

1955

PHILCO

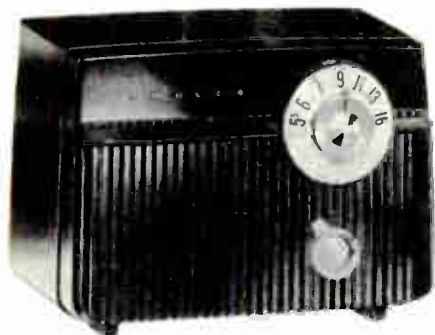
TELEVISION · RADIO-PHONOGRAPH · RADIO

# PHILCO HOME RADIO MODELS

D-592, D-593, D-595, D-598, D-727,  
D-728, D-730 and D-736



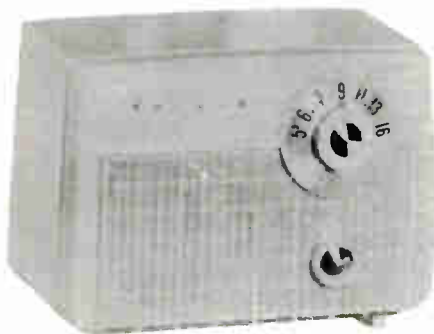
## HOME RADIO



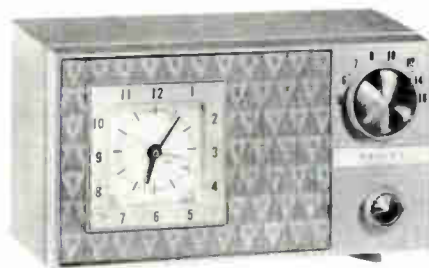
PHILCO MODEL D-592



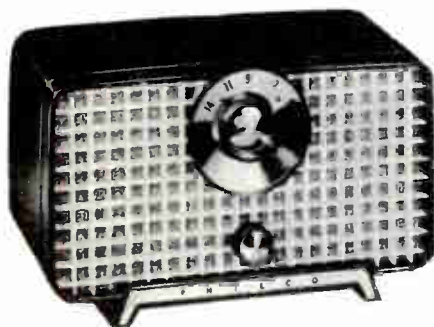
PHILCO MODEL D-727



PHILCO MODEL D-593



PHILCO MODEL D-728



PHILCO MODEL D-595



PHILCO MODEL D-730



PHILCO MODEL D-598



PHILCO MODEL D-736

### SPECIFICATIONS

Cabinet .....D-592, D-593, D-595, D-727,  
D-728 and D-730 — molded  
plastic; D-598 and D-736 —  
wood table model.

Circuit .....Four tube superheterodyne  
(plus rectifier).

Frequency Range .....540 KC to 1620 KC.

Audio Output .....1 Watt

Operating Voltage ...D-592, D-593, D-595  
and D-598—105 to 120 volts,  
AC or DC; D-727, D-728, D-  
730 and D-736—105 to 120  
volts AC only.

Power Consumption .....30 Watts

Aerial .....Self Contained Magnacore

Intermediate Frequency .....455 KC

Philco Tubes .....12BE6 Converter-  
Oscillator, 12BA6 I-F Ampli-  
fier, 12AV6 Detector — 1st  
Audio, 35C5 Audio Output  
and 35W4 Rectifier.

Clock Features .....D-727 — Sessions  
movement, radio alarm.  
D-728 — Sessions movement,  
radio alarm.  
D-730 — Sessions movement,  
radio and buzzer alarm.  
D-736 — Sessions or Tele-  
chron (C995) movement, ra-  
dio and buzz alarm.

Pilot Lamp .....Model D-598 employs  
a neon lamp as an off on  
indicator.

Phono. Input .....Model D-598 incor-  
porates a phono-input jack,  
a variable tone control and  
a "radio-phono" switch.

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World Radio History

PHILCO HOME RADIO MODELS D-592, D-593, D-595, D-598, D-727, D-728, D-730 and D-736

PR-2905

**ALIGNMENT PROCEDURE**

**RADIO CONTROLS** — Set volume control to maximum. Set tuning control as indicated in chart.

**SIGNAL GENERATOR** — Connect generator and set frequency as indicated in chart. Use modulated output.

**OUTPUT METER** — Connect across voice-coil terminals.

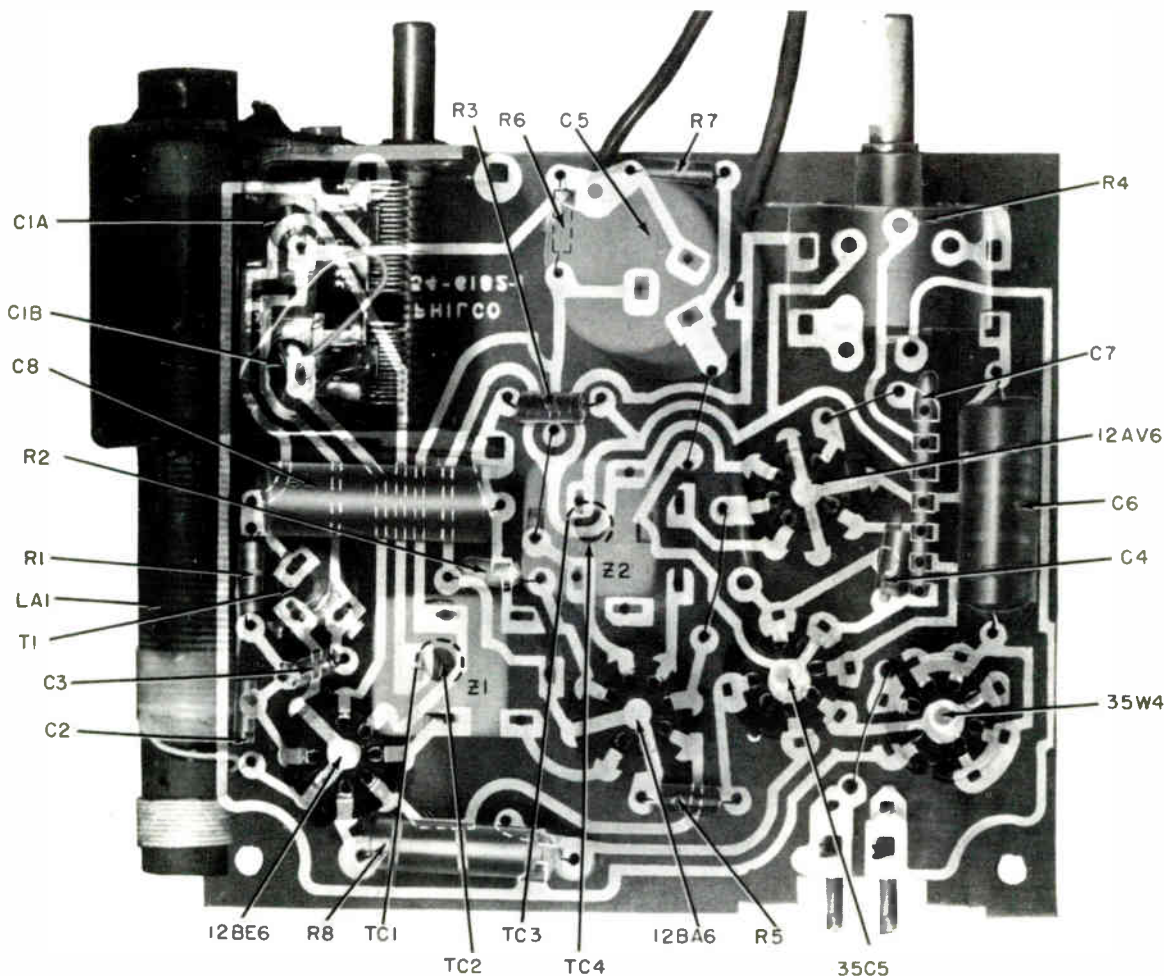
**OUTPUT LEVEL** — During alignment, adjust signal-generator output to hold output-meter reading below .5 volts.

**ALIGNMENT CHART**

STEP	SIGNAL GENERATOR		RADIO		ADJUST
	CONNECTION TO RADIO	DIAL SETTING	DIAL SETTING	SPECIAL INSTRUCTIONS	
1	Ground lead to B—; output lead through a .1 mf. condenser to grid (pin 7) of 12BE6.	455 KC	Tuning gang fully open.	Adjust tuning cores, in order given, for maximum output. TC1 and TC3 are located at top of transformers.	TC4—2nd i-f sec. TC3—2nd i-f pri. TC2—1st i-f sec. TC1—1st i-f pri.
2	Radiating loop (See note below).	1620 KC	1620 KC *	Adjust trimmer for maximum output.	C1-B—osc.
3	Same as Step 2.	1500 KC	1500 KC	Adjust trimmer for maximum output.	C1-A—aerial

**NOTE:** Make up a 6-8 turn, 6 inch diameter loop from insulated wire, connect to signal-generator leads, and place near radio loop.

For proper adjustment of the oscillator trimmer, fully open the tuning gang and insert a .006 inch non-metallic shim between the heel of the rotor and the top of the stator plates. Close the tuning gang sufficiently to hold the shim in place, and then remove the shim without disturbing the gang setting.

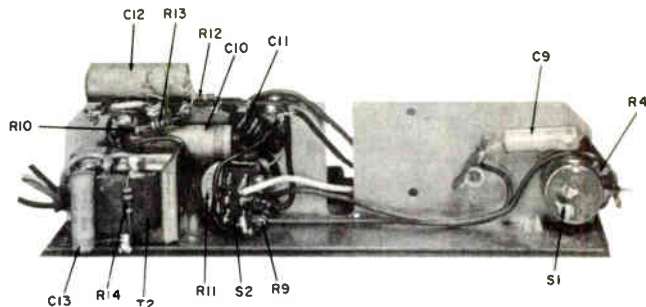


*Composite Photo of Printed Panel Showing Parts Layout*



# REPLACEMENT PARTS LIST

Ref. Sym.	Description	Service Part No.
C1	Condenser, tuning gang	31-2780-2
	Condenser, tuning gang, D-598 only	31-2780-5
C2	Condenser, neutralization, 9 mmf, ceramic	30-1251-5
C3	Condenser, oscillator grid, 47 mmf, ceramic	30-1230-4
C4	Condenser, tone compensation, .01 mfd, disc	30-1238-2
C5	Condenser, electrolytic, 3 section	30-2585-5
C6	Condenser, line by-pass, .047 mfd, moulded	30-4650-45
C7	Condenser-resistor network	30-6006
C8	Condenser, AVC by-pcass, .047 mfd, moulded	30-4650-45
C9	Condenser, audio coupling, .01 mfd, moulded, D-598 only	30-4650-41
C10	Condenser, tone control, 1 mfd, moulded, D-598 only	30-4650-47
C11	Condenser, tone control, .0082 mfd, D-598 only	30-4651-18
C12	Condenser, tone control, .1 mfd, moulded, D-598 only	30-4650-47
C13	Condenser, tone compensation, .01 mfd, moulded, D-598 only	30-4650-41
C14	Condenser, phono. jack isolation, .047 mfd, moulded, D-598 only	30-4650-45
J1	Jack, phono. connector, D-598 only	27-6186
IA1	Antenna, magnecore, and support assembly	76-9228-3
LS1	Speaker, D-592, D-593, D-595, D-727 and D-728	36-1654
	Speaker, D-598 (2 used)	36-1663-6
	Speaker, D-730	36-1660
	Speaker, D-736	36-1655
PL	Pilot lamp, neon, D-598 only (Type NE51)	34-2482-1
R1	Resistor, oscillator grid return, 22,000 ohms	66-3228340
R2	Resistor, I-F cathode bias, 68 ohms	66-0688340
R3	Resistor, AVC filter, 2.2 megohms	66-5228340
R4	Volume Control, 500,000 ohms, D-592, D-593 and D-595	33-5575-4
	Volume Control, 1 megohm, D-598	33-5566-73
	Volume Control, 500,000 ohms, D-727, D-728, D-730 and D-736	33-5575-3
R5	Resistor, output cathode bias, 150 ohms	66-1158340
R6	Resistor, B+ filter, 2200 ohms	66-2228340
R7	Resistor, B+ filter, 3300 ohms	66-2338340
R8	Resistor, filament current limiting, 100 ohms, D-592, D-593, D-598	33-1360-6
	Resistor, filament current limiting, 100 ohms, D-595, D-727, D-728, D-730 and D-736	33-1343-3
R9	Resistor, diode load, 390,000 ohms, D-598 only	66-4398340
R10	Resistor, tone, 560 ohms, D-598 only	66-1568340
R11	Tone control, 250,000 ohms, D-598 only	33-5581
R12	Resistor, tone, 1800 ohms, D-598 only	66-2188340
R13	Resistor, tone, 18,000 ohms, D-598 only	66-3188340
R14	Resistor, tone compensation, output plate, 4700 ohms, D-598 only	66-2478340
R15	Resistor, current limiting, neon bulb, 150,000 ohms, D-598 only	66-4158340
S1	Switch, on-off, D-592, D-593, D-595 and D-598 Part of R4	
	Switch, D-727, D-728, D-730 and D-736 Part of Clock Assy.	
S2	Switch, radio-phon., D-598 only	Part of R11
T1	Transformer, oscillator	32-4582-5
T2	Transformer, audio output	32-8384-2
	Transformer, audio output, D-598 only	32-8729
W1	Line cord	41-3865
Z1	Transformer, 1st I-F	32-4583-5
Z2	Transformer, 2nd I-F	32-4583-6



Parts Layout on Control Panel — Model D-598

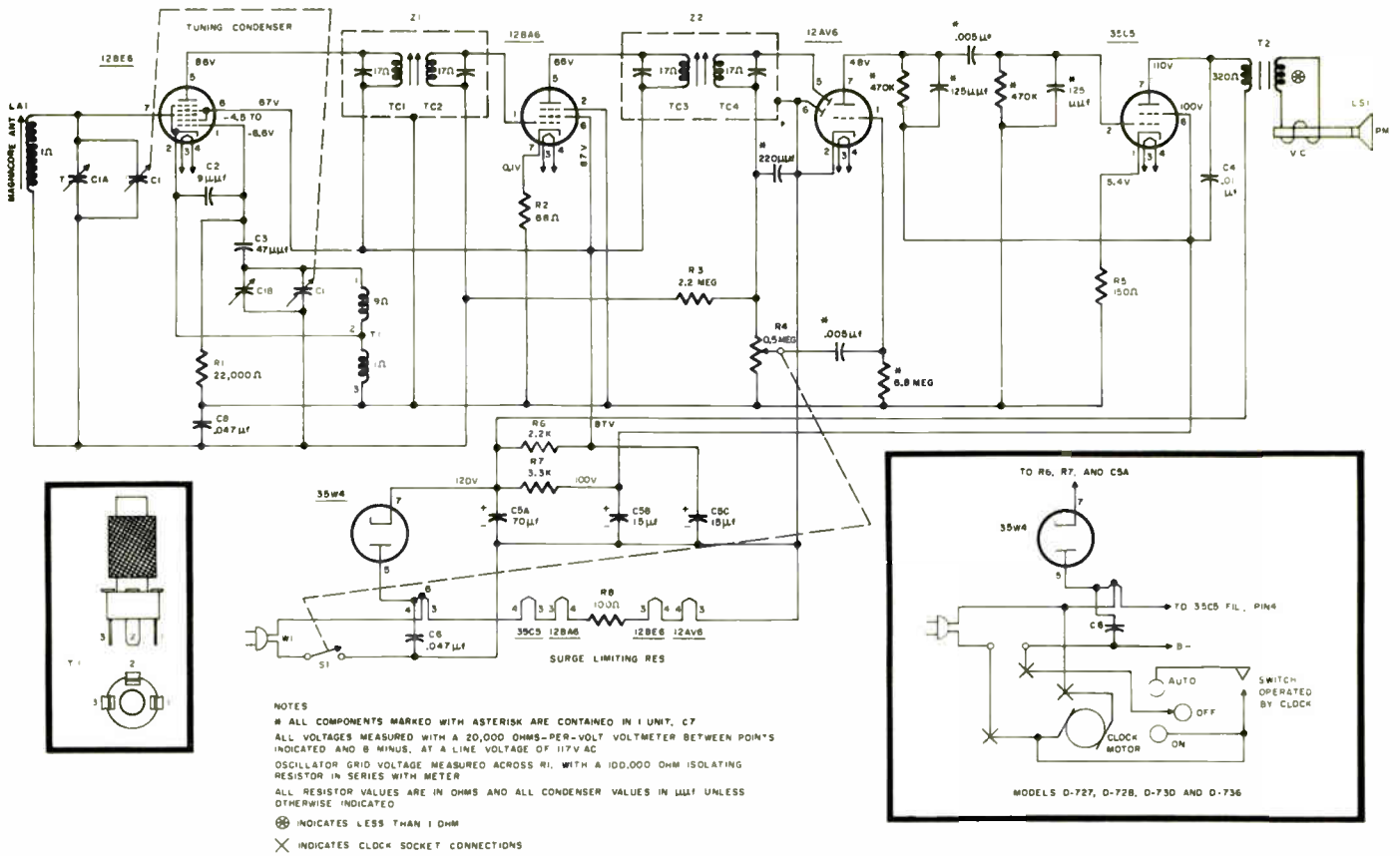
## MISCELLANEOUS PARTS

Description	Service Part No.
Printed Wire Panel	54-6182-1
Contact, male, AC interlock (2 used)	L3520FE18
Fastener, wire mounting	28-2669-3
Socket, tube, 12BE6 and 12BA6	27-6296-6
Socket, tube, 35W4 and 35C5	27-6309-1
Socket, tube, 12AV6	27-6296-16
Socket Assy., neon indicator, D-598 only	27-6233-6
Grille background	54-6222
Knob, tuning	54-6220-1
Knob, volume	54-6035-3
Cabinet, Calypso Red	11148-3
Grille	54-6219
Grille background	54-6222-1
Knob, tuning	54-6220-2
Knob, volume	54-6035-5
Cabinet, Lustre Ivory	11148-2
Grille	54-6219-1
Grille background	54-6222-1
Knob, volume	54-6035-4
Back and line cord assy. Model D-598	76-9866
Cabinet, Wood, Mahogany	11162
Back, cabinet	76-9992
Backplate, scale	28-11096
Dial scale	54-6244
Feet (4)	W2190
Jewel	54-4304-4
Clip, jewel mounting	56-3545-6
Knob, pointer	54-6240
Knob, tuning	54-6230-2
Knob, volume and tone (2)	54-4773-28
Model D-727	
Cabinet, black	11062-10
Back and line cord assy.	76-9946
Clock, crystal	54-5208
Clock face	28-10904-2
Clock, knobs (2)	54-6096-3
Clock, trim	28-10195-1
Knob, tuning	54-6156-13
Knob, volume	54-4773-23
Model D-728	
Cabinet, Bermuda Pink	11062-9
Grille	54-6193-2
Knob, tuning	54-6093-7
Knob, volume	54-6035-1
Cabinet, Caribbean Green	11062-7
Grille	54-6193
Knob, tuning	54-6147-17
Knob, volume	54-4773-16
Cabinet, Lustre Ivory	11062-8
Grille	54-6193-1
Knob, tuning	54-6147-18
Knob, volume	54-4773-17
Back and line cord assy.	76-9946
Clock	41-2057-3
Clock, crystal	54-5208
Clock, face	28-10904-2
Clock, knobs (2)	54-6096-3
Clock, trim	28-10195-3
Model D-730	
Cabinet, Bolero Red	11076-12
Back	54-6163-7
Knobs, tuning and volume (2)	54-6093-9
Cabinet, Lustre Ivory	11076-11
Back	54-6163-6
Clock (first production)	41-2048-7
Clock face (41-204807 clock)	28-10034-5
Knobs, tuning and volume (2)	54-6093-8
Cabinet, Mayan Turquoise	11076-13
Back	54-6163-8
Knobs, tuning and volume (2)	54-6093-10
Bezel, clock	28-10363-3
Bezel, radio	28-10364-5
Clock	41-2057-2
Clock, crystal	54-6196-1
Clock, face	28-10904-4
Clock, knobs (2)	54-6096-3
Knobs, tuning and volume (2)	54-6224

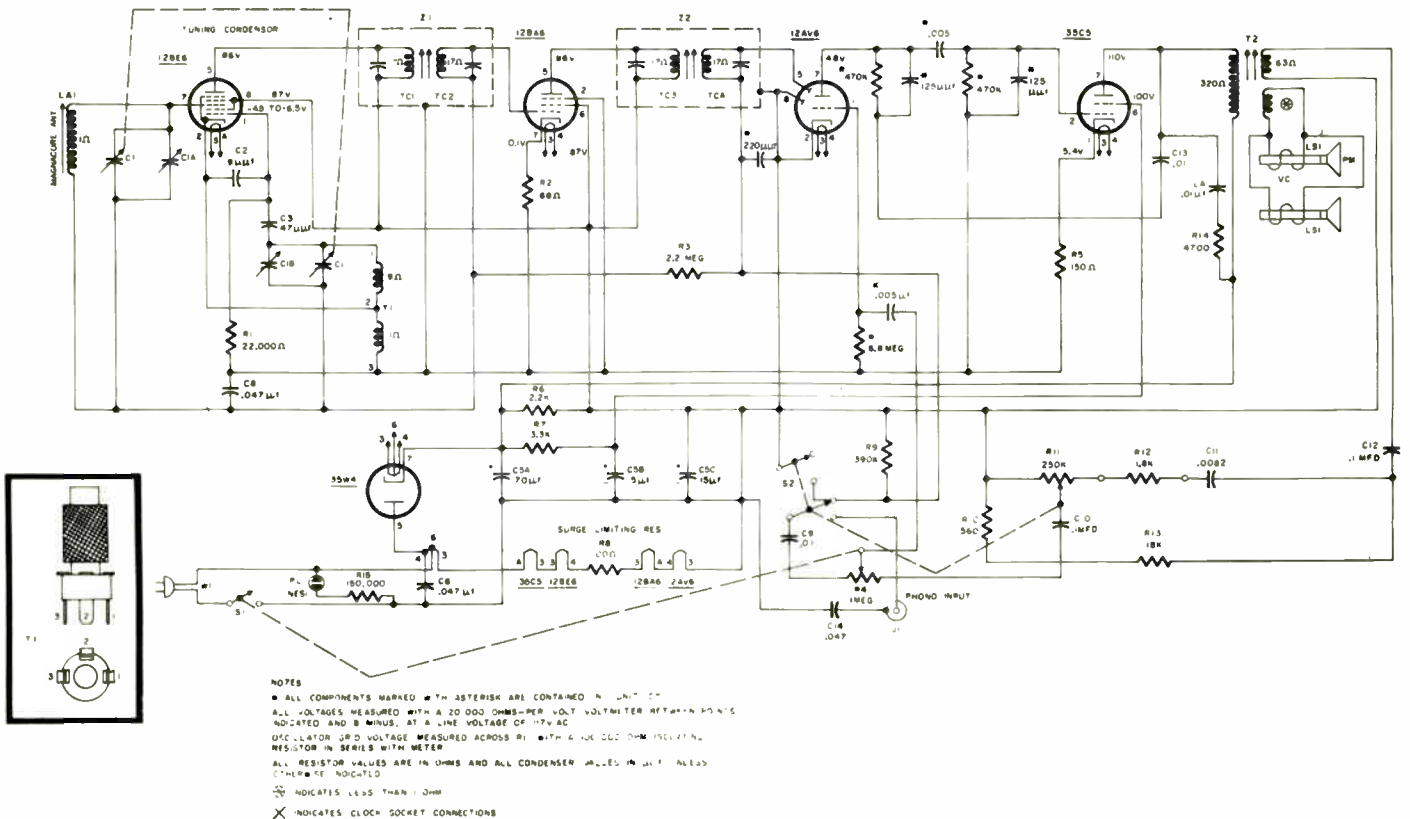
## CABINET PARTS

Description	Service Part No.
Model D-592	
Cabinet, Black	11063-8
Back and line cord assy.	76-9188
Dial scale	28-10231-4
Knob, tuning	54-6156-12
Knob, volume	54-6159-14
Model D-593	
Cabinet, Caribbean Green	11063-6
Grille	28-10246-3
Knob, tuning	54-6156-8
Knob, volume	54-6159-11
Cabinet, Cherry	11063-9
Grille	28-10246-2
Knob, tuning	54-6156-12
Knob, volume	54-6159-14
Cabinet, Lustre Ivory	11063-7
Grille	28-10246-4
Knob, tuning	54-6156-9
Knob, volume	54-6159-12
Back and line cord assy.	76-9188
Dial scale	28-10231-4
Model D-595	
Cabinet, Amazon Green	11148-1
Grille	54-6219
Model D-736	
Cabinet, Mahogany	11152
Back	54-9658-1
Bezel, clock	28-10363-2
Bezel, radio	28-10364-4
Clock	41-2057-2
Clock, crystal	54-6196-1
Clock, face	28-10904-4
Clock, knobs (2)	54-6096-3
Knobs, tuning and volume (2)	54-6224





SCHEMATIC OF MODELS D-592, D-593 AND D-595 FOR MODELS D-727, D-728, D-730 AND D-736 REFER TO CLOCK CIRCUIT IN INSERT



# PHILCO PORTABLE RADIO

MODELS D-664 AND D-665, CODE 124 AND  
D-665, CODE 126

**PHILCO**  
**Factory-Supervised**  
**Service**

HOME RADIO



MODEL D-665

MODEL D-664



## ALIGNMENT PROCEDURE

**General** — Allow set and test equipment to warm up for fifteen minutes before starting the alignment.

**Dial Indicator** — Before alignment, the dial knob should be set as follows: with the condenser gang plates fully meshed, the first knob marking (past the 550 KC point) should be in line with the gold spot.

