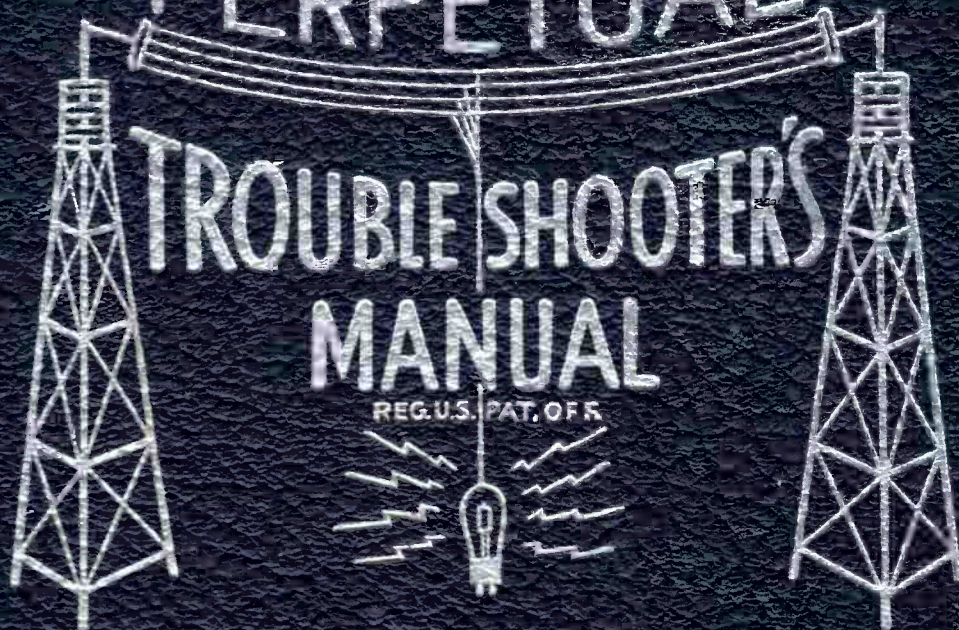


VOLUME XVIII

PERPETUAL



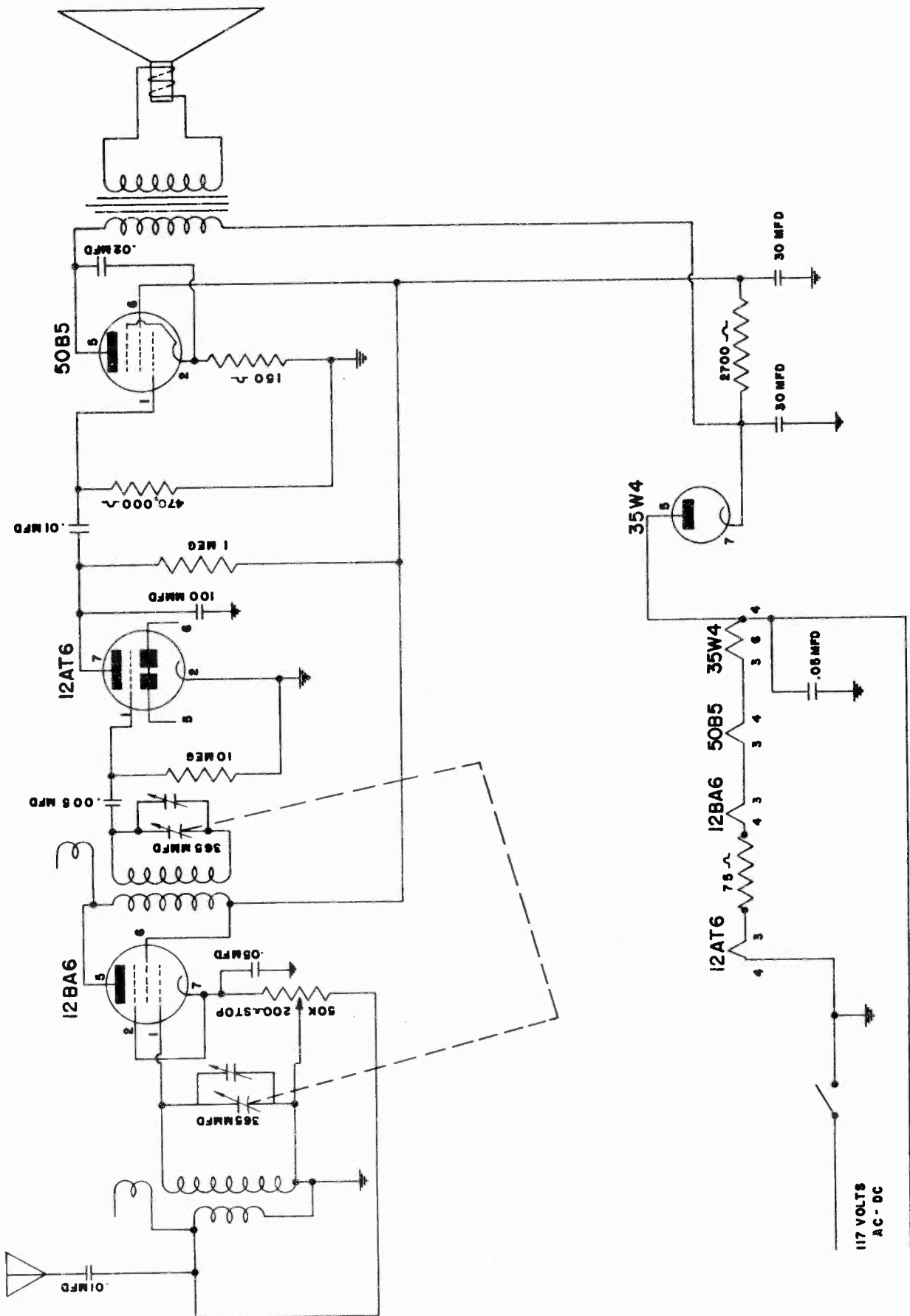
TROUBLE SHOOTER'S
MANUAL

REG. U.S. PAT. OFF.

JOHN F. RIDER

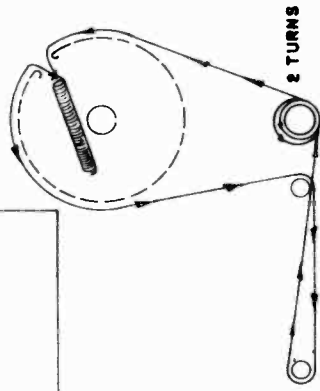
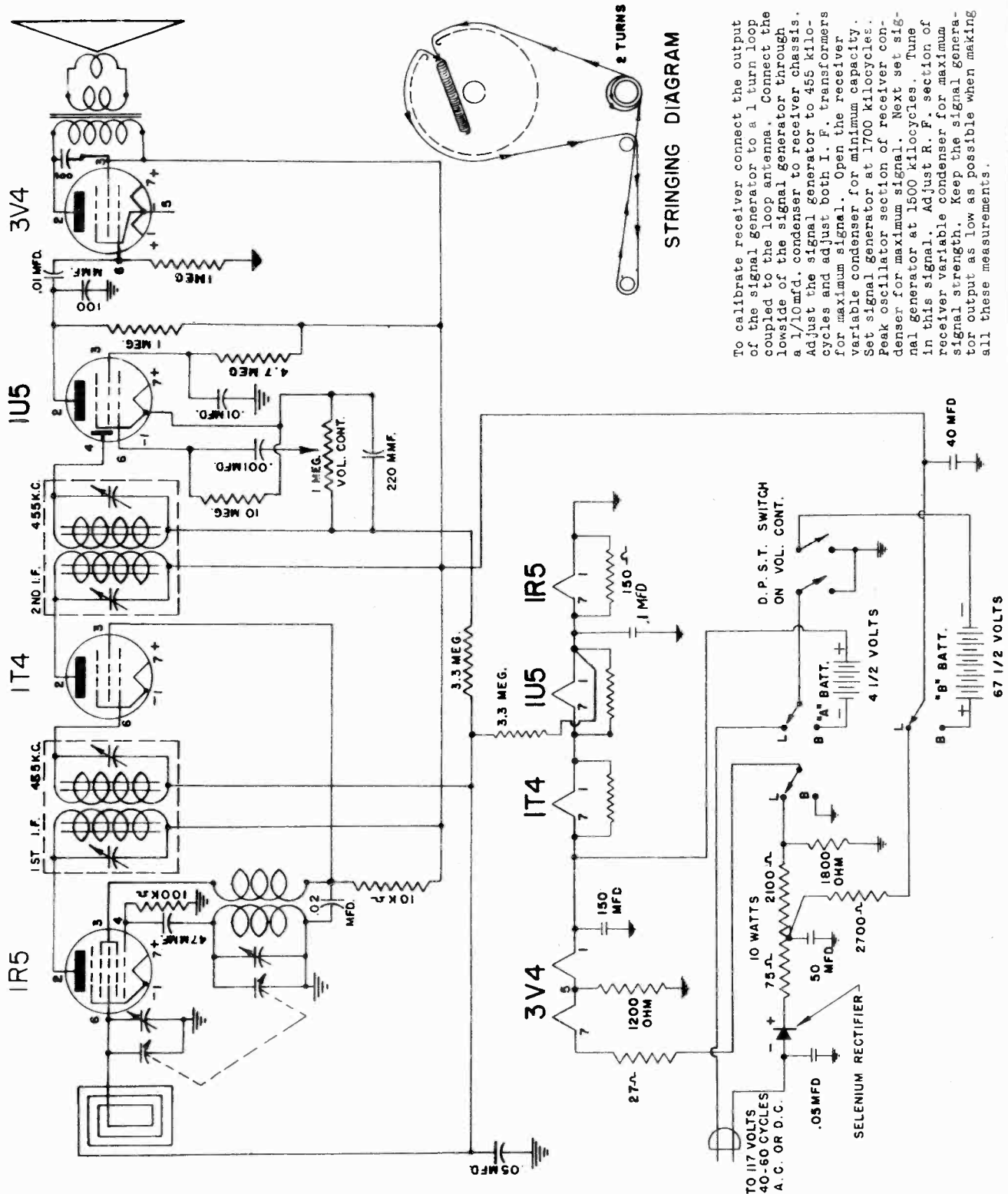
DEWALD RADIO

MODEL B-401



DEWALD RADIO

MODEL B-504



STRINGING DIAGRAM

To calibrate receiver connect the output of the signal generator to a 1 turn loop coupled to the loop antenna. Connect the lowside of the signal generator through a 1/10mfd. condenser to receiver chassis. Adjust the signal generator to 455 kilocycles and adjust both I. F. transformers for maximum signal. Open the receiver variable condenser for minimum capacity. Set signal generator at 1700 kilocycles. Peak oscillator section of receiver condenser for maximum signal. Next set signal generator at 1500 kilocycles. Tune in this signal. Adjust R. F. section of receiver variable condenser for maximum signal strength. Keep the signal generator output as low as possible when making all these measurements.

DEWALD RADIO

MODEL B-504



The DeWald model B-504 is a combination portable battery receiver. This receiver uses the latest type tubes for best performance. The circuit used is designed for excellent reception and long battery life.

The receiver uses an "A" supply of $4\frac{1}{2}$ volts and a "B" supply of $67\frac{1}{2}$ volts.

For good reception the life of the batteries is from 70 to 80 hours when the receiver is used about two hours per day.

The following or similar batteries may be used with this receiver:

"A" BATTERY $4\frac{1}{2}$ V

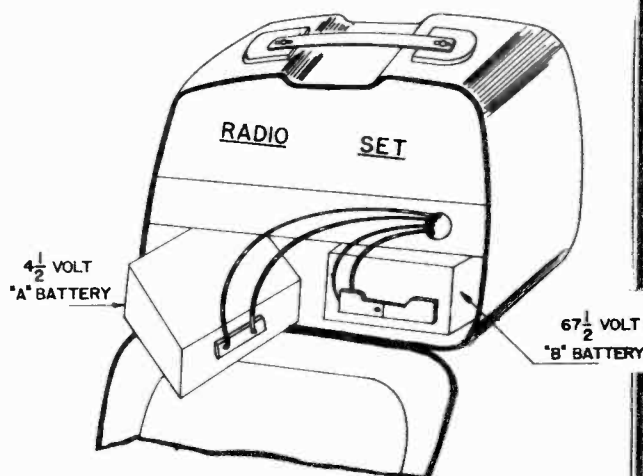
Eveready #746
General #3H3
Ray O Vac #P83A
Burgess #G3

"B" BATTERY $67\frac{1}{2}$ V

#467
#W45A
#P4367
#XX45

To install the batteries in the receiver, proceed as follows:

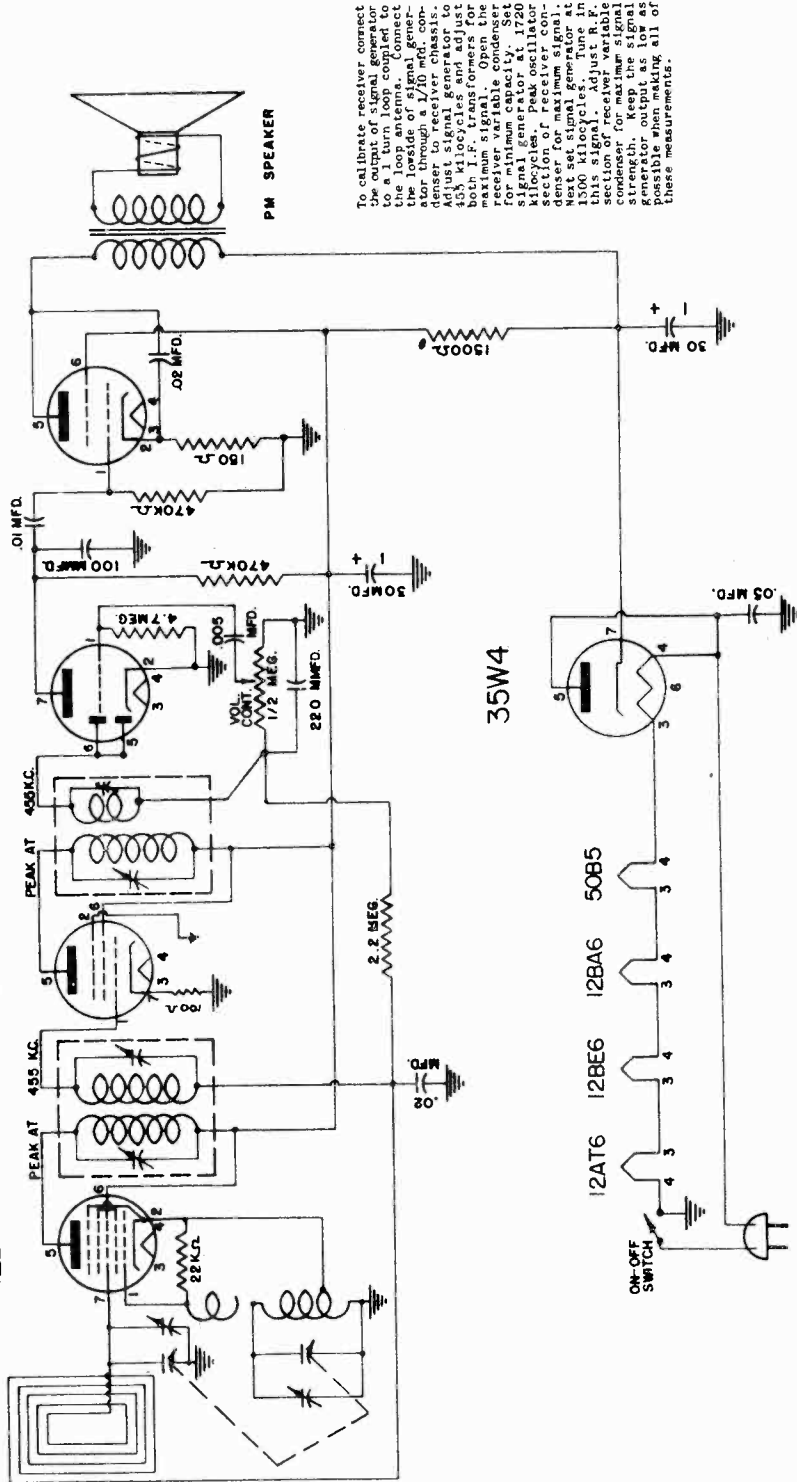
1. Open back by inserting fingers in slots provided on top of cabinet and pull back open.
 2. Connect battery clips to batteries.
 3. Put batteries in set as shown in sketch.
- BE CAREFUL NOT TO BREAK WIRES CONNECTED TO LOOPENNA.



LIST OF
REPLACEMENT PARTS

1st I.F.	1027C-4	Variable Cond.	2017B
2nd I.F.	1027-1	Electrolytic Cond.	2020B
Osc. Coil	1034	Volume Control	3012
Ant. Loop	1037	Cabinet	4064
Batt. Cable	5005	Speaker	7003B3
Knobs	4085A	Sel. Rect.	8018A

DEWALD RADIO



To calibrate receiver connect the output of signal generator to a 1 turn loop coupled to the secondary of signal generator through a 1/10 mfd. condenser to receiver chassis. Adjust R.F. transformer for 455 kilocycles and adjust both I.F. transformers for maximum signal. Open the receiver variable condenser and set signal generator at 1720 kilocycles. Peak oscillator section of receiver condenser for maximum signal. Next set signal generator at 1500 kilocycles. Tune in this signal. Adjust R.F. section of receiver for maximum signal strength. Keep the signal generator output as low as possible when making all of these measurements.

REPLACEMENT PARTS

- 1016 Loop antenna
- 1028 oscillator coil
- 1027-1 1st I.F. coil
- 1002-3 2nd detector coil
- 2000 paper condensers
- 2012 mica condensers
- 2002 comb. electrolytic
- 2003 var. condenser
- 3000 1/4 W. resistors
- 3001 2 W. resistors
- 3002 vol. cont. and switch
- 5000 line cord
- 7003 speaker
- 9050 shaft
- 9818 bushing
- 9762 drive spring
- #20 dial cord

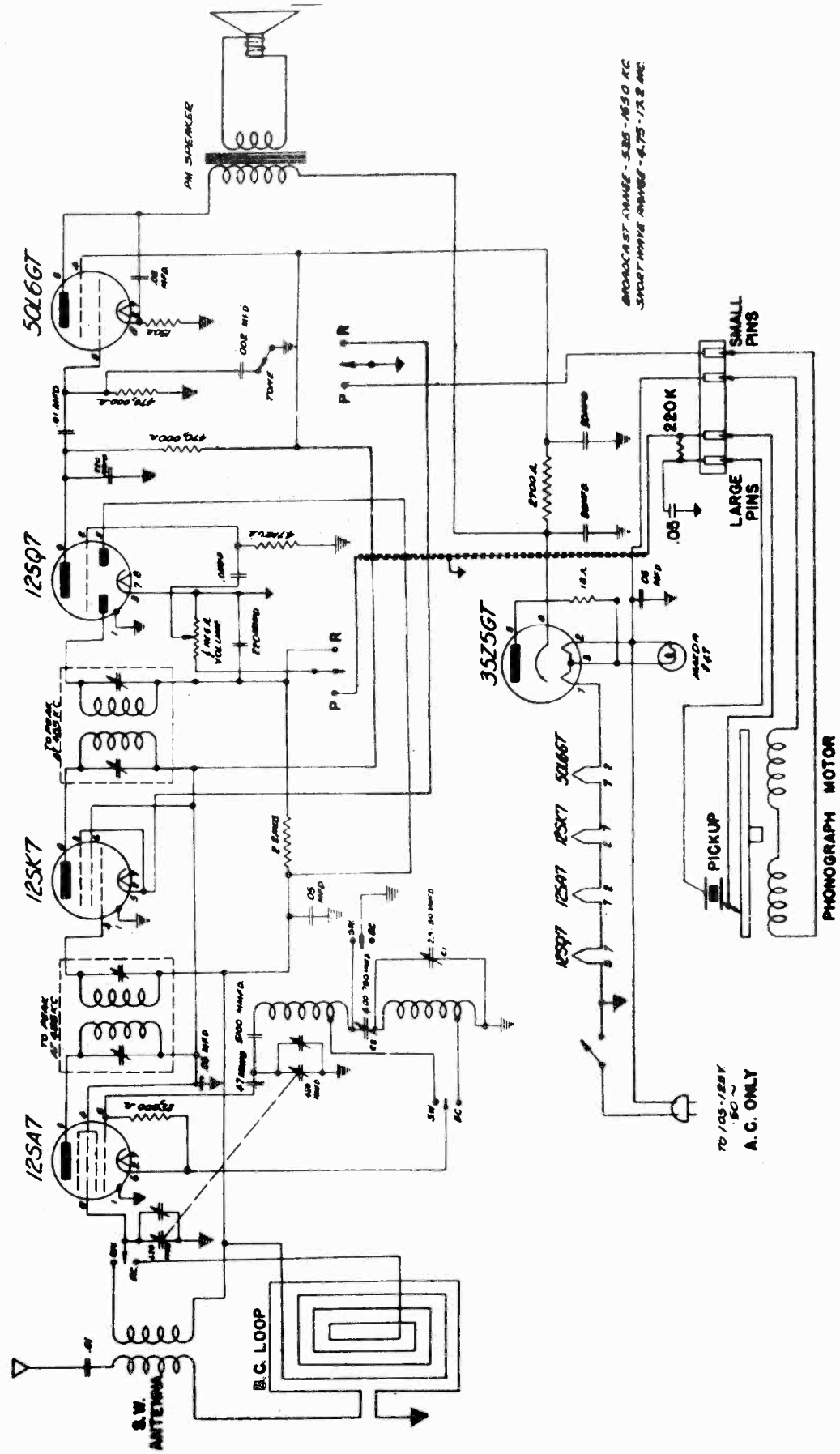
TUBES

- 1 35W4
- 1 50B5
- 1 12AT6
- 1 12BA6
- 1 12BE6
- CABINET 4053
- KNOB 4055
- BACK 4059

TO 105-125V. A.C.
50-60 CYCLES
OR D.C.

DEWALD RADIO

MODEL B-511

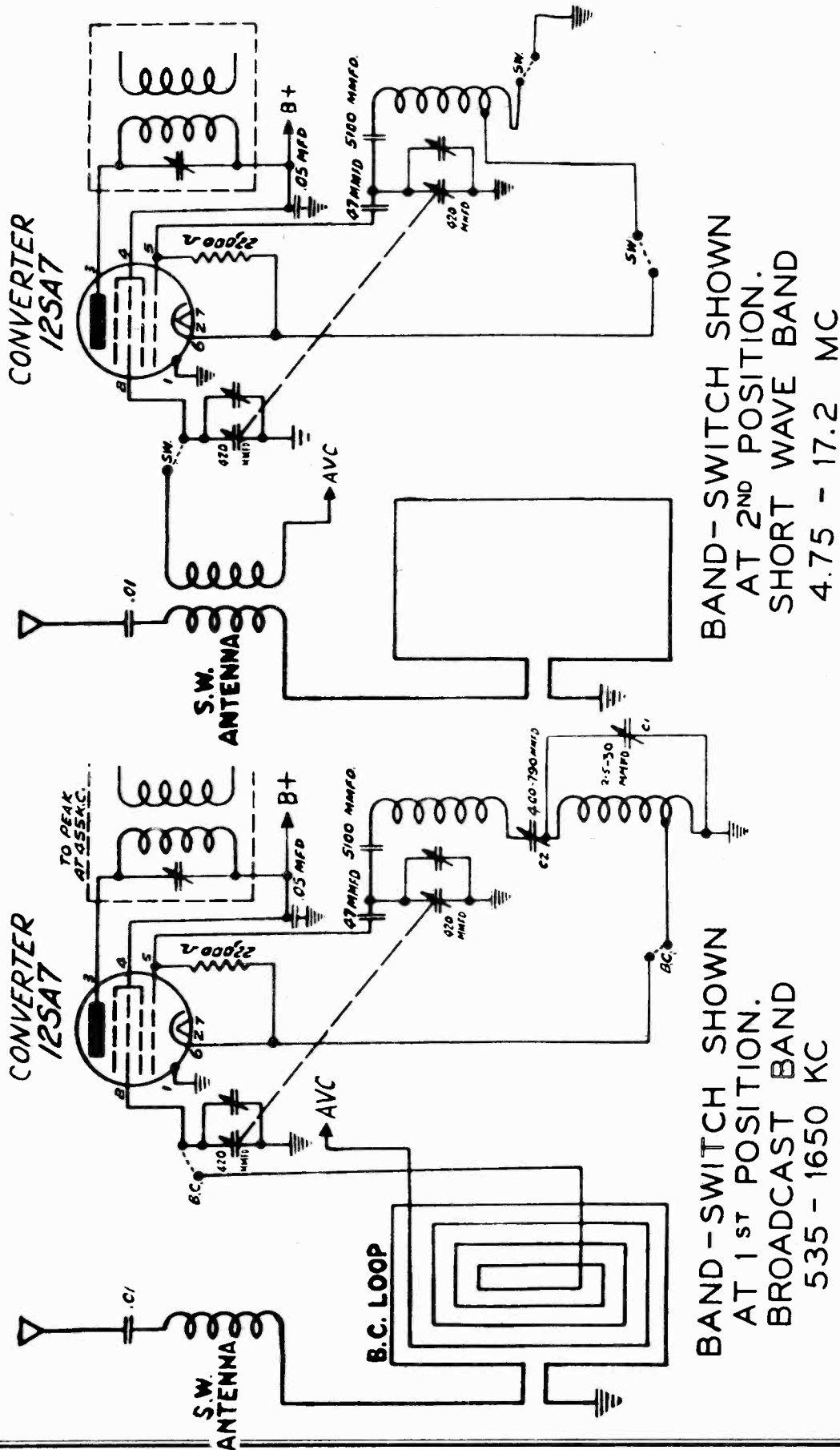


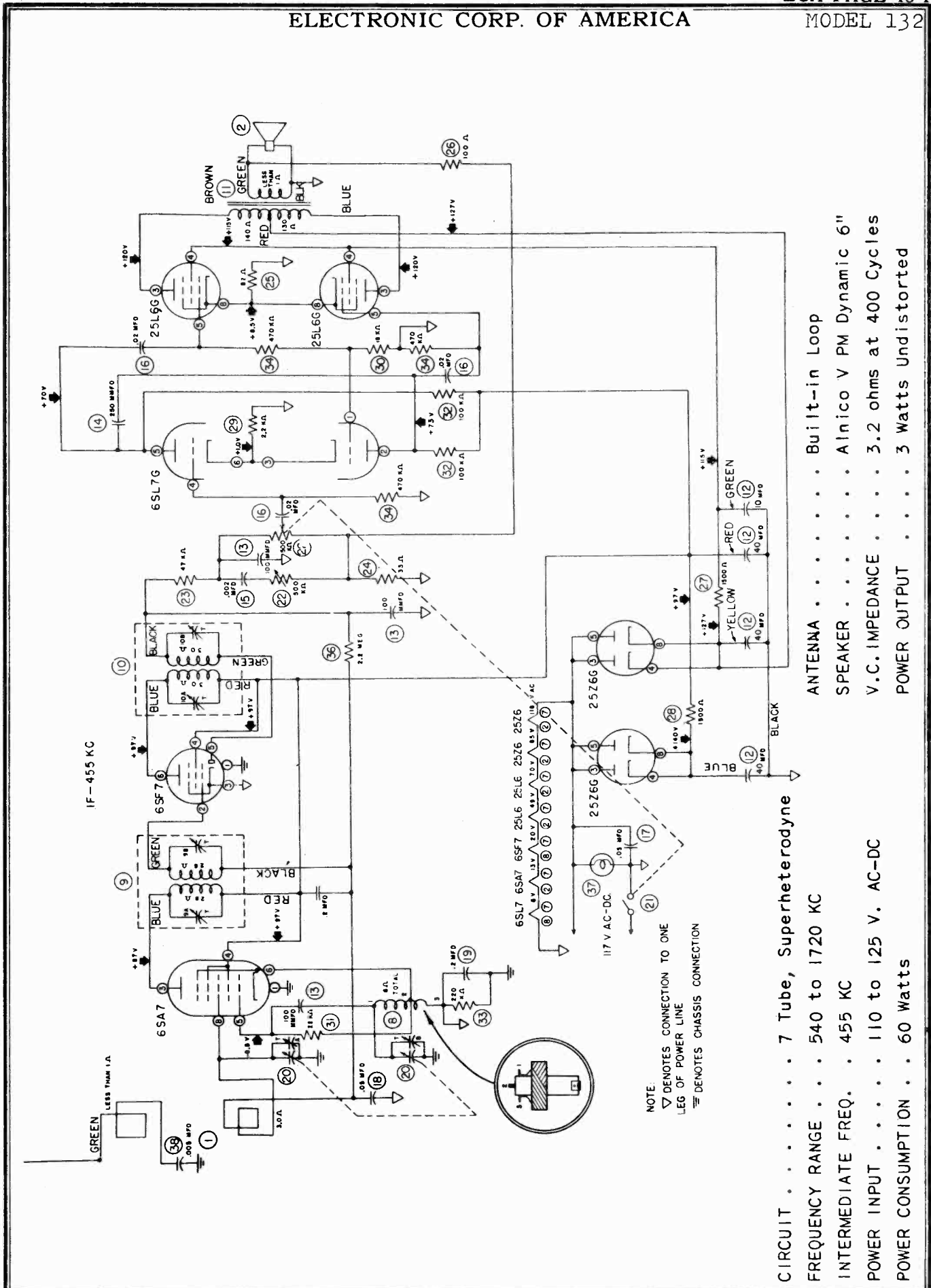
PHONO MOTOR RANGE - 5.85 - 16.50 KC
SPEED RANGE RANGE - 4.75 - 12.8 MC

TO 105-125V
50-165V
A.C. ONLY

CLARI-SKEMATIX

Registered Trademark





CIRCUIT 7 Tube, Superheterodyne

FREQUENCY RANGE . . . 540 to 1720 KC

INTERMEDIATE FREQ. . . 455 KC

POWER INPUT 110 to 125 V. AC-DC

POWER CONSUMPTION . . 60 Watts

ANTENNA Built-in Loop

SPEAKER Alnico V PM Dynamic 6"

V.C. IMPEDANCE 3.2 ohms at 400 Cycles

POWER OUTPUT 3 Watts Undistorted

With the receiver on and the volume control at maximum, connect the signal generator to the coupling loop and bring the loop close to the receiver chassis. Adjust the signal generator output to minimum necessary to give a suitable indication on the output meter, which should be connected from B minus to the plate of one output tube. CAUTION: Make sure the output meter is isolated from DC by a series blocking condenser.

With the gang condenser fully meshed, adjust the pointer so that the left hand edge of the pointer saddle is one inch from the end of the dial frame. (See *Dial Installation drawing*) Using the dial scale contained in this Service Bulletin, align the pointer to the indicated reference mark with the pointer set as above. Then proceed with the alignment in accordance with the chart below:

SET SIGNAL GENERATOR AT	SET GANG	LOOP DISTANCE	ADJUST TRIMMER	TUNE FOR	OPERATION
455 KC	Meshed	Close	9a 9b 10a 10b	Max.	Align - I.F.
1720 KC	Fully Open	Close	20a	Max.	Align Oscillator
1400 KC	1400 KC	Close	20b	Max.	Align - R.F.

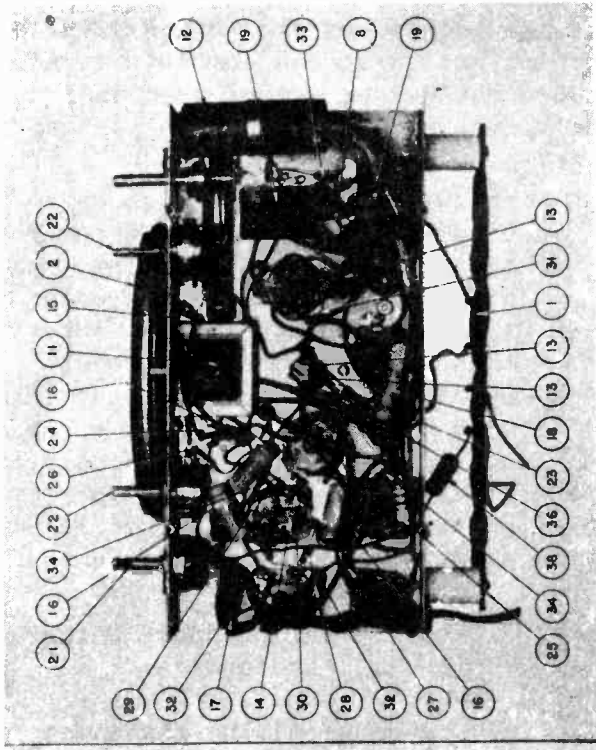
All DC voltage measurements in this Service Bulletin have been made with a 20,000 ohms per volt voltmeter, using B minus as a common reference point. All AC voltage measurements are with 1000 ohms per volt voltmeter. Line voltage was maintained at 117 volts for all voltage measurements. The condenser gang should be fully meshed and the volume control at its minimum point. Voltages may vary $\pm 10\%$ from the indicated nominal value.

Measurements of oscillator grid bias voltage should be made with a 50,000 ohm resistor in series with the negative probe of the meter, and the positive prod connected to B minus. Rotate the tuning condenser throughout its complete range with the meter connected. Absence of bias voltage at any point is an indication that the oscillator is not functioning.

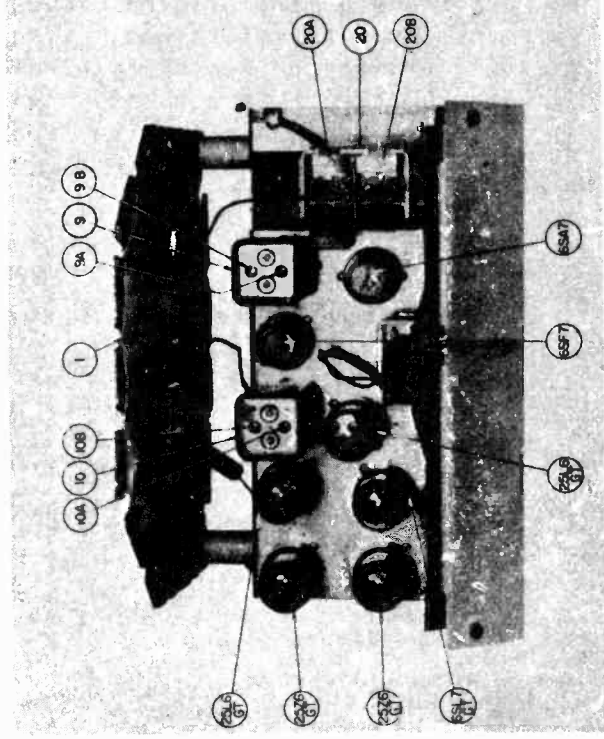
Alignment Procedure

In order to make a proper alignment, the following equipment is required:

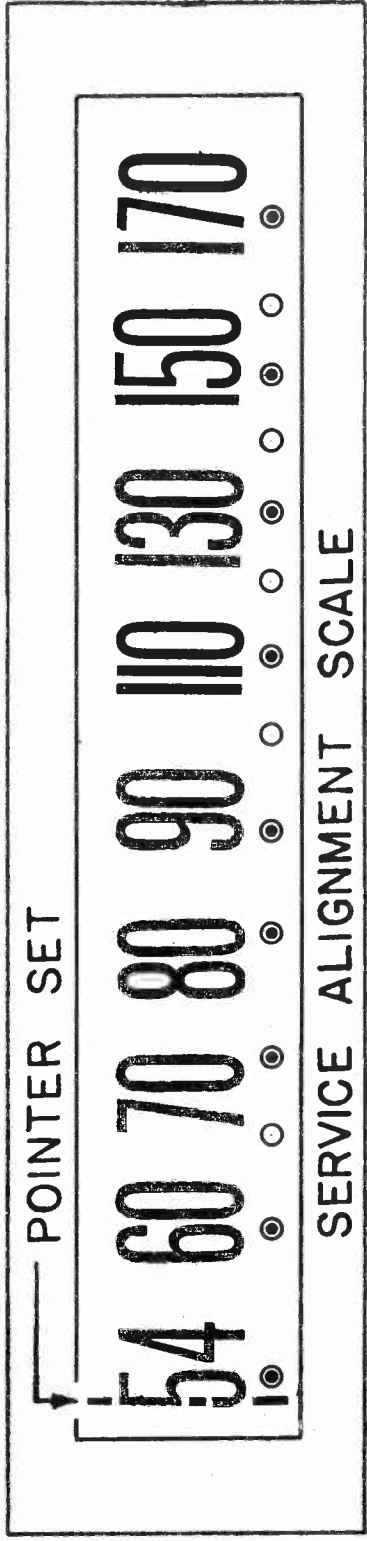
1. A signal generator capable of providing a modulated radio frequency output over the frequencies required.
2. A suitable output meter or sensitive AC voltmeter with a .1 mfd series blocking condenser.
3. A coupling loop, made of three turns of stiff hookup wire, 4 inches in diameter, mounted on a suitable block of wood or stand.
4. A non-metallic screwdriver.



Chassis Underside View



Chassis Top View



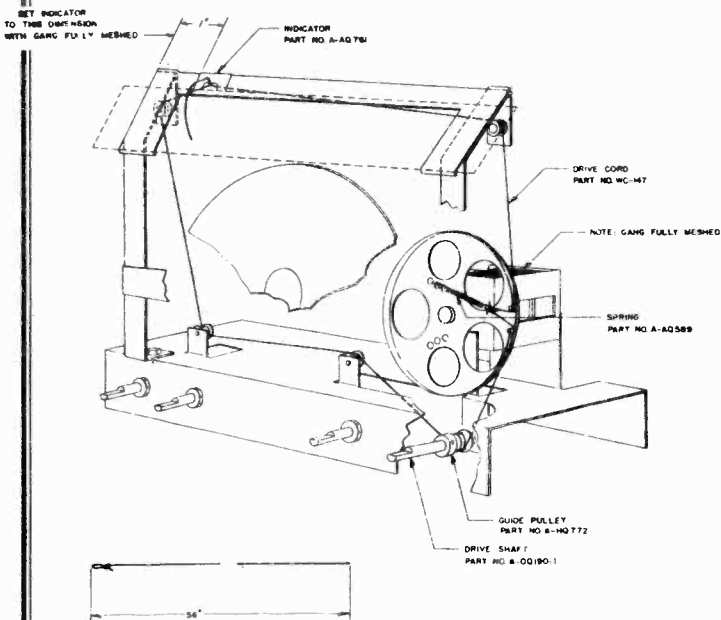
Replacement of I.F. Transformers

When replacing intermediate frequency transformers, either input or output, use caution to observe original lead dress.

Replacement of Dial Drive Cord

Completely remove remainder of defective dial cord. Inspect all pulleys and make sure they revolve freely. Determine that no grease or oil is present on any pulley surface. Attach the cord spring, part #A-AQ589, to one end of the drive cord. Fully mesh the gang condenser and hook the spring to the hole closest to the cord cutout on the dial drum. Proceed to string dial cord in accordance with the detail drawing. Take two full turns around the drive drum, part #A-HQ772. Pull the cord snug at this point. Wrap one complete turn around gang drum and pull cord snug. Securely tie free end of cord to the cord spring. Next, adjust spring tension by moving the hook end of the spring into the next spring hole.

Clip the pointer on to the dial cord with sufficient tension so as to prevent slippage and adjust pointer position, so that with fully meshed gang, the left edge of the pointer saddle is one inch from the edge of the dial support frame. Insert chassis in cabinet and check pointer and scale agreement. Then make final adjustment of pointer position. Remove the chassis and firmly crimp the pointer prongs on the dial cord, and secure with a small drop of speaker cement.



Replacement of Audio Output Transformers

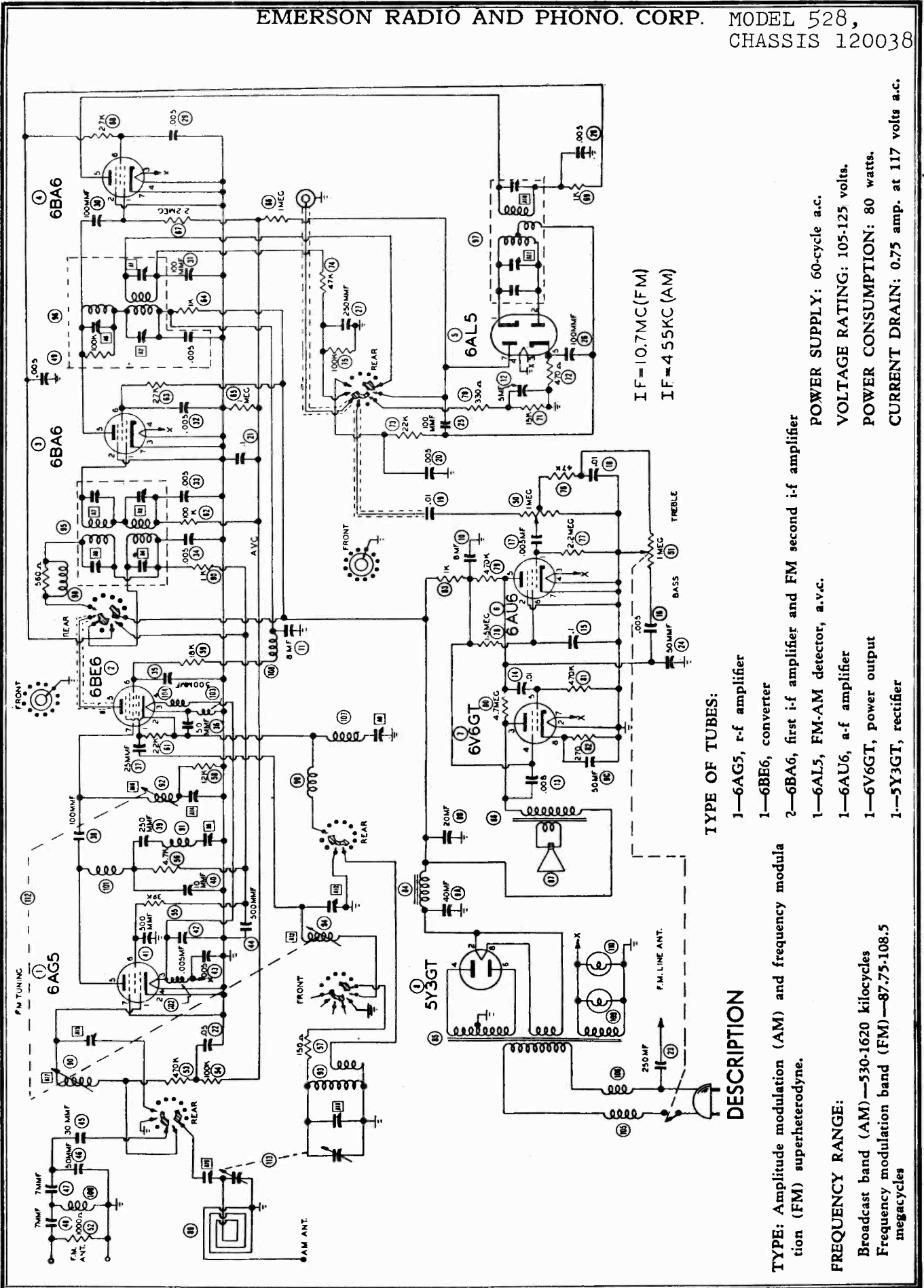
When replacing the audio output transformer, original lead dress must be maintained. If either primary or secondary windings are reversed, the set will have a severe audio oscillation, due to the inverse feedback network.

Service Parts List

No.	PART NAME	PART NO.	No.	PART NAME	PART NO.
1	Loop Antenna	C-ZQ-522*	30	Resistor, Fixed, 18K ohm, 1/4 w., 10%	RS-222B
2	Speaker	S-QL-105E*	31	" " 22K " 1/4 w.	RS-197B
8	Oscillator Coil	S-LR-120*	32	" " 100K " 1/4 w., 10%	RS-120B
9	Input I.F. Transformer	S-LR-127*	33	" " 220K " 1/4 w.	RS-190B
10	Output I.F. Transformer	S-LR-128*	34	" " 470K " 1/4 w., 10%	RS-189B
11	Output Transformer	S-TA-116*	36	" " 2.2 meg.	RS-223B
12	Electrolytic Condenser	S-CE-126M*	37	Pilot Bulb, G.E., 3 w., 110 v.	IP-115
13	Condenser, Mica, 100 mmf.	CM-103E	38	Condenser, Paper, .005 mf., 200 v.	CP-116D
14	" " 250 mmf.	CM-112E		Cabinet, Bakelite	E-AQ-640*
15	" " Paper, .002 mf., 400 v.	CP-122E		Knob Assembly	A-ZQ-577*
16	" " " .02 mf.	CP-104E		Dial Scale	C-NP-157-3*
17	" " " .05 mf.	CP-105E		Pointer	A-AQ-761*
18	" " " .05 mf., 200 v.	CP-105D		Dial Cord Spring	A-AQ-589*
19	" " " .2 mf., 200 V.	CP-133D		Tuning Shaft	A-QQ-190-1*
20	Variable Capacitor and Drum	S-ZQ-500*		"C" Washer	HN-405*
21	On-off Switch	S-SR-137*		Dial Cord Bushing	A-HQ-772*
22	Vol. Control, Tone Control, 500K ohms	S-RV-174-1*		Pilot Light Socket	S-XQ-164*
23	Resistor, Fixed, 47K ohm, 1/4 w.	RS-186B		Dial Background Plate	B-AQ-758*
24	" " 33 " 1/4 w.	RS-220B		Loop Spacer Block	A-AQ-637*
25	" " 82 " 1 w., 10%	RS-221D		Felt Knob Washers	HN-365*
26	" " 100 " 1/4 w.	RS-114B		Dial and Speaker Support	C-ZQ-619*
27	" " 1500 " 1/2 w., 10%	RS-195C		5 Lug Terminal Panel	EQ-380*
28	" " 1500 " 2 w., 10%	RS-195E		Line Cord and Plug	WC-148*
29	" " 2.2K " 1/4 w.	RS-185B			

Note: All items followed by an asterisk (*) will be stocked by the Electronic Corporation of America. All unmarked items may be replaced by any high quality component of equal electrical value.

EMERSON RADIO AND PHONO. CORP. MODEL 528,
CHASSIS 120038



IF=10.7MC (FM)
IF=4.55KC (AM)

POWER SUPPLY: 60-cycle a.c.
VOLTAGE RATING: 105-125 volts.
POWER CONSUMPTION: 80 watts.
CURRENT DRAIN: 0.75 amp. at 117 volts a.c.

TYPE OF TUBES:

- 1—6AG5, r-f amplifier
- 1—6BE6, converter
- 2—6BA6, first i-f amplifier and FM second i-f amplifier
- 1—6AL5, FM-AM detector, a.v.c.
- 1—6AU6, a-f amplifier
- 1—6V6GT, power output
- 1—5Y3GT, rectifier

DESCRIPTION

TYPE: Amplitude modulation (AM) and frequency modulation (FM) superheterodyne.

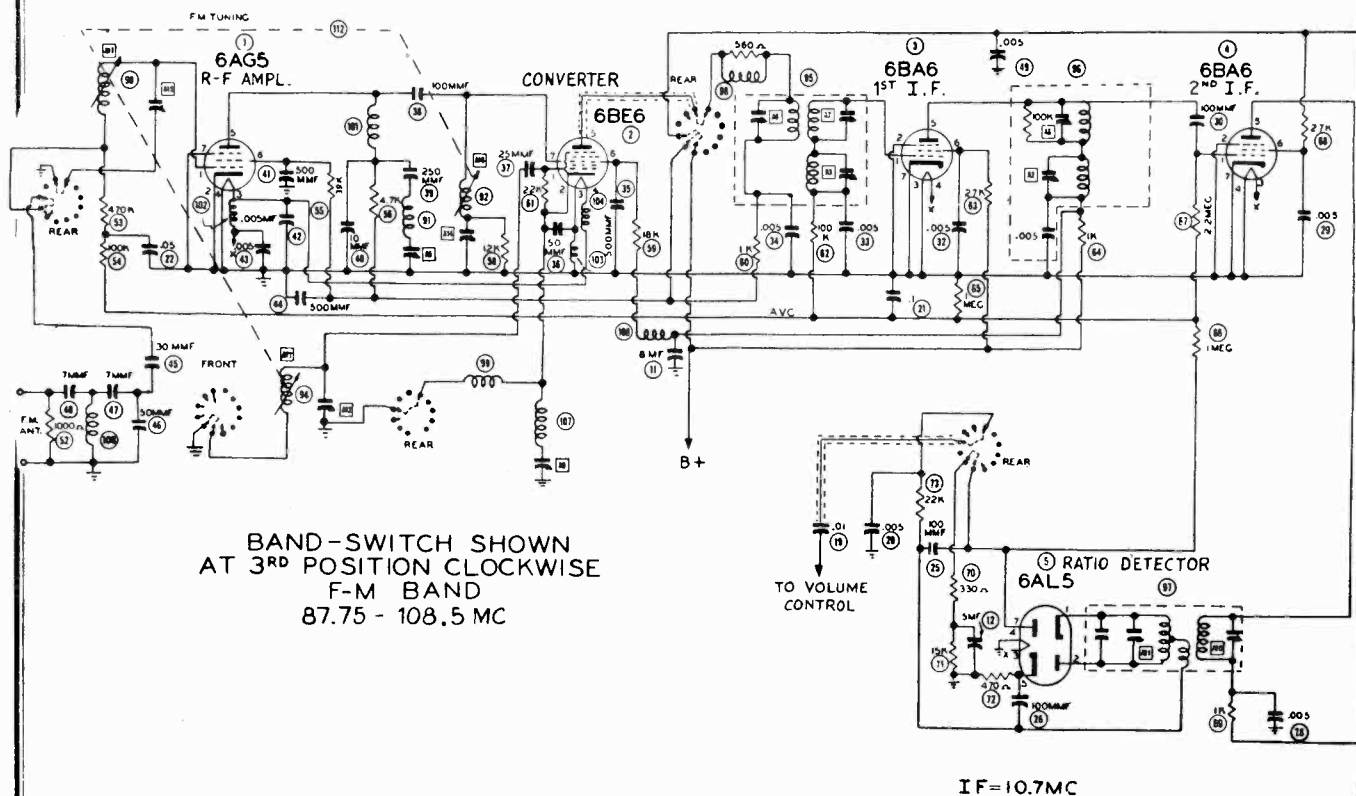
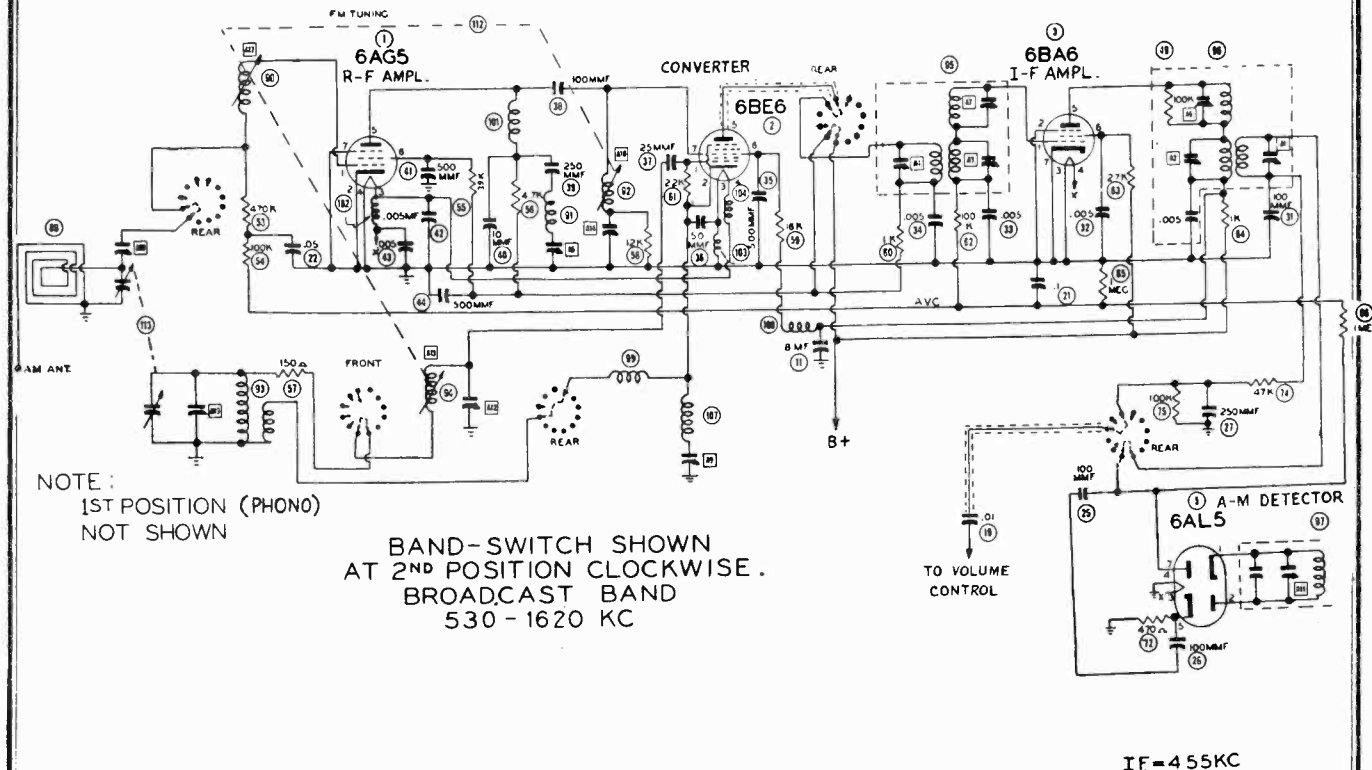
FREQUENCY RANGE:
Broadcast band (AM)—530-1620 kilocycles
Frequency modulation band (FM)—87.75-108.5 megacycles

CLARI-SKEMATIX

Registered Trademark

MODEL 528

EMERSON RADIO AND PHONO. CORP.



EMERSON RADIO AND PHONO. CORP.

MODEL 528,
CHASSIS 120038

ALIGNMENT

To set pointer turn variable condenser fully closed and set pointer to last reference mark at low-frequency end of dial. To inject signal in Steps 4, 5 and 6, remove tube and connect wire to pin 1. Replace tube, making certain that wire does not short to shield base. For Step 8, connect two 100,000 ohm resistors in series from pin 7 of 6AL5 to chassis. After Step 8, turn variable condenser fully counterclockwise and check adjustment of FM tuning unit per dial cord drawing. Volume control should be at maximum position; output of signal generator should be no higher than necessary to obtain an output reading. Use an alignment screwdriver for adjusting.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1	0.1 mfd.	High side to stator of front section of the variable condenser. Low side to chassis.	455 kc	BC (center position)	High frequency end of dial.	Across voice coil.	A1, A2, A3, A4	Adjust for maximum output.
2	0.1 mfd.	High side to stator of front section of the variable condenser. Low side to chassis.	455 kc	BC (center position)	Low frequency end of dial.	Across voice coil.	A5	Adjust for minimum output.
3	0.05 mfd.	High side to pin 1 (grid) of 6BA6, 1st 1-f tube (3). Low side to chassis.	10.7 mc (unmodulated)	FM (fully clockwise)	High frequency end of dial.	VTVM connected to pin 7 of 6AL5 and chassis.	A6	Adjust for maximum deflection.
4	0.05 mfd.	High side to pin 1 (grid) of 6BE6. Low side to chassis.	10.6 mc (unmodulated)	FM (fully clockwise)	High frequency end of dial.	VTVM connected to pin 7 of 6AL5 and chassis.	A7	Adjust for maximum deflection.
5	0.05 mfd.	High side to pin 1 (grid) of 6BE6. Low side to chassis.	10.8 mc (unmodulated)	FM (fully clockwise)	High frequency end of dial.	VTVM connected to pin 7 of 6AL5 and chassis.	A8	Adjust for maximum deflection.
6	0.05 mfd.	High side to pin 1 (grid) of 6BE6. Low side to chassis.	10.7 mc (unmodulated)	FM (fully clockwise)	High frequency end of dial.	VTVM connected to pin 7 of 6AL5 and chassis.	A9	Adjust for maximum deflection.
7	0.05 mfd.	High side to pin 1 (grid) of 6BA6, 2nd 1-f tube (4). Low side to chassis.	10.7 mc (unmodulated)	FM (fully clockwise)	High frequency end of dial.	VTVM connected to pin 7 of 6AL5 and chassis.	A10	Adjust for maximum deflection.
8	0.05 mfd.	High side to pin 1 (grid) of 6BA6, 2nd 1-f tube (4). Low side to chassis.	10.7 mc (unmodulated)	FM (fully clockwise)	High frequency end of dial.	VTVM connected from junction of two 100,000 ohm resistors and junction of condensers 25 and 26. (See preliminary alignment notes.)	A11	Adjust for zero deflection.
9	150 ohms in series with each lead.	High side to "A," low side to "G" on FM antenna terminals. Disconnect internal antenna.	108 mc (unmodulated)	FM (fully clockwise)	108 mc	VTVM connected to pin 7 of 6AL5 and chassis.	A 12	Adjust for maximum deflection.
10	150 ohms in series with each lead.	High side to "A," low side to "G" on FM antenna terminals. Disconnect internal antenna.	88 mc (unmodulated)	FM (fully clockwise)	88 mc	VTVM connected to pin 7 of 6AL5 and chassis.	A 13	Adjust iron core (hold brass in position) for maximum deflection.
11	150 ohms in series with each lead.	High side to "A," low side to "G" on FM antenna terminals. Disconnect internal antenna.	98 mc	FM (fully clockwise)	98 mc	VTVM connected to pin 7 of 6AL5 and chassis.	A 13	Adjust brass and iron cores (one screw) for maximum deflection. Repeat steps 9, 10 and 11 until no further improvement can be made.
12	150 ohms in series with each lead.	High side to "A," low side to "G" on FM antenna terminals. Disconnect internal antenna.	106 mc	FM (fully clockwise)	Tune for maximum deflection.	VTVM connected to pin 7 of 6AL5 and chassis.	A 14, A 15	Adjust for maximum deflection.
13	150 ohms in series with each lead.	High side to "A," low side to "G" on FM antenna terminals. Disconnect internal antenna.	90 mc	FM (fully clockwise)	Tune for maximum deflection.	VTVM connected to pin 7 of 6AL5 and chassis.	A 16, A 17	Adjust iron cores (hold brass in place) for maximum deflection.
14	150 ohms in series with each lead.	High side to "A," low side to "G" on FM antenna terminals. Disconnect internal antenna.	100 mc	FM (fully clockwise)	Tune for maximum deflection.	VTVM connected to pin 7 of 6AL5 and chassis.	A16, A17	Adjust both iron and brass cores for maximum deflection. Repeat steps 12, 13, and 14 until no further improvement can be made.
15	200 mmfd.	High side to "A," low side to "G" terminals of AM antenna terminals.	1600 kc	BC	1600 kc	Across voice coil.	A18	Adjust for maximum output.
16	20 mmfd.	High side to "A," low side to "G" terminals of AM antenna terminals.	1400 kc	BC	Tune for maximum output.	Across voice coil.	A19	Adjust for maximum output.

MODEL 528,
CHASSIS 120038

EMERSON RADIO AND PHONO. CORP.

INSTRUCTIONS FOR VOLTAGE AND RESISTANCE READINGS

- All readings taken in broadcast position except those for item 4A, 6BA6 tube, which should be taken in FM position.
- Voltage readings are in volts and resistance readings in ohms unless otherwise specified.
- D-C voltage measurements are at 20,000 ohms per volt; a-c voltages measured at 1,000 ohms.
- Socket connections are shown as bottom views.
- Measured values are from socket pin to common negative.
- Line voltage maintained at 117 volts for voltage readings.
- Nominal tolerance on component values makes possible a variation of $\pm 15\%$ in voltage and resistance readings.
- Volume control at maximum, no signal applied for voltage measurements.
- Resistance readings in the B+ circuits may vary widely according to the condition of the filter capacitors.

VOLTAGE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
1	6AG5	-0.5 DC	0	6.5 AC	0	225 DC	137 DC	0	
2	6BE6	-0.3 DC	0	0	6.5 AC	270 DC	100 DC	0	
3	6BA6	-0.1 DC	0	0	6.5 AC	260 DC	115 DC	0	
4	6BA6	-0.4 DC	0	6.5 AC	0	0	0	0	
4A	6BA6	-0.3 DC	0	6.5 AC	0	250 DC	110 DC	0	
5	6AL5	0	0	6.5 AC	0	0	0	-0.8 DC	
6	6AU6	-0.8 DC	0	6.5 AC	0	105 DC	32 DC	0	
7	6V6GT	0	0	260 DC	270 DC	0	105 DC	6.5 AC	13.5 DC
8	5Y3GT	0	300 DC	0	300 AC	0	300 AC	0	300 DC

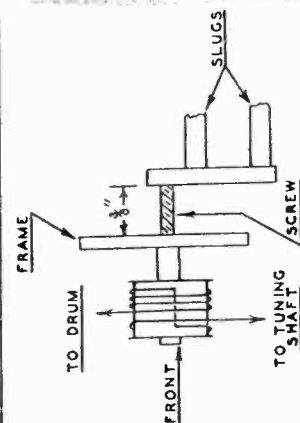
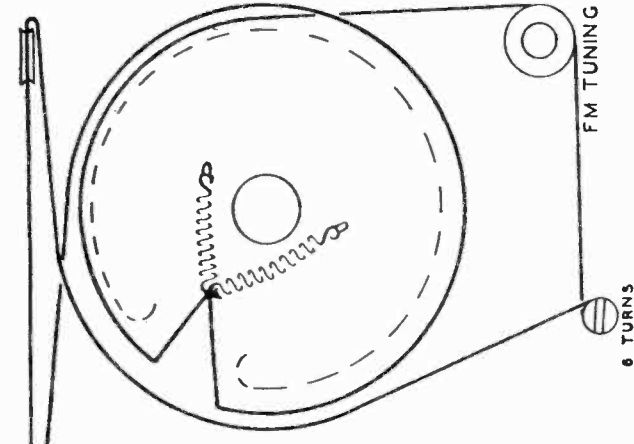
RESISTANCE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
1	6AG5	1.5 meg.	0	0.2	0	55,000	90,000	0	
2	6BE6	20,000	1	0.2	0.5	50,000	68,000	12,000	
3	6BA6	680,000	0	0	0.1	50,000	77,000	0	
4	6BA6	3 meg.	0	0.1	0	inf.	inf.	0	
4A	6BA6	3 meg.	0	0.1	0	50,000	77,000	0	
5	6AL5	inf.	inf.	0.1	0	520	0	135,000	
6	6AU6	2.5 meg.	0	0.1	0	520,000	1.5 meg.	0	
7	6V6GT	0	0	50,000	50,000	470,000	520,000	0.1	250
8	5Y3GT	inf.	50,000	inf.	130	inf.	125	inf.	50,000

- If replacements are made or the wiring disturbed in the r-f section of the circuit, the receiver should be carefully realigned.

- The color coding of the i-f transformer leads is as follows: Grid—green Plate—blue
- A self-contained loop antenna is provided for broadcast band reception. For permanent home installation, however, if it is desired to improve reception of weak stations, an additional outdoor antenna may be used. Connect the outdoor antenna to the single screw terminal on the loop terminal marked BCST. ANT. The loop antenna operates at maximum efficiency when its position is at right angles to the broadcasting source. Once the station is tuned in, rotate the cabinet back and forth through a quarter of a circle, leaving it in the position where the station is received with maximum volume.
- An internal power line antenna is provided for FM operation in relatively strong signal areas. An external dipole antenna is recommended for maximum FM operation. To connect the dipole, remove the wire from the FM ANT. screw terminal "A" and connect the dipole leads to "A" and "G."
- A ground connection is not required for AM or FM operation.

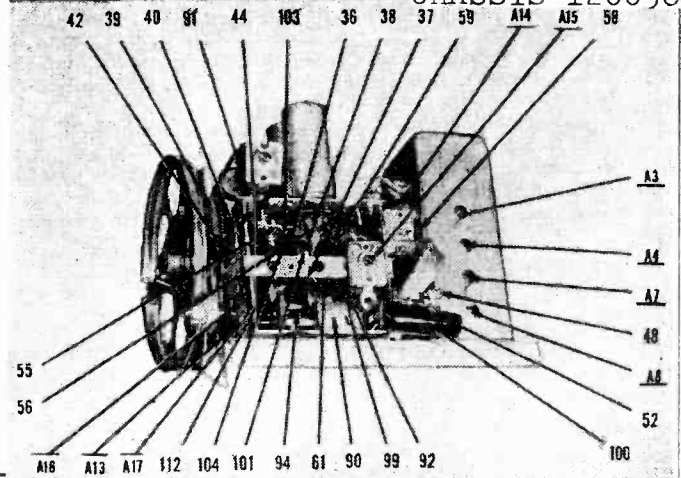
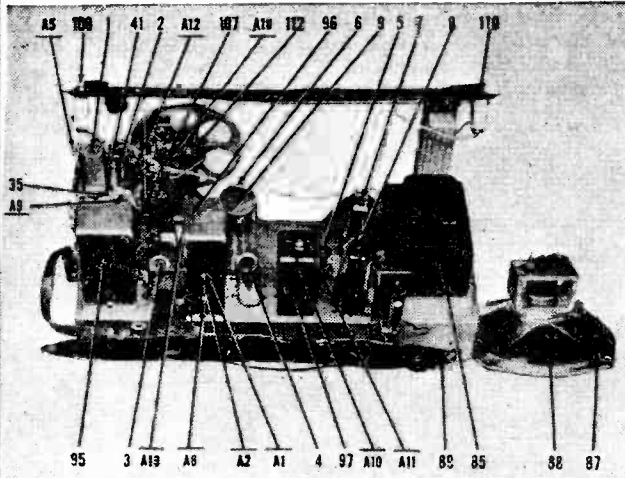
DIAL CORD DRIVE



DETAIL OF FM COLLAR STRINGING AND CORRECT SETTING OF SLUG TUNER WITH TUNING CONTROL FULLY COUNTER—CLOCKWISE.

An external phonograph can be connected to the jack. TONE CONTROL ON-OFF SWITCH provided at the rear of the chassis base.

EMERSON RADIO AND PHONO. CORP. MODEL 528,
CHASSIS 120038



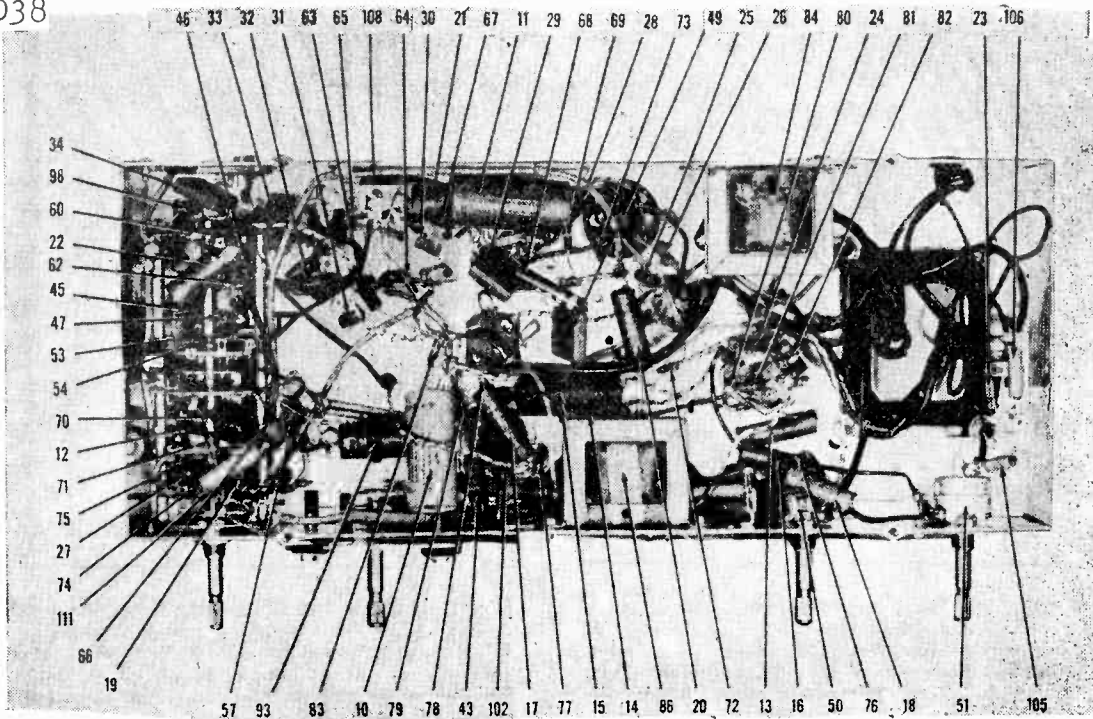
Symbol	†Part No.	DESCRIPTION	Symbol	†Part No.	DESCRIPTION
1	6AG5	Tube, r-f amplifier	32	910356	5000 mmfd., 500 volt condenser (1st i-f screen bypass)
2	6BE6	Tube, converter	33	910356	5000 mmfd., 500 volt condenser (a.v.c. filter)
3	6BA6	Tube, 1st i-f amplifier	34	910356	5000 mmfd., 500 volt condenser (converter plate decoupling)
4	6BA6	Tube, FM 2nd i-f amplifier	35	915003	500 mmfd., 300 volt button mica condenser (converter screen bypass)
5	6AL5	Tube, FM-AM detector, a.v.c.	36	928102	50 mmfd., 300 volt ceramic condenser (converter cathode bypass)
6	6AU6	Tube, a-f amplifier	37	928101	25 mmfd., 300 volt ceramic condenser (oscillator grid)
7	6V6GT	Tube, power output	38	928106	100 mmfd., 300 volt ceramic condenser (r-f coupling)
8	5Y3GT	Tube, rectifier	39	910320	250 mmfd., 300 volt mica condenser (wave trap)
9A, B, C	925268	40-20-50 mfd., 400-400-25 volt electrolytic condenser (filter)	40	928002	10 mmfd., 300 volt ceramic condenser (r-f plate decoupling)
10	925190	8 mfd., 450 volt electrolytic condenser (filter)	41	915003	500 mmfd., 300 volt button mica condenser (r-f screen bypass)
11	925190	8 mfd., 450 volt electrolytic condenser (filter)	42	910356	5000 mmfd., 500 volt mica condenser (r-f filament bypass)
12	925005	5 mfd., 50 volt condenser (ratio detector bias)	43	910356	5000 mmfd., 500 volt mica condenser (r-f filament bypass)
13	920512	0.008 mfd., 400 volt condenser (output plate bypass)	44	915003	500 mmfd., 300 volt button mica condenser (r-f bypass power supply)
14	920090	0.01 mfd., 400 volt condenser (audio coupling)	45	928107	30 mmfd., 300 volt ceramic condenser (FM r-f coupling)
15	920250	0.1 mfd., 400 volt condenser (audio screen bypass)	46	928102	50 mmfd., 300 volt ceramic condenser (FM r-f coupling)
16	920180	0.005 mfd., 400 volt condenser (tone compensation)	47	928105	7 mmfd., 300 volt ceramic condenser (FM r-f coupling)
17	920180	0.005 mfd., 400 volt condenser (audio coupling)	48	928105	7 mmfd., 300 volt ceramic condenser (FM r-f coupling)
18	920090	0.01 mfd., 400 volt condenser (tone compensation)	49	910356	5000 mmfd., 500 volt condenser (r-f bypass power supply)
19	920090	0.01 mfd., 400 volt condenser (audio coupling)	50	390378	Volume control, 1 meg.
20	920180	0.005 mfd., 400 volt condenser (deemphasis)	51	390379	Tone control and switch, 1 meg.
21	920040	0.1 mfd., 200 volt condenser (a.v.c. filter)	52	320490	1000 ohms, 1/4 watt resistor (antenna loading)
22	920060	0.05 mfd., 200 volt condenser (a.v.c. filter)	53	321130	470,000 ohms, 1/4 watt resistor (r-f grid)
23	910320	250 mmfd., 500 volt mica condenser (FM antenna coupling)	54	310970	100,000 ohms, 1/4 watt resistor (a.v.c. network)
24	928102	50 mmfd., 300 volt ceramic condenser (audio plate bypass)	55	370872	39,000 ohms, 1 watt resistor (r-f screen dropping)
25	910100	100 mmfd., 500 volt mica condenser (ratio detector load)	56	310650	4,700 ohms, 1/4 watt resistor (r-f plate decoupling)
26	910100	100 mmfd., 500 volt mica condenser (ratio detector load)	57	320290	150 ohms, 1/4 watt resistor (parasitic suppressor)
27	910320	250 mmfd., 500 volt mica condenser (diode filter)	58	310750	12,000 ohms, 1/4 watt resistor (converter grid)
28	910356	5000 mmfd., 500 volt mica condenser (2nd i-f plate decoupling)			
29	910356	5000 mmfd., 500 volt mica condenser (2nd i-f screen bypass)			
30	910100	100 mmfd., 500 volt mica condenser (i-f coupling)			
31	910100	100 mmfd., 500 volt mica condenser (diode filter)			

* Not supplied separately.

† Specify part numbers when ordering.

MODEL 528, CHASSIS EMERSON RADIO AND PHONO. CORP.

120038



REPLACEMENT PARTS LIST (continued)

Symbol	†Part No.	DESCRIPTION	Symbol	†Part No.	DESCRIPTION
59	397070	18,000 ohms, 2 watt resistor (converter screen dropping)	83	351370	1,000 ohms, ¼ watt resistor (filter)
60	340370	1,000 ohms, ¼ watt resistor (converter plate decoupling)	84	737068	Filter choke, 210 ohms d-c resistance
61	310810	22,000 ohms, ¼ watt resistor (oscillator grid)	85	730067	Power transformer
62	310970	100,000 ohms, ¼ watt resistor (a.v.c. network)	86	734202	Output transformer
63	370830	27,000 ohms, 1 watt resistor (1st i-f screen dropping)	87	180017	Speaker, 6-inch P.M.
64	320490	1,000 ohms, ¼ watt resistor (1st i-f plate decoupling)	*88		Speaker cone (part of 180017)
65	321210	1 meg., ¼ watt resistor (a.v.c. network)	89	700234	AM loop antenna
66	321210	1 meg., ¼ watt resistor (a.v.c. network)	90	710014	FM antenna coil
67	321290	2.2 meg., ¼ watt resistor (2nd i-f grid)	91	708001	AM wave trap
68	370830	27,000 ohms, 1 watt resistor (2nd i-f screen dropping)	92	714003	FM r-f coil
69	320490	1,000 ohms, ¼ watt resistor (2nd i-f plate decoupling)	93	708001	AM oscillator coil
70	340370	330 ohms, ½ watt resistor (ratio detector bias)	94	716112	FM oscillator coil
71	310771	15,000 ohms, ¼ watt resistor (ratio detector bias)	95	720523	1st i-f transformer
72	340410	470 ohms, ½ watt resistor (ratio detector bias)	96	720524	2nd i-f transformer
73	350810	22,000 ohms, ½ watt resistor (deemphasis)	97	708145	FM ratio and AM detector and transformer
74	310890	47,000 ohms, ¼ watt resistor (diode r-f filter)	98	705005	Plate r-f choke
75	310970	100,000 ohms, ¼ watt resistor (diode load)	99	705007	R-F choke
76	310890	47,000 ohms ¼ watt resistor (tone compensation)	100	705003	R-F choke
77	321290	2.2 meg., ¼ watt resistor (a-f grid)	101	705000	R-F choke
78	311250	1.5 meg., ¼ watt resistor (a-f screen dropping)	102	705002	R-F choke
79	321130	47,000 ohms, ¼ watt resistor (a-f plate load)	103	705002	R-F choke
80	351270	4.7 meg., ½ watt resistor (feedback)	104	705002	R-F choke
81	321130	470,000 ohms, ¼ watt resistor (output grid)	105	705002	R-F choke
82	370350	270 ohms, 1 watt resistor (output cathode)	106	705002	R-F choke
			107	705002	R-F choke
			108	705002	R-F choke
			109	807020	Dial light
			110	807020	Dial light
			111	510400	Band-phono switch
			112		FM tuning unit
			113	900312	Two-gang variable condenser
				508010	Phono input receptacle
				503150	Line cord and plug
				507040	Dial light socket assembly, left
				507050	Dial light socket assembly, right
				280501	Drive shaft, dial assembly
				280505	Drive shaft, FM tuner
				520506	Dial backplate
				520508	Dial glass
				525206	Pointer
				140056	Cabinet
				620012	Knob, with indicator dot
				620030	Knob

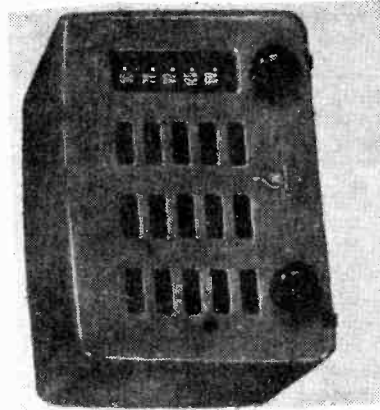
*Not supplied separately.

