**ELECTRICAL SPECIFICATIONS**

<b>Power Supply</b> .....	105-125 volts DC or 50-60 cycles AC 15 watts
<b>Batteries</b> .....	A—7½ volts. 50 ma. B—67½ volts. 8 ma. average.
<b>Frequency Range</b> .....	530 to 1700 kc.
<b>Intermediate Freq.</b> .....	455 kc.
<b>Tuning</b> .....	Two-gang capacitor
<b>Antenna</b> .....	Built-in loop
<b>Speaker</b> .....	4 inch PM; voice coil Impedance 3.5 ohms.
<b>Power Output</b> .....	80 milliwatts undistorted 140 milliwatts maximum
<b>Sensitivity</b> .....	500 microvolts per meter for 50 milliwatt output
<b>Selectivity</b> .....	55 kc broad at 1000 times signal at 1000 kc.



## THE B. F. GOODRICH COMPANY

MODEL 92752,  
CHASSIS W**ALIGNMENT PROCEDURE**

- Output meter across 3.5 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				SETTING TUNER	ADJUST TRIMMERS TO MAXIMUM OUTPUT (in order shown)
Frequency	Coupling Factor	Connection to Receiver	Ground Connection		
455 kc	.1 mfd	1R5 Grid	B—	Rotor full open (Plates out of mesh)	Input and output trimmers on IF cans
1700 kc	.1 mfd	1R5 Grid	B—	Rotor full open (Plates out of mesh)	Oscillator trimmer T2
1500 kc		Radiating Loop		1500 kc*	Antenna trimmer T1

\* Five markings on the dial bracket represent respectively 530 kc., 600 kc., 1000 kc., 1500 kc., and 1700 kc., reading from left to right. These points are to be used for the alignment of the receiver.

**REPLACEMENT PARTS LIST**

When ordering parts, specify part number, and model number.

*Ref. No. Part No. Description*

**CAPACITORS**

C1, } C2, C3, }	CE-12	{ 125 mfd, 10 volt } { 25-mfd, 150 volt }	Electrolytic condenser
C4	CP-503-1	.05 mfd, 400 volt, paper	
C5	CP-103-2	.01 mfd, 150 volt, paper	
C6	CP-104-2	.1 mfd, 200 volt, paper	
C7	CP-503-2	.05 mfd, 150 volt, paper	
C8	CP-202-3	.002 mfd, 200 volt, paper	
C9	CP-502-2	.005 mfd, 400 volt, paper	
C10	CP-102-3	.001 mfd, 200 volt, paper	
C11	CM-101-1	.0001 mfd, 300 volt, mica	
C12, C13	CV-10	Variable condenser, 2 gang	
C14	CP-103-4	.01 mfd, 100 volt, paper	

**RESISTORS**

R1	RC-180-1	18 ohms,	1/2 watt 20%
R2	RC-682-5	6800 ohms,	1 watt 10%
R3	RP-2	2650 ohms,	10 watt 5%
R4	RC-471-1	470 ohms,	1/2 watt 20%
R5	RC-821-2	820 ohms,	1/2 watt 10%
R6	RC-274-2	270,000 ohms,	1/2 watt 10%
R7	RC-225-1	2.2 megohms,	1/2 watt 20%
R8	RC-105-1	1 megohm,	1/2 watt 20%
R9	RC-335-1	3.3 megohms,	1/2 watt 20%
R10	RC-106-1	10 megohms,	1/2 watt 20%
R11	VC-6	1 meg. vol. control with switch	
R12	RC-105-2	1 megohm,	1/2 watt 10%
R13	RC-153-1	15,000 ohms,	1/2 watt 20%
R14	RC-104-2	100,000 ohms,	1/2 watt 10%

*Ref. No. Part No. Description*

**COILS AND TRANSFORMERS**

LC-4	Oscillator coil
LF-22	IF transformer
LP-6	Loop antenna
TR-7	Output transformer

**MISCELLANEOUS**

S1, S2, S3	SW-10	Three Pole Single Throw Switch
	SP-41	4 inch P.M. speaker
	PN-6	Pointer
	CR-2	Drive cord
	SG-1	Spring for drive cord
	KN-20-6	Knob
	BK-20	Cabinet back (with hardware)
	CB-117	Assembled cabinet (without back and handle)
	HA-2	Handle for cabinet (with springs and pins)
	AS-1	Assembled battery box

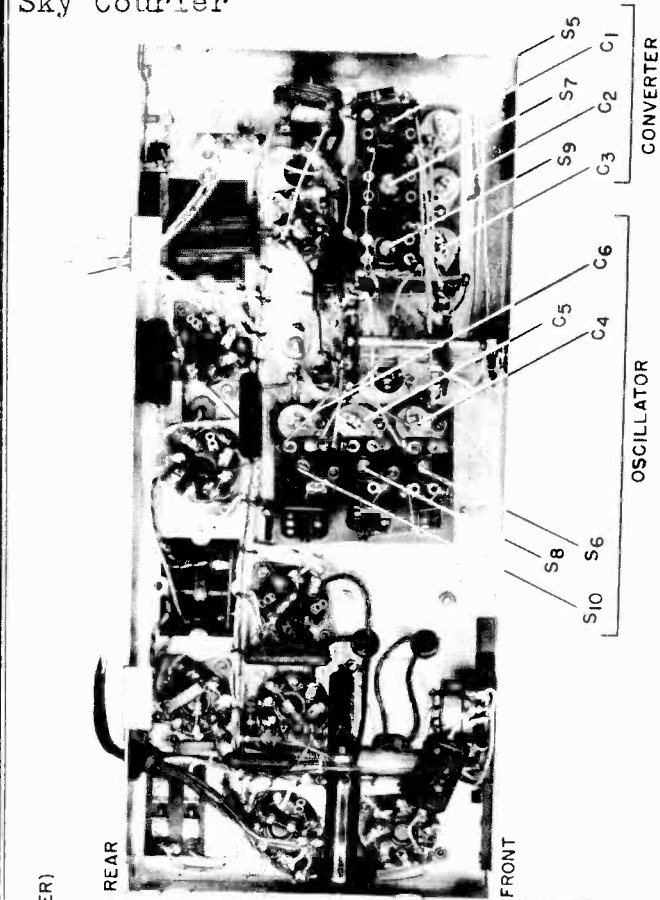




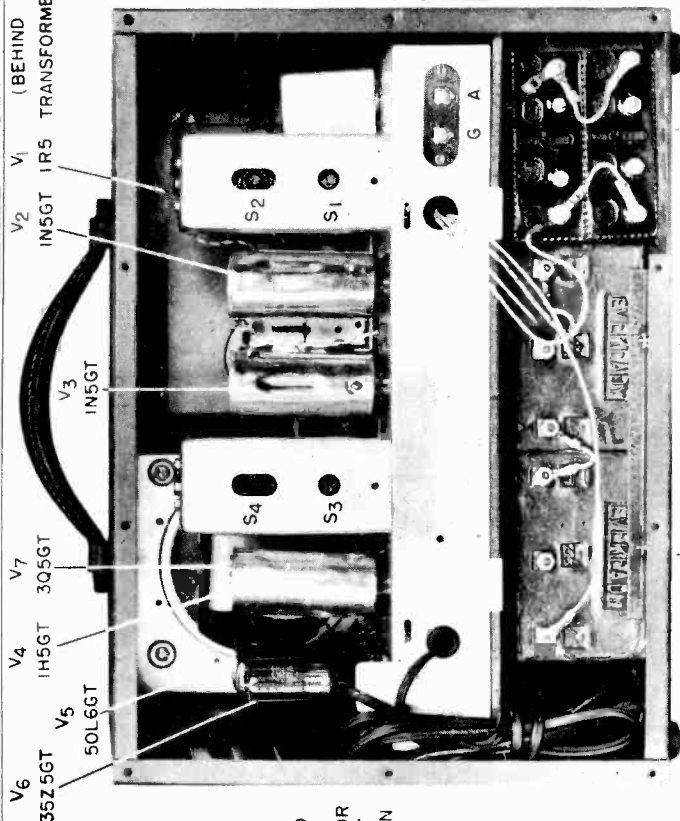


MODEL RE-1,  
Sky Courier

THE HALLICRAFTERS CO.



BOTTOM VIEW OF CHASSIS



LINE CORD  
PLUG IN  
SOCKET FOR  
BATTERY  
OPERATION

2-45 VOLT  
"B" BATTERIES  
CONNECTED  
IN SERIES

4-4 1/2 VOLT  
"A" BATTERIES  
CONNECTED IN  
SERIES PARALLEL

ALIGNMENT AND SERVICE

REAR VIEW—COVER REMOVED

EQUIPMENT REQUIRED -

- (1) Signal generator covering 455 KC. to 20 MC. and equipped to provide a 400 cycle modulated signal.
- (2) Non-metallic screw driver.
- (3) Output meter.
- (4) 0.1 mfd. condenser.
- (5) 100 mmfd. condenser.
- (6) 25 ohm non-inductive resistor.
- (7) 400 ohm non-inductive resistor.

THE HALLICRAFTERS CO.

MODEL RE-1,  
Sky Courier

I-F ALIGNMENT -

- (1) Connect the "hot" lead of the signal generator to the stator of the front section of the gang condenser through the 0.1 mfd. condenser. Connect the ground lead of the generator to the ground terminal on the antenna terminal strip.

CAUTION - Do not ground the chassis of the receiver directly, make all ground connections to the G terminal of the terminal strip.

- (2) Connect the output meter across the speaker terminals.
- (3) Turn on the receiver and set the VOLUME control at maximum volume.
- (4) Set the BAND SWITCH at BAND 2. and set the MAIN TUNING dial at approx. 7 MC.
- (5) Set the signal generator at 455 KC. and turn on the 400 cycle modulation.
- (6) Adjust i-f transformer slugs  $S_1$ ,  $S_2$ ,  $S_3$  and  $S_4$  for maximum output. Refer to the rear view of the receiver for location of the slug adjustments.

R-F ALIGNMENT -

- (1) Connect the "hot" lead of the signal generator to the antenna terminal through the dummy antenna specified in the chart. Leave the ground lead of the generator connected to the ground terminal of the antenna terminal strip.
- (2) Leave the output meter connected as for i-f alignment.
- (3) Set the VOLUME control for maximum volume.
- (4) Set the BAND SWITCH, MAIN TUNING dial, signal generator, trimmer condenser, and slug adjustments as follows:

SET BAND SWITCH	USE DUMMY ANT.	SET RECEIVER & SIGNAL GENERATOR	SET TRIMMER FOR MAX. OUTPUT	SET SLUG FOR MAX. OUTPUT
1	100 mmfd. condenser and 25 ohm resistor	1500 KC.	$C_1$ and $C_4$	-
1		600 KC.	-	$S_5$ and $S_6$
2		7 MC.	$C_2$ and $C_5$	-
2		3 MC.	-	$S_7$ and $S_8$
3	400 ohm resistor	18 MC.	$C_3$ and $C_6$	-
3		9 MC.	-	$S_9$ and $S_{10}$

NOTE: Refer to rear and bottom views of the receiver for location of adjustment screws.

MODEL RE-1, THE HALLICRAFTERS CO. Sky Courier

LIST OF REPLACEABLE PARTS (Cont'd.)

REF. SYMBOL	NAME OF PART AND DESCRIPTION	FUNCTION	MFG. CODE	CONTR.'S. PART NO.
C <sub>8</sub>	CAPACITOR, fixed, 1500 mfd., ± 10%, 500 V. D-C working, mica dielectric, humidity resistant	Padder for transformer T <sub>5</sub>	ASA	CM50E12K
C <sub>9</sub>	CAPACITOR, fixed, 3900 mfd., ± 10%, 500 V. D-C working, mica dielectric, humidity resistant	Padder for transformer T <sub>6</sub>	ASA	CM5E592K
C <sub>10A</sub>	CAPACITOR, 2 sections, ganged, section #1 (C <sub>10A</sub> ) min. cap. 39.7 mfd., max. cap. 353.4 mfd., air dielectric, section #2 (C <sub>10B</sub> ) min. cap. 33.9 mfd., max. cap. 353.3 mfd., air dielectric; bandspread plate for each section; three 6-32 NC-24/32" spade bolts mount assembly (2 on front frame 7/8" apart, 1 centered on rear frame 2-1/8" from front frame); a stamped sheet metal pulley 2-1/8" O.D. is fixed to the main gang and bandspread gang shafts.	Transformers T <sub>1</sub> , T <sub>2</sub> , T <sub>3</sub> main tuning	OM Special	48C125
C <sub>10B</sub>		Transformers T <sub>4</sub> , T <sub>5</sub> , T <sub>6</sub> main tuning		
C <sub>11A</sub>		Transformers T <sub>1</sub> , T <sub>2</sub> , T <sub>3</sub> bandspread tuning		
C <sub>11B</sub>		Transformers T <sub>4</sub> , T <sub>5</sub> , T <sub>6</sub> bandspread tuning		
C <sub>12</sub>		A-V-C by-pass		
C <sub>13</sub>	CAPACITOR, fixed, .01 mfd., ± 10% · 40%, 600 V. D-C working, paper dielectric, molded case. Same as C <sub>19</sub>	D-C voltage block between chassis and ground	MTC type 346	44ME003J
C <sub>14</sub>	CAPACITOR, fixed, 20 mfd., ± 20%, 500 V. D-C working, ceramic dielectric, 0.00075 mfd./mfd./degree Cent. temp. coeff.	Trimmer for transformer T <sub>3</sub> secondary	MTC type 342	44A0100J
C <sub>15</sub>	CAPACITOR, fixed, .001 mfd., ± 20% · 60%, 400 V. D-C working, paper dielectric, molded case. Same as C <sub>24</sub>	Coupling between oscillator inductance and plate circuit of tube V <sub>1</sub>	ASA	CM56602
C <sub>16</sub>	CAPACITOR, fixed, .25 mfd., ± 10% · 40%, 200 V. D-C working, paper dielectric, molded case	Filament by-pass for tube V <sub>1</sub>	MTC type 342	46AE224J
C <sub>17</sub>	CAPACITOR, fixed, .1 mfd., ± 10% · 40%, 400 V. D-C working, paper dielectric, molded case. Same as C <sub>25</sub>	Filament by-pass for tube V <sub>1</sub>	MTC type 342	46AF104J
C <sub>18</sub>	CAPACITOR, fixed, 47 mfd., ± 20%, 500 V. D-C working, mica dielectric, humidity resistant	Coupling between oscillator inductance and oscillator grid circuit of tube V <sub>1</sub>	ASA	CM20M470M
C <sub>19</sub>	CAPACITOR, same as C <sub>12</sub>	Plates circuit by-pass	SC Special	49A001
C <sub>20</sub>				
C <sub>21</sub>	CAPACITOR, fixed, .02 mfd., ± 10% · 40%, 200 V. D-C working, paper dielectric, molded case	Grid return by-pass for tube V <sub>2</sub>	MTC type 342	46AE003J
C <sub>22</sub>	CAPACITOR, fixed, 220 mfd., ± 20%, 500 V. D-C working, mica dielectric, humidity resistant. Same as C <sub>23</sub>	Coupling between tubes V <sub>2</sub> and V <sub>3</sub>	ASA	CM20A220M
C <sub>23</sub>	CAPACITOR, fixed, 100 mfd., ± 20%, 500 V. D-C working, mica dielectric, humidity resistant	Diode load r-f by-pass for tube V <sub>4</sub>	ASA	CM20A101M
C <sub>24</sub>	CAPACITOR, same as C <sub>15</sub>	A-F coupling between detector circuit and 1st audio amplifier section of tube V <sub>4</sub>		
C <sub>25</sub>	CAPACITOR, same as C <sub>17</sub>	Plate circuit decoupling for tube V <sub>4</sub>		

LIST OF REPLACEABLE PARTS.

REF. SYMBOL	NAME OF PART AND DESCRIPTION	FUNCTION	MFG. CODE	CONTR.'S. PART NO.
R <sub>1</sub>	RESISTOR, 100,000 ohm ± 20%, ½ watt, carbon, insulated, humidity resistant. Same as R <sub>12</sub>	Oscillator grid return for tube V <sub>1</sub>	ASA	RC10ME100M
R <sub>2</sub>	RESISTOR, 4,700 ohm ± 10%, ½ watt, carbon, insulated, humidity resistant	Decoupling for tube V <sub>1</sub>	ASA	RC10MA47K
R <sub>3</sub>	RESISTOR, 22,000 ohm ± 20%, ½ watt, carbon, insulated, humidity resistant	Plate load for tube V <sub>2</sub>	ASA	RC10ME22M
R <sub>4</sub>	RESISTOR, 470,000 ohm ± 10%, ½ watt, carbon, insulated, humidity resistant. Same as R <sub>11</sub> , R <sub>15</sub>	Grid return for tube V <sub>3</sub>	ASA	RC10MA47K
R <sub>5</sub>	RESISTOR, 2 megohm ± 20%, ½ watt, carbon, insulated, humidity resistant.	Grid return for tube V <sub>2</sub>	ASA	RC10ME20M
R <sub>6</sub>	RESISTOR, 10 megohm ± 20%, ½ watt, carbon, insulated, humidity resistant.	Grid return for tube V <sub>4</sub>	ASA	RC10ME10M
R <sub>7</sub>	RESISTOR, 3.3 megohm ± 20%, ½ watt, carbon, insulated, humidity resistant.	A-V-C decoupling	ASA	RC10ME33M
R <sub>8</sub>	RESISTOR, 47,000 ohm ± 20%, ½ watt, carbon, insulated, humidity resistant.	Diode load for tube V <sub>4</sub>	ASA	RC10MA47M
R <sub>9</sub>	RESISTOR, variable, 500,000 ohm ± 20%, bushing 3/8-32 x 1/4" long, shaft 5/8" long x 1/4" dia., includes DPDT toggle action switch on rear of control	VOLUME control	CT type 150	25A090
R <sub>10</sub>	RESISTOR, 10,000 ohm ± 20%, ½ watt, carbon, insulated, humidity resistant	Primary loading for transformer T <sub>1</sub>	ASA	RC10ME10K
R <sub>11</sub>	RESISTOR, same as R <sub>4</sub>	Plate load for tube V <sub>4</sub>		
R <sub>12</sub>	RESISTOR, same as R <sub>1</sub>	Decoupling for tube V <sub>4</sub>		
R <sub>13</sub>	RESISTOR, 2 sections, section #1 (R <sub>13</sub> ) 80 ohm ± 5%, 2.5 watts, wire wound; section #2 (R <sub>14</sub> ) 280 ohm ± 5%, 6.5 watts, wire wound; 3 solder lug terminals	Surge voltage stabilizing for tube V <sub>6</sub>	U type I-1300	24A54
R <sub>14</sub>		Filament voltage dropping for tubes V <sub>5</sub> and V <sub>6</sub>		
R <sub>15</sub>	RESISTOR, same as R <sub>4</sub>	Grid return for tubes V <sub>5</sub> and V <sub>6</sub>	ASA	RC10ME45K
R <sub>16</sub>	RESISTOR, 680 ohm ± 10%, ½ watt, carbon, insulated, humidity resistant	Filament voltage divider for battery operation	ASA	RC10ME68K
R <sub>17</sub>	RESISTOR, 270 ohm ± 10%, ½ watt, carbon, insulated, humidity resistant	Shunt for filament of tube V <sub>4</sub>	ASA	RC10ME27K
R <sub>18</sub>	RESISTOR, 47 ohm ± 10%, ½ watt, carbon, insulated, humidity resistant	Cathode bias for tube V <sub>5</sub>	ASA	RC21A47K
R <sub>19</sub>	RESISTOR, 330 ohm ± 10%, ½ watt, carbon, insulated, humidity resistant	Shunt for filament of tube V <sub>7</sub>	ASA	RC10ME33K
C <sub>1</sub>	CAPACITOR, adjustable, min. cap. 4 mfd., max. cap. 20 mfd., ceramic dielectric, solder lug terminals and tag.; same as C <sub>2</sub> , C <sub>3</sub> , C <sub>4</sub> , C <sub>5</sub> , C <sub>6</sub>	Trimmer for transformer T <sub>1</sub>	CEL type 820	44A118
C <sub>2</sub>	CAPACITOR, same as C <sub>1</sub>	Trimmer for transformer T <sub>2</sub>	ASA	CM20D391J
C <sub>3</sub>		Trimmer for transformer T <sub>3</sub>		
C <sub>4</sub>		Trimmer for transformer T <sub>4</sub>		
C <sub>5</sub>		Trimmer for transformer T <sub>5</sub>		
C <sub>6</sub>		Trimmer for transformer T <sub>6</sub>		
C <sub>7</sub>		Padder transformer T <sub>4</sub>		

THE HALLICRAFTERS CO.

MODEL RE-1,  
Sky Courier

LIST OF REPLACEABLE PARTS - (Cont'd.)

REF. SYMBOL	NAME OF PART AND DESCRIPTION	FUNCTION	MFG. CODE	CONTR.'S. PART NO.
C26	CAPACITOR, same as C22	Plate circuit r-f by-pass for tube V <sub>4</sub>	ASA	CN41B602
C27	CAPACITOR, fixed, .006 mfd., -20 + 6%, 600 V. D-C working, paper dielectric, humidity resistant. Same as C22	Coupling between tube V <sub>4</sub> and V <sub>5</sub>		
C28	CAPACITOR, same as C27	Plate circuit equalizer for tubes V <sub>5</sub> and V <sub>7</sub>		
C29	CAPACITOR, 3 section unit, 4 prong plug-in type dry electrolytic; section #1 (C <sub>29</sub> ) 40 mfd., -10 + 5%; 150 V. D-C working; section #2 (C <sub>3</sub> ) 40 mfd., -10 + 5%, 150 V. D-C working; section #3 (C <sub>29</sub> ) 100 mfd. #1 common to all sections	Filament circuit by-pass for battery operation Output filter capacitor for A-C/D-C operation Input filter capacitor for A-C/D-C operation	IC F-1	45A072
C30		Line filter for A-C/D-C operation		
C31	CAPACITOR, same as C <sub>13</sub>	Coupling between transformers T <sub>3</sub> and T <sub>6</sub> on band #3		
C32	Not used.			
C33	CAPACITOR, same as C <sub>20</sub>			
C34	TRANSFORMER, R-F, 3 unit assembly; unit #1 (T <sub>1</sub> ) 550-1600 KC., universal windings primary and secondary, Hallowax #2012 impregnation, variable iron core adjustment; unit #2 (T <sub>2</sub> ) 2.8 - 7.8 MC., universal winding primary, single layer winding secondary, Hallowax #2012 impregnation, variable iron core adjustment; unit #3 (T <sub>3</sub> ) 7.0 - 19.0 MC., single layer windings primary and secondary, Hallowax #2012 impregnation, variable iron core adjustment; assembly mounted on a bakelite board 3" long x 1-3/4" wide x 1/16" thick with 2 mtg. holes 1" apart centered on the board. Coils wound on bakelite form 1" long x 3/4" O.D.			
T <sub>1</sub>		Coupling between antenna and tube V <sub>1</sub> on band #1		
T <sub>2</sub>		Coupling between antenna and tube V <sub>1</sub> on band #2		
T <sub>3</sub>		Coupling between antenna and tube V <sub>1</sub> on band #3		
T <sub>4</sub>	TRANSFORMER, R-F, 3 unit assembly; unit #1 (T <sub>4</sub> ) 550-1600 KC., universal windings primary and secondary, Hallowax #2012 impregnation, variable iron core adjustment unit #2 (T <sub>4</sub> ) 2.8 - 7.8 MC., single layer windings, Hallowax #2012 impregnation, variable iron core adjustment; unit #3 (T <sub>4</sub> ) 7.0 - 19.0 MC., single layer interwoven primary and secondary, Hallowax #2012 impregnation, variable iron core adjustment; assembly mounted on a bakelite board 3" long x 2-3/8" wide x 1-1/16" thick with 2 mtg. holes 1" apart centered on the board; coils wound on bakelite form 1" long x 3/4" O.D.	Oscillator inductances for band #1 Oscillator inductances for band #2 Oscillator inductances for band #3		51C661
T <sub>5</sub>				
T <sub>6</sub>				
T <sub>7</sub>	TRANSFORMER, I-F, 455 KC., fixed trimmer capacitors, variable iron core tuning, shielded assembly	Coupling between tubes V <sub>1</sub> and V <sub>2</sub>	CU type 30-5225-2	50B152
T <sub>8</sub>	TRANSFORMER, I-F, 455 KC., fixed trimmer capacitors, variable iron core tuning, shielded assembly	Coupling between tubes V <sub>3</sub> and V <sub>4</sub>	CU type 30-5224-2	50B153
T <sub>9</sub>	TRANSFORMER, A-F; primary to match a 8000 ohm 306GT tube plate load, tapped to match a 2500 ohm 5026GT tube plate load; secondary to match 2:3 ohm voice coil. Metal case covered with corite wax except on mounting surface; two single hole mtg. feet with 1-3/4" mtg. centers.	Coupling between tube V <sub>5</sub> or V <sub>7</sub> and speaker	CU type Special	53A064

LIST OF REPLACEABLE PARTS - (Cont'd.)

REF. SYMBOL	NAME OF PART AND DESCRIPTION	FUNCTION	MFG. CODE	CONTR.'S. PART NO.
CH <sub>1</sub>	CHOKE, filter, 2500 turns of #35 wire wound on a 3/4" x 1/2" metal core, rated at 50 milliamperes, entire unit dipped in black corite wax except for mtg. surface; two single hole mtg. feet with 2-1/16" mtg. centers.	Plate circuit r-f by-pass for tube V <sub>4</sub>		
CH <sub>2</sub>	CHOKE, R-F, 37 turns of #22 SCE universal windings, air core, inductance 46 microhenries	Filament circuit by-pass for battery operation Output filter capacitor for A-C/D-C operation Input filter capacitor for A-C/D-C operation		
SW <sub>1A</sub>	SWITCH, 2 section, 3 positions, bakelite wafers, mounted by a 3/8" x 3/8" bushing 1/2" long, shaft 7/8" long	Converter stage transformer Primary selector		
SW <sub>1B</sub>		Converter stage transformer Secondary selector		
SW <sub>1C</sub>		Oscillator stage transformer Primary selector		
SW <sub>1D</sub>		Oscillator stage transformer Secondary selector		
SW <sub>2A</sub>	SWITCH, DPST, located on the rear or resistor R <sub>9</sub>	A-C/D-C line switch		
SW <sub>2B</sub>		Battery power supply switch		
T <sub>1</sub>	TERMINAL STRIP, two terminals brass solder lugs with 6-32 x 3/8" binding head metal screws, mounted with centers 3/4" apart on a XF brown bakelite strip 2" long x 1 1/16" wide x 1/16" thick, 2 mtg. holes with centers 1-1/16" apart; marked "A" and "B"	Antenna and ground connections		88A143
L <sub>1</sub>	SPEAKER; 5 inch semi moisture proof cone; 4.25 ounce field P.M.; 3.8 ohm voice coil; 8" long insulated leads soldered to speaker terminals at one end and a cinch plug (type #2724) at other end; includes a special mtg. plate 4-5/8" x 1-1/4" with three 7/16" dia. mtg. holes; mtg. centers 4" x 3-1/16" x 4-1/2"	Loudspeaker		85C084
V <sub>1</sub>	TUBE, pentagrid converter, type 1R5	Oscillator and converter		90J1B5
V <sub>2</sub>	TUBE, r-f amplifier pentode, type 1B6GT/G	1st I-F amplifier		90J1B6GT/G
V <sub>3</sub>	TUBE, same as V <sub>2</sub>	2nd I-F amplifier		90J1B6GT/G
V <sub>4</sub>	TUBE, diode high-mu triode, type 1B6GT/G	Detector and 1st audio amplifier		90J1B6GT/G
V <sub>5</sub>	TUBE, beam power amplifier, type 50L6GT	Audio power amplifier for A-C/D-C operation		90J50L6GT
V <sub>6</sub>	TUBE, half-wave high-vacuum rectifier, type 30Z6GT/G	Rectifier for A-C/D-C operation		90J30Z6GT/G
V <sub>7</sub>	TUBE, beam power amplifier, type 30G7/G	Audio power amplifier for battery operation		90J30G7/G

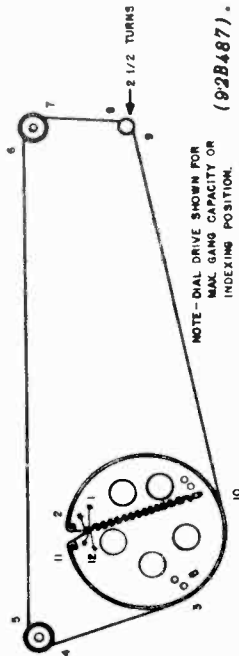




**RESTRINGING DIAL CORD**

To restring the general coverage dial cord, cut a 48-inch length of 30 lb. test dial cord and tie one end to the tension spring of the general coverage tuning capacitor drive pulley at position "1" on the diagram. Follow the sequence "1" through "12" and at position "12" stretch the tension spring and tie the cord securely.

