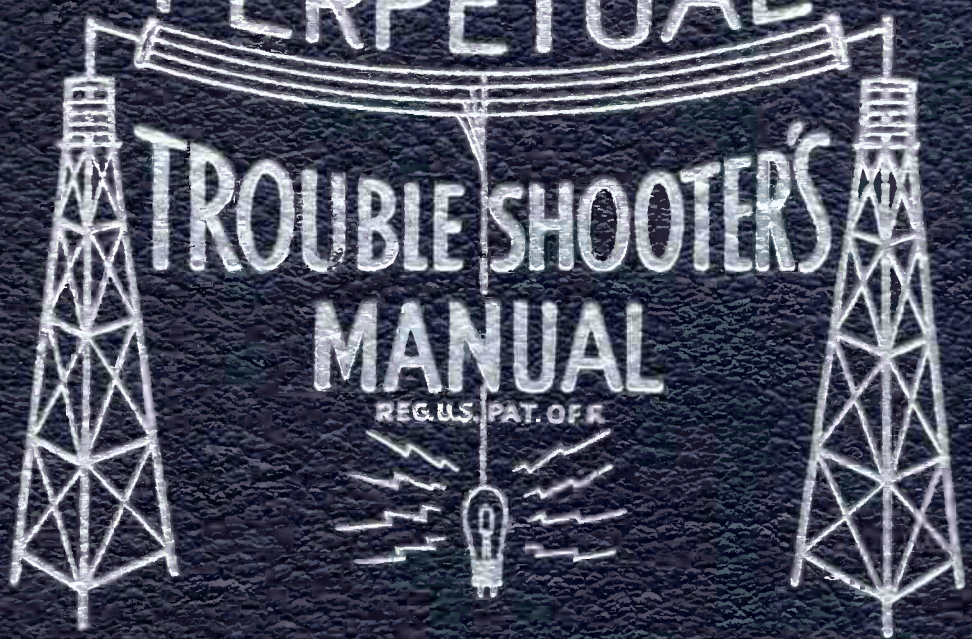
VOLUME XIX

PERPETUAL TROUBLE SHOOTER'S MANUAL



REG. U.S. PAT. OFF.

JOHN F. RIDER

DEWALD RADIO MODEL B-512

TO TURN RADIO ON AUTOMATICALLY:

Tune radio to station and volume desired. With timer switch set at "ON" press in "center" knob and turn until setting hand is at desired time. This operation turns radio off, but it will automatically turn on at the time set.

TO TURN RADIO OFF AUTOMATICALLY:

While radio is playing press in "center" knob and turn until setting hand is at desired time. This setting operation turns radio off. Turn "ON-OFF", by turning knob clockwise and radio will resume playing but will automatically turn off at the time set.

ANTENNA:

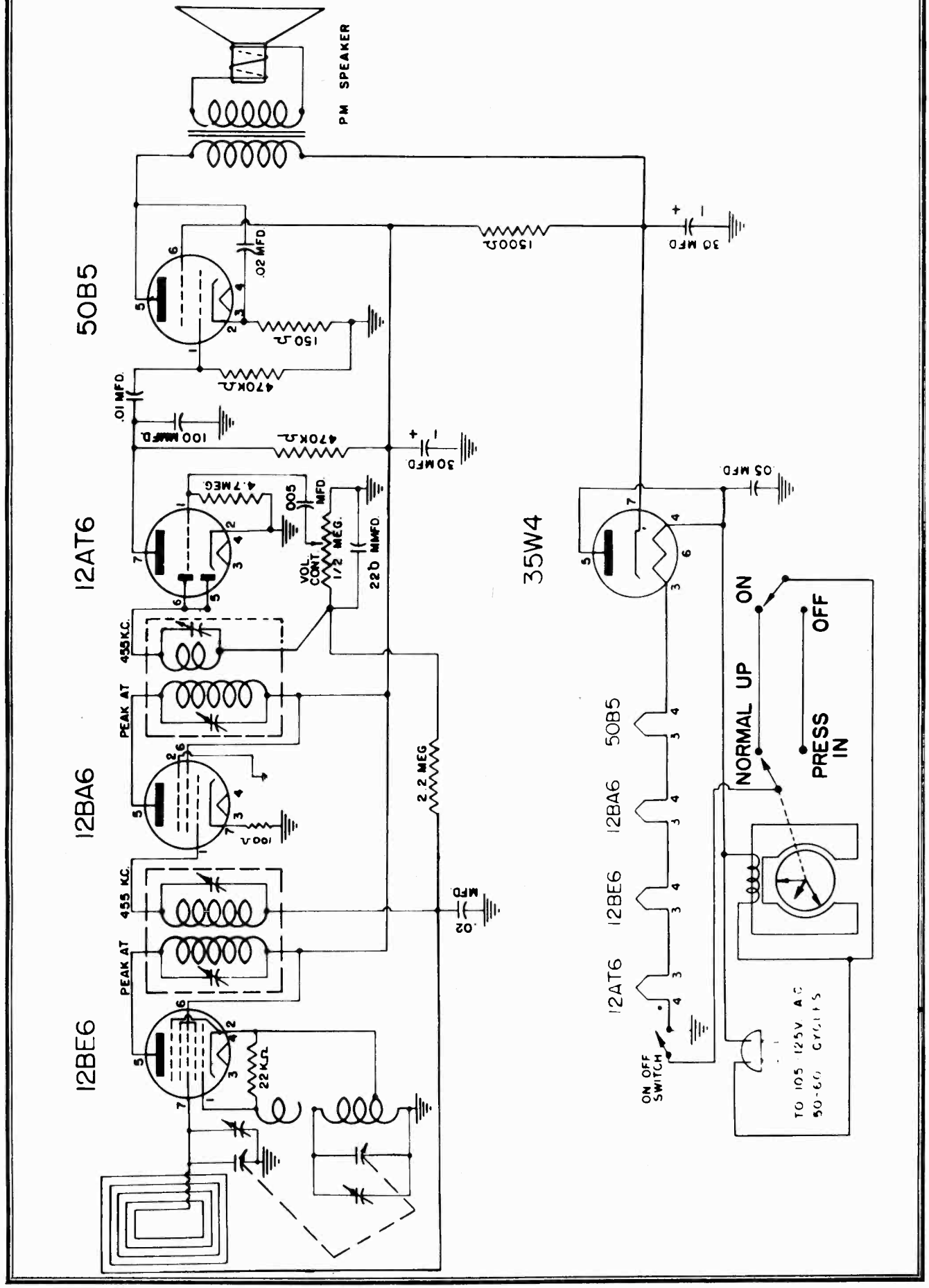
The looptenna incorporated in the DeWald Model B-512 receiver makes use of an outside antenna unnecessary in most localities. If additional pick-up is desired, weave an insulated wire through the outer holes of the cabinet back, connect one end to the outside antenna and the other end to an outside ground. See back of cabinet. The looptenna has a directional effect, it may be necessary to change the angle of the receiver for the best reception.

REPLACEMENT PARTS

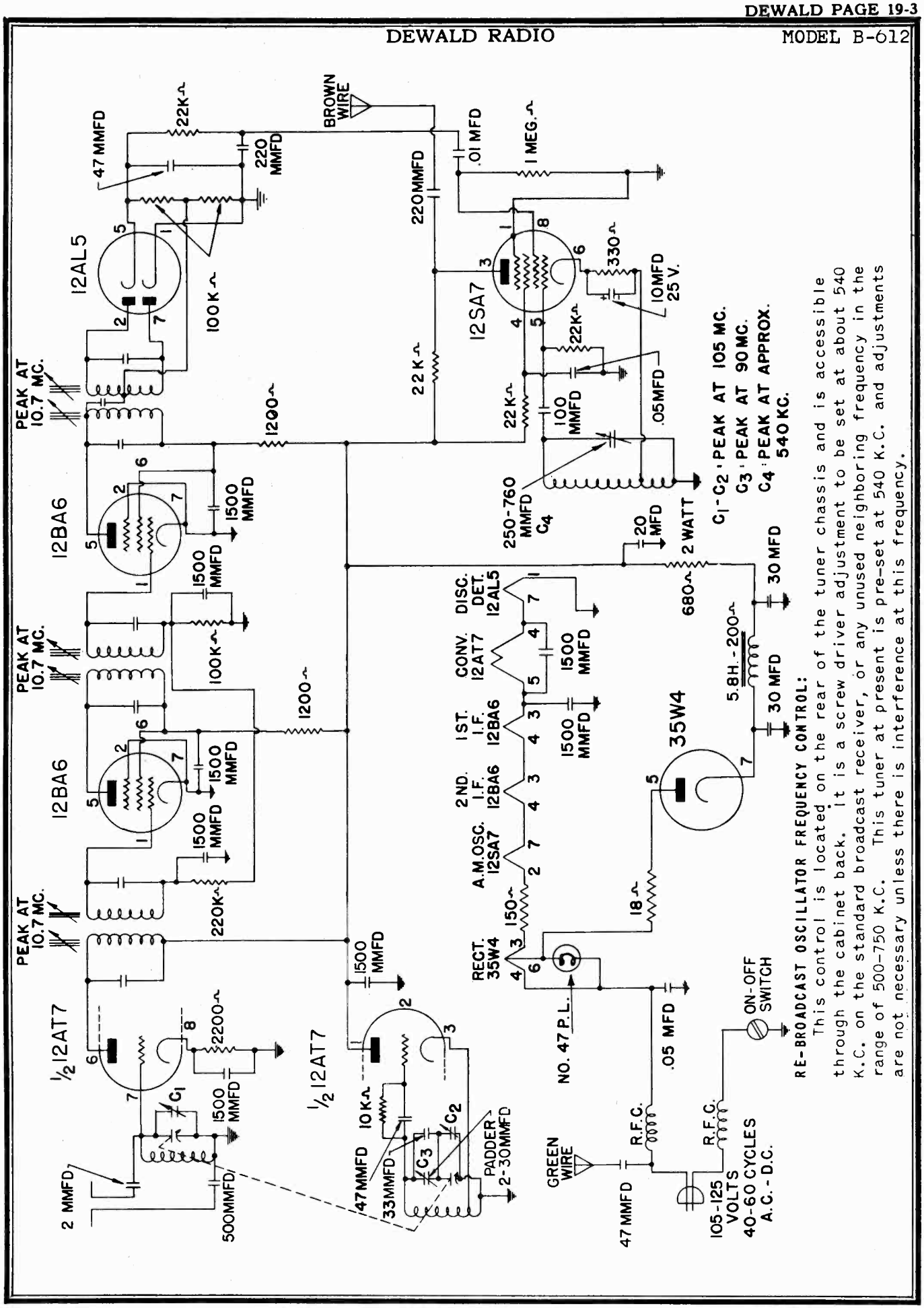
1001 Antenna Loop
1003 Oscillator Coil
1000 1st I.F. Coil
1002 2nd I.F. Coil
2000 Paper Condensers
2001 Mica Condensers
2002 Comb. Electrolytic
2003 Variable Condenser
3000 Resistors
3002 Volume Cont. & Sw.
5000 Line Cord
6000 Dial Scale
7006 Speaker
8001 Pilot Lamp Socket
9000 Shaft
9762 Drive Spring
4000-2 Cabinet
8026 Clock
6013 Crystal Face
#47 Pilot Lamp
8027 Clock Face

MODEL B-512

DEWALD RADIO



DEWALD RADIO MODEL B-612

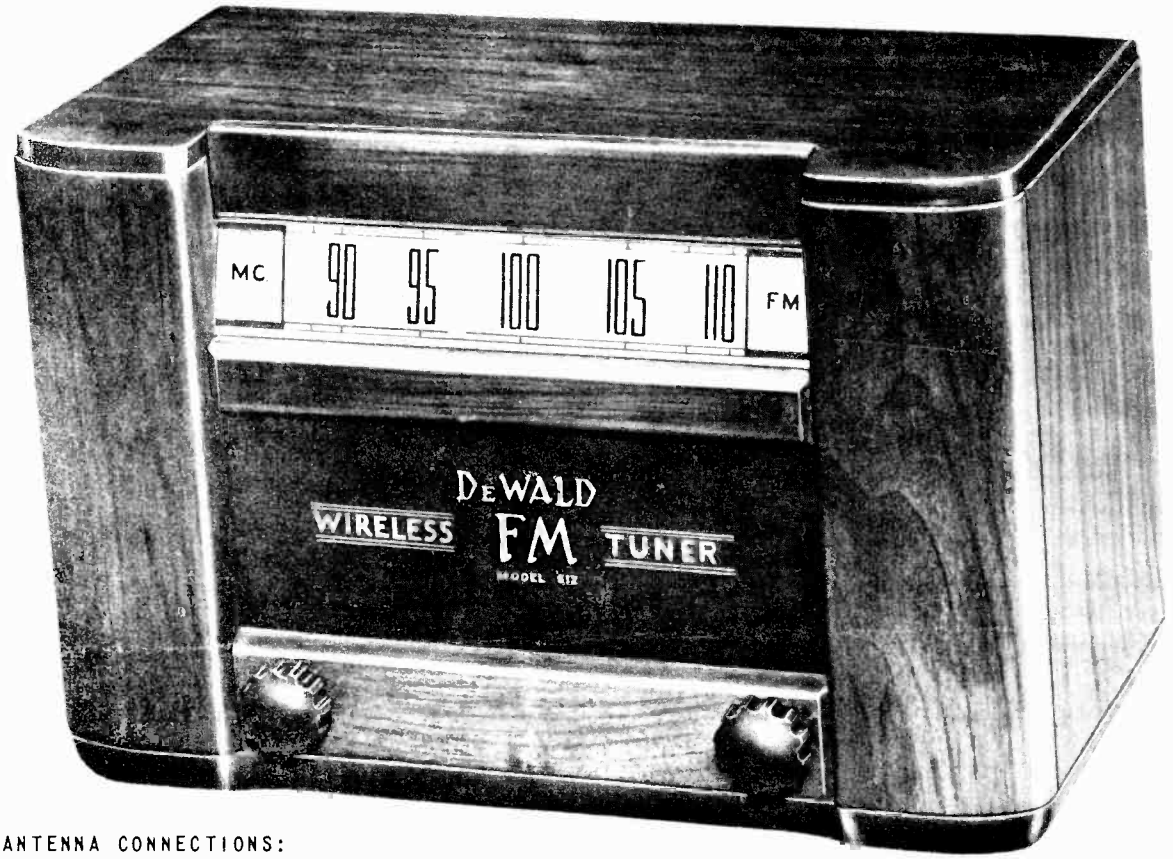


RE-BROADCAST OSCILLATOR FREQUENCY CONTROL:

This control is located on the rear of the tuner chassis and is accessible through the cabinet back. It is a screw driver adjustment to be set at about 540 K.C. on the standard broadcast receiver, or any unused neighboring frequency in the range of 500-750 K.C. This tuner at present is pre-set at 540 K.C. and adjustments are not necessary unless there is interference at this frequency.

MODEL B-612

DEWALD RADIO



ANTENNA CONNECTIONS:

The choice of antenna to be used for the best F. M. reception depends on many factors: location, the type of building, power and distance of the F. M. station. The three main types of antennas are explained below. Test your DeWald F. M. Wireless Tuner and choose the one most practical for your use.

A. **For local high-powered F. M. stations:** The Wireless Tuner is equipped with a permanent **built-in antenna** that will be satisfactory for good reception of most local F. M. stations. This built-in antenna is connected internally by connecting the green wire to the red wire in the rear of the tuner. For best results when using the built-in antenna, keep the electric line cord extended to its full length.

B. **For distant F. M. stations: An outside F. M. dipole antenna** may be found to be necessary when the Wireless Tuner is operated at a great distance from the broadcasting station, or under unusual operating conditions. The outside dipole antenna (equipped with a 300 ohm flat lead-in) should be connected to the red and orange leads, at the rear of tuner, after the green wire has been disconnected from the red wire.

C. **For local weak-powered F. M. stations:** If it is not possible to erect an outside F. M. dipole antenna, an indoor type of antenna, made of 300 ohm flat lead-in wire, can be used. This indoor antenna must be installed so that its horizontal view faces the location of the desired stations.

OPERATION OF THE F. M. TUNER:

After the necessary installation has been made according to the instructions contained in the preceding paragraphs, the electric line cord of the Wireless Tuner may be plugged into an electric wall socket. Turn the ON-OFF switches of both the tuner and your radio receiver to the "ON" position. The brown wire coming out of the rear of the tuner is to be placed approximately 1 foot near the radio receiver loop or antenna lead, if radio receiver has no loop. The radio receiver is to be set at 540 Kc or any nearby clear channel, and the re-broadcast oscillator frequency control slightly adjusted until a rushing sound is heard from your radio receiver. The volume for F. M. reception is regulated by the volume control of your own radio receiver.

The F. M. band is ultra-high frequency. This necessitates precision tuning. Therefore, it is necessary to move the tuning knob of the Wireless Tuner very slowly when tuning in stations. Rotate the tuning knob back and forth several times over the station desired. You will note that the station is "on the button" when all side band noise disappears.

If the Wireless Tuner is connected to an AC-DC type radio receiver operated on AC, a very slight hum may occur when the radio receiver volume control is on full for reception on weak powered stations. If this hum is excessive, reverse the electric line cord plug of your radio receiver or of the Wireless Tuner, or both in the wall socket.

Alignment of the Wireless Tuner

Insulated alignment tools are necessary. The output meter should be a D. C. vacuum tube voltmeter with a range of at least 20 volts. The signal generator should cover the frequencies of 10.7, 90 and 105 M. C. Allow the Wireless Tuner to warm up for at least 5 minutes before making any adjustments. The location of the adjustment screws is indicated clearly on the license label. Follow the following sequence.

I. F. ALIGNMENT:

Connect the signal generator through a .01 mfd condenser to the grid of the 12AT7 converter tube. Connect the low side of the generator through a 1/10th mfd. condenser to tuner chassis. Adjust signal generator to 10.7 mc. Connect VTVM to junction of 100 M -Ohm diode load resistors. Adjust primary and secondary slugs or trimmers of each I. F. for maximum D. C. voltage output. Remove VTVM lead from junction point and connect lead to pin 5 of 12AL5 tube. Adjust secondary slug or trimmer of discriminator for zero D. C. voltage output, (check proper zero set of VTVM. Meter should register reverse polarity when slug or trimmer is rotated through zero output.)

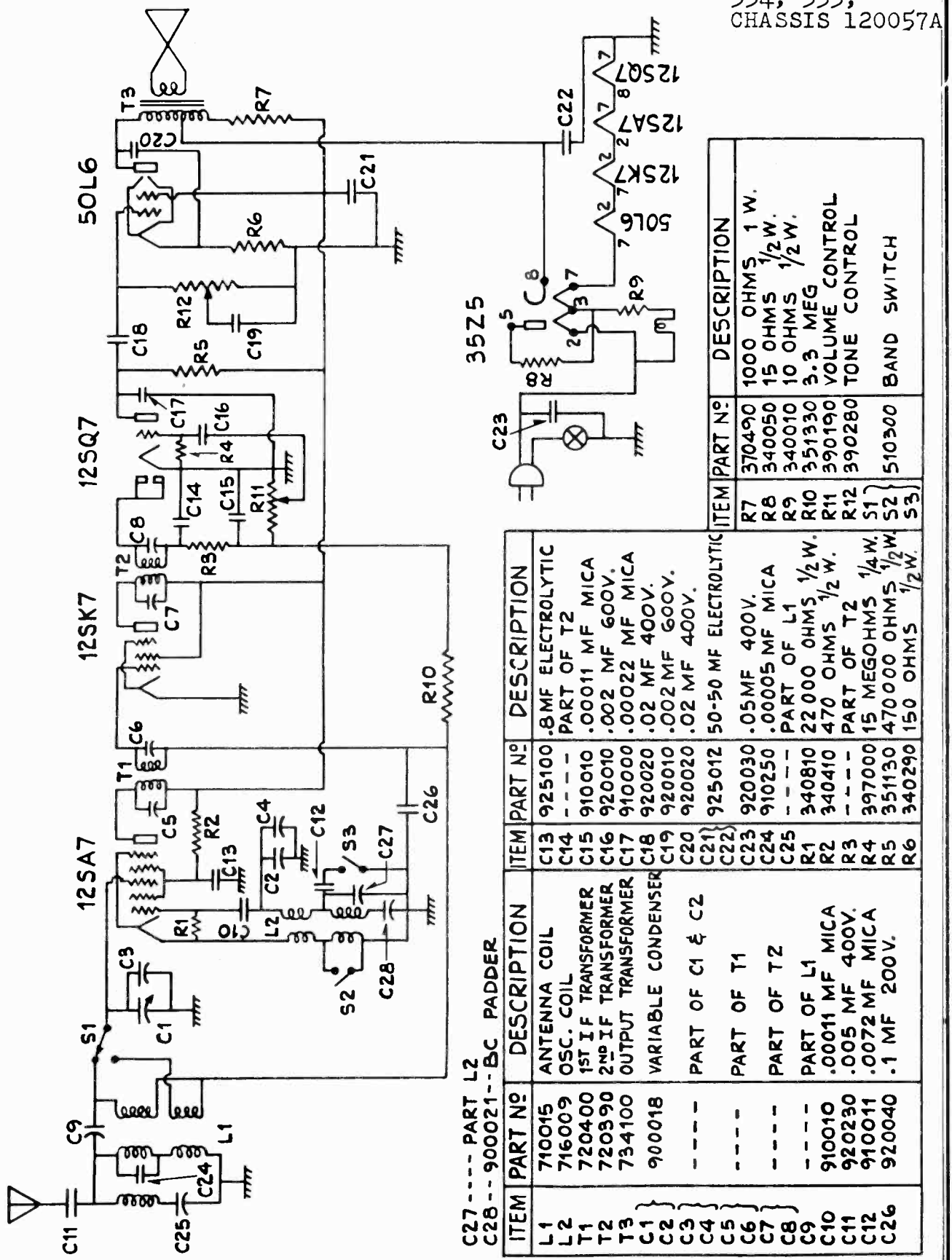
R. F. ALIGNMENT:

Remove signal generator leads from 12AT7 control grid. Connect in series with each generator lead a carbon 150 ohm resistor. Connect the high side generator lead to the red wire, in rear of tuner, and the low side generator lead to the orange wire. Adjust signal generator to 109 Mc. Open the tuner variable condenser for minimum capacity. Peak oscillator section of tuner condenser for maximum signal. Next set signal generator to 105 Mc. Tune in this signal. Adjust R.F. section of receiver variable condenser for maximum signal strength. To adjust the low frequency end, set the tuner and signal generator to 90 Mc. Peak the oscillator padder for maximum output. The variable condenser should be rocked during this operation. Keep the signal generator output as low as possible when making all of these measurements. It is extremely necessary in making the R.F. adjustments, that the fundamental oscillator signal be tuned in and not the image frequency. This can be checked by using a calibrated wavemeter.

REPLACEMENT PARTS

1038-1	I. F. Coil	3003	1/2 Watt Resistors
1038-2	Discriminator Coil	3005	4 Watt Pigtail Resistor
1040-2	R. F. Chokes	4016	Cabinet
1041	A. M. oscillator Coil	4069	Cabinet Back
1042	Filter Choke	4044-2	Knob
1043	Antenna Coil	5000	Line Cord
1044	F. M. oscillator Coil	6014	Dial Scale
2000	Paper Capacitors	8001	Pilot Lamp Socket
2005	Electrolytic	8003	Power Switch
2012	Ceramic Condensers	9762	Dial Spring
2023	Variable Condensers	2018	Electrolytic
2040	Trimmer Condensers	#47	Pilot Lamp

EMERSON RADIO AND PHONO. CORP. MODELS 512SW, 516SW, 531SW, 554, 555, CHASSIS 120057A



C27 ---- PART L2
C28 -- 900021 -- BC PADDER

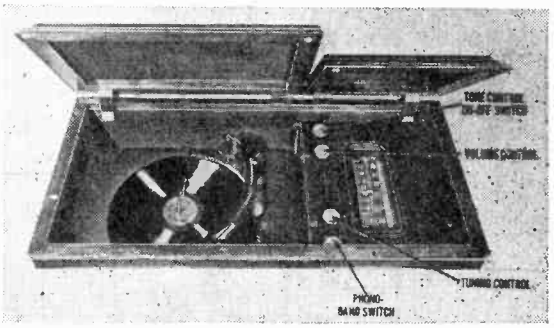
ITEM	PART Nº	DESCRIPTION
L1	710015	ANTENNA COIL
L2	716009	OSC. COIL
T1	720400	1ST I F TRANSFORMER
T2	720390	2ND IF TRANSFORMER
T3	734100	OUTPUT TRANSFORMER
C1	900018	VARIABLE CONDENSER
C2	----	PART OF C1 & C2
C3		
C4		
C5	----	PART OF T1
C6		
C7	----	PART OF T2
C8		
C9	----	PART OF L1
C10	910010	.00011 MF MICA
C11	920230	.005 MF 400V.
C12	910011	.0072 MF MICA
C26	920040	.1 MF 200V.

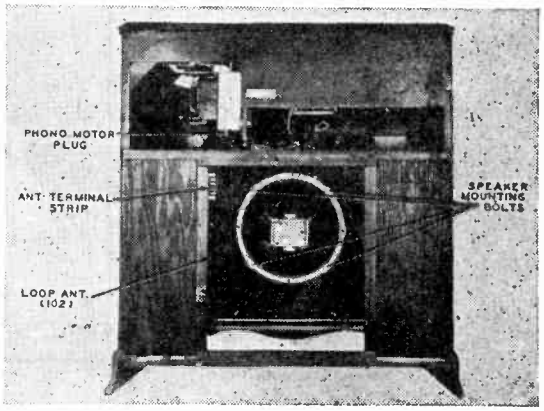
ITEM	PART Nº	DESCRIPTION
C13	925100	.8MF ELECTROLYTIC
C14	----	PART OF T2
C15	910010	.00011 MF MICA
C16	920010	.002 MF 600V.
C17	910000	.00022 MF MICA
C18	920020	.02 MF 400V.
C19	920010	.002 MF 600V.
C20	920020	.02 MF 400V.
C21 C22	925012	50-50 MF ELECTROLYTIC
C23	920030	.05MF 400V.
C24	910250	.00005 MF MICA
C25	----	PART OF L1
R1	340810	22000 OHMS 1/2 W.
R2	340410	470 OHMS 1/2 W.
R3	----	PART OF T2
R4	397000	15 MEGOHMS 1/4 W.
R5	351130	470000 OHMS 1/2 W.
R6	340290	150 OHMS 1/2 W.

ITEM	PART Nº	DESCRIPTION
R7	370490	1000 OHMS 1 W.
R8	340050	15 OHMS 1/2 W.
R9	340010	10 OHMS 1/2 W.
R10	351330	3.3 MEG
R11	390190	VOLUME CONTROL
R12	390280	TONE CONTROL
S1 S2 S3	510300	BAND SWITCH

MODEL 537,
CHASSIS 120043

EMERSON RADIO AND PHONO. CORP.





DESCRIPTION

TYPE: Console AM-FM superheterodyne with automatic record changer.

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

TYPE OF TUBES:
1—6AG5, r-f amplifier
1—6BE6, converter
2—6BA6, i-f amplifier
2—6AU6, limiter and AM second detector; audio amplifier
1—6AL5, FM ratio detector
2—6V6GT, power output
1—5U4G, rectifier
1—6U5/6G5, tuning eye

POWER SUPPLY: 60-cycle a.c.

VOLTAGE RATING: 105-125 volts.

POWER CONSUMPTION: 125 watts.

CURRENT DRAIN: 1.0 amp. at 117 volts a.c.

GENERAL NOTES

1. If replacements are made or the wiring disturbed in the r-f section of the circuit, the receiver should be carefully realigned.
2. The color coding of the i-f transformer leads is as follows:

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

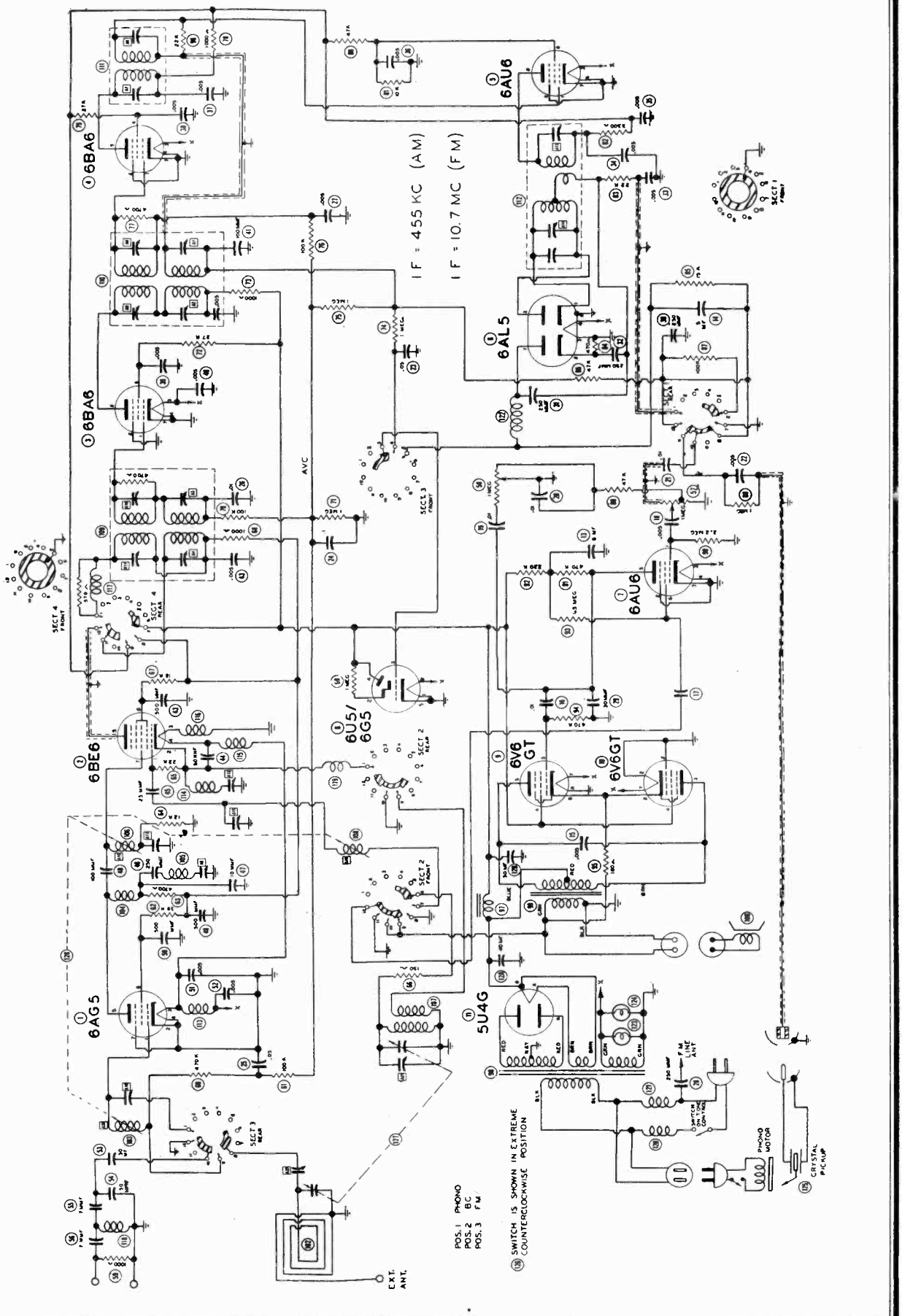
3. A self-contained loop antenna is provided for broadcast band reception. If it is desired to improve reception of weak stations, however, an additional outdoor antenna may be used. Connect the external antenna to the *outside* terminal on the "AM" side of the terminal strip at the rear of the cabinet. Connect the ground to the adjoining terminal.
4. An internal power line antenna is provided for FM operation in relatively strong signal areas. An external dipole antenna is recommended for best FM operation. To connect dipole, remove the wire from the terminal on the "FM" side of the terminal strips and connect the two dipole leads to the two "FM" terminals. A ground connection is not required for FM operation.

DISASSEMBLY INSTRUCTIONS

1. Remove four push-on type control knobs from top of cabinet.
2. Remove phono motor plug, phono pickup plug, and two speaker plugs from chassis.
3. Remove two Phillips head screws holding antenna terminal strip to chassis.
4. Remove two nuts and washers fastening loop to cabinet.
5. Remove two Phillips head bolts in phono compartment retaining chassis to cabinet.
6. Remove two hex head bolts and washers retaining chassis to cabinet. Remove loop and chassis from rear of cabinet.
7. Remove four nuts fastening speaker to cabinet and remove speaker.

EMERSON RADIO AND PHONO. CORP.

MODEL 537,
CHASSIS 120043



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MODEL 537,
CHASSIS 120043

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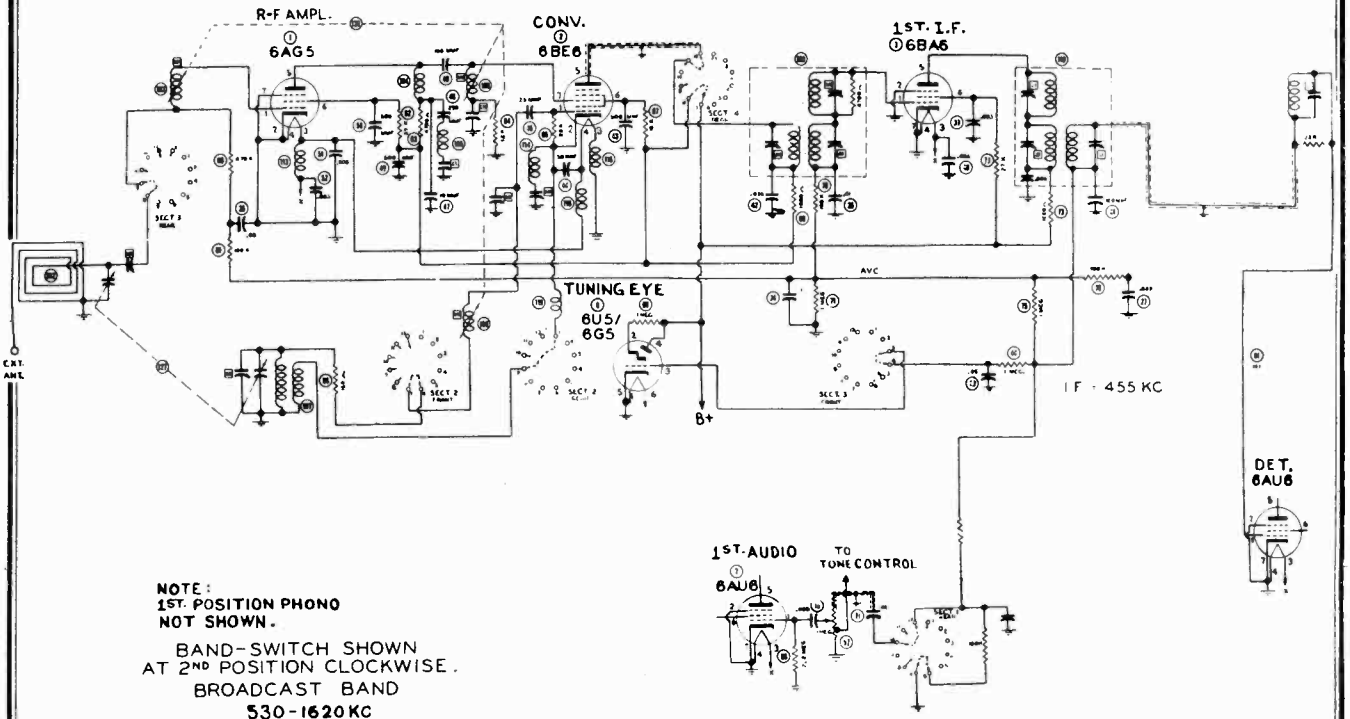
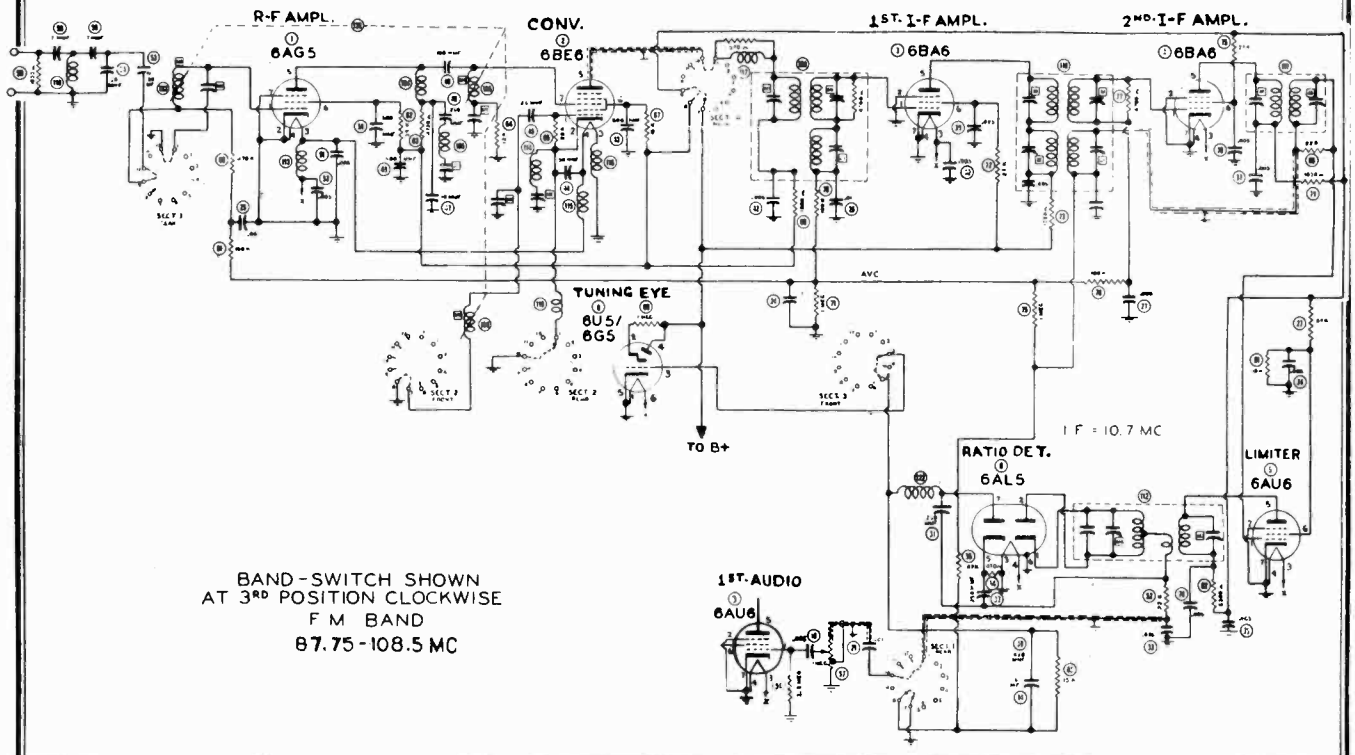


NOTE:
1ST. POSITION PHONO
NOT SHOWN.

BAND-SWITCH SHOWN
AT 2ND POSITION CLOCKWISE.
BROADCAST BAND
530-1620 KC



BAND-SWITCH SHOWN
AT 3RD POSITION CLOCKWISE
F M BAND
87.75-108.5 MC

EMERSON RADIO AND PHONO. CORP. MODEL 537, CHASSIS 120043

INSTRUCTIONS FOR VOLTAGE AND RESISTANCE READINGS

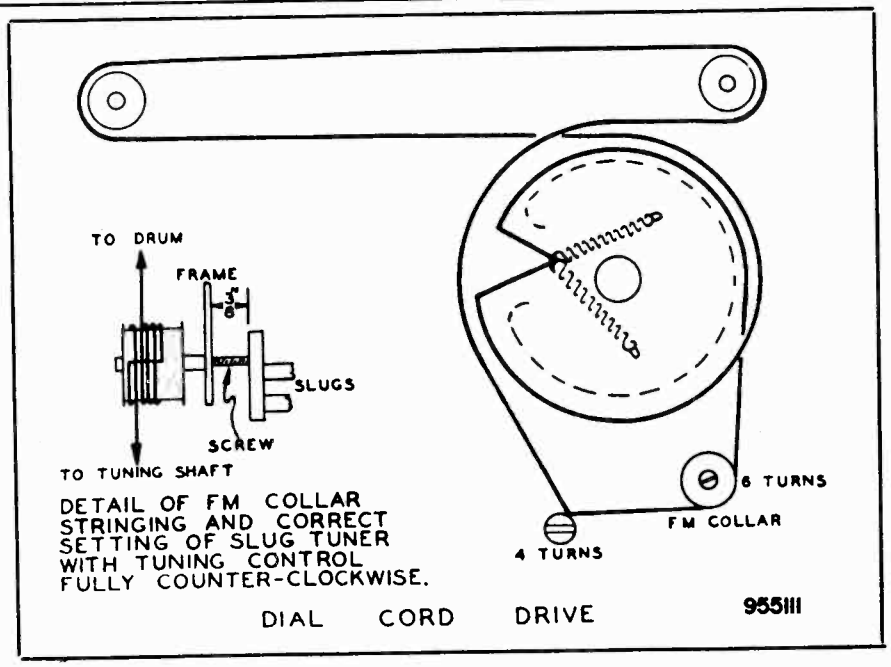
1. Voltage readings are in volts and resistance readings in ohms unless otherwise specified.
2. All readings taken in broadcast position except those for items 4, 5 and 6, which should be taken in FM position.
3. D-C voltage measurements are at 20,000 ohms per volt; a-c voltages measured at 1,000 ohms.
4. Socket connections are shown as bottom views.
5. Measured values are from socket pin to common negative.
6. Line voltage maintained at 117 volts for voltage readings.
7. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
8. Volume control at maximum, no signal applied for voltage measurements.
9. 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	-0.4DC	0	6.2AC	0	225DC	137DC	0	
2	6BE6	-0.3DC	0	0	6.2AC	270DC	100DC	0	
3	6BA6	-0.3DC	0	6.2AC	0	270DC	122DC	0	
4	6BA6	-0.5DC	0	6.2AC	0	260DC	110DC	0	
5	6AU6	-0.6DC	0	6.2AC	0	280DC	48DC	0	
6	6AL5	0	0	0	6.2AC	0.4DC	0	-11DC	
7	6AU6	-0.7DC	0	6.2AC	0	59DC	29DC	0	
9	6V6GT	0	0	320DC	290DC	0	59DC	6.2AC	15DC
10	6V6GT	0	0	320DC	290DC	0	0	6.2AC	15DC
11	5U4G	0	330DC	0	300AC	0	300AC	0	330DC

RESISTANCE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
1	6AG5	1.1 meg.	0	0.2	0	85,000	120,000	0	
2	6BE6	22,000	0.7	0.2	0	80,000	98,000	12,000	
3	6BA6	650,000	0	0.1	0	80,000	110,000	0	
4	6BA6	650,000	0	0.1	0	45,000	70,000	0	
5	6AU6	45,000	0	0.1	0	45,000	10,000	0	
6	6AL5	inf.	inf.	0	0.1	450	0	15,000	
7	6AU6	2.4 meg.	0	0.1	0	770,000	1.8 meg.	0	
9	6V6GT	0	0	80,000	80,000	450,000	0.3	0.1	170
10	6V6GT	0	0	80,000	80,000	0	620,000	0.1	170
11	5U4G	inf.	80,000	inf.	69	inf.	72	inf.	80,000



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

DIAL CORD DRIVE

MODEL 537,
CHASSIS 120043

EMERSON RADIO AND PHONO. CORP.

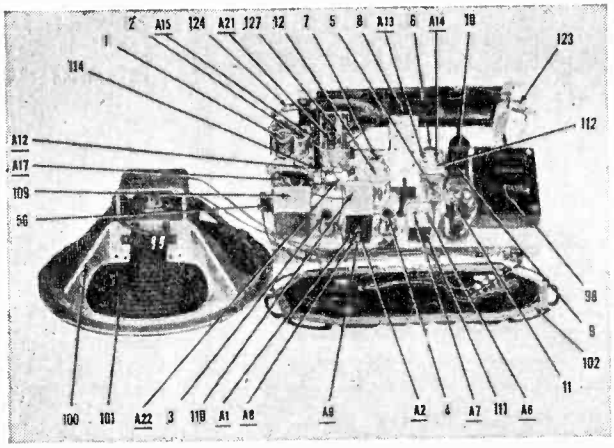
ALIGNMENT

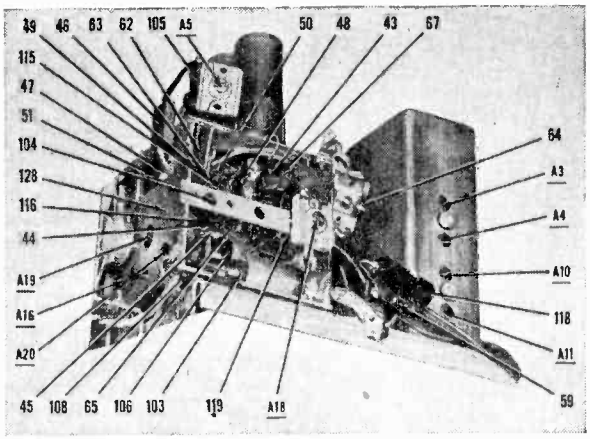
To set pointer turn variable condenser fully closed and set pointer to last reference mark at low frequency end of dial. To inject signal in Steps 5, 6 and 7, remove 6BE6 and connect wire to pin 1. Replace tube, making certain that wire does not short to shield base. In Step 9, connect two 100,000 ohm resistors in series from pin 7 of 6AL5 to chassis. These resistors should be equal within 5%. After Step 9, turn variable condenser fully counterclockwise and check adjustment of FM tuning unit per dial cord drawing. Loop should be maintained in same relative position to chassis as when receiver is in cabinet. 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	BAND SWITCH POSITION	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1	0.1 mfd.	High side to front stator of 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 front stator of 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, 2nd I-f tube (4). Low side to chassis.	10.7 mc (unmodulated)	FM (fully clockwise)	High frequency end of dial.	VTVM connected from pin 7 of 6AL5 to chassis.	A6, A7	Adjust for maximum deflection.
4	0.05 mfd.	High side to pin 1 (grid) of 6BA6, 1st I-f tube (3). Low side to chassis.	10.7 mc (unmodulated)	FM (fully clockwise)	High frequency end of dial.	VTVM connected from pin 7 of 6AL5 to chassis.	A8, A9	Adjust for maximum deflection.
5	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 from pin 7 of 6AL5 to chassis.	A10	Adjust for maximum deflection.
6	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 from pin 7 of 6AL5 to chassis.	A11	Adjust for maximum deflection.
7	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 from pin 7 of 6AL5 to chassis.	A12	Adjust for maximum deflection.
8	0.05 mfd.	High side to pin 1 (grid) 6AU6, 3rd I-f tube (5). Low side to chassis.	10.7 mc (unmodulated)	FM (fully clockwise)	High frequency end of dial.	VTVM connected from pin 7 of 6AL5 to chassis.	A13	Adjust for maximum deflection.
9	0.05 mfd.	High side to pin 1 (grid) 6AU6, 3rd I-f tube (5). 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 31 and 32. (See preliminary alignment notes).	A14	Adjust for zero deflection.
10	150 ohms in series with each lead.	High side to ungrounded FM antenna terminal. Low side to chassis. (Disconnect internal antenna.)	108 mc (unmodulated)	FM (fully clockwise)	108 mc	VTVM connected from pin 7 of 6AL5 to chassis.	A15	Adjust for maximum deflection.
11	150 ohms in series with each lead.	High side to ungrounded FM antenna terminal. Low side to chassis. (Disconnect internal antenna.)	88 mc (unmodulated)	FM (fully clockwise)	88 mc	VTVM connected from pin 7 of 6AL5 to chassis.	A16	Adjust iron core (hold brass in position) for maximum deflection.
12	150 ohms in series with each lead.	High side to ungrounded FM antenna terminal. Low side to chassis. (Disconnect internal antenna.)	98 mc (unmodulated)	FM (fully clockwise)	98 mc	VTVM connected from pin 7 of 6AL5 to chassis.	A16	Adjust iron and brass cores (single screw) for maximum deflection. Repeat steps 10, 11, 12 until no further improvement can be made.
13	150 ohms in series with each lead.	High side to ungrounded FM antenna terminal. Low side to chassis. (Disconnect internal antenna.)	106 mc (unmodulated)	FM (fully clockwise)	Tune for maximum deflection.	VTVM connected from pin 7 of 6AL5 to chassis.	A17, A18	Adjust for maximum deflection.
14	150 ohms in series with each lead.	High side to ungrounded FM antenna terminal. Low side to chassis. (Disconnect internal antenna.)	90 mc (unmodulated)	FM (fully clockwise)	Tune for maximum deflection.	VTVM connected from pin 7 of 6AL5 to chassis.	A19, A20	Adjust iron core (hold brass in position) for maximum deflection.
15	150 ohms in series with each lead.	High side to ungrounded FM antenna terminal. Low side to chassis. (Disconnect internal antenna.)	100 mc (unmodulated)	FM (fully clockwise)	Tune for maximum deflection.	VTVM connected from pin 7 of 6AL5 to chassis.	A19, A20	Adjust iron and brass cores (single screw) for maximum deflection. Repeat steps 13, 14, 15 until no further improvement can be made.
16	200 mmfd.	High side to AM ungrounded lug on antenna terminal strip. Low side to chassis.	1600 kc	BC	1600 kc	Across voice coil.	A21	Adjust for maximum output.
17	200 mmfd.	High side to AM ungrounded lug on antenna terminal strip. Low side to chassis.	1400 kc	BC	Tune for maximum output.	Across voice coil.	A22	Adjust for maximum output.

EMERSON RADIO AND PHONO. CORP.

MODEL 537,
CHASSIS 120043





REPLACEMENT PARTS LIST

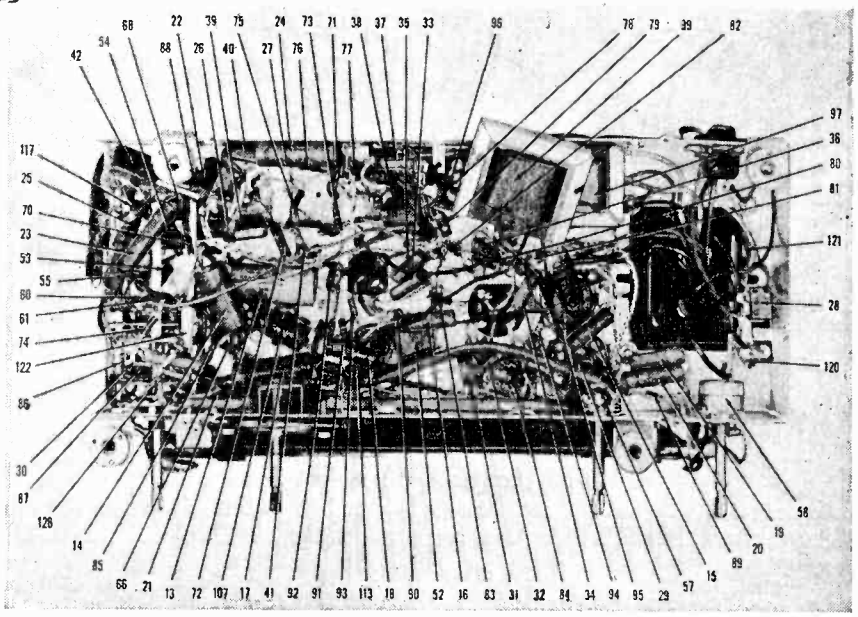
Symbol	†Part No.	DESCRIPTION
1	6AG5	Tube, r-f amplifier
2	6BE6	Tube, converter
3	6BA6	Tube, 1st i-f amplifier
4	6BA6	Tube, 2nd i-f amplifier
5	6AU6	Tube, limiter and AM 2nd detector
6	6AL5	Tube, FM ratio detector
7	6AU6	Tube, audio amplifier
8	6U5/6G5	Tube, tuning eye
9	6V6GT	Tube, power output
10	6V6GT	Tube, power output
11	5U4G	Tube, rectifier
12A, B	925006	40-30 mfd., 400 volt electrolytic condenser (filter)
13	925190	8 mfd., 450 volt electrolytic condenser (a-f plate decoupling)
14	925005	5 mfd., 50 volt electrolytic condenser (ratio detector bias)
15	920180	0.005 mfd., 400 volt condenser (tone compensation)
16	920090	0.01 mfd., 400 volt condenser (audio coupling)
17	920250	0.1 mfd., 400 volt condenser (feedback coupling)
18	920180	0.005 mfd., 400 volt condenser (audio coupling)
19	920090	0.01 mfd., 400 volt condenser (tone compensation)
20	920090	0.01 mfd., 400 volt condenser (tone compensation)
21	920090	0.01 mfd., 400 volt condenser (audio coupling)
22	920180	0.005 mfd., 400 volt condenser (phono coupling)
23	920060	0.05 mfd., 200 volt condenser (AM eye grid filter)
24	920040	0.1 mfd., 200 volt condenser (AVC filter)
25	920060	0.05 mfd., 200 volt condenser (AVC filter)
26	920090	0.01 mfd., 400 volt condenser (AVC filter)
27	920180	0.005 mfd., 500 volt mica condenser (AVC filter)
28	910320	0.00025 mfd., 500 volt mica condenser (FM antenna coupling)
29	928107	30 mmfd., 300 volt ceramic condenser (a-f plate bypass)
30	910320	0.00025 mfd., 500 volt mica condenser (diode filter)
31	910320	0.00025 mfd., 500 volt mica condenser (ratio detector load)
32	910320	0.00025 mfd., 500 volt mica condenser (ratio detector load)
33	920180	0.005 mfd., 500 volt mica condenser (deemphasis)
34	910356	0.005 mfd., 500 volt mica condenser (limiter plate decoupling)
35	910356	0.005 mfd., 500 volt mica condenser (r-f bypass power supply)
36	910356	0.005 mfd., 500 volt mica condenser (limiter screen bypass)
37	910356	0.005 mfd., 500 volt mica condenser (2nd i-f decoupling)
38	910356	0.005 mfd., 500 volt mica condenser 2nd i-f screen bypass)
39	910356	0.005 mfd., 500 volt mica condenser (1st i-f screen bypass)
40	910356	0.005 mfd., 500 volt mica condenser (1st i-f filament bypass)
41	910100	0.0001 mfd., 500 volt mica condenser (diode filter)
42	910356	0.005 mfd., 500 volt mica condenser (converter plate decoupling)
43	915003	0.0005 mfd., 300 volt mica condenser (converter screen bypass)
44	928102	50 mmfd., 300 volt ceramic condenser (converter cathode bypass)
45	928101	25 mmfd., 300 volt ceramic condenser (oscillator grid)
46	910320	0.00025 mfd., 500 volt mica condenser (wave trap)
47	928002	10 mmfd., 300 volt ceramic condenser (r-f plate decoupling)
48	928106	0.0001 mfd., 300 volt ceramic condenser (r-f coupling)
49	915003	0.0005 mfd., 300 volt mica condenser (r-f decoupling)
50	915003	0.0005 mfd., 300 volt mica condenser (r-f screen bypass)
51	910356	0.005 mfd., 300 volt mica condenser (r-f filament bypass)
52	910356	0.005 mfd., 300 volt mica condenser (r-f filament decoupling)
53	928107	30 mmfd., 300 volt ceramic condenser (r-f coupling)
54	928102	50 mmfd., 300 volt ceramic condenser (FM-r-f coupling)
55	928105	7 mmfd., 300 volt ceramic condenser (FM-r-f coupling)
56	928105	7 mmfd., 300 volt ceramic conden ser (FM-r-f coupling)
57	390004	Volume control, 1 meg.
58	390081	Tone control and switch, 1 meg.
59	320490	1000 ohms, ¼ watt resistor (FM antenna loading)
60	321130	470,000 ohms, ¼ watt resistor (r-f grid)
61	320970	100,000 ohms, ¼ watt resistor (AVC network)
62	370872	39,000 ohms, 1 watt resistor (r-f screen dropping)
63	310650	4,700 ohms, ¼ watt resistor (r-f plate decoupling)
64	310750	12,000 ohms, ¼ watt resistor (converter grid)
65	310810	22,000 ohms, ¼ watt resistor (oscillator grid)
66	320290	150 ohms, ¼ watt resistor (parasitic suppressor)
67	397070	18,000 ohms, 2 watt resistor (converter screen dropping)
68	320490	1,000 ohms, ¼ watt resistor (converter plate decoupling)

* Not supplied separately.

† Specify part numbers when ordering.

MODEL 537,
CHASSIS 120043

EMERSON RADIO AND PHONO. CORP.



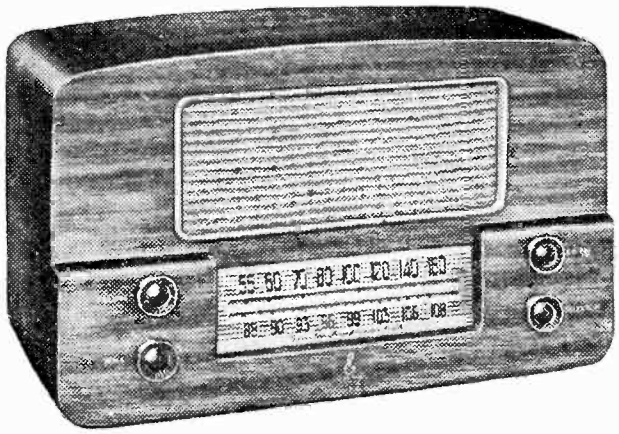
REPLACEMENT PARTS LIST (continued)

Symbol	†Part No.	DESCRIPTION
69	321210	1 meg., ¼ watt resistor (tuning eye plate load)
70	320970	100,000 ohms, ¼ watt resistor (AVC network)
71	311210	1 meg., ¼ watt resistor (AVC network)
72	370830	27,000 ohms, 1 watt resistor (1st i-f screen dropping)
73	320490	1,000 ohms, ¼ watt resistor (1st i-f plate decoupling)
74	321210	1 meg., ¼ watt resistor (AVC network)
75	321210	1 meg., ¼ watt resistor (AVC network)
76	320970	100,000 ohms, ¼ watt resistor (AVC network)
77	310650	4,700 ohms, ¼ watt resistor (2nd FM i-f transformer shunt)
78	320490	1,000 ohms, ¼ watt resistor (2nd i-f plate decoupling)
79	370830	27,000 ohms, 1 watt resistor (2nd i-f screen dropping)
80	370890	47,000 ohms, 1 watt resistor (limiter screen dropping)
81	370730	10,000 ohms, 1 watt resistor (limiter screen bleeder)
82	340610	3,300 ohms, ½ watt resistor (limiter plate decoupling)
83	350810	22,000 ohms, ½ watt resistor (de-emphasis)
84	340410	470 ohms, ½ watt resistor (ratio detector bias)
85	310771	15,000 ohms, ¼ watt resistor (ratio detector bias network)
86	310890	47,000 ohms, ¼ watt resistor (diode filter)
87	310970	100,000 ohms, ¼ watt resistor (diode load)
88	321210	1 meg., ¼ watt resistor (series phono)
89	310890	47,000 ohms, ¼ watt resistor (tone compensation)
90	321290	2.2 meg., ¼ watt resistor (a-f grid)
91	321130	470,000 ohms, ¼ watt resistor (a-f plate load)
92	321050	220,000 ohms, ¼ watt resistor (a-f plate decoupling)
93	311250	1.5 meg., ¼ watt resistor (a-f screen dropping)
94	321130	470,000 ohms, ¼ watt resistor (output grid)
95	394140	180 ohms, 2 watt resistor (output cathode)
96	310810	22,000 ohms, ¼ watt resistor (3rd i-f transformer shunt)
97	737002	Filter choke
98	730002	Power transformer
99	734004	Output transformer
100	180023	Speaker, 12 inch permanent magnet dynamic
*101		Speaker cone (part of 180023)
102	700003	Loop antenna
103	710014	FM antenna coil
104	705000	R-F plate choke
105	708001	AM wave trap
106	713013	FM r-f coil
107	716113	AM oscillator coil
108	716112	FM oscillator coil
109	720015	1st AM-FM i-f transformer
110	720016	2nd AM-FM i-f transformer
111	720014	3rd FM i-f transformer
112	708145	Ratio detector transformer
113	705002	R-F choke
114	705002	R-F choke
115	705002	R-F choke
116	705002	R-F choke
117	705005	Converter plate r-f choke
118	705003	R-F choke
119	705007	R-F choke
120	705002	R-F choke
121	705002	R-F choke
122	705000	R-F choke
123	807020	Dial light
124	807020	Dial light
125		Crystal pickup
126	510051	Band switch
127	900007	Two-gang variable condenser
128		FM tuning assembly
	500500	A-C receptacle
	508010	Phono receptacle
	555004	Terminal strip, speaker
	580032	Speaker pin terminal
	580033	Speaker pin terminal
	505005	A-C plug, phono motor
	505040	Connector plug, pickup
	583150	Line cord and plug
	507001	Dial light socket assembly
	585210	Tuning indicator socket and cable
	819020	Record Changer, curved spindle, brown
	819022	Record changer, straight spindle, blue
	140065	Cabinet
	620034	Knob, mahogany
	620035	Knob, mahogany, with indicator dot
	280002	Drive shaft, dial
	280505	Drive shaft, FM tuner
	520002	Dial back plate
	520003	Dial face
	525002	Pointer

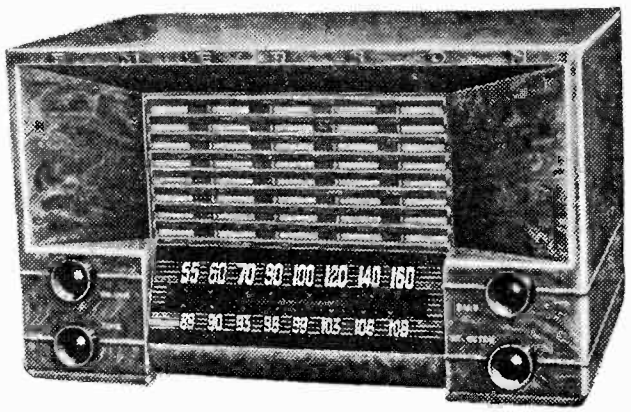
* Not supplied separately.

† Specify part numbers when ordering.

EMERSON RADIO AND PHONO. CORP. MODELS 556, 557, 565, CHASSIS 120018B



MODEL 565



MODEL 557

DESCRIPTION

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

FREQUENCY RANGE:
Broadcast band (AM)—540-1620 kilocycles
Frequency modulation band (FM)—88-108 megacycles

TYPE OF TUBES:
1—12BA6 FM r-f amplifier
1—12BA7 FM and AM converter
1—12BA6 FM and AM first i-f amplifier
1—12AU6 FM limiter
1—19T8 FM discriminator, AM detector, a.v.c., audio amplifier
1—35B5 Power output
1—Selenium rectifier

POWER SUPPLY: 60 cycle a.c.

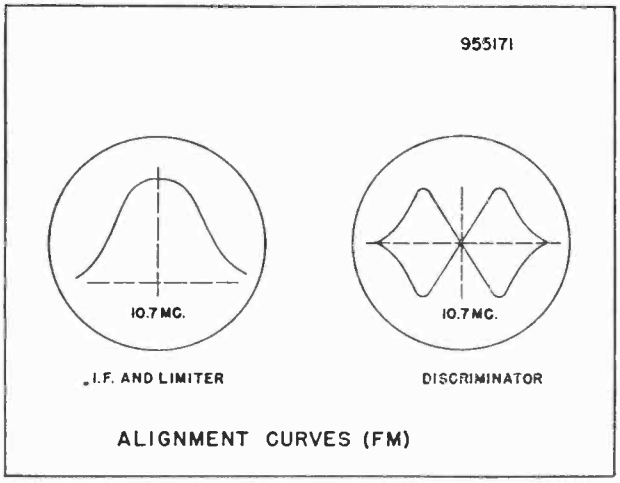
VOLTAGE RATING: 105-125 volts

POWER CONSUMPTION: 35 watts

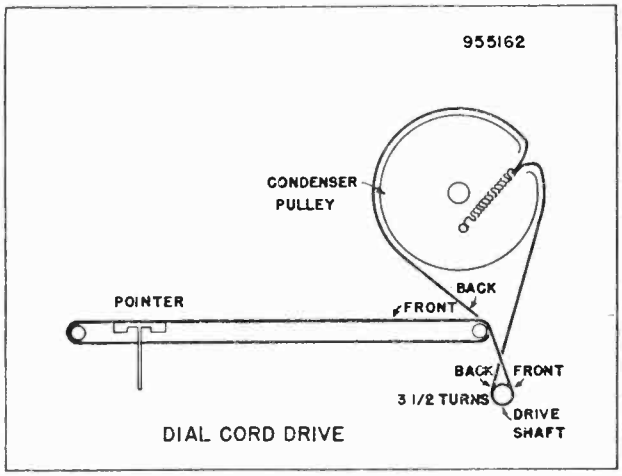
CURRENT DRAIN: 0.30 amps. at 117 volts a.c.

GENERAL NOTES

1. If replacements are made or the wiring disturbed in the r-f section of the circuit, the receiver should be carefully realigned.
2. 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 the outdoor antenna to the screw on the loop terminal strip marked "AM".
3. An internal power line antenna is provided for FM operation in relatively strong signal areas. The line cord should be completely uncoiled for effective operation of this antenna. An external dipole antenna is recommended for maximum FM operation. To connect the dipole, first remove the wire from the screw on the loop terminal strip marked "FM" and connect the dipole leads to the "FM" terminal and "G".
4. A ground connection is not required for AM and FM operation.



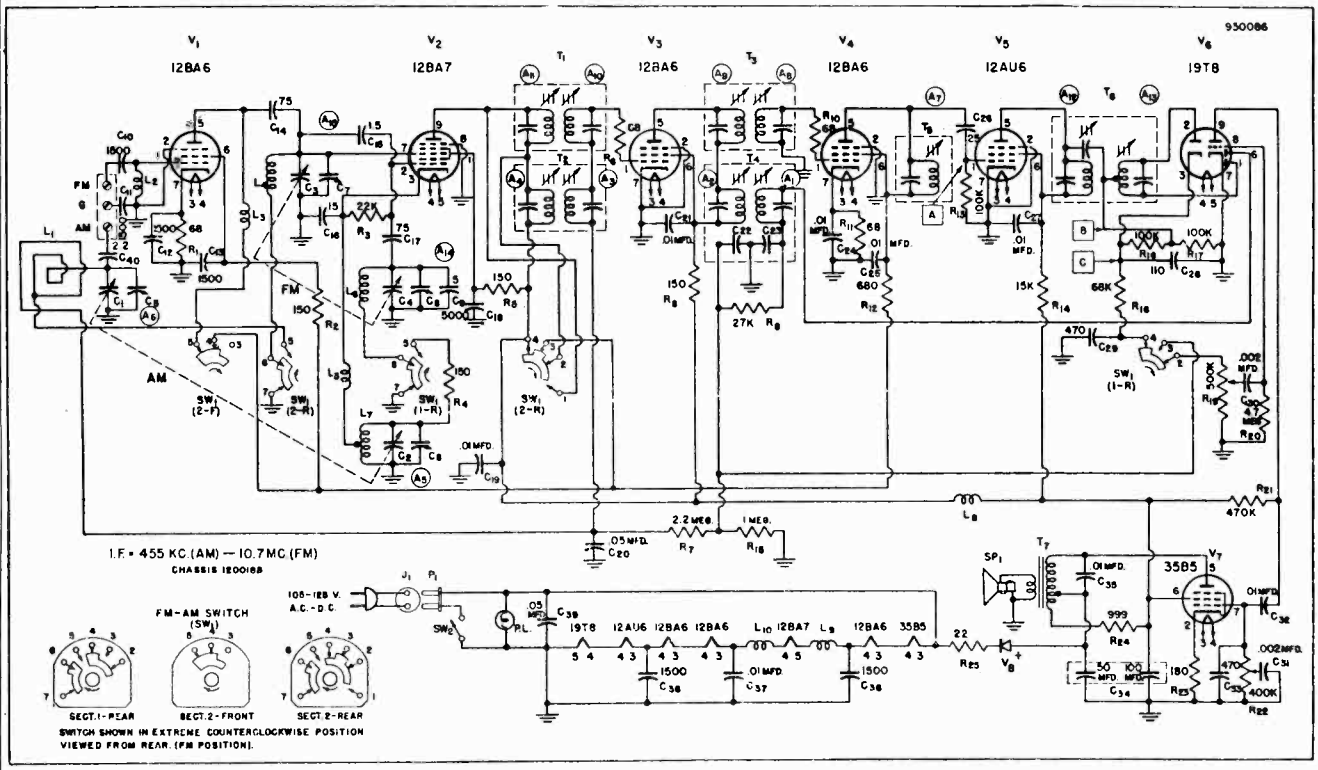
ALIGNMENT CURVES (FM)



DIAL CORD DRIVE

MODELS 556, 557, 565, CHASSIS 120018B

EMERSON RADIO AND PHONO. CORP.



INSTRUCTIONS FOR VOLTAGE AND RESISTANCE READINGS

1. Voltages readings are in d.c. volts and resistance readings in ohms, unless otherwise specified.
2. D.c. voltage measurements are made at 20,000 ohms-per-volt and a.c. voltages are measured at 1000 ohms-per-volt.
3. Socket connections are shown as bottom views. Values are measured from socket pin to common negative.
4. Line voltage maintained at 117 volts a.c. for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in readings.
6. Volume control at maximum, with no sig.... applied and bandswitch in broadcast position (unless otherwise noted), for voltage measurements.

VOLTAGE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V1	12BA6	0	0	80AC	67AC	76*	78*	.8*	—	—
V2	12BA7	100	-.5	0	67AC	55AC	0	-.5	0	95
V3	12BA6	-.2	0	55AC	43AC	93	98	0	—	—
V4	12BA6	0	0	43AC	30AC	70*	70*	.6*	—	—
V5	12AU6	-.4	0	30AC	18AC	50	50	0	—	—
V6	19T8	-.5	-.4	5.5*	18AC	0	-.8	0	-.5	33
V7	35B5	0	6	117AC	80AC	132	100	NC	—	—

NC denotes "no connection"; * for bandswitch in FM position only.

RESISTANCE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V1	12BA6	0	0	16	12	65K*	65K*	66	—	—
V2	12BA7	65K	24K	1	56	75	0	0	0	65K
V3	12BA6	2.8 meg.	0	56	44	65K	65K	0	—	—
V4	12BA6	68	0	44	32	65K	65K	68	—	—
V5	12AU6	100K	0	32	20	65K	65K	0	—	—
V6	19T8	90K	90K	150K	20	0	1 meg.	0	4 meg.	550K
V7	35B5	400K	190	112	80	65K	65K	NC	—	—

K—Kilohms; meg.—megohms.

EMERSON RADIO AND PHONO. CORP. MODELS 556, 557, 565, CHASSIS 120018B

ALIGNMENT INSTRUCTIONS

1. To position pointer, turn variable condenser fully closed and set pointer to reference mark on dial backplate at the low frequency end of the dial.
2. Volume control should be set at maximum position. The output of the signal generator should be no higher than necessary to obtain an output reading. Attenuate the signal input as alignment proceeds. Use an insulated alignment tool for all adjustments.
3. Use isolation transformer if available; otherwise connect a .1 mfd. condenser in series with low side of signal generator to chassis.

AM ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1	.1 mfd.	High side to Pin 7 (grid) of 12BA7. Low side to chassis.	455 KC.	Broadcast	Tuning condenser fully open.	Across voice coil.	A1, A2, (Trans. T4). A3, A4, (Trans. T2).	Adjust for maximum output. Reduce dummy antenna to .001 mfd. If isolation trans. is not used.
2		Loop	1600 KC.	Broadcast	Tuning condenser fully open.	Across voice coil.	A5, (Trimmer cond. C6).	Form loop of several turns of wire. Radiate signal into receiver loop. Adjust for maximum output.
3		Loop	1400 KC.	Broadcast	Tune for max. output.	Across voice coil.	A6, (Trimmer cond. C5).	Adjust for maximum output.

FM I-F and Disc. Alignment Using AM Signal Generator and VTVM

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
1	.01 mfd.	High side to Pin 1 (grid) of 12BA6 2nd i.f (V4). Low side to chassis.	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "A". Common to chassis.	A7, (Trans. T5).	Adjust for maximum output.
2	.01 mfd.	High side to Pin 1 (grid) of 12BA6 1st i-f (V3). Low side o chassis.	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "A". Common to chassis.	A8, A9, (Trans. T3).	Adjust for maximum output.
3	.01 mfd.	High side to Pin 2 (osc. grid) of 12BA7 conv. (V2). Low side to chassis.	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "A". Common to chassis.	A10, A11, (Trans. T1).	Adjust for maximum output.
4	.01 mfd.	High side to Pin 1 (grid) of 12BA6 2nd i-f (V4). Low side to chassis.	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "B". Common to chassis.	A12, (Trans. T6).	Adjust for maximum output.
5	.01 mfd.	"	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "C". Common to chassis.	A13, (Trans. T6).	Adjust for zero output. Continue with FM r-f alignment.

FM I-F AND DISC. ALIGNMENT USING SWEEP SIGNAL GENERATOR AND OSCILLOSCOPE. Use frequency modulated signal, with 60 cycle modulation and 450 kc. sweep. Use 120 cycle sowtooth sweep voltage in oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RADIO DIAL SETTING	CONNECT OSCILLOSCOPE	ADJUST	REMARKS
1	.01 mfd.	High side to Pin 1 (grid) of 12BA6 1st i-f (V3). Low side to chassis.	10.7 mc. (Unmodulated).	Frequency modulation	Tuning condenser fully open.	Vertical input to Point "A". Ground to chassis.	A7, A8, A9, (Trans. T5 and T3).	Adjust for maximum output (height) and symmetry as per i-f alignment curve shown (page 3).
2	.01 mfd.	High side to Pin 2 (osc. grid) of 12BA7 conv. (V2). Low side to chassis.	10.7 mc. (Unmodulated).	Frequency modulation	Tuning condenser fully open.	Vertical input to Point "A". Ground to chassis.	A10, A11, (Trans. T1).	Adjust for maximum output (height) and symmetry as per i-f alignment curve shown (page 3).
3	.01 mfd.	High side to Pin 1 (grid) of 12BA6 2nd i-f (V4). Low side to chassis.	10.7 mc. (Unmodulated).	Frequency modulation	Tuning condenser fully open.	Vertical input to Point "C". Ground to chassis.	A12, A13, (Trans. T6).	Alternately adjust A12 for maximum amplitude and A13 for maximum straightness of cross-over lines, with cross-over occurring at center of pattern as per discriminator alignment curve (page 3). Continue with FM r-f alignment.

FM R-F ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
1	150 ohm resistor in series with each gen. lead.	High side to FM ant. term. Low side to chassis.	108.0 mc. (Unmodulated).	Frequency modulation	Tuning condenser fully open (108.0 mc.)	Connect d.c. probe to point "A". Common to chassis.	A14 (Trimmer cond. C8).	Adjust for maximum output.
2	"	"	106.0 mc.	Frequency modulation	Tune for maximum output.	"	A15 (Trimmer cond. C7).	Adjust for maximum output.

REPLACEMENT PARTS LIST

Symbol	†Part No.	DESCRIPTION
V1	12BA6	FM r-f amplifier
V2	12BA7	FM and AM converter
V3	12BA6	FM and AM 1st i-f amplifier
V4	12BA6	FM 2nd i-f amplifier
V5	12AU6	FM limiter
V6	19T8	FM disc., AM det., a.v.c, audio amp.
V7	35B5	Power output
V8	817101	Selenium rectifier
C1, C2, C3, C4	900045	Two-gang, four section, variable condenser (alt. part. 900400 A).
C5, C6, C7, C8	*	Trimmers, part of C1-C2-C3-C4
C9	928017	5 mmf., ceramic condenser
C10, C11, C12, C13, C36, C38	928006	1500 mmf., ceramic condenser
C14, C17	928015	75 mmf., ceramic condenser
C15	915011	1.5 mmf., molded condenser
C16	928016	15 mmf., ceramic condenser
C18	928109	5000 mmf., ceramic condenser
C19, C21, C24, C25, C27	920092	.01 mfd., 200 volt paper condenser
C20, C39	920030	.05 mfd., 400 volt paper condenser
C22, C23	*	Part of T4 (2nd i-f, AM)
C26	928110	25 mmf., ceramic condenser
C28	910010	110 mmf., mica condenser
C29, C33	910014	470 mmf., mica condenser
C30, C31	920515	.002 mfd., volt paper condenser
C32, C35, C37	920090	.01 mfd., 400 volt paper condenser
C34	925126	100-50 mfd., 150 volt elect. cond.
C40	*	2.2 mmf., part of loop antenna L1
R1, R6, R10, R11	340210	68 ohms, ½ watt resistor
R2, R4, R5, R8	350290	150 ohms, ½ watt resistor
R3	340810	22 kilohms, ½ watt resistor
R7	351290	2.2 megohms, ½ watt resistor
R9	340830	27 kilohms, ½ watt resistor (may be part of T4)
R12	340450	680 ohms, ½ watt resistor
R13, R16, R17	340970	100 kilohms, ½ watt resistor
R14	350770	15 kilohms, ½ watt resistor
R15	351210	1 megohm, ½ watt resistor
R18	350930	68 kilohms, ½ watt resistor
R19	390057	500 kilohms, volume control
R20	351370	4.7 megohms, ½ watt resistor
R21	351130	470 kilohms, ½ watt resistor
R22	390046	400 kilohms, tone control
R23	370310	180 ohms, 1 watt resistor
R24	394042	999 ohms, 3 watt wire wound
R25	380090	22 ohms, 1 watt resistor
L1	700011	AM loop antenna (alternate part 700021) #
L2	710019	FM antenna coil
L3, L5, L9, L10	705002	FM oscillator choke
L4	713024	FM r-f coil
L6	716013	FM oscillator coil
L7	716015	AM oscillator coil
L8	705013	R-f choke
T1	720024	First i-f trans. (FM). (Alt. parts 720082, 720067) #
T2	720031	First i-f trans. (AM). (Alt. parts 720084, 720075) #
T3	720025	Second i-f trans. (FM). (Alt. parts 720082, 720067) #
T4	720032	Second i-f trans. (AM). (Alt. parts 720085, 720076) #
T5	720069	Third i-f trans. (FM). (Alt. parts 720083, 720077) #
T6	708005	Disc. trans. FM). (Alt. parts 708012, 708013) #
T7	734041	Output transformer
SW1	510037	Band switch, AM-FM
SW2	*	Line switch, part of vol. control
SP1	180031P	P.m. speaker, (6" oval)
P1	505007	Line cord connector plug
J1	500005	Line cord interlock socket
	583202	Line cord and internal ant.

CABINET AND DIAL PARTS

	†Part No.	DESCRIPTION		†Part No.	DESCRIPTION
	140113	Cabinet, maroon plastic (Models 556, 557)		520071	Dial crystal
	560041	Cabinet back (Models 556, 557)		410177	Dial backplate
	140125	Cabinet, wood (Model 565)		280039	Dial drive shaft
	560052	Cabinet back (Model 565)		530002	Dial drive cord (44")
	460470	Knob, black		587070	Dial cord spring
				525017	Pointer
				410503	Speaker grille (Model 556)

DESCRIPTION

TYPE: Single band (AM) superheterodyne

FREQUENCY RANGE: 540-1620 KC.

TYPES OF TUBES:

1—12SG7 converter
1—6SS7 oscillator
1—6SS7 i-f amplifier
1—12AT6 detector, a.v.c., a-f amplifier
1—50L6GT power output
1—35Z5GT rectifier

POWER SUPPLY: A.c. or d.c.

VOLTAGE RATING: 105-125 volts

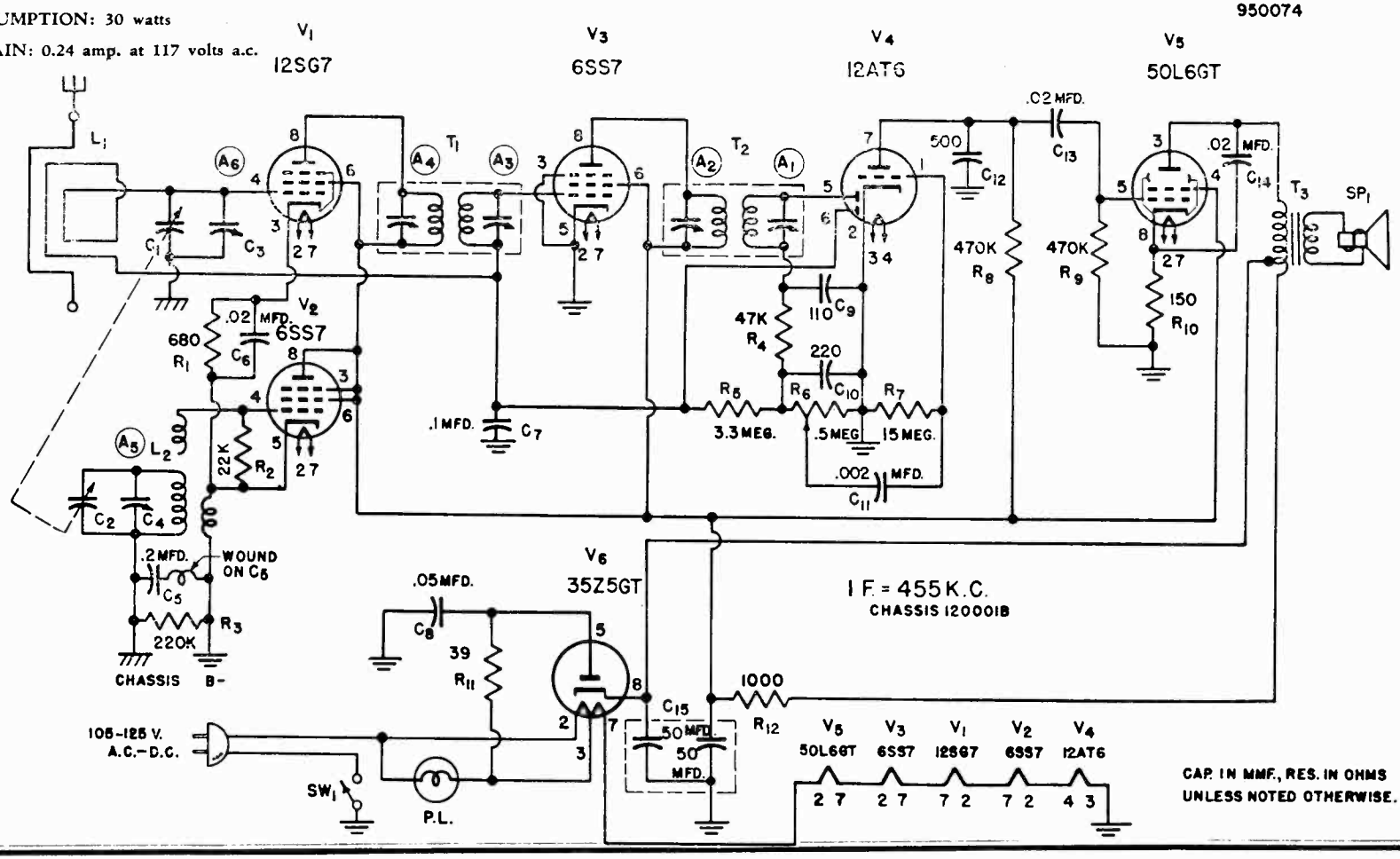
POWER CONSUMPTION: 30 watts

CURRENT DRAIN: 0.24 amp. at 117 volts a.c.

GENERAL NOTES

1. If replacements are made or the wiring disturbed in the r-f section of the circuit, the receiver should be carefully realigned.
2. In aperating the receiver on d.c., it may be necessary to reverse the line plug for correct polarity.
3. The receiver has a self-contained antenna, and does not require additional antenna connections. For permanent home installations, however, if it is desired to improve reception of weak stations, an additional outdoor antenna may be used. For this purpose a lead has been brought out in the rear near the line cord. Use no ground connection.
4. The self-contained loop antenna operates at maximum efficiency when its position is at right angles to the broadcasting source. It is important, therefore, once the station is tuned in, to rotate the cabinet back and forth through a quarter of a circle (90 degrees), leaving it at the position where the station is receiver with maximum volume.

950074



MODEL 561-615, EMERSON RADIO AND PHONO. CORP.
CHASSIS 120001B

INSTRUCTIONS FOR VOLTAGE AND RESISTANCE READINGS

1. Voltage readings are in d.c. volts and resistance readings in ohms unless otherwise specified.
2. D.c. voltage measurements are at 20,000 ohms-per-volt; a.c. voltages measured at 1,000 ohms-per-volt.
3. Socket connections are shown as bottom views.
4. Measured values are from socket pin to common negative (B—).
5. Line voltage maintained at 117 volts for voltage readings.
6. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
7. Volume control at maximum with 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
V1	12SG7	0	18 AC	1.2	-.5	NC	86	30 AC	82
V2	6SS7	0	12 AC	88	3	0	86	18 AC	86
V3	6SS7	0	36 AC	0	-.5	0	86	30 AC	86
V4	12AT6	-.7	0	0	12 AC	-.5	-.5	45	—
V5	50L6GT	NC	86 AC	105	86	0	NC	36 AC	5.5
V6	35Z5GT	NC	117 AC	112 AC	112	110 AC	NC	86 AC	112

RESISTANCE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
V1	12SG7	250 K	22	70	3.5 meg.	NC	150 K	33	150 K
V2	6SS7	250 K	15	150 K	22 K	0	150 K	22	150 K
V3	6SS7	250 K	40	0	3.5 meg.	0	150 K	33	150 K
V4	12AT6	10 meg.	0	0	16	480 K	3.5 meg.	600 K	—
V5	50L6GT	Inf.	90	150 K	150 K	420 K	Inf.	40	160
V6	35Z5GT	Inf.	120	118	150 K	160	NC	90	150 K

NC = no connection; K = kilohm; meg. = megohm; Inf. = infinity

ALIGNMENT PROCEDURE

1. To set pointer, turn variable condenser fully closed and set pointer at mark near left end of dial backplate.
2. Use isolation transformer if available. If not, connect a 0.1 mfd. condenser in series with low side of signal generator and chassis.
3. Volume control should be at maximum position; output of signal generator should be no higher than necessary to obtain an output reading.
4. Use an insulated alignment screwdriver for adjusting.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	METER OUTPUT	ADJUST	REMARKS
1	0.1 mfd.	High side to pin 4 (grid) of 12SG7 (V1). Low side to chassis.	455 kc	Variable condenser fully open.	Across voice coil.	A1, A2 (2nd i-f trans. T2) A3, A4 (1st i-f trans. T1)	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.	1620 kc	Variable condenser fully open.	Across voice coil.	A5 (Trimmer cond. C4).	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.	A6 (Trimmer cond. C3).	Adjust for maximum output.

REPLACEMENT PARTS LIST

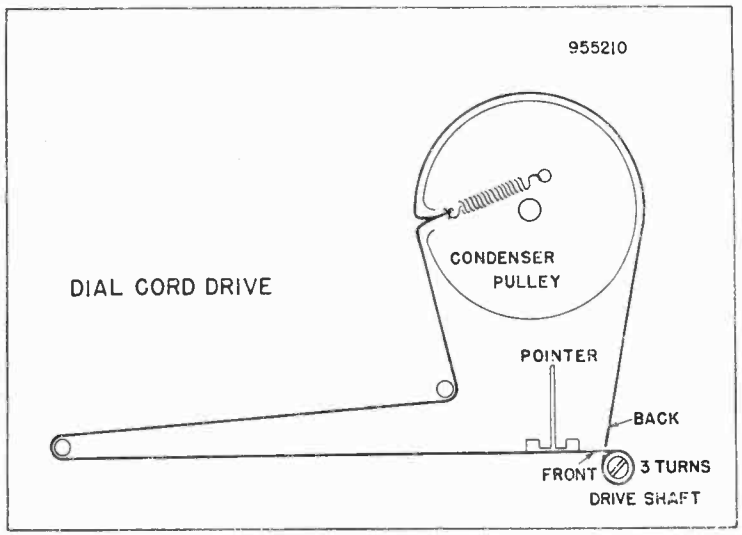
Symbol	†Patr No.	DESCRIPTION	Symbol	†Patr No.	DESCRIPTION
V1	12SG7	Converter	R2	340810	22 kilohms, ½ watt resistor
V2	6SS7	Oscillator	R3	351050	220 kilohms, ½ watt resistor
V3	6SS7	I-f amplifier	R4	340890	47 kilohms, ½ watt resistor
V4	12AT6	Detector, a.v.c., a-f amplifier	R5	351330	3.3 megohms, ½ watt rsistor
V5	50L6GT	Power output	R6	390044	.5 megohms, volume control
V6	35Z5GT	Rectifier	R7	351490	15 megohms, ½ watt resistor
C1, C2	900027	Two gang var. condenser	R8, R9	351130	470 kilohms, ½ watt resistor
C3, C4	*	Trimmers, part of var. cond.	R10	340290	150 ohms, ½ watt resistor
C5	920050	.2 mfd., 400 volt paper cond.	R11	370150	39 ohms, 1 watt resistor
C6	920100	.02 mfd., 200 volt paper cond.	R12	370490	1000 ohms, 1 watt resistor
C7	920040	.1 mfd., 200 volt paper cond.	L1	700000	Loop antenna
C8	920030	.05 mfd., 400 volt paper cond.	L2	716025	Oscillator coil
C9	910010	110 mmf., mica condenser	T1	720061	First i-f transformer
C10	910000	220 mmf., mica condenser	T2	720036	Second i-f transformer
C11	920010	.002 mmf., 600 volt paper cond.	T3	734043	Output transformer
C12	920240	500 mmf., 600 volt paper cond.	SP1	180045	P.m. speaker
C13, C14	920020	.02 mfd., 400 volt paper cond.	SW1	*	Line switch, part of vol. control
C15	925112	50-50 mfd., 150 volt electrolytic condenser	P.L.	807000	Dial light, 6-8 v., .15 amp.
				583014	Line cord
R1	340450	680 ohms, ½ watt resistor		507006	Dial light socket

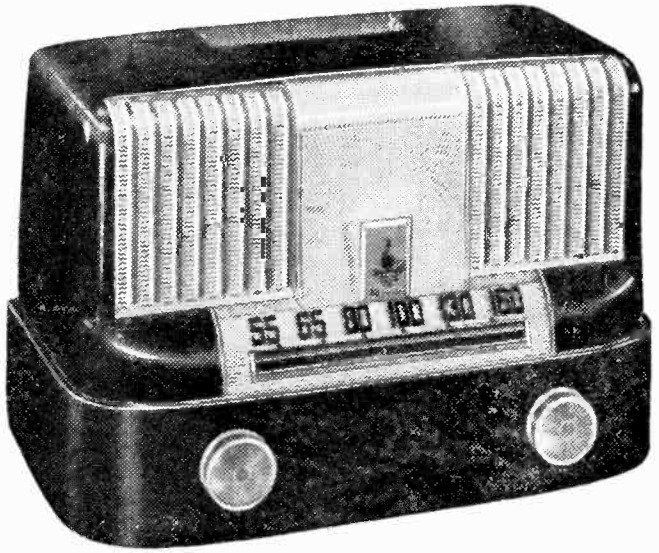
CABINET AND DIAL PARTS

†Part No.	DESCRIPTION
140119	Cabinet, ivory plastic
450310	Knob, ivory
460072	Speaker grille
525024	Pointer
520050	Dial backplate
280042	Dial drive shaft
530002	Dial cord (30")
587070	Dial cord spring

† Specify part numbers when ordering.