†Specify part numbers when ordering.

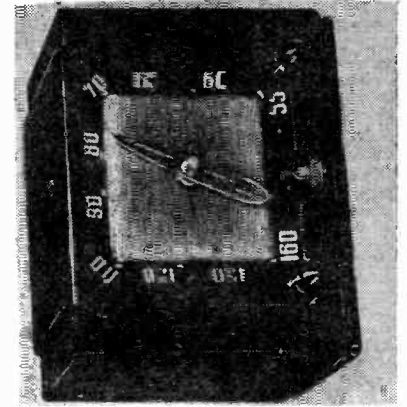
EMERSON RADIO AND PHONO. CORP. MODELS 540, 564,
572 CHASSIS 120042,
120027, 120065



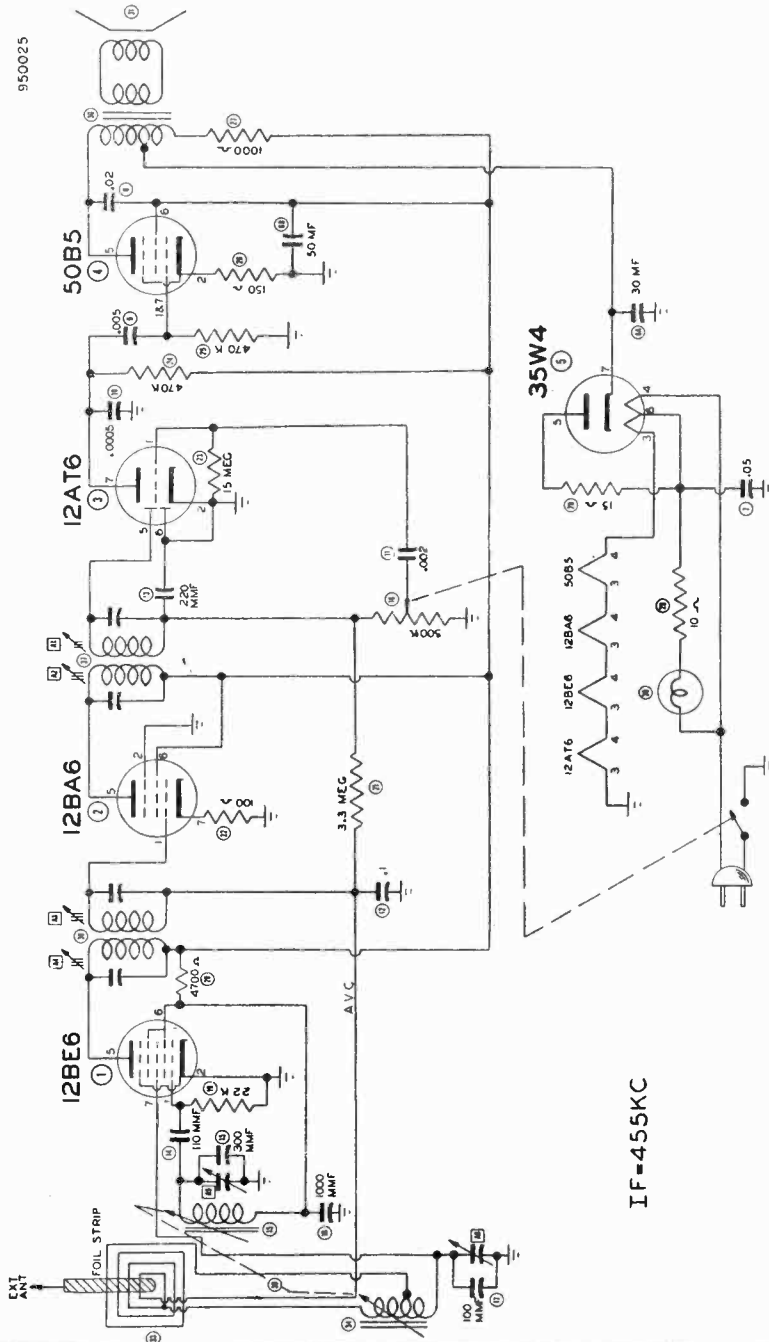
MODEL 540



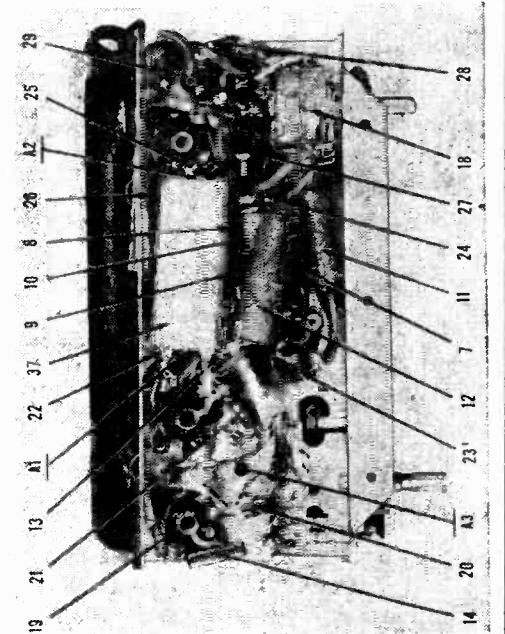
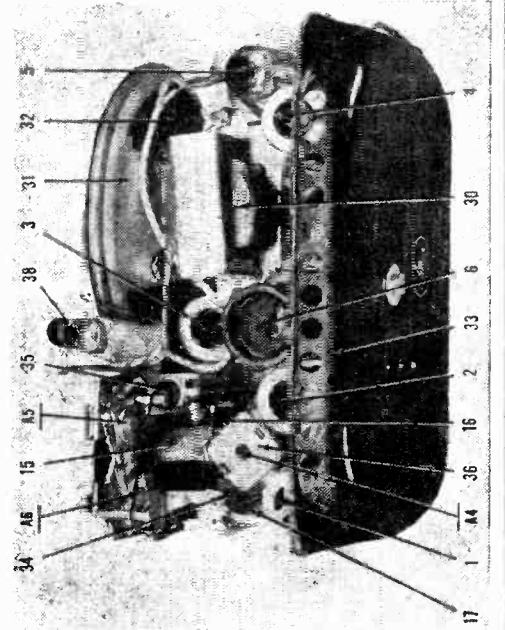
MODEL 564



MODEL 572



IF-455KC



MODELS 540,
564, 572

EMERSON RADIO AND PHONO. CORP.

ALIGNMENT

To set pointer on Models 540 and 564, turn tuning slugs completely in and set pointer to top reference dot on right side of dial backplate. On Model 572 set pointer in extreme clockwise position. Use isolation transformer if available. If not, connect a condenser in series with low side of signal generator and chassis. Volume control should be at maximum position; output of signal generator should be no higher than necessary to obtain an output reading. Use an insulated alignment screwdriver for adjusting.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1	0.1 mfd.	High side to pin 7 (grid) of 12BE6. Low side to B—.	455 kc	Tuning slugs completely out.	Across voice coil.	A1, A2, A3, A4	Adjust for maximum output. If isolation transformer is not used, reduce dummy antenna to 0.001 mfd. to reduce hum modulation.
2	200 mmfd.	High side to external antenna lead. Low side to chassis.	1600 kc for Models 540 and 564. 1620 kc for Model 572	Bottom reference dot at right side of dial backplate for Models 540 and 564. Tuning slugs completely out on Model 572.	Across voice coil.	A5, A6	Adjust for maximum output.
3	200 mmfd.	High side to external antenna lead. Low side to chassis.	1400 kc	Tune for maximum output.	Across voice coil.	Antenna coil (34)	Loosen screws on bracket of antenna coil (34). Adjust position of coil for maximum output. Tighten screws.

VOLTAGE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
1	12BE6	-4.3 DC	0	12 AC	24 AC	100 DC	77 DC	-0.1 DC
2	12BA6	-0.1 DC	0	24 AC	35 AC	100 DC	100 DC	1.3 DC
3	12AT6	-0.7 DC	0	0	12 AC	-0.5 DC	0	57 DC
4	50B5	0	6.2 DC	35 AC	85 AC	115 DC	100 DC	0
5	35W4	122 DC	115 AC	85 AC	117 AC	110 DC	110 AC	122 DC

RESISTANCE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
1	12BE6	20,000	0	11	22	40,000	45,000	3.5 meg.
2	12BA6	3.5 meg.	0	22	32	40,000	40,000	100
3	12AT6	15 meg.	0	0	11	500,000	0	500,000
4	50B5	450,000	125,000	32	75	40,000	40,000	450,000
5	35W4	40,000	100,000	75	102	110	97	40,000

VOLTAGE AND RESISTANCE READING INSTRUCTIONS

- Voltage readings are in volts and resistance readings in ohms unless otherwise specified.
- D-C voltage measurements are at 20,000 ohms per volt; a-c voltages measured at 1,000 ohms per volt.
- Socket connections are shown as bottom views.
- Measured values are from socket pin to common negative.
- Line voltage maintained at 117 volts for voltage readings.
- Nominal tolerance on component values makes possible a variation of $\pm 10\%$ in voltage and resistance readings.
- Volume control at maximum, no signal applied for voltage measurements.

GENERAL NOTES

- If replacements are made or the wiring disturbed in the r-f section of the circuit, the receiver should be carefully realigned.
- In operating the receiver on d.c., it may be necessary to reverse the line plug for correct polarity.
- The color coding of the i-f transformer leads is as follows:

Grid—green
Grid return—black
Plate—blue
B+—red

DESCRIPTION

TYPE: Single-band superheterodyne.
FREQUENCY RANGE: 540-1620 kc.
TYPE OF TUBES:

- 1—12BE6, pentagrid oscillator-modulator
- 1—12BA6, first i-f amplifier
- 1—12AT6, diode detector, a-f amplifier, a.v.c.
- 1—50B5, beam power output
- 1—35W4, half-wave rectifier

POWER SUPPLY: A.C. or D.C.
VOLTAGE RATING: 105-125 volts.
POWER CONSUMPTION: 30 watts.
CURRENT DRAIN: 0.24 amp. at 117 volts a.c.

EMERSON RADIO AND PHONO. CORP.

MODELS 540,
564, 572

REPLACEMENT PARTS LIST

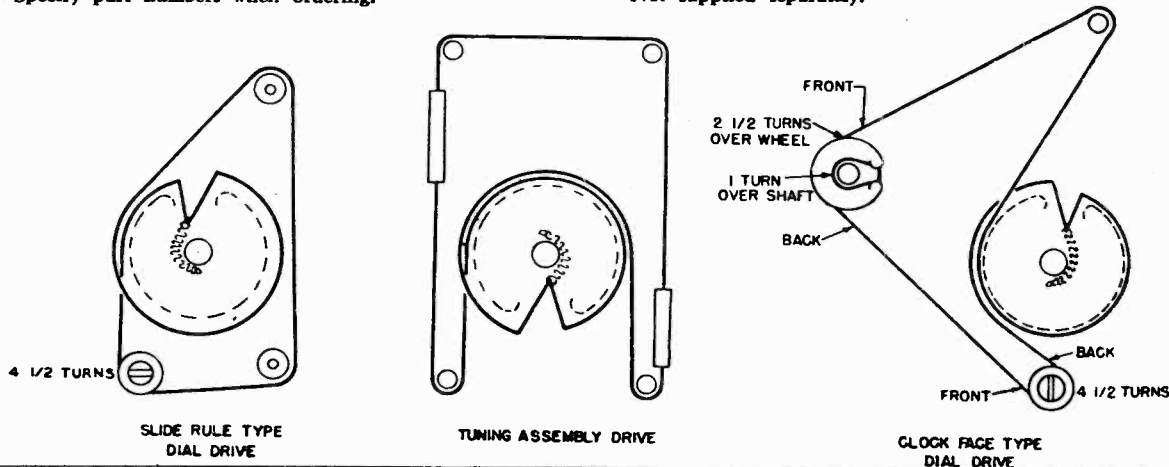
Symbol	†Part No.	DESCRIPTION	Symbol	†Part No.	DESCRIPTION
1	12BE6	Tube, converter	23	397000	15 meg., ½ watt resistor (a-f grid load)
2	12BA6	Tube, i-f amplifier	24	351130	470,000 ohms, ½ watt resistor (a-f plate load)
3	12AT6	Tube, detector, a-f amplifier, a.v.c.	25	351130	470,000 ohms, ½ watt resistor (output grid load)
4	50B5	Tube, power output	26	340290	150 ohms, ½ watt resistor (output cathode bias)
5	35W4	Tube, rectifier	27	370490	1000 ohms, 1 watt resistor (filter)
6A, 6B	925068	30-50 mfd., 150 volt electrolytic condenser (filter)	28	340050	15 ohms, ½ watt resistor (rectifier ballast)
7	920030	0.05 mfd., 400 volt condenser (line bypass) (alternate part 920539)	29	340010	10 ohms, ½ watt resistor (series pilot light)
8	920020	0.02 mfd., 400 volt condenser (output plate bypass) (alternate part 920540)	30	734006	Output transformer
9	920180	0.005 mfd., 400 volt condenser (audio coupling) (alternate part 920536)	31	180018	Speaker, 4" P.M. (alternate part 180036)
10	920240	0.0005 mfd., 600 volt condenser (audio plate bypass)	*32		Speaker cone, part of speaker
11	920010	0.002 mfd., 600 volt condenser (audio coupling) (alternate part 920537)	33	700235	Loop antenna and rear cover (Model 540)
12	920040	0.1 mfd., 200 volt condenser (a.v.c. filter) (alternate part 920538)	33	700013	Loop antenna and rear cover (Model 564)
13	910000	220 mmfd., 500 volt mica condenser (diode filter)	33	700022	Loop antenna and rear cover (Model 572)
14	910010	110 mmfd., 500 volt mica condenser (oscillator grid coupling)	*34		Antenna coil, part of tuner assembly
15	910007	300 mmfd., 500 volt mica condenser (fixed trimmer) (alternate part 910015)	*35		Oscillator coil, part of tuner assembly
16	910180	1000 mmfd., 300 volt mica condenser (oscillator feedback)	36	720527	First i-f transformer (455 kc) (Model 540), or
17	910008	80 mmfd., 500 volt mica condenser (fixed trimmer) (alternate ceramic condenser 928005)	36	720033	First i-f transformer (Models 564, 572), or
18	390381	Volume control and line switch, 0.5 meg. (Model 540)	36	720053	First i-f transformer (Models 540, 564, 572)
18	390029	Volume control and line switch, 0.5 meg. (Models 564, 572)	37	720527	Second i-f transformer (455 kc) (Model 540), or
19	340810	22,000 ohms, ½ watt resistor (oscillator grid)	37	720033	Second i-f transformer (Models 564, 572), or
20	340650	4,700 ohms, ½ watt resistor (converter screen dropping)	37	720053	Second i-f transformer (Models 540, 564, 572)
21	351330	3.3 meg., ½ watt resistor (a.v.c. network)	38	807000	Dial light, type 47
22	340250	100 ohms, ½ watt resistor (i-f cathode bias)	39	708147	Complete tuner assembly, includes items 34 and 35
				507214	Pilot light socket (Models 540, 564)
				507007	Pilot light socket (Model 572)
				583090	Line cord

CABINET AND DIAL PARTS

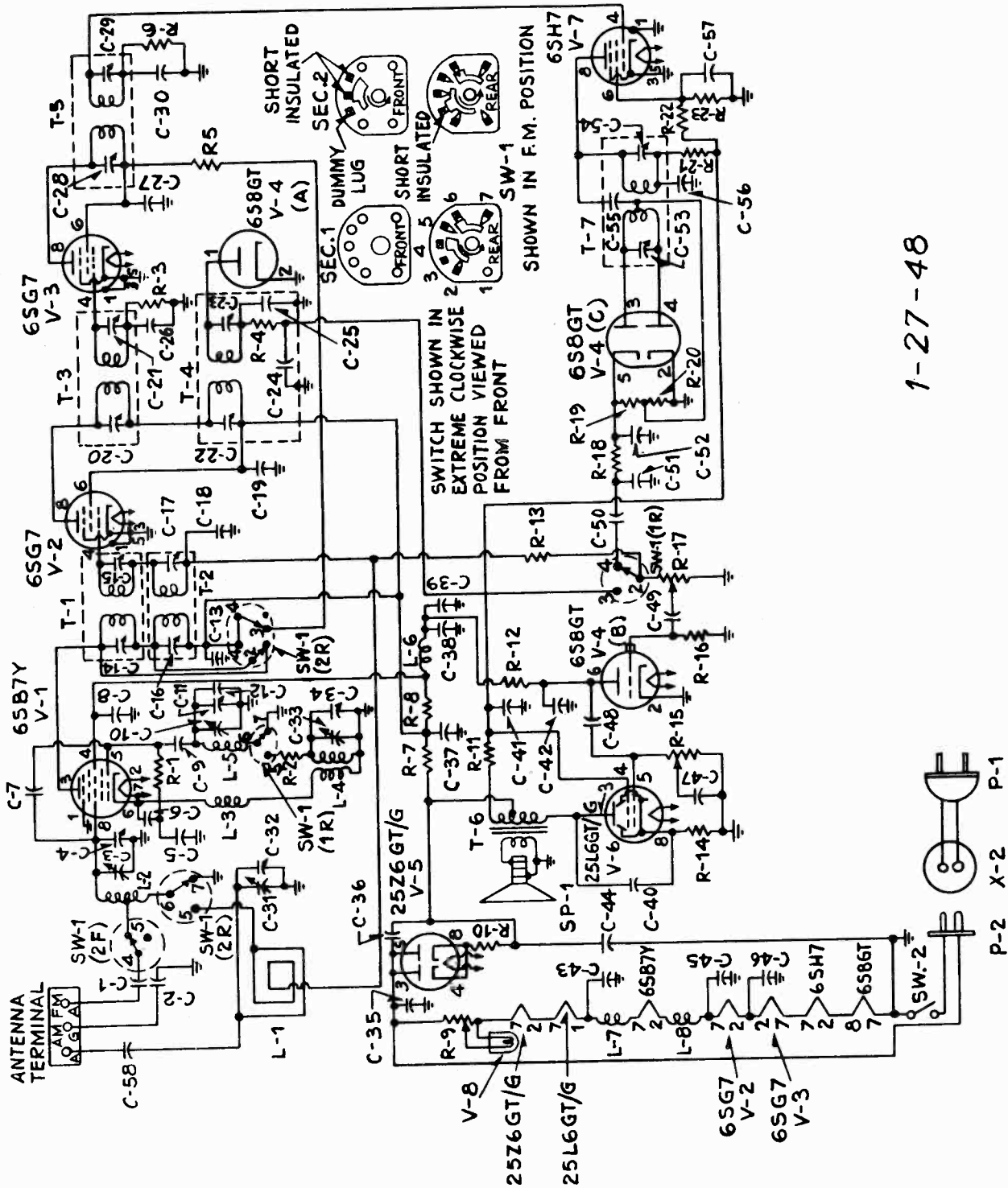
140078	Cabinet, walnut (Model 540)	525207	Dial pointer (Models 540, 564)
140075	Cabinet, ivory (Model 540)	525026	Dial Pointer (Model 572)
140076	Cabinet, red (Model 540)	470319	Pointer shaft and pulley assembly (Model 572)
140077	Cabinet, green (Model 540)	520053	Dial backplate (Model 564 green onyx)
140115	Cabinet, black (Model 540)	520511	Dial backplate (Model 540 and Model 564 red and ebony)
140121	Cabinet, green onyx (Model 564)	280509	Drive shaft
140139	Cabinet, red mottled (Model 564)	460001	Knob, black (Models 540, 572)
140140	Cabinet, ebony (Model 564)	450015	Knob, brown (Model 564)
140123	Cabinet, ivory (Model 572)	450016	Knob, red (Model 564)
140158	Cabinet, ebony (Model 572)	450017	Knob, black (Model 564)
140169	Cabinet, black and white mottled (Model 572)	410268	Metal grille, gold (Model 572)
520004	Dial crystal (Model 540)	635001	Jewel indicator (Model 572)
520051	Dial crystal (Model 564 green onyx)		
520055	Dial crystal (Model 564 red and ebony)		

† Specify part numbers when ordering.

* Not supplied separately.



MODEL 557,
CHASSIS 120048B



1-27-48

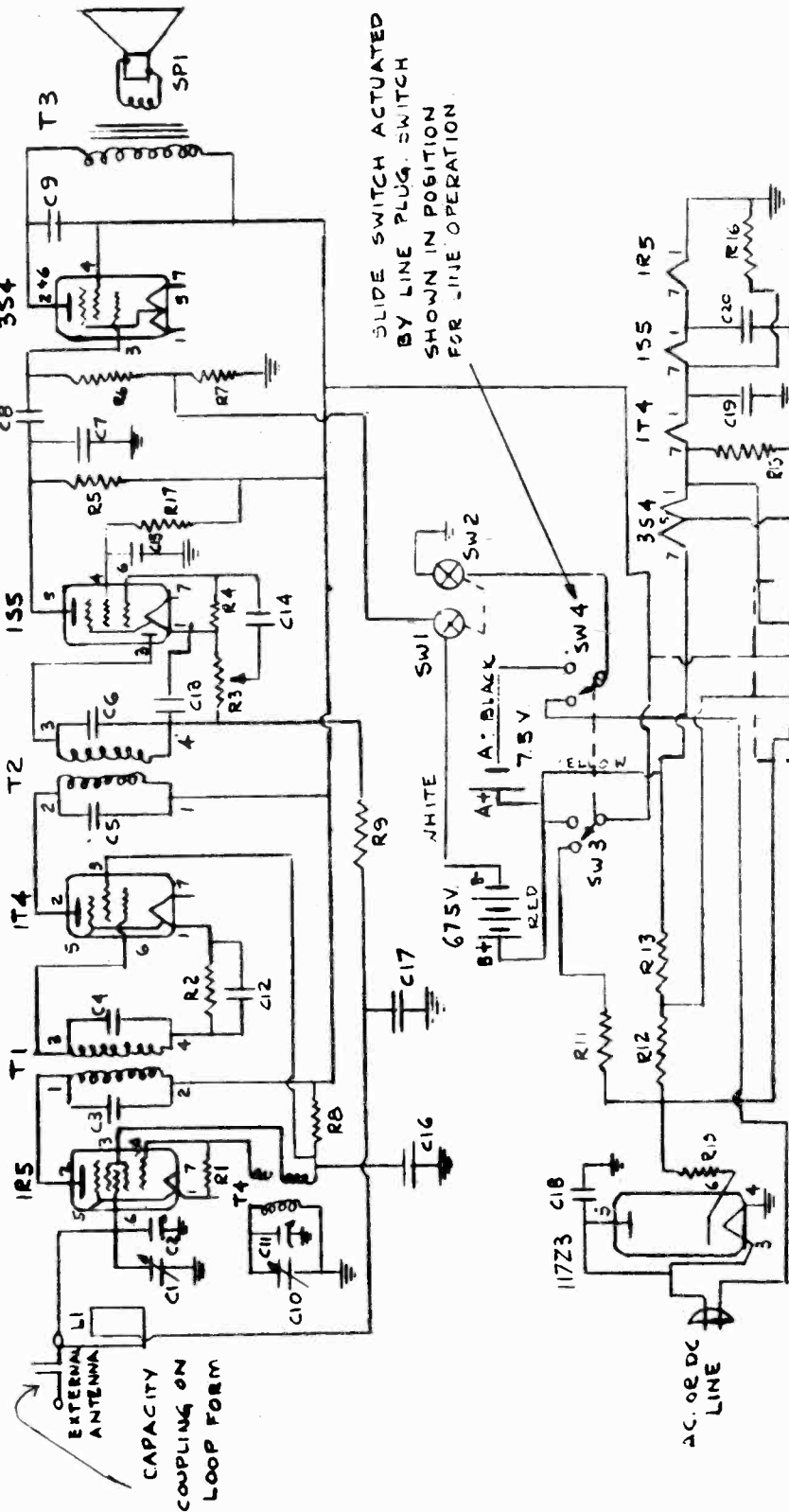
EMERSON RADIO AND PHONO. CORP.

MODEL 557,

CHASSIS 120048B

Item	Part No.	Description	Item	Part No.	Description
C-1	928003	1000MF CERAMIC	L-1	700011 or	ANTENNA LOOP
C-2	928003	1000MF CERAMIC	L-2	700021	R.F. TUNING COIL -FM
C-3	900400	VARIABLE CONDENSER	L-3	713009	OSCILLATOR CHOKE *FM
C-4	PT. OF C3	TRIMMER	L-4	715002	OSCILLATOR COIL -AM
C-5	928016	15 mmf CERAMIC	L-5	716015	OSCILLATOR COIL -FM
C-6	928014	50 mmf CERAMIC	L-6	705011	R.F. CHOKE - #22 WIRE - 15 TURNS
C-7	615005	2.2 mmf STACKPOLE GA-4	L-7	705011	R.F. CHOKE
C-8	928109	5000 mmf CERAMIC C.T.S.	L-8	180031P	R.F. CHOKE
C-9	928015	75 mmf CERAMIC	SP-1	180031P	P.M. SPEAKER
C-10	PT. OF C-3	Variable Condenser	SW-1	510009	BAND SWITCH
C-11	PT. OF C-10	TRIMMER	SW-2	PT. OF R-17	ON-OFF SWITCH
C-12	928017	5 mmf CERAMIC	P-1	583202	LINE CORD AND PLUG
C-13	920092	.01 MF Paper	P-2	505007	PLUG - AC (interlock)
C-14	PT. OF T-1	TRIMMER	R-1	340810	22000 OHM 1/2 WATT
C-15	PT. OF T-1	TRIMMER	R-2	350290	150 OHM 1/2 WATT
C-16	PT. OF T-2	TRIMMER	R-3	351290	2.2 Megohm 1/2 WATT
C-17	PT. OF T-2	TRIMMER	R-4	PT. OF T-4	
C-18	920060	.05 MF Paper	R-5	350450	680 OHM 1/2 WATT
C-19	920092	.01 MF Paper	R-6	340890	47000 OHM 1/2 WATT
C-20	PT. OF T-3	TRIMMER	R-7	370450	680 OHM 1/2 WATT
C-21	PT. OF T-3	TRIMMER	R-8	340450	680 OHM 1/2 WATT
C-22	PT. OF T-4	TRIMMER	R-9	394012	108 OHM TAP at 17 OHMS 10 W
C-23	PT. OF T-4	TRIMMER	R-10	380050	15 OHM 1 WATT
C-24	PT. OF T-4	TRIMMER	R-11	340490	1000 OHM 1/2 WATT
C-25	PT. OF T-4	TRIMMER	R-12	351130	470000 OHM 1/2 WATT
C-26	920092	.05 MF Paper	R-13	351330	3.3 MEGOHM 1/2 WATT
C-27	920092	.01 MF Paper	R-14	370290	150 OHM 1 WATT
C-28	PT. OF T-5	TRIMMER	R-15	390028	.5 MEGOHM TONE CONTROL
C-29	PT. OF T-5	TRIMMER	R-16	397000	.5 MEGOHM VOLUME CONTROL
C-30	928102	50 MMF CERAMIC	R-17	390027	.5 MEGOHM VOLUME CONTROL
C-31	PT. OF C-3	VARIABLE CONDENSER (AM)	R-18	350930	68000 OHM 1/2 WATT
C-32	PT. OF C-31	TRIMMER	R-19	340970	100000 OHM 1/2 WATT
C-33	PT. OF C-3	VARIABLE CONDENSER (AM)	R-20	340970	100000 OHM 1/2 WATT
C-34	PT. OF C-33	TRIMMER	R-21	350890	47000 OHM 1/2 WATT
C-35	920030	.05 MF Paper	R-22	340810	22000 OHM 1/2 WATT
C-36	920180	.005 MF Paper	R-23	340690	6800 OHM 1/2 WATT
C-37	925067	50 MF. ELECTROLYTIC	T-1	720024	1st I.F. TRANSFORMER -FM
C-38	910014	470 MMF MICA	T-2	720031	1st I.F. TRANSFORMER -AM
C-39	92002C	.01 MF Paper	T-3	720025	2nd I.F. TRANSFORMER -FM
C-40	925084	50 MF. ELECTROLYTIC	T-4	720032	2nd I.F. TRANSFORMER -AM
C-41	925084	50 MF. ELECTROLYTIC	T-5	720026	3rd I.F. TRANSFORMER -FM
C-42	910014	470 MMF MICA	T-6	731015	OUTPUT TRANSFORMER
C-43	920090	.01 MF Paper	T-7	708005	DISCRIMINATOR COIL
C-44	PT. OF C-41	TRIMMER			
C-45	920090	.01 MF Paper			
C-46	920090	.01 MF Paper			
C-47	920515	.002 MF Paper			
C-48	920090	.01 MF Paper			
C-49	920090	.01 MF Paper			
C-50	920092	.01 MF Paper			
C-51	920514	.001 MF Paper			
C-52	910010	110 MF MICA			
C-53	PT. OF T-7	TRIMMER			
C-54	PT. OF T-7	TRIMMER			
C-55	PT. OF T-7	TRIMMER			
C-56	920092	.01 MF Paper			
C-57	920092	.01 MF Paper			
C-58	915995	2.2 MMF (PT OF L-1) STACKPOLE GA-4			
C-58	P T of	PT.No 700011 33 MMF			
X-2	470302	SOCKET (interlock) shell holder ass'y.			
			140113		CABINET
			360041		CABINET BACK
			520046		DIAL CRYSTAL
			610177		DIAL BACKPLATE
			280039		DRIVE SHAFT
			525017		PCINTER
			507004		DIAL LIGHT SOCKET ASS'Y
			460170		KNOB

MODEL 559,
CHASSIS 120059A



SLIDE SWITCH ACTUATED
BY LINE PLUG SWITCH
SHOWN IN POSITION
FOR LINE OPERATION

SYMBOL	PART NO.	DESCRIPTION
T1	720525	FIRST I.F. TRANSFORMER
T2	720525	SECOND I.F. TRANSFORMER
T3	734013	OUTPUT TRANSFORMER
T4	716017	OSCILLATOR COIL
	140117	CABINET ALLIGATOR
	140118	CABINET BACK ALLIGATOR
	545003	BLACK HANDLE WITH RINGS
	450115	KNOB - BLACK
	585001	B BATTERY CABLE
	580038	PIN TERMINAL LEAD - AVC
	580039	PIN TERMINAL LEAD - GRID
	580012P	LINE CORD
	280087	DRIVE SHAFT
	530082	DRIVE CORD
	587040	SPRING-DRIVE CORD
	410124	DIAL BACK PLATE
	525019	DIAL POINTER - RED

R1	340970	100,000 Ω 1/2 W ± 10%
R2, R17	351330	3.3 MEG Ω 1/2 W ± 20%
R3	340026	VOLUME CONTROL
R4	351450	10 MEG Ω 1/2 W ± 20%
R5	351130	470,000 Ω 1/2 W ± 20%
R6	651250	1.5 MEG Ω 2 W ± 20%
R7	340330	220 Ω 1/2 W ± 10%
R8	340710	5200 Ω 1/2 W ± 10%
R9	351240	2.2 MEG Ω 1/2 W ± 20%
R10	370170	47 Ω 1 W ± 10%
R11	340610	3300 Ω 1/2 W ± 10%
R12, R13	344008	2200 Ω 8 W ± 5%
R14, R15, R16	340490	1000 Ω 1/2 W ± 10%
SPI	180030	SPEAKER
SPI	180034	SPEAKER
SW1, SW2	PART OF R3	D.P.S.T. SWITCH
SW3, SW4	510008	D.P.D.T. SLIDE SWITCH

SYMBOL	PART NO.	DESCRIPTION
C1, C10	400023	VARIABLE CAPACITOR
C2	PART OF C1	TRIMMER
C3, C4	PART OF T1	CAPACITOR
C5, C6	PART OF T2	CAPACITOR
C7, C13	910000	220 MFD ± 20% MICA
C7, C13	788011	220 MFD 300V ± 20% CERAMIC
C8	920180	.005 MFD 400V
C9, C14	920315	.002 MFD 400V
C11	PART OF C10	TRIMMER
C12, C15	920092	.01 MFD 200V
C16, C17, C20	920060	.05 MFD 200V
C18	922102	.05 MFD 400V
C19	920040	.1 MFD 200V
C21	90 MFD	150V ± 10%
C22	30 MFD	150V ± 10%
C23	40 MFD	150V ± 10%
C24	100 MFD	25V ± 10%
LI	700009	LOOP ANTENNA

INSTRUCTIONS FOR VOLTAGE AND RESISTANCE READINGS

- 1—DC Voltage measurements are at 20,000 ohms per volt; AC voltages measured at 1,000 ohms.
- 2—Socket connections are shown as bottom views.
- 3—Measured values are from socket pin to common negative.
- 4—Line voltage maintained at 117 volts for voltage readings.
- 5—Nominal tolerance on component values makes possible a variation of $\pm 15\%$ in voltage and resistance readings.
- 6—Volume control at maximum; no signal applied for voltage measurements

VOLTAGE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
1	1R5	OV	78VDC	50VDC	†3.2VDC	OV	OV	1.3VDC
2	1U4	2.5VDC	78VDC	78VDC	50VDC	2.5VDC	OV	3.8VDC
3	1S5	1.3VDC	78VDC	.2VDC	17VDC	26VDC	OV	2.5VDC
4	3S4	3.8VDC	75VDC	OV	78VDC	5.2VDC	75VDC	5.2VDC

† Taken with vacuum tube voltmeter.
NOTE: OV equivalent to zero volts.

RESISTANCE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
1	1R5	0 ohm	5400 ohm	20K ohm	100K ohm	0 ohm	4.3 meg.	*
2	1U4	*	5400 ohm	5400 ohm	20K ohm	*	2 meg.	*
3	1S5	*	5400 ohm	1 meg.	3.3 meg.	470K ohm	10 meg.	*
4	3S4	*	6000 ohm	1.5 meg.	5400 ohm	*	6000 ohm	*

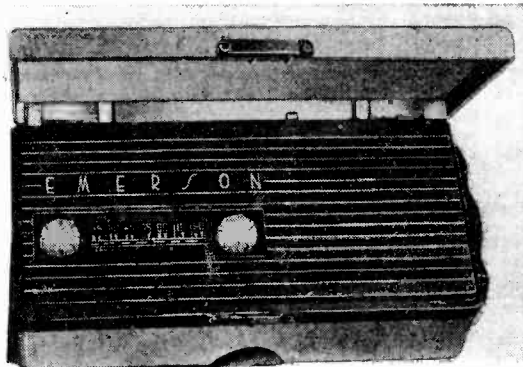
* Do not use ohmmeter to measure filament resistance.

ALIGNMENT INSTRUCTIONS

Use battery power when available. If AC power is used, use an isolation transformer when available. If not, connect a .1 mfd. capacitor in series with low side of the signal generator and B—.

Volume control should be at maximum position; output of signal generator should be no higher than necessary to obtain an output reading. Use an insulated alignment screwdriver for adjusting.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1	.1 mfd.	High side to Pin 6 (grid) of 1R5. Low side to B—.	455KC	Tuning cap. fully open.	Across voice coil.	A1, A2, A3, A4	Adjust for maximum output. If AC power is used without an isolation transformer reduce dummy ant. to 200 mmf. to reduce hum modulation.
2		Loop	1620KC	"	"	A5	Fashion loop of several turns of wire and radiate signal into loop of receiver. Adjust for maximum output.
3		"	600KC	Tune for maximum output.	"	A6	Rock tuning cap. and adjust for maximum output. Repeat Steps 2 and 3 until no further improvement can be made.



DESCRIPTION

TYPE: Three-way pocket portable superheterodyne.
FREQUENCY RANGE: 540-1600 kc.

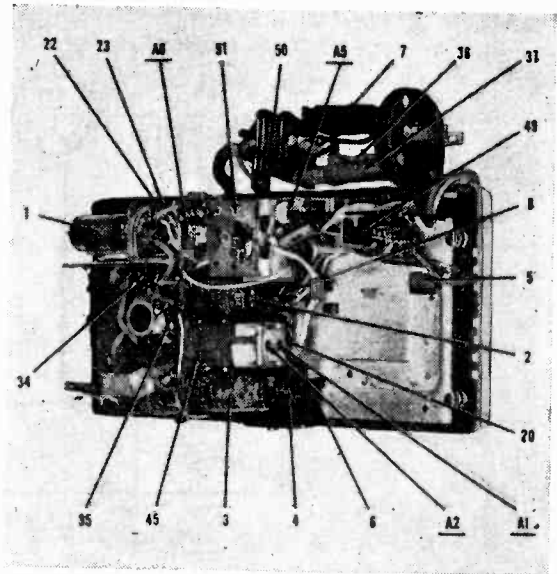
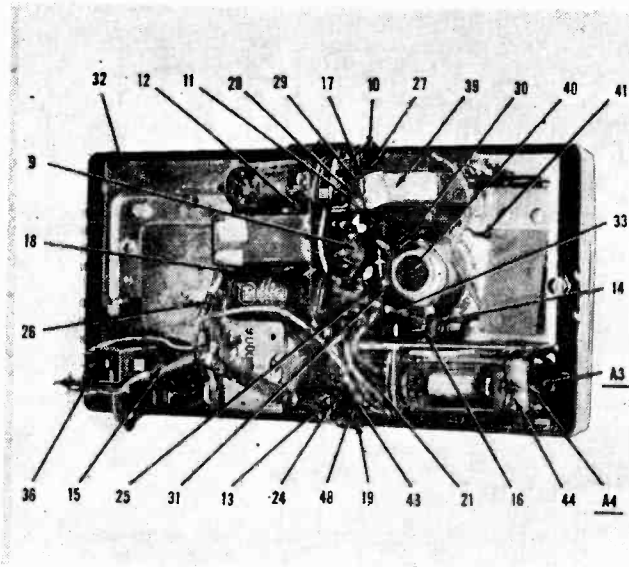
TYPE OF TUBES:
1—1R5, oscillator-modulator
1—1U4, i-f amplifier
1—1S5, 2nd detector, a.v.c., a-f amplifier
1—3S4, pentode output

POWER SUPPLY: A.C.-D.C. (105-125 volts) or self-contained batteries

VOLTAGE RATING:
"A" Battery—6 volts
"B" Battery—67.5 volts

POWER CONSUMPTION: 11 watts

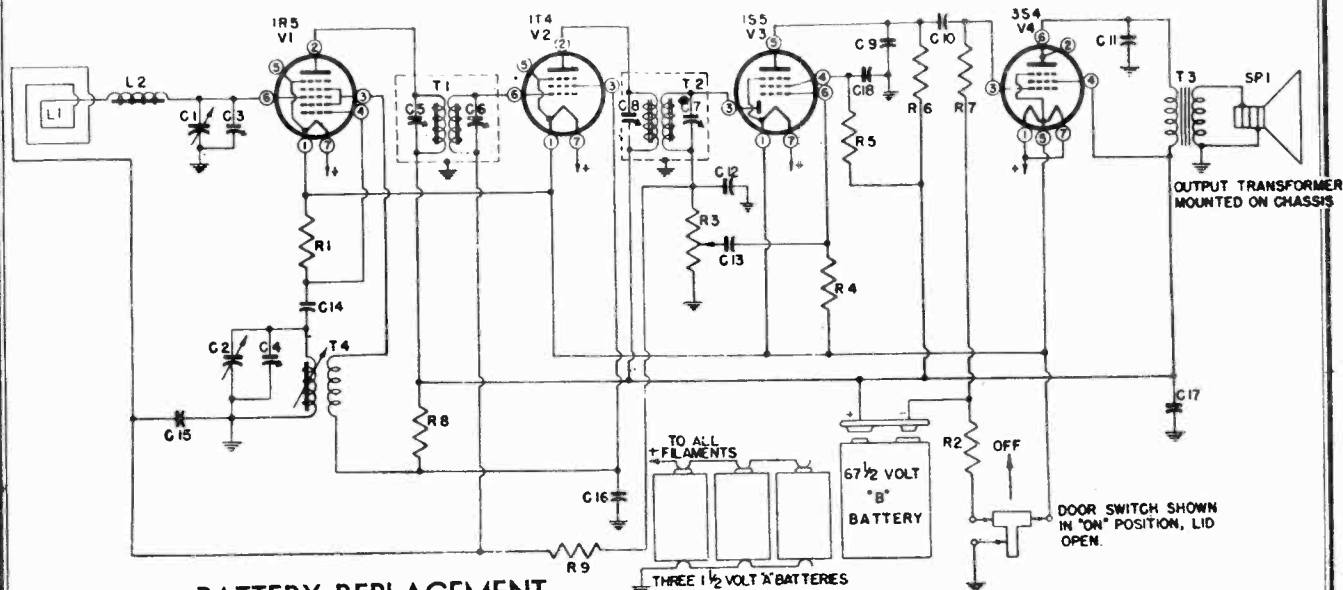
CURRENT DRAIN:
"A" Battery—60 ma.
"B" Battery—8 ma.



REPLACEMENT PARTS LIST

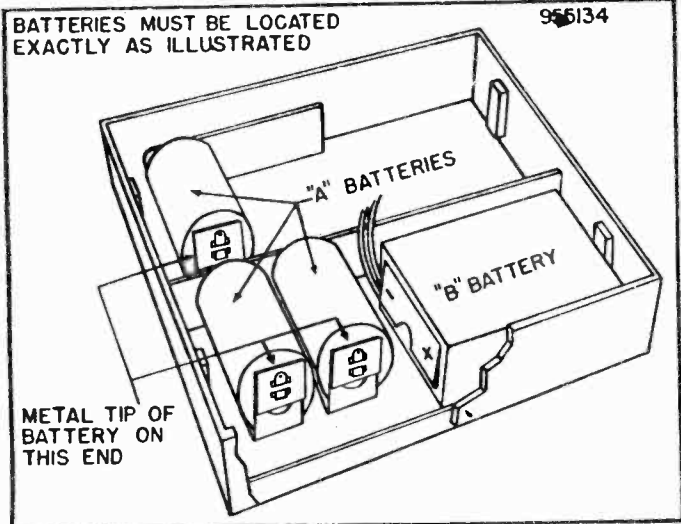
Symbol	† Part No.	DESCRIPTION	Symbol	† Part No.	DESCRIPTION
1	1R5	Converter	33	340530	Filament string, 1500 ohm, ½ watt resistor
2	1U4	IF amplifier	34	370432	Filament string, 560 ohm, 1 watt resistor
3	1S5	Det.—AVC—audio amplifier	35	370432	Filament string, 560 ohm, 1 watt resistor
4	3S4	Power output	36	340610	Filter string, 3300 ohm, ½ watt resistor
5A	925082	Filter (electrolytic), 80 mfd., 150 volt condenser	37	394019	Filament dropping, 2150 ohm, 10 watt resistor
B		Filter (electrolytic), 20 mfd., 150 volt condenser	38	394018	Rectifier ballast, 120 ohm, 3 watt resistor
6	925083	Filament bypass (elect.), 100 mfd., 25 volt condenser	39	734019	Output transformer
7	923006	Line filter, .03 mfd., 600 volt condenser	40	180029	3" PM speaker
8	920494	Line isolation, .05 mfd., 200 volt condenser	41		Cone—part of 180029
9	920550	Output plate bypass, .002 mfd., 200 volt condenser	42	700008	Loop antenna
10	920497	Audio coupling, .001 mfd., 200 volt condenser	43	716021	Oscillator coil
11	920499	AF screen bypass, .01 mfd., 100 volt condenser	44	720028	Input IF transformer
12	920497	Audio coupling, .001 mfd., 200 volt condenser	45	720028	Output IF transformer
13	920498	IF grid filter, .02 mfd., 100 volt condenser	46	Olin 4919	6-volt "A" battery
14	920498	Converter screen decoupling, .02 mfd., 100 volt condenser	47	Olin 1712	67½" "B" battery
15	920498	AVC filter, .02 mfd., 100 volt condenser	48	510019	On-off switch
16	920494	Filament bypass, .05 mfd., 200 volt condenser	49	510008	Change-over switch
17	928013	AF plate bypass, 100 mmf., 300 volt condenser	50	817001	Dry disc rectifier
18	928104	Diode RF filter, 212 mmf., 300 volt condenser	51	920029	2-gang tuning capacitor
19	928013	Oscillator grid capacitor, 100 mmf., 300 volt condenser		470330	Power supply unit
20	390025	Volume control, 1 megohm, resistor		585013	Plug and cable assembly
21	340970	Oscillator grid, 100K ohm, ½ watt resistor		585014	"B" battery cable
22	341390	IF grid, 5.6 megohm, ½ watt resistor		460064	Plastic bottom shell, black
23	351330	IF grid, 3.3 megohm, ½ watt resistor		460066	Plastic bottom shell, ivory
24	340410	Parasitic suppressor, 470 ohm, ½ watt resistor		460067	Plastic bottom shell, green
25	340770	Converter screen dropping, 15K ohm, ½ watt resistor		460028	Plastic lid, black
26	351330	AVC network, 3.3 megohm, ½ watt resistor		460038	Plastic lid, ivory
27	351450	AF grid, 10.0 megohm, ½ watt resistor		460068	Plastic lid, green
28	351330	AF screen, 3.3 megohm, ½ watt resistor		630058	Plastic loop cover, black
29	351130	AF plate, 470K ohm, ½ watt resistor		410254	Metal front
30	341250	Output grid, 1.5 megohm, ½ watt resistor		460031	Knob, black
31	341390	Bias, 5.6 megohm, ½ watt resistor		460037	Knob, ivory
32	351130	Line isolation, 470K ohm, ½ watt resistor		460061	Knob, green
				541170	Knob retaining clip
				460089	Handle, extruded plastic
				410519	Handle ring
				410298	Release catch, male
				410299	Release catch, female
				411055	Reinforcing plate, cover release catch
				410143	Lid hinge, spring loaded
				410144	Lid hinge stop
				470259	Hinge assembly, shell to metal front
				520038	Dial crystal
				520041	Dial backplate
				525016	Dial pointer
				280038	Drive shaft
				587326	Dial drive spring
				410150	"A" battery contact spring
				555000	"A" Battery contact assembly

MODELS 570, 574, EMERSON RADIO AND PHONO. CORP.
580, CHASSIS 120064



BATTERY REPLACEMENT

TO REPLACE BATTERIES: Close cover and turn set over. Unscrew large screw in center of base and remove bottom panel. This makes batteries accessible. Replace batteries as shown in illustration. Replace bottom panel and tighten screw.



DESCRIPTION

- DESIGNATION: "Memento."
- TYPE: Battery-operated superheterodyne.
- FREQUENCY RANGE: 540-1600 kc.
- TYPE OF TUBES:
 - 1—1S5, 2nd detector, a.v.c, a-f amplifier
 - 1—1R5, oscillator-modulator
 - 1—1T4, i-f amplifier
 - 1—3S4, pentode output
- POWER SUPPLY: "A" and "B" batteries.
- VOLTAGE RATING:
 - "A" Battery—1.5 volts
 - "B" Battery—67.5 volts
- CURRENT DRAIN:
 - "A" Battery—0.25 amp.
 - "B" Battery—0.0075 amp.



MODEL 570



MODEL 574



MODEL 580

ADJUSTMENTS

I-f Alignment

An oscillator with frequencies of 455, 600, 1420, and 1620 kc is required.

An output meter should be connected across the primary or secondary of the output transformer for observing maximum response.

Always use as weak a test signal as possible, turning down the output of the test oscillator as the alignment of the receiver progresses.

Turn the volume control on full.

1. Rotate the variable condenser to the minimum capacity position.
2. Feed 455 kc to the grid (pin 6) of the 1R5 tube through a 0.01 mfd. condenser.
3. Adjust the four i-f trimmer screws for maximum response. (Clip the test signal lead to the stator of the larger capacity section of the variable condenser.)

R-f Alignment

Location of Coils and Trimmer Adjustments

The first i-f transformer is located next to the 1R5 tube. The trimmers are accessible through holes in the top of the can.

The second i-f transformer is located between the 1T4 and 1S5 tubes. Trimmers are accessible through holes in the top of the can.

The oscillator coil is located behind the on-off switch. The trimmer for the oscillator is located on the smaller variable condenser section. The 600 kc oscillator core adjustment is the brass screw protruding from the end of the oscillator coil.

The loop antenna acts as the antenna coil. The trimmer for the loop is located on the larger section of the variable condenser.

1. Connect the test oscillator to a coil composed of three or four turns of wire wound in a circle approximately 12 inches in diameter. This coil should be placed parallel to and in line with the receiver loop at a distance of approximately 15 to 20 inches.
2. Radiate a signal at 1620 kc, rotate the variable condenser to minimum capacity, and adjust the oscillator trimmer, on the smaller section of the variable condenser, for maximum response.
3. Radiate a signal at 1420 kc, tune in the 1420 kc signal, and adjust the antenna trimmer, on the larger section of the variable condenser, for maximum response.
4. Radiate a signal at 600 kc, set the dial indicator to 60, and adjust the oscillator coil core trimmer while rocking the variable condenser for maximum response.
5. Return to 1620 kc and check alignment. If readjustment is necessary, repeat Steps 2 to 4 until no further improvement is noted.

VOLTAGE ANALYSIS

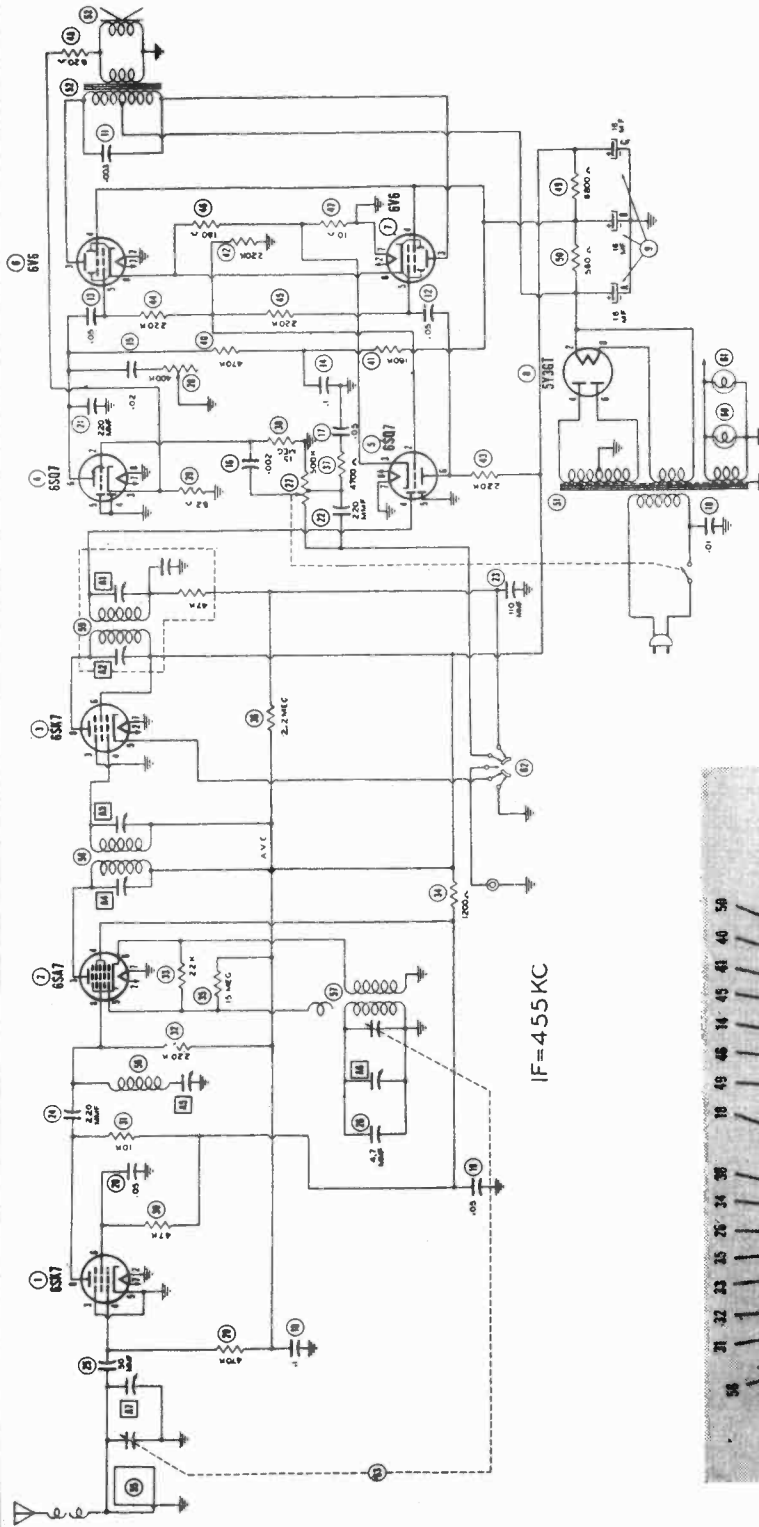
The following voltage readings are d-c measurements taken from B— (chassis) to the indicated tube-socket pin. A 1000 ohms-per-volt meter should be used for all readings except those indicated by an asterisk (*), which should be taken with a d-c vacuum-tube voltmeter. Take readings with the volume control set at minimum and the variable condenser closed. Use fresh batteries.

TUBE	PIN NUMBER						
	1	2	3	4	5	6	7
1R5		60	35	*.8		*.0.2	1.5
1T4		60	35			*.0.2	1.5
1S5			*.0.2	*17	*25	*.0.1	1.5
3S4	1.5	59	*.6.5	60		59	1.5

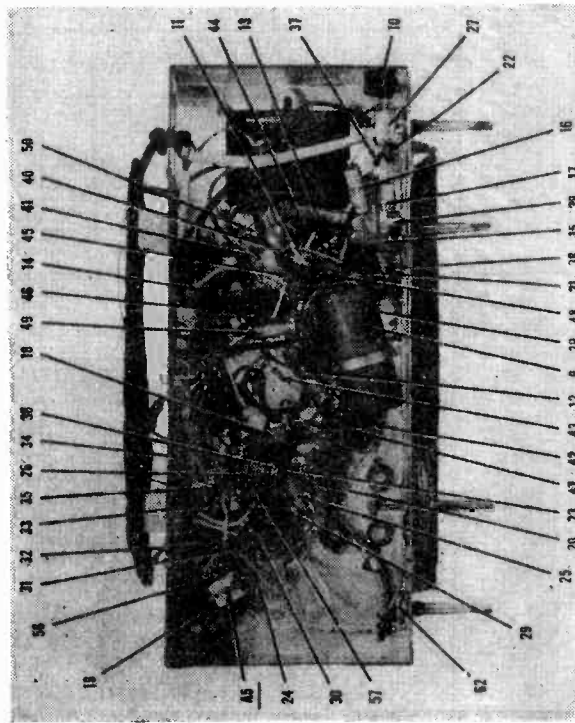
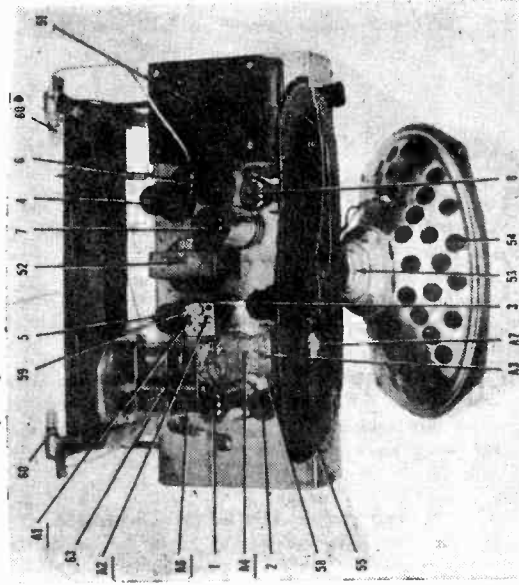
Schematic Symbol	†Part No.	DESCRIPTION	Schematic Symbol	†Part No.	DESCRIPTION
C1, C2	900022	Two-gang variable condenser	R5	351330	3.3 meg., ½ watt resistor
*C3	Part of C1	Trimmer	R6	351130	470,000 ohms, ½ watt resistor
*C4	Part of C2	Trimmer	R7	351250	1.5 meg., ½ watt resistor
*C5, C6	Part of T1	Trimmer	R8	340730	10,000 ohms, ½ watt resistor
*C7, C8	Part of T2	Trimmer	R9	351330	3.3 meg., ½ watt resistor
C9	928013	0.0001 mfd. ceramic condenser	SP1	180029	3-inch P.M. dynamic speaker
C10	920497	0.001 mfd., 200 volt condenser	T1	720028	First i-f transformer
C11	920496	0.005 mfd., 200 volt condenser	T2	720028	Second i-f transformer (alternate part 720035)
C12	928104	212 mmfd., ceramic condenser	T3	734011	Output transformer
C13	920497	0.001 mfd., 200 volt condenser	T4	716011	Oscillator coil
C14	928010	0.0001 mfd., ceramic condenser (Alternate part 928013)			
C15	920494	0.05 mfd., 200 volt condenser			
C16	920120	0.02 mfd., 100 volt condenser			
C17	925063	16 mfd., 100 volt electrolytic condenser			
C18	920485	0.01 mfd., 100 volt condenser			
L1	700019	Loop antenna			
L2	708007	Loading coil			
R1	340970	100,00 ohms, ½ watt resistor			
R2	340470	820 ohms, ½ watt resistor			
R3	390025	1 meg., volume control		510017	Lid switch
R4	351450	10 meg., ½ watt resistor		585007	"B" battery cable

MODEL 577,
CHASSIS 120012B

EMERSON RADIO AND PHONO. CORP.



IF=455 KC



EMERSON RADIO AND PHONO. CORP.

MODEL 577,
CHASSIS 120012B

ALIGNMENT

Volume control should be at maximum position; output of signal generator should be no higher than necessary to obtain an output reading. Use an insulated alignment screwdriver.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1	.1 mfd.	High side to Pin 8 (grid) of 6SA7. Low side to chassis.	455KC	Tuning cap. fully open.	Across voice coil.	A1, A2, A3, A4	Adjust for maximum output.
2	200 mmf.	High side to ext. ant. lead. Low side to chassis.	"	Tuning cap. fully closed.	"	A5	Adjust for minimum output.
3	200 mmf.	"	1620KC	Tuning cap. fully open.	"	A6	Adjust for maximum output
4	200 mmf.	"	1400KC	Tune for maximum output.	"	A7	" " "
5	200 mmf.	"	600KC	"	"		Adjust outside turn of loop for maximum output.

INSTRUCTIONS FOR VOLTAGE AND RESISTANCE READINGS

- 1—D.C. Voltage measurements are at 20,000 ohms per volt; AC Voltages measured at 1,000 ohms per volt.
- 2—Socket connections are shown as bottom views.
- 3—Measured values are from socket pin to common negative.
- 4—Line voltage maintained at 117 volts for voltage readings.

- 5—Nominal tolerance on component values makes possible a variation of $\pm 10\%$ in voltage and resistance readings.
- 6—Volume control at maximum, no signal applied for voltage measurements.

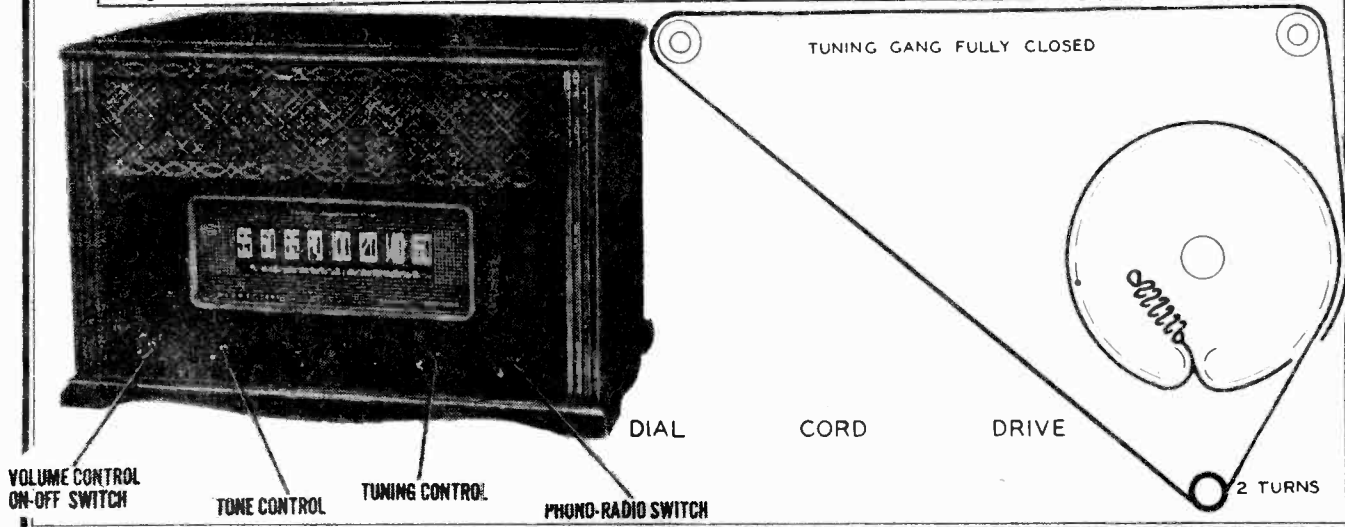
VOLTAGE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
1	6SK7	0	0	0	-.6V DC	0	45V DC	6.4V AC	60V DC
2	6SA7	0	6.4V AC	100V DC	85V DC	-.11V DC	0	0	-.3V DC
3	6SK7	0	6.4V AC	0	-.5V DC	0	100V DC	0	100V DC
4	6SQ7	0	-.5V AC	0	0	0	85V DC	6.4V AC	0
5	6SQ7	0	0	.9V DC	-.1V DC	0	60V DC	0	6.4V AC
6	6V6GT	0	0	290V DC	280V DC	0	0	6.4V AC	16V DC
7	6V6GT	0	6.4V AC	290V DC	280V DC	0	100V DC	0	16V DC
8	5Y3GT	0	300V DC	220V DC	300V AC	.9V DC	300V AC	75V AC	300V DC

† Taken with vacuum tube voltmeter, Radio-Phono switch in radio position.

RESISTANCE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
1	6SK7	0 ohm	0 ohm	0 ohm	3.1 meg.	0 ohm	200K ohm	.1 ohm	170K ohm
2	6SA7	0 ohm	.1 ohm	160K ohm	160K ohm	22K ohm	1 ohm	0 ohm	2.7 meg.
3	6SK7	0 ohm	.1 ohm	0 ohm	2.5 meg.	0 ohm	160K ohm	0 ohm	160K ohm
4	6SQ7	0 ohm	15 meg.	82 ohm	0 ohm	0 ohm	800K ohm	.1 ohm	0 ohm
5	6SQ7	0 ohm	220K ohm	10 ohm	550K ohm	0 ohm	370K ohm	0 ohm	.1 ohm
6	6V6GT	0 ohm	0 ohm	150K ohm	150K ohm	440K ohm	220K ohm	.1 ohm	180 ohm
7	6V6GT	0 ohm	.1 ohm	150K ohm	150K ohm	440K ohm	160K ohm	0 ohm	180 ohm
8	5Y3GT	inf.	150K ohm	350K ohm	87 ohm	10 ohm	80 ohm	inf.	150K ohm



MODEL 577,
CHASSIS 120012B

EMERSON RADIO AND PHONO. CORP.

TYPE OF TUBES:

- 1—6SK7 r-f amplifier
 1—6SA7 converter
 1—6SK7 i-f amplifier
 1—6SQ7 a-f amplifier
 1—6SQ7 detector—a.v.c. phase inverter
 2—6V6GT power output
 1—5Y3GT rectifier

TYPE: A.C. Superheterodyne.

FREQUENCY RANGE: 540-1620 kc.

POWER SUPPLY: 60 cycle a.c.

VOLTAGE RATING: 105-125 volts a.c., 60 cycles

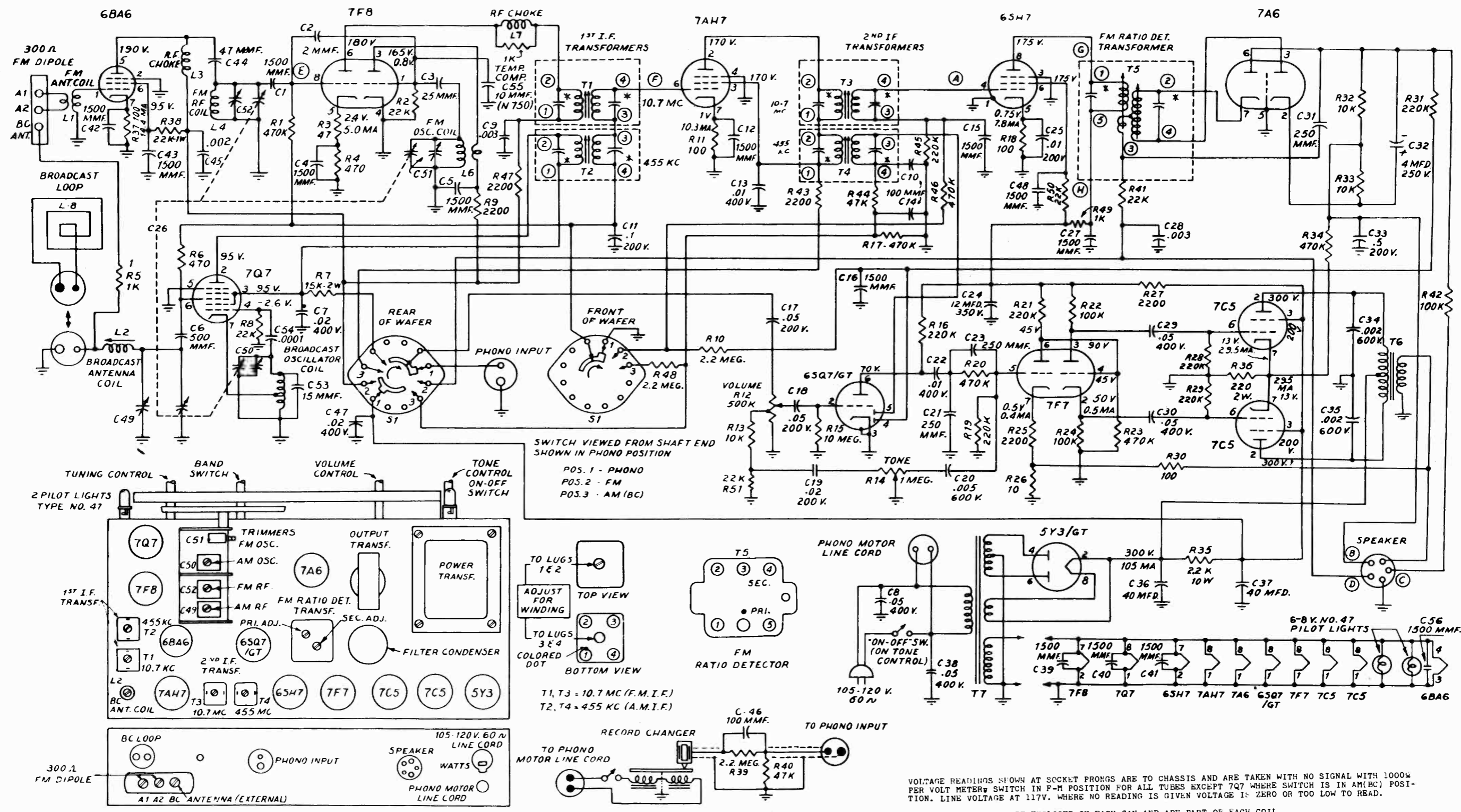
POWER CONSUMPTION: 90 watts

CURRENT DRAIN: .75 amp. at 117 volts a.c.

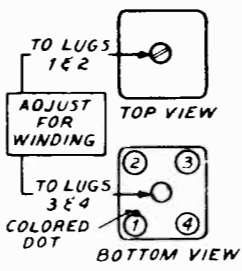
Symbol	†Part No.	DESCRIPTION	Symbol	†Part No.	DESCRIPTION
1	6SK7	RF amplifier	33	340810	Oscillator grid, 22K ohms, ½ watt resistor
2	6SA7	Converter	34	340510	Decoupling, 1200 ohms, ½ watt resistor
3	6SK7	IF amplifier	35	397000	AVC network, 15 meg., ½ watt resistor
4	6SQ7	Audio amplifier	36	351290	AVC network, 3.2 meg., ½ watt resistor
5	6SQ7	Det. a.v.c. phase inverter	37	350650	Tone compensation, 4700 ohms, ½ watt resistor
6	6V6GT	Power output	38	397000	AF grid, 15 meg., ½ watt resistor
7	6V6GT	Power output	39	340230	AF cathode, 82 ohms, ½ watt resistor
8	5Y3GT	Rectifier	40	351130	AF plate load, 470K ohms, ½ watt resistor
9A	925007	Filter (Elect.) 16 mfd., 450 volt condenser	41		AF plate decoupling, 180K ohms, ½ watt resistor
B		Filter (Elect.) 16 mfd., 450 volt condenser	42	351050	Phase inverter grid, 220K ohms, ½ watt resistor
C		Filter (Elect.) 16 mfd., 450 volt condenser	43	351050	Phase inverter plate load, 220K ohms, ½ watt resistor
10	922020	Line filter, .01 mfd., 400 volt condenser	44	351050	Output grid, 220K ohms, ½ watt resistor
11	920542	Output plate bypass, .003 mfd., 600 volt condenser	45	351050	Output grid, 220K ohms, ½ watt resistor
12	920539	Audio coupling, .05 mfd., 400 volt condenser	46	394140	Output Cathode, 180 ohms, 2 watt resistor
13	920539	Audio coupling, .05 mfd., 400 volt condenser	47	340010	Output cathode, 10 ohms, ½ watt resistor
14	920250	Audio plate decoupling, .1 mfd., 400 volt condenser	48	340470	Feedback, 820 ohms, ½ watt resistor
15	920020	Tone compensation, .02 mfd., 400 volt condenser	49	394002	Filter, 6800 ohms, 5 watt resistor
16	920010	Audio coupling, .002 mfd., 600 volt condenser	50	397001	Filter, 560 ohms, 2 watt resistor
17	920539	Tone compensation, .05 mfd., 400 volt condenser	51	730008	Power transformer
18	920040	AVC filter, .1 mfd., 200 volt condenser	52	734005	Output transformer
19	920539	Decoupling, .05 mfd., 400 volt condenser	53	180037	6" x 9" oval speaker
20	920539	RF screen bypass, .05 mfd., 400 volt condenser	54		Cone (part of 180037)
21	910000	AF plate bypass, 220 mmf., 300 volt condenser	55	700026	Loop antenna
22	910000	Tone compensation, 220 mmf., 300 volt condenser	56	708060	Wave trap
23	910010	Diode RF filter, 110 mmf., 500 volt condenser	57	716050	Oscillator coil
24	910000	RF coupling, 220 mmf., 300 volt condenser	58	720532	1st i-f transformer
25	910250	RF coupling, 50 mmfd., 500 volt condenser	59	720533	2nd i-f transformer
26	923004	Fixed trimmer, 4.7 mmfd., 500 volt condenser	60	807020	Type 44 pilot lamp
27	390006	Volume control with switch, 500K ohms, resistor	61	807020	Type 44 pilot lamp
28	390007	Tone control, 400K ohms, resistor	62	510002	Radio-Phono-switch
29	351130	RF grid, 470K ohms, ½ watt resistor	63	900008	2-gang variable capacitor
30	340890	RF screen, 47K ohms, ½ watt resistor		520066	Dial scale—glass
31	340730	RF plate load, 10K ohms, ½ watt resistor		525027	Dial pointer
32	351050	Converter grid, 220K ohms, ½ watt resistor		460470	Knob, plastic
				140148	Cabinet, walnut
				507001	Pilot lamp socket
				583010	Line cord
				555004	Speaker terminal strip
				520065	Dial escutcheon
				520130	Dial backplate
				280004	Dial drive shaft
				587070	Drive cord spring

* Not supplied separately.

† Specify part numbers when ordering.



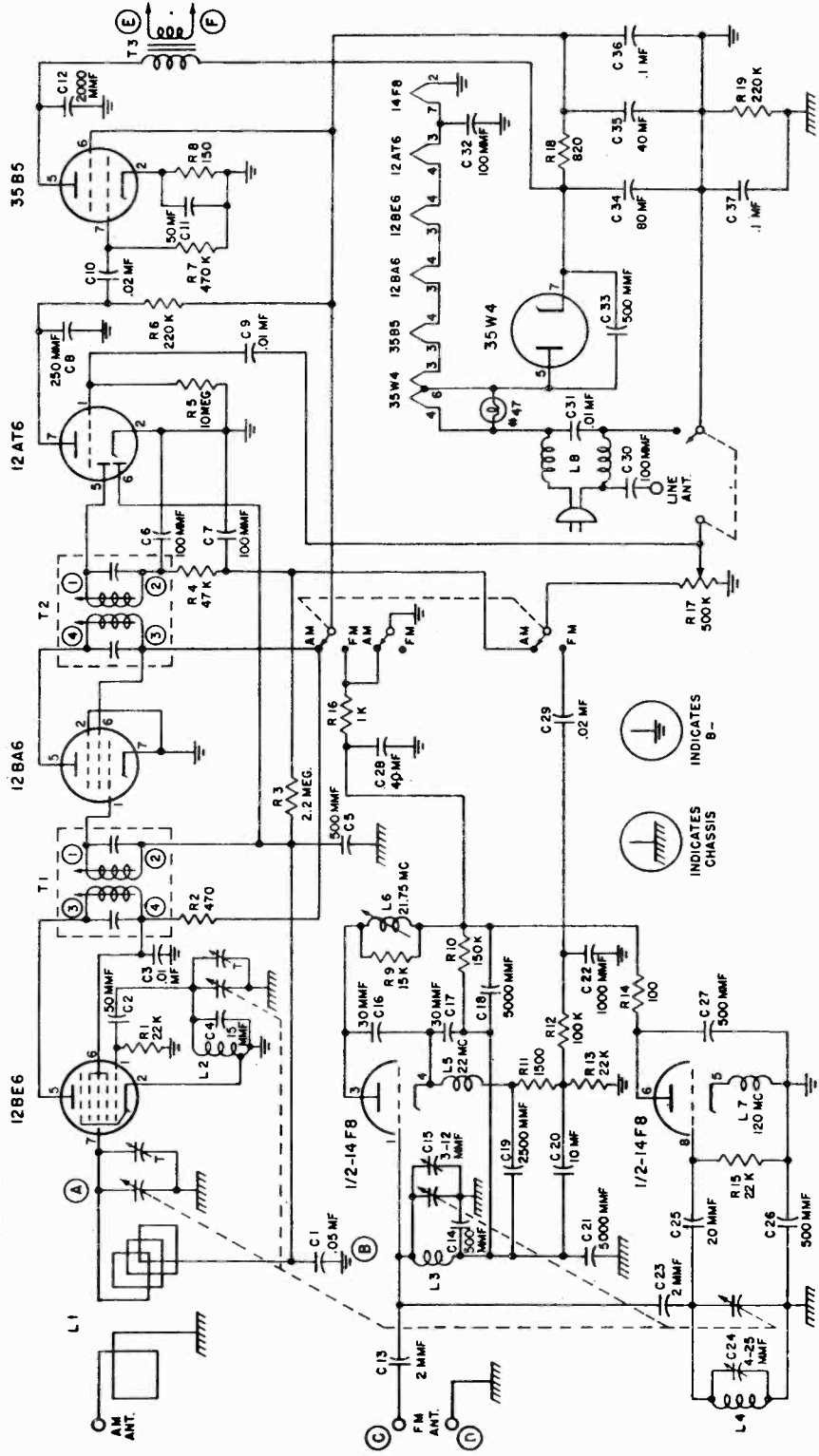
SWITCH VIEWED FROM SHAFT END SHOWN IN PHONO POSITION
 POS. 1 - PHONO
 POS. 2 - FM
 POS. 3 - AM (BC)



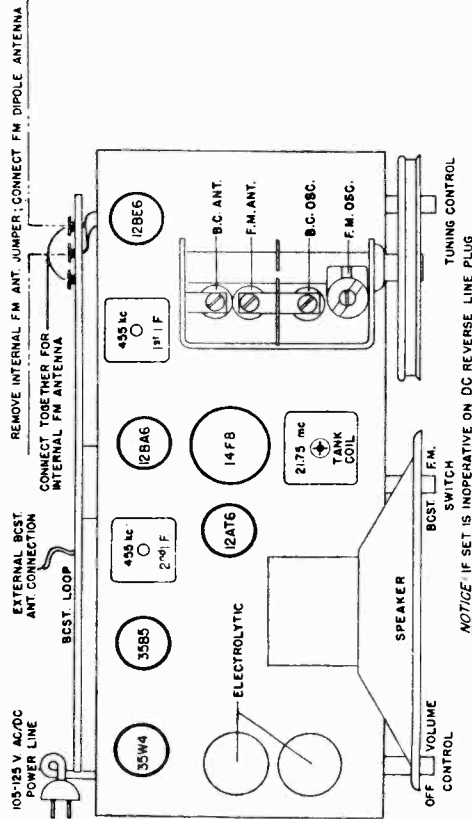
T1, T3 - 10.7 MC (F.M.I.F.)
 T2, T4 - 455 KC (A.M.I.F.)