**Output Indicator** — Connect a 1000-ohms-per-volt a-c voltmeter or an oscilloscope across the voice-coil terminals.

**Signal Generator** — Use an AM r-f signal generator. Connect the ground lead to B—, and connect the output lead as indicated in the alignment chart.

**Output Level** — Attenuate the signal-generator output throughout the alignment so as to maintain the output below .4 volts.

**Radio Controls** — Set the volume control to maximum. Set the tuning control as indicated in the alignment chart. It is recommended that a-c power be used when aligning the radio.

## SPECIFICATIONS

**Circuit** — Four tube superheterodyne (plus selenium rectifier).

**Audio Output** — AC or DC operation — 150 milliwatts.

Battery operation — 75 milliwatts.

**Supply Voltage** — 117 volts, AC or DC. 3.0 volt "A" supply and 75 volt "B" battery.

**Power Consumption** — AC or DC operation, 11 watts; battery operation, 10 MA from "B", 130 MA from "A".

**Antenna** — Magnecor, high-impedance loop.

**Intermediate Frequency** — 455 KC.

**Philco Tubes** — 1R5 Converter, 1U4 I-F amplifier, 1S5 detector - A.V.C. - 1 audio, 3V4 output.

**Battery Types** — P-144 "B" battery, (2) P-77 "A" batteries.

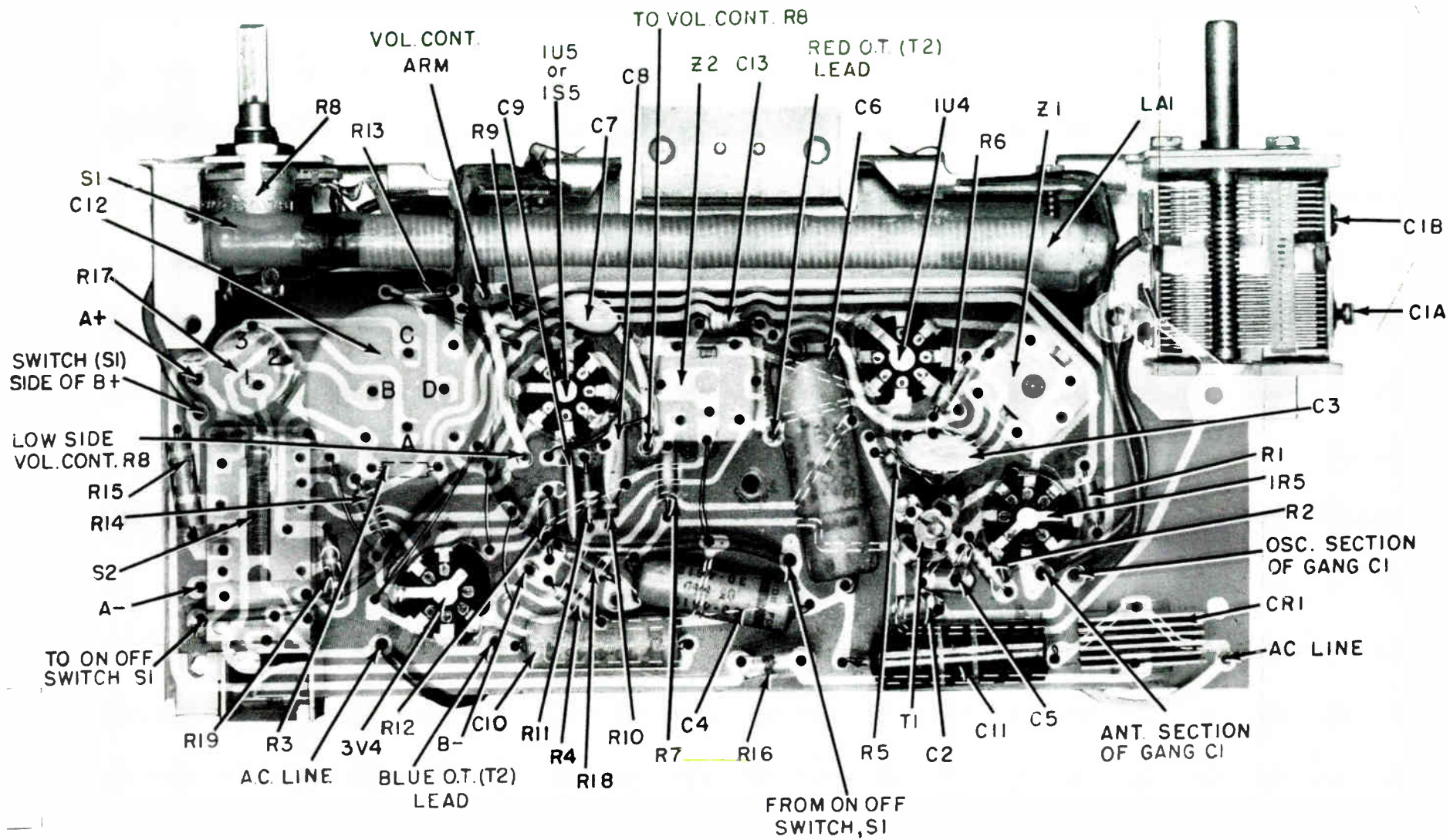
## ALIGNMENT CHART

STEP	SIGNAL GENERATOR		RADIO		ADJUST
	CONNECTION TO RADIO	DIAL SETTING	DIAL SETTING	SPECIAL INSTRUCTIONS	
1	Connect signal generator through a .1 mfd condenser to pin 6 (converter grid) of 1R5	455 kc.	Tuning gang fully open.	Adjust for maximum output in order given.	TC4—2nd I-F sec. TC3—1st I-F sec. (top Z1) TC2—1st I-F pri. (bot Z1)
2	Use radiating loop (See note one below).	1620 kc.	1620 kc. (See note 2 below).	Adjust for maximum.	C1B—osc. trimmer
3	Same as step 2.	1400 kc.	1400 kc. (Tune for signal.)	Adjust for maximum.	C1A—ant. trimmer
4	Same as step 2.	600 kc.	600 kc. (Tune for signal.)	Adjust for maximum output. Rock tuning gang while making this adjustment.	TC-1—Osc. core
5	Repeat steps 2, 3, and 4 until no further improvement is noted.				

NOTE 1: Use a 6- to 8-turn, 6 inch diameter loop made up of insulated wire. Connect to generator terminals, and place about one foot from radio loop.  
NOTE 2: The tuning condenser can be set to the proper frequency for the oscillator adjustment as follows: Fully open the tuning gang and insert a .006 non-metallic shim between the heel of the rotor and the top of the stator plates. Close the gang sufficiently to hold the shim in place, and then remove the shim without disturbing the gang setting.

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BASE VIEW



## REPLACEMENT PARTS LIST

## CABINET PARTS — D-664, Code 124

Reference Symbol	Description	Service Part No.
C1	Condenser, tuning gang, D-664 and D-665, Code 124	31-2735-9
	D-665, Code 126	31-2735-6
C2	Condenser, temperature compensation, 7.5 mmf	30-1224-13
C3	Condenser, dual by-pass, .004/.004 mfd	30-1239
C4	Condenser, a-v-c by-pass, .05 mfd	30-4650-45
C5	Condenser, oscillator coupling, 47 mmf	62-047009001
C6	Condenser, filament by-pass, .22 mfd	30-4650-49
C7	Condenser, audio coupling, .001 mfd	30-1238-3
C8	Condenser, audio screen by-pass, .01 mfd	30-1238-2
C9	Condenser, dual, audio coupling, and grid by-pass, .007 mfd/220 mmf	30-1239-7
	Condenser, tone compensation, .004 mfd	30-4650-56
C10	Condenser, line by-pass, .047 mfd	30-4650-47
C11	Condenser, electrolytic, four section, 40/10/50/50	30-2585-1
C12	Condenser, neutralizing, 5 mmf	30-1230
CR1	Rectifier, selenium	34-8003-18
L1	Line Cord	41-3865-6
LA1	Antenna coil and bracket assy., D-664 and D-665, Code 124	76-9545
	Antenna Coil, D-665, Code 126	32-4455-13
LS1	Speaker	36-1654-3
R1	Resistor, IR5 filament shunt, 820 ohms	66-1828340
R2	Resistor, oscillator grid leak, 68,000 ohms	66-3688340
R3	Resistor, IR5 bias, 470 ohms	66-1478340
R4	Resistor, output bias, 470,000 ohms	66-4478340
R5	Resistor, screen dropping, 15,000 ohms	66-3158340
R6	Resistor, grid return, 3.3 megohms	66-5338340
R7	Resistor, avc filter, 2.2 megohms	66-5228340
R8	Volume Control, 1 megohm, D-664 and D-665, Code 124	33-5566-70
	D-665, Code 126	33-5566-60
R9	Resistor, 1st audio grid return, 4.7 megohms	66-5478340
R10	Resistor, 1st audio screen dropping, 4.7 meg-ohms	66-5478340
R11	Resistor, 1st audio plate load, 680,000 ohms	66-4688340
R12	Resistor, output grid return, 2.2 megohms	66-5228340
R13	Resistor, filament dropping, 2200 ohms	66-2228340
R14	Resistor, filament dropping, 1500 ohms	66-2158340
R15	Resistor, B+ filter, 820 ohms, 1W., D-664 and D-665, Code 124	66-1824340
	1800 ohms, 1W., D-665, Code 126	66-2184340
R16	Resistor, fusible, current limiting, 120 ohms (replace with this special part only), D-664 and D-665, Code 124	33-1334-19
	60 ohms, D-665, Code 126	33-1334-18
R17	Resistor, filament dropping, 1050/1050 ohms, D-664 and D-665, Code 124	33-3445-8
	1130/1130 ohms, D-665, Code 126	33-3445-7
R18	Resistor, bias, 220 ohms	66-1228340
R19	Resistor, filament dropping, 27 ohms	66-0278340
S1	Switch, off-on	Part of R8
S2	Switch, line-battery	42-2033
T1	Transformer, oscillator	32-4618
T2	Transformer, audio output	32-8434-1
Z1	Transformer, 1st IF	32-4583-1
Z2	Transformer, 2nd IF	32-4619

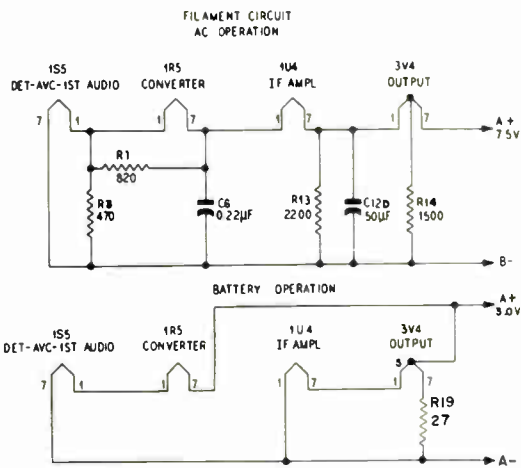
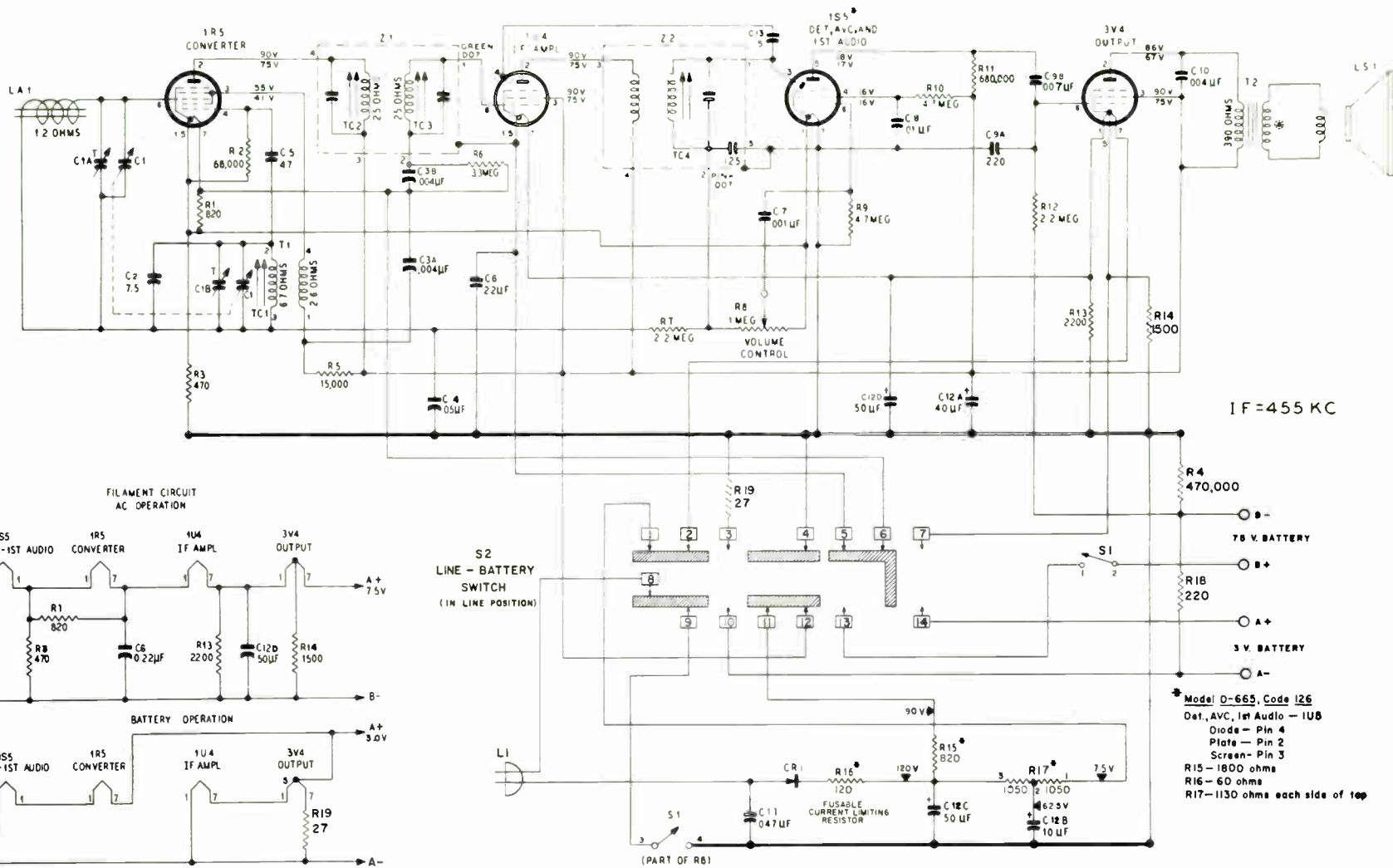
## MISCELLANEOUS PARTS

Description	Service Part No.
Bracket and spring, battery holder	76-9610
Cable, battery	41-3988-4
Fastener, wire mtg. (18)	28-2669-3
Interlock connector, A.C.	27-6240-3
Panel, printed wiring D-664 and D-665, Code 124	54-6124-1
D-665, Code 126	54-6124
Socket, tube, (104 and 1S5 or 1V5)	27-6296-11
Socket, tube, (1R5, 3V4)	27-6296-10
Spring, antenna mtg., D-665, Code 126 only (2)	28-10104
Spring, battery clamp	28-10767
Spring, contact, A +	28-10617-2
Tube shield (1U4 and 1S5 or 1U5) (2 used)	56-5629-12

Description	Service Part No.
Cabinet, two-toned green	11117
Grille	54-6127-8
Handle	54-5211-5
Knob, volume	54-6121-6
Knob, tuning	54-6121-7
Cabinet, two-toned gray	11117-1
Grille	54-6127-2
Handle	54-5211
Knob, volume	54-6121-10
Knob, tuning	54-6121-11
Cabinet, two-toned brown	11117-2
Grille	54-6127-7
Handle	54-5211-6
Knob, volume	54-6121-8
Knob, tuning	54-6121-9
Cabinet, Star Frost	11117-3
Grille	54-6127-10
Handle	76-9786
Knob, volume	54-6121-13
Knob, tuning	54-6121-12
Cabinet, Fiesta Red	11117-4
Grille	54-6127-11
Handle	76-9786-1
Knob, volume	54-6121-15
Knob, tuning	54-6121-14
Cabinet, Coral and Gray	11117-5
Grille	54-6127-12
Handle	76-9786-2
Knob, volume	54-6121-17
Knob, tuning	54-6121-16
Cabinet, Brown and Tan	11117-6
Grille	54-6127-13
Handle	76-9786-3
Knob, volume	54-6121-19
Knob, tuning	54-6121-18
Catch (2)	28-10621
Foot (4)	56-8765
Hinge (2)	28-10619
Strike (2)	1W24911FA3

## CABINET PARTS — D-665, Codes 124 and 126

Cabinet, Light Green, Code 124	11113
Grille	54-6127-5
Handle	54-5211-4
Knob, volume	54-6121-2
Knob, tuning	54-6121-3
Cabinet, Brown Alligator, Code 124	11113-1
Grille	54-6127-6
Handle	54-5211-3
Knob, volume	54-6121-4
Knob, tuning	54-6121-5
Cabinet, Light Green, Code 126	11113-2
Grille	54-6127-5
Handle	54-5211-4
Hinge, lid (2)	28-10417
Knob, volume	54-6121
Knob, tuning	54-6121-1
Knob, dial	54-6122
Cabinet, Star Frost	11113-3
Grille	54-6127-10
Handle	76-9786
Knob, volume	54-6121-13
Knob, tuning	54-6121-12
Cabinet, Fiesta Red	11113-4
Grille	54-6127-11
Handle	76-9786-1
Knob, volume	54-6121-15
Knob, tuning	54-6121-14
Catch	28-10621
Foot, light green and Star Frost (4)	56-8765
Foot, Fiesta Red and Brown Alligator (4)	56-8765-2
Hinge, lid (2) all colors — Code 124 only	76-9786-1
Hinge, front (2), all colors, both codes	28-10619
Lock, Star Frost and Red	28-10934
Lock, Green and Brown Alligator	28-10620
Mirror	54-5213
Clips, mirror mtg. (4)	28-10629
Strike	1W24911FA3



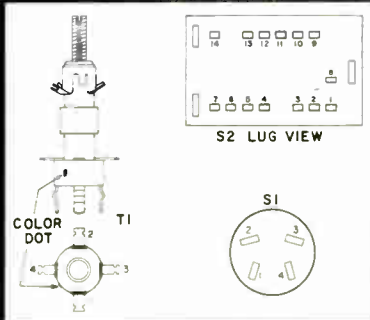
S2  
LINE - BATTERY  
SWITCH  
(IN LINE POSITION)

L1

(PART OF R8)

- \* Model D-665, Code 126
- Det., AVC, 1st Audio - 1U8
- Diode - Pin 4
- Plate - Pin 2
- Screen - Pin 3
- R15 - 1800 ohms
- R16 - 60 ohms
- R17 - 1130 ohms each side of top

**NOTES**  
VALUES-RESISTORS IN OHMS, CONDENSERS IN  $\mu$ F UNLESS OTHERWISE MARKED.  
⊙ LESS THAN 1 OHM.  
VOLTAGES MEASURED WITH A 20,000 OHMS-PER-VOLT METER FROM B-.  
TUBE VOLTAGES-TOP VOLTAGE WITH LINE SUPPLY, BOTTOM VOLTAGE WITH BATTERY.



**NOTES:**  
ALL RESISTOR VALUES IN OHMS AND ALL CONDENSER VALUES IN  $\mu$ F UNLESS OTHERWISE MARKED  
⊙ LESS THAN 1 OHM  
ALL VOLTAGES SHOWN WERE MEASURED WITH A 20,000 OHMS-PER-VOLT METER FROM POINTS INDICATED TO B-.