* Not supplied separately.

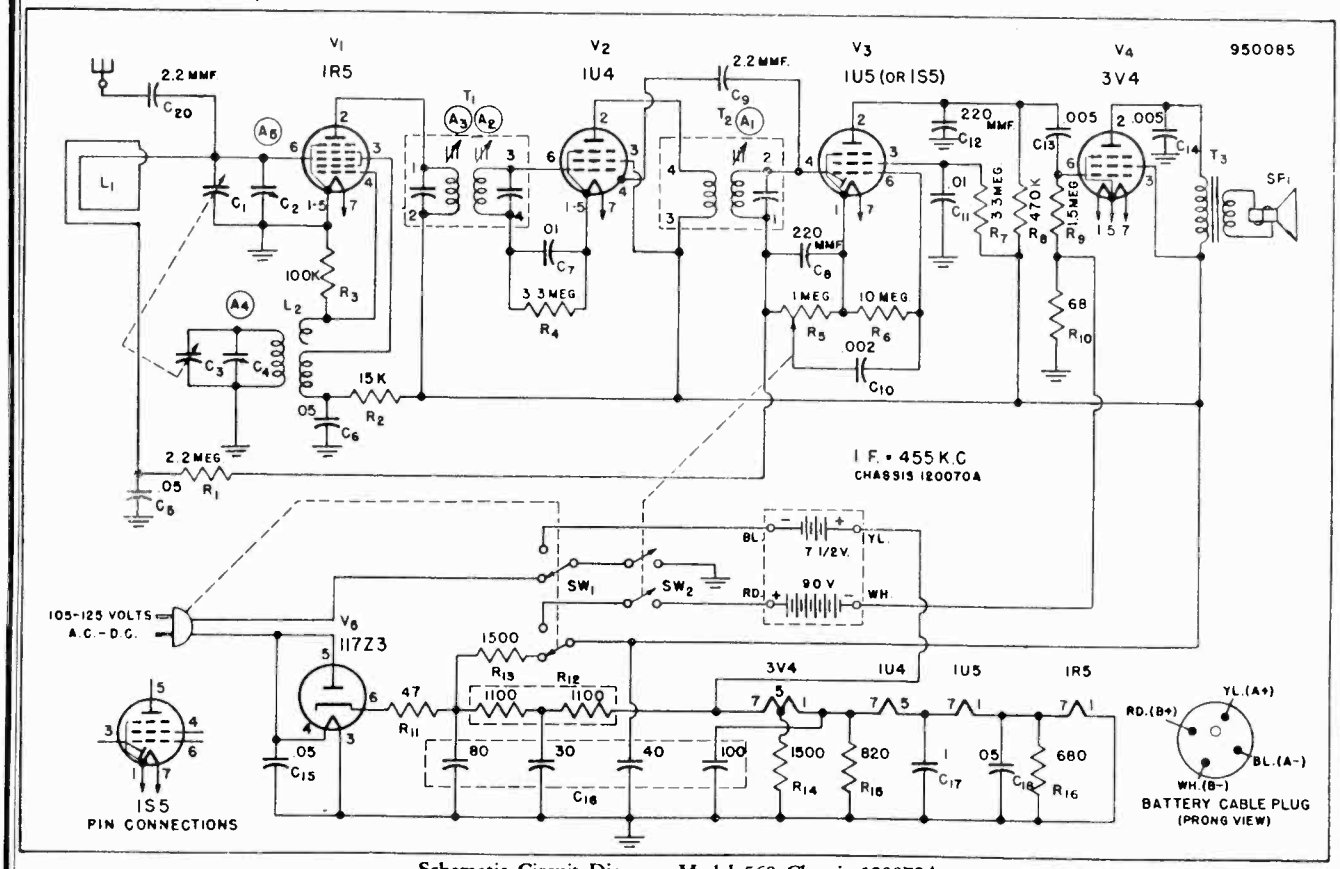




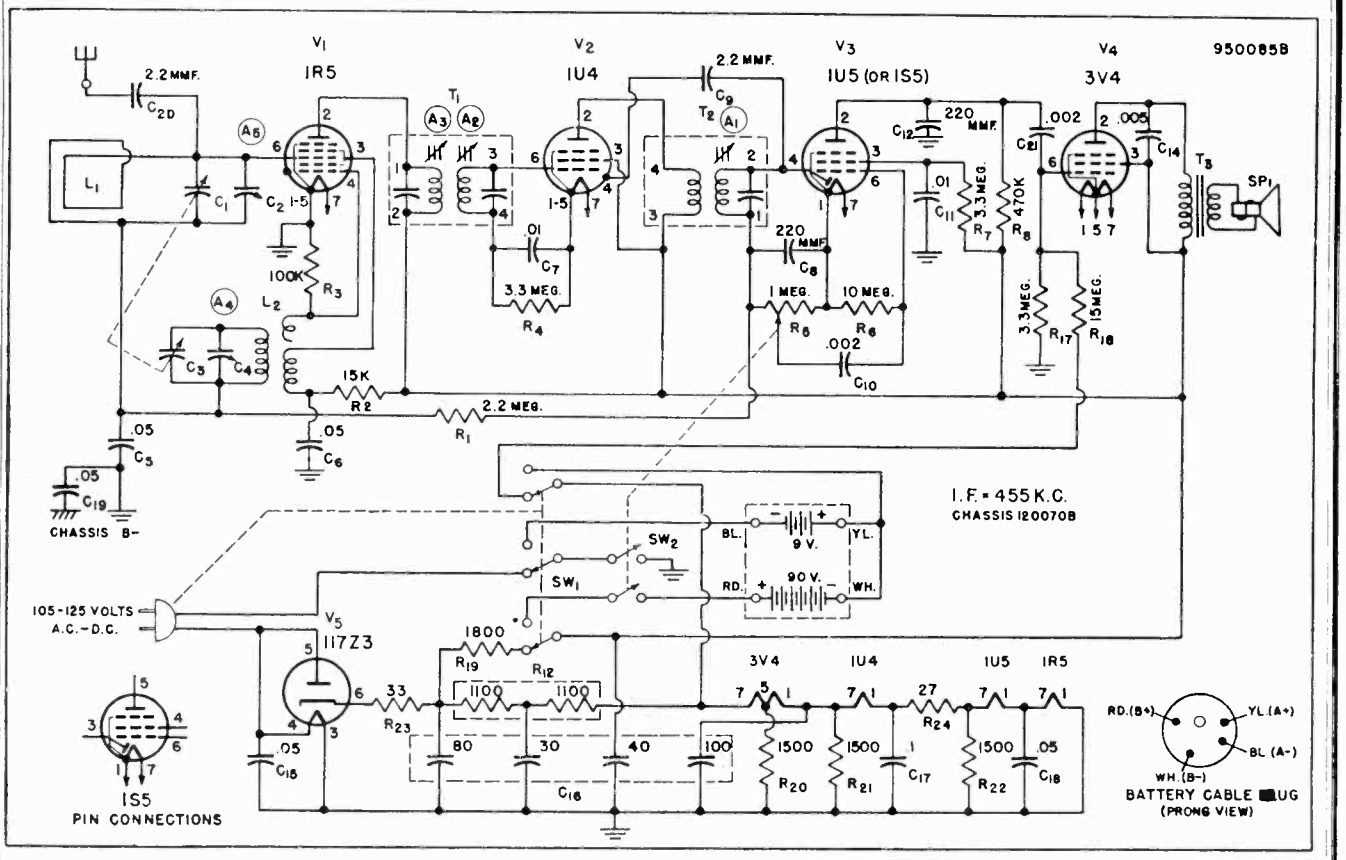
MODEL: 561 - 615

MODEL 568, CHASSIS 120070A, 120070B

EMERSON RADIO AND PHONO. CORP.



Schematic Circuit Diagram Model 568 Chassis 120070A



Schematic Circuit Diagram Model 568 Chassis 120070B

EMERSON RADIO AND PHONO. CORP. MODEL 568, CHASSIS 120070A, 120070B

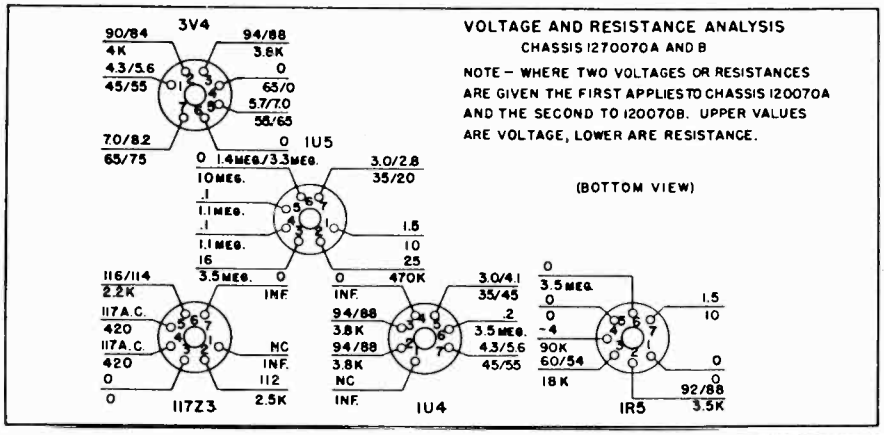
ALIGNMENT PROCEDURE

1. Use battery power when available. When a.c. power is used, connect the line cord through an isolation transformer if available. Otherwise connect a 0.1 mfd. condenser in series with the low side of the signal generator and B—.
2. Set the volume control at maximum. The output of the signal generator should be no higher than that necessary to obtain an output reading. Attenuate the signal input as alignment proceeds. Use an insulated alignment tool.
3. Maintain the loop in the same position relative to the chassis as when the receiver is in the cabinet.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1	0.1 mfd.	High side to grid (pin 6) of V1 (1R5). Low side to chassis.	455 KC.	Variable condenser fully open.	Across voice coil	A1, (2nd i-f trans), A2, A3 (1st i-f trans.)	Adjust for maximum output. If a.c. is used, without an isolation transformer, reduce dummy antenna to 200 mmf. to reduce hum modulation.
2	200 mmf.	High side to external antenna lead. Low side to chassis.	1620 KC.	Variable condenser fully open.	Across voice coil	A4 (trimmer cond. C4.)	Adjust for maximum output.
3	200 mmf.	"	1400 KC.	Tune for maximum output.	Across voice coil	A5 (trimmer cond. C2).	Adjust for maximum output.

INSTRUCTIONS FOR VOLTAGE AND RESISTANCE READINGS

1. Voltage and resistance readings are measured for 117 volt a.c. line operation. Socket connections are shown as bottom views. Measurements are taken from socket pin to chassis (chassis 120070A) or socket pin to common negative (chassis 120070B).
2. Voltages are d.c. unless otherwise indicated, measured with a 20,000 ohms-per-volt meter. A.c. voltages are measured at 1000 ohms-per-volt.
3. For voltage measurements, set volume control at maximum; no signal applied.
4. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
5. On the voltage and resistance analysis diagram NC denotes no connection; K—kilohms; meg.—megohms; inf.—infinity.



DESCRIPTION

TYPE: Three way (battery, a.c., d.c.) portable superheterodyne.

FREQUENCY RANGE: 540-1620 KC.

TYPE OF TUBES:
1—1R5, pentagrid converter
1—1U4, i-f amplifier
1—1S5, or 1U5, detector, a.v.c., a-f amplifier
1—3V4, power output
1—117Z3 rectifier

POWER SUPPLY: Battery powerpack, or a.c., or d.c.

VOLTAGE RATING:
Line operation—105-125 volts, a.c. or d.c.
Battery operation—7½ volts (chassis 120070A);
9 volts (chassis 120070B) "A" supply
90 volts "B" supply

POWER CONSUMPTION: Line operation 20 watts

CURRENT CONSUMPTION:
"A" battery—.053 amp. (chassis 120070A)
.055 amp. (chassis 120070B)
"B" battery—.013 amp.
117 volts a.c.—.170 amp.

MODEL: 568

MODEL 568, CHASSIS 120070A, 120070B

EMERSON RADIO AND PHONO. CORP.

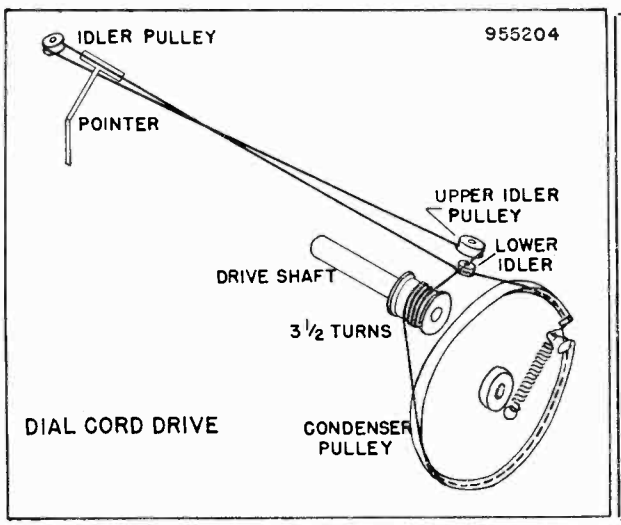
REPLACEMENT PARTS LIST

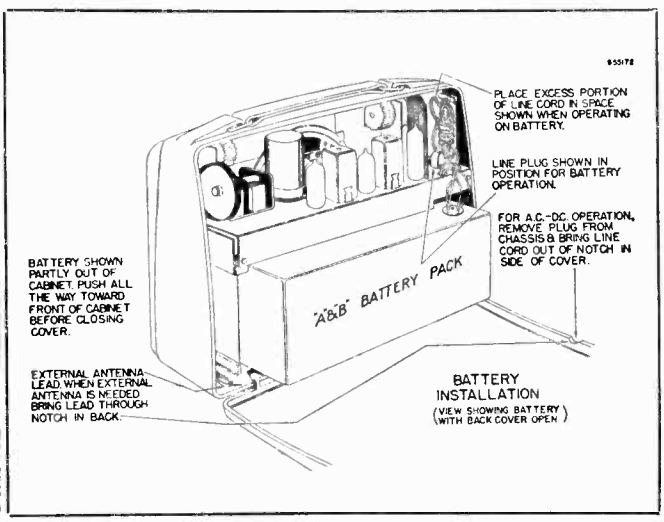
Symbol	†Part No.	DESCRIPTION
V1	1R5	Converter
V2	1U4	1-t amplifier
V3	1S5 or 1U5	Detector, a.v.c., a-f amplifier
V4	3V4	Power output
V5	117Z3	Rectifier
C1, C3	900043	Two-gang variable condenser
C2, C4	*	Trimmers, part of var. condenser
C5, C18	920060	.05 mfd., 200 volt condenser
C6, C15, C19	920539	.05 mfd., 400 volt condenser
C7, C11	920092	.01 mfd., 400 volt condenser
C8, C12	910000	220 mmf., mica condenser
C9, C20	915005	2.2 mmf., molded condenser
C10, C21	920515	.002 mfd., 400 volt condenser
C13, C14	920180	.005 mfd., 400 volt condenser
C16	925059	80-40-30-100 mfd., 150-150-150-25 volt electrolytic condenser
C17	920040	.1 mfd., 200 volt condenser
R1	351290	2.2 megohms, ½ watt resistor
R2	340770	15 kilohms, ± 10%, ½ watt res.
R3	350970	100 kilohms, ½ watt resistor
R4, R7	351330	3.3 megohms, ½ watt resistor
R5	390063	1 megohm, volume control
R6	351450	10 megohms, ½ watt resistor
R8	351130	470 kilohms, ½ watt resistor
R9	351250	1.5 megohms, ½ watt resistor
R10	340210	68 ohms, ± 10%, ½ watt resistor
R11	370170	47 ohms, ± 10%, ½ watt resistor
R12	394041	1100-1100 ohms, ± 5%, wire-wound resistor
R13, R14, R20, R21, R22	340530	1500 ohms, ± 10%, ½ watt resistor
R15	340470	820 ohms, ± 10%, ½ watt resistor
R16	340450	680 ohms, ± 10%, ½ watt resistor
R17	341330	3.3 meghoms, ± 10%, ½ watt resistor
R18	341490	15 megohms, ± 10%, ½ watt resistor
R19	340550	1800 ohms, ± 10%, ½ watt resistor
R23	370132	33 ohms, ± 10%, ½ watt resistor
R24	340110	27 ohms, ± 10%, ½ watt resistor
L1	700039△	Loop antenna
	700042□	" "
L2	716029	Oscillator coil
T1	720525	First i-f transformer (alternate parts 720051 or 720062) #
T2	720066	Second i-f transformer
T3	734039△	Output transformer
	734039A□	" "
SW1	510008△	Power changeover switch, d.p.d.t.
	510043□	" " " , t.p.d.t.
SW2	*	On-off switch, part of volume control
	585031△	Battery cable ("A" and "B")
	585033□	" " " " "
	583012P△	Line cord
	583017P□	" "
		Battery power pack unit (7½ or 9 volts "'A" and 90 volts "B"). Eveready No. 753 or Rayovac No. AB994.

CABINET AND DIAL PARTS

†Part No.	DESCRIPTION
140182°	Cabinet
140183S°	Cabinet back, with hinge springs
460081°	Speaker grille
520092	Dial Crystal
520085	Dial backplate
595006°	Handle, with rings
460082°	Knob
808205	Cabinet catch clip
280079	Cover catch stud
525041	Dial pointer
280070	Drive shaft
530002	Drive cord (30")
587040	Drive cord spring

† State part numbers when ordering.
* Not supplied separately.
# Replace with parts having same number as that removed.
△ Used on chassis 120070A.
□ Used on chassis 120070B.
° Specify color when ordering.





EMERSON RADIO AND PHONO. CORP. MODELS 563, 593, 603, CHASSIS 120063B

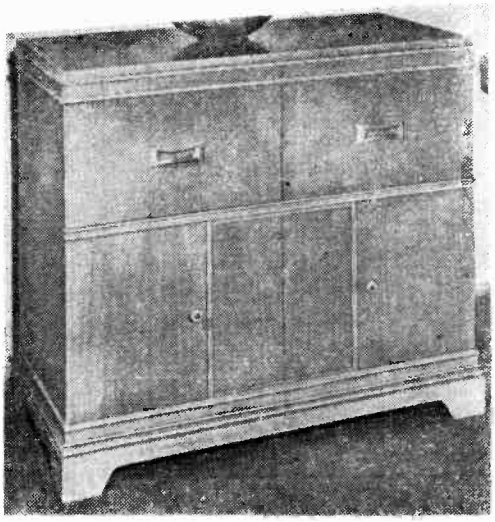
DESCRIPTION

TYPE: Console AM-FM superheterodyne with automatic record changer.

FREQUENCY RANGE:
Broadcast band (AM)—535-1620 kilocycles
Frequency modulation band (FM)—88.0 to 108.0 megacycles

1—6AG5, r-f amplifier
1—6BE6, converter
2—6SG7, i-f amplifiers
1—6U5/6G5, tuning eye
1—5U4G, rectifier
1—6S8/GT, AM detector, FM discriminator, audio amplifier
1—6SH7, FM limiter
2—6V6/GT, power output
1—6SQ7, phase inverter
POWER SUPPLY: 60-cycle a.c. only
VOLTAGE RATING: 105-125 volts
POWER CONSUMPTION: 140 watts

MODEL 563



MODEL 593

GENERAL NOTES

1. If replacements are made or the wiring disturbed in the r-f section of the circuit, the receiver should be carefully realigned.
2. The color coding of the i-f transformer leads is as follows:

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

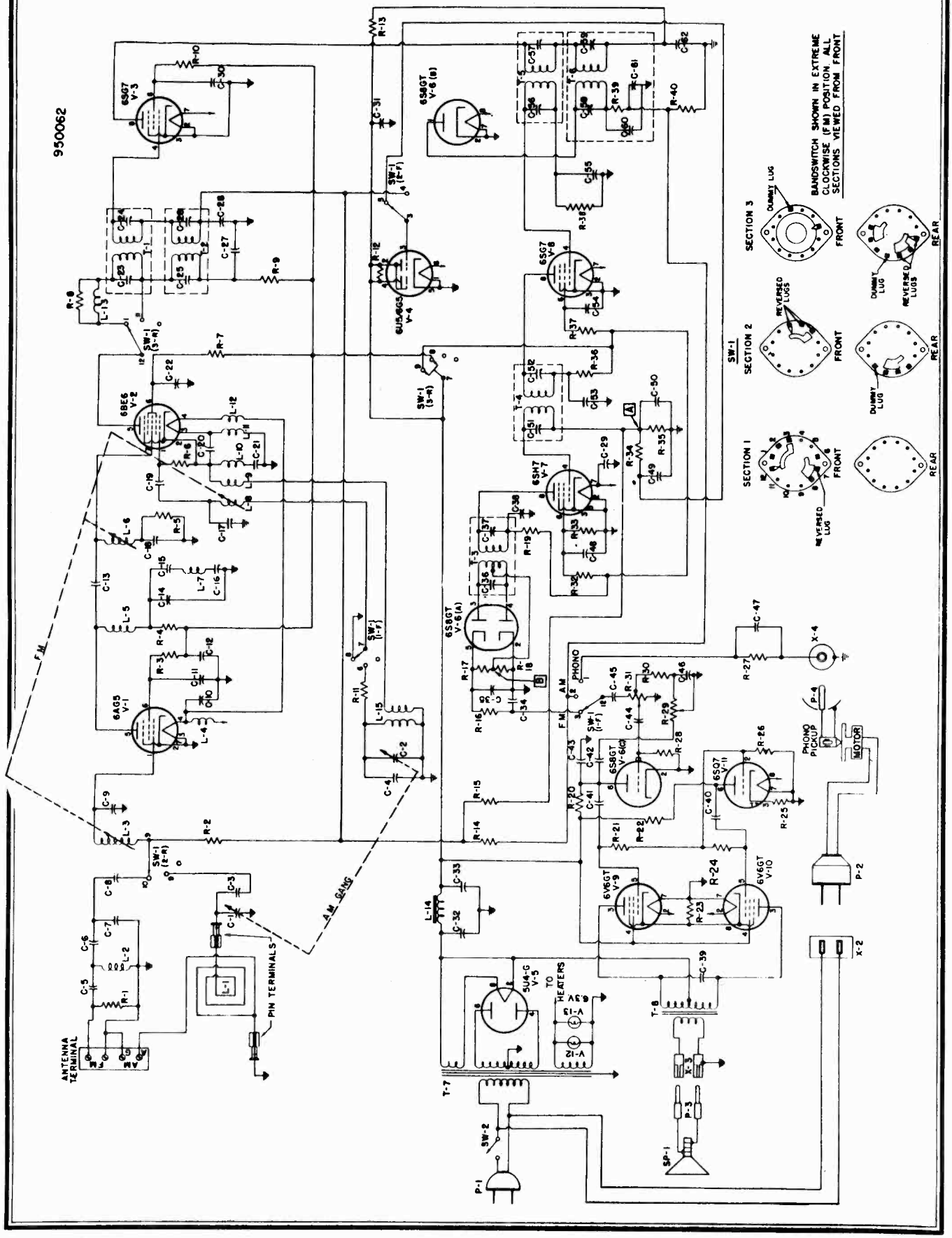
3. A self-contained loop antenna is provided for broadcast band reception. If it is desired to improve reception of weak stations, however, an additional outdoor antenna may be used. Connect the external antenna to the *outside* terminal on the "AM" side of the terminal strip at the rear of the cobinet. Connect the ground to the adjoining terminal.
4. An internal power line antenna is provided for FM operation in relatively strong signal areas. An external dipole antenna is recommended for best FM operation. To connect dipole, remove the wire from the terminal on the "FM" side of the terminal strips and connect the two dipole leads to the two "FM" terminals. A ground connection is not required for FM operation.

DISASSEMBLY INSTRUCTIONS

1. Remove four push-on type control knobs from front of cabinet.
2. Remove phone motor plug, phono pickup plug, and two speaker pin-terminals from chassis.
3. Remove two Phillips head screws holding antenna terminal strip to cabinet.
4. Remove two nuts and washers fastening loop to cabinet.
5. Remove for hex-head bolts in chassis shelf retaining chassis to cabinet.
6. Remove four nuts fastening speaker to cabinet and remove speaker.

MODELS 563, 593, 603,
CHASSIS 120063B

EMERSON RADIO AND PHONO. CORP.



EMERSON RADIO AND PHONO. CORP. MODELS 563, 593, 603, CHASSIS 120063B

AM 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 screw driver for adjusting.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1	.1 mfd.	High side to Pin No. 1 of V2 6BE6. Low side to chassis.	455 kc	Center position BC.	High frequency end of dial.	Across voice coil.	C-25, C-26 C-58, C-59	Adjust all trimmers for maximum response.
2	.1 mfd.	"	455 kc	"	"	"	C-16 IF-trap trimmer	Adjust for minimum response.
3	200 mmfd.	High side to AM ungrounded lug on antenna terminal strip. Low side to chassis.	1620 kc	"	1620 kc Reference marker on dial backplate.	"	C-4	Adjust for maximum response.
4	200 mmfd.	"	1400 kc	"	Tune in 1400 kc for maximum output.	"	C-3	Adjust for maximum response.

FM IF ALIGNMENT USING FM SIGNAL GENERATOR AND VTVM
Use FM Signal with 60 Cycle Modulation and 500 KC Deviation

	DUMMY ANTENNA	SIGNAL GENERATOR SIGNAL	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
1	.005 mfd.	High side to Pin No. 1 V2 6BE6. Low side to chassis.	10.7 mc freq. mod.	Fully clockwise FM position.	High frequency end of dial.	Point "A"	C-23, C-24 C-57, C-56 C-52, C-51	Adjust all trimmers for maximum deflection while attenuating signal so as to read approximately 2 volts at Point "A" during alignment.
2	.005 mfd.	"	10.7 mc freq. mod.	"	"	Point "A"	C-21	Adjust for maximum deflection.

FM IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
1	.05 mfd.	High side to Pin No. 1 V2 6BE6. Low side to chassis.	10.7 mc unmodulated	Fully clockwise FM pos.	High frequency end of dial.	Point "A"	C-52 C-51	Adjust for maximum deflection.
2	.05 mfd.	"	10.7 mc unmodulated	"	"	"	C-56 C-57	"
3	.05 mfd.	"	10.7 mc unmodulated	"	"	"	C-24 C-23	"
4	.05 mfd.	"	10.7 mc unmodulated	"	"	Point "B"	C-37	"
5	.05 mfd.	"	10.7 mc unmodulated	"	"	Pin No. 5 6S8-V6A	C-36	Adjust for zero minimum deflection

Vol. control in max. pos.

FM DISCRIMINATOR ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
1	.05 mfd.	High side to Pin No. 1 of 6BE6 V2. Low side to chassis.	10.7 mc freq. mod.	Fully clockwise Pos. FM.	High frequency end of dial.	Point "B"	C-37	Adjust for maximum deflection. Attenuate signal so that reading of approximately 2 volts indicates maximum response of discriminator alignment.
2	.05 mfd.	"	10.7 mc unmodulated	"	"	Connect scope or AC-VTVM across voice coil.	C-36	Adjust for minimum deflection. Making sure that a sharp rise can be obtained if the secondary of discriminator is aligned on either side of minimum deflection setting.

MODELS 563, 593, 603,
CHASSIS 120063B

EMERSON RADIO AND PHONO. CORP.

FM RF ALIGNMENT USING AM GENERATOR AND VTVM

Vol. control in max. pos.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
1	300 ohm carbon resistor	High side to FM antenna terminal. Low side to chassis. Disconnect interal antenna.	108 mc unmodulated	Fully clockwise FM pos.	108 mc	Point "A"	C-17	Adjust for maximum deflection.
2	"	"	88 mc unmodulated	"	88 mc	"	L-8	Adjust iron core only for maximum deflection. (Hold brass in position).
3	"	"	98 mc unmodulated	"	98 mc	"	L-8	Adjust iron and brass cores together (single screw). For maximum deflection repeat steps 1, 2, 3 until no further improvement can be obtained.
4	"	"	106 mc unmodulated	"	Tune for maximum deflection.	"	C-18 C-9	Adjust for maximum deflection
5	"	"	90 mc unmodulated	"	Tune for maximum deflection.	"	L-6 L-3	Adjust iron core only. For maximum deflection (Hold brass in position).
6	"	"	100 mc unmodulated	"	Tune for maximum deflection.	"	L-6 L-3	Adjust iron and brass cores together (single screw) for maximum deflection. Repeat 1, 2, 3 until no further improvement can be made.

FM-RF ALIGNMENT USING FM GENERATOR AND OSCILLOSCOPE

Vol. control in max. pos. Use FM Signal with 500 KC Deviation

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT SCOPE	ADJUST	REMARKS
1	300 ohm carbon resistor	High side to FM antenna terminal. Low side to chassis. Disconnect internal antenna.	108 mc unmodulated	Fully clockwise FM pos.	108 mc	Point "A"	C-17	Adjust trimmer so as to center response curve on scope. Choose 108 mc peak at maximum capacity.
2	"	"	108 mc unmodulated	"	"	"	C-18 C-9	Adjust trimmers for maximum response—use maximum height of response curve as indication—See Fig. 1
3	"	"	88 mc unmodulated	"	88 mc	"	L-8	Adjust iron core only for maximum response. (Hold brass in position).
4	"	"	100 mc unmodulated	"	100 mc	"	L-8	Adjust iron and brass cores together (single screw) for maximum response—Repeat steps 1, 2, 3, 4 until no further improvement can be made.
5	"	"	88 mc unmodulated	"	88 mc	"	L-6 L-3	Adjust iron core only for maximum response. (Hold brass in position).
6	"	"	100 mc unmodulated	"	100 mc	"	L-6 L-3	Adjust iron and brass cores together (single screw) for maximum response.
7	"	"	108 mc unmodulated	"	108 mc	"	C-18 C-9	Adjust trimmers for maximum response to 108 mc signal. Repeat steps 5, 6, 7 until no further improvement can be made.

EMERSON RADIO AND PHONO. CORP. MODELS 563, 593, 603, CHASSIS 120063B

INSTRUCTIONS FOR VOLTAGE AND RESISTANCE READINGS

1. Voltage readings are in volts and resistance readings in ohms unless otherwise specified.
2. D-C voltage measurements are at 20,000 ohms per volt; a-c voltages measured at 1,000 ohms.
3. Socket connections are shown as bottom views.
4. Measured values are from socket pin to common negative.
5. Line voltage maintained at 117 volts for voltage readings.
6. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
7. Volume control at maximum, no signal applied for voltage measurements.
8. 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	CAP.
1	6AG5	-0.4 DC	0	6.2 AC	0	195 DC	137 DC	0		
2	6BE6	-0.3 DC	0	0	6.2 AC	250 DC	100 DC	0		
3	6SG7	0	0	0	-0.75 DC	0	150 DC	6.2 AC	250 DC	
5	5U4G	0	260 DC	0	260 AC	0	260 AC	0	260 DC	
*6	6S8GT	-0.5 DC	0	-1.0 DC	-0.6 DC	-0.2 DC	100 DC	0	6.2 AC	-0.75 DC
*7	6SH7	0	0	0	-0.65 DC	0	35 DC	6.2 AC	175 DC	
*8	6SG7	0	0	0	-0.75 DC	0	125 DC	6.2 AC	235 DC	
9	6V6GT	0	6.2 AC	250 DC	240 DC	0	0	0	13 DC	
10	6V6GT	0	0	250 DC	240 DC	0	0	6.2 AC	13 DC	
11	6SG7	0	-0.25 DC	-0.5 DC	0	0	70 DC	6.2 AC	0	

RESISTANCE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	CAP.
1	6AG5	1 meg.	0	0	0.2	60,000	110,000	0		
2	6BE6	22,000	0.7	0.2	0.4	50,000	100,000	12,000		
3	6SG7	0	0	0	800,000	0	70,000	0	50,000	
5	5U4G	Inf.	60,000	Inf.	60	Inf.	60	Inf.	60,000	
6	6S8GT	250,000	0	100,000	100,000	200,000	100,000	0	0.2	15 meg.
7	6SH7	0	0	0	47,000	0	75,000	0.2	100,000	
*8	6SG7	0	0	0	2.2 meg.	0	80,000	0.2	50,000	
9	6V6GT	Inf.	0.2	60,000	60,000	440,000	Inf.	0	180	
10	6V6GT	Inf.	0.2	60,000	60,000	440,000	Inf.	0	180	
11	6SQ7	0	220,000	1000	Inf.	Inf.	80,000	0	0.2	

*Taken in FM Position.

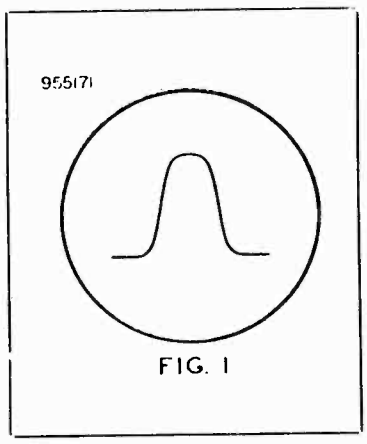
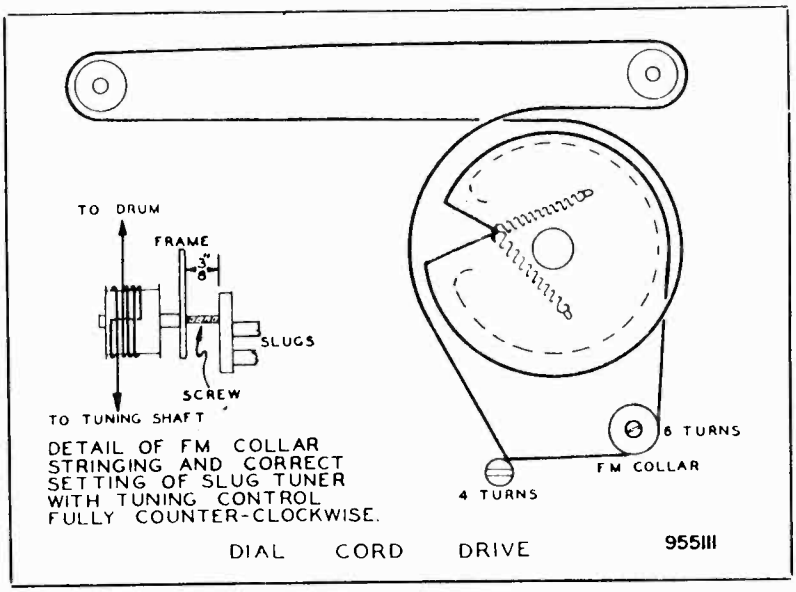


FIG. 1



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

DIAL CORD DRIVE

955111

MODELS 563, 593, 603, EMERSON RADIO AND PHONO. CORP.
CHASSIS 120063B

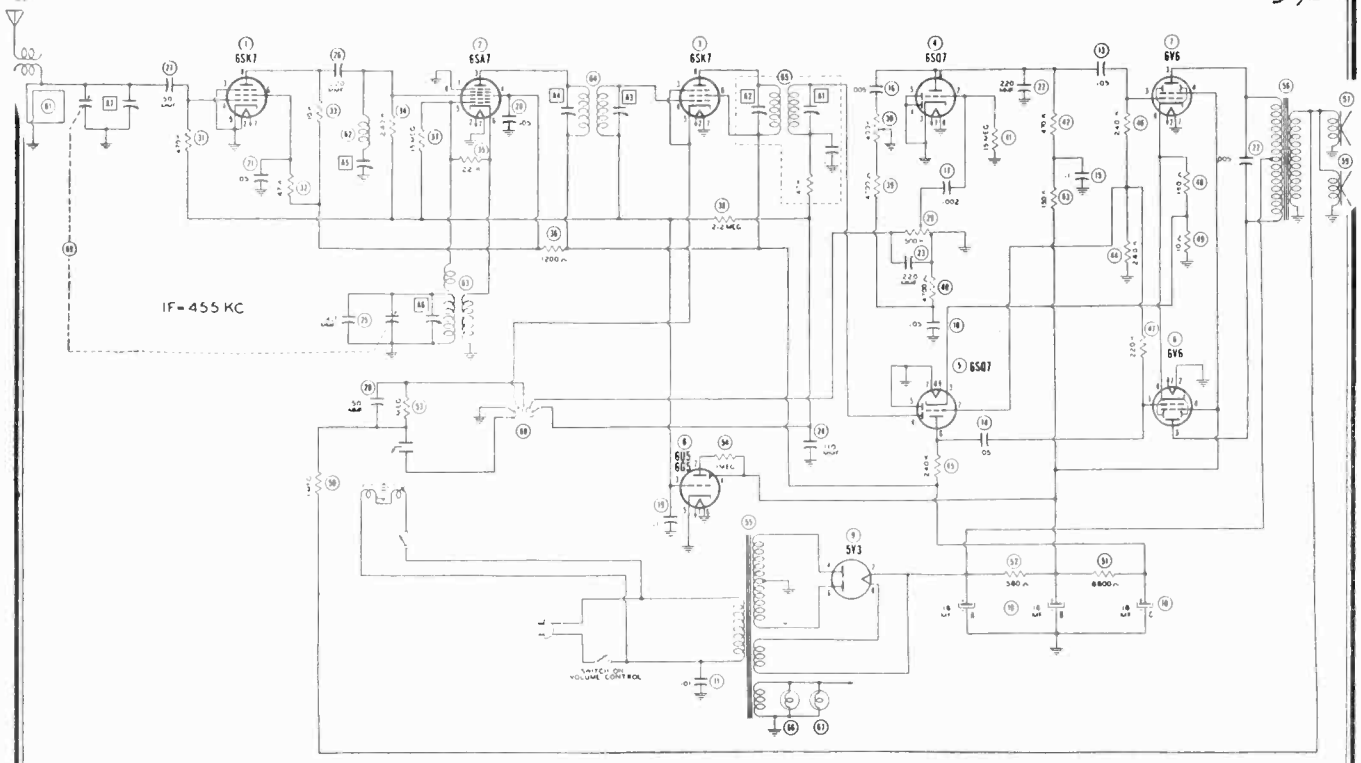
REPLACEMENT PARTS LIST

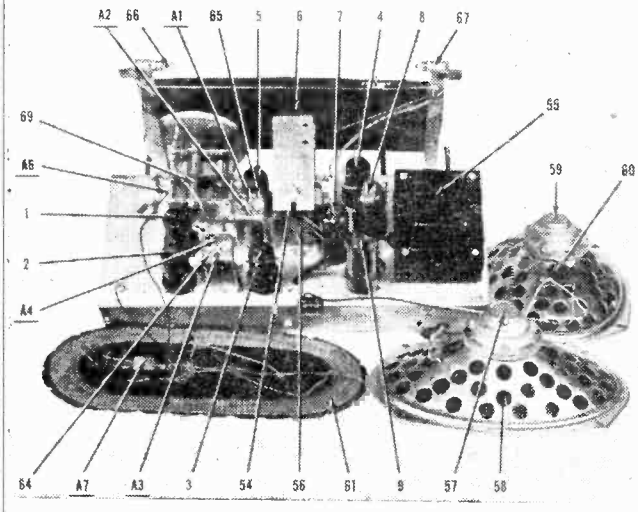
Symbol	†Part No.	DESCRIPTION
C1, C2	900007	Variable Condenser
*C3, C4		Trimmers, part of variable condenser
C5, C6	928105	7 mmf., 300 volts ceramic condenser
C7, C20, C50	928102	50 mmf., 300 volts ceramic condenser
C8	928107	30 mmf., 300 volts ceramic condenser
C9	900313	1.6-18 mmf., trimmer
C10	928109	5000 mmf., ceramic condenser C.T.S.
C11, C12, C22	915003	500 mmf., 300 volts ceramic condenser
C13	928106	100 mmf., 300 volts ceramic condenser
C14	928002	10 mmf., 300 volts ceramic condenser
C15, C43	910320	250 mmf., 500 volts mica condenser
*C16		Trimmer, part of L-7
C17	900026	1—8 mmf., trimmer
C18	900314	10—60 mmf., trimmer
C19	928101	25 mmf., 300 volts ceramic condenser
C21	900012	10—60 mmf., trimmer
*C23, C24		Trimmers, part of T-1
*C25, C26		Trimmers, part of T-2
C27, C29, C31, C38, C40, C41, C44, C45, C46, C53, C62	920090	.01 mfd., 400 volts tubular paper condenser
C28, C49	920040	.1 mfd., 200 volts tubular paper condenser
C32, C33	925006	30—40 mfd., 400 volts dual electrolytic condenser
C30, C42		.005 mfd., 400 volts tubular paper
C48, C54	920180	condenser
C34	920514	.001 mfd., 400 volts tubular paper condenser
C35	928013	100 mmf., 300 volts ceramic condenser
*C36, C37		Trimmers, part of T-3
C39	920544	.003 mfd., 600 volts tubular paper condenser
C47	910120	360 mmf., 400 volts mica condenser
*C51, C52		Trimmers, part of T-4
C55	920060	.05 mfd., 200 volts tubular paper condenser
*C56, C57		Trimmers, part of T-5
*C58, C59		Trimmers, part of T-6
*C60, C61		110 mmf., cond., part of T-6
V12, V13	807020	Pilot light
L1	700003	Antenna loop
L2	705003	R.F. choke
L3	710014	Antenna coil F.M.
L4, L10		
L11, L12	705002	R.F. choke
L5	705000	R.F. choke
L6	713013	R.F. coil F.M.
L7	708001	I.F. wave trap A.M.
L8	716112	Oscillator coil F.M.
L9	705007	R.F. choke
L13	705005	Converter plate R.F. choke
L14	737002	Filter choke
L15	716113	Oscillator coil A.M.
R1, R9, R13, R25, R36	350490	1000 ohms, ½ watt resistor
R2, R20, R22	351130	470,000 ohms, ½ watt resistor
R3	370872	39,000 ohms, 1 watt resistor
R4	340650	4,700 ohms, ½ watt resistor
R5	340750	12,000 ohms, ½ watt resistor
R6	340810	22,000 ohms, ½ watt resistor
R7	397070	18,000 ohms, 2 watt resistor
*R8		510 ohms, resistor, part of L-13
R10, R37	370830	27,000 ohms, 1 watt resistor
R11	350290	150 ohms, ½ watt resistor
*R12		1 meg., ½ watt resistor, part of tuning eye socket cable
R14, R34	351210	1 meg., ¼ watt resistor
R15, R27, R38	351290	2.2 meg., ¼ watt resistor
R16	350930	68,000 ohms, ½ watt resistor
R17, R18	340970	100,000 ohms, ½ watt resistor
R19, R30, R35	340890	47,000 ohms, ½ watt resistor
R21, R24	351050	220,000 ohms, ½ watt resistor
R26, R40		
R23	394140	180 ohms, 2 watt wirewound resistor
R28	397000	15 meg., ½ watt resistor
R29	390081	1 meg., ½ watt tone control
R31	390004	1 meg., ½ watt volume control
R32	370890	47,000 ohms, 1 watt resistor
R33	370730	10,000 ohms, 1 watt resistor
*R39		27,000 ohms, resistor, part of T-6
T1	720046	First I.F. transformer F.M.
T2	720045	First I.F. transformer A.M.
T3	708005	Discriminator coil
T4	720049	Third I.F. transformer F.M.
T5	720047	Second I.F. transformer F.M.
T6	720048	Second I.F. transformer A.M.
T7	730011	Power transformer
T8	734004	Output transformer
SP1	180023	P.M. speaker
SW1	510018	Band change switch
*SW2		On-Off switch, part of R-29
X2	500500	Power outlet
X3	555004	Terminal strip-speaker
X4	540540	Pick-up socket
P1	583204	Line cord and plug
P2	505005	A.C. plug record changer
P3	580006	Pin terminal leads—speaker
P4	505040	Connector plug—pick-up
	507001	Dial light socket assembly
	585210	Tuning eye socket and cable
	140144	Cabinet (model 563)
	140187	Cabinet (model 593)
	140229	Cabinet (model 603)
	620034	Knob for models (603-563)
	620035	Knob for models (603-563)
	620094	Knob for model (593)
	620095	Knob for model (593)
	819022	Automatic record changer—rotating action record support, or
	819039	Automatic record changer—lever action record support
	280002	Drive shaft
	280505	Drive shaft for F.M. tuner
	520002	Dial backplate
	520058	Dial face
	525002	Pointer

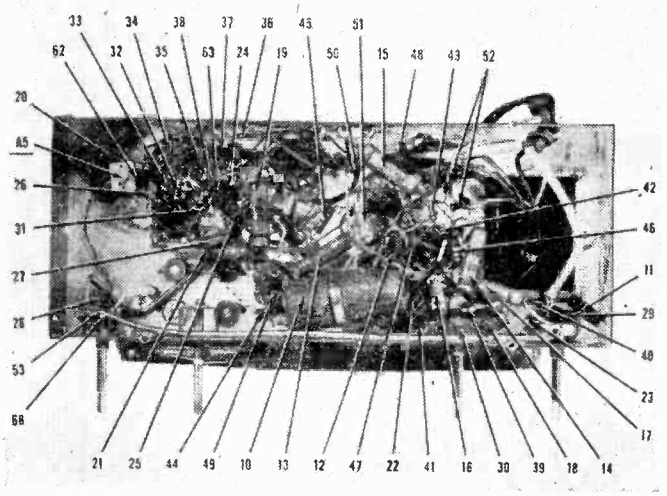
† Specify part numbers when ordering.

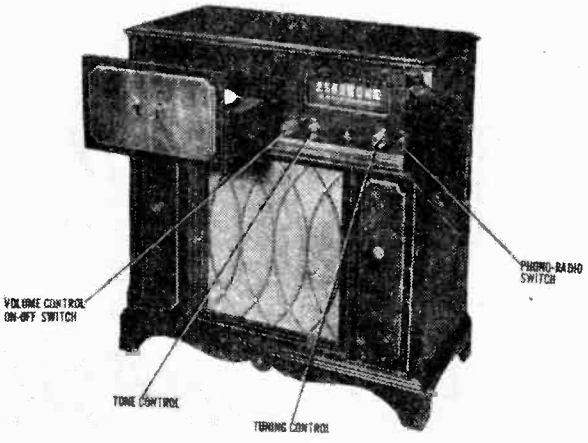
* Not supplied separately.

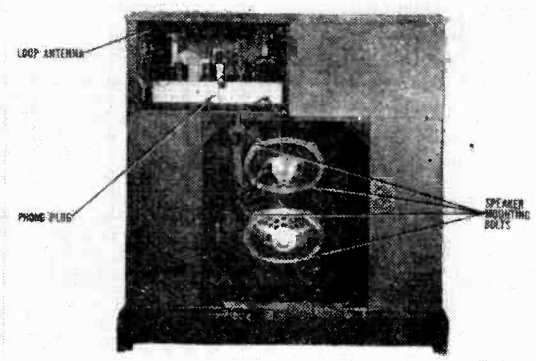
EMERSON RADIO AND PHONO. CORP. MODELS 573, 583, CHASSIS 120039B











ALIGNMENT

To set pointer, turn tuning cap. fully closed and set pointer 2-3/8" from left edge of dial backplate. This is the calibration mark referred to below.

Loop should be maintained in same relative position to chassis as when receiver is in cabinet.

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

	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	.1 mfd.	High side to ext. antenna lead. Low side to chassis.	"	Tuning cap. fully closed.	"	A5	Adjust for minimum output.
3	200 mmf.	"	1400KC	5" from calibration mark.	"	A6	Adjust for maximum output.
4	200 mmf.	"	"	Tune for maximum output.	"	A7	Adjust for maximum output.
5	200 mmf.	"	600KC	"	"		Use adjusting turn in rear of loop. Adjust for max. output.

DESCRIPTION

TYPE: Console A.C. superheterodyne phonoradio with automatic record changer.

FREQUENCY RANGE: 540-1620 K.C.

TYPE OF TUBES:

1—6SK7, r-f amplifier
1—6SA7 converter
1—6SK7, i-f amplifier
1—6SQ7, detector—a.v.c. phase inverter
1—6SQ7. a-f amplifier
1—6U5/6G5, tuning eye (omitted on Model 583)
2—6V6GT, power output
1—5Y3GT, rectifier

POWER SUPPLY: 60 cycle a.c.

VOLTAGE RATING: 105-125 volts

POWER CONSUMPTION: 110 watts

CURRENT DRAIN: .73 amp. at 117 volts a.c.

GENERAL NOTES

1. If replacements are made or the wiring disturbed in the r-f section of the circuit, the receiver should be carefully realigned.
2. The color coding of the i-f transformer leads is as follows:

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

3. The receiver has a self-contained antenna and normally does not require additional antenna or ground connection. For permanent home installations, however, in a location far removed from broadcasting stations, an additional outside antenna may be used. The outside antenna connection should be made to the colored lead at the rear of the cabinet. Ground connection may be used. Connect ground to black lead at rear.
4. The grille-work and tuning eye are omitted on Model 583. Other change noted in parts list.

EMERSON RADIO AND PHONO CORP. MODELS 573, 583 CHASSIS 120039B

INSTRUCTIONS FOR VOLTAGE AND RESISTANCE READINGS

1—DC 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 variance of ± 10% in voltage and resistance readings.

6—Volume control at maximum, no signal applied for voltage measurements.

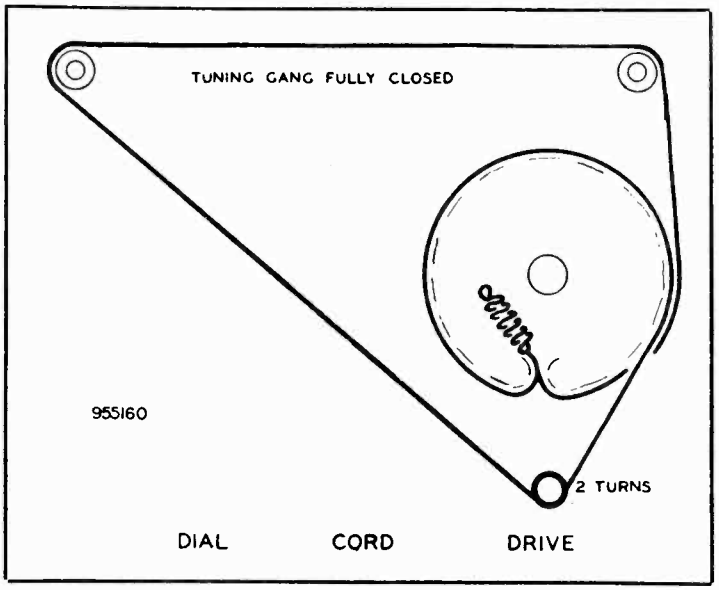
VOLTAGE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
1	6SK7	0	0	0	-.3V DC	0	43V DC	6.6V AC	53V DC
2	6SA7	0	6.6V AC	95V DC	80V DC	-11V DC	0	0	-.2V DC
3	6SK7	0	6.6V AC	0	-.3V DC	0	95V DC	0	95V DC
4	6SQ7	0	-.5V DC	0	0	0	95V DC	6.6V AC	0
5	6SQ7	0	1.1V DC	.7V DC	-.1V DC	0	55V DC	0	6.6V AC
6	6U5/6G5	—	—	—	—	—	—	—	—
7	6V6GT	0	6.6V AC	280V DC	280V DC	0	90V DC	0	15V DC
8	6V6GT	0	0	295V DC	280V DC	0	-.1V DC	6.6V AC	15V DC
9	5Y3GT	0	300V DC	225V DC	300V AC	78V AC	300V AC	.7V DC	300V DC

† Taken with Vacuum Tube Voltmeter.

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	160K ohm
2	6SA7	0 ohm	.1 ohm	150K ohm	150K ohm	22K ohm	1 ohm	0 ohm	2.9 meg.
3	6SK7	0 ohm	.1 ohm	0 ohm	2.7 meg.	0 ohm	150K ohm	0 ohm	150K ohm
4	6SQ7	0 ohm	15 meg.	0 ohm	0 ohm	0 ohm	770K ohm	.1 ohm	0 ohm
5	6SQ7	0 ohm	240K ohm	10 ohm	550K ohm	0 ohm	370K ohm	0 ohm	.1 ohm
6	6U5/6G5	—	—	—	—	—	—	—	—
7	6V6GT	0 ohm	.1 ohm	150K ohm	150K ohm	460K ohm	150K ohm	0 ohm	190 ohm
8	6V6GT	0 ohm	0 ohm	150K ohm	150K ohm	460K ohm	220K ohm	.1 ohm	190 ohm
9	5Y3GT	inf.	150K ohm	300K ohm	85 ohm	inf.	88 ohm	10 ohm	150K ohm



MODELS 573, 583,
CHASSIS 120039B

EMERSON RADIO AND PHONO. CORP.

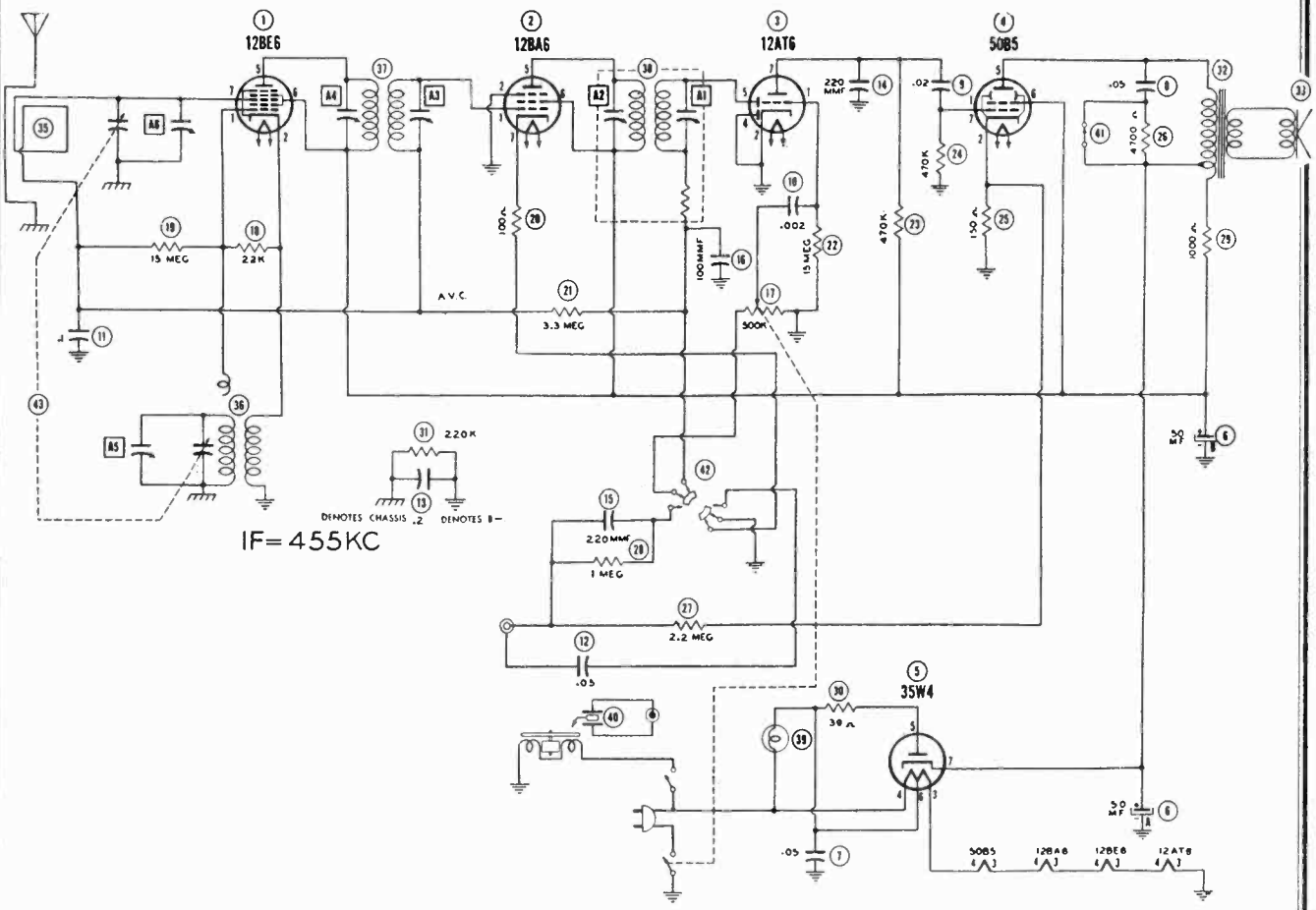
REPLACEMENT PARTS LIST

Symbol	†Part No.	DESCRIPTION
1	6SK7	RF amplifier
2	6SA7	Converter
3	6SK7	IF amplifier
4	6SQ7	Det.-AVC-phase inverter
5	6SQ7	AF amplifier
6	6U5/6G5	Tuning eye (omitted on Model 583)
7	6V6GT	Power output
8	6V6GT	Power output
9	5Y3GT	Rectifier
10A	925007	Filter (elect.), 16 mfd., 450 volt condenser
B		Filter (elect.), 16 mfd., 450 volt condenser
C		Filter (elect.), 16 mfd., 450 volt condenser
11	922020	Line filter, .01 mfd., 400 volt condenser
12	920230	Output plate bypass, .005 mfd., 600 volt condenser
13	920030	Audio coupling, .05 mfd., 400 volt condenser
14	920030	Audio coupling, .05 mfd., 400 volt condenser
15	920250	AF plate decoupling, .1 mfd., 400 volt condenser on Model 573
15	920260	AF plate decoupling, .25 mfd., 400 volt condenser on Model 583
16	920230	Tone compensation, .005 mfd., 600 volt condenser
17	920010	Audio coupling, .002 mfd.. 600 volt condenser
18	920030	Tone compensation, .05 mfd., 400 volt condenser
19	920040	A V C filter, .1 mfd., 200 volt condenser
20	920030	Decoupling, .05 mfd., 400 volt condenser
21	920030	RF Screen bypass, .05 mfd., 400 volt condenser
22	910000	AF plate bypass, 220 mmf., 500 volt condenser
23	910000	Tone compensation, 220 mmf., 500 volt condenser
24	910010	Diode RF filter, 110 mmf., 500 volt condenser
25	923004	Fixed trimmer, 4.7 mmf., 300 volt condenser
26	910000	RF coupling, 220 mmf., 500 volt condenser
27	910250	RF coupling, 50 mmf., 500 volt condenser
28	910250	Phono tone compensation, 50 mmf., 500 volt condenser
29	390006	Volume control with switch, 500K ohms
30	390007	Tone control
31	351130	RF grid, 470K ohms, ½ watt resistor
32	340890	RF screen 47K ohms, ½ watt resistor
33	340730	RF plate load, 10K ohms, ½ watt resistor
34		Converter grid, 240K ohms, ½ watt resistor
35	340810	Oscillator grid, 22K ohms, ½ watt resistor
36	340510	Decoupling, 1200 ohms, ½ watt resistor
37	397000	AVC network, 15 meg., ½ watt resistor
38	351290	AVC network, 2.2 meg., ½ watt resistor
39	350650	Tone compensation, 4700 ohms, ½ watt resistor
40	350650	Tone compensation, 4700 ohms, ½ watt resistor
41	397000	AF grid, 15 meg., ¼ watt resistor
42	351130	AF plate load, 470K ohms, ½ watt resistor
43	351010	AF plate decoupling, 150K ohms, ½ watt resistor
44		Phase inverter grid, 240K ohms, ½ watt resistor
45		Phase inverter plate, 240K ohms, ½ watt resistor
46		Output grid, 240K ohms, ½ watt resistor
47	351050	Output grid, 220K ohms, ½ watt resistor
48	394140	Output cathode, 180 ohms, 2 watt resistor
49	340010	Phase inverter cathode feedback, 10 ohms, ½ watt resistor
50	351210	Phono feedback, 1 meg., ½ watt resistor
51	394002	Filter, 6800 ohms, 5 watt resistor
52	397001	Filter, 560 ohms, 2 watt resistor
53	351210	Series phono, 1 meg., ½ watt resistor
54	Part of 585001	Tuning eye plate load, 1 meg., ½ watt resistor
55	730017	Power transformer
56	734005	Output transformer
57	180037	6" x 9" oval speaker (PM)
58		Cone (part of 180037)
59	180037	6" x 9" oval speaker (PM)
60		Cone (part of 180037)
61A	700024	Loop antenna
B		Antenna coupling coil (part of 700024)
62	708060	Wave trap
63	716050	Oscillator coil
64	720532	Input i-f
65	720533	Output i-f
66	807020	Type 44 pilot lamp
67	807020	Type 44 pilot lamp
68	510002	Radio-phono switch
69	900008	2-gang variable capacitor
	520062	Dial crystal
	525027	Dial pointer
	520130	Dial backplate
	280004	Drive shaft
	587070	Drive cord spring
	460241	Knob and cover assembly
	505040	Phono pickup plug
	508010	Phono pickup socket
	585001	Tuning socket and cable
	507001	Pilot lamp socket
	583001	Line cord
	555004	Speaker terminal strip
	140141	Mahogany cabinet
	819022	Record changer, or
	819031	Record changer, or
	819039	Record changer

* Not supplied separately.

† Specify part numbers when ordering.

EMERSON RADIO AND PHONO. CORP. MODEL 576, CHASSIS 120069A



FREQUENCY RANGE: 540-1620 kc.

TYPE OF TUBES:
- 1—12BE6, converter
- 1—12BA6, i-f amplifier
- 1—12AT6, detector a.v.c.-a.f. amplifier
- 1—50B5, power output
- 1—35W4, rectifier

POWER SUPPLY: 60 cycle a.c.

VOLTAGE RATING: 105-125 volts

POWER CONSUMPTION: 50 watts

CURRENT DRAIN: .43 amp. at 117 volts a.c.

MODEL 576,
CHASSIS 120069A

EMERSON RADIO AND PHONO. CORP.

ALIGNMENT

To set pointer turn tuning cap. fully closed and set pointer 2¼" from top right edge of dial backplate. This is calibration mark referred to below.

Use isolation transformer if available. If not, connect, a .1 mfd. capacitor in series with low side of 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 7 (grid) of 12BE6. Low side to B—.	455KC	Tuning cap. fully open.	Across voice coil.	A1, A2, A3, A4	Adjust for maximum output. If isolation transformer is not used, reduce dummy ant. to .001 mfd. to reduce hum modulation.
2	200 mmf.	High side to ext. ant. lead. Low side to ext. ground lead.	1600KC	4¼" from calibration mark.	"	A5	Adjust for maximum output.
3	200 mmf.	" "	1500KC	Tune for maximum output.	"	A6	" " " "

INSTRUCTIONS FOR VOLTAGE AND RESISTANCE READINGS

1—DC Voltage measurements are at 20,000 ohms per volt; AC Voltages measured at 1000 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 ± 15% in voltage and resistance readings.
6—Volume control at maximum, no signal applied for voltage measurements.

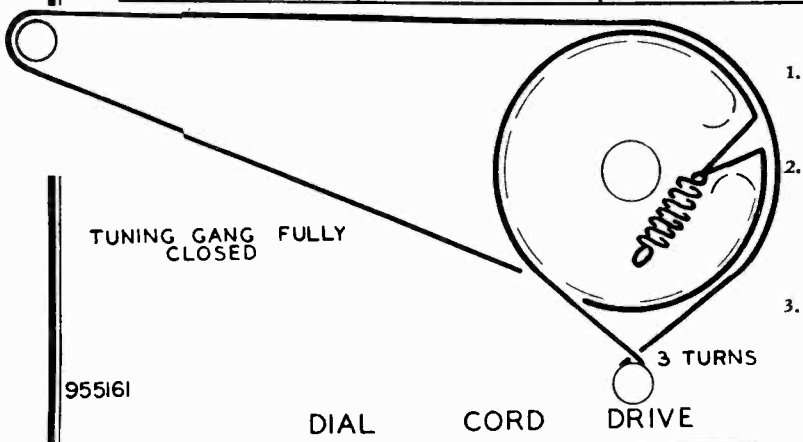
VOLTAGE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
1	12BE6	-14V DC†	0	27V AC	13V AC	95V DC	95V DC	1.1V DC	
2	12BA6	-1V DC	0	27V AC	40V AC	95V DC	95V DC	.7V DC	
3	12AT6	-.7V DC	0	0	13V AC	-.6V DC	0	46V DC	
4	50B5	0	5.8V DC	85V AC	40V AC	108V DC	95V DC	0	
5	35W4	0	115V DC	85V AC	117V AC	111V AC	113V AC	115V 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	12BE6	22K ohm	.5 ohm	24 ohm	12 ohm	200K ohm	200K ohm	3.8 meg.	
2	12BA6	3.8 meg.	0 ohm	24 ohm	37 ohm	200K ohm	200K ohm	100 ohm	
3	12AT6	15 meg.	0 ohm	0 ohm	12 ohm	540K ohm	0 ohm	670K ohm	
4	50B5	470K ohm	150 ohm	85 ohm	37 ohm	200K ohm	200K ohm	470K ohm	
5	35W4	inf.	200K ohm	85 ohm	115 ohm	150 ohm	110 ohm	200K ohm	



GENERAL NOTES

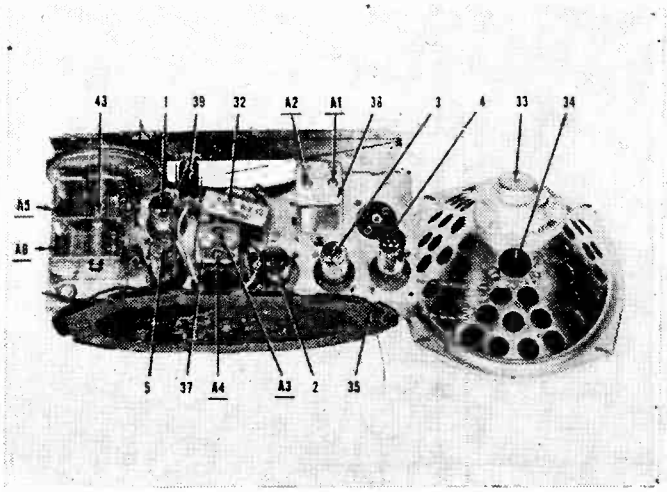
1. If replacements are made or the wiring disturbed in the i-f section of the circuit, the receiver should be carefully realigned.

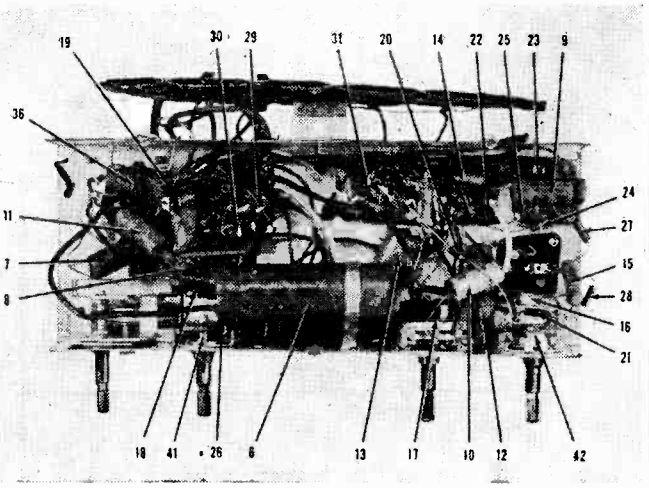
2. The color coding of the i-f transformer leads is as follows:

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

3. The receiver has a self-contained antenna and does not require additional antenna connections. For permanent home installations, however, if it is desired to improve reception of weak stations, an additional outdoor antenna should be used. For this purpose a lead has been brought out of the rear near the line cord.

EMERSON RADIO AND PHONO. CORP. MODEL 576 CHASSIS 120069A





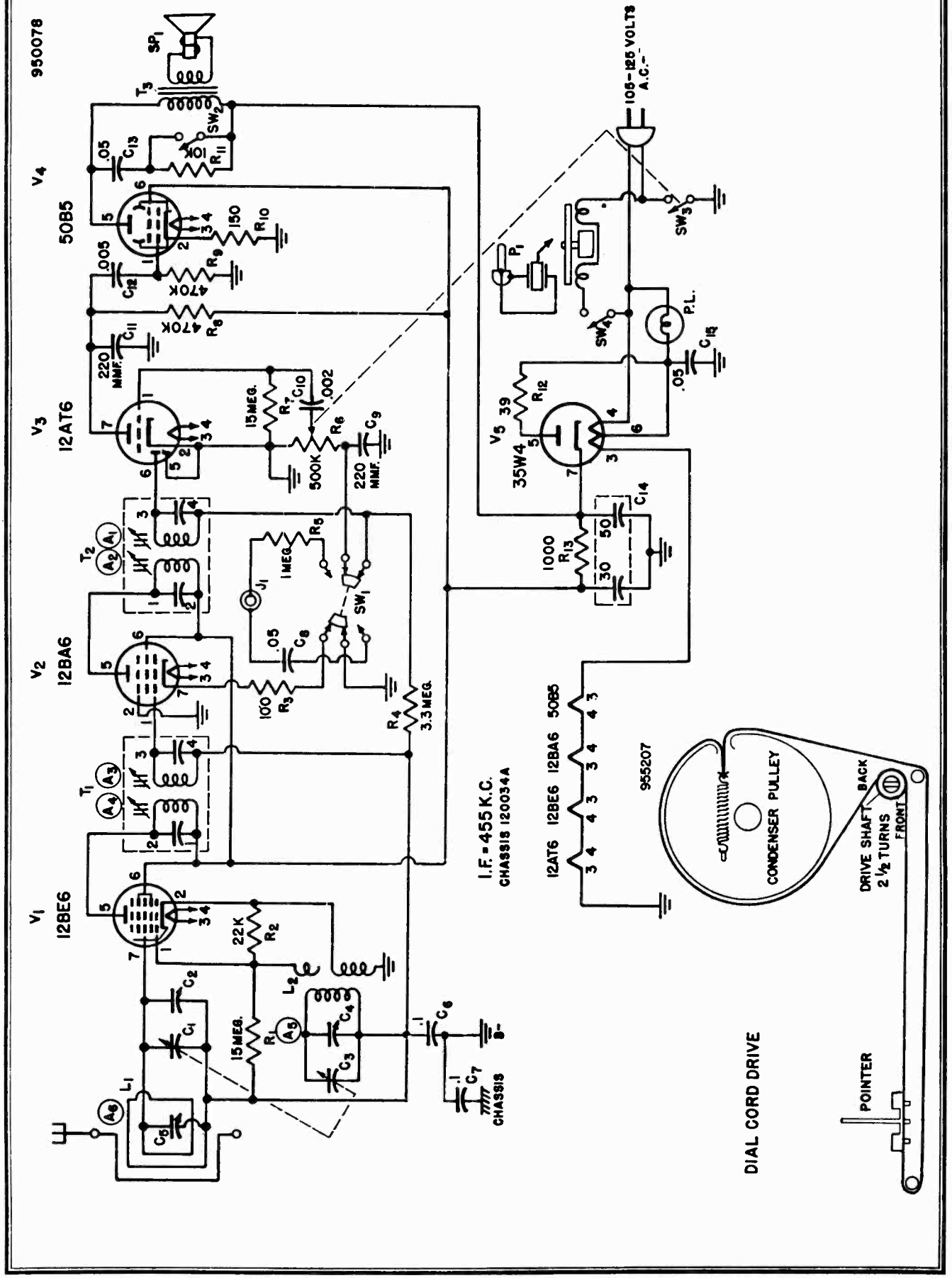
Symbol	†Part No.	DESCRIPTION
1	12BE6	Converter
2	12BA6	IF amplifier
3	12AT6	Detector - AVC - audio amplifier
4	50B5	Power output
5	35W4	Rectifier
6	925012	Filter (elect.), 50-50 mfd., 150 volt condenser
7	920030	Line filter, .05 mfd., 400 volt condenser
8	920030	Tone compensation, .05 mfd., 400 volt condenser
9	920020	Audio coupling, .02 mfd., 400 volt condenser
10	920010	Audio Coupling, .002 mfd., 600 volt condenser
11	920040	AVC filter, .1 mfd., 200 volt condenser
12	920030	Phono isolation, .05 mfd., 400 volt condenser
13	920050	Line isolation, .2 mfd., 200 volt condenser
14	910000	Audio plate bypass, 220 mmf., 300 volt condenser
15	910000	Phono tone compensation, 220 mmf., 300 volt condenser
16	910010	Diode r-f filter, 100 mmf., 300 volt condenser
17	390042	Volume control with switch, 500K ohm, resistor
18	340810	Oscillator grid, 22K ohms, ½ watt resistor
19	397000	AVC network, 15 megohms, ½ watt resistor
20	340250	IF cathode, 100 ohms, ½ watt resistor
21	351330	AVC network, 3.3 megohms, ½ watt resistor
22	397000	Audio grid, 15 megohms, ½ watt resistor
23	351130	Audio plate load, 470K ohms, ½ watt resistor
24	351130	Output grid, 470K ohms, ½ watt resistor
25	340290	Output cathode, 150 ohms, ½ watt resistor
26	340650	Tone compensation, 4700 ohms, ½ watt resistor
27	351290	Feedback, 2.2 megohms, ½ watt resistor
28	351210	Phono tone compensation, 1.0 megohms, ½ watt resistor
29	370490	Filter, 1000 ohms, ½ watt resistor
30	370150	Rectifier ballast, 39 ohms, ½ watt resistor
31	35150	Line isolation, 220K ohms, ½ watt resistor
32	734080	Output transformer
33	180037	6" x 9" oval speaker
*34		Cone (part of 180037)
35	700025	Loop antenna
36	716010	Oscillator coil
37	720220	Input i-f coil
38	720039	Output i-f coil
39	807000	Type 47 pilot lamp
40	L-70	Phono cartridge
41	510120	Tone switch
42	510391	Phono-radio switch
43	900070	2-gang variable capacitor
	520062	Dial glass
	525028	Dial pointer
	520061	Dial backplate
	280313	Dial drive shaft
	587070	Drive cord spring
	520064	Escutcheon
	460470	Plastic knob
	140149	Cabinet, mahogany
	140159	Cabinet, toasted mahogany
	507060	Pilot lamp socket
	508010	Pickup socket
	505040	Pickup plug
	583016	Line cord
	819031	Record changer
	819032	Record changer

* Not supplied separately.

† Specify part numbers when ordering.

MODELS 579, 596,
CHASSIS 120034A

EMERSON RADIO AND PHONO. CORP.



INSTRUCTIONS FOR VOLTAGE AND RESISTANCE READINGS

1. Voltages are d.c. volts; resistances in ohms unless otherwise indicated.
2. D.c. voltage measurements are at 20,000 ohms-per-volt; a.c. voltages are measured at 1000 ohms-per-volt.
3. Socket connections are shown as bottom viels. Values are measured from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Volume control at maximum; radio-phono switch in radio position; no signal applied for voltage measurements.
6. Nominal tolerance on component valves makes possible a variation of ± 15% in voltage and resistance readings.

VOLTAGE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
V1	12BE6	—4.5	0	25 A.C.	13 A.C.	95	96	—.1
V2	12BA6	—.1	0	25 A.C.	38 A.C.	95	96	.4
V3	12AT6	—.5	0	0	13 A.C.	0	—.3	42
V4	50B5	0	6.5	82 A.C.	38 A.C.	107	96	NC
V5	35W4	0	NC	82 A.C.	117 A.C.	110 A.C.	112 A.C.	115

RESISTANCE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7
V1	12BE6	24 K	.5	25	13	80 K	80 K	3 meg.
V2	12BA6	3 meg.	0	25	37	80 K	80 K	100
V3	12AT6	15 meg.	0	0	13	0	600 K	700 K
V4	50B5	550 K	150	82	37	80 K	80 K	Inf.
V5	35W4	0	Inf.	82	110	145	105	80 K

NC—no connection; K—kilohm; meg.—Megohm; Inf.—infinity.

ALIGNMENT INSTRUCTIONS

1. To position pointer, turn variable condenser fully closed and set pointer to reference mark at low-frequency end of dia backplate.
2. Use isolation transformer if available. If not, connect a .1 mfd. condenser in series with low side of signal generato and B—.
3. Volume control should be at maximum position; radio-phono switch in radio position. Output of signal generator shoul be no higher than necessary to obtain an output reading. Use an insulated screw driver for adjusting.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1	.1 mfd.	High side to Pin 7 (grid) of 12BE6. Low side to B—.	455KC	Tuning cond. fully open.	Across voice coil.	A1, A2, A3, A4 (I-f trans. T2 and T1)	Adjust for maximum output. If isolation transformer is not used, reduce dummy ant. to .001 mfd. to reduce hum modulaltion.
2	200 mmf.	High side to ext. ant. lead. Low side to ext. ground	1600KC	Tuning cond. fully open.	Across voice coil.	A5 (Var. cond. trimmer C4).	Adjust for maximum output.
3		High side to ext. ant. lead. Low side to ext. ground	1400KC	Tune for maximum output.	Across voice coil.	A6 (Loop ant. trimmer C5).	Adjust for maximum output.

DESCRIPTION

TYPE: Single band superheterodyne and automatic record changer.

FREQUENCY RANGE: 540-1620 kc.

TYPE OF TUBES:
1—12BE6, pentagrid converter
1—12BA6, i-f amplifier
1—12AT6, detector, a.v.c., a-f amplifier
1—50B5, power output
1—35W4, rectifier

POWER SUPPLY: A.C. only, 60 cycles

VOTAGE RATING: 105-125 volts

POWER CONSUMPTION:
Receiver—30 watts
Phono motor—20 watts

CURRENT DRAIN: 0.24 amp. (for receiver), at 117 volts a.c.

GENERAL NOTES

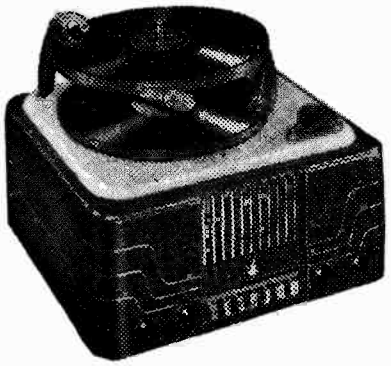
1. If replacements are made or the wiring disturbed in the r-f section of the circuit, the receiver should be carefully realigned.
2. The receiver has a self-contained antenna and does not require an additional antenna. For permanent installations, however, if it is desired to improve reception of weak stations, an additional outdoor antenna may be connected to the white lead (with colored tracer) at the rear of the cabinet. Connect a ground to the black lead, if desired.
3. The self-contained loop antenna has directional properties. It is important, therefore, once a station is tuned in, that the cabinet be rotated back and forth through a quarter-turn and left at that position where maximum volum is obtained.

DISASSEMBLY INSTRUCTIONS

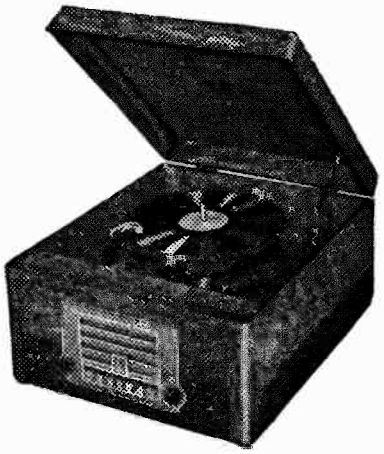
1. Remove four push-on type control knobs
2. Remove four corner cabinet supports
3. Disconnect phono-motor leads by unscrewing wirenut insulators. Remove phono pickup plug from chassis.
4. Remove remaining two screws holding chassis mounting plate to bottom of cabinet. Remove chassis from cabinet.
5. Remove two center screws holding chassis to mounting board.

MODELS 579, 596,
CHASSIS 120034A

EMERSON RADIO AND PHONO. CORP.



MODEL 579



MODEL 596

REPLACEMENT PARTS LIST

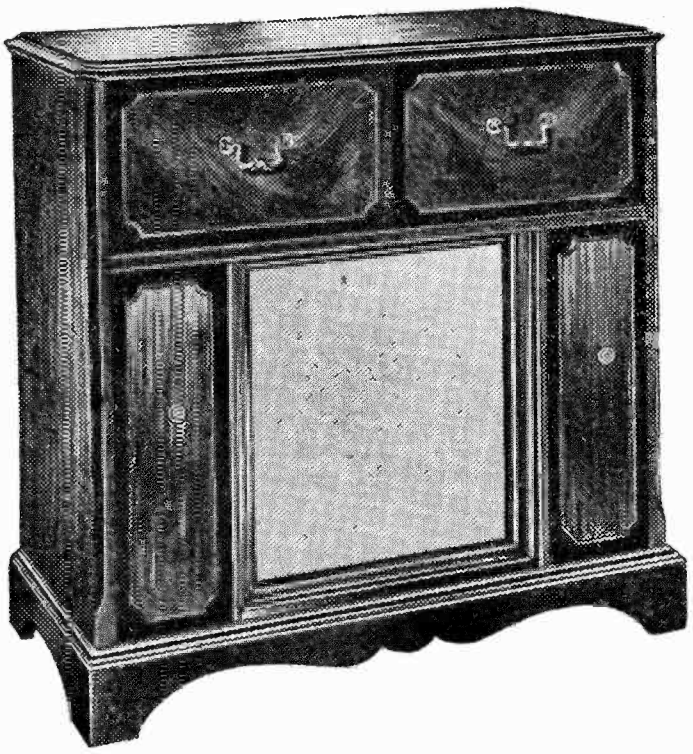
Symbol	†Part No.	DESCRIPTION	Symbol	†Part No.	DESCRIPTION
V1	12BE6	Pentagrid converter	R8, R9	351130	470 kilohms, ½ watt resistor
V2	12BA6	I-f amplifier	R10	340290	150 ohms, ½ watt resistor
V3	12AT6	Detector, a.v.c., a-f amplifier	R11	340730	10 kilohms, ½ watt resistor
V4	50B5	Power output	R12	370150	39 ohms, 1 watt resistor
V5	35W4	Rectifier	R13	370490	1000 ohms, 1 watt resistor
C1, C3	900023	Two-gang variable condenser	L1	700035	Loop antenna
C2, C4	*	Trimmer, part of var. condenser	L2	716026	Oscillator coil
C5	*	Trimmer, part of loop antenna	T1, T2	720055	First and second i-f transformers
C6, C7	920040	.1 mfd., 200 volt paper condenser	T3	734023	Output transformer
C8, C13, C15	920030	.05 mfd., 400 volt paper condenser	SP1	180032H	P.M. speaker
C9, C11	910000	220 mmf., mica condenser (alternate part 928104) #	SW1	510027	Radio-phono switch, d.p.d.t.
			SW2	510034	Tone control switch, s.p.s.t.
			SW3	*	Line switch, part of volume control
C10	920515	.002 mfd., 400 volt paper condenser	SW4	*	Phono-motor switch, part of record changer
C12	920180	.005 mfd., 400 volt paper condenser			
C14	925061	30-50 mfd., 150 volt elect. condenser	P1	505040	Phono pickup plug
R1, R7	351490	15 megohms, ½ watt resistor	J2	508010	Phono pickup socket
R2	340810	22 kilohms, ½ watt resistor		583021	Line cord
R3	340250	100 ohms, ½ watt resistor		819032	Record changer (alternate part 819031) #
R4	351330	3.3 megohms, ½ watt resistor			
R5	351210	1 megohm, ½ watt resistor		807000	Dial light
R6	390024	500 kilohms, volume control		507003	Dial light socket

CABINET AND DIAL PARTS

	520048	Dial backplate		140108	Cabinet, walnut plastic
	525023	Dial pointer		140196	Cabinet, walnut wood
	280035	Drive shaft		450115	Knob, black
	530002	Drive cord (26")		460076B	Speaker grille (Model 596 only)
	587040	Drive cord spring			

† Specify part numbers when ordering.
# Replace with part having same number as that removed.
* Not supplied separately.
Note: C9, C10, C11, C12 may be combined in one unit, part No. 470310, on some chassis.

EMERSON RADIO AND PHONO. CORP. MODEL 586, CHASSIS 120023B, 120083B



MODEL: 586

DESCRIPTION

TYPE: Console AM-FM superheterodyne, with automatic record changer.

FREQUENCY RANGE:
Broadcast band (AM)—540-1620 kilocycles.
Frequency modulation band (FM)—88-108 megacycles.

TYPE OF TUBES:
1—6BA6 FM r-f amplifier (chassis 120083B only)
1—6SB7Y FM and AM converter
1—6SG7 FM and AM first i-f amplifier
1—6SG7 FM second i-f amplifier
1—6SH7 FM limiter
1—6S8GT FM discriminator, AM detector, a.v.c., audio amplifier
1—6AT6 Phase inverter
2—25L6GT Push-pull power output
1—25Z6GT Rectifier

POWER SUPPLY: 60 cycle a.c.
VOLTAGE RATING: 105-125 volts
POWER CONSUMPTION: 90 watts
CURRENT DRAIN: 0.77 amp. at 117 volts a.c.

GENERAL NOTES

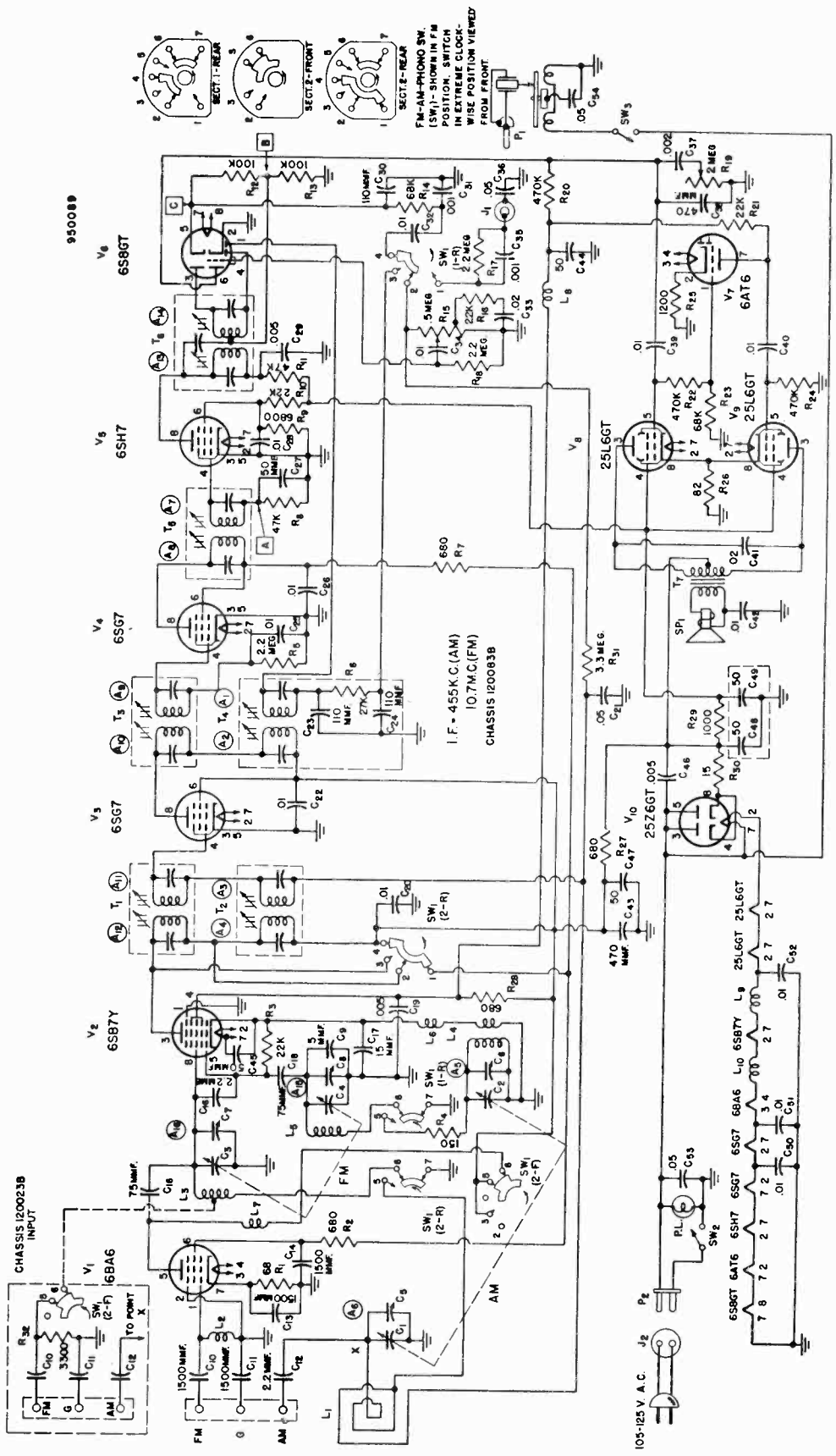
1. If replacements are made or the wiring disturbed in the r-f section of the circuit, the receiver should be carefully realigned.
2. A self-contained loop antenna is provided for broadcast band reception. For permanent home installation, however, if it is desired to improve reception of weak stations, an additional outdoor antenna may be used. Connect the outdoor antenna to the screw on the terminal strip marked "AM".
3. An internal power line antenna is provided for FM operation in relatively strong signal areas. The line cord should be completely uncoiled for effective operation of this antenna. An external dipole antenna is recommended for maximum FM operation. To connect the dipole, first remove the chassis cover at the rear of the cabinet. Then remove the wire from the screw on the terminal strip marked "FM" and connect the dipole leads to the "FM" terminal and "G".
4. A ground connection is not required for AM or FM operation.

DISASSEMBLY INSTRUCTIONS

1. Remove four push-on type knobs at front of cabinet.
2. Remove five screws holding chassis cover in place.
3. Remove phono plug at left side of chassis. Unscrew wire nuts from phono motor leads. Disconnect speaker leads.
4. Unfasten interlock socket by removing two screws from mounting bracket.
5. Remove four chassis mounting bolts and carefully withdraw chassis.

MODEL 586, CHASSIS 120023B, 120083B

EMERSON RADIO AND PHONO. CORP.



EMERSON RADIO AND PHONO. CORP. MODEL 586, CHASSIS 120023B, 120083B

ALIGNMENT INSTRUCTIONS

1. To position pointer, turn variable condenser fully closed and set pointer to reference mark on dial backplate at the low frequency end of the dial.
2. Volume control should be set at maximum position. The output of the signal generator should be no higher than necessary to obtain an output reading. Attenuate the signal input as alignment proceeds. Use an insulated alignment tool for all adjustments.
3. Use isolation transformer if available; otherwise connect a .1 mfd. condenser in series with low side of signal generator to chassis.