VOLTAGE READINGS SHOWN AT SOCKET PRONGS ARE TO CHASSIS AND ARE TAKEN WITH NO SIGNAL WITH 1000Ω PER VOLT METER SWITCH IN F-M POSITION FOR ALL TUBES EXCEPT 7Q7 WHERE SWITCH IS IN AM(BC) POSITION. LINE VOLTAGE AT 117V. WHERE NO READING IS GIVEN VOLTAGE IS ZERO OR TOO LOW TO READ.

* THESE CAPACITORS ARE ENCLOSED IN EACH CAN AND ARE PART OF EACH COIL.



4. Connect the "high" side of the Generator to the antenna terminal with a 200 mmf condenser inserted in series. Connect the "ground" side of the Generator to point "B".
 5. Tune receiver to 150 on the dial. Adjust Signal Generator to 1500 kc. Adjust BC oscillator and BC antenna trimmers for maximum output. Use a weak signal for final adjustment.
- FM Equipment:**
- Equipment Required:
- a) 21.75 kc oscillator.
 - b) FM Signal Generator for 88 to 108 megacycle range.
 - c) Output meter.
1. Connect output meter across points "E" and "F".
 2. With set switched on and volume control at maximum, feed modulated 21.75 mc signal into terminals "C" and "D".
 3. Adjust tank coil for maximum response on output meter.
 4. Disconnect 21.75 kc oscillator and connect FM signal generator to points "C" and "D".
 5. Set receiver dial to 88 megacycles and adjust Signal Generator for same frequency. Adjust spacing of FM oscillator coil for maximum signal response.
 6. Tune receiver to 108 megacycles and adjust Signal Generator to same frequency. Adjust FM oscillator trimmer for maximum signal response.
 7. Repeat operation 5 and 6.
 8. Tune receiver to 90 megacycles and adjust Signal Generator for same frequency. Adjust spacing of the FM antenna coil for maximum signal response with minimum background noise. Slowly rock tuning control while performing this adjustment.
 10. Repeat operations 8 and 9.



2. Ground.
- This set has been designed to operate without an external ground, and the use of any ground connection is not recommended.

3. Power Connection.
- After making certain that the power circuit is rated between 105 and 125 volts extend the line cord to its full length and insert the plug into the nearest convenient outlet. If the supply is DC, and the set fails to operate, it may be necessary to reverse the plug connection to secure operation of the set.

OPERATION:

The left hand knob controls the ON-OFF power switch and volume level. To turn receiver on, rotate this knob in a clockwise direction. Within a few degrees of rotation an audible click will be heard, and the dial will become luminous. After a half minute of warm up the receiver will be in an operating condition. Further advance of this control in a clockwise direction will provide an increase in volume level.

The center knob controls the selection of AM or FM stations. When rotated to the counterclockwise position, operation in the AM (standard broadcast) band is provided. When this control is rotated to the clockwise position, stations may be tuned in.

The right hand or tuning knob enables the selection of any desired station as indicated on the calibrated dial. The upper row of numbers is calibrated directly in megacycles and covers the FM band. The lower scale is used to tune in stations in the standard broadcast band. Add one zero to the numbers on this scale to obtain the station frequency in kilocycles.

VI. SERVICE ADJUSTMENTS:

Alignment or adjustment of the various circuits of this receiver can only be made by a skilled radio technician with the proper equipment.

NOTE: Points A, B, C, D, E, and F are noted on the circuit diagram.

AM Equipment:

Equipment Required:

- a) Broadcast Band Signal Generator.
- b) Output Meter.

1. Set band switch at AM. Advance volume control to full volume setting.
2. Connect output meter across voice control at points "E" and "F".
3. Connect the "high" side of the Signal Generator to point "A" through the Signal Generator to 455 kc and with the receiver switched on, adjust the first and second I.F. transformers for peak output as shown on the output meter. The signal injected into the receiver should be as small in magnitude as possible, consistent with a useful deflection on the output meter.

POWER SOURCE:

This receiver may be operated from either an AC or DC line, between 105 and 125 volts. On AC lines the frequency must be 50 to 60 cycles.

TUBE COMPLEMENT:

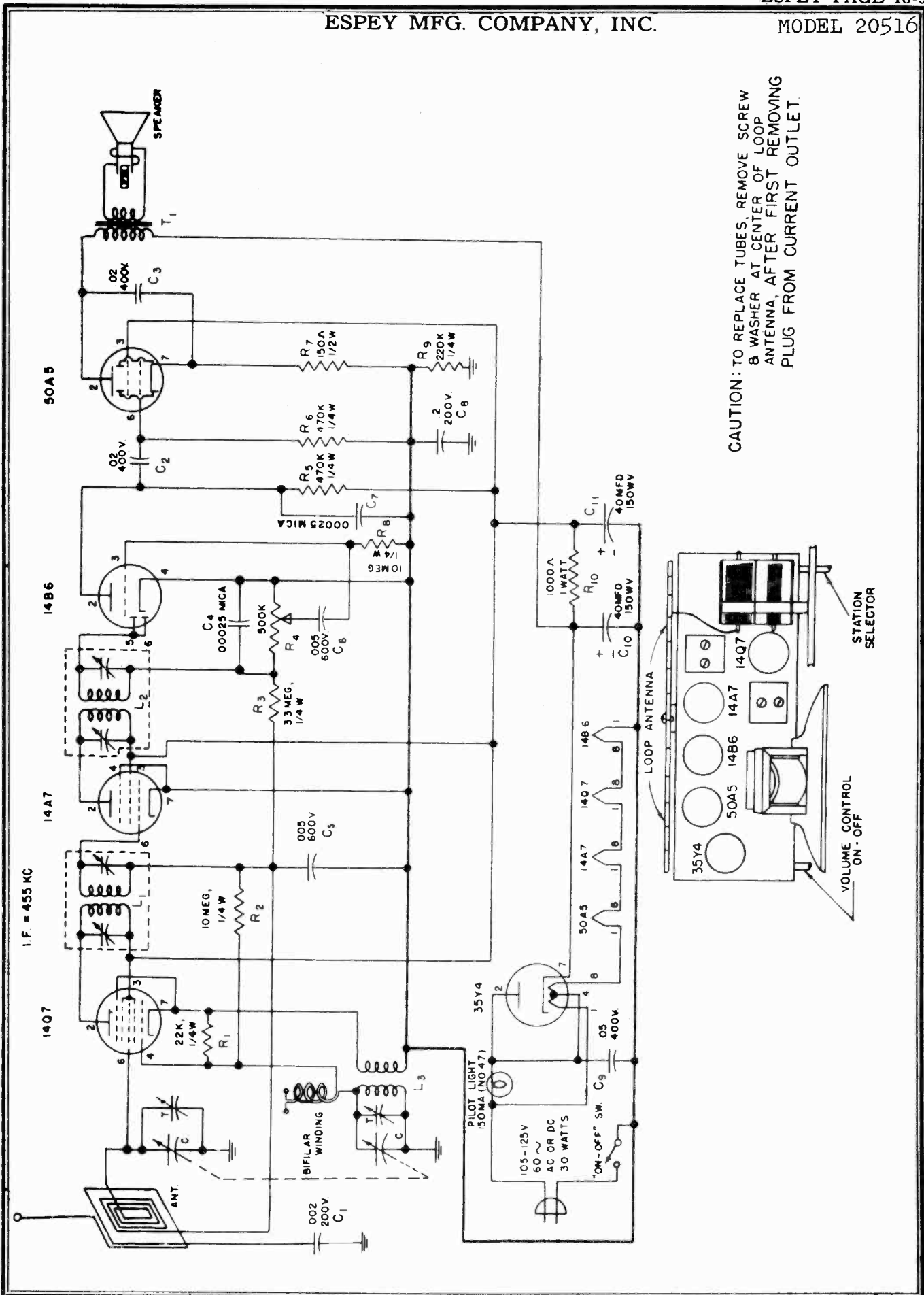
- 1 12BE6 — AM converter.
- 1 12BA6 — AM intermediate frequency amplifier.
- 1 12AT6 — AM demodulator and AVC; AM-FM 1st audio amplifier.
- 1 14F8 — FM oscillator-mixer-Super Regenerative I.F. amp.
- 1 35B5 — Audio output amplifier.
- 1 35W4 — Power rectifier.

INSTALLATION:

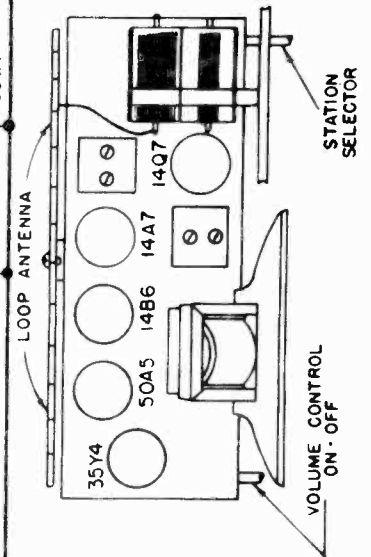
1. Antenna Connection.

AM—A self contained loop antenna is provided, which will give satisfactory reception on the standard broadcast band without requiring any additional external antenna. However, if stronger signals are desired from weak or distant stations an external antenna may be connected to the wire extending from the loop.

FM—A self contained line antenna system is provided for reception of stations appearing in the FM band. To use this line antenna a short wire jumper should be connected between the two outside screw terminals of the FM antenna panel, which is mounted on the broadcast loop antenna form. Should poor reception conditions make it necessary, an FM dipole antenna may be connected to the left hand and center screw terminals of the FM antenna panel. In such a case, the line antenna link should be disconnected.

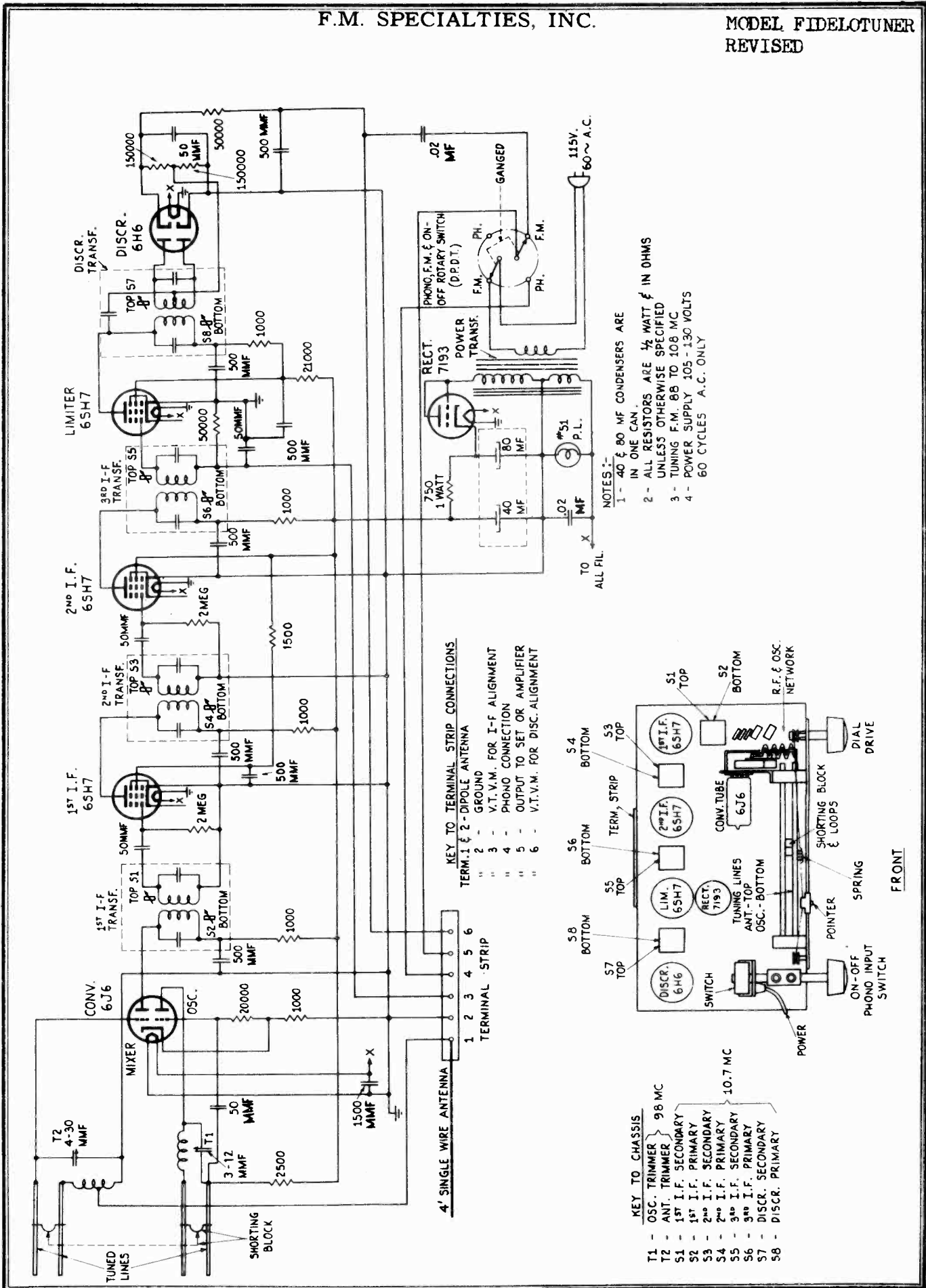


CAUTION: TO REPLACE TUBES, REMOVE SCREW & WASHER AT CENTER OF LOOP ANTENNA AFTER FIRST REMOVING PLUG FROM CURRENT OUTLET.



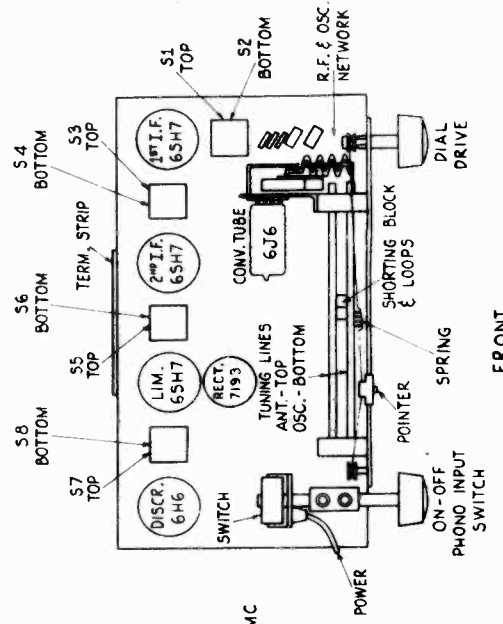
F.M. SPECIALTIES, INC.

MODEL FIDELOTUNER
REVISED



- NOTES:-
 1 - 40 & 80 MF CONDENSERS ARE IN ONE CAN
 2 - ALL RESISTORS ARE 1/2 WATT & IN OHMS UNLESS OTHERWISE SPECIFIED
 3 - TUNING F.M. 88 TO 108 MC
 4 - POWER SUPPLY 105 - 130 VOLTS 60 CYCLES A.C. ONLY

- KEY TO TERMINAL STRIP CONNECTIONS
 TERM. 1 & 2 - DIPOLE ANTENNA
 " 3 - GROUND
 " 4 - V.T.V.M. FOR I-F ALIGNMENT
 " 5 - PHONO CONNECTION TO SET OR AMPLIFIER
 " 6 - V.T.V.M. FOR DISC. ALIGNMENT



- KEY TO CHASSIS
 T1 - OSC. TRIMMER } 98 MC
 T2 - ANT. TRIMMER }
 S1 - 1st I.F. SECONDARY
 S2 - 1st I.F. PRIMARY
 S3 - 2nd I.F. SECONDARY } 10.7 MC
 S4 - 2nd I.F. PRIMARY }
 S5 - 3rd I.F. SECONDARY }
 S6 - 3rd I.F. PRIMARY }
 S7 - DISCR. SECONDARY
 S8 - DISCR. PRIMARY

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MODEL FIDELOTUNER
REVISED

F.M. SPECIALTIES, INC.

ALIGNMENT PROCEDURE

GENERAL NOTES

THE FIDELOTUNER SHOULD HAVE A WARMUP PERIOD OF ABOUT 30 MINUTES BEFORE ALIGNMENT PROCEDURE IS TO BE CARRIED OUT. IN ALL ADJUSTMENTS AN INSULATED ALIGNMENT TOOL IS TO BE USED. IF THE SIGNAL GENERATOR (USED IN EITHER THE METER OR VISUAL ALIGNMENT PROCEDURE) DOES NOT HAVE SUFFICIENT OUTPUT FOR AN INDICATION ON THE METER OR OSCILLOSCOPE WHEN THE OUTPUT OF THE GENERATOR IS FED INTO THE LIMITER OR THE LAST I-F AMPLIFIER THEN IT IS SUGGESTED THAT THE OUTPUT BE PLACED AT THE GRID INPUT TO THE R-F SECTION OF THE 6J6 CONVERTER AND THE REST OF THE ALIGNMENT PROCEDURE FOLLOWED AS IS. HOWEVER IF THE SIGNAL GENERATORS ARE CAPABLE OF STRONG SIGNAL OUTPUTS, THIS OUTPUT SHOULD BE JUST HIGH ENOUGH TO PRODUCE A DEFINITE INDICATION ON THE METER OR OSCILLOSCOPE.

I. METER METHOD OF ALIGNMENT

EQUIPMENT: A STANDARD SIGNAL GENERATOR CAPABLE OF FREQUENCIES ILLUSTRATED BELOW AND A VACUUM TUBE VOLTMETER (VTVM) AS AN OUTPUT INDICATOR. IF NO VTVM IS AVAILABLE USE AS HIGH A RESISTANCE PER VOLT DC VOLTMETER (PREFERABLY 20,000 OHMS PER VOLT METER). THE LOW SIDE OF THE SIGNAL GENERATOR AND METER SHOULD BE CONNECTED FOR ALL ALIGNMENTS TO CHASSIS GROUND OR PIN 2 OF THE TERMINAL STRIP.

STEPS	TUNER DIAL SETTING	SIGNAL GENERATOR FREQUENCY	CONNECT SIGNAL GENERATOR TO	DUMMY ANTENNA	METER CONNECTION	ADJUST TRIMMERS OR COILS IN ORDER SHOWN	REMARKS
A	HIGH FREQ. END OF BAND	10.7 MC UNMODULATED	PIN 4 GRID OF 6SH7 2ND IF AMPLIFIER	0.02 MF	TO PIN 3 OF TERMINAL STRIP	S5, S6	MAXIMUM DEFLECTION ON METER
B	"	"	PIN 4 GRID OF 6SH7 1ST IF	"	"	S3, S4	" " " "
C	"	"	PIN 6 RF GRID OF 6J6 CONVERTER TUBE	"	"	S1, S2	" " " "
D	98 MC	98MC UNMODULATED	PIN 1 OF TERMINAL STRIP	500 OHM CARBON RESISTOR	"	T1, T2	MAXIMUM DEFLECTION ON METER ROCK DIAL WHILE TUNING T2 FOR MAXIMUM
E	105 MC	105 MC UNMODULATED	"	"	"	T1	MAXIMUM DEFLECTION ON METER
F	TUNE DIAL FOR MAXIMUM METER DEFLECTION	90 MC UNMODULATED	"	"	"	OSCILLATOR COIL	IF DIAL READING IS TOO LOW ACCORDING TO THE FREQUENCY OF THE GENERATOR EXPAND OSCILLATOR COIL SLIGHTLY; IF DIAL READING IS HIGH, THEN COMPRESS COIL. IN EITHER CASE IT IS FOR MAXIMUM DEFLECTION. REPEAT STEPS E AND F FOR BEST POSSIBLE INDICATION.
G	REPEAT STEP D FOR FINAL ADJUSTMENTS OF R-F AND OSCILLATOR SECTIONS						
H	HIGH FREQ. END OF BAND	10.7 MC UNMODULATED	PIN 4 GRID OF 6SH7 LIMITER	0.02 MF	TO JUNCTION OF R11 AND R12 DISCRIMINATOR LOAD RESISTORS	S8	MAXIMUM DEFLECTION ON METER
I	"	"	"	"	TO PIN 6 OF TERMINAL STRIP	S7	ZERO DEFLECTION (ZERO READING)* ON METER

*VARY SIGNAL GENERATOR BY A SIMILAR AMOUNT ON EITHER SIDE OF THE 10.7 MC SIGNAL AND OBSERVE METER. THE RESULTS SHOULD BE THE SAME BUT OF OPPOSITE POLARITY. IF THEY ARE NOT, REPEAT STEPS H AND I IN THE ORDER INDICATED.

II. VISUAL METHOD OF ALIGNMENT

EQUIPMENT: OSCILLOSCOPE AND ANY GOOD STANDARD FM SIGNAL GENERATOR CAPABLE OF FREQUENCIES AND DEVIATIONS LISTED BELOW. THE OUTPUT FREQUENCY OF THE SIGNAL GENERATOR WILL ALWAYS BE FREQUENCY MODULATED. THE LOW SIDE OF THE SIGNAL GENERATOR AND OSCILLOSCOPE HORIZONTAL AND VERTICAL TERMINALS SHOULD BE CONNECTED FOR ALL ALIGNMENTS TO CHASSIS GROUND OR PIN 2 OF THE TERMINAL STRIP. THE MODULATING SIGNAL FROM THE F-M SIGNAL GENERATOR SHOULD, FOR ALL ALIGNMENTS, BE ATTACHED TO THE HORIZONTAL TERMINAL OF THE OSCILLOSCOPE.



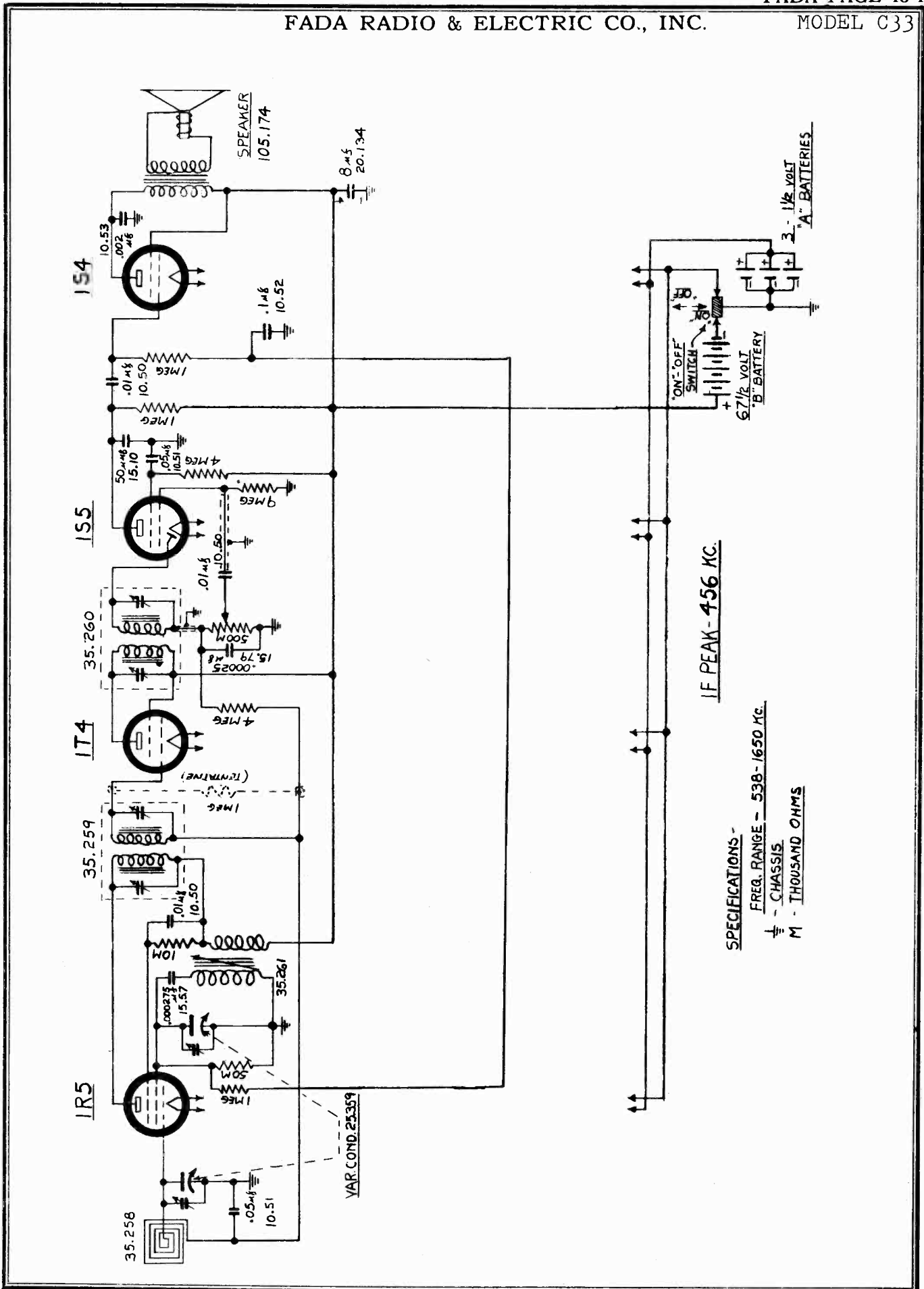
PATTERN A

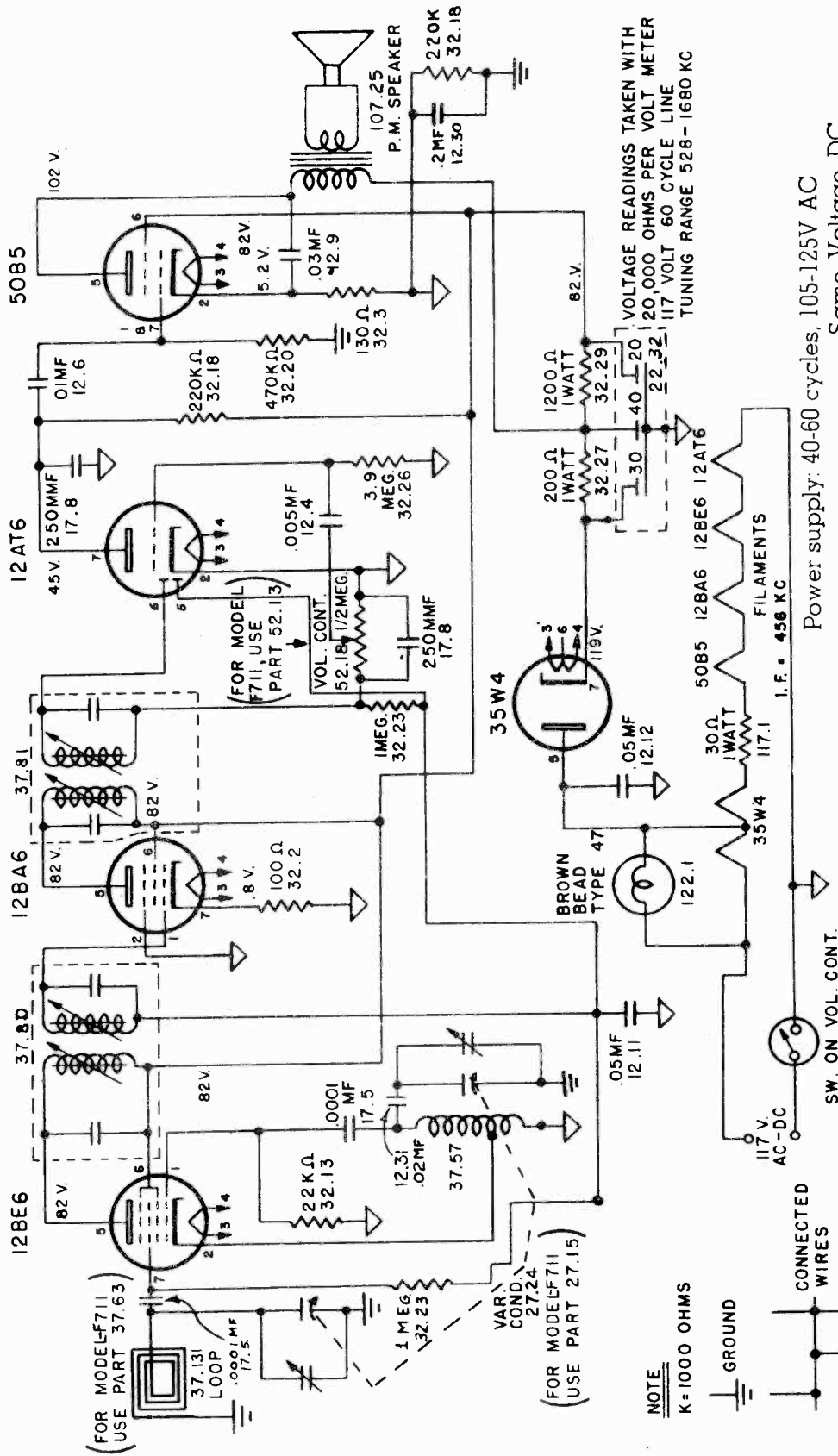


PATTERN B

STEPS	TUNER DIAL SETTING	SIGNAL* GENERATOR FREQUENCY AND DEVIATION SETTING	CONNECT SIGNAL GENERATOR TO	DUMMY ANTENNA	METER CONNECTION	ADJUST TRIMMERS OR COILS IN ORDER SHOWN	REMARKS
A	HIGH FREQ. END OF BAND	10.7 MC (FREQ. MOD) WITH ABOUT 500 KC FREQ. DEVIATION	PIN 4 GRID OF 6SH7 2ND IF AMPLIFIER	0.02 MF	VERTICAL TERMINAL TO PIN 3 ON TERMINAL STRIP	S5, S6	ADJUST FOR SYMMETRY AND MAXIMUM AMPLITUDE AS INDICATED IN PATTERN (A) ABOVE
B	"	"	PIN 4 GRID OF 6SH7 1ST IF	"	"	S3, S4	SAME AS ABOVE
C	"	"	PIN 6 RF GRID OF 6J6 CONVERTER TUBE	"	"	S1, S2	SAME AS ABOVE
D	98 MC	98 MC (FREQ. MODULATED) WITH ABOUT 500 KC DEVIATION	PIN 1 OF TERMINAL STRIP	500 OHM CARBON RESISTOR	"	T1, T2	SAME AS ABOVE ALSO ROCK DIAL WHILE TUNING T2 FOR MAXIMUM RESPONSE OF PATTERN (A) ABOVE
E	105 MC	105 MC (FREQ. MODULATED) WITH ABOUT 500 KC DEVIATION	"	"	"	T1	SAME AS REMARKS FOR STEP A
F	TUNE DIAL FOR MAXIMUM AND SYMMETRICAL RESPONSE	90 MC (FREQ. MODULATED) WITH ABOUT 500 KC DEVIATION	"	"	"	OSCILLATOR COIL	IF DIAL READING IS TOO LOW ACCORDING TO THE FREQUENCY OF THE GENERATOR, EXPAND OSCILLATOR COIL SLIGHTLY; IF DIAL READING IS HIGH THEN COMPRESS COIL. IN EITHER CASE THE ADJUSTMENT IS FOR MAXIMUM AND SYMMETRICAL RESPONSE AS SHOWN IN PATTERN (A) ABOVE
G	REPEAT STEP D FOR FINAL ADJUSTMENTS OF R-F AND OSCILLATOR SECTION						
H	HIGH FREQ. END OF BAND	10.7 MC (FREQ. MOD) WITH ABOUT 300 KC FREQ. DEVIATION	PIN 4 GRID OF 6SH7 LIMITER	0.02 MF	PIN 6 OF TERMINAL STRIP	S8	ADJUST S8 FOR GOOD LINEARITY AND MAXIMUM AMPLITUDE AS INDICATED IN PATTERN (B) ABOVE
I	"	"	"	"	"	S7	ADJUST S7 FOR CORRECT SYMMETRY OF THE MID POINT OF THE CURVE.

* IF THE F-M SIGNAL GENERATOR CANNOT PRODUCE THE FREQUENCY DEVIATION (I.E.) SWEEP FREQUENCY INDICATED THEN THE LARGEST FREQUENCY DEVIATION THAT THE GENERATOR CAN PRODUCE SHOULD BE USED.





Power consumption: 30 Watts
 Frequency Range: 530-1680 KC
 I.F. Circuits: 456 KC
 Tubes: Osc.-Converter 12BE6
 I.F. Amplifier 12BA6
 Det./Avc. A.F. 12AT6
 Power Output 50B5
 Rectifier 35W4

Speaker: 4" P.M. 68 ohms "Alnico V" Magnet
 Speaker Transformer: 2500 ohms—400 cycles
 Speaker Voice Coil: 3.2 ohms

NOTE
 K = 1000 OHMS

CONNECTED WIRES
 GROUND ABOVE CHASSIS

SW. ON VOL. CONT.

Power supply: 40-60 cycles, 105-125V AC
 Same Voltage DC

VOLTAGE READINGS TAKEN WITH
 120,000 OHMS PER VOLT METER
 117 VOLT 60 CYCLE LINE
 TUNING RANGE 528-1680 KC

ALIGNMENT PROCEDURE

No attempt should be made to realign the various circuits until all other causes have been checked, unless the condition is so obvious as to indicate that realignment is necessary. Then proceed as follows:

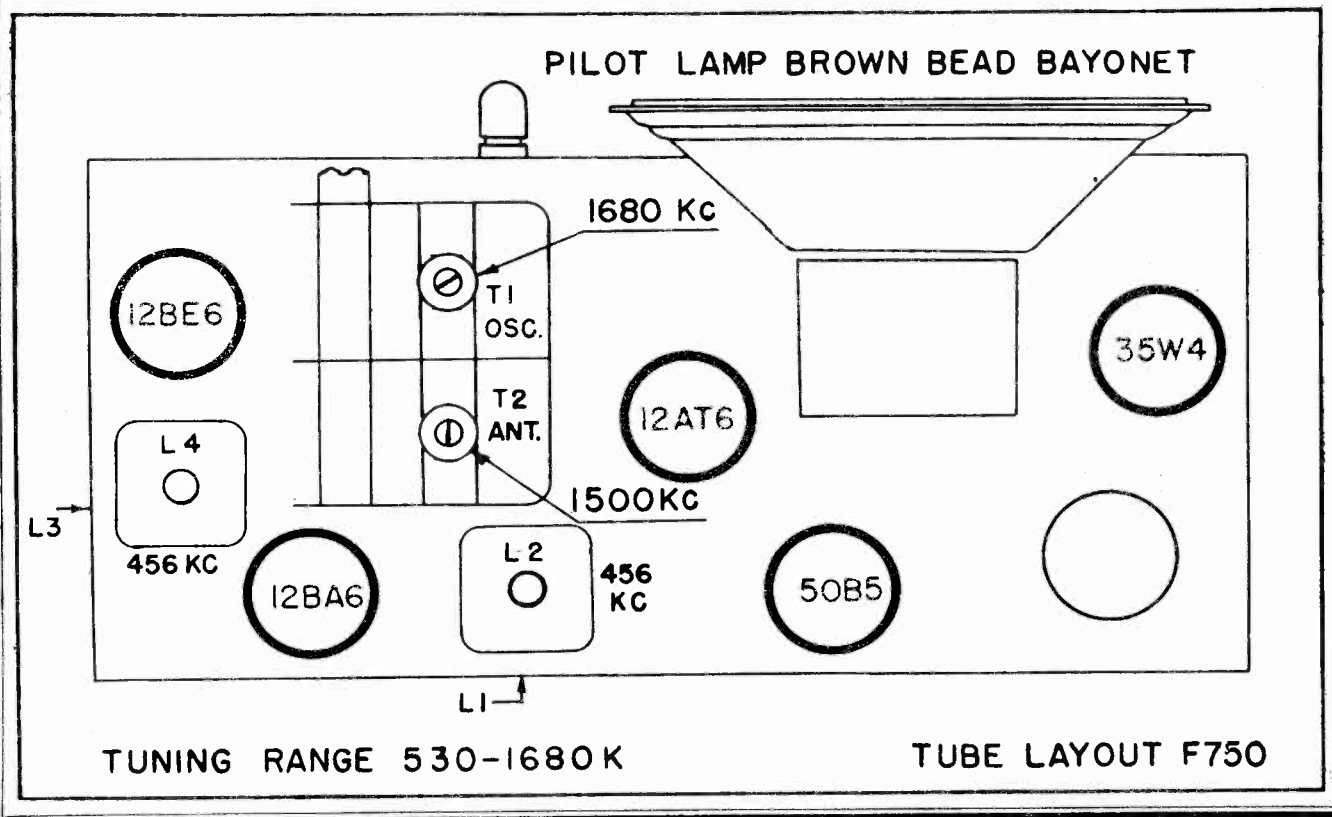
Volume Control full on.

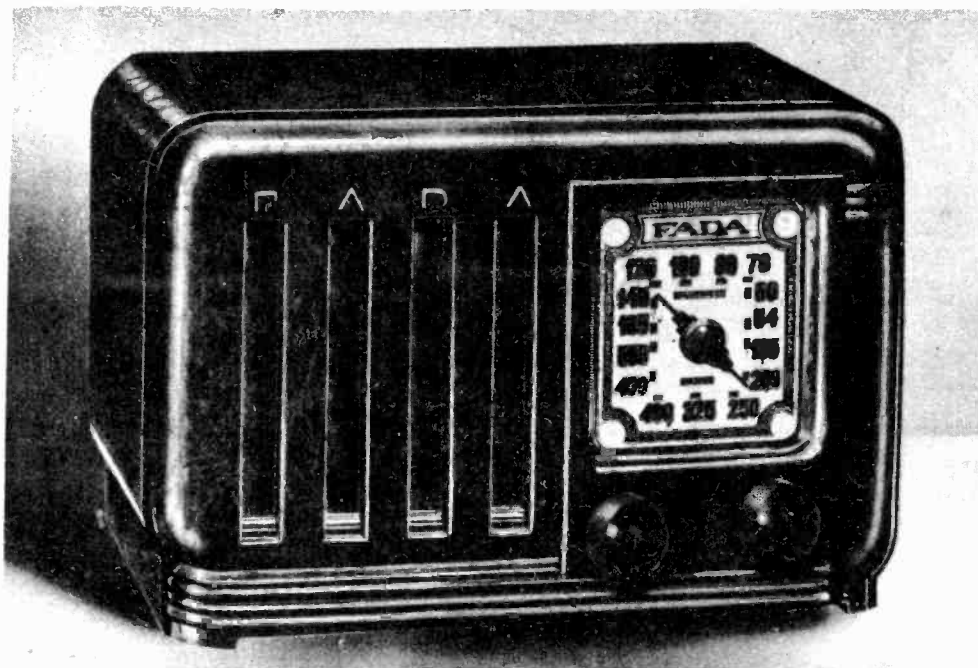
Low range A.C. meter connected across voice coil to indicate output.

Keep signal generator attenuated so as to maintain 1/2 scale reading on output meter.

Make certain that dial pointer is exactly horizontal when variable condenser is fully meshed.

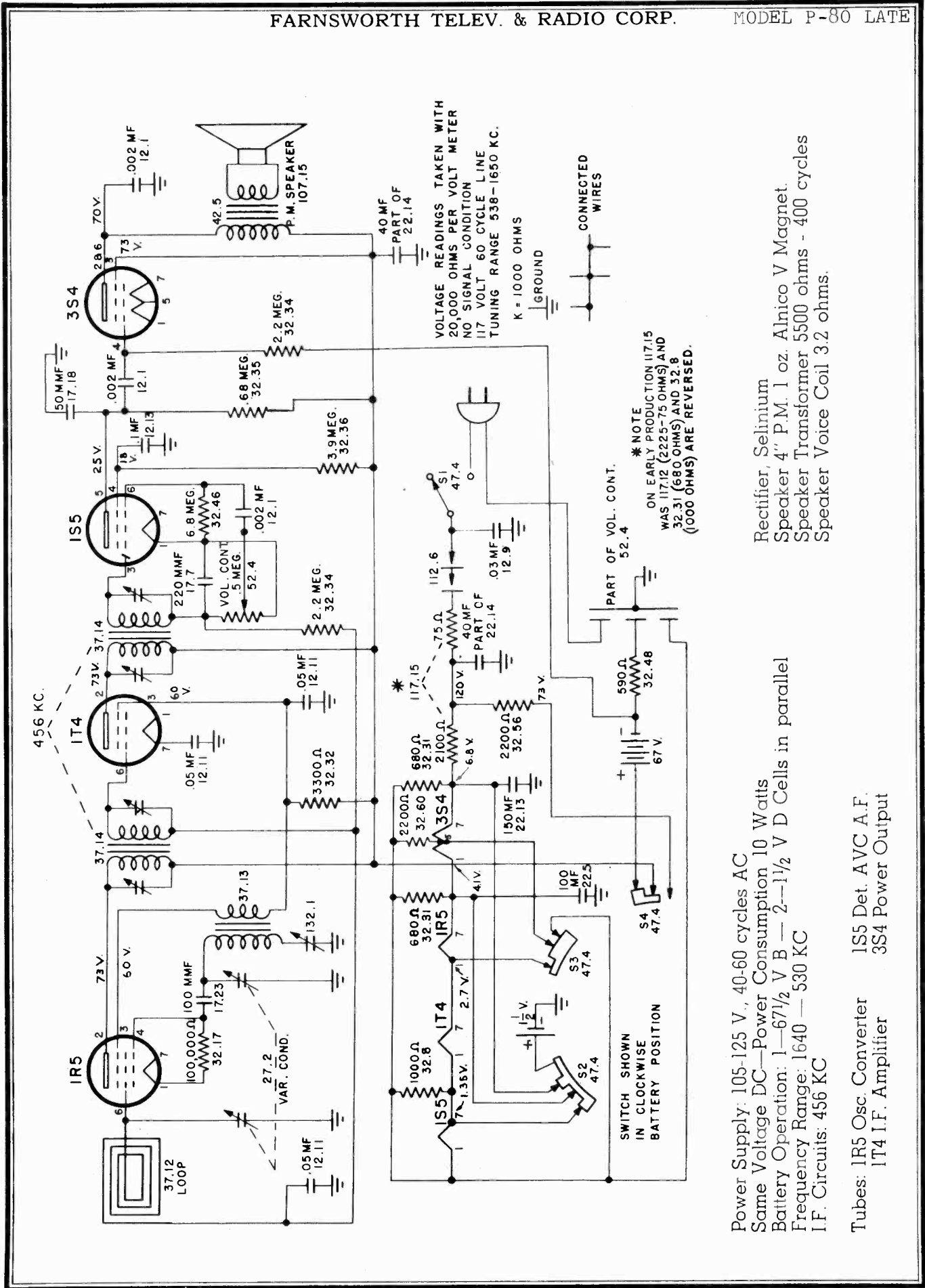
Receiver Dial at:	Signal Generator	Dummy Antenna	Connect Signal Generator to:	Refer to Chassis Layout for Location of Trimmers
1 Full Open	Exactly 456 KC	.1 MF	Control Grid 12BE6 Tube (Top) Rear Section Variable Condenser	Adjust for Maximum Output L1, L2, L3 & L4
2 Full Open	Exactly 1680 KC		Radiating Loop (1/2 meter) 20" from Receiver Loop	Adjust for Maximum Output T1
3 Approx. 1500 KC	Approx. 1500 KC		Radiating Loop (1/2 meter) 20" from Receiver Loop	Adjust for Maximum Output T2
4 Approx. 600 KC	Approx. 600 KC		Radiating Loop (1/2 meter) 20" from Receiver Loop	Check tracking and bend slotted end plate (rear section) of variable, if necessary.
5				





PARTS LIST

Part No.	Description
12.4	Tubular Condenser, .005 mf, 600 V
12.6	Tubular Condenser, .01 mf, 400 V
12.9	Tubular Condenser, .03 mf, 400 V
12.11	Tubular Condenser, .05 mf, 200 V
12.12	Tubular Condenser, .05 mf, 400 V
17.21	Mica Condenser, 100 mmf, $\pm 20\%$
17.22	Mica Condenser, 220 mmf, $\pm 20\%$
22.32	3 Section Electrolytic Condenser, 30-40-20 mf, 150 W.V.
27.24	Variable Condenser
37.37	Oscillator Coil
37.131	Loop Antenna & Back
37.80	Input I.F. Transformer, complete
37.81	Output I.F. Transformer, complete
52.18	Volume Control with Switch
72.1	Power Cord (Approved)
77.106	Dial Scale (Calibrated)
77.108	Dial Pointer
77.7	Dial Crystal
97.123W	Cabinet, Bakelite-Walnut
97.123V	Cabinet, Bakelite-Ivory
142.32W	Cabinet Knobs—Walnut
142.32V	Cabinet Knobs—Ivory
107.25T	4" P.M. Speaker with Transformer
107.25	4" P.M. Speaker less Transformer
42.25	Speaker Transformer for above U.L. approved
117.1	30 ohm 1 W. Resistor
12.30	.2 mf, 400 V.
12.31	.02 mf, 200 V.



Power Supply: 105-125 V., 40-60 cycles AC
 Same Voltage DC—Power Consumption 10 Watts
 Battery Operation: 1—67½ V B — 2—1½ V D Cells in parallel
 Frequency Range: 1640 — 530 KC
 I.F. Circuits: 456 KC

Tubes: IR5 Osc. Converter
 IT4 I.F. Amplifier
 IS5 Det. AVC A.F.
 3S4 Power Output

Rectifier, Selenium
 Speaker 4" P.M. 1 oz. Alnico V Magnet.
 Speaker Transformer 5500 ohms - 400 cycles
 Speaker Voice Coil 3.2 ohms.

ALIGNMENT PROCEDURE

No attempt should be made to realign the various circuits until all other causes have been checked, unless the condition is so obvious as to indicate that realignment is necessary. Then proceed as follows:

Disconnect Loop leads—Remove Chassis from Cabinet.

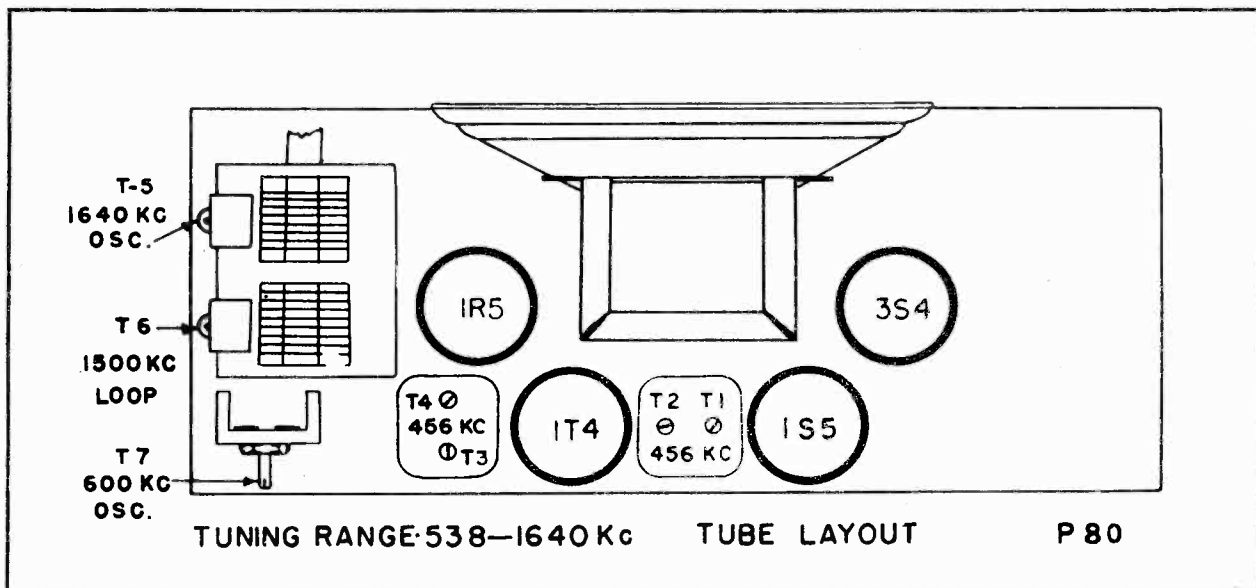
Volume Control full on.

Low range A.C. meter connected across voice coil to indicate output.

Keep signal generator attenuated so as to maintain 1/2 scale reading on output meter.

Use battery power when available.

Receiver Condenser at:	Signal Generator	Dummy Antenna	Connect Signal Generator to:	Refer to Chassis Layout for Location of Trimmers
1 Fully closed	Exactly 456 KC	.1 MF	Chassis Ground and Control Grid 1R5 Rear Section Var. Cond.	Adjust for maximum output T1, T2, T3, and T4.
2 Fully closed	Approx. 538 KC	.1 MF	"	Adjust for maximum output T7
3 Fully open	Exactly 1640 KC	.1 MF	"	Adjust for maximum output T5
Repeat Operations 2 and 3. The next two operations are performed with the chassis in the cabinet, the loop connected and tuning indicator in position.				
4 Approx. 1500 KC	Approx. 1500 KC		Radiating Loop 20" from Receiver	Adjust T6 for maximum output.
5 Approx. 600 KC	Approx. 600 KC		Radiating Loop 20" from Receiver	Adjust T7 for max. while rocking variable cond.

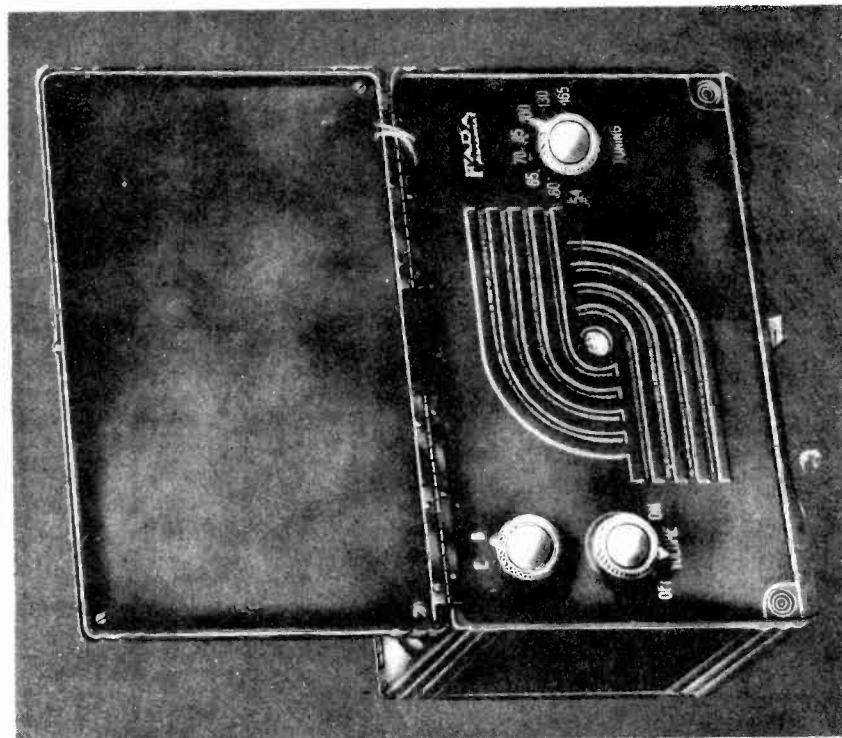


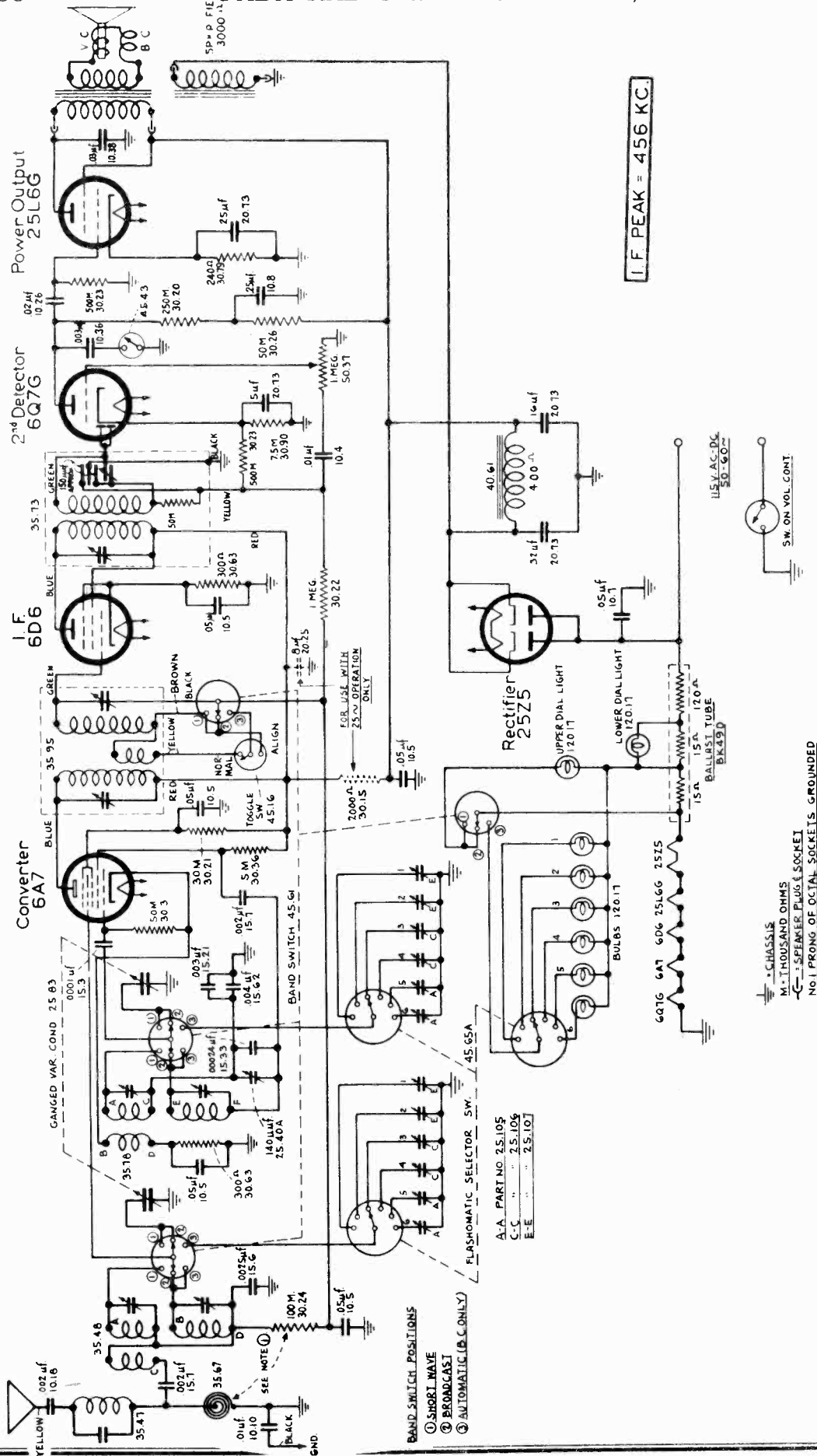
PARTS LIST

Part No.	Description
12.1	Tubular Condenser .002 mf 200 V
12.9	Tubular Condenser .03 mf 400 V
12.11	Tubular Condenser .05 mf 200 V
12.13	Tubular Condenser .1 mf 100 V
12.14	Tubular Condenser .1 mf 200 V
17.7	Ceramic Condenser 200 mmf ± 20%
17.18	Ceramic Condenser 50 mmf ± 20%
17.21	Ceramic Condenser 100 mmf ± 20%
22.5	Electrolytic Condenser 100 mf 15 V
22.13	Electrolytic Condenser 150 mf 15 V
22.14	Electrolytic Condenser 40-40 mf 150 V
27.2	Variable Condenser 2 gang
37.13	Oscillator Coil
37.14	Input & Diode I.F. Transformer
42.5	Speaker Transformer
47.4	Changeover Switch
52.4	Volume Control w/on-off switch
72.35	Power Cord
112.6	Rectifier Selenium
117.15	W. W. Resistor
132.1	Padder Condenser
142.6	Knob-Tuning — Ivory only
142.7	Knob-Pointer — Ivory only
142.8	Knob-Volume or Changeover — Ivory only
157.3	Loop & Cover Assembly
157.4	A. Battery Contact Assembly
92.25	B. Battery Connector
92.80	Spring Clip Phosphor Bronze
92.81	Ball Knob
157.5	Cabinet Assembly — complete w/front & rear lid & hinges less loop & spring catch (Specify color)
107.15	4" Speaker 1 oz. less transformer
107.15T	4" Speaker 1 oz. with transformer

De Luxe Portable Tri-Power

SUPERHETERODYNE RECEIVER





I.F. PEAK = 456 KC.

- ⊖ CHASSIS
- M - THOUSAND OHMS
- ⊖ - SPEAKER PLUG SOCKET
- NO. 1 PRONG OF OCTAL SOCKETS GROUNDED

- BAND SWITCH POSITIONS
- ① SHORT WAVE
 - ② BROADCAST
 - ③ AUTOMATIC (P.C. ONLY)

FLASHOMATIC SELECTOR SW. 45.65A

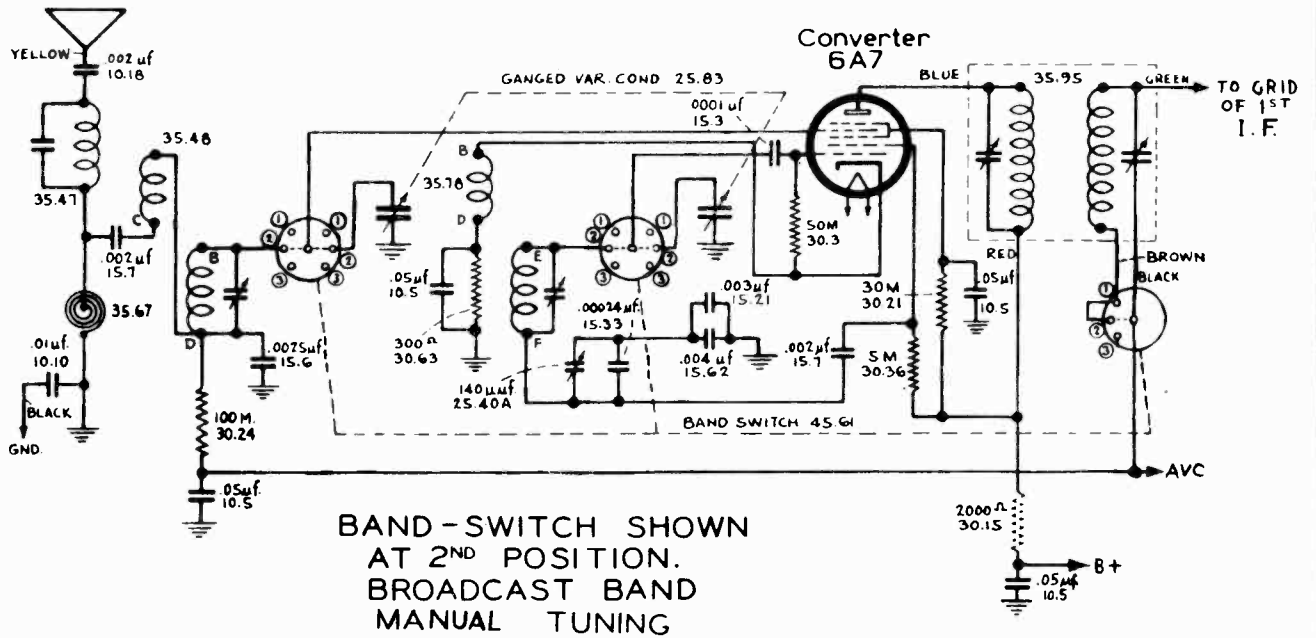
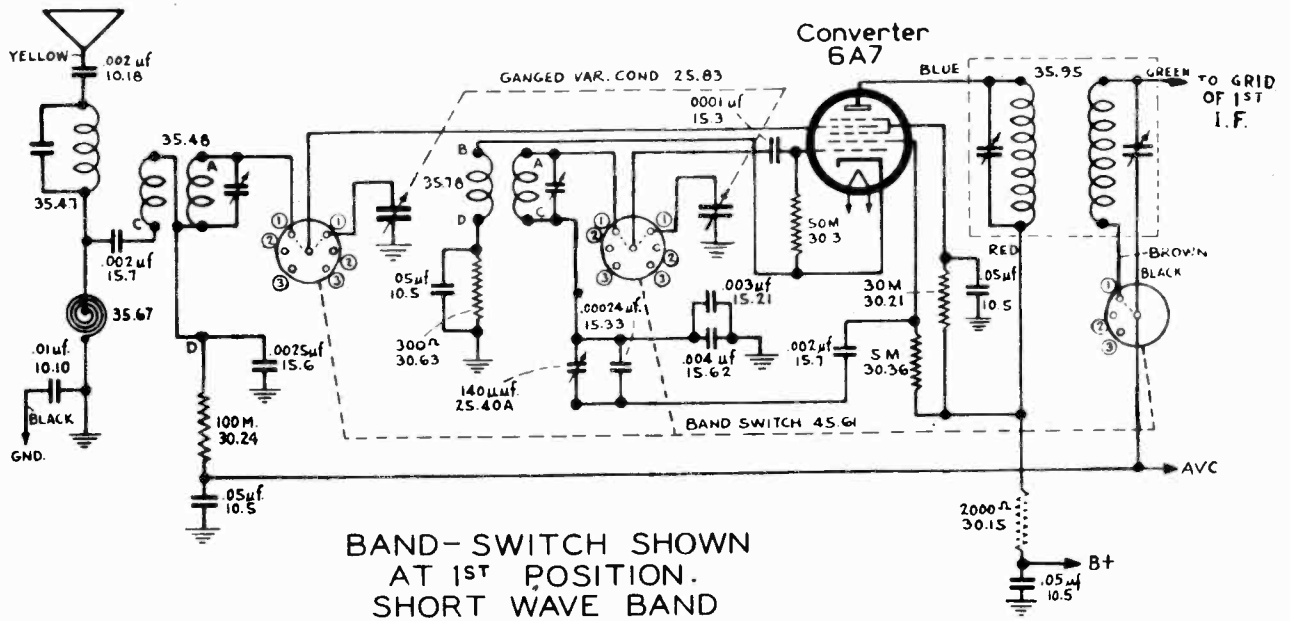
A-A	PART NO. 25.105
C-C	" 25.106
E-E	" 25.107

CLARI-SKEMATIX

Registered Trademark

FADA RADIO & ELECTRIC CO., INC.

MODEL 368

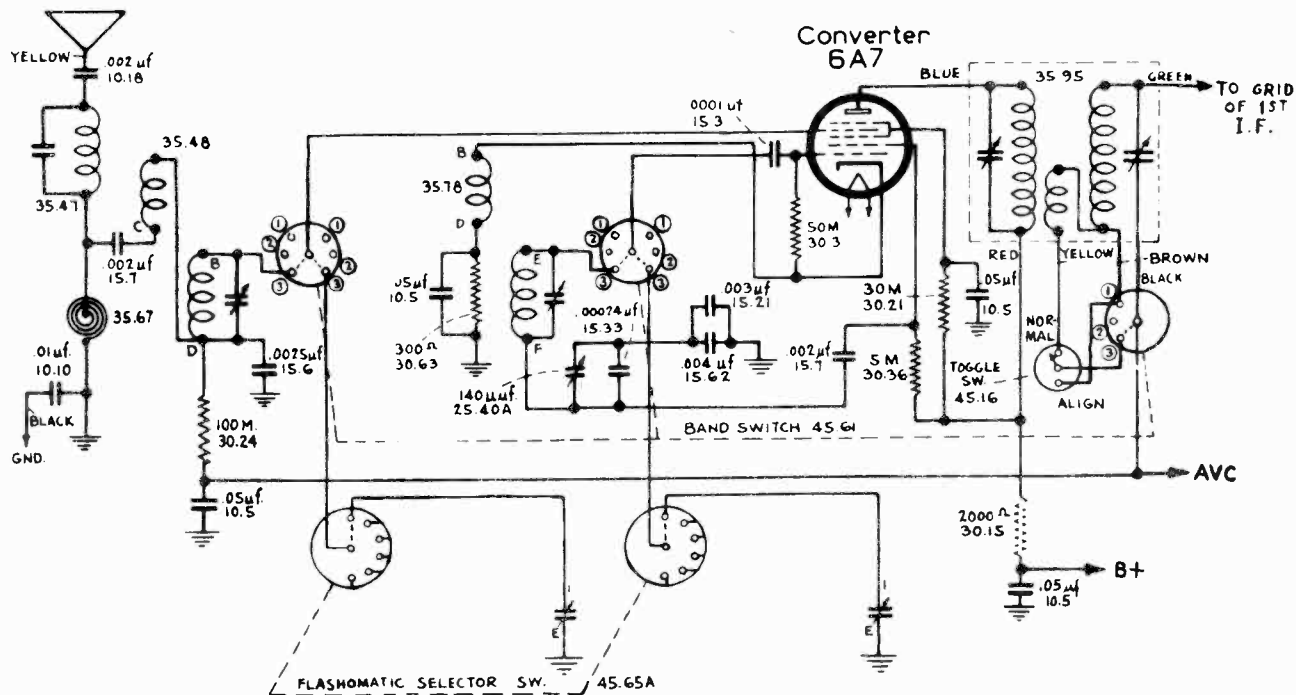


CLARI-SKEMATIX

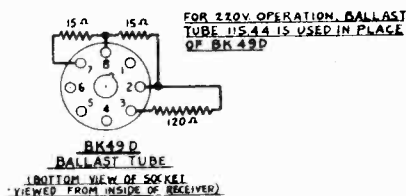
Registered Trademark

FADA RADIO & ELECTRIC CO., INC.

MODEL 368

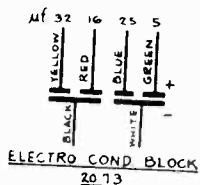


BAND-SWITCH SHOWN
AT 3RD POSITION.
BROADCAST BAND (AUTOMATIC)
#1 "E" BUTTON DEPRESSED

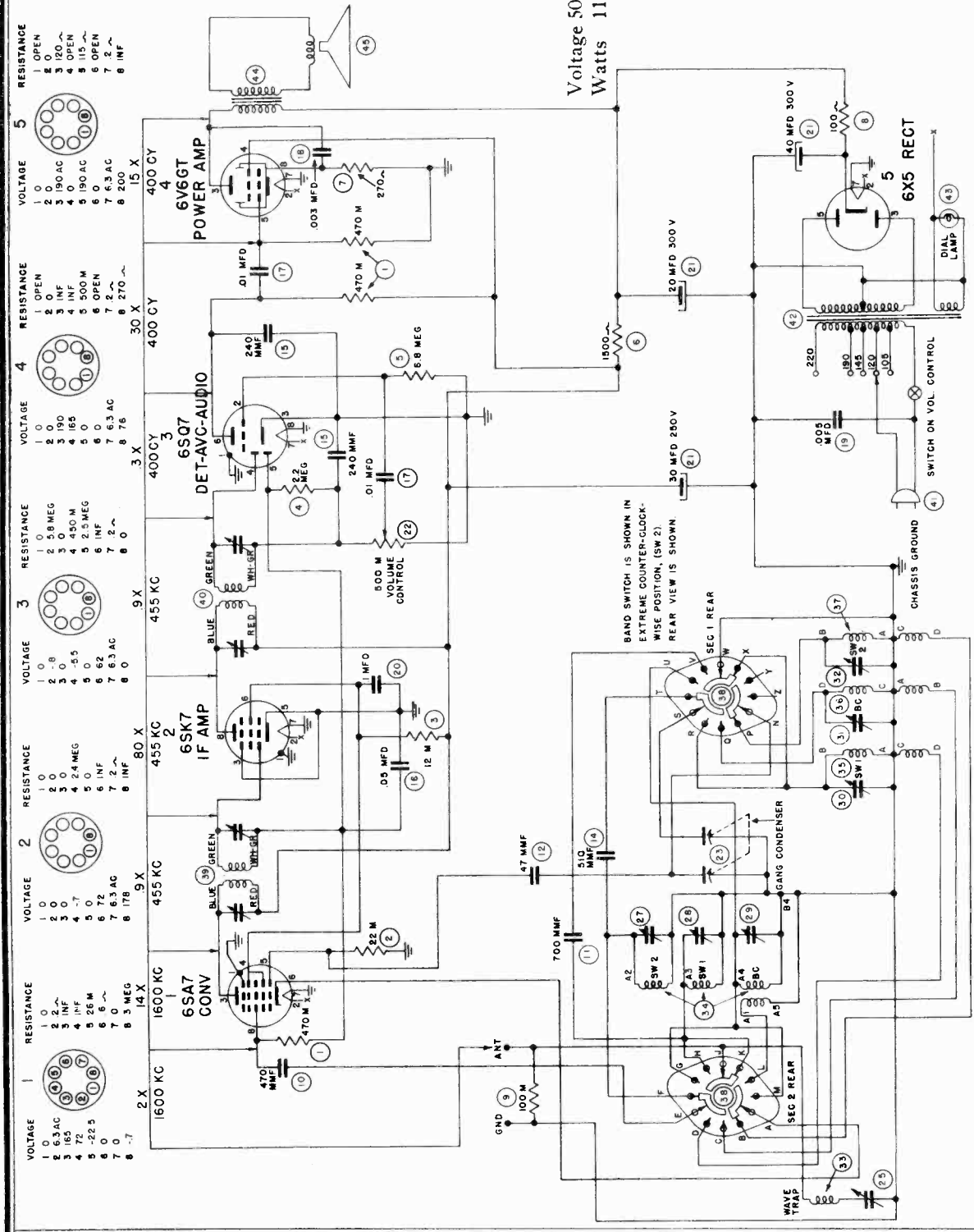


<p>Ant. Coil 35.48</p> <p>A-D • .02Ω B-D • 6.6Ω C-D • .78Ω</p>	<p>Osc. Coil 35.78</p> <p>A-C • .02Ω B-D • .33Ω E-F • 5.15Ω</p>
<p>1ST I.F. 35.95</p> <p>PRI • BLUE-RED • 23Ω SEC • GREEN-BROWN • 23Ω EXP. WINDING • YELLOW-BROWN • 15Ω</p>	<p>2ND I.F. 35.73</p> <p>PRI • BLUE-RED • 28Ω SEC • 28Ω</p>

NOTE ① ON EARLY MODELS .10M RESISTOR PART NO. 30.31 IS USED IN PLACE OF 35.67 & R.F. CHOKE 35.67 IS USED IN PLACE OF 100M. 30.24



FARNSWORTH TELEV. & RADIO CORP. MODELS ET-650BRZ,
 ET-651BKZ, ET-651BUZ,
 ET-651RDZ,
 CHASSIS 171



Voltage 50-60 cycle AC 105 to 220
 Watts 117 AC 30

1		2		3		4		5	
VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE
1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0
2 6.3 AC	2 2	2 .8	2 58 MEG	2 .8	2 58 MEG	2 .8	2 58 MEG	2 .8	2 58 MEG
3 185	3 INF	3 0	3 4.50 M	3 190	3 INF	3 190	3 INF	3 190 AC	3 120
4 72	4 26 M	4 -7	4 4.50 M	4 165	4 4.50 M	4 165	4 4.50 M	4 0	4 0
5 -22.5	5 INF	5 62	5 2.5 MEG	5 0	5 2.5 MEG	5 0	5 2.5 MEG	5 190 AC	5 115
6 0	6 INF	6 72	6 INF	6 62	6 INF	6 0	6 0	6 0	6 0
7 0	7 2	7 6.3 AC	7 2	7 6.3 AC	7 2	7 6.3 AC	7 2	7 6.3 AC	7 2
8 -7	8 3 MEG	8 178	8 INF	8 0	8 0	8 78	8 78	8 200	8 INF
9 X	9 X	9 X	9 X	9 X	9 X	9 X	9 X	9 X	9 X
100	100	100	100	100	100	100	100	100	100
15 X	15 X	15 X	15 X	15 X	15 X	15 X	15 X	15 X	15 X
30 X	30 X	30 X	30 X	30 X	30 X	30 X	30 X	30 X	30 X
400 CY	400 CY	400 CY	400 CY	400 CY	400 CY	400 CY	400 CY	400 CY	400 CY

To set transformer tap switch: Remove line cord plug from power outlet. Loosen the lock screw above the window. The switch knob should now be turned until the figures appearing in the center of the window area corresponds to, or are greater than the voltage of the power supply. The setting is locked by tightening the lock screw.

Five Tube AC operated Three Band Superheterodyne
 Broadcast Band 535 Kc. — 1605 Kc.
 Short Wave Band No. 1 3.3 Mc. — 8.25 Mc.
 Short Wave Band No. 2 8.6 Mc. — 21.8 Mc.
 Intermediate Frequency 455 Kc.

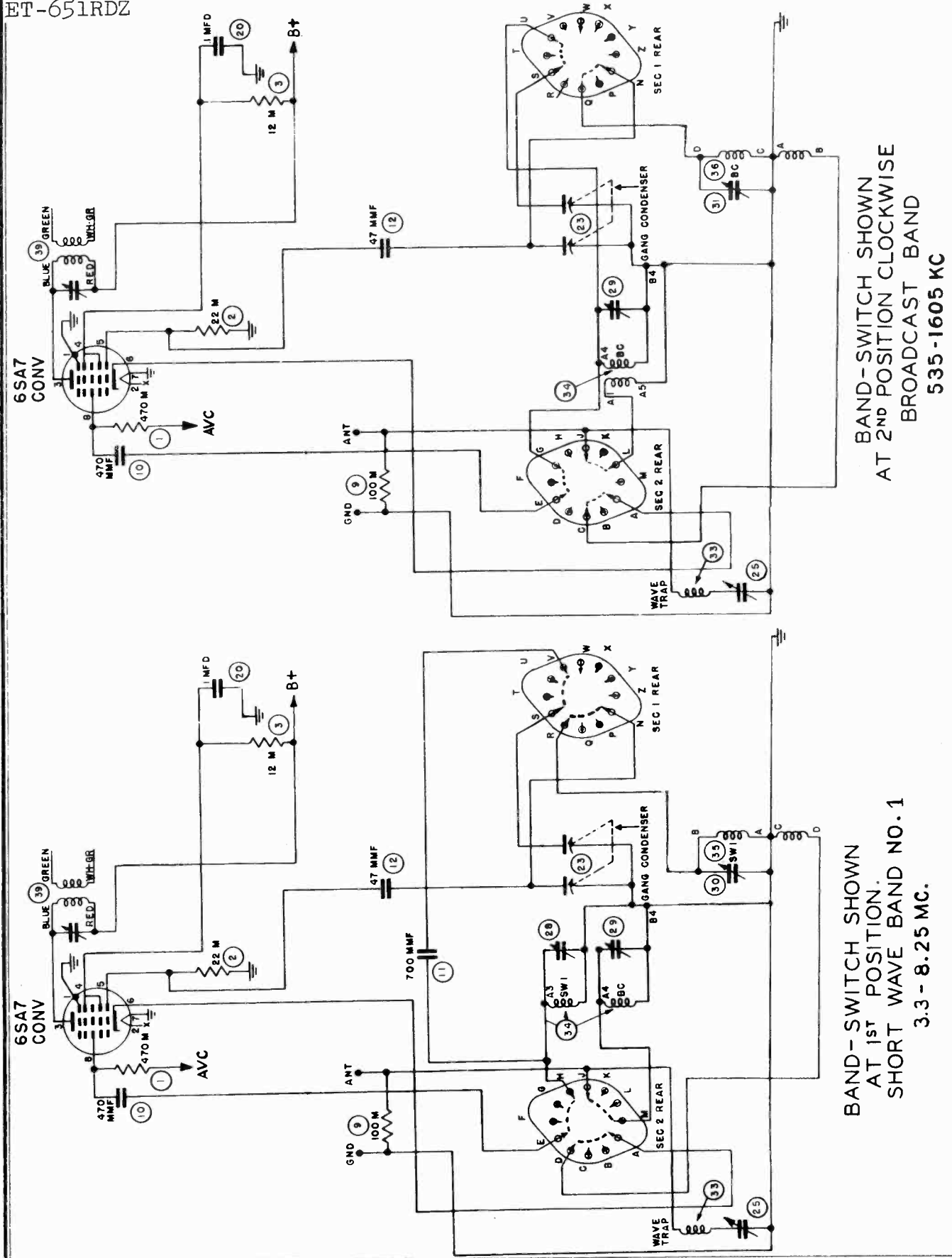
CLARI - SKEMATIX

Registered Trademark

PAGE 18-2 FARNSWORTH

MODELS ET-650BRZ, FARNSWORTH TELEV. & RADIO CORP.