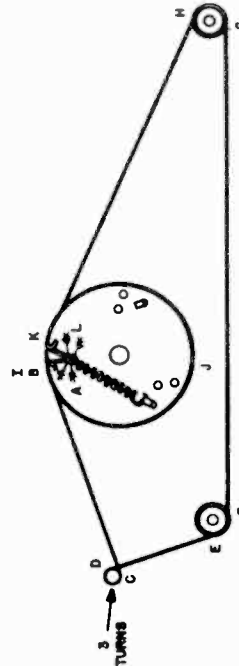
Set the general coverage tuning condenser at maximum capacity and attach and set the pointer in line with the left hand index marker.



*Dial cable stringing procedure, general coverage dial.*

To restring the band spread dial cord, cut a 36-inch length of 30 lb. test dial cord and follow the procedure as above, starting at position "A" ending at "L".

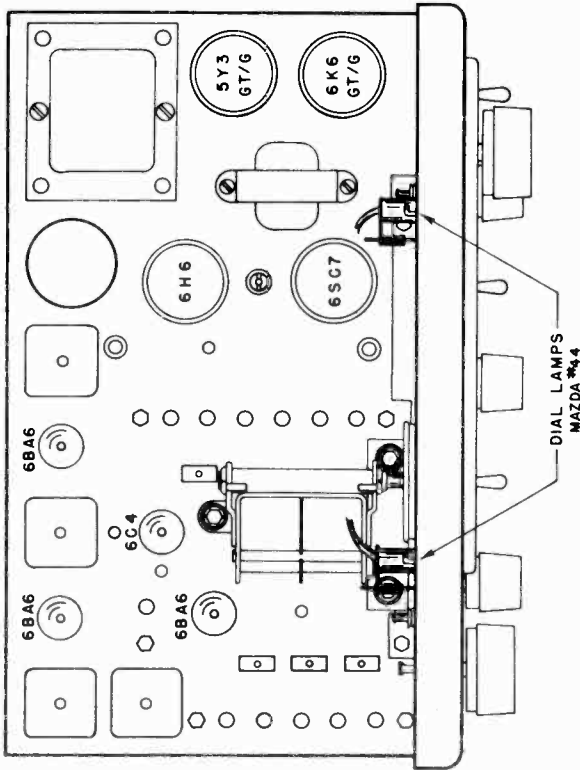
Set the bandspread condenser at minimum capacity and attach and set the pointer at "100" on the logging scale.



*Dial cable stringing procedure, band spread dial.*

**REPLACING LAMPS**

Refer to Fig. for the location of the two dial lamps used in the receiver. To gain access to defective lamps, reach in through cabinet cover and unclip the dial lamp sockets. The sockets may then be brought out into the open to change the defective lamp. Replace lamps with 6-8 V. Mazda #44, (Blue bead) lamps or equivalent.



*Top view, location of tubes and dial lamps.*

**ALIGNMENT PROCEDURE**

Set the following controls before alignment.

- STANBY/RECEIVE . . . . . Set at RECEIVE
- CW/AM . . . . . Set at AM (see step 2)
- SENSITIVITY . . . . . Set at maximum
- NOISE LIMITER . . . . . Set at OFF
- VOLUME . . . . . Set at maximum
- TONE switch. . . . . Set at HIGH
- BANDSPREAD . . . . . Set at 100
- SPEAKER/PHONES switch . . . . . Set at SPEAKER

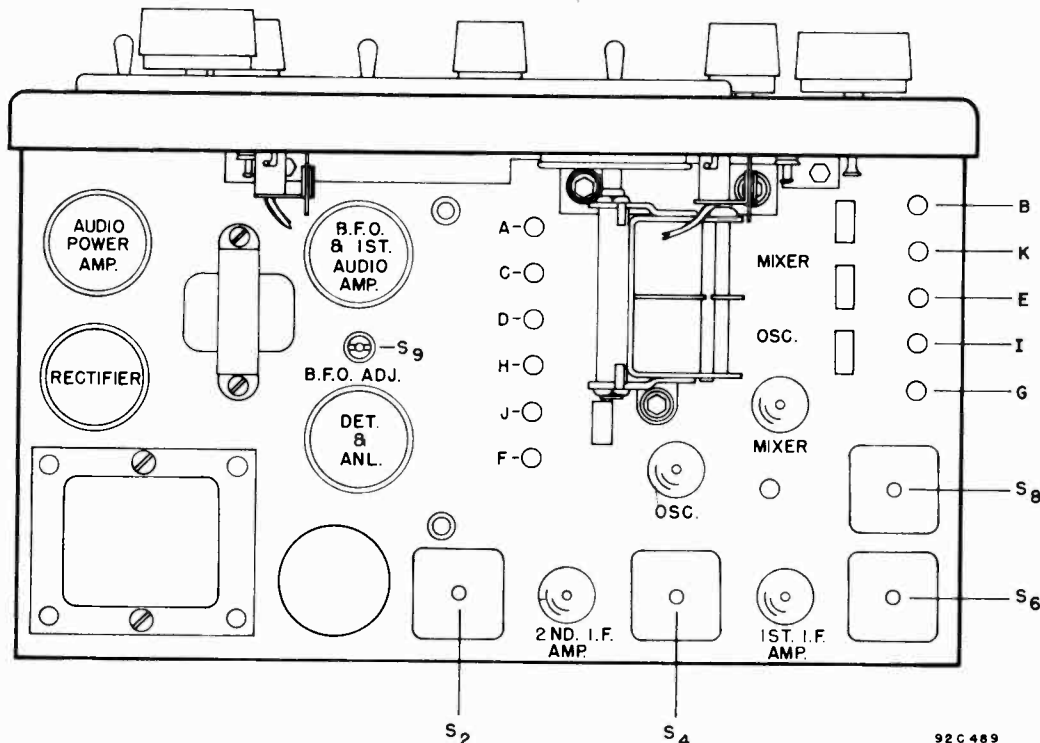
Remove the receiver chassis from the cabinet to make alignment adjustments. The chassis is held in the cabinet by three screws along both the bottom edge of the front panel and the rear of the cabinet, and two screws on either side of the front panel.

Before starting the alignment procedure, index the general coverage dial pointer on the low frequency end of the range and index the bandspread dial pointer at 100. The general coverage condenser should index at maximum capacity and the bandspread condenser should index at minimum capacity.

**ALIGNMENT CHART**

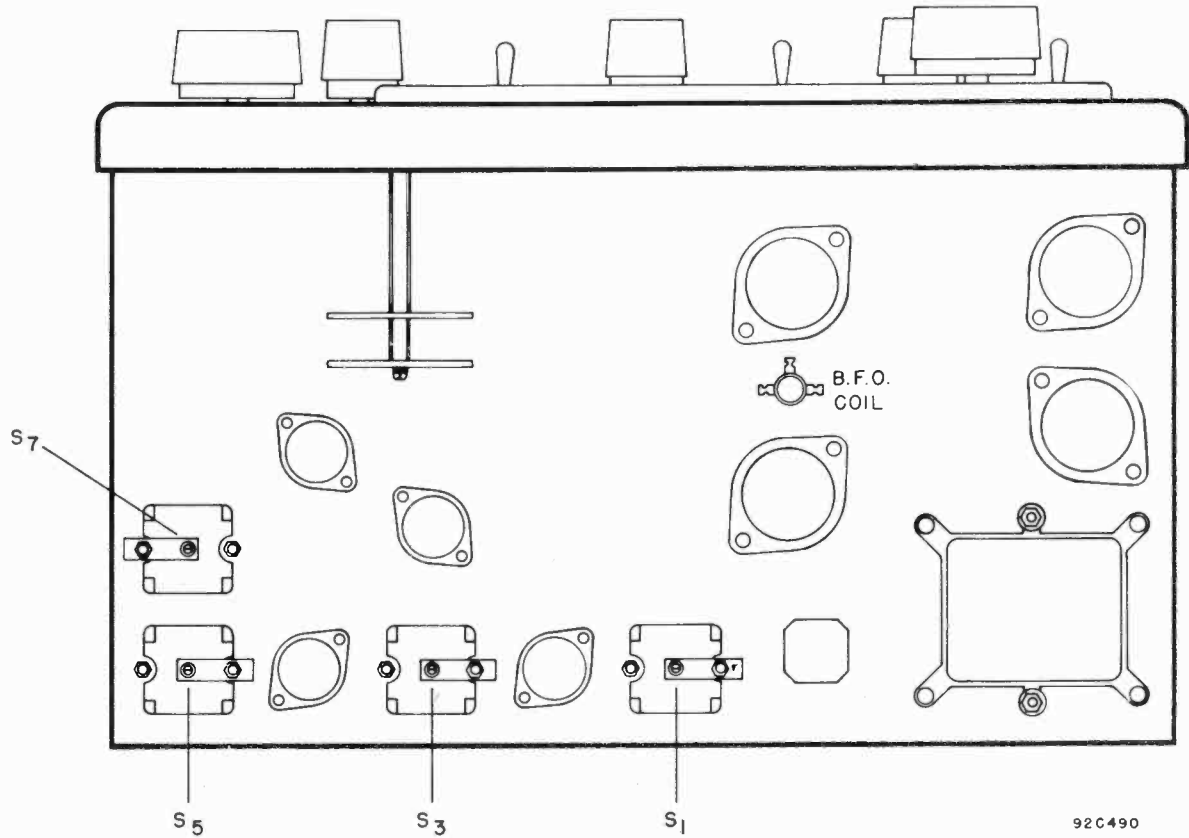
Step	Dummy Antenna	Signal Generator Coupling	Signal Generator Frequency	Band Selector Setting	Receiver Dial Setting	Adjust	Remarks
1	0.1 mfd. capacitor	High side to front stator section of tuning cap. Low side to chassis.	2.075 mc	A	Tuning cap. fully open	S1,S2,S3,S4,S5, S6,S7,S8	Adjust for maximum audio output at speaker voice coil. Use just enough signal generator output to obtain a 50 mw audio level.
2	See step 1.	See step 1.	2.075 mc	A	See step 1.	S9	With the CW/AM switch set at CW, adjust S-9 for zero beat.
3	300 ohm carbon resistor	High side to "A1" on antenna strip. Jumper connected between "A2" and "G"	1500 kc 600 kc	A	1500 kc 600 kc	*A,B *F	Adjust for maximum output as in step 1.
4	See step 3.	See step 3.	6 mc	B	6 mc	*D,E	Adjust for maximum output as in step 1.
5	See step 3.	See step 3.	15 mc	C	15 mc	*F,G	Adjust for maximum output as in step 1.
6	See step 3.	See step 3.	30 mc	D	30 mc	*H,I	Adjust for maximum output as in step 1.
7	See step 3.	See step 3.	52 mc	E	52 mc	*J,K	Adjust for maximum output as in step 1.

\*Note - Calibration adjustments.

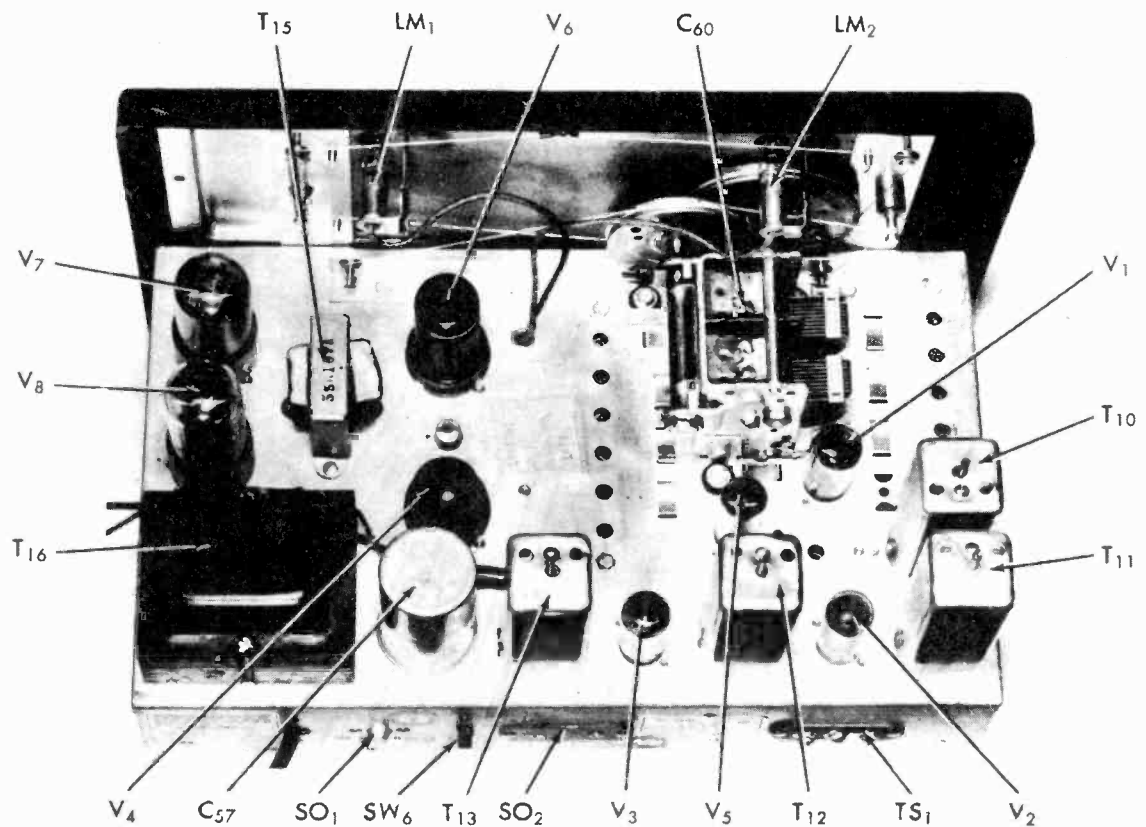


92C489

Alignment points, top view.

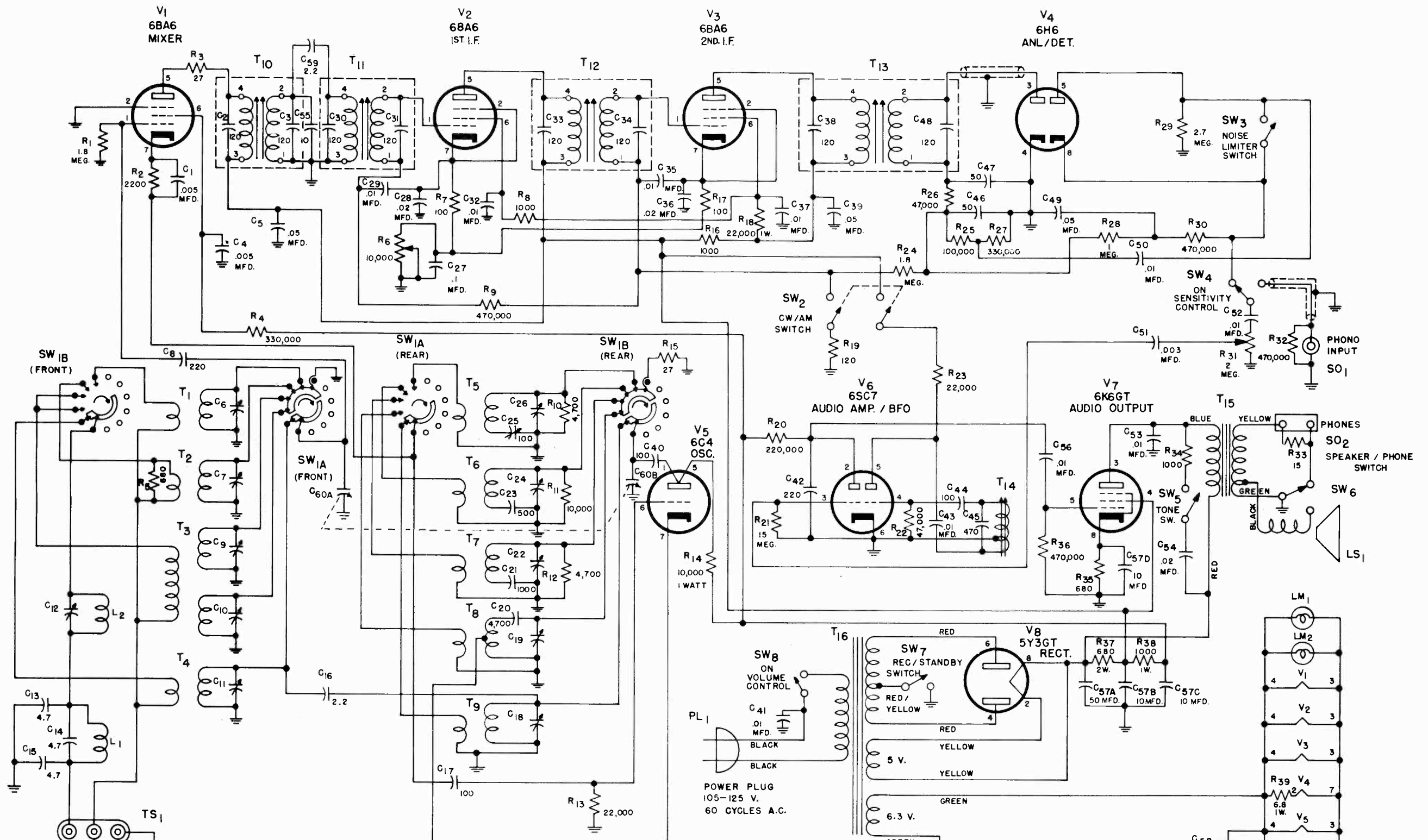


Alignment points, bottom view.



Component location, top view.





**BAND SELECTOR SWITCH SW. 1**

POSITION	RANGE
A	540-1650 KC.
B	2.5-6.6 MC.
C	6-11 MC.
D	13.5-32 MC.
E	47-55 MC.

NOTE: SWITCH SHOWN IN POSITION E.

RESISTOR VALUES ARE IN OHMS.  
CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.

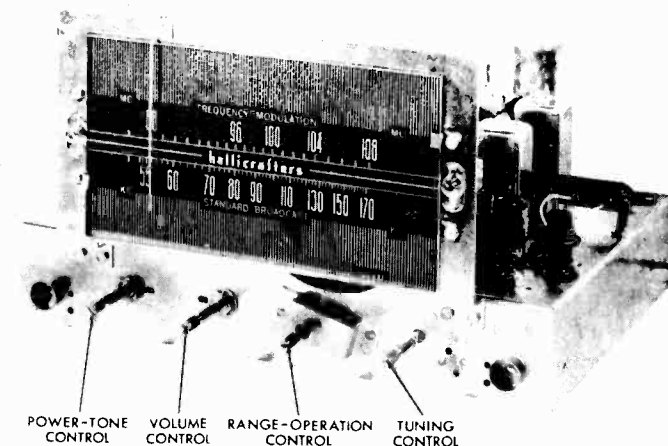
LAST RESISTOR SYMBOL — R-39  
LAST CAPACITOR SYMBOL — C-60

Intermediate Frequency . . . 2.075 kc  
Power Supply. . . . . 105-125 V. 60 cycles AC  
Power Consumption. . . . . 50 watts



**SERVICE PARTS LIST**

Ref. No.	Description	Hallicrafters Part Number	Ref. No.	Description	Hallicrafters Part Number
<b>CONDENSERS</b>					
C-1,4,58	.005 mfd. 450 V., ceramic	47A168	T-6	Transformer, oscillator stage, band B	51B1032
C-5,39,49	.05 mfd. 400 V., tubular	46AW503J	T-7	Transformer, oscillator stage, band C	51B1033
C-6,7,9,10,11	Trimmer assembly, 5 section antenna stage	44B355	T-8	Transformer, oscillator stage, band D	51B1034
C-8,42	220 mmf. 500 V., mica	CM20A221K	T-9	Transformer, oscillator stage, band E	51B1035
C-12	Trimmer adjustable, wave trap	44A356	T-10,11,12,13	Transformer, IF amp. and detector stages	50B369
C-13,14,15	4.7 mmf. 500 V., bakelite	47A160-6	T-14	Transformer, BFO	54B038
C-16,59	2.2 mmf. 500 V., bakelite	47A160-4	T-15	Transformer, audio output	55B107
C-17,40,44	100 mmf. 500 V., ceramic	47A086	T-16	Transformer, power	52C164
C-18,19,22,24,25,26	Trimmer assembly, 6 sections, oscillator stage	44B354	L-1	Coil, low pass filter	53A135
C-20	4700 mmf. 500 V., mica	CM35A472K	L-2	Coil, wave trap, antenna section	51B1036
C-21	1,000 mmf. 2% 500 V., silver mica	CM20C102G	<b>SWITCHES</b>		
C-23	500 mmf. 2% 500 V., silver mica	CM20C501G	SW-1	Band switch assembly	60B323
C-27	.1 mfd. 200 V., tubular	46AU104J	SW-2	Switch, toggle, DPST, CW/AM control	60A285
C-28,36,54	.02 mfd. 600 V., tubular	46AY203J	SW-3,5,7	Switch, toggle, SPST, STANBY/REC., NOISE LIMITER & TONE control	60A138
C-29,32,35,37,43,50,52,53,56	.01 mfd. 600 V., tubular	46AZ103J	SW-4	Switch, part of SENSITIVITY control, R-6	
C-41	.01 mfd. 400 V., molded paper	46AB103J	SW-6	Switch, slide, SPDT, SPEAKER/PHONE control	60A243
C-45	470 mmf. 500 V., mica	CM20A471J	SW-8	Switch, part of VOLUME control R-31	
C-46,47	50 mmf. 500 V., ceramic	47A091	<b>PLUGS AND SOCKETS</b>		
C-51	.003 mfd. 600 V., tubular	46AZ302J	PL-1	Line cord and plug	87A078
C-55	10 mmf. 500 V., mica	CC20UK100K	SO-1	Receptacle, phono motor	36A029
C-57	50-10-10 mfd. 350-100-25V., electrolytic	45B122	SO-2	Receptacle, headphone jack	88A071
C-59	Tuning condenser, 2 section	48C198		Socket, octal (tube)	6A269
<b>RESISTORS</b>					
R-1,24	1.8 megohms 1/2 watt, carbon	RC20AE185M		Socket, miniature (tube)	6A297
R-2	2200 ohms 1/2 watt, carbon	RC20AE222M		Socket, dial light	86B063
R-3,15	27 ohms 1/2 watt, carbon	RC20AE270M	<b>TUBES, RECTIFIERS AND LAMPS</b>		
R-4,27	330,000 ohms 1/2 watt, carbon	RC20AE334K	V-1,2,3	6BA6, mixer, 1st & 2nd IF amplifier	90X6BA6
R-5,35	680 ohms 1/2 watt, carbon	RC20AE681K	V-4	6H6, detector & ANL	90X6H6
R-6	10,000 ohms, variable, SENSITIVITY control	25B603	V-5	6C4, oscillator	90X6C4
R-7,17	100 ohms 1/2 watt, carbon	RC20AE101K	V-6	6SC7, audio amplifier & BFO	90X6SC7
R-8,16,34	1000 ohms 1/2 watt, carbon	RC20AE102M	V-7	6K6GT, power amplifier	90X6K6GT
R-9,30,32,36	470,000 ohms 1/2 watt, carbon	RC20AE474M	V-8	5Y3GT, rectifier	90X5Y3GT
R-10,12	4700 ohms 1/2 watt, carbon	RC20AE472K	LM-1,2	Lamp, 6-8 V., 250 ma., Mazda #44	39A003
R-11	10,000 ohms 1/2 watt, carbon	RC20AE103K	<b>MISCELLANEOUS</b>		
R-13,23	22,000 ohms 1/2 watt, carbon	RC20AE223M	TS-1	Terminal strip, antenna	88A032
R-14	10,000 ohms 1 watt, carbon	RC30AE103K		Lock, line cord	76A299
R-18	22,000 ohms 1 watt, carbon	RC30AE223M		Clip, coil mtg.	76A325
R-19	120 ohms 1/2 watt, carbon	RC20AE121M		Shaft, tuning drive	74A248
R-20	220,000 ohms 1/2 watt, carbon	RC20AE224K		"C" washer (tuning drive shaft)	4A139
R-21	15 megohms 1/2 watt, carbon	RC20AE156K		Spring, dial cord	75A012
R-22,26	47,000 ohms 1/2 watt, carbon	RC20AE473M		Dial cord	38A019
R-25	100,000 ohms 1/2 watt, carbon	RC20AE104K		Plate, dial	63C333
R-28	1 megohm 1/2 watt, carbon	RC20AE105M		Pointer, general coverage dial	82A149
R-29	2.7 megohms 1/2 watt, carbon	RC20AE275M		Pointer, band spread dial	82A148
R-31	2 megohms, variable, VOLUME control	25B602		Dial glass (calibrated)	22C204
R-33	15 ohms 1/2 watt, carbon	RC20AE150M		Gasket, dial glass	12A042
R-37	680 ohms 2 watts, carbon	RC40AE681M		Clip, dial glass mtg.	76A390
R-38	1000 ohms 1 watt, carbon	RC30AE102M		Pad, dial clip	16A126
R-39	6.8 ohms 1 watt, carbon	RC30AE068K		Pad, felt (round disc)	14A166
<b>TRANSFORMERS AND COILS</b>					
T-1	Transformer, antenna stage, band A	51B1028		Pad, sponge rubber	16A047-1
T-2	Transformer, antenna stage, band B	51B1027		Mounting feet, rubber	16A007
T-3	Transformer, antenna stage, bands C & D	51B1026		Speaker, P.M.	85C030
T-4	Transformer, antenna stage, band E	51B1030		Knob, BAND SELECTOR, SENSITIVITY, and VOLUME controls	15A049
T-5	Transformer, oscillator stage, band A	51B1031		Knob, BAND SPREAD and general coverage controls	15A047



92X421

**RESTRINGING DIAL CORD**

Restring the dial drive with 30 lb test dial cord. Tie one end to the tension spring and follow the sequence outlined in Fig. 1. Stretch the tension spring and tie the end of the cord securely to the spring as shown.

Set the tuning condenser at maximum capacity (closed), attach the pointer to the string and line it up with the left hand index mark on the dial scale.

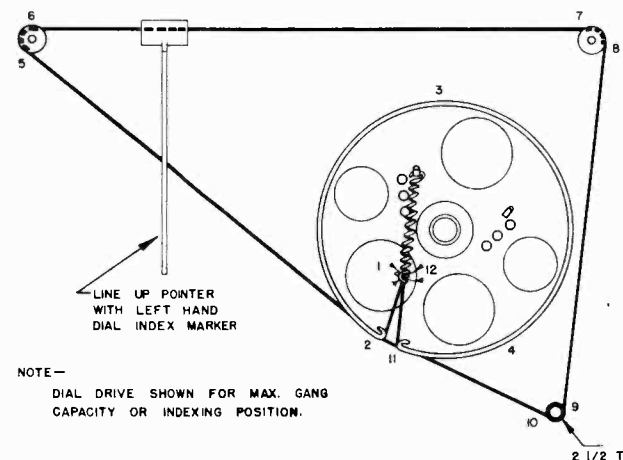


Fig. 1. Dial cable stringing procedure. (92B382)

**REPLACING LAMPS**

Refer to Fig. 7 for the location of two dial lamps used in the receiver. To gain access to defective lamps, reach in through the cabinet cover and unclip the dial lamp socket by compressing the side springs. The socket may then be brought out into the open to change the defective lamp. Replace all lamps with 6-8 V. Mazda #44 (Blue bead) lamps or equivalent.

**ALIGNMENT PROCEDURE**

The receiver is equipped with AUTOMATIC FREQUENCY CONTROL on the FM band to compensate for oscillator drift and improve the tuning function on the FM band. The correction factor is approximately 5 times: AFC takes hold 250 kc before the station frequency is reached and releases before tuning 500 kc beyond the station frequency when receiving a 1000 micro-volt signal.

The standard RMA dummy specified in the alignment chart consist of a 200 mmf condenser in series with a 20 uh r-f choke which is shunted by a 400 mmf condenser in series with a 400 ohm carbon resistor.

When making the alignment adjustments set the tone control at NORMAL and the volume control at maximum volume. Use just enough signal generator output to obtain the results indicated on the chart.

**ALIGNMENT CHART:**

Step	Dummy Antenna	Signal Generator Coupling	Signal Generator Frequency	Band Switch Pos.	Radio Dial Setting	Adjust	Remarks
1	0.01 mfd. cap.	To high cap. stator of center section.	455 kc	"BC"	1000 kc	A,B,C, D,E	Adjust for max. audio output. Keep audio output below 500 MW to avoid AVC action.
2	0.01 mfd. cap. in series with a 4700 ohm carbon resistor.	To low cap. stator of center section.	10.7 mc	"FM"	90 mc	F,G,H, I,J,K	Adjust for max. voltage as measured between pin #3 of 6H6 and ground with an electronic volt meter. Adjust signal generator output for approx. 2 volts DC at this point.
3	0.01 mfd. cap.	See step 2.	10.7 mc	"FM"	90 mc	L	Adjust for zero voltage as measured between the junction of R27 and R28 and ground with an electronic volt meter.
4	Std RMA dummy	To terminals "A" and "G" on terminal strip TS-2.	1500 kc	"BC"	1500 kc	*M,N,O	Adjust for max. output as in step 1.
5	Two 150 ohm carbon resistors	To terminals "D-D" on terminal strip TS-1.	105 mc	"FM"	105 mc	*P,Q	Adjust for max. voltage as measured across R24 with an electronic volt meter. Adjust signal generator output for approx. 1 volt DC at this point.