AM Alignment

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1	.1 mfd.	High side to Pin 8 (grid) of 6SB7Y. Low side to chassis.	455 KC.	Broadcast	Tuning condenser fully open.	Across voice coil.	A1, A2, (Trans. T4). A3, A4, (Trans. T2).	Adjust for maximum output. Reduce dummy antenna to .001 mfd. if isolation trans. is not used.
2		Loop	1600 KC.	Broadcast	Tuning condenser fully open.	Across voice coil.	A5, (Trimmer cond. C6).	Form loop of several turns of wire. Radiate signal into receiver loop. Adjust for maximum output.
3		Loop	1400 KC.	Broadcast	Tune for max. output.	Across voice coil.	A6, (Trimmer cond. C5).	Adjust for maximum output.

FM I-F and Disc. Alignment Using AM Signal Generator and VTVM

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
1	.01 mfd.	High side to Pin 4 (grid) of 6SG7 2nd i.f (V4). Low side to chassis.	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "A". Common to chassis.	A7, A8, (Trans. T5).	Adjust for maximum output.
2	.01 mfd.	High side to Pin 4 (grid) of 6SG7 1st i-f (V3). Low side to chassis.	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "A". Common to chassis.	A9, A10, (Trans. T3).	Adjust for maximum output.
3	.01 mfd.	High side to Pin 5 (osc. grid) of 6SB7Y conv. (V2). Low side to chassis.	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "A". Common to chassis.	A11, A12, (Trans. T1).	Adjust for maximum output.
4	.01 mfd.	High side to Pin 4 (grid) of 6SG7 2nd i-f (V4). Low side to chassis.	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "B". Common to chassis.	A13, (Trans. T6).	Adjust for maximum output.
5	.01 mfd.	"	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "C". Common to chassis.	A14, (Trans. T6).	Adjust for zero output. Continue with FM r-f alignment.

FM I-F and Disc. Alignment Using Sweep Signal Generator and Oscilloscope.

Use frequency modulated signal, with 60 cycle modulation and 450 kc. sweep. Use 120 cycle sawtooth sweep voltage in oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RADIO DIAL SETTING	CONNECT OSCILLOSCOPE	ADJUST	REMARKS
1	.01 mfd.	High side to Pin 4 (grid) of 6SG7 1st i-f (V3). Low side to chassis.	10.7 mc. (Unmodulated).	Frequency modulation	Tuning condenser fully open.	Vertical input to Point "A". Ground to chassis.	A7, A8, (Trans. T5). A9, A10, (Trans. T3).	Adjust for maximum output (height) and symmetry as per i-f alignment curve shown (page 5).
2	.01 mfd.	High side to Pin 5 (osc. grid) of 6SB7Y conv. (V2). Low side to chassis.	10.7 mc. (Unmodulated).	Frequency modulation	Tuning condenser fully open.	Vertical input to Point "A". Ground to chassis.	A11, A12, (Trans. T1).	Adjust for maximum output (height) and symmetry as per i-f alignment curve shown (page 5).
3	.01 mfd.	High side to Pin 4 (grid) of 6SG7 2nd i-f (V4). Low side to chassis.	10.7 mc. (Unmodulated).	Frequency modulation	Tuning condenser fully open.	Vertical input to Point "C". Ground to chassis.	A13, A14, (Trans. T6).	Alternately adjust A13 for maximum amplitude and A14 for maximum straightness of cross-over lines, with cross-over occurring at center of pattern as per discriminator alignment curve (page 5). Continue with FM r-f alignment.

FM R-F Alignment

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
1	150 ohm resistor in series with each gen. lead.	High side to FM ant. term. Low side to chassis.	108.0 mc. (Unmodulated).	Frequency modulation	Tuning condenser fully open (108.0 mc.)	Connect d.c. probe to point "A". Common to chassis.	A15, (Trimmer cond. C8).	Adjust for maximum output.
2	"	"	106.0 mc.	Frequency modulation	Tune for maximum output.	"	A16, (Trimmer cond. C7).	Adjust for maximum output.

MODEL 586, CHASSIS 120023B, 120083B

EMERSON RADIO AND PHONO. CORP.

INSTRUCTIONS FOR VOLTAGE AND RESISTANCE READINGS

1. Voltage readings are in d.c. volts and resistance readings in ohms, unless otherwise specified.
2. D.c. voltage measurements are made at 20,000 ohms-per-volt and a.c. voltages are measured at 1000 ohms-per-volt.
3. Socket connections are shown as bottom views. Values are measured from socket pin to common negative.
4. Line voltage maitained at 117 volts a.c. for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in readings.
6. Volume control at maximum, with no signal applied and bandswitch in broadcast position (unless otherwise noted), for voltage measurements.

VOLTAGE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	CAP
V1	6BA6	0	0	37AC	31AC	82*	80*	.7*	—	—
V2	6SB7Y	0	37AC	100	92	-.5	0	44AC	-.5	—
V3	6SG7	0	95	0	0	0	95	31AC	95	—
V4	6SG7	0	25AC	0	-.4	0	78*	19AC	78*	—
V5	6SH7	0	12AC	0	0	0	22	19AC	45	—
V6	6S8GT	-.5	0	0	0	5.5*	42	0	6AC	-.7
V7	6AT6	0	.8	6AC	12AC	0	0	74	—	—
V8	25L6GT	89	44AC	107	100	0	110	70AC	7.6	—
V9	25L6GT	0	70AC	107	100	0	74	95AC	7.6	—
V10	25Z6GT	107	95AC	117AC	107	117AC	83	117AC	107	—

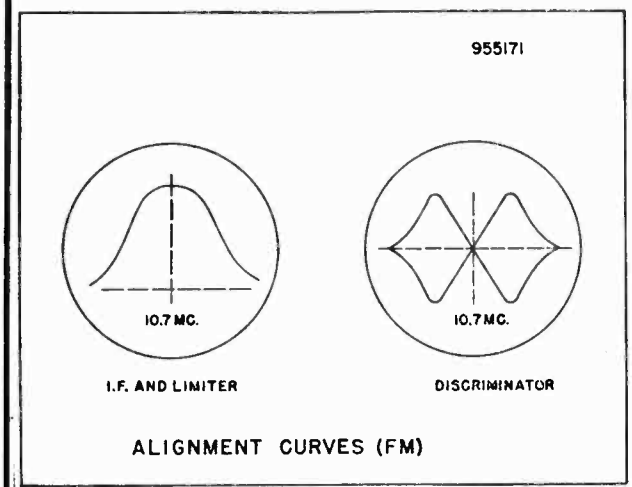
RESISTANCE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	CAP
V1	6BA6	0	0	26	20	30K*	30K*	68	—	—
V2	6SB7Y	0	29	30K	33K	25K	1	30	0	—
V3	6SG7	0	22	0	4 meg.	0	30K	26	30K	—
V4	6SG7	0	22	0	2 meg.	0	30K*	15	30K*	2.2 meg.
V5	6SH7	0	10	0	46K	0	8K	15	80K	—
V6	6S8GT	450K	0	100K	100K	200K	550K	0	5	—
V7	6AT6	68K	1200	5	10	Inf.	Inf.	50K	—	—
V8	25L6GT	30K	35	30K	30K	500K	30K	51	90	—
V9	25L6GT	Inf.	51	30K	30K	500K	65K	68	90	—
V10	25Z6GT	30K	68	86	30K	86	30K	86	40K	—

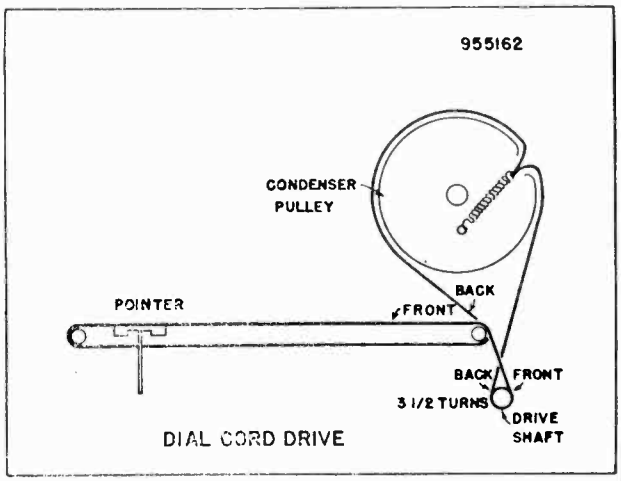
NC—No connection; * for bandswitch in FM position only

K—kilohms; meg.—megohms; Inf.—infinity

NOTE: Chassis 120023B does not contain the r-f amp. V1, (6BA6). Voltage and resistance measurements are substantially the same as chassis 120083B.



ALIGNMENT CURVES (FM)



DIAL CORD DRIVE

EMERSON RADIO AND PHONO. CORP. MODEL 586, CHASSIS 120023B, 120083B

REPLACEMENT PARTS LIST

Symbol	†Part No.	DESCRIPTION
V1	6BA6	I-M r-f amplifier (Chassis 120083B only)
V2	6SB7Y	FM and AM converter
V3	6SG7	FM and AM 1st i-f amplifier
V4	6SG7	FM 2nd i-f amplifier
V5	6SH7	FM limiter
V6	6S8GT	FM disc., AM detector, a.v.c., audio amplifier
V7	6AT6	Phase inverter
V8	25L6GT	Power output
V9	25L6GT	Power output
V10	25Z6GT	Rectifier
C1, C2	900046	Two gang, four section variable condenser
C3, C4		
C5, C6, C7, C8	*	Trimmers, part of C1, C2, C3, C4
C9	928023	5 mmf., ceramic condenser
C10, C11, C13, C14	928006	1500 mmf., ceramic condenser
C15, C18	928015	75 mmf., ceramic condenser
C16	915005	2.2 mmf., molded condenser
C17	928016	15 mmf., ceramic condenser
C19, C29	928109	.005 mfd., ceramic condenser
C20, C22, C25, C26, C28, C32	920092	.01 mfd., 200 volt paper cond.
C21	920060	.05 mfd., 200 volt paper condenser
C23, C24	*	110 mmf., part of i-f trans. T4
C27	928102	50 mmf., ± 10%, ceramic condenser
C30	910010	110 mmf., mica condenser
C31, C35	920514	.001 mfd., 400 volt paper condenser
C33	920100	.02 mfd., 200 volt paper condenser
C34, C39	920090	.01 mfd., 400 volt paper condenser
C40, C42, C50, C51 C52		
C36, C53	920030	.05 mfd., 400 volt paper condenser
C37	920515	.002 mfd., 400 volt paper condenser
C38, C43	910014	470 mmf., mica condenser
C41	920020	.02 mfd., 400 volt paper condenser
C44, C47	925067	50-50 mfd., 150 volt elect. condenser
C45	928014	50 mmf., ceramic condenser
C46	920180	.005 mfd., 400 volt paper condenser
C48, C49	925101	50-50 mfd., 150 elect. condenser
C54	922101	.05 mfd., 400 volt molded condenser
R1	340210	68 ohms, ± 10%, ½ watt resistor
R2, R28	340450	680 ohms, ± 10%, ½ watt resistor
R3, R10	340810	22 kilohms, ± 10%, ½ watt resistor
R4	350290	150 ohms, ½ watt resistor
R5, R17, R18	351290	2.2 megohms, ½ watt resistor
R6	340830	27 kilohms, ± 10%, ½ watt resistor (may be part of i-f trans. T4)
R7	350450	680 ohms, ½ watt resistor
R8	340890	47 kilohms, ± 10%, ½ watt resistor
R9	340690	6800 ohms, ± 10%, ½ watt resistor
R11	350890	47 kilohms, ½ watt resistor
R12, R13	340970	100 kilohms, ± 10%, ½ watt resistor
R14, R23	350930	68 kilohms, ½ watt resistor
R15	390057	.5 megohms, tapped volume control
R16, R21	350810	22 kilohms, ½ watt resistor
R19	390046	2 megohms, tone control
R20, R22, R24	351130	470 kilohms, ½ watt resistor
R25	340510	1200 ohms, ± 10%, ½ watt resistor
R26	370230	82 ohms, ± 10%, ½ watt resistor
R27	370450	680 ohms, ± 10%, 1 watt resistor
R29	340490	1000 ohms, ± 10%, ½ watt resistor
R30	380050	15 ohms, ± 10%, ½ watt resistor
R31	351330	3.3 megohms, ½ watt resistor
R32	350610	3300 ohms, ½ watt resistor
L1	700011	AM loop antenna
L2	710019	FM antenna coil
L3	713008	FM r-f coil
L4	716015	AM oscillator coil
L5	716013	FM oscillator coil
L6, L7	705002	FM oscillator choke
L8	—	R.f. choke, plate supply
L9, L10	705011	R.f. choke, filament
T1	720024	First i-f trans. (FM) (Alt. part 720067) #
T2	720031	First i-f trans. (AM) (Alt. part 720075) #
T3	720025	Second i-f trans. (FM) (Alt. part 720067) #
T4	720032	Second i-f trans. (AM) (Alt. part 720076) #
T5	720026	Third i-f trans. (FM) (Alt. part 720067) #
T6	708005	Discriminator trans. (FM) (Alt. parts 708012, 708013) #
T7	734028	Output transformer
SW1	510038	Three position, band-phono switch
SW2	*	Line switch, part of vol. control
SW3	*	Phono switch, part of changer
SP1	180042	P.m. speaker, 12"
P1	505040	Phono pickup plug
J1	508100	Phono pickup socket
P2	508008	Line cord interlock socket
J2	500005	Line cord connector plug
	583202	Line cord and internal antenna
	807003	Dial light, 115 volts, 10 watts
	507008	Dial light socket

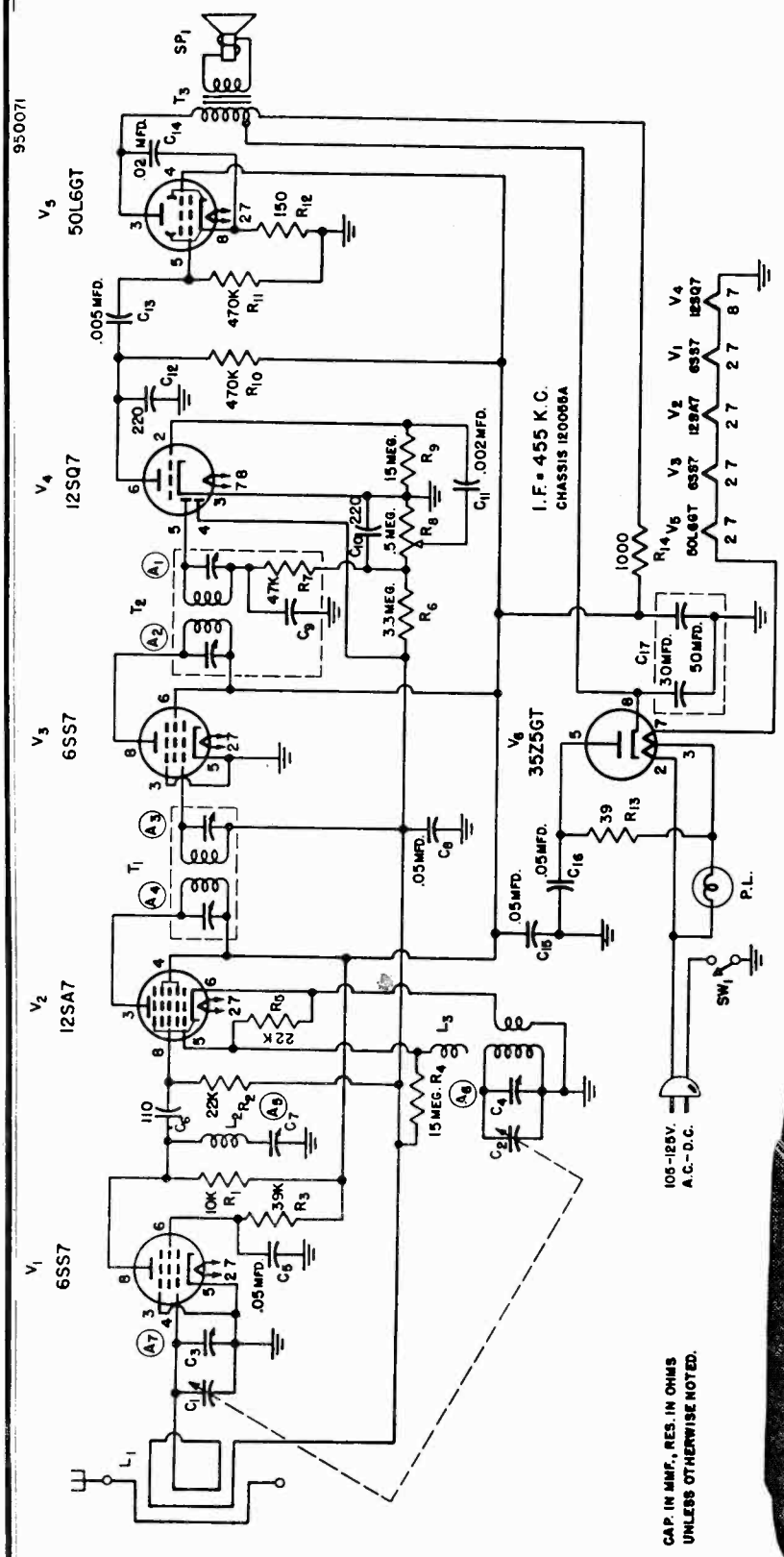
CABINET AND DIAL PARTS

Symbol	†Part No.	DESCRIPTION
	140181	Cabinet (for 819039 changer). (Alt. part 140233 for 819044 changer)
	560054	Cabinet back
	819039	Record changer (GI type 700 FS) (Alt. part 819044, Webster type 146)
	460470	Knob, black push-on
	460041	Knob, black, push-on, indicator type
	520071	Dial crystal
	410177	Dial backplate
	280039	Dial drive shaft
	530002	Dial drive cord (44")
	587070	Dial cord spring
	525017	Pointer

† Specify part numbers when ordering.
* Not supplied separately.
# Replace with part having same number as that removed.

MODEL 591,
CHASSIS 120055A

EMERSON RADIO AND PHONO. CORP.



DESCRIPTION

TYPE: Single band (AM) superheterodyne

FREQUENCY RANGE: 540-1620 kc.

TYPES OF TUBES:
1—6SS7 r-f amplifier
1—12SA7 converter
1—6SS7 i-f amplifier
1—12SQ7 detector, a.v.c., audio amplifier
1—50L6GT power output
1—35Z5GT rectifier

POWER SUPPLY: A.c. or d.c.

VOLTAGE RATING: 105-125 volts

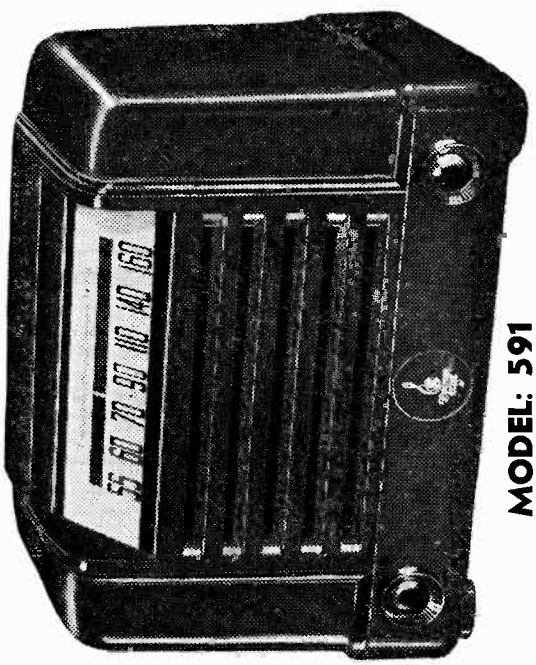
POWER CONSUMPTION: 30 watts

CURRENT DRAIN: 0.24 amp. at 117 volts a.c.

GENERAL NOTES

1. If replacements are made or the wiring disturbed in the r-f section of the circuit, the receiver should be carefully realigned.
2. The receiver has a self-contained antenna and does not require additional antenna connections. For permanent home installations, however, if it is desired to improve reception of weak stations, an additional outdoor antenna may be used. For this purpose a lead has been brought out of the rear near the line cord.
3. The self-contained loop antenna has directional properties. It is important, therefore, once the station is tuned in, that the cabinet be rotated on its base back and forth through a quarter of a circle (90 degrees), and left at the position where the station is received with maximum volume.
4. The color coding of the i-f transformer leads is as follows:

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



MODEL: 591

EMERSON RADIO AND PHONO. CORP. MODEL 591, CHASSIS 120055A

INSTRUCTIONS FOR VOLTAGE AND RESISTANCE READINGS

1. Voltages are in volts d.c.; resistances in ohms unless otherwise specified.
2. D.c. voltage measurements are at 20,000 ohms-per-volt; a.c. voltages measured at 1000 ohms-per-volt.
3. Socket connections are shown as bottom views.
4. Measured values are from socket pin to common negative (chassis).
5. Line voltage maintained at 117 volts for voltage readings.
6. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
7. Volume contral at maximum with 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
V1	6SS7	0	19 AC	0	-.6	0	55	12 AC	50
V2	12SA7	0	31 AC	83	85	-.4.5	0	19 AC	-.5
V3	6SS7	0	37 AC	0	-.6	0	85	31 AC	83
V4	12SQ7	0	-.9	0	-.4	0	52	0	12 AC
V5	50L6GT	NC	87 AC	100	85	0	NC	37 AC	5.8
V6	35Z5GT	NC	117 AC	113 AC	106	112 AC	NC	87 AC	106

RESISTANCE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8
V1	6SS7	0	26	0	2.8 meg.	0	100 K	19	60 K
V2	12SA7	0	40	45 K	45 K	25 K	0	26	2.8 meg.
V3	6SS7	0	47	0	2.8 meg.	0	45 K	40	45 K
V4	12SQ7	0	15 meg.	0	2.8 meg.	600 K	540 K	0	19
V5	50L6GT	Inf.	110	45 K	45 K	450 K	Inf.	47	150
V6	35Z5GT	Inf.	160	150	45 K	190	Inf.	110	45 K

NC = no connection; K = kilohm; meg. = megohm; Inf. = infinity

ALIGNMENT PROCEDURE

1. To set pointer, turn variable condenser fully closed and set pointer at mark near left end of dial backplate.
2. Use isolation transformer if available. If not, connect a 0.1 mfd. condenser in series with low side of signal generator and chassis.
3. Volume control should be at maximum position; output of signal generator should be no higher than necessary to obtain an output reading.
4. 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 8 (grid) of 12SA7 (V2). Low side to chassis.	455 KC.	Variable condenser fully open.	Across voice coil.	A1, A2 (2nd i-f trans. T2). A3, A4 (1st i-f trans. T1).	Adjust for maximum output. If isolation transformer is not used, reduce dummy antenna to .001 mfd. to reduce hum modulation.
2	0.1 mfd.	High side to external antenna lead. Low side to chassis.	455 KC.	Variable condenser fully open.	Across voice coil.	A5 (Trimmer) cond. C7).	Adjust for minimum output.
3	200 mmf.	"	1620 KC.	Variable condenser fully open.	Across voice coil.	A 6 (Trimmer) cond. C4).	Adjust for maximum output.
4	200 mmf.	"	1400 KC.	Tune for maximum output.	Across voice coil.	A7 (Trimmer) cond. C3).	Adjust for maximum output.

MODEL 591,
CHASSIS 120055A

EMERSON RADIO AND PHONO. CORP.

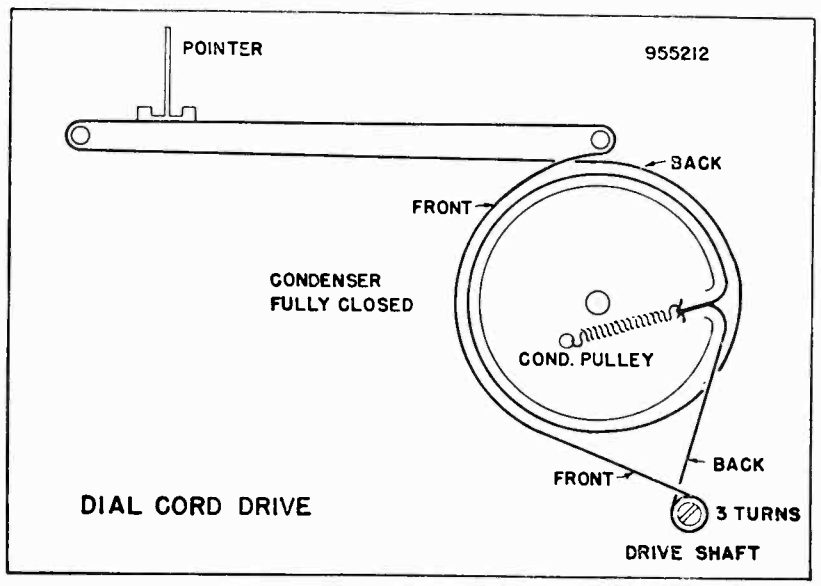
REPLACEMENT PARTS LIST

Symbol	†Part No	DESCRIPTION	Symbol	†Part No.	DESCRIPTION
V1	6SS7	R-f amplifier	R4, R9	351490	15 megohms, ½ watt resistor
V2	12SA7	Converter	R5	*	22 kilohms, part of L3
V3	6SS7	I-f amplifier	R6	351330	3.3 megohms, ½ watt resistor
V4	12SQ7	Detector, a.v.c., audio amplifier	R7	*	47 kilohms, part of T2
V5	50LGGT	Power output	R8	390053	.5 megohms, volume control
V6	35Z5GT	Rectifier	R10, R11	351130	470 kilohms, ½ watt resistor
C1, C2	900037	Two-gang variable condenser	R12	340290	150 ohms, ½ watt resistor
C3, C4	*	Trimmers, part of var. cond.	R13	370150	39 ohms, 1 watt resistor
C5, C8	920060	.05 mfd., 200 volt paper cond.	R14	370490	1000 ohms, 1 watt resistor
C6	910010	110 mmf., mica condenser	L1	700033	Loop antenna
C7	*	Trimmer, part of wave trap L2	L2	708060	Wave trap
C9	*	Part of 2nd i-f trans. T2	L3	716024	Oscillator coil
C10, C11, C12, C13	470310	220 mmf.—.002 mfd.—220 mmf.—.005 mfd.coupling cond. assembly	T1	720058	First i-f transformer
			T2	720390	Second i-f transformer
C14	920020	.02 mfd., 200 volt paper cond.	T3	734046	Output transformer
C15, C16	920030	.05 mfd., 400 volt paper cond.	SP1	180043	P.m. speaker, 4"
C17	925104	30-50 mfd., 150 volt elect. cond.	SW1	*	Line switch, part of vol. control
R1	340730	10 kilohms, ½ watt resistor	P.L.	807000	Dial light
R2	340810	22 kilohms, ½ watt resistor		507060	Dial light socket
R3	340870	39 kilohms ½ watt resistor		583070	Line cord

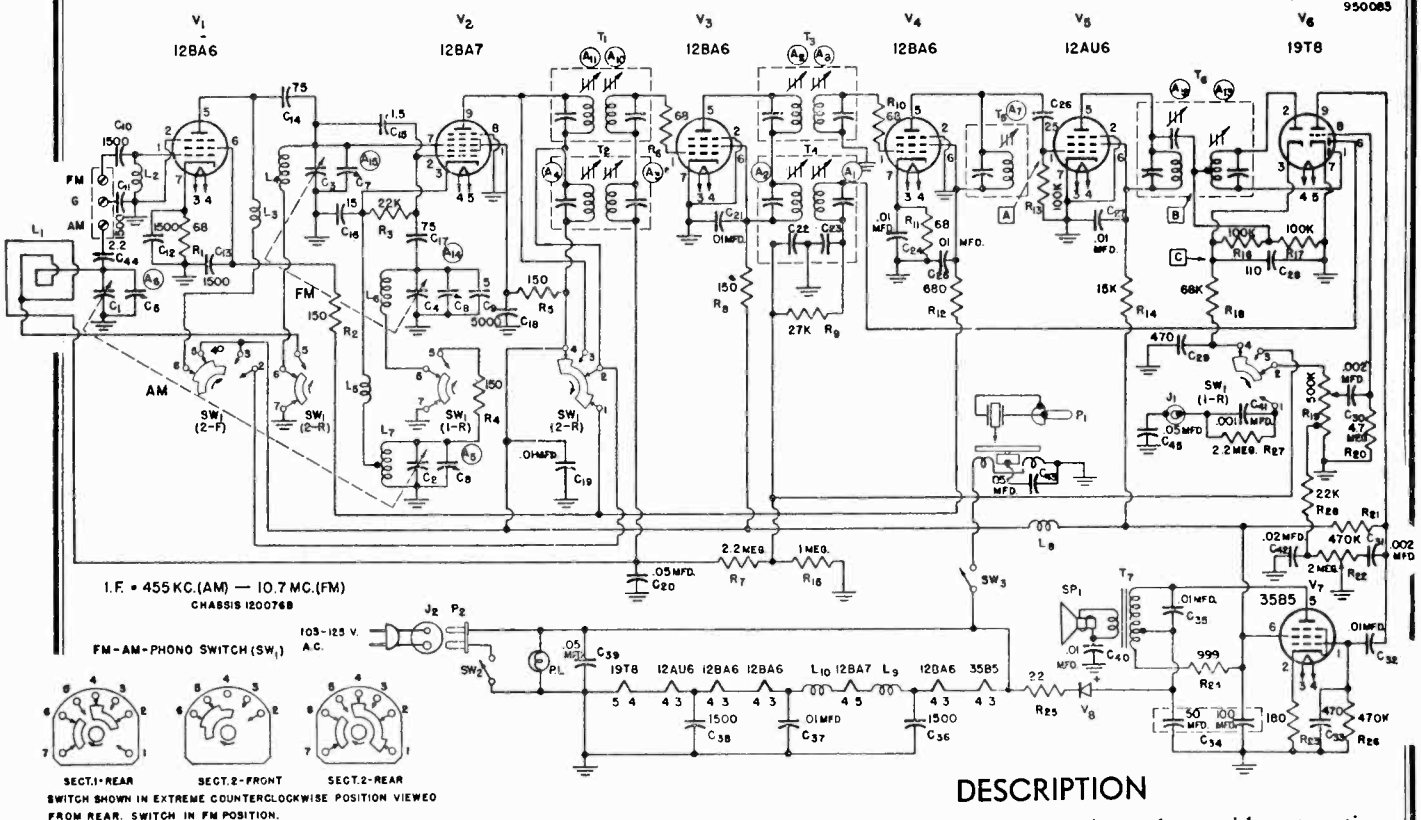
CABINET AND DIAL PARTS

†Part No.	
140210	Cabinet, walnut plastic
140213	Cabinet, ivory plastic
560190	Cabinet back
460470	Knob, black
525035	Pointer
520076	Dial glass
520078	Dial back plate
280313	Dial drive shaft
530002	Dial drive cord (39")
587070	Dial drive spring

† Specify part numbers when ordering. * Not supplied separately.



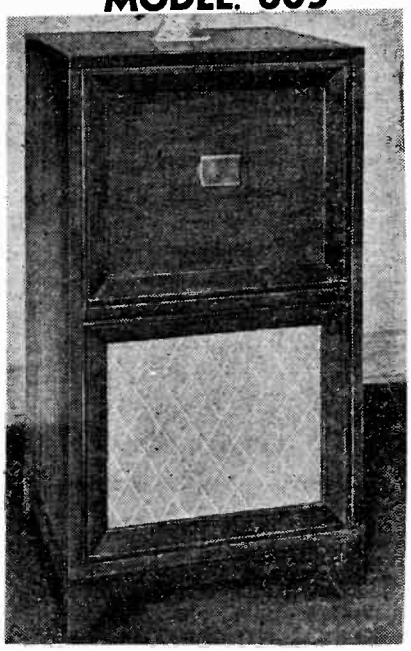
EMERSON RADIO AND PHONO. CORP. MODEL 605, CHASSIS 120076B



DISASSEMBLY INSTRUCTIONS

1. Remove four push-on type knobs at front of cabinet.
2. Remove chassis cover at rear of cabinet.
3. Disconnect speaker and phono-motor leads. Remove phono plug.
4. Remove chassis mounting bolts and carefully withdraw chassis.

MODEL: 605



DESCRIPTION

TYPE: Consolette AM-FM superheterodyne, with automatic record changer.

FREQUENCY RANGE:
Broadcast band (AM)—540-1620 kilocycles.
Frequency modulation band (FM)—88.108 megacycles.

TYPE OF TUBES:
1—12BA6 FM r-f amplifier
1—12BA7 FM and AM converter
1—12BA6 FM and AM first i-f amplifier
1—12BA6 FM second i-f amplifier
1—12AU6 FM limiter
1—19T8 FM discriminator, AM detector, a.v.c., audio amplifier
1—35B5 Power output
1—Selenium rectifier

POWER SUPPLY: 60 cycle a.c.

VOLTAGE RATING: 105-125 volts

POWER CONSUMPTION: 90 watts

CURRENT DRAIN: 0.77 amp. at 117 volts a.c.

GENERAL NOTES

1. If replacements are made or the wiring disturbed in the r-f section of the circuit, the receiver should be carefully realigned.
2. 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 the outdoor antenna to the screw on the loop terminal strip marked "AM".
3. An internal power line antenna is provided for FM operation in relatively strong signal areas. The line cord should be completely uncoiled for effective operation of this antenna. An external dipole antenna is recommended for maximum FM operation. To connect the dipole, first remove the wire from the screw on the loop terminal strip marked "FM" and connect the dipole leads to the "FM" terminal and "G".
4. A ground connection is not required for AM and FM operation.

MODEL 605, CHASSIS 120076B

EMERSON RADIO AND PHONO. CORP.

INSTRUCTIONS FOR VOLTAGE AND RESISTANCE READINGS

1. Voltages readings are in d.c. volts and resistance readings in ohms, unless otherwise specified.
2. D.c. voltage measurements are made at 20,000 ohms-per-volt and a.c. voltages are measured at 1000 ohms-per-volt.
3. Socket connections are shown as bottom views. Values are measured from socket pin to common negative.
4. Line voltage maintained at 117 volts a.c. for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in readings.
6. Volume control at maximum, with no signal applied and bandswitch in broadcast position (unless otherwise noted), for voltage measurements.

VOLTAGE READINGS

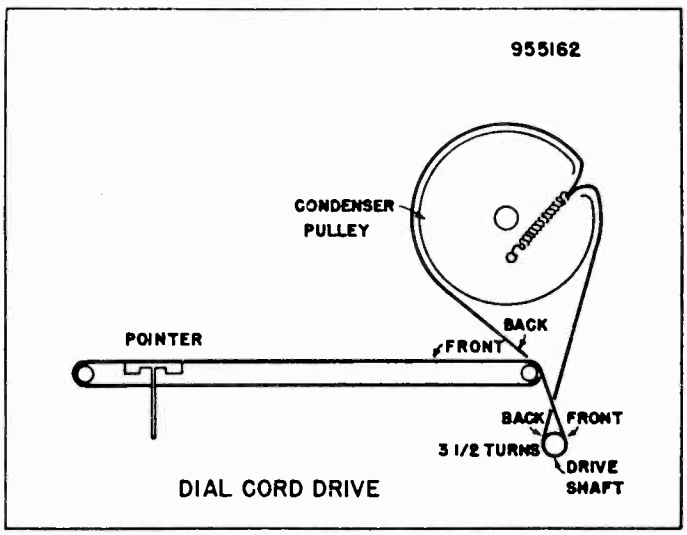
SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V1	12BA6	0	0	80AC	67AC	76*	78*	.8*	—	—
V2	12BA7	100	-.5	0	67AC	55AC	0	-.5	0	95
V3	12BA6	-.2	0	55AC	43AC	93	98	0	—	—
V4	12BA6	0	0	43AC	30AC	70*	70*	.6*	—	—
V5	12AU6	-.4	0	30AC	18AC	50	50	0	—	—
V6	19T8	-.5	-.4	5.5*	18AC	0	-.8	0	-.5	33
V7	35B5	0	6	117AC	80AC	132	100	NC	—	—

NC denotes "no connection"; * for bandswitch in FM position only.

RESISTANCE READINGS

SYMBOL	TUBE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V1	12BA6	0	0	16	12	65K*	65K*	66	—	—
V2	12BA7	65K	24K	1	56	75	0	0	0	65K
V3	12BA6	2.8 meg.	0	56	44	65K	65K	0	—	—
V4	12BA6	68	0	44	32	65K	65K	68	—	—
V5	12AU6	100K	0	32	20	65K	65K	0	—	—
V6	19T8	90K	90K	150K	20	0	1 meg.	0	4 meg.	550K
V7	35B5	400K	190	112	80	65K	65K	NC	—	—

K—Kilohms; meg.—megohms.



DIAL CORD DRIVE

EMERSON RADIO AND PHONO. CORP. MODEL 605, CHASSIS 120076B

ALIGNMENT INSTRUCTIONS

1. To position pointer, turn variable condenser fully closed and set pointer to reference mark on dial backplate at the low frequency end of the dial.
2. Volume control should be set at maximum position. The output of the signal generator should be no higher than necessary to obtain an output reading. Attenuate the signal input as alignment proceeds. Use an insulated alignment tool for all adjustments.
3. Use isolation transformer if available; otherwise connect a .1 mfd. condenser in series with low side of signal generator to chassis.

AM ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1	.1 mfd.	High side to Pin 7 (grid) of 12BA7. Low side to chassis.	455 KC.	Broadcast	Tuning condenser fully open.	Across voice coil.	A1, A2, (Trans. T4). A3, A4, (Trans. T2).	Adjust for maximum output. Reduce dummy antenna to .001 mfd. if isolation trans. is not used.
2		Loop	1600 KC.	Broadcast	Tuning condenser fully open.	Across voice coil.	A5, (Trimmer cond. C6).	Form loop of several turns of wire. Radiate signal into receiver loop. Adjust for maximum output.
3		Loop	1400 KC.	Broadcast	Tune for max. output.	Across voice coil.	A6, (Trimmer cond. C5).	Adjust for maximum output.

FM I-F and Disc. Alignment Using AM Signal Generator and VTVM

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
1	.01 mfd.	High side to Pin 1 (grid) of 12BA6 2nd i-f (V4). Low side to chassis.	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "A". Common to chassis.	A7, (Trans. T5).	Adjust for maximum output.
2	.01 mfd.	High side to Pin 1 (grid) of 12BA6 1st i-f (V3). Low side o chassis.	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "A". Common to chassis.	A8, A9, (Trans. T3).	Adjust for maximum output.
3	.01 mfd.	High side to Pin 2 (osc. grid) of 12BA7 conv. (V2). Low side to chassis.	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "A". Common to chassis.	A10, A11, (Trans. T1).	Adjust for maximum output.
4	.01 mfd.	High side to Pin 1 (grid) of 12BA6 2nd i-f (V4). Low side to chassis.	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "B". Common to chassis.	A12, (Trans. T6).	Adjust for maximum output.
5	.01 mfd.	"	10.7 mc. (Unmodulated)	Frequency modulation	Tuning condenser fully open.	Connect d.c. probe to point "C". Common to chassis.	A13, (Trans. T6).	Adjust for zero output. Continue with FM r-f alignment.

FM I-F AND DISC. ALIGNMENT USING SWEEP SIGNAL GENERATOR AND OSCILLOSCOPE. Use frequency modulated signal, with 60 cycle modulation and 450 kc. sweep. Use 120 cycle sowtooth sweep voltage in oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RADIO DIAL SETTING	CONNECT OSCILLOSCOPE	ADJUST	REMARKS
1	.01 mfd.	High side to Pin 1 (grid) of 12BA6 1st i-f (V3). Low side to chassis.	10.7 mc. (Unmodulated).	Frequency modulation	Tuning condenser fully open.	Vertical input to Point "A". Ground to chassis.	A7, A8, A9, (Trans. T5 and T3).	Adjust for maximum output (height) and symmetry as per i-f alignment curve shown (page 3).
2	.01 mfd.	High side to Pin 2 (osc. grid) of 12BA7 conv. (V2). Low side to chassis.	10.7 mc. (Unmodulated).	Frequency modulation	Tuning condenser fully open.	Vertical input to Point "A". Ground to chassis.	A10, A11, (Trans. T1).	Adjust for maximum output (height) and symmetry as per i-f alignment curve shown (page 3).
3	.01 mfd.	High side to Pin 1 (grid) of 12BA6 2nd i-f (V4). Low side to chassis.	10.7 mc. (Unmodulated).	Frequency modulation	Tuning condenser fully open.	Vertical input to Point "C". Ground to chassis.	A12, A13, (Trans. T6).	Alternately adjust A12 for maximum amplitude and A13 for maximum straightness of cross-over lines, with cross-over occurring at center of pattern as per discriminator alignment curve (page 3). Continue with FM r-f alignment.

FM R-F ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POSITION	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
1	150 ohm resistor in series with each gen. lead.	High side to FM ant. term. Low side to chassis.	108.0 mc. (Unmodulated).	Frequency modulation	Tuning condenser fully open (108.0 mc.)	Connect d.c. probe to point "A". Common to chassis.	A14 (Trimmer cond. C8).	Adjust for maximum output.
2	"	"	106.0 mc.	Frequency modulation	Tune for maximum output.	"	A15 (Trimmer cond. C7).	Adjust for maximum output.

MODEL 605,
CHASSIS 120076B

EMERSON RADIO AND PHONO. CORP.

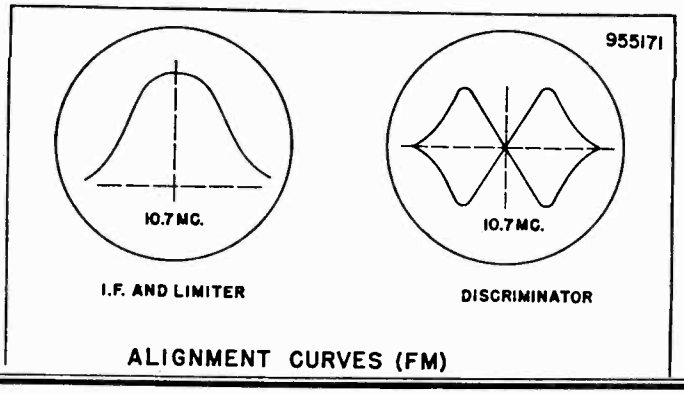
REPLACEMENT PARTS LIST

Symbol	†Part No.	DESCRIPTION
V1	12BA6	FM r-f amplifier
V2	12BA7	FM and AM converter
V3	12BA6	FM and AM 1st i-f amplifier
V4	12BA6	FM 2nd i-f amplifier
V5	12AU6	FM limiter
V6	19T8	FM disc., AM det., a.v.c., audio amp.
V7	35B5	Power output
V8	817101	Selenium rectifier
C1, C2, C3, C4	900045	Two-gang, four section variable condenser (alt. part 900400A)*
C5, C6, C7, C8	*	Trimmers, part of C1-C2-C3-C4
C9	928017	5 mmf., ceramic condenser
C10, C11, C12, C13, C36, C38	928006	1500 mmf., ceramic condenser
C14, C17	928015	75 mmf., ceramic condenser
C15	915011	1.5 mmf., molded condenser
C16	928016	15 mmf., ceramic condenser
C18	928109	5000 mmf., ceramic condenser
C19, C21, C24, C25, C27, C40	920092	.01 mfd., 200 volt paper cond.
C20, C39, C45	920030	.05 mfd., 400 volt paper cond.
C22, C23	*	Part of T4 (2nd i-f, AM)
C26	928110	25 mmf., ceramic condenser
C28	910010	110 mmf., mica condenser
C29, C33	910014	470 mmf., mica condenser
C30, C31	920515	.002 mfd., 400 volt paper cond.
C32, C35, C37	920090	.01 mfd., 400 volt paper cond.
C34	925126	100-50 mfd., 150 volt elect. cond.
C41	920514	.001 mfd., 400 volt paper cond.
C42	920100	.02 mfd., 200 volt paper cond.
C43	922101	.05 mfd., 400 volt molded paper condenser
C44	*	2.2 mmf., part of loop antenna L1
R1, R6, R10, R11	340210	68 ohms, ½ watt resistor
R2, R4, R5, R8	350290	150 ohms, ½ watt resistor
R3	340810	22 kilohms, ½ watt resistor, ± 10%
R7, R27	351290	2.2 megohms, ½ watt resistor
R9	340830	27 kilohm, ½ watt resistor (may be part of 2nd i-f T4)
R12	340450	680 ohms, ½ watt resistor
R13, R16, R17	340970	100 kilohms, ½ watt resistor
R14	350770	15 kilohms, ½ watt resistor
R15	351210	1 megohm, ½ watt resistor
R18	350930	68 kilohms, ½ watt resistor
R19	390057	500 kilohms, tapped volume control
R20	351370	4.7 megohms, ½ watt resistor
R21, R26	351130	470 kilohms, ½ watt resistor
R22	390046	2 megohms, tone control
R23	370310	180 ohms, 1 watt resistor
R24	394042	999 ohms, 3 watt wire wound res.
R25	380090	22 ohms, 1 watt resistor
R28	350810	22 kilohms, ½ watt resistor
L1	700011	AM loop antenna (alternate part of 700021) #
L2	710019	FM antenna coil
L3, L5, L9, L10	705002	FM oscillator choke
L4	713024	FM r-f coil
L6	716013	FM oscillator coil
L7	716015	AM oscillator coil
L8	705013	R-f choke
T1	720024	First i-f trans. (FM). (Alternate parts 720082, 720067) #
T2	720031	First i-f trans. (AM). (Alt. parts 720084, 720075) #
T3	720025	Second i-f trans. (FM). (Alt. parts 720082, 720067) #
T4	720032	Second i-f trans. (AM). (Alt. parts 720085, 720076) #
T5	720069	Third i-f trans. (FM). (Alt. parts 720083, 720077) #
T6	708005	Disc. trans. (FM). (Alt. parts 708012, 708013) #
T7	734042	Output transformer
SW1	510038	Three position band-phono switch
SW2	*	Line switch, part of vol. control
SW3	*	Phono switch, part of changer
SP1	180051	P.M. speaker (12")
P1	505040	Phono pickup plug
J1	508100	Phono pickup socket
P2	505007	Line cord connector plug
J2	500005	Line cord interlock socket
	583202	Line cord and internal ant.
	807003	Dial light, 115 volt, 10 watt
	507008	Dial light socket

CABINET AND DIAL PARTS

†Part No.	DESCRIPTION
140206	Cabinet (for 819039 changer). (Alt. part 140246 for 819044 changer).
560064	Cabinet back
819039	Record changer (GI type 700FS). (Alt. part 819044, Webster type 146).
460470	Knob, black push-on
460041	Knob, black indicator, push-on
410177	Dial backplate
520071	Dial crystal
280039	Dial drive shaft
530002	Dial drive cord (44")
587070	Dial cord spring
525017	Pointer

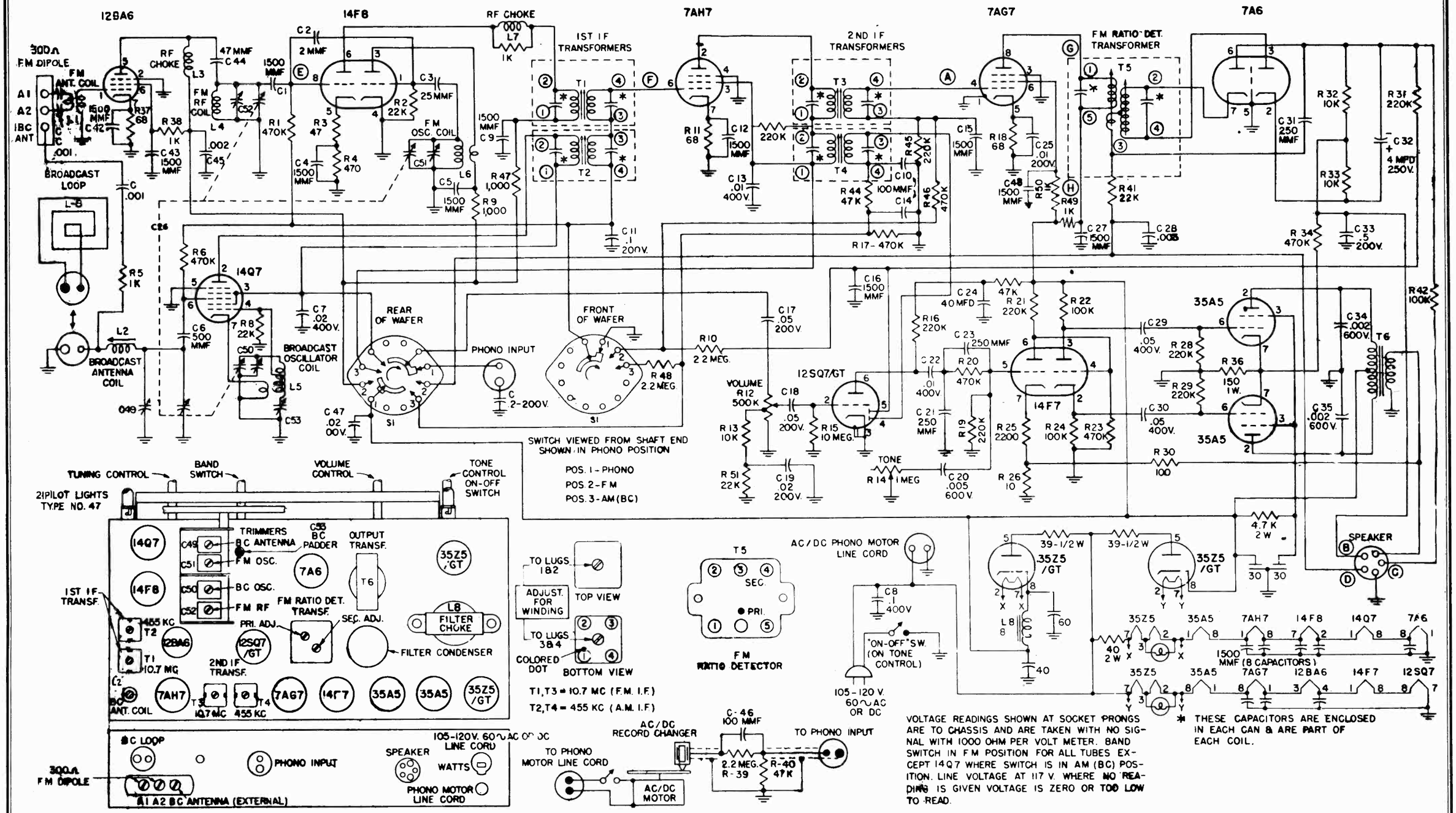
* Not supplied separately. † Specify part numbers when ordering. # Replace with part having same number as that removed.



ALIGNMENT CURVES (FM)

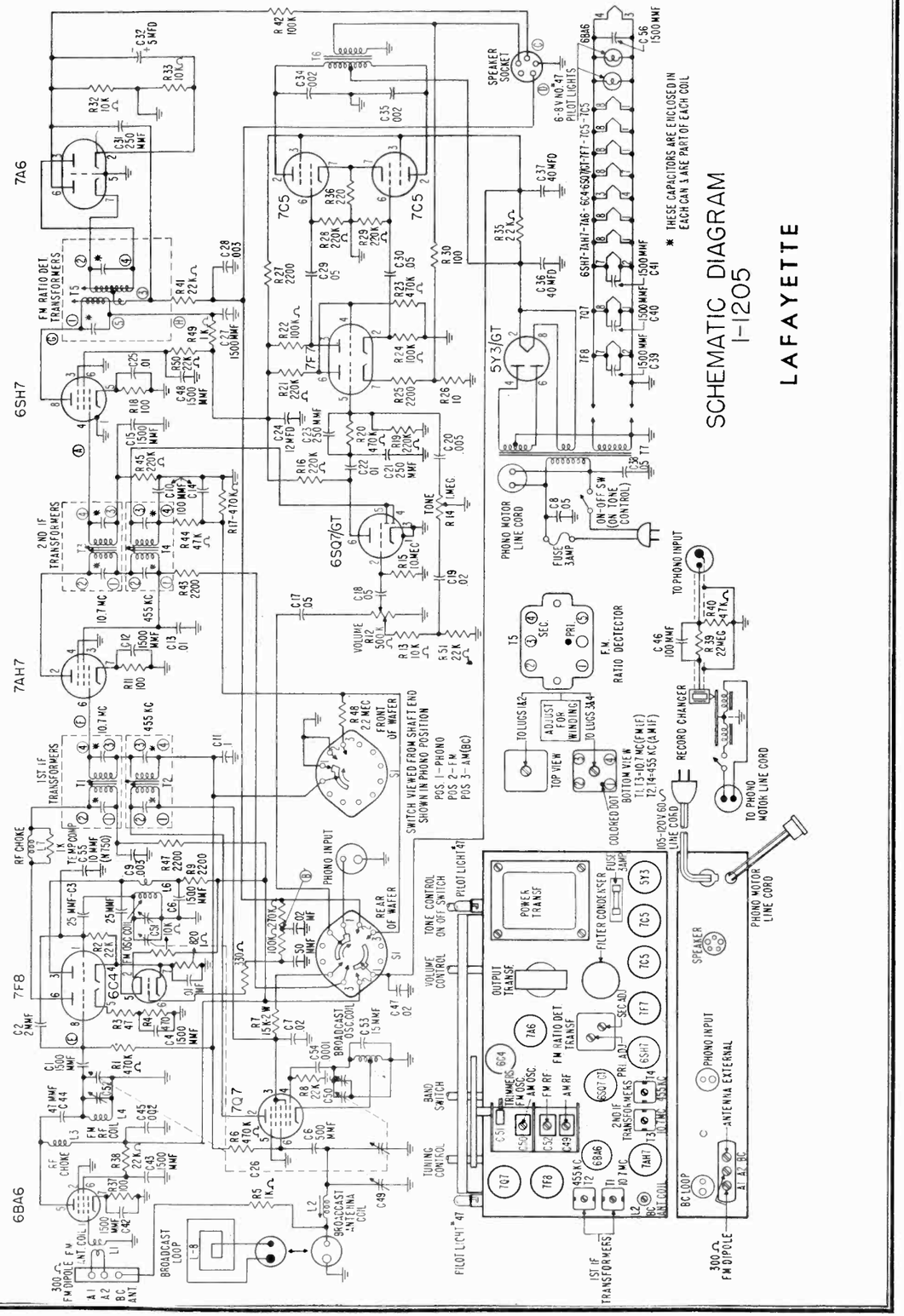
ESPEY MFG. COMPANY, INC.

MODEL 7B
AC-DC



RECORD CHANGER: Garrard Model RC60, RCD.CH. 15-1

ESPEY MFG. COMPANY, INC. MODEL 7B-12



MODEL 7B-12 ESPEY MFG. COMPANY, INC.

This Receiver features the latest in A. M. - F. M., Receiver Design. Eleven (11) tubes plus a Rectifier are used in the A. M. — F. M. superheterodyne circuit. separate antennas are supplied for A. M. and F. M. An automatic frequency control tube is used to stabilize the F. M. and simplify tuning.

TUBE COMPLEMENT:

1 Type 6BA6 — F. M. R F. Amplifier
1 Type 7F8 — F. M. Converter
1 Type 7Q7 — A. M. Converter
1 Type 6C4 — Automatic Frequency Control
1 Type 7AH7 — I. F. Amplifier
1 Type 6SH7 — Detector Driver (F.M.)
1 Type 6SQ7 — 1st Audio Amplifier, A. M. Detector
1 Type 7A6 — Ratio Detector
1 Type 7F7 — 2nd Audio Amplifier and phase inverter
2 Type 7C5 — Beam power output.
1 Type 5Y3/GT — Rectifier.

1. OPERATING CONTROLS:

1) The "ON-OFF" power switch and Tone Control is the knob at the extreme left of the set. Turn this control in a clockwise direction until the switch clicks and the dial becomes illuminated. Turning this control further in the same direction will change the tone.

2) The Volume Control is the second knob from the left. Turning this control in a clockwise direction will increase the volume.

3) The Band Switch is the third knob from the left. The extreme counterclockwise position of this knob is for phonograph operation. The center position is for F.M. reception. The extreme clockwise position is for A. M. reception.

4) The Tuning Control is the extreme right hand knob. Turning this knob in either direction will move the dial pointer and select the stations on the A. M. or F. M. Bands.

2. ANTENNAS:

In most cases it will not be necessary to use external antennas, since the receiver is equipped with a loop antenna for AM reception and an indoor type folded dipole antenna for FM reception.

When inadequate reception is obtained from a desired station, it may be necessary to reposition the antennas to favor that station. On AM, the loop should be turned so that the edge faces toward the station desired. On FM, the entire cabinet should be positioned so that the back is broadside to the direction from which the signals are transmitted.

For the reception of weak or distant stations, or for the operation of the receiver in unfavorable locations, provisions are made for the use of external antennas. The folded dipole should be disconnected when an external FM antenna is employed.

Do not disconnect the AM loop when an external antenna is used on standard broadcast.

3. SERVICE NOTES:

Failure of the Receiver to operate may be due to:

1) All tubes not firmly in sockets.
2) No current at power socket.
3) Band Switch in wrong position.
4) Speaker not plugged in.
5) Antennas not attached.
6) Defective fuse in Receiver.

4. ALIGNMENT PROCEDURE FOR A. M.:

Equipment Required:

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

1. Set band switch to AM, advance volume control to full volume setting.

2. Connect output meter across voice coil.

3. Connect the Signal Generator across the broadcast band antenna (Rear) section of the variable condenser. The "high" side of the Generator should connect to the stator section and the "ground" side to the chassis. Adjust 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.

4. Connect the "high" side of the Generator to the antenna terminal with a 200mmf condenser inserted in series. Connect the "ground" side of the Generator to the chassis. Tune receiver to 60 on the dial, adjust Signal Generator to 600kc. Adjust the BC antenna coil for maximum deflection on the output meter. Use a weak signal.

5. Tune receiver to 160 on the dial. Adjust Signal Generator to 1600kc. Adjust BC oscillator and BC antenna trimmers for maximum output.

6. Repeat operations 4 and 5.

5. *ALIGNMENT PROCEDURE FOR F. M.:*

NOTE: *Points A. B. C. D. E. F. G. and H are noted on circuit diagram. Points C, and D have been brought out to the unused contacts of the speaker socket at the rear of the chassis.*

Equipment Required:

a) High frequency Signal Generator with 88-108 Mc tuning range.

b) Signal Generator capable of delivering .1 Volt at 10.7mc.

c) Audio output meter.

d) D. C. vacuum tube voltmeter with zero center scale.

e) Tuning wand.

Disable A.F.C. during alignment of F.M. circuits by short circuiting point "B" to chassis.

A. Ratio Detector Alignment:

1. Connect V.T.V.M. across point "C" and ground, (Detector Voltage).

2. Feed 10.7mc unmodulated R.F. Signal into 6SH7 grid (point A) through .01 ufd. condenser. This signal should be .1 volt.

3. Adjust primary of Ratio Detector (T-5) for maximum voltage indication on V. T. V. M.

4. Connect zero centered V. T. V. M. across point "D" and ground.

5. Adjust secondary of Ratio Detector (T-5) for zero indication.

6. Tune 10.7mc Signal Generator higher in frequency (about 200kc) until maximum voltage reading is obtained on V. T. V. M.; note this voltage, then tune signal generator lower in frequency until maximum voltage of the opposite polarity is obtained. Note this voltage, then if necessary re-adjust primary of the Det. (T-5) until the voltages are about equal on either the high or low side of 10.7 mc.

B. 10.7 I. F. ALIGNMENT:

1. Shunt a 1,000-ohm carbon resistor across the primary of the detector (T-5) (Points G and H).

2. Connect output meter across speaker voice coil.

3. Volume and tone controls at maximum clockwise position.

4. Connect 10.7mc (modulated 30%) signal generator through .01ufd. condenser across point "F" and ground.

5. Adjust secondary, then primary of (T-3) for maximum audio output. (Reduce input signal to maintain output at .5-watt level.)

6. Connect 10.7mc 30% modulated signal generator across point "E" and ground.

7. Adjust secondary, then primary of (T-1) for maximum audio output. (Reduce input signal to maintain output at .5-watt level.)

8. Remove 1000-ohm shunting resistor from across primary of (T-5).

C. OSCILLATOR AND R. F. ALIGNMENT:

1. Connect V. T. V. M. across point "C" and ground, (detector voltage).

2. Connect 108mc signal generator to FM antenna terminals. If generator impedance is low, put one 150-ohm carbon resistor in series with each of the generator leads. Tune receiver dial to 108 mc.

3. Adjust FM oscillator trimmer (C-51) for maximum V. T. V. M. reading.

4. Adjust FM R.F. trimmer (C-52) for maximum V. T. V. M. reading. During alignment reduce input signal to maintain Detector voltage at 2.V.

5. Repeat steps 3 and 4.

6. Feed a 90mc signal into antenna terminals (as in C-2), tune receiver dial to signal.

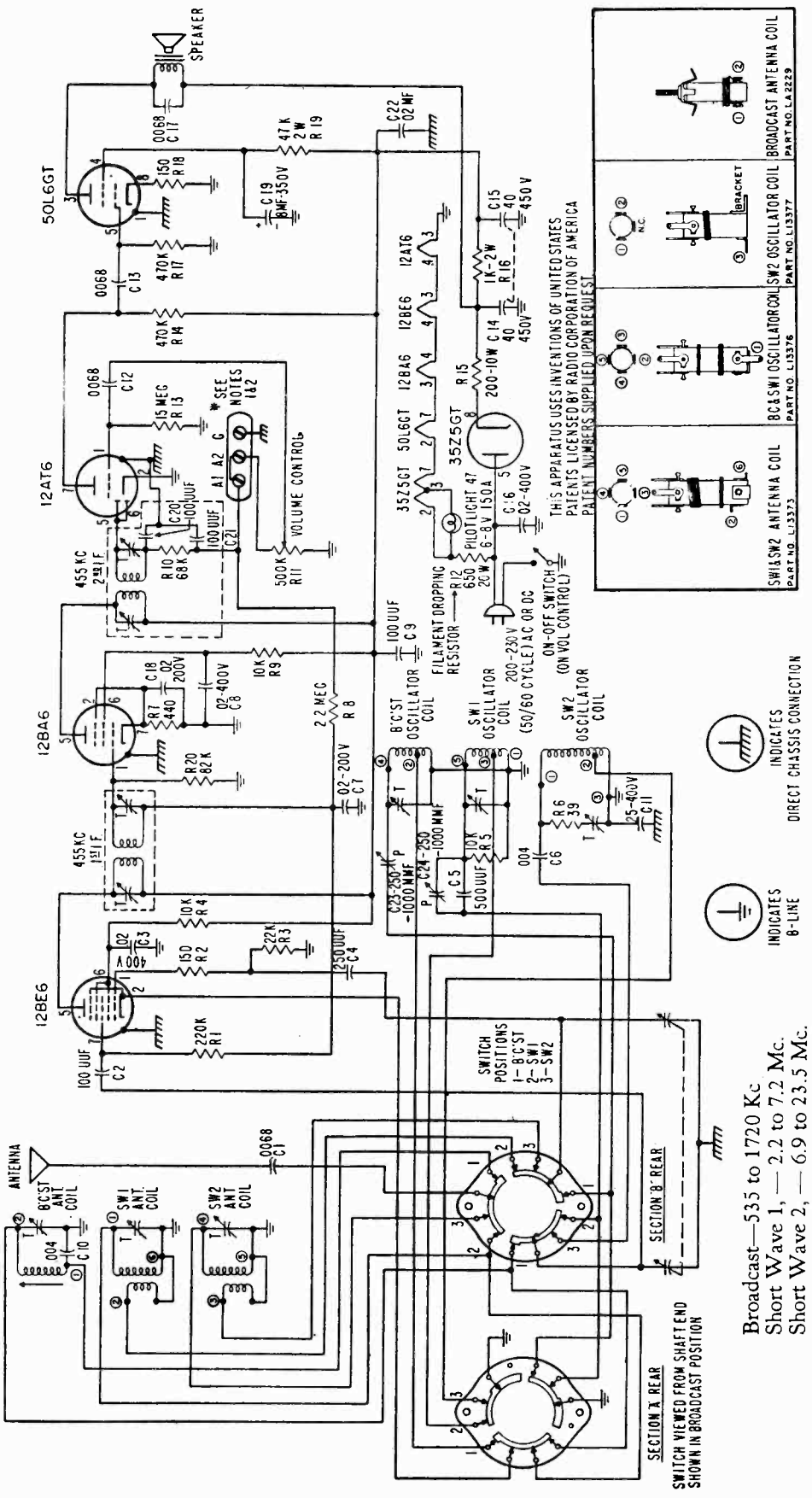
7. Test R. F. coil with tuning wand and if necessary adjust spacing of FM R.F. coil (L-4) for maximum V.T. V.M. reading at 90mc. During alignment reduce input signal to maintain Detector voltage at 2.V.

8. Repeat steps 2 and 4 if necessary.

9. Remove A.F.C. shorting jumper.

MODEL 502K

ESPEY MFG. COMPANY, INC.



Broadcast—535 to 1720 Kc
Short Wave 1, — 2.2 to 7.2 Mc.
Short Wave 2, — 6.9 to 23.5 Mc.

SCHEMATIC DIAGRAM (*figure 2*)

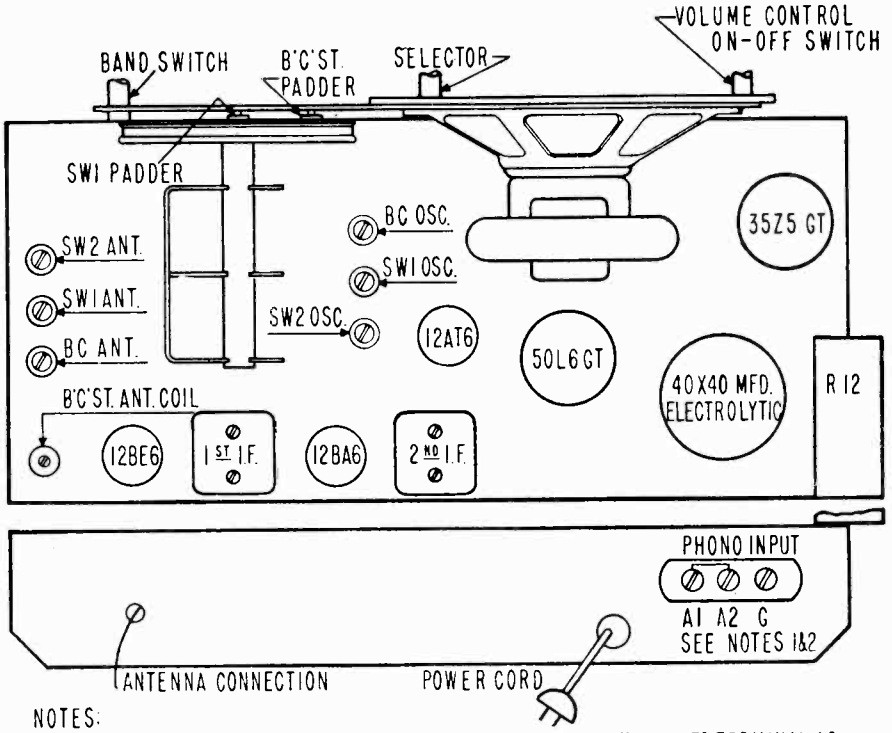
TUBE COMPLEMENT:

1 type 12BE6 — Converter, Oscillator
1 type 12BA6 — I.F. Amplifier
1 type 12AT6 — Detector, A.V.C., First Audio Amplifier
1 type 50L6GT — Beam power output
1 type 35Z5GT — Rectifier

ESPEY MFG. COMPANY, INC. MODEL 502K

FAILURE OF THE RADIO RECEIVER TO OPERATE MAY BE DUE TO:

1. No current at power socket.
2. Tubes not firmly in sockets.
3. Antenna not connected.
4. Defective tube.
5. Band Switch in wrong position.
6. "Phono" terminal jumper missing or or incorrectly connected.



NOTES:
1—FOR RADIO OPERATION CONNECT JUMPER FROM TERMINAL A1 TO TERMINAL A2.
2—FOR PHONO OPERATION REMOVE A1 TO A2 JUMPER. CONNECT PICKUP ACROSS TERMINAL A2 & G.

Figure 1 Tube and Trimmer Locations Radio Receiver Model 502K

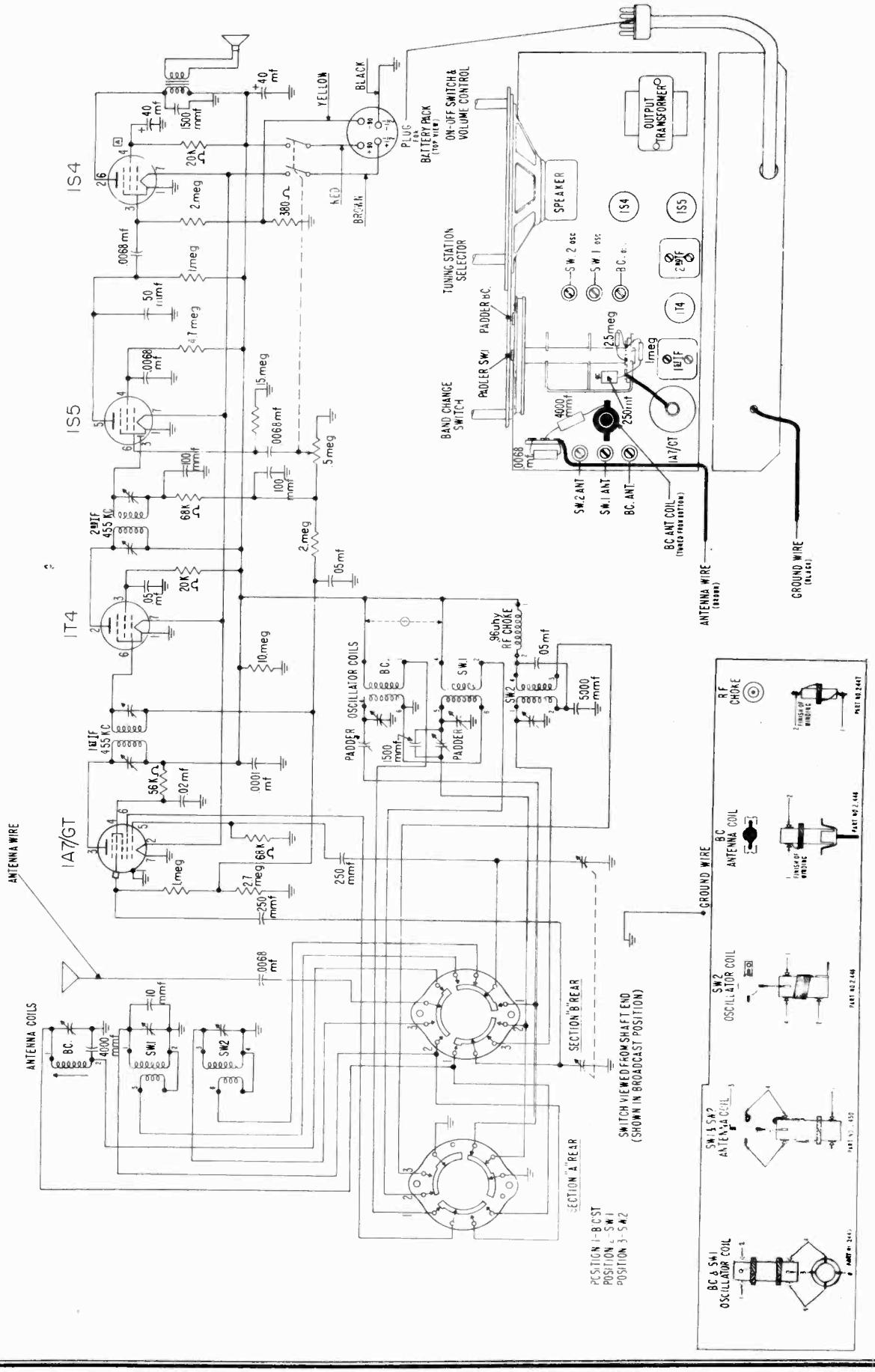
ALIGNMENT PROCEDURE:

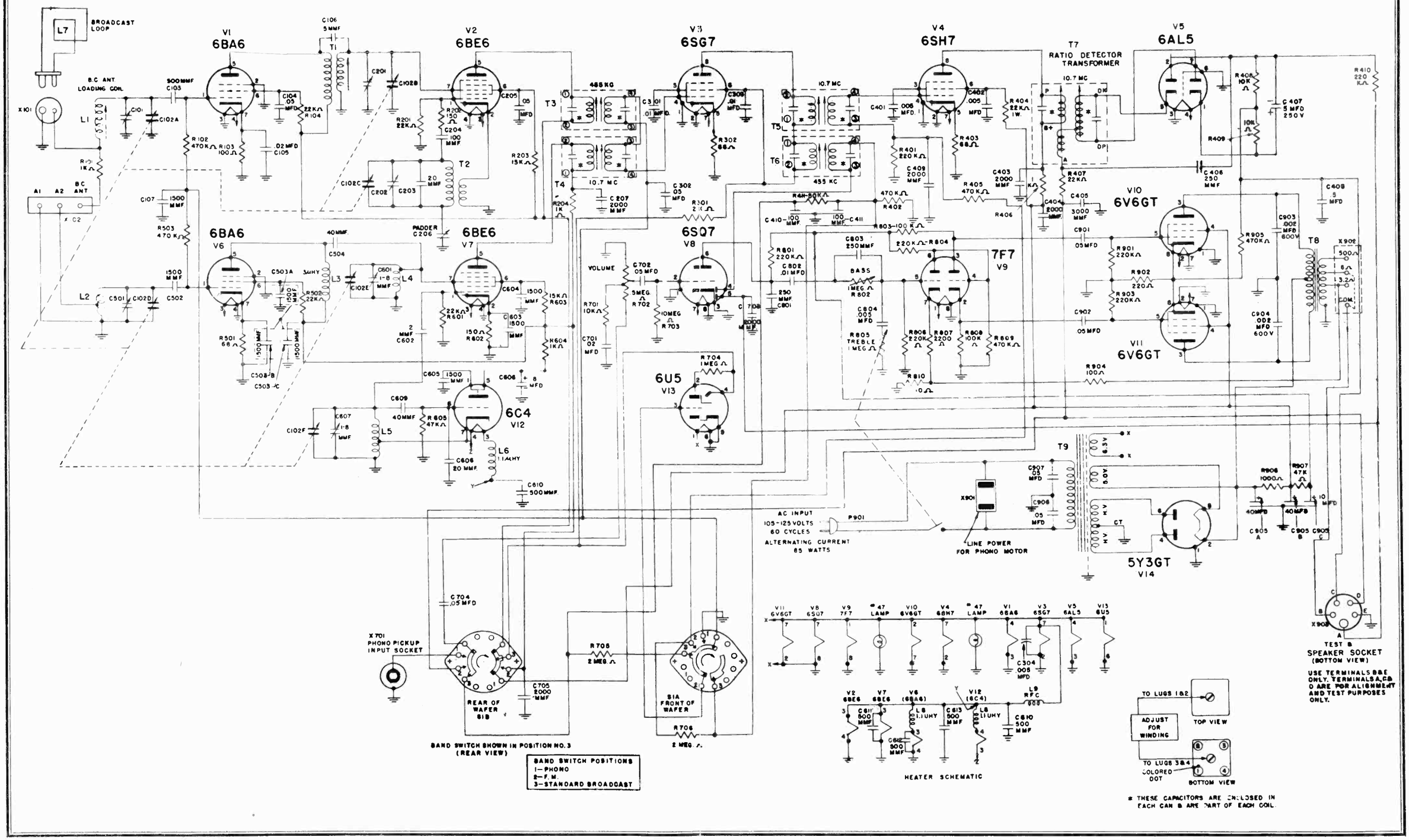
Steps	Connect Output of Generator to	Tune Generator to	Band Switch to	Tune Radio to	Adjust the following for maximum peak output
1.	Tuning condenser stator (RF) in series with .05 mfd.	455 kc	Bcst	Quiet point on high frequency end of dial.	2nd and 1st transformers.
2.	Ant in series with 200 mmf.	1500 kc	Bcst	1500 kc on dial.	BC Osc. Trimmer
3.	Same as above	1500 kc	Bcst	Sig. (1500 kc).	BC Ant. Trimmer
4.	Same as above	600 kc	Bcst	600 kc on dial.	BC Osc. padder. Ant. Coil core.
5.	Same as above	1500 kc	Bcst	1500 kc on dial.	BC Osc. trimmer. BC Ant. trimmer.
6.	Ant. in series with 400 ohm Carbon resistor	6Mc	SW1	6Mc on dial.	SW1 Osc. trimmer**
7.	Same as above	6Mc	SW1	6Mc	SW1 Ant. trimmer.
8.	Same as above	2.5Mc	SW1	2.5Mc	SW1 Ant. trimmer. Rock in SW1 Osc. padder.
9.	Same as above	6Mc	SW1	6Mc (sig.)	SW1 Ant. trimmer. SW1 Osc. trimmer.
10.	Same as above	21Mc	SW2	21Mc	SW2 Osc. trimmer.** SW2 Ant. trimmer.
11.	Same as above	21Mc	SW2	Sig. (21 Mc).	SW2 Ant. trimmer.

*Before alignment set dial pointer on dial point marker with condenser plate fully meshed.
**Caution adjust to peak closest to minimum trimmer capacity.

MODEL 528

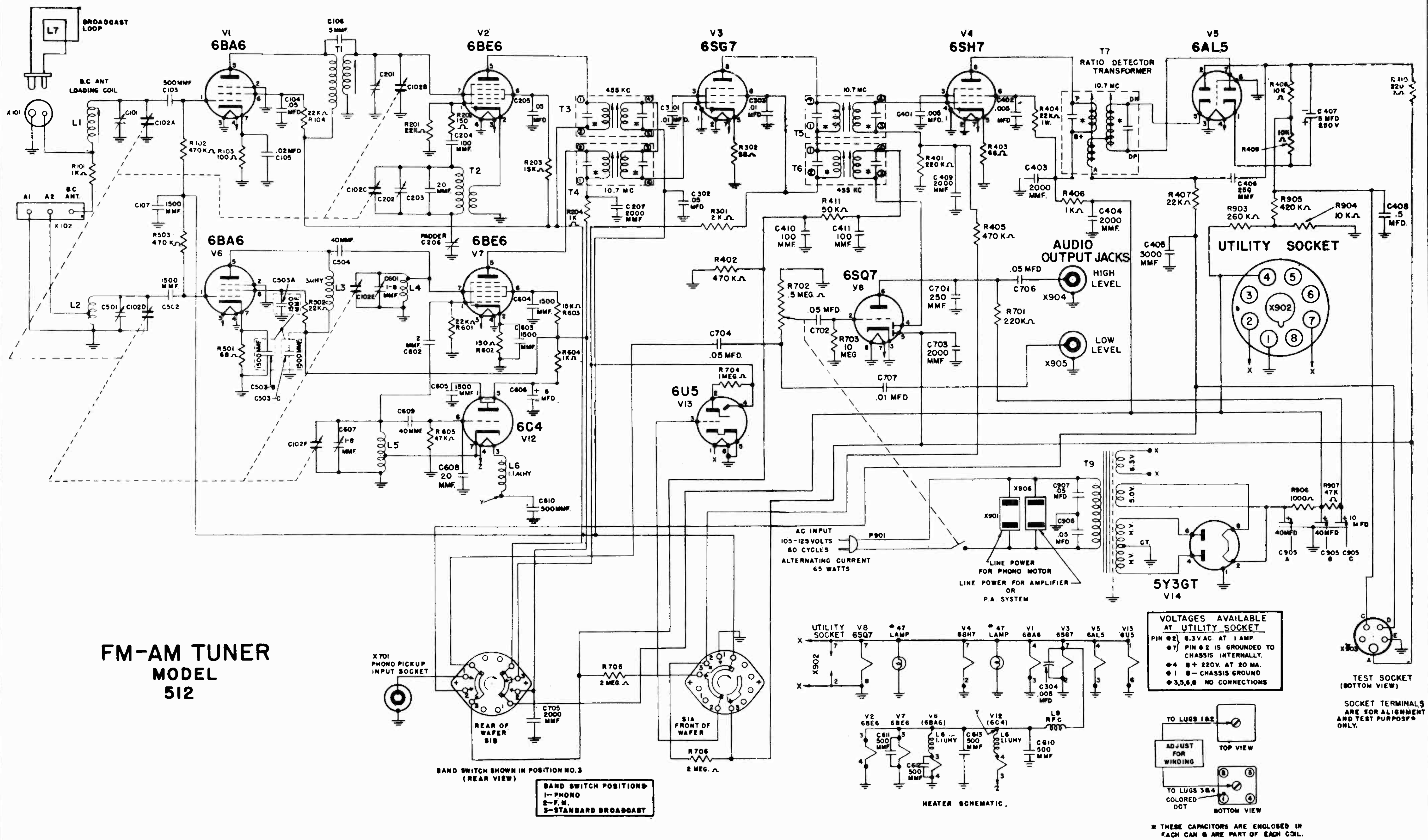
ESPEY MFG. COMPANY, INC.

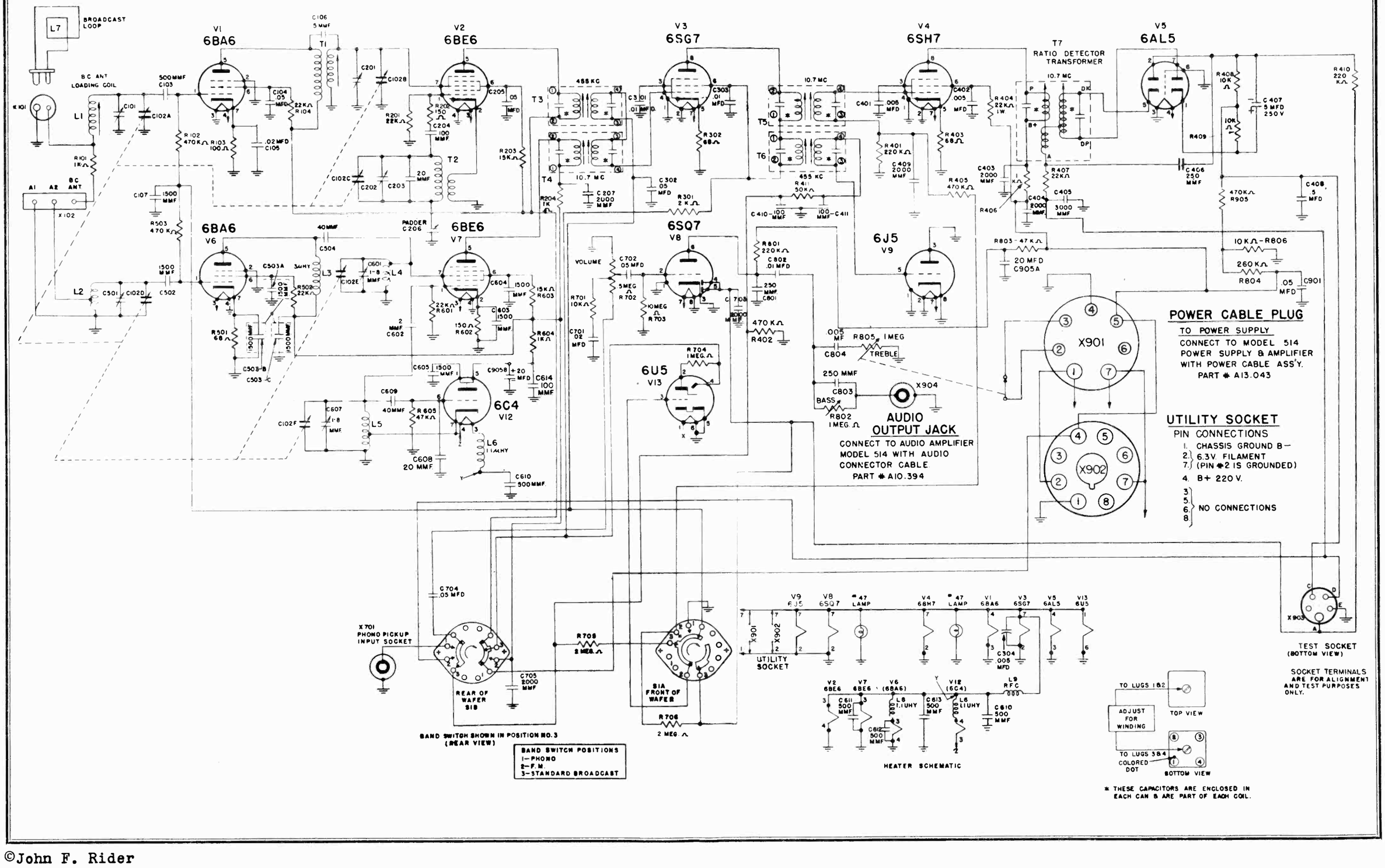




MODEL 512

ESPEY MFG. COMPANY, INC.

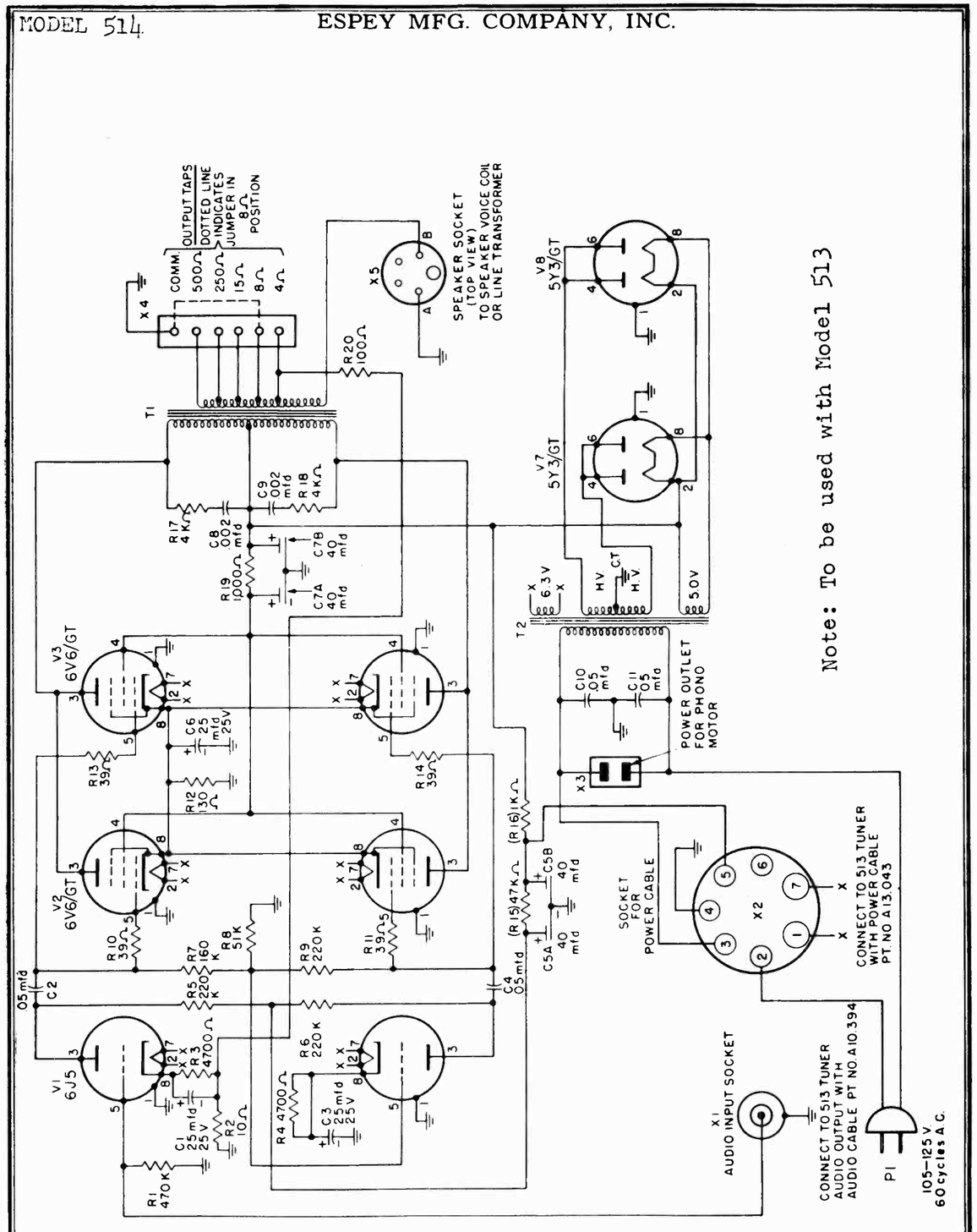




MODEL 514.

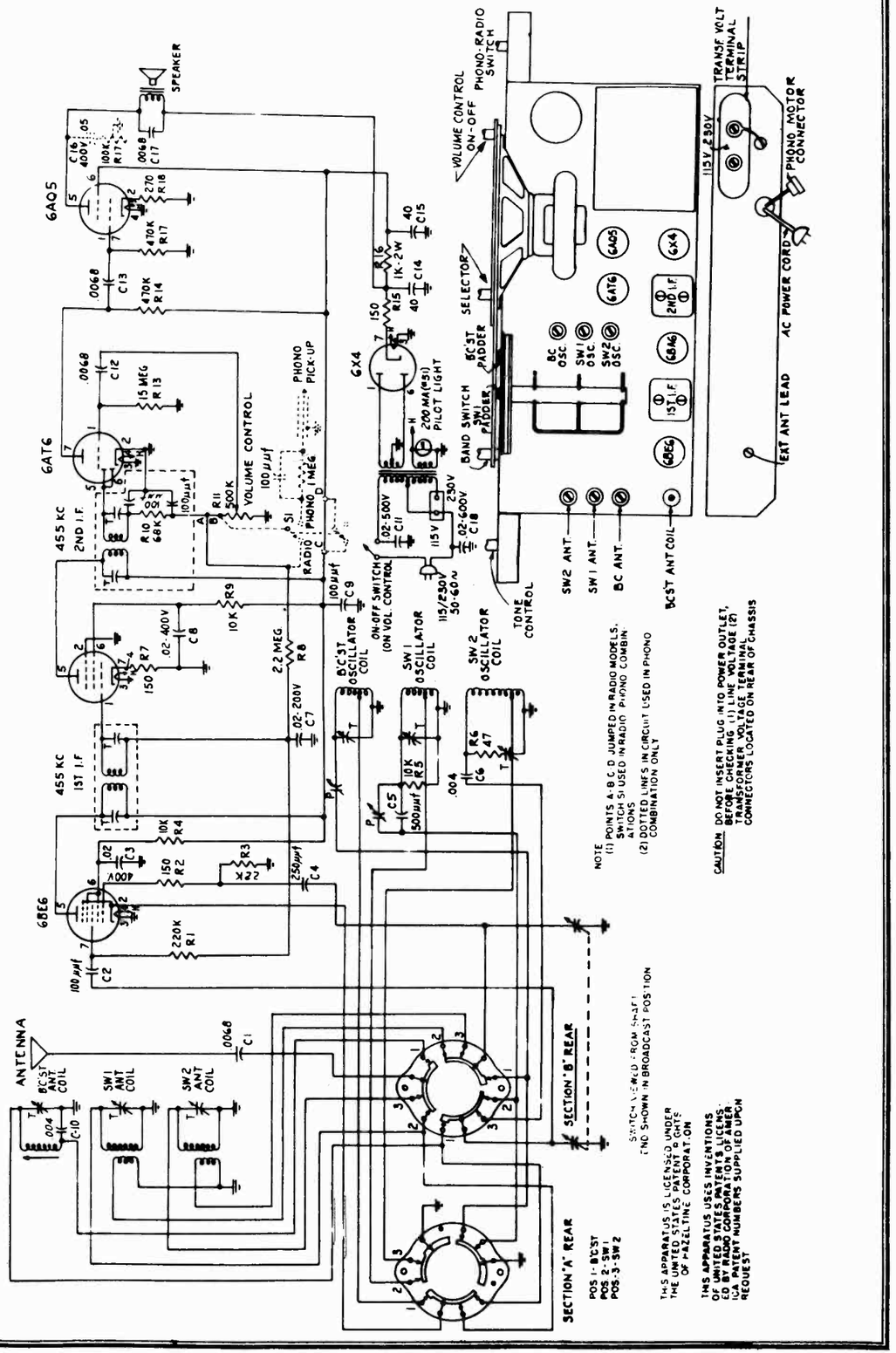
ESPEY MFG. COMPANY, INC.