ET-651BKZ,
ET-651BUZ,
ET-651RDZ



CLARI-SKEMATIX

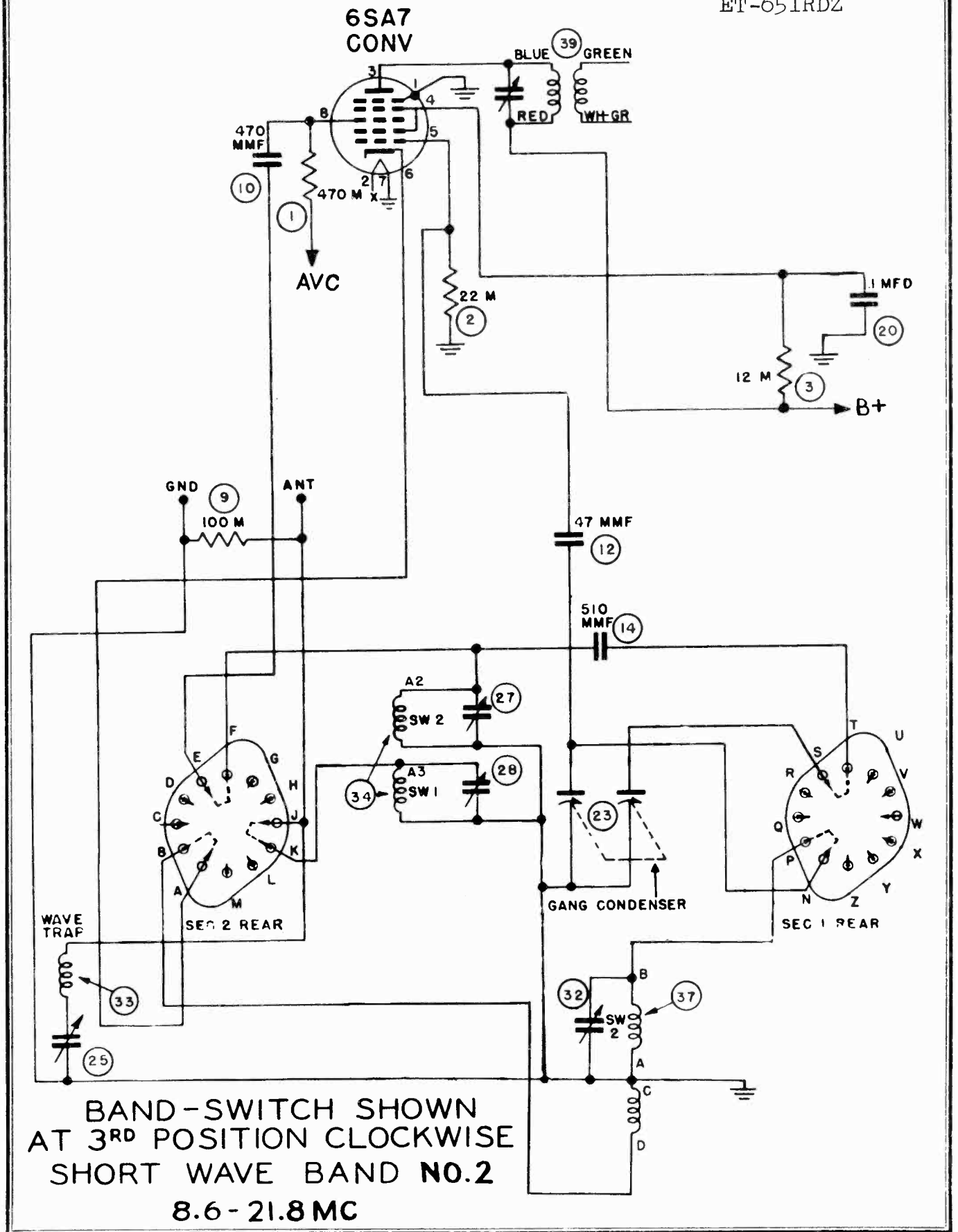
Registered Trademark

FARNSWORTH TELEV. & RADIO CORP MODELS ET-650BRZ,

ET-651BKZ,

ET-651BUZ,

ET-651RDZ



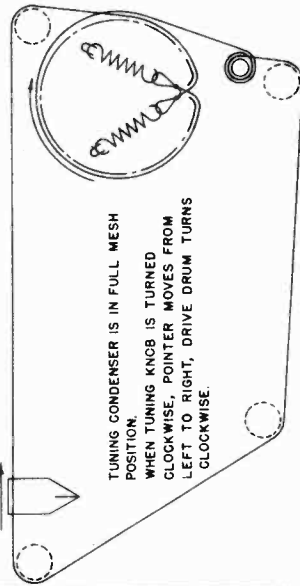
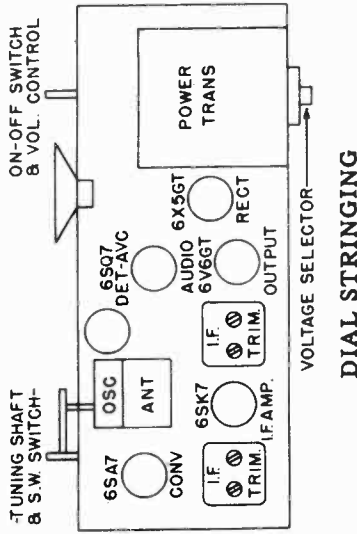
BAND-SWITCH SHOWN
AT 3RD POSITION CLOCKWISE
SHORT WAVE BAND NO.2
8.6 - 21.8 MC

MODELS ET-650BRZ,
ET-651BKZ

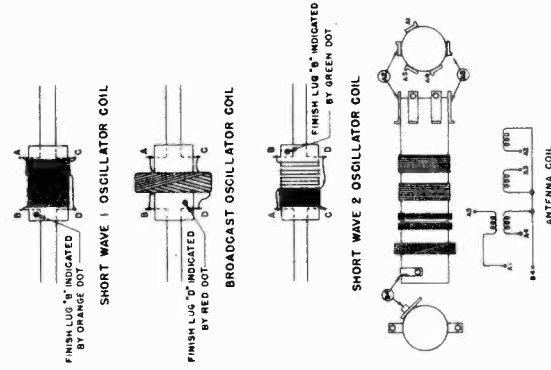
FARNSWORTH TELEV. & RADIO CORP.

MODELS ET-651BUZ,
ET-651RDZ

CHASSIS LAYOUT



ANTENNA AND OSCILLATOR COILS



EQUIPMENT AND PROCEDURE FOR ALIGNMENT

An output meter and a signal generator are required for proper alignment of these sets. The signal generator should be calibrated at the following points: 455 Kc., 600 Kc., 1000 Kc., 1500 Kc., 3.5 Mc., 7.5 Mc., 9.5 Mc. and 20 Mc. All adjustments should be made with the volume control set for maximum, keeping the signal generator output as low as possible to prevent AVC action and incorrect settings.

Connect the low side of the signal generator to the ground terminal on the chassis. Connect the high side of generator to antenna terminal through dummy load of 200 MMF for broadcast band and a dummy load of 400 ohms for shortwave.

STEPS	DUMMY ANTENNA	SET GENERATOR AT	SET GANG AT	ADJUST	LOCATED	TO OBTAIN
SET VOLUME CONTROL AT MAXIMUM						
1						Maximum Output
2	.1 Mfd.		Minimum	2nd. I.F. Trimmers	Top of I.F. Trans.	Minimum Output
3		455 Kc.		1st. I.F. Trimmers		
4			1000 Kc.	Wave Trap Trimmer	See Illustration on page one	
5	Broadcast		1500 Kc.	B.C. Osc. Trimmer		
6	200 MMF		1500 Kc.	B.C. RF Trimmer		
7			CHECK POINTER CALIBRATION AT 1000 Kc. & 600 Kc.			
8			7.5 Mc.	S.W. 1 Osc. Trimmer *		MAXIMUM OUTPUT
9	S.W. 1 400 ohms		7.5 Mc.	S.W. 1 RF Trimmer **	See Illustration on page one	
10			CHECK 3.5 Mc.			
11			20 Mc.	S.W. 2 Osc. Trimmer *		MAXIMUM OUTPUT
12	S.W. 2 400 ohms		20 Mc.	S.W. 2 RF Trimmer **	See Illustration on page one	
13			CHECK 9.5 Mc.			

*When aligning the Shortwave oscillators use the peak found farthest out from maximum capacity on the oscillator trimmers.

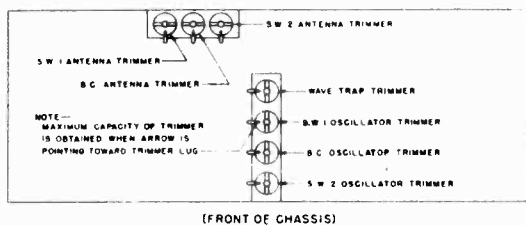
**Use the peak nearest maximum capacity on the R.F. trimmers and rock gang for maximum output.

MODELS ET-651BUZ, FARNSWORTH TELEV. & RADIO CORP. MODELS ET-650BRZ
 ET-651RDZ ET-651BKZ

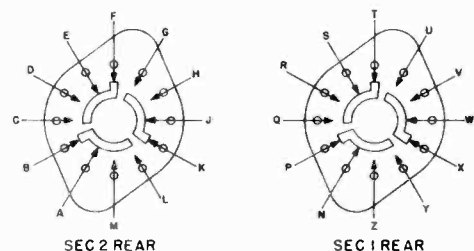
Ref. No.	Part No.	DESCRIPTION
1	77217	470M Ohms
2	77266	22M Ohms
3	77155	12M Ohms 2 watt
4	77270	2.2 Megohms
5	77273	6.8 Megohms
6	77342	1500 Ohms 1 watt
7	77174	270 Ohms 1 watt
8	77258	100 Ohms
9	77214	100M Ohms
10	25285	470 Mmf. Mica Capacitor
11	25418	700 Mmf. Mica Capacitor
12	25193	47 Mmf. Mica Capacitor
14	25417	510 Mmf. Mica Capacitor
15	25187	240 Mmf. Mica Capacitor
16	25080	.05 Mfd. 200 V. Export
17	25365	.01 Mfd. 600 V. Molded Oil Paper
18	25077	.003 Mfd. 600 V. Export
19	25323	.005 Mfd. Line Buffer 800 V.
20	25361	.1 Mfd. 400 V. Molded Oil Paper
21	25330	Electrolytic Capacitor 40 Mfd. 20 Mfd. 300 V., 30 Mfd. 250 V.
22	78070	Volume Control
23	26227	Gang Condenser
25	26229	Wave Trap Trimmer
27	26228	SW2 Antenna Trimmer
28	26228	SW1 Antenna Trimmer
29	26228	BC Antenna Trimmer
30	26228	SW1 Oscillator Trimmer
31	26228	BC Oscillator Trimmer
32	26229	SW2 Oscillator Trimmer
33	38650	Wave Trap Coil
34	38747	Antenna Coil
35	38730	SW1 Oscillator Coil
36	38729	BC Oscillator Coil
37	38731	SW2 Oscillator Coil
38	90198	Band Switch
39	36898	1st. I.F. Transformer
40	36899	2nd I.F. Transformer
41	27118	Line Cord
42	94207	Power Transformer
43	42186	Dial Lamp
44	94208	Output Transformer
45	81146	Speaker, 6"
	80139	Molded Octal Tube Socket
	80033	Antenna and Ground Terminal Strip
	31275	Dial Window
	31330	Dial Scale
	31329	Dial Background
	11299	Dial Pointer
	41106	Drive Cord (Approx. 38" long) and springs
	56994	Drive Drum
	09195	Knob and Set Screw ET-650BRZ
	09196	Knob and Set Screw ET-651RDZ
	09224	Knob and Set Screw ET-651BUZ
	09225	Knob and Set Screw ET-651BKZ
	54091	Band Switch Lever ET-650BRZ
	54118	Band Switch Lever ET-651 Series
	59168	Grille ET-650BRZ
	59190	Grille for ET-651RDZ
	59247	Grille for ET-651BUZ
	59248	Grille for ET-651BKZ
	H-268	Cabinet and Packing 650BRZ
	H-269	Cabinet and Packing 651 Series

The Service Department policy is to furnish 1/2 Watt 5% Carbon Resistors and 600 Volt Tubular Condensers, unless otherwise specified.

BOTTOM VIEW OF CHASSIS



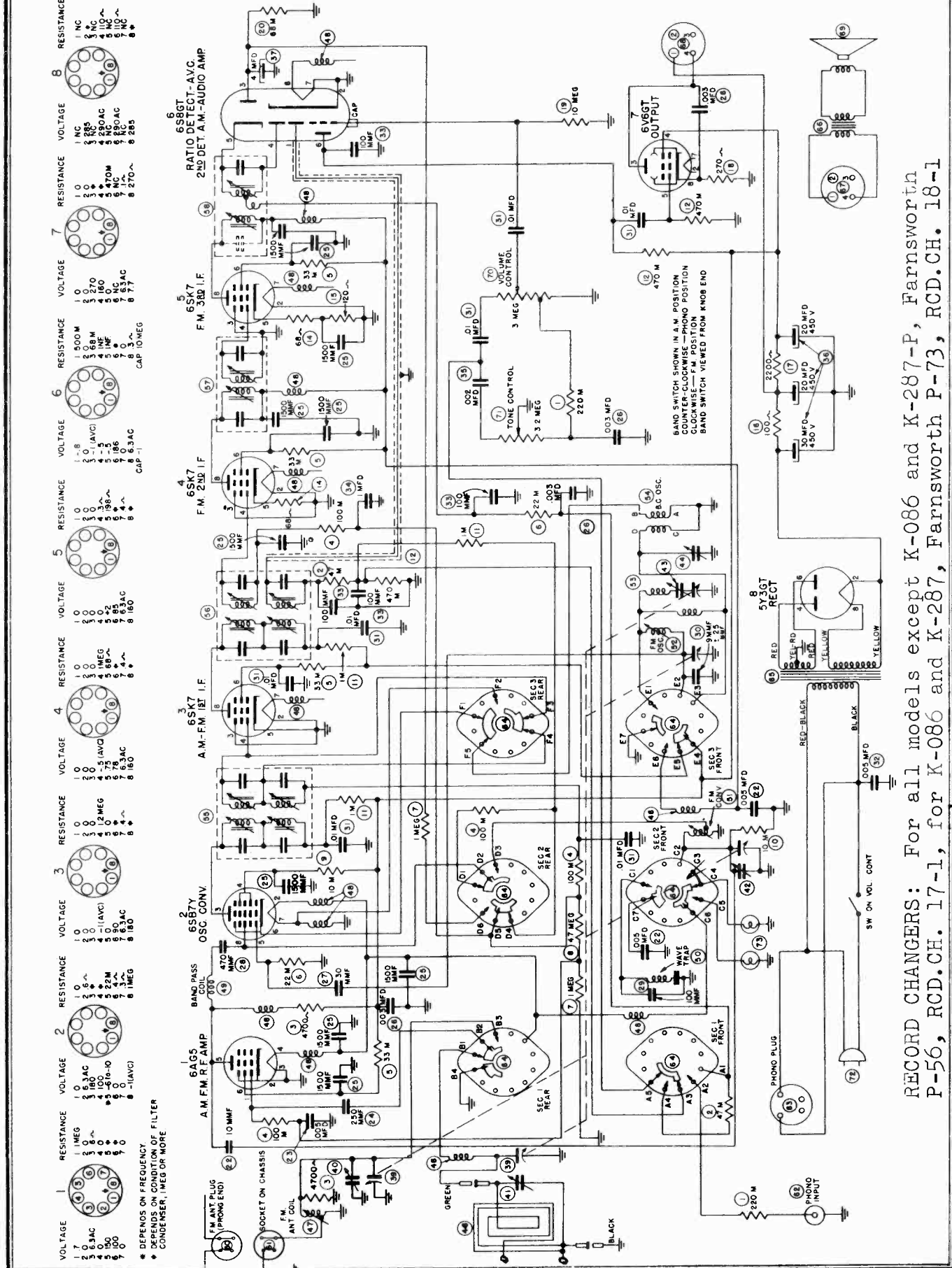
BAND SWITCH



MODELS GK-084,
-085, -086, -087

FARNSWORTH TELEV. & RADIO CORP.

MODELS K-084,
-086, -287-P



RECORD CHANGERS: For all models except K-086 and K-287-P, Farnsworth P-56, RCD.CH. 17-1, for K-086 and K-287, Farnsworth P-73, RCD.CH. 18-1

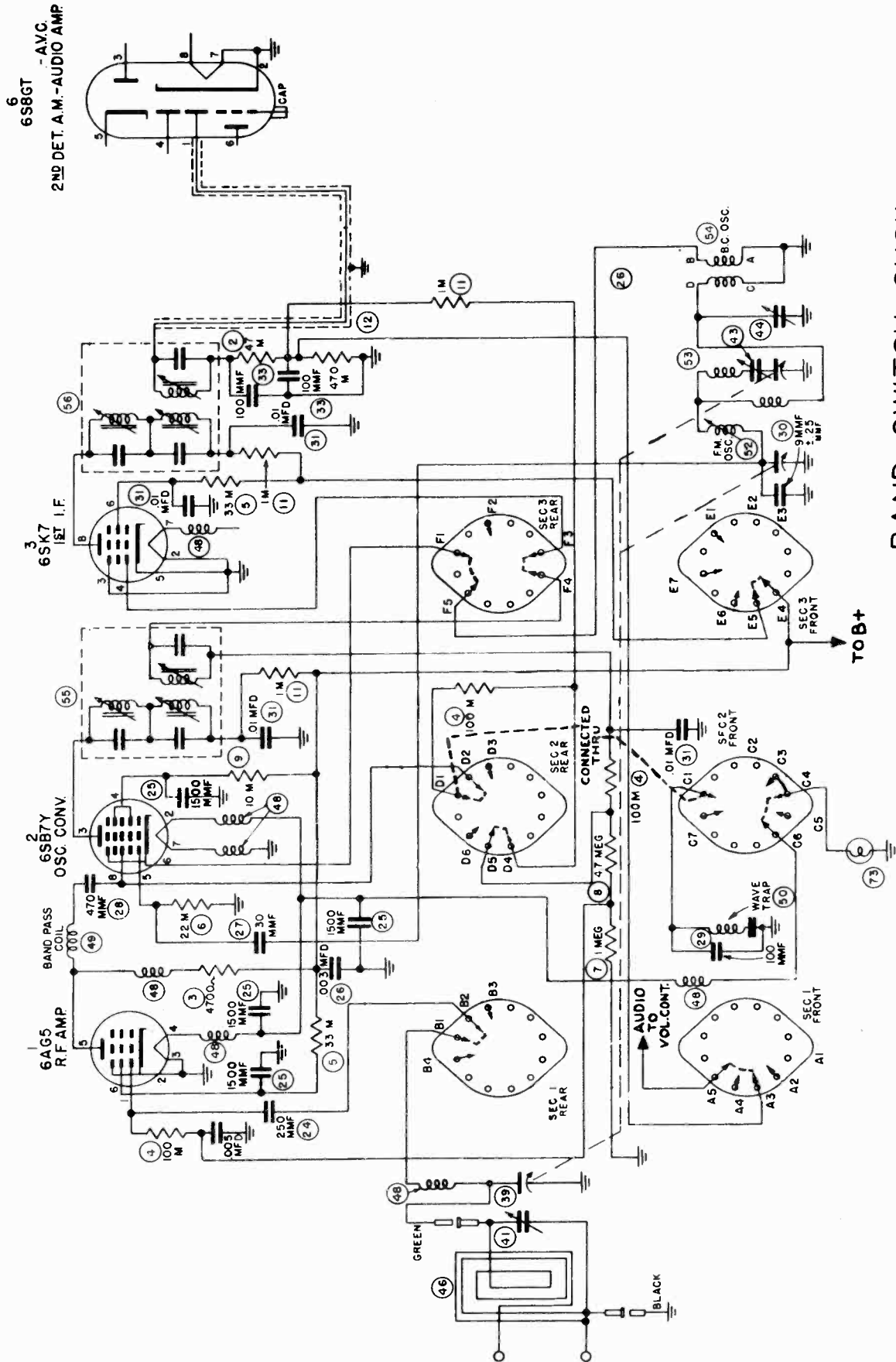
CLARI-SKEMATIX

Registered Trademark

MODELS K-084,
-086, -287-P

FARNSWORTH TELEV. & RADIO CORP.

MODELS GK-084,
-085, -086, -087



BAND-SWITCH SHOWN
AT 2ND POSITION CLOCKWISE
BROADCAST BAND
537 - 1620 KC

NOTE:
1ST POSITION
PHONO NOT SHOWN

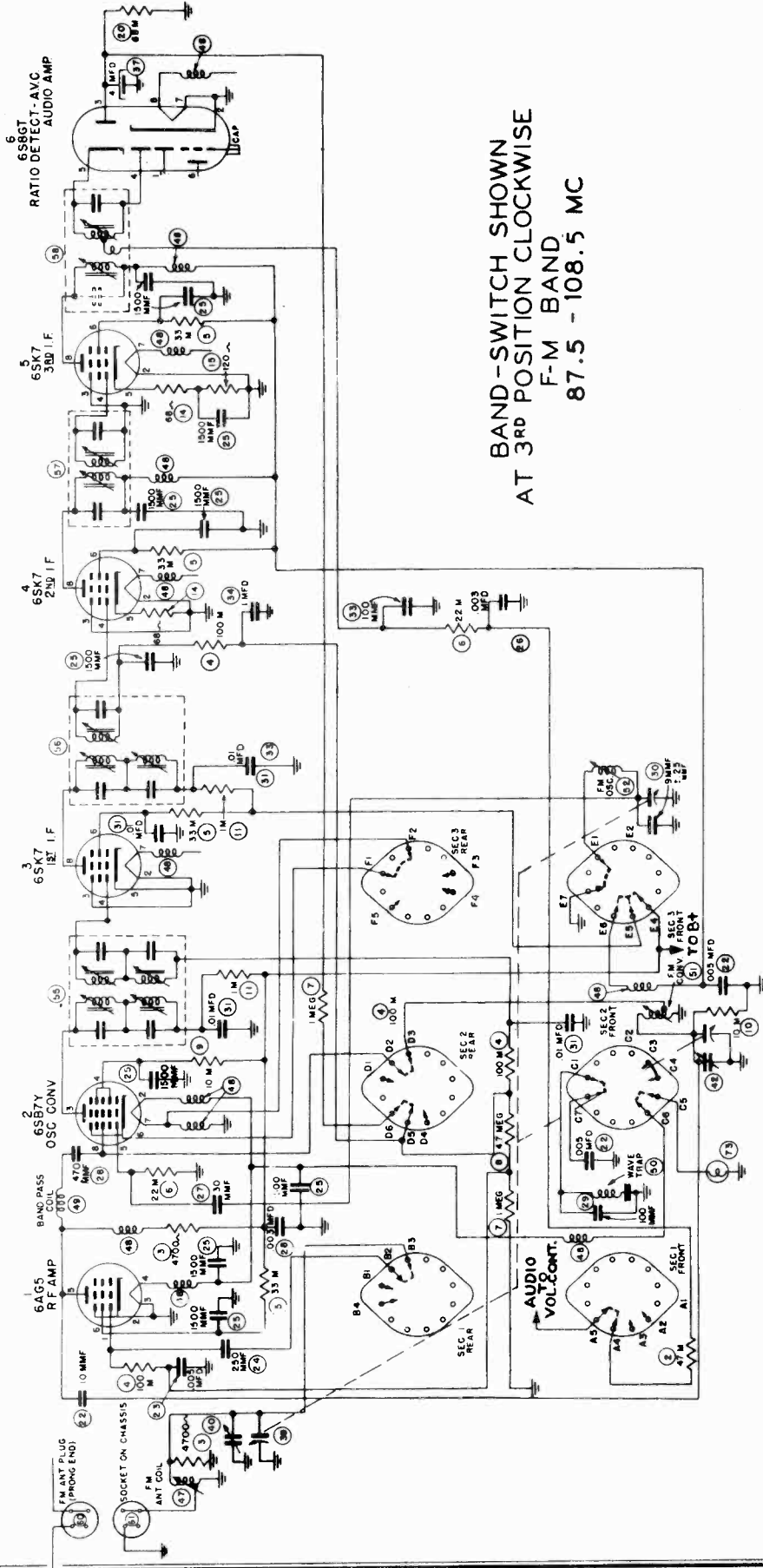
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PAGE 18-8 FARNSWORTH

MODELS GK-084, FARNSWORTH TELEV. & RADIO CORP.
-085, -086, -087

MODELS K-084,
-086, -287-P



BAND-SWITCH SHOWN
AT 3RD POSITION CLOCKWISE
F-M BAND
87.5 - 108.5 MC

MODELS K-084,
-086, -287-P

FARNSWORTH TELEV. & RADIO CORP.

MODELS GK-084,
-085, -086, -087

SPECIFICATIONS

RECEIVER FREQUENCIES

Broadcast Band	537 Kc. to 1620 Kc.	IF AM Band	455 Kc.
FM Band	87.5 Mc. to 108.5 Mc.	IF FM Band	10.7 Mc.

TUBE COMPLEMENT

Application	Type	Application	Type
AM, FM RF Amplifier	6AG5	FM 3rd. IF Amplifier	6SK7
Oscillator, Converter	6SB7Y	FM, AM Det., AVC, 1st Audio	6S8GT
AM, FM 1st IF Amplifier	6SK7	Output	6V6GT
FM 2nd. IF Amplifier	6SK7	Rectifier	5Y3GT

POWER AND VOLTAGE REQUIREMENTS

Voltage	105 to 125 volts at 50-60 cycles per second
Power Consumption, 117 volts, 60 cycles	88 watts
50 Cycle operation of changer requires modification	

INSTRUCTIONS FOR ALIGNMENT OF FM BAND

1. Necessary Equipment:

RF Signal Generator, Vacuum Tube Voltmeter, Insulated Screw Driver.

NOTE—All alignment should be done with only sufficient signal amplitude to provide satisfactory signal to noise ratio, and readable output on output meter. The use of excessively strong signal is almost certain to produce misalignment.

2. Procedure for IF Alignment, FM Band

- a. Connect V.T.V.M. from ground to audio lead of ratio detector (discriminator). Connect generator tuned to 10.7 mc. to grid of third FM IF tube through 0.1 MFD capacitor.
- b. Turn secondary slug of ratio detector transformer (bottom) out as far as it will turn.
- c. Tune primary for maximum output.

tor transformer for zero or minimum output.

- k. The FM IF system should be aligned if instructions have been carefully pursued.

3. *Instructions for Aligning FM RF Channel*
a. Equipment required: RF Signal Generator, Range 88 to 106 Mc., Output Meter, Insulated Screw Driver.

- b. Connect RF signal generator in series with 300 ohm carbon or metalized resistor to "high" side of FM antenna socket. Connect output meter across voice coil of speaker.

- c. Set tuning control for pointer to calibrate at the equivalent of half way between channels 280 and 300.

- d. Apply 106 Mc. signal.

- e. Set converter and antenna trimmers at minimum capacity.

- f. Adjust oscillator by changing physical location of 9 mmf ceramic capacitor until signal is heard at maximum output.

- g. Adjust antenna and converter trimmers for maximum output.

- h. Set tuning controls so that dial pointer calibrates at the pointer's width higher than channel 220.

- i. Apply 92 Mc. signal.

- j. Adjust oscillator slug until signal is heard. Adjust converter and antenna slugs to maximum output.

- k. Repeat operations c to j inclusive.

NOTE—The degree of adjustment required in the tuning of the oscillator slug will determine the number of times operations c to j must be repeated until no further gain in sensitivity is obtained.

- l. Carefully tune across the entire FM band for the observance of dead or weak spots that may be a result of improper alignment or defective components. This can be determined by carefully noting the degree of receiver hiss in the absence of a received signal.

MODELS GK-084,
-085, -086, -087

FARNSWORTH TELEV. & RADIO CORP.

MODELS K-084,
K-086, -287-P

ALIGNMENT INSTRUCTIONS FOR AM BAND

EQUIPMENT REQUIRED

For proper alignment, a calibrated signal generator having fundamental frequencies from 455 Kc to 1500 Kc should be provided.

The indicating device for showing correct alignment may be a high resistance AC voltmeter or a vacuum tube voltmeter.

Connect the AC voltmeter either across the voice coil of the loud speaker, or if the meter range is high enough, to the plate in the output stage (through a condenser [0.1 Mfd.] to keep the DC out of the meter).

Maintain the output of the signal generator as low as possible to prevent AVC action and false settings.

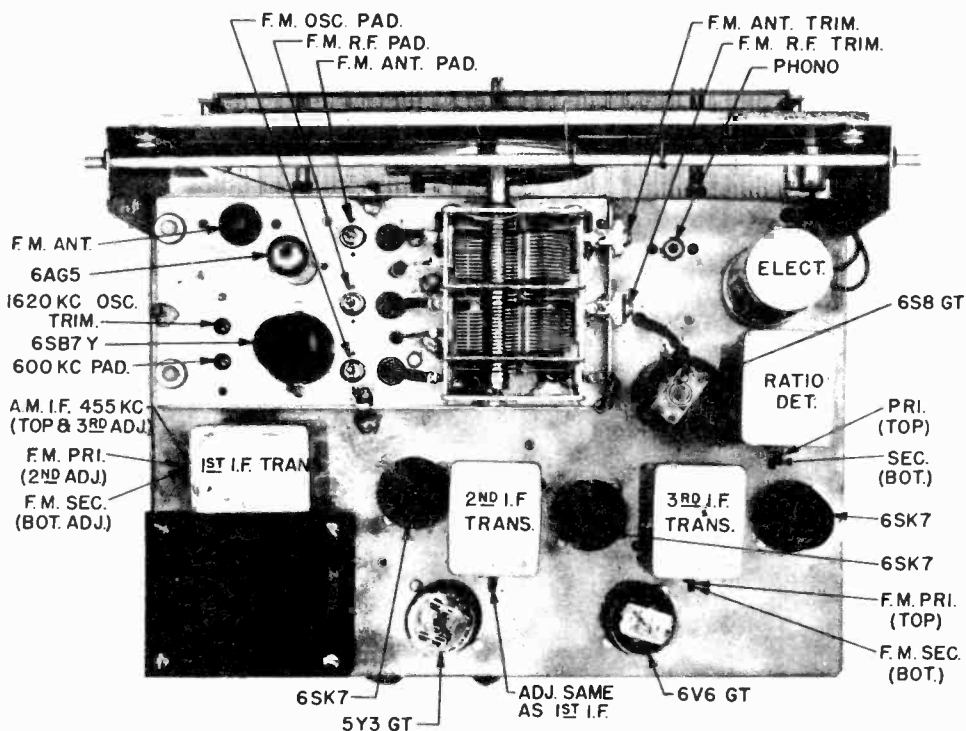
TABULATION FOR AM ALIGNMENT

STEPS	CONNECT GENERATOR	SET GENERATOR AT	SET GANG AT	ADJUST	TO OBTAIN
1		Set tone and volume controls at maximum			MAXIMUM OUTPUT
2	Sig. Grid (pin 8) Conv. Tube	455 Kc	Quiet Point	2nd IF Slugs # 1 and 3	
3				1st IF Slugs # 1 and 3	
4	External Antenna Post on Loop	1500 Kc	1500 Kc	BC Osc. Trimmer	
5		600 Kc	600 Kc	Osc. Padder*	
6	Check dial calibration at several frequencies. If not reasonably correct, adjust oscillator padder. See note 1.				
7	Ext. Ant. Binding Post	1500 Kc	1500 Kc	Loop Trimmer	

Through RMA dummy antenna.

*This adjustment should be made while gang is rocked.

Note 1. After any adjustment of oscillator padder, repeat steps 4 and 5.



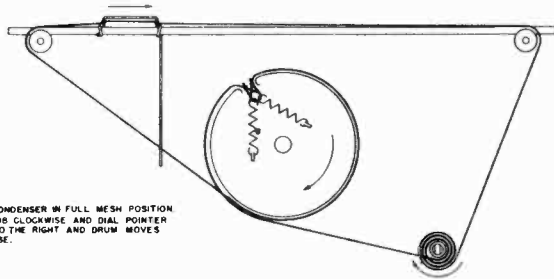
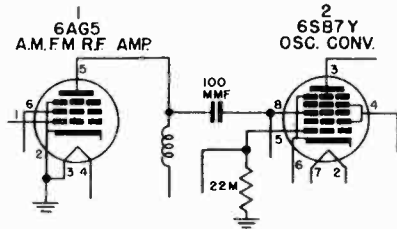
MODELS K-084,
K-086, -287-P

FARNSWORTH TELEV. & RADIO CORP.

MODELS GK-084,
-085, -086, -087

CIRCUIT MODIFICATION

Early sets did not incorporate the coil-condenser combination connecting between the plate of the RF amplifier and the grid of the converter. Below is an excerpt indicating that portion of the schematic of the early-production receiver.



TUNING CONDENSER IN FULL MESH POSITION
TURN KNOB CLOCKWISE AND DIAL POINTER
MOVES TO THE RIGHT AND DRUM MOVES
CLOCKWISE.

Dial Stringing Diagram

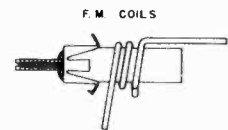
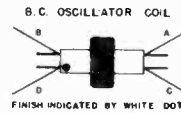
The GK-080 series instruments incorporate two internal antennas; a loop antenna used in broadcast band reception and a folded-dipole antenna used for FM reception.

These internal antennas are intended for use only in the presence of adequate field strength, as in large metropolitan areas where local stations supply the majority of desired programs. Neither a loop nor a dipole element which is within the confines of the cabinet can be considered as efficient signal pickup devices and, should field strength requirements be not fulfilled, it will be necessary, for satisfactory reception, to install an efficient outside folded dipole antenna which feeds the receiver through a 300 ohm transmission line.

Both the loop and the dipole (internal or external) antennas exhibit certain characteristics of directivity, with which the experienced serviceman is familiar, which should be borne in mind when locating the receiver (or external antenna) in the home. Slight orientation of the receiver may effect more satisfactory reception of desired weak signals.

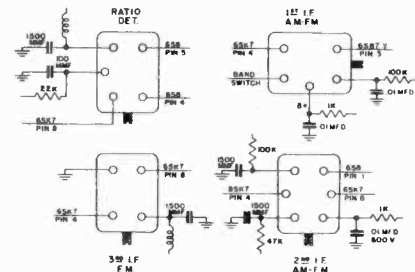
MULTIPLE RESPONSE AND WHISTLES

In metropolitan areas with close proximity to several strong transmitting stations, it may be necessary, on early production receivers, to connect a 200 mmf mica capacitor across the wave trap. This must be placed on the band switch so it is switched out on FM. Should oscillation on low end of the band be experienced in the GK-084 (chairside) instrument, it is recommended that a modified wave trap (part No. 38930) be substituted for wave trap connected between ground and terminal C1 of Section 2, front, of band switch.



TOTAL TURNS TAP AT
CONV. COIL 2 1/2 1/2 TURN FROM GROUND
ANT. COIL 2 1/2 NOT TAPPED
OSC. COIL 1 1/2 NOT TAPPED

Oscillator Coil Assemblies



Bottom View of IF Cans



GK-085

MODELS GK-084,
-085, -086, -087

FARNSWORTH TELEV. & RADIO CORP.

MODELS K-084,
K-086, -287-P

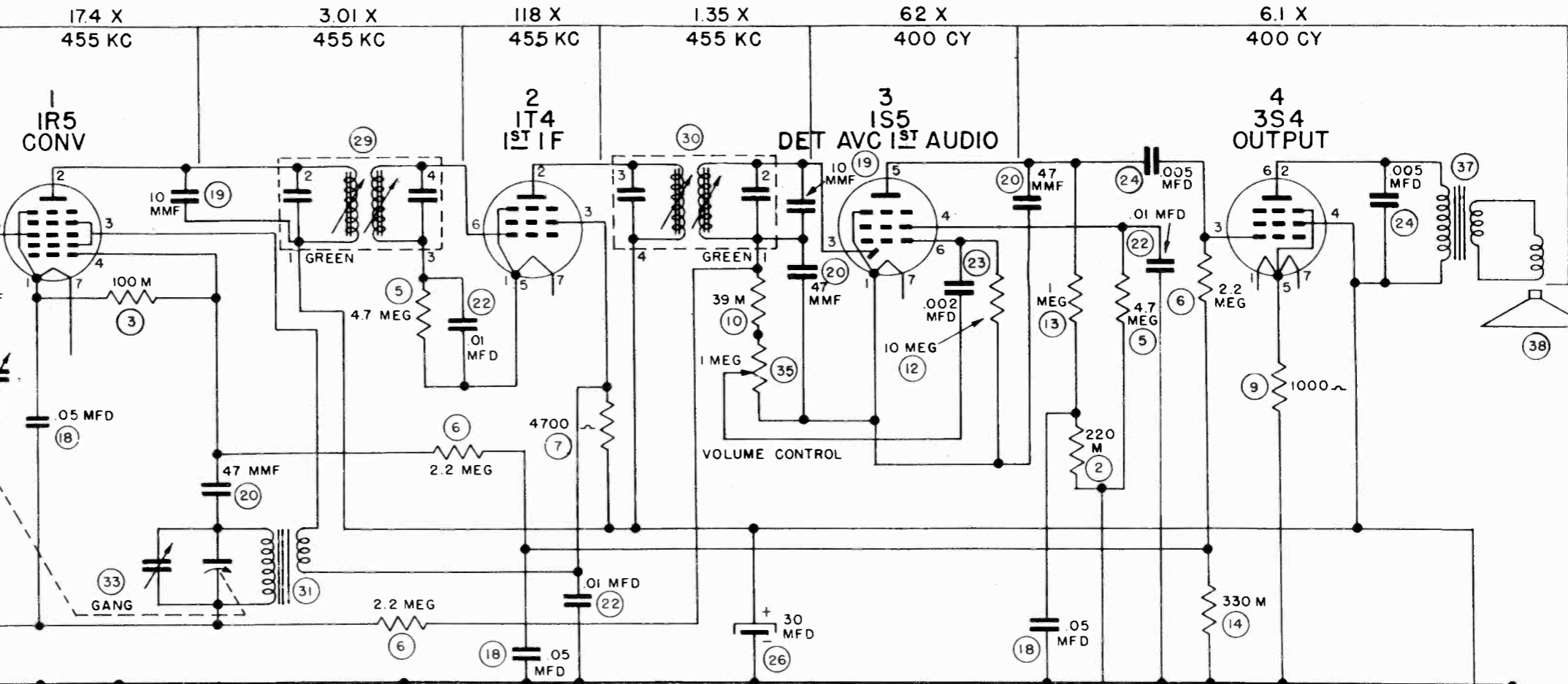
PARTS LIST

Ref. No.	Part Number	Description	Ref. No.	Part Number	Description
1	77216	220M Ohm Resistor	54	38883	B.C. Oscillator Coil
2	77213	47M Ohm Resistor	55	38876	1st AM FM IF Transformer
3	77211	4700 Ohm Resistor	56	38877	2nd AM FM IF Transformer
4	77214	100M Ohm Resistor	57	38878	3rd AM FM IF Transformer
5	77267	33M Ohm Resistor	58	38879	4th AM FM IF Transformer
6	77266	22M Ohm Resistor	60	80440	FM Antenna Plug
7	77218	1 Megohm Resistor	61	80439	FM Antenna Socket
8	77272	4.7 Megohm Resistor	62	80030	Phono Input Socket
9	77013	10M Ohm Resistor, 2 Watt	63	11274	Phono AC Plug and Cable
10	77212	10M Ohm Resistor	64	90240	Band Switch
11	77262	1000 Ohm Resistor	65	94204	Power Transformer
12	77217	470M Ohm Resistor	66	94325	Output Transformer
14	77269	68 Ohm Resistor	67	80444	Speaker Plug
15	77450	120 Ohm Resistor	68	80385	Speaker Socket
16	77258	100 Ohm Resistor	69	81175	Speaker GK-084, 085, 086
17	77449	200 Ohm Molded Resistor, 8 Watt	69	81169	Speaker GK-087, 088
18	77174	270 Ohm Resistor, 1 Watt	70	78150	Volume Control
19	77274	10 Megohm Resistor	71	78071	Tone Control
20	77305	68M Ohm Resistor	72	27118	Line Cord
22	25425	10 Mmf Ceramic Capacitor	73	42185	Pilot Lamp, 250 Ma.
23	25183	.005 Mfd Tubular Capacitor, 600 Volts			
24	25380	250 Mmf Ceramic Capacitor Hi "K"	13871		Dial Pointer and Tubing Assy.
25	25273	1500 Mmf Ceramic Hi "K"	22147		Pickup Cable (GK-084-88)
26	25184	.003 Mfd Tubular Capacitor, 600 Volts	22150		Pickup Cable (GK-085-86-87)
27	25439	30 Mmf N-1400	31421		AM Dial Glass
28	25189	470 Mmf Mica Capacitor	31422		FM Dial Glass
29	25435	100 Mmf Ceramic Capacitor	31423		Dial Escutcheon (Old Type)
30	25440	9 Mmf Ceramic Capacitor	31431		Dial Escutcheon (New Type)
31	25194	.01 Mfd Tubular Capacitor, 600 Volts	31432		Dial Escutcheon (Used on GK-088 Only)
32	25031	.005 Mfd Buffer Capacitor, 600 Volts	37498		# 3 x 5/8" Brass Finish Wood Screw (For Mtg Dial Escutcheon)
33	25188	100 Mmf Mica Capacitor	41106		Dial Tuning Cord (45 in.)
34	25215	.1 Mfd Tubular Capacitor, 600 Volts	55392		Ornamental Washer (For Mtg Dial Escutcheon)
35	25185	.002 Mfd Tubular Capacitor, 600 Volts	54091		Band Switch Lever
36	25424	30 Mfd, 20 Mfd, 450 Volt Electrolytic	59134		Volume and Tuning Knob (Wal.)
37	25270	4 Mfd Electrolytic	59193		Volume and Tuning Knob (Blonde)
39	17196	Gang Capacitor and Drum	60588		Dial Background (Used in Conjunction With #31423)
40	26269	FM Antenna Trimmer			
41	26032	AM Loop Trimmer	71223		Phono Needle
42	26269	FM Converter Trimmer			
43	26267	AM Padder	H-283-1		Cabinet and Carton for GK-084 (Wa.)
44	26267	AM Oscillator Trimmer	H-283-2		Cabinet and Carton for GK-084 (Bl.)
46	13766	Loop Antenna GK-084, 088	H-290		Cabinet and Carton for GK-085 (Wa.)
46	13789	Loop Antenna GK-085	H-285-1		Cabinet and Carton for GK-086 (Wa.)
46	13784	Loop Antenna GK-086, 087	H-285-2		Cabinet and Carton for GK-086 (Bl.)
47	38880	FM Antenna Coil	H-287		Cabinet and Carton for GK-087 (Mah.)
48	38884	RF Choke	H-301		Cabinet and Carton for GK-088 (Mah.)
49	38915	Band Pass Coil			
50	38484	Wave Trap			
51	38881	FM Converter Coil			
52	38882	FM Oscillator Coil			
53	38898	Oscillator Series Choke			

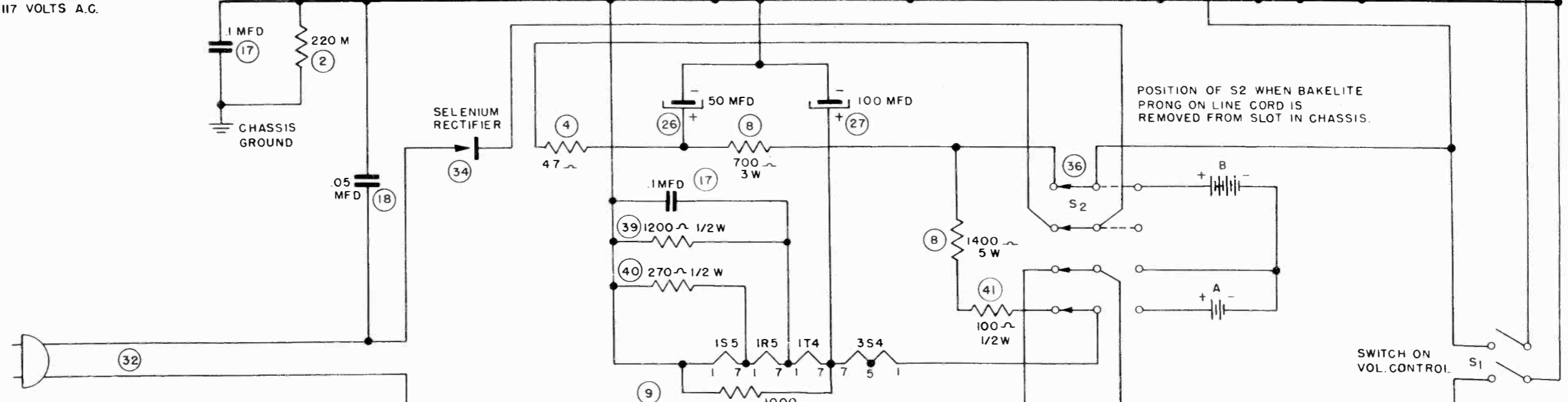
FARNSWORTH TELEV. & RADIO CORP.

MODEL P-860

VOLTAGE		RESISTANCE		VOLTAGE		RESISTANCE		VOLTAGE		RESISTANCE		
1	2	1	2	1	2	1	2	1	2	1	2	
0	7.8	0	1500 Ω	2.9	50 Ω	30 Ω	7.3	105 Ω	7.3	105 Ω	105 Ω	
3.64	6.4	3	6000 Ω	7.8	1500 Ω	NC	7.2	2000 Ω	7.2	2000 Ω	2000 Ω	
-15	0	4	100 M	6.4	6000 Ω	3	1 MEG	-1.9	2.5 MEG	-1.9	2.5 MEG	
5.0	6.9	5	0	NC	4	4.7 MEG	4	4.7 MEG	4.76	1500 Ω	4.76	1500 Ω
1.5		6	4 MEG	2.9	50 Ω	5	1.2 MEG	5.8	85 Ω	5.8	85 Ω	
		7	30 Ω	2.1	6	4 MEG	6	10 MEG	7.2	2000 Ω	7.2	2000 Ω
				4.3	7	70 Ω	7	50 Ω	4.3	7	70 Ω	



VOLTAGE MEASUREMENTS TAKEN A.C. POWER ON AND WITH LOOP DISCONNECTED.
 RESISTANCE MEASUREMENTS TAKEN WITH "ON-OFF" SWITCH "ON", A.C. POWER DISCONNECTED, BAKELITE PRONG REMOVED FROM SLOT AND LOOP BEING CONNECTED.
 GAIN MEASUREMENTS TAKEN WITH A.V.C. DISCONNECTED AND WITH 1.5 VOLT BIAS.
 VOLTAGE MEASUREMENTS MADE USING ELECTRONIC VOLT-OHM-METER AND SET USING 117 VOLTS A.C.



POSITION OF S2 WHEN BAKELITE PRONG ON LINE CORD IS REMOVED FROM SLOT IN CHASSIS.

SWITCH ON VOL. CONTROL. S1

FARNSWORTH TELEV. & RADIO CORP.

MODELS GK-140,
GK-141, GK-143,
GK-144

Ref. No.	Part No.	DESCRIPTION
64	80440	AM Antenna Plug
65	38678	S.W. Antenna Coil
66	90246	Band Switch Wafer #1
67	90247	Band Switch Wafer #2
68	90248	Band Switch Wafer #3
69	90249	Band Switch Wafer #4
70	90250	Band Switch Wafer #5
72	38661	RF Choke
73	38672	FM Mixer Coil
74	38673	FM Osc. Coil
76	38676	SW Mixer Coil
77	38675	BC & SW Osc. Coil
78	38677	BC Mixer Coil
79	38621	1st. IF Transformer
80	38622	2nd. IF Transformer
81	38623	3rd. IF Transformer
82	38624	Discriminator Transformer
83	80030	Phono Input Socket
84	78103	1 Megohm Treble Control
85	78057	3 Megohm Volume Control
86	78101	2.2 Megohm Bass Control
87	42185	Dial Light
88	11274	Phono Motor Lead & Socket
89	94170	Power Transformer
90	81145	Speaker
91	94257	Output Transformer
92	80444	Speaker Plug
93	80244	Speaker Socket
94	27118	Line Cord
95	90244	Phono Switch
	90192	Band Switch
	13585	Compartment Light Assy. for GK 140
	42191	Compartment Lamp for GK 140
	09260	Segment Gear Assy.
	09262	Drive Gear Assy.
	09263	Pointer Drive Drum Assy.
	59254	Pointer
	59254	Pointer
	31334	Dial Glass
	31327	S.W. Dial Glass
	55006	Dial Pointer Slider Bar
	22150	P.U. Cable
	31411	Volume Decal
	31412	Tuning Range & Switch Decal
	31413	Treble Decal
	41137	Push Button Spring Kit
	71223	Phono Needle
	59257	Push Button
	57134	Tuning Knob
	59111	Tone Control Knob
	92201	Felt Washer
	58046	Push Button Escutcheon
	H-242	Cabinet and Carton for GK 140
	H-275	Cabinet and Carton for GK 141 (Mah)
	H-276-1	Cabinet and Carton for GK 143 (Mah)
	H-276-2	Cabinet and Carton for GK 143 (Walnut)
	80370	Pilot Lamp Socket Assy.
	80139	Molded Octal Socket
	80239	Molded Octal Socket for Rectifier
	80319	Miniature Tube Socket
	80318	Molded Octal Socket (Loctal)
	41110	Call Letter Kit
	05096	Drive Cord Assy

Ref. No.	Part No.	DESCRIPTION
1	77323	270 Ohm Resistors
2	77214	100 M Ohm
3	77262	1000 Ohm
4	77258	100 Ohm
5	77305	68 M Ohm
6	77216	220 M Ohm
7	77266	22 M Ohm
8	77261	470 Ohm
9	77324	56 M Ohm
10	77499	4700 Ohm 1 Watt
11	77270	2.2 Megohms
12	77322	39 M Ohm 1 Watt
14	77217	470 M Ohm
15	77325	15 M Ohm 2 Watt
16	77213	47 M Ohm
17	77218	1 Megohm
18	77269	68 Ohm
19	77274	10 Megohms
20	77339	4.7 Ohms 2 Watt Wire Wound
21	77209	220 Ohm
22	77338	230 Ohms 5 Watt Wire Wound
23	77337	500 Ohms 5 Watt Wire Wound
24	77428	27 Ohm 1 Watt
25	77268	330 M Ohm
27	25196	.05 Mfd. Tubular Capacitor
28	25183	.005 Mfd. Tubular
29	25215	.1 Mfd. Tubular
30	25185	.002 Mfd. Tubular
31	25195	.01 Mfd. Tubular
32	25194	.01 Mfd. Tubular
33	25184	.003 Mfd. Tubular
34	25031	.005 Mfd. Buffer
36	25277	20 Mfd., 30 Mfd., 40 Mfd., 450 Volt Electrolytic
37	25269	50 Mfd., 250 V. Electrolytic
38	25270	4 Mfd., 100 V. Electrolytic
40	25347	90 Mmf. Ceramic N-470
41	25273	1500 Mmf. Ceramic HiK "L"
42	25274	600 Mmf. Ceramic HiK "K"
43	25143	50 Mmf. Ceramic Zero Temp.
44	25275	2 Mmf. Ceramic Zero Temp.
45	25272	.002 Mfd. Molded Mica
46	25346	55 Mmf. Ceramic N-330
47	25193	47 Mmf. Molded Mica
49	25188	100 Mmf. Molded Mica
50	25141	200 Mmf. Molded Mica
51	25141	.005 Mfd. Molded Mica
52	26222	Gang Capacitor and Push Button Assy
53	26221	Ceramic Trimmer 1.5-7 Mmf.
54	26031	Antenna Trimmer
55	26226	No. 4 Trimmer Strip
56	26223	No. 1 Trimmer Strip
57	26224	No. 2 Trimmer Strip
58	26225	No. 3 Trimmer Strip
60	38671	FM R.F. Coil Assy
61	80439	FM Antenna Socket
62	38679	Loop Antenna
63	80439	AM Antenna Socket

MODELS CAPEHART FARNSWORTH TELEV. & RADIO CORP. MODELS PANAMUSE
400N, 100N SERIES

19N3, 21N2, 25N2,
26N2

SECTION 1

RECEIVER FREQUENCIES

Broadcast Band	540 to 1600 K.C.
Short-Wave Band	9.4 to 15.4 M.C.
Frequency Modulation Band	88 to 108 M.C.
Intermediate Frequency—AM Bands	455 K.C.
FM Band	10.7 M.C.

TUBE COMPLEMENT

Application	Type	Type	Application
FM RF Amp.	6AG5	6SK7	3rd FM IF Amp
FM Converter	6AG5	6H6	FM 2nd Detector
FM Oscillator	6C4	6SK7	1st AM IF Amp.
AM RF Amp.	6SK7	6SK7	2nd AM IF Amp.
AM Converter	6SA7	6H6	AM 2nd Detector
AM Oscillator	6J5	6SN7	Audio Amplifier
1st FM IF Amp.	6SK7	6J7	Phono Preamplifier
2nd FM IF Amp.	6SK7		
N-1	1	6J5	Audio Amplifier
AMPLIFIER	1	6J5	Inverter
(400N Models)	2	6J5	Drivers
	4	2A3	Power Output
	2	5U4G	Rectifiers
	1	5Y3	Bias Rectifier
	11		Total

30 Watts	Undistorted	AMPLIFIER	Power Output	18 Watts
4 Ohms	Voice Coil	SPEAKER	Impedance	8 Ohms
	Frequency	SYSTEM	Response	

Linear from 50 to 12000 C.P.S.

Type	AUTOMATIC	41E
Speed	RECORD	78 RPM
Record Capacity	CHANGER	16 10" or 12" Records
Phonograph Pickup		Capehart "True Timbre"

POWER AND VOLTAGE REQUIREMENTS

Power Consumption—245 Watts at 117 Volts, 60 Cycles
Voltage—105-125 Volts at 60 Cycles per Second
50 Cycle Operation With Modification

FARNSWORTH TELEV. & RADIO CORP.

MODELS 19N3,
21N2, 25N2,
26N2

RECEIVER FREQUENCIES

Broadcast Band 540 to 1600 K.C.
Short-Wave Band 9.4 to 15.4 M.C.
Frequency Modulation Band 88 to 108 M.C.
Intermediate Frequency—AM Bands 455 K.C.
FM Band 10.7 M.C.

TUBE COMPLEMENT

TUNER

Application	Type	Application	Type
FM RF Amp.	6AG5	AM 2nd Detector	6H6
FM Converter	6AG5	Audio Amplifier	6SN7
FM Oscillator	6C4	Phono Preamplifier	6J7
AM RF Amp.	6SK7		
AM Converter	6SA7		
AM Oscillator	6J5		
1st FM IF Amp.	6SK7		
2nd FM IF Amp.	6SK7		
3rd FM IF Amp.	6SK7		
FM 2nd Detector	6H6		
1st AM IF Amp.	6SK7		
2nd AM IF Amp.	6SK7		

AMPLIFIER

Audio Amplifier	6J5
Inverter	6J5
Drivers	(2) 6J5
Power Output	(2) 6V6G
Rectifier	5V4G

Total 22 Tubes

AMPLIFIER SPEAKER SYSTEM

Undistorted Power Output 12 Watts
Voice Coil Impedance 8 Ohms
Uniform Frequency Response 50 to 12000 C.P.S.

AUTOMATIC RECORD CHANGER

Type P-63
Speed 78 RPM
Record Capacity 10 12" or 12 10" Records
Phonograph Pickup Capehart "True Timbre"

POWER AND VOLTAGE REQUIREMENTS

Power Consumption—195 Watts at 117 Volts, 60 Cycles
Voltage—105-125 Volts at 60 Cycles per Second
50 Cycle Operation With Modification

MODELS CAPEHART, FARNSWORTH TELEV. & RADIO CORP.
 PANAMUSE N SERIES

GENERAL DESCRIPTION

SECTION 2

This Maintenance Manual is intended to assist the serviceman in understanding and adjusting for proper operation of the Capehart, Panamuse N series instruments. No attempt has been made toward a theoretical analysis of the various electrical and mechanical functional parts, for it is assumed that none but qualified technicians shall attempt adjustments.

An entirely new instrument, in most respects, is this first post-war product of Capehart. Cabinets remain the authentic styling that was offered pre-war and basic principles of the 16-E changer are yet unique but otherwise, little semblance is seen to the previous De-Luxe Capehart. This change has been brought about largely by new standards of dependability and excellence, particularly as concerns the tuner-amplifier-speaker combination, established in the many military applications of communications equipment.

In specifically enumerating these outstanding features and advancements, the several portions of the instrument shall be considered individually.

SECTION 3

THE RADIO TUNER

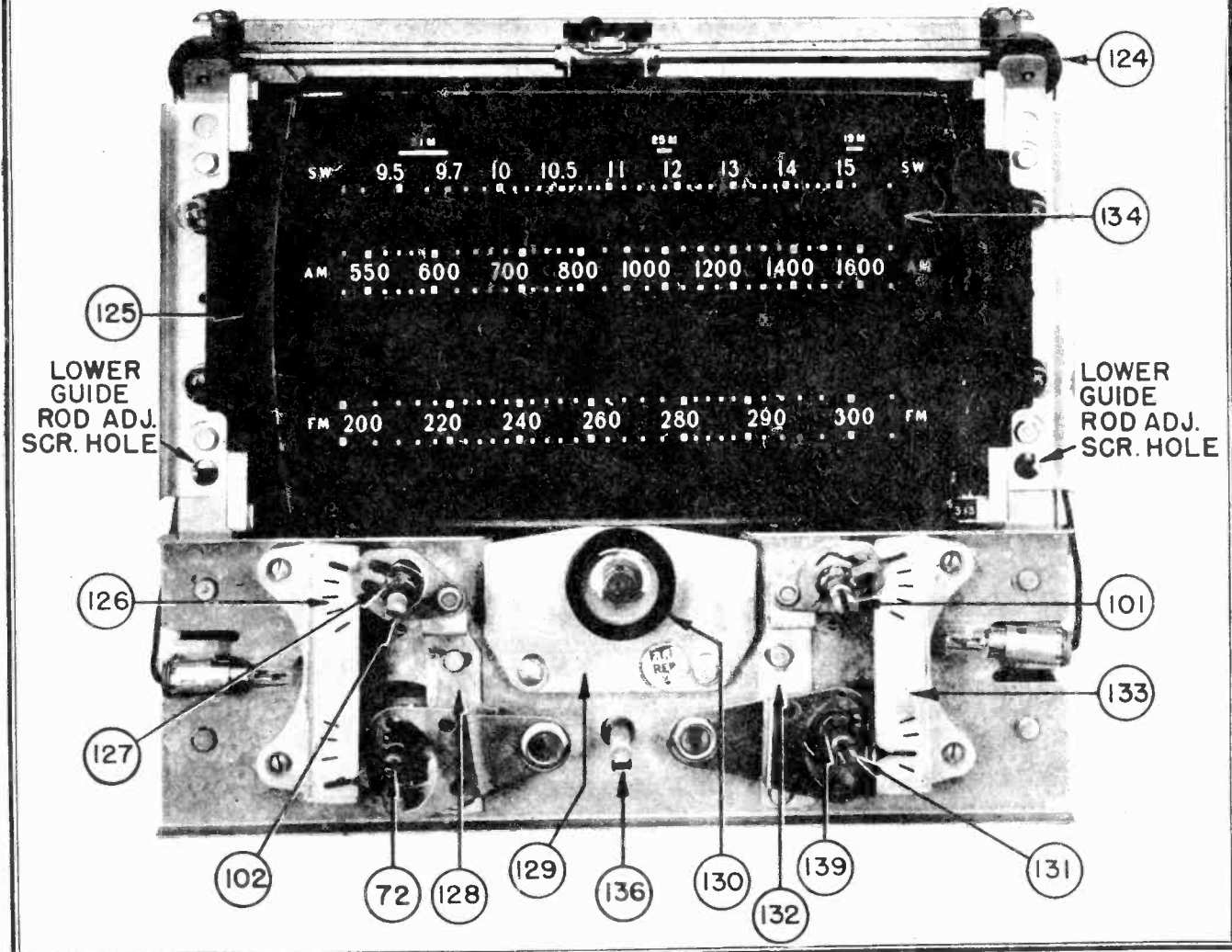
Those servicemen who dealt with the war-time application of communications equipment will readily recognize "the military" in the radio tuner. Paint over the cadmium chassis plating, bathtub-type oil-filled condensers, strip-mounting of small parts and extensive cabling are all new innovations which were basic to the armed forces' equipment. Other features also contribute to make this chassis, we believe, electrically and mechanically a masterpiece:

A. Completely separate FM-AM circuits up to entry into the audio system, leading to maximum efficiency in each circuit.

B. Copper FM tuning condenser plates, rubber-mounting of R-F assembly reduce microphonics.

C. R-F sub-assembly at the rear of chassis, easily removable for service.

D. Miniature tubes are employed in the FM R-F section for optimum performance in the 100 mc. range of FM.



**FARNSWORTH TELEV. & RADIO CORP. MODELS CAPEHART,
PANAMUSE N SERIES**

E. Negligible thermal effects in high frequency circuits. Low-drift ceramic condensers, temperature-compensation condensers, silver-plated invar wire to form the oscillator coil and polystyrene coil forms all contribute to frequency stability.

F. Adjustments for accurate tracking calibration. Adjustments are made to inductance, as well as capacity of tracking circuits—a feature usually to be had only in high-grade communications-type equipment.

G. Separate AM antenna coil and selector switch for use of either a loop or an external antenna.

H. Slug-tuned IF transformers and large capacity across tube input afford a high degree of stability. Changing of tubes and the "Miller effect" (a change of tuning under varying AVC potential) produce no detuning.

I. Quarter-wave resonant lines for FM RF circuit elements, accomplish image rejection of 100 decibels—a phenomenally high figure.

J. Cathode degeneration in IF stages enhances stability.

K. Ratio FM detector discriminates against AM (noise), particularly at low signal levels where the discriminator-limiter combination fail. Increased output also allows less gain in IF amplifier, effecting greater stability.

L. No critical wire placement. Detuning is practically impossible as a result of wire misplacement.

M. Improved tuning-eye circuit, showing proper tuning of FM, as well as AM.

N. Low impedance output stage. A cathode-follower provides an output of less than 500 ohms impedance. High frequencies are therefore not attenuated in the inter-chassis connecting line.

O. Reduced potential on those pilot lamps which necessitate chassis-removal for replacement. Lamp life-expectancy in excess of 10,000 hours—probably the life of the instrument.

P. Travel-light dial. By optically projecting a line of light upon the glass face, parallax is wholly eliminated. Positive band-indication is also thereby had.

These enumerate but major features of the tuner. Others, such as separate decoupling R-C networks for each stage, separate bass and treble controls, FM calibration to the new FCC channel assignments are apparent from inspection of the set and schematic. Neither esthetic appeal nor electrical efficiency have been neglected or compromised.

SECTION 4 AUDIO AMPLIFIERS

A portion of the audio system is incorporated in the tuner chassis. This is a 6SN7 tube, one section of which serves as an amplifier, the second section being used as a cathode-follower for low-impedance output. In addition, a 6J7 (triode-connected) gives added amplification in the "phono" position only.

Outstanding features of the amplifier chassis are:

A. *N-1 amplifier*: Individual output tube bias and hum-bucking adjustment. *N-2 amplifier*: Inverse feedback affords low distortion at high power levels.

N-1 and N-2 amplifiers:

B. Very low inter-modulation distortion.

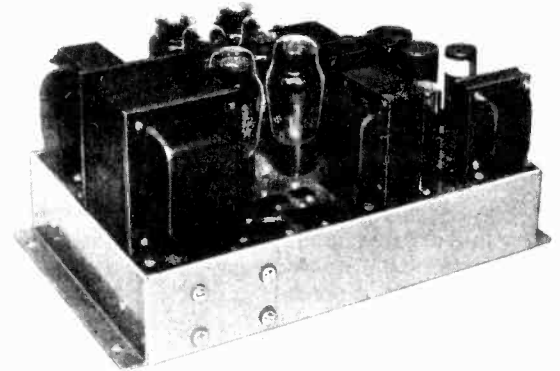
Compensation of deficiencies in one amplifier stage may be made in another stage. Such a practice however, gives rise to intermodulation or "cross-talk," resulting in the production of new and unwanted frequencies. This effect, often overlooked in amplifier design, has here been given particular attention, such distortion being held to less than one-half of one per cent.

C. Frequency response uniform from 50 cycles to 12,000 cycles per record.

D. Gain control in amplifier permits any "reference level" setting of the tuner-chassis control.

E. Auxiliary input provides for the use of wire recorder or other signal source.

F. Fuses in both primary of transformer and output of rectifier, affording complete transformer-rectifier protection.



G. Resistor in —B lead to avoid shock. To prevent hum pickup in the power cable, grounding between the two chassis is made through the audio cable. Should this cable be removed, there remains 33 ohms between chassis, maintaining continuity and preventing high electrical potential between chassis.

SECTION 5 SPEAKERS

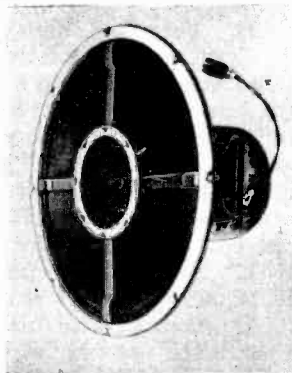
400N Series Instruments. The single speaker in the 400N Series instruments results from military-sponsored design to produce the finest of sound-reproducing units. This speaker, exclusively used for home-reproduction in The Capehart, is in reality a 2-cone unit for high-fidelity response to both high and low frequencies. Both cones are driven by a 4-inch voice coil of 4 ohms impedance, a helix of spirally-wound copper ribbon, operating in the intense magnetic field produced by 5 pounds of alnico metal. Its power capacity is in excess of the thirty watts delivered by the N-1 amplifier.

For proper frequency response, the speaker must be contained within a full enclosure of volume not less than 2½ nor more than 4 cubic feet, having firmly attached a lining of suitable absorbent material such as hair-felt.



MODELS CAPEHART, FARNSWORTH TELEV. & RADIO CORP. PANAMUSE N SERIES

N Series Instruments. Although but a single mounting is required for the reproducing unit of the 100-Series instrument, it consists of 2 speakers coaxially-mounted. One, with 15-inch cone, is responsive to low frequencies while the other, a 5-inch unit, acts as high-frequency reproducer. Both are

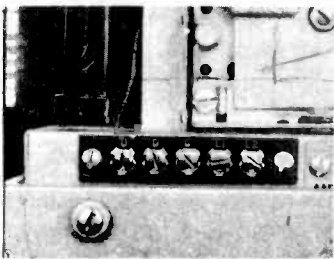


field-excited by heavy alnico permanent magnets. Such a "woofer-tweeter" combination has long been accepted in high-fidelity sound reproduction since but a single cone is incapable of proper response to both low and high-frequency electrical impulses.

The combined voice-coil impedance of the 2 units is 8 ohms.

SECTION 7 ANTENNAS

Capehart N-series instruments incorporate 2 internal antennas; a loop antenna used in broadcast-band reception only and a folded-dipole antenna used for FM reception. The latter is also, as a straight-wire antenna, employed in short-wave reception, and, if desired, in broadcast reception. This latter function is accomplished by a switch at the rear of the chassis.



These internal antennas are intended for use only in the presence of adequate field strength, as in large metropolitan areas where local stations supply the majority of desired programs. Neither a loop nor a dipole element which is within the confines of the cabinet can be considered as efficient signal pickup devices and, should field strength requirements be not fulfilled, it will be necessary, for satisfactory reception, to install an efficient outside folded dipole antenna which feeds the receiver through a 300 ohm transmission line.

Both the loop and the dipole (internal or external) antennas exhibit certain characteristics of directivity, with which the experienced serviceman is familiar, which should be borne in mind when locating the receiver (or external antenna) in the home. Slight orientation of the receiver may effect more satisfactory reception of desired weak signals.

An external folded-dipole antenna will, of course, afford optimum signal pickup on FM or short-wave AM and, when the rear-chassis switch is at the "antenna" position, it will provide a good external "flat-top" for broadcast-band reception.

The internal loop antenna connects to terminals L1, L2 of the rear-chassis terminal strip; the internal or external folded-dipole antenna connects to terminals D, D on the same strip—both without regard to polarity. Terminal "G" is the connection to an earth ground.

SECTION 8

SETTING UP FOR OPERATION

We cannot overemphasize the necessity for more than a perfunctory check of the instrument prior to demonstration on the dealer's floor or to installation in the home. Improperly installed or improperly operating when installed, extra service costs and customer dissatisfaction rise rapidly, overshadowing the short added time necessary to a thorough checking routine. At least the following items should be covered and if you are thorough in your work, you undoubtedly will make additions to the list.

SUGGESTED INSPECTION ROUTINE FOR THE CAPEHART INSTRUMENTS

1. Unpacking. Carefully remove the instrument from its shipping case.
2. Inspect condition of cabinet. Packing case should be scrutinized. If panel is broken, look for concealed damage—if cabinet is damaged by rough handling in transit, concealed damaged claim should be filed with the "carrier."
3. See that all shipping tie-downs are removed from back of magazine, reverse-arm guide, tone-changer-arm and swing lever and that the card-board block is removed from under the reverse arm lock. It is important that the reverse-arm lock be checked to see that it is not caught behind the stop, which would cause the changer to jam when started. To release such a jam, remove screws 55010 (see 41-E changer instruction manual). Set selector lever in one side position and run through 1 cycle. Although changer is shipped in 1 side position to prevent jam, main cam switch 57155 (see 41-E manual) may shift in transit, resulting in a jam.
4. The record changer must be free-floating and all 4 cushion supports in proper position. If changer is not free-floating, its position should be shifted slightly until there is no tendency to touch against any part of the mounting frame.
5. Level the cabinet with adjustable glides which are contained in a separate bag attached to the inside of shipping case. This is important for proper automatic phonograph operation.
6. Check level of changer mechanism in cabinet.

FARNSWORTH TELEV. & RADIO CORP. MODELS CAPEHART,
PANAMUSE N SERIES

7. Determine whether the power-line voltage and frequency agree with the electrical specifications on plate on rear of the instrument.

8. Read carefully operating instructions accompanying the instrument.

9. Place a phonograph record on the turntable. Place "on-off" switch on changer to "on" position. Set all controls; volume, bass, treble, in wide-open position for acoustic feedback test. RCA record No. 49196 is good for this purpose. This test will indicate any excessive noise or rumble. Shifting the changer to a free-floating position while this record is playing should clear up any rumble which may be present.

10. Operate volume, bass, and treble controls to observe proper action.

11. Check for reproduction quality. To do this, use a good record, of quality and type of reproduction with which you are familiar. Check record reproduction at both high and low volume levels.

12. Examine antenna connections. Check reception and calibration of radio tuner on all bands.

13. Observe action of the "Electric Eye" tube and position so that tuning segments are horizontal.

14. Tap tubes in tuner to locate any excessively microphonic tubes.

15. Affix station call letter tabs on the dial, following procedure in operating instructions. The knobs must be removed before the escutcheon can be replaced. The escutcheon is wrapped in the cardboard screwed to the inside of the cabinet near the base. After the escutcheon is attached, replace the knobs.

16. Effect a complete check of the record changer

17. Carefully clean cabinet to remove finger marks. A piece of cheesecloth folded into a pad and moistened with water to which a few drops of vinegar have been added is recommended. The use of furniture polish on Capehart cabinets is not recommended.

18. Instruct customer on all phases of operation of the machine. Personally place in the customer's hands the operation manual which accompanies the instrument.

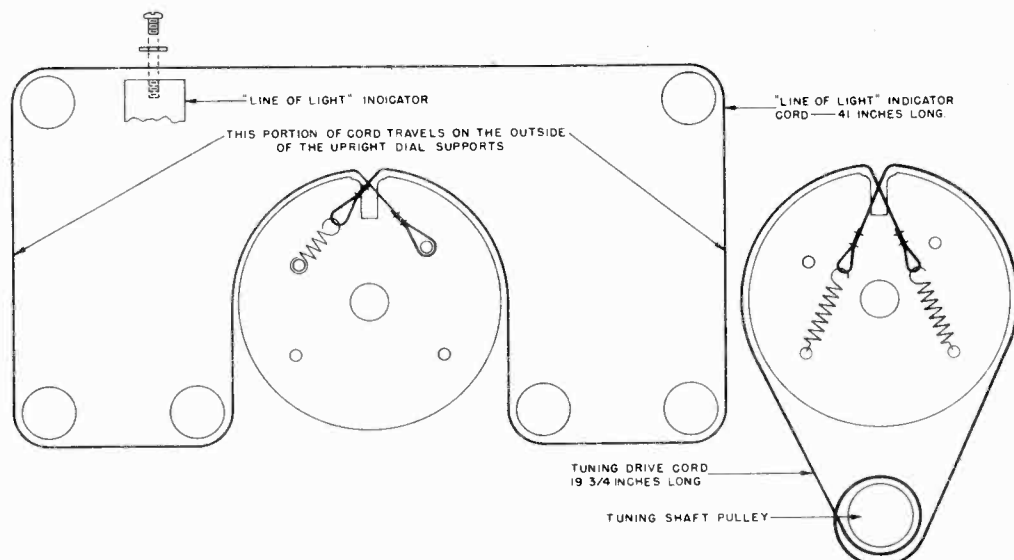
DRIVE CORD ASSEMBLIES

SECTION 9

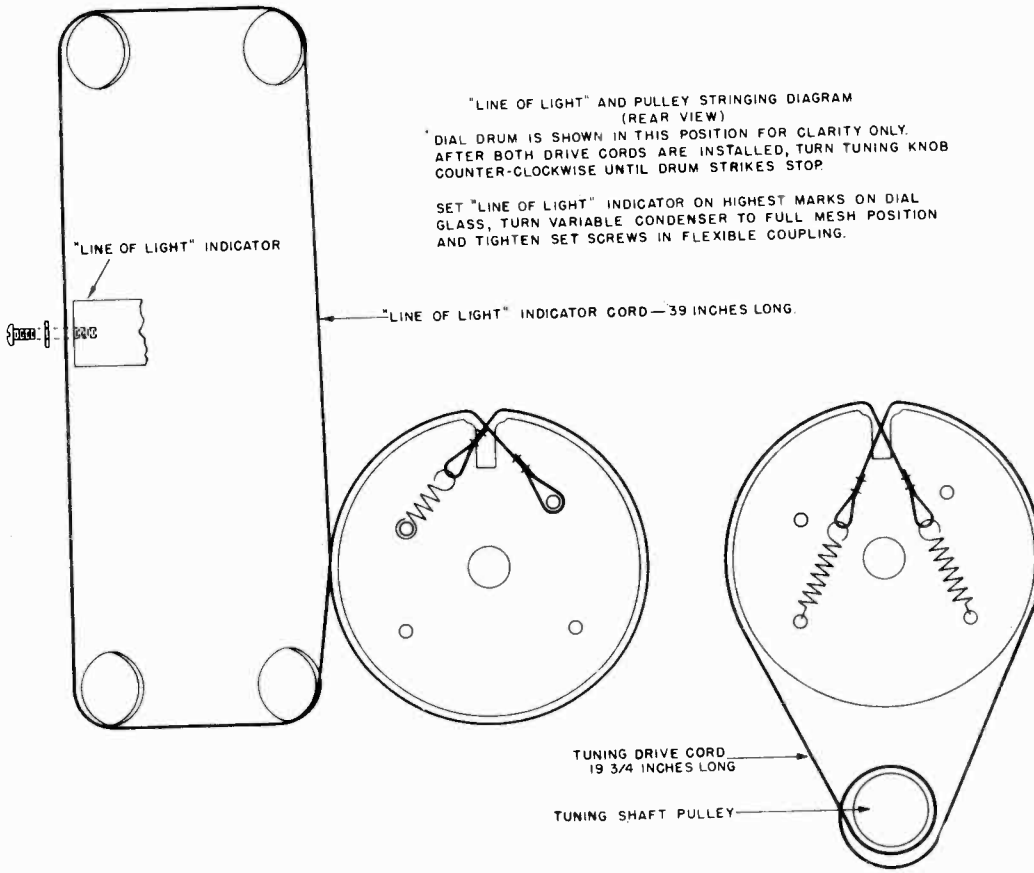
The dial cord assemblies are 2 in number; the main drive cord which causes rotation of the drum, and a second cord which operates the traveling-

light dial scale indicator. As an aid in stringing these cords, the schematics of both the vertical and horizontal type dials are shown below:

"LINE OF LIGHT" AND PULLEY STRINGING DIAGRAM
(REAR VIEW)
DIAL DRUM IS SHOWN IN THIS POSITION FOR CLARITY ONLY.
AFTER BOTH DRIVE CORDS ARE INSTALLED, TURN TUNING KNOB
COUNTER-CLOCKWISE UNTIL DRUM STRIKES STOP
SET "LINE OF LIGHT" INDICATOR ON MARKS ON EXTREME LEFT
END OF DIAL GLASS, TURN VARIABLE CONDENSER TO FULL
MESH POSITION AND TIGHTEN SET SCREWS IN FLEXIBLE
COUPLING.