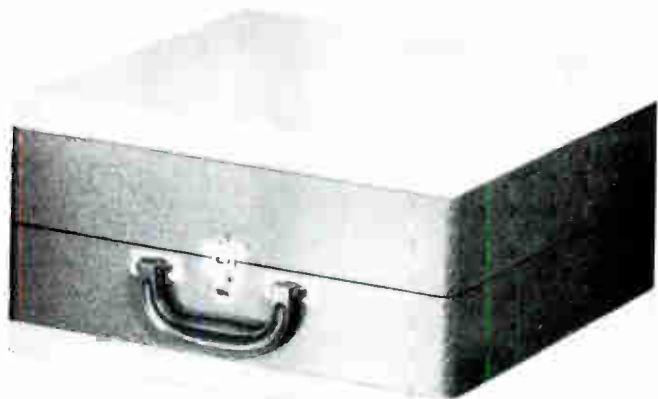
Schematic for Models D-664, D-665 - 124, D-665 - 126

# PHILCO HOME RADIO

PHONOGRAPH MODELS D-1337, D-1339, D-1344 and D-1346

**PHILCO**  
**Factory-Supervised**  
**Service**

**HOME RADIO**



Model D-1337



Model D-1339



Model D-1344

## SPECIFICATIONS

*Circuit* — Two tube amplifier plus rectifier.

*Audic Output* — 1.0 watt.

*Operating Voltage* — 105-125 volts, 60 cycles, A.C.

*Power Consumption* — 55 watts.

*Record Changer* — Model D-1337, first production uses M-24A; later production uses M-26.

Models D-1339, D-1344 and D-1346 use M-26. For service information on M-24A or M-26 refer to service manual PR-2178.

*Cabinets* — Leatherette covered wood portable.

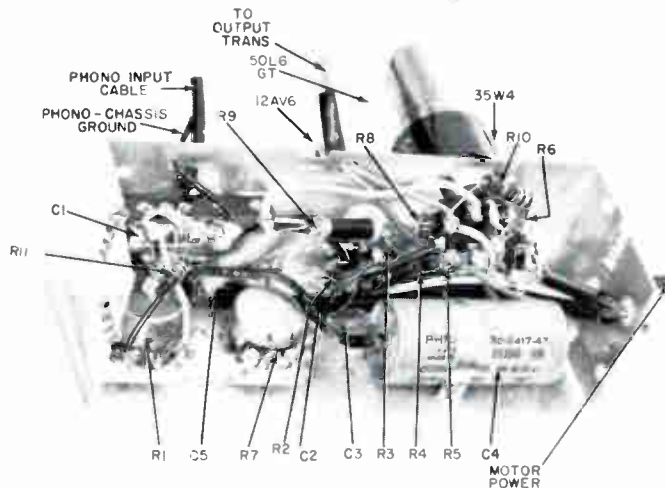
*Speakers* — Models D-1337 and D-1339, one 4" pm.

Model D-1344, two 4" pm.

Model D-1346, two 6" pm.



Model D-1346





# REPLACEMENT PARTS LIST

Reference Symbol	Service Part No.
C1	Condenser, B- to ground, .047 mfd, 400V ..... 30-4650-45
C2	Condenser, coupling, .01 mfd, ceramic disk ..... 30-1238-2
C3	Condenser, treble cut, .002 mfd, ceramic disk ..... 30-1238-8
C4	Condenser, electrolytic, filter, 2 section ..... 30-2417-47
C5	Condenser, coupling, .01 mfd, 400V ..... 30-4650-41
C6	Condenser, crystal isolating, .01 mfd ..... 30-4650-58
LS1	Speaker, Models D-1337 and D-1339, 1 used ..... 36-1654-5
	Model D-1344, 2 used ..... 45-9727
	Model D-1346, 2 used ..... 45-9735
R1	Volume Control and On-Off Switch, 1 megohm, Model D-1337 (no AC switch) ..... 33-5565-97
	Models D-1339, D-1344 and D-1346 ..... 33-5566-68
R2	Resistor, 1st audio grid return, 2.2 megohms ..... 66-5228340

Reference Symbol	Service Part No.
R3	Resistor, 1st audio grid bias, 1 megohm ..... 66-5108340
R4	Resistor, 1st audio plate lead, 100,000 ohms ..... 66-4108340
R5	Resistor, output grid return, 470,000 ohms ..... 66-4478340
R6	Resistor, output cathode bias, 150 ohms ..... 66-1158340
R7	Tone Control, 500,000 ohms, Model D-1337 ..... 33-5565-96
	Tone Control, 500,000 ohms, Models D-1339, D-1344 and D-1346 ..... 33-5565-81
R8	Resistor, filter, 4700 ohms ..... 66-2478340
R9	Resistor, tube saver ..... 33-1343-3
R10	Resistor, current limiting, 47 ohms, 1 watt ..... 66-0474340
R11	Resistor, bias boost, 470,000 ohms ..... 66-4478340
T1	Transformer, audio output ..... 322-0054
W1	Line Cord ..... 41-3821-20

## CABINET PARTS — D-1337

Description	Part No.
CABINET	
Bezel	28-11041
Catch	
Feet (4)	
Grille	
Hinge (2)	
Knob, Volume	54-4842-15
Knob, tone	54-4842-16
Lid Support	
Speed Nut, changer mounting, M-24A only (3)	W-2554
Spring, changer mounting, M-24A only, top (3)	56-7059
Spring, changer mounting, M-24A only, bottom (3)	56-7059-1

## CABINET PARTS — D-1344—Continued

Description	Part No.
Hinge (2)	28-10464
Lid Support	56-7947
Tapped Stud (4)	56-6296-1

## CABINET PARTS — D-1346

Cabinet, use for either 11110 or 11110-1 cabinet	11110
Bar, knob	28-10816
Catch (2)	28-10820
Feet 3/8" long (2)	56-8765
Feet, 5/8" long (4)	56-8765-2
Feet, 3/4" long (2)	56-8765-3
Grille	76-9491
Handle	54-5211-2
Hinge, top lid (2)	28-10464
Hinge, bottom (2)	28-10468
Knobs (2)	54-6157
Leg assembly, for 11110 cabinet only	76-9357
Leg assembly, for 11110-1 cabinet only	76-9740
Lid support, top lid	76-7947
Lid support, L.H. bottom	28-10423
Lid support, R.H. bottom	28-10423-1
Plunger, bottom leg lock	28-10625
Spring, bottom leg lock, plunger	28-10462
Strike plate	28-10626
Tapped stud (14)	56-6296-2

## CABINET PARTS — D-1339

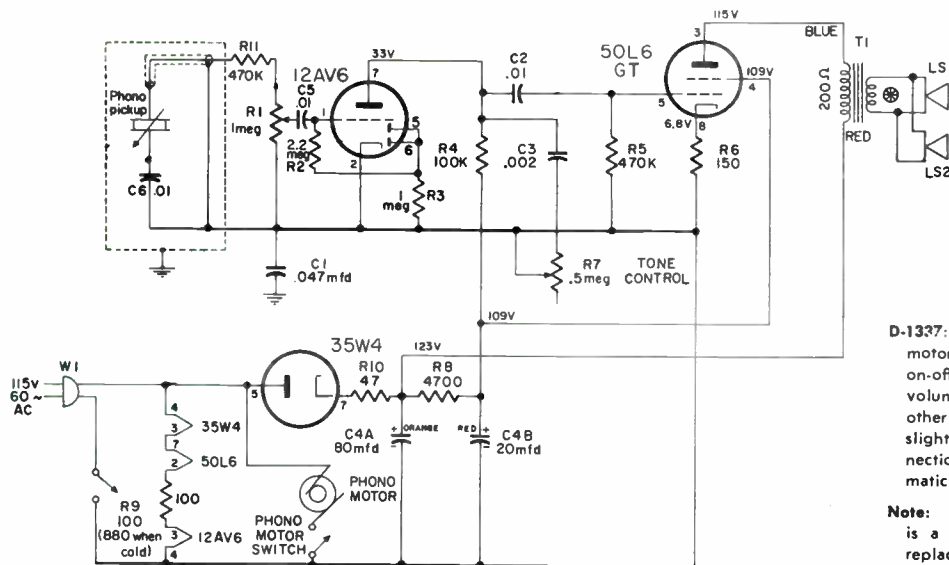
CABINET	11090-2
Catch, luggage	28-10418
Feet (2)	56-8765
Grille Assembly	76-9991
Hinge (2)	28-10464
Knobs (2)	27-4815-8
Lid Support	28-10457

## CABINET PARTS — D-1344

Cabinet, brown	11109-1
Grille, brown	76-9488-1
Handle, brown	54-5211-7
Knobs (2), brown	54-6157
Cabinet, black	11109
Grille, black	76-9488
Handle, black	54-5211
Knobs (2), black	54-6157-2
Bar, knob	28-10816
Catch (2)	28-10820
Feet (4)	56-8765
Feet, rubber (4)	54-4645-2

## MISCELLANEOUS PARTS

Clip, spindle mounting (2)	56-7634-2
Changer mounting hardware (M-26)	
Nuts (3)	W2564-9FE11
Screws (3)	28-10838
Springs (3)	28-10839
Lock, tone arm	28-10445
Socket, octal, 50L6GT	27-6305
Socket, 7 pin min., 12AV6	27-6294
Socket, 7 pin min., 35W4	27-6294-1
Spindle, 45 RPM adaptor	425-0010



**D-1337:** On this Model, the phono motor switch acts as the amplifier on-off switch. The switch on the volume control (as used in the other models) is omitted. This will slightly modify the AC cable connections as shown in the schematic and base view.

**Note:** In later production sets, R9 is a normal 100 ohms resistor. For replacement purposes, part number 33-1343-3 is still used.

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# PHILCO RECORD PLAYER

MODELS D-1331, D-1333 AND D-1335



HOME RADIO

## SPECIFICATIONS

CABINET.....	D-1331—Metal, D-1333 & D-1335—Wood (Plastic Covered)
CIRCUIT.....	One tube (plus Selenium Rectifier) Audio Amplifier
AUDIO OUTPUT.....	1 Watt
OPERATING VOLTAGES.....	105 Volts to 125 Volts, 60 cycle, o.c.
POWER CONSUMPTION.....	35 Watts at 117 Volts, 60 cycle, o.c.
PHILCO TUBE.....	25L6GT
MOTOR.....	90 Volts, 3 Speed (33 $\frac{1}{3}$ , 45 and 78 RPM.)

## REPLACEMENT PARTS LIST

REFERENCE SYMBOL	DESCRIPTION	SERVICE PART NO.
<b>(ELECTRICAL)</b>		
C1	Condenser, phono-coupling, .01 mfd.....	30-1238-2
C2	Condenser, isolation, .05 mfd.....	30-4650-45
C3	Condenser, electrolytic, 80-20 mfd/150V.....	30-2575-42
CR1	Selenium Rectifier.....	34-8003-23
LS1	Speaker.....	36-1654-4
R1	Volume Control, 500,000 ohms, plus switch.....	33-5566-69
R2	Resistor, cathode bias, 120 ohms.....	66-1128340
R3	Resistor, B + filter, 10,000 ohms.....	66-3108340
R4	Resistor, current limiting, 60 ohms.....	33-1334-18
T1	Transformer, audio output.....	32-8310-3
W1	Line Cord.....	L2183

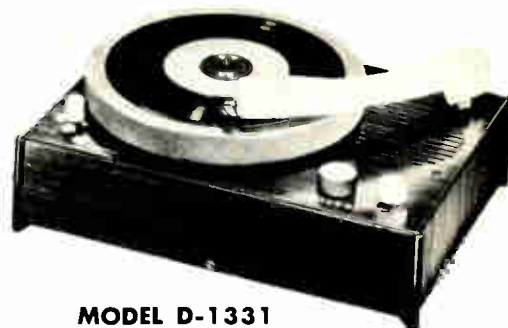
\*NOTE—Output transformer is mounted on speaker. Transformer listed may not fit all suppliers' speakers.

## (RECORD PLAYER)

Motor, 90 volts.....	35-1515
Idler Wheel, motor.....	76-9325
Tone Arm Assembly.....	35-2735
Cartridge and Needle assembly.....	425-0012
Needle, 78 RPM.....	325-0091
Needle, 33 $\frac{1}{3}$ and 45 RPM.....	325-0091-1
Pickup Knob and set screw.....	76-9380
Retaining Ring, tone arm.....	1W42296
Rest, tone arm, rubber.....	54-9672
Shaft Assembly, tone arm.....	76-9443
Spring, pickup detent.....	28-10461
Spring, needle pressure.....	28-10460
Spring, tone arm bushing.....	28-10376
Washer, tone arm.....	28-10377
Turntable.....	35-2734
45 RPM adaptor.....	54-6172
Spring, 45 RPM adaptor.....	28-10382

## (MISCELLANEOUS)

Model D-1331	
Corner trim, feet, 4 used.....	54-6183
Model D-1333	
Carrying case, Ginger.....	11122
Catch.....	28-10793
Feet, 4 used.....	56-8765
Handle.....	54-5210
Hinge, 2 used.....	28-10595
Model D-1335	
Carrying Case, antique white.....	11122-3
Caribbean Green.....	11122-2
Cork and Sierra Brown.....	11122-4
Patina Green.....	11122-1
Catch.....	28-10936
Feet, 4 used.....	56-8765
Handle, Antique White, Caribbean Green and Patina Green.....	54-5210-2
Handle, Cork and Sierra Brown.....	54-5210-3
Hinge, 2 used.....	28-10595
Knob, volume.....	54-4842-14
Socket, 25L6GT.....	27-6305



MODEL D-1331

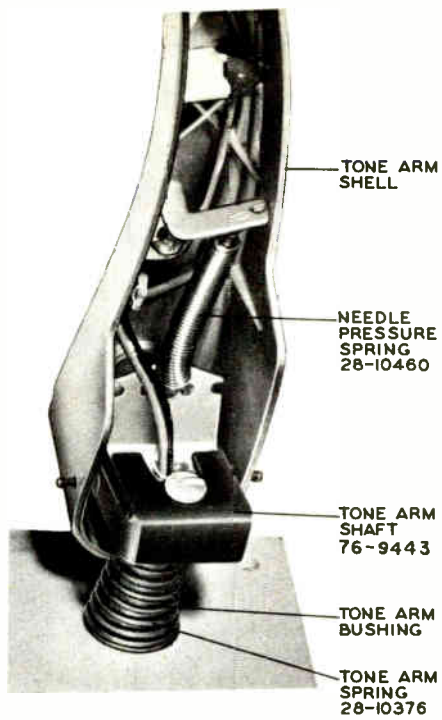


MODEL D-1333

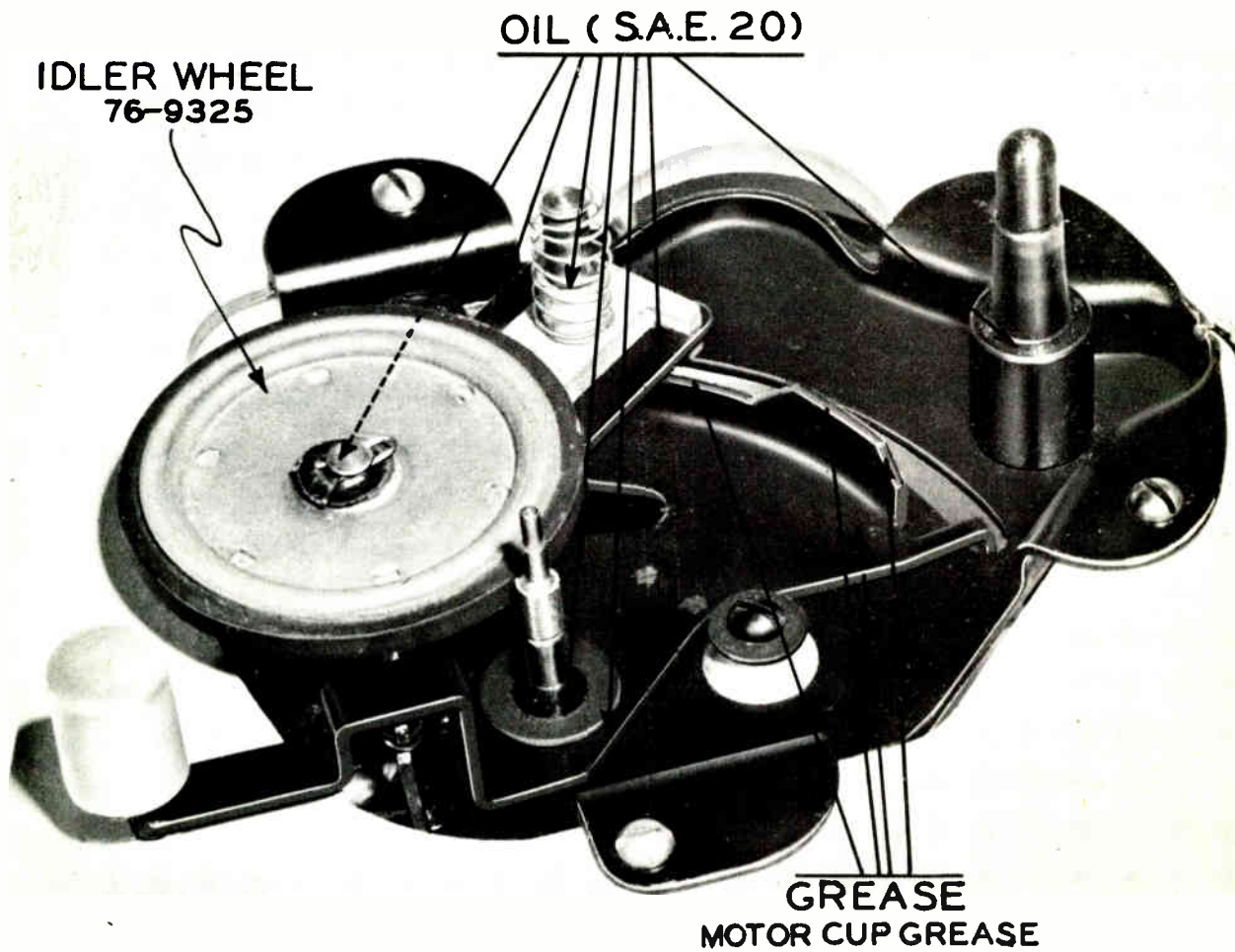


MODEL D-1335

PHILCO RECORD PLAYER MODELS D-1331, D-1333 AND D-1335 PR-2927



**FIGURE 1—Tone Arm Assembly Mounting**



**FIGURE 2—Lubrication**



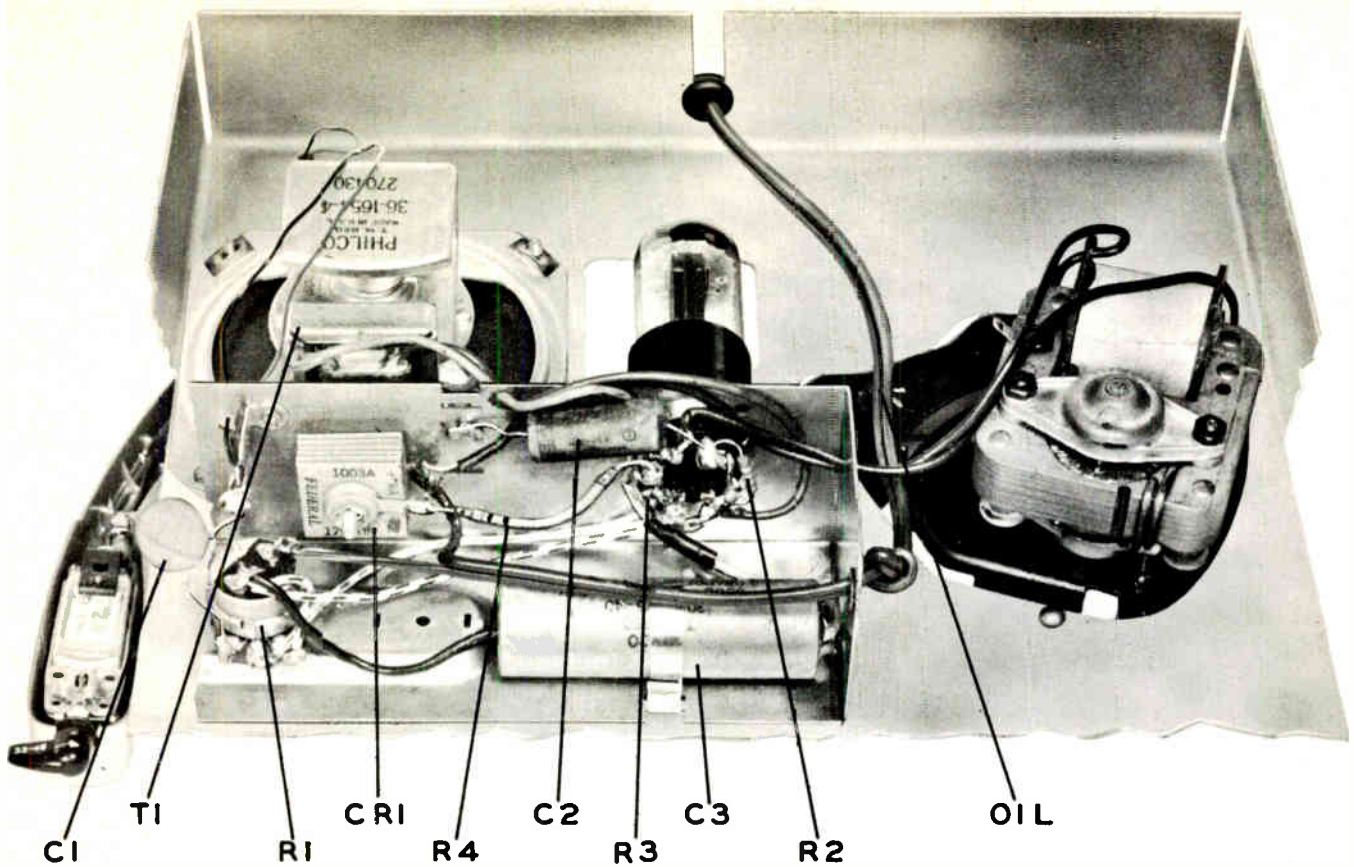
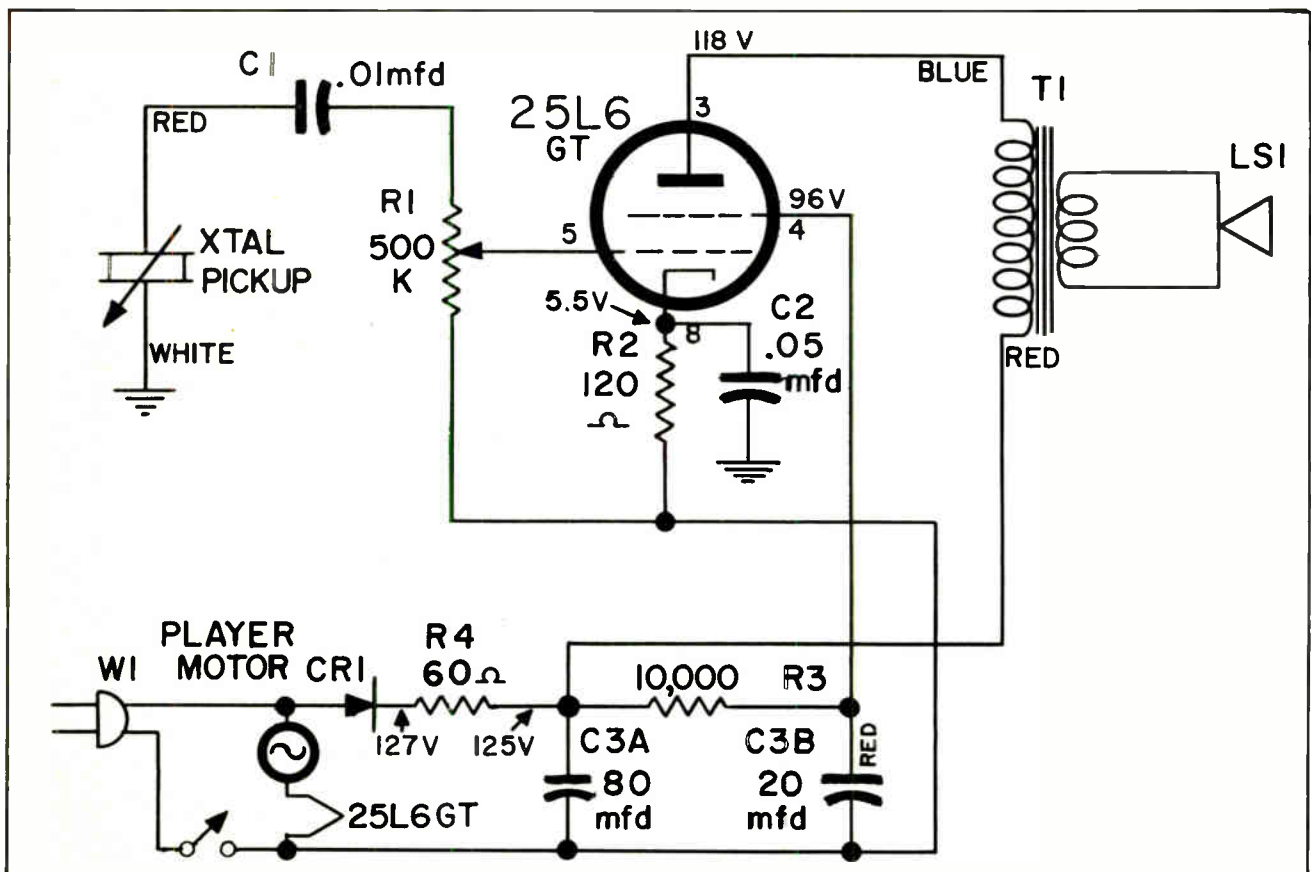