Note: To be used with Model 513

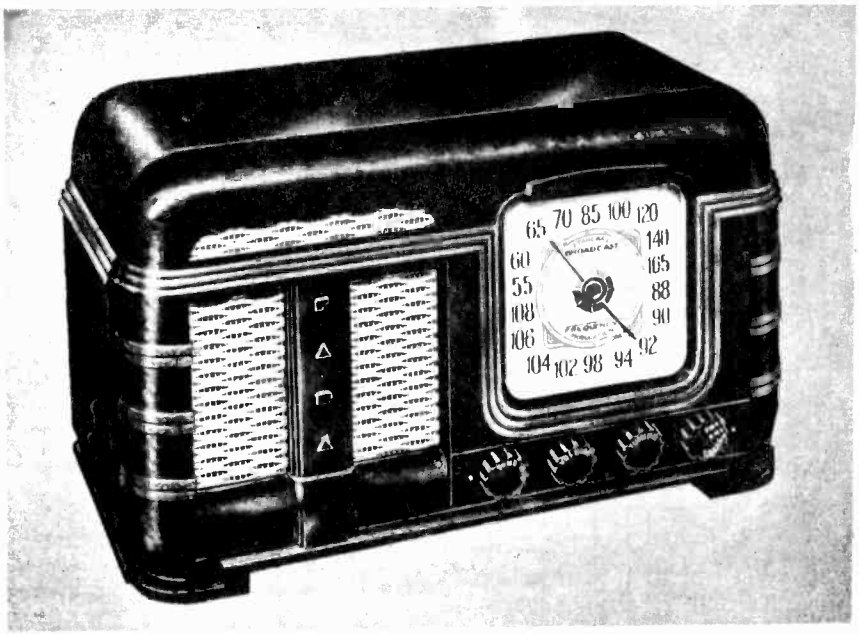


ESPEY MFG. COMPANY, INC.

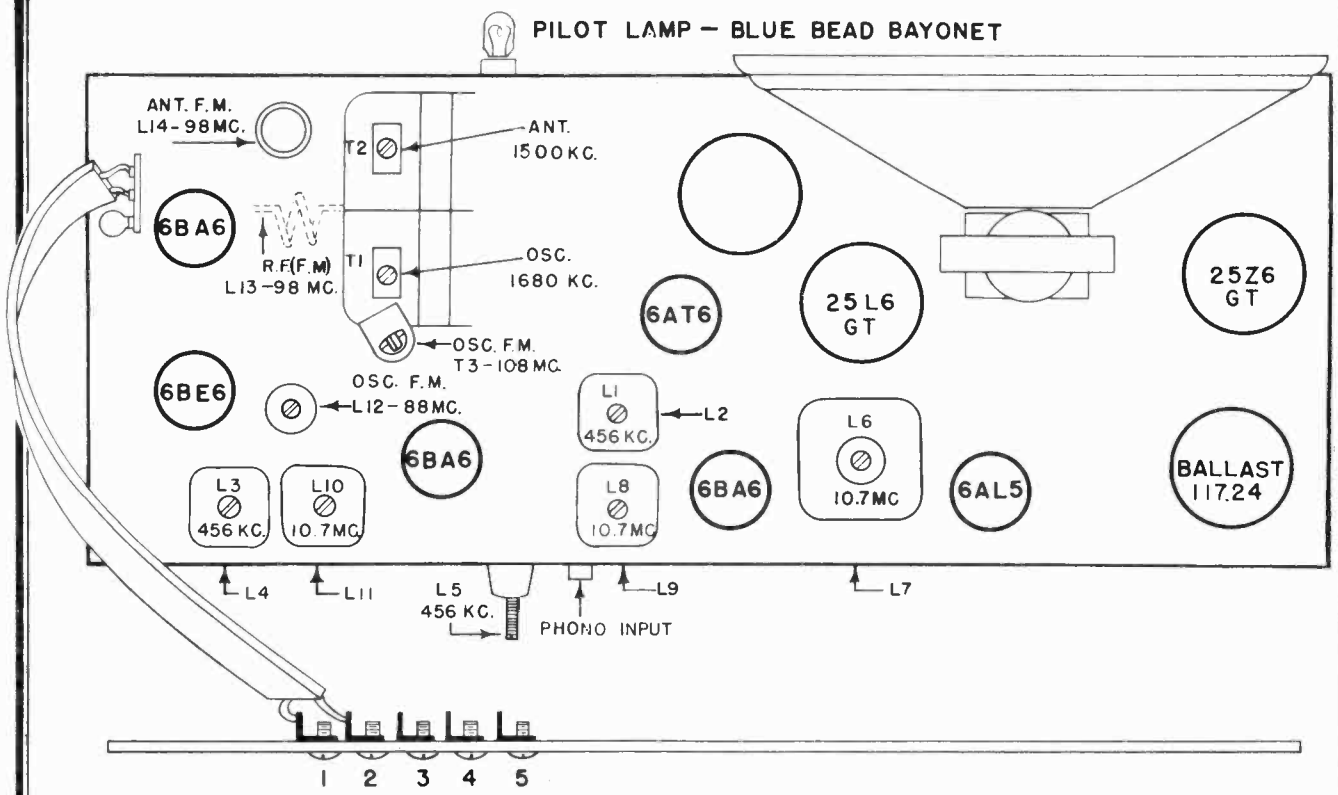
MODEL 10536A



FADA RADIO & ELECTRIC CO., INC. MODEL 790



TUBE LAYOUT

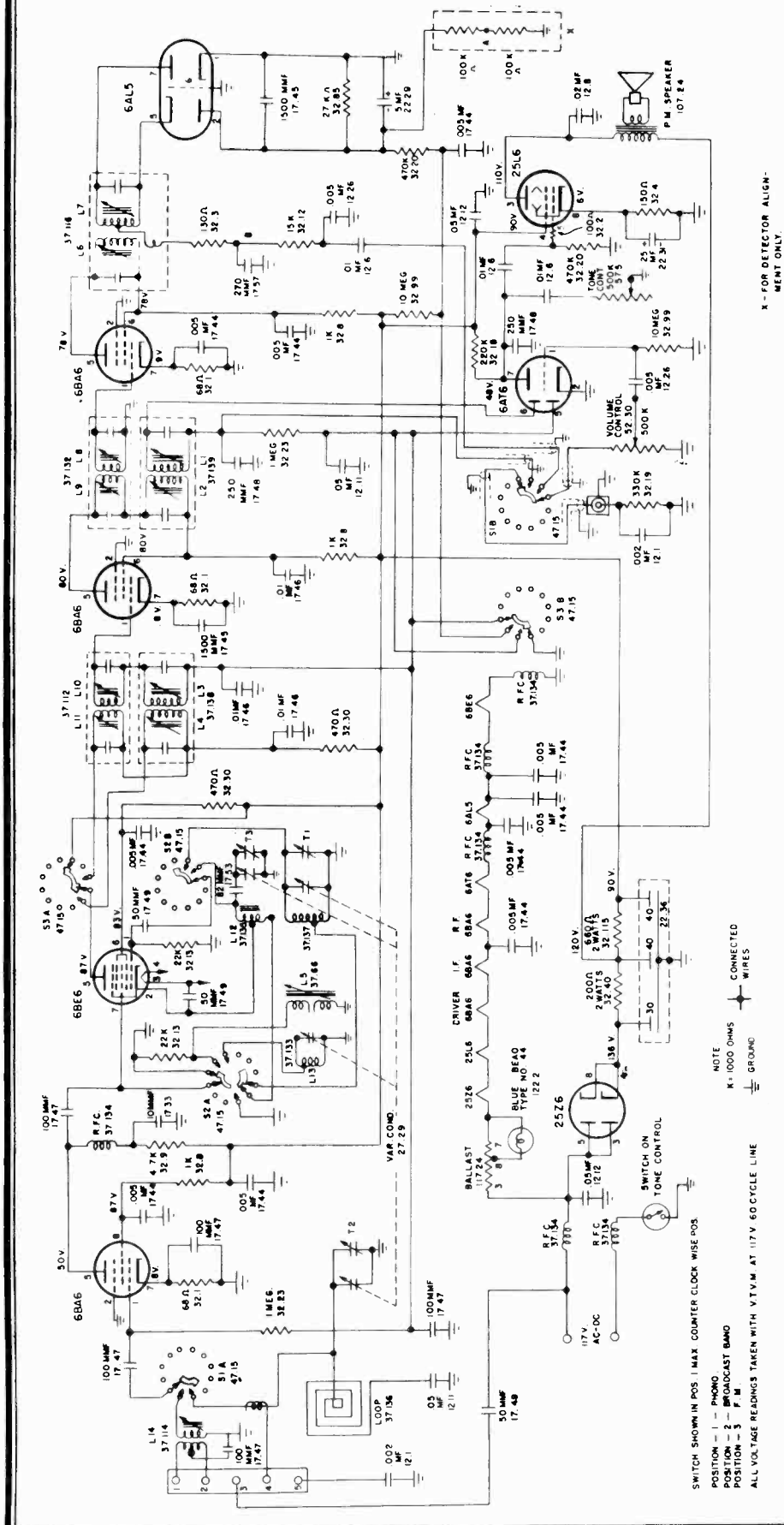


1 & 2 - EXT. F.M. ANT.
LINK 2 TO 3 FOR INT. F.M. ANT.
4 EXT. B.C. ANT.
5 GROUND.

TUNING RANGE
B.C. - 530 KC. - 1680 KC.
F.M. - 87MC. - 109MC.

MODEL 790

FADA RADIO & ELECTRIC CO., INC.



Tubes: 6BA6 R.F. Amplifier, A.M. and F.M.
6BE6 Osc. Converter, A.M. and F.M.
6BA6 I.F. stage, A.M. and F.M.
6BA6 Driver F.M.
6AT6 A.M. Detector and First Audio
6AL5 F.M. Detector
25L6 GT Power output
25Z6 GT Rectifier
Ballast

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

Power consumption: 60 watts

Frequency Range: Standard Broadcast—530-1680 KC
FM—87-109 MC

Speaker: 6" 1.47 oz. Alnico V Magnet
Speaker Transformer: 2000 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:

A.M.:

Band switch in A.M. position
Volume Control and Tone Control in maximum clockwise position.
Low range A.C. meter connected across voice coil to indicate output.
Keep signal generator attenuated so as to maintain ½ scale reading on output meter.
Make certain that the dial pointer is exactly horizontal when variable condenser is fully meshed.

	Receiver Dial at	Signal Generator Frequency	Dummy Antenna	Connect Signal Generator To:	Refer to Chassis Layout for Location of component to be adjusted
1.	Variable Cond. fully open.	456 KC	1 MF	Control Grid 6BE6 tube, pin #7.	Adjust L1, L2, L3 and L4 for maximum output.
2.	Variable Cond. fully open.	456 KC	.1 MF	Top of first section of variable condenser (stator of the A.M.-R.F. section.)	Adjust L5 for minimum output.
3.	Variable Cond. fully open.	1680 KC	200 MMF	Terminal #4 on back of loop.	Adjust T1 for maximum output.
4.	1500 KC	1500 KC	200 MMF	Terminal #4 on back of loop.	Adjust T2 for maximum output.
5.	600 KC	600 KC	200 MMF	Terminal #4 on back of loop.	Check tracking and bend slotted end plate (first section) of variable if necessary.

F.M.:

Band switch F.M. position. Allow at least 10 minutes "warming up" period.
Use a standard V.T.V.M. with zero center setting.
Use an A.M. signal generator with no modulation, taking harmonics if fundamentals are not available.
Keep signal generator attenuated so as to maintain approximately a 3 volt reading.
Make certain that the dial pointer is exactly horizontal when variable condenser is fully meshed.

	Receiver Dial at:	Signal Generator Frequency	Signal Generator Connected to:	V.T.V.M. Connected to:	Refer to Chassis Layout for Location of Components to be adjusted
1.	98 MC	10.7 MC	Control grid Pin #1 6BA6 (2nd. I.F.) Socket Series with .01 Condenser.	Across the two 100,000 ohm resistors marked X.	Adjust L6 and L7 for maximum output.
2.	98 MC	10.7 MC	Control grid Pin #7 6BE6 Socket Series with .01 condenser.	"	Shunt L9 with a 680 ohm carbon resistor and adjust L8 for maximum output.
3.	98 MC	10.7 MC	"	"	Shunt L8 with a 680 ohm carbon resistor and adjust L9 for maximum output.
4.	98 MC	10.7 MC	"	"	Adjust L10, L11 and L6 for maximum output.
5.	98 MC	10.7 MC	"	Ground lead of V.T.V.M. to point A on schematic and probe to point B.	Adjust L7 for zero output. (Check zero setting of V.T.V.M.) Meter should register reverse when slug is rotated through zero output.
6.	108 MC	108 MC	Terminals 1 & 2 in series with 2 130 ohm carbon resistors.	Same as step #1.	Adjust T3 for maximum output. Starting with the trimmer at minimum capacity use the first peak.
7.	88 MC	88 MC	"	"	Adjust L12 for maximum output.
8.		Repeat steps 6 & 7 until L12 requires no further adjustment.			
9.	98 MC	98 MC	Same as step #6	Same as step #1.	Adjust L13 and L14 for maximum output.

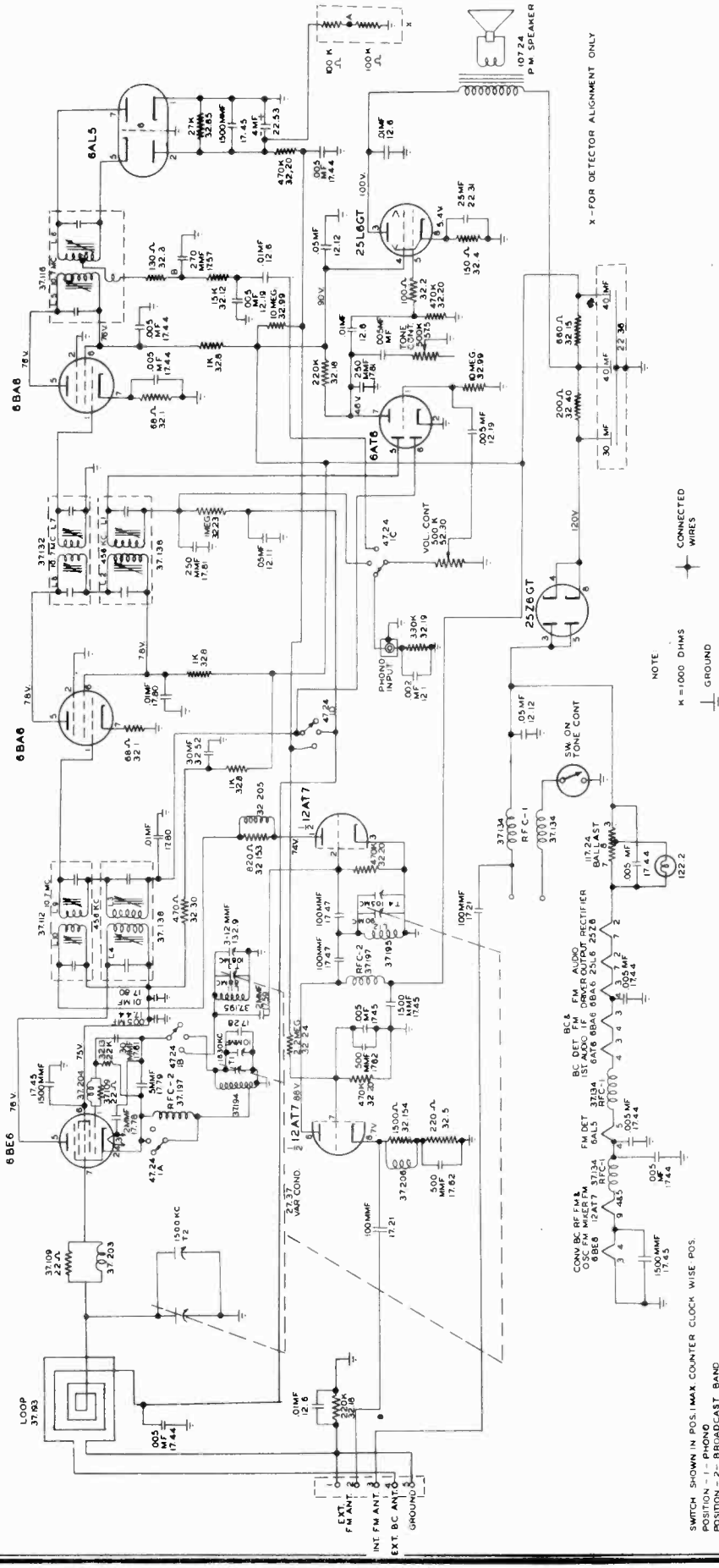
Caution: If any adjustments are made in the A.M.-I.F.'s after the F. M. I.F.'s have been aligned, it would be necessary to readjust the F.M. I.F.'s.

Part No.	Description
12.26	Tubular Condenser .005 mfd—200 W.V.
12.6	Tubular Condenser .01 mfd—400 W.V.
12.8	Tubular Condenser .02 mfd—400 W.V.
12.1	Tubular Condenser .002 mfd—200 W.V.
12.11	Tubular Condenser .05 mfd—200 W.V.
12.12	Tubular Condenser .05 mfd—400 W.V.
17.47	Ceramic Condenser 100 mfd ±10% Insul.
17.49	Ceramic Condenser 50 mmfd ±10% "
17.48	Ceramic Condenser 250 mmfd ±10% "
17.33	Ceramic Condenser 10 mmfd ±20% "
17.44	Ceramic Condenser 5000 mmfd gmv "
17.46	Ceramic Condenser .01 mfd gmv "
17.57	Ceramic Condenser 270 mmfd ±10% "
17.53	Ceramic or Mica 82 mmfd ±5% "
17.45	Ceramic 1500 mmfd ±20% "
22.29	Electrolytic 5 mfd 25 W.V. Alu. can.
22.31	Electrolytic 25 mfd 25 W.V. Alu. can.
22.36	Electrolytic 30-40-40 150 W.V. Alu. can.
27.29	Variable Condenser (with drum)
32.1	Carbon Resistors 68 ohm ½ Watt ±10%
32.4	Carbon Resistors 150 ohm ½ Watt ±10%
32.3	Carbon Resistors 130 ohm ½ Watt ±10%
32.30	Carbon Resistors 470 ohm ½ Watt ±10%
32.8	Carbon Resistors 1000 ohm ½ Watt ±10%
32.9	Carbon Resistors 4700 ohm ½ Watt ±10%
32.85	Carbon Resistors 27,000 ohm ½ Watt ±10%
32.12	Carbon Resistors 15,000 ohm ½ Watt ±10%
32.13	Carbon Resistors 22,000 ohm ½ Watt ±10%
32.18	Carbon Resistors 220,000 ohm ½ Watt ±20%
32.19	Carbon Resistors 330,000 ohm ½ Watt ±20%
32.20	Carbon Resistors 470,000 ohm ½ Watt ±20%
32.23	Carbon Resistors 1 megohm ½ Watt ±20%
32.99	Carbon Resistors 10 megohm ½ Watt ±20%

Part No.	Description
32.40	Carbon Resistors 200 ohms 2 Watts ±10%
32.115	Carbon Resistors 660 ohms 2 Watts ±10%
32.2	Carbon Resistors 100 ohms ½ Watt ±10%
37.116	Coil Ratio Detector
37.112	Coil Fm I.F. 1st.
37.132	Coil FM I.F. 2nd.
37.138	Coil BC I.F. 1st.
37.139	Coil BC I.F. 2nd.
37.137	Coil BC Oscl.
37.135	Coil FM Oscl.
37.133	Coil FM R.F.
37.117	Coil FM Ant.
37.136	BC Loop
37.66	Wave Trap
37.134	R.F. Choke
47.15	Switch
52.30	Volume Control
57.5	Tone Control (with switch)
77.128	Crystal
77.126	Dial (Pointer)
77.127	Dial (Scale)
77.124	Dial (Vernier Drive)
97.141	Grille Silk
97.130	Back
97.131W	Cabinet (Walnut)
97.131V	Cabinet (Ivory)
97.142	Metal Grille (Speaker)
97.138	Baffle (Speaker)
107.24	Speaker with Transformer & Bracket 6" P.M.
117.24	Ballast Tube
132.7	Ceramic Trimmer 5-20 mmf N 500
142.45V	Knob Band Selector (Ivory)
142.45W	Knob Band Selector (Walnut)
142.46V	Knob Tuning (Ivory)
142.46W	Knob Tuning (Walnut)
142.47W	Knob Volume (Walnut)
142.47V	Knob Volume (Ivory)
142.48W	Knob Tone AC-On-Off (Walnut)
142.48V	Knob Tone AC-On-Off (Ivory)

FADA RADIO & ELECTRIC CO., INC.

MODEL 790
Series B etc.



Tubes:
12AT7 F.M. R.F. and Mixer
6BE6 Osc. F.M. Converter A.M.
6BA6 I.F. stage, A.M. and F.M.
6BA6 Driver F.M.
6AT6 A.M. Detector and First Audio
6AL5 F.M. Detector
25L6 GT Power output
25Z6 GT Rectifier
Ballast

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

Power consumption: 60 watts

Frequency Range: Standard Broadcast—535-1630 KC
FM—87.5-108.5 MC

Speaker: 6" 1.47 oz. Alnico V Magnet
Speaker Transformer: 2000 ohms 400 cycles.
Speaker Voice Coil: 3.2 ohms

MODEL 790
Series B etc.

FADA RADIO & ELECTRIC CO., INC.

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:

A.M.:

Band switch in A.M. position
Volume Control and Tone Control in maximum clockwise position.
Low range A.C. meter connected across voice coil to indicate output.
Keep signal generator attenuated so as to maintain ½ scale reading on output meter.
Make certain that the dial pointer is exactly horizontal when variable condenser is fully meshed.

	Receiver Dial at	Signal Generator Frequency	Dummy Antenna	Connect Signal Generator To:	Refer to Chassis Layout for Location of component to be adjusted
1.	Variable Cond. fully open.	456 KC	1 MF	Control Grid 6BE6 tube, pin #7.	Adjust L1, L2, L3 and L4 for maximum output.
2	Variable Cond. fully open.	1630 KC	200 MMF	Terminal #4 on back of loop.	Adjust T1 for maximum output.
3	1500 KC	1500 KC	200 MMF	Terminal #4 on back of loop.	Adjust T2 for maximum output.
4	600 KC	600 KC	200 MMF	Terminal #4 on back of loop.	Check tracking and bend slotted end plate (last section) of variable if necessary.

F.M.:

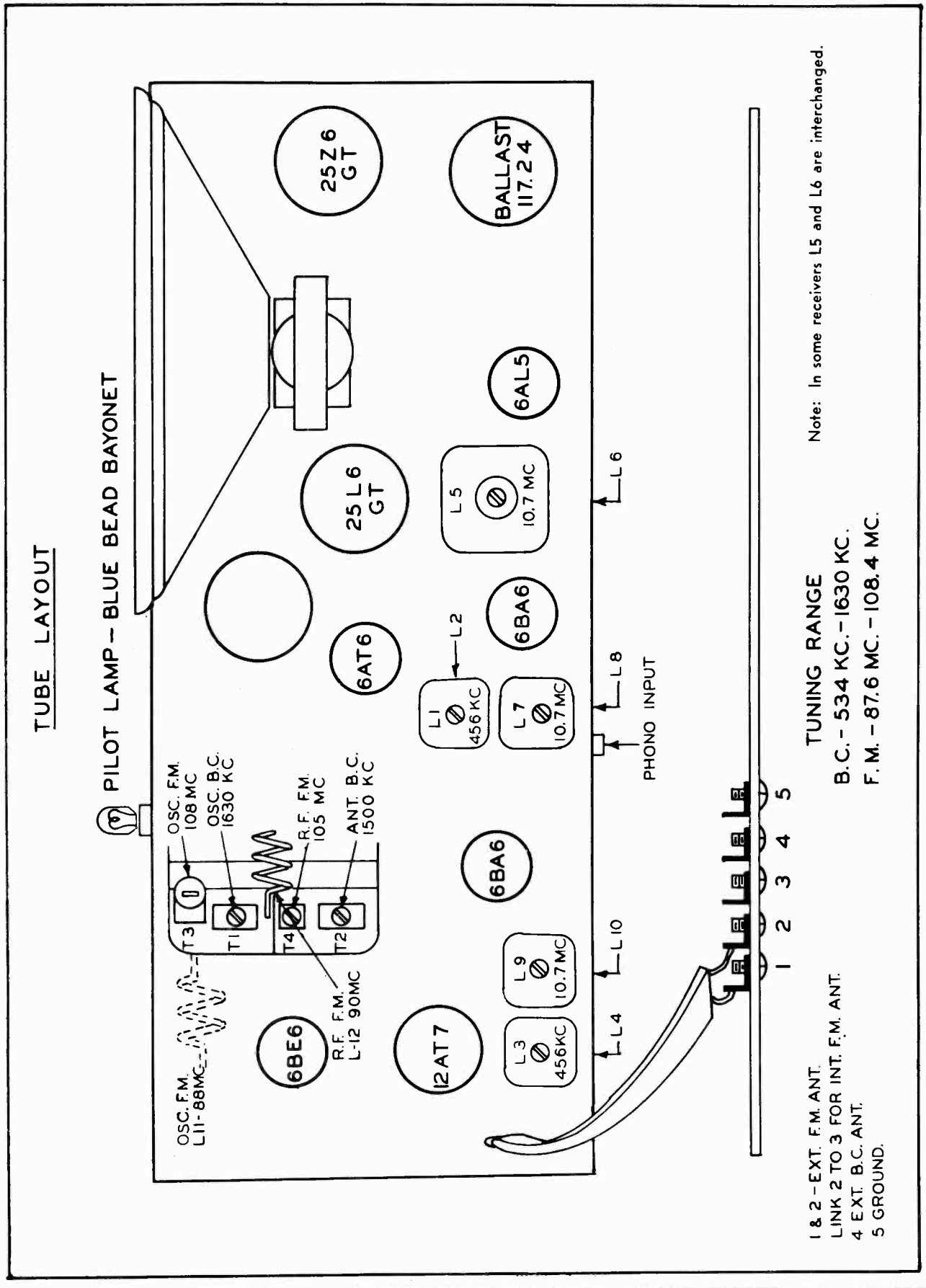
Band switch F.M. position. Allow at least 10 minutes "warming up" period.
Use a standard V.T.V.M. with zero center setting.
Use an A.M. signal generator with no modulation, taking harmonics if fundamentals are not available.
Keep signal generator attenuated so as to maintain approximately a 3 volt reading.
Make certain that the dial pointer is exactly horizontal when variable condenser is fully meshed.

	Receiver Dial at:	Signal Generator Frequency	Signal Generator Connected to:	V.T.V.M. Connected to:	Refer to Chassis Layout for Location of Components to be adjusted
1.	98 MC	10.7 MC	Control grid Pin #1 6BA6 (2nd. I.F.) Socket Series with .01 Condenser.	Across the two 100,000 ohm resistors marked X.	Adjust L5 and L6 for maximum output.
2.	98 MC	10.7 MC	Junction of L12 and T4 in Series with .01 condenser.	"	Shunt L8 with a 680 ohm carbon resistor and adjust L7 for maximum output.
3.	98 MC	10.7 MC	"	"	Shunt L7 with a 680 ohm carbon resistor and adjust L8 for maximum output.
4.	98 MC	10.7 MC	"	"	Adjust L9, L10 and L5 for maximum output.
5.	98 MC	10.7 MC	"	Ground lead of V.T.V.M. to point A on schematic and probe to point B.	Adjust L6 for zero output. (Check zero setting of V.T.V.M.) Meter should register reverse when slug is rotated through zero output.
6.	108 MC	108 MC	Ground to terminal 1 and hot side to terminal 2 in series with a 270 ohm carbon resistor.	Same as step #1.	Adjust T3 for maximum output. Starting with the trimmer at minimum capacity use the first peak.
7.	88 MC	88 MC	"	"	Adjust L11 for maximum output.
8.		Repeat steps 6 & 7 until L11 requires no further adjustment.			
9.	105 MC	105 MC	Same as step #6	Same as step #1.	Adjust T4 for maximum output.
10.	90 MC	90 MC	Same as step #6	Same as step #1	Adjust L12 for maximum output.
11.		Repeat steps 9 & 10 until T4 requires no further adjustment.			

Caution: If any adjustments are made in the A.M.-I.F.'s after the F. M. I.F.'s have been aligned, it would be necessary to readjust the F.M. I.F.'s.

FADA RADIO & ELECTRIC CO., INC.

MODEL 790
Series B etc.



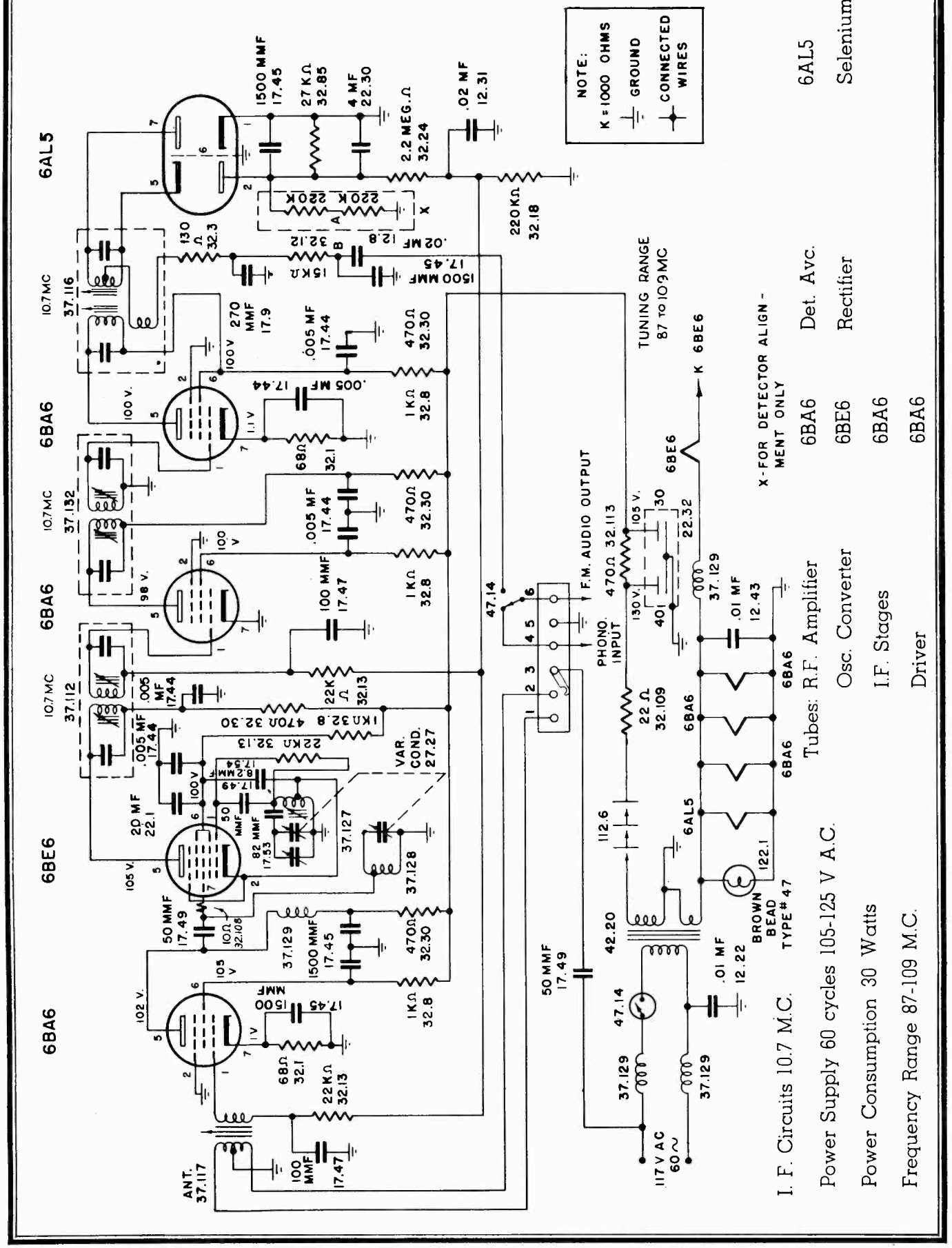
MODEL 790 FADA RADIO & ELECTRIC CO., INC.
Series B etc.

PARTS LIST

Part No.	Description
12.1	Tubular Condenser .002 200 W.V.
12.19	Tubular Condenser .005 400 W.V.
12.6	Tubular Condenser .01 400 W.V.
12.11	Tubular Condenser .05 200 W.V.
12.12	Tubular Condenser .05 400 W.V.
12.56	Tubular Condenser .005 200 W.V. ±10%
17.59	Ceramic Cond. 2 mmf ±.5 mmf Insul.
17.78	Ceramic Cond. 2 mmf ±.5 mmf Insul. M750
17.79	Ceramic Cond. 5 mmf ±.5 mmf Insul.
17.61	Ceramic Cond. 30 mmf ±10% Insul.
17.47	Ceramic Cond. 100 mmf ±10% "
17.21	Ceramic Cond. 100 mmf ±20% "
17.81	Ceramic Cond. 250 mmf ±20% "
17.57	Ceramic Cond. 270 mmf ±10% "
17.62	Ceramic Cond. 500 mmf. ±20% "
17.45	Ceramic Cond. 1500 mmf ±20% "
17.44	Ceramic Cond. 5000 mmf gmv "
17.80	Ceramic Cond. 10,000 mmf gmv "
17.46	Ceramic Cond. 10,000 mmf gmv "
17.28	Ceramic Cond. 10 mmf ±20% "
22.36	Electrolytic 30-40-40 150 W.V. Alum. Can
22.52	Electrolytic 30 mf 150 W.V. Alum. Tube
22.31	Electrolytic 25 mf 25 W.V. Alum. Tube
22.53	Electrolytic 4 mf 50 W.V. Alum. Tube
27.37	Variable Cond. With drum
32.109	Carbon Res. 22 ohm ½ W. ±10% Carbon
32.1	Carbon Res. 68 ohms ½ W. ±10% Carbon
32.3	Carbon Res. 130 ohms ½ W. ±10% Carbon
32.4	Carbon Res. 150 ohm ½ W. ±10% Carbon
32.5	Carbon Res. 220 ohm ½ W. ±10% Carbon
32.30	Carbon Res. 470 ohm ½ W. ±10% Carbon
32.153	Carbon Res. 820 ohm ½ W. ±20% Carbon
32.8	Carbon Res. 1000 ohm ½ W. ±10% Carbon
32.12	Carbon Res. 15000 ohm ½ W. ±10% Carbon
32.85	Carbon Res. 27000 ohm ½ W. ±10% Carbon
32.13	Carbon Res. 22000 ohm ½ W. ±10% Carbon
32.18	Carbon Res. 220,000 ohm ½ W. ±20% Carbon
32.19	Carbon Res. 330,000 ohm ½ W. ±20% Carbon
32.20	Carbon Res. 470,000 ohm ½ W. ±20% Carbon
32.23	Carbon Res. 1 megohm ½ W. ±20% Carbon
32.24	Carbon Res. 2.2 megohm ½ W. ±20% Carbon
32.99	Carbon Res. 10 megohm ½ W. ±20% Carbon
32.41	Carbon Res. 1000 ohm 1 W. ±10% Carbon
32.40	Carbon Res. 200 ohm 2 W. ±10% Carbon
32.115	Carbon Res. 660 ohm 2 W. ±10% Carbon
32.154	Carbon Res. 1500 ohm 2 W. ±20% Carbon
32.2	Carbon Res. 100 ohm ½ W. ±10% Carbon
37.116	Coil Ratio Det.
37.112	Coil F.M. 1st. I.F.
37.132	Coil F.M. 2nd I.F.
37.138	Coil B.C. 1st. & 2nd I.F.
37.194	Coil B.C. Oscl.
37.195	Coil F.M. Oscl. (Made at Fada)
37.196	Coil F.M. R.F. (Made at Fada)
37.193	Coil B.C. Loop
77.128	Crystal
77.125	Dial Plate
77.126	Dial Pointer
77.152	Dial Scale
77.5	Dial Cord
77.4	Dial Spring
77.124	Vernier Drive
97.138	Baffle Speaker
97.141	Grille Silk
97.130	Back
97.131W	Cabinet (Walnut)
97.131V	Cabinet (Ivory)
97.142	Metal Grille
107.24	Speaker with Trans. & Bracket 6" PM
117.24	Ballast Tube
132.9	Ceramic Trimmer 3-12 mmf NPO
142.45V	Knob Band Selector (Ivory)
142.45W	Knob Band Selector (Walnut)
142.46V	Knob Tuning (Ivory)
142.46W	Knob Tuning (Walnut)
142.47W	Knob Volume (Walnut)
142.47V	Knob Volume (Ivory)
142.48W	Knob Tone AC-On-Off (Walnut)
142.48V	Knob Tone AC-On-Off (Ivory)

FADA RADIO & ELECTRIC CO., INC.

MODEL 795
F.M. Tuner



MODEL 795
F.M. Tuner

FADA RADIO & ELECTRIC CO., INC.

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 re-alignment is necessary. Then proceed as follows:

Remove chassis from cabinet, turn on tuner and allow at least 10 minutes "warming up" period.

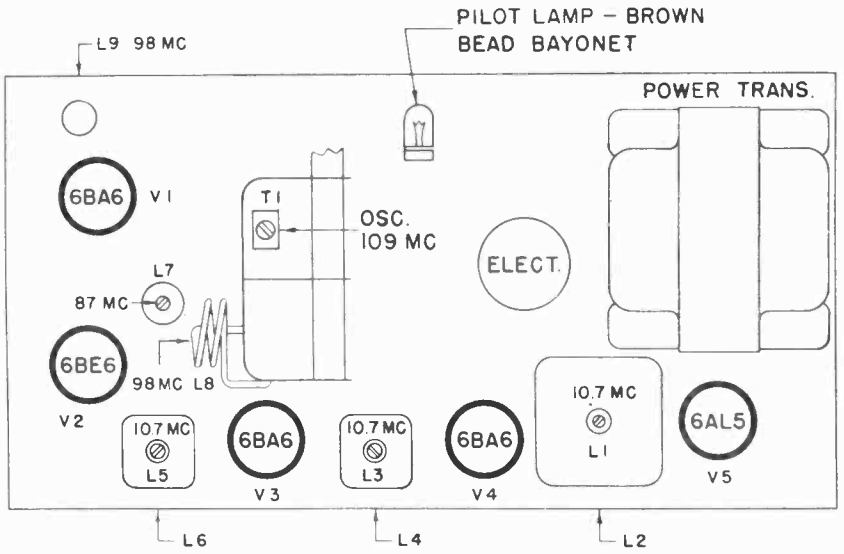
Use a standard V.T.V.M. with zero center setting.

Use an A.M. signal generator with no modulation, taking hormonics if fundamentals are not available.

Keep signal generator attenuated so as to maintain a 3 V reading.

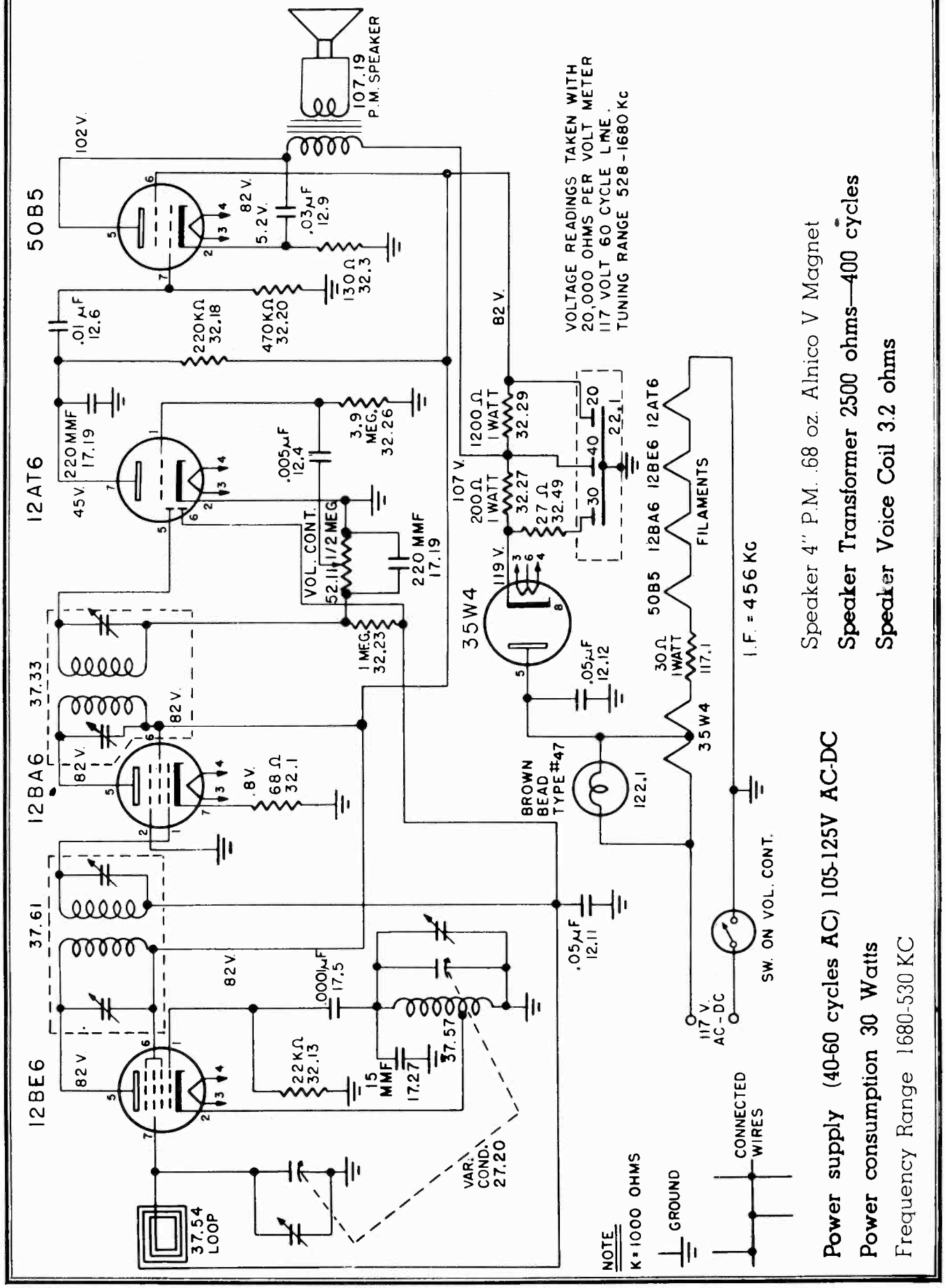
Receiver Dial at:	Signal Generator Frequency	Signal Generator Connected to:	V.T. V.M. Connected to:	Refer to chassis Layout for location of trimmers.
98 MC 1.	10.7MC	Control Grid Pin #1 6BA6 (2nd I.F.) Socket Series with .01 cond.	Across the (2) 22000 ohm Resistors Pin #2 6AL5, Marked X.	Adjust L1, L2 for Maximum Output.
98 MC 2.	10.7MC	Control Grid Pin #7 6BE6 Socket Series with .01 Cond.	"	Shunt L4 with a 680 ohm ½ W carbon & adjust L3 for maximum output.
98 MC 3.	10.7MC	"	"	Shunt L3 with a 680 ohm ½ W carbon & adjust L4 for maximum output.
98 MC 4.	10.7MC	"	"	Adjust L5, L6 & L1 for maximum output.
98 MC 5.	10.7MC	"	Ground lead of V.T. V.M. to point A on schematic, and probe to point B.	Adjust L2 for zero output. (Check zero setting of V.T. V.M.) Meter should register reverse when slug is rotated through zero output.
Variable Condenser Fully open. 6.	109MC	Terminals 1 & 2 in series with (2) 130 ohm carbon ½ W resistors.	Same as Step #1	Adjust T1 for maximum output "Top" peak on trimmer.
Variable Condenser Fully closed. 7.	87 MC	"	"	Adjust L7 for maximum output.
8	Repeat steps 6 & 7 until L7 requires no further adjustment.			
98 MC 9	98 MC	Same as step #6	Same as Step #1	Adjust L8 & L9 for maximum output.

Part No.	Description
12.43	Tubular Condenser .01 mf 200 V
12.8	Tubular Condenser .02 mf 400 V
12.22	Tubular Condenser .01 mf 400 V
12.31	Tubular Condenser .02 mf 200 V
17.9	Mica Condenser 270 mmf ±10%
17.49	Ceramic Condenser 50 mmf ±10%
17.45	Ceramic Condenser 1500 mmf ±20%
17.44	Ceramic Condenser 5000 mmf Gmv. Disk type
17.53	Mica Condenser 82 mmf ±5%
17.47	Ceramic Condenser 100 mmf
17.54	Ceramic Condenser 8.2 mmf ±10% N 1800
22.30	Electrolytic Condenser 4 mf 50 WV
22.32	Electrolytic Condenser 30-40-20 mf 150 WV
27.27	Variable Condenser w/Drum
37.116	Coil Ratio Detector
37.112	Coil 1st. I.F. Transformer
37.132	Coil 2nd. I.F. Transformer
37.127	Coil Oscillator
37.128	Coil R. F.
37.117	Coil Antenna
37.129	Coil R. F. Choke
42.20	Power Transformer
47.14	Switch
77.16	Dial Pointer
77.123	Dial Scale
97.118	Cabinet Back
97.125W	Cabinet Walnut
97.125V	Cabinet Ivory
112.6	Selinium Rectifier
142.4W	Knob Walnut
142.4V	Knob Ivory



TUNING RANGE 87-109 MC TUBE LAYOUT

MODEL 1005 FADA RADIO & ELECTRIC CO., INC.



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:

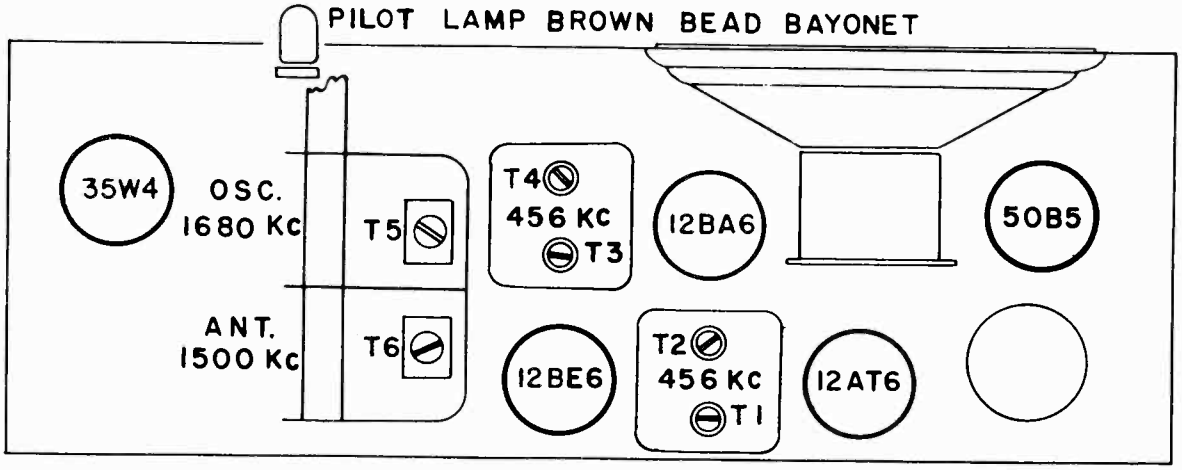
Volume Control full on.

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

Keep signal generator attenuated so as to maintain ½ scale reading on output meter.

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

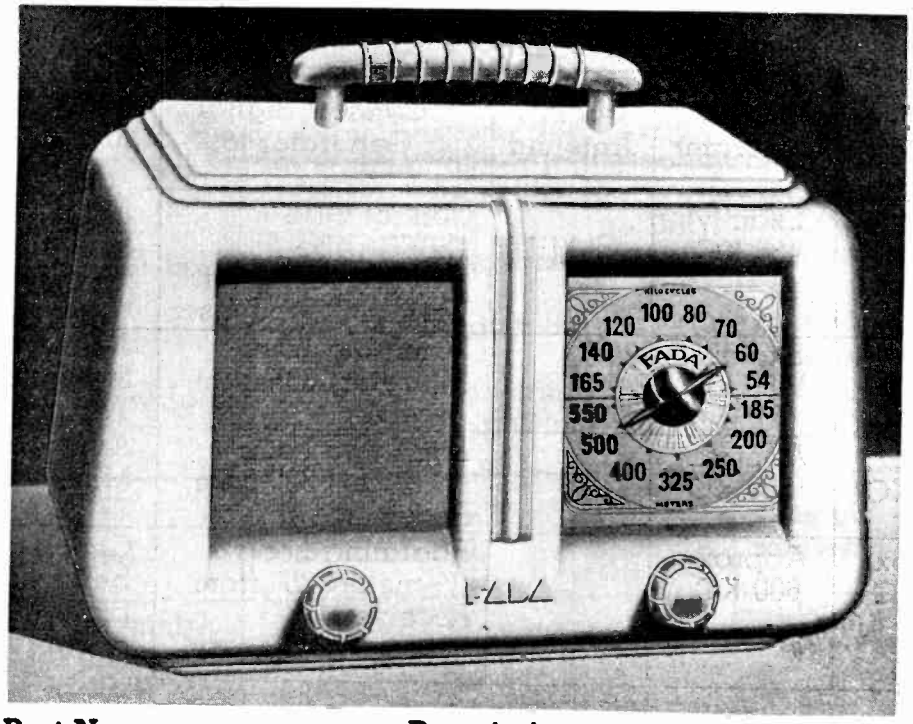
Receiver Dial at:	Signal Generator	Dummy Antenna	Connect Signal Generator to:	Refer to Chassis Layout for Location of Trimmers
1 Full Open	Exactly 456 KC	.1 MF	Control Grid 12BE6 Tube (Top) Rear Section Variable Condenser	Adjust for Minimum Output T5 Note: On later production this trimmer is eliminated.
2 Full Open	Exactly 1680 KC		Radiating Loop (½ meter) 20" from Receiver	Adjust for Maximum Output T6
3 Approx. 1500 KC	Approx. 1500 KC		Radiating Loop (½ meter) 20" from Receiver	Adjust for Maximum Output T7
4 Approx. 600 KC	Approx. 600 KC		Radiating Loop (½ meter) 20" from Receiver	Check tracking and bend slotted end plate (rear section) of variable if necessary.
5				



1005
TUNING RANGE 530-1680 Kc TUBE LAYOUT

MODEL 1005

FADA RADIO & ELECTRIC CO., INC.

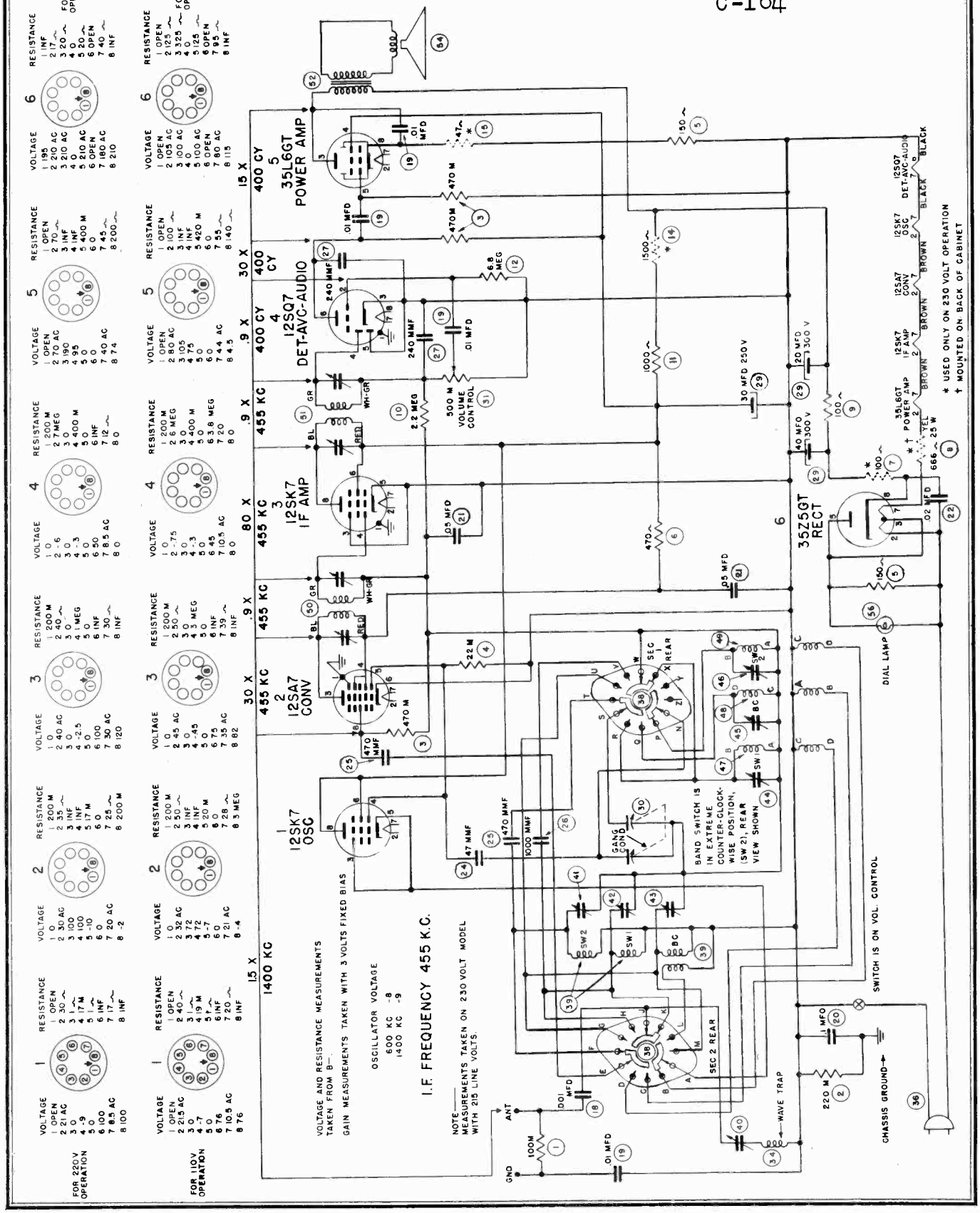


Part No.	Description
12.4	Tubular Condenser .005 mf 600 V
12.6	Tubular Condenser .01 mf 400 V
12.9	Tubular Condenser .03 mf 400 V
12.11	Tubular Condenser .05 mf 200 V
12.12	Tubular Condenser .05 mf 400 V
17.21	Mica Condenser 100 mmf ± 10%
17.22	Mica Condenser 220 mmf ± 10%
22.19	3 Section Electrolytic Condenser 30-40-20 mf 150 W.V.
27.20	Variable Condenser
37.57	Oscillator Coil
37.54	Loop Antenna & Back
37.61	Input I.F. Transformer complete
37.22	Output I.F. Transformer complete
52.1	Volume Control w/switch
72.1	Power Cord (Approved)
77.78	Dial Pointer
77.92	Dial Scale (Calibrated)
97.71	Cabinet — state color
142.25	Cabinet Knobs — state color
97.80	Cabinet Handle — state color
107.19T	4" P.M. Speaker with Transformer
107.19	4" P.M. Speaker less Transformer
42.2	Speaker Transformer for Above
117.1	30 ohm 1 W. Resistor

Tubes:

Osc. Converter	12BE6	Power Output	50B5
I.F. Amplifier	12BA6	Rectifier	35W4
Det. Avc. A.F.	12AT6		

FARNSWORTH TELEV. & RADIO CORP. MODELS ET-667BRV, CHASSIS C-172; ET-667BRX, CHASSIS C-164; ET-668WTV, CHASSIS C-172; ET-668WTX, CHASSIS C-164



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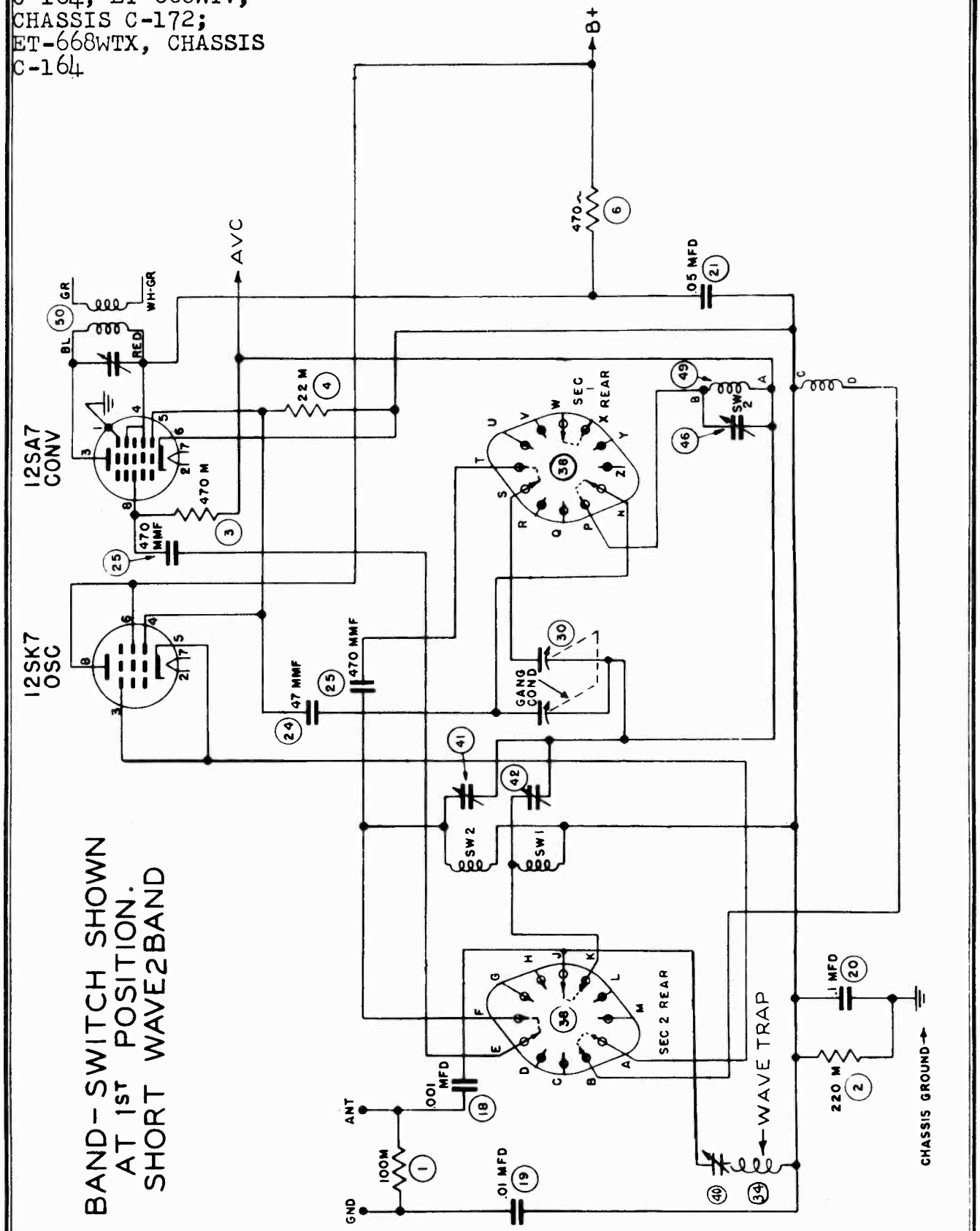
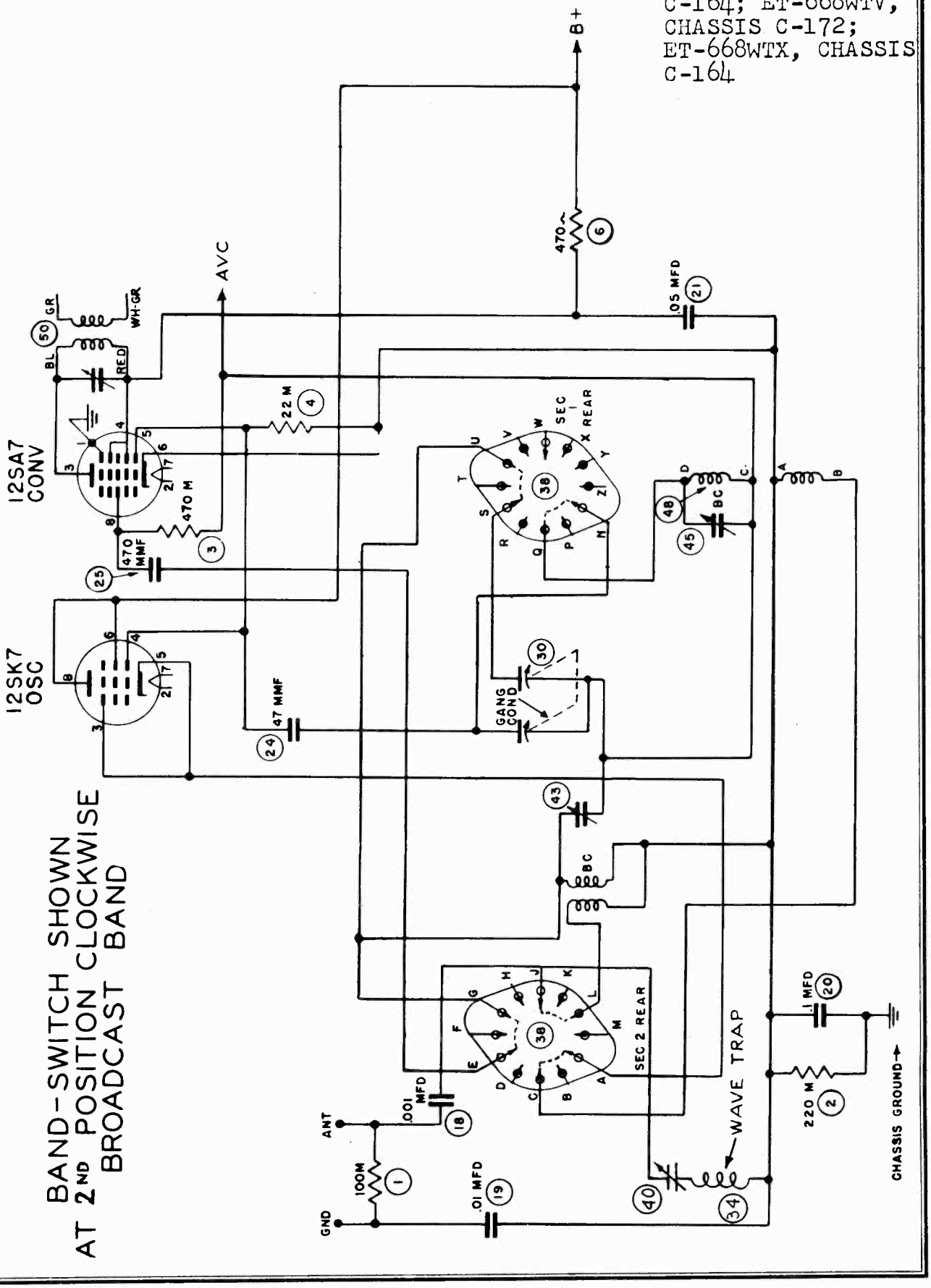
MODELS ET-667BRV, CHASSIS C-172; ET-667BRX, CHASSIS C-164; ET-668WTV, CHASSIS C-172; ET-668WTX, CHASSIS C-164

FARNSWORTH TELEV. & RADIO CORP.



FARNSWORTH TELEV. & RADIO CORP. MODELS ET-667BRV, CHASSIS C-172; ET-667BRX, CHASSIS C-164; ET-668WTV, CHASSIS C-172; ET-668WTX, CHASSIS C-164



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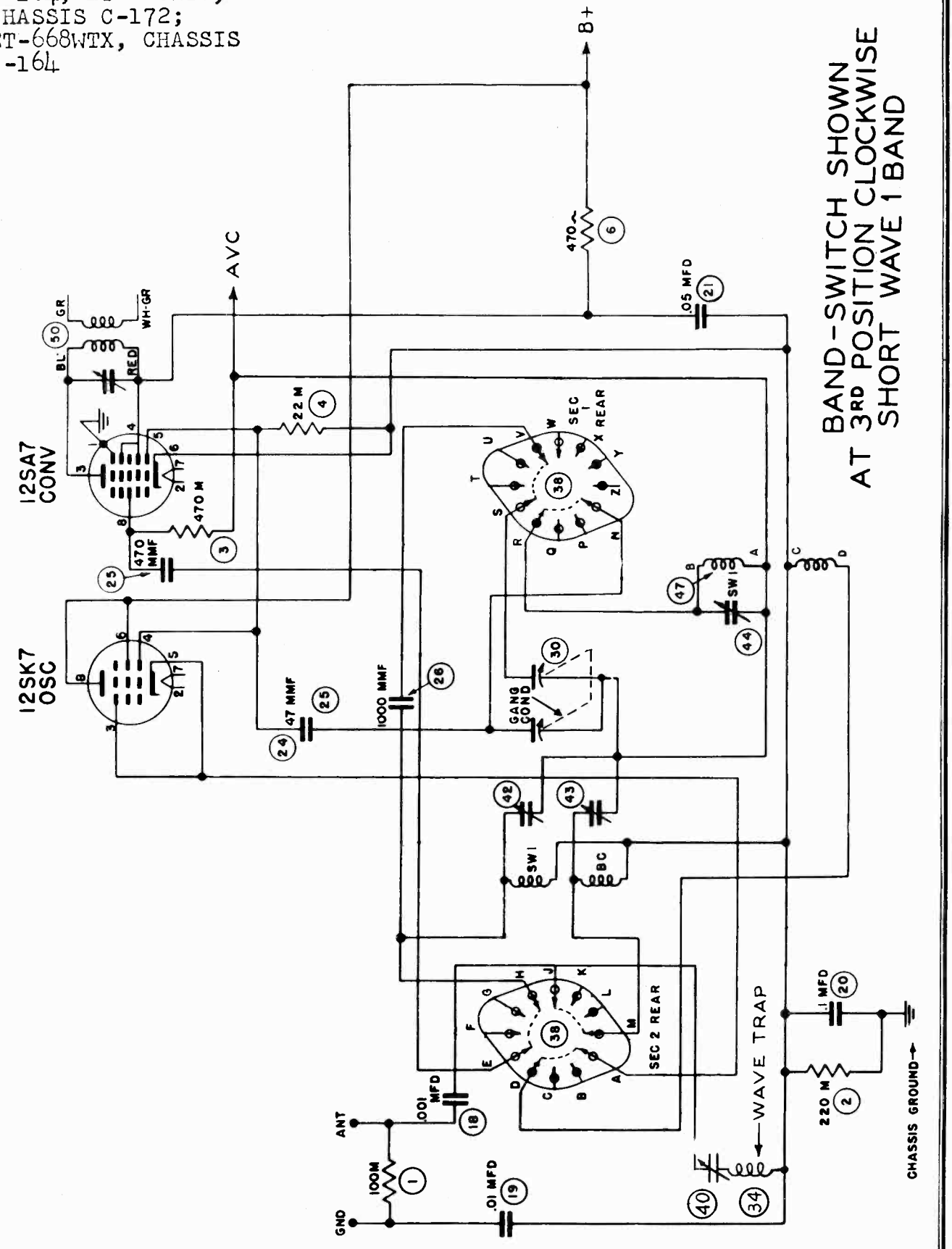
MODELS ET-667BRV, FARNSWORTH TELEV. & RADIO CORP.
CHASSIS C-172;
ET-667BRX, CHASSIS
C-164; ET-668WTV,
CHASSIS C-172;
ET-668WTX, CHASSIS
C-164



MODELS ET-668WTV, CHASSIS C-172; ET-668WTX, CHASSIS C-164

FARNSWORTH TELEV. & RADIO CORP.

MODELS ET-667BRV, CHASSIS C-172; ET-667BRX, CHASSIS C-164

EQUIPMENT AND PROCEDURE FOR ALIGNMENT

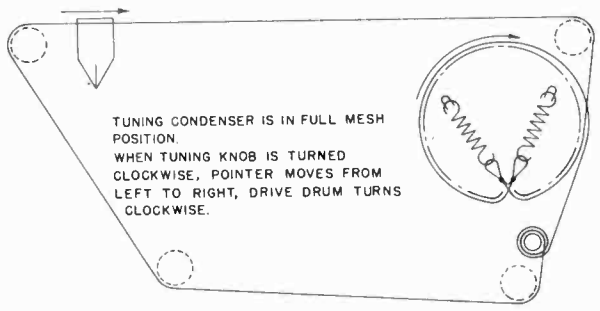
An output meter and a signal generator are required for proper alignment of these sets. The signal generator should be calibrated at the following points: 455 Kc., 600 Kc., 1000 Kc., 1500 Kc., 3.5 Mc., 8 Mc., 9 Mc. and 20 Mc. All adjustments should be made with the volume control set for maximum, keeping the signal generator output as low as possible to prevent AVC action and incorrect settings.

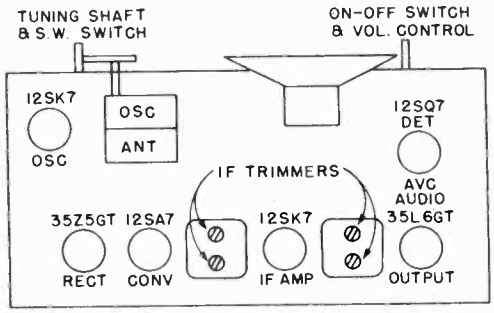
Connect the low side of the signal generator to the ground terminal on the chassis through a .1 Mfd. condenser. Connect the high side of generator to antenna terminal through dummy load of 200 MMF for broadcast band and a dummy load of 400 ohms for shortwave.

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





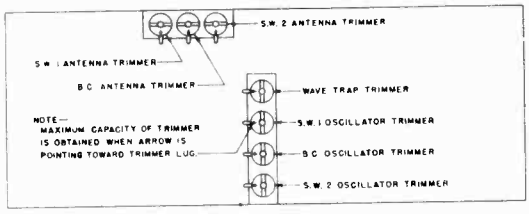
MODELS ET-667BRV, CHASSIS C-172; ET-667BRX, CHASSIS C-164

FARNSWORTH TELEV. & RADIO CORP.

MODELS ET-668WTV, CHASSIS C-172; ET-668WTX, CHASSIS C-164

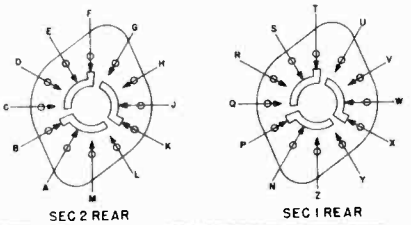
Ref. No.	Part No.	DESCRIPTION
1	77214	100M ohms
2	77216	220M ohms
3	77217	470M ohms
4	77266	22M ohms
5	77259	150 ohms
6	77261	470 ohms
7	77417	100 ohms, 4 watt, wire wound
8	77344	666 ohms, 25 watt, wire wound
9	77258	100 ohms
10	77270	2.2 megohms
11	77304	1000 ohms, 2 watt
12	77273	6.8 megohms
14	77332	1500 ohms, 3 watt
15	77208	47 ohms
18	25360	.001 mfd. molded oil paper capacitor 600 V.
19	25365	.01 mfd. molded oil paper capacitor 600 V.
20	25361	.1 mfd. molded oil paper capacitor 400 V.
21	25362	.05 mfd. Molded oil paper capacitor 200 V.
22	25363	.02 mfd. molded oil paper capacitor 800 V.
24	25193	47 mmf. Mica capacitor
25	25284	470 mmf. Mica capacitor
26	25053	1000 mmf. Mica capacitor
27	25187	240 mmf. Mica capacitor
29	25283	Electrolytic Capacitor 40-20 mfd. 300 V., 30 mfd., 250 V.
30	26227	2 Gang Tuning Capacitor
31	78118	Volume Control
34	38650	Wave Trap Coil
36	27118	Line Cord
38	90198	Band Switch
39	38651	Antenna Coil
40	26229	Wave Trap Trimmer
41	26228	SW2 Antenna Trimmer
42	26228	SW1 Antenna Trimmer
43	26228	BC Antenna Trimmer
44	26228	SW1 Oscillator Trimmer
45	26228	BC Oscillator Trimmer
46	26238	SW2 Oscillator Trimmer
47	38648	SW1 Oscillator Coil
48	38647	BC Oscillator Coil
49	38649	SW2 Oscillator Coil
50	38536	1st. I.F. Transformer
51	38537	2nd I.F. Transformer
52	94179	Output Transformer
54	81146	Speaker
56	42186	Dial Lamp 150 Ma.
	80033	Antenna and Ground Terminal Strip
	31339	Dial Scale
	60431	Dial Background
	11329	Dial Pointer
	41106	Drive Cord (36" long approx.) and Springs
	56994	Drive Drum
	80167	Molded octal tube socket
	07412	Back cover Ass'y. ET-667 BRX and ET-668 WTX
	13541	Back cover Ass'y. ET-667 BRV and ET-668 WTV
	09277	Knob and Set screw
	54091	Band Switch Lever
	05098	Baffle Assembly ET-667 BRV and ET-667 BRX
	05099	Baffle Assembly ET-668 WTX and ET-668 WTX
	H-263	Cabinet for ET-667 BRX and ET-667 BRV
	H-264	Cabinet for ET-668 WTV and ET-668 WTX

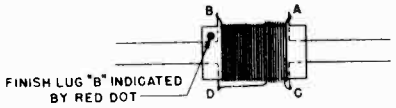
BOTTOM VIEW OF CHASSIS



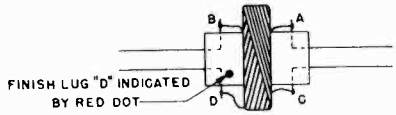
(FRONT OF CHASSIS)

BAND SWITCH

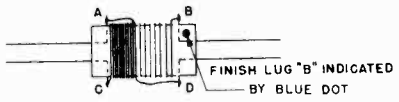




SHORT WAVE 1 OSCILLATOR COIL



BROADCAST OSCILLATOR COIL



SHORT WAVE 2 OSCILLATOR COIL

FARNSWORTH TELEV. & RADIO CORP. MODEL K-262P

SPECIFICATIONS

CIRCUIT	Superheterodyne
POWER	105-125 volts A.C. 50 watts at 117 volts A.C.
FREQUENCIES: Standard Broadcast Band	540 Kc—1625 Kc
Intermediate Frequency	455 Kc

TUBE COMPLEMENT

12SK7	RF Amplifier	12SQ7	Det, AVC, Audio
12SA7	Converter-Oscillator	35L6GT	Output
12SK7	IF Amplifier	35Z5GT	Rectifier

ANTENNA	Built-in loop (connection for external antenna)
SPEAKER	Alnico #5 PM—6 x 9 Elliptical
RECORD CHANGER	Type P-73

ALIGNMENT OF THE RECEIVER

EQUIPMENT REQUIRED

Signal generator, calibrated at 455 Kc, 600 Kc, and 1500 Kc.

Output Indicator

Insulated Screw Driver

PRELIMINARY INSTRUCTIONS

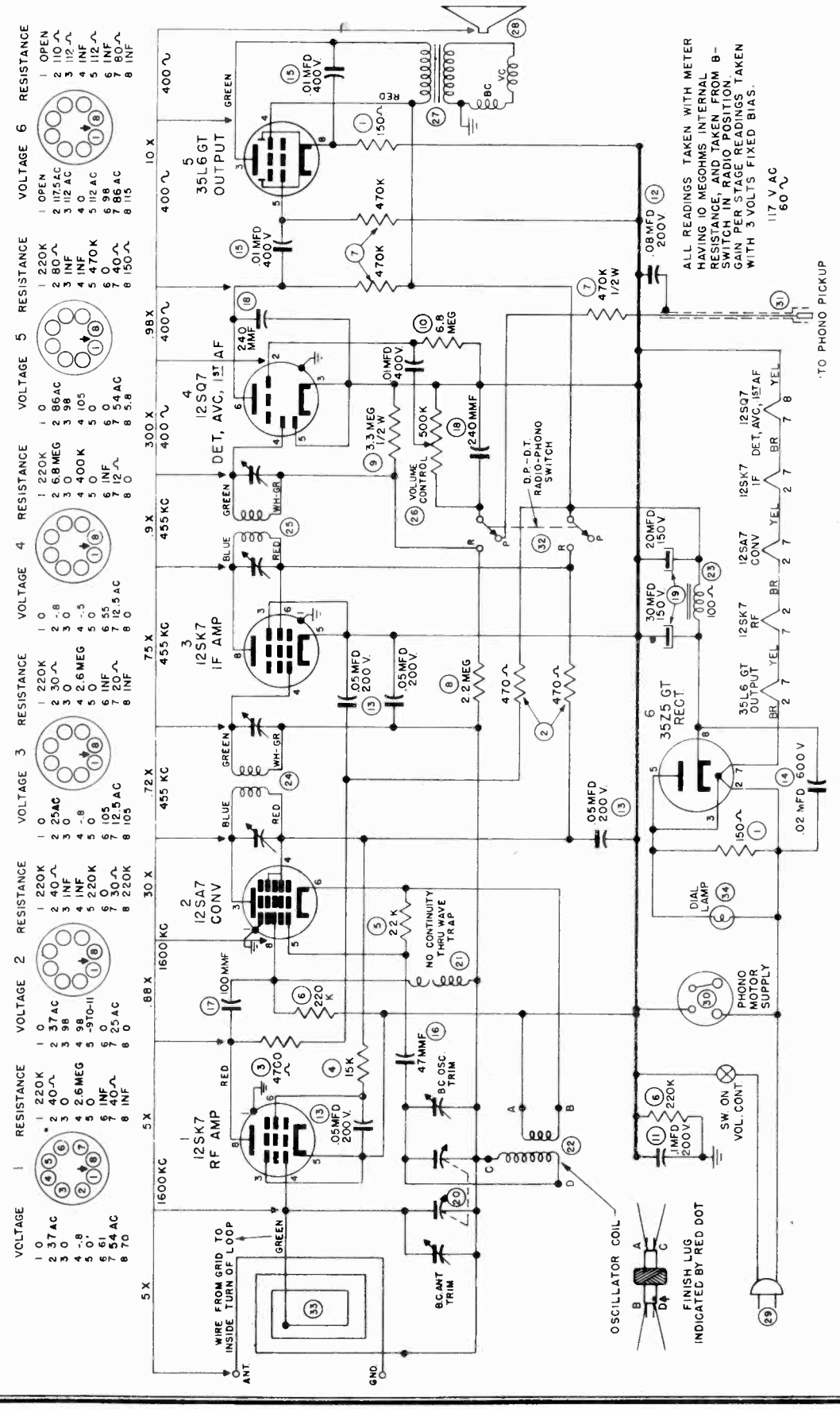
Volume control is set to maximum. Keep the signal generator output as low as possible to prevent A.V.C. action and incorrect alignment. The use of an excessively strong signal is almost certain to produce misalignment.

Connect the high side of the signal generator to one side of the loop primary. Connect the other side of the primary to the B-lead. The other side of the signal generator should then be connected to the B-lead.

TABULATION FOR ALIGNMENT

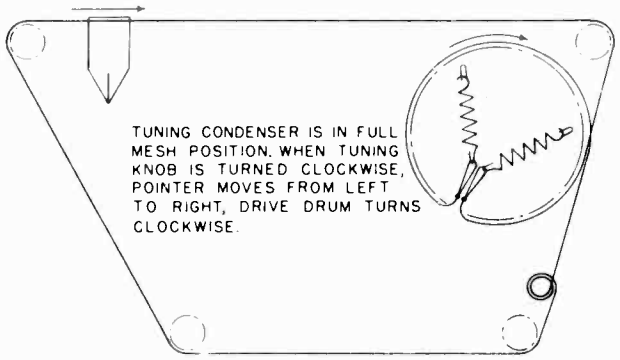
Steps	Connect Signal Generator	Set Generator At	Set Gang At	Adjust	Located	To Obtain
1	Set Volume Control For Maximum Output					
2	To Loop Primary	455 Kc.	Minimum Capacity	2nd I. F. Trimmers	Top of I.F. Transformer	Maximum Output
3				1st I. F. Trimmers		
4		1500 Kc.	1500 Kc.	Osc. Trimmer	On Tuning Condenser	
5		1500 Kc.	1500 Kc.	Ant. Trimmer	On Tuning Condenser	
6	Check Pointer Calibration at 600 Kc.					

MODEL K-262P FARNSWORTH TELEV. & RADIO CORP.

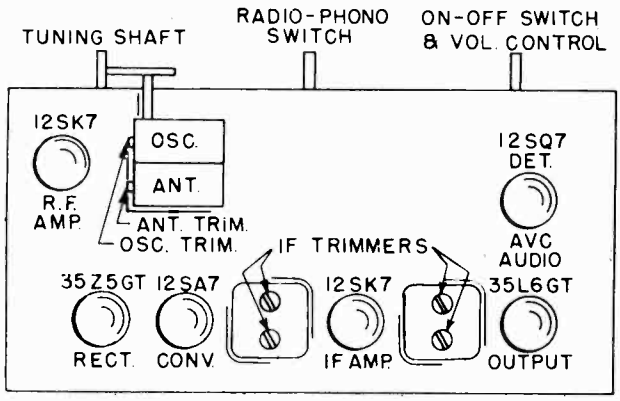


FARNSWORTH TELEV. & RADIO CORP. MODEL K-262P

DIAL STRINGING



CHASSIS LAYOUT



Ref. No.	Part No.	DESCRIPTION
1	77185	150 ohm resistor
2	77170	470 ohm resistor
3	77168	4700 ohm resistor
4	77246	15K ohm resistor
5	77169	22K ohm resistor
6	77178	220K ohm resistor
7	77173	470K ohm resistor
8	77171	2.2 Megohm resistor
9	77223	3.3 Megohm resistor
10	47177	6.8 Megohm resistor
11	25182	.1 mfd. tubular cap., 200 volts
12	25494	.08 mfd. tubular cap., 200 volts
13	25181	.05 mfd. tubular cap., 200 volts
14	25195	.02 mfd. tubular cap., 600 volts
15	25186	.01 mfd. tubular cap., 400 volts
16	25193	47 mmfd. mica capacitor
17	25188	100 mmfd. mica capacitor
18	25187	240 mmfd. mica capacitor
19	25022	Electrolytic Cond. 30 mfd. & 20 mfd., 150 volt
20	11448	Tuning Capacitor Assembly
21	38484	Wavetrap Coil Ass'y.
22	38706	Oscillator Coil Ass'y.
23	94267	Filter Choke
24	38322	1st I.F. Transformer
25	38324	2nd I.F. Transformer
26	78048	500M Volume Control
27	94091	Output Transformer
28	81188	Speaker
29	27050	Line Cord
30	22198	Phone Accord
31	22169	Pickup Cable
32	90273	Band Switch
33	38984	Loop Antenna Ass'y.
34	42186	Pilot Lamp Mazda 47
	22199	Speaker Cable
	07692	Pointer Slide Ass'y
	59183	Dial Pointer
	05047	Drive Cord Ass'y.
	92192	Drive Cord
	31265	Dial Scale
	18058	Dial Background Ass'y.
	59476	Knob
	H-313-1	Cabinet and Packing—Mahogany
	H-313-2	Cabinet and Packing—Walnut
	H-313-3	Cabinet and Packing—Maple

All Resistors are ½ watt, 20% Tolerance

MODELS 19N4, 24N4, 26N4, 31N4, 114N4, 116N4, 21P4, 24P4.

FARNSWORTH TELEV. & RADIO CORP.

MODELS 29P4, 30P4, 31P4, 116P4, 118P4

Model	Cabinet	Record Changer
118P4	Georgian	41E-MP
116P4	Sheraton	41E-MP
31P4	Hepplewhite	P-71
30P4	French Provincial	P-71
29P4	Early American	P-71
24P4	Hepplewhite	P-71
21P4	Chippendale	P-71
116N4		Capehart 41E
114N4	Early Georgian	41E
31N4	Sheraton	Panamuse P-63
26N4	Modern	P-63
24N4	Hepplewhite	P-63
19N4	Hepplewhite	P-63

"Whistles" and Heterodynes

Check IF rejection ratio by application of signal generator at the intermediate frequency to the antenna terminals.

A defective wave trap will cause heterodynes.

Low Volume

If low volume of N4 combinations is experienced, we suggest the following:

1. Test tubes.
2. Check alignment of the receiver.

RECEIVER SPECIFICATIONS

SECTION 1

RECEIVER FREQUENCIES

AM Broadcast Band.....540 to 1600 Kc. IF(AM Band).....455 Kc.
FM Band.....87.5 to 108.5 Mc. IF(FM Band).....10.7 Mc.

TUBE COMPLEMENT

Application	Type	Type	Application
FM RF Ampl.	6AG5	6H6	FM Detector, AVC
FM Converter-Osc.	6SB7Y	6SC7*	Phono Pre-Amplifier
AM RF Converter-Osc.	6SA7	6SL7	Audio Ampl., Phase Inverter
AM RF Ampl. FM 1st IF Ampl.	6SG7	6V6	Power Output
AM IF Ampl., AM Det., FM 2nd IF Ampl.	6SF7	5Y3GT	Rectifier

*The N4 Uses a 6J7 as Phono Pre-Amplifier.

POWER AND VOLTAGE REQUIREMENTS

185 Watts at 117 Volts.....60 Cycles 105 to 125 Volts.....AC

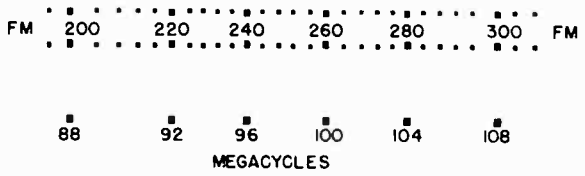
DIAL SCALE

The AM Band conventionally calibrated in Kilocycles

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., etc.

FM Band is marked with the new Channel Numbers



ANTENNAS

P4 & N4 series instruments both 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 antenna.

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.

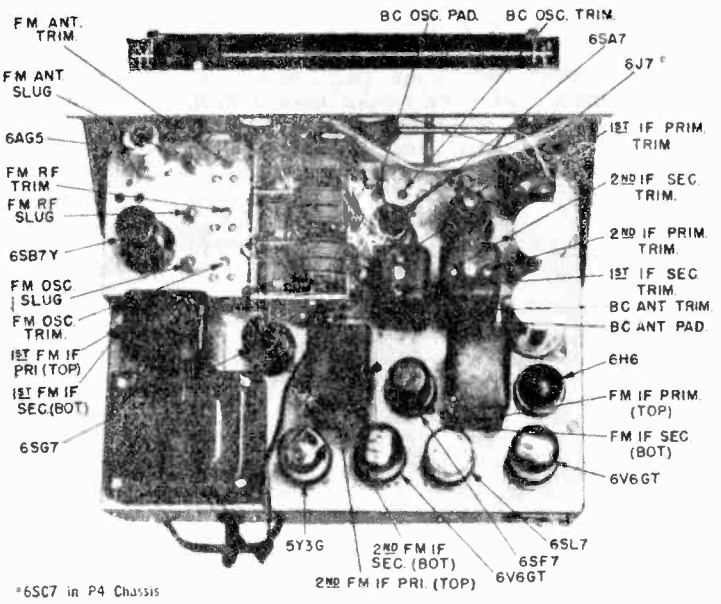
MODIFICATION KIT NO. 41140

The N4 tuner modification kit no. 41140 was issued for the purpose of revising the Phono Pre-Amplifier circuit of the tuner, in the field. This was so that P-71 record changers, using the variable reluctance pickup could be incorporated in N4 instruments already in the field. The kit is also applicable to N4 tuners that are used with the 41E record changers. A kit was also issued for the purpose of revising 41E changers to equal the new 41E-MP, by addition of the variable reluctance pickup, the Noise Eliminator and various other modernizations.

The N4 tuner which has been modified, following the instructions accompanying kit no. 41140, is the electrical equivalent of the P4 tuner

If the N4 tuner is of early production (C-175) then the circuit is different

N4 tuners that have not been modified by modification kit no. 41140 will have the Phono Pre-Amplifier circuit



ALIGNMENT OF THE RECEIVER

Two methods of alignment of P4 & N4 receivers are presented. Service shops possessing a suitable sweep generator and oscilloscope will effect a considerable saving of time by using the first method.

The alternate method using an amplitude modulated signal generator is preferred by some servicemen. This method requires careful attention to details to attain accurate alignment.

GENERAL INSTRUCTIONS

1. Adjustment of Dial Pointer

To prevent misalignment, do not proceed with alignment until dial pointer has been checked for correct mechanical adjustment

2. 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.

ALIGNMENT OF FM BAND

1. Equipment required will be an oscilloscope, a frequency modulated signal generator covering the range 87.5 mc to 108.5 mc on fundamentals, a sweep generator producing a signal of 10.7 mc and sweeping at least 150 kc each side of 10.7 mc, and an output meter.

2. The vertical or "Y" axis terminals of the oscilloscope should be connected between pin 3 of the 6H6 discriminator and ground. The sweep voltage of the sweep generator should be fed to the horizontal or "X" axis terminals of the oscilloscope. The 10.7 mc output of the sweep generator should be fed into the grid of the 6SF7 tube through a condenser of approximately 3300 mmfd.

3. Remove the negative lead of the 4 mfd. electrolytic from pin #3 of 6H6 socket. Remove 6SL7 tube from socket. Turn the set on and turn both the tone control and the volume control all the way to the right. Detune the secondary of the third FM IF transformer by turning the bottom slug screw out as far as possible. Adjust the primary top slug screw, until pattern (A) appears on the oscilloscope. Adjust the secondary, bottom slug screw, until pattern "B" is obtained on the oscilloscope and until both sides of this pattern are symmetrical.

4. Remove the 10.7 mc output of the sweep generator from the grid of the 6SF7 tube and connect to the grid of the 6SG7. Align the second FM IF transformer as in paragraph "3."