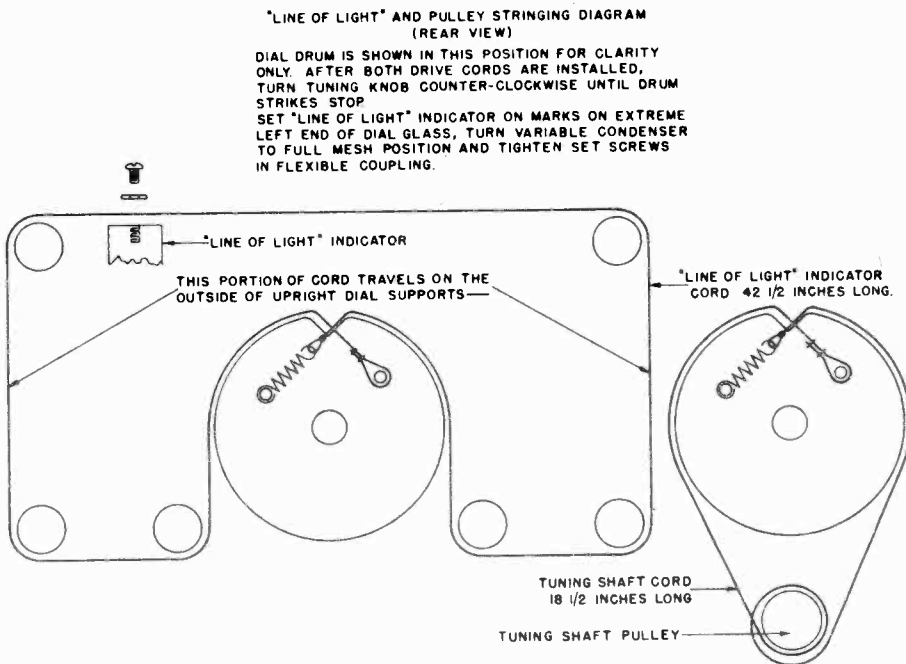


MODELS CAPEHART, FARNSWORTH TELEV. & RADIO CORP.
PANAMUSE N SERIES



MODELS
19N3 25N2
21N2 26N2

Drive cord assembly, current-production instruments



Drive cord assembly, earlier-production instruments, spring at one end of the cord

RECEIVER ALIGNMENT

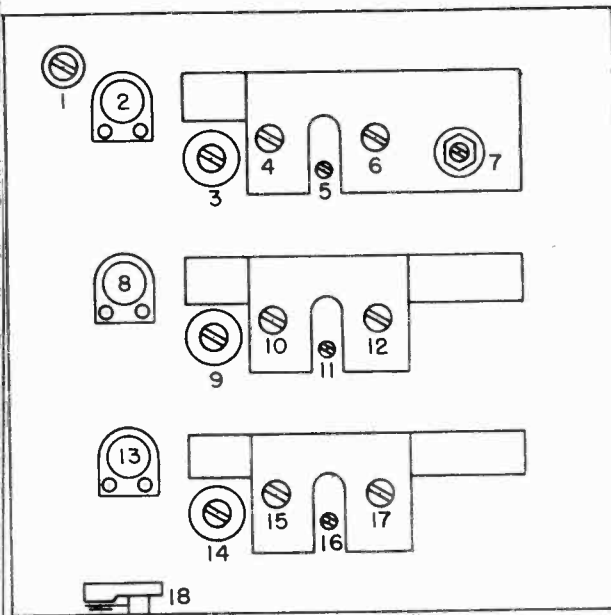
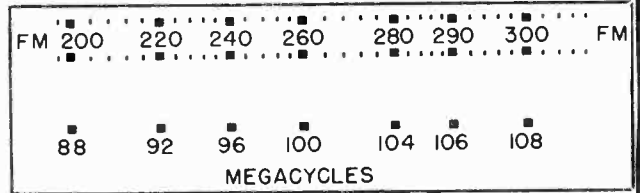
SECTION 10

Herewith are presented two methods of alignment of the Capehart receivers. Those service shops possessing a suitable sweep generator and oscillograph will effect considerable saving of time, as well as assuring more precise alignment, by using the first method, Section 1.00 through Section 7.08. This method is employed in factory alignment.

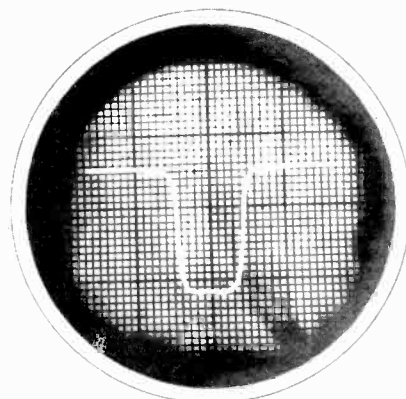
An alternative method, using the amplitude-modulated signal generator, is presented in the second portion of the papers which covers alignment of the FM-IF stages (Section 10.00 through Section 13.00) and of the AM portion of receiver (the chart showing Steps 1-22 which should be followed in sequence).

By following these detailed procedures, the original factory alignment of the receiver may be duplicated.

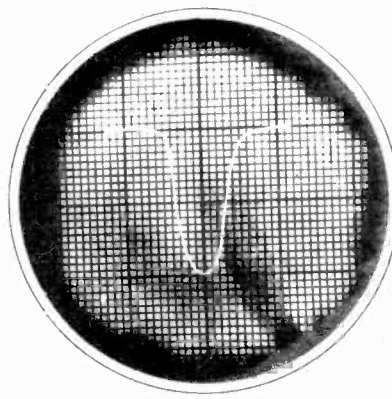
The conversion of FM dial scale readings to frequency may be made from the following analysis: The FM band extends from 88 to 108 mc., each station channel 200 kc. in width. Channel 201, that lowest in frequency, has center frequency at 88.1 mc. Each succeeding channel is successively 200 kc. higher, so channel 202 is centered at 88.3 (200 kc. higher), channel 203 is centered at 88.5 mc., 206 at 89.1 mc., etc.



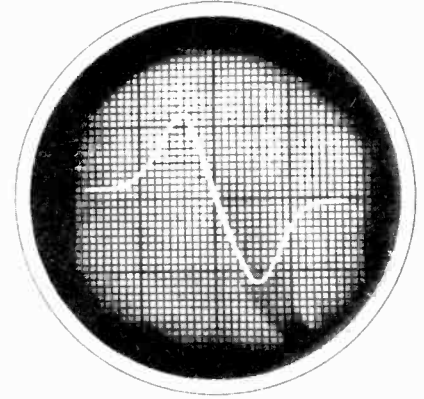
1. FM oscillator padder
2. FM oscillator trimmer
3. SW oscillator padder
4. SW oscillator trimmer
5. BC oscillator inductance slug (do not adjust in alignment procedure)
6. BC oscillator trimmer
7. BC oscillator padder
8. FM mixer trimmer
9. SW mixer inductance slug
10. SW mixer trimmer
11. BC mixer inductance slug
12. BC mixer trimmer
13. FM R-F trimmer
14. SW R-F inductance slug
15. SW R-F trimmer
16. BC R-F inductance slug
17. BC R-F trimmer
18. Loop antenna peaking condenser



Normal IF response curve



IF response curve, resistance loading



Alignment of the discriminator

MODELS CAPEHART, FARNSWORTH TELEV. & RADIO CORP.
PANAMUSE N SERIES

ALIGNMENT OF THE RECEIVER, SWEEP GENERATOR METHOD

1.00 GENERAL INSTRUCTIONS

1.01 *Adjustments of Dial Pointer*

a. Tune receiver to extreme low frequency end of dial and set pointer to index at the last calibration mark.

b. Carefully determine that the gang condenser plates are completely meshed with the pointer in this position.

WARNING: This adjustment is extremely important if subsequent alignment is to provide accurate calibration.

c. With the pointer at the extreme low end of the range, rotate band switch through all positions and note that the pointer line is accurately indexed on all three bands, and that the pointer is illuminated for the proper band in respect to the position of the band switch.

Note: The pointer remains dark when the band switch is in the phonograph position.

d. Tune the dial across the entire range and observe that the pointer line is a single sharply defined line of uniform brilliance. If this is not obtained, it indicates that mechanical adjustment of the spacing of the light box from the dial glass is necessary. Do not proceed with alignment until all mechanical adjustments have been made.

1.02 TUNING EYE BALANCE ADJUSTMENT

Remove last FM IF tube from its socket. Turn band switch to FM position, and adjust tuning eye balance control (located on top of the chassis between the 6H6 discriminator tube and discriminator transformer) for balance of the 2 sections of the eye. No further adjustment of this control is necessary or should be attempted. The IF tube is then replaced. If, after alignment has been completed the tuning eye does not assume this same degree of balance, it is an indication the FM IF alignment is incorrect and should be reworked. This observation must be made with no signal input to receiver. After electrical balance has been obtained, the tuning eye must be rotated in its mounting such that the 2 wedge shaped dark areas will be in horizontal alignment to the chassis.

1.03 SETTING OF RECEIVER CONTROLS

Unless otherwise indicated, the receiver controls shall be set as follows during all alignment operations:

a. Set treble tone control to maximum treble position (pointer up).

b. Set bass tone control to maximum bass position (pointer up).

c. Set volume control to maximum.

1.04 TEST SIGNAL CONDITIONS

All alignment shall be done with only sufficient signal amplitude to provide satisfactory, signal to noise ratio, and acceptable pattern size on oscilloscope or readable output on output meter. *The use of excessively strong signal is almost certain to produce misalignment.*

2.00 *Equipment Required*

2.01 455 KC IF sweep generator.

2.02 10.7 MC IF sweep generator.

2.03 5" cathode ray oscilloscope.

2.04 RF signal generator, range 400 KC to 18 MC.

2.05 RF signal generator (frequency modulation desirable). Range 88 to 108 MC.

2.06 Output meter.

2.07 Insulated screw driver.

2.08 Voltohmyst.

3.00 FM IF ALIGNMENT

3.01 Equipment required: From Section 2.00 use items numbers 2.02, 2.03, and 2.08.

3.02 Set band switch in FM position and other controls as in Section 1.03.

3.03 Make connection from vertical deflection amplifier of oscilloscope to pin #3 of 6H6 discriminator tube. Make certain that the 4 MFD electrolytic condenser is disconnected from this same circuit. It is necessary that the lead to the oscilloscope be shielded, of low total capacity, and connection to receiver isolated by means of a 1 meg. resistor.

3.04 Connect sweep generator to last FM IF grid (Pin 4) through a .1 MFD coupling capacitor.

3.05 Align discriminator to obtain a picture similar to an over coupled IF transformer.

3.06 Place 10K resistor across primary of discriminator transformer and retouch alignment to obtain symmetrical pattern. It will be noted that the pattern is now single peaked but rather broad. This does NOT constitute a final alignment of discriminator, but is a convenient expedient to assist in the alignment of the IF stages.

3.07 Shift connection of sweep signal generator the grid of the second FM IF tube (Pin 4).

3.08 Align third FM IF transformer for a symmetrical flat top pattern.

3.09 Shift signal generator to the grid of the first IF tube (Pin 4).

3.10 Align second IF transformer in same manner as described in Section 3.07. NOTE: The width of the nose of the curve is the same as before, but the sides have become steeper.

3.11 Connect the signal generator to the grid of the converter tube grid (Pin 1) in series with 10,000 ohm resistor and a .1 MFD capacitor, or loosely couple by stray capacity of an insulated wire.

3.12 Align first FM IF transformer in the same manner as in Section 3.07. NOTE: The sides of the curve have further steepened, but that the nose of the curve has retained approximately the same width.

3.13 Remove load resistor from primary of discriminator transformer and connect 4 MFD electrolytic capacitor that was previously disconnected.

3.14 Connect oscilloscope to audio output terminal of the discriminator. There are several points where this contact can be made and can be identified as the circuit connected to the terminal of the discriminator transformer to which a shielded lead is connected.

3.15 With sweep signal input to converter grid, (Pin 1) align discriminator transformer for conventional discriminator pattern.

3.16 Connect signal generator to converter tube grid (Pin 1) in series with a 10,000 ohm resistor and a .1 MFD condenser capacitor. A signal input of 4,000 uV at 10.7 MC shall develop 3 volts AVC as measured with a voltohmyst.

**FARNSWORTH TELEV. & RADIO CORP. MODELS CAPEHART,
PANAMUSE N SERIES**

4.00 FM RF ALIGNMENT

4.01 Equipment required: From Section 2.00 use items 2.05, 2.06, 2.07, and 2.08.

4.02 Connect RF signal generator in series with 400 ohm carbon or metalized resistor to terminal "D" of RF unit nearest the side of the tuner (extreme left hand terminal viewing rear of chassis).

4.03 Set tuning control for pointer to calibrate at the equivalent of half way between channels 300 and 301.

4.04 Apply 108 MC signal.

4.05 Set converter and antenna trimmers at minimum capacity.

4.06 Adjust oscillator trimmer by tuning from maximum capacity to first signal that is heard, and peak for maximum output.

4.07 Adjust antenna and converter trimmers from maximum output.

4.08 Set tuning controls so dial pointer calibrates at the equivalent of half way between channels 200 and 201.

4.09 Apply 88 MC signal.

4.10 Adjust oscillator slug to maximum output.

4.11 Repeat operations 4.03 to 4.10 inclusive.

NOTE: The degree of adjustment required in the tuning of the oscillator slug will determine the number of times operations 4.03 to 4.10 must be repeated until no further gain in sensitivity is obtained.

4.12 Carefully tune across the entire FM band for the observance of dead or weak spots that may be a function of improper alignment or defective components. This can be determined by carefully noting the degree of receiver noise, that is, high noise generally is accompanied by good sensitivity.

4.13 Signal input of 18 uV should produce approximately 3 volts AVC as measured with a voltohmmyst.

4.14 With no signal input to antenna the tuning eye should have the same balanced appearance as it had following operation 1.02. If this is not the case, it usually indicates inaccurate alignment of IF system.

5.00 AM IF ALIGNMENT

5.01 Equipment required: From Section 2.00 use items 2.01, 2.03, and 2.08.

5.02 Set band switch in broadcast position and other controls as in Section 1.03.

5.03 Connect oscilloscope to high potential side of volume control.

5.04 Connect 455 KC sweep generator to the grid of the second AM IF tube through a .1 MFD condenser.

5.05 Align diode transformer for symmetrical conventional IF pattern.

5.06 Connect signal generator to grid of first IF tube.

5.07 Align second IF transformer.

5.08 Connect signal generator to converter grid.

5.09 Align first IF transformer.

NOTE: The resulting overall pattern shall be symmetrical and slightly flat topped.

5.10 Signal input of 2700 uV should produce approximately 3 volts AVC as measured with a voltohmmyst.

6.00 BROADCAST BAND RF ALIGNMENT

6.01 Equipment required: From Section 2.00 use items 2.04, 2.06, 2.07, and 2.08.

6.02 Place antenna loop switch in antenna position.

6.03 Connect RF signal generator to either terminal "D" through 200 MF mica capacitor.

6.04 Set dial pointer to 1500 KC.

6.05 With 1500 KC signal align oscillator, converter, and antenna trimmers for maximum output.

6.06 Set dial pointer at 600 KC.

6.07 Align oscillator padder, converter and antenna slugs for maximum output. Do not adjust the coil slug in broadcast oscillator coil.

6.08 Repeat operations 6.04 to 6.07 inclusive until no further increase in sensitivity is obtained.

6.09 Check dial calibration at several frequencies. If calibration is not reasonably accurate it will be necessary to make an adjustment of the inductance slug.

WARNING: After any adjustment of the oscillator inductance slug it will be necessary to repeat operations 6.04 to 6.07 inclusive.

6.10 Signal input of 35 uV at 1000 KC should produce approximately 3 volts AVC as measured with a voltohmmyst.

6.11 Switch antenna loop switch to loop position.

6.12 Connect dummy loop to terminal L-1 and L-2, and signal generator to antenna connection of dummy loop.

6.13 Set dial pointer to 1500 KC.

6.14 With 1500 KC signal align the loop trimmer for maximum output.

6.15 Check sensitivity at 600 and 1500 KC.

7.00 SHORT WAVE RF ALIGNMENT

7.01 Equipment required: From Section 2.00 use items 2.04, 2.06, 2.07, and 2.08.

7.02 Set band switch in short wave position and other controls as in Section 1.03.

7.03 Connect RF signal generator to either terminal "D" through a 400 ohm resistor.

7.04 Set dial pointer to 15 MC. Adjust oscillator, converter, and antenna trimmers for maximum output.

WARNING: On the short wave band the oscillator is operating on the low frequency side of the RF signal. Therefore, to avoid error in setting oscillator frequency, first set oscillator trimmer to maximum capacity, then slowly turn trimmer until first signal is heard.

7.05 Set dial pointer to 9.5 MC.

7.06 Adjust oscillator, converter, and antenna slugs for maximum output.

7.07 Repeat Sections 7.04 to 7.06 inclusive, until no further gain in sensitivity is obtained.

7.08 With signal input of 90 microvolts at 15 MC should produce approximately 3 volts AVC as measured with voltohmmyst.

Upon completion of all alignment the oscillator padder should be sealed with a touch of glyptal on the adjustment screw and Ambroid or similar cement applied to all coil slugs to prevent their changing adjustment.

TABULATION FOR AM ALIGNMENT

10.00-10.04 Same as 1.00-1.04.

11.00 EQUIPMENT REQUIRED

- 11.01 Voltohmyst.
- 11.02 R-F signal generator range 450 KC to 108 mc.
- 11.03 Insulated screw-driver.

12.00 FM IF ALIGNMENT

12.01 Equipment required: From Section 11.00 use items numbers 11.01, 11.02, and 11.03.

12.02 Set bandswitch in FM position and other controls as in section 10.03.

12.03 Connect voltohmyst from ground to pin #3 on 6H6 ratio detector.

12.04 Connect signal generator in series with a .1 MFD capacitor between grid and ground of 3rd. FM IF tube (Pin 4) and set generator to 10.7.

12.05 Disconnect 4 mfd. condenser (1 lead is sufficient from detector circuit and place 10,000 ohm resistor across primary of the fourth or discriminator transformer. Resistor shall be left connected until operation calling for its removal.

12.06 Tune secondary and primary slugs for maximum voltage.

12.07 Connect generator in series with a .1 mfd. capacitor to grid of 2nd FM IF tube.

12.08 Place a 2200 ohm resistor across secondary of 3rd FM IF transformer.

12.09 Tune primary slug for maximum voltage.

12.10 Remove 2200 ohm resistor from secondary (and place across primary of same transformer).

12.11 Tune secondary slug for maximum output.

12.12 Remove 2200 ohm resistor from primary of 3rd FM IF transformer and place across secondary of 2nd FM IF transformer.

12.13 Connect generator, in series with a .1 mfd. capacitor to grid of 1st FM IF tube.

12.14 Tune primary slug for maximum voltage.

12.15 Remove resistor from 2nd IF transformer secondary and place across primary.

12.16 Tune secondary for maximum voltage.

12.17 Connect generator to grid of FM converter tube through a 10,000 ohm resistor and .1 mfd. condenser in series or loosely couple to the grid by placing the generator lead near the grid lead.

12.18 Remove resistor from 2nd IF transformer primary and place it across secondary of 1st IF transformer.

12.19 Tune primary slug for maximum voltage.

12.20 Remove resistor from secondary and place it across the primary.

12.21 Tune secondary for maximum voltage.

12.22 Move voltmeter to audio output lead on 4th FM IF transformer. This is a shielded lead.

12.23 Remove the 10,000 ohm resistor from the discriminator primary that was installed in item 12.05. Tune secondary of 4th FM IF transformer for zero voltage. Slight returning of the primary may be necessary after the secondary is tuned.

12.24 Tuning of the primary is done by slightly detuning signal generator to obtain a readable out-

put then tuning slug for maximum. This operation and that of 12.23 must be repeated several times to obtain final accurate alignment.

12.25 The FM IF system is now aligned. De-tuning the signal generator equal amounts each side of 10.7 mc should produce equal deflections of opposite polarity on the voltmeter. If the deflections are not equal (+10% or less) the alignment is not correct and the discriminator requires re-alignment.

13.00 FM RF ALIGNMENT

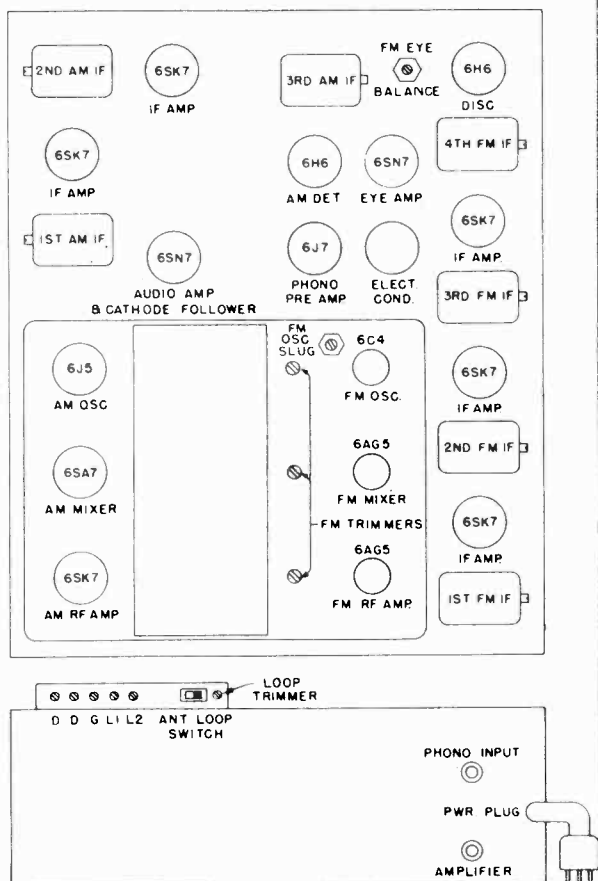
Follows exactly that given in sections 4.01 to 4.14.

14.00 ALIGNMENT OF THE A-M BANDS

Equipment required: Same as section 11.

CAUTION: Care must be taken when aligning the short wave band, for the adjustment of the shunt trimmer affects the adjustment of the oscillator coil slug.

At the high frequency end of the band it is possible to peak the oscillator trimmer, and to peak the slug at the low frequency end at the image; so in the alignment instructions we have indicated the fundamental frequency and the correct oscillator setting for the image so that by resetting the signal generator it is possible to see if the alignment is correctly made. In each case the image is found at a frequency 910 Kc. higher than the fundamental.



TABULATION FOR AM ALIGNMENT

STEPS	CONNECT GENERATOR	SET GENERATOR AT	SET GANG AT	ADJUST AND SEE FIG.	TO OBTAIN	
1		Set Tone and Volume Controls at Maximum				
2	Through .1 Mfd.	Grid 2nd IF tube	455 KC	3rd IF Slugs	MAXIMUM OUTPUT	
3		Grid 1st IF tube		Quiet Point		2nd IF Slugs
4		Grid Conv. tube				1st IF Slugs
5	Place Antenna loop switch in Antenna Position					
6	Through 200 MMF Mica	Either "D" Terminal	1500 KC	1500 KC		BC Osc. Trimmer
7				1500 KC		BC Ant. Trimmer
8				1500 KC		BC RF Trimmer
9		600 KC	600 KC	Osc. Padder		
10				600 KC		Converter Slug
11				600 KC		Antenna Slug
12	Check dial calibration at several frequencies. If not reasonably correct, adjust oscillator slug. See Note 1*.					
13	Connect dummy loop to terminals L1 and L2, then place Antenna Loop Switch in Loop Position.					
14	Antenna of dummy loop.	1500 KC	1500 KC	Loop Trimmer		
SHORT WAVE RF						
15	Place Ant-Loop switch in "Ant." position and Band Switch in Short Wave position.					
16	Through 400 ohm resistor	Either "D" Terminal	15 MC	15 MC	See Note 2 SW Osc. Trimmer	
17				15 MC	Image At 14.09 MC	SW Conv. Trimmer
18				15 MC	Image At 14.09 MC	SW Ant. Trimmer
19		9.5 MC	9.5 MC	9.5 MC	SW Osc. Slug	
20				9.5 MC	Image At 8.59 MC	SW Conv. Slug
21				9.5 MC	Image At 8.59 MC	SW Ant. Slug
22	Recheck Steps 16 to 21 inclusive.					

NOTE 1—After any adjustment of oscillator slug, repeat steps 6 to 11 inclusive.

NOTE 2—Set oscillator trimmer to maximum capacity, then slowly loosen trimmer until first signal is heard.

VOLTAGES AND RESISTANCES

Measurements taken from pins to chassis.

N TUNER

VOLTAGE 1		RESISTANCE		VOLTAGE 2		RESISTANCE		VOLTAGE 3		RESISTANCE		VOLTAGE 4		RESISTANCE	
1 0		1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0
2 6.3 AC		2 .2~	2 0	2 0	2 3.1 AC	2 0	2 3.1 AC	2 18~	2 3.1 AC	2 18~	2 3.1 AC	2 18~	2 3.1 AC	2 18~	2 3.1 AC
3 0		3 0	3 0	3 0	3 -.5	3 0	3 -.5	3 170M	3 86	3 170M	3 86	3 170M	3 86	3 170M	3 86
4 -2.7		4 5 MEG	4 .1	4 1 MEG	4 0	4 1 MEG	4 0	4 0	4 86	4 0	4 86	4 0	4 86	4 0	4 86
5 3.3		5 250~	5 7	5 220~	5 -.65	5 220~	5 -.65	5 1M	5 86	5 1M	5 86	5 1M	5 86	5 1M	5 86
6 160		6 .5 MEG	6 240	6 .5 MEG	6 NC	6 .5 MEG	6 NC	6 NC	6 NC	6 NC	6 NC	6 NC	6 NC	6 NC	6 NC
7 0		7 0	7 6.3 AC	7 .2~	7 3.1 AC	7 .2~	7 3.1 AC	7 18~	7 3.1 AC	7 18~	7 3.1 AC	7 18~	7 3.1 AC	7 18~	7 3.1 AC
8 340		8 .5 MEG	8 350	8 .5 MEG	8 0	8 .5 MEG	8 0	8 0	8 0	8 0	8 0	8 0	8 0	8 0	8 0

CAP -3

CAP 1.1 MEG

VOLTAGE 5		RESISTANCE		VOLTAGE 6		RESISTANCE		VOLTAGE 7		RESISTANCE		VOLTAGE 8		RESISTANCE	
1 48		1 .5 MEG	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0
2 340		2 .5 MEG	2 0	2 0	2 6.3 AC	2 0	2 6.3 AC	2 .2~	2 0	2 .2~	2 0	2 .2~	2 0	2 .2~	2 0
3 60		3 10M	3 0	3 0	3 310	3 0	3 310	3 .5 MEG	3 170	3 .5 MEG	3 170	3 .5 MEG	3 170	3 .5 MEG	3 170
4 0		4 1 MEG	4 0	4 4 MEG	4 130	4 4 MEG	4 130	4 .5 MEG	4 NC	4 .5 MEG	4 NC	4 .5 MEG	4 NC	4 .5 MEG	4 NC
5 48		5 .5 MEG	5 4.6	5 360~	5 24	5 360~	5 24	5 22 M	5 24	5 22 M	5 24	5 22 M	5 24	5 22 M	5 24
6 1.8		6 1500~	6 125	6 .5 MEG	6 2.4	6 .5 MEG	6 2.4	6 220~	6 NC	6 220~	6 NC	6 220~	6 NC	6 220~	6 NC
7 3.1 AC		7 18~	7 6.3 AC	7 .2~	7 0	7 .2~	7 0	7 0	7 6.3 AC	7 0	7 6.3 AC	7 0	7 6.3 AC	7 0	7 6.3 AC
8 3.1 AC		8 18~	8 310	8 .5 MEG	8 -1.6	8 .5 MEG	8 -1.6	8 4 MEG	8 0	8 4 MEG	8 0	8 4 MEG	8 0	8 4 MEG	8 0

FM		RESISTANCE		AM		RESISTANCE		FM		RESISTANCE		AM		RESISTANCE	
1 9		1 470	1 -.8	1 2.5 MEG	1 NC	1 2.5 MEG	1 NC	1 NC	1 NC	1 NC	1 NC	1 NC	1 NC	1 NC	1 NC
2 66		2 3.5 MEG	2 26.5	2 3.5 MEG	2 0	2 3.5 MEG	2 0	2 0	2 0	2 0	2 0	2 0	2 0	2 0	2 0
3 11.5		3 15M	3 0	3 0	3 49	3 0	3 49	3 2.7 MEG	3 22	3 2.7 MEG	3 22	3 2.7 MEG	3 22	3 2.7 MEG	3 22
4 0		4 INF	4 -.8	4 2.5 MEG	4 66	4 2.5 MEG	4 66	4 3.5 MEG	4 26.5	4 3.5 MEG	4 26.5	4 3.5 MEG	4 26.5	4 3.5 MEG	4 26.5
5 49		5 2.7 MEG	5 22	5 2.7 MEG	5 175	5 2.7 MEG	5 175	5 3.3 MEG	5 185	5 3.3 MEG	5 185	5 3.3 MEG	5 185	5 3.3 MEG	5 185
6 6.9		6 7	6 0	6 0	6 NC	6 0	6 NC	6 NC	6 NC	6 NC	6 NC	6 NC	6 NC	6 NC	6 NC
7 6.3 AC		7 0	7 6.3 AC	7 0	7 6.3 AC	7 0	7 6.3 AC	7 .2~	7 6.3 AC	7 .2~	7 6.3 AC	7 .2~	7 6.3 AC	7 .2~	7 6.3 AC
8 0		8 .2~	8 0	8 .2~	8 0	8 .2~	8 0	8 0	8 0	8 0	8 0	8 0	8 0	8 0	8 0

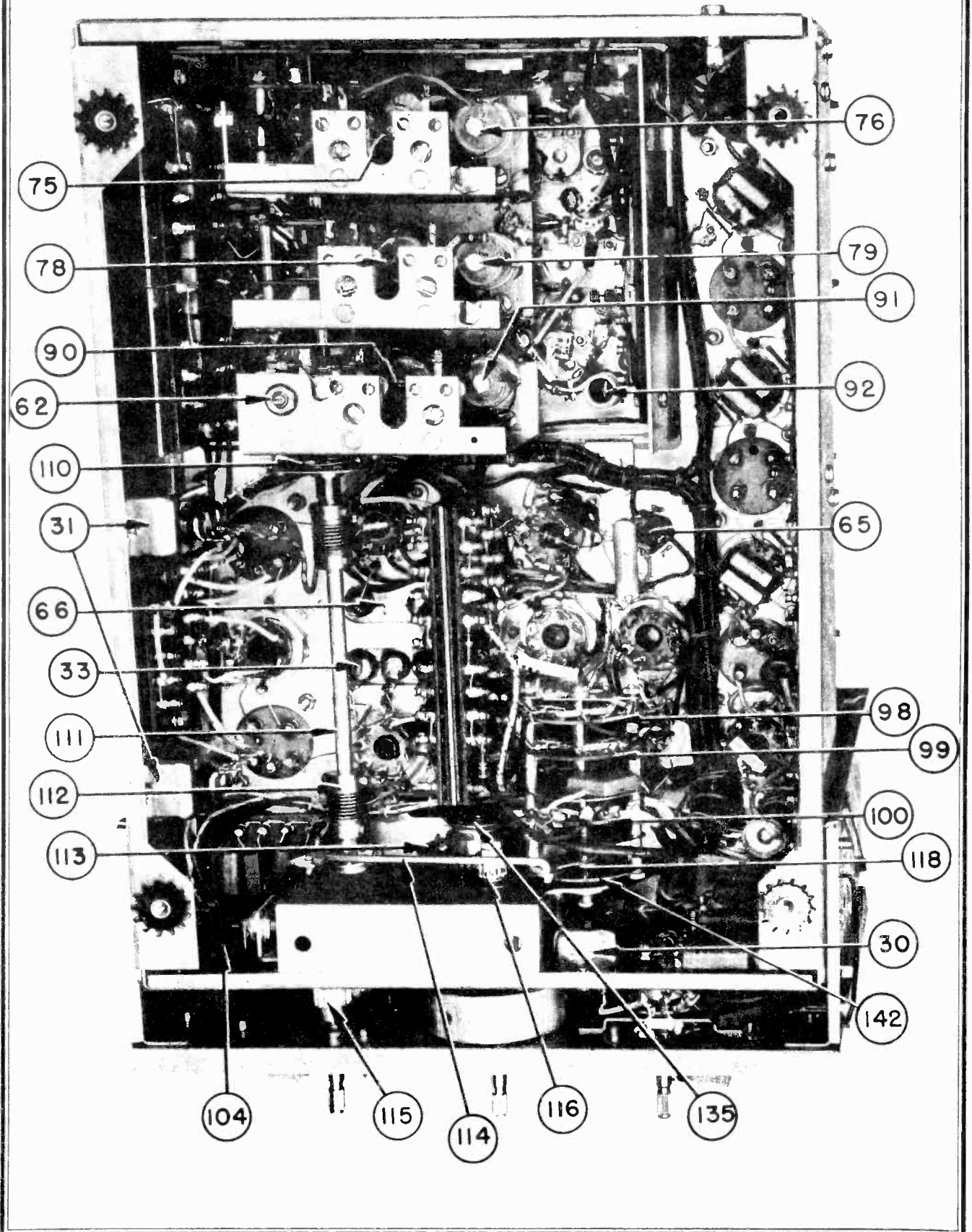
VOLTAGE 11		RESISTANCE		VOLTAGE 12		RESISTANCE		VOLTAGE 13		RESISTANCE		VOLTAGE 14		RESISTANCE	
1 0		1 0	1 -.8	1 1 MEG	1 NC	1 1 MEG	1 NC	1 NC	1 0	1 NC	1 0	1 NC	1 0	1 NC	1 0
2 19		2 220~	2 0	2 0	2 NC	2 0	2 NC	2 NC	2 0	2 NC	2 0	2 NC	2 0	2 NC	2 0
3 6.3 AC		3 0	3 0	3 0	3 6.3 AC	3 0	3 6.3 AC	3 4~	3 0	3 4~	3 0	3 4~	3 0	3 4~	3 0
4 0		4 4	4 6.3 AC	4 4	4 0	4 4	4 0	4 0	4 -3	4 0	4 -3	4 0	4 -3	4 0	4 -3
5 300		5 .5 MEG	5 320	5 .5 MEG	5 190	5 .5 MEG	5 190	5 .5 MEG	5 3.7	5 .5 MEG	5 3.7	5 .5 MEG	5 3.7	5 .5 MEG	5 3.7
6 130		6 .5 MEG	6 85	6 .5 MEG	6 -9.5	6 .5 MEG	6 -9.5	6 33M	6 135	6 33M	6 135	6 33M	6 135	6 33M	6 135
7 1.9		7 220~	7 0	7 0	7 0	7 0	7 0	7 0	7 6.3 AC	7 0	7 6.3 AC	7 0	7 6.3 AC	7 0	7 6.3 AC
8		8	8	8	8	8	8	8	8 325	8	8 325	8	8 325	8	8 325

VOLTAGE 15		RESISTANCE		VOLTAGE 16		RESISTANCE		VOLTAGE 17		RESISTANCE	
1 0		1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0
2 0		2 0	2 0	2 0	2 0	2 0	2 0	2 0	2 0	2 0	2 0
3 0		3 0	3 0	3 0	3 -.3	3 0	3 -.3	3 0	3 -.3	3 0	3 -.3
4 -3		4 2.4 MEG	4 0	4 100M	4 0	4 100M	4 0	4 100M	4 0	4 100M	4 0
5 3.5		5 290~	5 3	5 220~	5 0	5 220~	5 0	5 220~	5 0	5 220~	5 0
6 142		6 .5 MEG	6 105	6 .5 MEG	6 NC	6 .5 MEG	6 NC	6 .5 MEG	6 NC	6 .5 MEG	6 NC
7 6.3 AC		7 4~	7 6.3 AC	7 4~	7 6.3 AC	7 4~	7 6.3 AC	7 4~	7 6.3 AC	7 4~	7 6.3 AC
8 325		8 .5 MEG	8 325	8 .5 MEG	8 .3	8 .5 MEG	8 .3	8 .5 MEG	8 .3	8 .5 MEG	8 .3

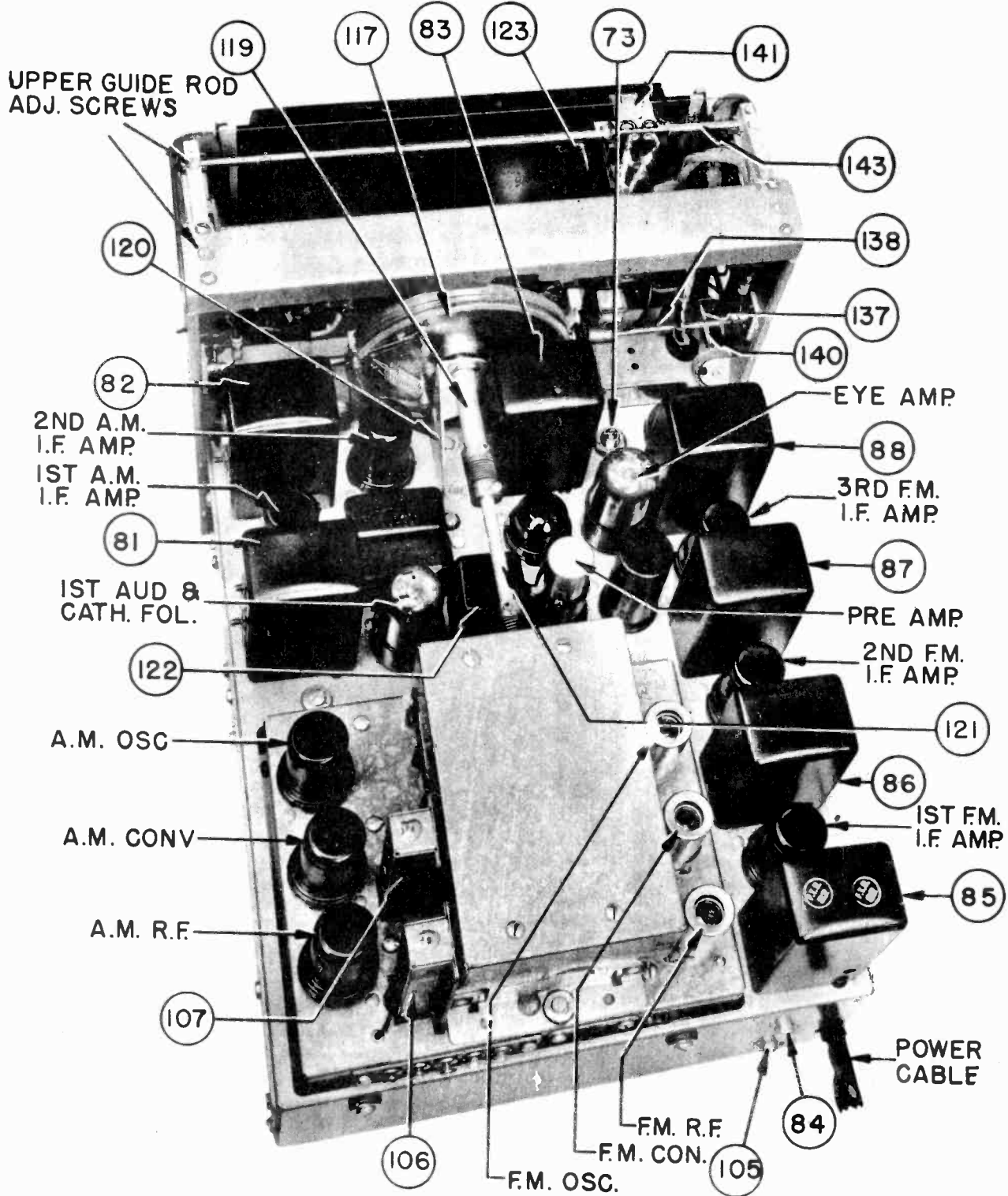
F—DEPENDS ON EYE ALIGNMENT O—10M.
DC VOLTS MEASURED WITH VACUUM TUBE VOLTMETER.
AC VOLTS MEASURED WITH METER HAVING 1000 OHMS PER VOLT.
AVC INOPERATIVE—3 VOLT BIAS SUBSTITUTED—NO SIGNAL.

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MODELS CAPEHART,
PANAMUSE N SERIES



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MAINTENANCE OF THE TUNER

SECTION 11

This section of the Maintenance Manual is purposed, in part, to acquaint the service man with the chronological status of the tuner. The automobile industry effects certain minor modifications to their product from time to time. In like manner, circuit developments, the result of a continuous program of searching for means of improving the instrument, lead to the incorporation of modifications as enumerated below.

In addition, herein are presented the solutions to maintenance problems which the service man may encounter, which solutions will assist him in the efficient servicing of the N-series tuner. The material is listed by subject headings which will quickly permit access to the information:

1. Capehart N-series tuner code markings.
2. High hum level.
3. Tone reproduction
 - a. Increasing the high frequency response.
 - b. Increasing the bass response.
 - c. Increasing the range of the treble control.
 - d. Tone reproduction—model 413N and NC
3. Tone reproduction—general.
 - a. Increasing the high frequency response.
 - b. Increasing the bass response.
 - c. Increasing the range of the treble control.
 - d. Tone reproduction—model 413N and NC instruments.
4. Dial drive adjustments.
5. Control knobs; eccentric, loose, how to remove.
6. Dial-glass plate.
7. Microphonics.

1. CAPEHART N SERIES TUNER CODE MARKINGS

Certain "N" series receivers are coded by "circle markings" to indicate electrical circuit modifications. These markings are located on top of the first FM IF transformer (BLACK PAINTED CAN ON REAR OF CHASSIS TO THE EXTREME RIGHT WHEN VIEWING REAR OF CHASSIS) and are in the form of red circles approximately one-half inch in diameter enclosing the initials F.T.R. and tester's number.

Following is a listing of the significance of these markings, whereby you may identify any chassis:

A. NO CODE MARKS

These tuners do not incorporate any of the modifications which are below-listed.

B. ONE CIRCLE

Indicates the change to a modified discriminator transformer in production which increases sensitivity and noise reduction.

(a) De-Emphasis Condenser

For tuners coming under classifications (A) and (B) above, we recommend the addition of a .001 mfd. de-emphasis condenser. In FM transmission, the high modulation frequencies are pre-emphasized (their

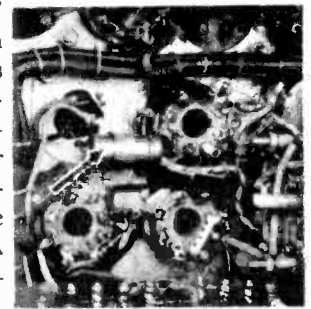


amplitude made greater). Heretofore, non-uniformity between stations caused some to evidence, in the receiver, apparent distortion—too much high-frequency response. Now, with greater uniformity in pre-emphasis, we can arrive at a more suitable overall amount of de-emphasis.

The de-emphasis condenser should be connected from the band switch side of the 47,000 ohm resistor which connects from the output of the discriminator to the auxiliary band switch, being mounted on the front wafer of the auxiliary band switch. Connection is made from the above-mentioned point to ground.

(b) Tuning Eye Time Constant

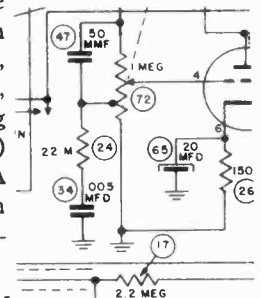
The action of the "eye" may be slowed-down by a longer time constant in its control circuit. This is accomplished by substituting a .1 mfd. condenser for the .01 mfd. unit connecting from pin #4 of the eye amplifier to ground. A 200 volt condenser is satisfactory.



(a) and (b) are not essential unless the customer desires a change but if the tuner is being serviced, it is suggested that these easily-performed modifications be made.

C. TWO OR THREE CIRCLES

(a) These chassis may have resistor-capacitor values, from volume control tap to ground, of 220,000 ohms and .003 mfd., in which case the bass-boosting effects (at low volume levels) of the tap are not great. A .005 condenser and 22,000 ohm resistor will increase the bass-boost effects.



(b) These circles also indicate a change in the connection of the 50 mfd. condenser associated with the single volume control circuit. Connection is changed from (1) between top of control and moving arm to (2) between top of control and fixed tap. This increases the bass response of the tuner at low volume levels.

D. FOUR CIRCLES—Tuners with 4 circles contain the above modifications.

E. ONE SQUARE—This signifies the tuner which incorporates a dual volume control as shown on the schematic, page 12. It also embodies all of the modifications listed in this portion of the manual.

2. HIGH HUM LEVEL

a. With external jumper, connect the 2 chassis together to check the ground connection in the audio cable.

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PANAMUSE N SERIES

b. Many tubes recently produced have heaters contaminated with the Barium-Strontium oxide emissive material, causing emission from heater to cathode if the cathode is positive with respect to the heater. This is a condition over which we have no control and we may only

(a) Substitute 6J5 or/and 6L6 tubes until those which have no such contamination are found or (b) Place the heaters at a positive potential with respect to cathode by:

1. Remove 6J5 (also 6L6 in N-2) heaters from ground. Also remove power transformer heater winding from ground.

2. Re-wire that side of the heater supply, using pin #6 (which is empty) as tie-down points, leaving both sides of the heater off ground.

3. Connect a 220,000 ohm and a 22,000 ohm resistor, in series, from +B to ground, the 22,000 ohm unit being placed at the ground end of the combination.

4. Connect the junction of the resistors to whichever side of the heaters results in the least hum.

This divider network places an approximate positive 30 volt potential upon the heaters.

All tuners in current production incorporate this feature.

3. TONE REPRODUCTION

The tonal reproduction of radio-combination instruments is occasionally commented upon by customers to be not in agreement with their personal preferences.

The human ear and the appreciation of musical rendition is a variable requiring some lee-way in tonal reproduction—thus tone-control adjustments, "treble" and "bass."

Should the customer desire a modification of the characteristics of his instrument, certain circuit re-arrangements may be made to effect the desired change. It is not recommended that such changes be done to sets whose tonal characteristics fulfill the individual's personal preferences.

Below are listed means of effecting a change in the receiver to accomplish increased high or low-frequency response and greater control-range of the treble control.

A. Increasing the high-frequency response.
If the instrument appears to lack high-frequency response

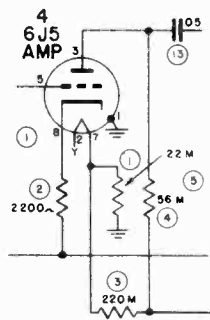
(a) Check the value of the capacitor in the pick up equalizer circuit. This component is mounted in the small shield can directly under the coupling shaft to the variable condenser. It should have a value of .0001 mfd. shunted with a 1.5 megohm resistor.

B. Increasing the Bass Response

(a) The resistor-capacitor combinations of part 1C should be checked.

C. Increasing Range of Treble Control

If comments are received regarding insufficient maximum treble control, the effect of this control may be increased as follows:



(a) Remove the shielded lead from terminal #5, also remove bus wire jumper between terminals 1 and 5 of the 6SN7GT first audio tube.

(b) Connect the shielded lead to pin #1 and install a 22,000 ohm half-watt resistor between pins 1 and 5. This makes each step of the treble control more pronounced and aids in minimizing record surface noise.

NOTE: Tuners "code marked" 3 or 4 circles incorporate this modification.

D. Tone Reproduction Model -413N and NC Instruments

The changes listed below are for purposes of rendering the reproduction more in keeping with the average ear and the personal preference of the listener. They are over-and-above the previous modifications and should be applied, if the 413N instrument is to be modified, after the pertinent previous changes have been made.

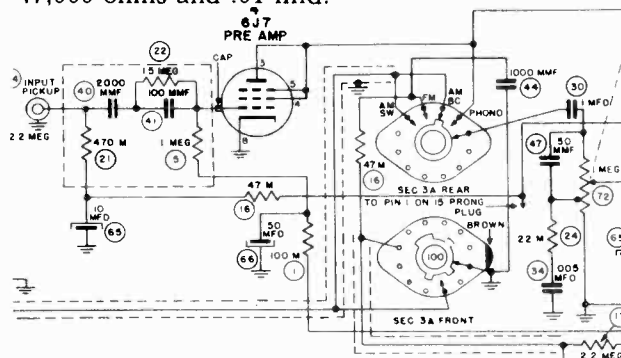
This applies to chassis with a 2, 3 or 4 code mark now in the field.

1. Change the grid resistor of the 6J7 phono preamp tube from 1 megohm to 470,000 ohms.

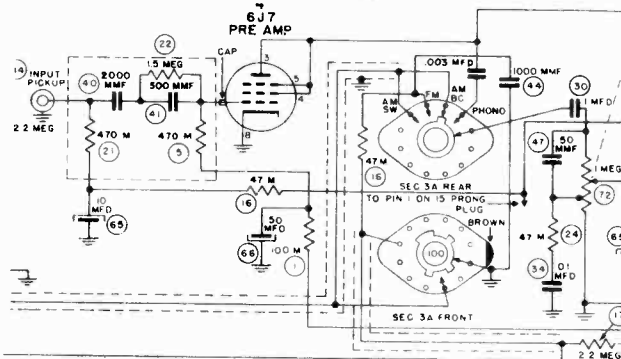
2. Change the condenser in series with the 6J7 preamp tube grid from 100 mfd. to 500 mfd. This is the condenser which has a 1.5 megohm resistor in shunt with it. This resistor should remain in the circuit.

3. Insert a .003 mfd. mica condenser in the connection between the plate of the 6J7 preamp tube and the band switch.

4. Change the series resistor-capacitor connected from volume control tap to ground, to 47,000 ohms and .01 mfd.



Early production of the "N" Series tuner



Modifications of Section D, above (413N and NC instruments only)

FARNSWORTH TELEV. & RADIO CORP. MODELS CAPEHART, PANAMUSE N SERIES

We pass on to you below the solution to several service problems which have been experienced in the field, anticipating that they may effect a saving of time and more efficient servicing on your part.

4. "N" TUNER—DIAL DRIVE ADJUSTMENTS

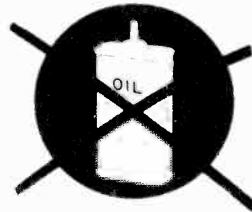
If dial slippage is experienced:

A. Clutch slipping. Tighten the drive clutch as tight as possible.

B. "Sticking" light boxes. The traveling light box may be sticking, causing dial slippage. This may be due to (a) lubricant on rods, (b) bent rods, (c) rough rods, (d) misalignment of rods.

(a) *The rods must be free of all lubricants.*

Lubrication, momentarily helpful, causes gum to form at the light-box mounting, resulting in "sticking." Clean well with carbon tetrachloride.



(b) Bent rods must be accurately straightened or replaced.

(c) Rough portions of the rod surface should be cleaned with crocus cloth until perfectly smooth.

C. Old type of endless belt. If this belt has stretched, the newer-type may be installed by:

(a) Remove the center mounting bolt for the center resistor strip toward the FM IF section of the receiver.

(b) Remove band switch rod. Remove the program switch and lay back out of the way. (No wires need be disconnected.)

(c) Remove all parts of the idler pulley assembly and discard.

(d) Replace the drive pulley and split-gear assembly with the later type which is similar to the old type but has wider belt groove. Be sure that there is some tension on the split gear springs to avoid backlash.

(e) Remove the upper dial bracket to allow free access to the drive down.

(f) With a small rat tail file, file down the square shoulder on the drive drum at the cable cross over point. This is done to allow more space for the 2 ends of the drive cable to cross without binding. Also, dress down the ends of the drive cable channels.

(g) Install new drive cable, winding 1½ turns about the drive pulley.

(h) In reinstalling program switch, be sure that it is properly indexed with band switch.

5. DIAL GLASS PLATE

Paint scratched. This is due to the light-box assembly contacting the painted surface. Adjust the horizontal positioning of the light box for optical focus of the projected line of light, so that (1) focus is maintained throughout the entire path of travel, (2) front of light-box assembly does not at any point touch the scale. The clamps which

hold the glass rod in place may be clipped back if necessary.

Touch-up paint may be obtained at automobile service stations.

6. CONTROL KNOBS—ECCENTRIC— LOOSE—HOW TO REMOVE

A. *Knobs eccentric (wobbly motion) or loose.*

This is caused by pinching together the 2 halves of the split-shaft end. One half-section becomes bent toward the axis of the shaft to a greater degree than does the other. Re-form the split portions of the shaft so that they are symmetrical with respect to the axis of the shaft.

B. *To Remove Control Knobs*

Loop a heavy cord behind the knob, bringing out the two ends at opposite sides of the knob. Pull both ends firmly. If the cord (both ends) is brought out on one side only, there will be a tendency to cause the difficulty of 6A, above.

7. MICROPHONICS AND FEEDBACK

A. Microphonic tubes.

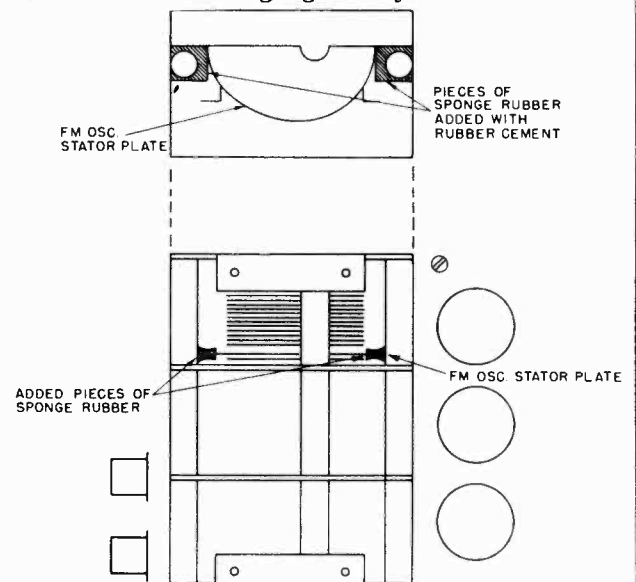
B. Check the variable condenser stator plates to ascertain whether they are loose. If so, apply a colloidal cement to the clamp which holds the stator plates to the insulating material.

C. "Twin lead" to antenna binding posts may be stapled to cabinet in taunt condition, whereby feedback is introduced mechanically. Re-staple the twin lead, leaving somewhat free and loose.

D. On FM microphonics and howl may be caused by the lead from stator plate to sub-chassis assembly being taunt. Re-solder with less tension in the flat ribbon lead.

NOTE: Oscillator trimmer may have to be re-adjusted.

E. If howl on the FM position persists, the following may alleviate the condition: Sponge rubber bits added as shown in sketch. Rubbers must be trimmed so that they will not touch rotor plates when the condenser gang is fully-meshed.



REMOTE SPEAKER INSTALLATIONS

SECTION 12

No provision has been made, in the design of the instrument, for the use of one or more extension speakers.

In the event that a customer desires a remote-speaker installation, we do not recommend that another speaker be connected either in series or in parallel with the cabinet speaker unit. Such an installation may be had by the use of an added amplifier unit which may be connected, in parallel with the cabinet amplifier, across the output of the tuner.

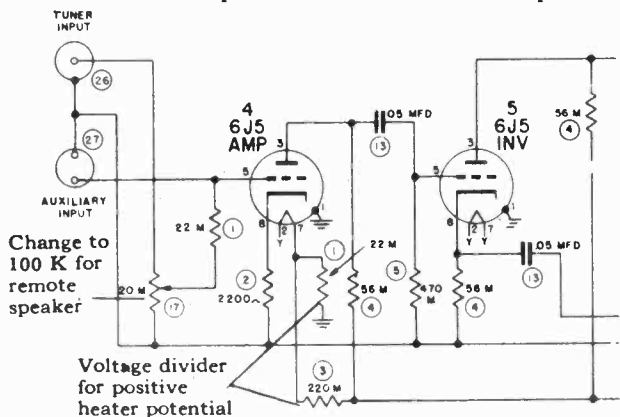
The added amplifier must have its original gain control, a 20,000 ohm unit, replaced by a control of 100,000 ohms. Connection may then be made, through a shielded lead of the low-capacity type, into the extra input jack on the cabinet amplifier chassis. Should it be so desired, the 100,000 ohm auxiliary amplifier gain control may be remotely-connected, for ready accessibility, to its amplifier circuit by individually-shielded leads of the low-capacity type. No shielding is necessary over the wires which connect amplifier to speaker.

If the remotely-located speaker installation is to display characteristics identical to those of the cabinet speaker-amplifier, the remote components must be identical to those of the cabinet; an N-1 amplifier and #81143 speaker for 400N-series instruments, an N-2 amplifier and #81152 speaker for 100N-series instruments. Proper speaker enclosures must be provided. The #81166 speaker

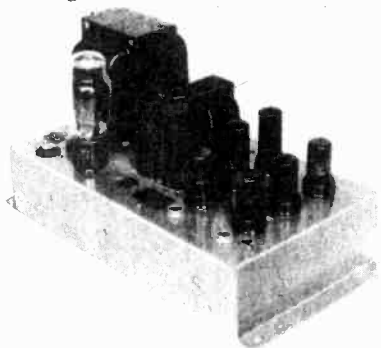
housing should be constructed of at least 1-inch plywood, wholly enclosed, lined with an acoustic absorbent such as hair-felt. Its volume is not less than $2\frac{1}{2}$, nor more than 4 cubic feet.

Should slightly lesser fidelity be permissible in the remote speaker at reduced cost, an N-3 amplifier may be employed as driver unit for the remote speaker. This amplifier provides an output power of 12 watts in an impedance of 8 ohms for driving the #81152 or #81149 speaker.

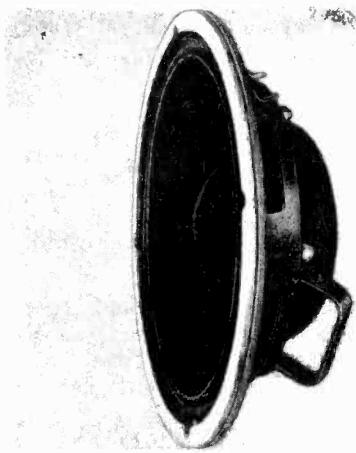
Enclosure for the 12" and 15" speakers, #81149 and 81152 respectively is after the usual fashion for cone-type speakers—it is not to be fully enclosed as is the #81143 unit.



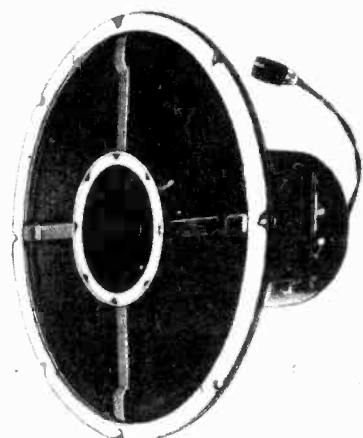
Circuit change necessary to the remote-speaker amplifier.



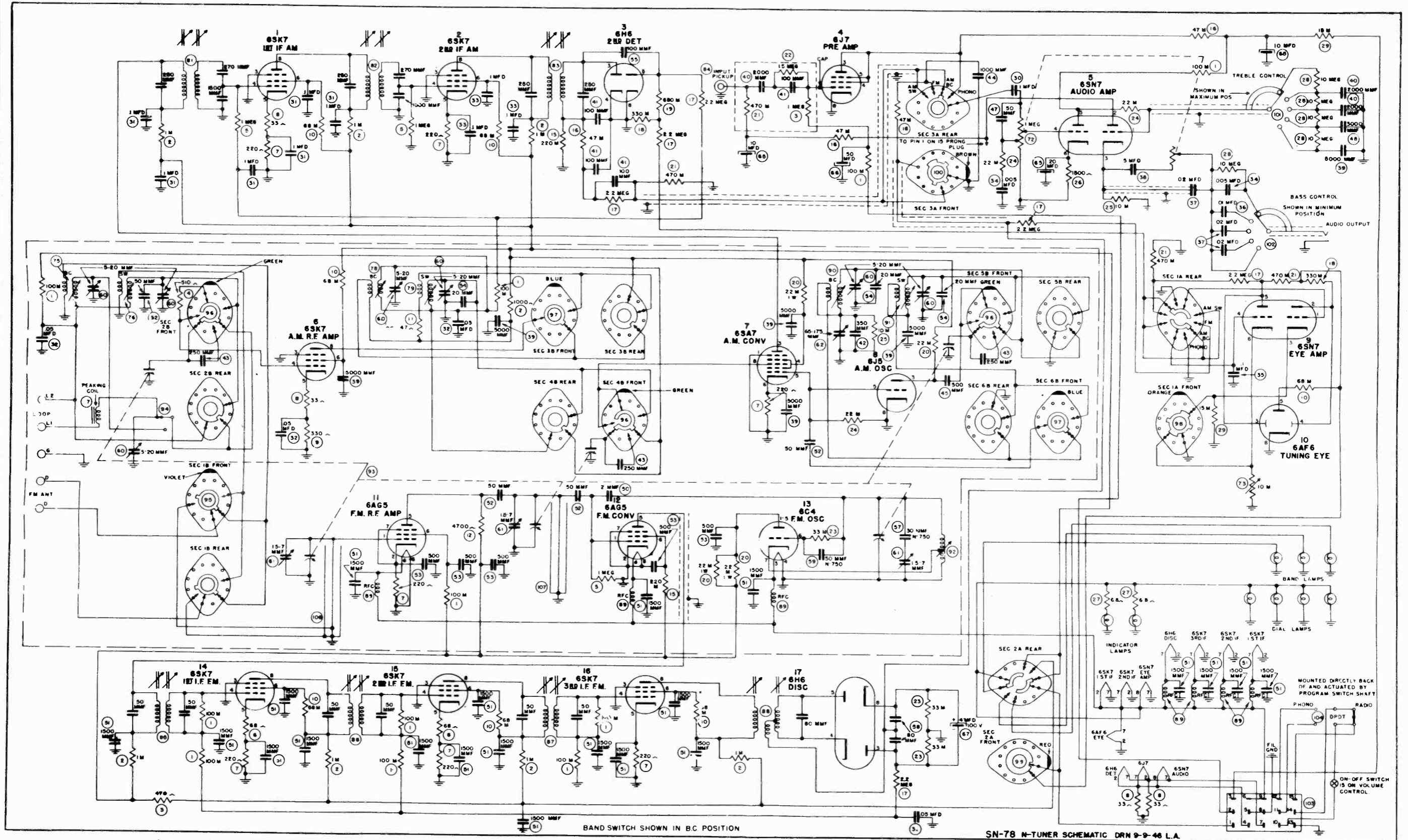
N3 amplifier giving 12 watts power output in 8 ohms.



No. 81166 speaker used in 400N model instruments, to be used with the N1 amplifiers. 4 ohms impedance.



No. 81152 (15"), No. 81149 (12") speakers for use with N2 or N3 amplifiers. 8 ohms impedance.



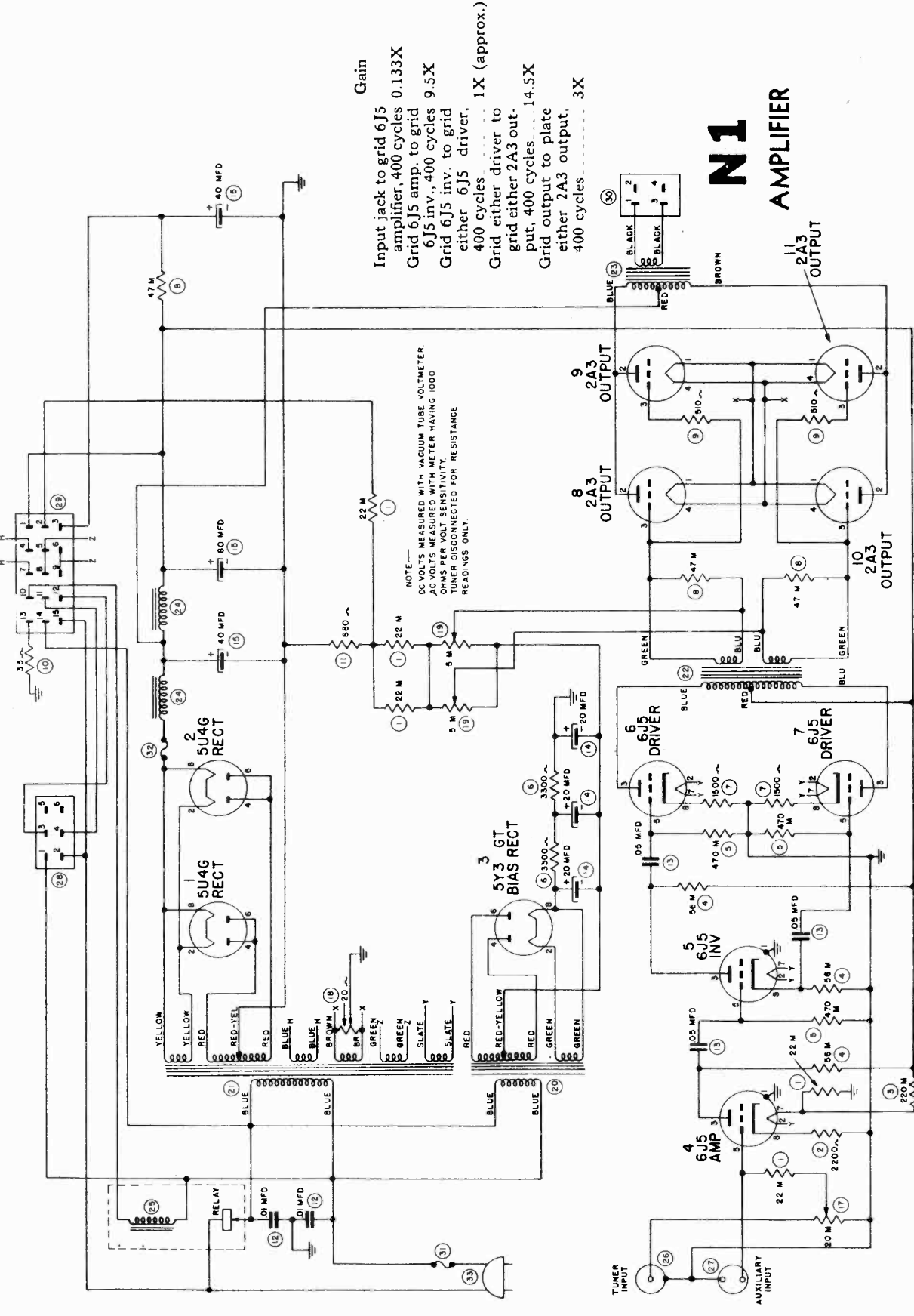
SCHMATIC 400N TUNER

Stage	Frequency	Gain
Ant to Grid RF tube	600 KC	2.5X
Grid RF tube to grid conv. tube	600 KC	11.5X
Grid conv. tube to grid 1st IF tube	455 KC	4.8X
Grid 1st IF tube to grid 2nd IF tube	455 KC	18X

Stage	Frequency	Gain
Grid 2nd IF tube to Det. plate	455 KC	55X
Det. plate to grid 1st audio	400 cycles	0.385X
Grid 1st audio to tuner output jack	400 cycles	13X

SN-78 N-TUNER SCHEMATIC DRN 9-9-46 L.A.

VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE
1.35 AC	1.0	2.66 AC	1.0	5.10 AC	1.0	11.0	1.0
1.35 DC	1.0	2.66 DC	1.0	5.10 DC	1.0	11.0	1.0
1.35 AC	2.2	2.66 AC	2.2	5.10 AC	2.2	11.0	2.2
1.35 DC	2.2	2.66 DC	2.2	5.10 DC	2.2	11.0	2.2
1.35 AC	4.4	2.66 AC	4.4	5.10 AC	4.4	11.0	4.4
1.35 DC	4.4	2.66 DC	4.4	5.10 DC	4.4	11.0	4.4
1.35 AC	8.8	2.66 AC	8.8	5.10 AC	8.8	11.0	8.8
1.35 DC	8.8	2.66 DC	8.8	5.10 DC	8.8	11.0	8.8
2.35 AC	1.0	4.70 AC	1.0	9.40 AC	1.0	22.0	1.0
2.35 DC	1.0	4.70 DC	1.0	9.40 DC	1.0	22.0	1.0
2.35 AC	2.2	4.70 AC	2.2	9.40 AC	2.2	22.0	2.2
2.35 DC	2.2	4.70 DC	2.2	9.40 DC	2.2	22.0	2.2
2.35 AC	4.4	4.70 AC	4.4	9.40 AC	4.4	22.0	4.4
2.35 DC	4.4	4.70 DC	4.4	9.40 DC	4.4	22.0	4.4
2.35 AC	8.8	4.70 AC	8.8	9.40 AC	8.8	22.0	8.8
2.35 DC	8.8	4.70 DC	8.8	9.40 DC	8.8	22.0	8.8
4.70 AC	1.0	9.40 AC	1.0	18.80 AC	1.0	44.0	1.0
4.70 DC	1.0	9.40 DC	1.0	18.80 DC	1.0	44.0	1.0
4.70 AC	2.2	9.40 AC	2.2	18.80 AC	2.2	44.0	2.2
4.70 DC	2.2	9.40 DC	2.2	18.80 DC	2.2	44.0	2.2
4.70 AC	4.4	9.40 AC	4.4	18.80 AC	4.4	44.0	4.4
4.70 DC	4.4	9.40 DC	4.4	18.80 DC	4.4	44.0	4.4
4.70 AC	8.8	9.40 AC	8.8	18.80 AC	8.8	44.0	8.8
4.70 DC	8.8	9.40 DC	8.8	18.80 DC	8.8	44.0	8.8
9.40 AC	1.0	18.80 AC	1.0	37.60 AC	1.0	88.0	1.0
9.40 DC	1.0	18.80 DC	1.0	37.60 DC	1.0	88.0	1.0
9.40 AC	2.2	18.80 AC	2.2	37.60 AC	2.2	88.0	2.2
9.40 DC	2.2	18.80 DC	2.2	37.60 DC	2.2	88.0	2.2
9.40 AC	4.4	18.80 AC	4.4	37.60 AC	4.4	88.0	4.4
9.40 DC	4.4	18.80 DC	4.4	37.60 DC	4.4	88.0	4.4
9.40 AC	8.8	18.80 AC	8.8	37.60 AC	8.8	88.0	8.8
9.40 DC	8.8	18.80 DC	8.8	37.60 DC	8.8	88.0	8.8

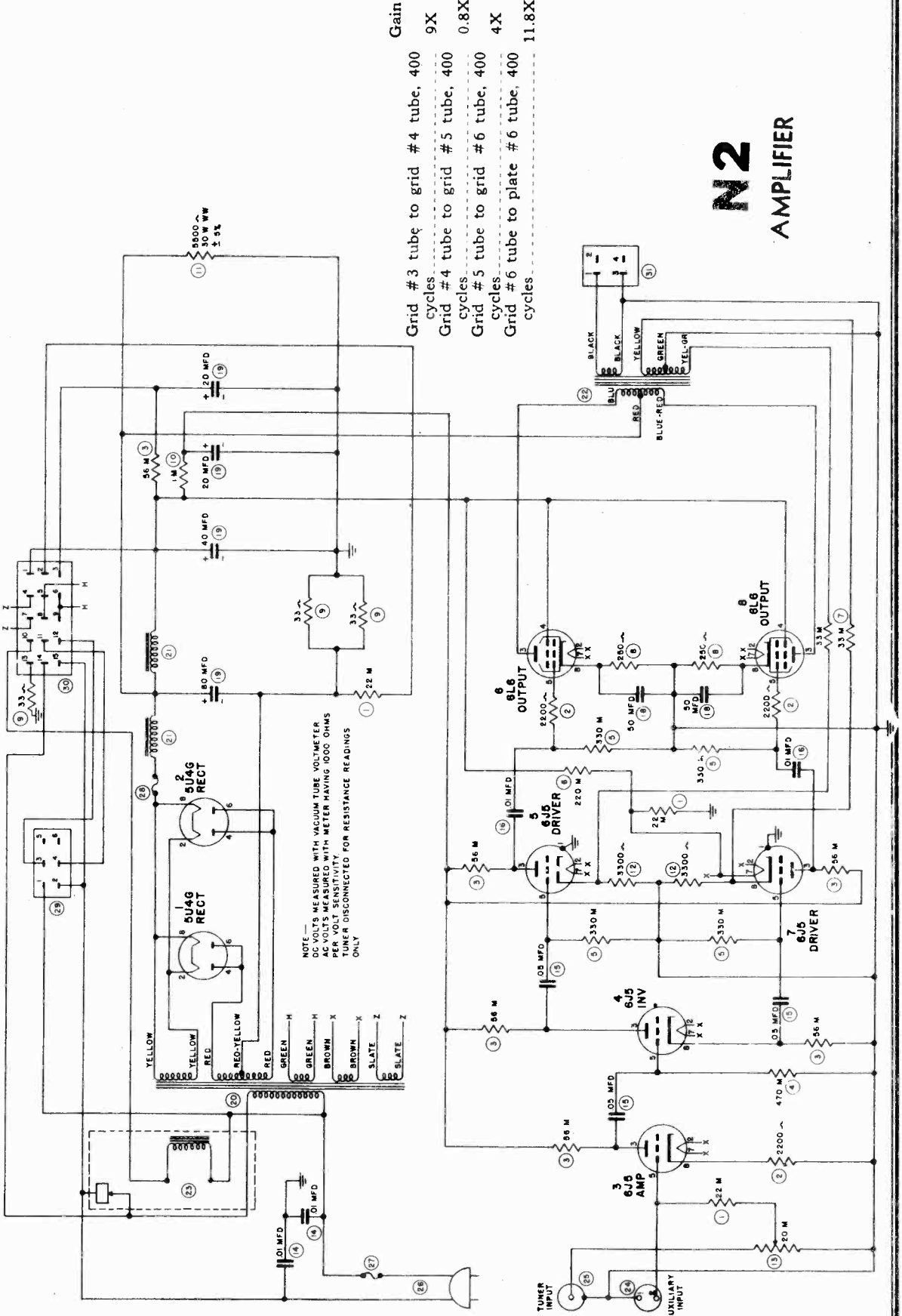


Gain
 Input jack to grid 6J5 amplifier, 400 cycles 0.133X
 Grid 6J5 amp. to grid 6J5 inv., 400 cycles 9.5X
 Grid 6J5 inv. to grid either 6J5 driver, 400 cycles 1X (approx.)
 Grid either driver to grid either 2A3 output, 400 cycles 14.5X
 Grid output to plate either 2A3 output, 400 cycles 3X

N1 AMPLIFIER

NOTE—
 DC VOLTS MEASURED WITH VACUUM TUBE VOLTMETER.
 AC VOLTS MEASURED WITH METER HAVING 1000 OHMS PER VOLT SENSITIVITY.
 TUNER DISCONNECTED FOR RESISTANCE READINGS ONLY.

VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE
1 NC	1.0	2 NC	1.0	3 NC	1.0	4 NC	1.0
1 DC	1.0	2 DC	1.0	3 DC	1.0	4 DC	1.0
1 AC	2.2	2 AC	2.2	3 AC	2.2	4 AC	2.2
1 DC	2.2	2 DC	2.2	3 DC	2.2	4 DC	2.2
1 AC	4.4	2 AC	4.4	3 AC	4.4	4 AC	4.4
1 DC	4.4	2 DC	4.4	3 DC	4.4	4 DC	4.4
1 AC	8.8	2 AC	8.8	3 AC	8.8	4 AC	8.8
1 DC	8.8	2 DC	8.8	3 DC	8.8	4 DC	8.8
2 NC	1.0	3 NC	1.0	4 NC	1.0	5 NC	1.0
2 DC	1.0	3 DC	1.0	4 DC	1.0	5 DC	1.0
2 AC	2.2	3 AC	2.2	4 AC	2.2	5 AC	2.2
2 DC	2.2	3 DC	2.2	4 DC	2.2	5 DC	2.2
2 AC	4.4	3 AC	4.4	4 AC	4.4	5 AC	4.4
2 DC	4.4	3 DC	4.4	4 DC	4.4	5 DC	4.4
2 AC	8.8	3 AC	8.8	4 AC	8.8	5 AC	8.8
2 DC	8.8	3 DC	8.8	4 DC	8.8	5 DC	8.8



Gain
 Grid #3 tube to grid #4 tube, 400 cycles 9X
 Grid #4 tube to grid #5 tube, 400 cycles 0.8X
 Grid #5 tube to grid #6 tube, 400 cycles 4X
 Grid #6 tube to plate #6 tube, 400 cycles 11.8X

N2 AMPLIFIER

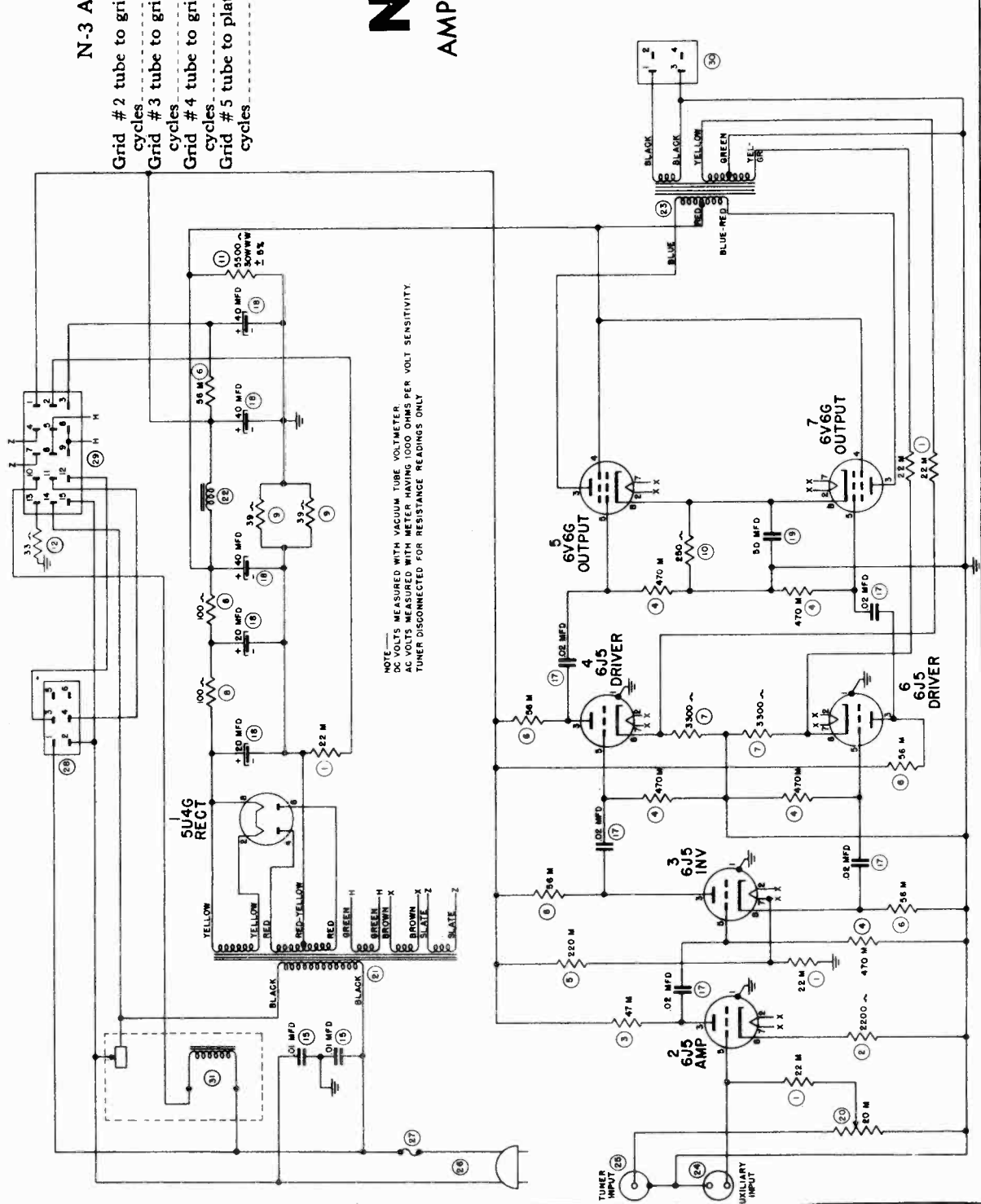
NOTE—
 DC VOLTS MEASURED WITH VACUUM TUBE VOLTMETER.
 AC VOLTS MEASURED WITH METER HAVING 1000 OHMS PER VOLT SENSITIVITY.
 TUNER DISCONNECTED FOR RESISTANCE READINGS ONLY.

FARNSWORTH TELEV. & RADIO CORP. MODELS CAPEHART,
PANAMUSE N SERIES

N-3 Amplifier
 Gain
 Grid #2 tube to grid #3 tube, 400 9X
 Grid #3 tube to grid #4 tube, 400 0.8X
 Grid #4 tube to grid #5 tube, 400 4X
 Grid #5 tube to plate #5 tube, 400 11X

N3
AMPLIFIER

VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE
1 NC	2 420	1 0	2 0	1 0	2 0	1 0	2 0	1 0	2 0	1 NC	2 6.6 AC
2 NC	3 180	2 0	3 185	2 0	3 185	2 0	3 185	2 0	3 185	2 2.2	3 350
3 NC	4 370 AC	3 0	4 NC	3 0	4 NC	3 0	4 NC	3 0	4 NC	3 6 M	4 6 M
4 NC	5 500 AC	4 NC	5 NC	4 NC	5 NC	4 NC	5 NC	4 NC	5 NC	5 360	5 360
5 NC	6 500 AC	5 0	6 NC	5 0	6 NC	5 0	6 NC	5 0	6 NC	5 470 M	5 470 M
6 NC	7 5.2 AC	6 0	7 2.5	6 0	7 2.5	6 0	7 2.5	6 0	7 2.5	6 NC	7 0
7 NC	8 420	7 0	8 2200	7 0	8 2200	7 0	8 2200	7 0	8 2200	7 0	8 2200
		8 7	8 56 M	8 7	8 3300	8 7	8 3300	8 7	8 3300	8 21	8 250



NOTE—VOLTS MEASURED WITH VACUUM TUBE VOLTMETER.
 AC VOLTS MEASURED WITH METER HAVING 1000 OHMS PER VOLT SENSITIVITY.
 TUNER DISCONNECTED FOR RESISTANCE READINGS ONLY.

PARTS LIST—400N, 100N SERIES INSTRUMENTS

MODEL N TUNER AND AMPLIFIER PARTS AND PRICE LIST

Ref. Part No.	Part No.	Description	SECTION 14	Ref. Part No.	Part No.	Description
1	77214	100M Ohms		85	38655	1st FM IF Transformer
2	77262	1000 Ohms		86	38655	2nd FM IF Transformer
3	77333	470 Ohms, 1 Watt		87	38655	3rd FM IF Transformer
4	77353	510 Ohms		88	38803	4th FM IF Transformer
5	77218	1 Megohm		89	38661	R. F. Choke
6	77269	68 Ohms		90	09304	BC Oscillator Coil
7	77209	220 Ohms		91	09305	SW Oscillator Coil
8	77257	33 Ohms		92	38752	FM Oscillator Coil
9	77260	330 Ohms		93	26230	Gang Condenser
10	77305	68M Ohms		94	90201	Antenna Loop Selector Switch
11	77208	47 Ohms		95	90206	Antenna Band Switch Wafer
12	77211	4700 Ohms		96	90203	Band Switch Wafer (Osc., Conv. and R. F. Grid)
15	77216	220M Ohms		97	90204	Band Switch Wafer (Osc. and R. F. Plate)
16	77213	47M Ohms		98	90208	Aux. Band Switch Tuning Eye Wafer
17	77270	2.2 Megohms		99	90210	Aux. Band Switch B-plus Wafer
18	77268	330M Ohms		100	90209	Aux. Band Switch Audio Wafer
19	77335	680M Ohms		101	78114	Treble Control
20	77069	22M Ohms, 1 Watt		102	78114	Bass Control
21	77217	470M Ohms		103	22149	Tuner and Amplifier Connecting Cable and Connector
22	77351	1.5 Megohm		104	90219	Phono-radio Switch
23	77267	33M Ohms		105	80030	Audio Output Jack
24	77266	22M Ohms		106		FM Antenna R. L. Line (for reference only, not stocked)
25	77212	10M Ohms		107		FM Converter R. F. Line (for reference only, not stocked)
26	77263	1500 Ohms		110	90211	Single Element Volume Control
27	77095	6.8 Ohms		111	55192	Band Switch Shaft and Detent assembly
28	77274	10 Megohms		112	11277	Band Switch Connecting Shaft
29	77265	15M Ohms		113	07455	Flexible Coupling Assembly
30	25309	.1 Mfd. Oil Paper Capacitor, 600 Vclt		114	55183	Split Gear and Pulley Assembly
31	25287	Capacitor 3 x .1 Mfd., 600 Volt		115	55158	Aux. Band Switch Connecting Rod
32	25080	.05 Mfd. Tubular Capacitor, 200 Volt		116	55159	Small Pinion Gear (Band Switch Drive)
33	25286	3 x .1 Capacitor, 600 Volt		117	15159	Pinion Gear, Tuning Shaft
34	25306	.005 Tubular Capacitor, 100 Volt		118	58348	Tuning Drum, and Shaft Assembly
35	25182	.1 Tubular Capacitor, 200 Volt		119	55174	Arm for Aux. Band Switch
36	25305	.01 Tubular Capacitor, 100 Volt		120	58326	Tuning Drive Bushing
37	25304	.02 Tubular Capacitor, 100 Volt		121	55191	Mtg. Bracket for Tuning Drum
38	25118	.5 Mfd., 100 Volts		122	13565	Connecting Shaft (tuning drive)
39	25298	5000 mmf. Silver Mica		123	13732	Pre Amplifier Phono Input Assembly (100N and 413N)
40	25295	2000 mmf. Mica		124	59332	Dial Light Box Assembly (100N and 413N)
41	25188	100 mmf. Mica		125	04026	Dial Cord Pulley
42	25331	350 mmf. Silver Mica		126	59439	Dial Light Shield Finishing Assembly (100N and 413N)
43	25069	250 mmf. Silver Mica		127	13730	Plastic Background (left)
44	25053	1000 mmf. Mica		128	07453	Plastic Pointer Crank and Clip Assembly
45	25307	500 mmf. Silver Mica		129	58350	Bass and Volume Control Pointer Assembly
47	25290	50 mmf. Ceramic		130	62134	Eye Tube Support Plate (100N)
48	25051	3000 mmf. Mica		131	15168	Rubber Tube for Eye Tube
50	25289	2 mmf. Ceramic		132	07450	Phono Switch Shaft and Lever Assembly
51	25273	1500 mmf. Hi-"K" Ceramic		133	59438	Treble and Band Switch Pointer Assembly
52	25290	50 mmf. Ceramic		134	31326	Plastic Background (right)
53	25293	500 mmf. Silver Button Mica Capacitor		135	36501	Dial Scale (100N and 413N)
54	25303	20 mmf. Ceramic		136	55160	"C" Washer (order # 41089 "C" washer kit of 12 washers @ .40)
55	25145	100 mmf. Ceramic		137	64382	Tuning Shaft
57	25329	30 mmf. Ceramic		138	55118	Compression Spring
58	25406	80 mmf. Ceramic		139	13731	Bottom Guide Bar (100N and 413N)
59	25375	50 mmf. Ceramic N750		140	2000-071	Plastic Pointer Pinion and Clip Assembly
60	26231	5-20 mmf. Ceramic Trimmer		141	2012-101	#3-48 x 1" lg. R.H.M.S. (lower guide rod adj. screw)
61	25221	1.5-7 mmf. Ceramic Trimmer				Dial Pointer Calibration Adj. Screw
62	26111	65-175 mmf. Padder				
65	25050	10 Mfd., 10 Mfd. 450 Volts; 20 Mfd. 25 Volts Electrolytic				
66	25313	50 Mfd. 25 Volt Electrolytic				
67	25270	4 Mfd. 100 Volt Electrolytic				
72	78147	Dual Volume Control				
73	78111	10M Ohm Potentiometer (tuning eye balance)				
75	09308	BC Antenna Coil				
76	09309	SW Antenna Coil				
77	38705	Loop Loading Coil				
78	09306	BC Converter Coil				
79	09307	SW Converter Coil				
81	38653	1st AM IF Transformer				
82	38653	2nd AM IF Transformer				
83	38654	3rd AM IF Transformer				
84	80030	Phono Input Jack				

FARNSWORTH TELEV. & RADIO CORP. MODELS CAPEHART,
PANAMUSE N SERIES

Ref. No.	Part No.	Description	Part No.	Ref. No.	Description
142	90207	Aux. Band Switch Frame	2041-141	2041-141	± 8-32 x 1/8" lg. Allen Cup Pt. Set Screw
143	55119	Upper Guide Rod	2041-143	2041-143	± 8-32 x 1/4" lg. Allen Cup Pt. Set Screw
	07456	Dial Drive Cord		2041-147	± 8-32 x 1/2" lg. Allen Cup Pt. Set Screw
	07629	Drive Cord Assembly		04027	Dial Light Shield Finishing Assembly
	07623	Light Box Roller Bracket Assembly		07481	Dial Drive Cord
	55190	Stud for Dial Drive Cord Pulley		13733	Dial Light Box Assembly
	54141	Glass Rod Station Pointer		13734	Preamplifier phono input assembly
	54161	Spacer, Ceramic Trimmer Mtg.		31331	Dial Scale
	58282	Mtg. Bracket for Glass Rod		55119	Guide Rod
	58335	Miniature Tube Shield		55228	Adjustable Guide Bar
	64392	Hair Pin Retainer Spring, Cord Pulley		58282	Glass Rod Station Pointer Strap
	80319	Miniature Tube Socket		58441	Eye Tube Support
	2000-115	± 4-40 x 5/8 lg. R.H.M.S.			
	2022-023	Pin for Pinion Gear			

N1 AMPLIFIER PARTS

1	77266	22M Ohms	19	78116	5M Ohm Potentiometer
2	77264	2200 Ohms	20	94203	Bias Power Transformer
3	77216	220M Ohms	21	94124	Power Transformer
4	77329	56M Ohms	22	94202	Audio Drive Transformer
5	77217	470M Ohms	23	94157	Output Transformer
6	77210	3300 Ohms	24	94161	Filter Choke
7	77263	1500 Ohms	25	90215	Relay (power line control)
8	77213	47M Ohms	26	80334	Tuner Input Connector
9	77353	510 Ohms	27	80364	Auxiliary Input Connector
10	77257	33 Ohms	28	80331	6-pin Jones Connector
11	77336	680 Ohms	29	80089	15-pin Jones Connector
12	25209	.01 Mfd., 600 Volt	30	80332	4-pin Jones Connector
13	25134	.05 Mfd., 600 Volt	31	48006	5 Ampere Fuse
14	25315	20 Mfd., 20 Mfd., 20 Mfd., 250 Volts	32	48015	1 Ampere Delayed Action Fuse
15	25297	20 Mfd., 20 Mfd., 20 Mfd., 20 Mfd., 450 Volts	33	80336	Male Connector (A.C. line)
17	78122	20M Ohm Potentiometer		80335	Fuse Receptacle
18	78117	20 Ohm Potentiometer		80081	Molded Octal Socket
				80300	Molded Octal Socket (4-prong)

N2 AMPLIFIER PARTS

1	77266	22M Ohms	19	25297	20 Mfd., 20 Mfd., 20 Mfd., 20 Mfd., 450 Volt
2	77264	2200 Ohms	20	94125	Power Transformer
3	77329	56M Ohms	21	94161	Filter Choke
4	77217	470M Ohms	22	94158	Output Transformer
5	77268	330M Ohms	23	90215	Relay (power line control)
6	77216	220M Ohms	24	80334	Tuner Input Connector
7	77267	33M Ohms	25	80364	Auxiliary Input Connector
8	77334	250 Ohms, Wire Wound, 5 Watt	26	80336	A. C. Male Connector
9	77257	33 Ohms	27	48006	5 Amp. Fuse
10	77262	1000 Ohms	28	48015	1 Amp. Delayed Action Fuse
11	77350	5500 Ohms, Wire Wound, 30 Watts	29	80331	6-pin Jones Connector
12	77210	3300 Ohms	30	80089	15-pin Jones Connector
13	78122	20M Ohms Potentiometer	31	80332	4-pin Jones Connector
14	25209	.01 Mfd. (metal cased)		80081	Octal Socket
15	25314	.05 Mfd.		80335	Fuse Receptacle
16	25083	.01 Mfd., 600 Volt			
18	25269	50 Mfd., 25 Volt Electrolytic			

N3 AMPLIFIER PARTS

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
			19	25269	50 Mfd. 25 Volt Electrolytic
1	77266	22M Ohms	20	78122	20M Ohm Potentiometer
2	77264	2200 Ohms	21	94126	Power Transformer
3	77213	47M Ohms	22	94201	Filter Choke
4	77217	470M Ohms	23	94159	Output Transformer
5	77216	220M Ohms	24	80364	Auxiliary Input Connector
6	77239	56M Ohms	25	80334	Tuner Input Connector
7	77210	3300 Ohms	26	80336	Male Connector (A.C.)
8	77341	100 Ohms 10 Watt Wire Wound	27	48006	5 Amp. Fuse
9	77347	39 Ohms	28	80331	6-Pin Jones Plug
10	77334	250 Ohms 5 Watt, Wire Wound	29	80089	15-Pin Jones Plug
11	77350	5500 Ohms, 30 Watt Wire Wound	30	80332	4-Pin Jones Plug
12	77257	33 Ohms	31	90215	Relay (Power Line Control)
15	25209	.01 Mfd. Capacitor 600 Volt (metal cased)		80335	Fuse Receptacle
17	25079	.02 Mfd. Capacitor 600 Volt		80081	Octal Socket
18	25297	20 Mfd., 20 Mfd., 20 Mfd., 20 Mfd., 450 Volt Electrolytic			

MODELS CAPEHART,
PANAMUSE N SERIES

FARNSWORTH TELEV. & RADIO CORP.

CAPEHART CABINET SPECIFICATIONS

SECTION 15

Model No.	Cabinet	Crated Dimensions	Shipping Weight	Model No.	Cabinet	Dimensions Crated	Shipping Weight
414N	Chippendale	45 1/4 x 44 1/2 x 24 1/2	330 lb.	114N2	Early Georgian	42 1/2 x 25 1/2 x 42 1/4	298 lb.
413N	Chippendale	39 3/8 x 45 1/2 x 24 1/2	330 lb.	112N2	George II	42 1/2 x 25 1/2 x 41 3/4	286 lb.
406N	Adam	26 3/4 x 46 x 47	331 lb.	Subtract 1 3/4" for cabinet dimensions.			

PANAMUSE CABINET SPECIFICATIONS

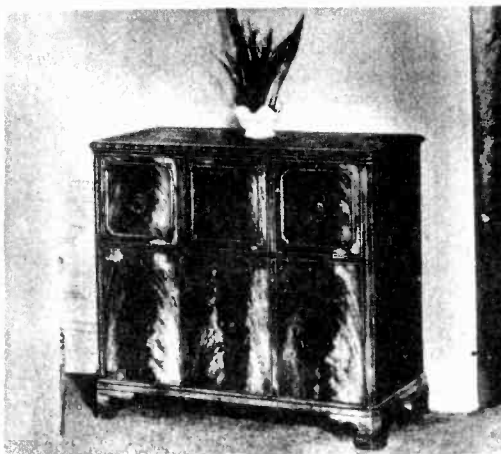
SECTION 15

Model	Cabinet	Crated Dimensions	Shipping Weight	Model	Cabinet	Crated Dimensions	Shipping Weight
19N3	Sheraton	37 1/2 x 38 1/2 x 23 3/4	197 lb.	25N2	Sheraton Upright	40 1/4 x 37 3/4 x 24 1/4	219 lb.
21N2	Chippendale	43 1/2 x 24 1/4 x 39 3/4	300 lb.	26N2	Modern	40 1/2 x 24 x 37 3/4	236 lbs.

Subtract 1 3/4" for cabinet dimensions.



"Sheraton Upright" 25N2



"Chippendale" 21N2

PANAMUSE "N" SERIES CABINET PARTS LIST AND CORRECTION SHEET

Delete the following parts:

- 13219 Basic glides
- 56538 Hinge (Soss type)
- 37376 Lid lift and stay arm mechanism R.H.
- 37374 Lid lift and stay arm mechanism L.H.

Change part number 67485 Hinge concealed type, etc., to part number 37485 Hinge concealed type, etc.

Add the following parts:

- H-255-1 Cabinet and packing (Bisque)
- H-255-2 Cabinet and packing (Cordovan)
- 67459 Bisque phono lid } Order in matched
- 67460 Bisque radio lid } sets only
- 67501 Bisque R.H. speaker door } Order in matched
- 67502 Bisque L.H. speaker door } sets only
- 67553 Cordovan phono lid } Order in matched
- 67554 Cordovan radio lid } sets only
- 67499 Cord. R.H. speaker door } Order in matched
- 67500 Cord. L.H. speaker door } sets only
- 37479 Cabinet glides 3/4" nickel plated (4 req.)
- 37438 Stay arm 13 3/4" phono compartment
- 13188 Lid lift mechanism radio side
- 13189 Lid lift mechanism phono side

25N2

Add:

- 37479 Cabinet glides 3/4" nickel plated (4 req.)
- 37475 Door catch, bullet type (3 req.)

CLARIFICATION OF TUNER PARTS LIST

Part number 07456 Dial drive cord is the pointer drive cord.
Part number 07629 Drive cord assy. is the variable condenser drive cord assy.
Part number 07481 Dial drive cord should be deleted from the Panamuse tuner parts list as it is the Pointer drive cord for the vertical dial 400 series tuner.
Part number 13733 Dial light box assy. should be deleted as this is used only on the vertical dial 400 series tuner.

Delete the following parts:

- H-255-1 Cabinet and packing (Bisque)
- H-255-2 Cabinet and packing (Cordovan)
- 37374 Stay arm and lid lift mechanism L.H.

Add the following:

- 13189 Lid lift mechanism phono compartment
- 37438 Stay arm 13 3/4" phono compartment
- 37479 Cabinet glides, 3/4" nickel plated (4 req.)

The radio door and speaker doors are grain matched to the stationary front panels of the cabinet and are therefore not supplied separately.

19N3

Delete:

- 37497 Cabinet glides 3/4" nickel plated (4 req.)

Add:

- 37479 Cabinet glides 3/4" nickel plated (4 req.)

All parts on the "N3 Panamuse cabinet parts list—miscellaneous" are common to the N2 Panamuse cabinet except part number 81149 speaker for N3 series Panamuse.

NOTE: 81149 consists of 12" bass speaker and 6" treble speaker assembly for N3 Panamuse.

Add to this list:

- 81150 12" bass speaker only for N3 Panamuse
- 81151 6" treble speaker only for N2 and N3 Panamuse
- 81152 Bass and treble speaker assembly for N2 Panamuse
- 81182 15" bass speaker only for N2 Panamuse

Part number 13734 preamplifier phono input assy., should be deleted as it is used only on 400 series tuners.

Part number 31331 Dial Scale should be deleted as this is the dial scale for the vertical dial 400 series only tuner.

Part number 55119 Guide rod should be deleted as it is used only on vertical Dial 400 series tuner.

Part number 55228 Adjustable guide bar should be deleted as it is used only on vertical dial 400 series tuner.

FARNSWORTH TELEV. & RADIO CORP. MODELS CAPEHART,
PANAMUSE N SERIES

SECTION 16

Part No.	Description	Part No.	Description
MODEL 410N			
67518	Mahogany Complete Top—2 Pieces—Matched	67539	Speaker Doors, Mah., 4 Pieces, Matched Sets
56538	Hinge (Soss Type) To Mount Lid 2 Req., pr.	67540	Speaker Doors, Bisque, 4 Pieces, Matched Sets
67519	Mah. Radio Comp. Door	56542	Door Pulls, 2 Req. (Speaker Doors)
67520	Wal. Radio Comp. Door	37476	Tandem Door Control 5 $\frac{3}{8}$ " , Left Hand
67521	Wal. Speaker Doors—Matched Sets	37477	Tandem Door Control, 5 $\frac{3}{8}$ " , Right Hand
67522	Mah. Speaker Doors—Matched Sets	37374	Lid Lift and Stay Arm Mech. Assy., Left Hand
67523	Wal. Phono Comp. Doors—Matched Sets	37376	Lid Lift and Stay Arm Mech. Assy., Right Hand
67524	Mah. Phono Comp. Doors—Matched Sets	59462	Stay Arm Escutcheon (Clear Plastic)
56116	Hinge, Butt Type, 10 Req. to Mount 5 Doors	92264	Felt Pads 1 $\frac{1}{2}$ " x 1 $\frac{1}{8}$ "
37487	Door Knobs, 6 Req.	13219	Basic Cabinet Glides, 4 Req.
13219	Basic Cabinet Glides, 4 Req.	37475	Door Catch, Bullet Type, 2 Req.
92264	Felt Pads 1 $\frac{1}{2}$ " x 1 $\frac{1}{8}$ " , 2 Req.	37476	Tandem Door Control 5 $\frac{3}{8}$ " L. H., Oxidized
37475	Door Catch, Bullet Type, 5 Req.	37477	Tandem Door Control, 5 $\frac{3}{8}$ " R. H., Oxidized
92301	Grille Silk-Wal.	41130	Escutcheon Mtg. Kit
92302	Grille Silk-Mah.	59255	Glass Dial Escutcheon
41130	Escutcheon Mtg. Kit	MODEL 112N2	
59258	Glass Dial Escutcheon	67539	Speaker Doors, Mah., 4 Pieces, Matched Sets
MODEL 406N			
67525	Complete Cabinet Top—2 Pieces—Matched Wal.	67540	Speaker Doors, Bisque, 4 Pieces, Matched Sets
67526	Complete Cabinet Top—2 Pieces—Matched Mah.	56542	Door Pulls, 2 Req. (Speaker Doors)
67527	Phono Comp. Doors, Wal., 2 Pieces, Matched Sets	37476	Tandem Door Control 5 $\frac{3}{8}$ " , Left Hand
67528	Phono Comp. Doors, Mah., 2 Pieces, Matched Sets	37477	Tandem Door Control, 5 $\frac{3}{8}$ " , Right Hand
56768	Door Pulls, 6 Req.	37374	Lid Lift and Stay Arm Mech. Assy., Left Hand
37381	Hinge, Butt Type, 10 Req.	37376	Lid Lift and Stay Arm Mech. Assy., Right Hand
37482	Hinge, Soss Type (large size) 2 Req.	13219	Basic Cabinet Glides, 4 Req.
92303	Grille Cloth 22" x 20" Wal.	56538	Hinge, Soss Type, 4 Req.
92304	Grille Cloth 22" x 20" Mah.	92264	Felt Pads, 1 $\frac{1}{2}$ " x 1 $\frac{1}{8}$ " , 4 Req.
13219	Basic Cabinet Glides, 4 Req.	92307	Grille Cloth, 18" x 19", Wal.
67529	Radio Door, Wal., 7 $\frac{3}{4}$ " x 13 $\frac{3}{4}$ "	92308	Grille Cloth, 18" x 19", Mah.
67530	Radio Door, Mah., 7 $\frac{3}{4}$ " x 13 $\frac{3}{4}$ "	37475	Door Catch, Bullet Type, 2 Req.
67531	Speaker Doors, Wal., 2 Pieces, Matched Sets	59255	Glass Dial Escutcheon
67532	Speaker Doors, Mah., 2 Pieces, Matched Sets	Misc. Description	
37475	Door Catch, Bullet Type, 5 Req.	11301	AC Power Cord Assembly
41130	Escutcheon Mtg. Kit	22145	15 Wire Extension Patch Cord and Plug Ass'm
59258	Glass Dial Escutcheon	22151	Amplifier Input Cable Assembly
MODEL 413N			
67533	Complete Cabinet Top, Wal., 2 Pieces Matched	22152	Pickup Cable Assembly
67471	Complete Cabinet Top, Mah., 2 Pieces Matched	22167	Record Changer AC Cable Assembly
56538	Hinge, Soss Type, 2 Req., pair	42190	7 $\frac{1}{2}$ Watt Light Bulb
67534	Radio Comp. Door, Wal.	59044	Stay Arm Escutcheon, Wal.
67535	Radio Comp. Door, Mah.	59255	Glass Dial Escutcheon (100 Series and 413)
67536	Speaker Comp. Door, Wal.	80365	Male Connector, 6 Prong, for Record Changer, AC Cable
67537	Speaker Comp. Door, Mah.	80366	Female Connector, Round, for Record Changer, AC Cable
37488	Door Knobs, 00 Req.	80368	Female Connector, Round, for Record Changer, AC Cable
37381	Hinge, Butt Type, 4 Req.	80371	Speaker Connector Plug to Amplifier
13219	Basic Cabinet Glides	80373	Male Connector Plug for Reject Button
37475	Door Catch, Bullet Type, 2 Req.	80358	Light Socket and Switch Assembly
92264	Felt Pads, 1 $\frac{1}{2}$ " x 1 $\frac{1}{2}$ " , 2 Req.	90194	Reject Switch
92305	Grille Cloth, Wal.	59316	Lucite Tuning Knob for 100N and 400N Series
92306	Grille Cloth, Mah.	59373	Control Knobs (Lucite) for 100N and 400N Series
41130	Escutcheon Mtg. Kit	58460	Escutcheon Mtg. Plate for 100N and 413N Series
59255	Glass Dial Escutcheon	58473	Escutcheon Mtg. Plate for 406-410-414
Model 112N2			
67490	Complete Top, Wal., 3 Pieces, Matched	53461	Special Tapped Brkt. to Mount Escutcheon Mtg. Frame (4 required) each
67491	Complete Top, Mah., 3 Pieces, Matched	36478	#3-48 x 1 $\frac{1}{2}$ " L. Phil F.H.M.S. to Mtg. Escutcheon Mtg. Frame (4 required) each
67492	Complete Top, Bisque, 3 Pieces Matched		
67538	Speaker Doors, Wal., 4 Pieces, Matched Sets		

PANAMUSE CABINET PARTS LIST

SECTION 16

26-N2

37431	Hinge—Piano Type—16"—2 Req. to Mount Lids
37484	Hinge—Concealed Type—(For Speaker Doors) 2 Req. Upper Left Lower Right
67485	Hinge—Concealed Type—(For Speaker Doors) 2 Req. Upper Right Lower Left
37493	Door Knobs—Burnished Brass—2 Req. For Speaker Doors
37374	Stay Arm & Lid Lift Mech. Assy. L.H.
13188	Lid Lift Mech. R.H.
92264	Felt Pads $\frac{1}{2}$ " x $\frac{1}{8}$ ", 4 Req.
37494	Stay Arm Assy. 9"
59462	Stay Arm Escutcheon (Clear Plastic)
92313	Bisque Grille Cloth
92314	Cordovan Grille Cloth
37376	Lid Lift and Stay Arm Mech. R.H.
13219	Basic Cabinet Glides (4 Req.)
56538	Hinge—SOSS Type (4 Req.)
37475	Door Catch—Bullet Type

21-N2

H-255-1	Cabinet and Packing—Bisque
H-255-2	Cabinet and Packing—Cordovan
67543	Walnut Complete Cabinet Top 2 Pieces, Matched
67544	Mahogany Complete Cabinet Top 2 Pieces, Matched
92309	Walnut Grille Cloth
92310	Mahogany Grille Cloth
37489	Door Knobs for Speaker Doors (2 Req.)
37490	Door Pulls (2 Req.)
37381	Hinge—Butt Type (6 Req.)
37506	Hinge—Piano Type (1 Req.)
37374	Stay Arm and Lid Lift Mech. Assy., L.H. (1 Req.)
37479	Cabinet Glides $\frac{3}{4}$ " Nickel Plated (4 Req.)
H-258-1	Walnut Cabinet and Packing
H-258-2	Mahogany Cabinet and Packing

25-N2

92311	Walnut Grille Cloth
92312	Mahogany Grille Cloth
59462	Stay Arm Escutcheon

25-N2 (Continued)

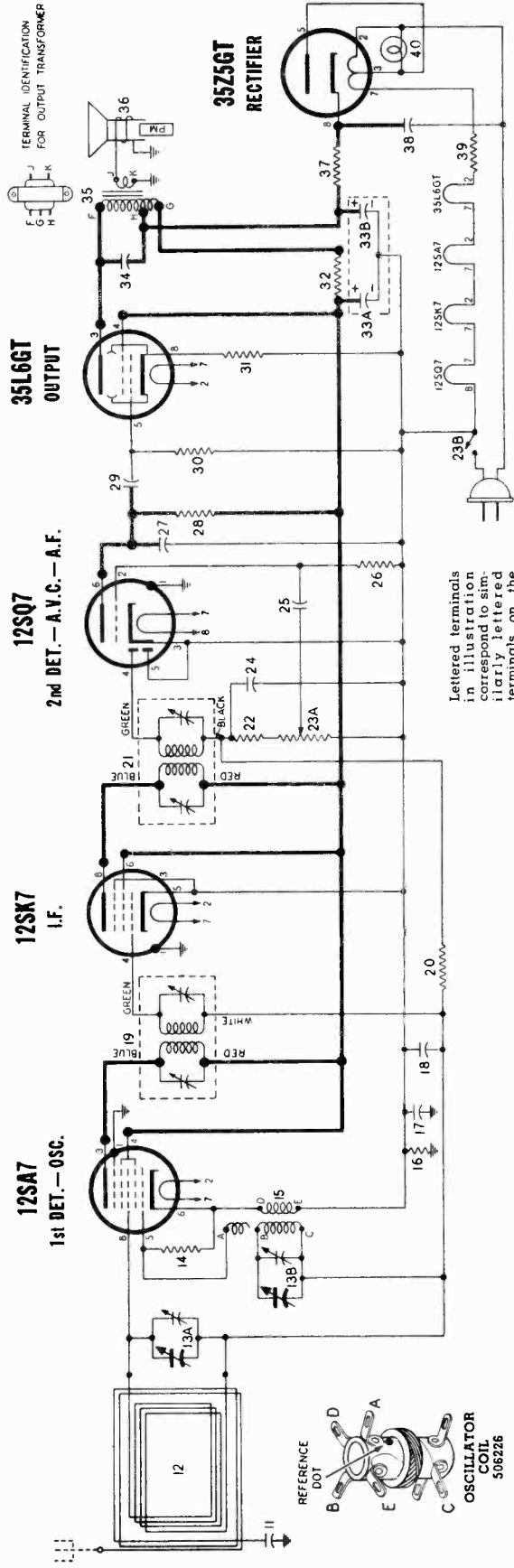
67469	Complete Top, Wal. 2 Pieces, 1 Phono Lid and 1 Top Matched
67470	Complete Top, Mah. 2 Pieces, 1 Phono Lid and 1 Top Matched
67549	Speaker Doors, Wal., 2 Pieces, Matched Sets
67550	Speaker Doors, Mah., 2 Pieces, Matched Sets
37483	Hinge—Split or Concealed Type, 4 Req. (For Speaker Doors)
37381	Hinge—Butt Type, 2 Req. (For Radio Door)
—	Door Catch—Bullet Type, 3 Req.
37491	Door Pulls, 2 Req. (Radio Door and Corresponding Panel)
37492	Door Knob, 1 Req. (For Speaker Door)
92264	Felt Pads, $\frac{1}{2}$ " x $\frac{1}{8}$ ", 2 Req.
37497	Cabinet Glides, $\frac{3}{4}$ " Nickel Plated, 4 Req.
37374	Stay Arm and Lid Lift Mech. Assy., Left Hand
37507	Hinge—Piano Type (To Mount Phono Lid)
25N2	Cabinet and Packing—Wal. H-253-1
25N2	Cabinet and Packing—Mah. H-253-2

19-N3

67474	Walnut Phono Lid L.H. Matched to R.H. Lid
67472	Mahogany Phono Lid L.H. Matched to R.H. Lid
67475	Walnut Radio Lid R.H. Matched to L.H. Lid
67473	Mahogany Radio Lid R.H. Matched to L.H. Lid
67555	Walnut Speaker Doors Two Pieces—Matched-sets
67556	Mahogany Speaker Doors Two Pieces—Matched- Sets
56523	Door Pull (4 Req.)
37495	Door Knob (2 Req.)
37475	Door Catch—Bullet Type (2 Req.)
37381	Hinge—Butt Type (4 Req.)
37440	Hinge—Piano Type 18" (1 Req.) Phono Lid
37497	Cabinet Glides $\frac{3}{4}$ " Nickel Plated (4 Req.)
37374	Stay Arm and Lid Lift Mech. Assy. L.H.
37376	Stay Arm and Lid Lift Mech. Assy. R.H.
37486	Hinge—Piano Type 12 $\frac{1}{2}$ " (1 Req.) Radio Lid
59044	Stay Arm Escutcheon (2 Req.)
92264	Felt Pads $\frac{1}{2}$ " x $\frac{1}{8}$ " (4 Req.)
92315	Walnut Grille Cloth
92316	Mahogany Grille Cloth
H-243-1	Walnut Cabinet and Packing
H-243-2	Mahogany Cabinet and Packing

N3 PANAMUSE CABINET PARTS LIST—MISCELLANEOUS

Part No.	Description	Part No.	Description
09271	Record changer mtg. spring assy. (4 req.)	58461	Special tapped brkt. to mount escutcheon mtg. frame (4 req.)
11301	A. C. Power cord assy.	59044	Plastic stay arm escutcheon
22144	Record changer A. C. cable	59256	Glass dial escutcheon
22145	15 wire extension patch cord	59316	Lucite tuning knob (large)
22151	Amplifier input cable	59373	Lucite knob (small)
22152	Pickup cable assy.	80365	Male connector, 6 prong, for record changer A.C. cable
36478	#3-48 x $\frac{1}{2}$ " long Phil. F.H.M.S. to mount es- cutcheon mtg. frame (4 req.)	80371	Speaker connector plug to amplifier (male)
37475	Door catch (Bullet type)	81149	Speaker for N3 series Panamuse
41130	Escutcheon mtg. screw kit		
58460	Escutcheon mtg. frame		



Lettered terminals in illustration correspond to similarly lettered terminals on the circuit diagram.

PARTS LIST

DIA. GRAM NO.	PART NO.	DESCRIPTION
12		Loop antenna
13		Coil—oscillator
19		Transformer—1st I.F.
21		Transformer—2nd I.F.
35		Transformer—output
36		Speaker—P.M. dynamic (4")
40		Lamp dial (Mazda No. 47) 6-8 V. 150 Ma.

DIA. GRAM NO.	PART NO.	DESCRIPTION
11	512002	Condenser—.002 Mfd. 600 volt.
13-A, B	506219	Condenser—variable gang (with drum)
17, 18	502153	Condenser—.05 Mfd. 200 volt.
24	502931	Condenser—ceramic 100 Mmfd. 500 volt.
25	502479	Condenser—.006 Mfd. 600 volt.
27	504727	Condenser—mica 500 Mmfd. 500 volt.
29	502151	Condenser—.01 Mfd. 400 volt.
33-A, B	506222	Condenser—electrolytic E. 35 Mfd. 150 volt. F. 35 Mfd. 150 volt.
34	502152	Condenser—.02 Mfd. 400 volt.
38	502157	Condenser—.05 Mfd. 400 volt.

DIA. GRAM NO.	PART NO.	DESCRIPTION
14	510061	Resistor—carbon 22,000 Ohms 1/4 watt.
16	510079	Resistor—carbon 220,000 Ohms 1/4 watt.
20	510091	Resistor—carbon 1 Meg. 1/4 watt.
22	510067	Resistor—carbon 47,000 Ohms 1/4 watt.
23-A, B	506206	Volume control 500,000 Ohms (with switch)
26	510096	Resistor—carbon 6.8 Meg. 1/4 watt.
28	510079	Resistor—carbon 220,000 Ohms 1/4 watt.
30	510085	Resistor—carbon 470,000 Ohms 1/4 watt.
31	510123	Resistor—carbon 180 Ohms 1/2 watt ± 10%
32	510137	Resistor—carbon 1000 Ohms 1/2 watt
37	510210	Resistor—carbon 33 Ohms 1 watt
39	510617	Resistor—wire wound 82 Ohms 2 watt ± 10%

DIA. GRAM NO.	PART NO.	DESCRIPTION
12	506208	Loop antenna
13	506226	Coil—oscillator
19	506209	Transformer—1st I.F.
21	506210	Transformer—2nd I.F.
35	506221	Transformer—output
36	506212	Speaker—P.M. dynamic (4")
40	118921	Lamp dial (Mazda No. 47) 6-8 V. 150 Ma.

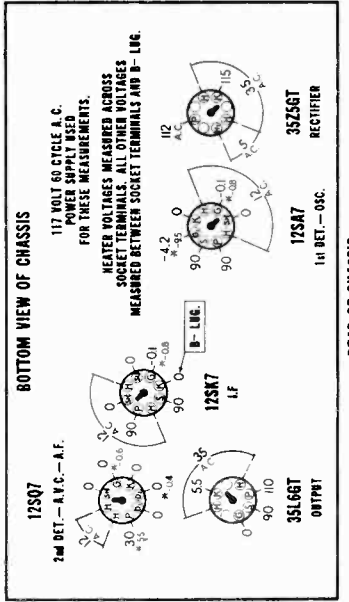
DIA. GRAM NO.	PART NO.	DESCRIPTION
505165		"C" washer—for tuning shaft.
506228		Cabinet
114955		Clip—retainer on end of dial cord
506230		Clip—retains cabinet back to chassis
500497		Clip—retains cabinet back to cabinet
117057		Cord—dial drive (4 ft. required)
506216		Dial scale
506218		Diffuser—light
506215		Knob
506217		Painter
119087		Ring for dial cord
170162		Screw—#8-32 x 3/8" retains chassis
506207		Shaft—tuning
506211		Socket—dial light (with leads)
116690		Socket—octal base
506220		Socket—octal (rectifier)
161384		Spring—dial cord tension.

I.F. 455 KC.

SOCKET VOLTAGES

Measured with voltmeter having sensitivity of 1000 ohms per volt except where indicated by (*). The (*) symbol designates a vacuum tube volt-meter measurement.

VOLUME ON FULL WITH NO SIGNAL DIAL TUNED TO 540 KC.

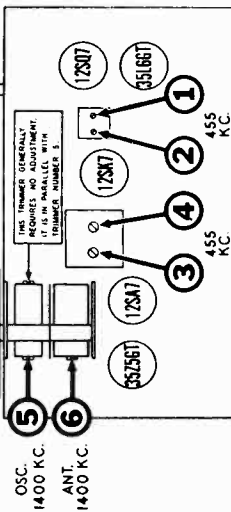


ALIGNMENT PROCEDURE

1. Remove chassis and loop antenna (on cabinet back) from cabinet—allow loop to remain attached to chassis.
2. With the gang condenser fully meshed, dial pointer should be in the position indicated by the last division below 55 on the dial. If it is incorrectly, release pointer clip on dial cord and reposition pointer.
3. Couple the signal generator to the receiver by connecting its output to several turns of wire formed in a circular shape so that it may be placed adjacent and parallel to the receiver loop antenna.
4. Connect an output meter across the speaker voice coil or from the plate of the 35L6GT tube to B—through a 0.1 Mfd. condenser.
5. Set volume control at maximum volume position and use a weak signal from the signal generator.

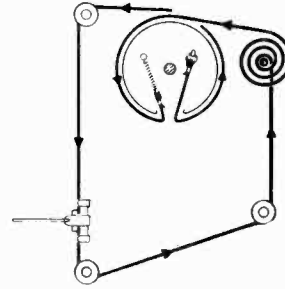
DUMMY ANT. IN SERIES WITH SIGNAL GENERATOR	SIGNAL GENERATOR CONNECTION	SIGNAL GENERATOR FREQUENCY	RECEIVER DIAL SETTING	TRIMMER OR SLUG NUMBER	TRIMMER DESCRIPTION	TYPE OF ADJUSTMENT
None	Connect directly to coupling turn as instructed in Step 3 above.	455 KC	Any point where it does not affect the signal.	1-2 3-4	2nd I.F. 1st I.F.	Adjust for maximum output. Then repeat adjustment.
None	Connect directly to coupling turn as instructed in Step 3 above.	1400 KC	1400 KC	5	Broadcast Oscillator	Adjust for maximum output.
None	Connect directly to coupling turn as instructed in Step 3 above.	1400 KC	Tune to 1400 KC generator signal	6	Broadcast Antenna	Adjust for maximum output.

TOP VIEW OF CHASSIS



TRIMMER LOCATIONS

DIAL AND POINTER DRIVE CORD ARRANGEMENT

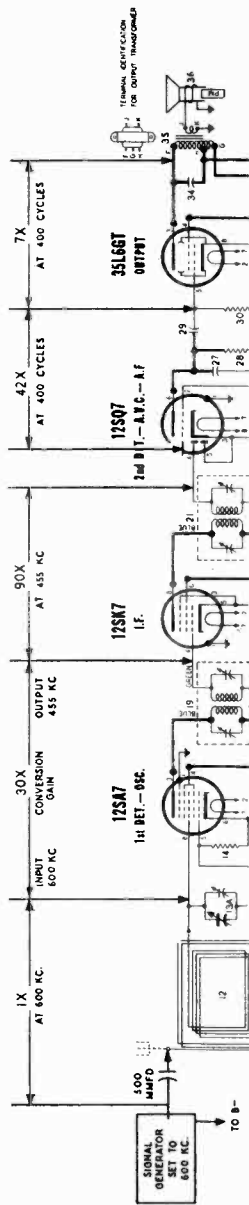


To string dial cord, turn the main drive drum to maximum counter - clockwise position and use following parts:

- 114955 Clip on end of cord
- 117057 Cord (4 feet)
- 119087 Ring for dial cord
- 161384 Tension Spring

STAGE GAIN MEASUREMENT PROCEDURE

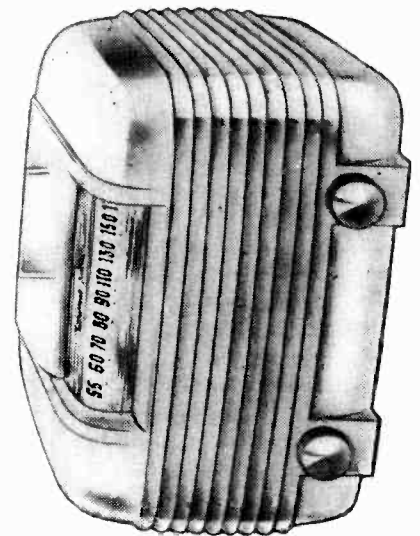
- REQUIRED INSTRUMENTS:** The amount of amplification or "gain" of each of the stages of this receiver may be measured with an A.C. Vacuum Tube Voltmeter or a "channel" type instrument containing a tuned and calibrated amplifier.
- PROCEDURE:** It is exceedingly important to adhere to the procedure outlined below since the accuracy of these measurements will be affected to a considerable extent by the failure to establish proper operating conditions.
1. Be sure that R.F. and I.F. stages are carefully and accurately aligned by utilizing the alignment procedure given above.
 2. Connect Signal Generator as shown below.
 3. The values of stage gain which are given here were measured with a fixed bias of 3 volts on the control grids of all R.F. and I.F. tubes which are connected to the A.V.C. circuit. Therefore, these values are not intended to indicate the full capability of a stage but they will serve as a convenient basis for determining proper operation. In order to duplicate the fixed bias voltage, connect the negative terminal of a 3 volt battery to A.V.C. at terminal "C," of the oscillator coil and connect the positive battery lead to B— in receiver chassis.
4. Set Signal Generator for operation at 600 Kc with 400 cycle modulation and carefully tune radio receiver to this signal by using an output meter to indicate peak output. If a local station interferes, set generator to a nearby frequency and re-tune the receiver.
 5. R.F. and I.F. circuits are slightly de-tuned when contact is made with an instrument probe and this action, which is indicated by a change in the output meter reading, may seriously affect the gain measurement. Therefore, it is important to adjust the associated circuit trimmer for a maximum output meter reading and to set the input signal level to a convenient reference point on the gain measuring instrument while the probe is making contact. After removing the probe it is again necessary to adjust the trimmer so as to obtain the same output meter reading and thereby assure that the signal voltage at the specified point has not changed as a result of circuit de-tuning.
 6. When using a "channel" type instrument carefully tune it for maximum output at desired frequency before making measurements.

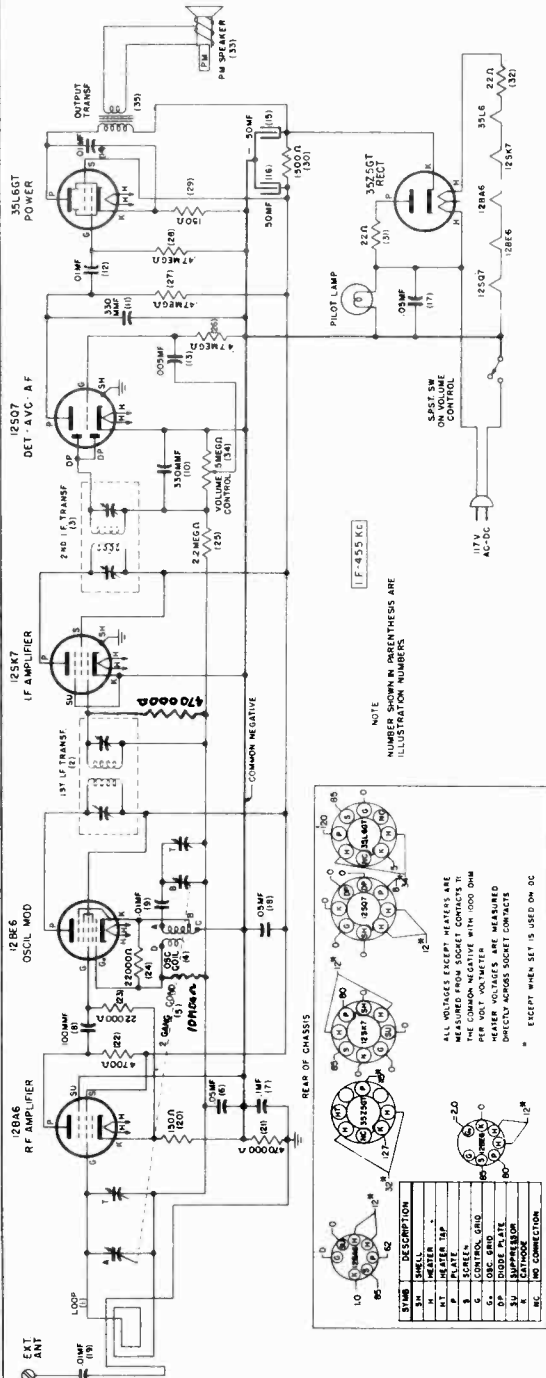


DIFFERENCES in tube characteristics, tolerance of parts, adjustment of tuned circuits and variations in line voltage will influence stage gain. These factors should be given due attention in event the gain of a stage varies extensively from the values shown above.

SPECIFICATIONS

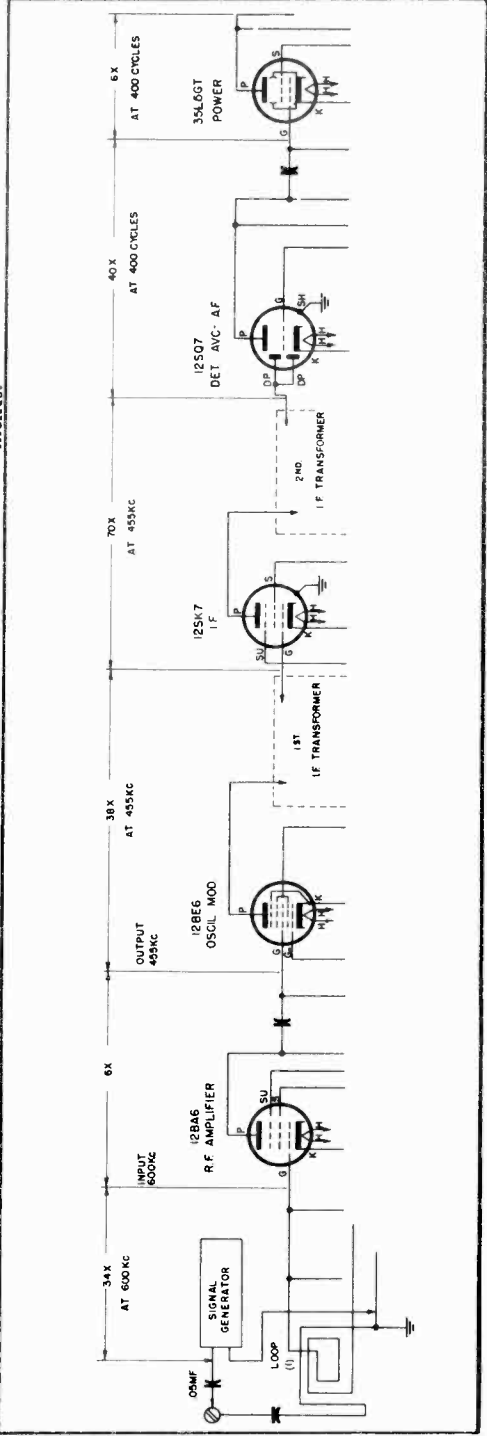
- CABINET DIMENSIONS**
 10-5/8" x 7-1/16" x 6-21/32"
- WEIGHT**
 6 pounds 8 ounces
- POWER SUPPLY**
 105 to 125 volts AC-DC
- FREQUENCY RANGE**
 540 to 1600 KC.
- I. F. FREQUENCY**
 455 KC.
- SPEAKER**
 4 inch P-M Dynamic
- VOICE COIL IMPEDANCE**
 3.2 ohms
- POWER OUTPUT**
 Undistorted — 0.8 watts
 Maximum — 1.2 watts
- TUBE COMPLEMENT**
- 12SA7
 - 12SK7
 - 12SQ7
 - 35L6GT
 - 35Z5GT
- 1st Det. — Osc.**
I. F. Amplifier
2nd Det. — A.V.C. — 1st A.F.
Power output
Rectifier





Be sure R-F and I-F stages are accurately aligned before measuring gain. R-F gains can be measured with a "channel" type instrument containing a tuned and calibrated R-F amplifier. A vacuum tube voltmeter may be used for audio gain measurements. Observe following precautions:

1. For all gain measurements connect signal generator as shown. Use 600 KC signal with 400 cycle modulation (use nearby frequency if local station interferes)
2. Be sure radio is carefully tuned to generator signal (use weak signal for sharp tuning).
3. When using a "channel" type instrument carefully tune it for maximum output at desired frequency before making measurements.



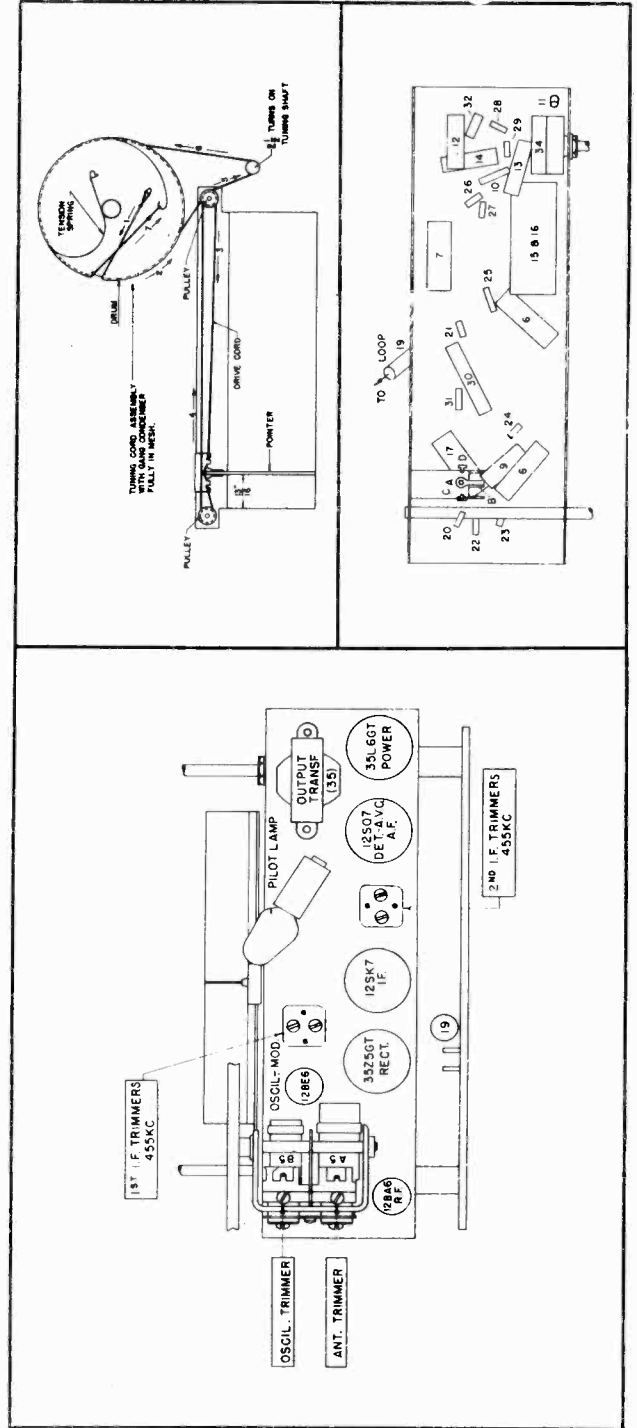
Differences in tube characteristics, tolerance of parts, adjustment of tuned circuits, and variations of line voltage will influence stage gain. Accuracy of measurements is dependent upon careful tuning of receiver to generator signal and experience in using your test equipment. These factors may create considerable variation in gain measurements.

ALIGNMENT PROCEDURE

For alignment procedure read tabulations from left to right, and make the adjustment marked (1) first, (2) next, (3) third.
 Before starting alignment:

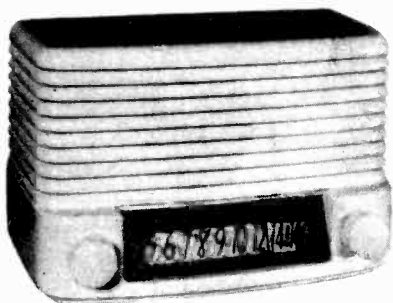
- (a) Check tuning dial adjustment by tuning gang condenser until plates touch maximum capacity stop (completely in mesh) at which point the dial needle must be exactly $\frac{1}{16}$ " from edge of dial plate. If dial needle does not have this position, move to correct one.
- (b) Use an accurately calibrated test oscillator with some type of output measuring device.

Steps	TEST OSCILLATOR		Refer to parts layout diagram for location of trimmers mentioned below:
	Set receiver dial to:	Adjust test oscillator frequency to:	
1	Any point where no interfering signal is received.	455 K. C.	Adjust each of the second I-F transformer trimmers for maximum output—then adjust each of the first I-F trimmers for maximum output.
2	Minimum Capacity	Exactly 1620 K. C.	Adjust 1620 K. C. oscillator trimmer for maximum output.
3	Approx. 1400 K. C.	Approx. 1400 K. C.	While rocking gang condenser adjust 1400 K. C. antenna trimmer for maximum output.



MODEL 4-A-11

THE FIRESTONE TIRE & RUBBER CO.



POWER SUPPLY..... 105 to 125 Volt AC-DC
 TUNING RANGE..... 540 to 1600 KC
 INTERMEDIATE FREQ..... 455 KC
 LOUDSPEAKER..... 4 Inch P.M.
 VOICE COIL IMPEDANCE..... 3.2 Ohm at 400 Cycles

TUBE COMPLEMENT..... 12BA6 R-F Amplifier
 12BE6 Oscillator Modulator
 12SK7 IF, 12SQ7 Det. AVC.,
 35L6GT Power Output
 35Z5GT Rectifier

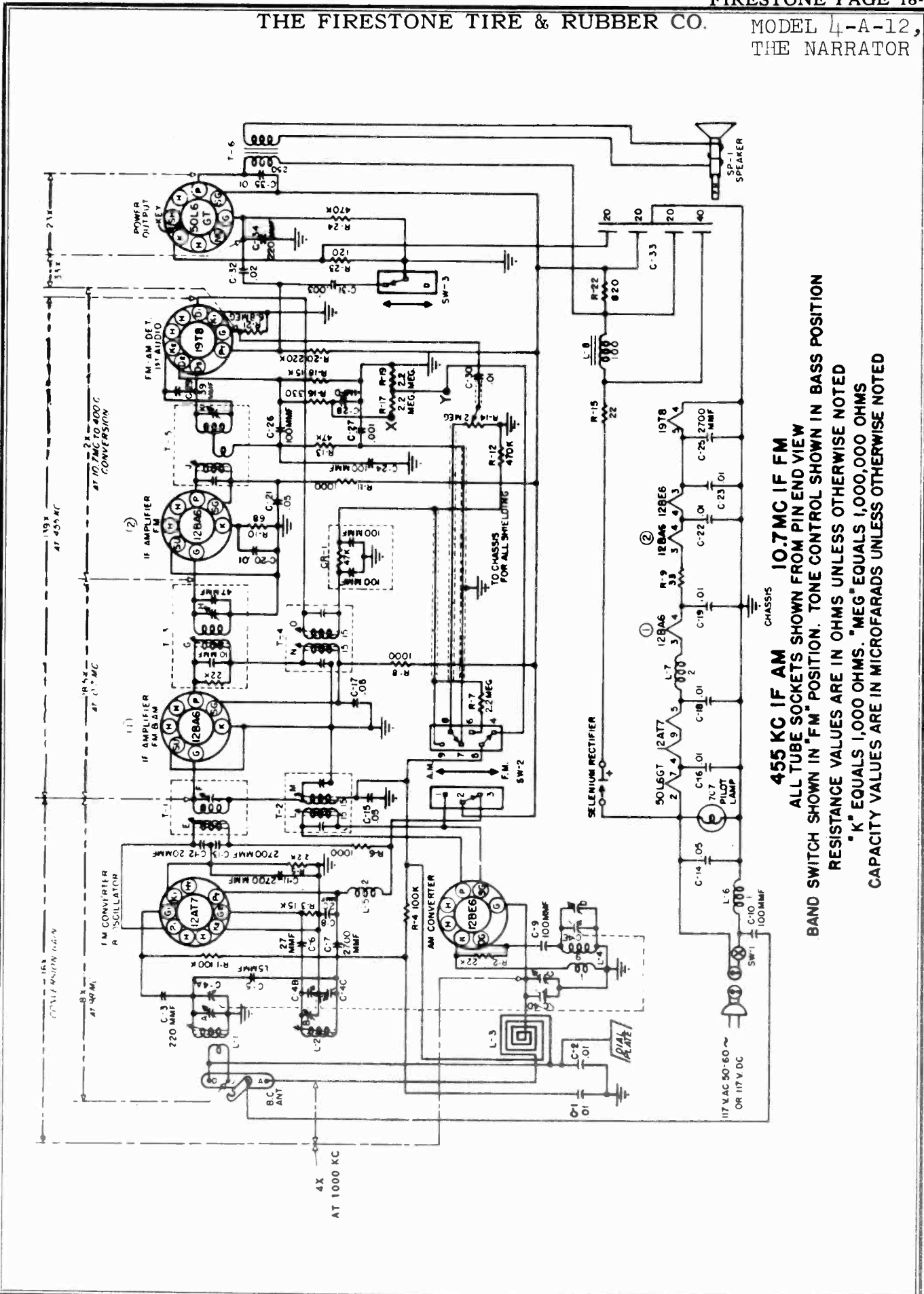
POWER OUTPUT..... Undistorted - 0.8 Watts
 Maximum - - 1.25 Watts

PARTS LIST

Ill. No.	Part No.	Part Name	Description	Ill. No.	Part No.	Part Name	Description
1	RAB-064	Antenna	Loop and back of cabinet.	20, 29	URD-029	Resistor	Carbon, 150 Ohm 1/2W...
2	RTL-075	Coil	1st I-F transformer.	21, 27, 28	URD-113	Resistor	Carbon, 470000 Ohm 1/2W.
3	RTL-051	Coil	2nd I-F transformer.				
4	RLC-058	Coil	Oscillator coil.	22	URD-065	Resistor	Carbon, 4700 Ohm 1/2W..
5	RCT-027	Condenser	Tuning, two gang.	23, 24	URD-081	Resistor	Carbon, 22000 Ohm 1/2W..
6, 18	UCC-028	Condenser	Tubular, .05 Mfd. 400V.	25	URD-129	Resistor	Carbon, 2.2 Megohm 1/2W.
7	UCC-030	Condenser	Tubular, .1 Mfd. 400V.	26	URD-137	Resistor	Carbon, 4.7 Megohm 1/2W.
8	UCU-028	Condenser	Tubular, .0001 Mfd. 500V.	30	URF-053	Resistor	Carbon, 1500 Ohm 2W...
9, 12, 19	UCC-025	Condenser	Tubular, .01 Mfd. 400V.	31	URD-089	Resistor	Carbon, 22 Ohm 1/2W....
10, 11	UCU-040	Condenser	Mica, .00033 Mfd.	32	URE-009	Resistor	Carbon, 22 Ohm 1W....
13	UCC-022	Condenser	Tubular, .005 Mfd. 400V.	33	UOP-420	Speaker	4 inch speaker.....
14	UCC-040	Condenser	Tubular, .01 Mfd. 600V.	34	RRC-063	Volume Control	With S.P.S.T. Switch...
15, 16	RCE-050	Condenser	Dry Elec. 2 x 50 Mfd. 150V.	35	RTO-039	Trans-former	Output Transformer for speaker
17	UCC-045	Condenser	Tubular, .05 Mfd. 600V.		URD-145	Resistor	Carbon, 10 Megohm 1/2W
					URD-113	Resistor	Carbon, 470000 Ohm 1/2W

MISCELLANEOUS PARTS

RAU-027	CABINET—Plastic cabinet.	RMS-119	DIAL SPRING—Tension spring for drive cord
RDC-032	CORD—Dial cord.	RDK-115	KNOB.
RAX-022	DIAL PLATE ASSEMBLY—Dial back plate assembly	RJS-001	PILOT LAMP SOCKET.
RDS-057	DIAL SCALE—Calibrated scale.	RMW-015	PULLEY—Dial drive pulley.
RMU-038	DIAL SHAFT—Drive shaft.	RWL-017	POWER CORD.
RDP-037	DIAL POINTER—Dial indicator.	RJS-006	TUBE SOCKET.
		RJS-100	TUBE SOCKET—Miniature.



455 KC IF AM **10.7 MC IF FM**

ALL TUBE SOCKETS SHOWN FROM PIN END VIEW

BAND SWITCH SHOWN IN "FM" POSITION. TONE CONTROL SHOWN IN BASS POSITION

RESISTANCE VALUES ARE IN OHMS UNLESS OTHERWISE NOTED

"K" EQUALS 1,000 OHMS. "MEG" EQUALS 1,000,000 OHMS

CAPACITY VALUES ARE IN MICROFARADS UNLESS OTHERWISE NOTED

MODEL 4-A-12,
THE NARRATOR

ALIGNMENT PROCEDURE

The chassis and loop should remain in their normal position in the cabinet when making loop adjustment. With the gang condenser fully meshed, the dial pointer should be in the position indicated by the last division below 55 on the dial. If it is set incorrectly, slide the pointer along the dial cord to correct position.

Connect an output meter across the speaker voice coil. Connect the ground side of signal generator to B—. Set the volume control at maximum volume position and use a weak signal from the signal generator.

CAUTION: The chassis of this receiver is connected directly to one side of the line. Use an isolation transformer between the 117-volt AC line and AC input to the radio to avoid shock.

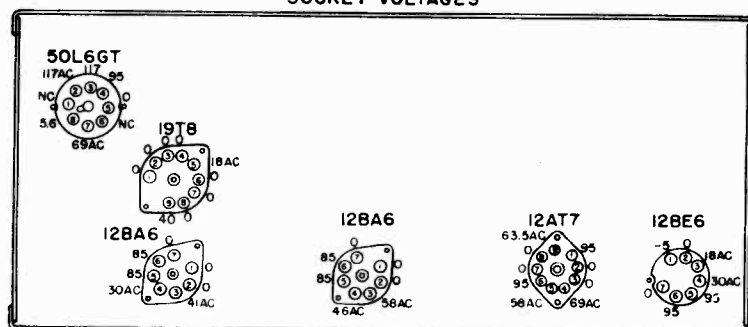
Step No.	Band Switch Position	SIGNAL GENERATOR		Dummy Antenna	Connect High Side of Signal Generator to	Radio Dial Setting	Trimmer Letter	Trimmer Description	Type of Adjustment	
		Frequency	Type of Modulation							
1	AM	455 kc	30% AM	0.1 mfd. Condenser	12BE6 Grid Pin No. 7	Any position where it does not affect the signal.	N - O L - M	2nd IF 1st IF	Adjust for maximum output, then repeat adjustment.	
2	AM	1620 kc	30% AM	0.1 mfd. Condenser	12BE6 Grid Pin No. 7	Gang condenser completely out of mesh.	D	Oscillator	Adjust for maximum output.	
3	AM	1400 kc	30% AM	RMA Loop		Tuned to 1400 kc generator signal.	C	Loop Antenna	Adjust for maximum output.	
4	FM	10.7 mc	CW	0.1 mfd. Condenser	12BA6 Driver Grid Pin No. 1	High frequency end.	J	Ratio Detector Primary	Adjust for maximum AVC between Point X on wiring diagram and chassis, using Electronic Voltmeter. (See Note 1.)	
5	FM	10.7 mc	CW	0.1 mfd. Condenser	12BA6 Driver Grid Pin No. 1	High frequency end.	K	Ratio Detector Secondary	See Note 1. Adjust for zero position (using Electronic Voltmeter) from point "Y" on the wiring diagram to the top of the volume control.	
6	FM	10.7 mc	CW	0.1 mfd.	12AT7 Grid Pin No. 7	High frequency end.	G - H E - F	2nd IF 1st IF	Adjust for maximum AVC. (See Note 1.)	
7	FM	108.5 mc	30% FM	300 ohm Carbon resistor	Antenna Terminal J with jumper disconnected.	High frequency end.	B	FM Oscillator	Adjust for maximum output. (See Note 2.)	
8	FM	87.5 mc	30% FM	300 ohm Carbon resistor	Antenna Terminal J with jumper disconnected.	Low frequency end.	L ₂	FM Oscillator	Adjust for maximum output. (See Note 2.)	
9	FM	108 mc	30% FM	300 ohm Carbon resistor	Antenna Terminal J with jumper disconnected.	Tuned to 108 mc generator signal.	A	FM Antenna	Adjust for maximum output. (See Note 2.)	
10	FM	87 mc	30% FM	300 ohm Carbon resistor	Antenna Terminal J with jumper disconnected.	Tune to 87 mc generator signal.	L ₁	FM Antenna	Adjust for maximum output. (See Note 2.)	
11	Repeat operations 9 and 10 if an appreciable change is made in the adjustment of L ₁ .									

NOTE 1—Adjust input voltage to give approximately 4 volts AVC before final adjustment is made. For steps 4 and 6—Voltmeter common lead to chassis. For step 5—Voltmeter common lead to point "Y" on wiring diagram. The desired zero position is at the point where the meter indicates a polarity change from plus to minus or vice versa.

NOTE 2—For all tests requiring an FM signal, the generator output (22.5 kc deviation, 400 cycles) must be adjusted to give approximately 50 milliwatts receiver output before final adjustments are made.

SOCKET VOLTAGES

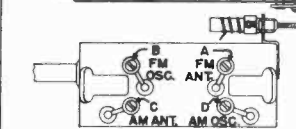
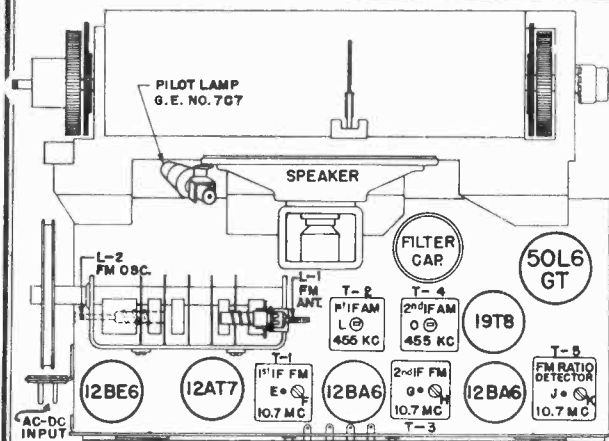
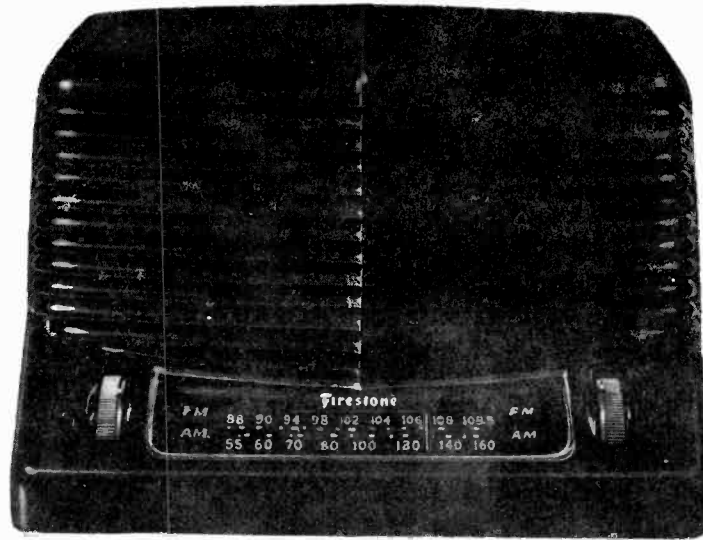
SOCKET VOLTAGES: Measured with voltmeter having sensitivity of 1000 ohms per volt. Tone control in treble position. Volume on full with no signal. 117 volt, 60 cycle AC power input. All voltages measured from chassis (B-) to points indicated. Voltage measurements are positive DC unless otherwise indicated.



BOTTOM VIEW - PIN CONNECTIONS
ALL VOLTAGES MEASURED FROM CHASSIS (B-) TO POINT INDICATED.
ALL VOLTAGES ARE POSITIVE DC UNLESS OTHERWISE INDICATED.
MEASUREMENTS TAKEN WITH A 1,000 OHM/VOLT METER

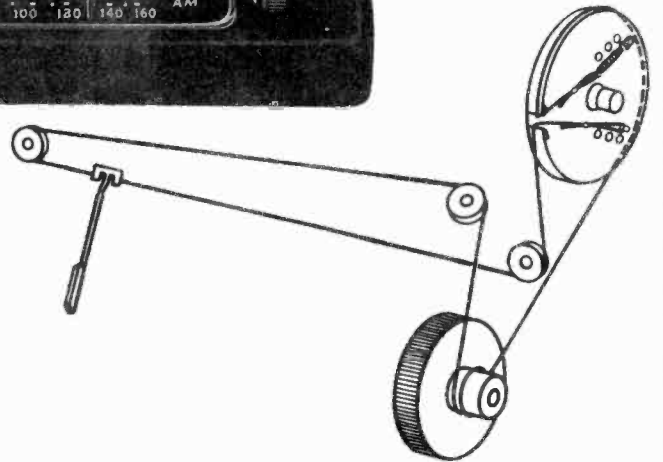
THE FIRESTONE TIRE & RUBBER CO.

MODEL 4-A-12,
THE NARRATOR



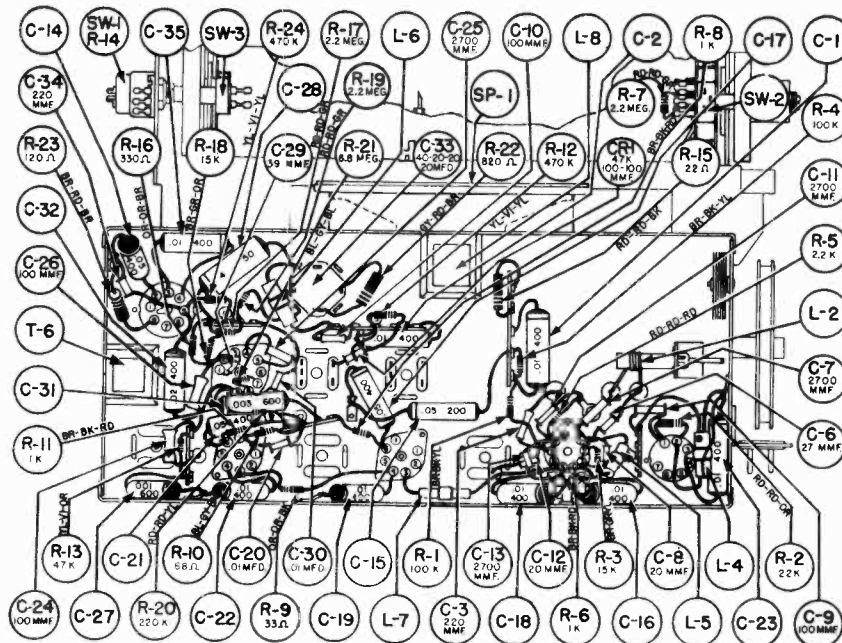
SIDE VIEW OF VARIABLE CAPACITOR

ADJUSTMENT "M", 1st IF AM BENEATH CHASSIS
ADJUSTMENT "N", 2nd IF AM BENEATH CHASSIS



DRIVE CABLE ARRANGEMENT: To string dial cable, set the gang condenser to fully meshed position. Use the following parts for assembly:

- B-55402-2 Cable Assembly
- A-51787 Spring, Cable
- B-59580 Pointer Assembly



STAGE GAIN DATA

Be sure RF and IF stages are accurately aligned before measuring gain. RF gains can be measured with a "channel" type instrument containing a tuned and calibrated RF amplifier. A vacuum tube voltmeter may be used for audio gain measurements. Observe the following precautions:

1. For all gain measurements, use 1000 KC signal with 400 cycle modulation (use nearby frequency if local station interferes).
2. Be sure radio is carefully tuned to generator signal. (Use weak signal for sharp tuning.)
3. When using a "channel" type instrument, carefully tune it for maximum output at the desired frequency before making measurements.