FIGURE 3—Base View, Components Layout



Schematic Diagram, Models  
D-1331, D-1333 and D-1335



# PHILCO

**PHILCO**  
**Factory-Supervised**  
**Service**

# SERVICE

## HOME RADIO

### SERVICE BULLETIN FOR PHILCO THREE-SPEED CUSTOM AUTOMATIC RECORD CHANGER M-25

#### CARTRIDGE AND NEEDLE CHANGE PROCEDURE

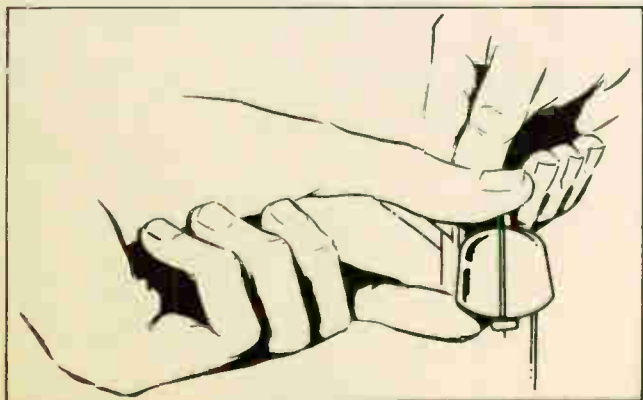
If loss of sensitivity, distortion, mistracking, or excessive record wear occur, the needle and cartridge should be checked and, if necessary, replaced.

Defective or worn needles may cause mistracking, distortion, and excessive record wear. Since most needles are composed of very hard, brittle materials, they are subject to chipping if carelessly handled. A chipped needle will act as a chisel and cut away the impressed variations in the record grooves, thereby destroying the record. This action is usually indicated by a deposit of fine dust on the surface of the record after the record has been played. A worn needle will sometimes result in mistracking and usually in the loss of the higher frequencies.

Occasionally poor connections to the cartridge contacts, corroded contacts, or defective leads may create the suspicion that the cartridge itself is defective. Therefore, check for these conditions before assuming that the cartridge must be replaced.

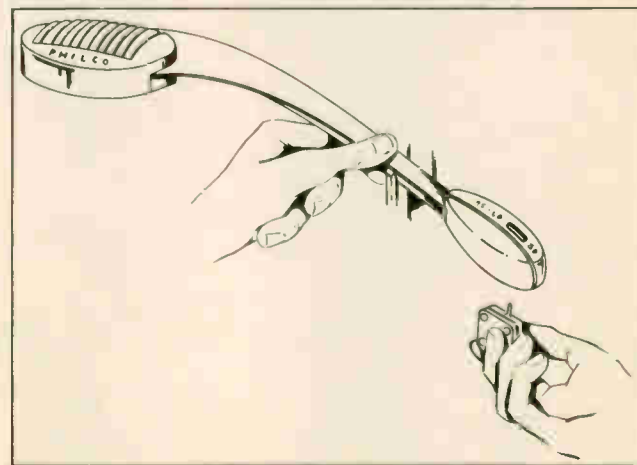
#### Cartridge Replacement

To replace a defective cartridge, or to exchange one type of cartridge for another, perform the following steps:



TP3-2852

Figure 1



TP3-2853

Figure 2

1. Hold the tone arm rigidly on the tone-arm rest with the right hand, and press the lower exposed side of the cartridge to the right with the forefinger of the left hand, as shown in figure 1. Then press downward lightly on the SELECTOR SWITCH in the top of the tone arm, using the thumb of the left hand, until the end of the switch lever disappears below the top surface of the tone-arm head. The cartridge can then be removed completely from underneath the head.

2. With the tone arm on the tone-arm rest, insert the cartridge into the head of the tone arm so that the guide channel (see figure 2) on the cartridge is facing inside, toward the turntable. Position the lever on the cartridge in the center of the tone-arm head, and gently push upward on the cartridge until it snaps into position.

When the cartridge is in the correct position, the lever will extend slightly above the head. When properly installed, the cartridge cannot be pushed out by pressure on the top of the lever.

The dual-needle cartridge, when properly installed, should move freely forward and backward to enable the selection of either Standard Play or Microgroove. The "Phonorama" cartridge is automatically locked into the 45-LP position when properly installed.

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The replacement dual-needle cartridge (dual needle included) may be ordered by Part No. 45-9785.

The replacement "Phonorama" cartridge ("Phonorama" needle included) may be ordered by Part No. 45-9792.

### Needle Replacement

To replace a needle in the cartridge, perform the following steps:

1. Remove the cartridge from the tone-arm head as explained above. (Do not attempt to replace the needle with the cartridge in the tone-arm head.)

2. Gently remove the needle by pulling straight out, using tweezers or a knife blade under the heel of the needle. See figure 3.

3. Before installing a new needle, observe that the keyway in the needle socket will allow the needle to be inserted only one way. See figure 4. After properly

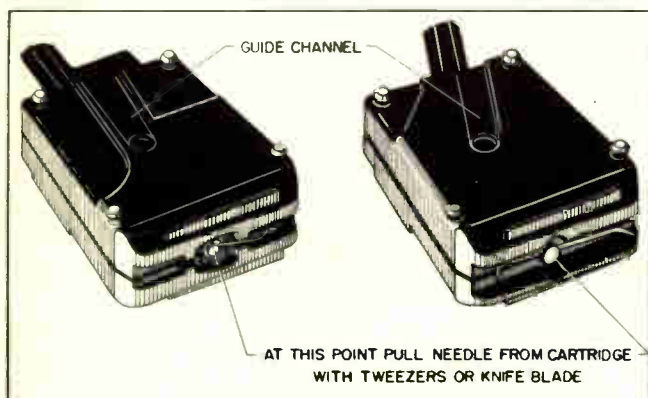


Figure 3

TP3-1357

aligning the needle, press on the shaft of the needle to seat it firmly in the cartridge.

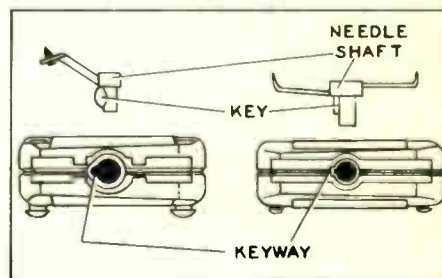
**CAUTION:** Do not press upon any part of the needle except the shaft. Also, do not twist or turn the needle in any way that may cause damage to the crystal within the cartridge.

The replacement dual needle may be ordered by Part No. 45-9784.

The replacement "Phonorama" needle may be ordered by Part No. 45-9793 for the Philco Sapphire-Tipped Needle, or Part No. 45-1993-1 for the Philco Diamond-Tipped Needle.

### PARTS LIST CHANGE FOR M-25 SERVICE MANUAL, PR-2557

The part number for lifter lever spring, Part No. 28-9626, should be changed to Part No. 28-9929. The part should be ordered by this new number.



TP9-192A

Figure 4

Mfg: Admiral Chassis No. 19F1A

Card No. AD19F1A-1

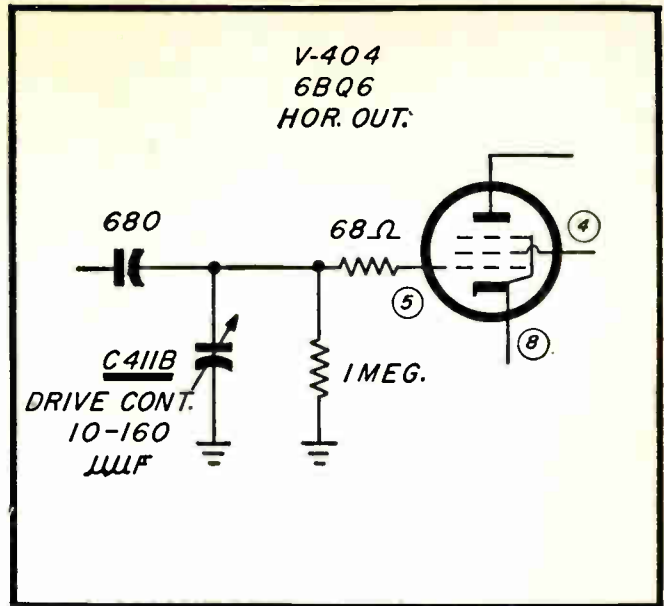
Section Affected: Raster

Symptom: No raster, no H.V.

Cause: Defective component.

What To Do:

Replace: C411B (10-160  $\mu\mu\text{f}$ ), which is shorted.



Mfg: Admiral Chassis No. 19F1A

Card No. AD19F1A-2

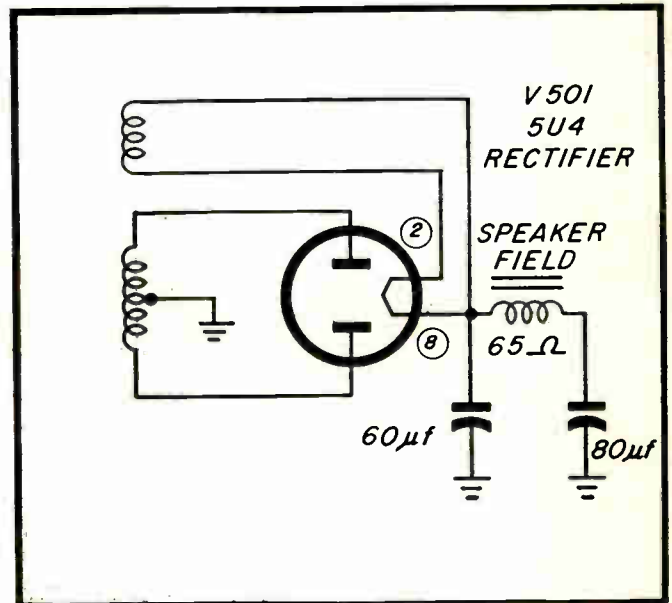
Section Affected: Raster and sound.

Symptom: No B+

Cause: Defective component.

What To Do:

Replace: Entire speaker; field is open.



Mfg: Admiral Chassis No. 19F1A

Card No. AD19F1A-3

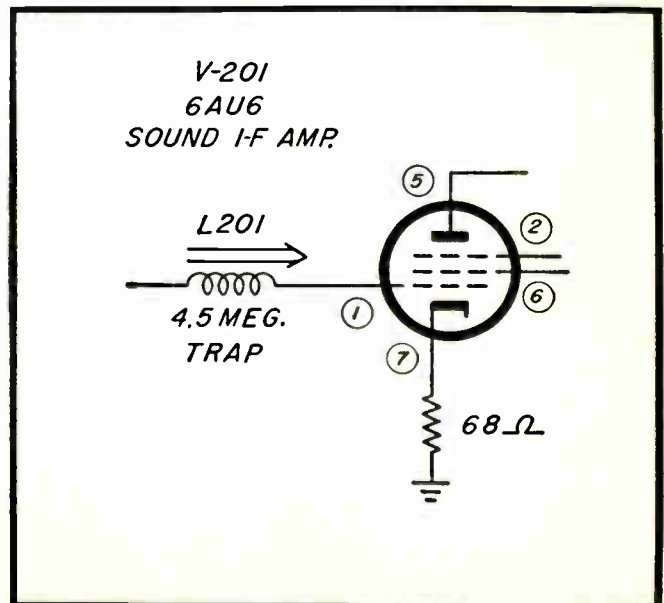
Section Affected: Sound.

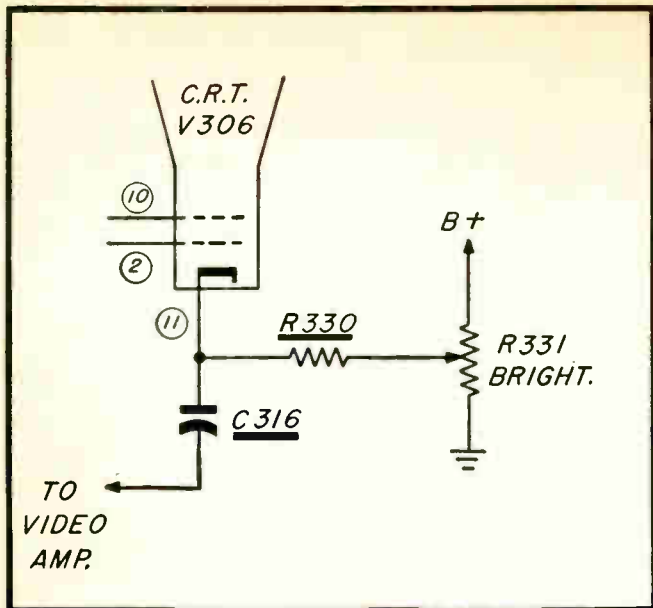
Symptom: No sound.

Cause: Defective component.

What To Do:

Repair or replace: L201 (4.5 mc trap) which is open.





Mfg: Admiral

Chassis No. 19FIA

Card No. AD19F1A-4

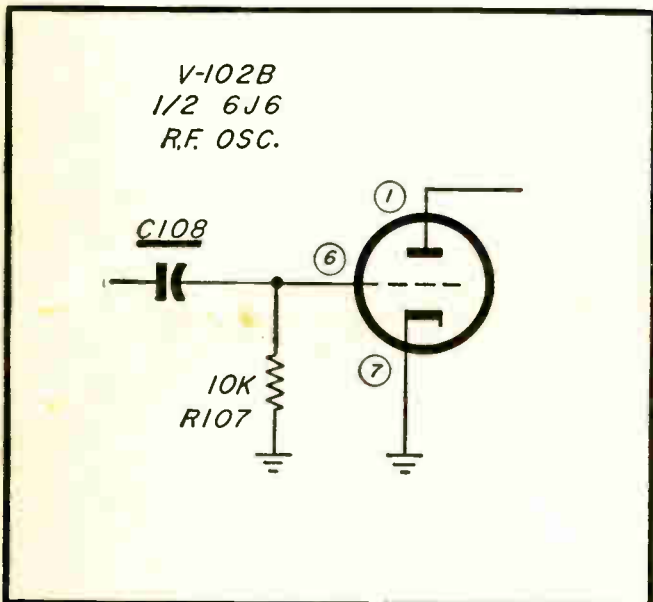
Section Affected: Pix.

Symptom: Not enough brightness.

Reason For Change: Modification to increase brightness.

What To Do:

Change: R330 (470K) to 180K; also C316 (.01 $\mu$ f) to .22  $\mu$ f.



Mfg: Admiral

Chassis No. 19FIA

Card No. AD19FIA-5

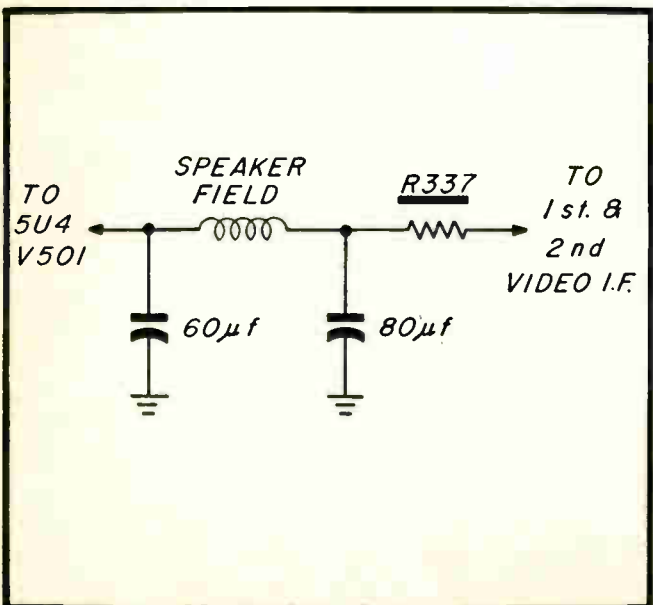
Section Affected: Pix

Symptom: Stations drift off frequency.

Cause: Defective component.

What To Do:

Replace: C108 (10  $\mu$ f), which has changed value.



Mfg: Admiral

Chassis No. 19FIA

Card No. AD19FIA-6

Section Affected: Pix and sound.

Symptom: No B+ to first and second video if.

Cause: Defective component.

What To Do:

Replace: R337 (4.5K), which is open.



Mfg: Admiral Chassis No. 19B1

Card No. AD 19B1-1

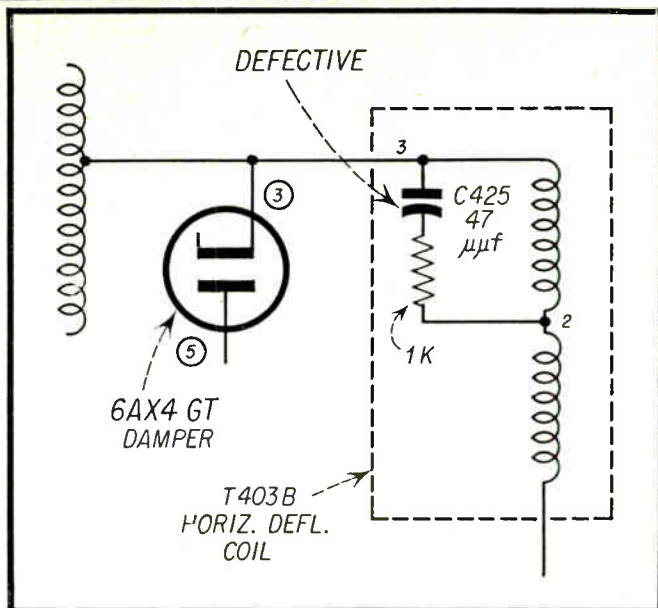
Section Affected: Pix and raster

Symptom: Ripples on left side of pix

Cause: Open yoke condenser

What to Do:

Replace: Open condenser C425, 47 uuf



Mfg: Admiral Chassis No. 19B1

Card No. AD 19B1-2

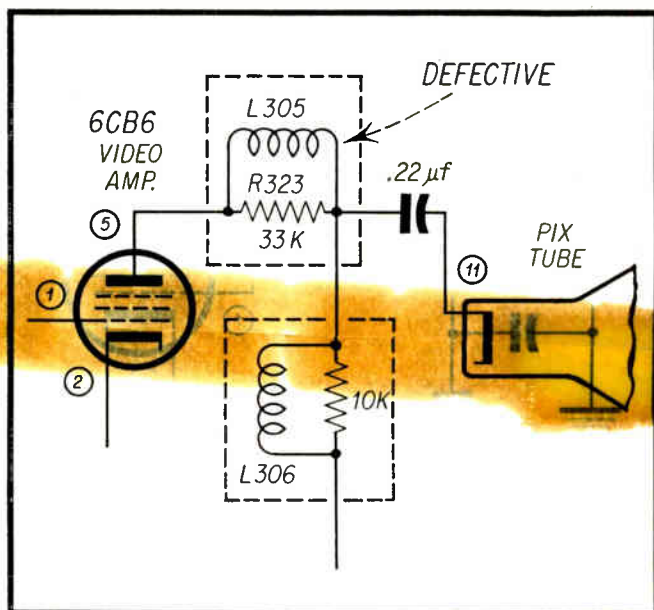
Section Affected: Pix

Symptom: Trailing ghosts in pictures

Cause: Defective peaking coil

What to Do:

Replace: Peaking coil L305



Mfg: Admiral Chassis No. 19B1

Card No. AD 19B1-3

Section Affected: Pix and sound

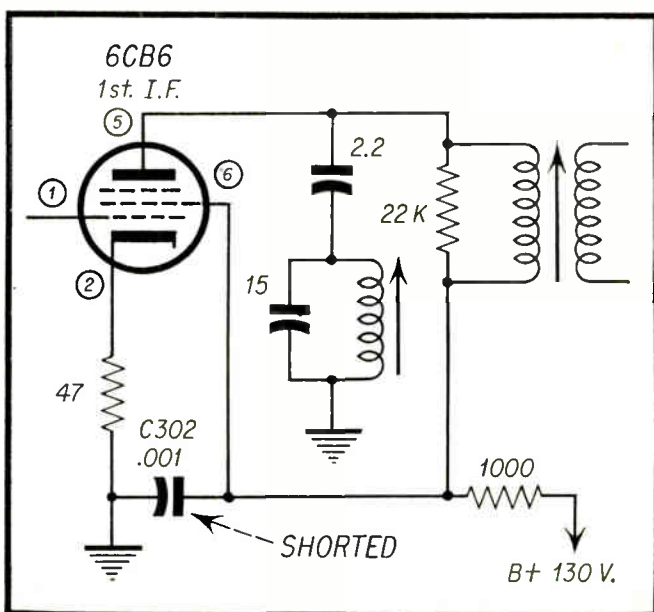
Symptom: No sound or picture

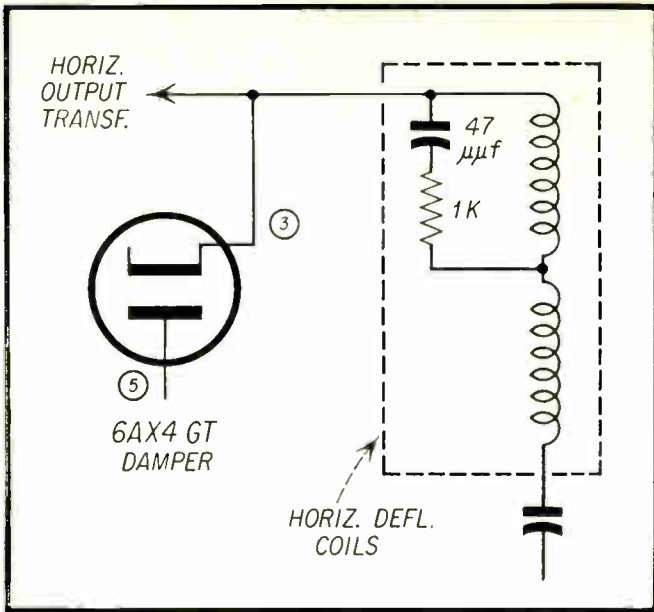
Cause: Shorted bypass condenser

What to Do:

Replace: C302, .001 uf condenser

Check: Associated resistors





Mfg: Admiral Chassis No. 19B1

Card No. AD 19B1-4

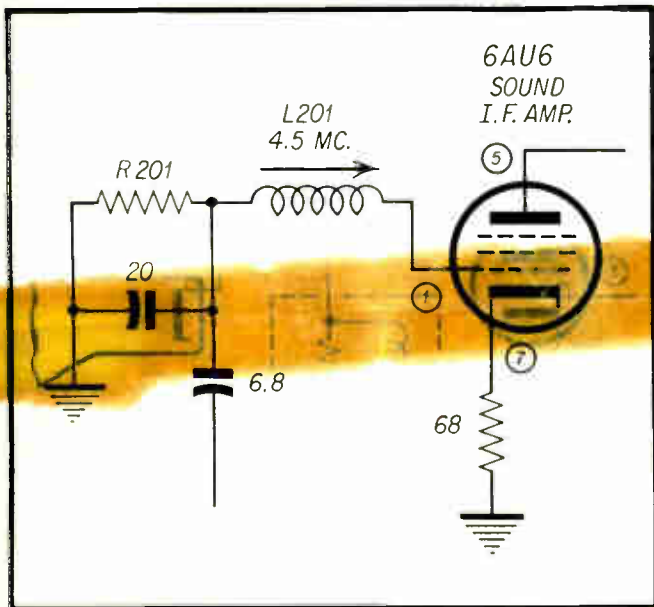
Section Affected: Raster

Symptom: Fold over on right side of raster

Cause: Defective horizontal deflection coils

What to Do:

Replace: Deflection yoke, T403



Mfg: Admiral

Chassis No. 19B1

Card No. AD 19B1-5

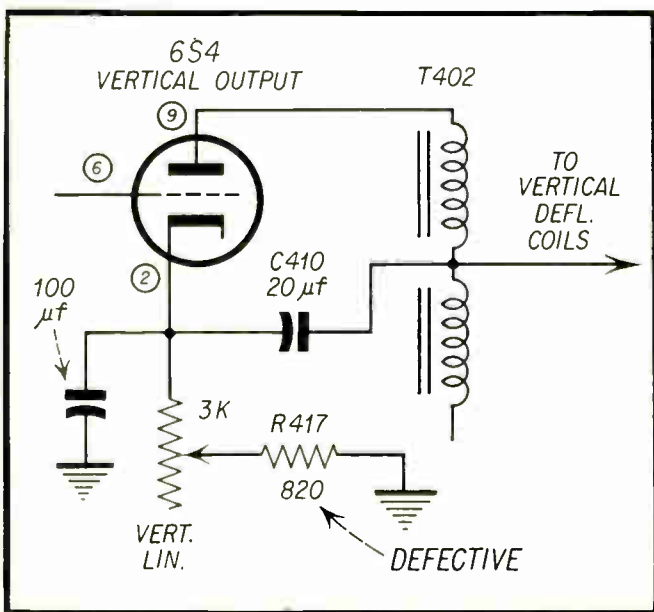
Section Affected: Sound

Symptom: Buzz in Audio

Cause: Defective tuning core in sound take-off coil

What to Do:

Replace: Sound take-off coil if another core is not available



Mfg: Admiral

Chassis No. 19B1

Card No. AD 19B1-6

Section Affected: Raster

Symptom: Vertical linearity compressed at top of pix

Cause: Increased resistor value

What to Do:

Replace: Resistor R417 820 ohms

Mfr: Admiral Chassis No. 17XP3

Card No: AD 17XP3-1

Section Affected: Pix

Symptom: Blooming when brightness control is advanced.

Reason for Change: To improve high voltage regulation.

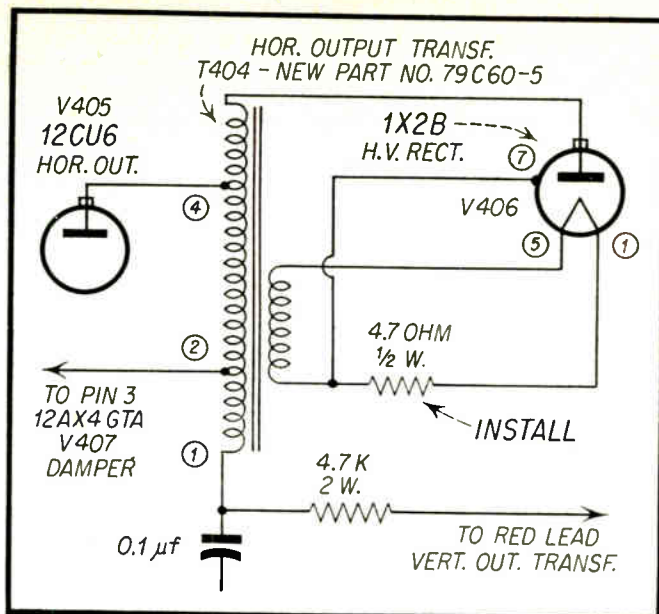
Note: This change is included in all 17XP3 receivers starting with Run 2.

What to Do:

Replace: Horizontal Out. Trans. part No. 79C60-4, having a 1-turn filament winding for 1X2B with part No. 79C60-5 having a 2-turn winding.

Connect: 4.7 ohm, 1/2 W resistor in series with 1X2B filament leads.

Note: Before replacing transformer try another 1X2B.



Mfr: Admiral Chassis No. 17XP3

Card No: AD 17XP3-2

Section Affected: Pix

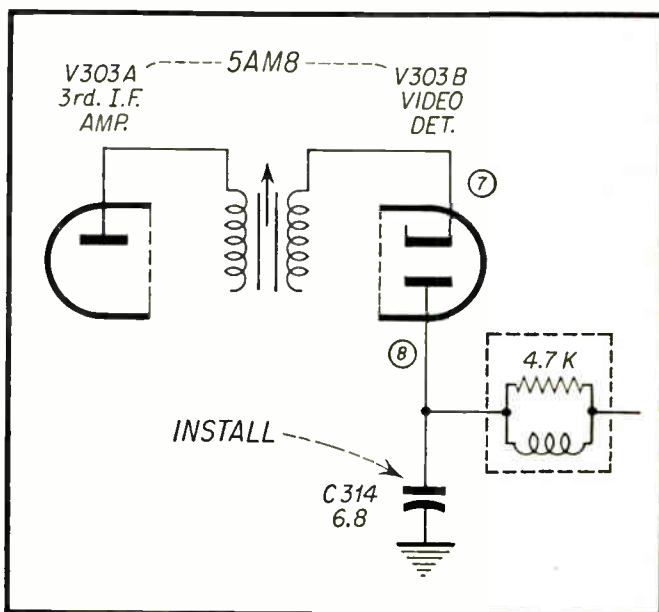
Symptom: RF interference (rotating "bars" on Channel 5).

Cause: 3rd harmonic if radiation at certain settings of fine tuning control usually under weak signal conditions.

Note: This change is included in all 17XP3 receivers starting with Run 2.

What to Do:

Connect: Capacitor—C314 (6.8 μf ceramic, part No. 65B28-068) from pin 8 of V303-5AM8 to chassis ground.



Mfr: Admiral Chassis No. 17XP3

Card No: AD 17XP3-3

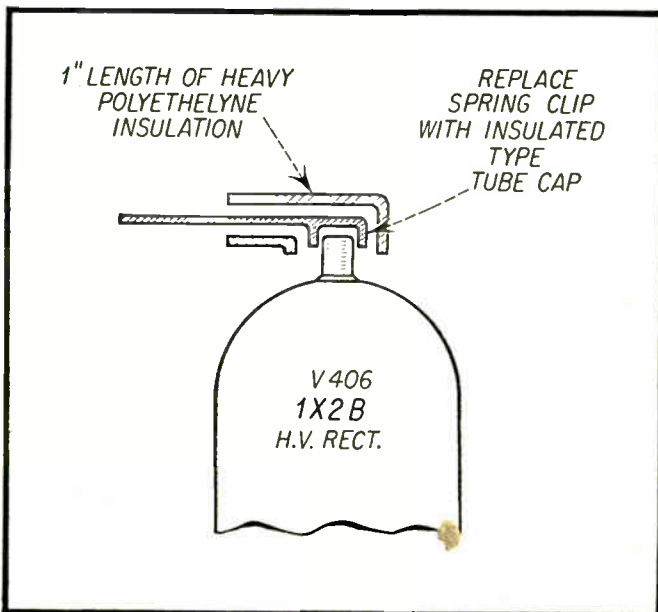
Section Affected: High voltage.

Symptom: Corona discharge present at cap of 1X2B.

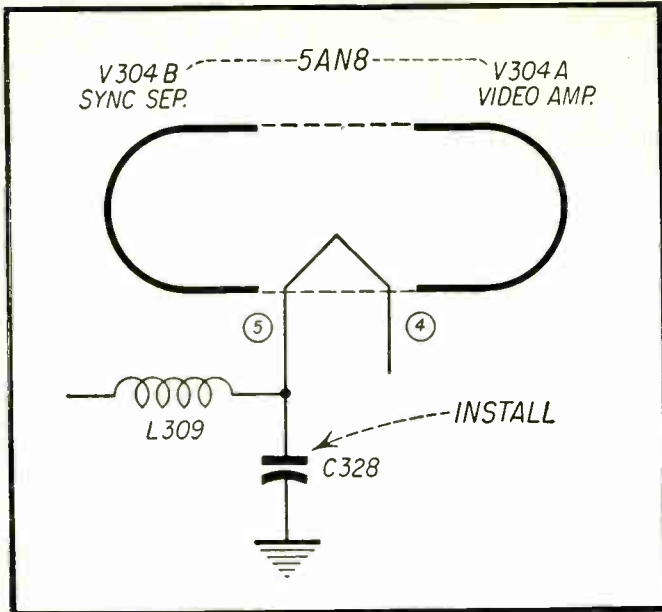
Reason for Change: Reduce corona discharge. Note: This change included in later production models.

What to Do:

Replace: Spring type clip with insulated type tube cap. Also, slip one inch length of heavy polyethylene tube over tube cap.







Mfr: Admiral Chassis No. 17XP3

Card No: AD 17XP3-4

Section Affected: Pix

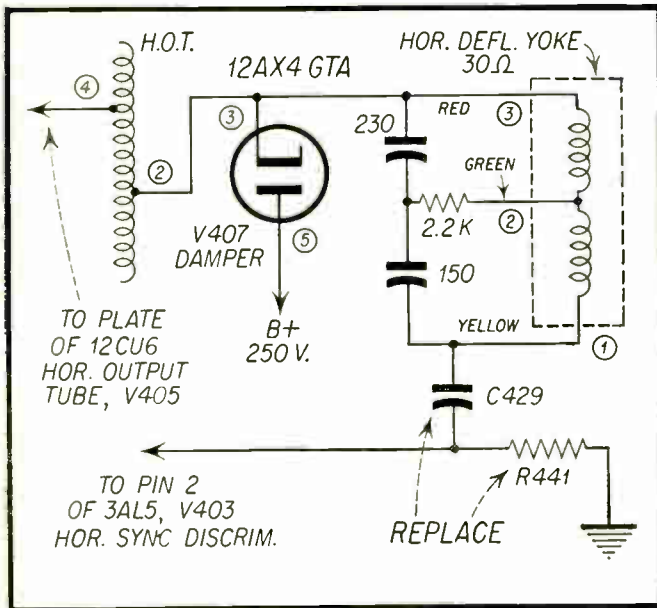
Symptom: Unstable Pix

Cause: IF Regeneration.

Note: This change is included in all 17XP3 receivers starting with Run 5.

What to Do:

Install: C328 (.005  $\mu$ f—450V ceramic—part number 65C10-5) between junction of pin 5—V304 (5AN8) and chassis ground.



Mfr: Admiral Chassis No. 17XP3-17SX3

Card No: AD 17XP3-5

Section Affected: Raster and possibly sound.

Symptom: No raster, sound may or may not be present. 12AX46TA Damper gets red hot; R441 burns up; horizontal deflection yoke overheats or burns up.

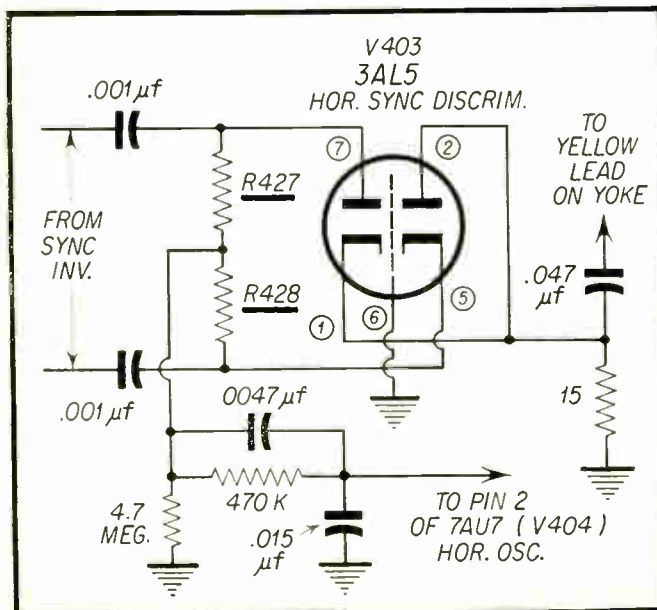
Cause: Shorted horizontal sweep by-pass condenser.

Note: This condenser was increased from a 600V to a 1000V rating in all 17XP3 chassis beginning with Run 9 and all 17SX3 chassis beginning with Run 5.

What to Do:

Replace: C429 (.047  $\mu$ f—600 V) with .047  $\mu$ f—1000 V condenser. Also, R441—15 ohm 1 W with 15 ohm 2 W resistor.

Note: Some early production receivers employ two .1  $\mu$ f—600 V condensers in series, which is OK.



Mfr: Admiral

Card No: AD 17XP3-6

Section Affected: Sync

Symptom: Horizontal frequency out of range. When V403-3AL5, the horizontal sync discriminator, is removed, horizontal frequency, though out of sync, comes back into range.

Cause: Discriminator load resistor changed in value.

What to Do:

Replace: R427 or R428 (100K—5%).

**Mfr:** Arvin                      **Chassis No.** TE 276

**Card No:** AR276-1

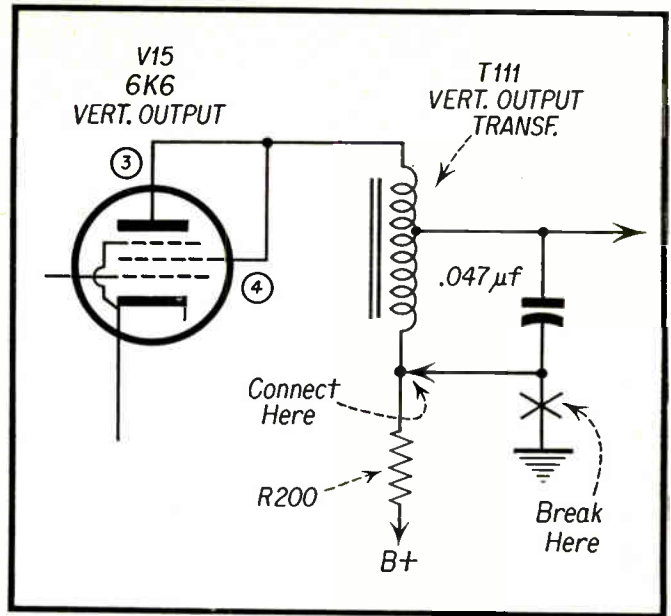
**Section Affected:** Sound

**Symptom:** Buzz in speaker with volume control at minimum

**Reason for Change:** Reduce vertical sync pickup through chassis

**What to Do:**

Remove: Ground side of C178 and connect to junction of T-111 and R200 (1K)



**Mfr:** Arvin                      **Chassis No.** TE 276

**Card No:** AR276-2

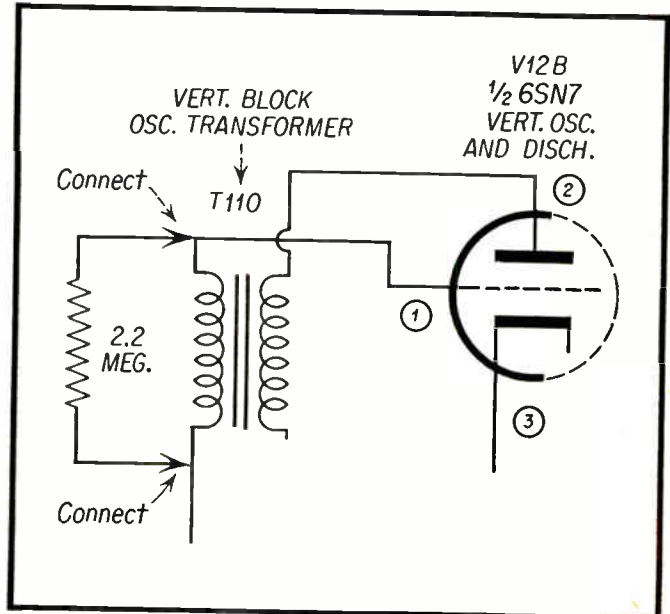
**Section Affected:** Sync

**Symptom:** White horizontal band at top of pix, and touchy vertical hold

**Reason for Change:** Damp out parasitics

**What to Do:**

Add: 2.2 meg resistor across primary of T110 (vertical blocking oscillator transformer)



**Mfr:** Arvin                      **Chassis No.** TE 276

**Card No:** AR276-3

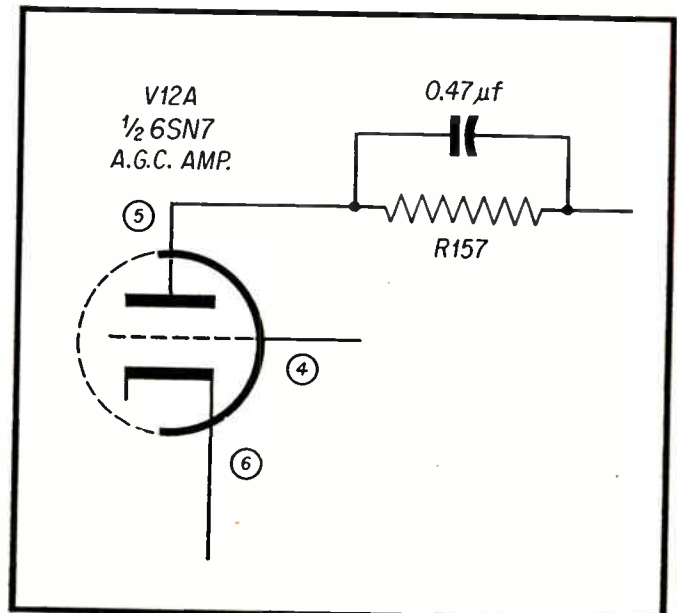
**Section Affected:** Sound

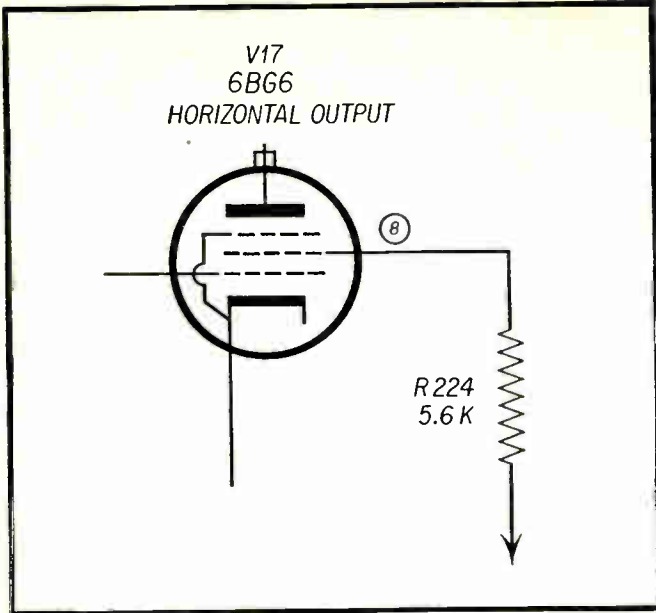
**Symptom:** Buzz in sound on strong signals