\*Note - Calibration adjustments.

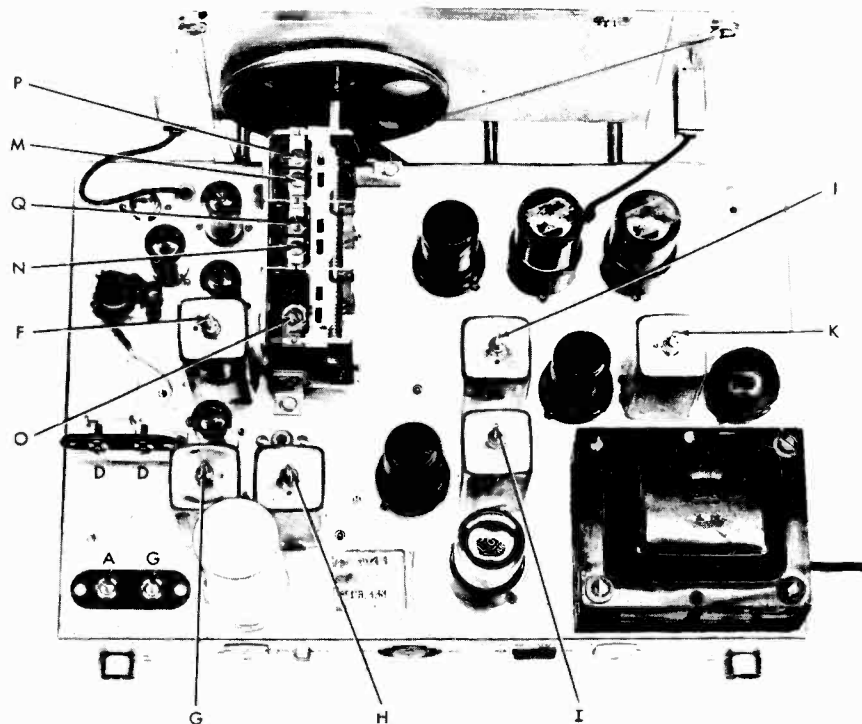


Fig. 2. Alignment adjustments, top view.

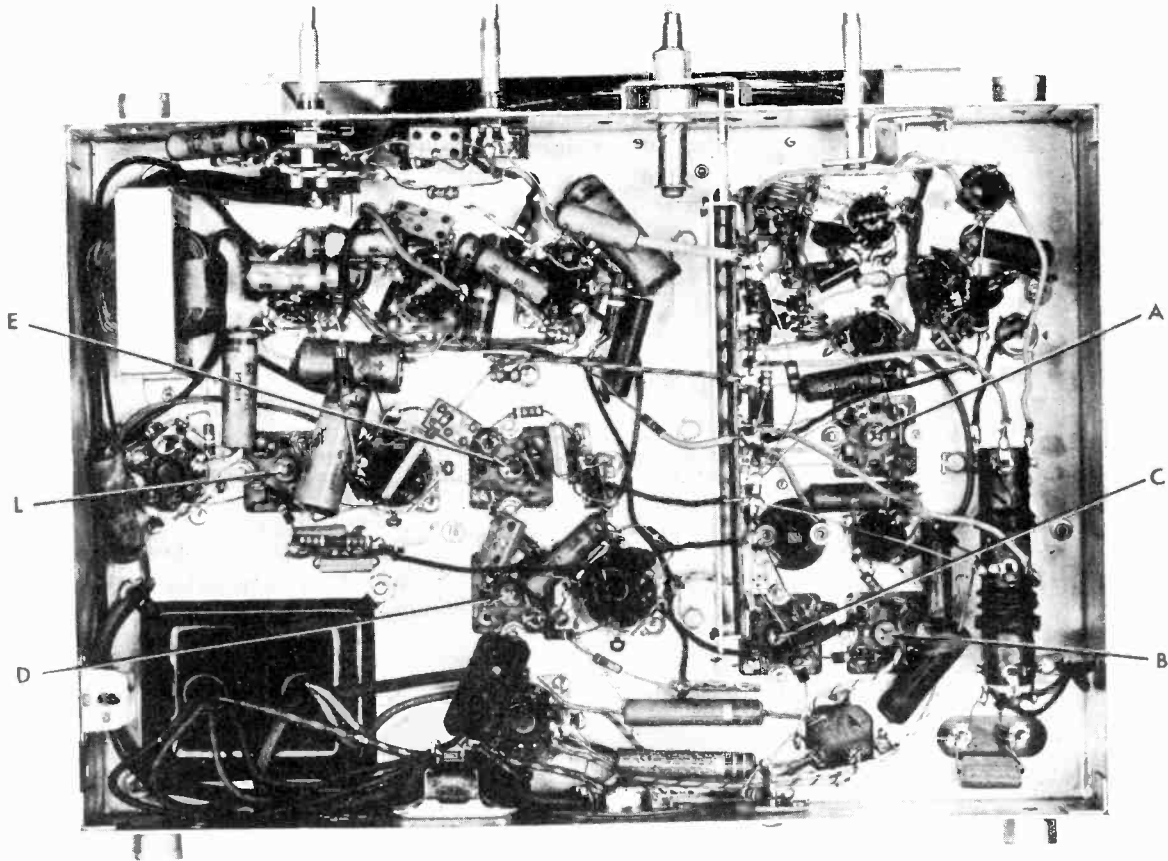


Fig. 3. Alignment adjustments, bottom view.

(92X410)

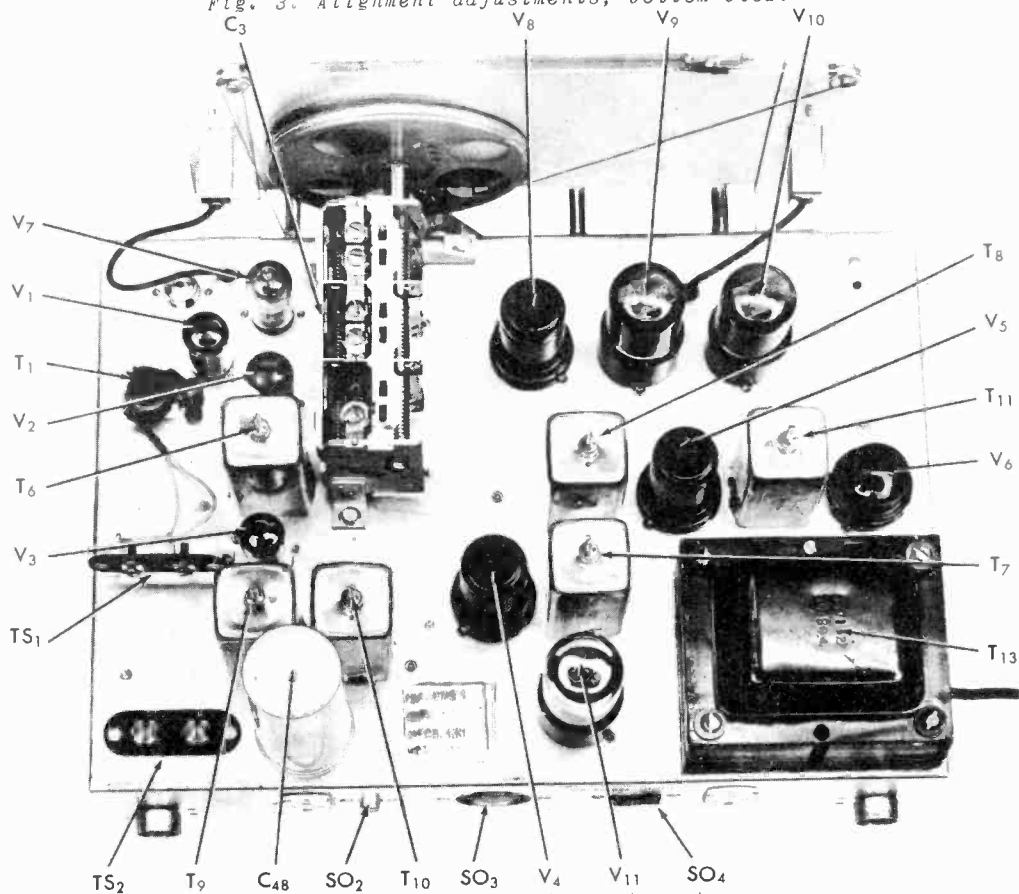


Fig. 4. Component location, top view.



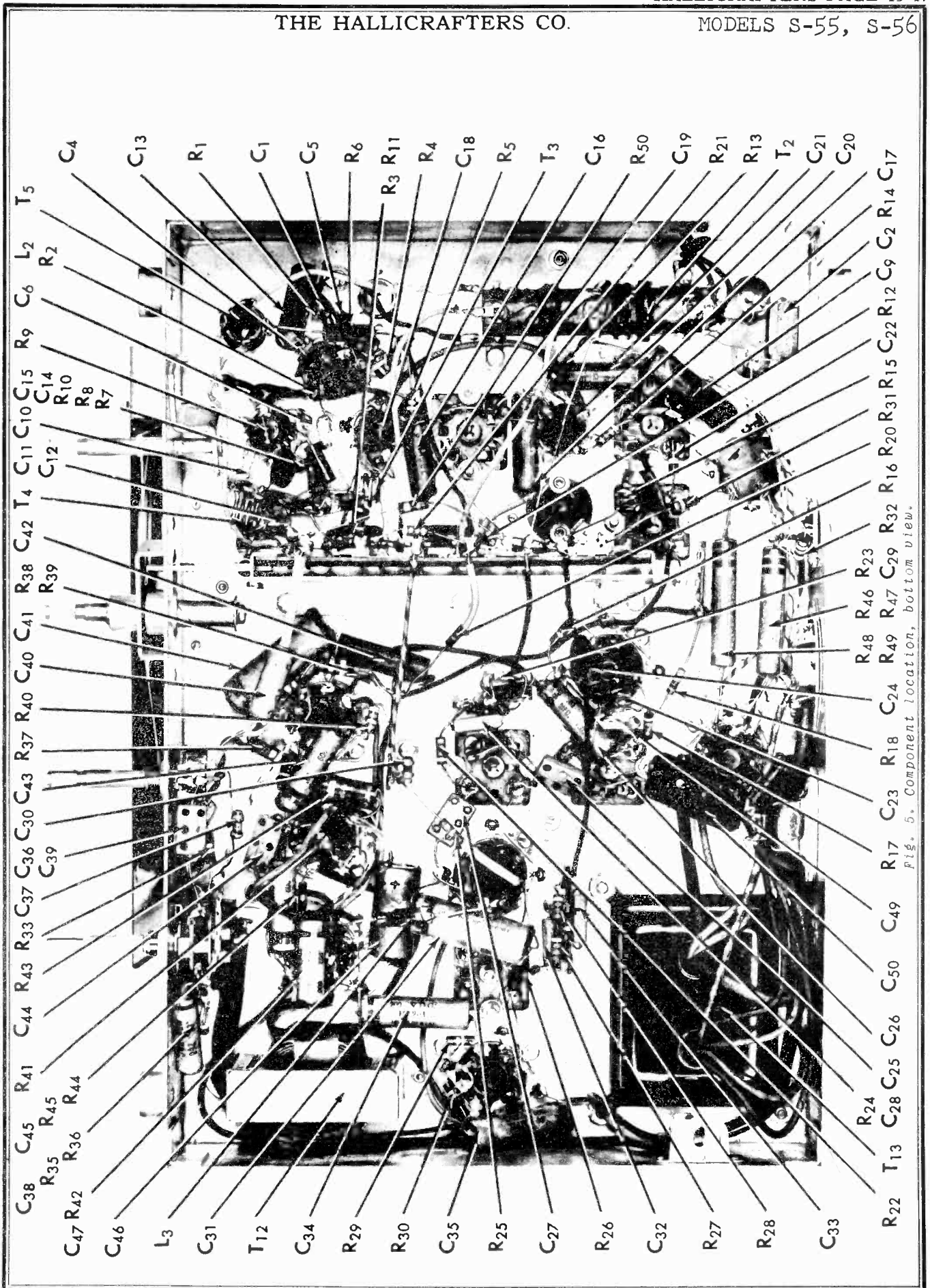
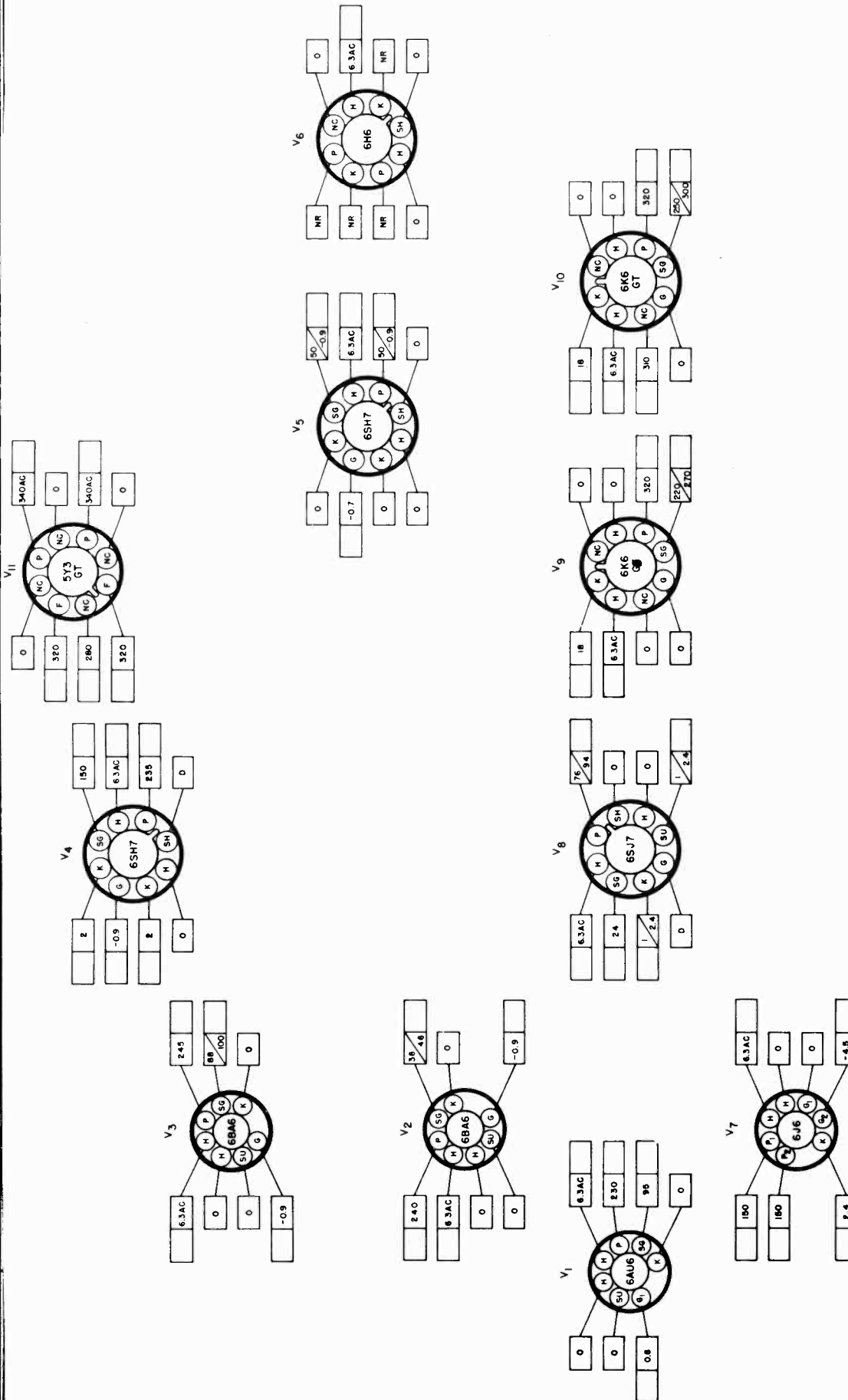


Fig. 5. Component location, bottom view.

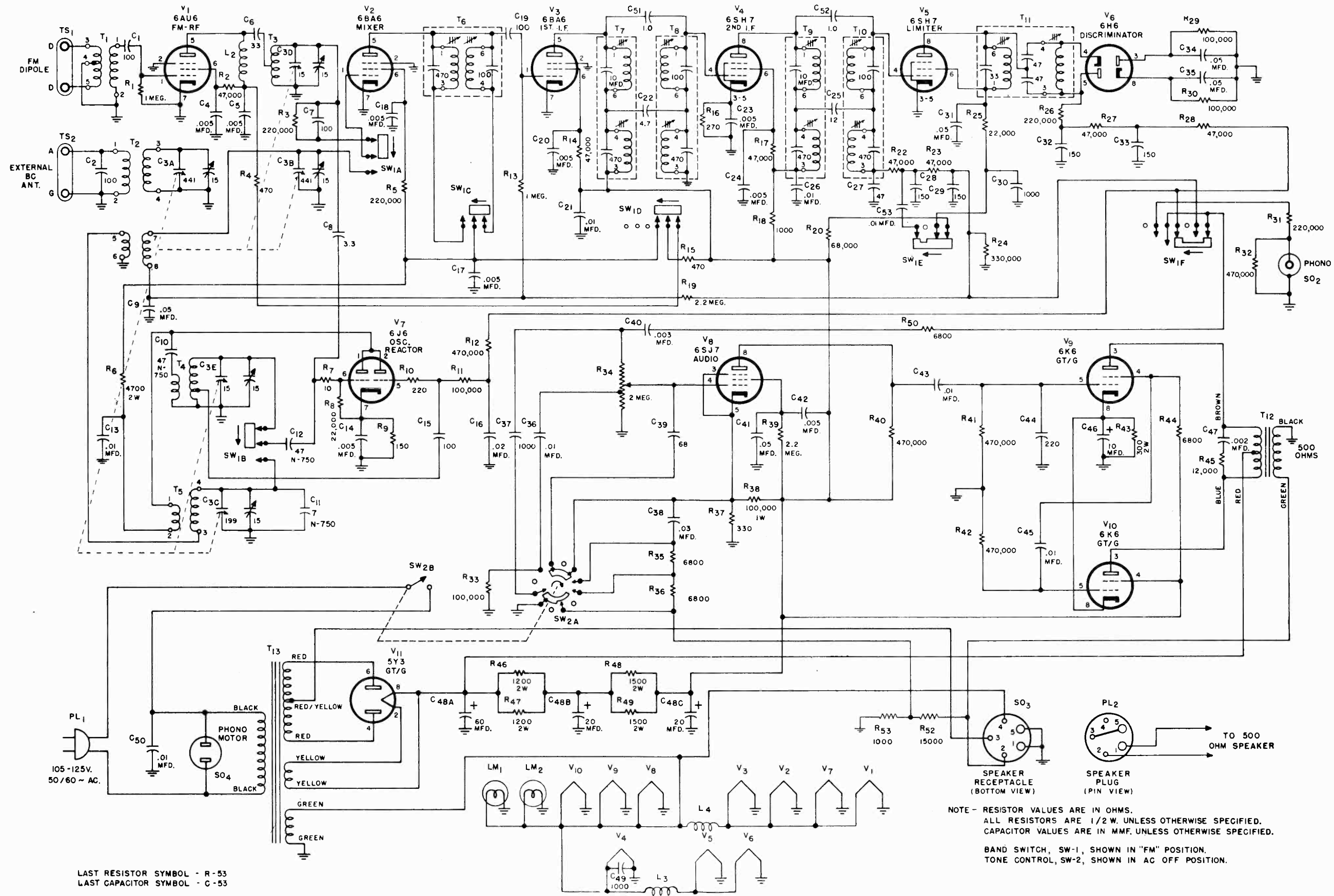


FRONT APRON

NOTES -

1. SOCKET VIEWS ARE BOTTOM VIEWS
2. VOLTAGES SHOWN BETWEEN TUBE SOCKET TERMINALS AND CHASSIS.
3. LINE VOLTAGE - 117 V. AC.
4. ALL VOLTAGES SHOWN WERE MEASURED WITH A 20,000 OHM/VOLTMETER AND AT ZERO SIGNAL.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE SPECIFIED.
6. MIC-RO CONNECTIONS.
7. FULL IN THE ACTUAL READING ARE PROVIDED FOR THE SERVICEMAN.
8. A NORMAL OPERATING RADIO SHOULD BE USED FOR THESE MEASUREMENTS.
9. WHERE TUBE SOCKET VOLTAGES CHANGE FROM FM TO AM RECEPTION TWO READINGS ARE SHOWN, UPPER LEFT SHOWS FM READINGS - LOWER RIGHT SHOWS AM READINGS.
9. NOT READABLE.

Fig. 6. Tube socket voltage chart.



LAST RESISTOR SYMBOL - R-53  
 LAST CAPACITOR SYMBOL - C-53

NOTE - RESISTOR VALUES ARE IN OHMS.  
 ALL RESISTORS ARE 1/2 W. UNLESS OTHERWISE SPECIFIED.  
 CAPACITOR VALUES ARE IN MMF. UNLESS OTHERWISE SPECIFIED.

BAND SWITCH, SW-1, SHOWN IN "FM" POSITION.  
 TONE CONTROL, SW-2, SHOWN IN AC OFF POSITION.

Fig. 8. Schematic diagram.

**SERVICE PARTS LIST**

Ref. No.	Description	Hallcrafters' Part Number
C-1,7,15,19	100 mmf. 500 V., ceramic	47B20101M5
C-2	100 mmf. 500 V., mica	CM20A101M
C-3	Tuning condenser, 5 sections	48C196
C-4,5,14,17,18,20,23,24	.005 mfd. 450 V., ceramic	47A168
C-6	3.3mmf. 500 V., ceramic	CC20UK330K
C-8	3.3 mmf. 500 V., bakelite	47A160-5
C-9,34,35	.05 mfd. 200 V., tubular paper	46AU503J
C-10,12	47 mmf. 500 V., ceramic	CC20UK470M
C-11	7 mmf. 500 V., ceramic	CC20UJ070K
C-13,21,26,36,43,45	.01 mfd. 600 V., tubular paper	46AZ103F
C-16	.02 mfd. 200 V., tubular paper	46AU203J
C-22	4.7 mmf. 500 V., bakelite	47A160-6
C-25	12 mmf. 500 V., mica	CM20A120K
C-27	47mmf. 500 V., mica	CM20A470M
C-28,29,32,33	150 mmf. 500 V., mica	CM20A151M
C-30,37,49	1000 mmf. 500 V., ceramic	47B20102M5
C-31,41	.05 mfd. 600 V., tubular paper	46AY503J
C-38	.03 mfd. 200 V., tubular paper	46AU303J
C-39	68 mmf. 500 V., mica	CM20A680M
C-40	.003 mfd. 600 V., tubular paper	46AZ302J
C-42	.005 mfd. 600 V., tubular paper	46AZ502J
C-44	220 mmf. 500 V., mica	CM20A221M
C-46	10 mfd. 25 V., electrolytic	45A121
C-47	.002 mfd. 600 V., tubular paper	46AZ202J
C-48	60-20-20 mfd. 450 V., electrolytic	45B113
C-50	.01 mfd. 600 V., molded paper	46AG103J
C-51,52	1 mmf. 500 V., bakelite	47A160-2
C-53	.01 mfd. 600 V., tubular paper	46AY103J

**RESISTORS**

R-1,13	1 megohm 1/2 watt, carbon	RC20AE105M
R-2,14,17,22,23,27,28	47,000 ohms 1/2 watt, carbon	RC20AE473M
R-3,5,26,31	220,000 ohms 1/2 watt, carbon	RC20AE224M
R-4,15	470 ohms 1/2 watt, carbon	RC20AE471M
R-6	4700 ohms 2 watts, carbon	RC40AE472M
R-7	10 ohms 1/2 watt, carbon	RC20AE100M
R-8,25	22,000 ohms 1/2 watt, carbon	RC20AE223M
R-9	150 ohms 1/2 watt, carbon	RC20AE151M
R-10	220 ohms 1/2 watt, carbon	RC20AE221M
R-11,33	100,000 ohms 1/2 watt, carbon	RC20AE104M
R-12,32,40,	470,000 ohms 1/2 watt, carbon	RC20AE474M

**TRANSFORMERS AND COILS**

T-1	Transformer, FM, antenna stage	51B1021
T-2	Transformer, BC, mixer stage	51B1059
T-3	Transformer, FM, mixer stage	51B1022
T-4	Transformer, FM, osc. stage	51B1073
T-5	Transformer, BC, osc. stage	51B1020
T-6	Transformer, 1st I.F.	50B469
T-7,9	Transformer, 2nd I.F. and AM Detector & FM limiter	50B407
T-8,10	Transformer, 2nd I.F. and AM Detector & FM limiter	50B410
T-11	Transformer, FM, detector stage	50B410
T-12	Transformer, audio output	55B109
T-13	Transformer, power	52C152
L-2	Plate choke for tube V1	53B124
L-3	Filament choke for tubes V5 & 6	53B123
L-4	Filament choke for tubes V1,2,3, & 7	53A136

41,42	270 ohms 1/2 watt, carbon	RC20AE271K
R-16	1000 ohms 1/2 watt, carbon	RC20AE102M
R-18,53	2.2 megohms 1/2 watt, carbon	RC20AE225M
R-19,39	68,000 ohms 1/2 watt, carbon	RC20AE683M
R-20	330,000 ohms 1/2 watt, carbon	RC20AE334M
R-24	100,000 ohms 1/2 watt, carbon	RC20AE104K
R-29,30	volume control, 2 megohms (tapped)	25B623
R-34	6800 ohms 1/2 watt, carbon	RC20AE682M
R-35,36	330 ohms 1/2 watt, carbon	RC20AE331K
44,50	100,000 ohms 1 watt, carbon	RC30AE104K
R-37	300 ohms 2 watt, carbon	RC40AE301J
R-38	12,000 ohms 1/2 watt, carbon	RC20AE123K
R-43	1200 ohms 2 watt, carbon	RC40AE122K
R-45	1500 ohms 2 watt, carbon	RC40AE152K
R-46,47		
R-48,49		

**SWITCHES**

SW-1	Band switch assembly	60B318
SW-2	Switch, tone control	60B319

**PLUGS AND SOCKETS**

PL-1	Line cord and plug	87A078
SO-2	Receptacle, television, phono	36A029
SO-3	Receptacle, speaker	6A277
SO-4	Receptacle, phono motor	10A015
	Socket, octal (tube)	6A296
	Socket, miniature (tube)	6A297
	Socket & bracket, dial light	86A062

**TUBES, RECTIFIERS AND LAMPS**

V-1	6AU6 antenna	90X6AU6
V-2,3	6BA6 mixer, 1st I.F.	90X6BA6
V-4,5	6SH7 2nd I.F., limiter	90X6SH7
V-6	6H6 discriminator	90X6H6
V-7	6J6 osc. & AFC	90X6J6
V-8	6SJ7 audio amp.	90X6SJ7
V-9,10	6K6GT power amp.	90X6K6GT
V-11	5Y3GT rectifier	90X5Y3GT
LM-1,2	Lamp, 6-8 V., 250 Ma., Mazda #44	39A003

**MISCELLANEOUS**

	Shaft, tuning	74A247
	Pulley, idler	28A052-6
	Switch, cam	77A261
	Drive pin	74A246
	Collar	77A267
	Bushing	77A266
	Bracket, dial plate mtg.	67A793
	Dial plate	63B332
	Dial background (paper)	32A446
	Dial glass (calibrated)	22C201
	Clip (for dial glass 22C201)	76A390
	Rubber spacer, for dial clip	16A126
	Pointer	82A147
	Dial cord	38A019
	Spring, dial cord	75A012
	Dial glass (clear)	22B205
	Clip (for dial glass 22B205)	76A331
	Escutcheon (Model S-55)	7C067-1
	Escutcheon (Model S-56)	7C067
	Knob, tone and range controls (Model S-55)	15B077-4
	Knob, tone and range controls (Model S-56)	15B068-3

TS-1	Knob, tuning and volume controls (Model S-55)	15B068-4
TS-2	Knob, tuning and volume controls (Model S-56)	15B077-3
	Terminal strip, antenna (Marked D-D)	87A379
	Terminal strip, antenna (Marked A-G)	88A327
	Line cord lock	76A299
	Mounting foot, rubber	16A007

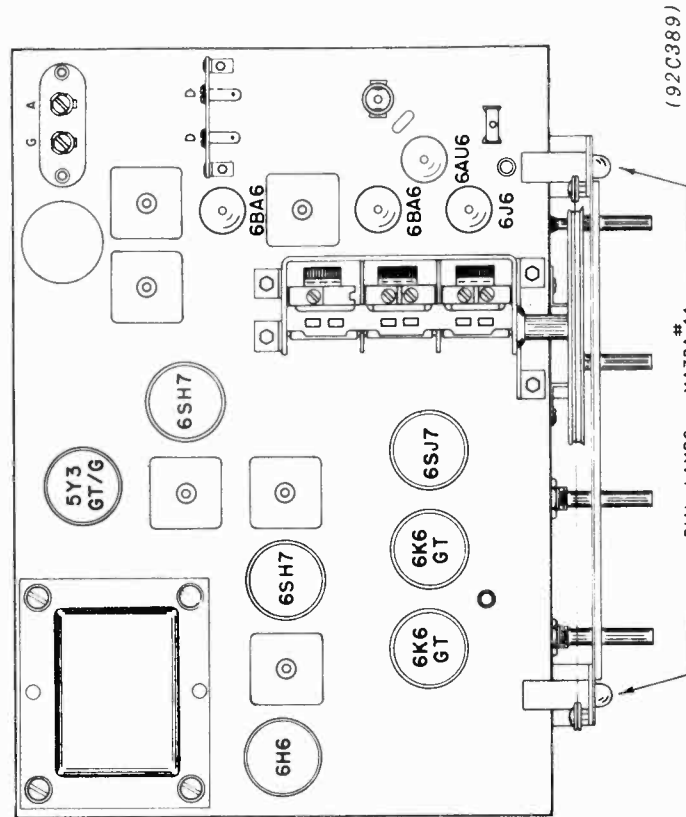
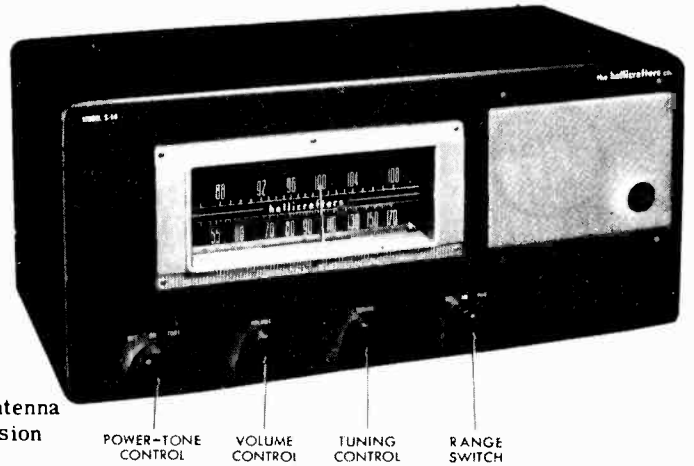


Fig. 7. Top view, location of tubes and dial lamps.