Differences in tube characteristics, tolerance of parts, adjustment of tuned circuits, and variations of line voltage will influence stage gain. Accuracy of measurements is dependent upon careful tuning of receiver to generator signal and experience in using your test equipment. These factors may create considerable variation in gain measurements.

FREQUENCY RANGE: SPEAKER:

540-1600 KC (AM)
88-108 MC (FM)

5-inch PM
Voice coil impedance—
3.2 ohms at 400 cycles

TUBE COMPLEMENT:

12AT7—FM Conv. and Osc.
12BE6—AM Converter
12BA6—I. F. Amplifier (FM-AM)
12BA6—I. F. Amplifier (FM)
19T8—Detector—1st Audio
50L6GT—Power Output

POWER SUPPLY:

105-125 volts
50-60 cycles AC or
105-125 volts DC
38 watts

TUNING CONDENSER:

5-section gang

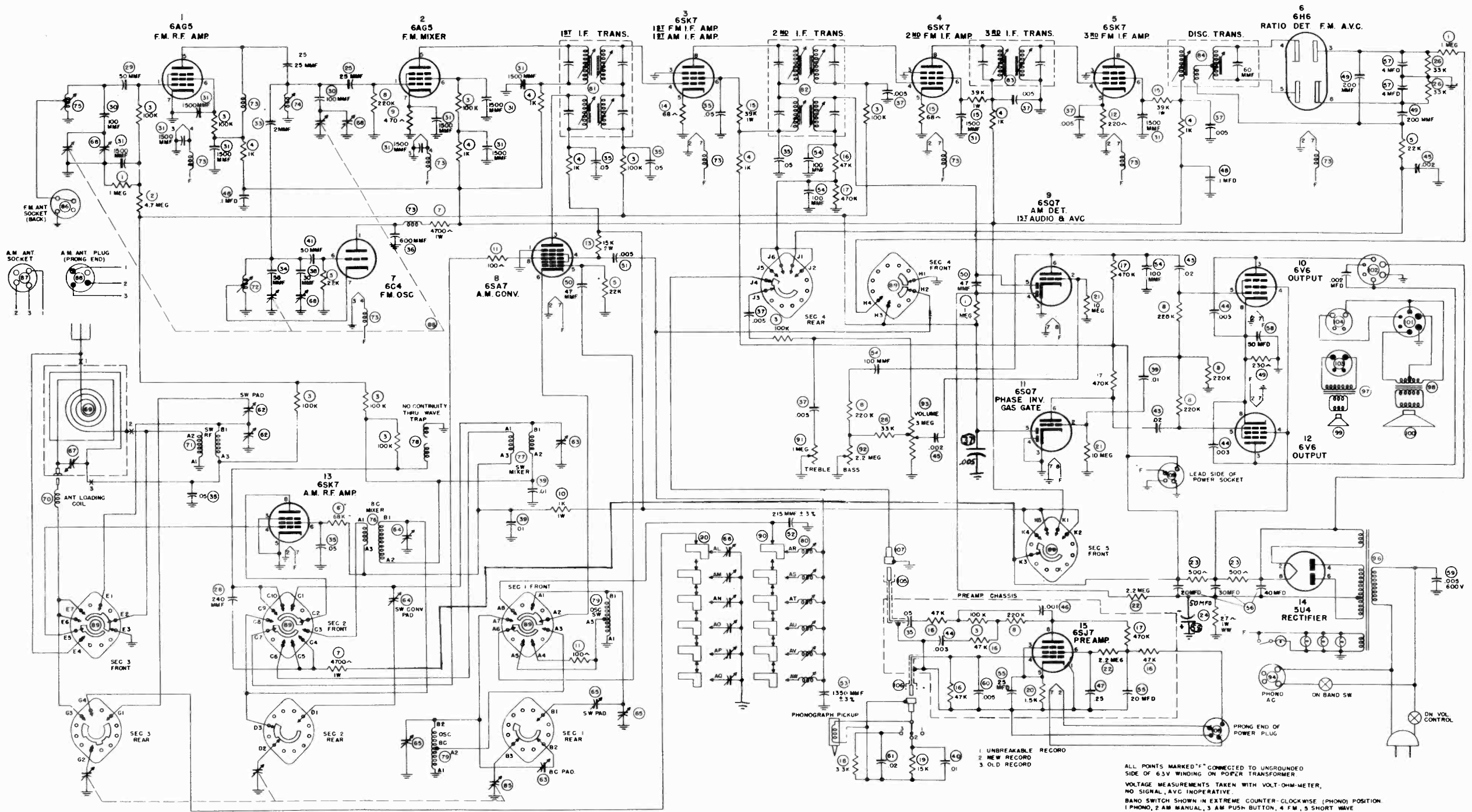
POWER OUTPUT:

Undistorted—1.0 watt
Maximum—2.0 watts

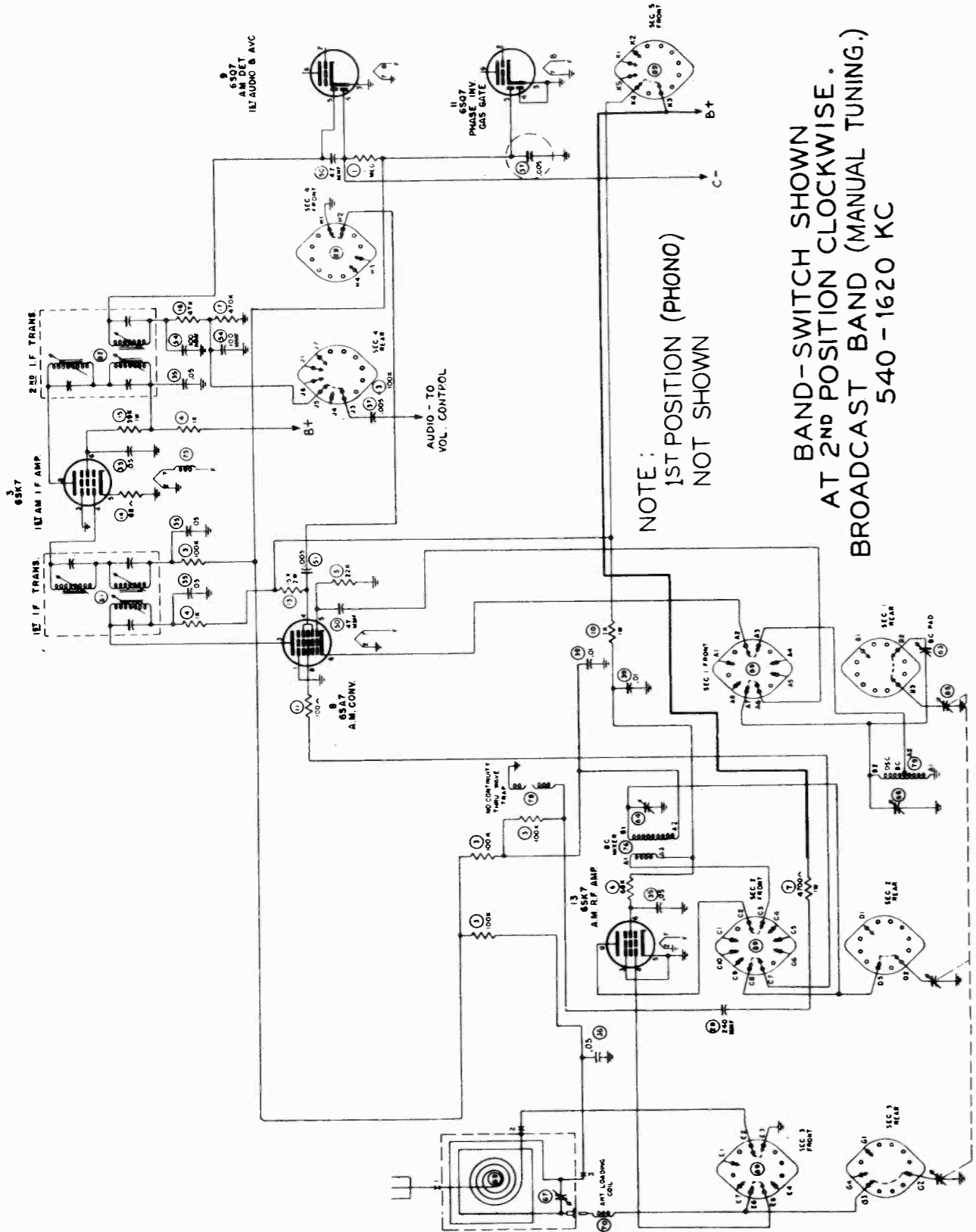
Symbol	Part No.	DESCRIPTION
CAPACITORS		
C-1, 2, 16, 18, 19, 22, 23, 35	BD410103	Capacitor, Paper, .01 Mfd., 400 volt
C-3	B-58810-8	Capacitor, Ceramic 220 mmf., ±20%
C-4A, B, C	C-59663-1	Capacitor, Variable (5-Section) D, E
C-5	B-51839-3	Capacitor, 1.5 mmf., ±20%
C-6	B-58808-2	Capacitor, Ceramic 27 mmf., ±20%
C-7, 11, 13, 25	B-58815-6	Capacitor, Ceramic 2700 mmf., ±20%
C-8	B-58807-12	Capacitor, Ceramic 20 mmf., ±10%
C-9	B-58809-16	Capacitor, Ceramic 100 mmf., ±20%
C-10	B-58804-18	Capacitor, Ceramic 100 mmf., ±20%
C-12		Capacitor, 20 mmf. (Part of T-11)
C-14, 17, 21	BD410503	Capacitor, Paper .05 Mfd., 400 volt
C-15	BD210503	Capacitor, Paper .05 Mfd. 200 volt
C-20, 30	B-58814-2	Capacitor, Ceramic .01 Mfd., ±20%
C-24, 26	B-58813-18	Capacitor, Ceramic 100 mmf., ±10%
C-27	BD610102	Capacitor, Paper .001 Mfd., 600 volt
C-28	B-55520-3	Capacitor, Electro., 4 Mfd., 50 volt
C-29	B-58805-6	Capacitor, Ceramic 39 mmf., ±10%
C-31	BD610302	Capacitor, Paper .003 Mfd., 600 volt
C-32	BD410203	Capacitor, Paper .02 Mfd., 400 volt
C-33	A-55521	Capacitor, Electro., 40-20-20 Mfd., 150 volt, 20 Mfd., 25 volt
C-34	B-58812-5	Capacitor, Ceramic 220 mmf., ±20%
CR-1	B-58852-1	Capristor, 100-100 mmf., 47K ohms ½ watt
RESISTORS		
R-1, 4	BR17B104	Resistor, 100K ohms, ±20% ¼ watt
R-2	BR17B223	Resistor, 22K ohms, ±20% ¼ watt
R-3	BR17B153	Resistor, 15K ohms, ±20% ¼ watt
R-5	BR17B222	Resistor, 2.2K ohms, ±20% ¼ watt
R-6, 8, 11	BR17B102	Resistor, 1000 ohms, ±20% ¼ watt
R-7, 17, 19	BR17B225	Resistor, 2.2 meg., ±20% ¼ watt
R-9	BR17E330	Resistor, 33 ohms, ±20% 1 watt
R-10	BR17B680	Resistor, 68 ohms, ±20% ¼ watt
R-12, 24	BR17B474	Resistor, 470K ohms, ±20% ¼ watt
R-13	BR17B473	Resistor, 47K ohms, ±20% ¼ watt
R-14	B-55585-1	Control, 2 meg. (Vol. & Sw.)
R-15	BR17E220	Resistor, 22 ohms, ±20% 1 watt
R-16	BR16B331	Resistor, 330 ohms, ±10% ¼ watt
R-18	BR16B153	Resistor, 15K ohms, ±10% ¼ watt
R-20	BR17B224	Resistor, 220K ohms, ±20% ¼ watt
R-21	BR17B685	Resistor, 6.8 meg., ±20% ¼ watt
R-22	BR16E821	Resistor, 820 ohms, ±10% 1 watt
R-23	BR16E121	Resistor, 120 ohms, ±10% 1 watt

Symbol	Part No.	DESCRIPTION
COILS AND TRANSFORMERS		
L-1	B-59692	Coil Assy., FM Ant.
L-2	B-59693	Coil Assy., FM Osc.
L-3	D-59681	Coil Assy., Loop
L-4	B-57842	Coil Assy., AM Osc.
L-5	B-59572	Coil Assy., RF Choke
L-6	B-57931	Coil Assy., RF Choke
L-7	B-57931	Coil Assy., RF Choke
L-8	B-51726-1	Choke, Filter
T-1	B-59665-1	Trans. Assy., 1st I.F. FM
T-2	C-59694	Trans. Assy., 1st I.F. AM
T-3	B-59680-1	Trans. Assy., 2nd I.F. FM
T-4	C-59564	Trans. Assy., 2nd IF. AM
T-5	B-59695-1	Trans. Assy., Ratio Det.
T-6	C-59563-1	Transformer, Output
MISCELLANEOUS PARTS		
C-59560		Back-Cabinet Assembly
C-59688		Back
D-58069-1		Cord Assembly
B-59561		Insulator
B-59559-1		Pin. Guide
A-5243		Socket, 2-Prong
A-55447		Socket, Shell and Bracket Assembly
E-59660-1		Cabinet, Plastic
A-55451-1		Clip, Tube Hold-Down
B-55380-2		Clip, Tuning Knob Retainer
A-51163		Clip, Tuning Shaft Retainer
D-59671-1		Dial, Crystal Plastic
B-55121-2		Fastener, for Loop Back
A-59672		Insulator, Chassis Mounting
C-59658-1		Knob, Tuning Control
C-59659-1		Knob, Volume Control
A-55431		Lamp, Pilot G.E. No. 7C7
B-59580		Pointer Assembly Dial
B-58069-1		Power Cord
A-58612		Rectifier, Selenium
B-55440-2		Socket, Dial Lamp (with Leads)
SP-1	D-59657	Speaker, 5-inch P.M.
	A-51787	Spring, Dial Cable Tension
	B-55122-1	Stud, Cabinet Back Mounting
SW-1		Switch (Part of R-14)
SW-2	A-55506	Switch, Band (2-Position)
	A-55507	Switch, Tone Control

VOLTAGE	1 RESISTANCE	VOLTAGE	2 RESISTANCE	VOLTAGE	3 RESISTANCE	VOLTAGE	4 RESISTANCE	VOLTAGE	5 RESISTANCE	VOLTAGE	6 RESISTANCE	VOLTAGE	7 RESISTANCE	VOLTAGE	8 RESISTANCE	VOLTAGE	9 RESISTANCE	VOLTAGE	10 RESISTANCE	VOLTAGE	11 RESISTANCE	VOLTAGE	12 RESISTANCE	VOLTAGE	13 RESISTANCE	VOLTAGE	14 RESISTANCE	VOLTAGE	15 RESISTANCE	
1.12V	1.1MEG	1.36	1.22K	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
2.0	2.0	2.16	2.47K	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
4.63ACV	4.2	4.63AC	4.2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
5.230V	5.1MEG	5.205	5.1NF	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
5.90V	5.9NF	6.10	6.1NF	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95
7.0	7.0	7.16	7.47K	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0

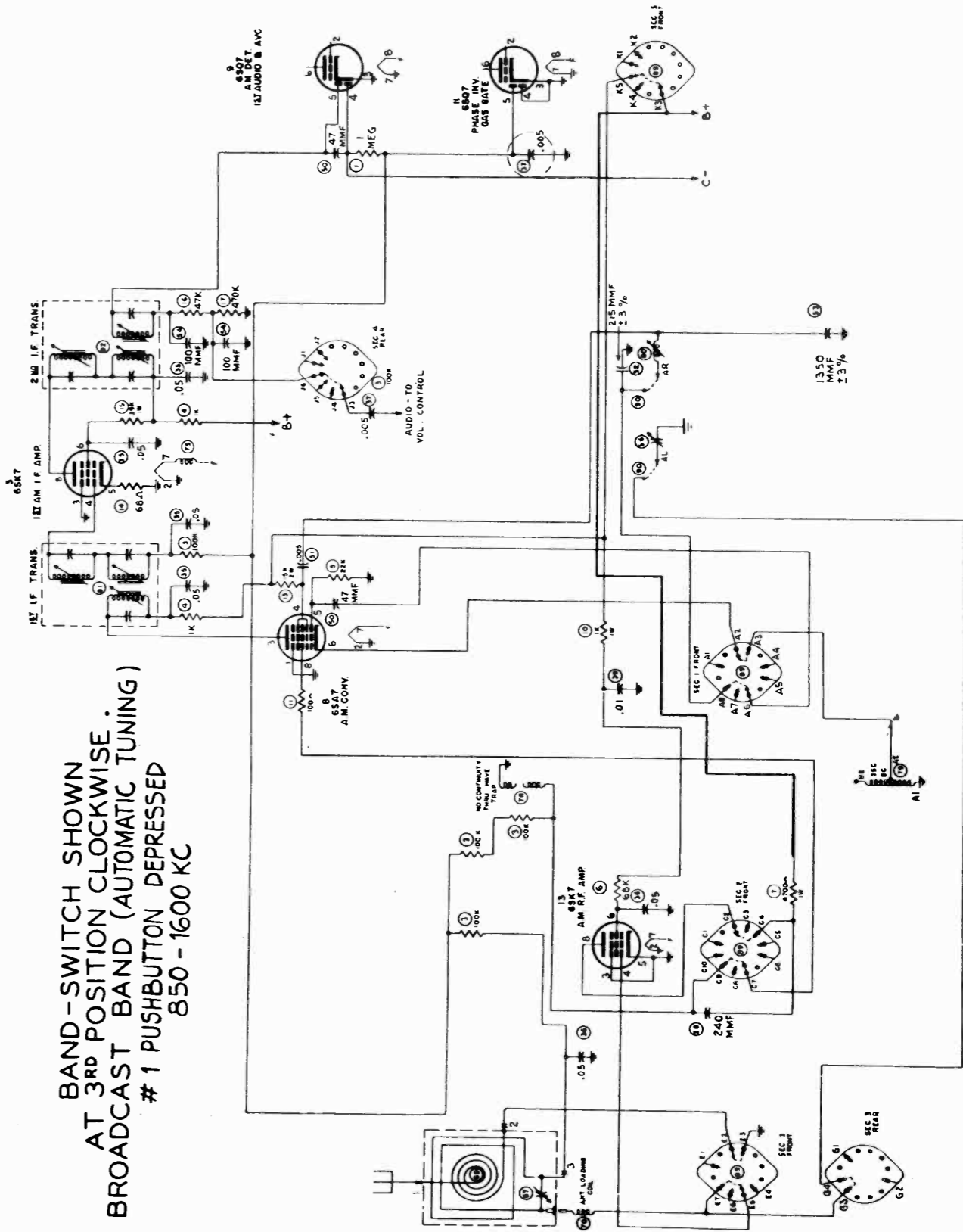


ALL POINTS MARKED "G" CONNECTED TO UNGROUND
 SIDE OF 6.3V WINDING ON POWER TRANSFORMER.
 VOLTAGE MEASUREMENTS TAKEN WITH VOLT-OHM-METER,
 NO SIGNAL, AVC INOPERATIVE.
 BAND SWITCH SHOWN IN EXTREME COUNTER-CLOCKWISE (PHONO) POSITION
 1 PHONO, 2 AM MANUAL, 3 AM PUSH-BUTTON, 4 FM, 5 SHORT WAVE

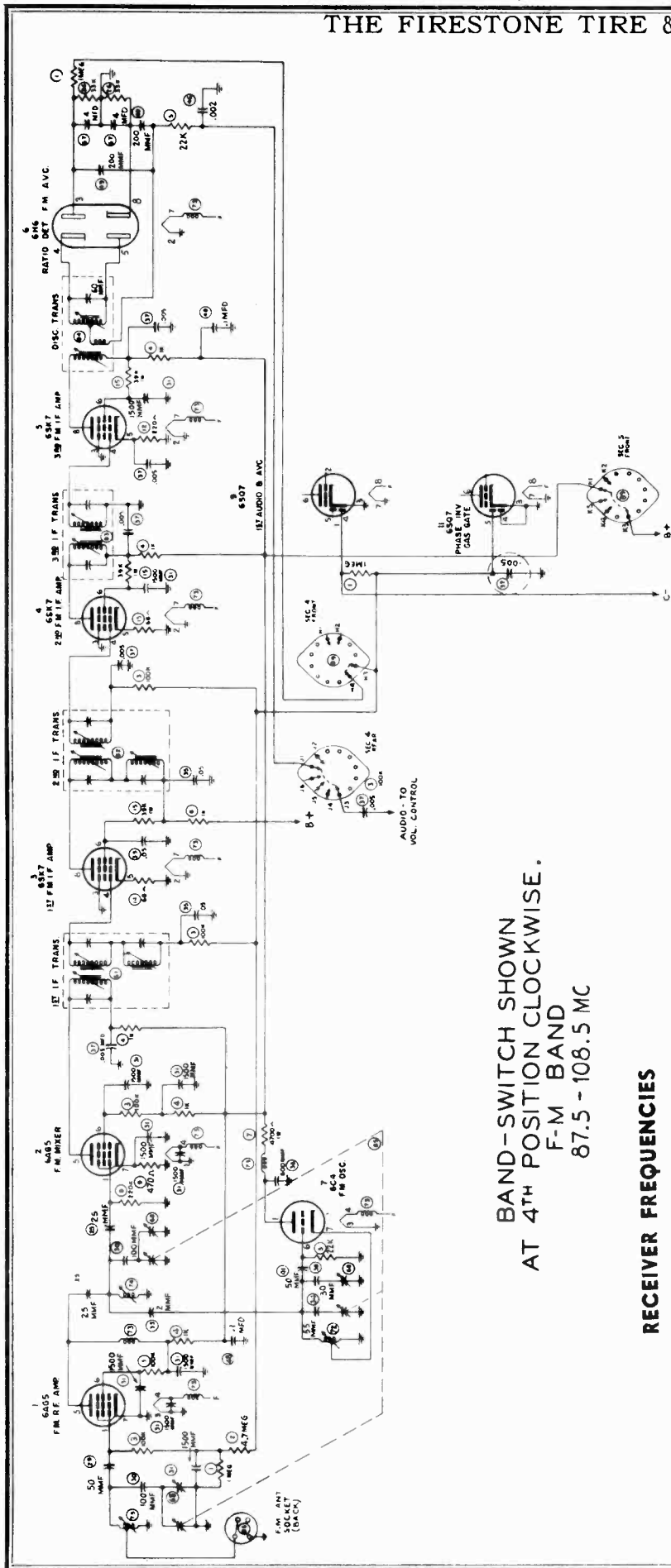


NOTE:
1ST POSITION (PHONO)
NOT SHOWN

BAND-SWITCH SHOWN
AT 2ND POSITION (CLOCKWISE)
BROADCAST BAND (MANUAL TUNING)
540 - 1620 KC



BAND-SWITCH SHOWN
AT 3RD POSITION (CLOCKWISE)
BROADCAST BAND (AUTOMATIC TUNING)
1 PUSHBUTTON DEPRESSED
850 - 1600 KC



BAND-SWITCH SHOWN
AT 4TH POSITION CLOCKWISE.
F-M BAND
87.5 - 108.5 MC

RECEIVER FREQUENCIES

Broadcast Band	540 to 1620 K.C.
Short-Wave Band	9.4 to 15.4 M.C.
Frequency Modulation Band	87.5 to 108.5 M.C.
Intermediate Frequency—AM Bands	455 K.C.
FM Bands	10.7 M.C.

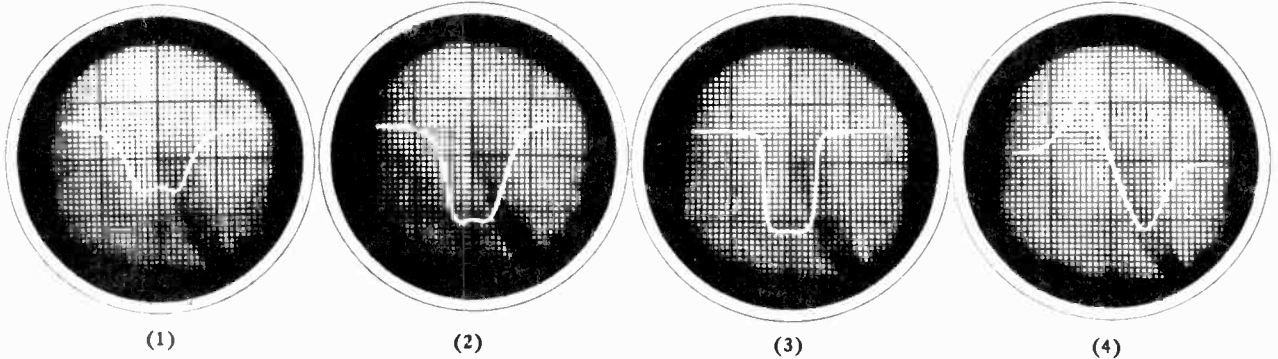
POWER AND VOLTAGE REQUIREMENTS

Power Consumption—120 Watts at 117 Volts, 60 Cycles
Voltage—105-125 Volts at 60 Cycles per Second
50 Cycle Operation With Modification
To The Record Changer

AMPLIFIER SPEAKER SYSTEM

Power Output	15 Watts
Voice Coil Impedance, each speaker	3.2 Ohms
Speakers	12 inch and 6 inch

Oscilloscope Alignment—FM Band



These curves were obtained under ideal conditions and show curves to be expected. They should be duplicated as nearly as practicable.

FM IF ALIGNMENT

1. Equipment required: Oscilloscope, 10.7 MC sweep generator, voltomyst, and RF signal generator.
2. Set band switch in FM position.
3. Make connection from vertical deflection amplifier of oscilloscope to pin #3 of 6H6 discriminator tube. Make certain that the 4MFD electrolytic condenser is disconnected from this same circuit. It is necessary that the lead to the oscilloscope be shielded, of low total capacity, and connection to receiver isolated by means of a 1 meg. resistor.
4. Connect sweep generator to last FM IF grid through a .1 MFD coupling capacitor.
5. Load primary of discriminator transformer with resistor of approximately 3900 ohms. Back out secondary slug (top slug) as far as it will turn. Align primary (bottom slug) to obtain curve similar to figure 1. This does not constitute a final alignment of discriminator, but is a convenient expedient to assist in IF alignment.
6. Shift connection of sweep signal generator to the grid of the second FM IF tube.
NOTE: As alignment moves from stage to stage, reduce input instead of reducing oscilloscope gain.
7. Align third FM IF transformer for a symmetrical flat top pattern. (Fig. 2).
8. Shift signal generator to the grid of the first IF tube.
9. Align second IF transformer in same manner as described in Section 7.
Note that the width of the nose of the curve is the same as before, but the sides have become steeper, as in Fig. 3.
10. Connect the signal generator to the grid of the converter tube grid in series with 10,000 ohm resistor and a .1MFD capacitor, or loosely couple by stray capacity of an insulated wire.
11. Align first FM IF transformer in the same manner as in Section 7.
Note that the sides of the curve have further steepened, but that the nose of the curve has retained approximately the same width as in Fig. 3.

12. Connect 4 MFD electrolytic capacitor that was previously disconnected, and take off load resistor on discriminator primary.
13. Connect oscilloscope to audio output terminal of discriminator. There are several points where contact can be made and can be identified as the circuit connected to the terminal on the terminal board (nearest the discriminator transformer) to which the shielded lead is connected.
14. With sweep signal input to converter grid, align discriminator transformer for conventional discriminator pattern, as in Fig. 4.
15. Connect signal generator to converter tube grid through .1MFD capacitor. An unmodulated signal input of 65 microvolts at 10.7 MC should develop .55 volt rise on the AVC line with voltomyst connected to AVC line through 1 megohm resistor.

Alternate FM IF Alignment Procedure

1. Connect voltomyst or high resistance voltmeter on AVC line (Pin 3 on 6H6 socket) through 1 meg. resistor. Connect AM signal generator, set at 10.7 MC, to grid on 6SK7 which feeds diode transformer. Connect output meter on voice coil of speaker.
2. Turn bottom slug (nearest the chassis) of disc. transformer out as far as possible.
3. Tune top slug of disc. transformer for maximum output (negative voltage) on the volt meter.
4. Connect generator to grid of second IF amplifier.
5. Detune slug of 3rd IF transformer under chassis by turning out as far as possible
6. Tune top slug for maximum voltage, next tune bottom slug for maximum voltage. In each step do not use an input greater than necessary to give three volts AVC.
7. Connect signal generator to grid of first IF amplifier.
8. Detune bottom FM slug (nearest corner of can) by turning out as far as possible.

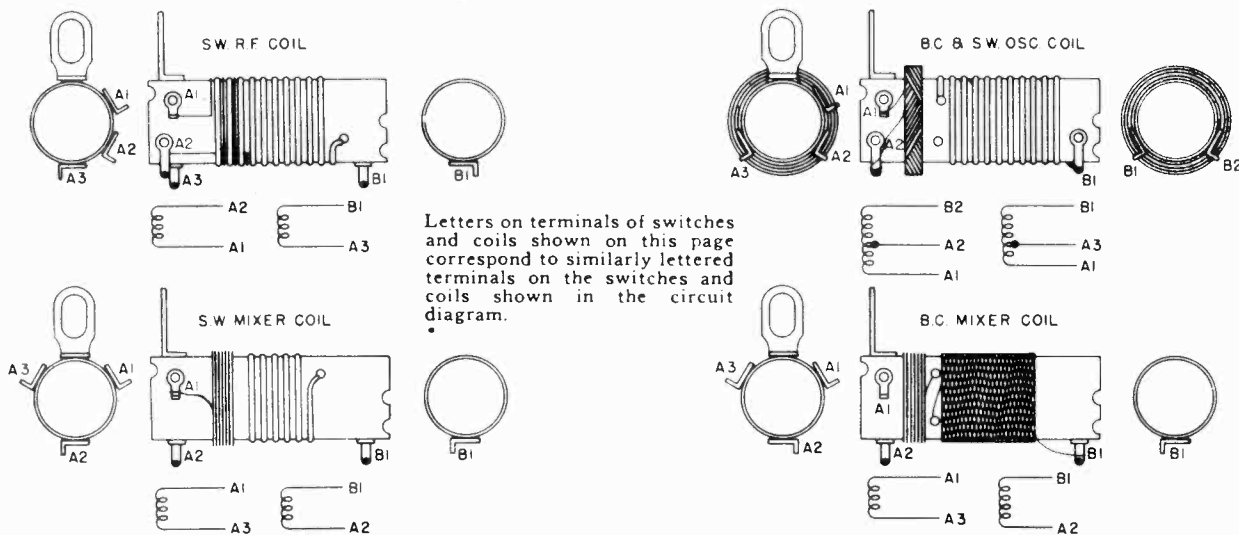
9. Tune top slug (nearest corner of can) for maximum voltage, next tune bottom slug for maximum voltage.
10. Connect signal generator to 6AG5 converter grid and tune first IF transformer as above.
11. With generator still hooked to 6AG5 grid and modulated with 400 cycles, about 200 microvolts input, adjust slug next to chassis on disc. transformer for minimum output voltage on output meter which is on voice coil.

FM RF Alignment

1. Equipment Required:
 - a. RF Signal Generator. Range 88 to 108 MC.
 - b. Output Meter.
 - c. Insulated Screw Driver.
2. Connect RF signal generator in series with 330 ohm carbon resistor to "high" side of FM antenna socket. Connect output meter across voice coil of speaker.
3. Set tuning control for pointer to calibrate at 108.
4. Apply 108 MC Signal.
5. Set converter and antenna trimmers at minimum capacity.
6. Adjust oscillator trimmer by tuning from maximum capacity to first signal that is heard, and peak for maximum output.
7. Adjust antenna and converter trimmers for maximum output.
8. Set tuning controls so dial pointer calibrates at 88 MC.
9. Apply 88 MC signal.
10. Adjust oscillator, converter, and antenna slugs to maximum output.
11. Repeat operations 3 to 10 inclusive.

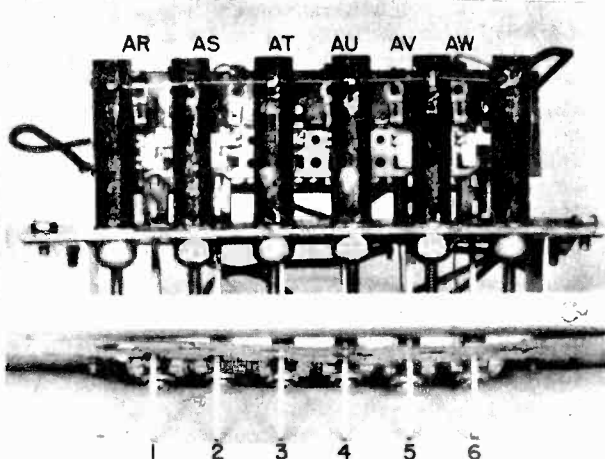
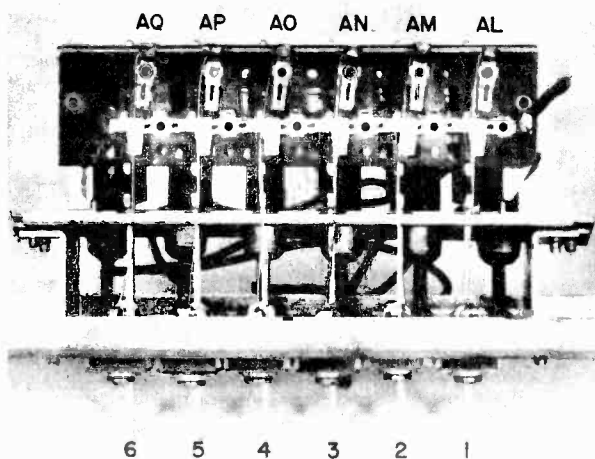
NOTE: The degree of adjustment required in the tuning of the oscillator slug will determine the number of times operations 3 to 10 must be repeated until no further gain in sensitivity is obtained.
12. Carefully tune across the entire FM band for the observance of the dead or weak spots that may be a resultant of improper alignment or defective components. This can be determined by carefully noting the degree of receiver noise, that is, high noise generally is accompanied by good sensitivity.

RF, OSCILLATOR AND MIXER COILS



TOP VIEW OF PUSHBUTTON ASSEMBLY

BOTTOM VIEW OF PUSHBUTTON ASSEMBLY



Alignment of AM Bands

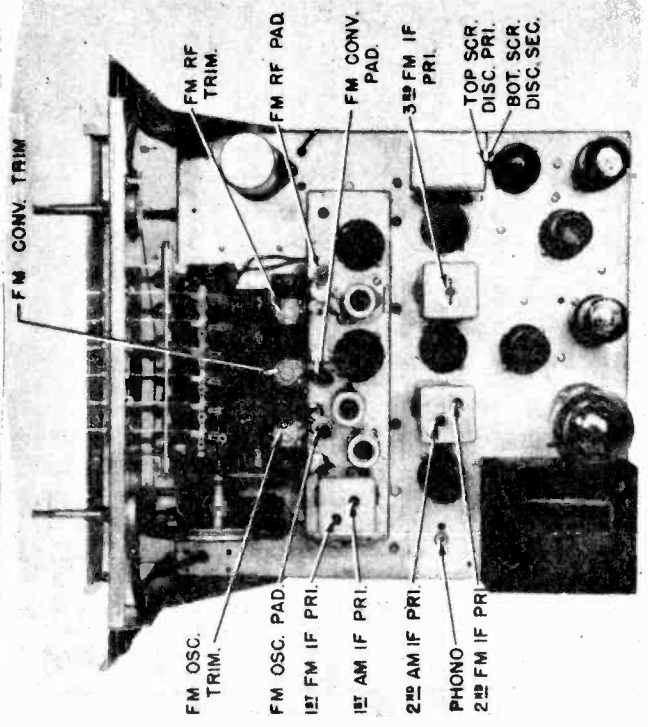
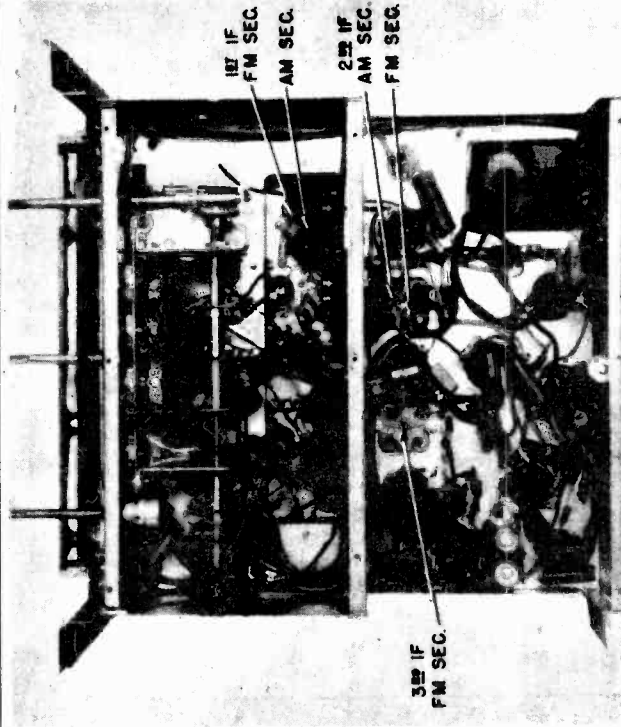
EQUIPMENT REQUIRED

A calibrated signal generator having fundamental frequencies from 455 Kc to 16 MC. In addition to the signal generator a crystal calibrator is a great convenience.

The indicating device for showing correct alignment may be a high resistance A.C. voltmeter, a vacuum tube voltmeter or a Cathode Ray oscilloscope.

The A.C. voltmeter can be used either across the voice coil of the loud speaker or if the meter range is high enough, from the plate to plate in the output stage (don't forget a condenser (0.1 Mfd.) to keep the D.C. out of the meter).

Special care must be employed when aligning the short wave band, for the adjustment of the shunt trimmer affects the adjustment of the series pad. At the high frequency end of the band it is possible to peak the oscillator trimmer (and the pad at the low frequency end) at the image so in the alignment instructions we have indicated the fundamental frequency and the correct oscillator setting for the image so by resetting the signal generator it is possible to see if the alignment is correctly made. In each case, the image is found at a frequency 910 Kc. higher than the fundamental. Trimmers are accessible by removing top radio panel, eliminating necessity of chassis removal from cabinet.



TABULATION FOR AM ALIGNMENT

STEPS	CONNECT GENERATOR	SET GENERATOR AT	SET GANG AT	ADJUST	TO OBTAIN	
1	Set Tone and Volume Controls at Maximum					
2	Grid Conv. tube	455 Kc	Quiet Point	2nd. I.F. A.M. Slugs	MAXIMUM OUTPUT	
3				1st. I.F. A.M. Slugs		
4	RF of GANG	1500 Kc	1500 Kc	BC Osc. Trimmer		
5				BC R.F. Trimmer		
6				600 Kc		600 Kc
7	Check dial calibration at several frequencies. If not reasonably correct, adjust oscillator padder. See Note †					
8	# Ext. Ant. Binding Post	1500 Kc	1500 Kc	Loop Trimmer		

Through RMA dummy antenna.

* This adjustment should be made while gang is rocked.

SHORT WAVE RF

9	Place Band Switch in Short Wave position.					
10	Through 400 ohm resistor	External Antenna	15 MC	15 MC	SW Osc. * Trimmer	MAXIMUM OUTPUT
11					SW R.F. Trimmer	
12					SW Ant. Trimmer	
13			9.4 MC	9.4 MC	SW Osc. † Padder	
14					SW R.F. Padder	
15					SW Ant. Padder	
16	Recheck Steps 10 to 15 inclusive.					

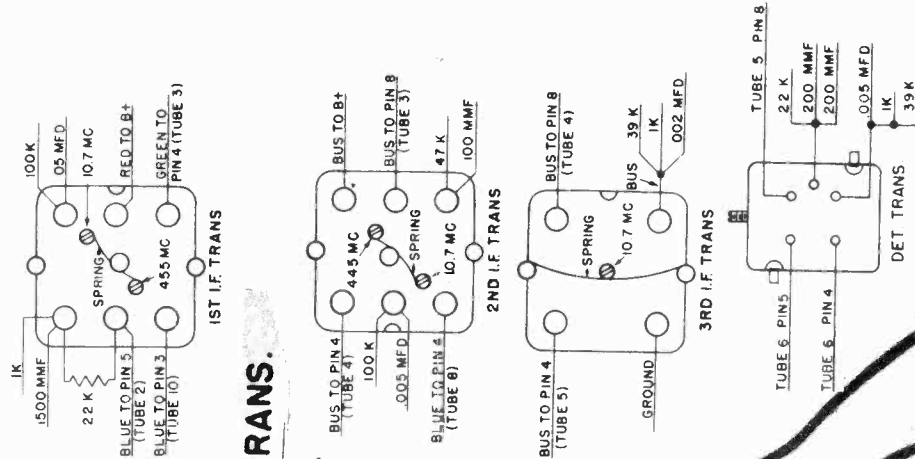
* Set oscillator trimmer to maximum capacity, then slowly loosen trimmer until 2nd signal is heard. Check for proper alignment of OSC trimmer by tuning set to approximately 14.1 MC at which point or image signal should appear.

† After any adjustment of oscillator padder, repeat steps 4, 5 and 6.

ANTENNAS

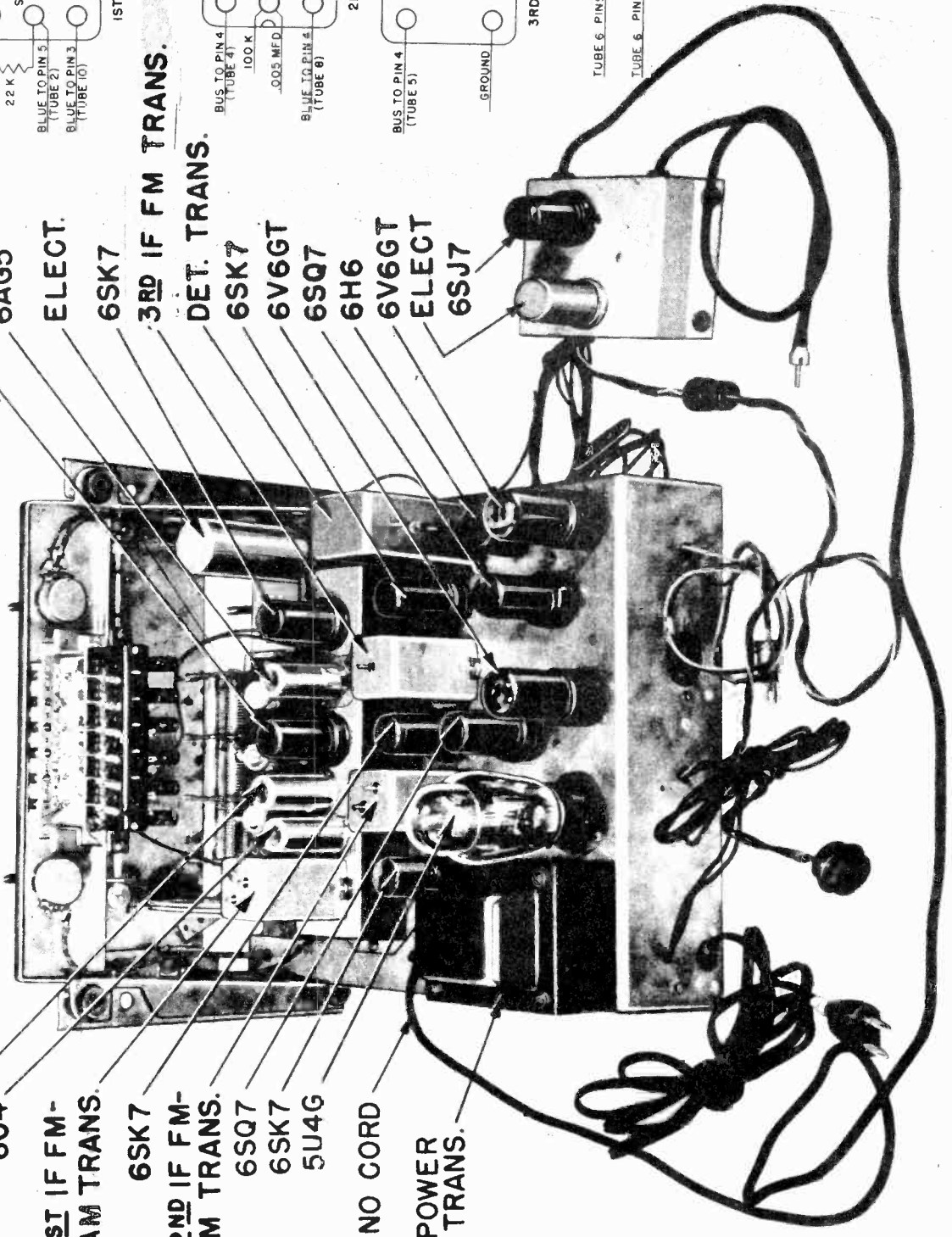
Broadcast Band..... Firestone "Powerscope"
 Shielded rotatable loop
 Shortwave Band... BC loop shield acting as a capacity antenna
 FM Band..... Folded dipole with 300 ohm cable

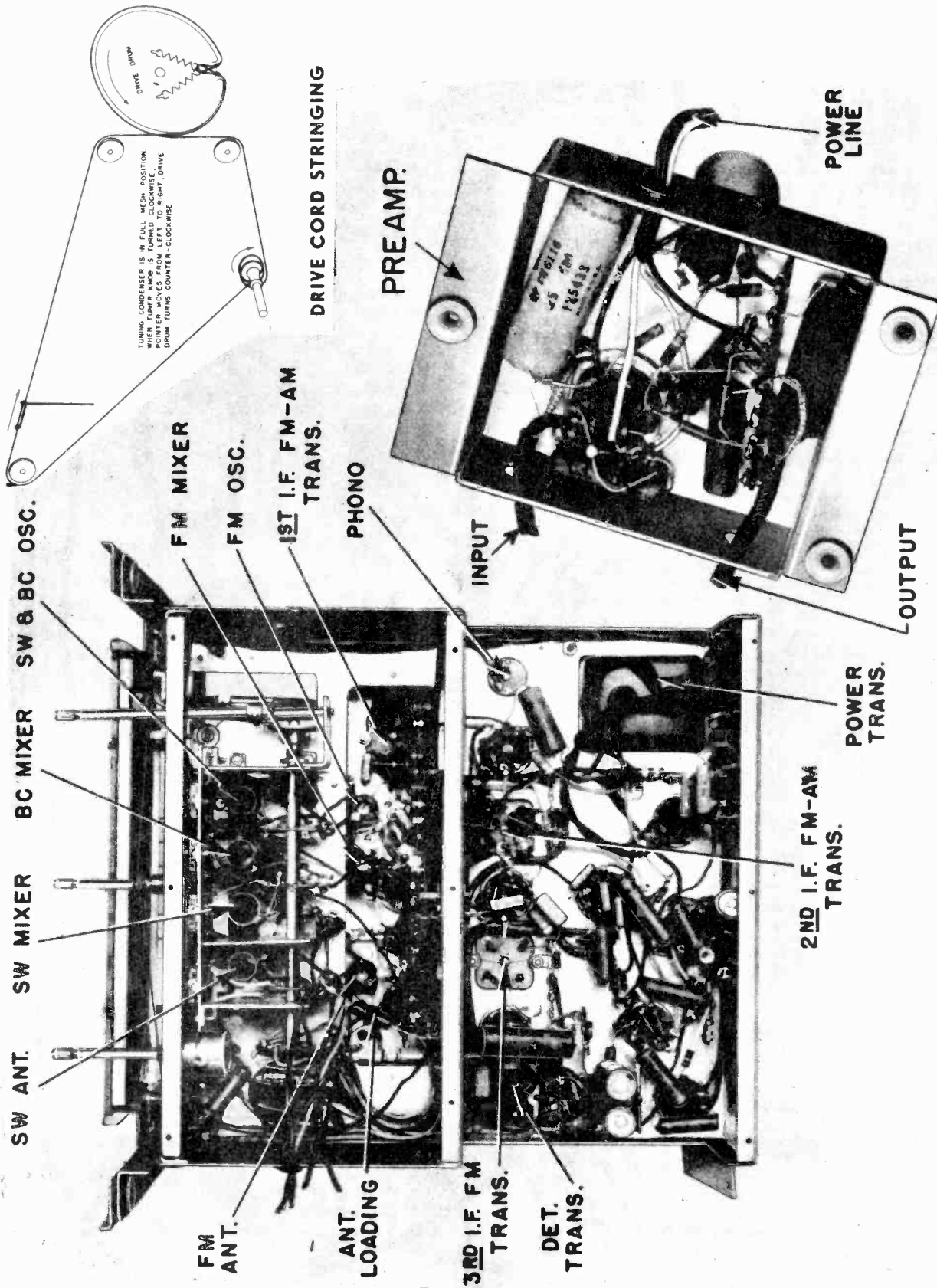
BOTTOM VIEW OF I.F. CANS



- 6SA7
- 6AG5
- ELECT.
- 6SK7
- 3RD IF FM TRANS.
- DET. TRANS.
- 6SK7
- 6V6GT
- 6SQ7
- 6H6
- 6V6GT
- ELECT
- 6SJ7

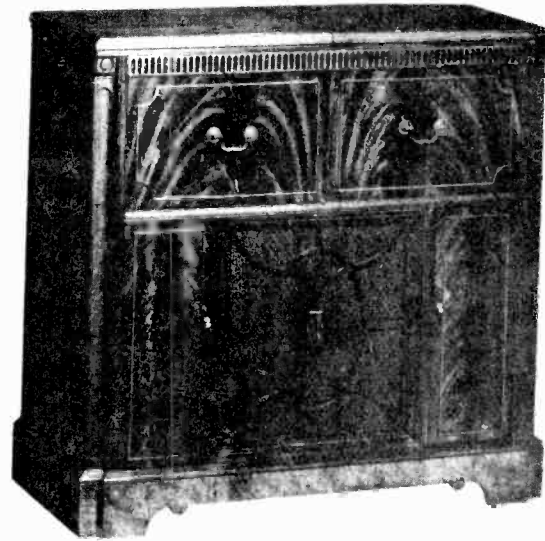
- 6AG5
- 6C4
- 1ST IF FM-AM TRANS.
- 6SK7
- 2ND IF FM-AM TRANS.
- 6SQ7
- 6SK7
- 5U4G
- PHONO CORD
- POWER TRANS.





THE FIRESTONE TIRE & RUBBER CO.

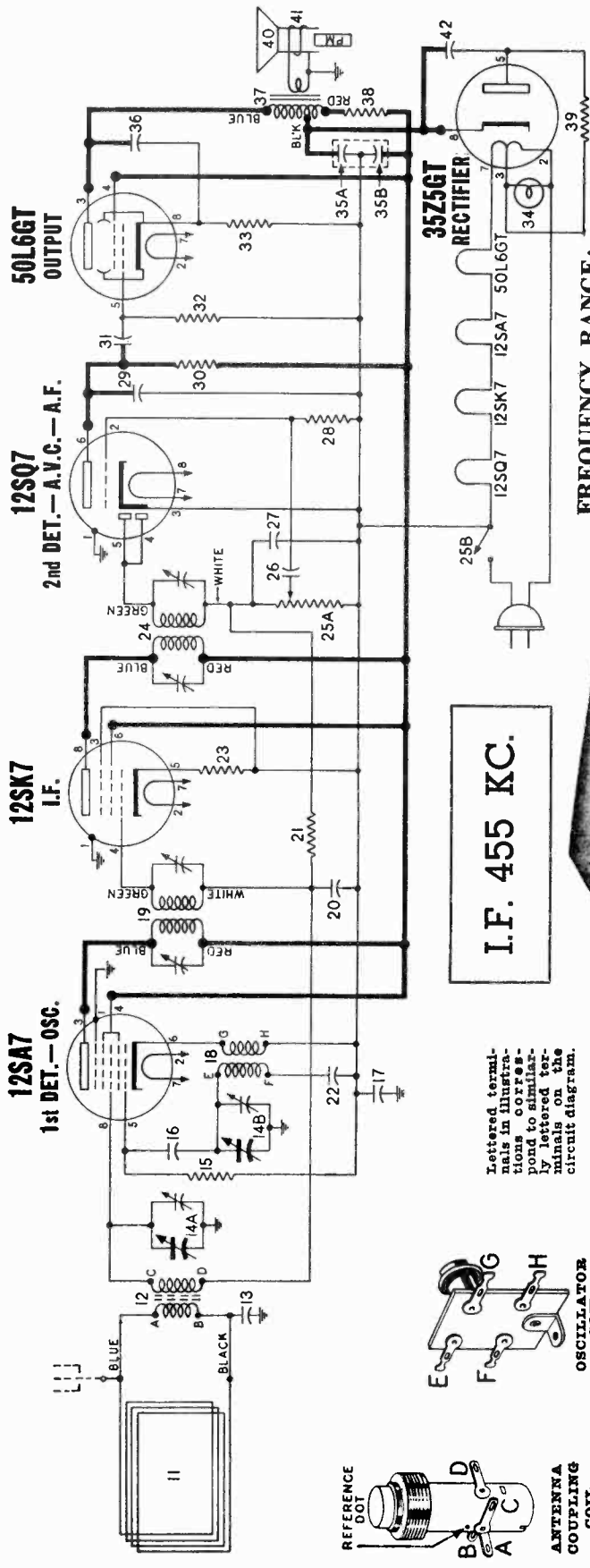
MODEL 4-A-15



Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
1	77218	1 Megohm Resistor.....	63	26272	#3 Trimmer Strip.....
2	77272	4.7 Megohm Resistor.....	64	26271	#2 Trimmer Strip.....
3	77214	100K Ohm Resistor.....	65	26270	#1 Trimmer Strip.....
4	77262	1000 Ohm Resistor.....	66	26274	Push Button Switch Trimmer Strip
5	77266	22K Ohm Resistor.....	67	26031	Antenna Trimmer.....
6	77305	68K Ohm Resistor.....	68	26221	Ceramic Trimmer 1.5-7 Mmf.....
7	77429	4700 Ohm Resistor 1 Watt.....	69	38896	Loop Antenna Assembly.....
8	77216	220K Ohm Resistor.....	70	38845	Loop Loading Coil.....
9	77261	470 Ohm Resistor.....	71	38905	S.W. Antenna Coil.....
10	77106	1000 Ohm Resistor 1 Watt.....	72	38673	FM Oscillator Coil.....
11	77258	100 Ohm Resistor.....	73	38661	R.F. Choke.....
12	77209	220 Ohm Resistor.....	74	38672	FM Converter Coil.....
13	77325	15K Ohm Resistor 2 Watt.....	75	38673	FM R.F. Coil Assembly.....
14	77269	68 Ohm Resistor.....	76	38904	BC Converter Coil.....
15	77322	39K Ohm Resistor 1 Watt.....	77	38903	S.W. Converter Coil.....
16	77213	47K Ohm Resistor.....	78	38484	Wave Trap.....
17	77217	470K Ohm Resistor.....	79	38902	B.C. & S.W. Oscillator Coil.....
18	77210	3300 Ohm Resistor.....	80	38906	P.B. Coil Assembly.....
19	77265	15K Ohm Resistor.....	81	38621	1st I.F. Transformer.....
20	77263	1.5K Ohm Resistor.....	82	38622	2nd I.F. Transformer.....
21	77274	10 Megohm Resistor.....	83	38623	3rd I.F. Transformer.....
22	77270	2.2 Megohm Resistor.....	84	38879	Discriminator Transformer.....
23	77337	500 Ohm Resistor Wire Wound 5 Watt	85	26230	Gang Capacitor.....
24	77428	27 Ohm Resistor 1 Watt.....	86	80439	FM Antenna Socket.....
25	77338	230 Ohm Wire Wound 5 Watt.....	87	80439	AM Antenna Socket.....
26	77267	33K Ohm Resistor.....	88	80440	AM Antenna Plug.....
27	77268	330K Ohm Resistor.....	89	90263	Band Switch.....
28	25349	240 Mmf Mica Capacitor.....	90	90264	P.B. Switch.....
29	25143	50 Mmf Ceramic Capacitor, Zero Temp.	91	78103	Treble Control.....
30	25447	100 Mmf Ceramic Capacitor, N-470	92	78102	Bass Control.....
31	25273	1500 Mmf Ceramic Capacitor.....	93	78101	Volume Control.....
32	25159	25 Mmf Ceramic Capacitor, Zero Temp.	94	11274	Phono Motor Lead & Socket.....
33	25275	2 Mmf Ceramic Capacitor, Zero Temp.	95	27118	Line Cord.....
34	25346	55 Mmf Ceramic Capacitor, N-330	96	94170	Power Transformer.....
35	25196	.05 Mfd Tubular Capacitor 600 Volts	97	94258	Output Transformer for 81178
36	25274	600 Mmf Ceramic Capacitor Hi-K	98	94259	Output Transformer for 81179
37	25141	.005 Mfd Mica Capacitor.....	99	81178	Speaker (6 inch).....
38	25329	30 Mmf Ceramic Capacitor.....	100	81179	Speaker (12 inch).....
39	25194	.01 Tubular Capacitor 600 Volts	101	80465	Speaker Plug for 81179
40	25112	.01 Tubular Capacitor 200 Volts	102	80245	Speaker Socket for 81179, 6 Prong, Wafer Type
41	25375	50 Mmf Ceramic Capacitor.....	103	80468	Speaker Plug for 81178
43	25195	.02 Mfd Tubular Capacitor 600 Volts	104	80236	Speaker Socket for 81178
44	25184	.003 Mfd Tubular Capacitor 600 Volts	105	22170	Output Cable.....
45	25185	.002 Mfd Tubular Capacitor 600 Volts	106	22169	Pick-up Cable.....
46	25432	.001 Mfd Tubular Capacitor 200 Volts	107	80030	Phono Jack.....
47	25433	.25 Mfd Tubular Capacitor 500 Volts	108	22171	Power Adapter Cable (male)
48	25215	.1 Mfd Tubular Capacitor 600 Volts	109	22173	Power Adapter Cable (female)
49	25318	200 Mmf Molded Mica Capacitor		05141	Drive Cord (46").....
50	25193	47 Mmf Molded Mica Capacitor		11431	Dipole Antenna Assembly.....
51	25183	.005 Mfd Tubular Capacitor.....		11441	On-Off Indicator Light Assembly
52	25212	215 Mmf Silver Mica Capacitor		13801	Flexible Shaft Assembly.....
53	25213	1350 Mmf Silver Mica Capacitor		13806	Pointer Assembly.....
54	25188	100 Mmf Molded Mica Capacitor		17199	Miniature Tube Socket & Shield Assembly
55	25431	20 Mfd, 450 Volts, 25 Mfd, 25 Volt Electrolytic Capacitor	31424		Dial Glass.....
56	25277	20 Mfd, 30 Mfd, 40 Mfd, 450 Volt Electrolytic Capacitor	59435		Push Button.....
57	25270	4 Mfd, Electrolytic Capacitor	59436		Push Button Escutcheon
58	25269	50 Mfd, 25 Volts Electrolytic Capacitor	64305		Push Button Retainer.....
59	25031	.005 Mfd Buffer Capacitor 600 Volts	67512		Knob (Volume).....
60	25126	.005 Mfd Tubular Capacitor 200 Volts	67513		Knob (Tuning).....
61	25276	.02 Mfd Tubular Capacitor 200 Volts	67514		Knob (Bandswitch).....
62	26273	#4 Trimmer Strip.....	67515		Knob (Bass Tone).....
			67516		Knob (Treble).....
			67517		Knob (Powerscope).....
			92228		Felt Washer.....
			11412		Compartment Light Assy.....
			37530		Lid Support R.H.....
			37531		Door Pull.....
			37532		Drawer Slides (Set).....
			37533		Cabinet Knob.....
			37534		Door Catch—Bullet Type.....
			37535		Hinge—Piano Type 17¼".....
			37536		Hinge RH.....
			37537		Hinge LH.....
			37538		1 Prong Glides (Set of 4).....

MODEL 4-A-26,
THE NEWCASTER

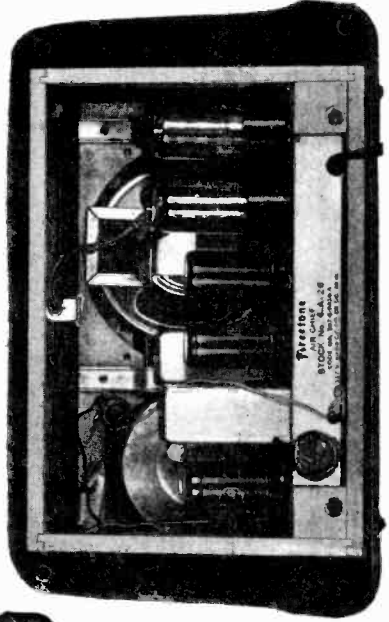
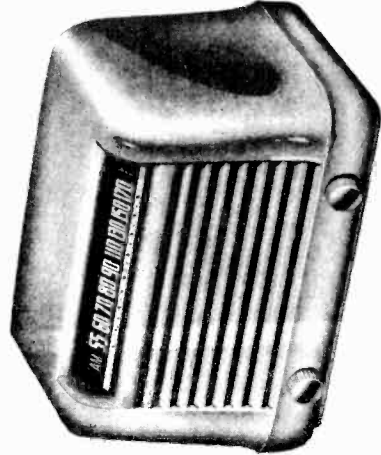
THE FIRESTONE TIRE & RUBBER CO.



I.F. 455 KC.

FREQUENCY RANGE:
Standard Broadcast Band
540-1725 KC.

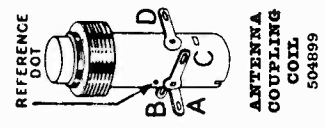
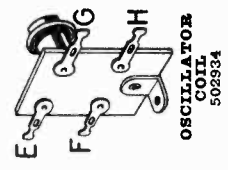
SPEAKER:
4 inch P-M Dynamic
Voice coil impedance—3.2 ohms



POWER SUPPLY:
117 volts
50-60 cycles A.C. or D.C.
80 watts

POWER OUTPUT:
Undistorted — 1.0 watts
Maximum — 1.9 watts

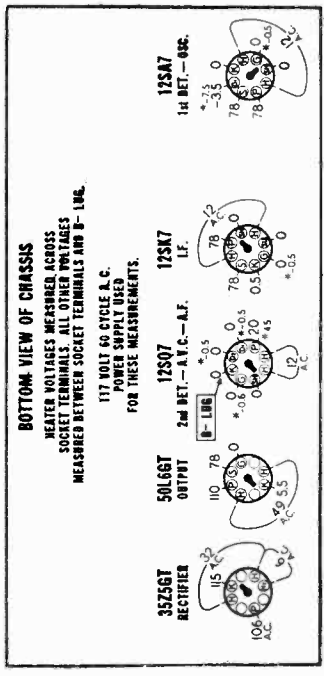
Lettered terminals in illustrations correspond to similarly lettered terminals on the circuit diagram.



SOCKET VOLTAGES

Measured with voltmeter having sensitivity of 1000 ohms per volt except where indicated by (*). The (*) symbol designates a vacuum tube voltmeter measurement.

VOLUME ON FULL WITH NO SIGNAL DIAL TUNED TO 540 KC.

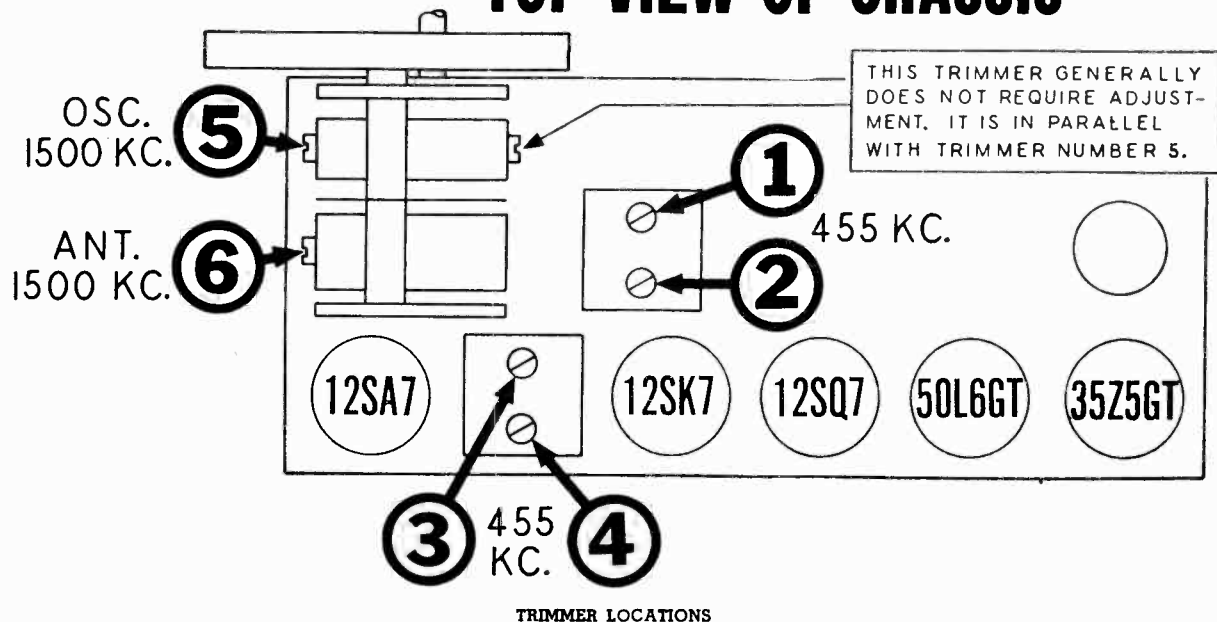


ALIGNMENT PROCEDURE

1. With the gang condenser fully meshed, the dial pointer should be in the position indicated by the last mark below 55 on the dial. If it is set incorrectly, release the pointer clip on dial cord and reposition pointer.
2. Remove chassis from cabinet by taking out two screws which hold chassis to bottom of cabinet. Solder approximately 8" of insulated wire to any B— connection (see voltage chart on Page 6 for convenient B— location).
3. Connect ground lead of signal generator to B— through a 0.25 Mfd. condenser.
4. Connect output meter across speaker voice coil (terminals at back of speaker) or from plate of type 50L6GT tube to B— through a 0.1 Mfd. condenser.
5. Set volume control at maximum volume position and use a weak signal from the signal generator.

DUMMY ANT. IN SERIES WITH SIGNAL GENERATOR	CONNECT HIGH SIDE OF GENERATOR TO	SIGNAL GENERATOR FREQUENCY	RECEIVER DIAL SETTING	TRIMMER NUMBER	TRIMMER DESCRIPTION	TYPE OF ADJUSTMENT
200 MMFD. Mica Condenser	Lug on trimmer No. 6 on rear section of gang (see figure below for location of trimmer.)	455 KC	Any point where it does not affect the signal.	1-2	2nd I.F.	Adjust for maximum output. Then repeat adjustment.
				3-4	1st I.F.	
200 MMFD. Mica Condenser	External Antenna Clip on Loop Antenna	1500 KC	1500 KC	5	Broadcast Oscillator	Adjust for maximum output.
200 MMFD. Mica Condenser	External Antenna Clip on Loop Antenna	1500 KC	Tune to 1500 KC generator signal.	6	Broadcast Antenna	Adjust for maximum output.

TOP VIEW OF CHASSIS



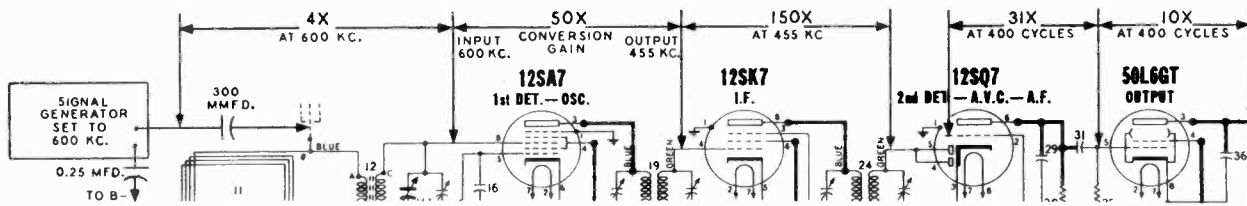
MODEL 4-A-26,
THE NEWSCASTER

STAGE GAIN MEASUREMENT PROCEDURE

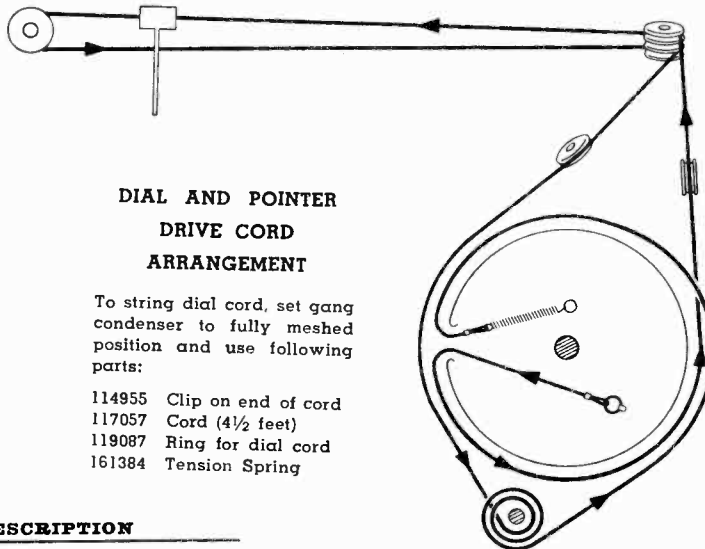
REQUIRED INSTRUMENTS: The amount of amplification or "gain" of each of the stages of this receiver may be measured with an A.C. Vacuum Tube Voltmeter or a "channel" type instrument containing a tuned and calibrated amplifier.

PROCEDURE: It is exceedingly important to adhere to the procedure outlined below since the accuracy of these measurements will be affected to a considerable extent by the failure to establish proper operating conditions.

1. Be sure that R.F. and I.F. stages are carefully and accurately aligned by utilizing the alignment procedure given on page 4.
2. Connect Signal Generator as shown below.
3. The values of stage gain which are given here were measured with a fixed bias of 3 volts on the control grids of all R.F. and I.F. tubes which are connected to the A.V.C. circuit. Therefore, these values are not intended to indicate the full capability of a stage but they will serve as a convenient basis for determining proper operation. In order to duplicate the fixed bias voltage, connect the negative terminal of a 3 volt battery to the A.V.C. lead at terminal "D" of antenna coil and then connect positive battery lead to B— in the receiver chassis.
4. Set Signal Generator for operation at 600 Kc with 400 cycle modulation and carefully tune radio receiver to this signal by using an output meter to indicate peak output. If a local station interferes, set generator to a nearby frequency and re-tune the receiver.
5. R.F. and I.F. circuits are slightly de-tuned when contact is made with an instrument probe and this action, which is indicated by a change in the output meter reading, may seriously affect the gain measurement. Therefore, it is important to adjust the associated circuit trimmer for a maximum output meter reading and to set the input signal level to a convenient reference point on the gain measuring instrument while the probe is making contact. After removing the probe it is again necessary to adjust the trimmer so as to obtain the same output meter reading and thereby assure that the signal voltage at the specified point has not changed as a result of circuit de-tuning.
6. When using a "channel" type instrument, carefully tune it for maximum output at desired frequency before making measurements.



DIFFERENCES in tube characteristics, tolerance of parts, adjustment of tuned circuits and variations in line voltage will influence stage gain. These factors should be given due attention in event the gain of a stage varies extensively from the values shown above.



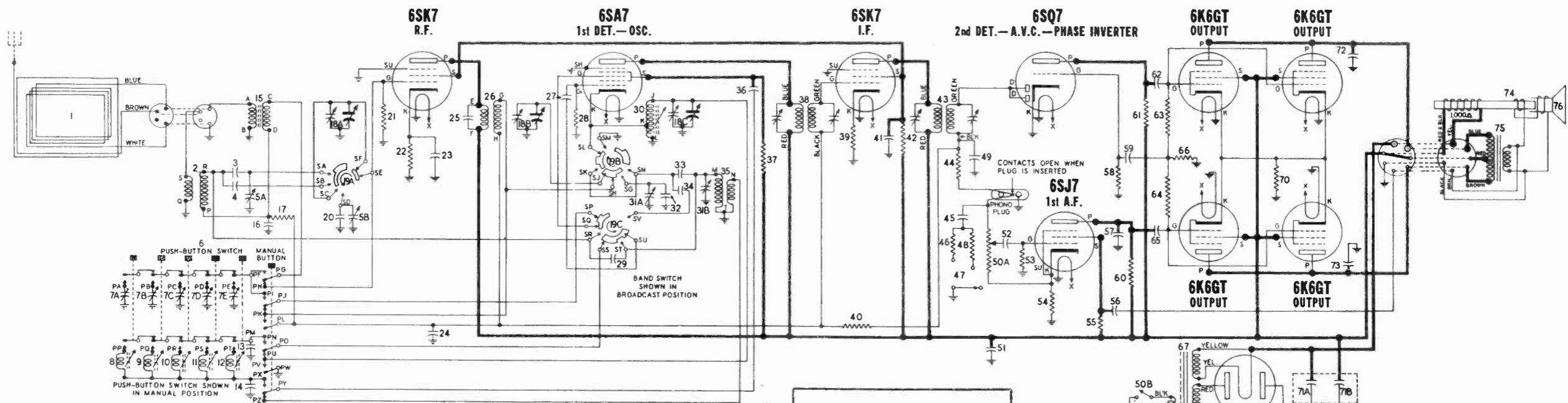
**DIAL AND POINTER
DRIVE CORD
ARRANGEMENT**

To string dial cord, set gang condenser to fully meshed position and use following parts:

- 114955 Clip on end of cord
- 117057 Cord (4½ feet)
- 119087 Ring for dial cord
- 161384 Tension Spring

DIA-GRAM NO.	PART NO.	DESCRIPTION
CONDENSERS		
13	502156	Condenser—.004 Mfd. 400 volt.
14-A, B	502925	Condenser—variable gang (with drum).
16	502929	Condenser—.47 Mmfd. 500 volt.
17	502158	Condenser—.2 Mfd. 400 volt.
20	502153	Condenser—.05 Mfd. 200 volt.
22	502410	Condenser—.1 Mfd. 400 volt.
26	502156	Condenser—.004 Mfd. 400 volt.
27	502882	Condenser—.220 Mmfd. 500 volt.
29	502470	Condenser—.0008 Mfd. 400 volt.
31	502156	Condenser—.004 Mfd. 400 volt.
35-A, B	500256	Condenser—electrolytic A—40 Mfd. 150 volt B—20 Mfd. 150 volt
36	502152	Condenser—.02 Mfd. 400 volt.
42	502157	Condenser—.05 Mfd. 400 volt.
RESISTORS		
15	502130	Resistor—carbon 22,000 ohms ¼ watt
21	502135	Resistor—carbon 2.2 Meg. ¼ watt
23	502264	Resistor—carbon 47 ohms ¼ watt
25-A, B	502928	Volume control—with switch; 1 Meg.
28	502136	Resistor—carbon 10 Meg. ¼ watt
30	502134	Resistor—carbon 470,000 ohms ¼ watt
32	502134	Resistor—carbon 470,000 ohms ¼ watt

DIA-GRAM NO.	PART NO.	DESCRIPTION
33	502932	Resistor—carbon 150 ohms 1 watt
38	502933	Resistor—carbon 1,500 ohms 1 watt
39	502574	Resistor—carbon 33 ohms ½ watt
COILS AND TRANSFORMERS		
11	504348	Loop antenna
12	504899	Coil—antenna
18	502934	Coil—oscillator
19	502926	Transformer—1st I.F.
24	505040	Transformer—2nd I.F.
37	502817	Transformer—output for C-502816 speaker
	504583	Transformer—output for W-502816 speaker
OTHER ELECTRICAL PARTS		
34	118921	Lamp—dial (Mazda 47) 6-8V. 150 Ma.
	502818	Cone and voice coil for C-502816 speaker
40	504584	Cone and voice coil for W-502816 speaker
41	502816	Speaker—P.M. dynamic (4 inch)

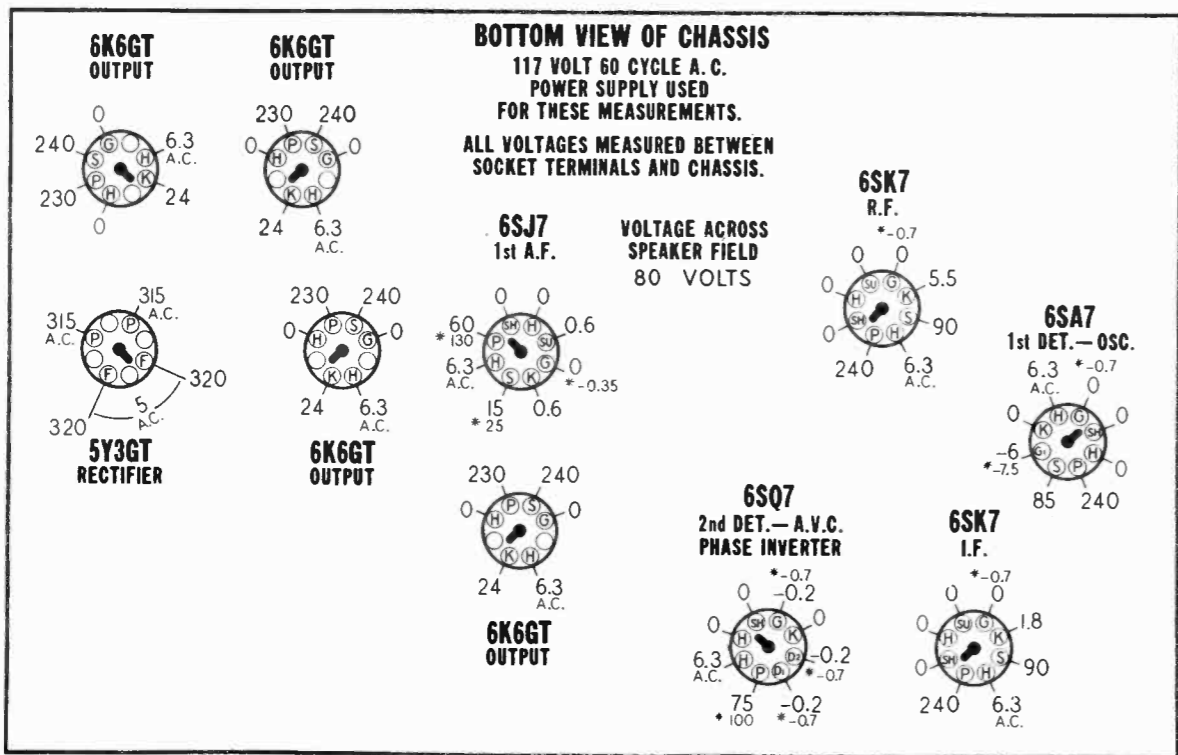


SOCKET VOLTAGES

Measured with voltmeter having sensitivity of 1000 ohms per volt except where indicated by (*). The (*) symbol designates a vacuum tube voltmeter measurement.