5. Connect the 10.7 mc output of the sweep generator to the signal grid of the 6SB7Y, (pin 8) detune secondary of the first FM IF transformer and tune primary as before for pattern (A). Tune secondary for pattern "C" and make both sides of pattern as symmetrical as possible. This completes alignment of the FM IF transformers.

6. Reconnect the negative lead of the 4 mfd. electrolyitic to pin #3 of the 6H6 socket and move the oscilloscope leads to the middle terminal on third FM IF (to which tertiary winding connects) and ground. With the sweep generator connected to the 6SB7Y signal grid as before, the discriminator pattern (D) should appear on the oscilloscope if the IF alignment instructions have been followed carefully. Remove the oscilloscope and sweep generator leads and reinstall 6SL7 tube in socket. Never adjust AM IF transformers without rechecking FM IF alignment.

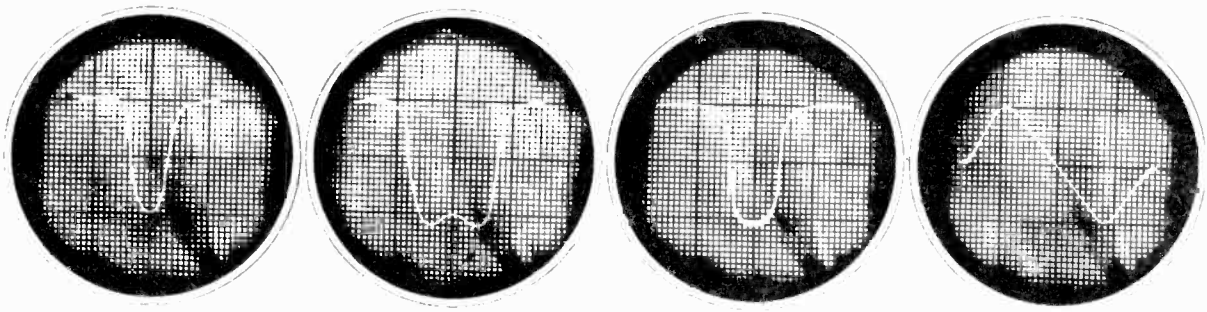
7. Connect the 87.5 to 108.5 mc signal generator to the antenna socket of the receiver through a 300 ohm resistor. The generator should be frequency modulated at some frequency in the audible range. Connect output meter across secondary of

MODELS N4, P4, Series, Capehart — FARNSWORTH TELEV. & RADIO CORP.

output transformer. Tune receiver to channel 300 FM dial. With signal generator set at 107.9 mc adjust oscillator trimmer condenser, third from front, for maximum reading on output meter. Set signal generator to 87.9 mc and tune receiver to channel 200 on FM dial. Adjust oscillator coil screw, third from front, (see chassis layout) for maximum reading on output meter. Recheck oscillator setting for channel 300.

8. Tune signal generator and receiver to 105 mc (channel 285 approx.). Adjust converter signal grid trimmer condenser, second from front, for maximum reading on output meter. Tune signal generator and receiver to 92 mc, (channel 220 approx.) and adjust converter coil screw, (second from front), to maximum reading on output meter. Recheck converter trimmer setting at 105 mc (channel 285 approx.).

9. Repeat operations of paragraph (7) for antenna trimmer condenser and coil. This completes FM RF alignment.



A B C D

ALTERNATE FM ALIGNMENT PROCEDURE

Necessary Equipment:

Signal generator.

Vacuum tube voltmeter or DC voltmeter 20,000 ohms per volt.

FM IF ALIGNMENT

Adjust dial pointer as outlined in section VII.

Connect voltohmyst from ground to pin #3 of 6H6. Connect generator tuned to 10.7 mc to pin #4 on 6SG7. Turn secondary slug of third FM IF (closest to chassis) out as far as it will turn. Tune primary of third IF for maximum negative voltage. Tune primary and secondary of the second FM IF for maximum output. Move generator to pin #8 of 6SB7Y and tune primary and secondary of first FM IF for maximum output. Next tune secondary of third FM IF to balance to zero volts, using high resistance voltmeter connected to middle terminal of FM IF transformer (tertiary winding).

FM RF ALIGNMENT

With high resistance voltmeter connected between ground and pin #3 on 6H6 socket, connect generator between ground and small pin of dipole antenna socket. Use very short leads on generator and a 300 ohm resistor as a dummy antenna. Set generator to 108.5 mc and gang to minimum and adjust oscillator trimmer for maximum voltage. Go back and check low frequency end. Next set generator at 92 mc, tune in signal on receiver, approximately 220 on dial. Adjust converter and antenna slug for maximum voltage output. Set generator at 105 mfd. Tune in signal on receiver, approximately 280 on dial. Tune converter and antenna trimmer for maximum voltage output. Check adjustment of antenna and converter slugs at 92 mc.

ALIGNMENT INSTRUCTIONS FOR AM BAND

An output meter and a signal generator calibrated at 455 Kc., 600 Kc., 1500 Kc. and 1600 Kc., are required to properly align these receivers on AM band. Keep the output of the signal generator as low as possible to prevent AVC action and false settings. Connect the high side of the generator to the blue wire found at rear of set and low side to the white wire.

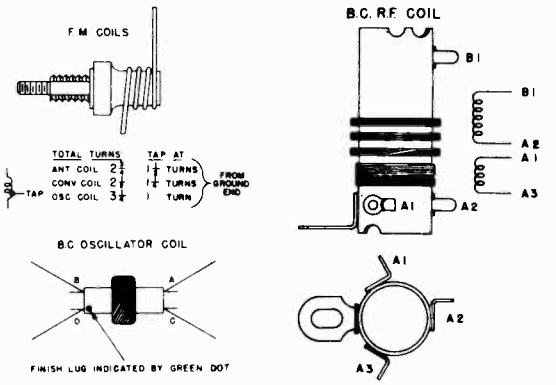
STEPS	DUMMY ANTENNA	SET GENERATOR AT	SET GANG AT	ADJUST	LOCATED	TO OBTAIN
1	SET VOLUME AND TONE CONTROLS AT MAXIMUM					
2	.1 Mfd. to converter RF grid	455 Kc.	Minimum	2nd IF Trimmers*	Top of IF Transformers	MAXIMUM OUTPUT
3				1st IF Trimmers**		
4		1600 Kc.	1600 Kc.	B.C. Osc. Trimmer	See Trimmer Layout	
5	200 MMF.	1500 Kc.	1500 Kc.	B.C. RF Trimmer**	See Under Chassis	
6		1500 Kc.	1500 Kc.	B.C. Ant. Trimmer	On Loop	
7		600 Kc.	600 Kc. Rock Gang	600 Kc. Padder	See Trimmer Layout	
8		600 Kc.	600 Kc.	Peak loading coil slug	See Trimmer Layout	
9	Recheck 1500 Kc.					

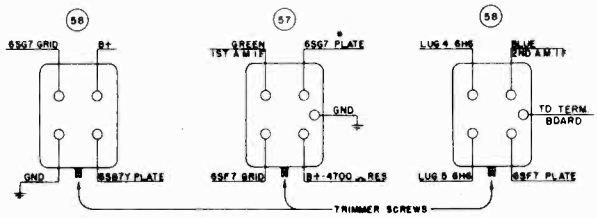
* Recheck after FM alignment.

** Not used on early production.

FARNSWORTH TELEV. & RADIO CORP. MODELS N4, P4, Series, Capehart

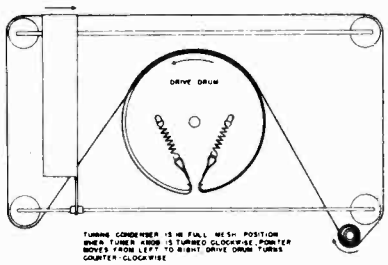
RECEIVER RF-IF COILS





Letters on terminals of coils correspond to similarly lettered terminals on the coils shown in the circuit diagram.

MAINTENANCE OF THE TUNER



1. Adjustments of Dial Pointer

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

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.

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

c. 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.

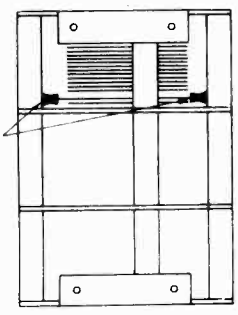
2. "Sticking" Light-Boxes

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.



3. 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.

4. Control Knobs—Eccentric—Loose—How to Remove

A. Knobs eccentric (wobbly motion) or loose. This may be caused by pinching together the two 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 4A, above.

5. Microphonics and Feedback

A. Microphonic tubes.

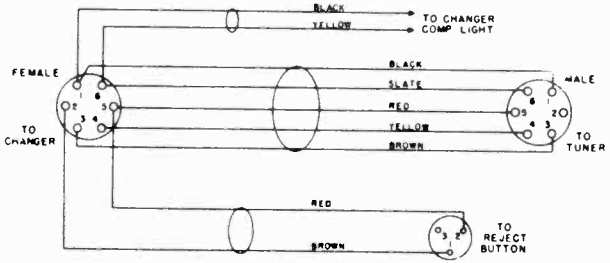
B. Check the variable condenser stator plates to ascertain whether they are loose. If so, apply a laquer cement to the clamp which holds the stator plates to the insulating material.

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

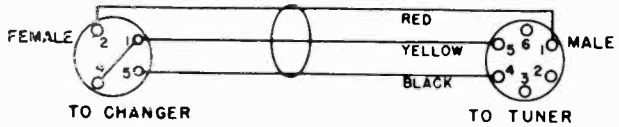
D. On FM, microphonics and howl may be caused by the lead from stator plate to sub-chassis assembly being taut. Re-solder with less tension in the flat ribbon lead.

NOTE: Oscillator trimmer may have to be readjusted.

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 is fully-meshed. Observe dial calibration for any change resulting from increased capacity.

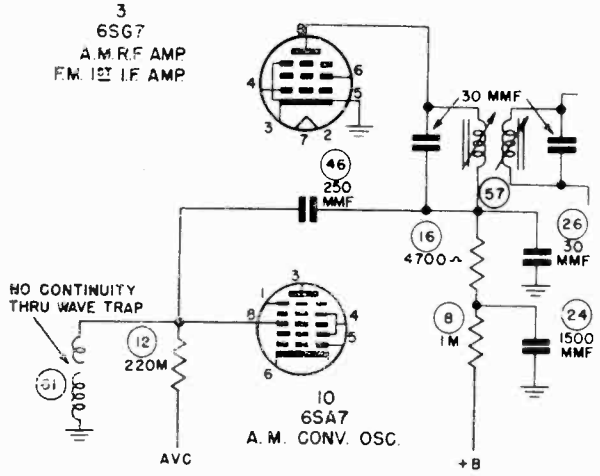


Record Changer AC Cable, Part No. 22182

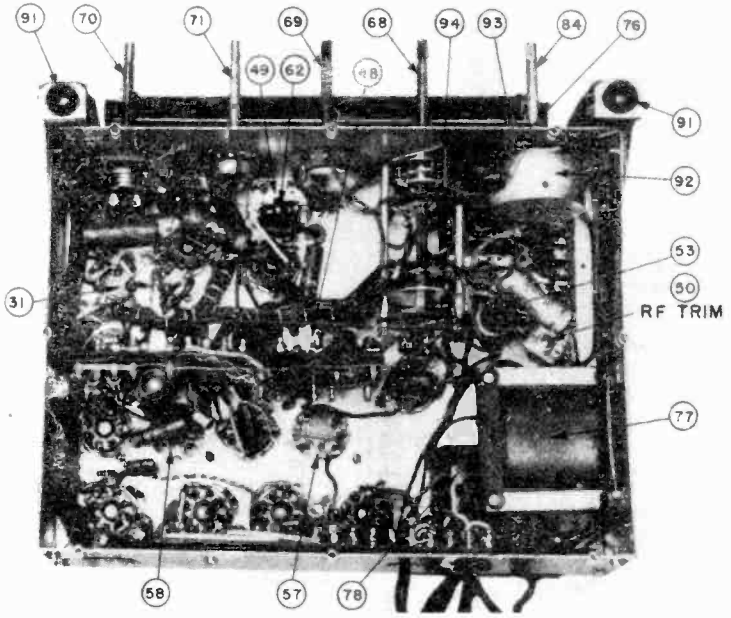


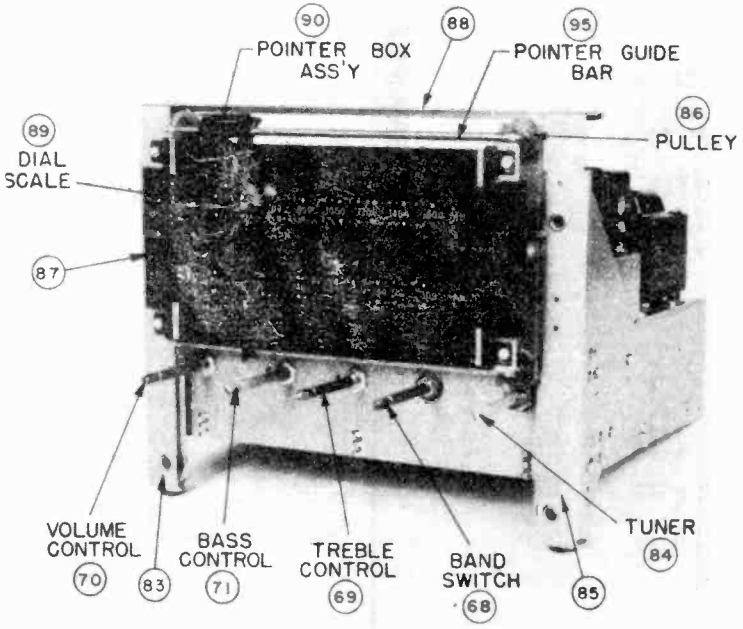
Record Changer AC Cable, Part No. 22184

CIRCUIT DIAGRAM MODIFICATIONS



Early production N4 tuners used a two gang broadcast tuning capacitor and wave trap connected as indicated in the RF portion of the schematic reproduced above:





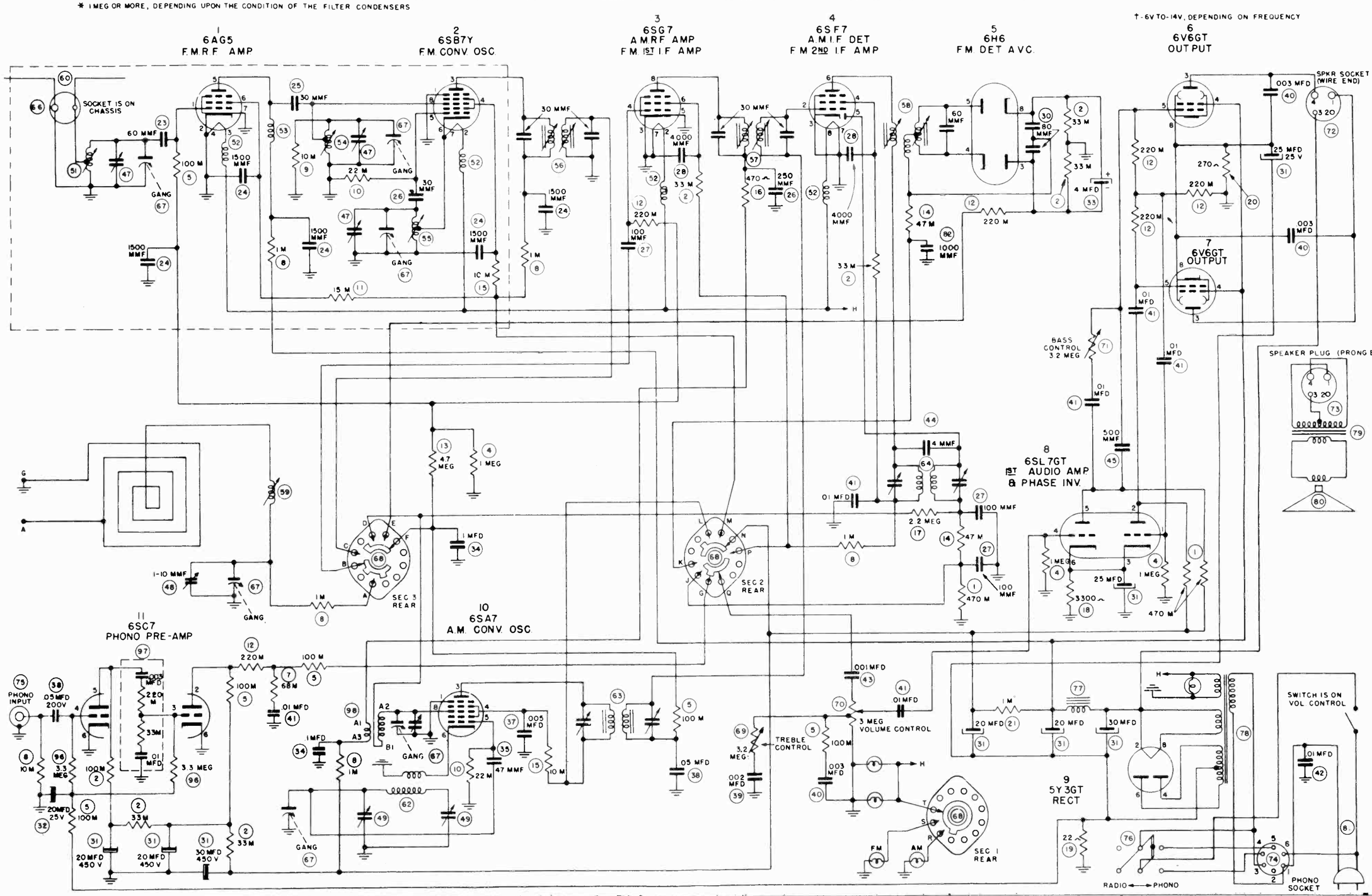
FARNSWORTH TELEV. & RADIO CORP.

MODELS N4, P4, Series, Capehart

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
1 D	1 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	1 MEG	1 0	1 0	1 0	1 0	1 0	1 0
2 0	2 0	2 6.3 AC	2 1	2 6.3 AC	2 1	2 1	2 1.8 MEG	2 0	2 0	2 6.3 AC	2 1	2 1	2 1	2 100	2 *	2 2295	2 *	2 0	2 0	2 180	2 2200 M
3 6.3 AC	3 1 ~	3 225	3 *	3 0	3 *	3 0	3 0	3-4	3 333 M	3 290	3 *	3 290	3 *	3 100	3 33300 ~	3 0	3 322 ~	3 225	3 *	3-3	3 *
4 115	4 0	4 115	4 *	4 8	4 *	4 90	4 550 M	4 1	4 4 INF	4 270	4 *	4 270	4 *	4 100	4 1 MEG	4 320 AC	4 470 ~	4 110	4 *	4 190	4 *
5 250	5 *	5-5.5	5 *	5 100	5 41 MEG	5 6	5 *	5 1	5 INF	5 0	5 *	5 0	5 *	5 100	5 *	5 270	5 *	5 †	5 *	4-3	5 200 M
6 200	6 *	6 0	6 *	6 180	6 *	6 210	6 *	6 NC	6 NC	6 0	6 *	6 0	6 *	6 100	6 33300 ~	6 320 AC	6 670 ~	6 0	6 *	6 0	6 *
7 0	7 0	7 0	7 0	7 0	7 0	7 0	7 0	8 4	7 1	8 17	7 0	8 17	7 0	8 6.3 AC	7 0	7 NC	7 NC	7 60	7 1	7 60	7 1
8 0	8 1	8 0	8 1	8 180	8 *	8 0	8 1	8 4	8 33 M	8 17	8 8270 ~	8 17	8 8270 ~	8 6.3 AC	8 1	8 295	8 *	6 3 AC	8 1	6 3 AC	8 0

* 1 MEG OR MORE, DEPENDING UPON THE CONDITION OF THE FILTER CONDENSERS

† - 6V TO 14V, DEPENDING ON FREQUENCY



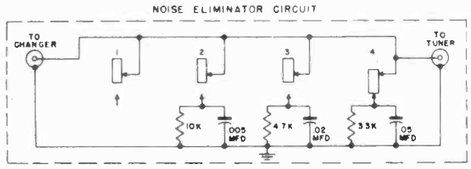
RECORD CHANGERS: For 114N4, 116N4, Model 41-E Capehart, RCD.CH. 18-25; For 21P4, 24P4, 29P4, 30P4, 31P4, Model P-71, RCD.CH. 19-1;

SPECIAL INFORMATION
P-4 SERIES

THE NOISE ELIMINATOR

P4 series instruments are divided into two groups, the instruments using the 41E-MP record changer (100P4 series) and those using the P-71 drop type record changer. The N4 series is also divided in a like manner.

The 41E-MP automatic record changer, used in the 100P4 series instruments, uses the new "Magnetic True Timbre" pickup, which is of the variable reluctance type. The Noise Eliminator used with these instruments is contained in a metal control box which is mounted on the inner wall of the record changer compartment. A schematic diagram of the noise eliminator circuit, as used in the 100P4 series is shown below:



On P4 series instruments using the P-71 record changer the noise eliminator circuit and selector switch are included on the changer itself.

RECORD CHANGER AC CABLES

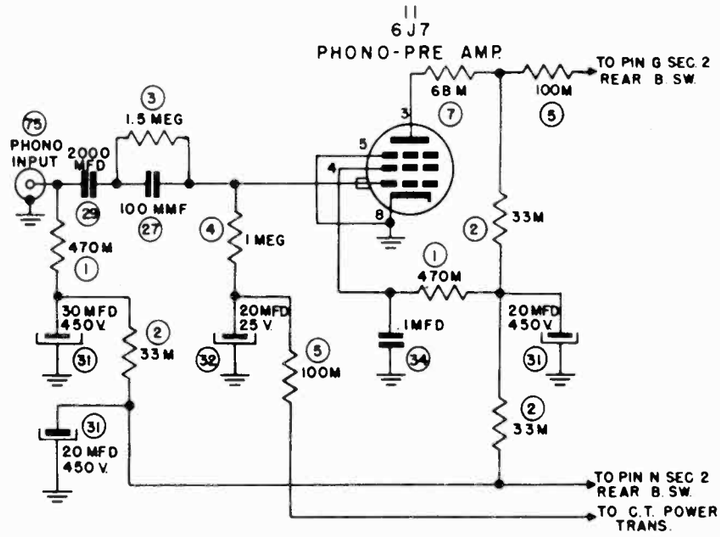
100P4 and 100N4 series instruments use the Record Changer AC Cable, part no. 22182. This cable is a multi-purpose cable, in that it not only supplies A.C. power to the 41E-MP record changer, but also supplies 110 volts to the record changer compartment light and in addition serves to connect the Reject Button to the record changer.

P4 instruments using the P-71 record changer and N4 instruments using the P-63 changer, both use the Record Changer AC Cable, part no. 22184. This cable serves merely as a power carrier to the record changer.

Schematic diagrams of both cables are shown

The 41E-MP & 41E record changers used in the P4 and N4 respectively are identified by a brown dot painted on the bearing cover plate of the main cam support bracket. Early production of the 41E, carrying either no dot or a red dot, are not directly interchangeable in the N4 and P4 without a modification in the wiring of the junction box. Reference should be made to the 41E manual.

This maintenance manual deals with the radio chassis of the instrument. For servicing information on the record changer, reference should be made to the manuals dealing with the 41E, P-71 or the P-63.



The N4 tuner is essentially the same as the P4 tuner, the schematic diagram with exception of the Phono Pre-Amplifier circuit. The Phono Pre-Amplifier, as used in the N4 tuner, is shown in that portion of the schematic reproduced above:

PARTS LIST

Ref. No.	Part No.	Description
1	77217	470M ohm Resistor
2	77267	33M ohm Resistor
3	77351	1.5 Meg ohm Resistor
4	77218	1 Meg ohm Resistor
5	77214	100M ohm Resistor
6		
7	77305	68M ohm Resistor
8	77262	1000 ohm Resistor
9	77212	10M ohm Resistor
10	77266	22M ohm Resistor
11	77265	15M ohm Resistor
12	77216	220M ohm Resistor
13	77272	4.7 Meg ohm Resistor
14	77213	47M ohm Resistor
15	77013	10M ohm 2 Watt Carbon Resistor
16	77211	4700 ohm Resistor (used on 2 gang chassis)
17	77270	2.2 Meg ohm Resistor
18	77210	3300 ohm Resistor
19	77360	22 ohm Resistor
20	77189	270 ohm 2 Watt Carbon Resistor
21	77440	1000 ohm 5 Watt Wire Wound Resistor
22	77261	470 ohm Resistor
23	25333	60 mmf Ceramic Capacitor N-470
24	25273	1500 mmf (350V-20%+50%) (Hi-"K") Ceramic Capacitor
25	25332	30 mmf Ceramic Capacitor +5% N-150
26	25329	30 mmf Ceramic Capacitor +5% N-750
27	25188	100 mmf Molded Mica Capacitor
28	25271	4000 mmf Molded Mica Capacitor
29	25295	2000 mmf Molded Mica Capacitor
30	25406	80 mmf Ceramic Capacitor
31	25214	Filter Condenser (30 Mfd., 20 Mfd.. 20 Mfd., at 450 V., 25 Mfd., at 25V)
32	25269	50 Mfd., 25 Volt Electrolyitc Condenser
33	25270	4 Mfd., 100 Volt Electrolytic Condenser
34	25215	.1 Mfd., 600 Volt Tubular Condenser
35	25193	47 mmf Molded Mica Capacitor
36		
37	25183	.005 Mfd., 600 Volt Tubular Condenser
38	25196	.05 Mfd., 600 Volt Tubular Condenser
39	25185	.002 Mfd., 600 Volt Tubular Condenser
40	25184	.003 Mfd., 600 Volt Tubular Condenser
41	25194	.01 Mfd., 600 Volt Tubular Condenser
42	25209	.01 Mfd., 600 Volt Condenser (Metal encased)
43	25197	.001 Mfd., 600 Volt Condenser
44	25327	4 mmf. Ceramic Capacitor
45	25189	500 mmf Mica Capacitor
46	25187	250 mmf Mica Capacitor (2 gang chassis)
47	26231	5-20 mmf Ceramic Trimmer Capacitor
48	26023	1-10 mmf Trimmer Condenser (Broadcast Antenna)
49	26240	Dual Trimmer Condenser Strip
50	26036	Trimmer Condenser for Broadcast Converter Coil
51	38690	FM Antenna Coil
52	38661	RF Choke
53	38913	Broadcast Converter Coil
54	38691	FM Converter Coil
55	38692	FM Osc. Coil
56	38824	1st FM Intermediate Freq. Trans.
57	38825	2nd FM Intermediate Freq. Trans.
58	38826	3rd FM Intermediate Freq. Trans.
59	38805	Loop Loading Coil Assy.
60	11325	FM Antenna & Plug Assy. (Mounted on Cabinet)
61	38484	Wave Trap Coil (Used with Two Gang Chassis)
62	38694	Broadcast Osc. Coil Assy.
63	38822	1st AM Intermediate Freq. Trans.
64	38823	2nd AM Intermediate Freq. Trans.
66	80361	Female Input Socket for FM Dipole
67	26275	Three Gang Tuning Condenser for C-226 N-4 Chassis and C-235 P-4 Chassis
	26237	Two Gang Tuning Condenser for C-175 N4 Chassis
68	90223	Band Switch
69	78123	Treble Tone Control
70	78101	Master Volume Control & Switch
71	78148	Bass Tone Control
72	80244	Five Prong Speaker Connecting Socket (Female)
73	80284	Five Prong Male Speaker Plug and Cap
74	80368	Six Prong Female Socket for Phono AC Cable
75	80030	Phono Signal Input Socket (Female)
76	90219	Phono AC Switch
77	94226	Filter Choke
78	94225	Power Transformer
79	94260	Output Trans. for 8115 Speaker on P4 & N4 series
80	81155	Speaker & Output Trans. Assy.
81	27118	AC Line Cord
82	25053	1000 mmf Capacitor
83	07524	Left Hand Dial Support Brkt. and Pulley Assy.
84	15174	Tuning Drive Shaft & Pulley Assy.
85	07525	Right Hand Dial Support Brkt. & Pulley Assy.
86	59279	Fibre Dial Cord Pulley
87	04070	Mount. Clamp for Dial Glass Scale
88	04098	Top Dial Support Angle Brkt.
89	13807	Dial Glass Scale Assy.
90	13631	Dial Pointer Box Assy.
91	62115	Rubber Grommet (on bottom of dial Support
92	55261	Tuning Fly Wheel
93	07410	Brg. Assy. for Lower Pointer Guide
94	58552	Mount. Brkt. for Phono AC Switch
95	55259	Guide Rod (upper & lower) for Pntr. Box Assy.
96	77207	3.3 Meg. Ohm Resistor
97	13889	Pre-Amp. Equalizer Assy.

MISCELLANEOUS PARTS LIST

Part No.	Description
07529	Dial cord and spring assy.
11382	AC phono cable & plug assy. (for two gang N4 chassis, C-175)
17019	Tuning drive drum
22183	AC phono cable and plug assy. for C-226, N4 Chassis and C-235, P4 Chassis
25187	Molded mica cap. 240 mmf +10%
25270	Tubular Elec. cap. 4 mfd. 100V.
25325	Ceramic cap. 60 mmf. +5%
36927	Snap washer (for tuning drive shaft)
36936	Flange sleeve to mount tuning cond.
42185	Pilot light
54144	Bakelite mtg. wafer for fltr. cond.
54161	Ceramic spacer for mtg. trm. cond.
54193	Glass rod pointer for stat. pointer box
55260	Mtg. stud for fibre dial cord pulley
56183	Tuning shaft bearing
56518	Rear mtg. brkt. for tuning condenser
56528	Front mtg. brkt. for 2 gang tun. cond.
58302	Capacitor clip
58335	Min. tube shield
58446	Clamp to hold dial string to pntr. box
58524	Mtg. clip for glass rod sta. pointer
58880	Front mtg. brkt. for 3 gang cond.
59391	Plastic prism for sta. pntr. box
60315	N4 chassis bottom cover
62099	Rubber mtg. grommet for tuning cond.
64351	Spring only for dial cord
64382	Compression spring for pntr. guide bar
80139	Molded octal socket
80319	Miniature tube socket
80344	Pilot light socket and lead
2000-007	#2-56x5/16" R.H.M.S. (to mount plastic prism in pointer box)
2000-071	#3-48x1" lg. R.H.M.S. (adj. screw for pointer guide bar)
11325	Dipole antenna assy. (mounted on cab.)
13581	Speaker network term. board assy. (100 series P4 & N4)
22152	Pickup cable (100N4 & 100P4 series
22156	Pickup cable (for P4 & N4)
22182	Record changer AC cable (100N4 & 100 P4 series
22184	Record changer AC cable (P4 & N4 series)
31419	Escutcheon for Pan. N4 series
31429	Escutcheon for 100N4 & P4 series
36478	#3-48 x 1/4" lg. Phillips F.H.M.S. to mount escutcheon mtg. plate
41130	Mounting screw kit for dial escutch.
58461	Special #3-48 tapped nut for escutch. mtg. plate
58546	Escutcheon mtg. plate (metal)
59316	Tuning and volume knob
59373	Tone control knob
80284	5 prong male speaker plug with cap
80362	2 prong male plug for FM dipole ant.
80366	3 prong female connector on phono AC cable (100N4 & 100P4 series)
80368	6 prong female plug and cap for phono AC cable (100N4 & 100P4 series)
80373	Male connector plug for reject switch cable (100N4 & 100 P4 series)
80422	Ant. and ground terminal strip
80463	6 prong male plug and cap for phono AC cable (100N4 & 100P4 series)
81155	Speaker and output trans. assy. (12")
81183	Cone and voice coil assy. (12")
81184	Treble speaker only (100N4 & 100P4)
90194	Reject switch (100N4 & 100P4)

FARNSWORTH TELEV. & RADIO CORP. MODELS 35P7, 32P9, 33P9, 34P10

SECTION I

RECEIVER FREQUENCIES

Broadcast Band	540 to 1620 KC
Frequency Modulation Band	87.5 to 108.5 MC
Intermediate Frequency—AM Band	455 KC
FM Band	10.7 MC

TUBE COMPLEMENT

P7 Type	P7 Application	P9 & P10 Type	P9 & P10 Application
6AG5	AM-FM, RF Amplifier	6AG5	AM-FM, RF Amplifier
12AT7	FM Oscillator-Mixer	12AT7	FM Oscillator-Mixer
6BE6	AM Converter-Osc.	6BE6	AM Converter-Osc.
6SK7	1st IF Amplifier, FM-AM	6SK7	1st IF Amplifier, FM-AM
6SK7	2nd IF Amplifier, FM-AM	6SK7	2nd IF Amplifier, FM-AM
6SK7	3rd IF Amplifier, FM	6SK7	3rd IF Amplifier, FM
6T8	FM-AM Detector, AVC and 1st Audio Amp.	6T8	FM-AM Detector, AVC and 1st Audio Amp.
6SQ7	Phase Inv. and Gas Gate	6V6GT	Power Amplifier
6V6GT (2)	Push Pull Power Amps.	5Y3G/GT	Full Wave Rectifier
5Y3G/GT	Full Wave Rectifier	6SC7*	Phono. Pre-Amplifier
6SC7*	Phono. Pre-Amplifier		

* Used only in P7 and P9 instruments.

Total Number Of Tubes

P7—12 tubes P9—10 tubes P10—9 tubes

AMPLIFIER SPEAKER SYSTEM

P7		P9 & P10
12 watts	Power Output	8 watts
4 ohms	Voice Coil Impedance	4 ohms
12" PM	Type Speaker	12" PM
40 to 12,000 c. p. s.	Frequency Response	50 to 10,000 c. p. s.

AUTOMATIC RECORD CHANGER

P7		P9 & P10
P-71	Type	P-72 (P9)—P-73 (P10)
78 RPM	Speed	78 RPM

POWER AND VOLTAGE REQUIREMENTS

Power Consumption—105 watts at 117 volts. Voltage—105 to 125 volts at 60 cycles per second.

ANTENNAS--INTERNAL AND EXTERNAL

SECTION III

Two antennas are provided within the cabinet—a Capehart Low Impedence Loop and a Folded Dipole, constructed of 300 ohm "twin lead."

The loop antenna provides signal pickup for broadcast-band AM reception. This antenna is a directional device (its radiation pattern would show greatest signal pickup directly in front and in back of the loop, with very little if any pickup from its sides). Therefore, the reception of a desired weak signal may be improved by swinging the loop to a new position. The loop is fastened to the inner cabinet wall by means of two hinges which permit it to be adjusted. The built-in loop normally provides satisfactory reception, however in locations remote from broadcasting stations or where poor receiving conditions exists, an outdoor antenna will improve reception.

By shorting terminals 3 and 4 on the antenna terminal strip on the rear of the chassis, the outdoor FM dipole (if used) can be utilized as an outdoor antenna for AM reception. However, if a separate AM outdoor antenna is to be used the lead-in from the antenna should be connected to terminal 4 on the antenna terminal strip, on the rear of the chassis.

The half-wave folded dipole within the cabinet is for FM reception, connection being made by a section of 300 ohm transmission line. It should be borne in mind that the dipole is also a directional device. Should the reception of a desired FM station be inadequate after installation in the home, it may be possible to correct the condition by relocating the receiver in the room.

Internal antennas are intended for use only in the presence of adequate field strength, as

MODELS P7, P9, P10, FARNSWORTH TELEV. & RADIO CORP.
Series, Capehart

in large metropolitan areas where local stations supply the majority of desired programs. Neither a loop nor a dipole element which is confined within a cabinet can be considered as efficient signal pickup devices, therefore if field strength requirements are not met, it will be necessary for satisfactory reception, to install an efficient outside antenna.

When an outside dipole is used, disconnect the transmission line to the internal dipole from the Fahenstock clips on the rear of the cabinet and connect the transmission line from the outside dipole to these clips.

The same chassis as used in the P7 instruments is also used as an AM-FM chassis in Capehart Television-Radio-Phono Combinations. In this case an outside television antenna will be connected to the clips at the rear of the cabinet and it will be necessary to connect the antenna terminals on the video chassis to terminals 1 and 2 on the receiver antenna terminal strip.

MAINTENANCE OF THE RECEIVER

SECTION IV

1. *Adjustment of Dial Pointer*

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

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.

2. *Dial Slippage*

a. The dial pointer may be sticking, causing dial slippage. This may be due to (a) lubricant on rod, (b) bent rod, (c) rough rod.

(a) The rod must be free of all lubricants. Lubrication, momentarily helpful, causes gum to form at the pointer 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.

3. *Replacing Miniature Tubes*

Inadvertently inserting miniature tubes in their sockets incorrectly will result in damage to the tube pins. Therefore extreme care should be taken to see that the tube pins are properly aligned with the tube socket before applying pressure to insert the tube. As an aid to the serviceman we have placed an indicating mark on the miniature tube sockets to show the correct position for the center of the separation space between the first and last pins on the tube. In this manner it is posible to line-up the tube with the socket before exerting pressure.

4 *Control Knobs—Eccentric—Loose—How to Remove*

a. Knobs eccentric (wobbly motion) or loose.

This may be caused by pinching together the two 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 4a, above.

5. *Microphonics and Feedback*

a. Microphonic tubes.

b. Check the variable condenser stator plates to ascertain whether they are loose. If so, apply a laquer 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 taut 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 subchassis assembly being taut. Re-solder with less tension in the flat ribbon lead.

NOTE: Oscillator trimmer may have to be readjusted.

REMOVING CHASSIS FROM CABINET

Following is the suggested procedure to be employed in removing the receiver and preamplifier chassis from the cabinet for service purposes.

Model 35P7

1. Remove the knobs.

2. Disconnect the A.C. cable and phono input cable from the record changer. To do this simply remove the two palnuts in the front of the record changer slide drawer and lift the drawer up just enough to reach in and remove the plugs from the power socket and the phono output jack on the changer. It will be necessary to unfasten the cables from the changer slide where they are held in place. Upon reassemblying the instrument, be certain that these cables are again fastened so that they will not become entangled in the changer mechanism.

3. Remove the Phono Pre-amplifier chassis by removing the three mounting screws which fasten it to the cabinet wall.

4. Remove the pre-amp output cable from the phono input jack on the receiver chassis and disconnect the pre-amp power cable.

5. Disconnect the speaker cable and antenna leads.

6. Remove the two mounting bolts in rear of the receiver chassis and slide the chassis out on the chassis mounting board. The mounting board will have to be removed to get at the underside of the chassis.

Models 32P9 and 33P9

1. Remove the knobs.
2. Disconnect the a.c. cable and phono input cable from the record changer. The underside of the changer is easily accessible from the rear of the cabinet. Both cables are fastened to the inner wall of the cabinet by means of insulated staples, it will be necessary to remove these staples. Upon reassembling the instrument, be certain that these cables are again fastened as they were.
3. Remove the phono preamplifier chassis by removing the three mounting screws which fasten it to the cabinet wall.
4. Remove the pre-amp output cable from the phono input jack on the receiver chassis and disconnect the pre-amp power cable.
5. Disconnect the speaker cable and antenna leads.
6. Remove the molding from around the glass escutcheon and remove the escutcheon.
7. Remove the chassis mounting bolts. (The chassis is mounted on the wall of the cabinet. The bolts, which are accessible from the record storage compartment, are concealed by plug buttons.) The two top bolts are to be removed first, then loosen the bottom bolt slightly. Grasp the chassis from the top, preferably by placing the fingers under the dial background panel, remove the final mounting bolt with the other hand and then lower the chassis to the bottom of the cabinet.

Model 34P10

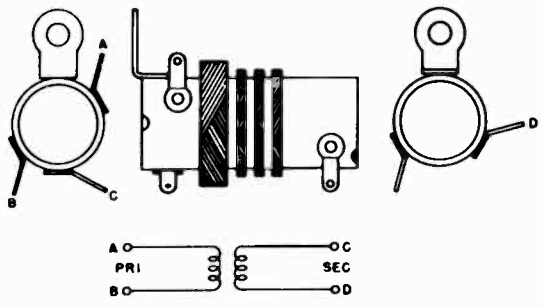
1. Use the same procedure as described for models 32P9 and 33P9 with exception of steps 3 and 4. (The 34P10 does not use the phono preamplifier.)

NOTE: It is not necessary to remove the chassis from the cabinet to replace tubes or dial lights or to remove tubes for testing in any of these models. All tubes are accessible from the rear of the cabinet in the 35P7. In the other models there is a removable panel in the partition separating the receiver and record changer compartments. Tubes that are not accessible from the rear of the cabinet are accessible through the opening provided by this panel.

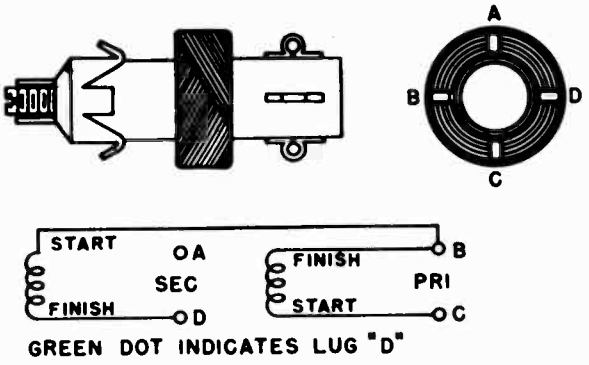
PARTS IDENTIFICATION

SECTION V

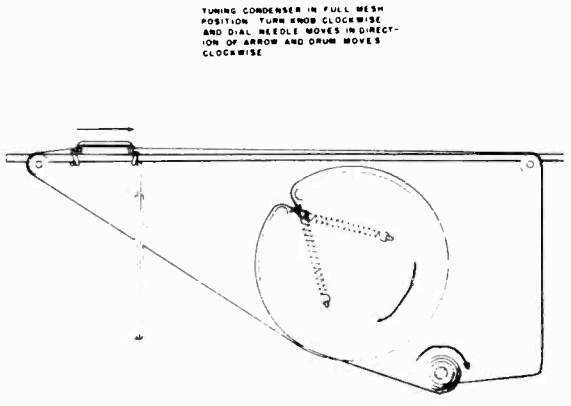
RF. OSCILLATOR AND MIXER COILS



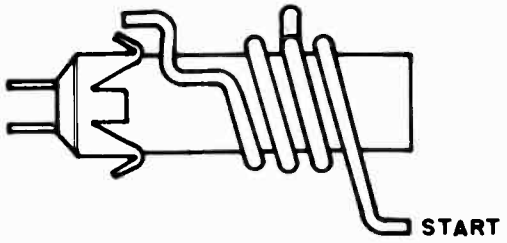
AM Conv. Coil



AM OSC. Coils



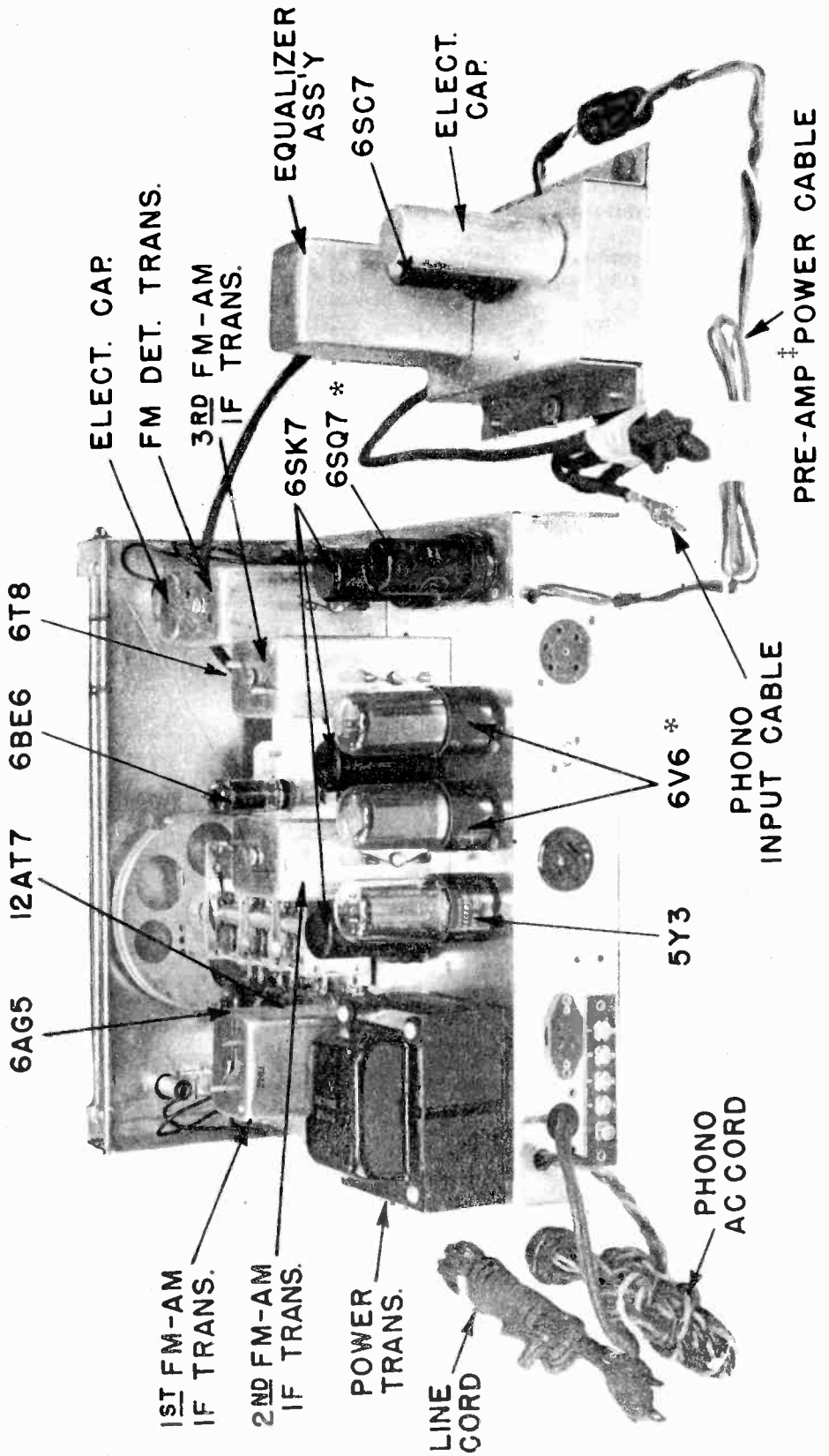
Dial Stringing



TOTAL TURNS	TAP AT
MIXER COIL — $3\frac{1}{4}$	$\frac{1}{2}$ TURN
OSC. COIL — $3\frac{1}{4}$	$1\frac{1}{8}$ & $2\frac{1}{8}$ TURNS

FM Coils

MODELS P7, P9, P10, FARNSWORTH TELEV. & RADIO CORP.
Series, Capehart



P7 CHASSIS

* P9 & P10 chassis have only (1) 6V6 and no 6SQ7.

‡ P10 does not use Pre Amplifier

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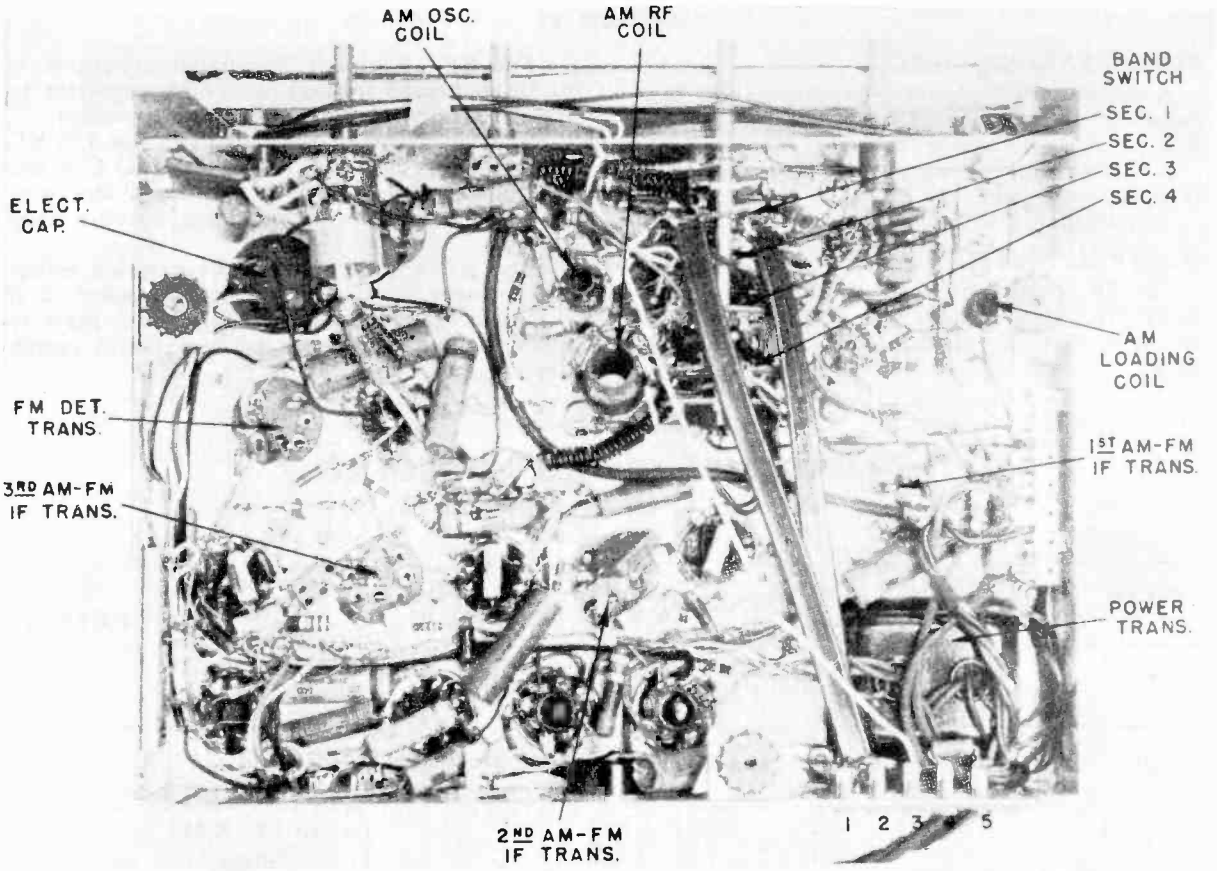
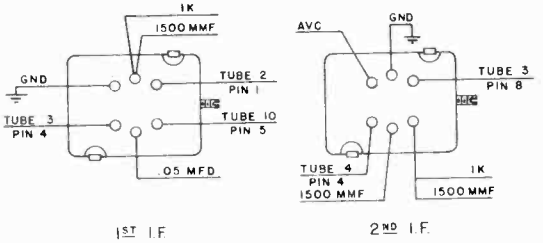
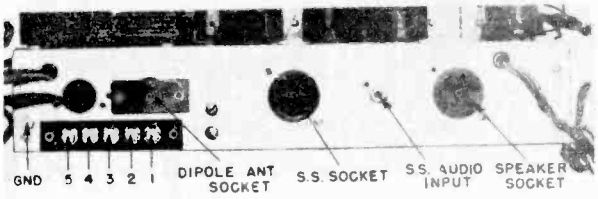
MODELS P7, P9, P10, Series, Capehart

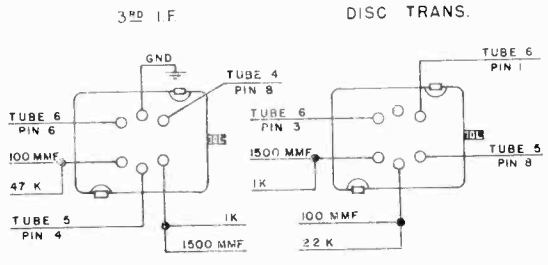


Bottom View of P7 Chassis

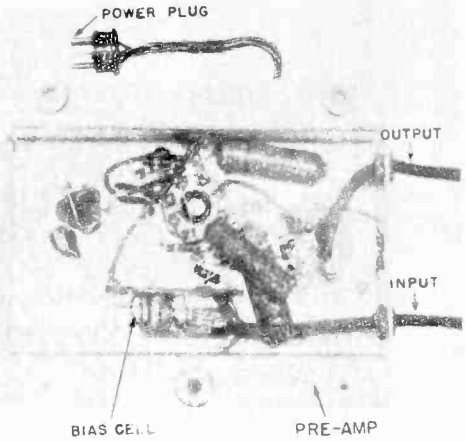




Rear View of Chassis



Bottom View of I.F. Cans



Bottom View of Pre-Amplifier

MODELS P7, P9, P10, Series, Capehart — FARNSWORTH TELEV. & RADIO CORP.

ALIGNMENT OF AM BAND

SECTION VI

EQUIPMENT REQUIRED

A calibrated RF Signal Generator having fundamental frequencies of from 455 KC to 1620 KC.

A Voltohmyst, or some such high resistance type AC voltmeter.

An insulated screwdriver.

GENERAL INSTRUCTIONS

For IF alignment the signal generator is to be connected through a .1 mfd. capacitor to the grid (pin 7) of the 6BE6 AM converter tube.

For RF alignment the signal generator is to be connected through a .1 mfd. capacitor to the RF section of the gang tuning capacitor.

For adjustment of the wavetrap the 455 KC signal should be connected to terminal 4 on the Antenna Terminal Strip on the rear of the chassis. The wavetrap is mounted on the loop antenna.

The AC voltmeter can be connected either across the voice coil of the loud speaker or if the meter range is high enough, from plate to plate of the output tubes, using a .1 mfd. capacitor for isolation.

TABULATION FOR AM ALIGNMENT

See page 11 for Trimmer locations

STEPS	CONNECT GENERATOR		SET GENERATOR AT	SET GANG AT	ADJUST	TO OBTAIN
1	Set Bandswitch in AM position					
2	Set Tone and Volume Controls at Maximum					
3	Through .1 Mfd.	Grid Conv. tube	455 Kc	Quiet Point	3rd I.F. A.M. Slugs	MAXIMUM OUTPUT
4					2nd I.F. A.M. Slugs	
5					1st I.F. A.M. Slugs	
6	Through .1 Mfd.	RF Section of GANG	1620 Kc	1620 Kc	A.M. Osc. Trimmer	
7					A.M. R.F. Trimmer	
8			1500 Kc	1500 Kc	A.M. Ant. Trimmer	
9			600 Kc	600 Kc	A.M. Ant. Padder	
10			600 Kc	600 Kc	A.M. Osc. Padder*	
11	Check dial calibration at several frequencies. If not reasonably correct, adjust oscillator padder. See Note †					
12	Terminal 4 Ant. Term. Strip		455 Kc	Quiet Point	Wave Trap on Loop	MINIMUM OUTPUT

* This adjustment should be made while gang is rocked.

† After any adjustment of oscillator padder, repeat steps 4 to 8 inclusive.

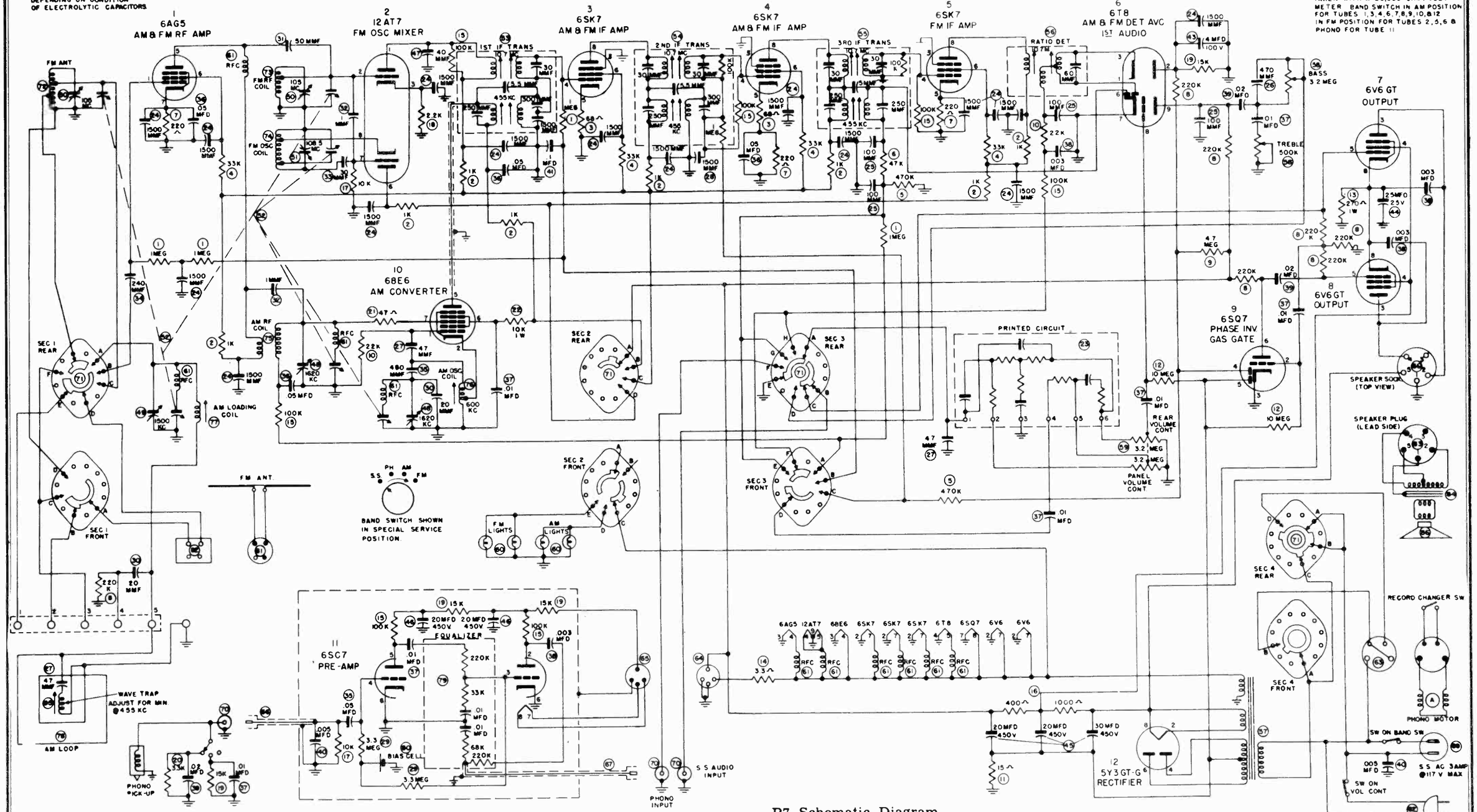
FARNSWORTH TELEV. & RADIO CORP.

MODELS P7, P9, P10, Series, Capehart

	1		2		3		4		5		6		7		8		9		10		11		12	
	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE
1	1-3	1 3.5MEG	1 200	1 ◆	1 0	1 0	1 0	1 0	1 0	1 0	1 -.5	1 INF	1 0	1 0	1 0	1 0	1 0	1 0	1 ◆	1 22K	1 0	1 0	1 -1.3	1 15Ω
2	1.65	2 220Ω	2 0	2 0	2 0	2 0	2 0	2 0	2 0	2 0	2 -.95	2 15K	2 0	2 0	2 0	2 0	2 0	2 INF	2 0	2 INF	2 150	2 200K	2 290	2 ◆
3	3 0	3 0	3 4.5	2 0	3 0	3 0	3 0	3 0	3 0	3 0	3 -.5	3 INF	3 275	3 275	3 ◆	3 0	2 -.82	2 INF	3 0	3 INF	3 -3	3 INF	3 NC	3 NC
4	6.3AC	4 4Ω	4 6.3AC	3 2.2K	4 -.65	4 2MEG	4 2MEG	4 2MEG	4 0	4 25Ω	4 0	4 0	4 235	4 235	4 ◆	4 0	3 0	4 288K	4 3Ω	4 INF	4 -3	4 INF	4 300AC	4 150Ω
5	218	5 ◆	5 6.3AC	4 3	5 1.15	5 68Ω	5 220Ω	5 220Ω	5 2.2	5 220Ω	6 -.93	5 .4Ω	5 0	5 0	5 450K	5 450K	4 -.25	5 17Ω	4 3Ω	5 ◆	5 135	5 200K	5 NC	5 NC
6	180	6 ◆	6 190	5 ◆	6 100	6 ◆	6 ◆	6 ◆	6 110	6 ◆	7 0	6 500K	6 0	6 0	6 220K	6 220K	5 -1	6 ◆	5 5Ω	6 4Ω	6 0	6 0	6 300AC	6 150Ω
7	1.65	7 220	7 -3.8	6 110K	7 6.3AC	7 7.3Ω	7 7.3Ω	7 7.3Ω	7 6.3AC	7 5Ω	8 -1.2	8 10MEG	7 6.3AC	7 6.3AC	7 7.2Ω	7 7.2Ω	6 1.35	7 3Ω	6 12Ω	7 15MEG	7 0	7 0	7 NC	7 NC
8			8 0	8 0	8 210	8 ◆	8 205	8 ◆	8 180	8 ◆	9 105	9 ◆	8 14	8 14	8 270Ω	8 270Ω	7 6.3AC	8 0	7 7	▸ -10 @ 540KC -14 @ 1620KC	8 54AC	8 254	8 295	8 ◆
9			9 0	9 0													8 0							

◆ APPROX. 5 MEG OR LESS DEPENDING ON CONDITION OF ELECTROLYTIC CAPACITORS.

VOLTAGE AND RESISTANCE READINGS TAKEN WITH A 20,000 OHM/VOLT METER. BAND SWITCH IN AM POSITION FOR TUBES 1,3,4,5,7,8,9,10,&12. IN FM POSITION FOR TUBES 2,5,6 & PHONO FOR TUBE 11.



P7 Schematic Diagram

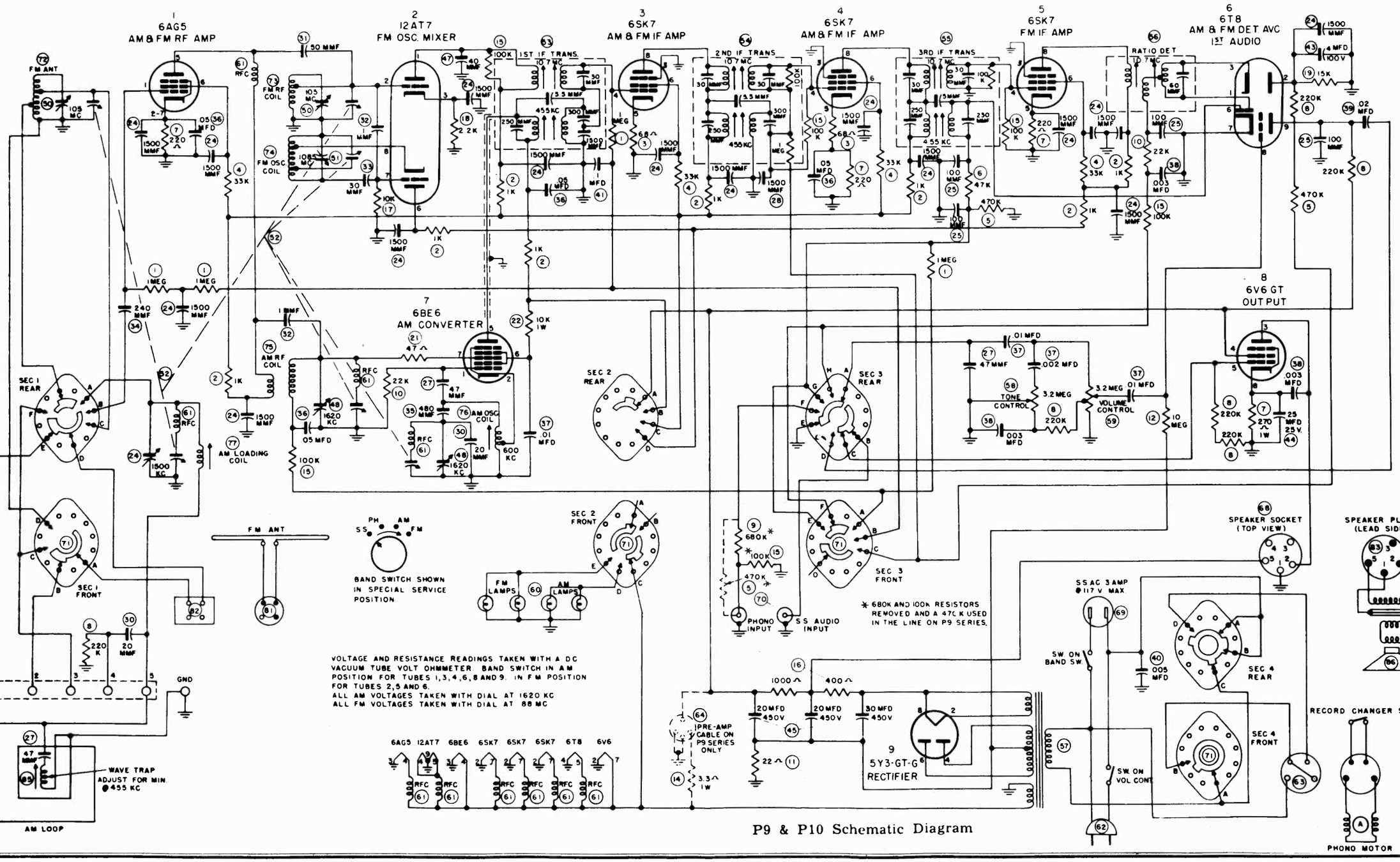
RECORD CHANGER: For P7, Model P71 RCD.CH. 19-1

MODELS P7, P9, P10,
Series, Capehart

FARNSWORTH TELEV. & RADIO CORP.

	1		2		3		4		5		6		7		8		9	
	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE
1	1.-4	1.27 MEG	1	1 MF	1	1.0	1	1.0	1	1.0	1	1 INF	1	122K	1	1.0	1	1.22Ω
2	1.6	2 220Ω	2	2.0	2	2.0	2	2.0	2	2.0	2	2.15K	2	2.25Ω	2	2.0	2	2 INF
3	0	3 0	3	3 2.2K	3	3.0	3	3.0	3	3.0	3	3 INF	3	0	3	3 260	3	3 NC
4	6.3AC	4 .4Ω	4	4 .4Ω	4	4-5	4	4 L7 MEG	4	4 .25Ω	3	4 0	4	0	4	4 220	4	4 120Ω
5	215	5 INF	5	5 .4Ω	5	5.9	5	5 290Ω	5	5 220Ω	4	5 .4Ω	5	INF	5	.05	5	5 NC
6	180	6 INF	6	6 INF	6	6 100	6	6 INF	6	6 INF	5	6 500K	6	INF	6	0	6	6 120Ω
7	155	7 220Ω	7	7 10K	7	7 6.3AC	7	7.4Ω	7	7.4Ω	6	7 0	7	116 MEG	7	6.3AC	7	7 NC
8		8 0	8	8 0	8	8 210	8	8 INF	8	8 INF	7	8 10MEG	8		8	8 10	8	8 INF
9		9 0	9	9 0							8	9 INF						
											9							

* 11.5 @ 540KC
17 @ 1620KC



* 680K AND 100K RESISTORS REMOVED AND A 470K USED IN THE LINE ON P9 SERIES.

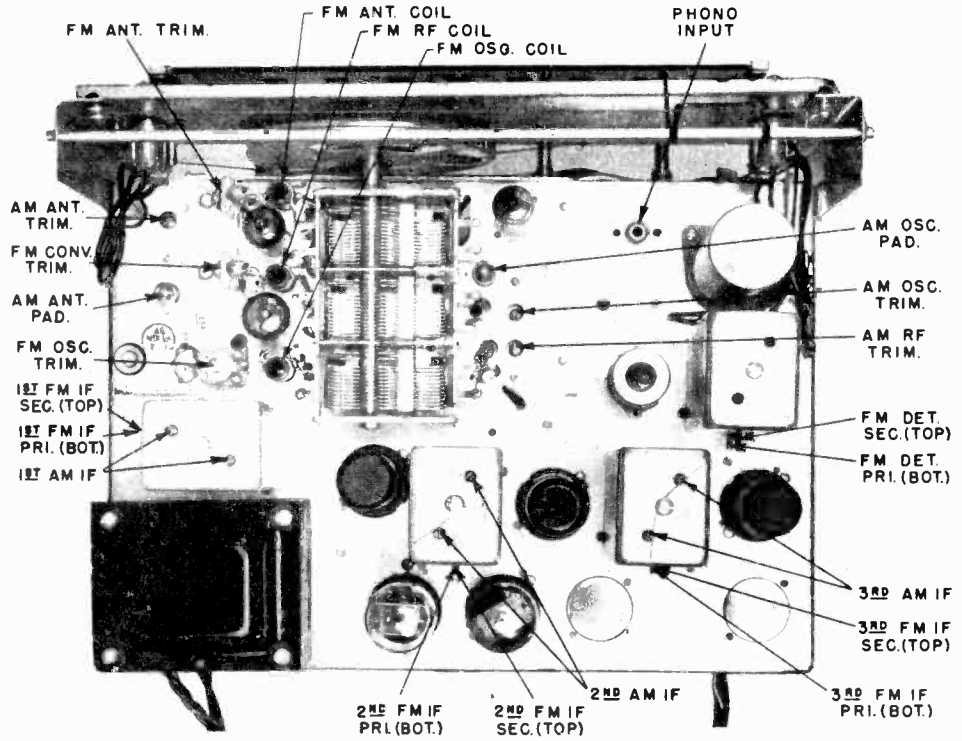
VOLTAGE AND RESISTANCE READINGS TAKEN WITH A DC VACUUM TUBE VOLT OHMMETER. BAND SWITCH IN AM POSITION FOR TUBES 1, 3, 4, 6, 8 AND 9. IN FM POSITION FOR TUBES 2, 5 AND 6.
ALL AM VOLTAGES TAKEN WITH DIAL AT 1620 KC
ALL FM VOLTAGES TAKEN WITH DIAL AT 88 MC

P9 & P10 Schematic Diagram

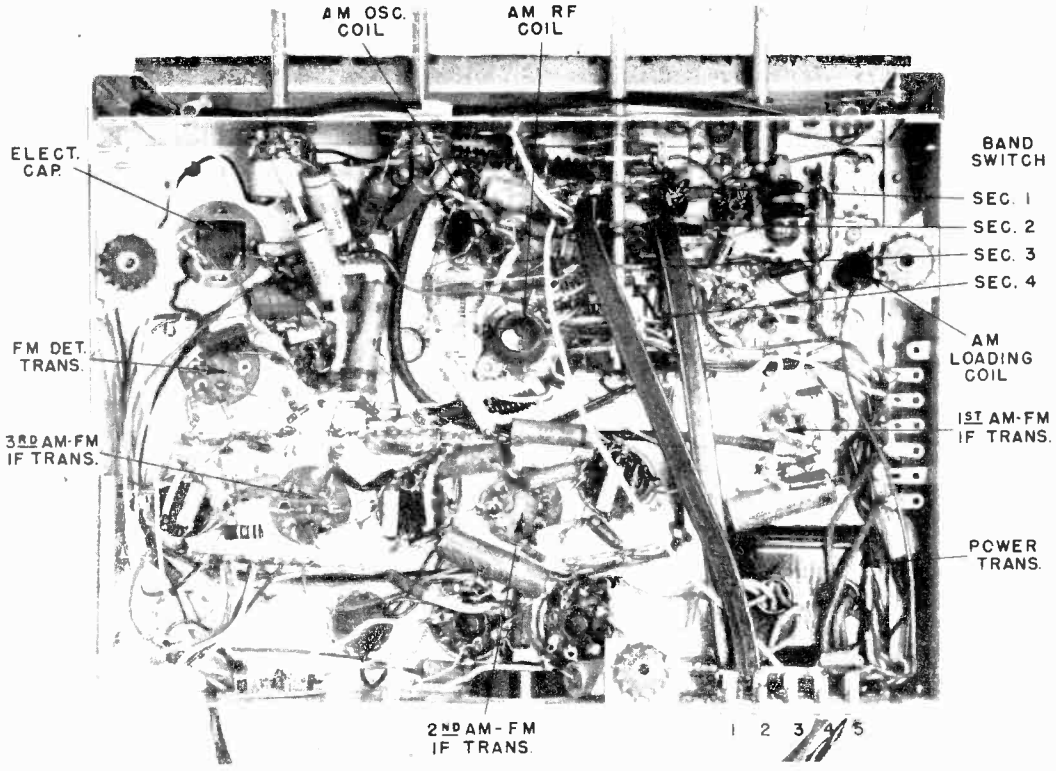
FARNSWORTH TELEV. & RADIO CORP. MODELS P7, P9, P10, Series, Capehart

LOCATION OF TRIMMERS

SECTION VIII



Top View of P9, P10 Chassis



Bottom View of P9, P10 Chassis

MODELS P7, P9, P10, FARNSWORTH TELEV. & RADIO CORP.
Series, Capehart

FM ALIGNMENT

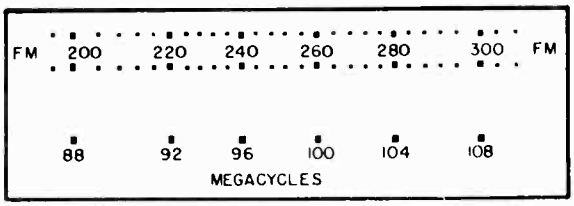
SECTION IX

This section presents information on two methods of alignment of 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, the sweep generator method. This is the method used in factory alignment.

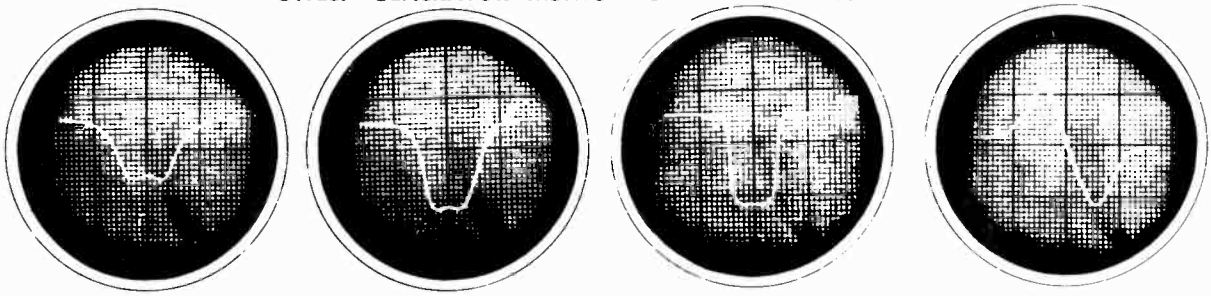
An alternative method, using an amplitude-modulated signal generator, is presented in the second portion of this section, which covers alignment of FM, IF and RF stages.

The conversion of FM dial scale readings to channel numbers can be made, with the help of the charts shown here, 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.



SWEEP GENERATOR METHOD OF FM IF ALIGNMENT



(1) (2) (3) (4)

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

1. Equipment required: Oscilloscope, 10.7 MC Sweep Generator, Voltohmyst and RF Signal Generator.

2. Make connection from vertical deflection amplifier of oscilloscope to pin No. 2 of 6T8 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 the receiver isolated by means of a 47K resistor.

3. Connect Sweep Generator to last FM IF grid (pin 4 6SK7) through a .001 MFD coupling capacitor.

4. Connect a 350 mmf. capacitor across the discriminator secondary. Back out discriminator secondary slug (top slug) as far as it will turn. Align primary (bottom slug) to obtain a somewhat broad but single peaked curve. Then remove the 350 mmf. capacitor and tune the secondary to obtain a curve similar to figure 1. This does not constitute a final alignment of the discriminator, but is a convenient expedient to assist in IF alignment.

5. 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.

6. Align the third FM IF transformer by first turning the secondary slug all the way out, adjust the primary and then the secondary for a symmetrical flat top pattern, as in Fig. 2.

7. Align second IF transformer in same manner as described in Section 6. 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.

8. Connect the signal generator to the grid of the mixer tube, in series with a 10,000 resistor and a .001 MFD capacitor or loosely couple by stray capacitance of an insulated wire.

9. Align first FM IF Transformer in the same manner as in Section 6. 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.

10. Connect 4 MFD electrolytic capacitor, that was previously disconnected.

11. Connect oscilloscope to audio output terminal of the discriminator transformer.

12. With sweep signal input to converter grid, align discriminator transformer for conventional discriminator pattern, as in Fig. 4.

15. Connect the signal generator to the mixer tube grid. With an unmodulated signal at 10.7 MC adjust the input to 190 microvolts. Connect a voltohmyst to the AVC line. Rock the signal generator until the peak is obtained on the voltohmyst. With a 190 microvolt input this peak should read -1 volt.

SIGNAL GENERATOR METHOD

GENERAL INSTRUCTIONS

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 both the AM and FM bands.

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

a. Set treble tone control to maximum treble position.

b. Set bass tone control to maximum bass position.

c. Set volume control to maximum.

FM IF ALIGNMENT

1. Connect a voltohmyst or high resistance voltmeter on AVC line (negative lead to pin 2 of 6T8 and positive lead to chassis) through a .001 capacitor. Connect on AM signal generator, set at 10.7 MC, to the grid of the last FM IF amplifier. Connect output meter on voice coil of speaker.

2. Turn the secondary slug of the FM detector transformer (top slug) out as far as it will turn. Then, tune the primary (bottom slug) for maximum output (negative voltage) on the voltmeter.

3. Connect generator to grid of second FM IF amplifier (6SK7).

4. Detune the secondary of the 3rd IF transformer by turning out as far as possible.

5. Tune the primary of the 3rd IF transformer for maximum voltage, next tune the secondary for maximum voltage.

NOTE: In each step do not use an input greater than necessary to give three volts AVC.

6. Connect signal generator to grid of first IF amplifier (6SK7).

7. Detune the secondary of the 2nd IF amplifier by turning out as far as possible.

8. Tune the primary of the 2nd IF for maximum voltage, next tune the secondary for maximum voltage.

9. Connect the signal generator to the FM mixer grid (12AT7).

10. Tune the 1st IF transformer as in steps 7 and 8.

11. With the generator still connected to the FM mixer grid and modulated with 400 cycles, about 200 microvolts input, adjust the FM detector secondary slug for minimum output voltage on the output meter which is connected across the 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.

MODELS
P7, P9, P10,
Series, Capehart

FARNSWORTH TELEV. & RADIO CORP.

P7 INSTRUMENTS

Ref. No.	Part No.	Description
1	77181	Ins. Carbon Res. 1 Meg.
2	77233	Ins. Carbon Res. 1K
3	77245	Ins. Carbon Res. 68
4	77183	Ins. Carbon Res. 33K
5	77173	Ins. Carbon Res. 470K
6	77172	Ins. Carbon Res. 47K
7	77186	Ins. Carbon Res. 220
8	77178	Ins. Carbon Res. 220K
9	77187	Ins. Carbon Res. 4.7 Meg.
10	77169	Ins. Carbon Res. 22K
11	77491	Ins. Carbon Res. 15 ohms
12	77182	Ins. Carbon Res. 10 Meg.
13	77174	Ins. Carbon Res. 270 1W
14	77492	Ins. Carbon Res. 3.3 ohms 1W
15	77167	Ins. Carbon Res. 100K
16	77463	Molded Res. 1000 ohms, 400 ohms
17	77180	Ins. Carbon Res. 10K
18	77184	Ins. Carbon Res. 2.2K
19	77246	Ins. Carbon Res. 15K
20	77240	Ins. Carbon Res. 3.3K
21	77219	Ins. Carbon Res. 47 ohms
22	77022	Ins. Carbon Res. 10K 1W
23	77462	Printed Circuit
24	25273	Ceramic Cap. 1500 mmf.
25	25188	Ceramic Cap. 100 mmf.
26	25285	Ceramic Cap. 470 mmf.
27	25193	Ceramic Cap. 47 mmf.
28	25299	Mica Cap. 1500 mmf.
29	77223	Ins. Carbon Res. 3.3 Meg.
30	25492	Ceramic Cap. 20 Mmf.
31	25493	Ceramic Cap. 50 Mmf.
32	25497	Ceramic Cap. 1 Mmf.
33	25329	Ceramic Cap. 30 Mmf. (N750)
34	25427	Ceramic Cap. 240 Mmf.
35	25504	Silver Mica Cap. 480 Mmf. ±3%
36	25196	Tub. Paper Cap. .05-600V.
37	25186	Tub. Paper Cap. .01-400V.
38	25184	Tub. Paper Cap. .003-600V.
39	25195	Tub. Paper Cap. .02-600V.
40	25031	Tub. Paper Cap. .005-600V.
41	25182	Tub. Paper Cap. .1-200V.
42	25194	Tub. Paper Cap. .01-600V.
43	25270	Elect. Cap. 4 Mfd. 100V
44	25158	Elect. Cap. 25 Mf.-25V
45	25424	Elect. Cap. 30, 20, 20 Mf.-450V.
46	25463	Elect. Cap. 20, 20, Mf.-450V.
47	25507	Ceramic Cap. 40 Mmf. (N-750)
48	26278	AM Conv. Osc. Trim. Strip
49	26279	AM Ant. Trimmer
50	26280	FM Mixer-Ant. Trim. Strip
51	26231	FM Osc. Trimmer
52	17210	Gang Capacitor & Drive Drum Assembly
53	38957	1st IF Trans.
54	38950	2nd IF Trans.
55	38951	3rd IF Trans.
56	38952	Discriminator Trans.
57	94262	Power Trans.
58	78159	Tone Control
59	78158	Volume Control
60	42185	Dial Light Mazda #44
61	38884	RF Choke (heater)
62	27118	Line Cord
63	22193	Phono AC Cord & Socket
64	22173	Pre-Amp Power Cable (Fem.)
65	22171	Pre-Amp Power Cable (Male) (Pre-Amp Chassis)
66	22169	Pickup Cable (Pre-Amp Chassis)
67	22170	Output Cable (Pre-Amp Chassis)
68	80244	5 Prong Speaker Socket
69	80497	(SS) Power Adapter Socket
70	80030	Phono Socket
71	90269	Band Switch
72	38958	FM Ant. Coil Ass'y.
73	38959	FM Mixer Coil Ass'y.
74	38960	FM Osc. Coil Ass'y.
75	38961	AM Conv. Coil Ass'y.
76	38962	AM Osc. Coil Ass'y.
77	38963	AM Loading Coil Ass'y.
78	13893	Low Impedance Loop Antenna Assembly
79	13869	Equalizer Ass'y. (Pre-Amp Chassis)
80	95005	Bias Cell (Pre-Amp Chassis)
81	05150	Dipole Lead and Plug Assembly
82	80439	3 prong socket (FM dipole)
83	80469	Speaker Plug (part of #13897)
84	94239	Output Transformer
85	38996	Wave Trap Coil
86	13897	12" PM Speaker & Output Transformer
87	38898	Osc. Series choke
	31446	Dial Escutcheon (35P7)
	05144	Dial Drive Cord Ass'y.
	31439	AM Dial Glass
	31440	FM Dial Glass
	59492	Volume Knob
	59495	Tuning Knob
	59498	Band Switch Knob
	59496	Bass Tone Knob
	59497	Treble Tone Knob
	60428	Washer
	05151	Dipole Antenna Ass'y.
	15214	Drive Shaft Assembly
	80456	Miniature Tube Socket
	80479	Miniature 9-pin Tube Socket
	17213	Dial Back Plate Ass'y.
	55385	Drive Shaft Bearing
	62032	Rubber Grommet (R. F. Chassis)
	80139	Molded Octal Socket
	80239	Molded Octal Socket
	58939	9-pin Min. Tube Shieldbase
	58940-2	Tube Shield (9-pin Min)
	80494	Bias Cell Mounting (Pre-Amp Chassis)
	80491	9-pin Min. Mica Tube Socket (12AT7)
	62172	Rubber Grommet
	62189	Rubber Bushing
	36260-003	Phil Rd. Hd. Wood Screw, #6 x 3/8" (Pre-Amp. Mtg.)
	80348	Pilot Lamp Soc. & Cord
	80522	Pilot Lamp Soc. & Cord
	07674	Chassis End Brkt. Ass'y. (R.H.)
	07673	Chassis End Brkt. Ass'y. (L.H.)
	05154	Light Shield
	04133	Dial Pointer Ass'y.
	55383	Pointer Rod
	62099	Rubber Grommet
	H-321	Cabinet (35P7)
	2000-323 003	#10/32 x 1 1/8" Rd. Hd. Mach. screw (Chassis Mtg.)
	2000-321 003	#10/32 x 1" Rd. Hd. Mach. screw (Chassis Mtg. Board)
	2015-005 003	#8/32 Steel Hex nut (Speaker Mtg.)
	09374	Mtg. Spring Assy. (P-71 Changer)
	37066-072	#10/32 Acorn Palnut (Changer Mtg.)
	13890	Air Compression Stay Arm (35P7)
	64481	Spring
	37662	Cup Hook
	36490	Spring Washer
	74611	Operating Instructions (35P7)

All resistors are ½ watt unless otherwise specified

FARNSWORTH TELEV. & RADIO CORP. MODELS P7, P9, P10, Series, Capehart

P9 & P10 INSTRUMENTS

Ref. No.	Part No.	Description
.1	77181	Ins. Carbon Res. 1 Meg.
2	77233	Ins. Carbon Res. 1K
3	77245	Ins. Carbon Res. 68
4	77183	Ins. Carbon Res. 33K
5	77173	Ins. Carbon Res. 470K
6	77172	Ins. Carbon Res. 47K
7	77186	Ins. Carbon Res. 220
8	77178	Ins. Carbon Res. 220K
9	77508	Ins. Carbon Res. 680K (P10 only)
10	77169	Ins. Carbon Res. 22K
11	77236	Ins. Carbon Res. 22
12	77182	Ins. Carbon Res. 10 Meg.
13	77174	Ins. Carbon Res. 270 1W
14	77492	Ins. Carbon Res. 3.3 ohms 1W
15	77167	Ins. Carbon Res. 100K
16	77463	Molded Res. 1000 ohms, 400 ohms
17	77180	Ins. Carbon Res. 10K
18	77184	Ins. Carbon Res. 2.2K
19	77246	Ins. Carbon Res. 15K
21	77219	Ins. Carbon Res. 47 ohms
22	77022	Ins. Carbon Res. 10K 1W
24	25273	Ceramic Cap. 1500 mmf.
25	25188	Ceramic Cap. 100 mmf.
27	25193	Ceramic Cap. 47 mmf.
28	25299	Mica Cap. 1500 mmf.
29	77223	Ins. Carbon Res. 3.3 Meg. (Pre-Amp Chassis)
30	25492	Ceramic Cap. 20 Mmf.
31	25493	Ceramic Cap. 50 Mmf.
32	25497	Ceramic Cap. 1 Mmf.
33	25329	Ceramic Cap. 30 Mmf. (N750)
34	25427	Ceramic Cap. 240 Mmf.
35	25504	Silver Mica Cap. 480 Mmf. ±3%
36	25196	Tub. Paper Cap. .05-600V.
37	25185	Tub. Paper Cap. .002-600V.
38	25184	Tub. Paper Cap. .003-600V.
39	25195	Tub. Paper Cap. .02-600V.
40	25031	Tub. Paper Cap. .005-600V.
41	25182	Tub. Paper Cap. .1-200V.
42	25194	Tub. Paper Cap. .01-600V.
43	25270	Elect. Cap. 4 Mfd. 100V
44	25158	Elect. Cap. 25 Mf.-25V
45	25424	Elect. Cap. 30, 20, 20 Mf.-450V.
46	25463	Elect. Cap. 20, 20, Mf.-450V. (Pre-Amp Chassis)
47	25507	Ceramic Cap. 40 Mmf. (N-750)
48	26278	AM Conv. Osc. Trim. Strip
49	26279	AM Ant. Trimmer
50	26280	FM Mixer-Ant. Trim. Strip
51	26231	FM Osc. Trimmer
52	17210	Gang Capacitor & Drive Drum Assembly
53	38957	1st IF Trans.
54	38950	2nd IF Trans.
55	38951	3rd IF Trans.
56	38952	Discriminator Trans.
57	94262	Power Trans.
58	78153	Tone Control
59	78155	Volume Control
60	42185	Dial Light Mazda #44
61	38884	RF Choke (heater)
62	27118	Line Cord
63	22193	Phono AC Cord & Socket
64	22173	Pre-Amp Power Cable (Fem.) (P9 only)
65	22171	Pre-Amp Power Cable (Male) (Pre-Amp Chassis)
66	22169	Pickup Cable (Pre-Amp Chassis)
67	22170	Output Cable (Pre-Amp Chassis)
68	80244	5 Prong Speaker Socket
69	80497	(SS) Power Adapter Socket
70	80030	Phono Socket
71	90269	Band Switch
72	38958	FM Ant. Coil Ass'y.
73	38959	FM Mixer Coil Ass'y.
74	38960	FM Osc. Coil Ass'y.
75	38961	AM Conv. Coil Ass'y.
76	38962	AM Osc. Coil Ass'y.
77	38963	AM Loading Coil Ass'y.
78	13893	Low Impedance Loop Antenna Assembly
79	13869	Equalizer Ass'y. (Pre-Amp Chassis)
80	95005	Bias Cell (Pre-Amp Chassis)
81	05150	Dipole Lead and Plug Assembly
82	80439	3 prong socket (FM dipole)
83	80469	Speaker Plug (part of #13897)
84	94235	Output Transformer
85	38996	Wave Trap Coil
86	13892	12" PM Speaker & Output Transformer
87	38898	Osc. Series choke
	31460	Dial Escutcheon (32P9)
	05144	Dial Drive Cord Ass'y.
	31437	AM Dial Glass
	31438	FM Dial Glass
	59495	Tuning Knob
	59508	Band Switch Knob
	59509	Bass Tone Knob
	31459	Dial Escutcheon (33P9 &34P10)
	60428	Washer
	05151	Dipole Antenna Ass'y.
	15214	Drive Shaft Assembly
	80456	Miniature Tube Socket
	80479	Miniature 9-pin Tube Socket
	17213	Dial Back Plate Ass'y.
	37609	Plug Button 1" dia.
	55385	Drive Shaft Bearing
	62032	Rubber Grommet (R. F. Chassis)
	80139	Molded Octal Socket
	80239	Molded Octal Socket
	58939	9-pin Min. Tube Shieldbase
	58940-2	Tube Shield (9-pin Min)
	80494	Bias Cell Mounting (Pre-Amp Chassis)
	80491	9-pin Min. Mica Tube Socket (12AT7)
	62172	Rubber Grommet
	62189	Rubber Bushing
	36260-003	Phil Rd. Hd. Wood Screw, #6 x 5/8" (Pre-Amp. Mtg.)
	80348	Pilot Lamp Soc. & Cord
	80522	Pilot Lamp Soc. & Cord
	07674	Chassis End Brkt. Ass'y. (R.H.)
	07673	Chassis End Brkt. Ass'y. (L.H.)
	05154	Light Shield
	04133	Dial Pointer Ass'y.
	55383	Pointer Rod
	62099	Rubber Grommet
	H-318	Cabinet ((33P9)
	H-319	Cabinet (34P10)
	H-320	Cabinet (32P9)
	2000-325 071	#10/32 x 1¼ Rd. Hd. Mach. screw (Chassis Mtg.)
	2000-321 003	#10/32 x 1" Rd. Hd. Mach. screw (Chassis Mtg. Board)
	2015-005 003	#8/32 Steel Hex nut (Speaker Mtg.)
	09373	Mtg. Spring Assy. (P72 & P73 Changers)
	37066-072	#10/32 Acorn Palnut (Changer Mtg.
	74605	Operating Instructions (32P9 & 33P9)
	74608	Operating Instructions (34P10)

All resistors are ½ watt unless otherwise specified.