**GENERAL**

- Tubes . . . . . Six plus rectifier
- Speaker. . . . . 5-inch PM
- Voice Coil Impedance. . . . . 3.2 ohms
- Antenna. . . . . Provisions for external antenna with 300-ohm transmission line
- Phono Input . . . . . High Impedance
- Tuning . . . . . Manual
- Frequency Range. . . . . Broadcast 540 kc - 1600 kc  
Frequency Modulation 88 mc - 108 mc
- Intermediate Frequency. 455 kc/10.7 mc
- Power Supply . . . . . 105-125 V., DC or 60 cycles AC
- Power Consumption . . . . . 28 Watts



**ALIGNMENT PROCEDURE**

- Generator connection . . . . . See chart
- Generator ground . . . . . See chart.
- Output meter connection . . . . . Across voice call
- Electronic voltmeter . . . . . See chart connection
- Volumn control position . . . . . Maximum
- Tone control position . . . . . Optional

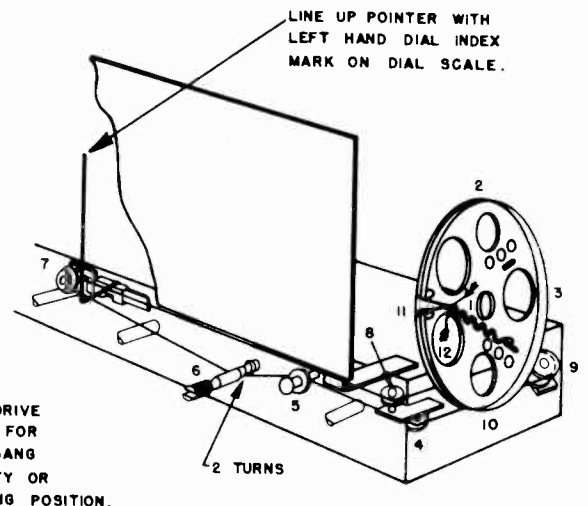
The standard RMA dummy specified in the alignment chart consist of a 200 mmf condenser in series with a 20 uh r-f choke which is shunted by a 400 mmf condenser in series with a 400 ohm carbon resistor.

**REPLACING LAMPS**

Refer to Fig. 4. for the location of the dial lamps used in receiver. To gain access to the defective lamp, reach in through the cabinet cover and unclip the dial lamp socket by compressing the side springs. The socket may then be brought out into the open to change the defective lamp. Replace defective lamps with 6-8 V. Mazda #47 (Brown bead) lamps or equivalent.

**RESTRINGING DIAL CORD**

To restring the dial cable, the chassis must be removed from the cabinet. Pull the four control knobs from their shafts, remove the three chassis screws at the bottom of the cabinet and lift the chassis from the cabinet through the top cover. Restringing the dial drive with a 48-inch length of 20 lb. test dial cord following the stringing sequence shown in Fig. 1. With the tuning condenser set at maximum capacity (closed) attach the dial pointer to the drive string and line it up with the left hand index mark on the dial scale.

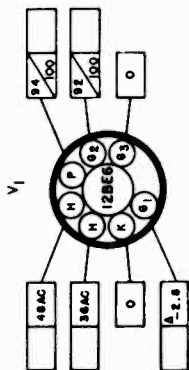
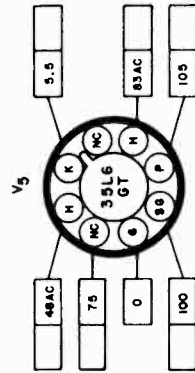
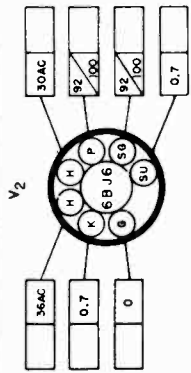
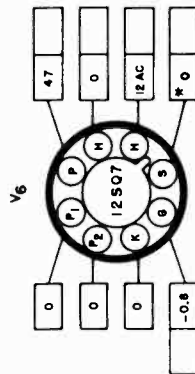
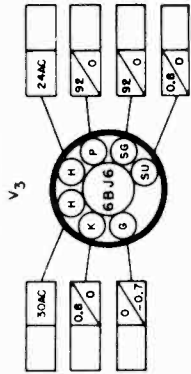
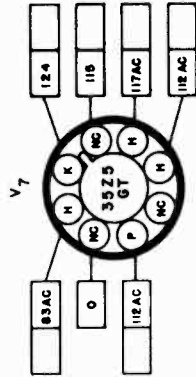
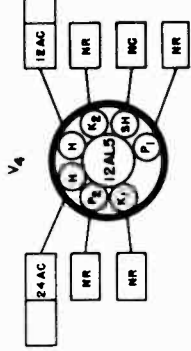


DIAL DRIVE SHOWN FOR MAX. GANG CAPACITY OR INDEXING POSITION.

92B513

Fig. 1. Dial cable stringing procedure (92B513)

MODEL S-58



▲ APPROXIMATE

\* CAUTION - SEE NOTE 9

FRONT VIEW OF APRON

BOTTOM VIEW OF CHASSIS

NOTES -

1. SOCKET VIEWS ARE BOTTOM VIEWS.
2. ALL VOLTAGES ARE MEASURED BETWEEN TUBE SOCKET TERMINALS AND ELECTRICAL GROUND BUSS (NOT CHASSIS) WITH ZERO SIGNAL INPUT. WHERE TWO READINGS ARE SHOWN THE FIRST IS FOR FM THE SECOND FOR BC.
3. LINE VOLTAGE - 117V. AC. AC VOLTAGES SHOWN WILL BE DC WHEN OPERATING FROM A DC LINE.
4. ALL VOLTAGES SHOWN ARE DC UNLESS OTHERWISE SPECIFIED.
5. DC VOLTAGES SHOWN WERE MEASURED WITH AN ELECTRONIC VOLTMETER.
6. "NC" - NO CONNECTION. (VOLTAGES SHOWN FOR THIS TERMINAL ONLY WHEN TERMINAL IS USED AS A TIE LUG).
7. "NR" - NOT READABLE. (READING GENERALLY MEANINGLESS).
8. [ ] SPACE PROVIDED FOR SERVICE METER READINGS.
9. ALL READINGS TAKEN WITH LINE PLUG POLARIZED SO THAT GROUND BUSS AND CHASSIS ARE AT THE SAME POTENTIAL WITH CHASSIS GROUNDED.

Fig. 5. Tube socket voltage chart.



**ALIGNMENT CHART**

Dummy Antenna	Signal Generator Coupling	Signal Generator Frequency	Radio Range Switch Position	Radio Dial Setting	Adjust	Remarks
1. .01 mfd. cap.	High side to stator plates of high cap. mixer section. Generator ground to chassis.	455 kc	AM	1000 kc	A,B,C,D	Adjust for max. audio output at voice coil. Keep audio output below 50 mw to avoid AVC action.
2. .01 mfd. cap.	High side to stator plates of low cap. mixer section. Generator ground to chassis.	10.7 mc (No modulation)	FM	100 mc	E,F,G,H	Adjust for max. DC voltage between pin #7 of the 12 AL5 and ground buss. Connect a 500,000 ohm resistor in series with voltmeter probe. Use just enough signal generator output to obtain approx. 2 volts at the electronic voltmeter.
3. After completing the adjustments required by step 2, detune the signal generator on each side of 10.7 mc and note the generator dial or frequency reading for one half of the DC voltage measured by the electronic voltmeter. Use just enough signal generator output to obtain a maximum of 2 volts at the center frequency of the IF channel. Set the signal generator frequency at the midpoint of the two readings obtained above and align the FM detector transformer as follows:						
4. Without changing the setup, adjust the primary of the FM detector transformer(I) for maximum DC voltage. Disconnect the electronic voltmeter probe and reconnect it at the junction of R-13 and 14 using the 500,000-ohm resistor as before for isolation. Adjust the secondary of the FM detector (J) for the null or zero DC voltage. This completes the IF amplifier adjustment.						
5. Std. RMA dummy	To terminals "D-D" on rear chassis apron. Connect RMA dummy to unby-passed terminal.	1500 kc	AM	1500 kc	*K,L	Adjust for max. audio output as in step 1.
		600 kc	AM	600 kc	*M	
6. 300-ohm carbon resistor	To terminals "D-D" on rear chassis apron. Connect resistor to high side or unby-passed terminal.	108 mc	FM	108 mc	*N,O	Adjust for max. DC voltage as in step 2.

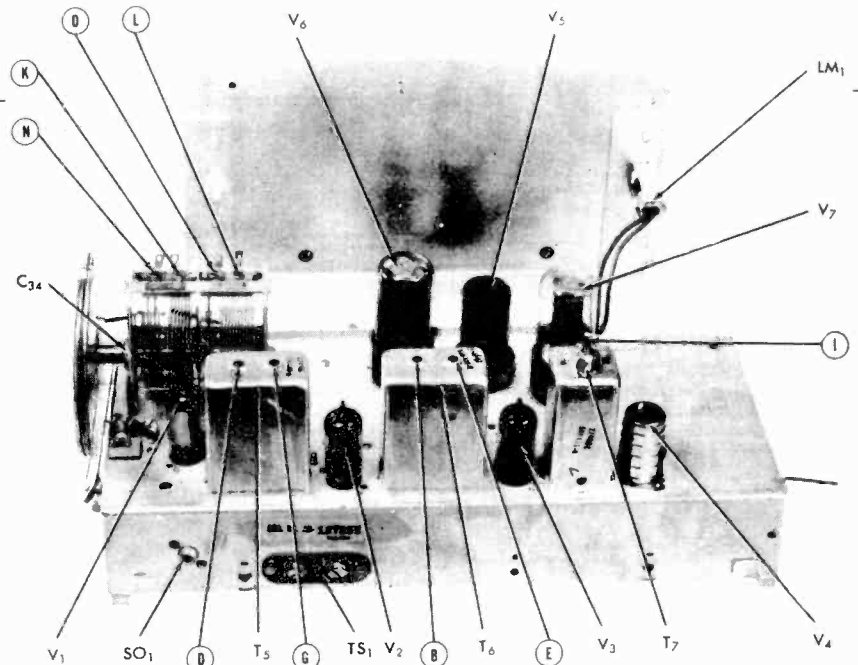
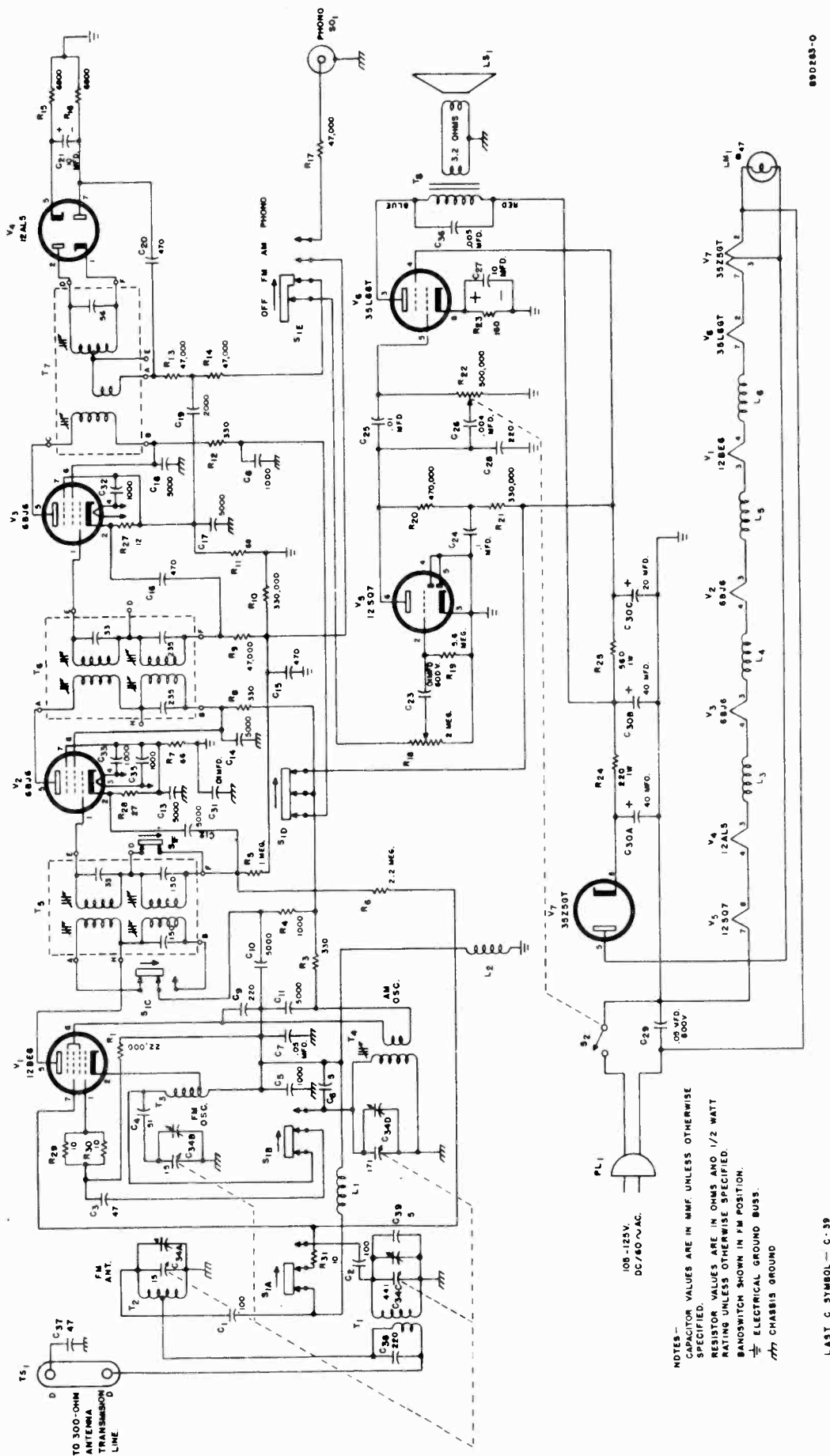


Fig. 2. Top view, alignment, adjustments and component location



MODEL S-58

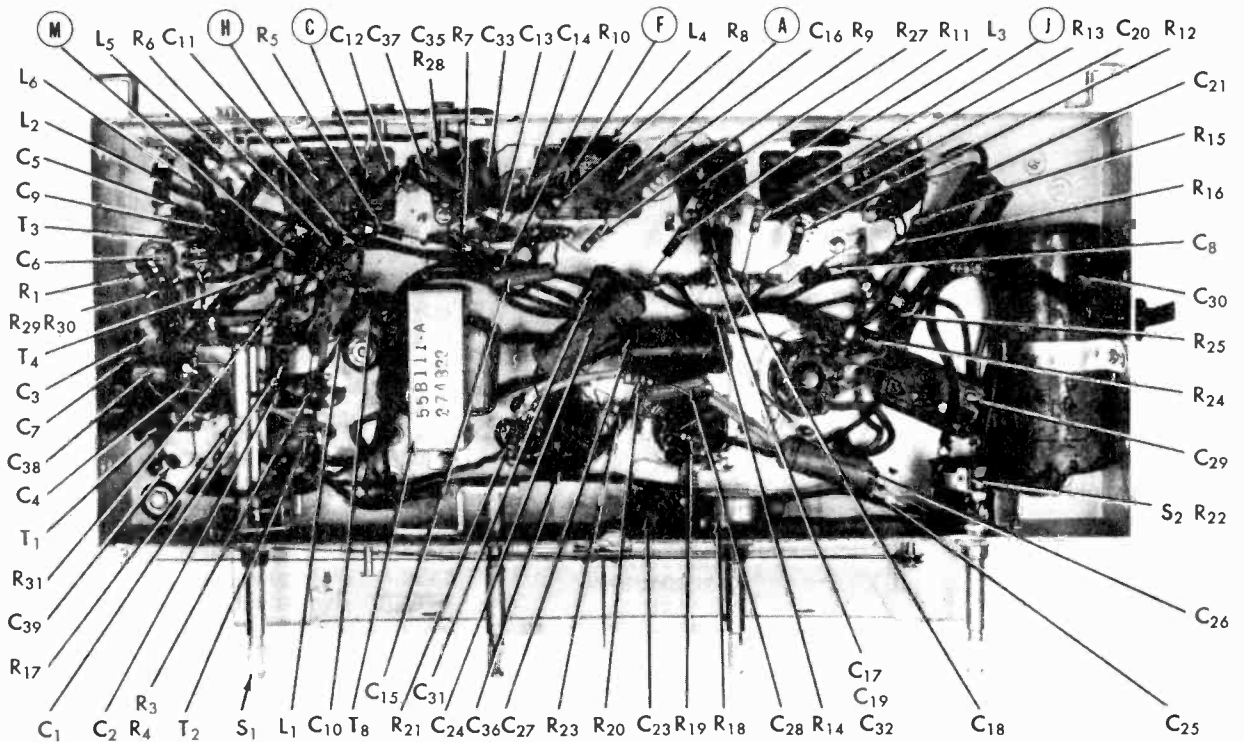


NOTES—  
 CAPACITOR VALUES ARE IN MMF UNLESS OTHERWISE SPECIFIED.  
 RESISTOR VALUES ARE IN OHMS AND 1/2 WATT RATING UNLESS OTHERWISE SPECIFIED.  
 BANDSWITCH SHOWN IN FM POSITION.  
 ≡ ELECTRICAL GROUND BUS.  
 ≡ CHASSIS GROUND

LAST C SYMBOL — C-39  
 LAST R SYMBOL — R-31

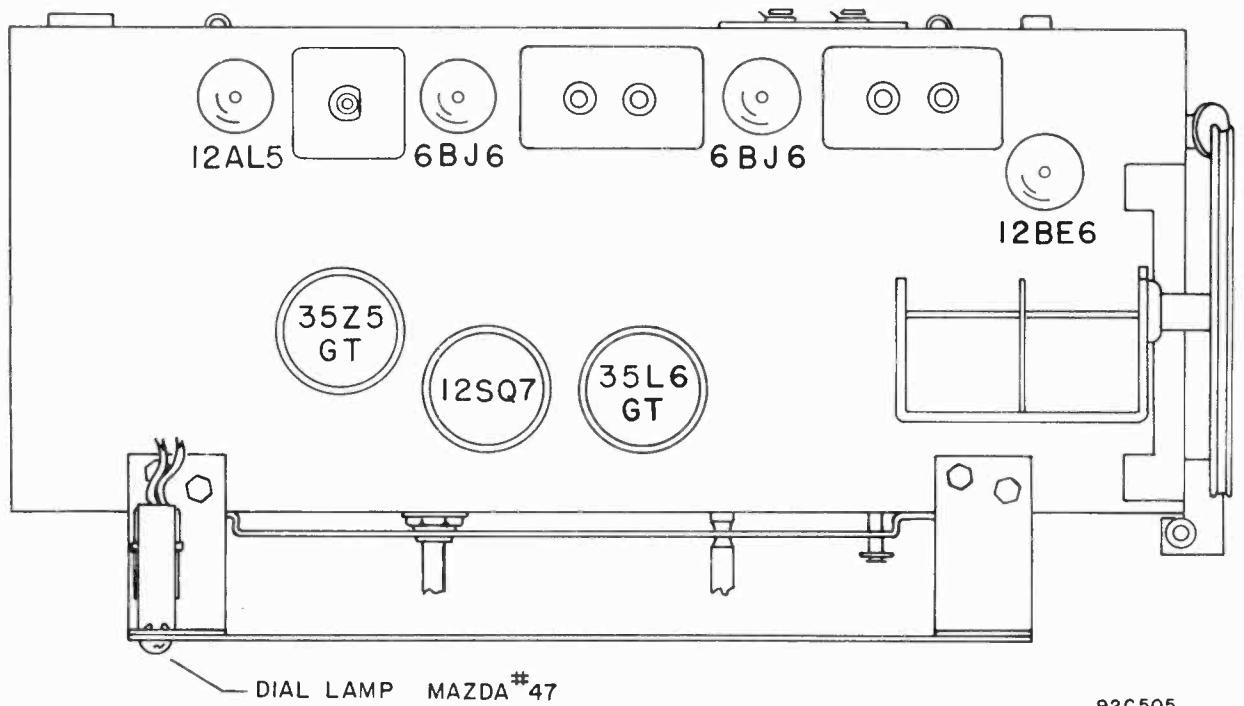
Fig. 6. Schematic diagram.

880683-0



92X512

Fig. 3. Bottom view, alignment adjustments and component location



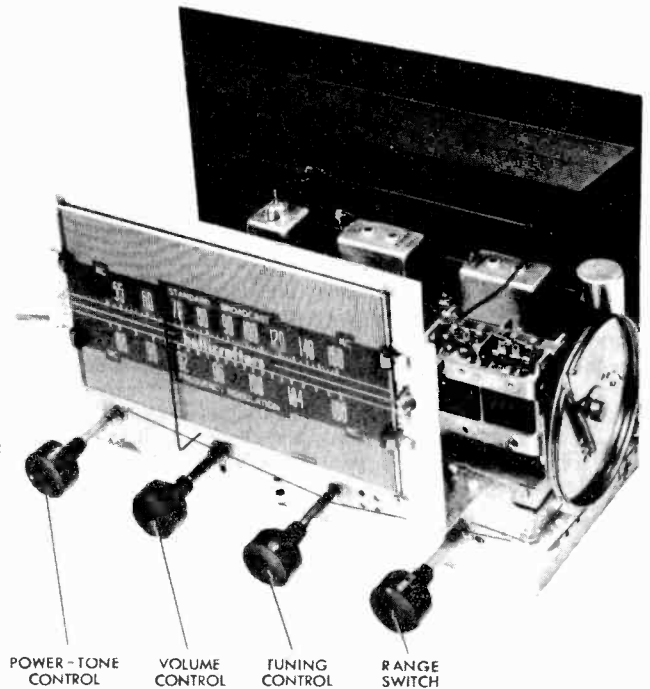
92C505

Fig. 4. Top view, location of tubes and dial lamps.



**GENERAL**

- Tubes . . . . . Seven plus rectifier
- Output Impedance. . . . . 500 ohms
- Antenna . . . . . Built-in loop type antenna.  
Provisions for external antenna
- Phono Input . . . . . High impedance
- Tuning . . . . . Manual
- Frequency Range . . . . . Broadcast 540 kc - 1600 kc  
Frequency Modulation 88 mc - 108 mc
- Intermediate Frequency. . . . . 455 kc/10.7 mc
- Power Supply . . . . . 105 - 125 V. 60 cycles AC
- Power Consumption. . . . . 60 watts



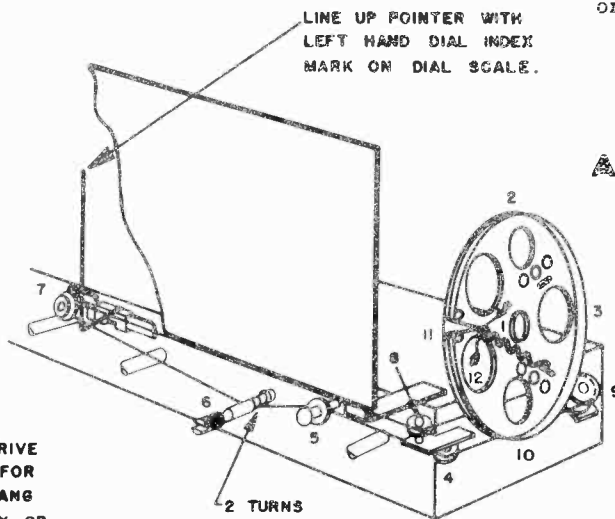
**RESTRINGING DIAL CORD**

Restring the dial drive with a 48-inch length of 20 lb. test dial cord. Tie one end to the tension spring and follow the stringing sequence outlined in Fig. 1. Stretch the tension spring and tie the end of the cord securely to the spring as shown.

Set the tuning condenser at maximum capacity (closed), attach the dial pointer to the drive string and line it up with the left hand index mark on the dial scale.

**REPLACING LAMPS**

Refer to Fig. 4 for the location of the two dial lamps used in the receiver. To gain access to defective lamps, unclip the dial lamp socket by compressing the side springs. Replace defective lamps with 6-8 V. Mazda #44 (Blue bead) lamps or equivalent.



DIAL DRIVE SHOWN FOR MAX. GANG CAPACITY OR INDEXING POSITION.

**ALIGNMENT**

- Generator connection . . . . . See chart
- Generator ground . . . . . To chassis
- Output meter connection . . . . . Across voice coil
- Electronic voltmeter connection . . . . . See chart
- Volume control position . . . . . Maximum
- Tone control position . . . . . Optional

The standard RMA dummy specified in the alignment chart consists of a 200 mmf condenser in series with a 20 uh r-f choke which is shunted by a 400 mmf condenser in series with a 400 ohm carbon resistor.

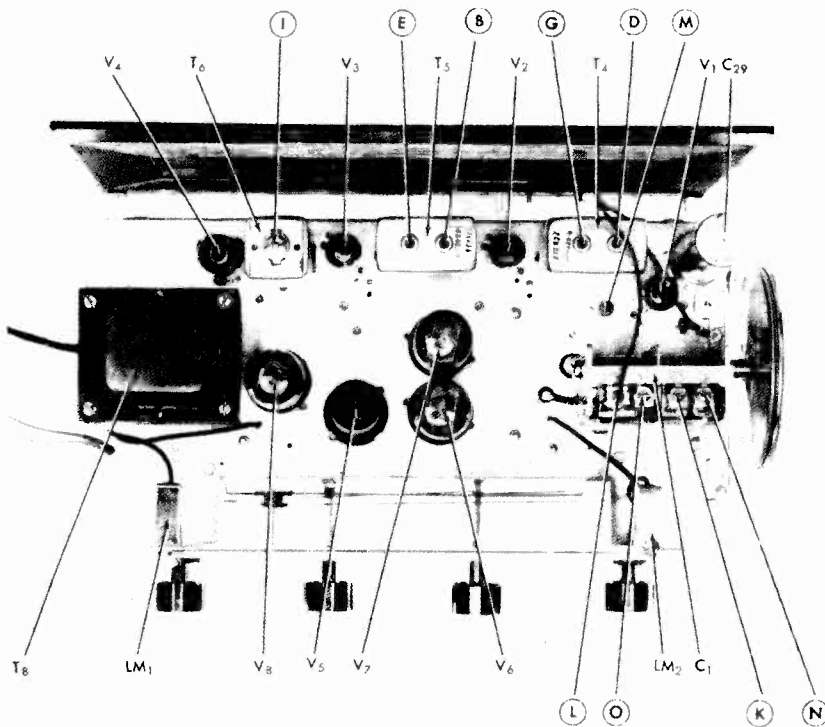
THE HALLICRAFTERS CO.