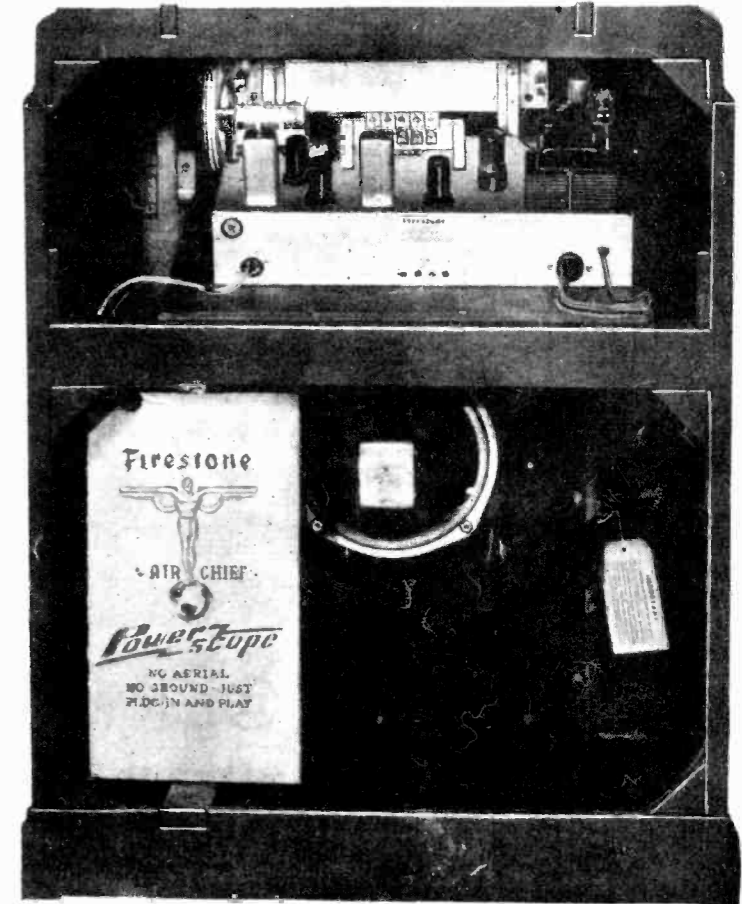
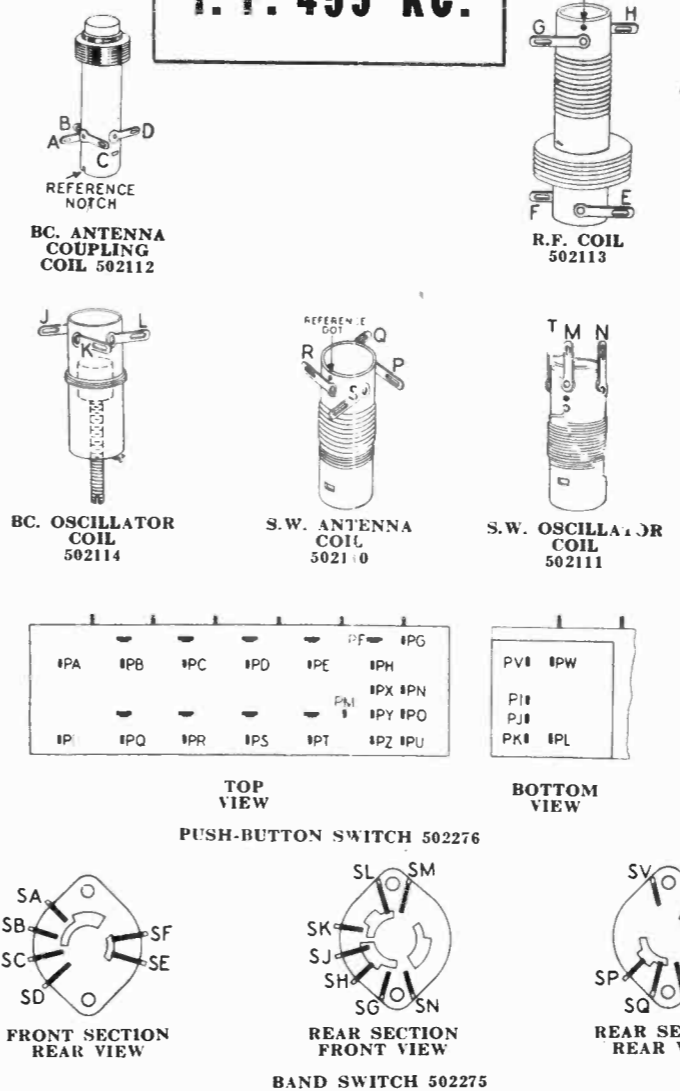
VOLUME ON FULL WITH NO SIGNAL
RANGE SWITCH IN BROADCAST ("A") POSITION

DIAL TUNED TO 540 KC.
MANUAL BUTTON PUSHED IN



REAR OF CHASSIS

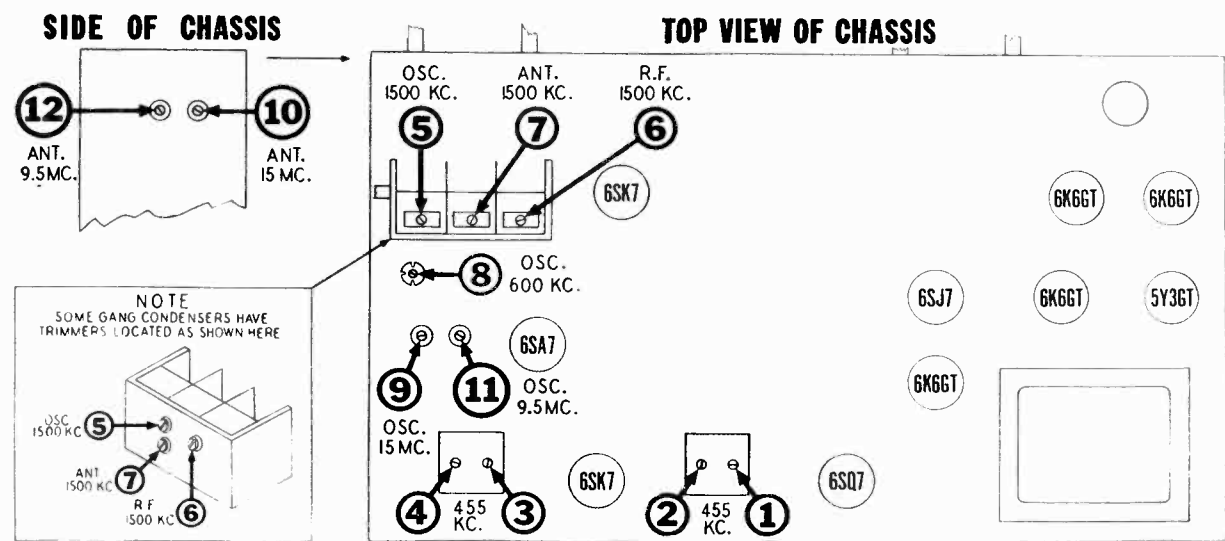
I. F. 455 KC.



ALIGNMENT PROCEDURE

1. Remove chassis and loop antenna from cabinet (do not remove loop of wire stapled to cabinet). Wind one turn of insulated wire around frame of antenna so as to provide a means of coupling it to the signal generator. Space chassis approximately same distance from loop as when installed in cabinet. Connect plug on loop antenna cable to socket at rear of chassis. Brown lead in antenna cable (which was connected to loop of wire stapled to cabinet) should now be connected to one end of new coupling turn on frame of loop.
 2. With the gang condenser fully meshed, dial pointer should be in the position indicated by the last division below 55 on the dial. If it is set incorrectly, release pointer clip on dial cord and reposition pointer.
 3. Connect output meter across speaker voice coil.
 4. Connect the ground lead of the signal generator to the receiver chassis.
 5. Set volume control at maximum volume position and use a weak signal from the signal generator.
 6. Push in the manual button and leave it in that position throughout the alignment procedure.
- IMPORTANT:**—Align this receiver in exactly the order shown below. Broadcast band must be aligned before short wave bands.

DUMMY ANT. IN SERIES WITH SIGNAL GENERATOR	CONNECT HIGH SIDE OF SIGNAL GENERATOR TO	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RECEIVER DIAL SETTING	TRIMMER NUMBER	TRIMMER DESCRIPTION	TYPE OF ADJUSTMENT
1 MFD. Condenser	Trimmer on rear section of gang	455 KC	"A" Broadcast (counter-clockwise)	Any point where it does not affect the signal.	1-2 3-4	2nd I.F. 1st I.F.	Adjust for maximum output. Then repeat adjustment.
500 MMFD. Condenser	Coupling turn on Loop Frame	1500 KC	"A" Broadcast (counter-clockwise)	1500 KC	5	Broadcast Oscillator (Shunt)	Adjust for maximum output
500 MMFD. Condenser	Coupling turn on Loop Frame	1500 KC	"A" Broadcast (counter-clockwise)	Tune to 1500 KC Generator Signal	6	Broadcast R.F.	Adjust for maximum output
500 MMFD. Condenser	Coupling turn on Loop Frame	1500 KC	"A" Broadcast (counter-clockwise)	Tune to 1500 KC Generator Signal	7	Broadcast Antenna	Adjust for maximum output
500 MMFD. Condenser	Coupling turn on Loop Frame	600 KC	"A" Broadcast (counter-clockwise)	Tune to 600 KC Generator Signal	8	Adjustable core of Broadcast Oscillator Coil.	Adjust for maximum output. Try to increase output by rotating core in and out and retuning receiver dial until maximum output is obtained.
500 MMFD. Condenser	Coupling turn on Loop Frame	Repeat adjustments of trimmers 5, 6 and 7 at 1500 Kc. Then re-check adjustment of trimmer 8 at 600 Kc.					
400 OHM Carbon Resistor	Coupling turn on Loop Frame	15.5 MC	"B" Short wave (center)	15.5 MC	9	S.W. ("B") Oscillator	Adjust for maximum output. Check to see if proper peak was obtained by tuning in image at approx. 14.6 MC. If image does not appear, realign at 15.5 MC, with trimmer screw farther out. Recheck image.
400 OHM Carbon Resistor	Coupling turn on Loop Frame	15.5 MC	"B" Short wave (center)	Tune to 15.5 MC Generator Signal	10	S.W. ("B") Antenna	Adjust for maximum output. Try to increase output by detuning trimmer and retuning receiver dial until maximum output is obtained.
400 OHM Carbon Resistor	Coupling turn on Loop Frame	9.5 MC	"C" Short wave (clockwise)	9.5 MC	11	S.W. ("C") Oscillator	Adjust for maximum output. Check to see if proper peak was obtained by tuning in image at approx. 8.6 MC. If image does not appear, realign at 9.5 MC, with trimmer screw farther out. Recheck image.
400 OHM Carbon Resistor	Coupling turn on Loop Frame	9.5 MC	"C" Short wave (clockwise)	Tune to 9.5 MC Generator Signal	12	S.W. ("C") Antenna	Adjust for maximum output. Try to increase output by detuning trimmer and retuning receiver dial until maximum output is obtained.



- FREQUENCY RANGES:**
Standard Broadcast Band 540-1725 KC.
Band "B" (Short Wave) 11.4-15.5 MC.
Band "C" (Short Wave) 5.9-10.0 MC.
- I.F. FREQUENCY:** 455 KC.
- PUSH-BUTTON RANGES:**
Button No. 1 —540-1000 KC.
Button No. 2 & 3 —650-1300 KC.
Button No. 4 & 5 —975-1600 KC.
- POWER SUPPLY:**
117 volts
50-60 cycles A.C.
80 watts
- POWER OUTPUT:**
Undistorted—4.0 watts
Maximum —6.5 watts
- SPEAKER:**
10 inch Electro-Dynamic
Voice coil impedance—3.2 ohms
- TUNING CONDENSER:**
3 section gang,
shock resistant mounting

- SETTING-UP THE PUSH BUTTONS**
5. Now push in the first button on the left. Return to rear of radio and use vertical pair of adjusting screws on extreme right to tune-in the same station. Adjust bottom screw first until desired station is heard. If station is not heard, change setting of top screw to a position where the slight static noise or rushing sound is the loudest. Then try adjusting bottom screw again; repeat this procedure until desired station is found. After locating station, carefully set bottom screw for deepest tone and top screw for maximum volume.
 6. The set-up of the first push-button is now complete. Proceed to set-up remaining buttons by first tuning-in station manually to identify program, then push in desired button and use appropriate pair of adjusting screws to tune-in the same station. The pair of adjusting screws associated with a particular button are located directly behind that button.
 7. A set of station call-letter tabs will be found in the envelope containing the operating instructions. Use these tabs to label the push-buttons.

PARTS LIST

DIA-GRAM PART No.	DESCRIPTION	DIA-GRAM PART No.	DESCRIPTION
3	Condenser—ceramic 82 Mmfd. 500 volt	17	Resistor—carbon 470,000 ohms 1/4 watt
4	Condenser—mica 670 Mmfd. 500 volt	18	Resistor—carbon 47 meg. 1/4 watt
5A, B	Condenser—trimmer assembly	19	Resistor—carbon 1,500 ohms 1/4 watt
7A to E	Section A 2 to 15 Mmfd.	20	Resistor—carbon 22,000 ohms 1/4 watt
13	Condenser—mica 270 Mmfd. 500 volt	21	Resistor—carbon 18,000 ohms 1/4 watt
14	Condenser—mica 1,000 Mmfd. 500 volt	22	Resistor—carbon 220 ohms 1/4 watt
15	Condenser—.05 Mfd. 200 volt	23	Resistor—carbon 17,000 ohms 1/4 watt
16	Condenser—mica 49 Mmfd. 500 volt	24	Resistor—carbon 100,000 ohms 1/4 watt
18A, B, C	Condenser—variable 49 Mmfd. 500 volt	25	Resistor—carbon 100,000 ohms (with switch)
20	Condenser—ceramic 49 Mmfd. 500 volt	26	Resistor—carbon 1.5 meg. 1/4 watt
21	Condenser—1 Mfd. 200 volt	27	Resistor—carbon 1.5 meg. 1/4 watt
22	Condenser—.05 Mfd. 200 volt	28	Resistor—carbon 1.5 meg. 1/4 watt
23	Condenser—.05 Mfd. 200 volt	29	Resistor—carbon 220,000 ohms 1/4 watt
24	Condenser—ceramic 10 Mmfd. 500 volt	30	Resistor—carbon 220,000 ohms 1/4 watt
25	Condenser—mica 50 Mmfd. 500 volt	31A, B	Section A 2 to 15 Mmfd.
27	Condenser—mica 50 Mmfd. 500 volt	32	Condenser—ceramic 82 Mmfd. 500 volt
29	Condenser—2 Mmfd. 500 volt	33	Condenser—ceramic 68 Mmfd. 500 volt
31A, B	Section B 2 to 15 Mmfd.	34	Condenser—ceramic 430 Mmfd. 500 volt
32	Condenser—ceramic 82 Mmfd. 500 volt	35	Condenser—.01 Mfd. 400 volt
33	Condenser—ceramic 68 Mmfd. 500 volt	36	Condenser—.01 Mfd. 400 volt
34	Condenser—ceramic 430 Mmfd. 500 volt	37	Condenser—.02 Mfd. 400 volt
35	Condenser—.01 Mfd. 400 volt	38	Condenser—.05 Mfd. 400 volt
36	Condenser—.01 Mfd. 400 volt	39	Condenser—.05 Mfd. 400 volt
37	Condenser—.02 Mfd. 400 volt	40	Condenser—.25 Mfd. 400 volt
38	Condenser—.05 Mfd. 400 volt	41	Condenser—.01 Mfd. 400 volt
39	Condenser—.05 Mfd. 400 volt	42	Condenser—.01 Mfd. 400 volt
40	Condenser—.25 Mfd. 400 volt	43	Condenser—electrolytic
41	Condenser—.01 Mfd. 400 volt	44	Condenser—20 Mfd. 400 volt
42	Condenser—.01 Mfd. 400 volt	45	Condenser—.004 Mfd. 600 volt
43	Condenser—electrolytic	46	Transformer—2nd I.F.
44	Condenser—20 Mfd. 400 volt	47	Transformer—output for M-502305 spkr.
45	Condenser—.004 Mfd. 600 volt	48	Transformer—2nd I.F.
46	Transformer—2nd I.F.	49	Transformer—output for M-502305 spkr.
47	Transformer—output for M-502305 spkr.	50	Transformer—2nd I.F.
48	Transformer—output for M-502305 spkr.	51	Transformer—output for M-502305 spkr.
49	Transformer—2nd I.F.	52	Transformer—output for M-502305 spkr.
50	Transformer—output for M-502305 spkr.	53	Transformer—output for M-502305 spkr.
51	Transformer—output for M-502305 spkr.	54	Transformer—output for M-502305 spkr.
52	Transformer—output for M-502305 spkr.	55	Transformer—output for M-502305 spkr.
53	Transformer—output for M-502305 spkr.	56	Transformer—output for M-502305 spkr.
54	Transformer—output for M-502305 spkr.	57	Transformer—output for M-502305 spkr.
55	Transformer—output for M-502305 spkr.	58	Transformer—output for M-502305 spkr.
56	Transformer—output for M-502305 spkr.	59	Transformer—output for M-502305 spkr.
57	Transformer—output for M-502305 spkr.	60	Transformer—output for M-502305 spkr.
58	Transformer—output for M-502305 spkr.	61	Transformer—output for M-502305 spkr.
59	Transformer—output for M-502305 spkr.	62	Transformer—output for M-502305 spkr.
60	Transformer—output for M-502305 spkr.	63	Transformer—output for M-502305 spkr.
61	Transformer—output for M-502305 spkr.	64	Transformer—output for M-502305 spkr.
62	Transformer—output for M-502305 spkr.	65	Transformer—output for M-502305 spkr.
63	Transformer—output for M-502305 spkr.	66	Transformer—output for M-502305 spkr.
64	Transformer—output for M-502305 spkr.	67	Transformer—output for M-502305 spkr.
65	Transformer—output for M-502305 spkr.	68	Transformer—output for M-502305 spkr.
66	Transformer—output for M-502305 spkr.	69	Transformer—output for M-502305 spkr.
67	Transformer—output for M-502305 spkr.	70	Transformer—output for M-502305 spkr.
68	Transformer—output for M-502305 spkr.	71A, B	Transformer—output for M-502305 spkr.
69	Transformer—output for M-502305 spkr.	72, 73	Transformer—output for M-502305 spkr.
70	Transformer—output for M-502305 spkr.		

OTHER ELECTRICAL PARTS

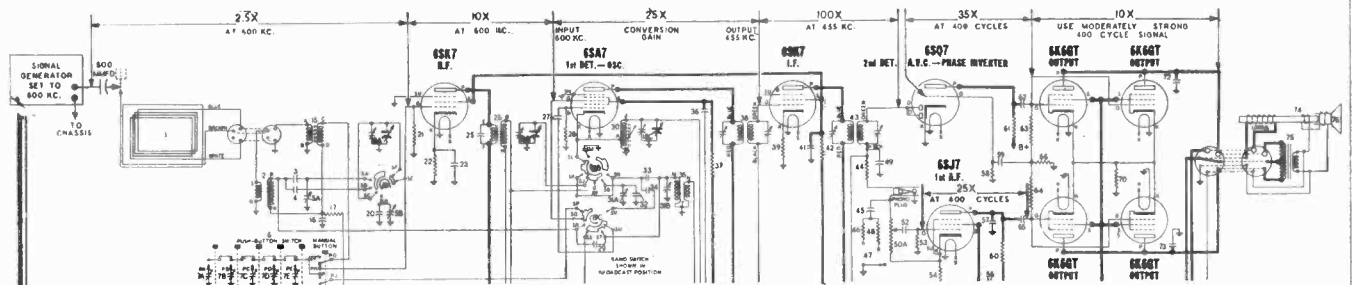
DIA-GRAM PART No.	DESCRIPTION
6	19A, B, C 502276 Switch—push button
47	502275 Switch—band
68, 69	502299 Switch—tone control
74	110629 Lamp-dial (Mazda 14) 6.3 V. 0.25 amps.
76	505305 Speaker—electro-dynamic (10 inch)
	502297 Cone & Voice coil for M-502305 speaker.

APPROXIMATE STAGE GAIN DATA

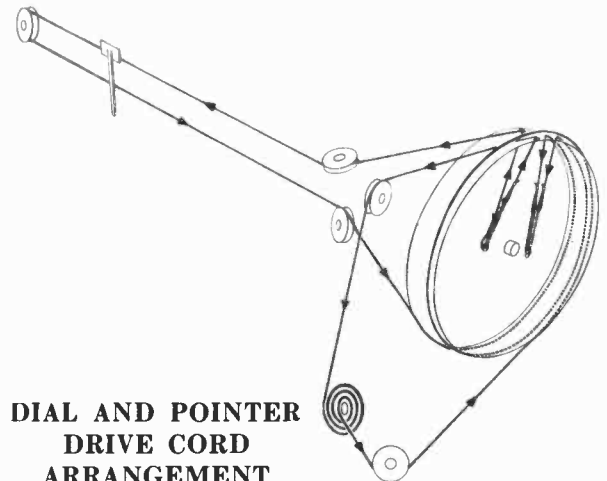
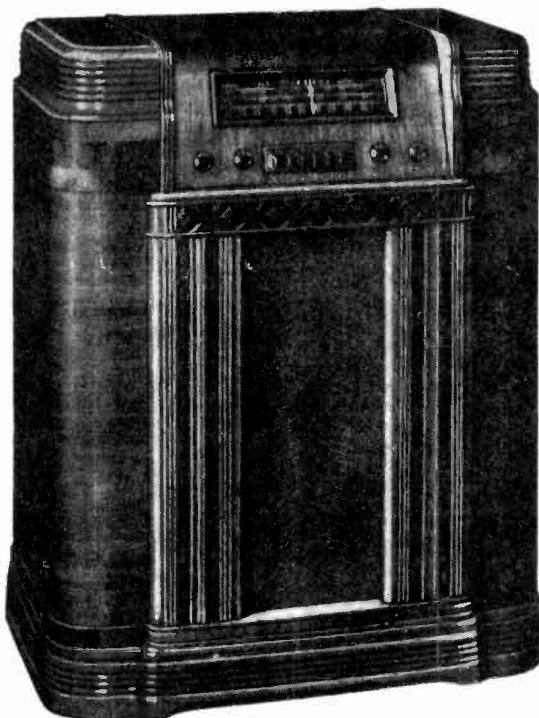
Be sure R.F. and I.F. stages are accurately aligned before measuring gain. R.F. gains can be measured with a "channel" type instrument containing a tuned and calibrated R.F. amplifier. A vacuum tube voltmeter may be used for audio gain measurements. Observe following precautions:

1. For all gain measurements connect signal generator as shown. Use 600 KC. signal with 400 cycle modulation (use nearby frequency if local station interferes.)
2. For R.F. and I.F. measurements connect negative terminal of a 3 volt battery (two 1½ volt cells in series) to A.V.C. lead at lug "P" of S.W. Antenna Coil and positive terminal to chassis. This provides a definite operating point. **IMPORTANT: Disconnect battery when measuring audio stage gains.**
3. Be sure radio is carefully tuned to generator signal (use weak signal for sharp tuning.)
4. When using a "channel" type instrument carefully tune it for maximum output at desired frequency before making measurements.

The R.F. and I.F. stage gains shown below are less than under normal operating conditions due to the use of 3 volts fixed bias in order to establish a definite operating point. Therefore, these values are not intended to indicate the full capability of a stage.



Differences in tube characteristics, tolerance of parts, adjustment of tuned circuits, and variations of line voltage will influence stage gain. Accuracy of measurements is dependent upon careful tuning of receiver to generator signal and experience in using your test equipment. These factors may create considerable variation in gain measurements.



DIAL AND POINTER DRIVE CORD ARRANGEMENT

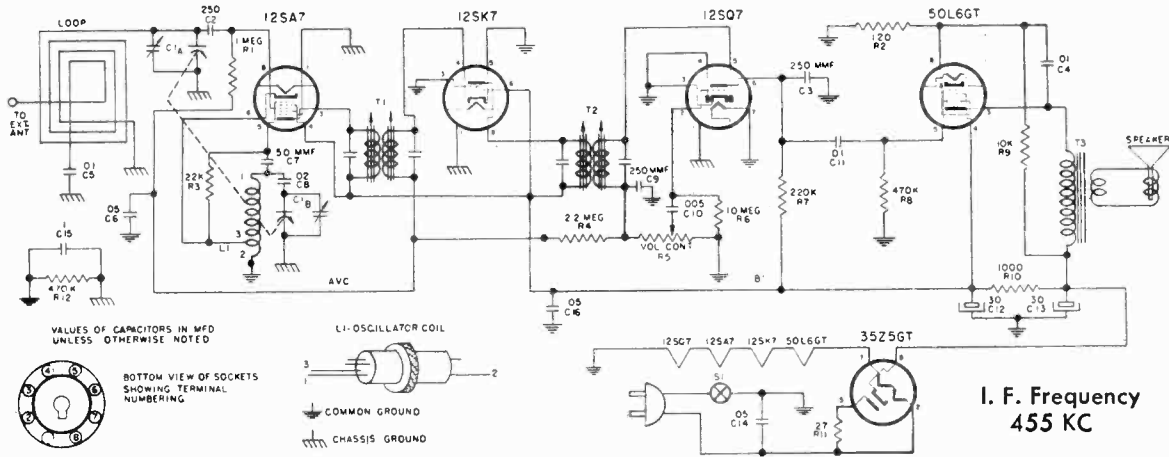
To string dial cord, set gang condenser to fully meshed position and use following parts:

- 113177 Tension Spring
- 114955 Clip on end of cord
- 119087 Ring for dial cord
- 117057 Cord (9 feet)
Pointer drive 5 feet
Gang drive 4 feet

AUDIO OSCILLATION

The audio system of this receiver utilizes a two stage type of inverse feed-back arrangement and, should it ever be necessary to replace the speaker or output transformer, it is important to maintain a definite phase relationship in this feedback circuit. If the connections to the output transformer are reversed or if the feed-back connection is made to the wrong side of the output transformer secondary, the system will become regenerative instead of degenerative. Under such conditions audio oscillation may result. If that occurs, oscillation may be prevented by reversing the connections to the primary of the output transformer.

MODEL 4-A-61,
THE CAMEO



VALUES OF CAPACITORS IN MFD UNLESS OTHERWISE NOTED



BOTTOM VIEW OF SOCKETS SHOWING TERMINAL NUMBERING

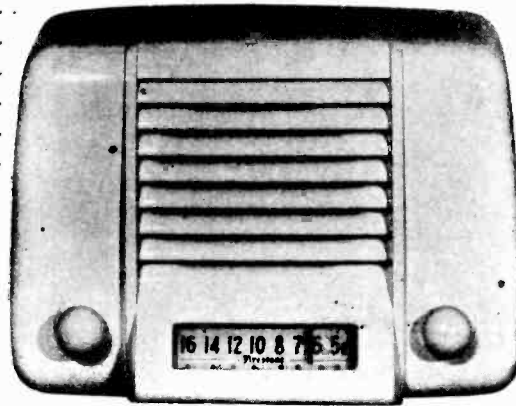
L1-OSCILLATOR COIL

COMMON GROUND
CHASSIS GROUND

I. F. Frequency
455 KC

Code No.	Part No.	Description
C1A, C1B	19-173	Variable condenser
C2, C3, C9	A15-176	250 MMF mica condenser
C4, C5, C11	A16-156	.01 MFD 400 volt condenser
C6, C16	A16-152	.05 MFD 200 volt condenser
C7	A15-175	50 MMF mica condenser
C8	A16-150	.02 MFD 400 volt condenser
C10	A16-153	.005 MFD 600 volt condenser
C12, C13	B18-283	30 X 30 MFD 150 volt electrolytic condenser
C14	A16-158	.05 MFD 400 volt condenser
C15	A16-160	.1 MFD 400 volt condenser
R1	A60-668	1 megohm 1/2 watt resistor
R2	A60-702	120 ohm 1/2 watt resistor
R3	A60-659	22K ohm 1/2 watt resistor
R4	A60-684	2.2 megohm 1/2 watt resistor
R5	24-157	Volume control and switch, 1 megohm
R6	A60-663	10 megohm 1/2 watt resistor
R7	A60-667	220K ohm 1/2 watt resistor
R8, R12	A60-662	470K ohm 1/2 watt resistor
R9	A60-698	10K ohm 1 watt resistor
R10	A60-732	1000 ohm 1 watt resistor
R11	A60-690	27 ohm 1/2 watt resistor
T1	C10-475	1st I. F. Transformer
T2	A10-479	2nd I. F. Transformer
T3		Output transformer (part of speaker)
L1	B10-480	Oscillator coil

Tube Complement	
12SA7	— Oscillator Converter
12SK7	— I. F. Amplifier
12SQ7	— AVC, Detector, 1st Audio
50L6GT	— Power Output
35Z5GT	— Rectifier



Power Supply
105-125 volt AC-DC

Tuning Range
540 to 1630 KC

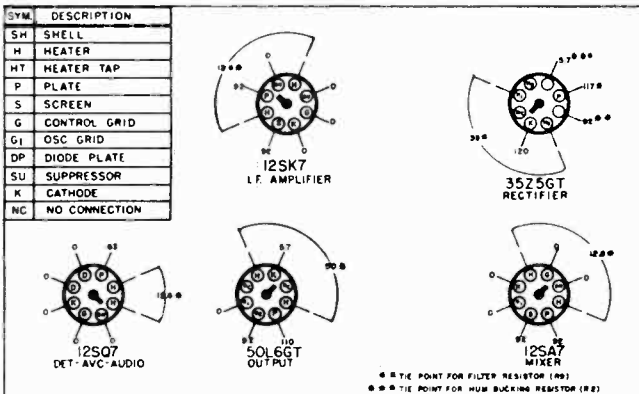
Loud Speaker
4 inch P. M.

Voice Coil Impedance
3.2 ohms at 400 cycles

Power Output
Maximum 1.65 watts

REAR OF CHASSIS

VOLTAGE TABLE
(BOTTOM OF CHASSIS)



All voltages except heaters are measured from socket contacts to "common negative." Heater voltages are measured across socket contacts. All voltages measured with a 1000 ohms per volt meter.

*AC except when used on DC.

THE FIRESTONE TIRE & RUBBER CO.

MODEL 4-A-61,
THE CAMEO

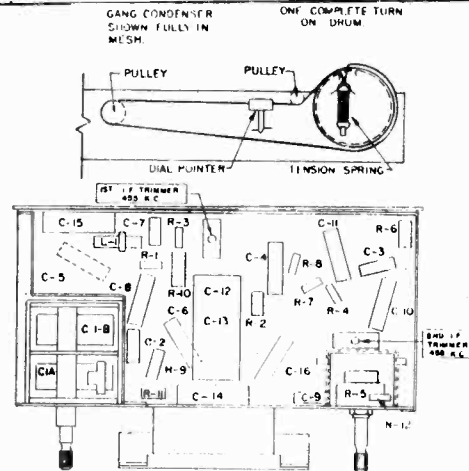
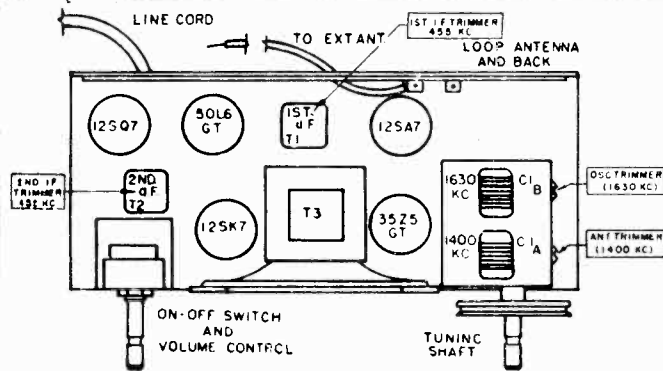
ALIGNMENT PROCEDURE

The alignment should be made with volume control fully on, and the output from the signal generator as low as possible, to prevent A.V.C. action from interfering with correct alignment.

For alignment procedure read tabulations from left to right, and make the adjustment marked (1) first, (2) next, (3) third. Before starting alignment:

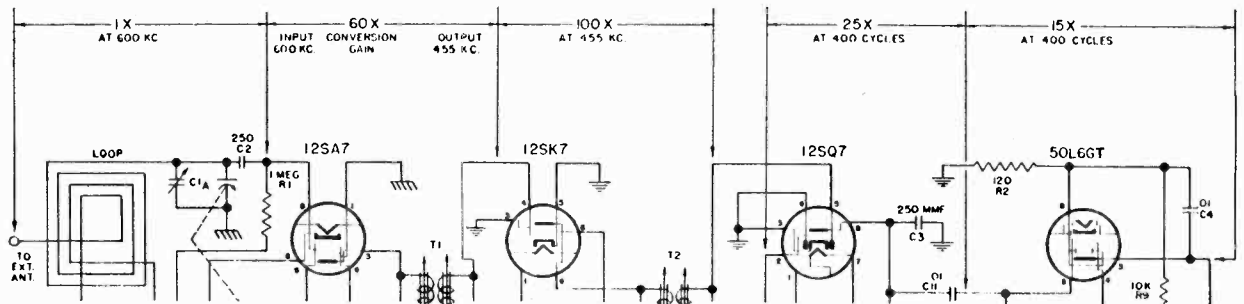
- (a) Check tuning dial adjustment by tuning gang condenser until plates touch maximum capacity stop (completely in mesh) at which point the dial pointer must be exactly even with the last mark at the low frequency end of the dial calibration. If dial pointer is incorrectly set, release pointer clip on dial cord and reposition pointer.
- (b) Use an accurately calibrated test oscillator with some type of output measuring device.
- (c) PLACE LOOP ANTENNA IN THE SAME POSITION IT WILL BE IN WHEN THE SET IS IN THE CABINET.

Steps	Set receiver dial to:	TEST OSCILLATOR			Refer to parts layout diagram for location of trimmers mentioned below:
		Adjust test oscillator frequency to:	Use dummy antenna in series with output of test oscillator consisting of:	Attach output of test oscillator to:	
1	Minimum capacity (fully open)	455 K.C.	.1 MFD. condenser	High side to grid of tuning condenser. Low side to common negative. (through .25 MFD. Cond.)	Adjust each trimmer on the second I. F. transformer for maximum output—then adjust each trimmer on the first I. F. transformer for maximum output.
2	Minimum capacity (fully open)	Exactly 1630 K.C.	.00025 MFD. condenser	Receiver antenna lead. common negative	Adjust 1630 K.C. oscillator trimmer for maximum output.
3	Approx. 1400 K.C.	Approx. 1400 K.C.	.00025 MFD. condenser	Receiver antenna lead. common negative	While rocking gang condenser adjust 1400 K.C. antenna trimmer for maximum output.



Before proceeding with stage measurements be sure the receiver is properly aligned. R.F. gains can be measured by a "channel" type instrument containing a tuned and calibrated R.F. amplifier. A vacuum tube voltmeter may be used for audio gain measurements. Observe the following precautions:

1. For all gain measurements connect the "high" side of a signal generator to the antenna lead through a .00025 mica condenser. The ground side of the signal generator should be connected to common negative. Use a 600 KC signal with 400 cycle modulation (use nearby frequency if local station interferes).
2. Be sure radio is carefully tuned to generator signal (use weak signal for sharp tuning.)
3. When using a "channel" type instrument carefully tune it for maximum output at desired frequency before making measurements.



Stage gain measurements can be influenced by the normal manufacturers tolerances allowed in parts, differences in individual tube characteristics, the adjustment of the tuned circuits and variations in line voltage. Careful tuning of the receiver as well as experience in using your test equipment will determine the accuracy of the measurements taken. Due to all of these factors, the stage gains shown in the above diagram are approximate values rather than absolute as it is possible to introduce many variations in these measurements.

MODELS 4-A-62,
4-A-63

STAGE GAIN MEASUREMENT PROCEDURE

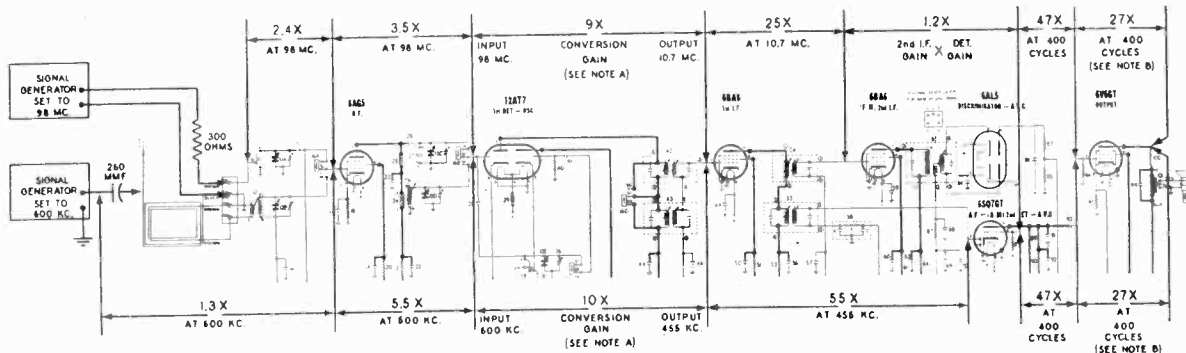
REQUIRED INSTRUMENTS: The amount of amplification or "gain" of most of the stages of this receiver can be measured with an A.C. Vacuum Tube Voltmeter of the high frequency type. An AM (600 KC.) as well as an FM (98 MC.) signal source is required. For gain measurements in the FM antenna—FM converter—FM 1st I.F. stages, a microvolt calibrated FM signal generator should preferably be used.

PROCEDURE: It is exceedingly important to adhere to the procedure outlined below since the accuracy of these measurements will be affected to a considerable extent by the failure to establish proper operating conditions.

1. Be sure that R.F., I.F. and Discriminator stages are carefully and accurately aligned by utilizing the alignment procedure given in this manual.
2. Connect Signal Generator as shown below. Note that generator connections differ for "AM" and "FM" measurements.
3. For "AM" measurements, set signal generator to 600 KC. (400 cycle modulation) and then carefully tune radio receiver to this signal by using an output meter to indicate peak output. If a local station interferes, set generator to a nearby frequency and re-tune the receiver.
4. For "FM" measurements, set signal generator to 98 MC. (400 cycle modulation with 22½ KC. deviation) and then carefully tune radio receiver to this signal by using a D.C. Vacuum Tube Volt-

meter as an output indicator—meter must be connected between pin No. 7 of 6AL5 tube and chassis. If a local station interferes, set generator to a nearby frequency and re-tune the receiver.

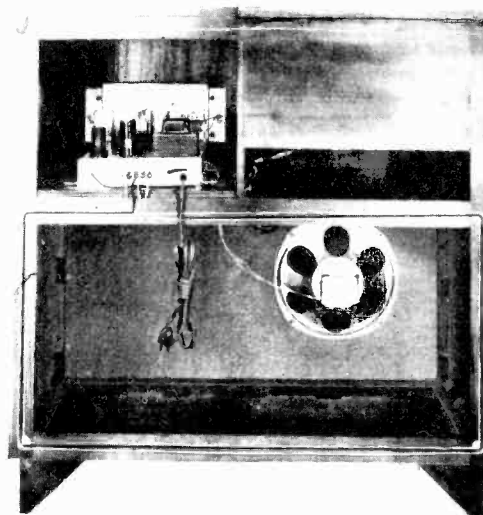
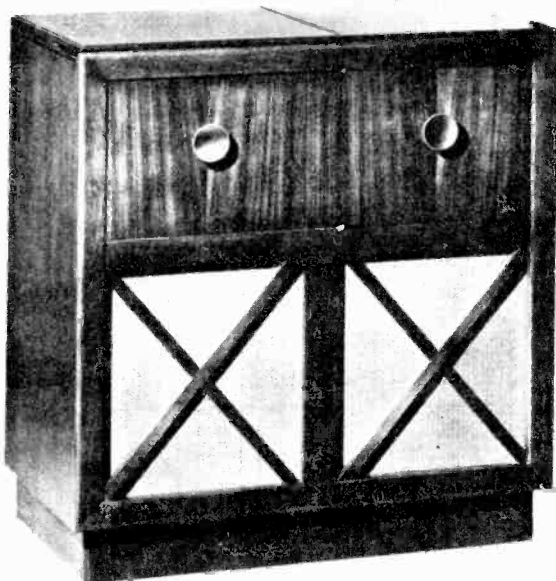
5. The values of stage gain which are given here were measured with a fixed bias of -3 volts on the control grids of all R.F. and I.F. tubes which are connected to the A.V.C. system. Therefore, these values are not intended to indicate the full capability of a stage but they will serve as a convenient basis for determining proper operation. In order to duplicate the fixed bias voltage, connect the negative terminal of a 3 volt battery to both A.V.C. supply lines by effecting a common connection to terminal 4 of 2nd FM-I.F. transformer and terminal 2 of 1st AM-I.F. transformer. Then connect the positive battery lead to the receiver chassis.
6. R.F. and I.F. circuits are slightly de-tuned when contact is made with an instrument probe and this action, which is indicated by a change in the output meter reading, may seriously affect the gain measurement. Therefore, it is important to adjust the associated circuit trimmer for a maximum output meter reading and to set the input signal level to a convenient reference point on the gain measuring instrument while the probe is making contact. After removing the probe it is again necessary to adjust the trimmer so as to obtain the same output meter reading and thereby assure that the signal voltage at the specified point has not changed as a result of circuit de-tuning.



NOTE A: Short oscillator grid (pin 2 of 12AT7) to ground when measuring input voltage at signal grid (pin 7) of 12AT7 tube.

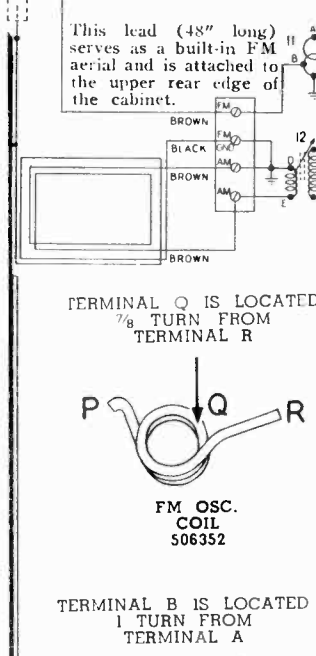
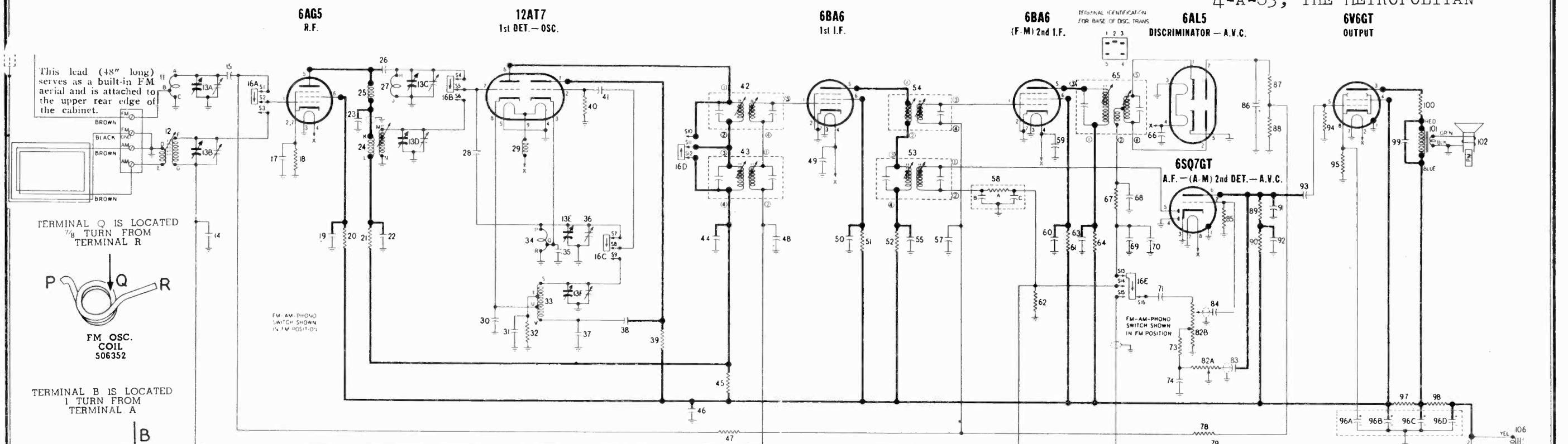
NOTE B: Measured with input voltage of 0.3.

DIFFERENCES in tube characteristics, tolerance of parts, adjustment of tuned circuits and variations in line voltage will influence stage gain. These factors should be given due attention in event the gain of a stage varies extensively from the values shown above.



THE FIRESTONE TIRE & RUBBER CO.

MODELS 4-A-62, THE MARLBOROUGH,
4-A-63, THE METROPOLITAN



I.F. FREQUENCY:
AM — 455 KC.
FM — 10.7 MC.

SPEAKER:
10 inch P-M Dynamic
Voice coil impedance—3.2 ohms

Lettered terminals in illustrations correspond to similarly lettered terminals on the circuit diagram.

DIA-GRAM NO.	PART NO.	DESCRIPTION
CONDENSERS		
13-A to F	506348	Condenser-variable gang (with drum)
14	512026	Condenser-.05 Mfd. 200 volt
15	504973	Condenser-ceramic 22 Mmfd. 500 volt
17	504974	Condenser-ceramic 47 Mmfd. 500 volt
19	505873	Condenser-ceramic .005 Mfd. 450 volt
22	505873	Condenser-ceramic .005 Mfd. 450 volt
23	504974	Condenser-ceramic 47 Mmfd. 500 volt
26	504905	Condenser-ceramic 5 Mmfd. 500 volt ± 10%
28	504983	Condenser-ceramic 1.0 Mmfd. 500 volt
30	506341	Condenser-ceramic 330 Mmfd. 500 volt
31	505873	Condenser-ceramic .005 Mfd. 450 volt
35	513429	Condenser-ceramic 10 Mmfd. 500 volt ± 10%
36	506336	Condenser-trimmer; 3 to 30 Mmfd.
37	506544	Condenser-ceramic 10 Mmfd. 500 volt
38	505873	Condenser-ceramic .005 Mfd. 450 volt
41	504974	Condenser-ceramic 47 Mmfd. 500 volt
44	505873	Condenser-ceramic .005 Mfd. 450 volt
46	505873	Condenser-ceramic .005 Mfd. 450 volt
48, 49, 50	505873	Condenser-ceramic .005 Mfd. 450 volt
55	505873	Condenser-ceramic .005 Mfd. 450 volt
57	505873	Condenser-ceramic .005 Mfd. 450 volt
58-B, C	506338	Condenser-ceramic 100 Mmfd. 400 volt (part of diode filter unit)
59, 60	505873	Condenser-ceramic .005 Mfd. 450 volt
63	505873	Condenser-ceramic .005 Mfd. 450 volt
66	505873	Condenser-ceramic .005 Mfd. 450 volt
68	506341	Condenser-ceramic 330 Mmfd. 500 volt
69	506340	Condenser-ceramic 100 Mmfd. 500 volt
70	512004	Condenser-.003 Mfd. 600 volt
71	512006	Condenser-.005 Mfd. 600 volt
74	512006	Condenser-.005 Mfd. 600 volt
76	505873	Condenser-ceramic .005 Mfd. 450 volt
83, 84	512006	Condenser-.005 Mmfd. 600 volt
86	504937	Condenser-electrolytic 5 Mfd. 50 volt
91	506340	Condenser-ceramic 100 Mmfd. 500 volt
92	512034	Condenser-.1 Mfd. 400 volt
93	512016	Condenser-.02 Mfd. 400 volt
96-A to D	505908	Condenser-electrolytic A-20 Mfd. 25 volt B-10 Mfd. 450 volt C-30 Mfd. 450 volt D-40 Mfd. 450 volt
99	512006	Condenser-.005 Mfd. 600 volt
107	512256	Condenser-.01 Mfd. 600 volt

DIA-GRAM NO.	PART NO.	DESCRIPTION
RESISTORS		
18	510017	Resistor-carbon 82 Ohms 1/4 watt ± 10%
20	510164	Resistor-carbon 33,000 Ohms 1/2 watt
21	510137	Resistor-carbon 1000 Ohms 1/4 watt
32	510041	Resistor-carbon 1800 Ohms 1/4 watt
39	510137	Resistor-carbon 1000 Ohms 1/2 watt
40	510055	Resistor-carbon 10,000 Ohms 1/4 watt
45	510137	Resistor-carbon 1000 Ohms 1/4 watt
47	510067	Resistor-carbon 47,000 Ohms 1/4 watt
51	510165	Resistor-carbon 39,000 Ohms 1/2 watt
52	510137	Resistor-carbon 1000 Ohms 1/4 watt
56	510093	Resistor-carbon 2.2 Meg. 1/4 watt
58-A	506338	Resistor-carbon 47,000 Ohms 1/5 watt (Part of diode filter unit)
61	510165	Resistor-carbon 39,000 Ohms 1/2 watt
62	510085	Resistor-carbon 470,000 Ohms 1/4 watt
64	510137	Resistor-carbon 1000 Ohms 1/4 watt
67	510059	Resistor-carbon 18,000 Ohms 1/4 watt
73	510070	Resistor-carbon 68,000 Ohms 1/4 watt
75	510070	Resistor-carbon 68,000 Ohms 1/4 watt
77	510079	Resistor-carbon 220,000 Ohms 1/4 watt
78	510093	Resistor-carbon 2.2 Meg. 1/4 watt
82-A, B, C	505911	Volume and tone control A-2 Megohms B-2 Megohms C-"ON-OFF" switch
85	510098	Resistor-carbon 15 Meg. 1/4 watt
87, 88	510053	Resistor-carbon 8200 Ohms 1/4 watt ± 10%
89	510093	Resistor-carbon 2.2 Meg. 1/4 watt
90	510079	Resistor-carbon 220,000 Ohms 1/4 watt
94	510085	Resistor-carbon 470,000 Ohms 1/4 watt
95	510128	Resistor-carbon 330 Ohms 1/2 watt
97, 98	510709	Resistor-wire wound 600 Ohms 5 watt
100	510013	Resistor-carbon 47 Ohms 1/4 watt

DIA-GRAM NO.	PART NO.	DESCRIPTION
OTHER ELECTRICAL PARTS		
16-A to E	506347	Switch-FM-AM-Phono
58-A, B, C	506338	Diode filter unit A-Resistor-carbon 47,000 Ohms 1/5 watt B-Condenser-ceramic 100 Mmfd. 400 volt C-Condenser-ceramic 100 Mmfd. 400 volt
79	505100	Crystal cartridge
80	506705	Motor—for type "W"—506373 Record changer 115 volt 60 cycle
81	506704	Switch—"ON-OFF" for type "W"—506373 Record Changer
102	506374	Speaker-P.M. (10 inch)
103 to 105	118921	Lamp dial (Mazda No. 47) 6-8V. 150 Ma.

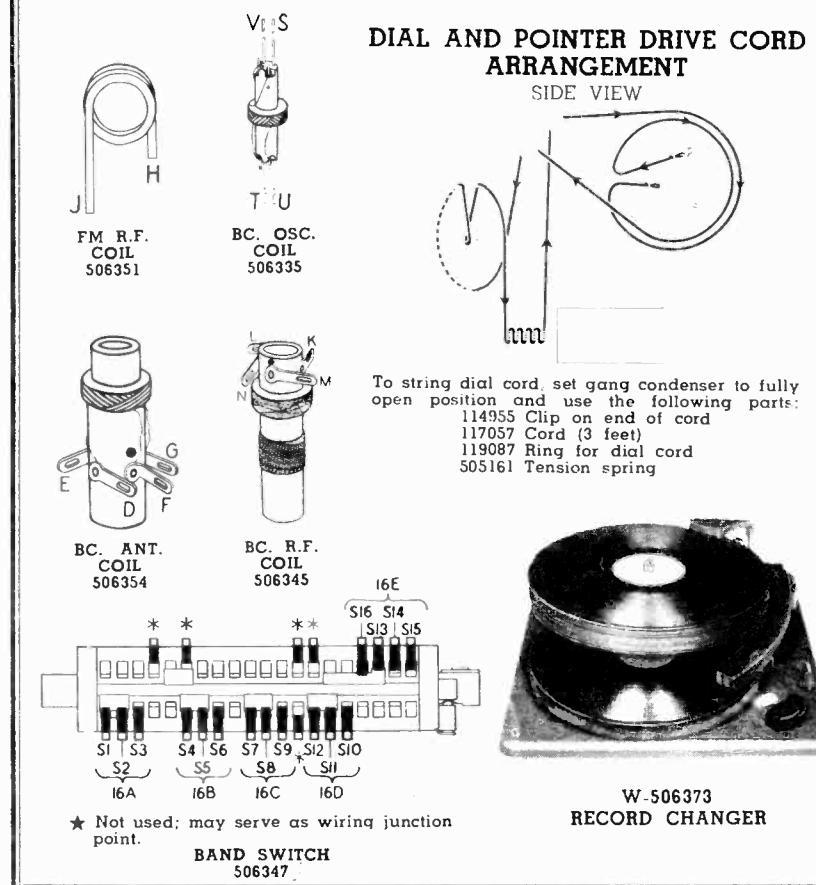
FREQUENCY RANGES:
STANDARD BROADCAST — 540-1700 KC.
FM — 88-108 MC.

POWER SUPPLY:
117 volts
60 cycles A.C.
85 watts (radio)
20 watts (phono)

MANUAL TUNING DEVICE:
3 section gang condenser;
shock resistant mounting.

POWER OUTPUT:
Undistorted — 2.8 watts
Maximum — 5.4 watts

BUILT-IN AERIALS:
AM — High efficiency loop.
FM — Single ended half-wave aerial.



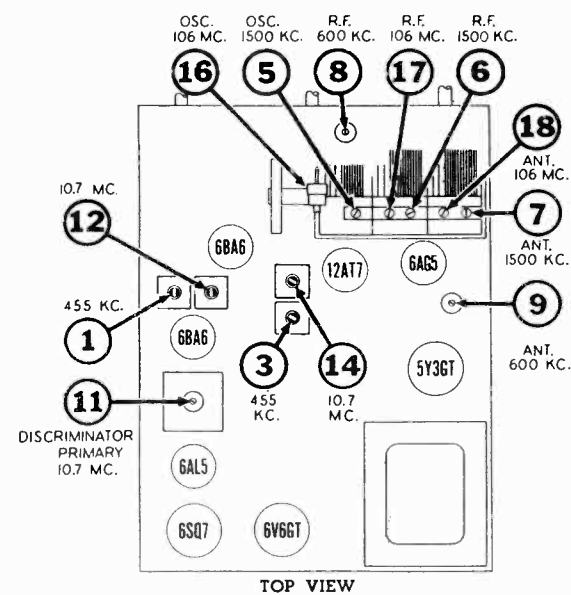
BROADCAST BAND --"AM"--ALIGNMENT PROCEDURE

1. Disconnect leads from FM-AM aerial terminal strip (labeled FM-FM-AM-AM) at back of chassis; also disconnect speaker leads and phono plugs. Remove chassis and speaker. If desired, allow speaker to remain in cabinet and connect to receiver by extension leads.
2. Stand chassis on one edge so that all trimmers are accessible.
3. Loop aerial leads (on cabinet) do not have to be connected to terminal strip on chassis while I. F. stages are being aligned. Before starting alignment of Ant., R.F., and Osc. stages, reconnect all four aerial leads to chassis—do not attempt to use extension leads; place chassis as close as required to cabinet so that connections may be made direct to aerial terminal strip at back.
4. With the gang condenser fully meshed, dial pointer should be in the position indicated by the last division below 55 on the dial. If it is set incorrectly, hold tuning shaft steady and reposition pointer.
5. Connect an output meter across speaker voice coil, or from plate of 6V6GT tube to chassis through a 0.1 Mfd. condenser.
6. Connect ground lead of signal generator to the receiver chassis.
7. Set volume control at maximum volume position and use a weak signal from the signal generator.

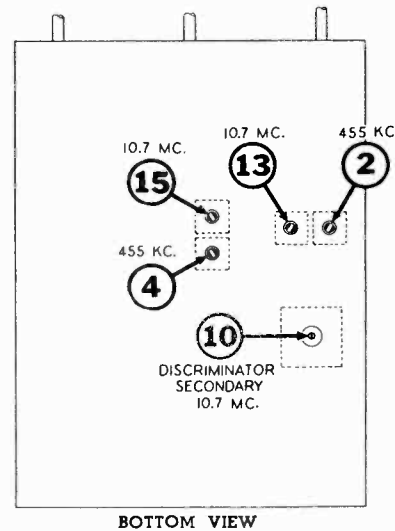
DUMMY ANT. IN SERIES WITH SIGNAL GENERATOR	CONNECT HIGH SIDE OF SIGNAL GENERATOR TO	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RECEIVER DIAL SETTING	TRIMMER OR SLUG NUMBER	TRIMMER DESCRIPTION	TYPE OF ADJUSTMENT
.1 MFD. Condenser	Lug on trimmer No. 6 at top of gang (see figure below for location of trimmer).	455 KC	AM Broadcast (Middle)	Any point where it does not affect the signal.	1-2	2nd I.F.	Adjust for maximum output. Then repeat adjustment.
					3-4	1st I.F.	
260 MMFD. Mica Condenser	External Aerial Clip on Cabinet	1500 KC	AM Broadcast (Middle)	1500 KC	5	Broadcast Oscillator	Adjust for maximum output.
260 MMFD. Mica Condenser	External Aerial Clip on Cabinet	1500 KC	AM Broadcast (Middle)	Tune to 1500 Kc. generator signal.	6	Broadcast R.F.	Adjust for maximum output.
					7	Broadcast Antenna	Adjust for maximum output.
260 MMFD. Mica Condenser	External Aerial Clip on Cabinet	600 KC	AM Broadcast (Middle)	Tune to 600 Kc. generator signal.	8	Adjustable core of Broadcast R.F. Coil.	Adjust for maximum output.
					9	Adjustable core of Broadcast Antenna Coil.	Adjust for maximum output.

Repeat adjustment of trimmers 6 & 7 and slugs 8 & 9 until one no longer detunes the other.

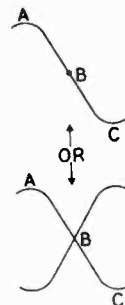
NOTE: It is preferable to check the alignment of the I.F. stages in the FM channel after completing AM alignment.



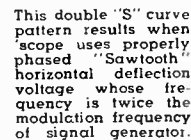
TRIMMER LOCATION CHART



This single "S" curve pattern results when scope uses properly phased "sine wave" horizontal deflection voltage.



This double "S" curve pattern results when scope uses properly phased "sawtooth" horizontal deflection voltage whose frequency is twice the modulation frequency of signal generator.



**FREQUENCY MODULATION--"FM"--ALIGNMENT PROCEDURE
(USING A VACUUM TUBE VOLTMETER AND AM SIGNAL GENERATOR)**

INSTRUMENTS: Although it is preferable to use an FM generator and an oscilloscope, reasonably accurate alignment is obtainable when using a conventional AM generator and vacuum tube voltmeter providing proper care is exercised in adjusting the discriminator circuit trimmer.

IMPORTANT: When using an AM signal generator, it should be capable of producing fundamental frequencies of 10.7 MC and 88 to 108 MC — avoid using an AM generator which produces signals in the 88 to 108 MC range by using harmonics higher than the second. Generators which are dependent upon third, fourth or fifth harmonics for output frequencies of 88 to 108 MC will generally produce undesirable spurious beat signals with the local oscillator in the receiver and alignment will be exceedingly difficult.

1. If alignment of both AM and FM channels is required it is necessary to align the AM channel first, then align the FM channel as instructed in chart below (AM alignment procedure is given on the preceding page).

2. Disconnect leads from FM-AM aerial terminal strip (labeled FM-FM-AM-AM) at back of chassis; also disconnect speaker leads and phono plugs. Remove chassis and speaker. If desired, allow speaker to remain in cabinet and connect to receiver by extension leads.
3. With the gang condenser fully meshed, dial pointer should be in the position indicated by the last division below 88 on the dial. If it is set incorrectly, hold tuning shaft steady and reposition pointer.
4. A specific setting of the receiver volume control is not required. However, it will be found convenient to leave it in the maximum volume position so that alignment signals will be audible even though the output indication is obtained by a V-T voltmeter connected to points in the discriminator circuit.
5. Dress FM circuit leads as short and straight as possible, particularly those in the oscillator circuit. I.F. plate and grid leads should also be kept short and straight.
6. Set band switch to the FM (extreme counter-clockwise) position.

SIGNAL GENERATOR CONNECTIONS	FREQUENCY & TYPE OF MODULATION	VACUUM TUBE VOLTMETER CONNECTIONS	RECEIVER DIAL SETTING	TRIMMER OR SLUG NUMBER	TRIMMER DESCRIPTION	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
Connect high side in series with an .01 Mfd condenser to lug on trimmer No. 17 at top of gang (see illustration on page 9 for location of trimmer). Connect ground lead to receiver chassis in vicinity of 12AT7 tube.	10.7 MC AM signal may be 400 cycle modulated.	Connect common (or ground) terminal of V.T. voltmeter to receiver chassis. D.C. probe lead of meter is then connected to pin No. 7 of the 6AL5 tube.	Any position where it does not affect the signal.	11	Discriminator Primary	Adjust these trimmers for maximum meter reading the output voltage will be of negative polarity.
				12 and 13	2nd I.F.	
				14 and 15	1st I.F.	
Same as above	Same as above	Connect common (or ground) terminal of V.T. voltmeter to the junction of resistors 87 and 88 in the discriminator circuit. D.C. probe lead of meter is then connected to junction of resistor No. 67 (18,000 ohms) and condenser No. 70 (.003 MFD.) which are in the discriminator output circuit.	Same as above	10	Discriminator Secondary	Note that as trimmer No. 10 is rotated a point will be found where voltmeter will swing from a positive to a negative reading or vice versa. Correct setting of trimmer No. 10 is obtained when meter reads zero as trimmer is moved through this point. The adjustment is somewhat critical and considerable care must be exercised to set the trimmer for a zero meter indication.

Recheck adjustment of trimmers No. 10 and No. 11 to be sure that both are set as accurately as possible to obtain the specified output indication.

Connect generator "high" side in series with a 300 ohm carbon resistor to end terminal marked "FM" on strip at back of chassis. Generator ground lead must connect to next terminal marked "GND".	106 MC AM signal may be 400 cycle modulated.	Connect common (or ground) terminal of meter to receiver chassis. D.C. probe lead of meter is then connected to Pin No. 7 of the 6AL5 tube.	106 MC	16	Oscillator Trimmer	Set trimmer No. 16 to receive 106 MC. signal as indicated by maximum meter reading. IMPORTANT: It will be noted that there are two different settings of trimmer No. 16 at which the 106 MC. signal will be received always select the trimmer setting which is nearest to the low capacity end of its range.
				17	R.F. Trimmer	Adjust trimmer No. 17 for maximum meter reading.
				18	Antenna Trimmer	Adjust trimmer No. 18 for maximum meter reading.
Same as above	Same as above	Same as above	Tune to 106 MC. generator signal.	14 and 15	1st I.F.	Recheck adjustment of these trimmers for maximum meter reading.

Check calibration and tracking of receiver with input signals of 90 and 98 MC. If difference between dial pointer setting and 90 or 98 MC. calibration mark does not exceed ± 0.3 MC. and antenna and R.F. circuits are tracking properly, then alignment may be considered satisfactory and no further adjustment is necessary. Where the calibration error is greater than ± 0.3 MC. it is advisable to make the following adjustments:

1. If pointer falls above the 90 MC. calibration point, it will be necessary to slightly spread the windings of the FM oscillator coil. Then repeat the two preceding adjustments of trimmers 16, 17 and 18 at 106 MC. Should it be found impossible to obtain the 106 MC. signal at the proper point on the dial by adjust-

ment of the trimmers it will then be necessary to adjust the spacing of the gang condenser plates.

2. If pointer falls below the 90 MC. calibration point, it will be necessary to push the windings together on the FM oscillator coil. Then repeat the two preceding adjustments of trimmers 16, 17 and 18 at 106 MC. Should it be found impossible to obtain the 106 MC. signal at the proper point on the dial by adjustment of the trimmers it will then be necessary to adjust the spacing of the gang condenser plates.
3. Correction for mistracking of antenna and R.F. may be accomplished by adjusting coil turns and gang plate spacing in the same manner as outlined above for the oscillator stage.

**FREQUENCY MODULATION—"FM"—ALIGNMENT PROCEDURE
(USING AN OSCILLOSCOPE AND FM "SWEEP" GENERATOR)**

INSTRUMENTS: Alignment of the FM circuits in this receiver can be most conveniently accomplished with an FM signal generator. When using this type generator, the output indicator must be an oscilloscope.

1. If alignment of both AM and FM channels is required it is necessary to align the AM channel first, then align the FM channel as instructed in chart below (AM alignment procedure is given on page 8).
2. Disconnect leads from FM-AM aerial terminal strip (labelled FM-FM-AM-AM) at back of chassis; also disconnect speaker leads and phono plugs. Remove chassis and speaker. (If desired, allow speaker to remain in cabinet and connect to receiver by extension leads.)
3. With the gang condenser fully meshed, dial pointer should be in the position indicated by the last division below 88 on the dial.

If it is set incorrectly, hold tuning shaft steady and reposition pointer.

4. A specific setting of the receiver volume control is not required, however, it will be found convenient to leave it in the maximum volume position so that alignment signals will be audible even though the output indication is obtained by an oscilloscope connected to points in the discriminator circuit.
5. Dress FM circuit leads as short and straight as possible, particularly those in the oscillator circuit. I.F. plate and grid leads should also be kept short and straight.
6. Set band switch to the FM (extreme counter-clockwise) position.
7. Set tone control to fully counter-clockwise position.

SIGNAL GENERATOR CONNECTIONS	FREQUENCY & TYPE OF MODULATION	OSCILLOSCOPE CONNECTIONS	RECEIVER DIAL SETTING	TRIMMER OR SLUG NUMBER	TRIMMER DESCRIPTION	TYPE OF ADJUSTMENT AND OUTPUT INDICATION
Connect high side in series with an .01 Mfd condenser to lug on trimmer No. 17 at top of gang (see illustration on page 8 for location of trimmer). Connect ground lead to receiver chassis in vicinity of 12AT7 tube.	10.7 MC FM signal should preferably be modulated ± 400 KC.	Connect vertical amplifier "high" lead to junction of resistor No. 67 (18000 ohms) and condenser No. 70 (.003 Mfd.) which are in discriminator output circuit. Connect scope ground lead to receiver chassis. Set vertical amplifier of scope for maximum amplification. Where FM signal generator provides an output voltage for synchronization, connect this voltage to "sync" terminals of the scope.	Any position where it does not affect the signal.	10	Discriminator Secondary	Before attempting to adjust trimmer No. 10, set trimmers No. 11, 12, 13, 14 and No. 15 for approximately maximum sound output from the speaker (output meter not required). This is done to obtain sufficient signal for an oscilloscope pattern of desirable amplitude when making the following discriminator trimmer adjustment. Adjust setting of trimmer No. 10 until a pattern similar to that shown in Fig. 2 appears on the screen. If pattern does not remain stationary operate sweep frequency control on 'scope and also "sync" control until desired result is obtained. Correct setting of trimmer No. 10 is obtained when crossover point "B" (Fig. 2) is centrally located in both the horizontal and vertical directions; in addition that portion of the curve between "A" and "C" should be as linear (straight) as possible.
Same as above	Same as above	Same as above	Same as above	11	Discriminator Primary	Adjust these trimmers for maximum amplitude and steepness of that portion of the pattern between "A" and "C" (see Fig. 2).
				12 and 13	2nd I.F.	
				14 and 15	1st I.F.	
Recheck adjustments of trimmers No. 10 and No. 11 to be sure that both are set as accurately as possible to obtain correct cross-over point or symmetry of pattern.						
Connect generator "high" side in series with a 300 ohm carbon resistor to end terminal marked "FM" on strip at back of chassis. Generator ground lead must connect to next terminal marked "GND".	106 MC FM signal should preferably be modulated ± 400 KC.	Same as above	106 MC	16	Oscillator Trimmer	Adjust trimmer No. 16 to obtain the symmetrical pattern shown in Fig. 2. Correct setting of trimmer No. 16 is obtained when cross-over point in pattern is centrally located. IMPORTANT: It will be noted that there are two different settings of trimmer No. 16 at which the desired 'scope pattern can be obtained—always select the trimmer setting which is nearest to the low capacity end of its range.
Same as above	Same as above	Same as above	Tune to 106 MC. generator signal.	17	R.F. Trimmer	Adjust trimmer No. 17 for maximum amplitude of pattern.
				18	Antenna Trimmer	Adjust trimmer No. 18 for maximum amplitude of pattern.
				14 and 15	1st I.F.	Recheck adjustment of these trimmers for maximum amplitude of pattern.

Check calibration and tracking of receiver with input signals of 90 and 98 MC. If difference between dial pointer setting and 90 or 98 MC. calibration mark does not exceed ± 0.3 MC. and antenna and R.F. circuits are tracking properly, then alignment may be considered satisfactory and no further adjustment is necessary.

Where the calibration error is greater than ± 0.3 MC. it is advisable to make the following adjustments:

1. If pointer falls above the 90 MC. calibration point, it will be necessary to slightly spread the windings of the FM oscillator coil. Then repeat the two preceding adjustments of trimmers 16, 17 and 18 at 106 MC. Should it be found impossible to obtain the 106 MC. signal at the proper point on the dial by adjustment

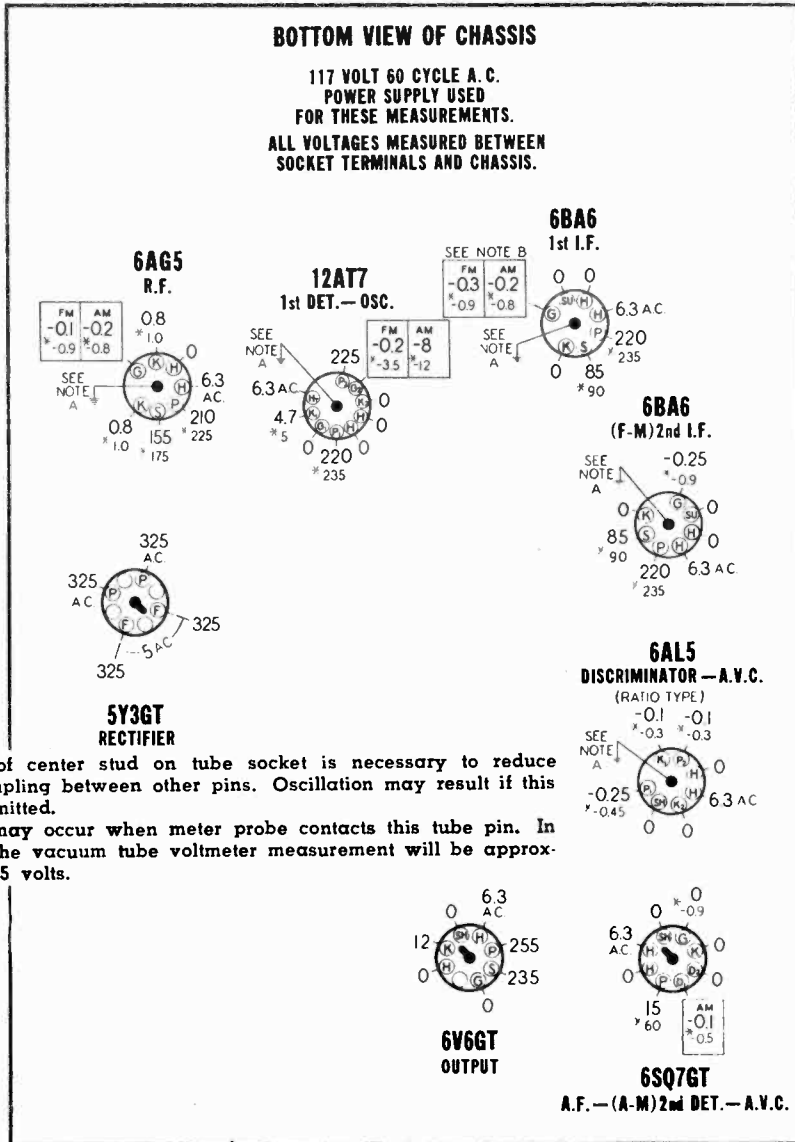
of the trimmers it will then be necessary to adjust the spacing of the gang condenser plates.

2. If pointer falls below the 90 MC. calibration point, it will be necessary to push the windings together on the FM oscillator coil. Then repeat the two preceding adjustments of trimmers 16, 17 and 18 at 106 MC. Should it be found impossible to obtain the 106 MC. signal at the proper point on the dial by adjustment of the trimmers it will then be necessary to adjust the spacing of the gang condenser plates.
3. Correction for mistracking of antenna and R.F. may be accomplished by adjusting coil turns and gang plate spacing in the same manner.

MODELS 4-A-62, THE FIRESTONE TIRE & RUBBER CO.
4-A-63

SOCKET VOLTAGES

Measured with voltmeter having sensitivity of 1000 ohms per volt except where indicated by (*). The (*) symbol designates a vacuum tube voltmeter measurement.
ALL MEASUREMENTS MADE WITH BAND SWITCH IN "FM" POSITION UNLESS OTHERWISE INDICATED
 DIAL TUNED TO 88MC. FOR "FM" MEASUREMENTS
 DIAL TUNED TO 540KC. FOR "AM" MEASUREMENTS
 VOLUME CONTROL SET TO MINIMUM WITH NO SIGNAL
 GROUND ALL ANTENNA TERMINALS



NOTE A: Grounding of center stud on tube socket is necessary to reduce capacity coupling between other pins. Oscillation may result if this ground is omitted.
NOTE B: Oscillation may occur when meter probe contacts this tube pin. In that event, the vacuum tube voltmeter measurement will be approximately -4.5 volts.

**REAR OF CHASSIS
TUBE COMPLEMENT:**

FM FUNCTION	TYPE	AM FUNCTION
R.F. Amplifier	6AG5	R.F. Amplifier
1st Detector and Oscillator	12AT7	1st Detector and Oscillator
1st I.F. Amplifier	6BA6	1st I.F. Amplifier
2nd I.F. Amplifier	6BA6	_____
Discriminator (Ratio Type)	6AL5	_____
Audio Amplifier	6SQ7	2nd Det., A.V.C.; A.F. Amp.
Power Output	6V6GT	Power Output
Rectifier	5Y3GT	Rectifier