MODEL 400M FARNSWORTH TELEV. & RADIO CORP.
Series, Capehart

PART I

SECTION I ELECTRICAL AND MECHANICAL SPECIFICATIONS

Receiver - Amplifiers - Speakers - Record Changer

Four Band Receiver — Broadcast - 540 to 1600 K.C. — Short Wave - 5.4 to 18 M.C. — Band Spread - 25 and 31 Meters — F.M. - 41.9 to 51 M.C.

Type Receiver Circuit. . . . . Superheterodyne
Intermediate Frequency - AM Band. . . . . 455 K.C.
Intermediate Frequency - FM Band. . . . . 4.3 M.C.

Tubes in Receiver - 13 — Total 31

TUBE COMPLEMENT

In Amplifiers - 18

1 6AB7 R.F. Amplifier (A.M. & F.M.)
1 6SA7 Converter (A.M. & F.M.)
1 6J5 Oscillator (A.M. & F.M.)
1 6SG7 1st I.F. Amplifier (A.M. & F.M.)
1 6SG7 2nd I.F. Amplifier (F.M.)
1 6SJ7 Limiter (F.M.)
1 6SN7 Eye Amplifier (A.M. & F.M.)
1 6SJ7 A.V.C. Amplifier (A.M.)
1 6B8 2nd I.F. and A.V.C. (A.M.)
1 6H6 Discriminator F.M.
1 6SN7 Silencer F.M.
1 6Q7 2nd Det. A.M. & 1st Audio (A.M. & F.M.)
1 6AF6G Tuning Eye (A.M. & F.M.)
2 6R7 Voltage Amplifiers
2 6C8G Duo Drivers
8 6V6G Power Output Tubes
6 5Y3G Rectifier Tubes

DUAL AMPLIFIER SYSTEM

Power output tubes each amplifier - four 6V6G - Push - Pull - Parallel - 20 Watts
Total Power Output - Audio Amplifier System. . . . . 40 Watts

DUAL SPEAKER EQUIPMENT

1 - 12" Treble Electrodynamic - 450 ohm field - 8 ohm voice coil at 400 cycles
1 - 14" Bass Electrodynamic - 450 ohm field - 8 ohm voice coil at 400 cycles

AUTOMATIC RECORD CHANGER

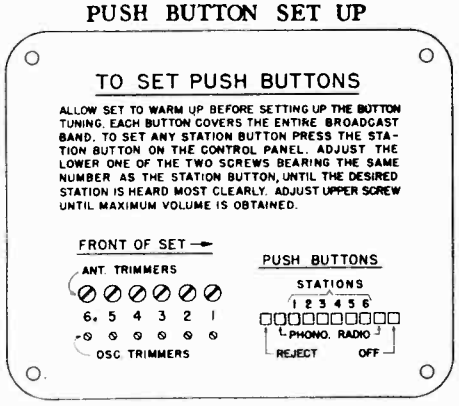
Type - Capehart 16-E. . . . . Fully Automatic
Record Capacity . . . . . 16 to 18 records either 10" or 12"
Turntable Speed . . . . . 78 R.P.M.
Drive . . . . . 78 Motor - Thru gear reduction unit
Pickup - Light Weight - Crystal Unit. . . . . 1-1/4 oz. Needle Pressure
True Tangent Tone Arm — Electric Play Control Unit

POWER AND VOLTAGE REQUIREMENTS

Power Watts. . . . 400 — At — 117 Volts — 60 Cycles
Voltage - 105 - 125 AC — Frequency - Either 50 or 60 Cycles

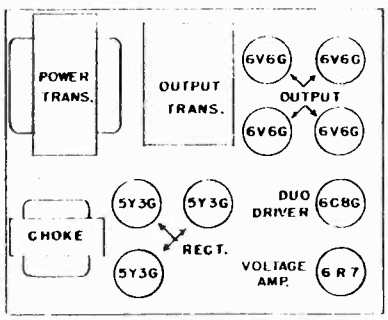
400-M Models not adaptable for 25 cycle operation

PUSH BUTTON SET UP

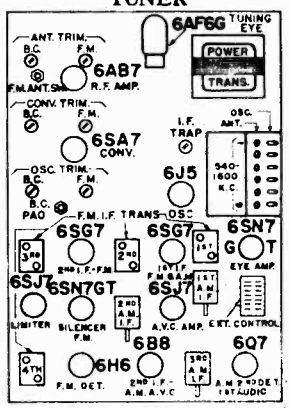


TUBE LOCATIONS

A-10 AMPLIFIER



TUNER



FARNSWORTH TELEV. & RADIO CORP. MODEL 400M Series, Capehart

GENERAL DESCRIPTION

SECTION 2

It has been our aim in this Service Brochure to include all of the necessary information to guide an experienced service man in locating and correcting all types of service difficulties that may be encountered during normal operation of the instrument. No attempt has been made to include an elementary discussion of the basic fundamentals or principles of operation of the component parts since it is assumed that no attempt will be made to service a Capehart DeLuxe Instrument unless the service man has sufficient technical training or experience to be familiar with the practice and theory involved in fundamental radio circuits and automatic record changing mechanisms.

In the design of the 400 M series Capehart DeLuxe Instruments we have endeavored to not only retain all of the desirable features incorporated in the "K" series, but to improve upon the performance of every unit in keeping with Capehart tradition. When considered as a whole each 400 M series Instrument represents a group of interconnected components of sound design offering the best in radio and record reproduction as we know it today.

The features retained in the tuner are the motor driven selector switch to permit extended and remote control; separate Bass, Master and Treble volume controls, the latter being used in conjunction with a high fidelity switch; and the "FM" band for the reception of frequency modulated signals. For record reproduction we have retained the famous Capehart 16-E Record Changer, which is the only fully automatic, continuous playing record changer on the market today, plus the play control feature which permits playing a predetermined number of selections and then automatically shuts the instrument off.

Again triple unit construction is employed, i.e., separate chassis for the tuner and each amplifier, resulting in improved circuit stability and performance, together with dual speakers for perfect Bass and Treble response. Authentic cabinet styling is a characteristic of all fine Capeharts. Each cabinet bears the stamp of approval of the Walnut and Mahogany Institutes.

The new improvements incorporated in the "M" series DeLuxe Capeharts are the electrically operated play control; improved broadcast and shortwave reception, due to improvements in tubes and circuits; superior "FM" performance, which includes an exclusive Capehart squelch circuit to prevent inter-station noise; band spread tuning on the important 25 and 31 meter bands for added ease of tuning, and improved performance in the motor driven selector switch which has been accomplished by modifications in design.

A brief review of features incorporated in the various units of this instrument will be of considerable assistance in following the circuit diagram and in analyzing circuit difficulties when present. In the event trouble is experienced with an instrument it is important to first localize the condition in a particular unit before an attempt at correction is made. For example, do not "pull a speaker" as has been done, when the pickup crystal is really at fault, and when switching from phono to radio would have disclosed the fact that the reproduction was only bad on record reproduction.

SECTION 3 THE RADIO TUNER

The radio tuner is an assembly complete in itself except for the plate voltage supply which is obtained from the amplifiers, The filament or heater transformer for tubes in the tuner, however, is mounted on the tuner chassis. Electrically, the tuner is of sound design utilizing the the highest quality of parts available and incorporates many modern improvements.

Features which contribute to its performance are as follows:

A. Provision for doublet or regular antenna system with a switch provided to rearrange the input circuit for maximum efficiency with either type system.

B. Tuned "RF" stage on all bands in manual tuning position, and use is made of a high gain 1853/6AB7 tube in this circuit.

C. Separate oscillator and mixer greatly improving stability and conversion gain.

D. Two "IF" stages using permeability tuned iron core "IF" transformers for increased over-all gain and selectivity.

E. Separate "IF" channel for "FM" using air core air tuned "IF" transformers for minimum drift and maximum gain.

F. In the "FM" position a second 6SG7 high gain pentode replaces a 6B8 tube used in the "AM" position, the change being automatically handled by the band switch.

G. Amplified "AVC" which tends to reduce fading and allows substantially constant output with wide variations in signal input.

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Series,
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H. Tuning eye amplifier which assures sufficient deflection of the tuning eye for correct tuning even on weak signals.

I. An exclusive Capehart "FM" squelch circuit for the elimination of noise when tuning from station to station in the "FM" band. This arrangement makes use of a 6SN7GT tube, one section being used as an oscillator operating on approximately 200 KC. and used as a source of voltage for control of the bias on the first audio stage. The other section of the 6SN7GT is used as a grid controlled rectifier for the rectification and control of the squelch voltage applied to the first audio grid.

J. Improved system of push button tuning permitting the setting of any push button to any desired frequency within the broadcast band.

K. Motor driven selector switch allows selection of stations or other services at instrument or for Extended or Remote Control.

L. The incorporation of this switch and a 15 prong socket in the tuner chassis makes possible either remote or extended control of the complete instrument when the necessary extended or remote units are added. The remote and extended control feature of the 400 M instrument greatly increases its flexibility and operating convenience and opens added sales opportunities for the dealer who has not taken advantage of this feature previously.

M. Bass and Treble volume controls allow individual adjustment of the high or low frequency response.

SECTION 4 AUDIO AMPLIFIERS

The first audio stage is located in the tuner chassis. The output of this tube after passing through the Bass and Treble networks is fed into two separate 20 watt audio power amplifiers, the inputs of which are effectively in parallel. The audio power amplifiers make use of the most modern tubes and circuits. Inverse feedback is incorporated effectively lowering the plate impedance of the push-pull•parallel connected output tubes and contributes to over-all noise and hum reduction. All of the tubes and components in the audio system are operated conservatively as evidenced by the use of three 5Y3G rectifiers in each amplifier. The operation of the push-pull parallel connected output tubes at conservative voltage rather than using only two such tubes in each output stage operating at higher potentials results in longer tube life.

SECTION 5 SPEAKERS

Two heavy duty electrodynamic speakers are incorporated in each 400 M series instrument. Adequate field excitation is provided and the construction of the speaker is such that the 14" speaker responds to the lower frequencies and the 12" speaker favors the highs. Careful consideration has been given to baffle and cabinet design for high fidelity reproduction.

SECTION 6 CAPEHART 16-E RECORD CHANGER

This record changer is fully automatic, is continuous in operation has a maximum capacity of 20 records, either 10" or 12" or intermixed, and will play either one or both sides of a record as desired. Because of variations in records (thickness and warpage) we recommend that 16 to 18 records generally be loaded in the record magazine.

An outstanding feature of the 16-E Changer is the "True Tangent Tone Arm" which maintains the needle or stylus at the correct tangent with respect to the record groove throughout the playing of the record.

Another important feature not found in other automatic record changers is the heavy duty drive motor and gear reduction unit. This gear reduction unit controls the speed or R.P.M. of the turntable which for perfect reproduction of records must be constant and even. This motor and gear reduction unit in addition to the use of a heavy cast turntable compares with the precision type of equipment generally found in broadcast stations.

SECTION 7 EXTENDED AND REMOTE CONTROL

The Capehart 400 M Series DeLuxe Instruments are designed to permit either Extended or Remote Control. Extended or Remote Control equipment may be added so that Radio or Record reproduction identical to that reproduced at the instrument may be controlled or distributed to any number of rooms around the house or grounds.

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PART 2
OPERATION AND MAINTENANCE RADIO TUNER

SECTION 8 SETTING INSTRUMENT UP FOR OPERATION

The importance of care in checking every part of the equipment in setting up an instrument for operation cannot be over emphasized. This applies when the instrument is being set up on the sales floor for sales demonstration purposes, as well as when delivered to the customer's home. It is obvious that an instrument not properly set up in the dealer's store may fail to perform to its best advantage when demonstrated. An improperly installed instrument in the customer's home means extra service calls, customer dissatisfaction and excessive service costs.

Following is a suggested Inspection Routine, covering "30" important items to check when installing a DeLuxe Capehart Instrument. We request that you at least cover all of these, and if you are thorough in your work, you undoubtedly will add to this list. We would also advise that a check of these "30" items will often be found to quickly isolate service difficulties when trouble is encountered.

SUGGESTED INSPECTION ROUTINE FOR THE INSTALLATION OF CAPEHART DELUXE 400 SERIES INSTRUMENTS

1. Unpacking...Remove the instrument from its shipping case carefully

2. Inspect condition of Cabinet. NOTE: Packing case should be checked carefully. If panel broken, look for concealed damage -- if cabinet damaged due to rough handling in transit consealed damage claim should be filed with "carrier."

3. Remove packing material around the record changer and shipping bolts which hold the changer in place during transit. Put plug buttons in changer base. Remove back covering tuner and amplifier compartments.

4. Insert tubes in proper position in the amplifier, by refering to tube complement label. Put "Eye Tuning" tube in position, making certain not to place tube too far forward as it is likely to press dial scale out of shape.

5. Put in Gear Reduction Unit "Bottle of Oil" supplied with instrument...Be sure to replace oil plug.

6. Important -- Make sure record changer is free floating on mounting rubbers and that all four support rubbers are in proper position. Changer unit position should be shifted slightly until there is no tendency to touch against any part of changer mounting frame.

7. Level Cabinet by adjustable glides. This is important for proper automatic phonograph operation.

8. Check adjustment of clutch tension and clutch shaft assembly connecting gear box to record changer, making certain that it is straight and in line...A tendency to MOTOR RUMBLE or HUM may be prevalent otherwise, and this may also cause uneven turntable speed.

9. Make sure Reverse Arm and Fork Assembly is in correct position by moving this through its normal reverse motion.

10. Make sure Automatic Trip Switch under turntable is in proper position. This means end of lever arm or quadrant should be in the center of the trip switch contacts.

11. Make sure Tone Arm Stop Lever, Part Number 64197, is adjusted properly.

12. Insert New Needle or desired type of permanent point stylus in Pickup.

13. Attach "Control Knobs" to Tuner, putting felts between the knobs and the Escutcheon.

14. Check Line Voltage and Frequency to determine if same agrees with electrical specifications plate on rear of the instrument. Plug instrument into proper source of power supply.

15. Read carefully Operating Instructions accompanying instrument, then...Turn Instrument On.

16. Place a blank phonograph record on turntable. Set all controls, Volume, Bass and Treble in wide open position for acoustic feedback test. RCA Record, Number 49196 is good for this purpose. This test will locate excessive noise or rumble. Shifting the changer into a "free floating position" while this record is playing should clear up any rumble which may be present. If this does not quiet operation, again check for proper positioning of drive shaft between gear box and record changer, try shifting motor and gear box "mounting board" assembly.

17. Properly load 16 or 18 assorted 10" and 12" records in record magazine. Warped or damaged records should not be used. Make sure all record edges are free of "flash"...Records with excessive "flash" and rough edges should be smoothed down with fine sand paper.

18. Put automatic "On-Off" switch in "On Position." Instruments are all shipped with this switch in "Automatic 'OFF' Position."

19. Put selector arm lever in "REPEAT" position. Play one record.
Put selector arm lever in "ONE SIDE" position. Play one record.
Put selector arm lever in "BOTH SIDES" position. Play one record.

The above tests check for proper action of the "Selector Arm Lever." At the same time that the

MODEL 400M Series, FARNSWORTH TELEV. & RADIO CORP.
Capehart

above tests are being made, a visual check for "Feed In" or "Indexing" of the pickup, Trip Action and setting down of records from magazine to turntable can be made.

20. Check Play Control action for indexing and shutting instrument off.

21. Operate Volume, Bass and Treble Controls to observe proper action.

22. Check next for maximum and minimum hum by lifting Pickup off record. When this has been done rotate Volume Control wide open. If excessive hum is present, reverse power line cord or attach good ground connection to instrument. Hum should be negligible except possibly with the volume control in "wide open" position which is seldom if ever necessary during normal operation of the instrument.

23. Check for Quality Reproduction. To do this, use a good record, the quality of and type of reproduction with which you are familiar. Check reproduction of the record at both High and Low Volume Levels.

24. Attach proper "Antenna System." A fine instrument deserves a good antenna. Check reception and calibration of radio tuner on all bands. If a new antenna is required, install a Capehart Stock Number 41-80, or Stock Number 41-79 Dipole especially efficient for reception of "FM" signals.

25. Check action of "Electric Eye" tube, and position, so tuning segments are horizontal.

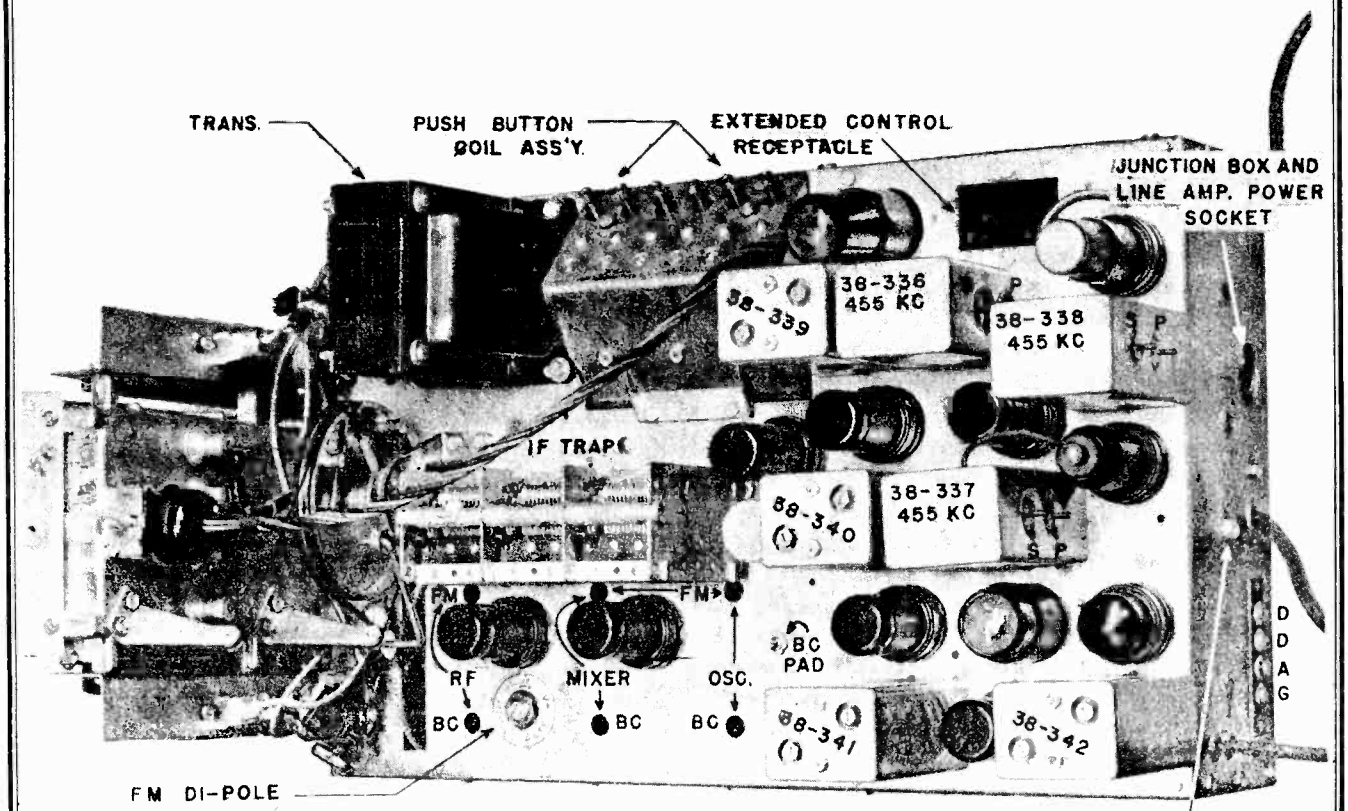
26. Tap tubes in tuner gently to locate any excessively microphonic tubes.

27. By the time the foregoing tests have been conducted, the instrument will have been in operation for 35 or 40 minutes and should be sufficiently warmed up so that the "Push Buttons" may be set without subsequent drift. Set up "Push Buttons" according to instructions accompanying instrument.

28. Attach proper Station Tabs.

29. Replace "back" of cabinet. Carefully clean up cabinet to remove all finger marks. For this purpose a piece of cheese cloth folded into a pad and moistened with water and a few drops of vinegar is very good. The use of furniture polish on Capehart cabinets is not recommended.

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



TOP DECK VIEW TUNER CHASSIS

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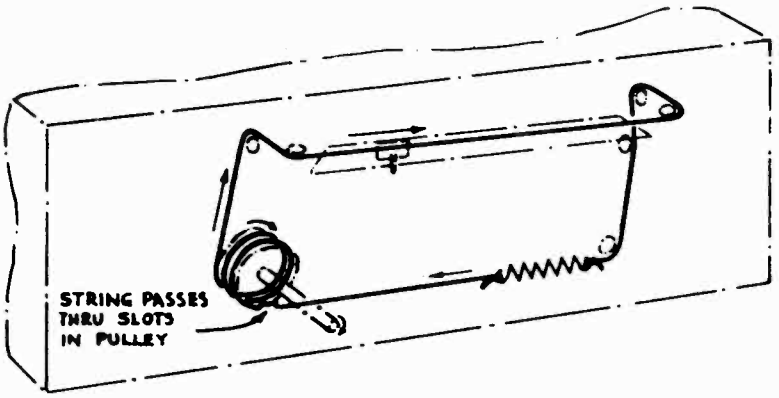
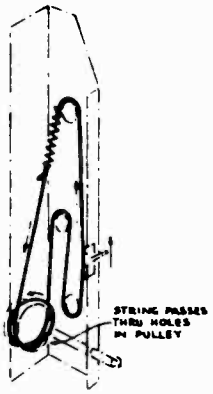
SECTION 9 DRIVE CORD ASSEMBLIES

Quite often in handling a radio chassis the "drive cord" may slip off the controls or pulleys on which it rides. So many different types of mechanical drive methods have been devised depending on the tuner construction or the mechanical genius who designed them that it is impossible for a service man to quickly figure out just how they should be restrung. In this connection we are sure that stringing diagrams below will be found most welcome.



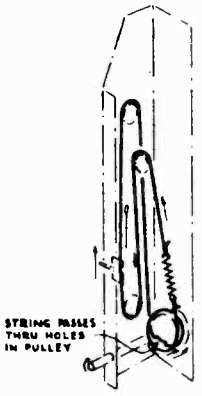
VOLUME CONTROL

Turning knob in clockwise direction causes pointer to move to right.



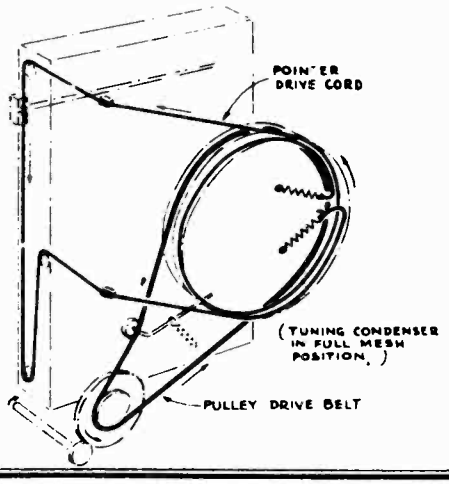
BASS TONE CONTROL

Shaft geared to tone control, turning knob in clockwise direction causes pointer to move upward.



TREBLE TONE CONTROL

Shaft geared to tone control, turning knob in clockwise direction causes pointer to move upward.



METHOD OF DIAL STRINGING

Turning tuning knob counter-clockwise moves pointer from top to bottom, drive drum turns clockwise, viewed from shaft end.

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SECTION 10 ALIGNMENT OF AM BANDS

EQUIPMENT NECESSARY

A calibrated signal generator having fundamental frequencies from 455 Kc. to 20 Mc. In addition to the signal generator a crystal calibrator is a great convenience.

An indicating device for showing correct alignment, this may be a high resistance A.C. calibrator, a vacuum tube voltmeter, a high resistance D.C. voltmeter (20,000 ohms per volt minimum) or a Cathode Ray oscilloscope.

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

Either the vacuum tube voltmeter or high resistance D.C. voltmeter may be used to read the AVC voltage. This may be connected to pin #4 of the 6AB7 while aligning the I.F. and to pin #4 of the 6B8 while aligning the R.F. Converter and Oscillator.

The use of a Rider Volt Ohmist connected from ground to the AVC Bus is the preferred method as the high input impedance of the meter does not appreciably affect the alignment. And its high sensitivity allows the use of low input voltages.

Special care must be employed when aligning the short wave spread 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 that is if the set is aligned at 12 Mc. when the oscillator using high output is tuned to 12.91 Mc., the signal will be heard if the right peak has been used. This also applies to the short wave band.

TABULATION FOR ALIGNMENT

STEPS	IN SERIES WITH ANT	SET GENERATOR AT	SET GANG AT	ADJUST AND SEE FIG.	TO OBTAIN
1	250 MMF	455 KC	Quiet Point	3rd IF Trimmers	MAXIMUM OUTPUT
2				2nd IF Trimmers	
3				1st IF Trimmers	
4		1500 KC	1500 KC	B C Osc Trimmer	
5				B C Ant Trimmer	
6				B C R F Trimmer	
7		600 KC	600 KC	600 KC Pad	
8		455 KC	Press Any Push Button	IF Trap	Min Output
9	400 Ω	15 MC	15 MC Image At 15.91 MC	S W Osc Trimmer.	MAXIMUM OUTPUT
10				S W Ant Trimmer	
11				S W R F Trimmer	
12	Check At		6 Mc		
13	400 Ω	12 MC	12 MC Image At 12.91 MC	B S Osc Trimmer	
14				B S Ant Trimmer	
15				B S R F Trimmer	
16	400 Ω	9.5 MC	9.5 MC Image At 10.41 MC	B S Osc Pad	
17				B S Ant Pad	
18				B S R F Pad	
19	Recheck Steps 13 to 18 Inclusive				

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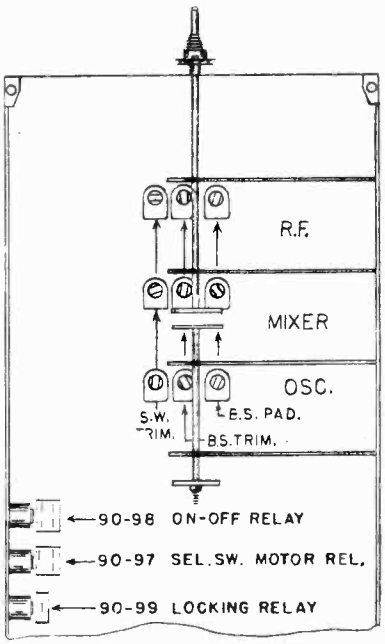
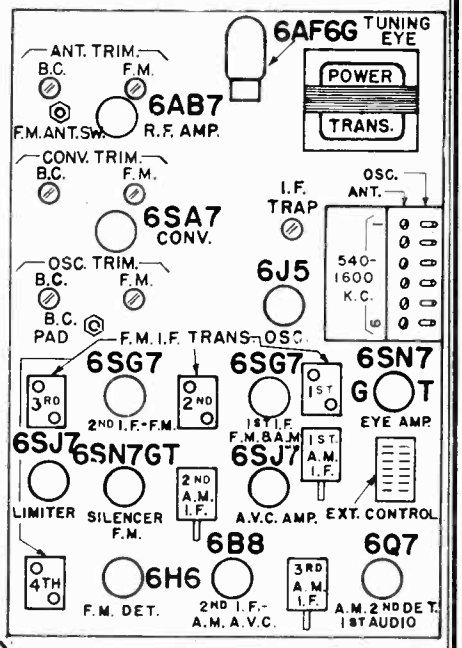
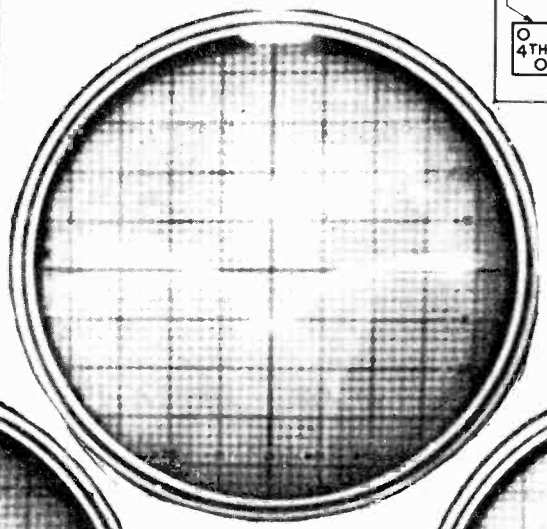


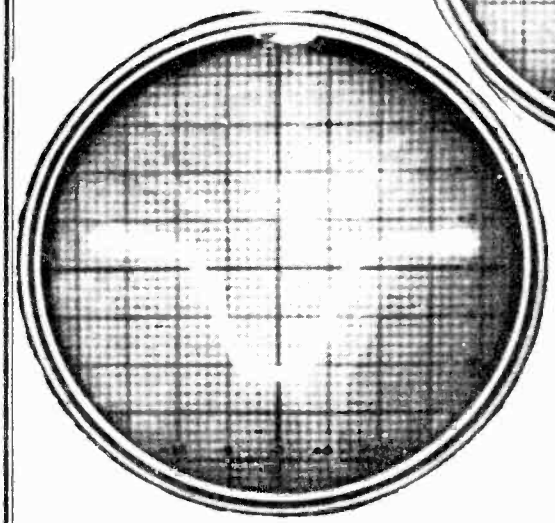
BOTTOM VIEW 400M



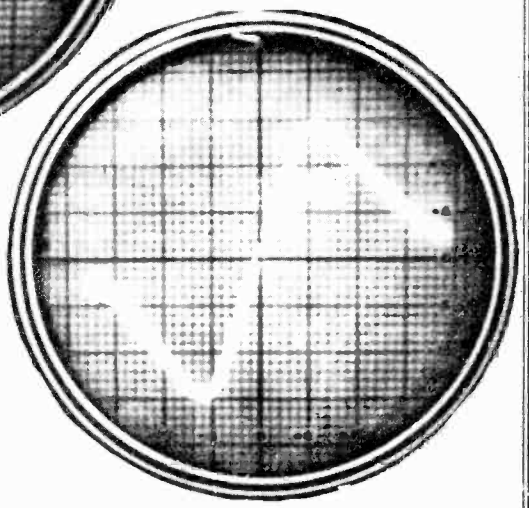
TUBE LOCATION LABEL



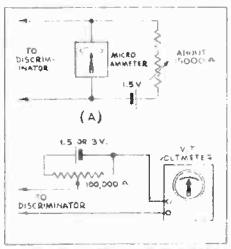
I.F. BEFORE ALIGNMENT FM

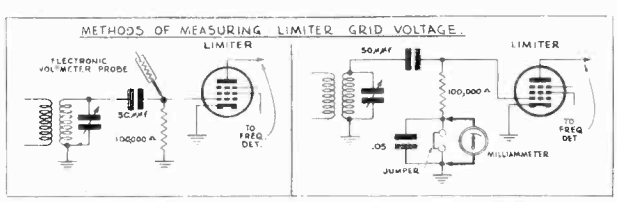


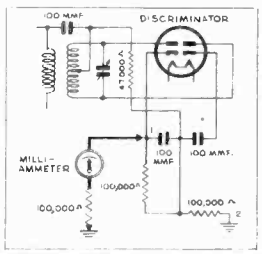
I.F. AFTER ALIGNMENT FM



ALIGNMENT OF THE DISCRIMINATOR







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ALIGNMENT OF FM BAND

SECTION II

Following are described two (2) methods for the Alignment of the F.M. Band.

Method 1 will require the use of a Cathode Ray Oscilloscope, a sweep frequency generator providing a fundamental frequency at 4.3 Mc and a deviation of at least 150 Kc and also a signal generator with a fundamental high frequency range of 42-50 Mc.

As an indicating device, a meter with at least 10 Meg. ohm internal resistance can be used or as a second choice - a low range micro-ammetor with a 1 Meg. ohm resistor in series.

Method 2 will require the same equipment with the exception of the Oscilloscope and the 4.3 Mc sweep generator.

ALIGNMENT BY METHOD 1

Connect the vertical deflection input of the oscilloscope with a 1 Meg. ohm resistor in series to the grid of the limiter tube. Care must be exercised to maintain the connection of the resistor to the grid of the limiter tube as short as possible to avoid regeneration. The ground terminal of the oscilloscope must be connected to the chassis.

Limiter Alignment - Connect the ground terminal of the 4.3 Mc. I.F. sweep generator to the chassis. Connect the output of the signal generator to the grid of the second I.F. tube with a .1 Mfd. paper condenser in series, adjust the deviation control of the generator for a usable picture on the oscilloscope screen, with the input control of the oscilloscope set at maximum gain. Detune the secondary trimmer of the limiter transformer, adjust the primary trimmer until you obtain a pattern as shown in Figure 1 of the oscilloscope photos. Then adjust the secondary trimmer until you obtain a pattern as shown in Figure 2. The pattern should be kept centered on the oscilloscope screen.

Align 2nd I.F. - Move the signal generator to the grid of the 1st I.F. tube and repeat the same procedure as described for the limiter stage.

Align 1st I.F. - Move the signal generator to the grid of the Mixer tube and repeat the limiter stage procedure.

Align Discriminator - Connect the oscilloscope to the Cathode of the 6H6 F.M. detector which is not grounded. Connect the signal generator to the secondary of the limiter transformer as indicated by A in Figure 6. Adjust the secondary trimmer of the discriminator transformer with an insulated screw driver, for pattern as in Figure 2, then adjust the primary trimmer to obtain symetrical and linear trace and centering of the picture on the oscilloscope screen. It will be necessary to go over the primary and secondary trimmer several times to adjust the stage accurately.

R.F. Alignment F.M. Band - Connect the high frequency generator to the regular antenna terminal with a 400 ohm carbon resistor in series. Make certain the F.M. antenna Selector Switch is in regular position.

Set the signal generator at 50 Mc and adjust the Oscillator trimmer for correct dial calibration at this frequency. Connect high resistance Voltmeter to point A, Figure 4 and then adjust the signal generator to 49.5 Mc adjust the mixer and the R.F. Trimmers for maximum deflection of the meter.

Another indicating device for the R.F. alignment - connect a 0-1 millameter between point A and ground or a low range micro-ammeter with a 1 Meg. ohm resistor as series between C and ground. Tune for maximum deflection of the meter.

Lacking the above meters, the R.F. and Mixer alignment may be trimmed for minimum noise on signal. To avoid false peak when aligning the Mixer and the R.F. Trimmers the gang condenser must be rocked through the signal.

ALIGNMENT BY METHOD 2

Limiter Alignment - Connect one of the indicating meters as shown in Figure 4 or Figure 5.

Feed a 4.3 Mc signal through .1 Mfd. paper condenser to the grid of the second I.F. tube. Place a 1000 ohm carbon resistor across the secondary of the limiter transformer then tune the primary for maximum meter deflection. Remove the 1000 ohm carbon resistor from the secondary and place it across the primary and tune the secondary for maximum meter deflection.

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SECTION 11 ALIGNMENT OF FM BAND

To check how accurate this stage has been aligned tune the signal generator 75 Kc each side of 4.3 Mc. Only a slight loss in maximum meter deflection should be noted.

Align 2nd I.F.F.M. - Move the signal generator to the grid of the 1st I.F. tube and repeat the same procedure described above for the limiter stage.

Align 1st I.F.F.M. - Move the signal generator to the grid of the mixer tube and repeat alignment procedure as described above for the limiter stage.

Discriminator Alignment - Connect a meter to Point A as shown in accompanying illustrations to the ungrounded Cathode.

Feed a 4.3 Mc signal to the grid of the second I.F. tube.

With an insulated screw driver turn the secondary trimmer screw for maximum and minimum capacity. You will note that there are two points where you have maximum meter deflection. Tune to the point between the maximum meter deflections where the meter will read as near zero as possible.

Tune the signal about 150 Kc each side of 4.3 Mc. You will note that the meter deflection rises about equal distance each side of 4.3 Mc. Tune the primary trimmer until you have maximum meter deflection an equal distance each side of 4.3 Mc.

Note: The meter will have to be reversed when reading the other side of the signal.

Another indicating device for the R.F. alignment - connect a 0-1 millameter between point A and ground or a low range micro-ammeter with a 1 Meg. ohm resistor in series between C and ground. Tune for maximum deflection of the meter.

Lacking the above meters, the R.F. and Mixer alignment may be trimmed for minimum noise on signal. To avoid false peak when aligning the Mixer and the R.F. trimmers the gang condenser must be rocked through the signal.

Note: If a high frequency signal generator is not available a standard signal generator which will give good harmonic output between 42 - 50 Mc can be used.

Two methods using a micro-ammeter or a V.T. voltmeter may be used for the alignment of the discriminator are shown in the accompanying illustrations.

It will be necessary to go over the primary and secondary trimmers several times to accurately align this stage.

R.F. Alignment F.M. Band - Connect the high frequency generator to the regular antenna terminal with a 400 ohm carbon resistor in series. Make certain the F.M. antenna Selector Switch is in regular position.

Set the signal generator at 50 Mc and adjust the Oscillator trimmer for correct dial calibration at this frequency. Connect high resistance Voltmeter to point A, Figure 4 and then adjust the signal generator to 49.5 Mc adjust the mixer and the R.F. trimmer for maximum deflection of the meter.

SECTION 13 CABINET PARTS LIST & PRICES

Stock No.	Description	Stock No.	Description
31-95	Capehart Decal	67-179	Band Switch Knob (Bl.)
31-96	DeLuxe Decal	61163	Compartment Lamp
59-58	Dial Escutcheon	31-93	Push Button Trimmer Cover
59-71	Dial Escutcheon (Bl.)	13-368	Play Control & Cab Light (Comp.
59-62	Push Button Knob	36-468	Escutcheon Screws (Pkg. 10)
59-74	Push Button Knob (Bl.)	56-538	Soss Hinge for 506, 410, 411
6058	Tuning Knob	13-219	Basic Glide ea.
77-176	Tuning Knob (Bl.)	36-383	16-F Mtg. Bolts ea.
6060	Bass or Treble Knob	5092	16-F Mtg. Rubbers ea.
67-177	Bass or Treble Knob (Bl.)	50117	16-F Main Frame Pads
67-178	Band Switch Knob	36-597	16-E Plug Buttons

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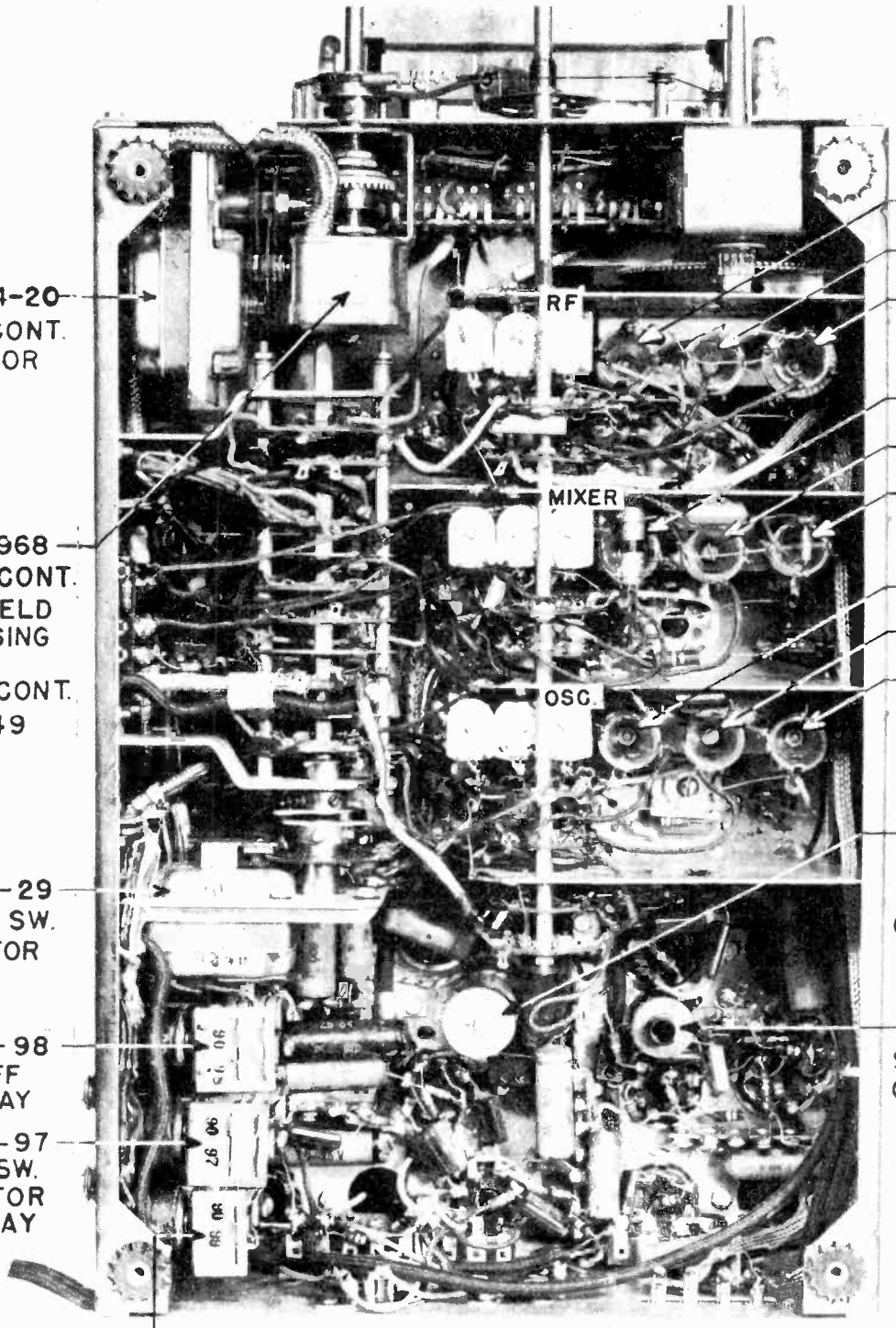

BOTTOM VIEW TUNER CHASSIS

FARNSWORTH TELEV. & RADIO CORP. MODEL 400M Series, Capehart

SECTION 14 — RADIO TUNER PARTS LIST

Reference No.	Part No.	Description
0	773-40	1500 Ohms
1	773-36	220 Ohms
2	773-55	2.2 Megohms
3	773-49	100 M Ohms
4	773-46	22 M Ohms
5	773-41	2200 Ohms
6	773-38	470 Ohms
7	773-80	150 M Ohms
8	773-78	47 M Ohms
9	773-39	1 M Ohms
10	77-98	6800 Ohms
11	773-42	3300 Ohms
12	773-54	1 Megohm
13	773-47	33 M Ohms
14	773-43	4700 Ohms
15	773-51	220 M Ohms
16	77-95	6.8 Ohms
17	78-49	3 Meg. Vol. Control
18	78-36	4 Meg. Treble Control
19	78-35	3 Meg. Bass Control
20	26-138	3 Gang Condenser
21	26-151	BC and FM Ant. and Mixer Trim.
22	26-147	BC and FM Osc. Trimmers
23	26-140	Short Wave Ceramic Trim.
24	26-141	BS Padder Ceramic Condenser
25	26-142	BS Trimmer Ceramic Condenser
26	263-1	BC Osc. Padder Condenser
27	26-33	Wave Trap Trimmer
28	26-66	Push Button Ant. Trim. Strip
29	25-136	80 MMF Silver Mica Cond.
30	253-1	100 MMF Cond.
31	25-141	500 MMF Cond.
32	25-140	15 MMF Cond.
33	25-166	10 MMF Cond.
34	258-2	350 MMF Silver Mica Cond.
35	253-5	50 MMF Cond.
36	25-52	200 MMF Silver Mica Cond.
37	25-68	300 MMF Cond.
38	25-53	1000 MMF Cond.
39	25-69	250 MMF Cond.
40	25-141	5000 MMF Cond.
41	25-134	.05 MF 600 V.
42	256-1	.05 MF 200 V.
43	255-1	.01 MF 600 V.
44	256-2	.1 MF 200 V.
45	25-97	.01 MF 200 V.
46	25-142	10 MF 25 V.
47	25-50	Dual 10 MF 450 V.
48	38-226	BC Ant Coil
49	38-361	FM Ant. Coil
50	38-360	SW Ant. Coil
51	38-356	BC Mixer Coil
52	38-358	FM Mixer Coil
53	38-357	SW Mixer Coil
54	38-353	BC Osc. Coil
55	38-355	FM Osc. Coil
56	38-354	SW Osc. Coil
57	38-343	Squelch Osc. Coil
58	38-352	Osc. Push Button Coil Assembly
59	38-351	Wave Trap Coil
60	38-344	A V C Amp. Plate Coil
61	38-339	1st I F FM Transformer
62	38-340	2nd I F FM Transformer
63	38-341	3rd I F FM Transformer
64	38-342	4th I F FM Transformer
65	38-336	1st I F AM Transformer
66	38-337	2nd I F AM Transformer
67	38-338	3rd I F AM Transformer
68	90-89	No. 1, 3 and 5 Band Switch Wafers
69	90-90	No. 2 and 8 Band Switch Wafers
70	90-91	No. 4 Band Switch Wafer
71	90-92	No. 6 Band Switch Wafer
72	90-93	No. 7 Band Switch Wafer
73	90-100	No. 1 Selector Switch Wafer
74	90-101	No. 2 Selector Switch Wafer
75	90-102	No. 3 Selector Switch Wafer
76	90-103	No. 4 and 5 Selector Switch Wafers
77	90-104	No. 6 Selector Switch Wafer
78	90-105	No. 7 Selector Switch Wafer
79	90-96	Ant. Selector Switch
80	90-88	Push Button Switch
81	94-90	18 V. and 6.3 V Transformer
82	44-20	Volume Motor
83	44-29	Selector Switch Motor
84	90-97	Selector Switch Motor Relay
85	90-98	On-Off Relay
86	90-99	Off Relay
87	80-84	Ant. Strip
88	38-359	FM RF Plate Choke
89	22-116	No. 1 Input Sig. Cable
90	22-117	No. 2 Input Sig. Cable
91	22-15	Plug and Cable to Junction Box
92	22-118	Power Plug and Cable to Amps.
93	80-132	Remote Line Amp. Power Socket and Cable
94	80-170	15 Prong Socket
95	80-30	Input Socket to Remote Line Amp
96	22-124	Phono Input Strip and Cable
	80-82	Octal Ceramic Socket
	80-175	Octal Ceramic Socket for Osc. only
	80-81	Octal Socket
	31-181	Dial Scale
	36-541	Dial Scale Fasteners (In lots of 10)
	31-97	Dial Glass Window
	56-453	Tone Control Pointers
	56-598	Volume Control Pointer
	56-462	Dial Pointer
	07-136	Bass Control Drive Cord Assembly
	07-137	Treble Control Drive Cord Assembly
	07-134	Volume Control Drive Cord Assembly
	07-135	Tuning Drive Cord Assembly
	92-82	Endless Belt for Gang Drive
	59-77	Small Pulley for Tone and Volume Control
	13-175	Split Gear Assembly
	22-115	Tuning Eye Cable and Socket Assembly
	56-883	Coupling Arm on Selector Switch
	42[illegible]-2	Pilot Lamp
	73-52[illegible]	Operating Instruction Book

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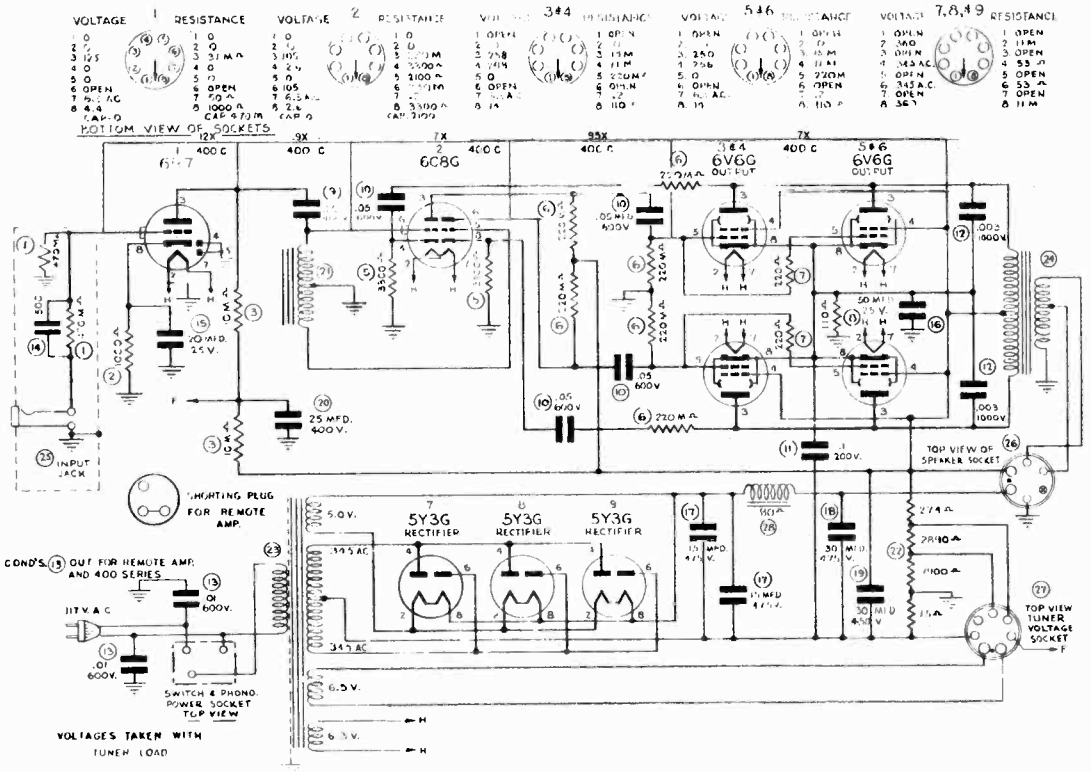
PART 3 MAINTENANCE - AMPLIFIERS - JUNCTION BOX - SPEAKERS

SECTION 15 AUDIO AMPLIFIER CIRCUIT WIRING DIAGRAM



SECTION 16 A-10 AUDIO AMPLIFIER PARTS LIST

Reference No.	Part No.	Description
1	773-53	470 M Ohms ½ Watt
2	773-39	1000 Ohms ½ Watt
3	77-32	10 M Ohms ½ Watt
4	773-41	2200 Ohms ½ Watt
5	773-72	3300 Ohms ½ Watt
6	773-81	220 M Ohms ½ Watt
7	773-51	220 Ohms ½ Watt
8	77-71	110 Ohms 10 Watt
9	25-54	.25 Mfd. 600 V.
10	254-8	.05 Mfd. 600 V.
11	256-2	.1 Mfd. 200 V.
12	25-46	.003 Mfd. 1000 V.
13	257-2	.01 Mfd. 600 Line Buffer
14	253-3	500 M.M.F. Mica
15	25-52	20 Mfd. 25 V.
16	25-38	50 Mfd. 25 V.
17	25-138	15 Mfd. 475 V.
18	25-139	30 Mfd. 475 V.
19	35-146	30 Mfd. 450 V.
20	24-42	25 Mfd. 400 V.
21	94-85	Phase Conector Reactor
22	77-102	Voltage Divider
23	94-61	Power Trans.
24	94-32	Output Trans.
25	805-1	Input Jack
26	80-57	Speaker Socket
27	80-50	Tuner Voltage Socket
28	94-65	Choke
	27-118	A.C. Line Cord
	13-204	Shorting Plug

SECTION 17 LOUD SPEAKER PARTS LIST

Stock No.	Description
81-72	Treble Speaker 12"
81-73	Bass Speaker 14"
81-114	Field Coil for 81-72 Speaker
38-287	Field Coil for 81-73 Speaker
81-101	Cone & Voice Coil for 81-72 Speaker
81-113	Cone & Voice Coil for 81-73 Speaker

Should it be necessary to replace either the cone and voice coil assembly or the field coil, care should be taken in order to insure proper phasing.

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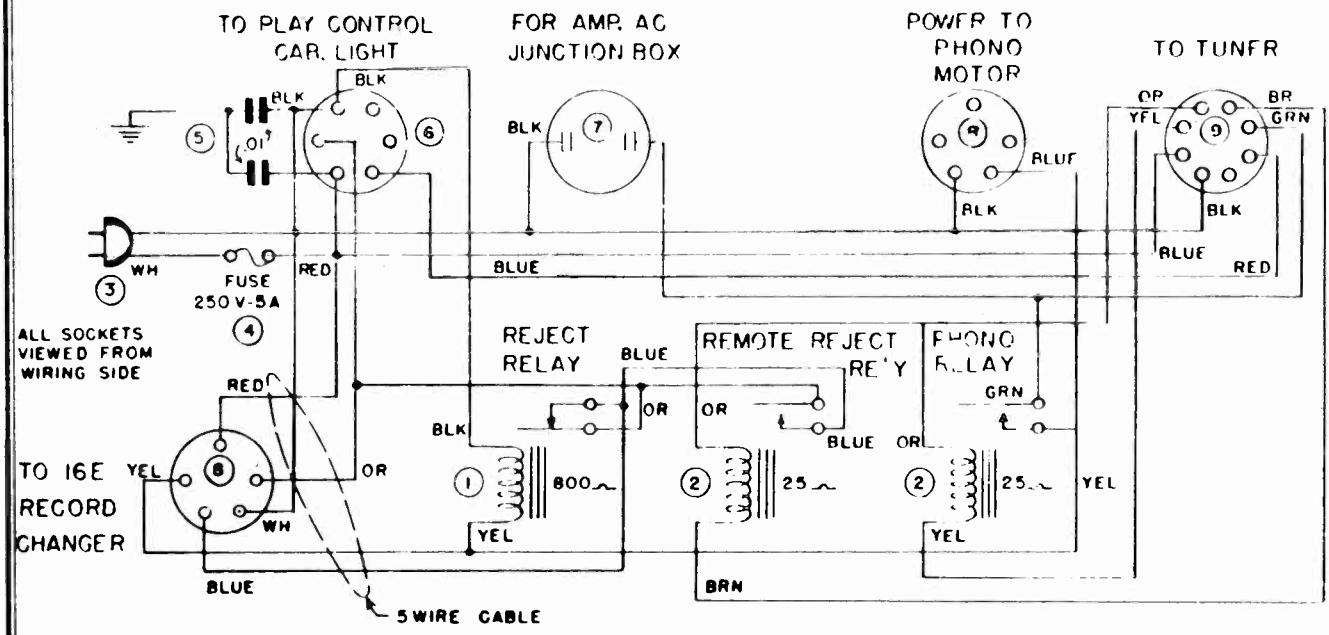
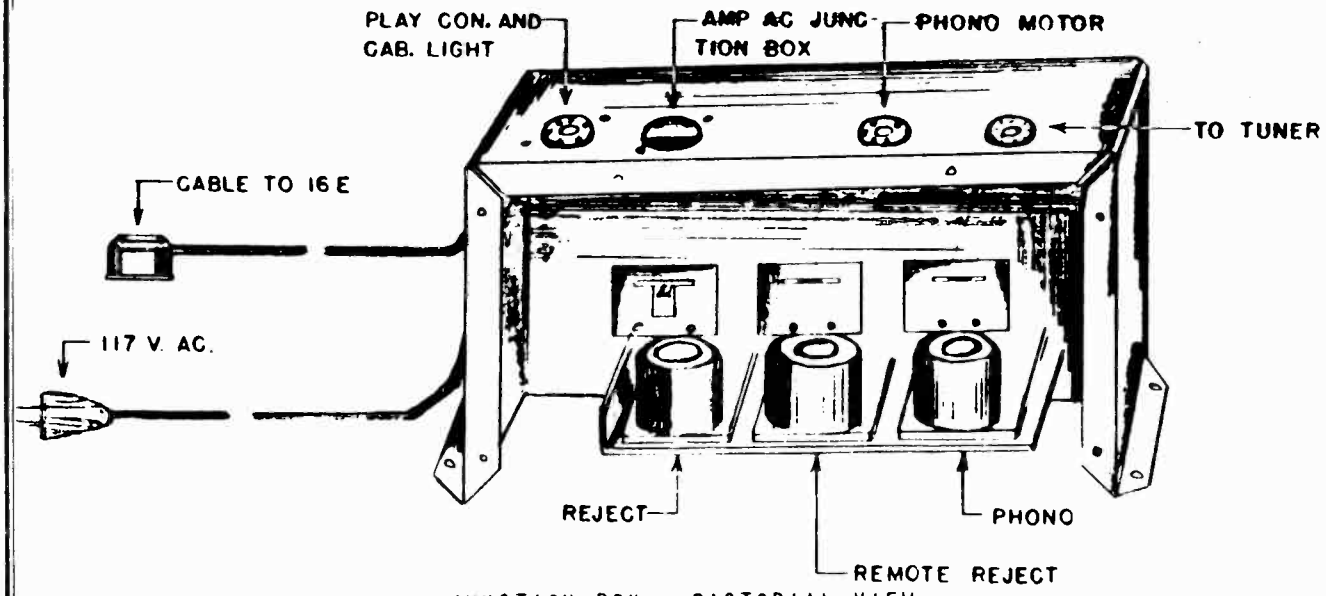
SECTION 18 JUNCTION BOX CIRCUIT WIRING DIAGRAM



SECTION 19 JUNCTION BOX SERVICE PARTS

Reference No.	Stock No.	Description
1	90-109	Reject Relay 50-60 Cycle
2	90-110	Motor Relay 50-60 Cycle
3	27-134	AC Line Cord
4	48-6	Fuse 250 V 5 A.
5	2512-1	.01 Mfd. 600 V. Condenser
6	80-61	6 Prong Socket
7	80-69	2 Pole AC Socket
8	80-57	5 Prong Socket
9	80-71	Octal Socket (8 Prong)
	22-9	Cable and Socket Assy.
	80-68	Fuse Socket



JUNCTION BOX - PICTORIAL VIEW

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SECTION 20 OPERATION AND MAINTENANCE - RECORD REPRODUCING EQUIPMENT PART 4

It is not the purpose in these Service Notes to cover the 16-E Record Changer completely because a separate publication is devoted to that instrument. In the event of some difficulty with the 16-E Record Changer we urge technicians not to attempt any service adjustments until they have carefully analized the trouble. Too many service men have the habit of aimlessly delving into the instrument and often attempt adjustments which are entirely foreign to the fault, and thereby, disturb adjustments which were entirely proper. We urge you to first read all service material available covering the operation and servicing of the 16-E Changer before attempting any extensive adjustments.

Because of rough handling an instrument may be subjected to intransit between factory and the customer, each instrument should be carefully checked in the customer's home. Once the record changer has been adjusted and properly set up in the customer's home it seldom requires attention, barring misuse by those operating the machine, or because of a faulty record product.

Before considering adjustments that may be required from time to time it would be well to consider a few factors which are quite often responsible for unnecessary service calls.

1. Failure to carefully instruct the customer as to the proper procedure to be followed in loading and operating the record changer.

2. Variations in records such as trip groove, thickness, feed-in groove, diameter, rough edges, improperly centered spindle hole, pinched recording grooves and warpage.

3. Failure of customer or dealer to insist upon a complete periodic inspection of the instrument for lubrication and cleaning.

OPERATING SEQUENCE

In order to more easily understand the operation of the 16-E we should consider it as being able to perform as four individual or separate record playing devices all built into one machine. If this thought is kept in mind a clearer comprehension of its structure and operating sequence will be possible.

MANUAL OPERATION

On the top rear right hand corner of the base plate is located the automatic On-Off switch. When this switch is in the "Off" position the circuit to the clutch solenoid relay is opened. When such is the case, and the record changer motor is turned on, the turntable revolves and records may be played manually.

REPEAT POSITION

When the selector lever is moved to the repeat position and the previously mentioned automatic "On-Off" switch is changed to the "On" position, the tone arm and trip mechanism operates automatically. In the repeat position it will be noted that when the needle moves into the trip groove it operates the trip. The record magazine tips but does not discharge a record to the turntable and the record tray does not lift. The record originally placed on the turntable will continue to repeat as many times as desired.

ONE SIDE

When the selector lever is moved to the "One Side" position, the record tray is in gear and will operate to remove the record from the turntable and return it to the record magazine, as this record returns to the magazine another record is discharged from the bottom of the stack and placed on the turntable by the record tray, then the tone arm swings into the playing position. At the completion of the record the mechanism trips and the above cycle is repeated.

TURNOVER POSITION

When it is desired to play the stack of records in the record magazine in sequence on both sides, the selector lever is moved to the "Both Sides" position.

In addition to the cycle outlined under "One Side" the operation of turning the record over is introduced. That is, after the first side is played, the reverse arm intercepts the record before being fully returned to the magazine and returns it to the turntable with the other side up ready for playing. A new record is discharged from the magazine only after the complete record (both sides) has been played.

To facilitate repairs or adjustments to the electrical circuits we have prepared a complete wiring diagram of the 16-E control circuits which has been included in this booklet.

Starting in the tuner when the "Phono" button is pressed the "On Off" relay shelf holding through the "Off" relay whose contacts are closed except when energized by "Off" button.

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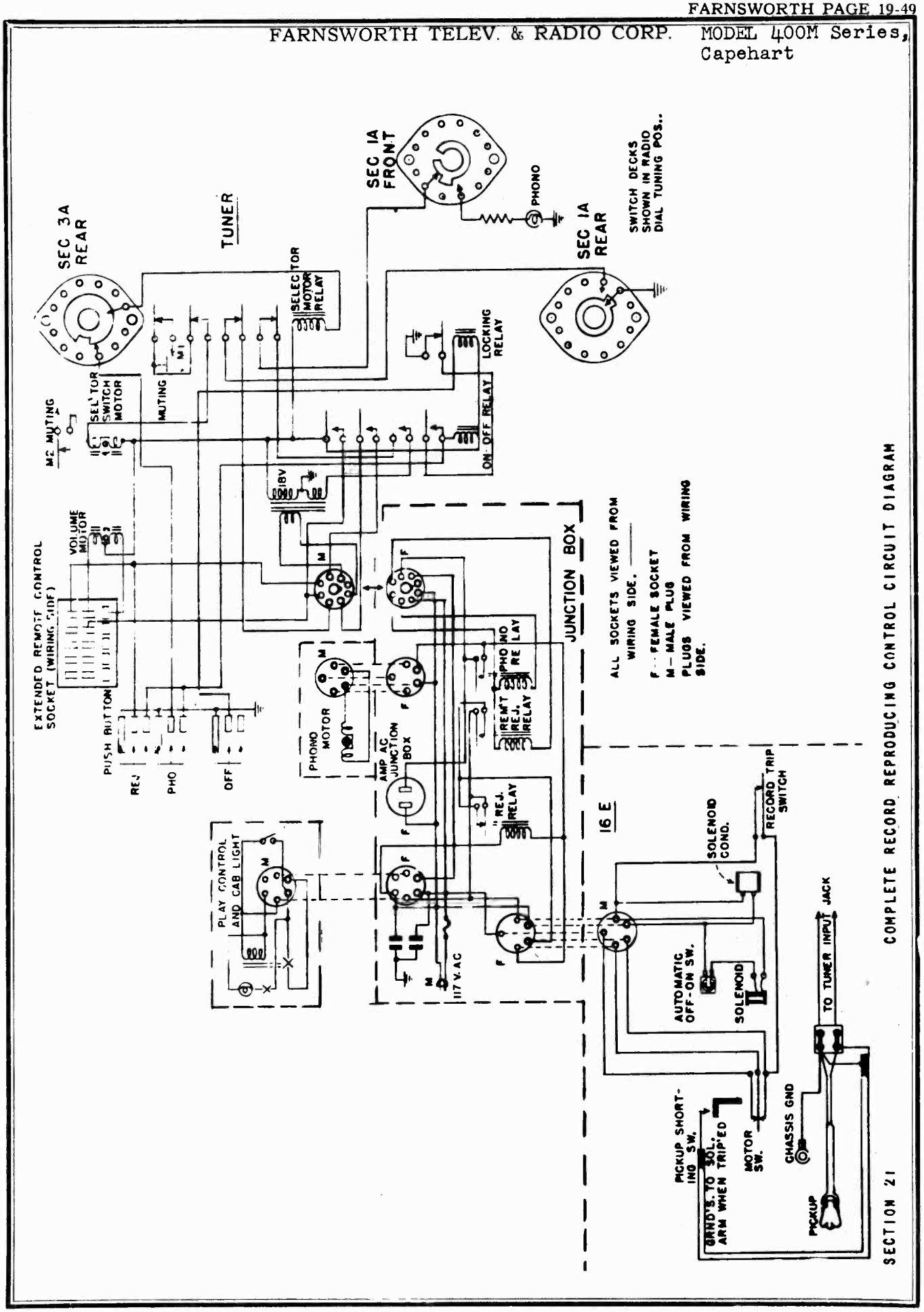

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SECTION 22 MOTOR DRIVE - GEAR REDUCTION UNIT - DRIVE SHAFT ALIGNMENT

A silent and smooth operating drive motor, and gear reduction unit properly coupled to the record changer is of utmost importance for perfect reproduction of records. Unless these parts are all functioning properly there is a possibility that waver, or wows may be noticed in the sound reproduction from records. It is also possible that objectionable hum or rumble may be discernable during low passages in records or the change cycle. If such conditions are apparent we suggest a careful check and adjustment in accordance with the procedures which follow.

After freeing the record changer by removing the four hold down bolts used in shipment, make certain that the record changer is floating freely on its rubber mounting supports and that it does not touch the record changer mounting shelf at any point. There should be a feeling of entirely free floating motion when the changer is shaken slightly. If such is the case, it is a good indication of full free floating action. By making sure that the record changer is "free floating" the possibility of acoustic feedback, hum or rumble is eliminated.

Because of the importance for positioning the record changer into a free floating position it is always advisable to check the alignment relation of the record changer drive shaft with respect to the gear reduction unit and between this unit and the drive motor. Unless the correct alignment relationship is maintained excessive hum or rumble may be present as well as the possibility of uneven turntable speed causing waver or wows in the record reproduction.

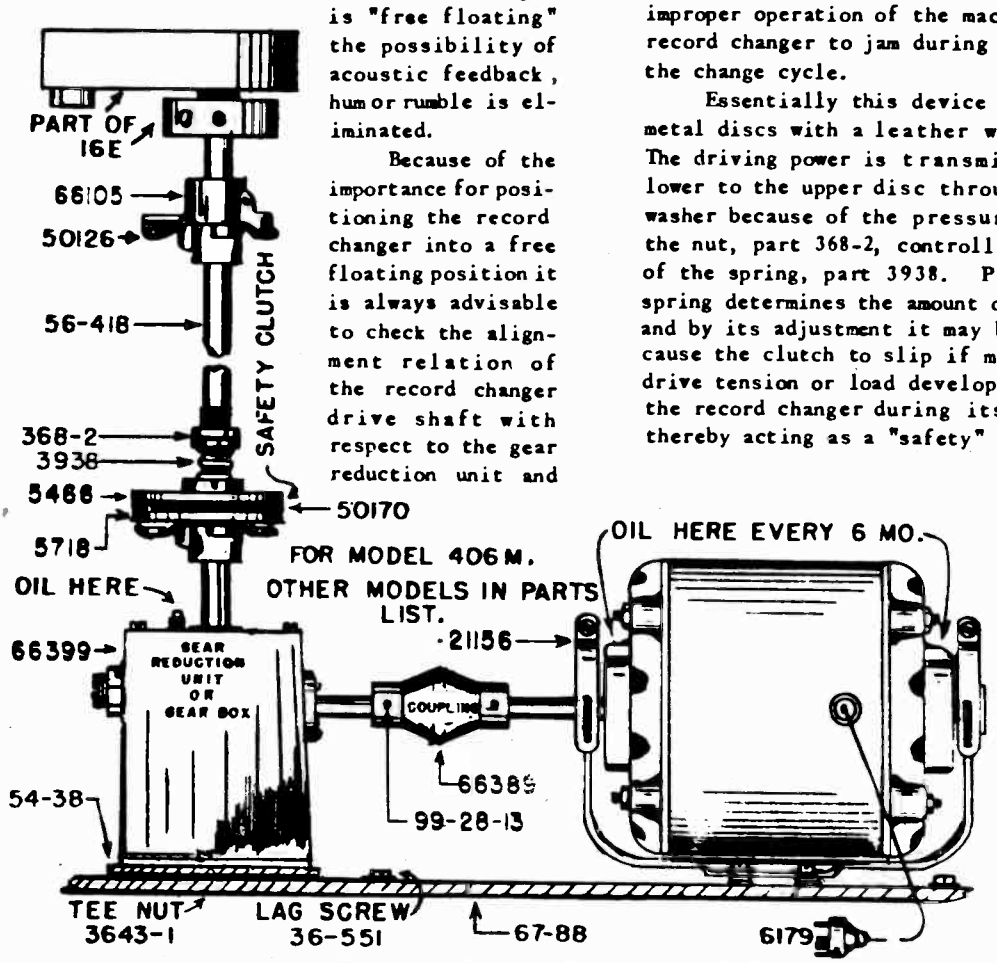
If the above conditions are apparent with record changer in free floating position, try shifting the gear reduction and motor assembly slightly until a position is found where the difficulty is eliminated or negligible.

NOTE: Drive motors and gear reduction units are "run-in" and aligned on the mounting board at the factory, and will seldom, if ever, require adjustment in the field unless they have been tampered with or in the event the motor has shifted due to rough handling in transit. If hum or rumble persists after trying previous suggestions, loosen the motor and shift slightly locking same back in place when minimum hum position is located.

SECTION 23 SAFETY CLUTCH - PURPOSE AND ADJUSTMENT

The purpose of this feature is to uncouple the record changer from the gear reduction unit in the event a faulty record or improper operation of the machine causes the record changer to jam during some portion of the change cycle.

Essentially this device consists of two metal discs with a leather washer between. The driving power is transmitted from the lower to the upper disc through the leather washer because of the pressure developed by the nut, part 368-2, controlling the pressure of the spring, part 3938. Pressure of the spring determines the amount of back pressure and by its adjustment it may be set so as to cause the clutch to slip if more than normal drive tension or load developes soemwhere in the record changer during its change cycle, thereby acting as a "safety" feature.



FARNSWORTH TELEV. & RADIO CORP.

MODEL 400M Series, Capehart

1		2		3		4		5		6		7		8		9		10		11		12	
VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE	VOLTAGE	RESISTANCE
1.0	1-	1.0	20	1.0	20	1.0	20	1.0	20	1.0	20	1.0	20	1.0	20	1-5	2-1	1.48 M	20	1.0	20	1-	20
2.0	20	3.0	30	2.0	3208	2.0	334 M	2.0	3215	2.0	327 M	2.0	3215	2.0	3120 M	2-1	3-1	2 INF	20	2.0	3320	1-	328
3.0	30	4-	50	3.0	355 M	3.0	4250 M	3.0	3210	3.0	4132 M	3.0	3215	3.0	4650 M	3-1	4-75	3.0	40	3.0	3320	1-	428
4-4.5	50	5-6.4	60	4-	523 M	4-4.6	60	4-5.7	40	4-5.7	50	4-2.7	60	4-5.0	5140 M	4-7.5	5-5	4.1 MEG	50	4.0	5300	1-	5175
5.0	60	6.0	76.3	5-	5.8	5.16	60	5-1.7	60	5.18	60	5.9	60	5.0	6730 M	5-5	6-0	5.11 MEG	60	5.0	6300	1-	6175
6.105	76.3	7.2	84.4 MEG	6-	76.3	6.124	76.3	6.30	76.3	6.125	76.3	6-2.2	76.3	6.0	7.2	6-0	7.0	6.0	76.3	6.13 MEG	76.3	6-	76.3
8.200	7.2	8.0	7.6.3	8.0	7.6.3	7.2	8200	8.0	7.6.3	8.195	7.2	8.0	7.6.3	7.2	8.0	8.6.3	7.0	8.2	8200	7.2	8.8	7.2	7.6.3
	7.6.3		8-1.7		8.0		8.0		8.0		7.2		8.0		8.0		7.0		8.2		8.8		8.12
	8.200										8.30 M						8.6.3						8.6.8 M

CAP 2.3 MEG

CAP 3.2 MEG

13.	
VOLTAGE	RESISTANCE
1-1.4	1.1.4 MEG
2.37	2.42 M
3.0	3.1 M
4-1.4	4.1.4 MEG
5.39	5.90 M
6-	6.1 M
7.0	7.0
8.6.3	8.2

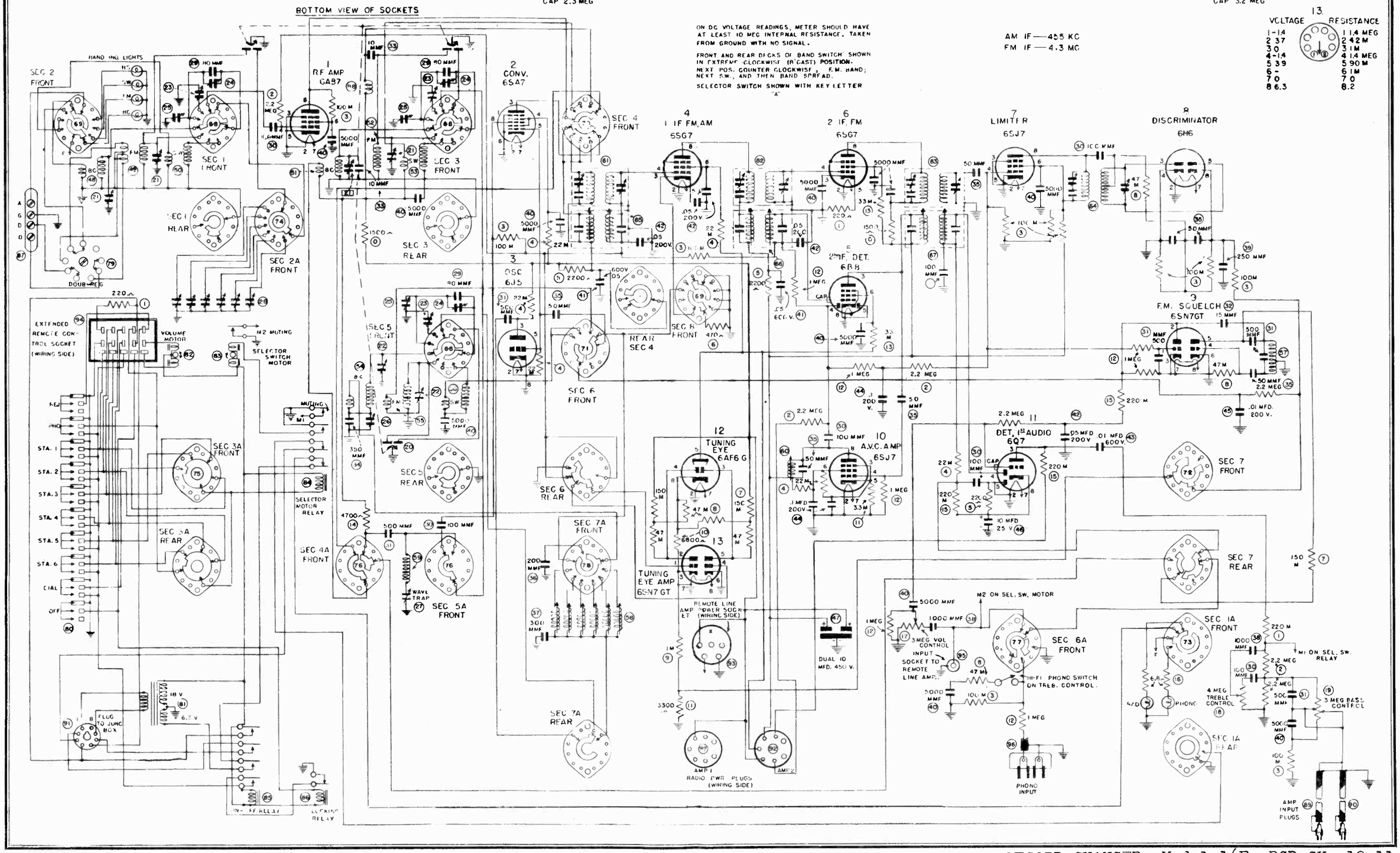
BOTTOM VIEW OF SOCKETS

ON DC VOLTAGE READINGS, METER SHOULD HAVE AT LEAST 10 MEG INTERNAL RESISTANCE. TAKEN FROM GROUND WITH NO SIGNAL.

FRONT AND REAR DECKS OF BAND SWITCH SHOWN IN EXTREME CLOCKWISE (R'CAST) POSITION. NEXT POS. COUNTER CLOCKWISE, F.M. BAND; NEXT S.W., AND THEN BAND SPREAD.

SELECTOR SWITCH SHOWN WITH KEY LETTER "A"

AM IF — 455 KC
FM IF — 4.3 MC



RECORD CHANGER: Model 16E, RCD.CH. 19-11

FARNSWORTH TELEV. & RADIO CORP. MODEL 400M Series, Capehart

SECTION 25 PLAY CONTROL - INSTALLATION - ADJUSTMENTS & MAINTENANCE

1. The following parts comprise a complete play control installation. Play control with cables, plug and switch, compartment light, mounting bracket, two bracket mounting screws, two switch mounting bolts, and four wood screws. Check packing material so no parts are overlooked.

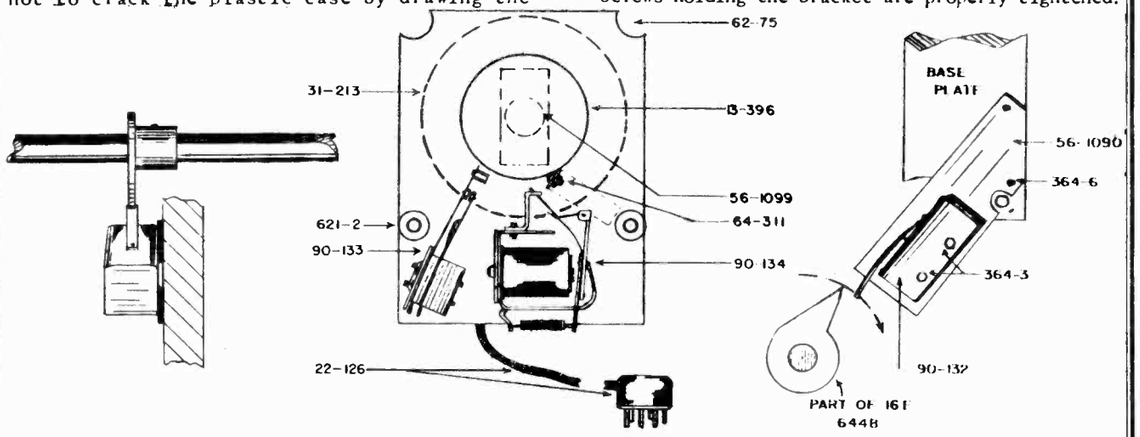
2. The mounting bracket should be installed on the record changer first. See illustration 3.

3. The bracket is mounted on the boss which supports the clutch fork shaft and the reverse cam shaft, on the side of the boss away from the main cam, so the clutch fork shaft sets in the cutout. Pass the two screws that fit the tapped holes in the switch bracket through the old play control bracket holes when mounting the bracket.

4. Remove the plug button from the partition between radio and changer, put the six prong plug, the switch and the cables through the holes in the partition. Fasten the play control on the partition by means of the wood screws being careful not to crack the plastic case by drawing the screws too tight or driving the screws in crooked. Also be sure the record tray clears the play control housing before driving any screws.

5. Fasten the switch to the bracket by means of the two bolts. See illustration. This puts the switch in such a position that the throw out cam can actuate the switch. Of course, the switch goes on the bracket with the leads at the bottom and pointing toward the left (when looking in the back of the cabinet), this brings the spring finger in line with the throw out cam.

6. Remove play control shorting plug (six prong) from junction box and plug in cable from play control. Set play control at any number except zero (off) and run changer through several cycles, if the switch is too close to the throw out cam the relay in the play control will buzz, if not close enough the action will be erratic. Be sure the bolts holding the switch and the screws holding the bracket are properly tightened.



SECTION 26 400M SERIES PLAY CONTROL PARTS LIST

Stock No.	Description	Stock No.	Description
13-396	Ratchet Ass'y	64-311	Dog Spring
22-126	Cable and Plug	90-125	Light Switch
31-213	Dial Scale	92-140	Back Cushion
56-1099	Shaft	61163	Light Bulb
56-1100	Steel Ball Bearing	90-133	Relay (Complete)
59-142	Control Knob	90-134	Switch
59-143	Housing	621-2	Rubber Grommet
62-75	Rubber Grommet	13-368	Play Control & Cabinet Assembly (Complete)

MODEL 400M Series, FARNSWORTH TELEV. & RADIO CORP. Capehart

SECTION 20 OPERATION AND MAINTENANCE 16-E RECORD CHANGER

The "On-Off" relay is used to turn on the 117 volts for the entire set. Due to the fact 117 volts are always on the transformer in the set, the 6.3 volts for the heaters is supplied through one set of contacts on the relay. Another set of contacts supplies the audio amplifiers and another set in conjunction with the selector switch energizes the Reject Relay located in the Junction Box.

This latter relay closes the AC circuit to the Phono motor and the "Phono Relay" also in the Junction Box. Due to the fact the "Phono Relay" contacts are closed until it is energized the AC is also applied to the Clutch Solenoid in the 16-E Changer causing the clutch to be engaged. Thus whenever the "Phono" button is pushed the 16-E goes into cycle to permit the tubes to reach operating temperature before a record is played.

In the 16-E Changer the Clutch Solenoid is energized by the above starting cycle, pressing the Reject Button or by the Automatic Trip Switch. As soon as the change cycle starts the Solenoid Motor Switch opens the Solenoid circuit and shunts the reject relay to keep the motor running until the change cycle is completed even if the "Off" button is pushed.

The Automatic Trip Switch, located under the turntable is actuated by the tone arm moving the trip lever when the needle enters the trip or change groove.

The "Automatic On-Off" switch is used to open the Clutch Solenoid circuit when it is desirable to play records manually.

SECTION 23 SAFETY CLUTCH - PURPOSE AND ADJUSTMENT

The proper method of checking the adjustment of the safety clutch follows. With the record changer in cycle and the record magazine fully loaded apply a slight downward pressure on the bottom of the record magazine, while the magazine is tilting backward. When such pressure is applied it should cause the safety clutch to slip and the turntable should stop revolving. In the event the action of the safety clutch is not as described loosen nut, part 368-2, thereby releasing pressure on spring, 3938, this will permit safety clutch to unload sooner. After this adjustment is made the changer should be put through a number of cycles to make certain that the clutch does not slip at any point in the normal change cycle as this would cause the changer to stall.

The action of this safety clutch should always be checked when the instrument is permanently set up in the customer's home since it acts as a safety device to prevent record breakage or damage to changer in the event of a jam because of reasons previously mentioned. CAUTION: The leather clutch facing should be kept free of oil or grease.

GEAR REDUCTION UNIT

At least once a year the gear reduction unit should be removed, the oil drained, gear box flushed and refilled with 1/2 ounce, No. 10 S.A.E. oil. Stock No. 1315-1.

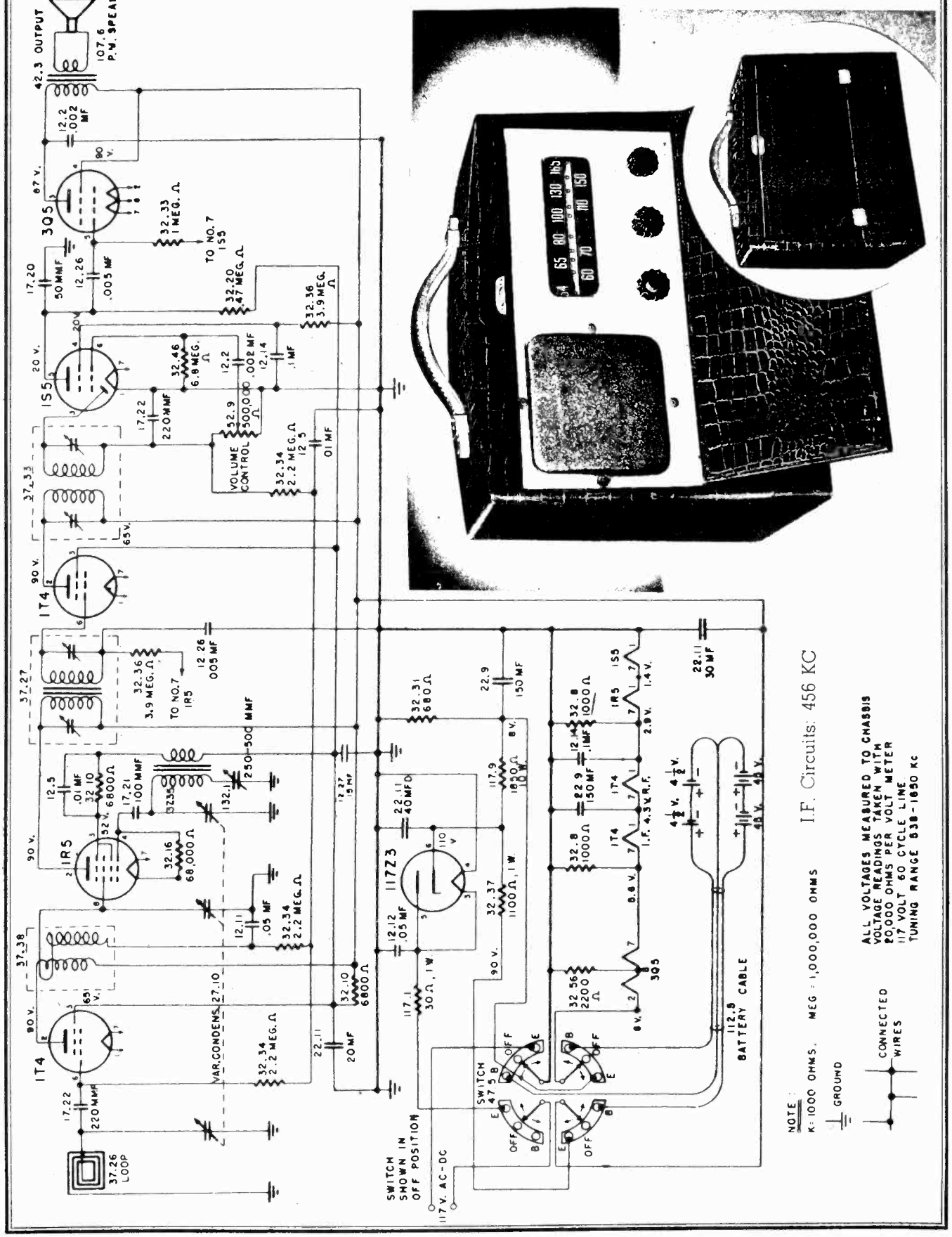
LUBRICATION

At lesst every six months a few drops of oil should be applied to the drive motor oil cups. See illustration. For this purpose use the special electrical motor oil which is carried by most all oil companies for electric fans, sewing machine motors, etc.

SECTION 24 MOTOR DRIVE ASSEMBLY PARTS

Stock Number	Description	Stock Number	Description
13-151	406M Frict. Drive Ass'y.	66105	Flexible Coupl. Set Screw 99-28-13
56-418	406M Shaft	50126	Leather Disc
5466	406M Upper Frict. Drive Disc.	21156	Motor 60 Cycle
5718	406M Lower Frict. Drive Disc.	21157	Motor 50 Cycle
50170	406M Drive Facint (Leather)	66399	Gear Box 60 Cycle
36-501	"C" for Friction Drive	66435	Gear Box 50 Cycle
41-89	"C" Washer Pkg. 12	1315-1	Reduct Unit Oil SAE 10, 1/2 oz.
99-34-7	406M Cotter Pin	6019	1/4" Allen Wrench
3938	406M Spring	67-88	Mtg. Board
368-2	406M 3/8 x 32" Hex Nut	54-38	Reduction Unit Soim
13-151	410 M Frict. Drive Ass'y.	62-46	Motor Grommet
56-119	Shaft for Friction Drive	36-258	Spacers
13-148	411M Friction Drive Ass'y.	36-136	#10 Plain Washer
56-415	411M Shaft for Friction Drive	36-550	#10/32xx 3/4" Slotted RHMS
13-150	412M Friction Drive Ass'y	3611-4	#10 S.P. Lock Washer
56-417	412M Shaft for Friction Drive	3643-1	#10/32 Hex Nut
66389	Motor Couplings (rubber)	6179	5 Prong Motor Plug
99-28-13	1/4 x 20 x 4" Allen Set Screw	36-551	Lag Screw

FEDERAL TELEPHONE AND RADIO CORP. MODEL 6001 PO



Power Supply: 105-125V., 40-60 cyles AC
Same Voltage DC, 15 Watts Power Consumption
Battery Operation: 9 V.A — 90 V.B
Frequency Range: 1650 - 540 KC
I.F. Circuits: 456 KC

Tubes: 1T4 R.F. Amplifier — 1S5 Det Avc. A.F.
1R5 Osc. Converter — 3Q5 Power Output
1T4 I.F. Amplifier — 117z3 Rectifier

Speaker: 5" P.M., 1.47 oz. Alnico V Magnet
Speaker Transformer: 8500 ohms - 400 cycles
Speaker Voice Coil: 3.2 ohms

Part No.	Description
12.2	Tubular Condenser .002 mf 600 V
12.5	Tubular Condenser .01 mf 200 V
12.11	Tubular Condenser .05 mf 200 V
12.12	Tubular Condenser .05 mf 400 V
12.14	Tubular Condenser .1 mf 200 V
12.17	Tubular Condenser .25 mf 400 V
12.26	Tubular Condenser .005 mf 400 V
12.27	Tubular Condenser .15 mf 200 V
17.20	Mica Condenser 50 mmf ±10%
17.22	Mica Condenser 220 mmf ±10%
17.21	Mica Condenser 100 mmf ±10%
22.9	Electrolytic Condenser 150-150mf — 15 W.V.
22.11	Electrolytic Condenser 40-30-20 mf — 150 W.V.
27.10	3 Section Variable Condenser 397 mmf
37.26	Loop Antenna w Trimmer
37.27	Input I.F. Transformer
37.33	Diode I.F. Transformer
37.35	Oscillator Coil
37.38	R. F. Coil
52.9	Volume Control
47.5	Battery Electric Changeover Switch
77.54	Dial Pointer
77.50	Dial Scale (Calibrated)
97.92	Cabinet
42.3	Output Transformer
107.6	5" P. M. Speaker
117.9	1850 ohm 10-W W.W. Resistor
132.1	Padder Condenser
142.30	Tuning Knob
142.29	Volume Knob
142.28	Battery-Off-Electric Knob
	The following apply to Model PO2 only.
97.51	Cabinet
117.1	30 ohm 1 W — W.W. Resistor
142.12	Tuning Knob (wood)
142.13	Volume Knob (wood)
142.14	Battery-Off-Electric Knob (wood)

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.