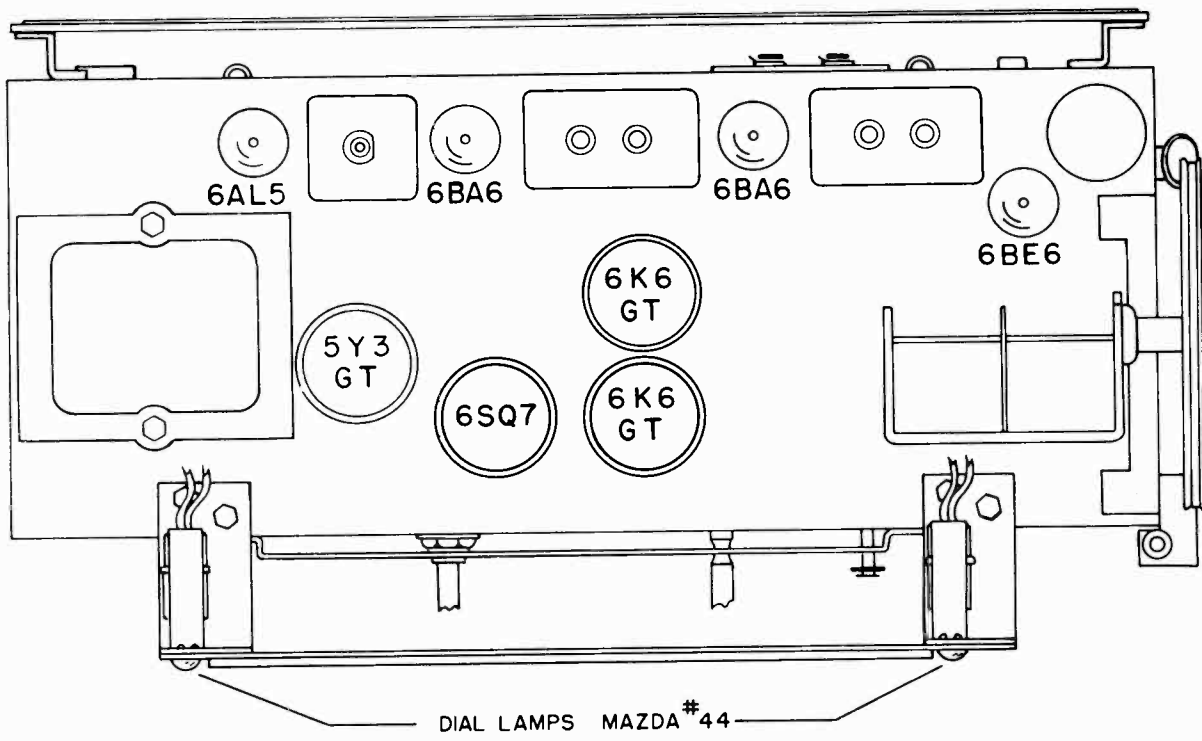
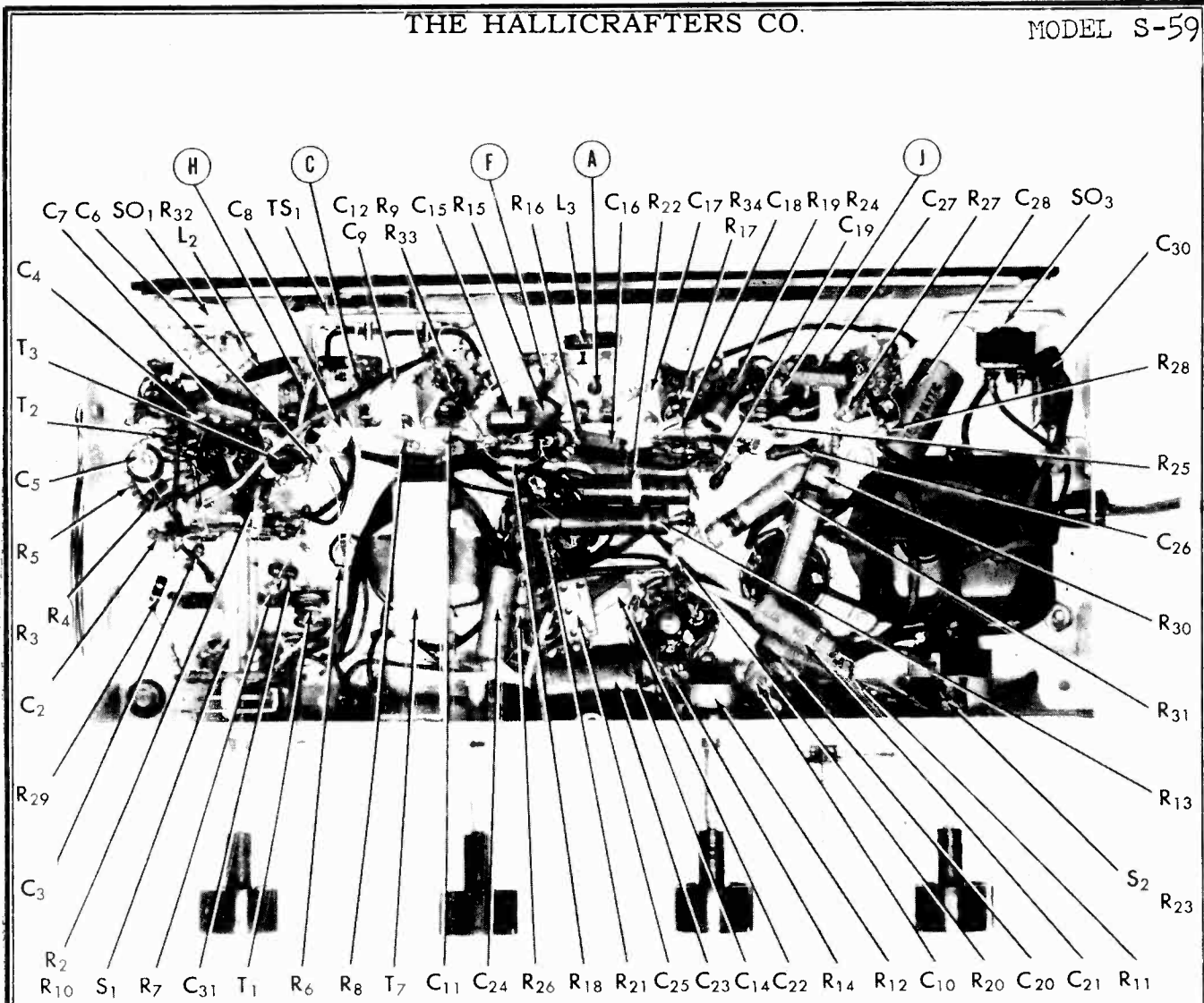
MODEL S-59

**ALIGNMENT CHART**

Dummy Antenna	Signal Generator Coupling	Signal Generator Frequency	Radio Range Switch Position	Radio Dial Setting	Adjust	Remarks
1. .01 mfd. cap.	To stator plates of high cap. mixer section	455 kc	2	1000 kc	A,B,C,D	Adjust for max. audio output at voice coil. Keep audio output below 50 mw to avoid AVC action.
2. .01 mfd. cap.	To stator plates of low cap. mixer section	10.7 mc (No modulation)	1	100 mc	E,F,G,H	Adjust for max. DC voltage between pin #7 of the 6AL5 and chassis. Connect a 500,000 ohm resistor in series with voltmeter probe. Use just enough signal generator output to obtain approx. 2 volts at the electronic voltmeter.
3. After completing the adjustments required by step 2, detune the signal generator on each side of 10.7 mc and note the generator dial or frequency reading for one half of the DC voltage measured by the electronic voltmeter. Use just enough signal generator output to obtain a maximum of 2 volts at the center frequency of the IF channel. Set the signal generator frequency at the midpoint of the two readings obtained above and align the FM detector transformer as follows:						
4. Without changing the setup, adjust the primary of the FM detector transformer (I) for maximum DC voltage. Disconnect the electronic voltmeter probe and reconnect it to the junction of R24 and R25 using the 500,000-ohm resistor as before for isolation. Adjust the secondary of the FM detector (J) for the null or zero DC voltage. This completes the IF amplifier adjustment.						
5. Std. RMA dummy	To BC antenna terminal on back of loop.	1500 kc	2	1500 kc	*K,L	Adjust for max. audio output as in step 1.
		600 kc	2	600 kc	*M	
6. 300-ohm carbon resistor	To terminals "D-D" on rear chassis apron. Connect resistor to high side or ungrounded terminal	108 mc	1	108 mc	*N,O	Adjust for max. DC voltage as in step 2.

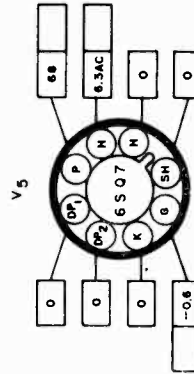
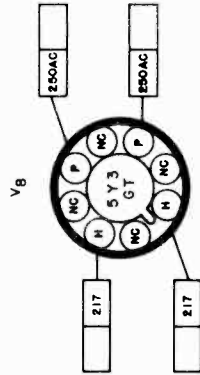
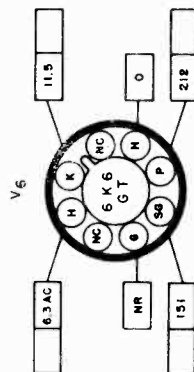
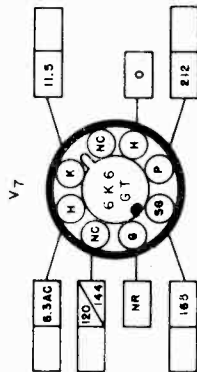
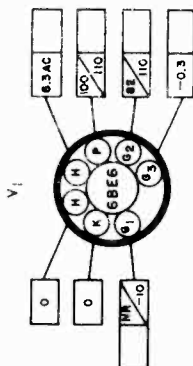
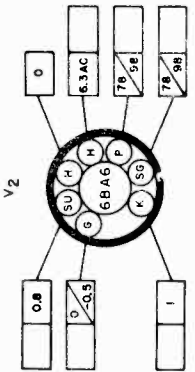
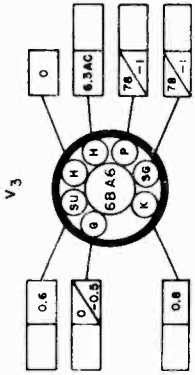
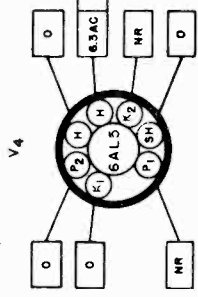
\*Calibration adjustment.





MODEL S-59

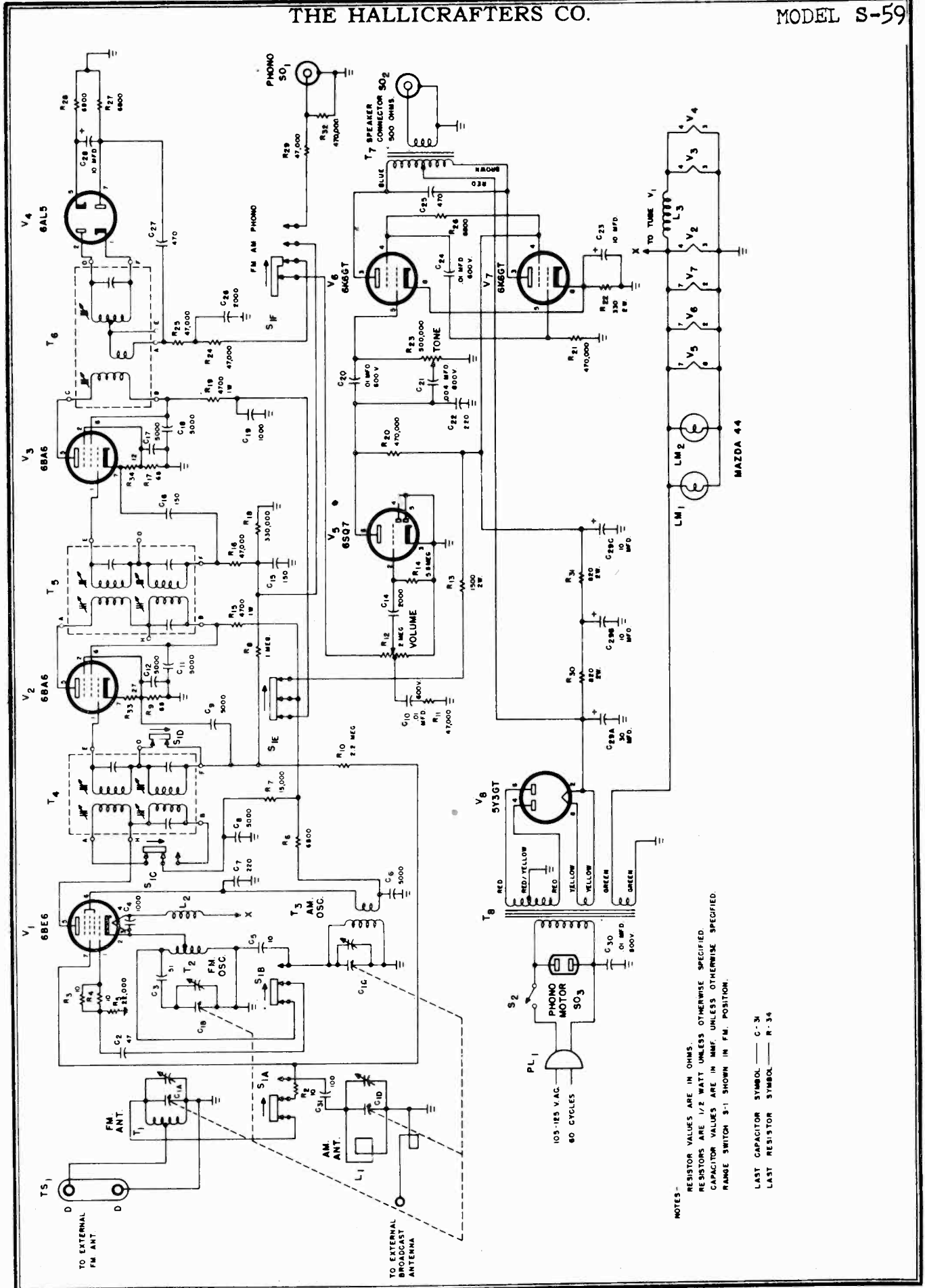
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FRONT APRON  
BOTTOM VIEW OF CHASSIS

- NOTES -
1. SOCKET VIEWS ARE BOTTOM VIEWS.
  2. ALL VOLTAGES MEASURED BETWEEN TUBE SOCKET TERMINALS AND CHASSIS.
  3. LINE VOLTAGE --- 117V. AC.
  4. ALL VOLTAGES SHOWN WERE MEASURED WITH AN ELECTRONIC VOLTMETER AND AT ZERO SIGNAL.
  5. ALL VOLTAGES ARE DC UNLESS OTHERWISE SPECIFIED.
  6. WHERE TUBE SOCKET VOLTAGES CHANGE FROM FM TO AM RECEPTION TWO READINGS ARE SHOWN, UPPER LEFT SHOWS FM READINGS - LOWER RIGHT SHOWS AM READINGS.
  7. "NC" - NO CONNECTION, READING SHOWN ONLY WHEN TERMINAL IS USED AS A TIE LUB.
  8. "NR" - NOT READABLE OR READINGS GENERALLY MEANINGLESS.
  9. THE BLANK SPACES ARE PROVIDED FOR THE SERVICE METER READING. FILL IN THE ACTUAL READING AS TAKEN WITH YOUR OWN TEST EQUIPMENT USING A NORMAL OPERATING RADIO FOR THESE MEASUREMENTS.
  10. TUBES V-1, 2 AND 3 ARE DISABLED DURING PHONO OPERATION.





NOTES—  
 RESISTOR VALUES ARE IN OHMS.  
 RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED.  
 CAPACITOR VALUES ARE IN MUF UNLESS OTHERWISE SPECIFIED.  
 RANGE SWITCH S1 SHOWN IN FM POSITION.  
 LAST CAPACITOR SYMBOL — C-34  
 LAST RESISTOR SYMBOL — R-34

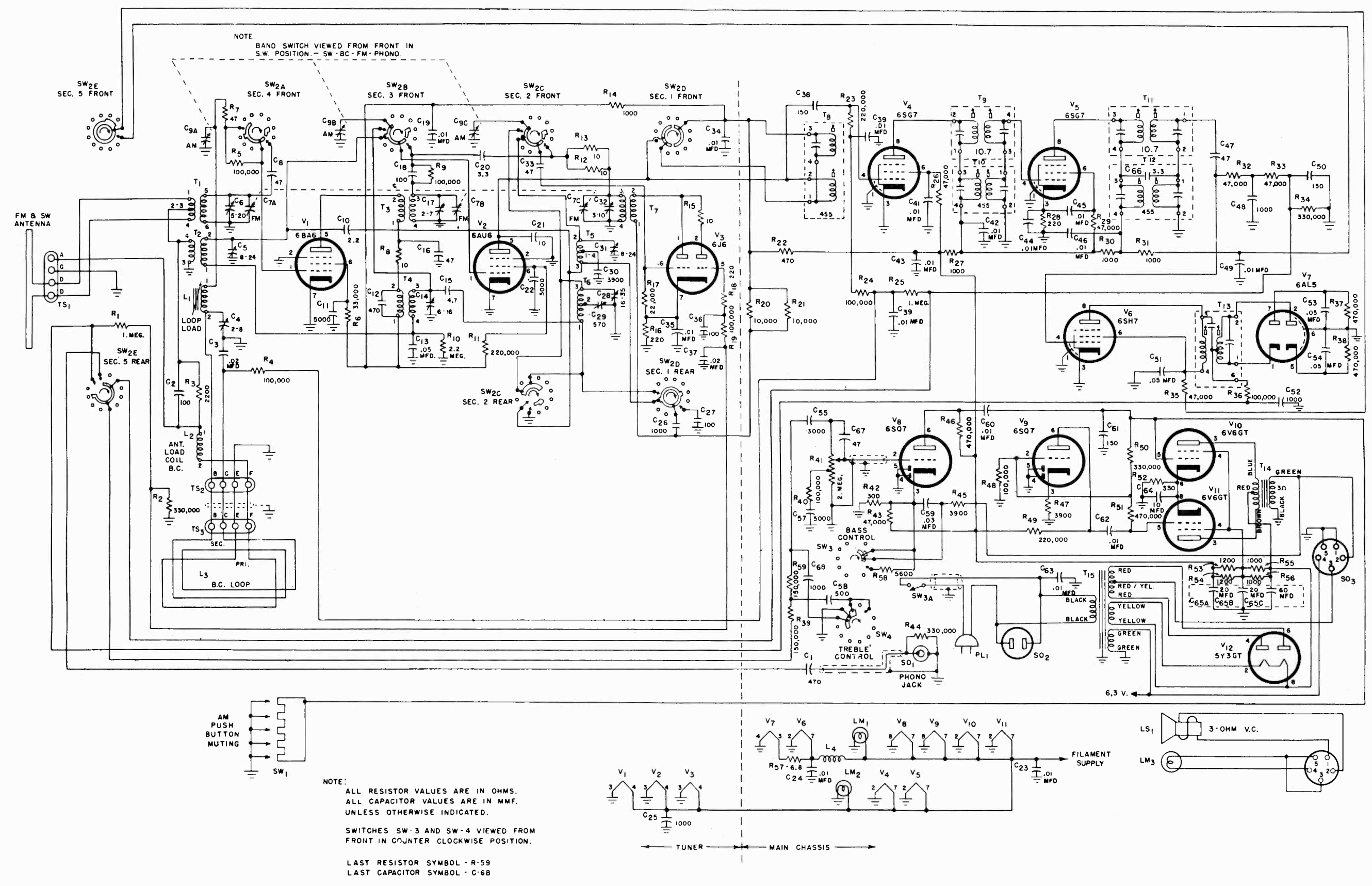
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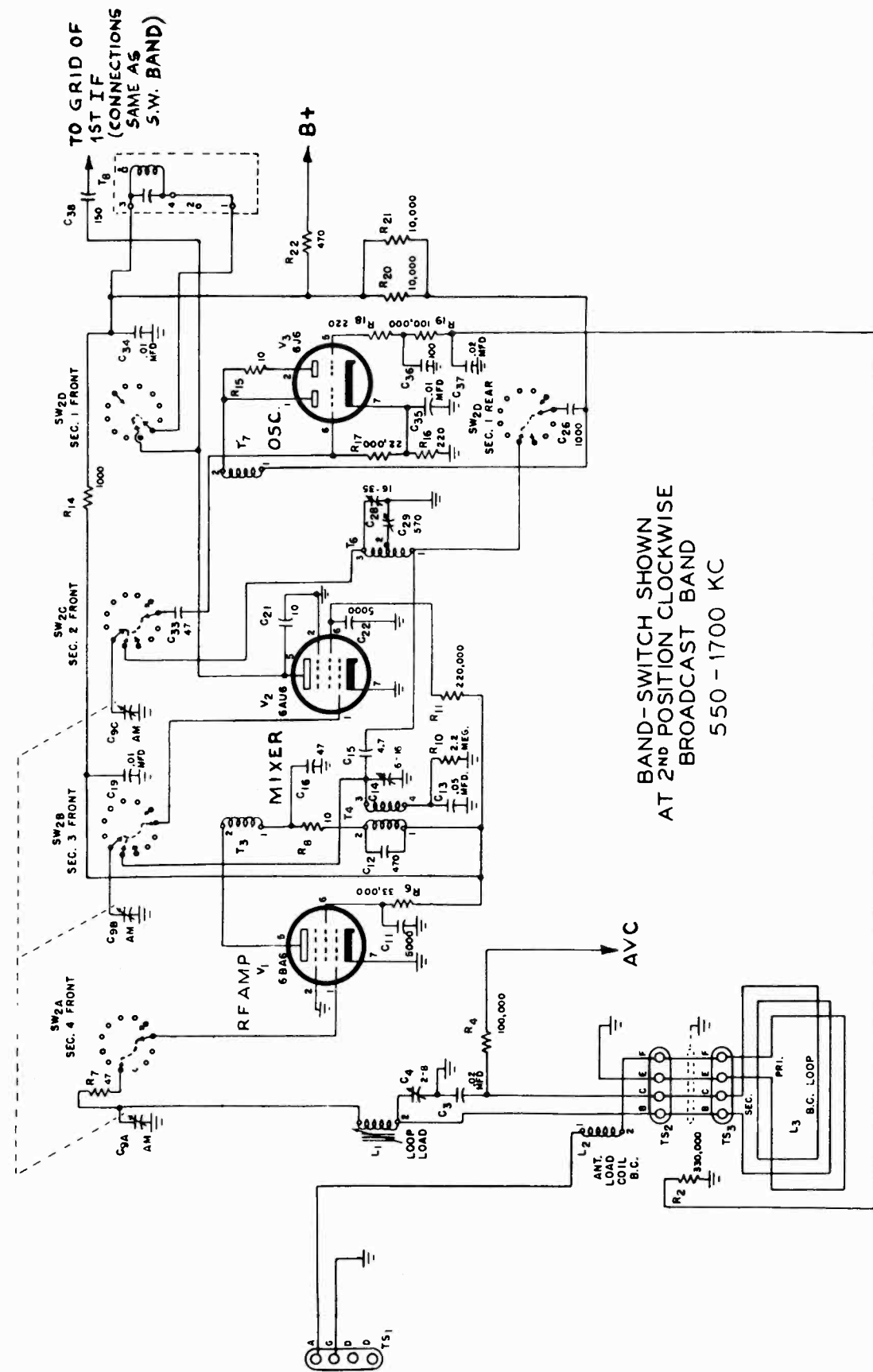
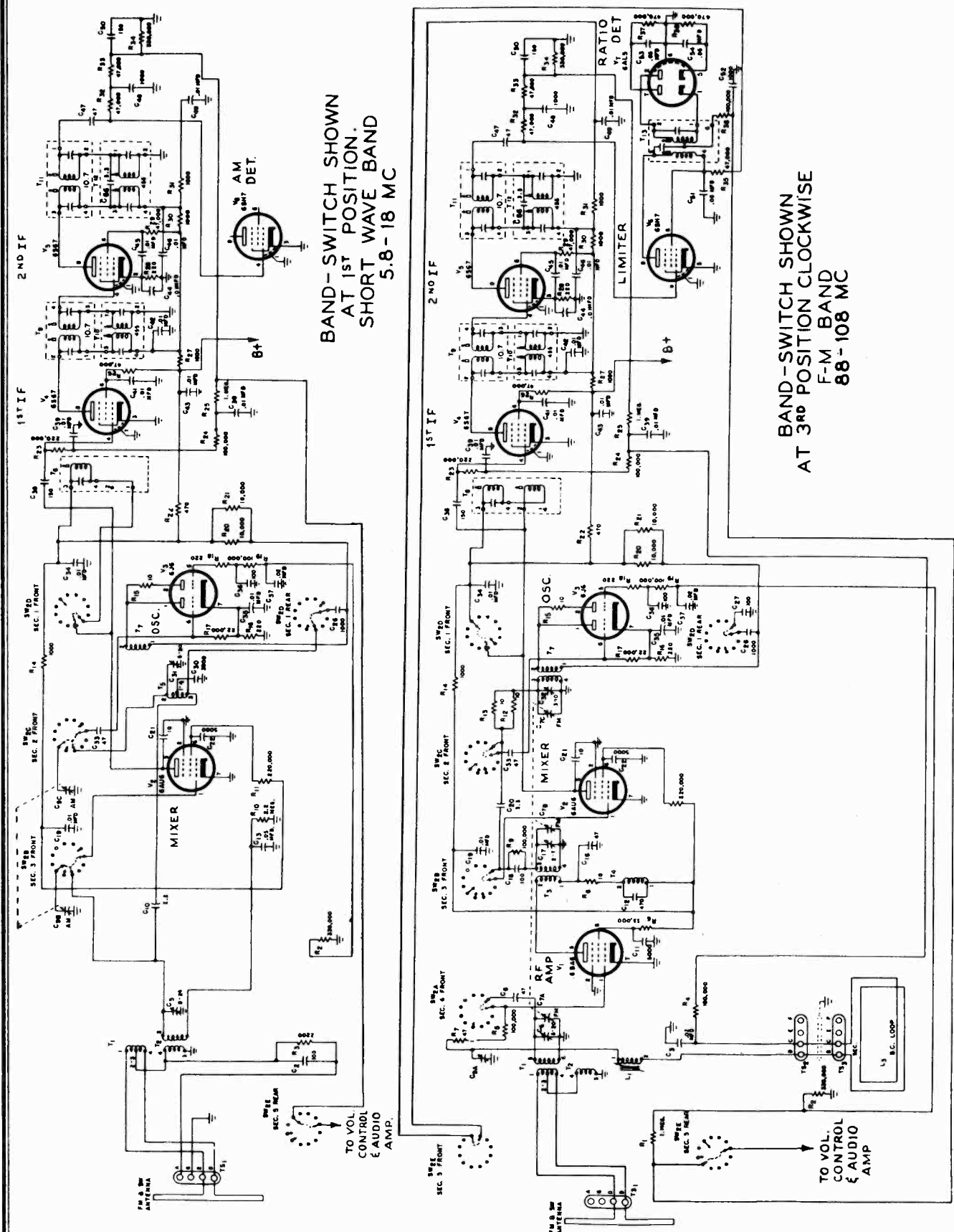
MODEL S-59

Ref. No.	Description	Hallicrafters Part Number	Ref. No.	Description	Hallicrafters Part Number
<b>CONDENSERS</b>			<b>TRANSFORMERS AND COILS (Cont.)</b>		
C-1	Capacitor, main tuning	48C203	T-8	Transformer, power	52C166
C-2	47 mmf. 500 V., ceramic	CC21UK470K	L-1	Loop antenna	57C123
C-3	51 mmf. 500 V., ceramic	CC21UK510J	L-2,3	Coil, R.F. choke	53A136
C-4,19	1000 mmf. 500 V., ceramic	47B20A102N5			
C-5	10 mmf. 500 V., ceramic	CC21UK100K			
C-6,8,9,11,12,17,18	.005 mfd. 500 V., ceramic	47A168			
C-7,22	220 mmf. 500 V., mica	CM20A221M	S-1	Switch assembly, band selector	60B328
C-10,20,24	.01 mfd. 600 V., tubular	46A147	S-2	Switch, power (part of tone control R-23)	
C-14,26	2,000 mmf. 500 V., ceramic	47B20A202M5			
C-15,16	150 mmf. 500 V., mica	CM20A151M			
C-21	.004 mfd. 600 V., tubular	46AZ402J			
C-23,28	10 mfd. 25 V., electrolytic	45A121			
C-25,27	470 mmf. 500 V., mica	CM20A471M			
C-29	30-10-10 mfd. 350 V., electrolytic	45B131	PL-1	Line cord and plug	87B1669
C-30	.01 mfd. 600 V., molded paper	46A147	SO-1	Receptacle, phono	36A029
C-31	100 mmf. 2% 500 V., ceramic	47B20A101M5	SO-2	Speaker connector	10A287
			SO-3	Socket, A.C. receptacle	10A015
				Socket, octal (tube)	6A296
				Socket, miniature (tube)	6A308
				Socket, dial light	86A062-1
<b>RESISTORS</b>			<b>PLUGS AND SOCKETS</b>		
R-2,3,4	10 ohms 1/2 watt, carbon	RC20AE100K			
R-5	22,000 ohms 1/2 watt, carbon	RC20AE223K			
R-6,26,27,28	6800 ohms 1/2 watt, carbon	RC20AE682K			
R-7	15,000 ohms 1/2 watt, carbon	RC20AE153M			
R-8	1 megohm 1/2 watt, carbon	RC20AE105M			
R-9,17	68 ohms 1/2 watt, carbon	RC20AE680K			
R-10	2.2 megohms 1/2 watt, carbon	RC20AE225M	V-4	Type 6AL5, detector (FM)	90X6AL5
R-11,16,24,25,29	47,000 ohms 1/2 watt, carbon	RC20AE473K	V-5	Type 6SQ7, audio amp.	90X6SQ7
R-12	Resistor variable, volume control	25B624	V-6,7	Type 6K6 GT, audio power amp.	90X6K6GT
R-13	1500 ohms 2 watts, carbon	RC40AE152M	V-8	Type 5Y3GT, rectifier	90X5Y3GT
R-14	5.6 megohms 1/2 watt, carbon	RC20AE565M	LM-1,2	Lamp, 6-8 V., Mazda #44 (Blue bead)	39A003
R-15,19	4700 ohms 1 watt, carbon	RC30AE472M			
R-18	330,000 ohms 1/2 watt, carbon	RC20AE334M			
R-20,21,32	470,000 ohms 1/2 watt, carbon	RC20AE474M			
R-22	330 ohms 2 watts, carbon	RC40AE331K			
R-23	Resistor, variable, tone control	25B758			
R-30,31	820 ohms 2 watts, carbon	RC40AE821K			
R-33	27 ohms 1/2 watt, carbon	RC20AE270K			
R-34	12 ohms 1/2 watt, carbon	RC20AE120K			
<b>TRANSFORMERS AND COILS</b>			<b>MISCELLANEOUS</b>		
T-1	Transformer, FM mixer stage	51A1060	TS-1	Terminal Strip, antenna	89A379
T-2	Transformer, FM osc. stage	51A1062		Lock, line cord	76A397
T-3	Transformer, AM osc. stage	51B1063		Shaft, tuning	74A251
T-4	Transformer, 1st I.F. stage	50B399		Retainer, spring	75A062
T-5	Transformer, 2nd I.F. stage	50B400		Rail, pointer	67B820
T-6	Transformer, ratio detector	50B401		Pointer	82B152
T-7	Transformer, audio output	55B112-1		Bracket, dial plate mtg.	67A834
				Dial plate	63B332
				Dial background (Black)	32A446
				Dial scale (glass)	22C212
				Clip, dial scale	76A390
				Spacer, rubber	16A126
				Escutcheon	7DO67
				Shield, miniature (tube)	69A232
				Dial, glass (clear)	22B305
				Clip, dial glass	76A331
				Spring, dial drive	75B012
				Knob, tuning and volume controls	15B067-2
				Knob, tone and range controls	15B143

THE HALLICRAFTERS CO.