**Reason for Change:** Circuit improvement

**What to Do:**

Replace R157 (120K) with 75K resistor





Mfr: Arvin

Chassis No. TE 276

Card No: AR276-4

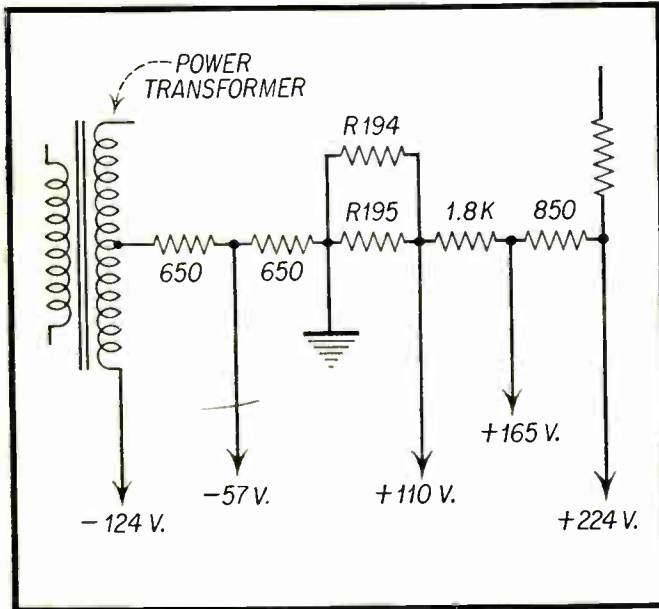
Section Affected: Raster

Symptom: Intermittent high voltage — R224 (5.6K) overheats

Cause: Resistor overloads

What to Do:

Replace: R224 (5.6K-2W) with 5.6K-5W



Mfr: Arvin

Chassis No. TE 276

Card No. AR276-5

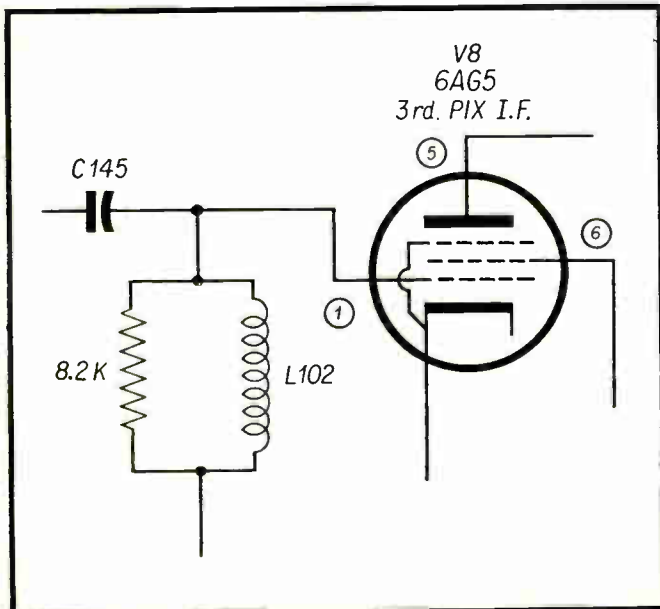
Section Affected: Sync

Symptom: Poor horizontal and vertical sync and age

Cause: Resistors increase in value

What to Do:

Replace: R194 and R195 (both 6.8K)



Mfr: Arvin

Chassis No. TE 276

Card No: AR276-6

Section Affected: Pix

Symptom: Video overload on normal contact control setting

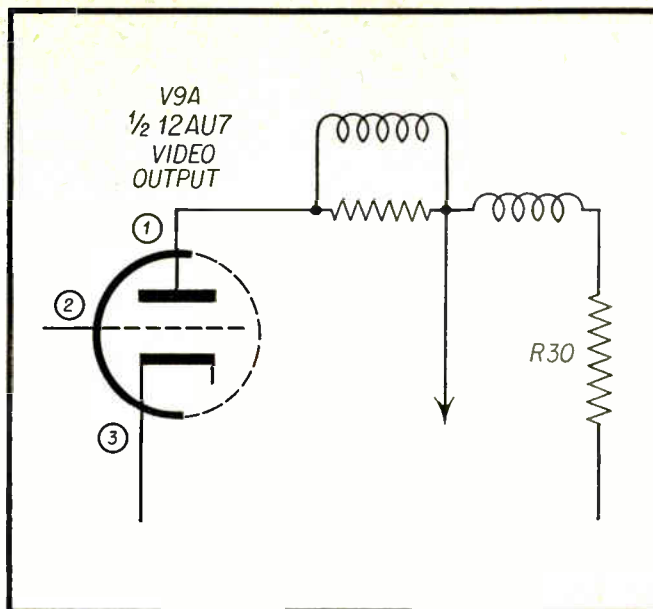
Cause: Leaky coupling condenser

What to Do:

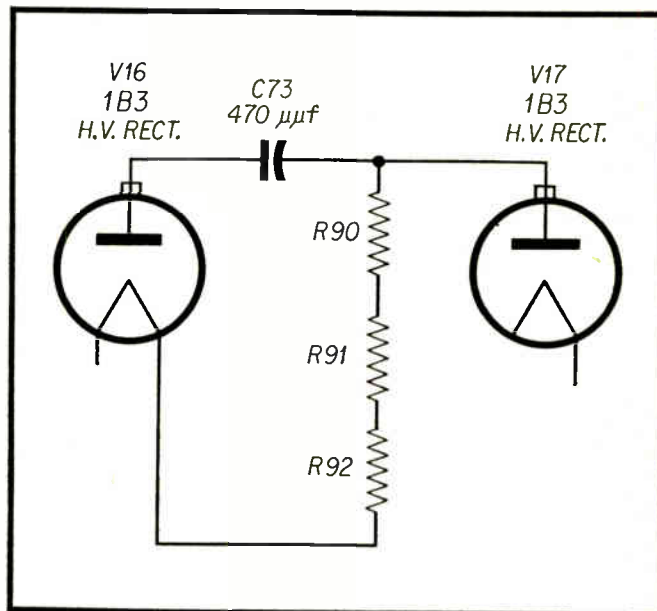
Replace: C145 (33  $\mu$ f)



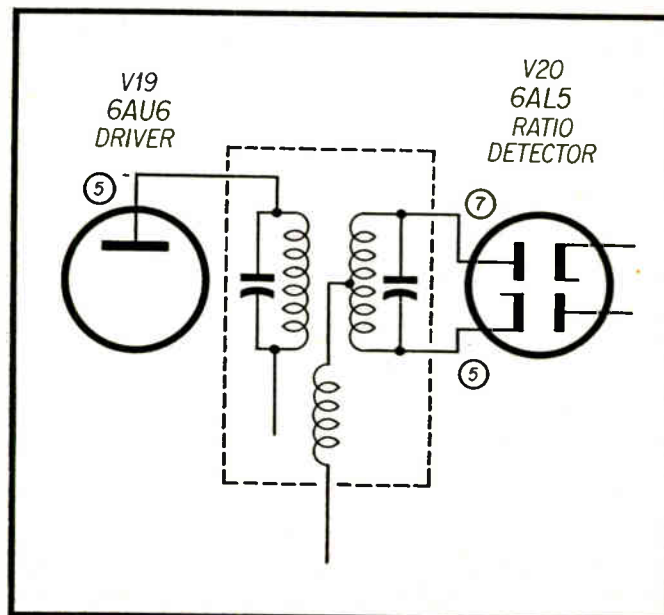
**Mfr:** Andrea      **Model No.** T-VL16  
**Card No:** ANVL16-1  
**Section Affected:** Pix  
**Symptom:** Pix smeared and weak  
**Cause:** Plate load resistor increased in value  
**What to Do:**  
 Replace: R30 (3.3K)

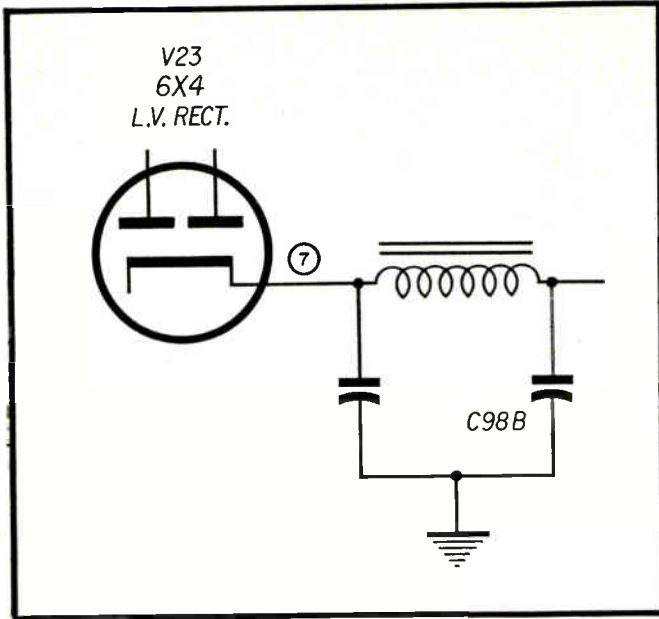


**Mfr:** Andrea      **Model No.** T-VL16  
**Card No:** ANVL16-2  
**Section Affected:** Raster  
**Symptom:** Blooming  
**Cause:** High voltage string resistors increase in value  
**What to Do:**  
 Replace: R90, R91, R92 (all 470K)

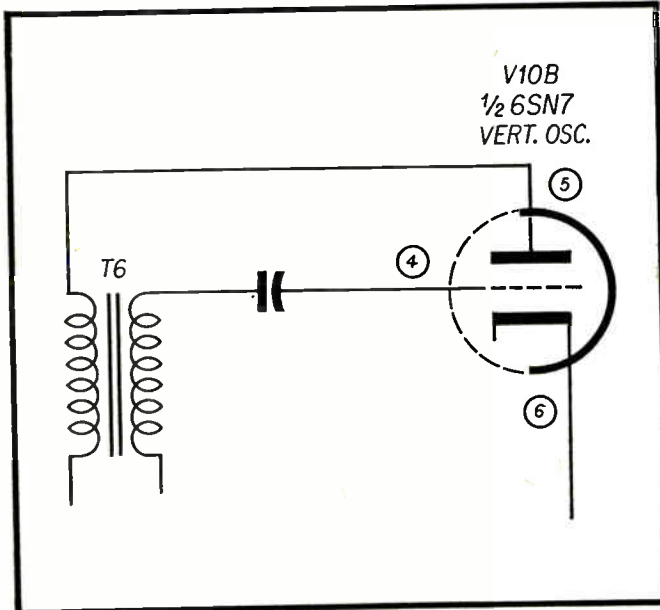


**Mfr:** Andrea      **Model No.** T-VL16  
**Card No:** ANVL16-3  
**Section Affected:** Sound  
**Symptom:** Noise in sound  
**Cause:** Sound discriminator transformer shorts intermittently  
**What to Do:**  
 Replace: Sound discriminator transformer

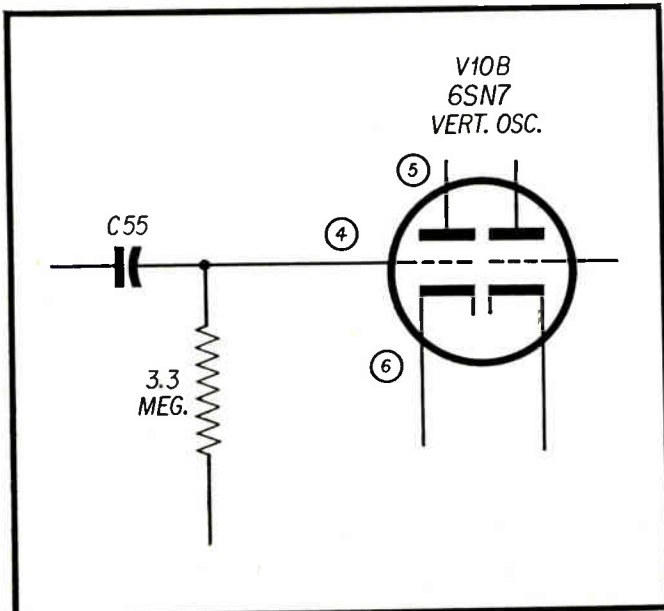




Mfr: Andrea                      **Model No. T-VL16**  
 Card No: ANVL16-4  
**Section Affected:** Sound  
**Symptom:** Loud hum in sound  
**Cause:** Open or leaky output filter condenser  
**What to Do:**  
 Replace: C98B (30  $\mu$ f)



Mfr: Andrea                      **Model No. T-VL16**  
 Card No: ANVL16-5  
**Section Affected:** Raster  
**Symptom:** No vertical sweep  
**Cause:** Shorted primary to secondary of vertical blocking transformer  
**What to Do:**  
 Replace: T6 vertical blocking transformer



Mfr: Andrea                      **Model No. T-VL16**  
 Card No: ANVL16-6  
**Section Affected:** Sync  
**Symptom:** Horizontal frequency drift  
**Cause:** Leaky coupling condenser  
**What to Do:**  
 Replace: C55 (.002  $\mu$ f)

Mfr: Capehart Chassis No. CX-38S

Card No: CA 38-1

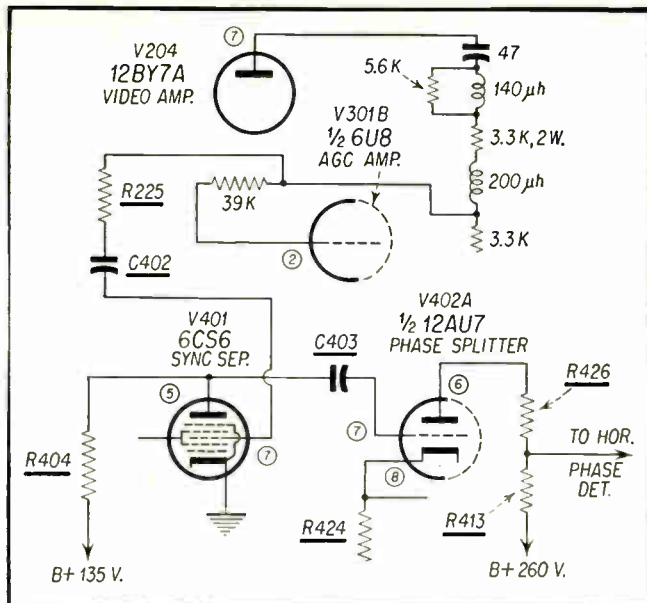
Section Affected: Sync

Symptom: No horizontal or vertical sync

Cause: Defective sync component

**What to Do:**

- 1—Check by substitution: 6CS6 (V401) sync separator; also, 12AU7 (402) phase splitter; also, C402 (1500  $\mu\text{f}$ ) ceramic and C403 (.047  $\mu\text{f}$ —600 V tubular)
- 2—Check by measurement: R225 (10K), R404 (560K), R424 (3.9K), R426 (10K), R413 (3.9K)



Mfr: Capehart Chassis No. CX-38S

Card No: CA 38-2

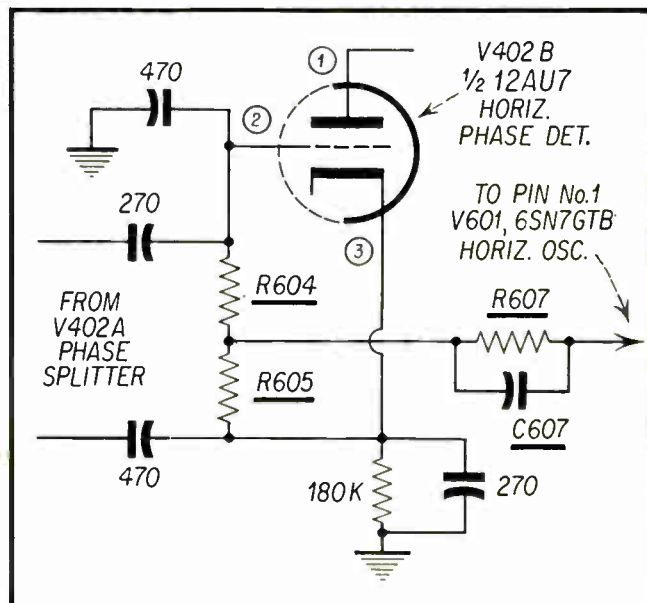
Section Affected: Sync

Symptom: Jittery horizontal sync

Cause: Defective phase detector component

**What to Do:**

- Check by substitution: 12AU7 (V402B) phase detector; also, C607 (.0022  $\mu\text{f}$ —200 V)
- Check by measurement: R604 (82K), R605 (82K), R607 (2.2 meg)



Mfr: Capehart Chassis No. CX-38S

Card No: CA 38-3

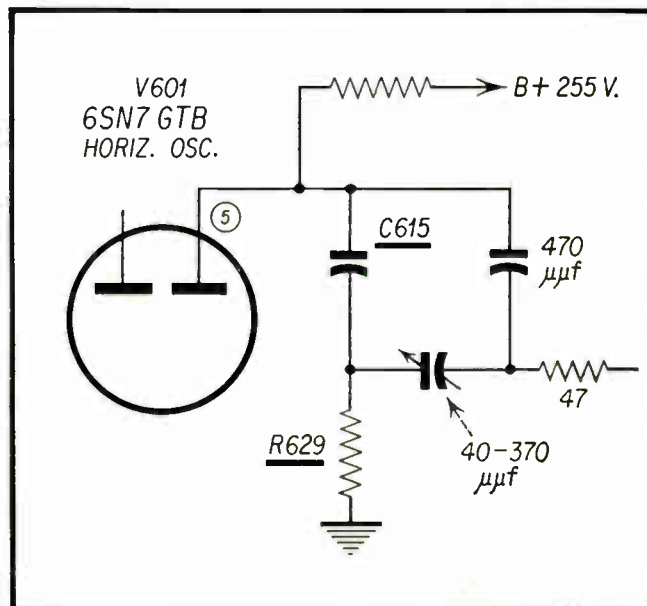
Section Affected: Sync

Symptom: Three overlapping pictures (horizontal oscillator frequency too high)

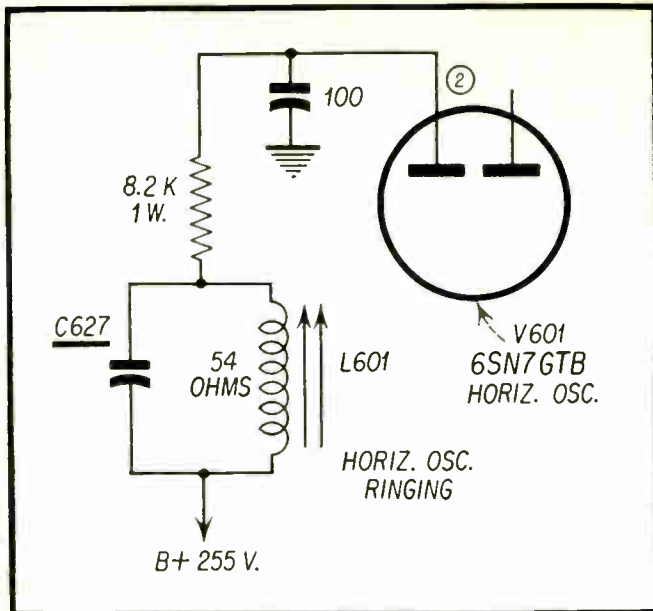
Cause: Defective horizontal oscillator circuit component

**What to Do:**

- Check by substitution: 6SN7 (V601) horizontal oscillator; also C615 (330  $\mu\text{f}$ )
- Check by measurement: R629 (10K)







Mfr: Capehart Chassis No. CX-38S

Card No: CA 38-4

Section Affected: Sync

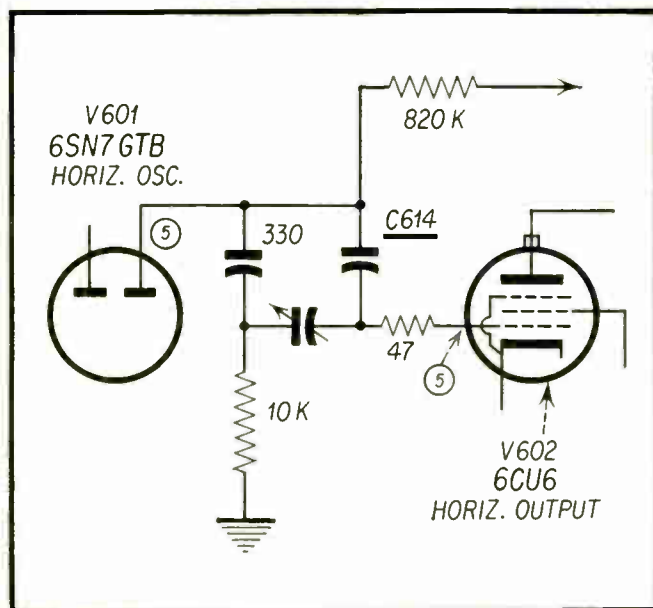
Symptom: Tearing at top of pix

Cause: Open capacitor or misadjustment of Horizontal Osc., AGC or Pix Lock Control

What to Do:

Check adjustment of: Horizontal Oscillator, AGC and Pix Lock Control

Check by substitution: C627 (4700  $\mu\text{f}$ )



Mfr: Capehart

Chassis No. CX-38S

Card No: CA 38-5

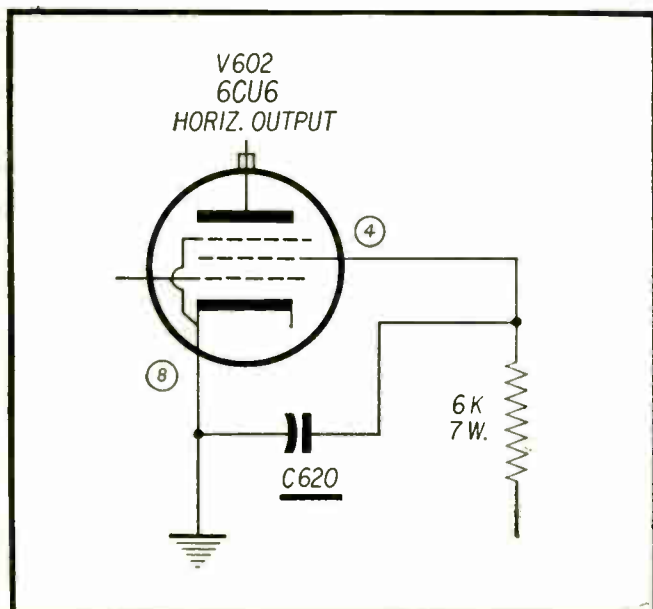
Section Affected: Pix

Symptom: Insufficient horizontal sweep with foldover on right side

Cause: Leaky condenser

What to Do:

Replace: C614 (470  $\mu\text{f}$ )



Mfr: Capehart

Chassis No. CX-38S

Card No: CA 38-6

Section Affected: Pix

Symptom: Horizontal foldover in center of pix

Cause: Leaky condenser

What to Do:

Replace: C620 (.047  $\mu\text{f}$ —400 V tubular cond)

Mfr: Crosley Chassis No: 402, -1, -2, -3, etc.