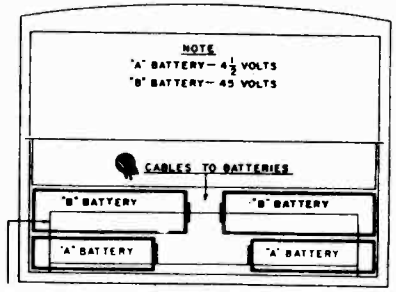
Low range A.C. meter connected across voice coil to indicate output.

Keep signal generator attenuated so as to maintain ½ scale reading on output meter.

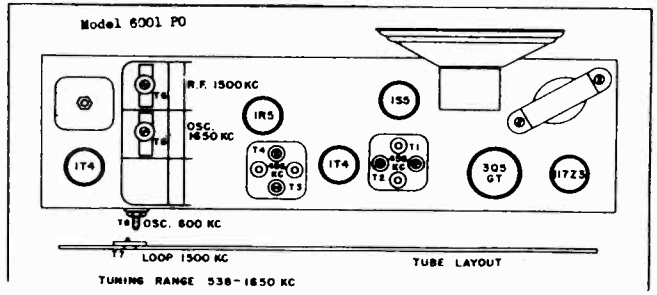
Make certain that dial pointer is exactly on index line (top left side of dial plate) when variable condenser is fully meshed.

REMOVE CHASSIS BOTTOM PLATE

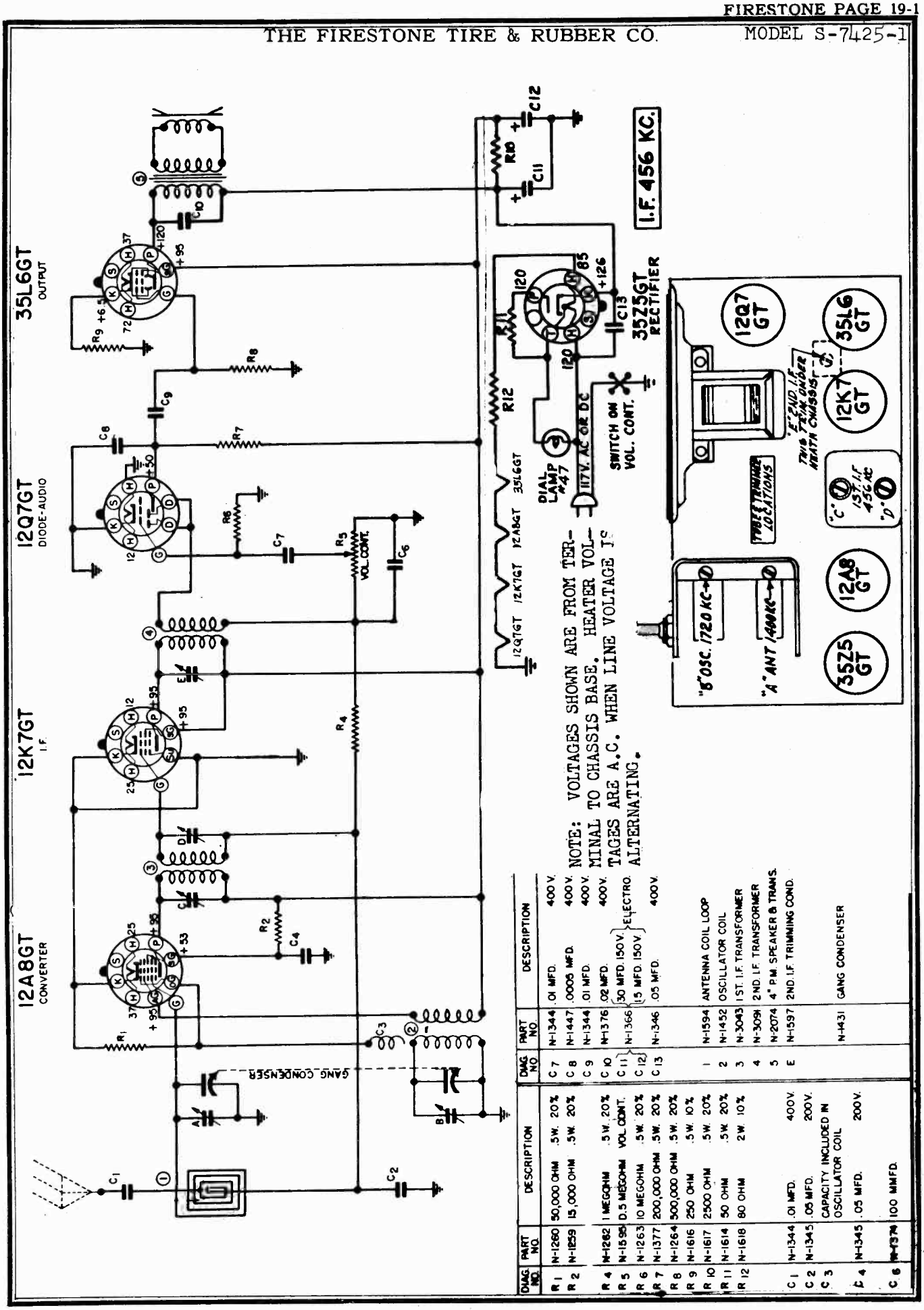
	RECEIVER DIAL AT:	SIGNAL GENERATOR	DUMMY ANTENNA	CONNECT SIGNAL GENERATOR TO:	REFER TO CHASSIS LAYOUT FOR LOCATION OF TRIMMERS
1	Fully closed	Exactly 456 KC	.1 MF	Common Ground and Control Grid 1R5 top front section var. cond.	Adjust for maximum output T1, T2, T3, and T4
2	Fully closed	Approx. 538 KC	.1 MF	Control Grid 1T4 top rear section var. condenser	Adjust for maximum output T8
3	Fully open	Exactly 1650 KC	.1 MF	Control Grid 1T4 top rear section var. cond.	Adjust for maximum output T5
	REPEAT OPERATIONS 2 and 3.				
4	Approx. 1500 KC	Approx. 1500 KC	.1 MF	Control Grid 1T4 same as No. 3	Adjust for maximum output T6
	The next two operations are performed with the bottom plate on and the chassis in the cabinet — with lid closed				
5	Approx. 1500 KC	Approx. 1500 KC	.1 MF	Radiating Loop 20" from Receiver	Adjust T7 for maximum output
6	Approx. 600 KC	Approx. 600 KC		Radiating Loop 20" from Receiver	Adjust T8 for maximum while rocking variable condenser



Battery Block Battery Layout



THE FIRESTONE TIRE & RUBBER CO. MODEL S-7425-1



DIAG NO.	PART NO.	DESCRIPTION	DIAG NO.	PART NO.	DESCRIPTION
R 1	N-1280	50,000 OHM .5W. 20%	C 7	N-1344	.01 MFD. 400 V.
R 2	N-1259	15,000 OHM .5W. 20%	C 8	N-1447	.0005 MFD. 400 V.
R 4	N-1262	1 MEGOHM .5W. 20%	C 9	N-1344	.01 MFD. 400 V.
R 5	N-1590	0.5 MEGOHM VOL CONT.	C 10	N-1376	.02 MFD. 400 V.
R 6	N-1263	10 MEGOHM .5W. 20%	C 11	N-1366	30 MFD. 150 V. ELECTRO.
R 7	N-1377	200,000 OHM .5W. 20%	C 12		15 MFD. 150 V. ELECTRO.
R 8	N-1264	500,000 OHM .5W. 20%	C 13	N-1346	.05 MFD. 400 V.
R 9	N-1616	250 OHM .5W. 10%	1	N-1594	ANTENNA COIL LOOP
R 10	N-1617	2500 OHM .5W. 20%	2	N-1452	OSCILLATOR COIL
R 11	N-1614	50 OHM .5W. 20%	3	N-3043	1 ST. I.F. TRANSFORMER
R 12	N-1618	80 OHM 2W. 10%	4	N-3091	2 ND. I.F. TRANSFORMER
			5	N-2074	4" P.M. SPEAKER & TRANS.
C 1	N-1344	.01 MFD. 400V.	E	N-1597	2 ND. I.F. TRIMMING COND.
C 2	N-1345	.05 MFD. 200V.			
C 3		CAPACITY INCLUDED IN OSCILLATOR COIL		N-1431	GANG CONDENSER
C 4	N-1345	.05 MFD. 200V.			
C 6	N-1374	100 MMFD.			

MODEL 4-A-60 THE FIRESTONE TIRE & RUBBER CO.

CIRCUIT DESCRIPTION

The chassis utilized in these modern Firestone radio receivers incorporates a basic superheterodyne type of circuit that is designed to provide reception from standard broadcast stations in the frequency range of 540 to 1600 KC as well as reception from the new frequency modulation stations that are located in the 88 to 108 MC band. Many of the stages of the complete circuit will be readily recognized as necessary elements of a typical superheterodyne system, however, the detection method that is used for frequency modulation reception embodies an entirely new principle that will be fully explained in this pamphlet. All sections of the circuit have been developed in accordance wtih the most modern radio engineering technique and some of the more prominent features are described in the following paragraphs.

Built-in antennas are provided for reception of AM as well as FM stations. In locations where signal strength is adequate, these built-in antennas will give satisfactory performance but where FM signals are weak, it is desirable to obtain greater signal pick-up by installing an outdoor antenna such as:

FIRESTONE
FOLDED DIPOLE
FM ANTENNA
STOCK NO. 4-D-126

The built-in antenna used for AM reception is a high impedance loop that is mounted on rear edge of cabinet. A specially arranged and accurately cut length of "ribbon-type" high frequency transmission line serves to form the built-in folded dipole antenna for FM reception.

Tuning of the radio frequency circuits of the receiver is accomplished by a sturdily constructed permeability ("slug") tuner. This tuning system provides a means of minimizing the effects of "microphonism" that are inherent in other tuning devices. A high degree of accuracy in calibration and alignment of tuned circuits is also obtained with the permeability tuning system.

An R. F. amplifier stage is utilized to give maximum sensitivity and selectivity as well as high image rejection on FM and manual tuning AM reception.

Both transformer coupled I.F. stages are used for FM and one stage is used for AM. The first and second I.F. transformers have two sets of windings; one set is tuned to 455 KC for AM operation and the other is tuned to 10.7 MC for FM operation. Switching of the windings, to alleviate undesired beat frequencies, is necessary only in the first I.F. transformer.

Detection of amplitude modulated 455 KC signals is accomplished by the 6SQ7 diode rectification circuit and the resulting audio signal is passed to a conventional 6SJ7 audio amplifier stage.

Frequency modulation detection is obtained by an entirely new circuit that is known as the "RATIO DISCRIMINATOR." This FM detector circuit has the unusual ability to reject noise or other brief variations in the amplitude of the signal. The relative insensitivity of the Ratio Discriminator to signal amplitude variation makes it possible to eliminate the use of a "limiter" stage that ordinarily precedes the discriminator in other types of FM detector systems. It will therefore be noted that this receiver utilizes a normal I.F. amplifier stage instead of a low gain limiter stage preceding the FM discriminator. The theory of operation of the Ratio Discriminator is given in a subsequent section.

Two stages of voltage amplification (6SQ7 and 6SJ7) are provided for the audio frequency output from the FM discriminator circuit. The final audio power amplifier stage incorporates a 6V6GT tube in a special inverse feedback arrangement which reduces distortion and contributes to exceptionally good tone quality.

When the receiver is used for phonograph operation, audio voltage and power amplification is accomplished by the 6SJ7 and 6V6GT audio stages. Gain of this system is intentionally limited so that the output tube will not be driven into the high distortion region. This design permits the volume control to be advanced to its maximum position before reaching an audio level where distortion would otherwise cause unintelligible blasting—hence the maximum volume control position approximates the highest sound level that would be obtainable with an acceptable percentage of distortion.

THE RATIO DISCRIMINATOR

(Theory of Operation)

With the introduction of frequency modulated radio transmission it was necessary to devise a means of "detecting" or extracting the audio frequency intelligence from a carrier wave after it was appropriately amplified at the receiver. Since the frequency modulation process involves variation of a given carrier frequency for as much as 75 KC in either direction, it is apparent that the intelligence (or modulating signal) can best be extracted from the wave by a circuit that is capable of "discriminating" or recognizing the frequency of the carrier at any instant. Thus, the receiver circuit which converts FM carrier frequency variations into a corresponding voltage variation has become known as a discriminator.

When considering the function of a discriminator it is important to keep in mind that the output voltage amplitude is determined by the extent of the carrier frequency deviation from its center frequency; **the greater the deviation, the greater the amplitude of the discriminator output voltage—this determines volume of the resultant audible signal.**

The rate at which the FM carrier frequency is being deviated above and below its center value determines the rate at which the discriminator output voltage will vary and therefore it will be seen that **this rate of variation of output voltage corresponds to the audio frequency of the intelligence that was to be extracted from the carrier wave;** rapid variation of carrier frequency causes the discriminator to produce high audio frequencies and vice versa.

Unfortunately the conventional type of discriminator circuit is also sensitive to amplitude variations in the carrier wave and it must be preceded by a limiter stage that is capable of delivering a constant amplitude FM carrier wave to the discriminator. If the limiter stage were omitted, noise signals, which cause a variation in signal amplitude, would pass through the discriminator and would be audible in the output system.

With the advent of the "RATIO" Discriminator, an FM detector circuit was devised which was found to be relatively insensitive to amplitude variation of the incoming signal and therefore the use of a limiter stage could be dispensed with. After careful consideration of the performance of the Ratio Discriminator, Firestone engineers selected it as the means of FM detection in this receiver.

The outstanding difference between the "Ratio" Discriminator and other discriminators is as its name implies—the output voltage is dependent upon the **ratio** of two voltages rather than upon a comparison of these voltages on the basis of magnitude alone. Full significance of this feature will become apparent after studying the following description of the Ratio Discriminator circuit.

Operation of the Ratio Discriminator can best be understood by starting with a simple 3 wire D.C. circuit as an analogy and building up the discriminator circuit in easily comprehended sections. A typical 3 wire D.C. circuit is therefore shown in Fig. 1 and the following performance characteristics should be particularly noted.

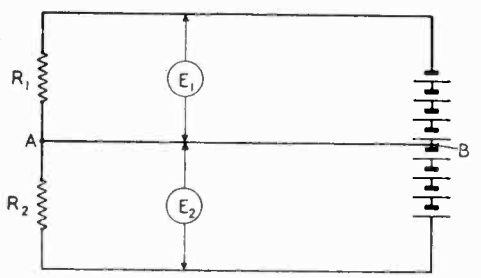


Fig. 1

When resistors R_1 and R_2 are equal, the circuit is said to be balanced and no current will flow in the center conductor A-B providing point B is a center tap on the battery supply voltage. In addition the voltage drop E_1 across resistor R_1 equal to voltage drop E_2 across resistor R_2. If we now introduce batteries of equal voltage in the R_1 and R_2 sec-

tions of the circuit as shown in Fig. 2, the system will remain balanced and although the current changes, there will be no change in the reading of voltmeters E_1 and E_2. It should be noted that the introduction of the batteries (with polarity as indicated) has caused a reduction in current. This current reduction results in a lower voltage drop across both load resistors but the sum of the drop across either resistor plus the battery voltage V must be equal to one-half of the supply voltage which is E_1 or E_2.

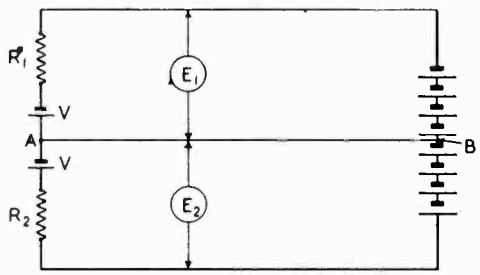


Fig. 2

This principle is made use of in the Ratio Discriminator so as to make it relatively insensitive to variation in amplitude of the incoming signal. By substituting the center tapped secondary winding of an I.F. transformer as shown in Fig. 3 for the two batteries labelled V in Fig. 2 it will be seen that a comparable condition is produced as equal voltages are induced in both halves of the secondary winding. Diode rectifier tubes are substituted for resistor R_1 and R_2 since we are now dealing with A.C. induced voltages that must be rectified. Do not overlook the fact that the plate resistance of the diodes creates a voltage drop and is analogous in that respect to the action of R_1 and R_2.

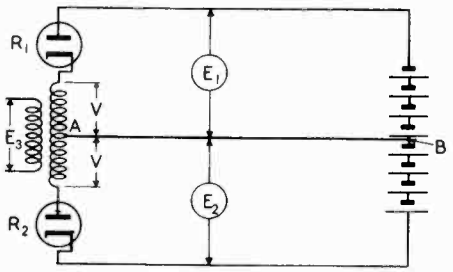


Fig. 3

Observe that irrespective of the magnitude of incoming signal voltage E_3, the voltage V induced in each half of the secondary winding will be equal since it is center-tapped. It has been previously shown that as long as equal voltages V are added to each load section of the 3 wire system, there would be no change in the reading of meters E_1 and E_2 and thus these voltages remain the same irrespective of the variation in the input signal voltage E_3. The **ratio** of the voltages E_1/E_2 also may be said to remain constant with variation in magnitude of incoming signal.

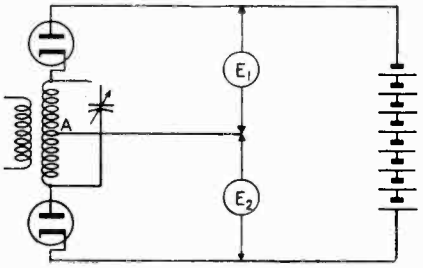


Fig. 4

Fig. 4 shows a slight rearrangement of the same circuit that was illustrated in Fig. 3 with the exception that the I.F. transformer has a condenser across the secondary in order to resonate it to the desired frequency. In addition, the conductor between points A and B has been eliminated since current will not flow thru it as long as the system is balanced. Center tap A on transformer secondary is still retained.

The foregoing circuit has been shown to be insensitive to variations in amplitude of the incoming signal and if it can now be arranged so that it will be capable of "discriminating" between variations in the frequency of the incoming signal, it will prove to be an ideal FM detector. Frequency discrimination can be accomplished by introducing some voltage from the primary of the I.F. transformer in series with the resonant voltage of the secondary so that the vector sum of these two voltages will effectively determine the instantaneous voltage between points A and E as well as between A and F. (These are the voltages that are measured by meters E_1 and E_2). The circuit of Fig. 5 shows how a portion of the primary voltage of the I.F. transformer is introduced into the secondary circuit by means of a tertiary winding on the transformer.

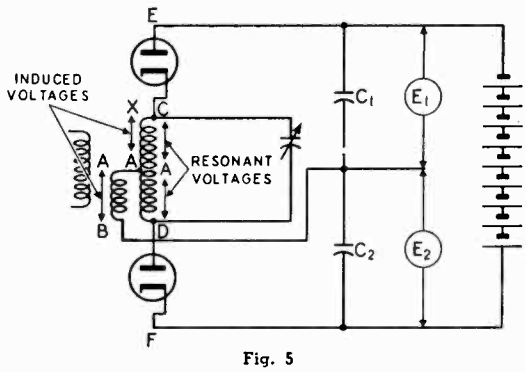


Fig. 5

Condensers C_1 and C_2 have low reactance at the I.F. frequency, however, their reactance is appreciable at audio frequencies and therefore the voltage drop across these condensers will readily follow circuit voltage variations that occur at an audio rate.

If an examination is now made of the conditions that would prevail under each of the following circumstances, it will be possible to determine whether the voltages E_1 and E_2 can be made to vary in accordance with the variation of carrier frequency since that action would follow the intelligence that is contained in the FM signal.

1. Ratio of voltage E_1 to E_2 when frequency of incoming signal is exactly **equal** to the I.F.
2. Ratio of voltage E_1 to E_2 when frequency of incoming signal is **above** I.F.
3. Ratio of voltage E_1 to E_2 when frequency of incoming signal is **below** I.F.

CONDITION #1: INCOMING SIGNAL EQUAL TO I.F.: When this condition prevails, the vector diagram shown in Fig. 6 illustrates how the voltage across tertiary winding AB is added vectorially to the resonant secondary voltage across AC or across AD to produce a resultant voltage that determines the voltage indicated by meters E_1 and E_2.

AX and AB represent the voltages that are coupled into the secondary and tertiary windings of the I.F. transformer. When the secondary is tuned to resonance, the voltage AC (across one-half the resonant circuit) will be 90 degrees ahead of induced voltage AX as well as induced voltage AB. It should be remembered that the phase difference between applied voltage (or induced voltage as in this case) and the voltage developed across an inductance in an A.C. circuit will vary with frequency and only at the resonant frequency will the phase difference be equal to 90 degrees.

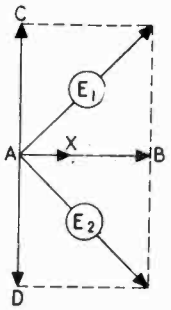


Fig. 6

By again examining the circuit shown in Fig. 5 it may now be appreciated that the voltages read on meters E_1 and E_2 will be respectively proportional to the vector resultant voltages E_1 and E_2 illustrated in Fig. 6 (these resultants represent the vector sum of voltage AB and AC or the vector sum of AB and AD). Since the resultant voltages E_1 and E_2 are equal in magnitude, the voltage from point A to E will equal the voltage from point A to F and hence **meters E_1 and E_2 will have identical readings.**

CONDITION #2; INCOMING SIGNAL ABOVE I.F.: When this condition prevails, the vector diagram shown in Fig. 7 illustrates the phase relation of the induced voltage in the tertiary winding and the resonant voltage in the tuned secondary. Note that the resonant secondary voltage AC does not lead the voltage AB by 90 degrees as was the case when the incoming signal was exactly equal to the I.F.

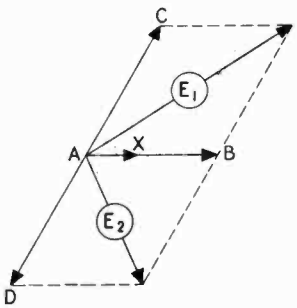


Fig. 7

Vector addition of voltages AB plus AC and AB plus AD produces the respective resultants E_1 and E_2. Since E_1 is obviously larger than E_2, the voltage that appears across the A to E portion of the circuit will be greater than the voltage that appears across the A to F portion. Hence, the reading of meter E_1 is larger than that of meter E_2 and the ratio of E_1/E_2 is **greater than unity.**

CONDITION #3; INCOMING SIGNAL BELOW I.F.: When this condition prevails, the vector diagram shown in Fig. 8 illustrates the phase relation of induced voltage in the tertiary winding and the resonant voltage in the tuned secondary. Note that the resonant secondary voltage AC leads the voltage AB by more than 90 degrees and that the vector resultant E_1 is now smaller than the resultant E_2. In this case the voltage that appears across the A to E portion of the circuit will be smaller than the voltage from A to F. Hence, the reading of meter E_1 is smaller than that of meter E_2 and the ratio of E_1/E_2 is **less than unity.**

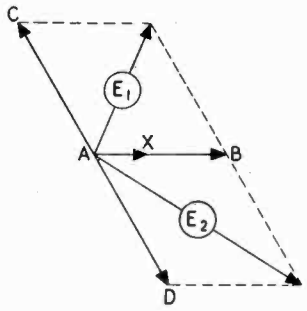


Fig. 8

The manner in which a Ratio Discriminator extracts the intelligence from a frequency modulated carrier by means of a variation in the **ratio** between two voltages should now be apparent from the foregoing discussion and Fig. 9 illustrates the complete discriminator circuit as used in this receiver.

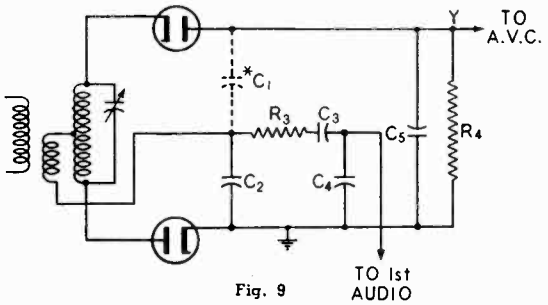


Fig. 9

*Condenser C_1 is represented in the actual circuit by distributed capacitance of associated wiring.

Elimination of the battery that was shown in previous illustrations is accomplished by using a long time constant resistor-condenser combination consisting of R_4 and C_5. Since the two diodes in the discriminator circuit are in series, they will conduct on the same half cycle, and the rectified current thru R_4 will charge condenser C_5 so that the point labelled Y becomes negative. The time constant of R_4-C_5 is about 0.1 second so that the negative potential at point Y will remain constant at even the lowest audio frequencies.

A rapid increase in carrier voltage cannot momentarily increase the voltage across R_4-C_5 due to the large time constant; similarly, a sudden reduction in carrier voltage will not be accompanied by a change in voltage across R_4-C_5. Thus, the voltage across this R-C combination stabilizes the Ratio Discriminator against amplitude modulation. In addition it should be noted that the same voltage serves as an excellent A.V.C. voltage and is used for that purpose in this receiver.

The "threshold" effect that is noticeable in other types of FM limiter-discriminator combinations is absent in the ratio type discriminator and there is no specific minimum carrier level that must be applied (as in the case of a limiter stage) to prevent noise from reaching the audio system.

Since the higher audio frequencies are intentionally emphasized in the frequency modulation transmission process, de-emphasis is used at the receiver in order to provide normal tone rendition and to reduce high frequency noises. De-emphasis is accomplished by resistor R_3 and condensers C_3 and C_4 in the discriminator circuit shown in Fig. 9.

THE FIRESTONE TIRE & RUBBER CO. MODEL 4-A-60

BROADCAST BAND — "AM" — ALIGNMENT PROCEDURE

1. Disconnect leads from FM antenna terminal strip (labelled "A-G-A") at back of chassis; also disconnect speaker plug, AM loop antenna plug and phono plugs. Remove chassis from cabinet.

2. It will be necessary to perform this alignment procedure with the chassis placed relatively close to the cabinet in order to avoid removing the AM loop antenna that is attached to cabinet frame.

3. After conveniently locating chassis with respect to the cabinet, reconnect AM loop antenna plug, speaker plug and brown lead of "External Antenna" coupling turn to blue lead at back of receiver.

4. Connect an output meter across speaker voice coil or from plate of 6V6GT tube to chassis through a 0.1 Mfd. condenser.

5. Connect ground lead of signal generator to receiver chassis.

6. Set volume control to the maximum volume position and use a weak signal from the signal generator.

7. If alignment of both AM and FM channels is required, it is necessary to align the AM channel first; then align FM channel as instructed in preceding section.

8. R.F. leads from slug tuner assembly should be dressed away from wave trap coil and close to chassis.

9. After alignment procedure is completed and chassis has been reinstalled in cabinet, arrange leads to loop antenna so that they are separated from each other as much as possible—avoid twisting or taping these leads together.

DUMMY ANT. IN SERIES WITH SIGNAL GENERATOR	CONNECT HIGH SIDE OF SIGNAL GENERATOR TO	SIGNAL GENERATOR FREQUENCY	FM-AM PHONO SWITCH POSITION	RECEIVER DIAL SETTING	TRIMMER OR SLUG NUMBER	TRIMMER DESCRIPTION	TYPE OF ADJUSTMENT
0.1 MFD. Condenser	Terminal K on tuner unit (see Fig. 11).	455 KC	"AM" Center Position	Any position where it does not affect the signal.	1-2	2nd I.F.	Adjust for maximum output. Then repeat adjustment.
					3-4	1st I.F.	
0.1 MFD. Condenser	Terminal K on tuner unit (see Fig. 11).	455 KC	"AM" Center Position	Any position where it does not affect the signal.	5	Wave Trap	Adjust for minimum output.
If positions of movable slugs in the slug tuner assembly have been disturbed (examine cement seal near top of threaded stem on each slug) or if a coil or slug has just been replaced in the tuner assembly, omit the next 5 instructions in this chart and start with the procedure entitled "Slug Tuner Adjustment Procedure—AM Section." Where the tuner assembly has not been disturbed, ignore this instruction and proceed with the next step.							
500 MMFD. Mica Condenser	External Antenna clip at back of Cabinet.	535 KC	"AM" Center Position	Set Slug tuner assembly to fully closed position. Disregard position of dial pointer.	6	Oscillator Trimmer	Adjust for maximum output.
500 MMFD. Mica Condenser	External Antenna clip at back of Cabinet.	1000 KC	"AM" Center Position	Tune to 1000 KC generator signal and check position of dial pointer. If it is set incorrectly, release clip on pointer and repcsition to 1000 KC calibration mark. Note that the 1000 KC mark is located under the last "0" in the numeral "100." Exercise care to set pointer accurately.			
500 MMFD. Mica Condenser	External Antenna clip at back of Cabinet.	1500 KC	"AM" Center Position	Tune to 1500 KC generator signal.	7	Antenna Trimmer	Note the difference between the dial pointer setting and the 1500 KC mark on the scale—do not disturb pointer position even if pointer does not coincide with 1500 KC mark. If the difference does not exceed 20 KC, adjust trimmer No. 7 for maximum output and proceed with next two instructions in this chart. Where the calibration error exceeds 20 KC it is advisable to omit the next two instructions in this chart and adjust the slug tuner as described in the following section.
500 MMFD. Mica Condenser	External Antenna clip at back of Cabinet.	600 KC	"AM" Center Position	Tune to 600 KC generator signal.	8	Antenna Padder	Adjust for maximum output. Try to increase output by detuning padder and retuning receiver dial until maximum output is obtained.
Repeat adjustment of trimmers 7 and 8 until one no longer detunes the other. This completes the AM band alignment procedure. The following procedure should only be used where the conditions described under the heading are encountered.							

MODEL 4-A-60 THE FIRESTONE TIRE & RUBBER CO.

"AM" ALIGNMENT PROCEDURE CONTINUED

SLUG TUNER ADJUSTMENT PROCEDURE — AM SECTION

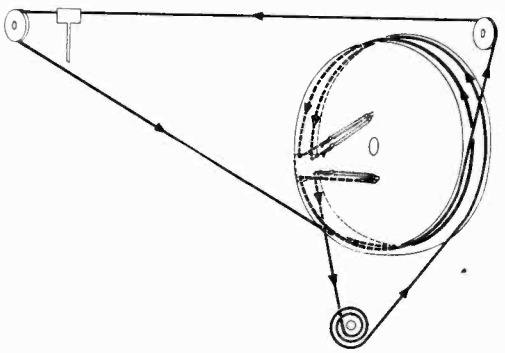
This procedure is to be used only where the positions of slugs in the slug tuner have been disturbed or in event of a coil or slug replacement, or where a serious calibration or tracking error is noted after attempting to align the receiver as described in the preceding section.

DUMMY ANT. IN SERIES WITH SIGNAL GENERATOR	CONNECT HIGH SIDE OF SIGNAL GENERATOR TO	SIGNAL GENERATOR FREQUENCY	FM-AM PHONO SWITCH POSITION	RECEIVER DIAL SETTING	TRIMMER OR SLUG NUMBER	TRIMMER DESCRIPTION	TYPE OF ADJUSTMENT
500 MMFD. Mica Condenser	External Antenna clip at back of Cabinet.	535 KC	"AM" Center Position	Set Slug tuner assembly to fully closed position. Disregard position of dial pointer.	9	Oscillator Tuning Slug	The object of this adjustment is to set slug #9 to a position where the oscillator coil reaches maximum inductance at 535 KC. That is accomplished by first backing off trimmer condenser #6 until its plates are well spaced (lowest capacity); then rotate slug #9 and note whether a peak can be obtained on the output meter. If a peak cannot be reached, turn trimmer condenser #6 to a slightly higher capacity setting and repeat adjustment of slug #9 for peak output. **When adjusting this slug, always approach the peak output setting by rotating the slug so that it is moving down into the coil form.** The correct setting of slug #9 is determined when a **definite peak** can be reached with trimmer #6 at the lowest capacity position that permits the coil and condenser to resonate at 535 KC.
500 MMFD. Mica Condenser	External Antenna clip at back of Cabinet.	1500 KC	"AM" Center Position	Set Accurately to 1500 KC mark on scale.	6	Oscillator Trimmer	Adjust for maximum output.
500 MMFD. Mica Condenser	External Antenna clip at back of Cabinet.	535 KC	"AM" Center Position	Set Slug tuner assembly to fully closed position.	10	Oscillator Padder Slug	Adjust to receive 535 KC signal and for maximum output.
Repeat adjustment of oscillator trimmer #6 at 1500 KC and oscillator padder slug at 535 KC until both points are correctly calibrated with the dial scale.							
500 MMFD. Mica Condenser	External Antenna clip at back of Cabinet.	1500 KC	"AM" Center Position	Tune to 1500 KC generator signal.	7	Antenna Trimmer	Adjust for maximum output.
500 MMFD. Mica Condenser	External Antenna clip at back of Cabinet.	1000 KC	"AM" Center Position	Tune to 1000 KC generator signal.	11	Antenna Tuning Slug	Adjust for maximum output.
500 MMFD. Mica Condenser	External Antenna clip at back of Cabinet.	600 KC	"AM" Center Position	Tune to 600 KC generator signal.	8	Antenna Padder	Adjust for maximum output. Try to increase output by detuning padder and retuning receiver dial until maximum output is obtained.
Repeat the three preceding adjustments until no further improvement can be made in output at 1500 KC, 1000 KC and 600 KC. Apply a coating of speaker cement at top of each tuning slug stem to prevent movement.							

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 (7 feet)
119087—Ring for dial cord
113177—Tension Spring



THE FIRESTONE TIRE & RUBBER CO. MODEL 4-A-60

FREQUENCY MODULATION — "FM" — ALIGNMENT PROCEDURE

INSTRUMENTS: Alignment of the FM circuits in this receiver may be accomplished with either a conventional AM type signal generator or an FM signal generator. The output indicator should be an oscilloscope or a vacuum tube voltmefer.

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 condenser.

IMPORTANT: If an AM signal generator is used, 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.

The following procedure is adaptable for use with either an AM or FM generator and oscilloscope or vacuum tube voltmeter—merely follow the instructions which are applicable to the instruments that are used.

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 adjacent chart (AM alignment procedure is given on page 9). Do not attempt to reposition pointer by releasing it from clip on dial cord this is done only during AM alignment.

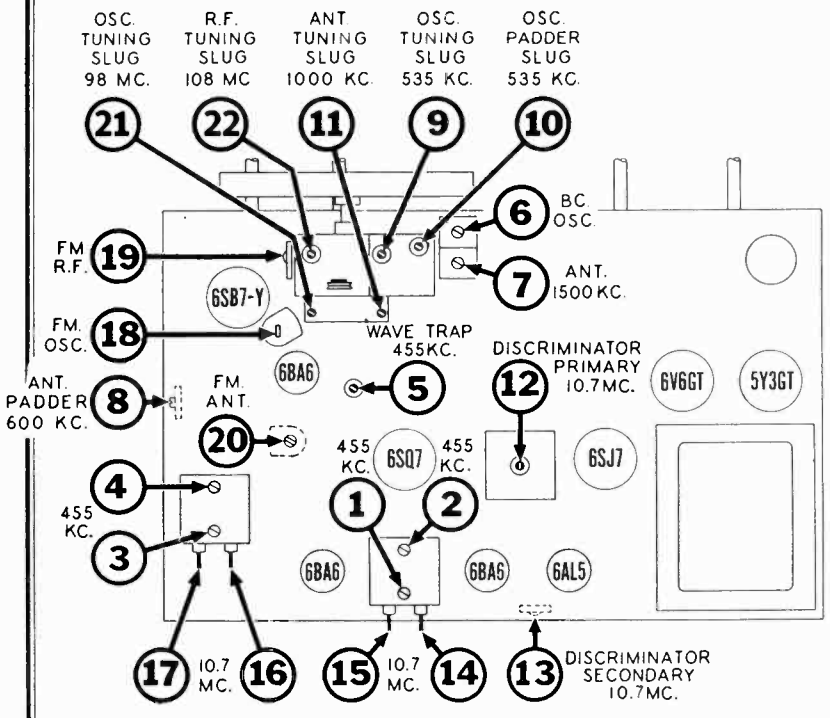
2. Disconnect leads from FM antenna terminal strip (labelled "A-G-A") at back of chassis; also disconnect all other plugs on rear of chassis and remove chassis from cabinet. It is not necessary to remove the built in antennas.

3. Remove speaker from cabinet and reconnect plug to receiver chassis.

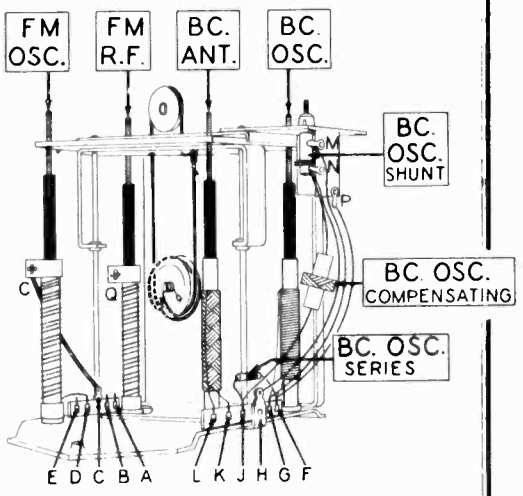
4. A specific setting of the receiver volume control is not required, however, it will be found convenient to leave it in the maximum volume position so that alignment signals will be audible even though the output indication is obtained by a V-T voltmeter or 'scope connected to points in the discriminator circuit.

5. FM circuit leads should be dressed 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. Alignment of receiver circuits may now be accomplished by using the procedure in the adjoining chart.



TRIMMER LOCATION CHART



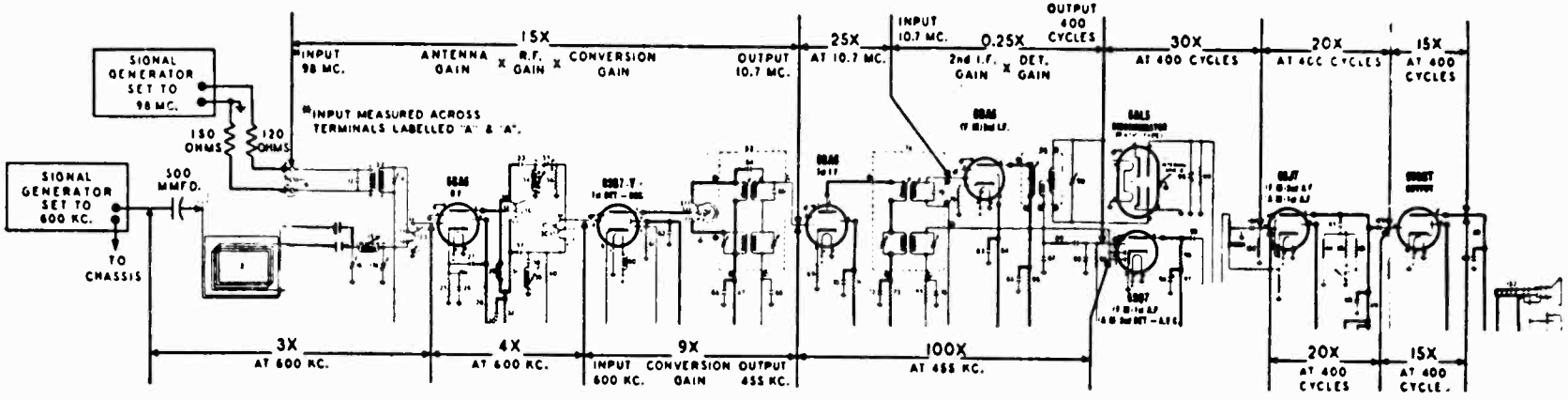
SLUG TUNER ASSEMBLY

STAGE GAIN MEASUREMENT PROCEDURE

REQUIRED INSTRUMENTS: The amount of amplification or "gain" of each of the stages of this receiver should be measured with an A. C. Vacuum Tube Voltmeter of the high frequency type (uniform response up to 100 MC). A conventional "AM" type signal generator may be used but it must be capable of producing **fundamental** frequencies of 600 KC. and 98 MC—**avoid using a generator that produces the 98 MC. signal by means of harmonics.**

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. 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. and then carefully tune radio receiver to this signal by using a D. C. Vacuum Tube Voltmeter as an output indicator—meter must be connected between pin #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. 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 7 of the 1st I.F. transformer and 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-detuning.

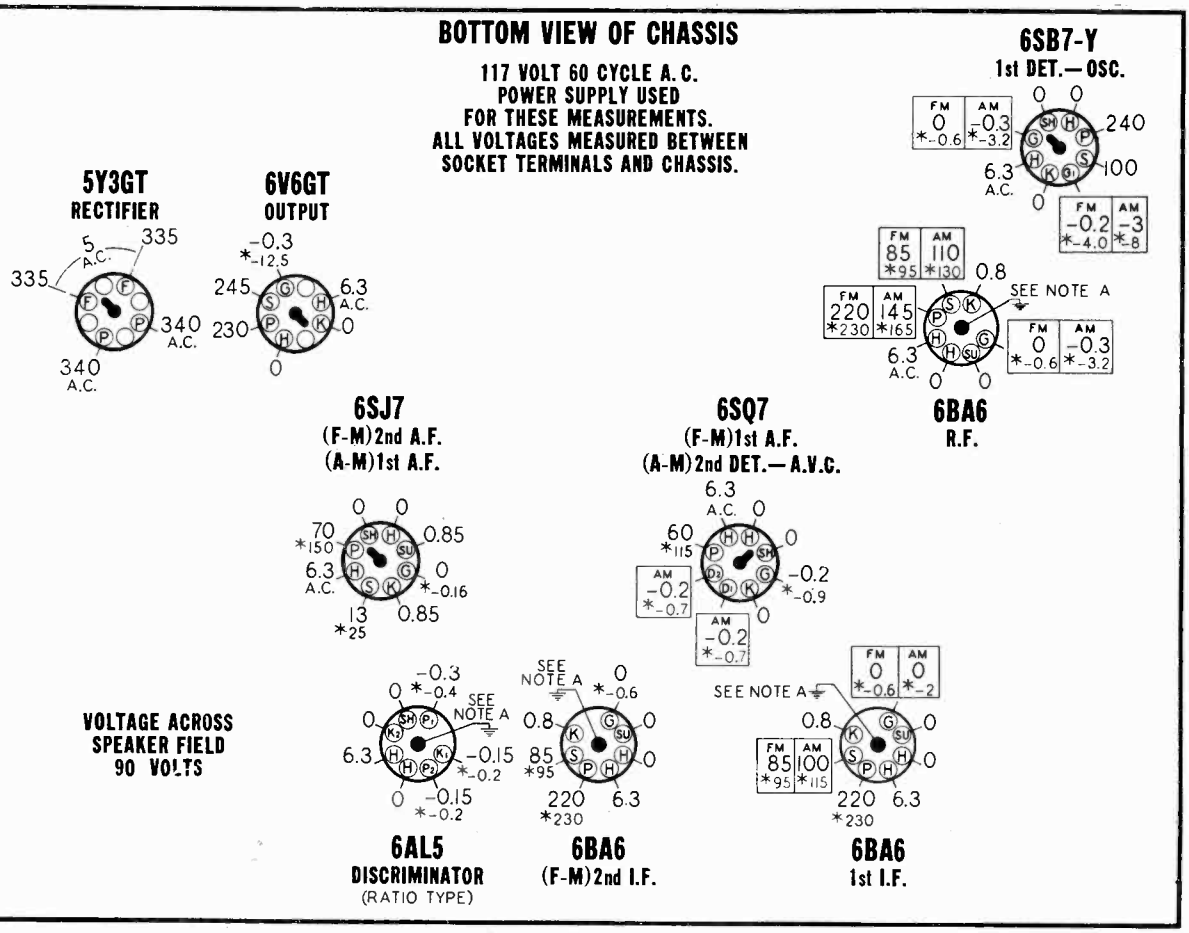


DIFFERENCES in tube characteristics, tolerance of parts, adjustment of tuned circuits and variations in line voltage will influence stage gain. These factors should be given due attention in event the gain of a stage varies extensively from the values shown above.

THE FIRESTONE TIRE & RUBBER CO. MODEL 4-A-60

BOTTOM VIEW OF CHASSIS

117 VOLT 60 CYCLE A.C.
POWER SUPPLY USED
FOR THESE MEASUREMENTS.
ALL VOLTAGES MEASURED BETWEEN
SOCKET TERMINALS AND CHASSIS.



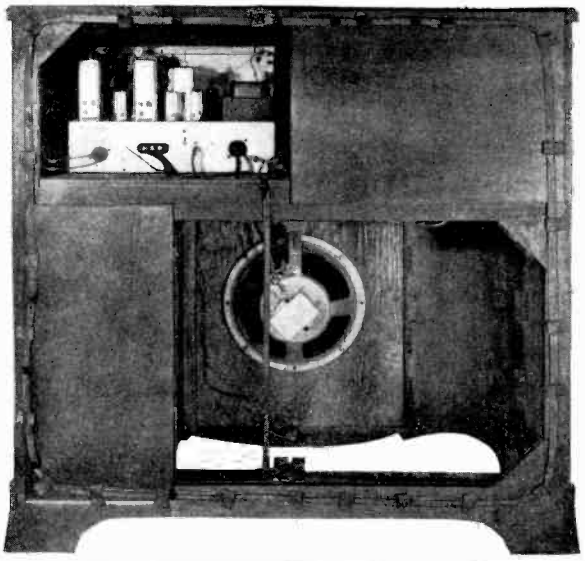
REAR OF CHASSIS

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.

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 FM-AM-PHONO SWITCH IN "FM" POSITION UNLESS OTHERWISE INDICATED
DIAL TUNED TO 108MC. FOR "FM" MEASUREMENTS
DIAL TUNED TO 540KC. FOR "AM" MEASUREMENTS
VOLUME CONTROL SET TO MINIMUM WITH NO SIGNAL
TONE SWITCH IN SPEECH POSITION

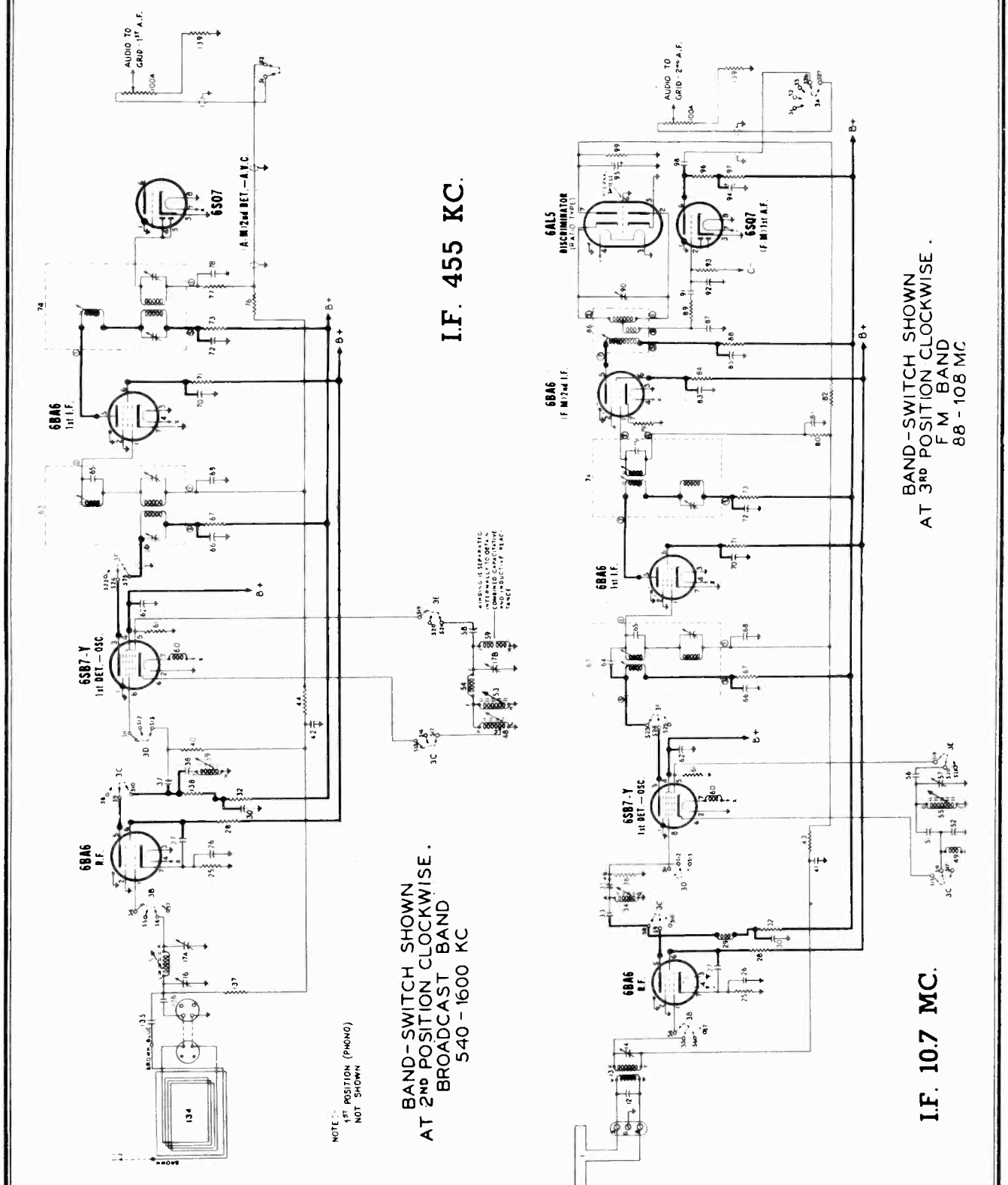


REAR VIEW OF RECEIVER

CLARI-SKEMATIX
Registered Trademark

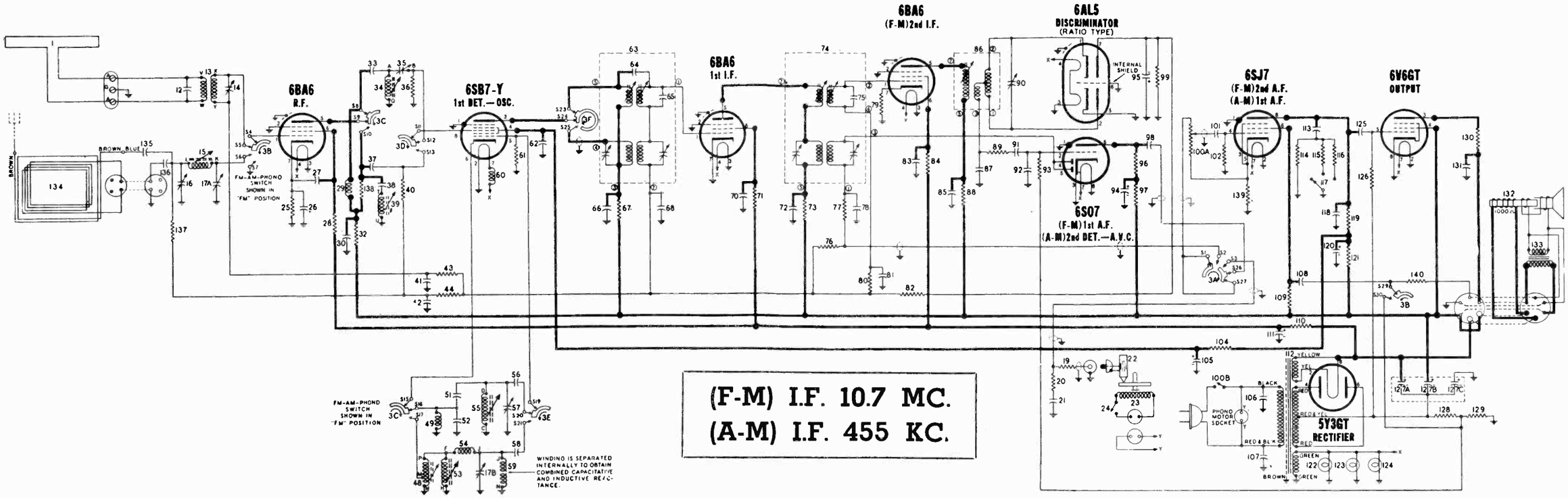
MODEL 4-A-60

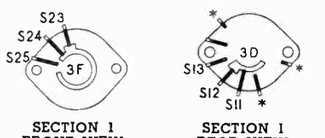
THE FIRESTONE TIRE & RUBBER CO.



THE FIRESTONE TIRE & RUBBER CO.

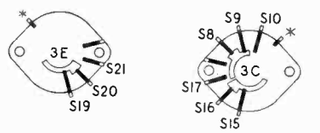
MODEL 4-A-60





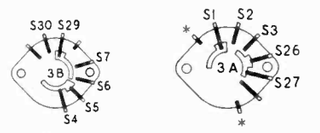
SECTION 1
FRONT VIEW

SECTION 1
REAR VIEW



SECTION 2
FRONT VIEW

SECTION 2
REAR VIEW



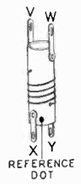
SECTION 3
FRONT VIEW

SECTION 3
REAR VIEW

★Not used; may serve as wiring junction point.

BAND SWITCH
504593

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



FM ANT. COIL
504692

FM R.F. COIL
505159

FM OSC. COIL
505159

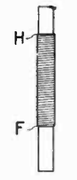
SLUGS FOR MANUAL TUNING COILS

FM R.F. } 505160
FM OSC. }

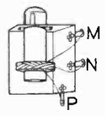
BC. ANT. } 505152
BC. OSC. }

BC. ANT. COIL
505151

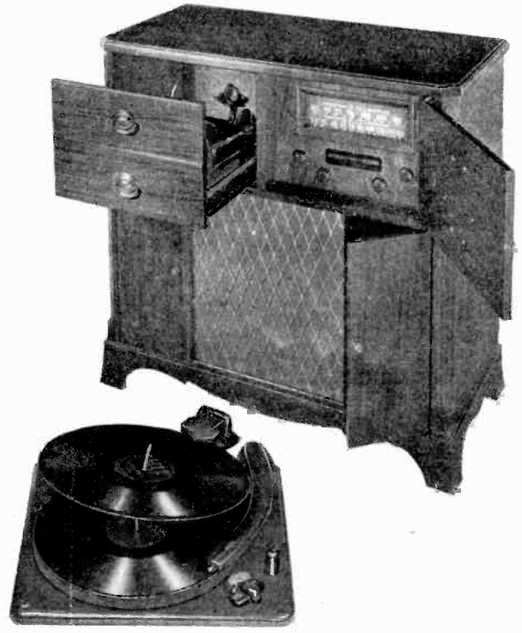
WAVE TRAP COIL
504670



BC. OSC. COIL
505153



BC. OSC. COIL (SHUNT)
505155



W-504138
RECORD CHANGER

FREQUENCY RANGES:
Standard Broadcast } 540-1600 KC.
FM — 88-108 MC.

POWER OUTPUT:
Undistorted — 3.5 watts
Maximum — 6.0 watts

MANUAL TUNING DEVICE:
Permeability tuned coils; shock resistant mounting.

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

BUILT-IN ANTENNA:
AM — High efficiency loop.
FM — "Ribbon Type" folded dipole.

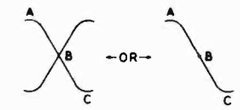
SPEAKER:
10 inch Electro-Dynamic Voice coil impedance — 3.5 ohms

RECORD CHANGER: Webster Model 50, RCD.CH. 15-1

THE FIRESTONE TIRE & RUBBER CO.

"FM" ALIGNMENT PROCEDURE CONTINUED

INSTRUCTIONS GIVEN ON PRECEDING PAGE MUST BE FOLLOWED BEFORE USING THIS CHART

SIGNAL GENERATOR CONNECTIONS			OSCILLOSCOPE OR V-T VOLTMETER CONNECTIONS		RECEIVER				TYPE OF ADJUSTMENT AND OUTPUT INDICATION	
CONNECT HIGH SIDE OF SIGNAL GENERATOR TO	CONNECT GROUND LEAD OF SIGNAL GENERATOR TO	FREQUENCY & TYPE OF MODULATION	IF AN OSCILLOSCOPE IS USED, CONNECT IT AS FOLLOWS:	IF A V-T VOLTMETER IS USED, CONNECT IT AS FOLLOWS:	FM-AM-PHONO SWITCH POSITION	DIAL SETTING	TRIMMER OR SLUG NUMBER	TRIMMER DESCRIPTION	ADJUSTMENT AND OUTPUT INDICATION WHEN USING A V-T VOLTMETER	ADJUSTMENT AND OUTPUT INDICATION WHEN USING AN OSCILLOSCOPE
Pin ⌀1 of 6BA6 (FM) **2nd I.F.** use a .01 MFD. condenser in series with generator lead.	Receiver chassis in vicinity of 6BA6 (FM) 2nd I.F. tube.	**10.7 MC** AM signal may be 400 cycle modulated or FM signal should preferably be modulated ±300 KC.	Connect vertical amplifier "high" lead in series with an 0.1 MFD. condenser to pin ⌀6 of 6SQ7 tube. Connect scope ground lead to receiver chassis.	Connect common (or ground) terminal of meter to receiver chassis. D.C. probe lead of meter is then connected to pin ⌀7 of the 6AL5 tube.	**FM** Maximum clockwise position	Any position where it does not affect the signal.	**12**	Discriminator Primary	Set meter to a low D.C. voltage range and adjust trimmer ⌀12 for maximum meter read.ng. (This voltage will be negative.)	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. Then adjust setting of trimmer ⌀13, before attempting to adjust trimmer ⌀12, until a pattern similar to the following 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.  This double "S" curve pattern results when 'scope uses "Sawtooth" horizontal deflection voltage. This single "S" curve pattern results when 'scope uses properly phased "sine wave" horizontal deflection voltage. Adjust trimmer ⌀12 for maximum amplitude and steepness of that portion of the curve between "A" and "C".
Same as above	Same as above	Same as above	Same as above	Before connecting V-T voltmeter, it is necessary to connect two 68,000 ohm resistors (**resistance of both units must compare within 1%**) in series from pin ⌀7 of the 6AL5 tube to the chassis. Then connect common (or ground) terminal of V-T voltmeter to the junction of these two resistors. D.C. probe lead of meter is now connected to junction of resistor ⌀89 (3300 ohms) and condenser ⌀ 91 (.01 MFD.) which are in the discriminator output circuit.	Same as above	Same as above	**13**	Discriminator Secondary **Use an insulated phasing tool to adjust this trimmer.**	Set meter for operation on its lowest D.C. voltage range. Note that as trimmer ⌀13 is rotated a point will be found where voltmeter will swing rather sharply from a positive to a negative reading or vice versa. Correct setting of trimmer ⌀13 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.**	With the 'scope set up as described above, adjust trimmer ⌀13 until the cross-over point "B" is centrally located in both the horizontal and vertical directions; in addition, the portion of the curve between "A" and "C" should be as linear (straight) as possible.
Recheck the two preceding adjustments to be sure that both trimmers are set as accurately as possible to obtain the spetified output indication on vacuum tube voltmeter or oscilloscope. Then disconnect and remove the two 68,000 ohm resistors that were used for the vacuum tube voltmeter connection in the 2nd step.										
Pin ⌀1 of 6BA6 (FM) 1st I.F. tube; use a .01 MFD. condenser in series with generator lead.	Receiver chassis in vicinity of 6BA6 (FM) 1st I.F. tube.	Same as above	Same as above	Connect common (or ground) terminal of meter to receiver chassis. D.C. probe lead of meter is then connected to Pin ⌀7 of the 6AL5 tube.	Same as above	Same as above	**14 and 15**	2nd I.F.	Adjust trimmers ⌀14 and ⌀15 for maximum meter reading.	With scope set up as described above, adjust trimmers ⌀14 and ⌀15 for maximum amplitude and steepness of that portion of the pattern between "A" and "C".
Terminal "B" on slug tuner unit (see Fig. 11); use a .01 MFD. condenser in series with generator lead.	Receiver chassis in vicinity of slug tuner unit.	Same as above	Same as above	Same as above	Same as above	Same as above	**16 and 17**	1st I.F.	Adjust trimmers ⌀16 and ⌀17 for maximum meter reading.	Adjust trimmers ⌀16 and ⌀17 for maximum amplitude and steepness of pattern as described above. If the enlarged pattern now indicates a lack of symmetry, readjust trimmer ⌀13 for correct cross-over point.
If positions of movable slugs in the slug tuner assembly have been disturbed (examine cement seal near top of threaded stem on each slug) or if a coil or slug has just been replaced in the tuner assembly, omit the next 4 instructions in this chart and start with the procedure entitled "Slug Tuner Adjustment Procedure—FM Section." Where the tuner assembly has not been disturbed, ignore this instruction and proceed with the next step.										
Generator output leads must be connected to the two terminals labelled "A" on the "A-G-A" terminal strip at back of chassis. Connect "high" lead to one "A" terminal in **series with a 120 ohm resistor** and connect generator ground lead to the other "A" terminal **in series with a 150 ohm resistor.**	**98 MC** AM signal may be 400 cycle modulated or FM signal should preferably be modulated ±300 KC.	Same as above	Same as above	Same as above	**FM** Maximum clockwise position	**98 MC**	**18**	Oscillator Trimmer	Set trimmer ⌀18 to receive 98 MC. signal and adjust for maximum meter reading.	Adjust trimmer ⌀18 to obtain the symmetrical pattern shown above. Correct setting of trimmer ⌀18 is obtained when cross-over point in pattern is centrally located.
Same as above	Same as above	Same as above	Same as above	Same as above	Same as above	**98 MC**	**19**	R.F. Trimmer	Adjust trimmer ⌀19 for maximum meter reading.	Adjust trimmer ⌀19 for maximum amplitude of pattern.
							16 and 17	1st I.F.	Recheck adjustment of these trimmers for maximum meter reading.	Recheck adjustment of these trimmers for maximum amplitude and symmetry of pattern.
Same as above	**90 MC** AM signal may be 400 cycle modulated or FM signal should preferably be modulated ±300 KC.	Same as above	Same as above	Same as above	Same as above	Tune to 90 MC. generator signal.	**20**	Antenna Trimmer	Adjust trimmer ⌀20 for maximum meter reading.	Adjust trimmer ⌀20 for maximum amplitude of pattern.
Check calibration and tracking of receiver with input signals of 88 and 108 MC. If difference between dial pointer setting and 88 or 108 MC. calibration mark does not exceed ±0.4 MC. and R.F. circuit is tracking properly, then alignment may be considered satisfactory and no further adjustment is necessary. Where calibration error is greater than ±0.4 MC. it is advisable to adjust the slug tuner as described in the following section.										

SLUG TUNER ADJUSTMENT PROCEDURE — FM SECTION

This procedure is to be used only where the positions of slugs in slug tuner have been disturbed or in event of a coil or slug replacement, or where a serious calibration or tracking error is noted after attempting to align the receiver as described in the preceding section.

Same as above	**88 MC** AM signal may be 400 cycle modulated or FM signal should preferably be modulated ±300 KC.	Same as above	Same as above	Same as above	By means of tuning control knob, set dial pointer to 88 MC. mark on dial.	**18**	Oscillator Trimmer	Set trimmer ⌀18 to receive 88 MC. signal.	Adjust trimmer ⌀18 to obtain the symmetrical pattern shown above.
						19	R.F. Trimmer	Adjust trimmers ⌀19 and ⌀20 for maximum meter reading.	Adjust trimmers ⌀19 and ⌀20 for maximum amplitude of pattern.
						20	Antenna Trimmer		
Same as above	**98 MC**	Same as above	Same as above	Same as above	By means of tuning control knob, set dial pointer to 98 MC. mark on dial.	**21**	Oscillator tuning slug	Set slug ⌀21 to receive 98 MC. signal and adjust for maximum meter reading.	Adjust slug ⌀21 to obtain the symmetrical pattern shown above.
Same as above	**108 MC**	Same as above	Same as above	Same as above	By means of tuning control knob, set dial pointer to 108 MC. mark on dial.	—	—	Note heavy braided lead connection to osc. coil; adjust position of this braid until 108 MC. signal is received and meter reading is maximum. Coat braid with speaker cement after correct position is located.	Note heavy braided lead connection to osc. coil; adjust position of this braid until symmetrical pattern shown above is obtained. Coat braid with speaker cement after correct position is located.
						22	R.F. tuning slug	Adjust slug ⌀22 for maximum meter reading.	Adjust slug ⌀22 for maximum amplitude of 'scope pattern.
Repeat the three preceding adjustments until satisfactory calibration and tracking is obtained at 88 MC., 98 MC., and 108 MC. Apply a coating of speaker cement at top of each tuning slug stem to prevent movement.									

THE FIRESTONE TIRE & RUBBER CO. MODEL 4-A-60

DIA-GRAM NO.	PART NO.	DESCRIPTION
		CONDENSERS
12	504723	Condenser mica 30 Mmfd. 500 volt
14	504663	Condenser trimmer 5-20 Mmfd.
16	504956	Condenser trimmer 390-550 Mmfd.
17-A, B	504712	Condenser trimmer assembly A 50 to 120 Mmfd. B 220 to 340 Mmfd.
21	502261	Condenser .01 Mfd. 600 volt
26	504447	Condenser .05 Mfd. 150 volt
27	504724	Condenser mica 1000 Mmfd. 500 volt
30	502261	Condenser .01 Mfd. 600 volt
33	502929	Condenser mica 47 Mmfd. 500 volt
35	502757	Condenser trimmer; 6.5 to 35 Mmfd.
37	502931	Condenser mica 100 Mmfd. 500 volt
38	504659	Condenser ceramic 39 Mmfd. 500 volt
41	504725	Condenser .02 Mfd. 200 volt
42	502153	Condenser .05 Mfd. 200 volt
51	504905	Condenser ceramic 5 Mmfd. 500 volt
52	502929	Condenser mica 47 Mmfd. 500 volt
56	504733	Condenser ceramic 15 Mmfd. 500 volt
57	502757	Condenser trimmer; 6.5 to 35 Mmfd.
58	502929	Condenser mica 47 Mmfd. 500 volt
62	502261	Condenser .01 Mfd. 600 volt
64	504983	Condenser ceramic 1.0 Mmfd. 500 volt
65	504982	Condenser ceramic 39 Mmfd. 500 volt
66	502261	Condenser .01 Mfd. 600 volt
68	502153	Condenser .05 Mfd. 200 volt
70	502261	Condenser .01 Mfd. 600 volt
72	502261	Condenser .01 Mfd. 600 volt
75	504982	Condenser ceramic 39 Mmfd. 500 volt
78	502931	Condenser mica 100 Mmfd. 500 volt
81	504727	Condenser mica 500 Mmfd. 500 volt
83	502261	Condenser .01 Mfd. 600 volt
85	502261	Condenser .01 Mfd. 600 volt
87	502202	Condenser ceramic 150 Mmfd. 500 volt
90	504662	Condenser trimmer 35-55 Mmfd.
91	502261 504725	Condenser .01 Mfd. 600 volt Condenser .02 Mfd. 200 volt (used only in chassis stamped with letter "S")
92	502157	Condenser .05 Mfd. 400 volt
94	504719	Condenser electrolytic 4 Mfd. 450 volt
95	504937	Condenser electrolytic 5 Mfd. 50 volt
98	502261	Condenser .01 Mfd. 600 volt
101	502150	Condenser .004 Mfd. 600 volt
105	505150	Condenser electrolytic 16 Mfd. 400 volt
106, 107	502804	Condenser .01 Mfd. 400 volt
108	502405	Condenser .25 Mfd. 400 volt
111	505150	Condenser electrolytic 16 Mfd. 400 volt
113	502261	Condenser .01 Mfd. 600 volt
118	502271	Condenser mica 260 Mmfd. 500 volt
120	504719	Condenser electrolytic 4 Mfd. 450 volt
125	502152	Condenser .02 Mfd. 400 volt
127-A,B,C	161193	Condenser electrolytic A 20 Mfd. 450 volt B 15 Mfd. 450 volt C 10 Mfd. 25 volt
131	502479	Condenser .006 Mfd. 600 volt
135	502931	Condenser mica 100 Mmfd. 500 volt
136	502261	Condenser .01 Mfd. 600 volt
		RESISTORS
19	502132	Resistor carbon 100,000 Ohms 1/2 watt
20	502408	Resistor carbon 68,000 Ohms 1/4 watt
25	502794	Resistor carbon 68 Ohms 1/4 watt
28	502466	Resistor carbon 33,000 Ohms 1 watt
32	502128	Resistor carbon 2,200 Ohms 1/4 watt
36	502130	Resistor carbon 22,000 Ohms 1/4 watt
40	502130	Resistor carbon 22,000 Ohms 1/4 watt
43	504907	Resistor carbon 560,000 Ohms 1/4 watt
44	502134	Resistor carbon 470,000 Ohms 1/4 watt
61	502130	Resistor carbon 22,000 Ohms 1/4 watt
67	502128	Resistor carbon 2,200 Ohms 1/4 watt
71	502466	Resistor carbon 33,000 Ohms 1 watt
73	502128	Resistor carbon 2,200 Ohms 1/4 watt
76	502267	Resistor carbon 680,000 Ohms 1/4 watt
77	502131	Resistor carbon 47,000 Ohms 1/4 watt
79	502794	Resistor carbon 68 Ohms 1/4 watt
80	502133	Resistor carbon 220,000 Ohms 1/4 watt
82	502135	Resistor carbon 2.2 Meg. 1/4 watt
84	502466	Resistor carbon 33,000 Ohms 1 watt
88	502128	Resistor carbon 2,200 Ohms 1/4 watt
89	502514	Resistor carbon 3,300 Ohms 1/4 watt
93	502136	Resistor carbon 10 Meg. 1/4 watt
96	502132	Resistor carbon 100,000 Ohms 1/4 watt
97	502892	Resistor carbon 330,000 Ohms 1/4 watt
99	502130	Resistor carbon 22,000 Ohms 1/4 watt
100 A, B	502148	Volume control 500,000 Ohms (with switch)
102	502168	Resistor carbon 4.7 Meg. 1/4 watt
104	504731	Resistor carbon 12,000 Ohms 2 watt
109	502135	Resistor carbon 2.2 Meg. 1/4 watt
110	504731	Resistor carbon 12,000 Ohms 2 watt
114	502468	Resistor carbon 4.7 Meg. 1/4 watt
115	502131	Resistor carbon 47,000 Ohms 1/4 watt
116	502291	Resistor carbon 4,700 Ohms 1/4 watt
119	502133	Resistor carbon 220,000 Ohms 1/4 watt
121	502178	Resistor carbon 1,000 Ohms 1/4 watt
126	502134	Resistor carbon 470,000 Ohms 1/4 watt
128	504729	Resistor carbon 130 Ohms 2 watt
129	504728	Resistor carbon 11 Ohms 1/2 watt

DIA-GRAM NO.	PART NO.	DESCRIPTION
130	502454	Resistor wire wound 47 Ohms 1 watt
137	502267	Resistor carbon 680,000 Ohms 1/4 watt
138	502406	Resistor carbon 1,500 Ohms 1/4 watt
139	502478	Resistor carbon 1,000 Ohms 1/4 watt
140	502126	Resistor carbon 470 Ohms 1/4 watt
		COILS & TRANSFORMERS
1	504895	Antenna FM ("Twin Lead" Assembly)
13	504692	Coil FM antenna
15	505151	Coil BC. antenna (less slug)
	505152	Tuning slug for BC. ant. coil (may have end colored yellow, green, blue or violet)
29	504675	Coil R.F. choke
34	505159	Coil FM R.F. (less slug)
	505160	Tuning slug for FM R.F. coils (may have end colored black, grey, red or orange)
39	504670	Coil wave trap (455 Kc.)
	504671	Slug core for wave trap
48	505155	Coil BC. oscillator; shunt (less slug)
	505156	Slug core for BC. osc. shunt coil (505155)
49	504675	Coil R.F. choke (FM)
53	505153	Coil BC. oscillator (less slug)
	505152	Tuning slug for BC. osc. coil (may have end colored yellow, green, blue or violet)
54	505157	Coil BC. oscillator; series
55	505159	Coil FM oscillator (less slug)
	505160	Tuning slug for FM osc. coil (may have end colored black, grey, red or orange)
59	505158	Coil BC. oscillator; compensating
60	504675	Coil R.F. choke (FM)
63	504645	Transformer 1st I.F.
74	504646	Transformer 2nd I.F.
86	504690	Transformer discriminator
112	504643	Transformer power
133	502994 505029 505394	Transformer output for M-502302 speaker Transformer output for E-502302 speaker Transformer output for O-502302 speaker
134	505668	Loop antenna for AM
		OTHER ELECTRICAL PARTS
3-A to F	504593	Switch FM-AM-Phono
22	502461	Crystal cartridge (Astatic L-71)
23	504201	Motor for type "W"-504138 Record Changer 115 volt 60 cycle
24	504203	Switch "ON-OFF" for type "W"-504138 Record Changer
117	504592	Switch tone
122, 123, 124	110629	Lamp dial (Mazda #44) 6.3V 0.25 Amps.
132	502302	Speaker electro-dynamic (10 in.)
		MISCELLANEOUS PARTS
	506099	Background for Dial
	116467	Base for mtg. electrolytic condenser
	117131	Bulls Eye for indicator light
	506100	Cabinet (mahogany)
	119989	Clamp for dial glass
	114955	Clip retainer on end of dial cord
	504691	Clip coil mtg.; wave trap
	505368	Clip for tube shield
	117057	Cord dial drive (7 ft. required) per ft.
	506147	Dial Scale
	505417	Door radio compartment; upper right (mahogany)
	505420	Door record storage compartment; lower right (mahogany)
	505426	Drawer record changer compartment
	506101	Escutcheon Firestone
	505433	Handle for upper door or drawer
	505432	Hinges for all doors (supplied in pairs)
	504835	Knob volume or tuning
	504837	Knob tone or band
	505431	Knob for record storage compartment doors
	502460	Needle phonograph
	504711	Perm. tuning mechanism (less coils)
	500966	Plug phono. pick-up cable
	501031	Plug phono. motor cable
	504097	Plug speaker
	504838	Pointer
	505430	Rail for drawer (supplied in sets)
	504138	Record Changer
	119087	Ring for dial cord
	17843	Rubber grommets for mtg. FM coils
	85078	Rubber grommets for mtg. BC. coils
	113463	Rubber pad for mtg. chassis
	116584	Rubber spacer for mtg. dial scale

SOCKET VOLTAGES

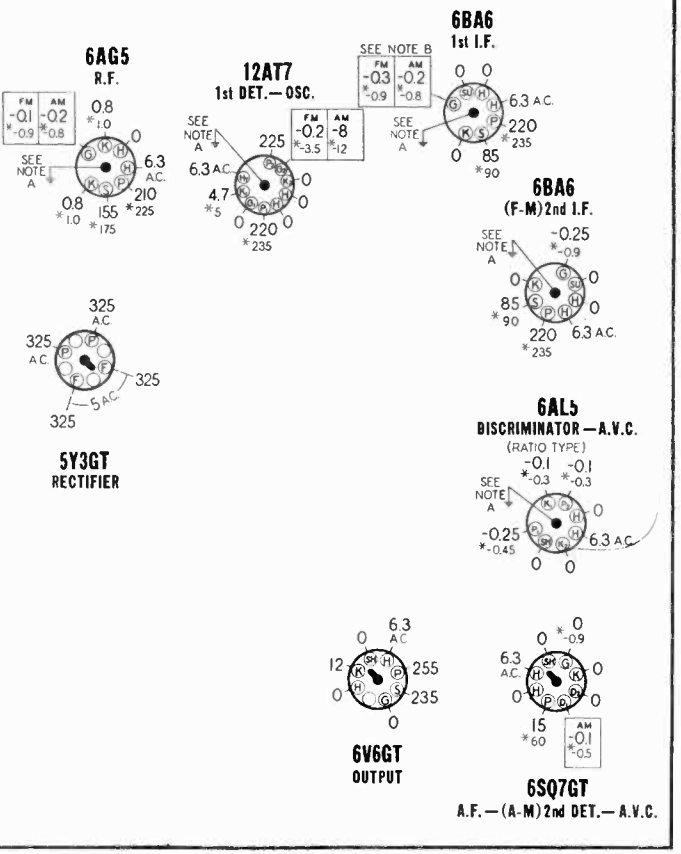
Measured with voltmeter having sensitivity of 1000 ohms per volt except where indicated by (*). The (*) symbol designates a vacuum tube voltmeter measurement.

ALL MEASUREMENTS MADE WITH BAND SWITCH IN "FM" POSITION UNLESS OTHERWISE INDICATED
DIAL TUNED TO 88 MC. FOR "FM" MEASUREMENTS
DIAL TUNED TO 540 KC. FOR "AM" MEASUREMENTS
VOLUME CONTROL SET TO MINIMUM WITH NO SIGNAL
GROUND ALL ANTENNA TERMINALS

BOTTOM VIEW OF CHASSIS

117 VOLT 60 CYCLE A.C. POWER SUPPLY USED FOR THESE MEASUREMENTS.

ALL VOLTAGES MEASURED BETWEEN SOCKET TERMINALS AND CHASSIS.



REAR OF CHASSIS

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.

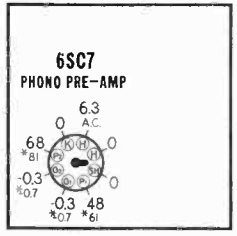
NOTE B: Oscillation may occur when meter probe contacts this tube pin. In that event, the vacuum tube voltmeter measurement will be approximately -4.5 volts.

USE OF WIRE RECORDER CONNECTION

A special cable and socket, extending from the rear of the chassis, is provided for the connection of a wire recorder unit which may be obtained as an accessory.

IMPORTANT: It should be noted that a dummy plug is inserted in this socket. The dummy plug contains a jumper connection which is necessary to maintain continuity of the B+ voltage supply line to the R.F., Mixer, and Oscillator stages of the receiver.

Where a wire recorder has been installed, it is necessary that the recorder controls be properly set when normal radio operation is desired otherwise the aforementioned B+ circuit will remain open. See instructions accompanying the recorder unit for proper setting of controls.



PHONO PRE-AMP CHASSIS

4-A-64

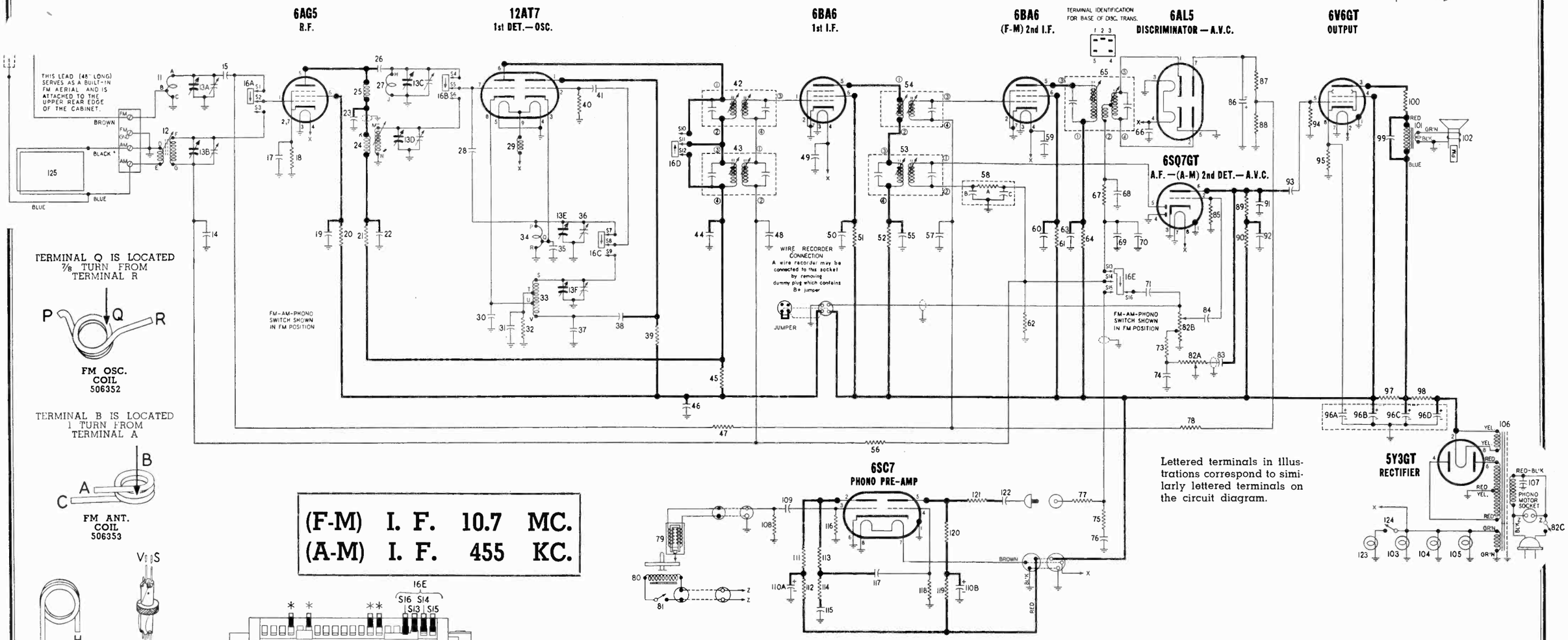
THE CONTEMPORARY

4-A-65

THE CANTERBURY

THE FIRESTONE TIRE & RUBBER CO.

MODELS 4-A-64, 4-A-65



TERMINAL Q IS LOCATED 7/8 TURN FROM TERMINAL R

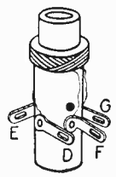
FM OSC. COIL 506352

TERMINAL B IS LOCATED 1 TURN FROM TERMINAL A

FM ANT. COIL 506353

FM R.F. COIL 506351

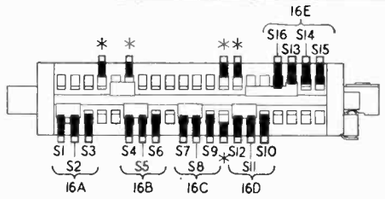
AM OSC. COIL 506335



AM ANT. COIL 506354

AM R.F. COIL 506345

(F-M)	I. F.	10.7	MC.
(A-M)	I. F.	455	KC.

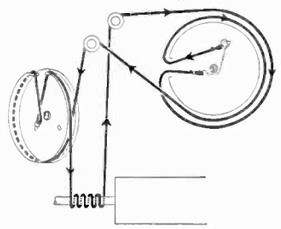


★ Not used; may serve as wiring junction point.

BAND SWITCH 506347

DIAL AND POINTER DRIVE CORD ARRANGEMENT

SIDE VIEW



To string dial cord, set gang condenser to fully open position and use the following parts:
114955 Clip on end of cord
117057 Cord (3 feet)
119087 Ring for dial cord
505161 Tension spring

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

SPECIFICATIONS

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

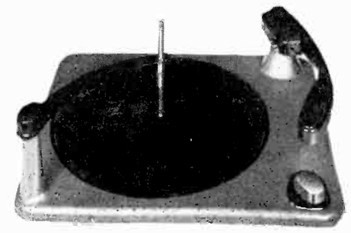
POWER SUPPLY:
117 volts
60 cycles A.C.
85 watts (radio)
30 watts (phono)

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

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

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

POWER OUTPUT:
Undistorted — 2.8 watts
Maximum — 5.4 watts



VM-506569
RECORD CHANGER

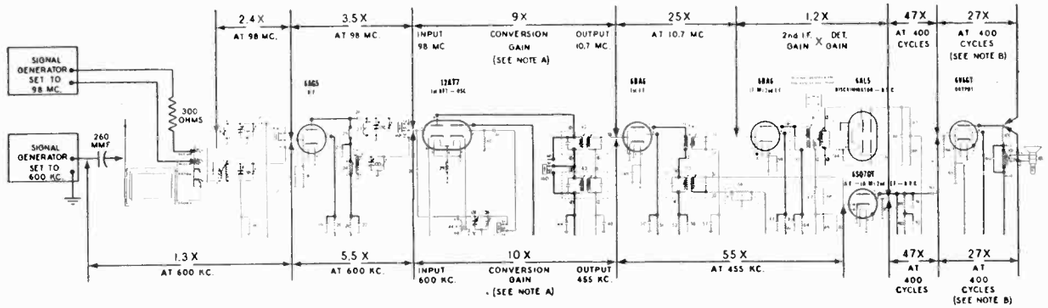
THE FIRESTONE TIRE & RUBBER CO. MODELS 4-A-64, 4-A-65

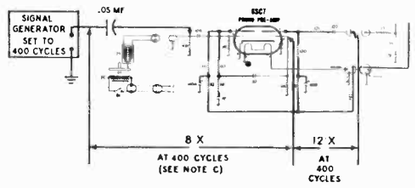
STAGE GAIN MEASUREMENT PROCEDURE

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 Voltmeter 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.



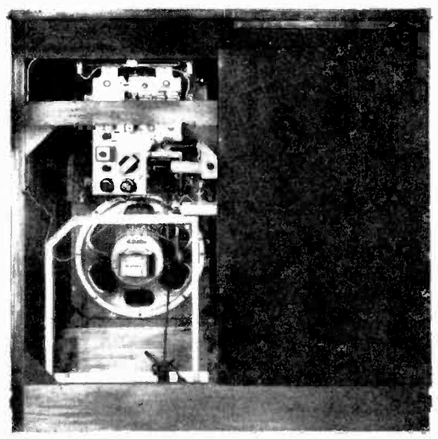


NOTE A: Short oscillator grid (pin 2 of 12AT7) to ground when measuring input voltage at signal grid (pin 7) of 12AT7 tube.

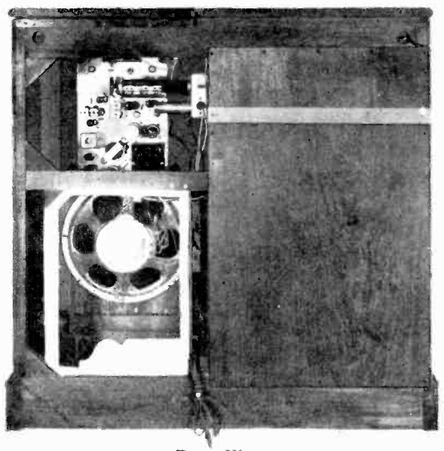
NOTE B: Measured with input voltage of 0.3.

NOTE C: Measured with input voltage of 0.05.

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.



Rear View
Model 4-A-64



Rear View
Model 4-A-65

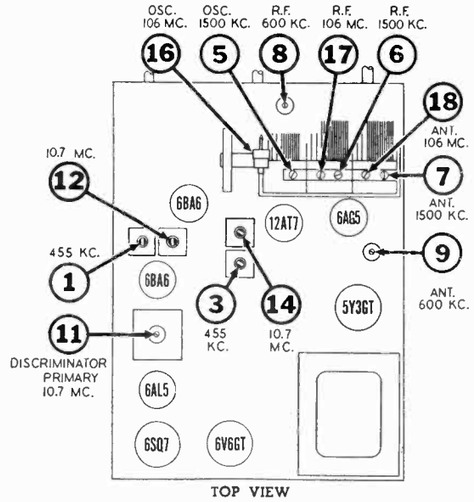
MODELS 4-A-64, 4-A-65 THE FIRESTONE TIRE & RUBBER CO.

BROADCAST BAND —"AM"—ALIGNMENT PROCEDURE

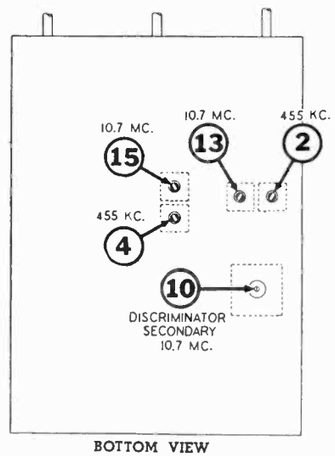
1. Disconnect leads from FM-AM aerial terminal strip (labeled FM-FM-AM-AM) at back of chassis; also disconnect speaker leads and phono plugs. Remove chassis and speaker. If desired, allow speaker to remain in cabinet and connect to receiver by extension leads.
2. Stand chassis on one edge so that all trimmers are accessible.
3. Built-in loop aerial leads do not have to be connected to terminal strip on rear of chassis while I. F. stages are being aligned. Before starting alignment of Ant., R.F., and Osc. stages, the loop aerial must be reconnected to chassis—do not attempt to use extension leads, remove loop aerial from cabinet to facilitate connection to chassis. Loop can be taken out of cabinet by merely lifting so as to release pivot dowel at bottom of frame; then remove screw which holds external aerial clip on top support block so as to release connecting lead.
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	1500 KC	AM Broadcast (Middle)	1500 KC	5	Broadcast Oscillator	Adjust for maximum output.
260 MMFD. Mica Condenser	External Aerial Clip	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	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.

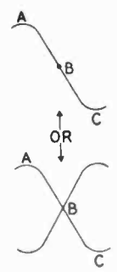


TOP VIEW



BOTTOM VIEW

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.

TRIMMER LOCATION CHART

THE FIRESTONE TIRE & RUBBER CO. MODELS 4-A-64, 4-A-65

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-64, 4-A-65

THE FIRESTONE TIRE & RUBBER CO.

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

INSTRUMENTS: Although it is preferable to use on 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 (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 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 8 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 meter 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. Set meter for operation on its lowest D.C. voltage range.	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.
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 meter reading.
				18	Antenna Trimmer	Adjust trimmer No. 18 for maximum meter reading.
				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 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 condsenser 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.