MODELS 400, 406, 409, 410, 411, 412





THE HALLICRAFTERS CO.

MODELS 400, 406,  
409, 410, 411, 412

**REPLACING DIAL AND PILOT LAMPS**

Refer to Fig. 11 for location of the two dial lamps used in the receiver. To gain access to them, remove the dial escutcheon. The pilot lamp at the base of the cabinet is removed by slipping the socket assembly straight back a short distance releasing it from its mounting tongue. The defective lamp may now be brought out in the open for replacement. Replace all lamps with 6-8 volt Mazda #44 or equivalent.

**ALIGNMENT PROCEDURE**

Removal of the receiver chassis from the cabinet requires the use of other calibration means than the dial glass. Calibration strips mounted on the pointer rails are provided for alignment purposes.

To use these calibration strips, it is necessary to remove the dial plate (brown metal cover) in the following manner.

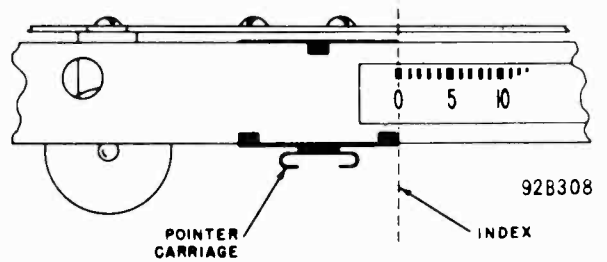
1. Remove dial pointers - Pull them straight out of their spring clips.
2. Remove the two dial lamp sockets.
3. Remove dial plate fastened to the chassis with seven sheet metal screws.

With the variable condensers fully mashed, the right hand side of the pointer carriage will be

indexed to zero on the calibration strips. Refer to Fig. 4.

The receiver is equipped with AUTOMATIC FREQUENCY CONTROL on the FM band to compensate for mechanical variations in the push-button mechanism. The correction factor is approximately 5 times: AFC takes hold 100 kc before the station frequency is reached and released before tuning 450kc passed the station frequency when receiving a 0.1 volt signal.

The standard RMA dummy specified in the alignment chart consists of a 200 mfd condenser in series with a 20 oh r-f choke which is shunted by a 400 mfd condenser in series with a 400 ohm carbon resistor.



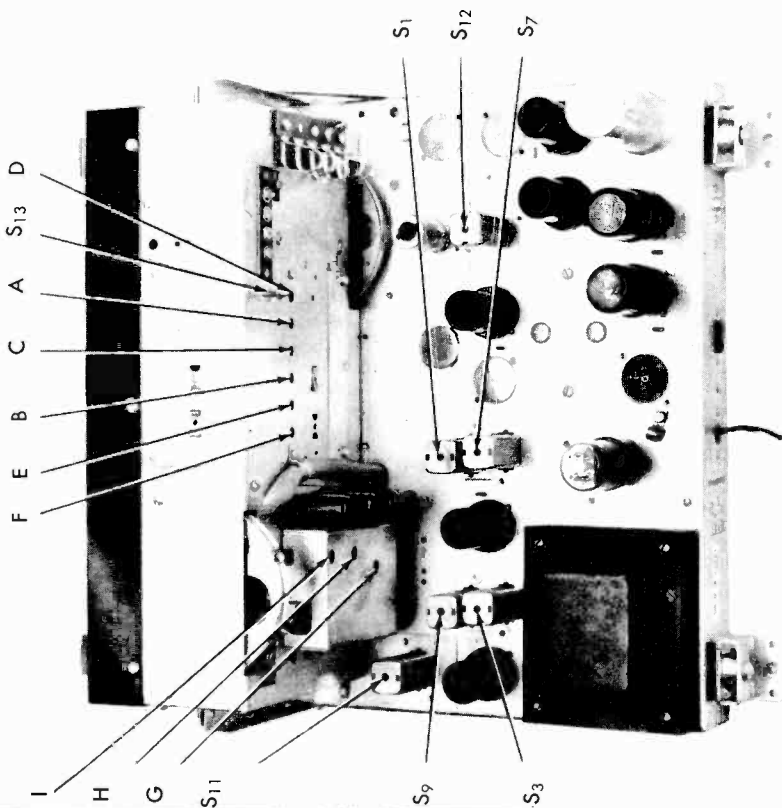
Calibration strip detail.

**ALIGNMENT CHART**

Step	Dummy Antenna	Signal Generator Coupling	Signal Generator Frequency	Band Switch Pos.	Radio Dial Setting	Cal. No.	Adjust	Remarks
1	0.01 mfd cap.	To stator plates of center section of AM tuning cap.	455 kc	"BC"	1000 kc	55	S1, S2, S3, S4, & S5	Adjust for max. output.
2	0.01 mfd cap.	To stator plates of center section of FM tuning cap	10.7 mc (No modulation)	"FM"	Mid-scale	55	S6, S7, S8, S9, S10, & S11	Adjust for max. AVC voltage as measured between pin #7 of 6AL5 and ground with a 20,000-ohm per volt meter.
3	0.01 mfd cap.	To stator plates of center section of FM tuning cap.	10.7 mc (No modulation)	"FM"	Mid-scale	55	S12	Adjust for zero voltage as measured between the junction of C55 and C68 ground with a 20,000-ohm per volt meter.
4	Std. RMA dummy.	To terminals "A" and "G" on ant. term. strip	1500 kc 600 kc	"B" "BC"	1500 kc 600 kc	82 15.5	A*, B, & C D* & S13	Adjust for max. output
5	Std. RMA	To terminals "A" and "G" on ant. term. strip.	16 mc	"SW"	16 mc	84	E* & F	Adjust for max. output.
6	Two 150 ohm carbon resistors	To "D" terminals on ant. term. strip;	108 mc	"FM"	108 mc	83.5	G*, H & I	Adjust for max. limiter grid voltage as measured between the junction of R33 and R34 and ground with a 20,000-ohm per volt meter

\* NOTE - Calibration adjustments.

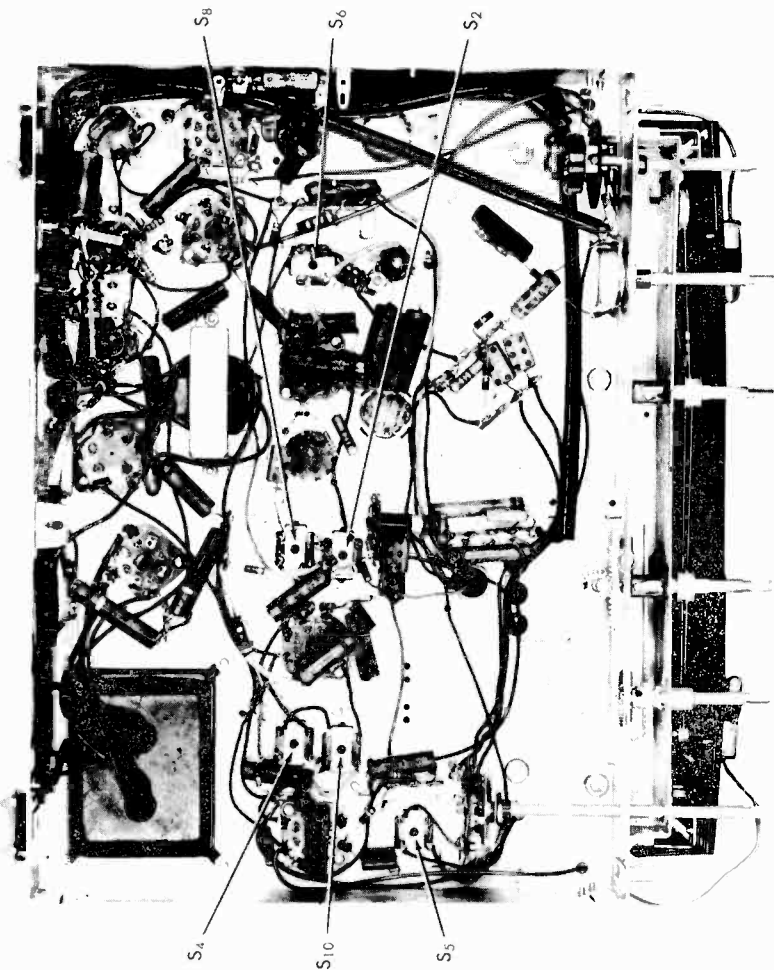
MODELS 400, 406,  
409, 410, 411, 412



Top view showing alignment points.

**GENERAL**

- Tubes.....Eleven plus rectifier
- Speaker.....12-inch PM
- Voice Coil Impedance...3.2 ohms
- Antenna.....Built-in loop, "AM"  
Built-in dipole, "FM"  
and shortwave. Pro-  
visions for external  
antennas.
- Tuning.....Manual and mechani-  
cal push-buttons;  
five P.B. for "AM";  
five P.B. for "FM".



Bottom view showing alignment points.

- Tuning Range.....Band -  
BC 550 kc - 1700 kc.  
SW 5.8 mc - 18 mc.  
FM 88 mc - 108 mc.
- Intermediate Frequency...455 kc/10.7 mc.
- Power Supply.....105-125 V. 60  
cycles AC.
- Power Consumption.....120 Watts (140 watts  
with changer).

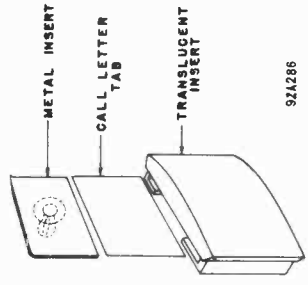


THE HALLICRAFTERS CO.

MODELS 400, 406,  
409, 410, 411, 412

3. Insert screw driver blade through large hole of pushbutton into slot of locking screw
4. Loosen locking screw about one-half turn (Not more than one full turn.)
5. With pushbutton depressed, carefully tune in desired station with the manual control and tighten the locking screw.
6. Replace the translucent insert with the proper station call letters inserted.

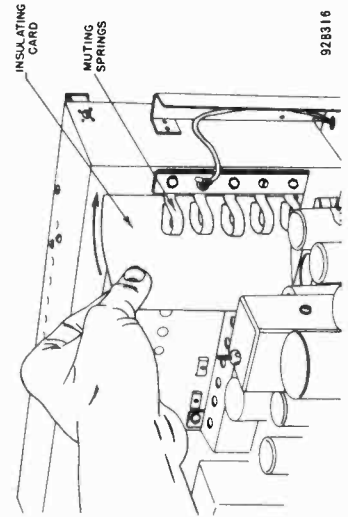
**INSERTING CALL LETTERS**



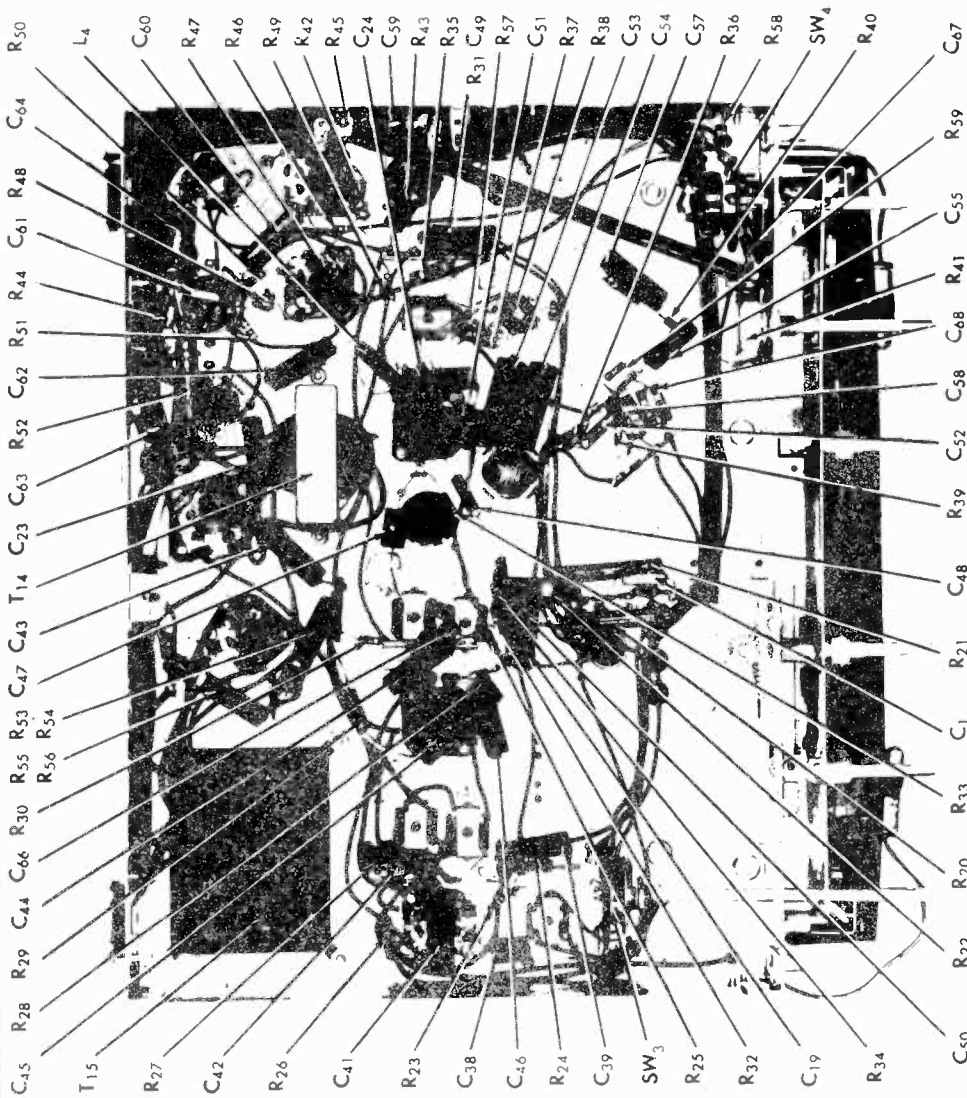
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1. Slide out metal insert from translucent insert assembly. (See Fig. 2.)
2. Insert desired call letter tab.
3. Replace metal insert behind call letter tab.
4. Replace translucent insert assembly into pushbutton mechanism.

Fig. 2. View showing call letter installation.



Insulating the mating switch contacts.

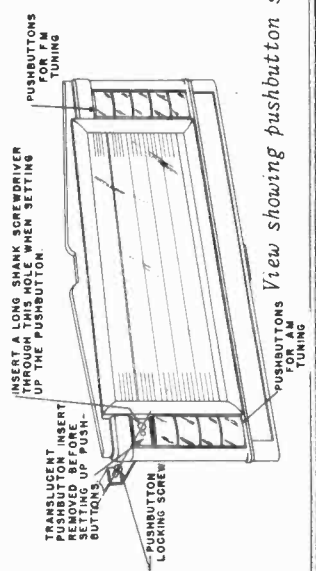


Bottom view of receiver showing component location.

**BUTTON SETTING**

Insulate the muting switch contacts before setting the left hand group of AM push buttons.

1. Select any one pushbutton.
2. Pull translucent insert straight out.



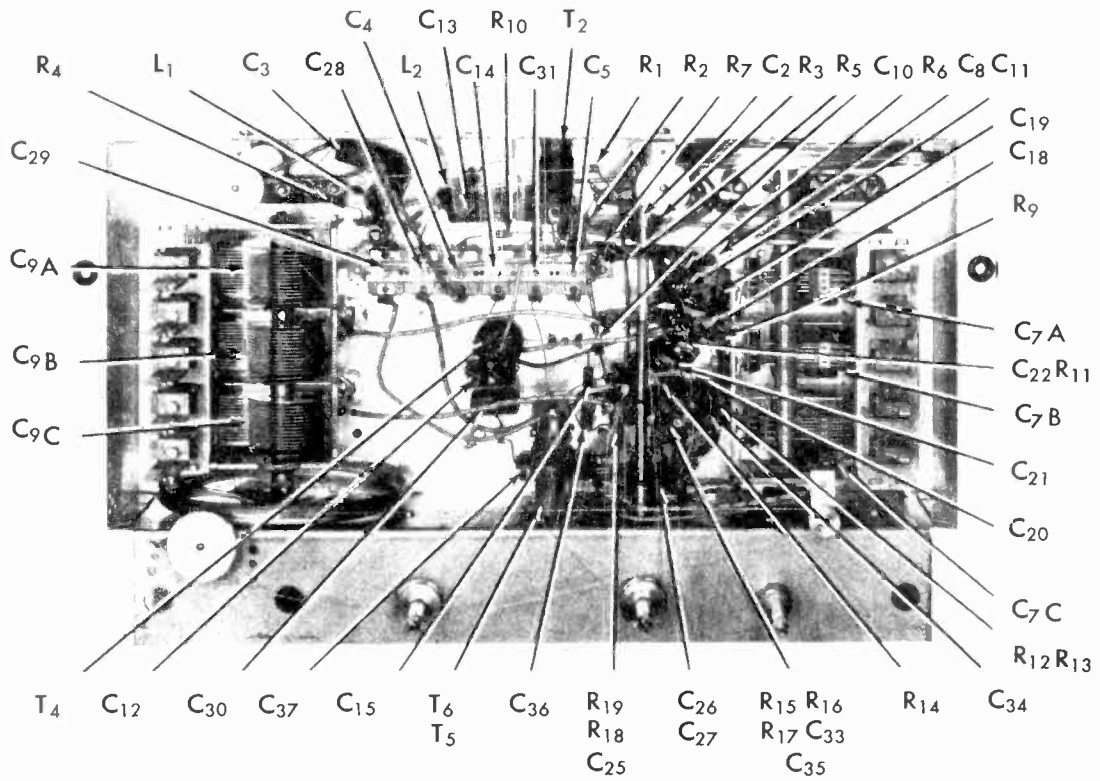
View showing pushbutton setup.



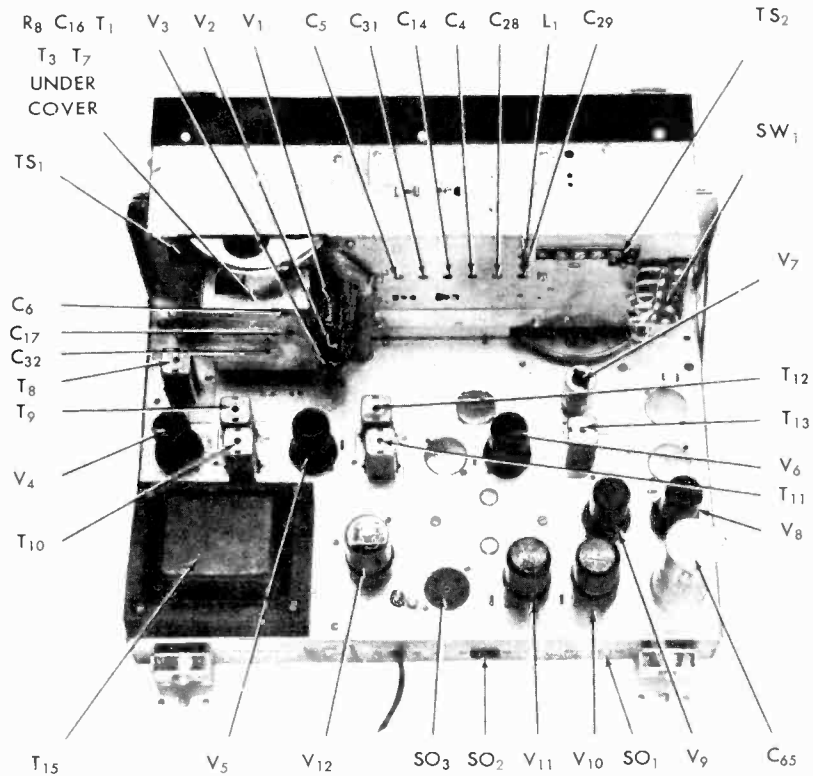


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Front view of R.F. chassis showing component location.



Top view showing component location.



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MODELS 400, 406,  
409, 410, 411, 412

SERVICE PARTS LIST

Ref. No.	Description	Hallcrafters Part No.
<b>CONDENSERS</b>		
C-1	470 mmf. 500 V., mica	CM20A471M
C-2,36	100 mmf. 500 V., mica	CM20A101M
C-3,37	.02 mfd. 600 V., tubular paper	46AY203F
C-4,5,14,28,29; 31	Trimmer assembly	44B34B
C-6	Trimmer, FM, ant. stage	44A194
C-7	Tuning condenser, FM	48C175
C-8,33	47 mmf. 500 V., ceramic	47A150
C-9	Tuning condenser, AM	49C176
C-10	2.2 mmf., ceramic	47A160-4
C-11,22	5000 mmf. 500 V., ceramic	47A16B
C-12	470 mmf. 500 V., mica	CM20A471K
C-13,51,53,54	.05 mfd. 600 V., tubular paper	46AY503F
C-15	4.7 mmf., ceramic	47A160-6
C-16,47, 67	47 mmf. 500 V., mica	CM20A470M
C-17	Trimmer, FM, mixer stage	44A192
C-18,27	100 mmf. 500 V., ceramic	47A045
C-19,23,24,34, 39,40,41,42,43, 44,45,46,49,60, 62	.01 mfd. 600 V., tubular paper	46AZ103F
C-20,66	3.3 mmf., ceramic	47A160-5
C-21	10 mmf. 500 V., ceramic	47A149
C-25,26,48,52	1000 mmf. 500 V., ceramic	47A14B
C-30	3900 mmf. 500 V., mica	CM35A392J
C-32	Trimmer, FM, osc. stage	44A21B
C-35	.008 mfd. 150 V., ceramic	47B32802M1
C-38,50, 61	150 mmf. 500 V., mica	CM20A151M
C-55	.003 mfd. 600 V., tubular paper	46AZ302J
C-57	.005 mfd. 600 V., tubular paper	46AZ502J
C-58	500 mmf. 350 V., ceramic	47A147
C-59	.03 mfd. 200 V., tubular paper	46AU303J
C-63	.01 mfd. 600 V., molded paper	46AG103J
C-64	10 mfd. 25 V., electrolytic	45A121
C-65	60-20 mfd. 450 V., 20 mfd. 400 V., electrolytic	45B113
C-68	1000 mmf. 500V., mica	CM20A102M
<b>RESISTORS</b>		
R-1,25	1 megohm $\frac{1}{2}$ watt, carbon	RC20AE105M
R-2,34,44	330,000 ohms $\frac{1}{2}$ watt, carbon	RC20AE334M
R-3	2200 ohms $\frac{1}{2}$ watt, carbon	RC20AE222M
R-4,5,9,19,24, 36,40	100,000 ohms $\frac{1}{2}$ watt, carbon	RC20AE104M
R-6	33,000 ohms 1 watt, carbon	RC30AE333M
R-7	47 ohms $\frac{1}{2}$ watt, carbon	RC20AE470M
R-8,12,13,15	10 ohms $\frac{1}{2}$ watt, carbon	RC20AE100M
R-10	2.2 megohms $\frac{1}{2}$ watt, carbon	RC20AE225M
R-11,23,49	220,000 ohms $\frac{1}{2}$ watt, carbon	RC20AE224M
R-14,27,30,31	1000 ohms $\frac{1}{2}$ watt, carbon	RC20AE102M
R-16,18,28	220 ohms $\frac{1}{2}$ watt, carbon	RC20AE221M
R-17	22,000 ohms $\frac{1}{2}$ watt, carbon	RC20AE223M
R-20,21	10,000 ohms 2 watts, carbon	RC40AE103M
R-22	470 ohms 1 watt, carbon	RC30AE471M
R-26,29,35	47,000 ohms 1 watt, carbon	RC30AE473M
R-32,33	47,000 ohms $\frac{1}{2}$ watt, carbon	RC20AE473M
R-37,38,51	470,000 ohms $\frac{1}{2}$ watt, carbon	RC20AE474K
R-39,59	150,000 ohms $\frac{1}{2}$ watt, carbon	RC20AE154M
R-41	Resistor, variable, 2 megohms (tapped)	25B622
R-42	300 ohms $\frac{1}{2}$ watt, carbon	RC20AE301J
R-43	47,000 ohms 2 watts, carbon	RC40AE473K
R-45,47	3900 ohms $\frac{1}{2}$ watt, carbon	RC20AE392K
R-46	470,000 ohms $\frac{1}{2}$ watt, carbon	RC20AE474M
R-46	10,000 ohms $\frac{1}{2}$ watt, carbon	RC20AE104K
R-50	330,000 ohms $\frac{1}{2}$ watt, carbon	RC20AE334K
R-52	330 ohms 2 watts, carbon	RC40AE331M
R-53,54	1200 ohms 2 watts, WW	24BV122E
R-55,56	1000 ohms 2 watts, WW	24BV102E
R-57	6.8 ohms 1 watt, carbon	RC30AE068K
R-58	5600 ohms $\frac{1}{2}$ watt, carbon	RC20AE562K
<b>TRANSFORMERS AND COILS</b>		
T-1	Transformer, FM, antenna stage	51B916
T-2	Transformer, Sw, antenna stage	51B993
T-3	Transformer, FM, mixer stage	51B915
T-4	Transformer, BC, mixer stage	51B910
T-5	Transformer, Sw, osc. stage	51B908
T-6	Transformer, BC, osc. stage	51B911
T-7	Transformer, FM, osc. stage	51B914
T-8	Transformer, 1st I.F.	50C29B
T-9,11	Transformer, FM, interstage I.F.	50C237
T-10	Transformer, AM, interstage I.F.	50C236
T-12	Transformer, AM, detector stage I.F.	50C235
T-13	Transformer, FM, detector stage I.F.	50C263