Card No: CR 402-1

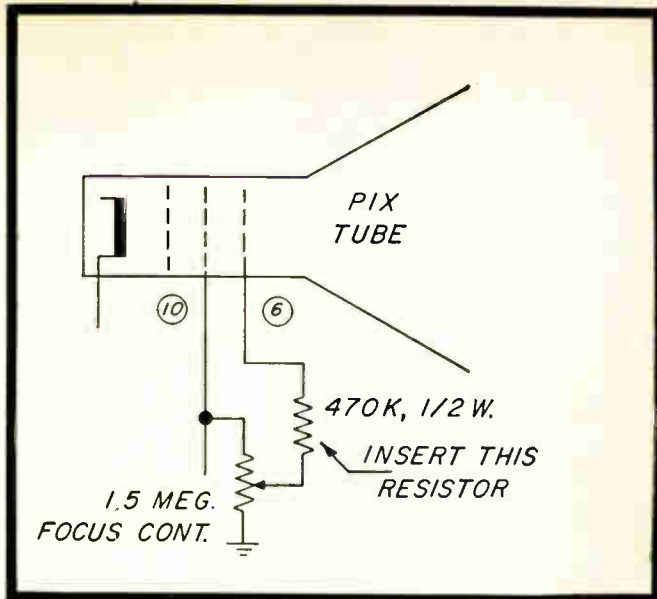
Section Affected: Pix and Raster.

Symptom: Arcing at focus control.

Reason for Change: Circuit modification (This is a manufacturer's circuit change).

What to do:

Connect: 470K, 1/2 watt resistor between center tap of focus control and pin 6 of picture tube.



Mfr: Crosley Chassis No. 402, -1, -2, -3, etc.

Card No: CR 402-2

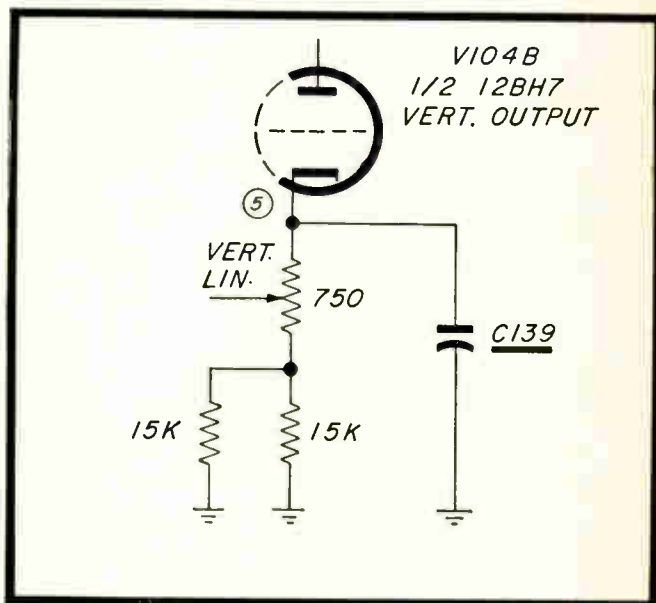
Section Affected: Pix and raster.

Symptom: Horizontal line on screen.

Cause: Component failure. Cathode bypass condenser has shorted.

What to do:

Replace: C139 (.005  $\mu$ f, 500 V. ceramic).



Mfr: Crosley Chassis No. 402, -1, -2, -3, etc.

Card No: CR 402-3

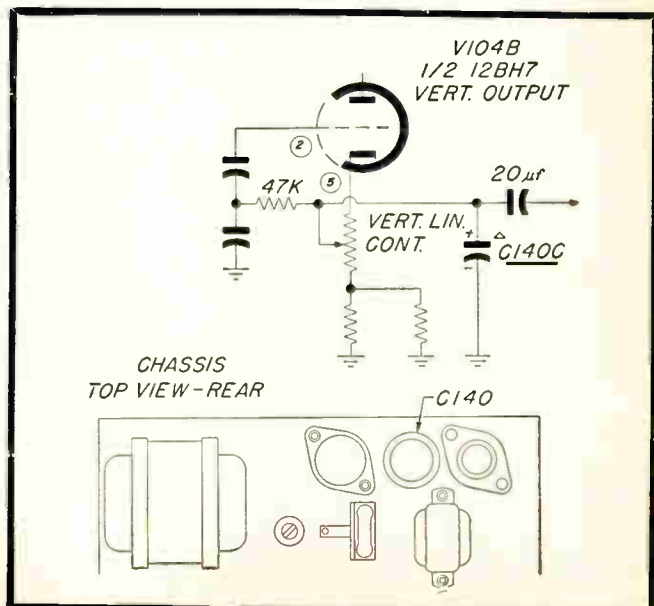
Section Affected: Pix and Raster.

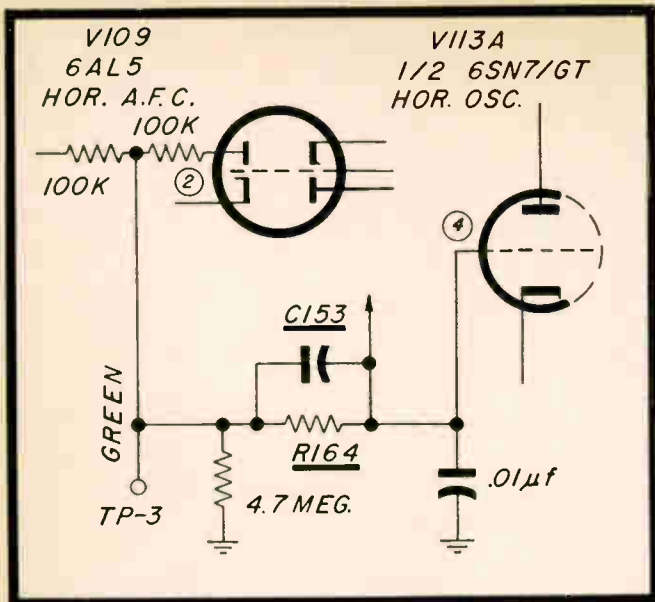
Symptom: No vertical deflection.

Cause: Component failure. Condenser in wave shaping circuit has shorted.

What to do:

Replace: C140C (30  $\mu$ f—150 V electrolytic).





Mfr: Crosley Chassis No. 402, -1, -2, -3, etc.

Card No: CR 402-4

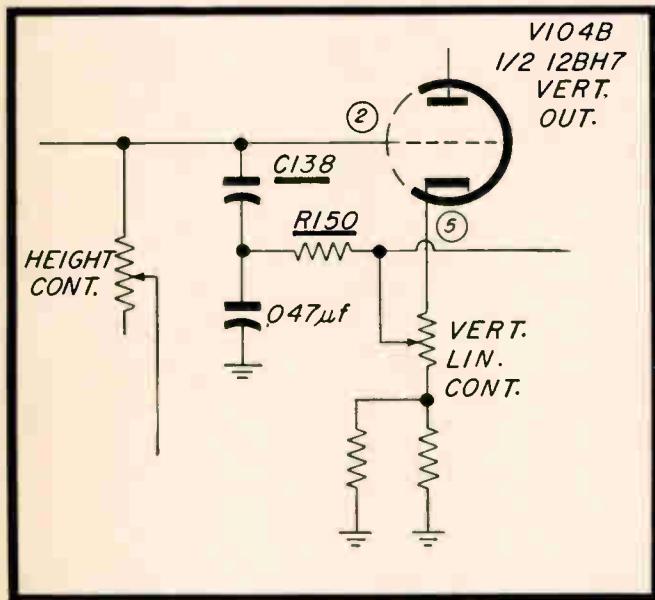
Section Affected: Pix

Symptom: No horizontal sync.

Cause: Component failure. Defective resistor and/or condenser in afc circuit.

What to Do:

Replace: R164 (4.7 meg, 1/2 W), and/or C153 (.003 µf, 600V).



Mfr: Crosley Chassis No. 402, -1, -2, -3, etc.

Card No: CR 402-5

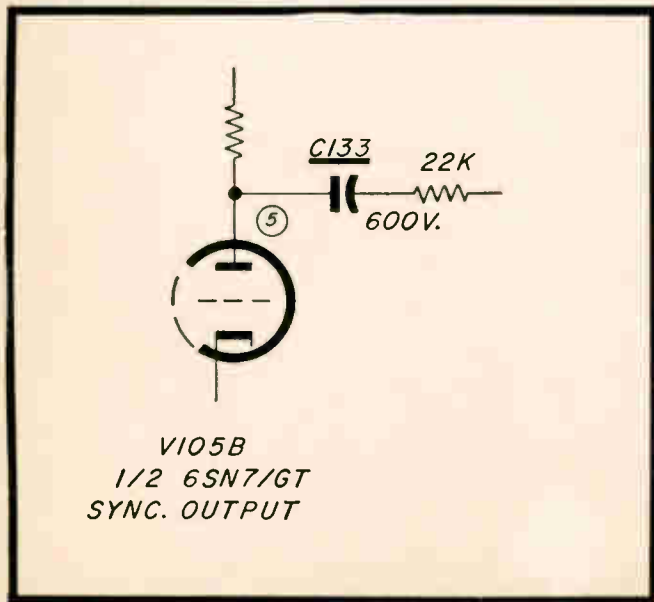
Section Affected: Pix and Raster.

Symptom: No vertical deflection.

Cause: Component failure. Open resistor and/or shorted capacitor in wave shaping circuit.

What to Do:

Replace: R150 (47.7K— 1/2 W) and/or C138 (.047 µf, 600 V).



Mfr: Crosley Chassis No. 402, -1, -2, -3, etc.

Card No: CR 402-6

Section Affected: Pix

Symptom: Loss of vertical synchronization.

Cause: Component failure. Coupling condenser to integrator network has opened.

What to Do:

Replace: C133 (.0047 µf, 600 V).



Mfr: Crosley Chassis No. 431-3, 432-3

Card No: CR 431-3-1

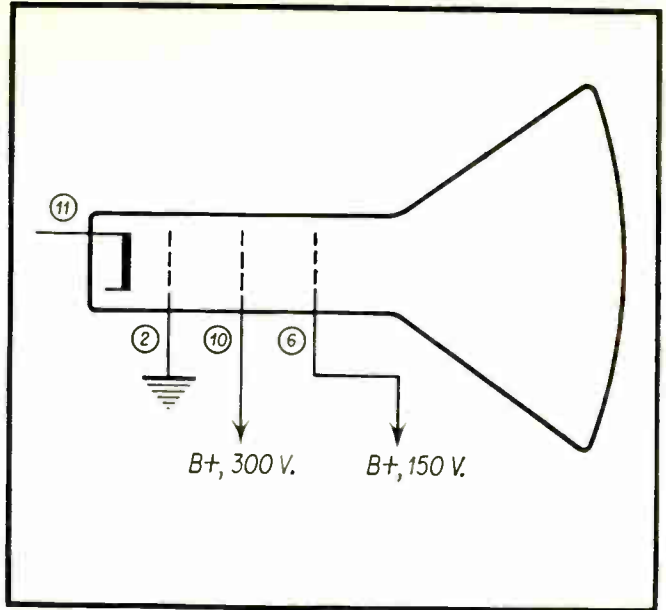
Section Affected: Pix

Symptom: Unsatisfactory focus

Possible Cause: Incorrect focus anode voltage

What to Do:

Try connecting Focus Anode (pin 6 of CRT) to various points other than B+ 150 V such as: chassis ground, B+ 260 V (pin 5 of damper VIII—12AX4GTA), B+ 300 V (pin 10 of picture tube), and B+ 495 V (B+ Boost-Term.  $\pm 2$  of horizontal output transformer)



Mfr: Crosley Chassis No. 431-3, 432-3

Card No: CR 431-3-2

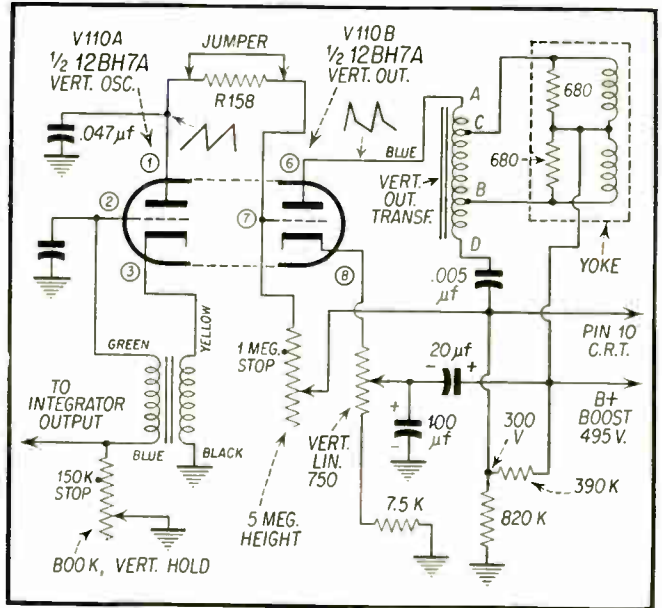
Section Affected: Pix

Symptom: Slight compression at top of pix out of range of linearity and height controls

Cause: Combination of characteristic of V110B  $\frac{1}{2}$  12BH7A vertical output tube and T107 (vertical output transformer) affects waveshape in vertical output circuit. See Card No. CR 431-3-3.

What to Do:

Try connecting in or out of circuit R158 (68K) by clipping off jumper across this resistor. Note: This operation alters waveshape of voltage applied to grid of V110B thereby introducing a slight amount of compensating spread in the output



Mfr: Crosley Chassis No. 431-3, 432-3

Card No: CR 431-3-3

Section Affected: Pix

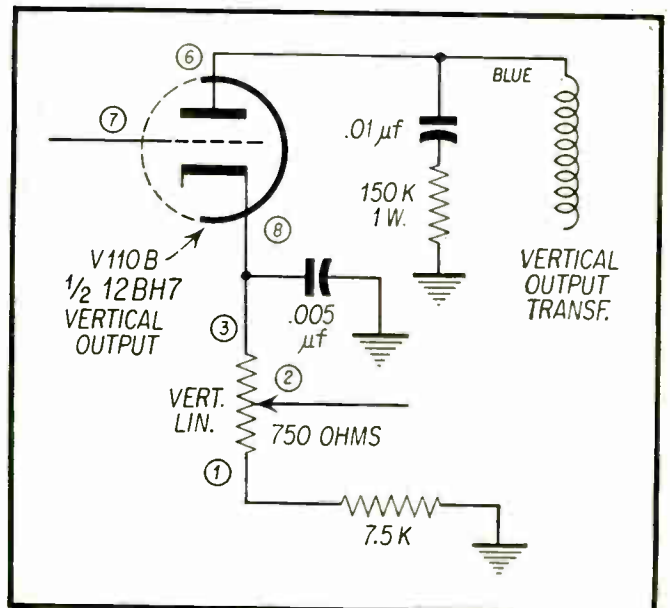
Symptom: Vertical spreading out of range of linearity and height controls.

Cause: Combination of characteristics of V110B  $\frac{1}{2}$  BH7A vertical output tube and T107 (vertical output transformer) affects waveshape in vertical output circuit. See Card No. CR 431-3-2.

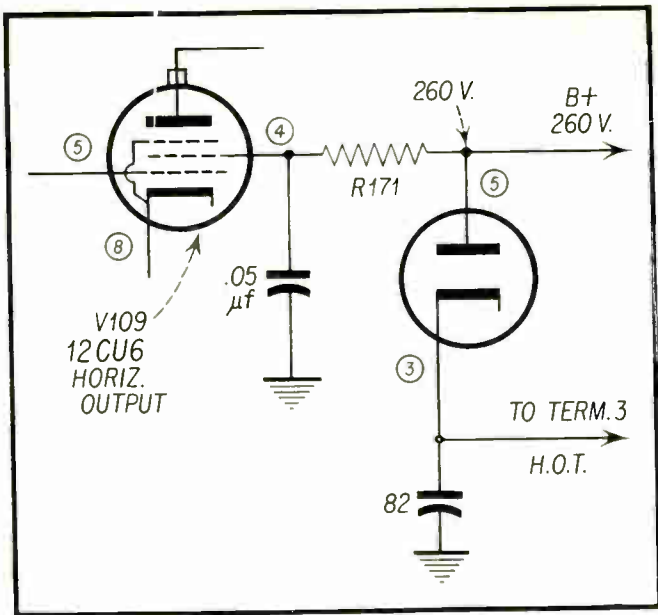
What to Do:

Connect: .01  $\mu$ f—600 V condenser in series with 150K—1W (10%) resistor from plate to ground in vertical output stage

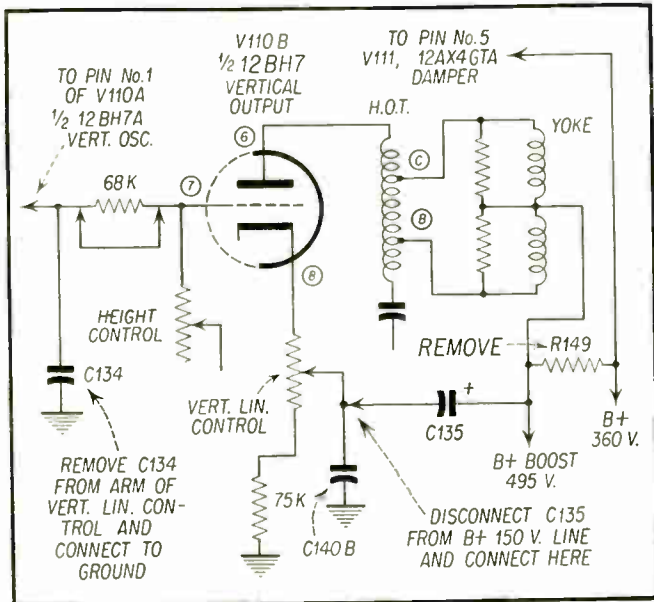
Note: These changes are designed to introduce a slight amount of negative peaking and affect the current waveshape in the yoke in a manner designed to introduce a slight amount of compression



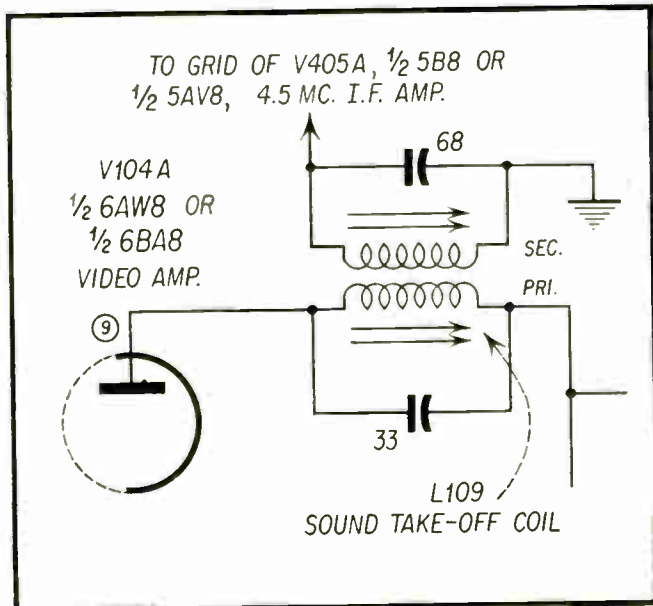
Radio



**Mfr:** Crosley **Chassis No.** 431-3, 432-3  
**Card No:** CR 431-3-4  
**Section Affected:** Raster  
**Symptom:** Insufficient width  
**Reason for Change:** Provide increased horizontal output tube gain.  
 Note: This change was included in chassis 431-3 Code D and 432-3 Code E, and continued in later chassis  
**What to Do:**  
 Change: R171 (12K) to 8.2K



**Mfr:** Crosley **Chassis No.** 431-3, 432-3  
**Card No:** CR 431-3-5  
**Section Affected:** Pix  
**Symptom:** Picture stability could be improved  
**Reason for Change:** To improve picture stability  
 Note: This change was begun in chassis 431-3 Code F and 432-3 Code H.  
**What to Do:**  
 Change: C140B from 30  $\mu$ f—150 V to 100  $\mu$ f—150 V by shunting with 70  $\mu$ f—150 V condenser (observe polarity)  
 Remove: Low side of C135 (20  $\mu$ f—500 V) from B+ 150 and connect to arm of vertical linearity control  
 Remove: Low side of C134 (.047  $\mu$ f—600 V) from arm of vertical linearity control and connect to chassis ground  
 Remove: R149 (470K)



**Mfr:** Crosley **Chassis No.** 431-3, 432-3  
**Card No:** CR 431-3-6  
**Section Affected:** Sound  
**Symptom:** Buzz or distortion that cannot be corrected by realignment. Peaks and nulls when realigning sound may be hard to find.  
**Possible Cause:** Reversed connections on primary of L109 (sound take-off coil)  
**What to Do:**  
 Reverse: Connections on the primary of L109

Mfr: Du Mont Chassis No. RA 312/313

Card No. DM 312-1

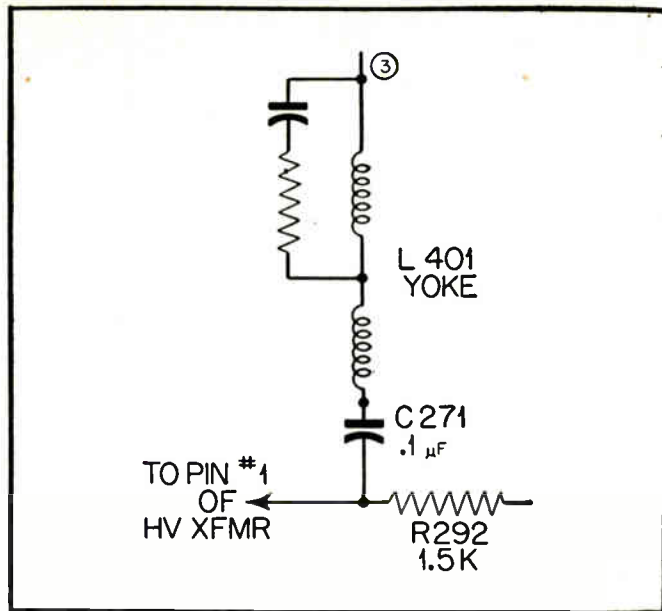
Section Affected: Raster

Symptom: No raster

Cause: Open resistor

What To Do:

Replace: R292 (1.5K) and/or open.  
Check: Yoke for leakage.



Mfr: Du Mont Chassis No. RA 312/313

Card No. DM 312-2

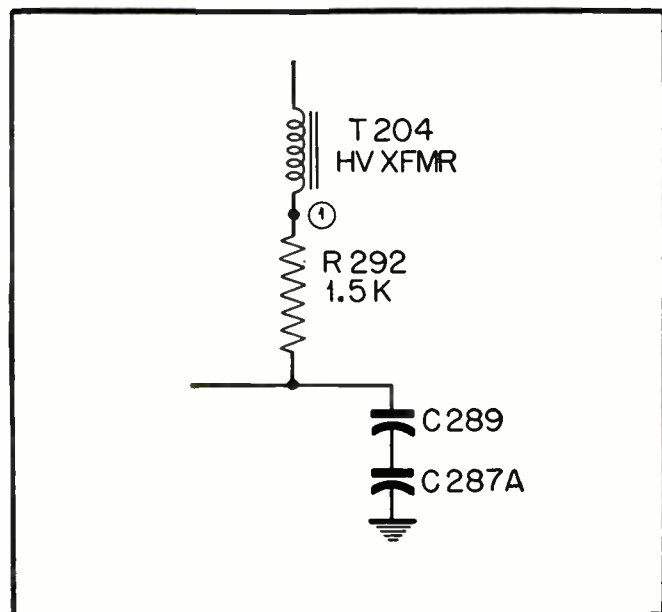
Section Affected: Raster

Symptom: Top half of raster brighter than bottom half. Also possible loss of vertical size.