CONDENSERS

DIA. GRAM NO.	PART NO.	DESCRIPTION
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	512009	Condenser-.01 Mfd. 200 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	513409	Condenser-ceramic 39 Mmfd. 500 volt ± 5%
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 Mfd. 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
109	512026	Condenser-.05 Mfd. 200 volt
110 A, B	506527	Condenser-electrolytic A — 15 Mfd. 400 volt B — 15 Mfd. 400 volt
115	512010	Condenser-.01 Mfd. 400 volt
117	512028	Condenser-.05 Mfd. 400 volt
122	512016	Condenser-.02 Mfd. 400 volt

RESISTORS

DIA. GRAM NO.	PART NO.	DESCRIPTION
18	510017	Resistor-carbon 82 Ohms ¼ watt ± 10%
20	510164	Resistor-carbon 33,000 Ohms ½ watt
21	510137	Resistor-carbon 1000 Ohms ½ watt
32	510041	Resistor-carbon 1800 Ohms ¼ watt
39	510137	Resistor-carbon 1000 Ohms ½ watt
40	510055	Resistor-carbon 10,000 Ohms ¼ watt
45	510137	Resistor-carbon 1000 Ohms ½ watt
47	510067	Resistor-carbon 47,000 Ohms ¼ watt
51	510165	Resistor-carbon 39,000 Ohms ½ watt
52	510137	Resistor-carbon 1000 Ohms ½ watt
56	510093	Resistor-carbon 2.2 Meg. ¼ watt
58-A	506338	Resistor-carbon 47,000 Ohms 1/5 watt. (part of diode filter unit)
61	510165	Resistor-carbon 39,000 Ohms ½ watt
62	510085	Resistor-carbon 470,000 Ohms ¼ watt
64	510137	Resistor-carbon 1000 Ohms ½ watt
67	510059	Resistor-carbon 18,000 Ohms ¼ watt
73	510070	Resistor-carbon 68,000 Ohms ¼ watt
75	510070	Resistor-carbon 68,000 Ohms ¼ watt
77	510079	Resistor-carbon 220,000 Ohms ¼ watt
78	510093	Resistor-carbon 2.2 Meg. ¼ watt
82-A, B, C	505911	Volume and tone control (with switch) A-2 Megohms B-2 Megohms C-"ON-OFF" switch
85	510098	Resistor-carbon 15 Meg. ¼ watt
87, 88	510053	Resistor-carbon 8200 Ohms ¼ watt ± 10%
89	510093	Resistor-carbon 2.2 Meg. ¼ watt
90	510079	Resistor-carbon 220,000 Ohms ¼ watt
94	510085	Resistor-carbon 470,000 Ohms ¼ watt
95	510128	Resistor-carbon 330 Ohms ½ watt
97, 98	510709	Resistor-wire wound 600 Ohms 5 watt
100	510013	Resistor-carbon 47 Ohms ¼ watt
108	510152	Resistor-carbon 6800 Ohms ½ watt
111	510170	Resistor-carbon 68,000 Ohms ½ watt
112	510179	Resistor-carbon 220,000 Ohms ½ watt
113	510173	Resistor-carbon 100,000 Ohms ½ watt
114	510162	Resistor-carbon 27,000 Ohms ½ watt ±10%
116	510194	Resistor-carbon 3.3 Meg. ½ watt
118	510194	Resistor-carbon 3.3 Meg. ½ watt
119	510179	Resistor-carbon 220,000 Ohms ½ watt
120	510164	Resistor-carbon 33,000 Ohms ½ watt
121	510170	Resistor-carbon 68,000 Ohms ½ watt

COILS AND TRANSFORMERS

DIA. GRAM NO.	PART NO.	DESCRIPTION
11	506353	Coil—Antenna (FM)
12	506354	Coil—Antenna (AM)
	506349	Slug core for AM antenna coil
24	506345	Coil—R. F. (AM)
	506344	Slug core for AM R. F. coil
25	506337	Coil—R. F. choke (FM)
27	506351	Coil—R. F. (FM)
29	505075	Coil—R. F. choke (FM)
33	506335	Coil—Oscillator (AM)
34	506352	Coil—Osc. (FM)
42	506080	Transformer-1st I. F. (FM)
43	506333	Transformer-1st I. F. (AM)
53	505797	Transformer-2nd I. F. (AM)
54	505905	Transformer-2nd I. F. (FM)
65	506332	Transformer-discriminator
101	505912	Transformer-output
106	506709	Transformer-power
125	506670	Loop Aerial

OTHER ELECTRICAL PARTS

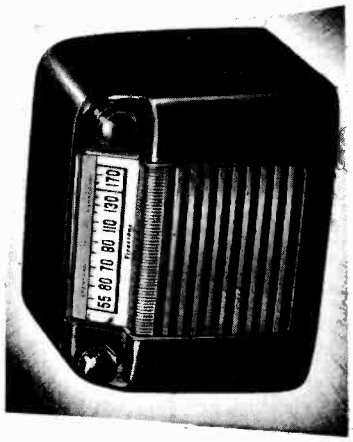
DIA. GRAM NO.	PART NO.	DESCRIPTION
16-A to E	506347	Switch—FM-AM-Phono
58-A, B, C	506338	Diode filter unit A-Resistor-carbon 47,000 Ohms 1/5 watt B-Condenser-ceramic 100 Mmfd. 400 volt C-Condenser-ceramic 100 Mmfd. 400 volt
79	506707	Pick-up Cartridge (includes sapphire point)
80	506789	Motor for type "VM"-506569 Record Changer 115 volt 60 cycle
	505274	Motor for type "VM"-506569 Record Changer 115 volt 50 cycle
81	505269	Switch-"ON-OFF" for type "VM"-506569 Record Changer
102	506667	Speaker-P.M. (12 inch)
103 to 105	118921	Lamp-dial (Mazda No. 47) 6-8 V. 150 Ma.
123	118921	Lamp-Record Changer compartment (Mazda No. 47) 6-8 V. 150 Ma.
124	506685	Socket and Switch for light in Changer compartment
	506659	Record Changer

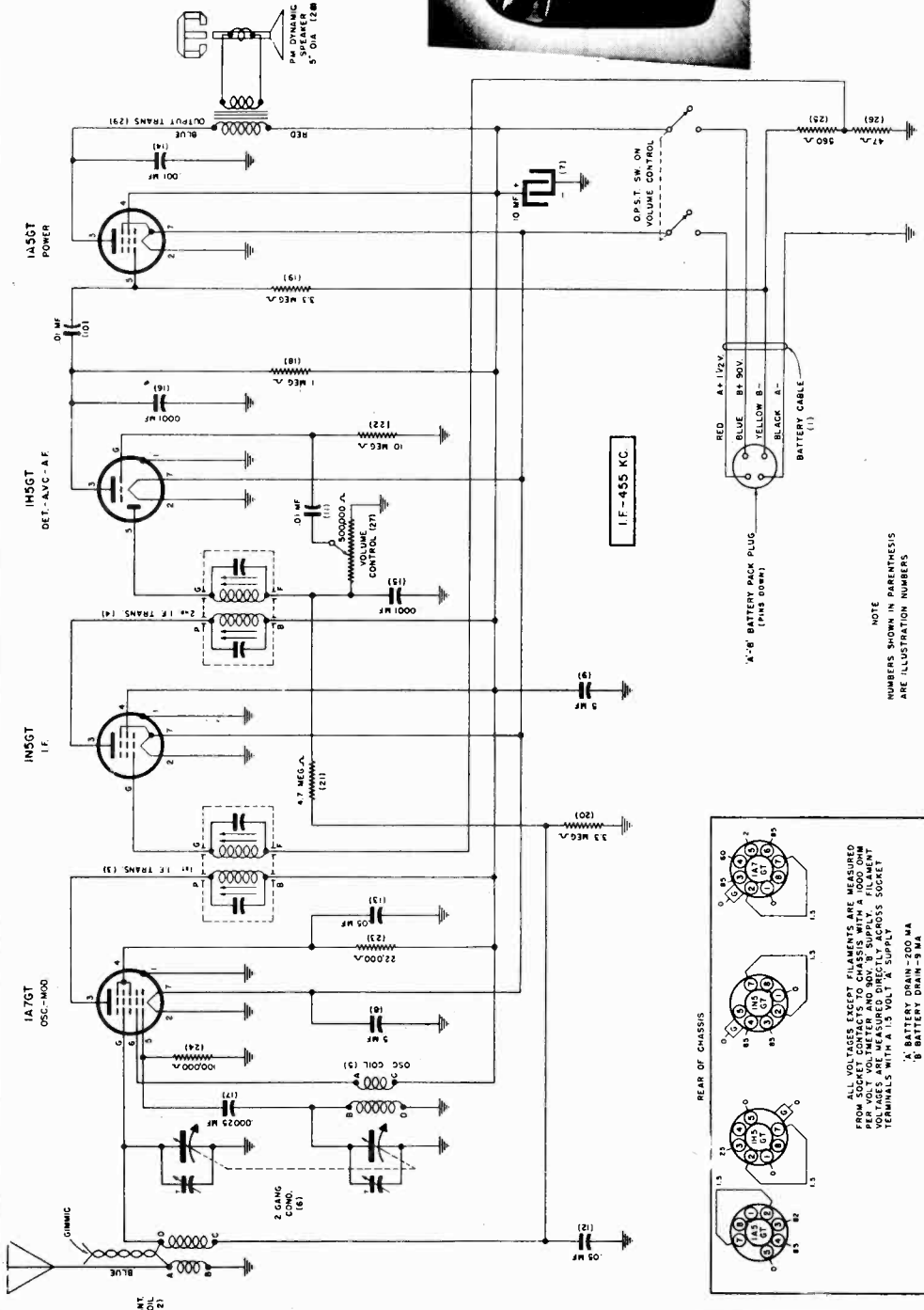
MISCELLANEOUS PARTS

DIA. GRAM NO.	PART NO.	DESCRIPTION
	506369	Background for dial
	160026	Base for mtg. elect. cond. (pre-amp.)
	401270	Base for mtg. electrolytic condenser
	506371	Bull's eye for indicator light
	506683	Cabinet — Stock No. 4-A-64
	506664	Cabinet — Stock No. 4-A-65
	500420	Clamp — dial glass
	506343	Clip-coil mtg. for R. F. and Ant. coil (AM)
	505101	Clip-I. F. transformer mtg.
	114955	Clip-retainer on end of dial cord
	160326	Clip-retains dial background
	160832	Clip-retains escutcheon
	117057	Cord-dial drive (3 ft. required) per ft.
	505165	"C" Washer-tuning and band switch shaft
	506368	Dial scale-glass
	506747	Door for Record Storage compartment; Stock No. 4-A-64 (less hardware)
	506693	Door for Record Changer and Storage compartment; Stock No. 4-A-65 (less hardware)
	506642	Door Pull for Radio compartment; Stock No. 4-A-64
	506749	Door Pull for Record Storage compartment; Stock No. 4-A-64
	506694	Door Pull for Record Changer and storage compartment; Stock No. 4-A-65
	506696	Drawer for Record Changer; Stock No. 4-A-65
	506763	Escutcheon
	506476	Hinge-lid; Stock No. 4-A-64
	506748	Hinge-door; Stock No. 4-A-64 (supplied in pairs)
	506695	Hinge-door; Stock No. 4-A-65 (supplied in pairs)
	506692	Hinge-lid; Stock No. 4-A-65
	506381	Knob-"VOLUME"
	506382	Knob-"TONE"
	506383	Knob "TUNING"
	506384	Knob-"FM-AM-PHONO"
	506744	Lid for Record Changer compartment; Stock No. 4-A-64 (less hardware)
	506690	Lid for Radio Compartment; Stock No. 4-A-65 (less hardware)
	506745	Lid Support for Stock No. 4-A-64
	506691	Lid Support for Stock No. 4-A-65
	506795	Plug for phono pick-up cable
	500966	Plug for phono input to receiver
	501031	Plug for phono motor cable
	506652	Plug for Pre-amp power cable
	506751	Plug (contains jumper)-wire-recorder socket
	506370	Pointer
	506697	Rail for Record Changer Drawer; Stock No. 4-A-65 (supplied in pairs)
	119087	Ring for dial cord
	38501	Rubber bushing for band switch
	160496	Rubber pad for mounting chassis
	116584	Rubber spacer for mtg. dial scale
	170167	Screw-No. 8-32x⅜" for mounting chassis
	503588	Shaft and drum assembly-dial
	503757	Shaft and Link assy'-band switch
	505923	Shaft-tuning
	506349	Slug core for antenna coil (AM)
	506344	Slug core for R. F. coil (AM)
	506470	Socket-phono pick-up plug
	160039	Socket-phono input to receiver
	505307	Socket and phono motor cable
	506626	Socket-Pre-amp power cable
	506750	Socket and Cable assembly-wire recorder connection
	506372	Socket-dial lamp; pair (with leads)
	504595	Socket-indicator lamp at base of cabinet
	503780	Socket and Mtg. Ring assy.—Pre-amp tube
	504597	Socket-miniature
	506331	Socket-noval base
	116690	Socket-octal base
	160392	Socket-octal (rectifier)
	505161	Spring-dial cord tension
	505924	Terminal strip (FM-FM-AM-AM)
	506689	Tilt Door assembly—Stock No. 4-A-64 (less hardware)

MODEL 4-A-67

THE FIRESTONE TIRE & RUBBER CO.





POWER SUPPLY	Battery Operated
BATTERY SPECIFICATIONS	1000 hour Firestone Battery Stock No. 4-D-I
TUNING RANGE	528 to 1730 KC
INTERMEDIATE FREQUENCY	455 KC

LOUD SPEAKER	5 Inch P.M.
VOICE COIL IMPEDANCE	3.2 OHM at 400 Cycles
POWER OUTPUT	Undistorted - 100 Milliwatts Maximum - 200 Milliwatts
TUBE COMPLEMENT	1A7GT Oscillator Modulator, 1N5GT IF, 1H5GT Det. AVC, 1A5GT Power Output.

ALIGNMENT PROCEDURE

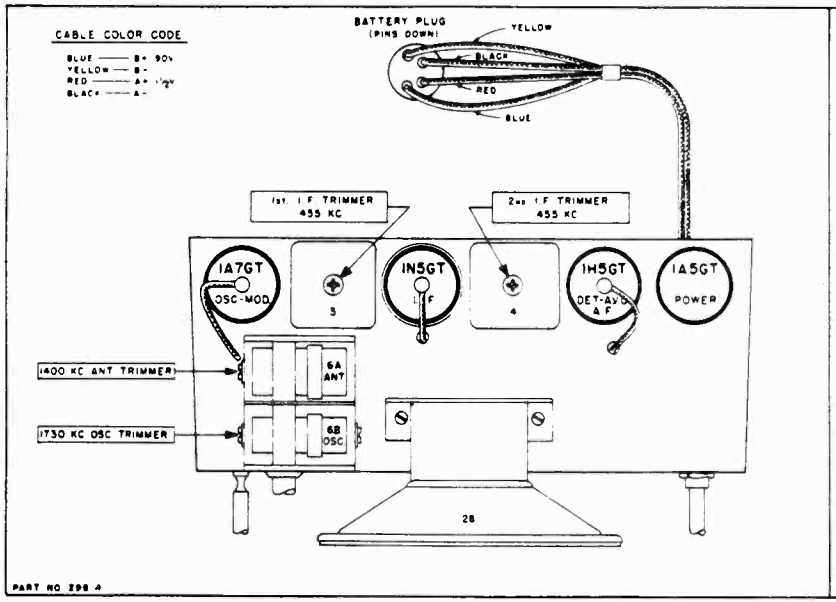
Be sure to follow procedure carefully and in the order given—otherwise the receiver will be insensitive and the dial calibration incorrect. For alignment procedure read tabulations from left to right. Make the adjustment marked (1) first, (2) next, etc.

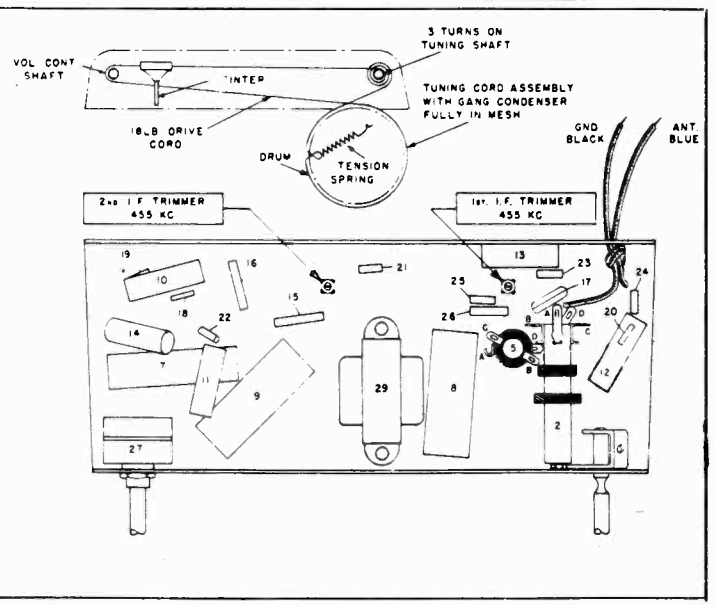
Before starting alignment:

(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 even with the last line at the low frequency end of the dial calibration. If dial needle does not point exactly to last line move to correct position.

(b) Use an accurately calibrated test oscillator with some type of output measuring device.

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	I.F. Any point where no interference signal is received	455 K. C.	.02 MFD. condenser	High side to grid terminal of 1A7GT tube DO NOT REMOVE CAP. Low side to receiver black ground lead.	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	Exactly 1730 K. C.	Exactly 1730 K. C.	.00025 MFD. condenser	Receiver blue antenna lead Receiver black ground lead	Adjust 1730 K. C. oscillator trimmer for maximum output.
3	Exactly 1400 K. C.	Exactly 1400 K. C.	.00025 MFD. condenser	Receiver blue antenna lead Receiver black ground lead	While rocking gang condenser adjust 1400 K. C. antenna trimmer for maximum output.

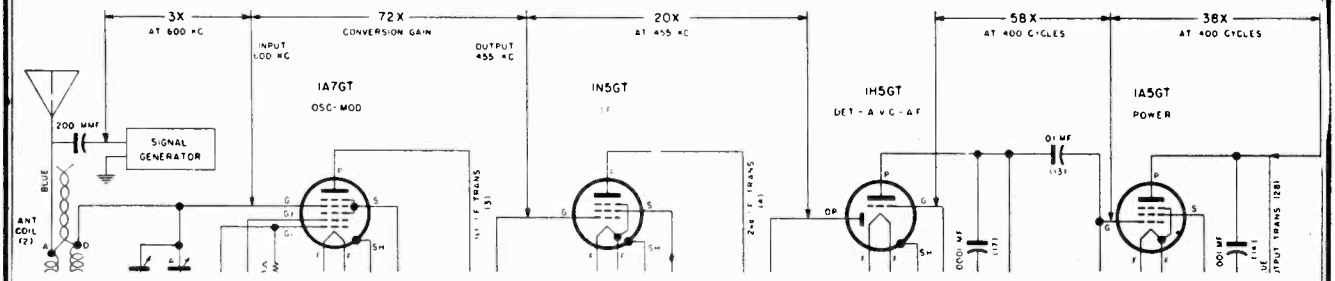




MODEL 4-A-67 THE FIRESTONE TIRE & RUBBER CO.

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. Avacuum 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 gains. 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.

PARTS LIST

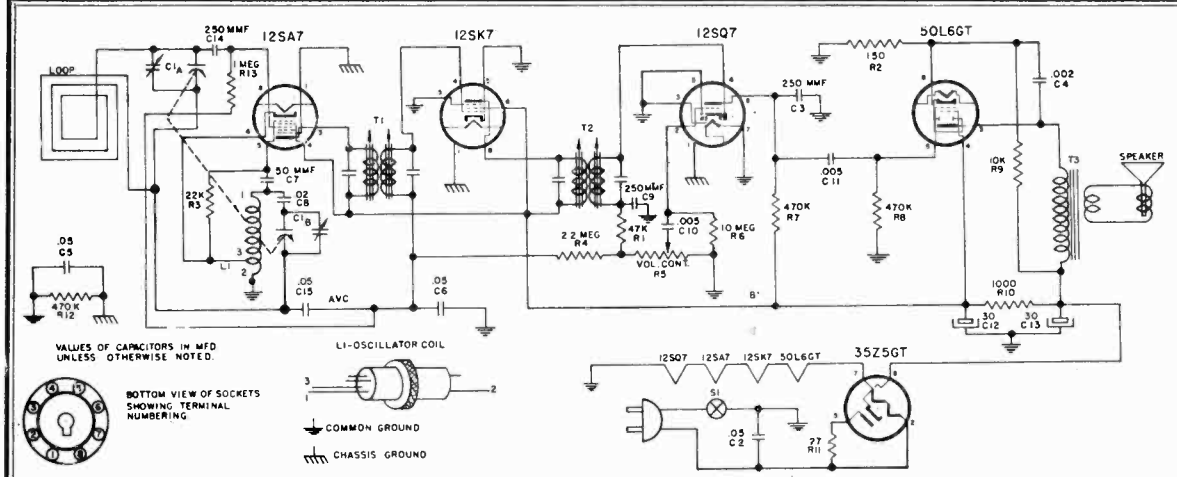
Illus. No.	Part No.	Part Name	Description
1	20E94-2	Cable	Battery with 4 Prong Plug
2	20E32	Coil	Antenna
3	20E261	Coil	1st I.F. Transformer
	or		
	20E307	Coil	1st I.F. Transformer
4	20E261-3	Coil	2nd I.F. Transformer
	or		
	20E307-3	Coil	2nd I.F. Transformer
5	20E77	Coil	Oscillator
6	**24E2**	**Condenser**	**Tuning, 2 Gang**
7	**25E9**	**Condenser**	**Tubular, Dry Elect. 10 Mfd. 100 V.**
8	23E224	Condenser	Tubular, .5 Mfd. 200 V.
9	23E224	Condenser	Tubular, .5 Mfd. 200 V.
10	23E151	Condenser	Tubular, .01 Mfd. 120 V.
11	23E151	Condenser	Tubular, .01 Mfd. 120 V.
12	23E216	Condenser	Tubular, .05 Mfd. 200 V.
13	23E216	Condenser	Tubular, .05 Mfd. 200 V.
14	23E204	Condenser	Tubular, .001 Mfd. 200 V.
15	23E11	Condenser	Fixed Ceramic, .0001 Mfd. 500 V.
16	23E11	Condenser	Fixed Ceramic, .0001 Mfd. 500 V.
17	23E42	Condenser	Mica, .00025 Mfd. 500 V.
18	27E105	Resistor	Carbon, 1 Megohm, 1/3 Watt
19	27E335	Resistor	Carbon, 3.3 Megohm, 1/3 Watt
20	27E335	Resistor	Carbon, 3.3 Megohm, 1/3 Watt
21	27E475	Resistor	Carbon, 4.7 Megohm, 1/3 Watt
22	27E106	Resistor	Carbon, 10 Megohm, 1/3 Watt
23	27E223	Resistor	Carbon, 22,000 Ohm, 1/3 Watt
24	27E104	Resistor	Carbon, 100,000 Ohm, 1/3 Watt
25	27E561	Resistor	Carbon, 560 Ohm, 1/3 Watt
26	27E470	Resistor	Carbon, 47 Ohm, 1/3 Watt
27	**28E11**	**Vol. Control**	**With D.P.S.T. Switch, 500,000 Ohm**
28	1E9	Speaker	5" P.M.
29	22E25	Transformer	Output

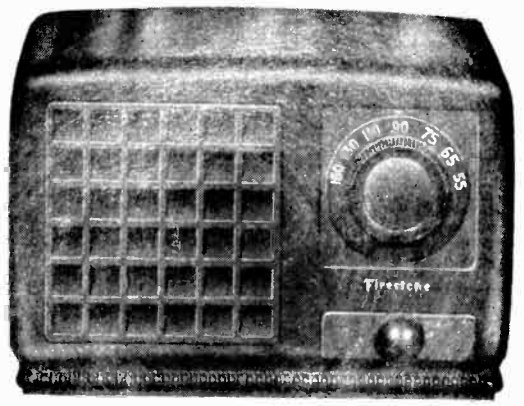
MISCELLANEOUS PARTS

Part No.	Part Name	Description
7E76-4	**Cabinet**	**Walnut Cabinet**
7E83	Cabinet Back	Back for Cabinet
20E253-11	Dial Cord	Drive, Cord Assembly
65E2	Dial Cord Spring	Dial Cord Tension Spring
20E270-3	Dial Shaft Assembly	Drive Shaft Assembly
36E40	**Dial Scale**	**Calibrated Scale**
35E8	Dial Pointer	Dial Needle
35E15	Dial Indicator	"ON-OFF" Indicator
37E27-41	Knob	Walnut Knob
17E3-4	Plug	4 Prong Battery Plug
46E14	Throw-Arm	Operates "ON-OFF" Indicator

MOUNTING HARDWARE

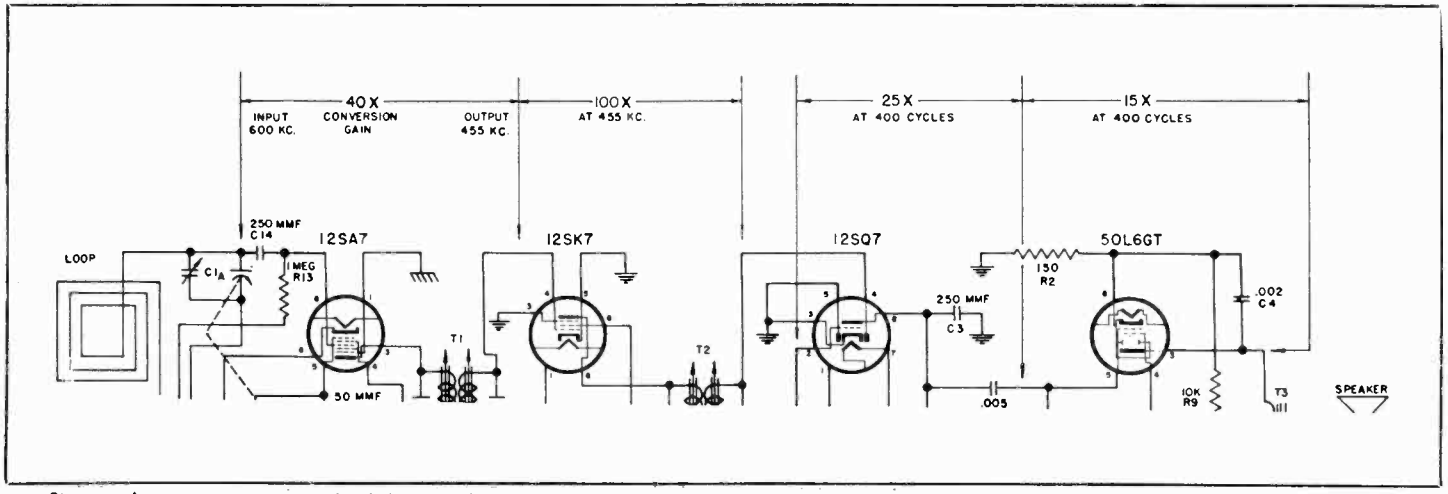
Part No.	Part Name	Description
12E6-F10	Washer	Metal Washer used with 82E36 Screw for Mtg. Back —Lower Right & Left Corners
82E36	Screw	6—20x5/16 Rd. Rec. Hd. Shakeproof Type No. 25 used with 12E6 Washer
82E3	Screw	4—24x1/4 Rd. Rec. Hd. Shakeproof Type No. 25 For Mtg. Dial Scale
10E43	Stud	Trimount Stud to Mount Cabinet Back
12E52	Washer	Fibre Washer for Mounting Dial Scale
12E104	Washer	Spring Washer for Mounting Dial Scale
13E103-2	Washer	Speed Clip Washer for Mtg. Dial Scale
82E55	Screw	8—18x1/2 Rd. Rec. Hd. Shakeproof Type No. 25 Chassis Mounting Screw
12E114	Washer	Special Washer Used with 82E55 Chassis Mounting Screw





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 grid of the tuning condenser, C1A, 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.

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. When making alignment:

(a) Use an accurately calibrated test oscillator with some type of output measuring device.

(b) 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, C1A. 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	High side to grid of tuning condenser, C1A. Low side to common negative.	Adjust 1630 K.C. oscillator trimmer for maximum output.
3	Approx. 1400 K.C.	Approx. 1400 K.C.	.00025 MFD. condenser	Loosely coupled to loop.	While rocking gang condenser adjust 1400 K.C. antenna trimmer for maximum output.

SPECIFICATIONS

I. F. Frequency
455 KC

Loud Speaker
5 inch P. M.

Voice Coil Impedance
3.2 ohms at 400 cycles

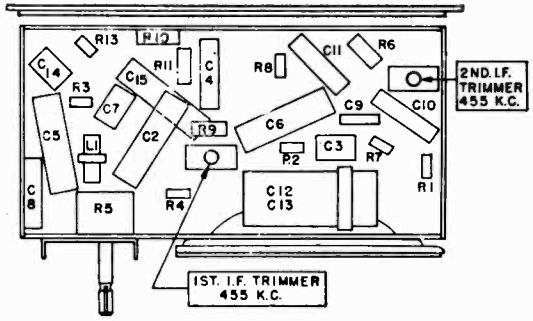
Power Output
Maximum 1.65 watts

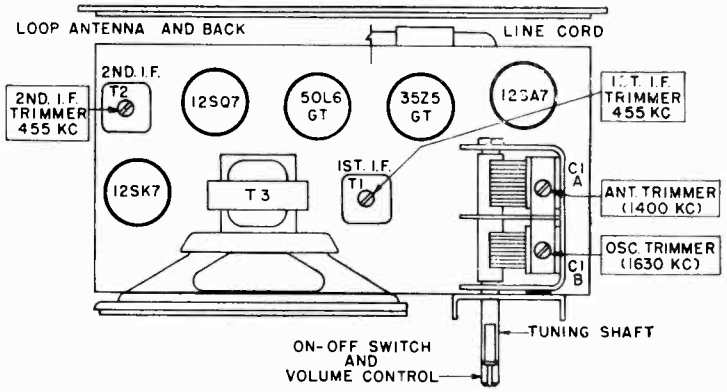
Tube Complement

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

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

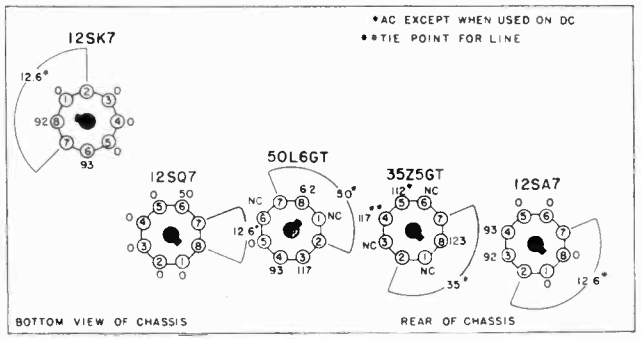
Tuning Range
540 to 1630 KC





VOLTAGE TABLE

(BOTTOM OF CHASSIS)



REAR OF CHASSIS

All voltages except heaters are measured from socket contacts to "common negative." Heater voltages are measured across socket contacts. All voltoges measured with a 20,000 ohms per volt meter.

*AC except when used on DC.

Code No.	Part No.	Description
C1A, C1B	B19-199	Variable condenser
C2, C5	A16-158	.05 MFD 400 volt condenser
C3, C9, C14	A15-176	250 MMF mica condenser
C4	A16-155	.002 MFD 600 volt condenser
C6, C15	A16-152	.05 MFD 200 volt condenser
C7	A15-175	50 MMF mica condenser
C8	A16-150	.02 MFD 400 volt condenser
C10, C11	A16-153	.005 MFD 600 volt condenser
C12, C13	B18-283	30 x 30 MFD 150 volt electrolytic condenser
R1	A60-685	47K ohm ½ watt resistor
R2	A60-686	150 ohm ½ watt resistor
R3	A60-659	22K ohm ½ watt resistor
R4	A60-684	2.2 megohm ½ watt resistor
R5	A24-174	Volume control and switch, 1 megohm
R6	A60-663	10 megohm ½ watt resistor
R7, R8, R12	A60-662	470K ohm ½ watt resistor
R9	A60-698	10K ohm 1 watt resistor
R10	A60-732	1000 ohm 1 watt resistor
R11	A60-690	27 ohm ½ watt resistor
R13	A60-668	1 megohm ½ watt resistor
T1, T2	A10-479	1st and 2nd I. F. Transformer
T3		Output transformer (part of speaker)
L1	B10-502	Oscillator coil

MISCELLANEOUS PARTS

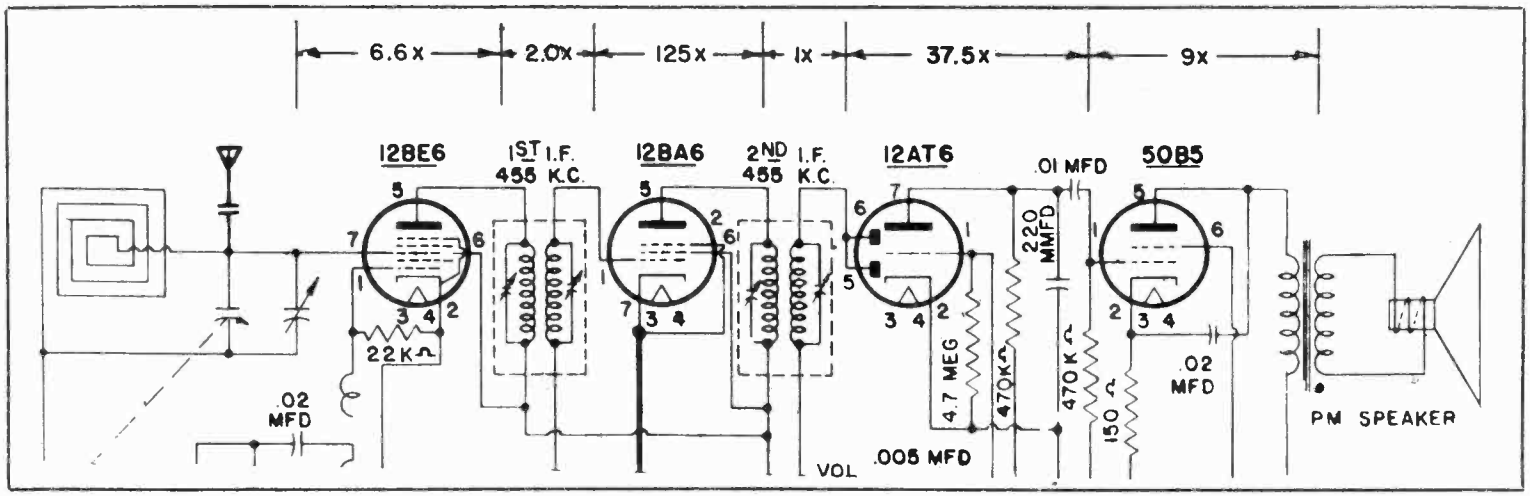
C42-449	Cabinet, molded
C52-274	Knob, tuning, calibrated
A52-275	Knob, volume control
A23-151	Line cord
SB82-56	Loop antenna, with cabinet back
B79-363	Speaker, 5" P.M. (includes output transformer)

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 flexible antenna lead. The ground side of the signal generator is connected through a .25 Mfd. condenser to receiver chassis. Use a 600 K.C. 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.

I. F. Frequency
455 KC

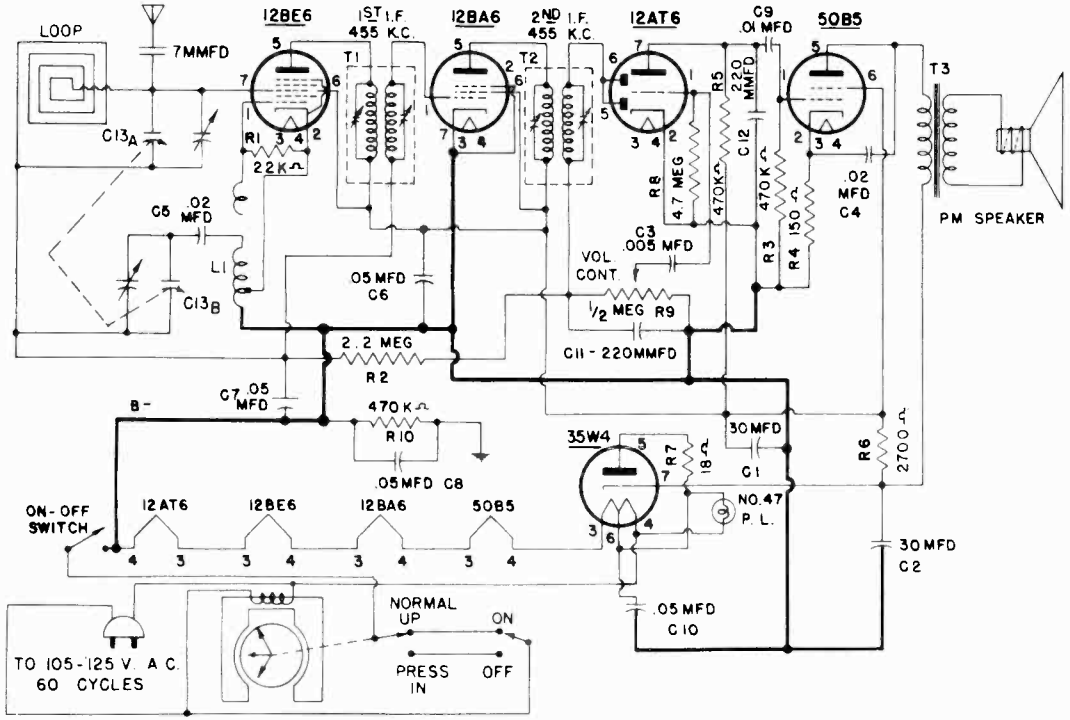
Loud Speaker
4 inch P. M.

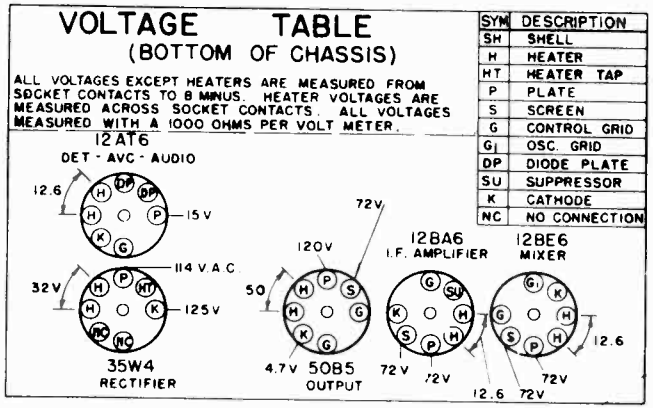
Voice Coil Impedance
3.2 ohms at 400 cycles

Power Output
Maximum 1.25 watts

Power Supply
105-125 Volt, 60 Cycle. A.C. only

Tuning Range
535 to 1700 KC





Tube Complement

- 12BE6 — Oscillator Converter
- 12BA6 — I. F. Amplifier
- 12AT6 — AVC, Detector, 1st Audio
- 50B5 — Power Output
- 35W4 — Rectifier

Code No.	Part No.	Description
C1, C2	2033-2	30 x 30 MFD 150 volt electrolytic condenser
C3	2000-5	.005 MFD 400 volt condenser
C4, C5	2000-2	.02 MFD 400 volt condenser
C6, C7, C10	2000-4	.05 MFD 400 volt condenser
C8	2000-25	.05 MFD 600 volt condenser
C9	2000-1	.01 MFD 400 volt condenser
C11, C12	2012-1	220 MMFD ceramicon condenser
C13A, C13B	2003 C	Variable condenser
R1	3003-16	22K ohm ½ watt resistor
R2	3003-14	2.2 Megohm ½ watt resistor
R3, R5, R10	3003-13	470K ohm ½ watt resistor
R4	3003-11	150 ohm ½ watt resistor
R6	3004-3	2700 ohm 2 watt resistor
R7	3003-12	18 ohm ½ watt resistor
R8	3003-15	4.7 Megohm ½ watt resistor
R9	3013-3	½ Megohm volume control and switch

Code No.	Part No.	Description
T1	1046-3	1st I.F. transformer
T2	1046-4	2nd I.F. transformer
T3	1048	Output transformer
L1	1049	Oscillator coil
	1073	Loop antenna
	7009	Speaker, 4 inch P.M.
	5008	Line Cord
	8026-2	Clock
	6017 B	Clock face
	6013C	Clock Crystal
	9113	Dial pointer
	6016	Dial scale (glass)
	8001	Pilot lamp socket
		#47 Pilot lamp
	4077A	Cabinet, molded, mahogany
	4079	Cabinet back
	4080-3	Knob, mahogany
	4066-2	Clock knob, mahogany
		Dial Cord, 40" long

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.

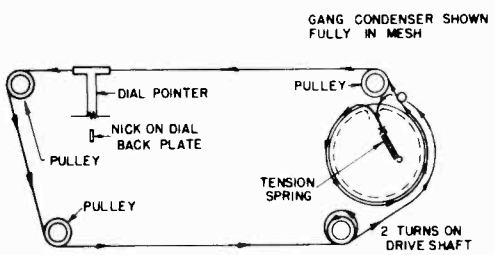
For alignment procedure read tabulations from left to right, and make the adjustment marked (1) first, (2) next, (3) third. Before starting alignment:

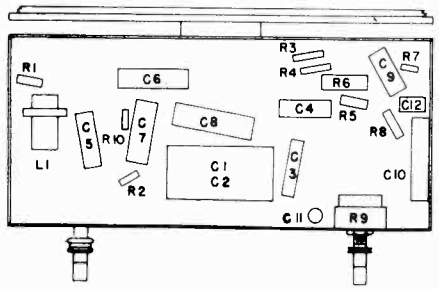
(a) Check tuning dial adjustment by tuning gang condenser until plates touch maximum capacity stop (completely in mesh) at which point the dial pointer must be exactly even with the last mark at the low frequency end of the dial calibration. If dial pointer is incorrectly set, release pointer clip on dial cord and reposition pointer.

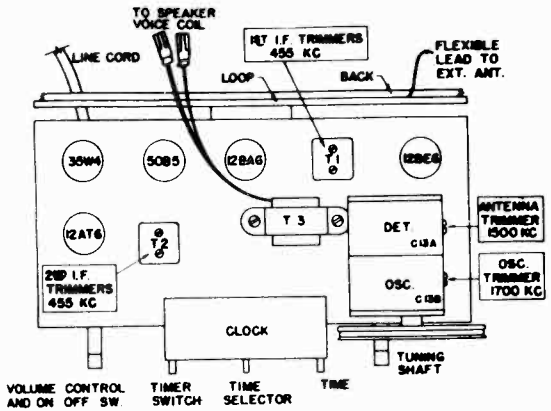
(b) Use an accurately calibrated test oscillator with some type of output measuring device.

(c) PLACE LOOP ANTENNA IN THE SAME POSITION IT WILL BE IN WHEN THE SET IS IN THE CABINET.

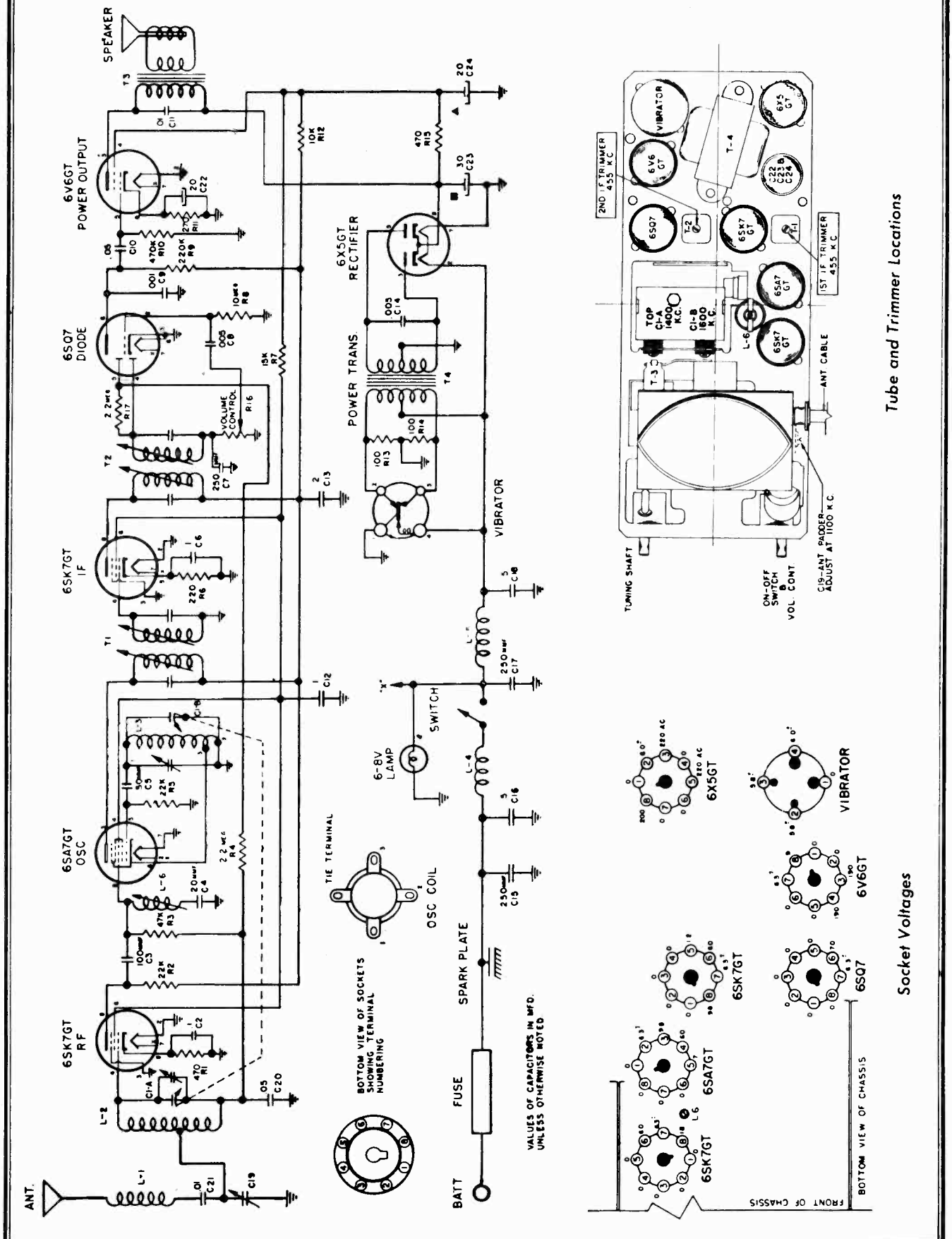
Steps	Set receiver dial to:	TEST OSCILLATOR			Refer to parts layout diagram for location of trimmers mentioned below:
		Adjust test oscillator frequency to:	Use dummy antenna in series with output of test oscillator consisting of:	Attach output of test oscillator to:	
1	Minimum capacity (fully open)	455 K.C.	.1 MFD. condenser	High side to grid of tuning condenser. Low side to B– buss (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 1700 K.C.	NONE	High side to receiver antenna lead. Low side to chassis. (Through .25 Mfd. Cond.)	Adjust 1700 K.C. oscillator trimmer for maximum output.
3	Approx. 1500 K.C.	Approx. 1500 K.C.	NONE	High side to receiver antenna lead. Low side to chassis. (Through .25 Mfd. Cond.)	While rocking gang condenser adjust 1500 K.C. antenna trimmer for maximum output.





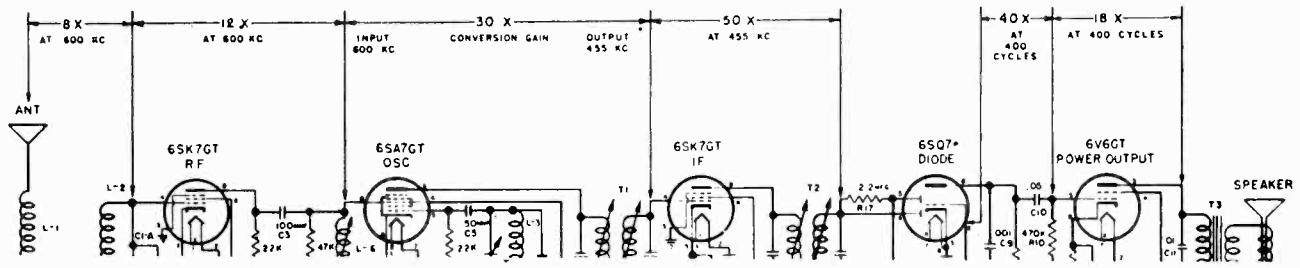


THE FIRESTONE TIRE & RUBBER CO. MODEL 4-B-31 THE ROAMER



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 the chassis. 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.



Voice Coil Impedance
3.2 ohms at 400 cycles

Power Output
1.2 watts, undistorted
2.5 watts, maximum

Sensitivity
10 microvolts average for 1 watt output

Selectivity
50 KC broad at 1000 times signal, at 1000 KC

Power Supply
6.3 volts DC
4.8 amp. average

Tuning Range
540 to 1600 KC

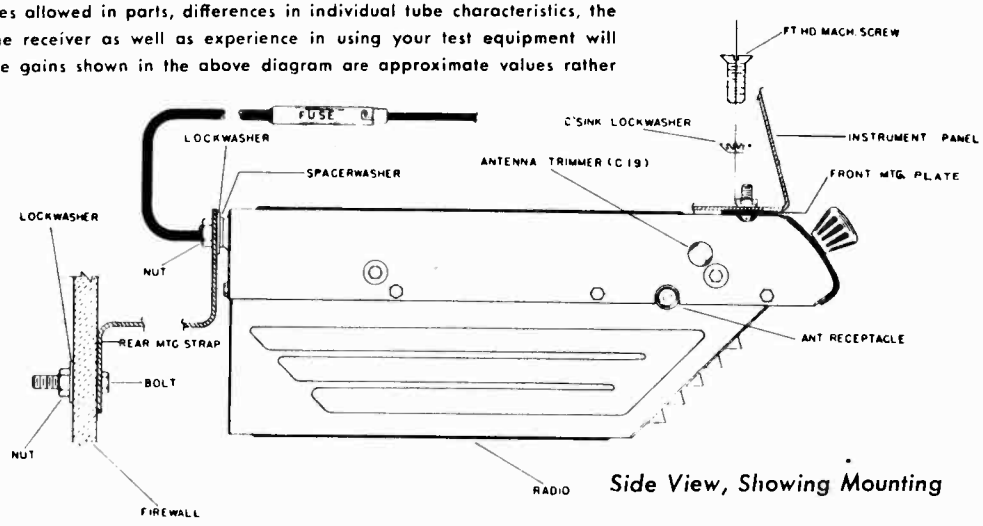
I.F. Frequency
455 KC

Loud Speaker
4" P.M.

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 input 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.

Tube Complement

1—6SK7GT	R.F. Amplifier
1—6SA7GT	Converter
1—6SK7GT	I.F. Amplifier
1—6SQ7	Det., AVC, Audio
1—6V6GT	Power output
1—6X5GT	Rectifier



Side View, Showing Mounting

ALIGNMENT PROCEDURE

Volume control—Maximum, all adjustments.

No signal applied to antenna.

Power input—6.3 volts

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

Connect output meter across voice coil.

Connect ground lead of signal generator to chassis.

Repeat alignment procedure as a final check.

The following equipment is necessary for proper alignment:

Signal generator that will provide the test frequencies as listed.

Non-metallic screwdriver.

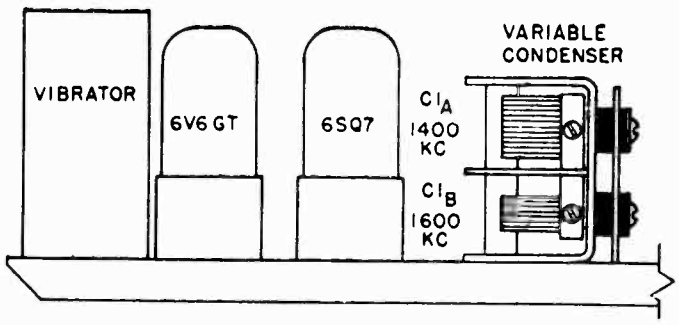
Output meter.

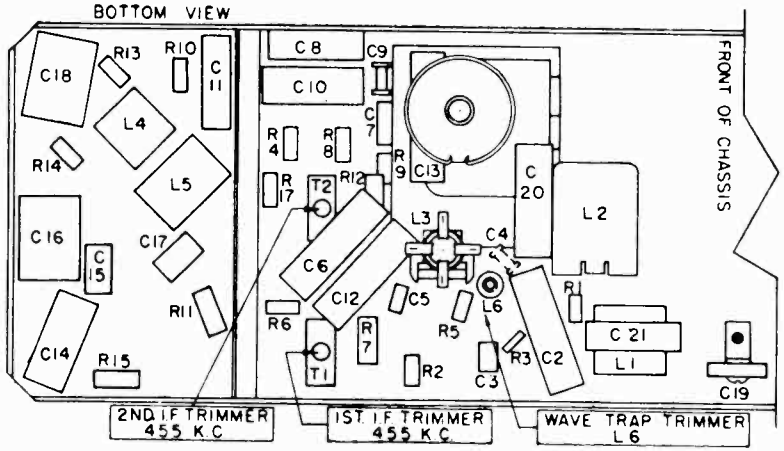
Dummy antennas—.1 MFD., .00025 MFD.

For alignment points refer to Figures 4, 5 and 8.

Dial Setting	*Generator Frequency*	*Dummy Ant.*	*Generator Connections*	*Trimmer Reference*	*Trimmer Adjustment*	*Trimmer Function*
Fully Open	455 KC	.1 MFD.	6SA7 Grid	T2	Maximum	Output I.F.
Fully Open	455 KC	.1 MFD.	6SA7 Grid	T1	Maximum	Input I.F.
Fully Open	455 KC	.00025 MFD.	Ant. lead	L6	Minimum	Wave trap
Fully Open	1600 KC	.00025 MFD.	Ant. lead	C1B	Maximum	Oscillator
Tune in signal from generator	1400 KC	.00025 MFD.	Ant. lead	C1A	Maximum	Antenna

NOTE: The antenna padder condenser, C19, (see Fig. 1) should be adjusted after the radio is installed in the car. Tune the receiver to a weak station at about 1100 KC and adjust this trimmer for maximum volume.





Component Parts Location

MODEL 4-B-31,
THE ROAMER

THE FIRESTONE TIRE & RUBBER CO.

SERVICE NOTES

Voltages taken from the different points of the circuit to the chassis are measured with volume control in maximum position, all tubes in their sockets, no signal applied, and with a volt meter having a resistance of 20,000 ohms per volt. These voltages are clearly shown on the voltage chart, (Fig. 7).

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

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

ALIGNING INSTRUCTION

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

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

DIAL POINTER ADJUSTMENT

If it should become necessary to readjust the dial pointer for correct calibration, this may be easily done without removing the radio from the car by proceeding as follows:

A. Turn tuning knob to the right (clockwise) as far as it will go.

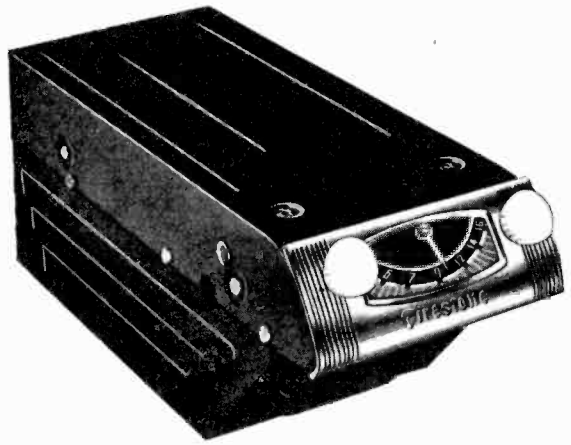
B. Remove snap button located on the right side of the case (viewed from the front), in the extreme upper front corner.

C. Insert screwdriver through hole in case and move dial pointer directly over white dot at high end of dial (1600KC).

D. Tune receiver to station of known frequency in the center of the dial and readjust pointer for more accurate indication, if necessary.

E. Replace snap button into hole in case.

CAUTION: Be careful not to scratch or damage dial scale or dial pointer when making this adjustment.



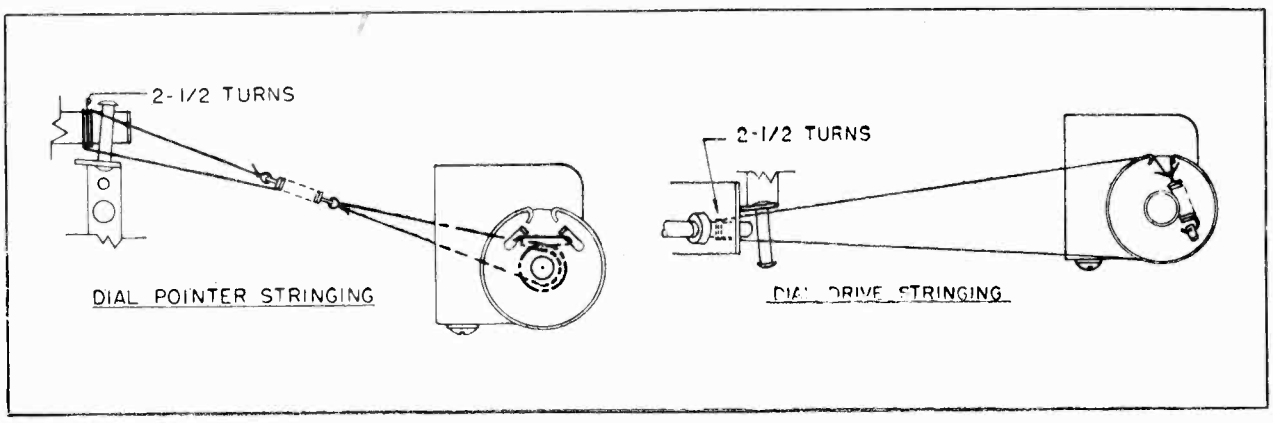
INSTRUCTIONS FOR REMOVING CHASSIS FROM THE CASE

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

CAUTION: Before attempting to remove the top cover, to service condensers, resistors, etc., the screw connecting the spark plate to the "A" terminal (inside case) must be removed. This is a round head screw, and is located on the rear of the case, close to the mounting stud bolt. It is recessed in a ½ inch hole in the case itself, thereby permitting contact with the spark plate.

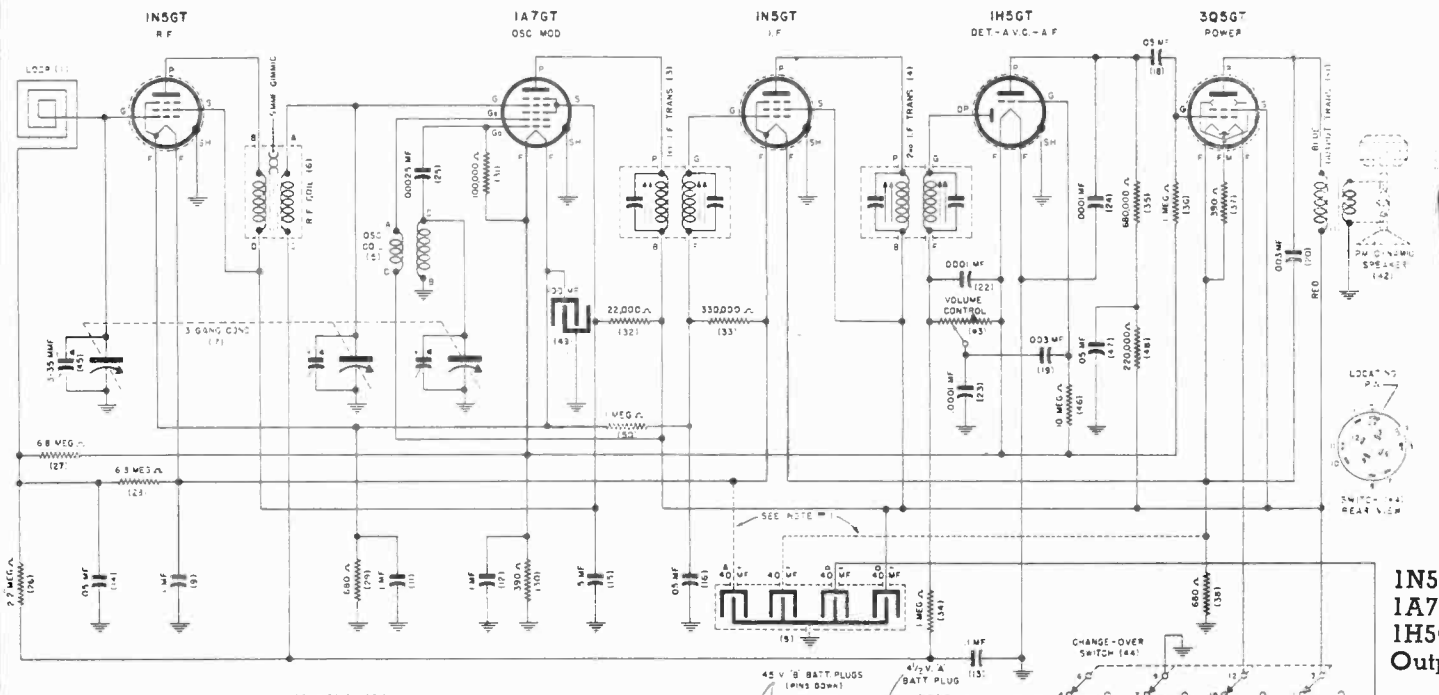
After removing the spark plate screw, remove the two knobs by pulling forward and remove the eight (8) screws securing the cover to the chassis. Lift the chassis at the rear, at the same time moving it away from the front of the case so that the volume and tuning shafts will clear the holes in the cover.

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



THE FIRESTONE TIRE & RUBBER CO. MODEL 4-B-31, The Roamer

Schematic Diagram Reference	Part No.	Description
CONDENSERS		
C1A, C1B	B19-196	Variable Condenser
C2, C6, C12	A16-187	.1 MFD. 400 Volt Condenser
C3	A15-196	100 MMFD Ceramic Condenser
C4	A15-202	20 MMFD Ceramic Condenser
C5	A15-204	50 MMFD Ceramic Condenser
C7, C15, C17	A15-176	250 MMFD Mica Condenser
C8	A16-190	.005 MFD. 600 Volt Condenser
C9	A16-195	.001 MFD. Ceramic Condenser
C10	A16-193	.05 MFD. 600 Volt Condenser
C11, C21	A16-192	.01 MFD. 400 Volt Condenser
C13	A16-188	.2 MFD. 400 Volt Condenser
C14	A16-185	.005 MFD. 1600 Volt Oil Filled Condenser
C16, C18	A16-184	.5 MFD. 100 Volt Condenser
C19	A20-145	Trimmer Condenser
C20	A16-189	.05 MFD. 400 Volt Condenser
C22	A18-289	20 MFD 25 Volt Electrolytic Condenser
C23		30 MFD 350 Volt Electrolytic Condenser
C24		20 MFD. 350 Volt Electrolytic Condenser
RESISTORS		
R1	A60-722	470 Ohm ½ Watt 20% Resistor
R13, R14	A60-752	100 Ohm ½ Watt 10% Resistor
R2, R5	A60-744	22K Ohm ½ Watt 10% Resistor
R3	A60-685	47K Ohm ½ Watt 20% Resistor
R4, R17	A60-726	2.2 Megohm ½ Watt 20% Resistor
R6	A60-753	220 Ohm ½ Watt 10% Resistor
R7	A60-716	15K Ohm 1 Watt 10% Resistor
R8	A60-728	10 Megohm ½ Watt 20% Resistor
R9	A60-667	220K Ohm ½ Watt 20% Resistor
R10	A60-731	470K Ohm ½ Watt 20% Resistor
R11	A60-754	270 Ohm 1 Watt 10% Resistor
R12	A60-698	10K Ohm 1 Watt 10% Resistor
R15	A60-694	470 Ohm 1 Watt 10% Resistor
R16	A24-177	Volume Control, 500,000 Ohms, with Switch
COILS		
L1	A10-513	Antenna Loading Coil
L2	B10-511	Antenna Coil
L3	A10-512	Oscillator Coil
L4	A33-229	Choke, "A" Line
L5	A33-228	Choke, Vibrator Hash
L6	A10-510	I.F. Trap Coil
T1	A10-508	1st I.F. Transformer
T2	A10-509	2nd I.F. Transformer
TRANSFORMERS		
T3	B80-242	Output Transformer (Part of Speaker)
T4	B80-243	Power Transformer
DIAL PARTS		
	A11-303	Bracket, Dial Scale
	A11-304	Bracket, String Guide
	A72-29	Bushing, Tuning Shaft Bearing
	A70-130	Clip, Spring, for Tuning Shaft
	B48-44	Dial Crystal
	C40-144	Dial Escutcheon
	A58-55	Dial Pointer
	B67-526	Dial Scale
	A52-270	Knob
	A89-10	Pilot Light, Type 47
	A71-39	Pilot Light Shield
	A65-37	Rivet, Shoulder, for String Guide Bracket
	A75-68	Shaft, Tuning
	A75-67	Shaft, for Dial Pointer
	A70-132	Spring, for Pilot Light Socket
	A70-133	Spring, String Tension, Pointer Drive and Tuning
MISCELLANEOUS		
	A83-421	Clip, I.F. Transformer Mounting
	A83-517	Clip, Oscillator Coil Mounting
	A43-10	Fuse, 15 Amp.
	A28-101	Gasket for Speaker
	A47-112	Grommet, Rubber (for Mounting Speaker and Variable Condenser)
	B31-134	Mounting Strap, Rear
	A31-140	Mounting Plate, Front
	S84-192	Mounting Parts Kit
	A87-38	Receptacle, Antenna Cable
	B79-362	Speaker, 4" P.M. (includes Output Transformer)
	S84-232	Suppression Kit Assembly
	A34-105	Vibrator
	A83-519	Wiper, Grounding, for Case Covers



VOLTAGE TABLE
(BOTTOM VIEW OF CHASSIS)

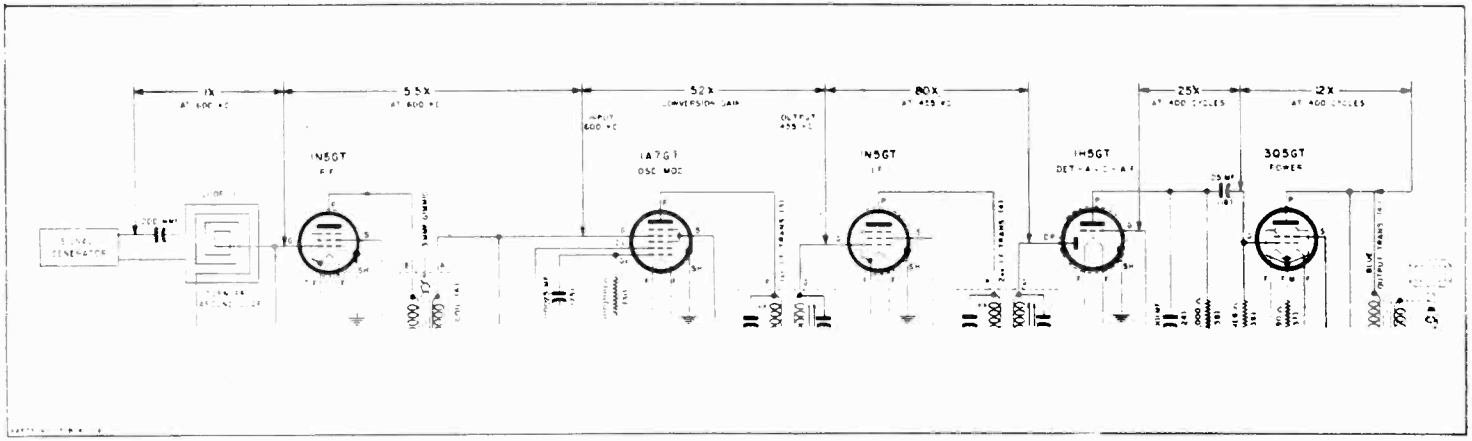
TUBE COMPLEMENT

1N5GT R.F., 1N5GT I.F.,
1A7GT Oscillator Modulator,
1H5GT Det., AVC, 3Q5GT Power Output, 117Z6GT Rectifier.

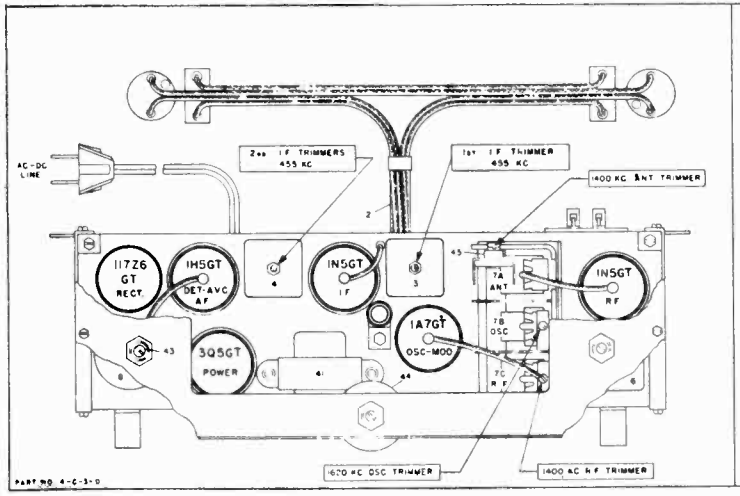
POWER SUPPLY	110-120 Volt AC-DC & Battery
BATTERIES	Two 4½ Volt "A" Firestone Type 4-D-86 Two 45 Volt "B" Firestone Type 4-D-85
TUNING RANGE	1620 to 530 K. C.
INTERMEDIATE FREQ	455 K. C.
LOUD SPEAKER	5 Inch P. M.
VOICE COIL IMPEDANCE	3.2 Ohms at 400 Cycles
POWER OUTPUT	Undistorted — .25 Watts Maximum — .4 Watts

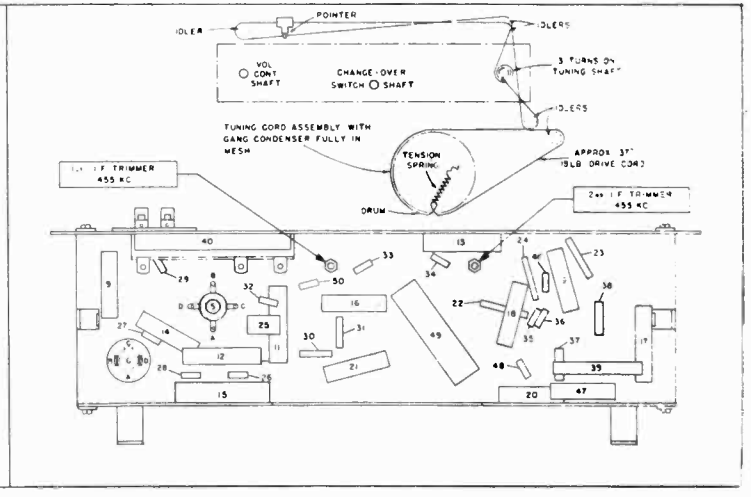
Be sure R.F. and I.F. stages are accurately aligned before measuring gain. R.F. gains can be measured with a "channel" type instrument containing a tuned and calibrated R.F. amplifier. A vacuum tube voltmeter may be used for audio gain measurements. Observe following precautions:

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.





MODEL 4-C-3 THE FIRESTONE TIRE & RUBBER CO.

ALIGNMENT PROCEDURE

Be sure to follow procedure carefully and in the order given—otherwise the receiver will be insensitive and the dial calibration incorrect. For alignment procedure read tabulations from left to right. Make the adjustment marked (1) first, (2) next, (3) third, etc.

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 even with the last line at the low frequency end of the dial calibration. If dial needle does not point exactly to last line, move to correct position.

(b) Use an accurately calibrated test oscillator with some type of output measuring device.

(c) WHEN ADJUSTING 1620 KC OSCILLATOR TRIMMER AND 1400 KC R. F. TRIMMER, remove chassis from cabinet and disconnect the white-green and white-black loop connection wires from the two Fahenstock clips mounted on rear of chassis. Attach a 1 megohm resistor across these Fahenstock clips and feed output of test oscillator across the 1 megohm resistor.

(d) THE 1400 KC LOOP ANTENNA TRIMMER is accessible from the rear of the chassis when the inner back is removed. It should be adjusted only after all other adjustments have been made and with the set mounted in the cabinet, and the loop in an upright position. When aligning the 1400 KC Antenna Trimmer, couple test oscillator to receiver loop by: (1) make loop consisting of five to ten turns of No. 20 to No. 30 size wire, wound on a 2" or 3" form; (2) connect this loop across output of test oscillator; (3) place test oscillator loop near radio loop. BE SURE THAT NEITHER LOOP MOVES WHILE ALIGNING.

Steps	Set receiver dial to:	TEST OSCILLATOR: Adjust test oscillator frequency to:	TEST OSCILLATOR: Use dummy antenna in series with output of test oscillator consisting of:	TEST OSCILLATOR: Attach output of test oscillator to	Refer to parts layout diagram for location of trimmers mentioned below:
1	Any point where no interfering signal is received	Exactly 455 K. C.	0.2 Mfd. Condenser	High side to grid of 1A7GT tube, Low side to chassis (If non-Underwriter Approved) or Common Negative (If Underwriter Approved).	Adjust each of the 2nd I.F. transformer trimmer adjustment screws for maximum output, then adjust each of the 1st I.F. transformer trimmer adjustment screws for maximum output.
2	Rotate gang condenser to minimum capacity	Exactly 1620 K. C.	See paragraph (C) above	See paragraph (C) above	Adjust 1620 Osc. Trimmer for maximum 1620 K. C. signal.
3	Rotate gang condenser to 1400 K.C.	Exactly 1400 K. C.			Adjust 1400 K.C. R.F. Trimmer for maximum output.
4	Approximately 1400 K. C.	Approx. 1400 K. C.	See paragraph (D) above	See paragraph (D) above	Adjust 1400 K.C. antenna trimmer for maximum output.

PARTS LIST

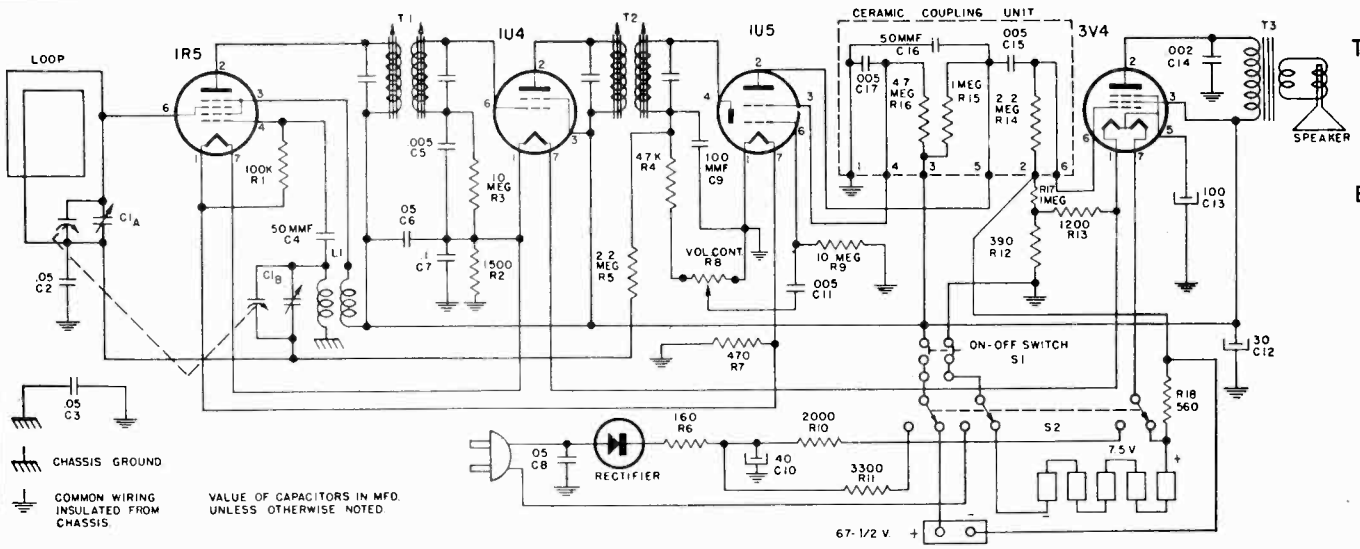
Ill. No.	Part No.	Part Name	Description
1	20E120-1	Antenna	Cabinet Door Assembly Complete with Hinges & Door Stop
2	20E118	Cable	Battery Cable with "A" & "B" Plugs
3	20E53	Coil	1st I.F. Transformer
4	20E54	Coil	2nd I.F. Transformer
*5	20E237	Coil	Oscillator (use with 24E7A Cond.)
	OR		
*5	20E248	Coil	Oscillator (use with 24E7B Cond.)
6	20E48	Coil	R. F.
*7	24E7A	Condenser	Tuning, 3 Gang (use with 20E237 Osc. Coil)
	OR		
*7	24E7B	Condenser	Tuning, 3 Gang (use with 20E248 Osc. Coil)
8	25E11	Condenser	Tubular, Dry Elect. {40-40 Mfd. 150 V. / 40-40 Mfd. 25 V.}
9	23E218	Condenser	Tubular, .1 Mfd. 200 V.
10	23E218	Condenser	Tubular, .1 Mfd. 200 V.
11	23E218	Condenser	Tubular, .1 Mfd. 200 V.
12	23E218	Condenser	Tubular, .1 Mfd. 200 V.
13	23E218	Condenser	Tubular, .1 Mfd. 200 V.
14	23E216	Condenser	Tubular, .05 Mfd. 200 V.
15	23E224	Condenser	Tubular, .5 Mfd. 200 V.
16	23E216	Condenser	Tubular, .05 Mfd. 200 V.
17	23E416	Condenser	Tubular, .05 Mfd. 400 V.
18	23E216	Condenser	Tubular, .05 Mfd. 200 V.
19	23E406	Condenser	Tubular, .003 Mfd. 400 V.
20	23E406	Condenser	Tubular, .003 Mfd. 400 V.
21	23E408	Condenser	Tubular, .005 Mfd. 400 V.
22	23E39	Condenser	Mica, .0001 Mfd.
23	23E39	Condenser	Mica, .0001 Mfd.
24	23E39	Condenser	Mica, .0001 Mfd.
25	23E42	Condenser	Mica, .00025 Mfd.
26	27E225	Resistor	Carbon, 2.2 Megohm, 1/3 W.
27	27E685	Resistor	Carbon, 6.8 Megohm, 1/3 W.
28	27E685	Resistor	Carbon, 6.8 Megohm, 1/3 W.
29	27E681	Resistor	Carbon, 680 Ohm, 1/3 W.
30	27E391	Resistor	Carbon, 390 Ohm, 1/3 W.
31	27E104	Resistor	Carbon, 100.000 Ohm, 1/3 W.
32	27E223	Resistor	Carbon, 22.000 Ohm, 1/3 W.
33	27E334	Resistor	Carbon, 330.000 Ohm, 1/3 W.
34	27E105	Resistor	Carbon, 1 Megohm, 1/3 W.
35	27E684	Resistor	Carbon, 680.000 Ohm, 1/3 W.
36	27E105	Resistor	Carbon, 1 Megohm, 1/3 W.
37	27E391	Resistor	Carbon, 390 Ohm, 1/3 W.
38	27E681	Resistor	Carbon, 680 Ohm, 1/3 W.
39	27E1001	Resistor	Flexible Wire Wound, 75 Ohm, 2 W.
40	27E1000	Resistor	Wire Wound 500 & 1900 Ohms
41	22E15	Transformer	Output
42	1E18	Speaker	5" P.M. Dynamic
43	28E13	Volume Control	500,000 Ohms
44	29E10	Switch	4 Pole 3 Pos.
45	24E21	Condenser	Trimmer 3-35 Mmf.
46	27E106	Resistor	Carbon, 10 Megohm, 1/3 W.
47	23E216	Condenser	Tubular, .05 Mfd. 200 V.
48	27E224	Resistor	Carbon, 220.000 Ohm, 1/3 W.
**49	25E19	Condenser	Tubular, Dry Elect. 100 Mfd. 25 V.
50	27E105	Resistor	Carbon, 1 Megohm, 1/3 W.

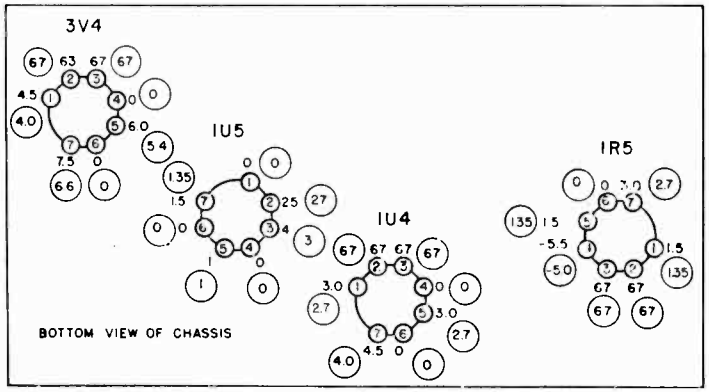
MISCELLANEOUS PARTS

Part No.	Part Name	Description
17E3-2	"A" Battery Plug	2 Prong "A" Battery Plug
17E3-5	"B" Battery Plug	3 Prong "B" Battery Plug
7E63	Cabinet	Cabinet less Loop Door & Inner Barrier
41E1	Cord	6 Ft. Rubber Line Cord
20E121	Door Stop Assembly	Stop for Door & Loop Assembly
5E17	Dial Plate Assembly	Dial Back Plate Assembly less Dial Scale
5E16	Dial Front Plate	Metal Control Plate for Cabinet, less Crystal
9E6	Dial Crystal	Crystal for Front Plate
36E22	Dial Scale	Calibrated Scale
4E1	Dial Cord	18 lb. Dial Drive Cord
68E10	Dial Shaft	Complete Shaft Assem.
10E43	Dial Scale Fastener	Trimount Stud for fastening Scale
35E20-1	Dial Pointer	Dial Indicator
65E2	Dial Spring	Tension Spring for Drive Cord
37E1-1	Knob	1-1/8" Dia. for Tuning & Volume Control
37E2-1	Knob	5/8" Dia. for Changeover Switch
55E18	Hinge	Hinge for Cabinet Door & Loop Assembly
17E17	Pilot Lamp Socket Assembly	Pilot Lamp Socket Assembly less Lamp
40E2	Pilot Lamp	6-8 volt .250 amp. Type No. 44 Lamp
69E72F47	Rivet	For Hinge
69E92F47	Rivet	For Door Stop

**NOTE No. 1: In early production, the two low voltage sections of filter condenser, Illus. No. 8, Part 25E11, shown in dotted lines on circuit diagram, were not used and in their place the 100 Mfd., Illus. No. 49, Part 25E19 was used.
In later production all four sections of Illus. No. 8, Part 25E11, were used and condenser, Illus. No. 49, Part 25E19, was eliminated.

*NOTE No. 2 CHASSIS MARKED WITH LETTER "A" adjacent to serial number use Part 24E7A Gang Condenser and Part 20E237 Oscillator Coil.
CHASSIS MARKED WITH LETTER "B" adjacent to serial number use Part 24E7B Gang Condenser and Part 20E248 Oscillator Coil.
THESE GANG CONDENSERS AND OSCILLATOR COILS ARE NOT INTERCHANGEABLE
DO NOT use Part 24E7A Gang Condenser with Part 20E248 Osc. Coil, or Part 24E7B Gang Condenser with Part 20E237 Osc. Coil.





VOLTAGE CHART

All voltages are measured from tube pin to common "B" negative with a 20,000 ohm per volt voltmeter.

Voltages shown in circles are obtained when set is operated on 117 volt current.

Voltages shown outside the circles are obtained when the set is operated on batteries. New batteries in good condition should be used for these measurements.

Tube Complement
- 1R5—Oscillator Converter
- 1U4—I. F. Amplifier
- 1U5—AVC, Detector, 1st Audio
- 3V4—Power Output

Batteries
- Five 1½ volt "A" Firestone Stock No. 7-C-1
- One 67½ volt "B" Firestone Stock No. **4-D-84**

I. F. Frequency
455 KC

Loud Speaker
4 inch P.M.

Voice Coil Impedance
3.2 ohms at 400 cycles

Power Output
Maximum 100 milliwatts

Power Supply
105-125 volt 60 cycle AC-DC or Self-Contained batteries

Tuning Range
545 to 1610 KC

ALIGNMENT PROCEDURE

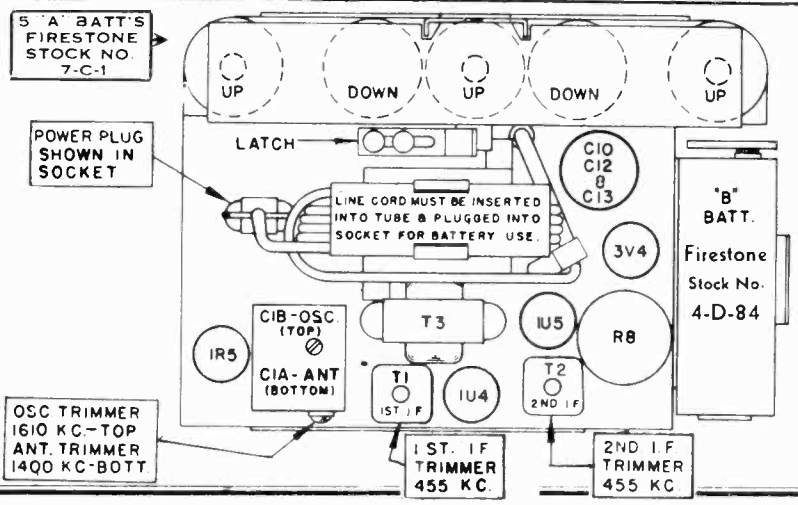
The alignment should be made with volume control fully on, and the output from the signal generator as low as possible, to prevent A.V.C. action from interfering with correct alignment.

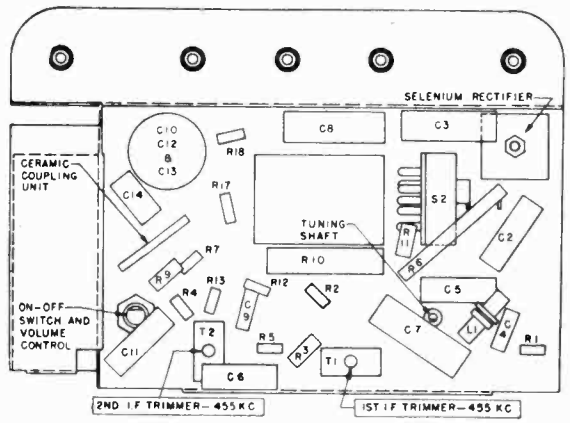
For alignment procedure read tabulations from left to right, and make the adjustment marked (1) first, (2) next, (3) third. Before starting alignment:

(a) Check calibrated dial knob to see that it is positioned correctly. Turn Variable Condenser to its maximum capacity, plates completely in mesh. Adjust the knob so that the right hand edge of the small 5 in the 55 calibration number is in line with the indicator (dot) on the cabinet.

(b) Use an accurately calibrated test oscillator with some type of output measuring device.

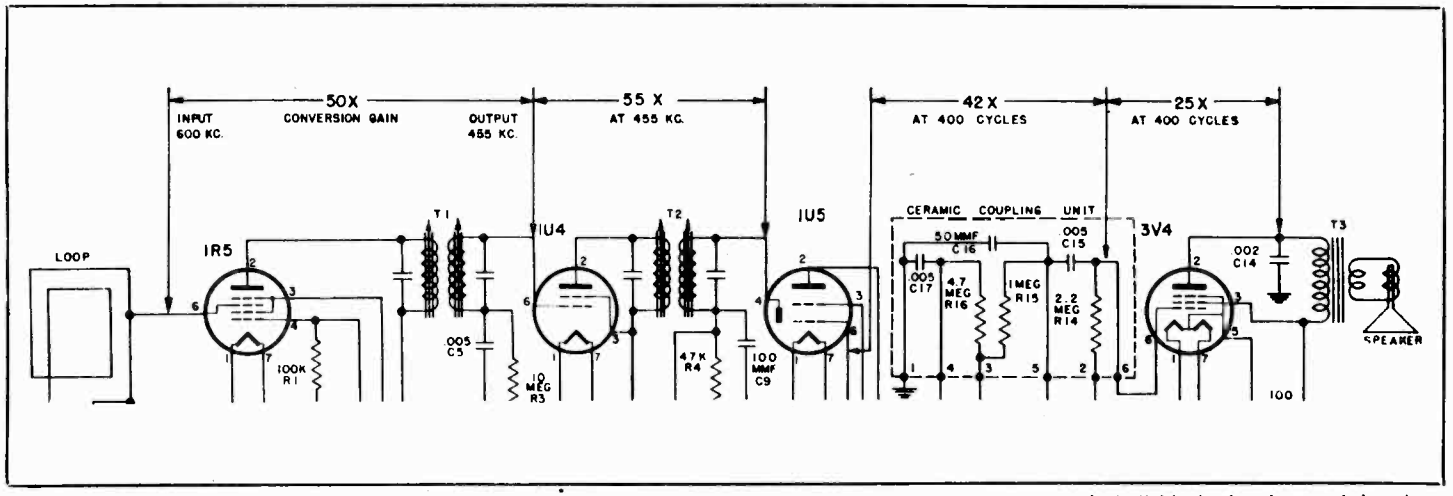
Steps	Set receiver dial to:	TEST OSCILLATOR: Adjust test oscillator frequency to:	TEST OSCILLATOR: Use dummy antenna in series with output of test oscillator consisting of:	TEST OSCILLATOR: Attach output of test oscillator to:	Refer to parts layout diagram for location of trimmers mentioned below:
1	Minimum capacity (fully open)	455 K.C.	.1 MFD. condenser	High side to grid of 1R5 tube. 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 1610 K.C.	.1 MFD. condenser	High side to grid of 1R5 tube. Low side to common negative.	Adjust 1610 K.C. oscillator trimmer for maximum output.
3	Approx. 1400 K.C.	Approx. 1400 K.C.		Loosely coupled to Loop Antenna	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 gain measurements connect the high side of the signal generator through a .1 MFD condenser to the appropriate point as indicated on the diagram below. The ground of the signal generator should be connected to common negative. The RF and IF measurements are made using 30% 400 cycle modulation.
2. Be sure radio is carefully tuned to generator signal (use weak signal for sharp tuning).
3. When using a "channel" type instrument carefuly 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.

Code No.	Part No.	Description
C1A, C1B	B19-197	Variable condenser
C2, C6	A16-152	.05 MFD 200 volt condenser
C3	A16-158	.05 MFD 400 volt condenser
C4	A15-175	50 MMF mica condenser
C5, C11	A16-153	.005 MFD 600 volt condenser
C7	A16-157	.1 MFD 200 volt condenser
C8	A16-189	.05 MFD 400 volt condenser
C9	A15-188	100 MMF mica condenser
C10	A18-290	40 MFD 150 volt electrolytic cond.
C12		30 MFD 150 volt electrolytic cond.
C13		100 MFD 10 volt electrolytic cond.
C14	A16-182	.002 MFD 200 volt condenser
C15	*A17-100	.005 MMF — See Note Below
C16		.005 MFD — See Note Below
C17		50 MMF — See Note Below
R1	A60-671	100K ohm ½ watt 20% resistor
R2	A60-680	1500 ohm ½ watt 10% resistor
R3, R9	A60-663	10 megohm ½ watt 20% resistor
R4	A60-685	47K ohm ½ watt 20% resistor
R5	A60-684	2.2 megohm ½ watt 20% resistor
R6	A60-725	160 ohm 5 watt 10% resistor
R7	A60-722	470 ohm ½ watt 10% resistor
R8, S1	A24-178	Volume control, with switch
R10	A60-757	2000 ohm 10 watt 10% resistor
R11	A60-724	3300 ohm 1 watt 10% resistor
R12	A60-655	390 ohm ½ watt 10% resistor
R13	A60-756	1200 ohm ½ watt 10% resistor
R14	*A17-100	2.2 megohm — See Note Below
R15		1 megohm — See Note Below
R16		4.7 megohm — See Note Below
L1	A10-514	Oscillator coil
T1, T2	C10-475	1st and 2nd I.F. transformer
T3	B80-245	Output transformer
S2	A69-182	Switch, AC-DC, battery

*NOTE: C15, C16, C17, R14, R15, R16 are contained in the Ceramic Coupling Unit Part No. A17-100