SERVICE PARTS LIST

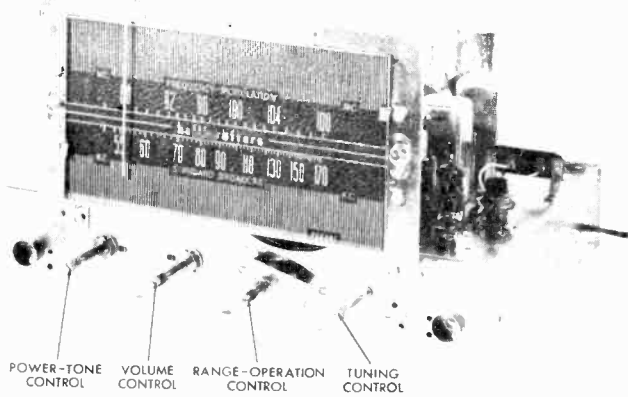
Ref. No.	Description	Hallcrafters Part No.
<b>TRANSFORMERS AND COILS (Continued)</b>		
T-14	Transformer, audio output	55B105
T-15	Transformer, power	52C153
L-1	Coil, loop loading	51B907
L-2	Coil, antenna loading	51B994
L-3	Loop antenna (Models 400,406,409)	57C114
L-3	Loop antenna (Models 410,411,412)	57C116
L-4	Coil, R.F. choke	53B009
<b>SWITCHES</b>		
SW-1	Switch, muting	18A092
SW-2	Band switch assembly	60C30B
SW-3	Switch, power and bass tone cont.	60B265
SW-4	Switch, treble tone control	60B325
<b>PLUGS AND SOCKETS</b>		
PL-1	Line cord and plug	87B1625
SO-1	Receptacle, phono pickup	36A034
SO-2	Receptacle, phono motor	10A015
SO-3	Socket, speaker (5 pin)	6A277
-	Socket, octal (tube)	6A190
-	Socket, octal (6V6GT tubes)	6A296
-	Socket, miniature (tube)	6A276
-	Socket & bracket, dial light, L.H.	86A046
-	Socket & bracket, dial light, R.H.	86A047
-	Socket, cabinet pilot light	86B050-2
<b>TUBES, RECTIFIERS AND LAMPS</b>		
V-1	Type 6BA6, antenna	90X6BA6
V-2	Type 6AU6, mixer	90X6AU6
V-3	Type 6J6, osc.	90X6J6
V-4,5	Type 6SG7, 1st & 2nd I.F.	90X6SG7
V-6	Type 6SH7, FM limiter, AM detector	90X6SH7
V-7	Type 6AL5, FM detector	90X6AL5
V-8,9	Type 6SQ7, audio amp.	90X6SQ7
V-10,11	Type 6V6GT/G, power amp.	90X6V6GT/1
V-12	Type 5Y3GT, rectifier	90X5Y3GT
LM-1,2,3	Lamp, 6" V., 250 MA., G.E. #44	39A003
<b>MISCELLANEOUS</b>		
	Shield, tube base (miniature tube)	69A169
	Shield, tube (miniature tube)	69A104
	Spring, tube retainer	75A076
	Shield, dial light	86A037
	Shield, pilot light	69A197
	Shield, FM coil section	69C172
	Carriage, pointer	67B645
	Pointer, FM	82A145
	Pointer, AM	82A146
	Spring, pointer	75A132
	Push-button (brown)	17B026
	Insert, push-button, lucite	17A027
	Insert, push-button, metal	17A029
	Call letters	17A025
	Spring, dial drive	75A006
	Cord, dial drive	38A017
	Plate, dial drive cover	83A300
	Escutcheon (Models 409,410)	70C39
	Escutcheon (Models 400,406,411,412)	70D39-2
	Dial glass, upper	22D195
	Dial glass, lower	22B207
	Clips, dial glass	76A331
	Knob, power switch & tone control (Models 400,406,411,412)	15B96-1
	Knob, power switch & tone control (Models 409,410)	15B096
	Knob, tuning & volume controls (Models 400,406,411,412)	15B095-2
	Knob, tuning & volume controls (Models 409,410)	15B093
	Knob, & pin ass'y bandswitch (Models 400,406,411,412)	15A136
	Knob & pin ass'y, bandswitch (Models 409,410)	15A129
TS-1	Terminal strip, antenna	88A277
TS-2	Terminal strip, loop	88A278
	Transmission line, loop	87A1615-1
	FM folded doublet	57C10B-1
	Jewel, pilot lamp	86A057
	Bracket, pilot lamp	67A765
	Speaker assembly	85C069
LS-1	Record changer	115C017

MODEL 414

**GENERAL**

- Tubes . . . . . Ten plus rectifier
- Speaker . . . . . 12 inch PM
- Voice Coil Impedance . . . 6 ohms
- Antenna . . . . . Built in loop, "BC"  
Built in dipole, "FM"  
Provisions for external  
antennas
- Tuning . . . . . Manual
- Tuning Range . . . . . Broadcast 540 kc - 1750 kc  
Frequency  
Modulation 88 mc - 108 mc
- Intermediate Frequency. . . 455 kc/21.75 mc.
- Power Supply . . . . . 105-125 V. 50/60 cycles AC
- Power Consumption. . . . . 90 Watts (110 watts with  
changer)

When making the alignment adjustments set the tone control at NORMAL and the volume control at maximum volume. Use just enough signal generator output to obtain the results indicated on the chart.



92X 421

**RESTRINGING DIAL CORD**

Restring the dial drive with 30 lb test dial cord. Tie one end to the tension spring and follow the sequence outlined in Fig. 1. Stretch the tension spring and tie the end of the cord securely to the spring as shown.

Set the tuning condenser at maximum capacity (closed), attach the pointer to the string and line it up with the left hand index mark on the dial scale.

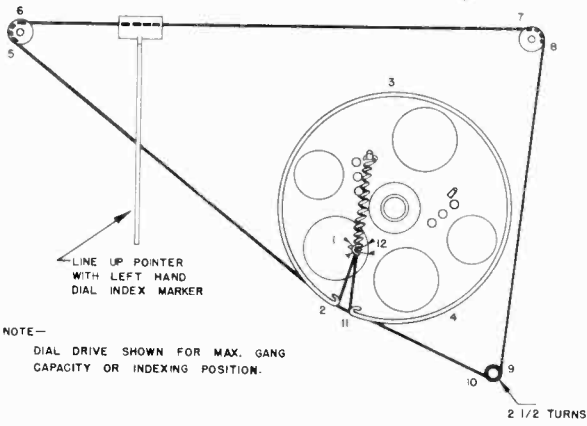


Fig. 1. Dial cable stringing procedure.

**ALIGNMENT PROCEDURE**

The receiver is equipped with AUTOMATIC FREQUENCY CONTROL on the FM band to compensate for oscillator drift and improve the tuning function on the FM band. The correction factor is approximately 5 times; AFC takes hold 250 kc before the station frequency is reached and releases before tuning 500 kc beyond the station frequency when receiving a 1000 micro-volt signal.

The standard RMA dummy specified in the alignment chart consist of a 200 mmf condenser in series with a 20 uh r-f choke which is shunted by a 400 mmf condenser in series with a 400 ohm carbon resistor.

**REPLACING LAMPS**

Refer to Fig. 7 for the location of two dial lamps used in the receiver. To gain access to defective lamps, reach in through the rear of the cabinet and unclip the dial lamp socket by compressing the side springs. The socket may then be brought out into the open to change the defective lamp. The lamp in the record changer compartment may be reached directly through the compartment door. Replace all lamps with 6-8 V. Mazda #44 (Blue head) lamps or equivalent.

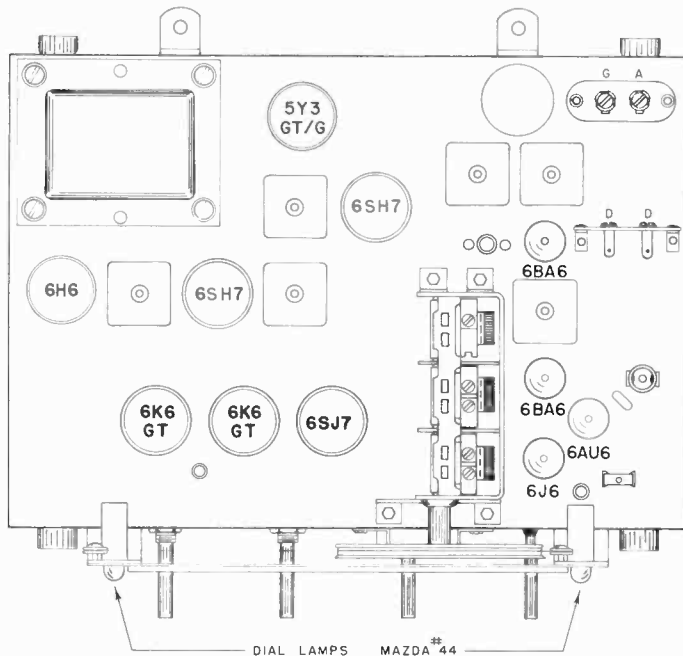


Fig. 7. Top view, location of tubes and dial lamps.

**ALIGNMENT CHART**

Step	Dummy Antenna	Signal Generator Coupling	Signal Generator Frequency	Band Switch Pos.	Radio Dial Setting	Adjust	Remarks
1	0.01 mfd. cap.	To high cap. stator of center section.	455 kc	"BC"	1000 kc	A,B,C, D,E	Adjust for max. output.
2	0.01 mfd. cap. in series with a 4700 ohm carbon resistor.	To low cap. stator of center section.	21.75 mc	"FM"	90 mc	F,G,H, I,J,K	Adjust for max. voltage as measured between pin #3 of 6H6 and ground with an electronic volt meter.
3	0.01 mfd. cap.	See step 2.	21.75 mc	"FM"	90 mc	L	Adjust for zero voltage as measured between the junction of R27 and R28 and ground with an electronic volt meter.
4	Std RMA dummy	To terminals "A" and "G" on terminal strip TS-2.	1500 kc	"BC"	1500 kc	*M,N,O	Adjust for max. output
5	Two 150 ohm carbon resistors	To terminals "D-D" on terminal strip TS-1.	105 mc	"FM"	105 mc	*P,Q	Adjust for max. voltage as measured across R24 with an electronic volt meter.

\*Note - Calibration adjustments.

\*\*Note - The intermediate frequency for the FM channel in this receiver is 21.75 megacycles. This is a value which has been standardized by the Radio Manufacturers Association for the television sound channel. A "TLV" position on the band switch and a suitable connector (on the chassis, near the tuning condenser) have been provided so that this receiver can be used with a relatively inexpensive video unit for high-quality television reception.

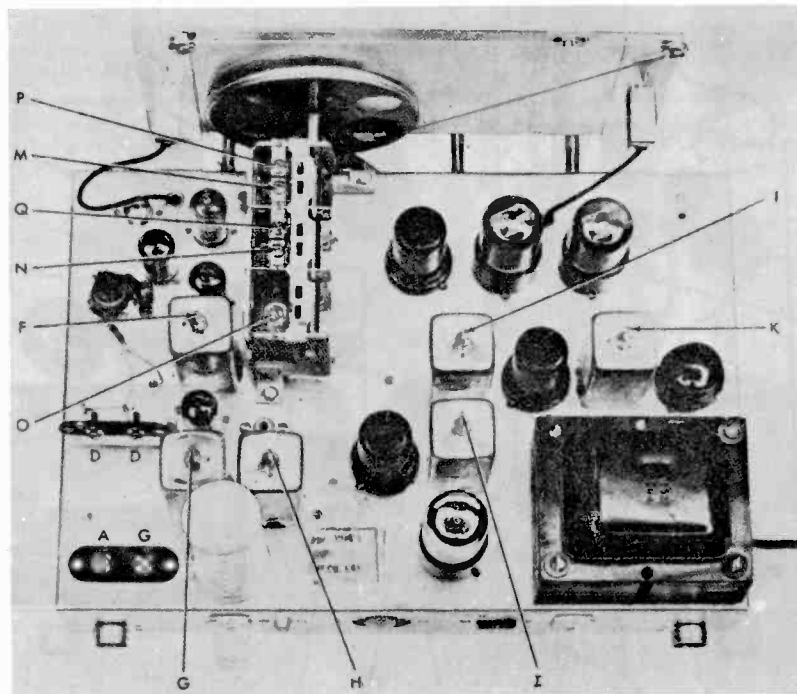


Fig. 2. Alignment adjustments, top view.

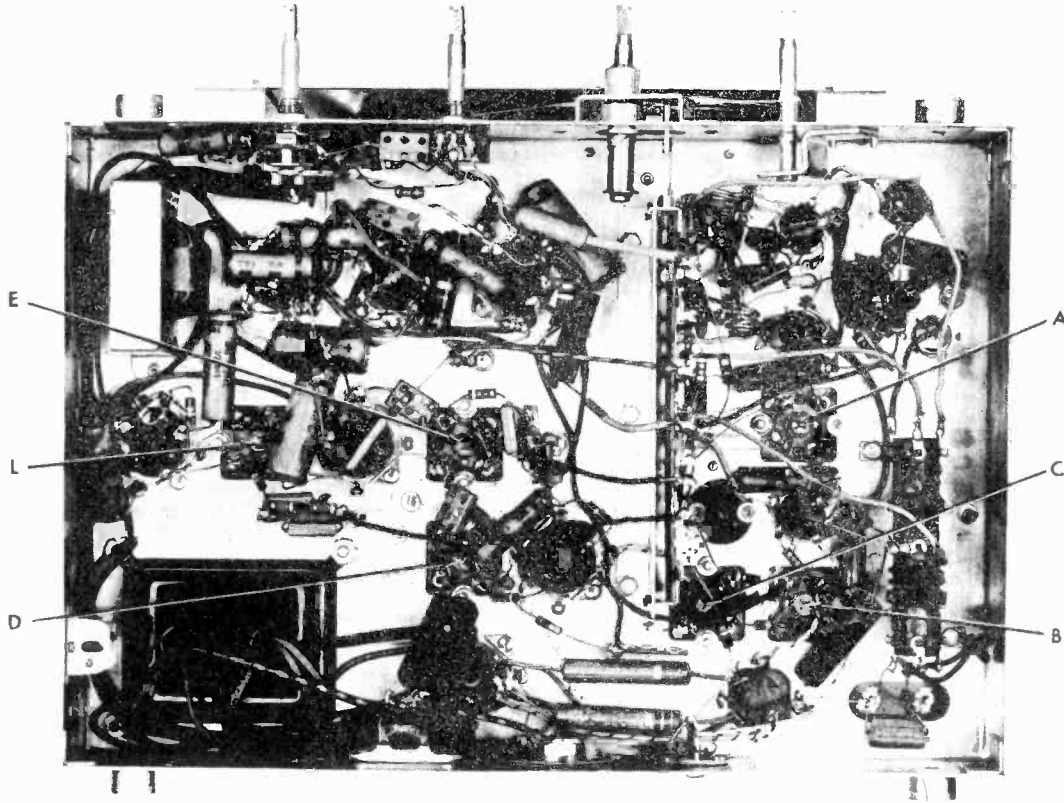


Fig. 3. Alignment adjustments, bottom view.

(92X410)

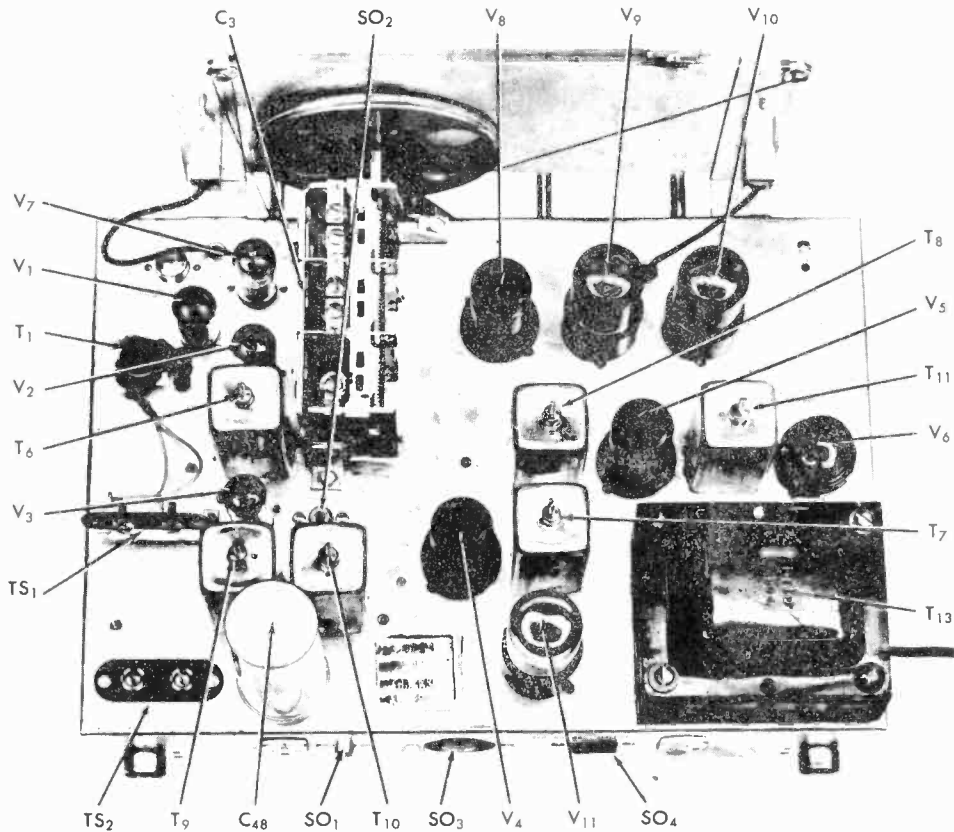


Fig. 4. Component location, top view.



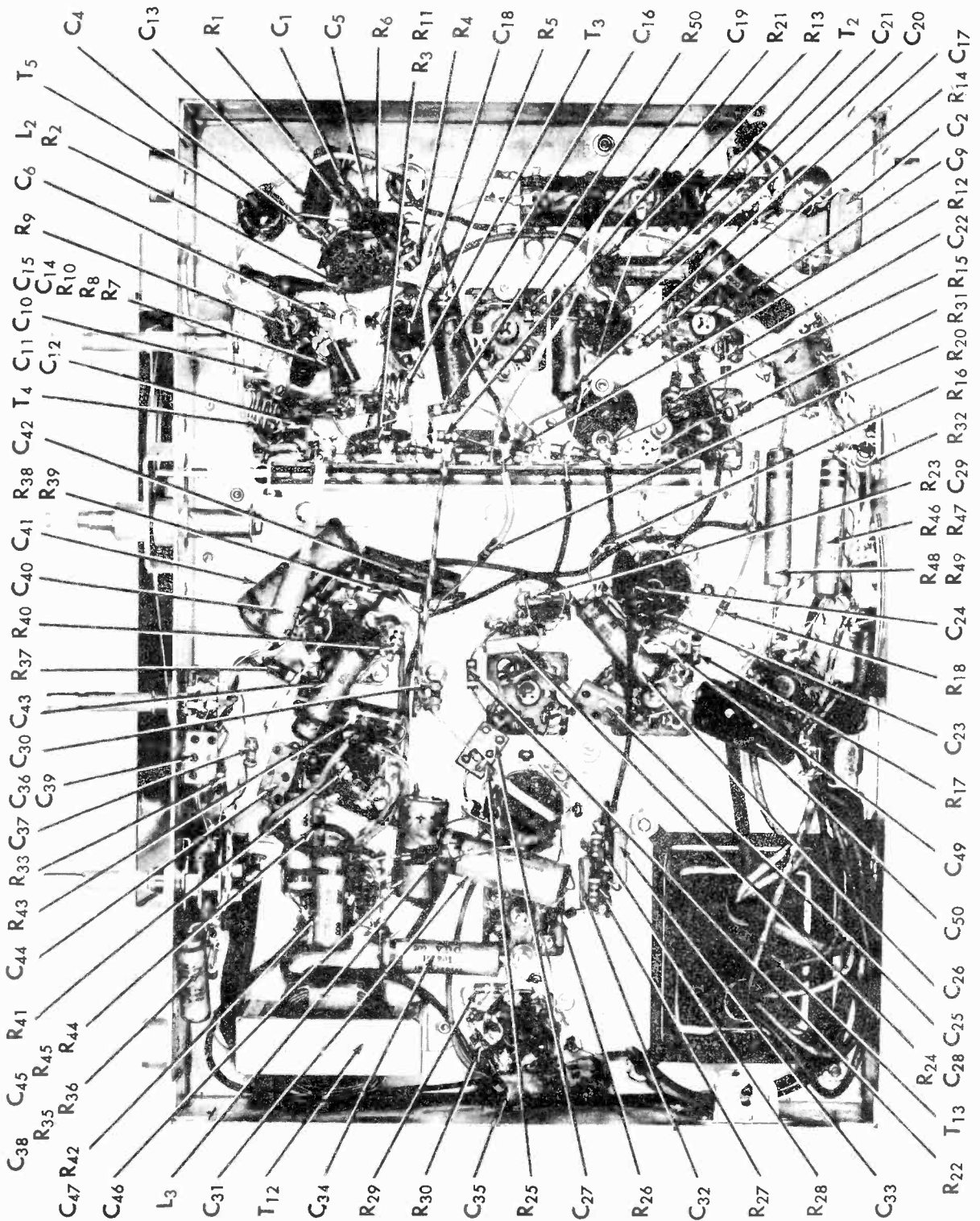
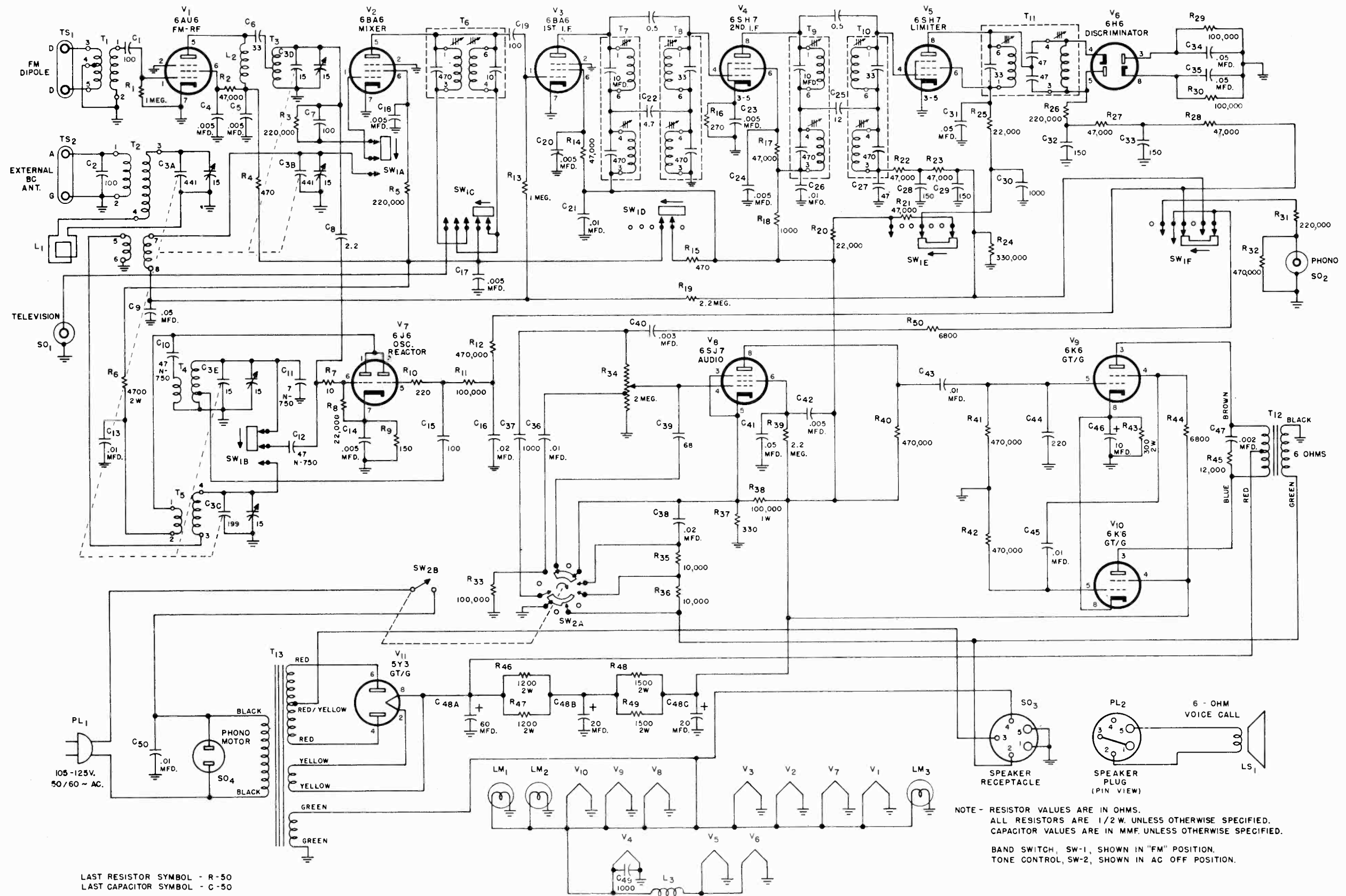


Fig. 5. Component location, bottom view. (92X423)





LAST RESISTOR SYMBOL - R-50  
 LAST CAPACITOR SYMBOL - C-50

NOTE - RESISTOR VALUES ARE IN OHMS.  
 ALL RESISTORS ARE 1/2 W. UNLESS OTHERWISE SPECIFIED.  
 CAPACITOR VALUES ARE IN MMF. UNLESS OTHERWISE SPECIFIED.  
 BAND SWITCH, SW-1, SHOWN IN "FM" POSITION.  
 TONE CONTROL, SW-2, SHOWN IN AC OFF POSITION.

Fig. 8. Schematic diagram.

(89D272)

**SERVICE PARTS LIST**

Ref. No.	Description	Hallicrafter's Part Number
<b>CONDENSERS</b>		
C-1,7,15,19	100 mmf. 500 V., ceramic	47B20101M5
C-2	100 mmf. 500 V., mica	CM20A101M
C-3	Tuning condenser, 5 sections	48C196
C-4,5,14,17,18,20,23,24	.005 mfd. 450 V., ceramic	47A168
C-6	33 mmf. 500 V., ceramic	CC20UK330K
C-8	3.3 mmf. 500 V., bakelite	47A160-5
C-9,34,35	.05 mfd. 200 V., tubular paper	46AU503J
C-10,12	47 mmf. 500 V., ceramic	CC20UK470M
C-11	7 mmf. 500 V., ceramic	CC20UJ070K
C-13,21,26,36,43,45	.01 mfd. 600 V., tubular paper	46AZ103F
C-16,38	.02 mfd. 200 V., tubular paper	46AU203J
C-22	4.7 mmf. 500 V., bakelite	47A160-6
C-25	12 mmf. 500 V., mica	CM20A120K
C-28,29,32,33	150 mmf. 500 V., mica	CM20A151M
C-30,37,49	1000 mmf. 500 V., ceramic	47B20102M5
C-31,41	.05 mfd. 600 V., tubular paper	46AY503J
C-39	68 mmf. 500 V., mica	CM20A680M
C-40	.003 mfd. 600 V., tubular paper	46AZ302J
C-42	.005 mfd. 600 V., tubular paper	46AZ502J
C-44	220 mmf. 500 V., mica	CM20A221M
C-46	10 mfd. 25 V., electrolytic	45A121
C-47	.002 mfd. 600 V., tubular paper	46AZ202J
C-48	60-20-20 mfd. 450 V., electrolytic	45B113
C-50	.01 mfd. 600 V., molded paper	46AG103J

**RESISTORS**

R-1,13	1 megohm 1/2 watt, carbon	RC20AE105M
R-2,14,17,21,22,23,27,28	47.000 ohms 1/2 watt, carbon	RC20AE473M
R-3,5,26,31	220.000 ohms 1/2 watt, carbon	RC20AE224M
R-4,15	470 ohms 1/2 watt, carbon	RC20AE471M
R-6	4700 ohms 2 watts, carbon	RC40AE472M
R-7	10 ohms 1/2 watt, carbon	RC20AE100M
R-8,20,25	22.000 ohms 1/2 watt, carbon	RC20AE223M
R-9	150 ohms 1/2 watt, carbon	RC20AE151M
R-10	220 ohms 1/2 watt, carbon	RC20AE221M
R-11,33	100.000 ohms 1/2 watt, carbon	RC20AE104M
R-12,32,40,41,42	470.000 ohms 1/2 watt, carbon	RC20AE474M
R-16	270 ohms 1/2 watt, carbon	RC20AE271K
R-18	1000 ohms 1/2 watt, carbon	RC20AE102M
R-19,39	2.2 megohms 1/2 watt, carbon	RC20AF225M
R-24	330.000 ohms 1/2 watt, carbon	RC20AE334M
R-29,30	100.000 ohms 1/2 watt, carbon	RC20AF104K
R-34	Volume control, 2 megohms (tapped)	25B623
R-35,36	10.000 ohms 1/2 watt, carbon	RC20AF103M
R-37	330 ohms 1/2 watt, carbon	RC20AE331K
R-38	100.000 ohms 1 watt, carbon	RC30AF104K
R-43	300 ohms 2 watt, carbon	RC40AE301J
R-44,50	6800 ohms 1/2 watt, carbon	RC20AF682M
R-45	12.000 ohms 1/2 watt, carbon	RC20AF123K
R-46,47	1200 ohms 2 watt, carbon	RC40AE122K
R-48,49	1500 ohms 2 watt, carbon	RC40AE152K

**TRANSFORMERS AND COILS**

T-1	Transformer, FM, antenna stage	51B1021
T-2	Transformer, BC, mixer stage	51B1019
T-3	Transformer, FM, mixer stage	51B1020
T-4	Transformer, FM, osc. stage	51B1023
T-5	Transformer, BC, osc. stage	51B1020
T-6	Transformer, 1st I.F.	50B367
T-7,9	Transformer, 2nd I.F. and AM Detector & FM limiter	50B370

**SERVICE PARTS LIST (Cont.)**

Ref. No.	Description	Hallicrafter's Part Number
<b>TRANSFORMERS AND COILS (Cont.)</b>		
T-8,10	Transformer, 2nd I.F. and AM Detector & FM limiter	50B366
T-11	Transformer, FM, detector stage	50B368
T-12	Transformer, audio output	55B105-1
T-13	Transformer, power	52C152
L-1	Loop antenna	57C118
L-2	Plate choke for tube V1	53B124
L-3	Filament choke for tubes V5 & V6	53B123

**SWITCHES:**

SW-1	Band switch assembly	60B318
SW-2	Switch, tone control	60B319

**PLUGS AND SOCKETS:**

PL-1	Line cord and plug	87A078
SO-1,2	Receptacle, television, phono	36A029
SO-3	Receptacle, speaker	6A277
SO-4	Receptacle, phono motor	10A015
	Socket, octal (tube)	6A296
	Socket, miniature (tube)	6A297
	Socket & bracket, dial light	86A062
	Socket, pilot light	86B065

**TUBES RECTIFIERS AND LAMPS**

V-1	6AU6 antenna	90X6AU6
V-2,3	6BA6 mixer, 1st I.F.	90X6BA6
V-4,5	6SH7 2nd I.F., limiter	90X6SH7
V-6	6H6 discriminator	90X6H6
V-7	6J6 osc. & AFC	90X6J6
V-8	6SJ7 audio amp.	90X6SJ7
V-9,10	6K6GT power amp.	90X6K6GT
V-11	5Y3GT rectifier	90X5Y3GT/C
LM-1,2,3	Lamp, 6-8 V., 250 Ma., Mazda #44	39A003

**MISCELLANEOUS**

	Shaft, tuning	74A247
	Pulley, idler	28A052-6
	Switch, cam	77A261
	Drive pin	74A246
	Collar	77A267
	Bushing	77A266
	Bracket, dial plate mtg.	67A793
	Dial plate	63B332
	Dial background (paper)	32B433
	Dial glass (calibrated)	22C201
	Clip (for dial glass 22C201)	76A390
	Rubber spacer, for dial clip	16A126
	Pointer	82A147
	Dial cord	38A019
	Spring, dial cord	75A012
	Dial glass (clear)	22B205
	Clip (for dial glass 22B205)	76A331
	Escutcheon	7D067
	Knob, tone and range controls	15B077-3
	Knob, tuning and volume controls	15B068-3
LS-1	Speaker assembly	85C072
TS-1	Terminal strip, antenna (Marked D-D)	87A379
TS-2	Terminal strip, antenna (Marked A-G)	88A327
	Dipole assembly	57C108-1
	Line cord lock	76A299
	Grommet, chassis mtg.	16A124
	Shield, pilot light	86A037
	Record changer	115C019

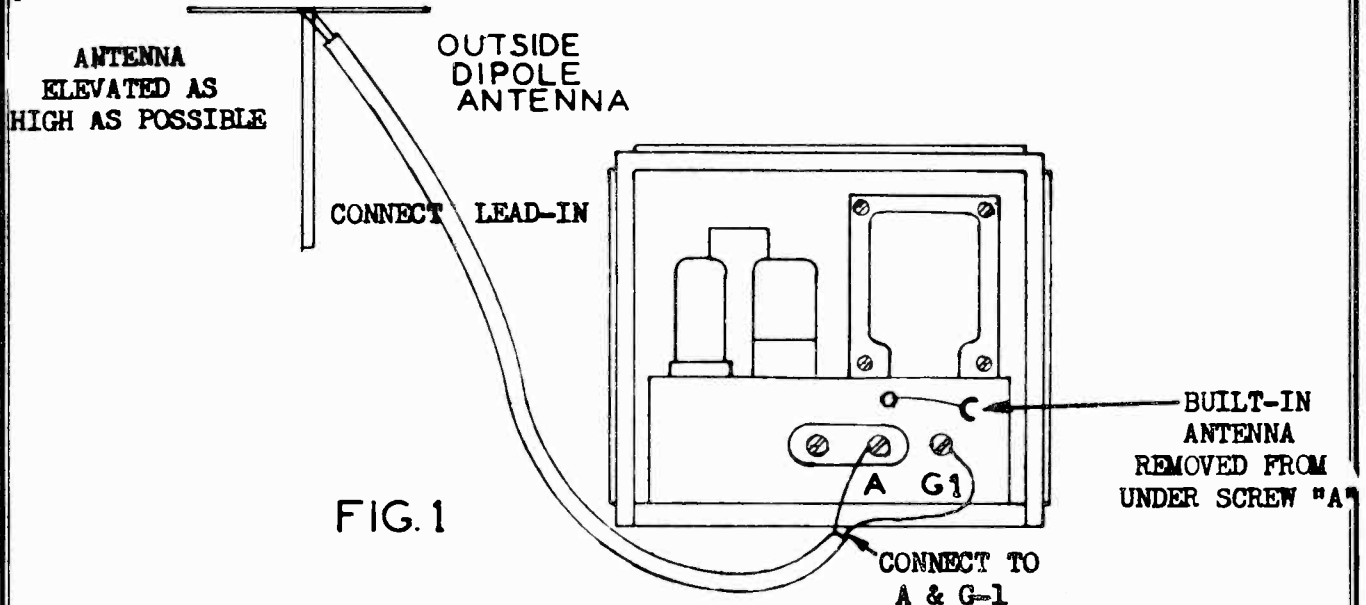




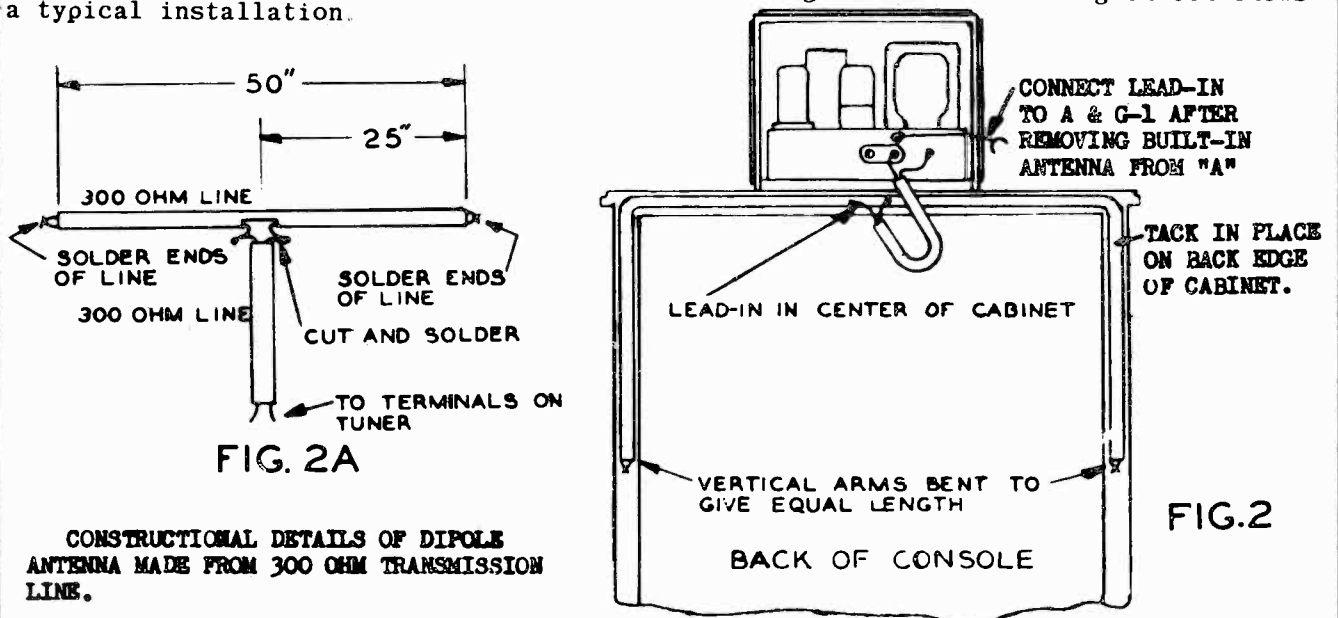


**ANTENNA REQUIREMENTS:** Although the Howard Model "482" Tuner is the most sensitive built today, the successful operation of your FM Tuner depends on the signal strength of the transmitter and the efficiency of the antenna connected to the Tuner. In localities a number of miles from the sending station, it is advisable that a good antenna be used. It must be remembered that a great many things influence FM reception: elevation, high buildings or hills will intercept the waves and reduce signal strength. Each installation presents a different problem however, in most cases the built-in antenna will provide sufficient signal strength to operate the Tuner. Below are listed the different types of antennas which may be used with the "482" Tuner and a diagram to show how they are connected. The various antennas will be listed according to their efficiency.

1. **DIPOLE ANTENNA:-** Mounted as high as possible and away from all obstructions. Connect as shown in Fig. 1 using 300 ohm twin lead-in wire. Maximum pickup will be experienced when the arms of the antenna are flatside toward the transmitter.



2. **INSIDE DIPOLE ANTENNA:-** This type of antenna is made of 300 Ohm Transmission Line (See Fig. 2-A) and may be mounted on the back of the average console radio. Connections to the "482" Tuner are the same as shown in Fig. 2. The following sketch shows a typical installation.



**CONSTRUCTIONAL DETAILS OF DIPOLE ANTENNA MADE FROM 300 OHM TRANSMISSION LINE.**

This type of antenna while economical and easy to install gives excellent results. The arms may also be stretched out and placed under a rug if the cabinet is too small to attach to the back.



3. **BUILT-IN ANTENNA:-** The antenna built into the "482" Tuner is quite efficient in most localities within the primary coverage area of the transmitter. For best results the line cord should be stretched out straight and away from metal objects. The Tuner is shipped with the built-in antenna attached as shown in Fig. 3.

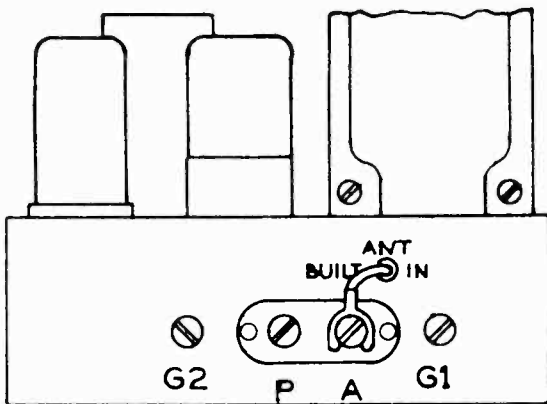
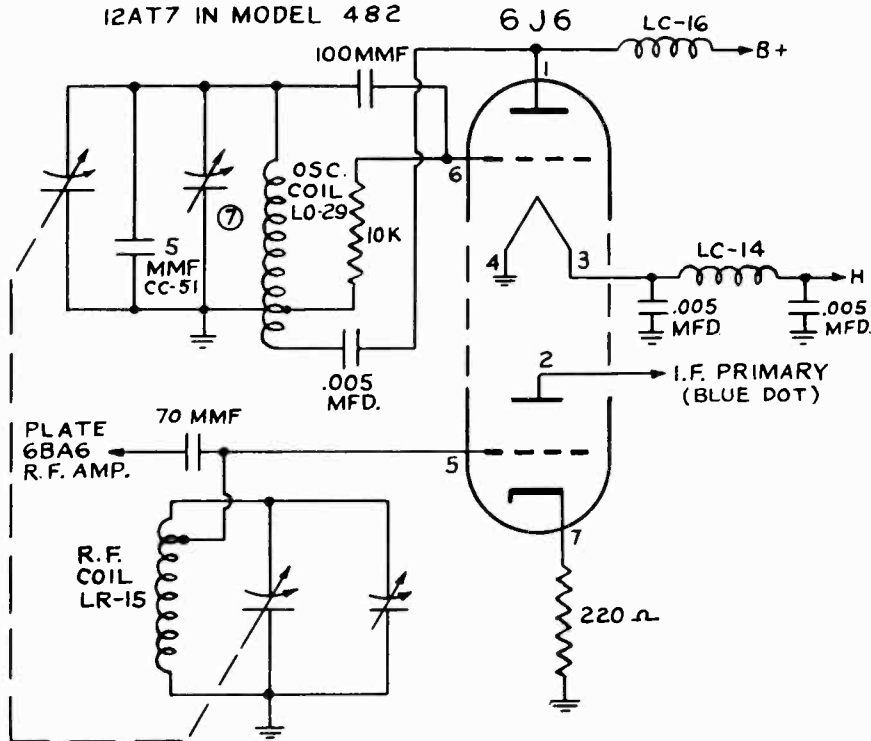


FIG. 3

CONNECTIONS TO RADIO RECEIVER

THE 6J6 IN MODEL 482-A REPLACES THE 12AT7 IN MODEL 482



**GENERAL:-** Most receivers have connections in the rear of the chassis for a phonograph. The type of connection varies with different manufacturers, but it usually is in the form of a terminal strip marked PHONO and consists of two screws or a socket. In the following paragraphs each type of connection will be shown with the "482" Tuner connected in the proper manner. It will be necessary for you to determine which of the two screws or which terminal of the plug is "live". By "live" we mean which is the audio connection and which is the ground connection; no voltage capable of giving a shock will be encountered. To determine which is the "live" terminal, turn the radio on with the selector switch in the PHONO position and volume up; touch the two screws or the plug connections one at a time, the one which produces a loud hum in the speaker is the "live" terminal.

1. **RADIO HAVING NO PHONO CONNECTION:-** In this case it is advisable to call a competent serviceman to make the installation as the "482" Tuner will have to be connected internally to your receiver.

2. RADIO WITH TWO SCREW TERMINALS (OR CLIPS)

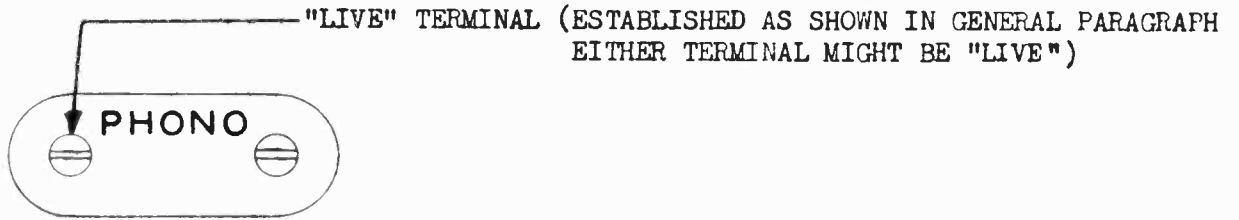


FIG. 4

3. RADIO WITH ONE SCREW TERMINAL (OR CLIPS)

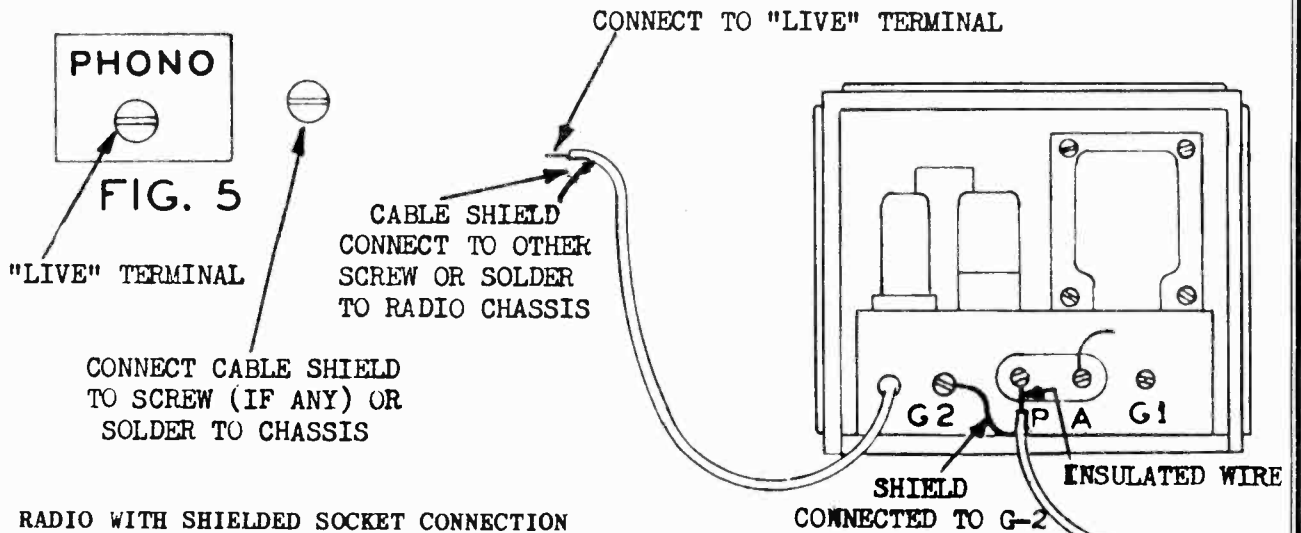


FIG. 5

4. RADIO WITH SHIELDED SOCKET CONNECTION

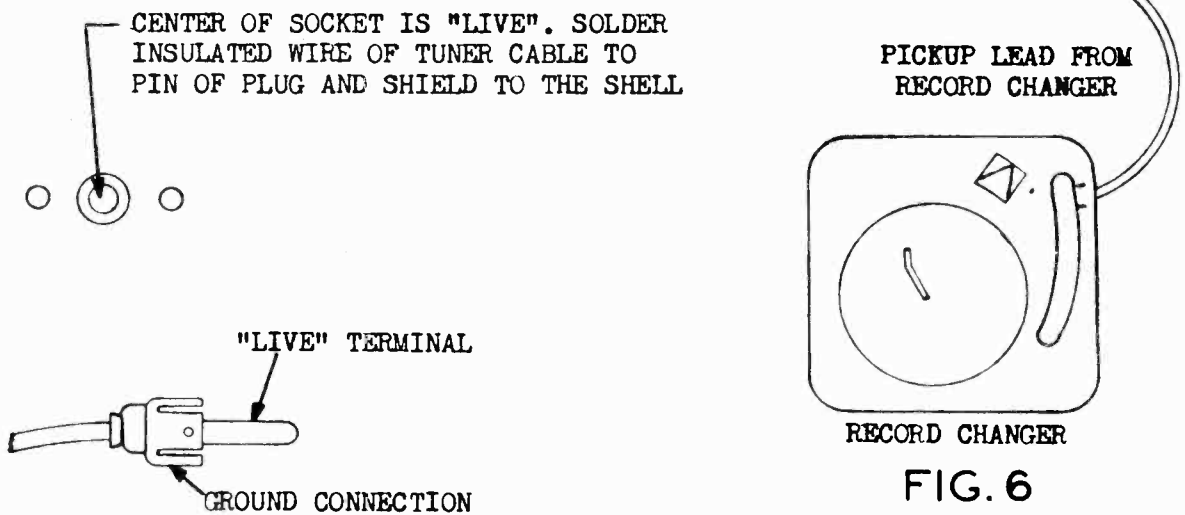


FIG. 6

UNSOLDER PLUG AND CONNECT TO "P" & G-2 AS SHOWN.

MODELS 482, 482A

HOWARD RADIO COMPANY

**NOTE:**

It is impossible to show all the means used to connect a record player to a radio, but by remembering to find the "live" connection going to the record player and attaching the Tuner insulated lead to this point and the cable shield to the chassis, then your Tuner will be connected properly. Then connect the lead from your record changer that went to the "live" terminal to "P" on your Tuner chassis and the other lead or shield to G-2 then your record player will play normally when the center switch on the "482" Tuner is turned to the left or OFF position.

The "482" Tuner is designed for AC operation only and should never be connected to a DC supply. It operates best with a receiver designed for AC operation as a slight hum may be noticed on high volume if the Tuner is connected to an AC-DC receiver. This may be eliminated by reversing the power cord plug in its socket on either the radio or the Tuner, or both.

**TO OPERATE:**

Plug power cord into 115 volt, 60 cycle, A.C. power outlet. Turn radio on, place radio in phono position, and turn radio volume control approximately half on. Turn FM Tuner to ON position, use volume control on Tuner to adjust volume level and carefully tune in FM Stations.

**PARTS LIST**

	<b>CONTROLS</b>		<b>DIAL AND CONTROL ACCESSORIES</b>
VC-0009	Volume Control	DG-0021	Dial Scale
SW-0025	Switch (On-Off) (AM-FM)	DC-0001	Dial Cord 28" long
	<b>CONDENSERS</b>	HD-0003	Pointer - Dial.
CV-0018	Tuning Gang and Drive Hub	SL-0006	Dial Light Socket Assy.
CE-0007	Capacitor - Electrolytic 50x30x30 MFD 150 volts	LS-0001	Lamp Type #47
CE-0028	Capacitor - Electrolytic 10 MFD 50 volts	SP-0010	Spring-Dial 12 oz. Load Spr. Stl.
CT-0005	Trimmer - Cap. 2.5-30MMF	SM-0188	Shaft-tuning 2-9/64" long
CC-0005	Capacitor - Ceramic 30MMFD 500 V. D.C.		<b>KNOBS</b>
CC-0014	Capacitor - Ceramic 50MMFD 500 V. D.C.	KB-0022-1	Knob - Moulded 3/4" Dia. Walnut
CC-0050	Capacitor - Ceramic 68-72MMFD 500 V. D.C.	KB-0022-2	Knob - Moulded 3/4" Dia. Onyx
CC-0016	Capacitor - Ceramic 100MMFD 500 V. D.C.	KB-0023-1	Knob - Moulded 1-1/32" Dia. Walnut
CC-0020	Capacitor - Ceramic 10MMFD 500 V. D.C.	KB-0023-2	Knob - Moulded 1-1/32" Dia. Onyx
CC-0022	Capacitor - Ceramic 70MMFD 500 V. D.C.		<b>TRANSFORMER</b>
CC-0028	Capacitor - Ceramic 300MMFD 500 V. D.C.	TP-0012	Power Transformer (60 Cycle, 110 V.
CC-0034	Capacitor - Ceramic 5000MMFD 500 V. D.C.		<b>TUBES</b>
CC-0049	Capacitor - Ceramic 15MMFD 500 V. D.C.	TU -	6AL5
	<b>COILS</b>	TU -	6BA6 (3 used)
LA-0017	Antenna Coil	TU -	6J5
LC-0014	Choke Coil - Filament	TU -	6X5GT
LC-0016	F.M.-R.F. Choke Coil	TU -	12AT7
LC-0030	Line Antenna Choke Coil		<b>SOCKETS</b>
LI-0037	1st I.F. Transformer	SO-0007	Socket - Octal - 8 Prong
LI-0038	2nd I.F. Transformer	SO-0019	Socket - Miniature - 7 Pin
LI-0039	Discriminator Transformer	SO-0022	Socket - Miniature - 9 Pin
LO-0028	Oscillator Coil	SO-0029	Socket - Miniature - 7 Pin
LR-0015	R.F. Coil	SO-0030	Socket - - 3 Pin
		TB-0018	Antenna Terminal Strip
			<b>LINE CORD</b>
		CA-0038	A.C. Line Cord 6 ft. W/Plastic Plug
			<b>CABINETS</b>
		CW-0012-1	Wood Cabinet (Mahogany)
		CW-0012-2	Wood Cabinet (Blonde)
		DG-0020	Cabinet Dial Escutcheon

**ALIGNMENT NOTES**

Volume control should be turned on full before aligning radio.  
Tuning gang should be in a closed condition unless otherwise stated in the following data. Pointer on last line below 88 MC.  
Use an F.M. Signal Generator.

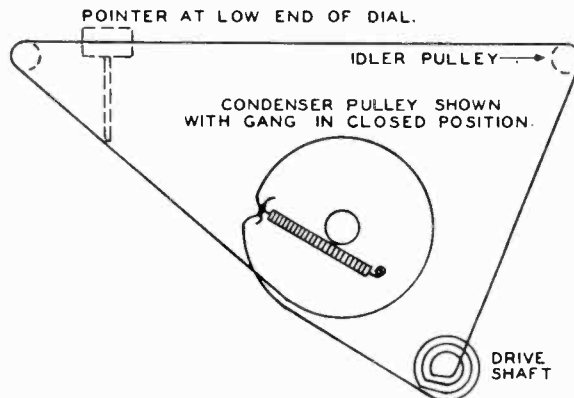
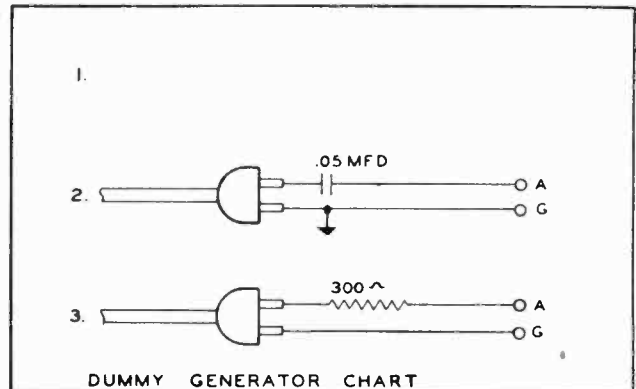


DIAGRAM SHOWING DIAL STRINGING FOR MODEL 482



DUMMY GENERATOR CHART

ALIGNMENT CHART USING MODULATED GENERATOR

SEE DUMMY GEN. CHART	SIG. GEN CONNECTION	GEN. FREQ.	BAND SW. POSITION	DIAL SETTING	ORDER OF SLUG AND TRIMMER ADJUSTMENTS	TRIMMER OR SLUG FUNCTION	SEE NOTES BELOW
2	Point B on Circuit Diagram	10.7 MC.	FM	Gang Closed	6	F. M. Det. Adj.	A & B
2	Point B on Circuit Diagram	10.7 MC.	FM	Gang Closed	5 Adjust to zero Voltage	F. M. Det. Adj.	C
2	Point D on Circuit Diagram	10.7 MC.	FM	Gang Closed	1 2 3 4	F.M. - I.F.	D
3	Ant. and Grd. Back of Chassis	105 MC.	FM	105 MC.	7 8 9	Osc. and R.F.-F.M	E F & G
3	Ant. and Gnd. Back of Chassis	90 MC.	FM	90 MC.		F.M. - R.F. Ind. Adj.	H & I

- A. Signal generator modulation off and turned up to about 100,000 microvolts
- B. Connect electronic volt meter (equivalent to voltohmmist) at point "B" of alignment socket as shown on the wiring diagram and turn slug (6) on trimmer location chart to extreme counter-clockwise position. Turn clockwise to 1st peak and adjust to maximum.
- C. Turn slug (5) to extreme counter-clockwise position. Connect electronic voltmeter to Point A of alignment socket and turn slug (5) until voltmeter is to zero voltage. Repeat adjustments given in Notes B & C until no further improvement can be made.
- D. Connect voltmeter to Point B and generator at Point D. Adjust (1) (2) (3) (4), then retrim (6). Move voltmeter to Point A and recheck zero voltage (retrim if necessary). These adjustments should be made with input signal necessary to produce approximately .7 volts at Point B.
- E. Remove built-in antenna from the connection A on back of chassis
- F. Change generator dummy as shown on dummy antenna chart, Picture 3, and modulation on, and fasten generator to A & G-1.
- G. Turn the first Detector or R.F. Trimmer (8) well to the left - almost open - so you will not have a locking condition and be able to locate the signal at 105 M.C. when turning Trimmer (7).
- H. Should 90 M.C. signal not fall in at 90 M.C. on the dial, adjust F.M. oscillator coil to correct calibration. It is only necessary to press together or open the spacing on one turn of the coil to do so.
- I. After adjusting oscillator coil for the correct calibration at 90 M.C., check the detector and antenna coil for proper tracking with the oscillator. If they do not track it will be necessary to adjust the detector and antenna coils for perfect tracking.
- J. Repeat adjustments (7) (8) (9) until no further improvement can be made.

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