Cause: Open boost capacitor

What To Do:

Replace: C287A (20 μf) and/or C289 (20 μf).



Mfr: Du Mont Chassis No. RA 312/313

Card No. DM 312-3

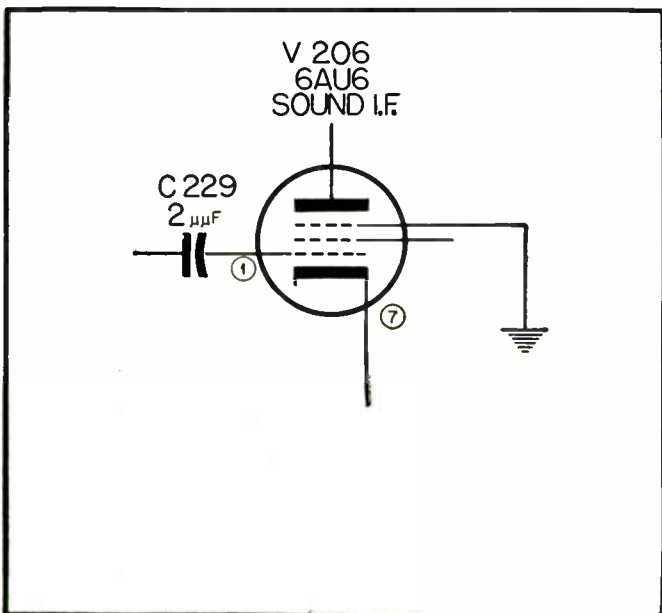
Section Affected: Pix and sound

Symptom: Poor sync, buzz in sound, weak video

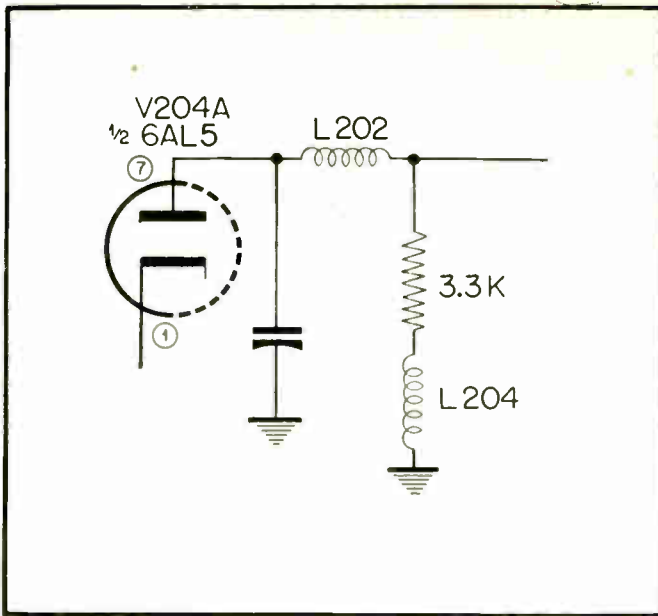
Cause: Leaky condenser

What To Do:

Replace: C229 (2.2 μf).







Mfr: Du Mont Chassis No. RA 312/313

Card No. DM 312-4

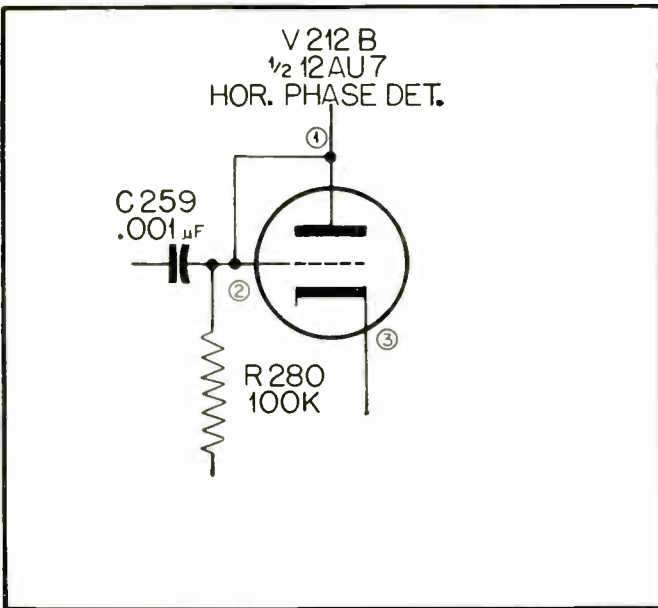
Section Affected: Pix

Symptom: Video smear

Cause: Open choke

What To Do:

Replace: L204; or repair.



Mfr: Du Mont Chassis No. RA 312/313

Card No. DM 312-5

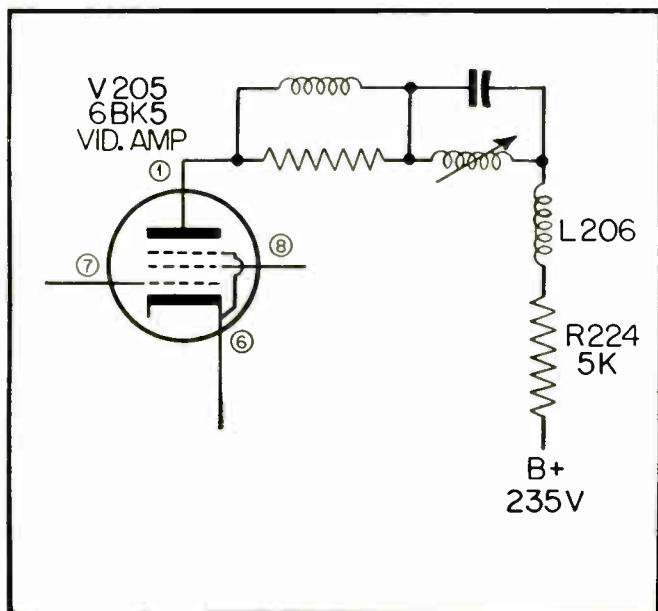
Section Affected: Raster

Symptom: No raster; no high voltage

Cause: Shorted condenser

What To Do:

Replace: C259 (.001  $\mu$ f).



Mfr: Du Mont Chassis No. RA 312/313

Card No. 312-6

Section Affected: Pix

Symptom: Weak, negative pix

Cause: Open choke

What To Do:

Replace: L206; or repair.

Mfr: Du Mont Chassis No. RA 312/313

Card No: DM 312-1

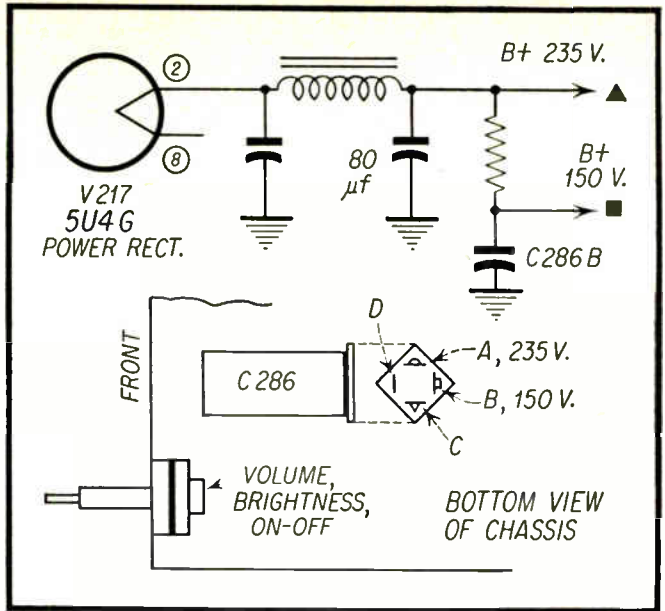
Section Affected: Sync

Symptom: Critical vertical and horizontal hold.  
Picture jitters and pulls horizontally.

Cause: Open filter condenser in B+ 150 V line.

What to Do:

Replace: C286B (40  $\mu$ f—350 V).



Mfr: Du Mont Chassis No. RA 312/313

Card No: DM 312-2

Section Affected: Pix and sync.

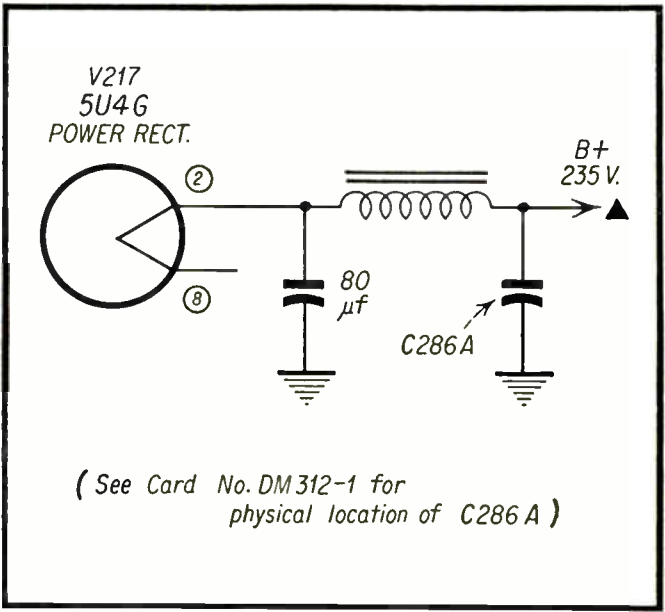
Symptom: Dark vertical bars in raster (5 or 6),  
widest and most pronounced on left side.  
Contrast control adjustment changes intensity  
and width of bars.  
Also, washed out pix.

Also, critical vertical and horizontal hold.

Cause: Open filter condenser in B+ 235 V line.

What to Do:

Replace: C286A (80  $\mu$ f—350 V).



( See Card No. DM 312-1 for physical location of C286 A )

Mfr: Du Mont Chassis No. RA 312/313

Card No: DM 312-3

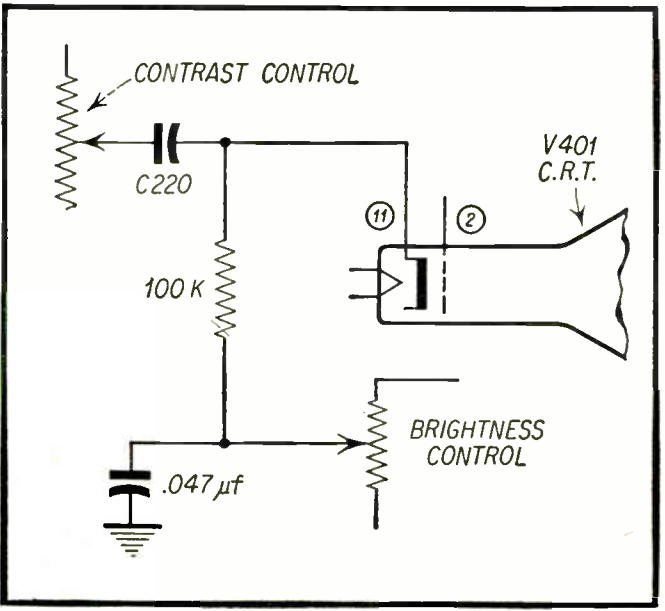
Section Affected: Pix

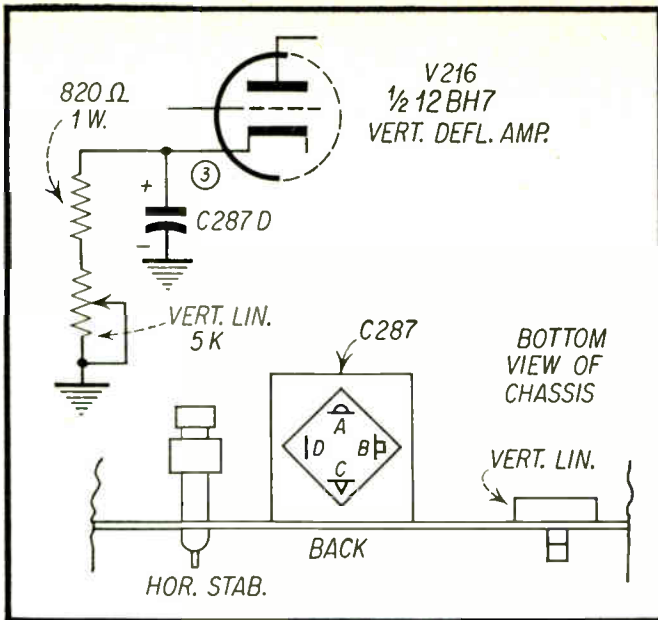
Symptom: No raster; sound-OK. HV-OK.

Cause: Shorted video coupling condenser to CRT cathode.

What to Do:

Replace: C220 (.22  $\mu$ f—400 V).





Mfr: Du Mont

Chassis No. RA 312-4

Card No: DM 312-4

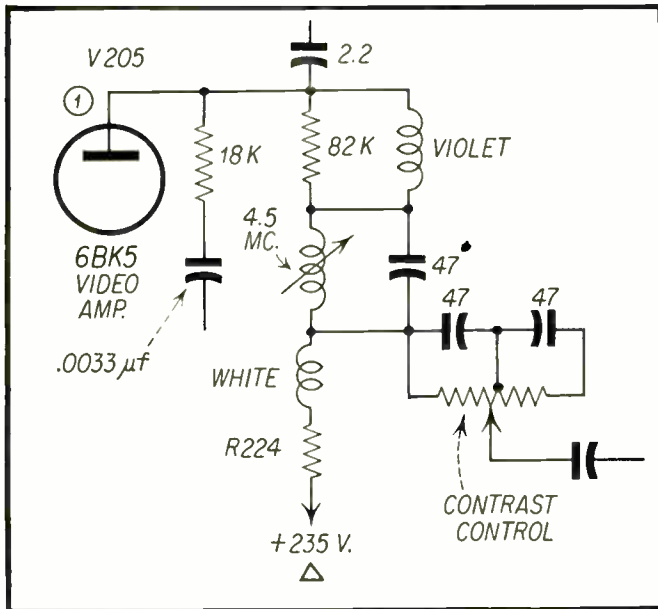
Section Affected: Pix

Symptom: Poor vertical linearity and loss in size which cannot be properly adjusted with normal adjustment of vertical size and linearity controls.

Cause: Open condenser in cathode of vertical deflection amplifier.

What to Do:

Replace: C287D (10 μf—50 V).



Mfr: Du Mont

Chassis No. RA 312/313

Card No: DM 312-5

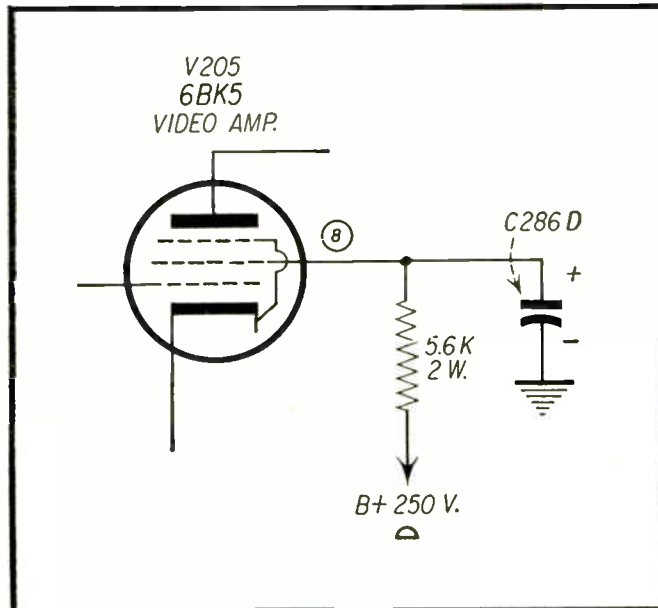
Section Affected: Pix

Symptom: Weak and washed out pix. Sound normal except for strong buzz.

Cause: Open resistor in plate circuit of video amp.

What to Do:

Replace: R224 (5K-10 W).



Mfr: Du Mont

Chassis No. RA 312/313

Card No: DM 312-6

Section Affected: Pix and sync.

Symptom: Pix overload and loss of vertical and horizontal hold on strong or average signals. When weak signal is obtained overload does not occur but excessive loss of contrast occurs accompanied by severe horizontal pull and jitter.

Cause: Leaky screen bypass condenser in video amplifier.

What to Do:

Replace: C286D (4 μf—350 V).



Mfg: Emerson Chassis No. 120162-A

Card No. EM162-1

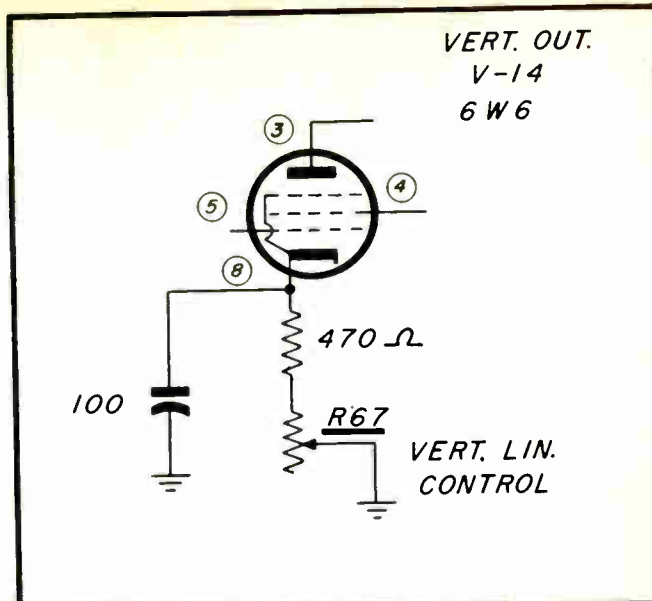
Section Affected: Raster

Symptom: Vertical jumps.

Cause: Defective component.

What To Do:

Replace: R67 (vertical linearity control 5K ohms), which is arcing.



Mfg: Emerson Chassis No. 120162-A

Card No. EM162-2

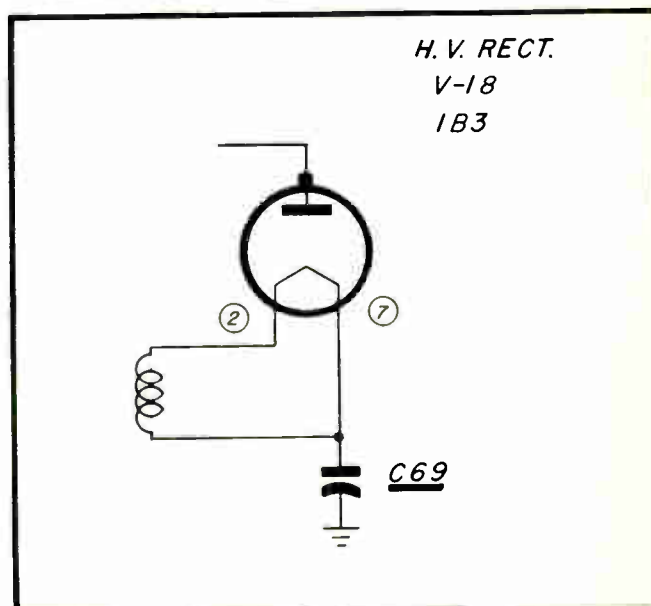
Section Affected: Raster

Symptom: H.V. Ticking.

Cause: Defective component.

What To Do:

Replace: C-69 (500 μμf), which is breaking down.



Mfg: Emerson Chassis No. 120162-A

Card No. EM162-3

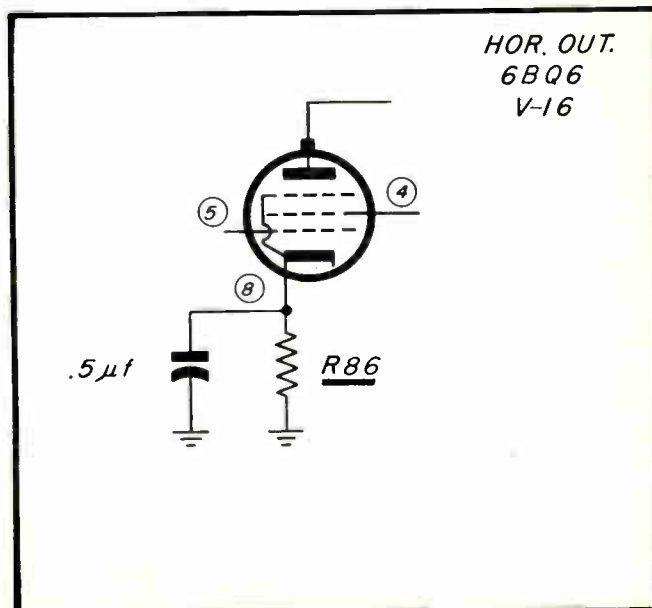
Section Affected: Raster

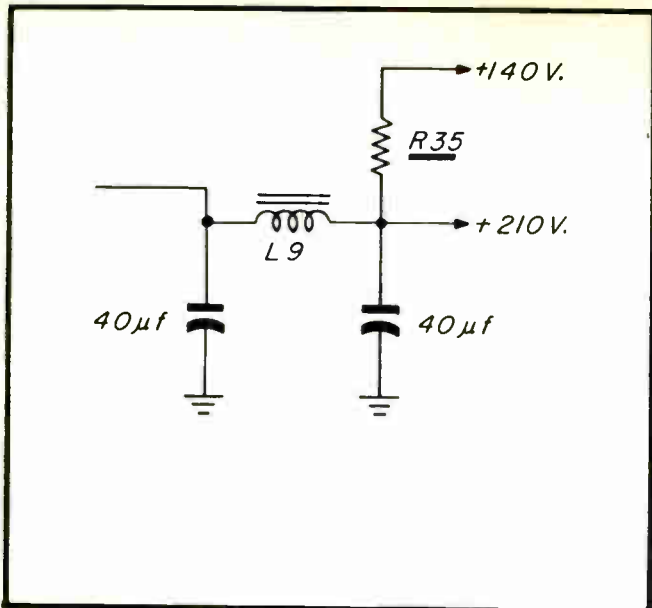
Symptom: Intermittent raster and intermittent H.V.

Cause: Defective component.

What To Do:

Replace: R86 (100 ohms), which opens intermittently.





Mfg: Emerson Chassis No. 120162-A

Card No. EM162-4

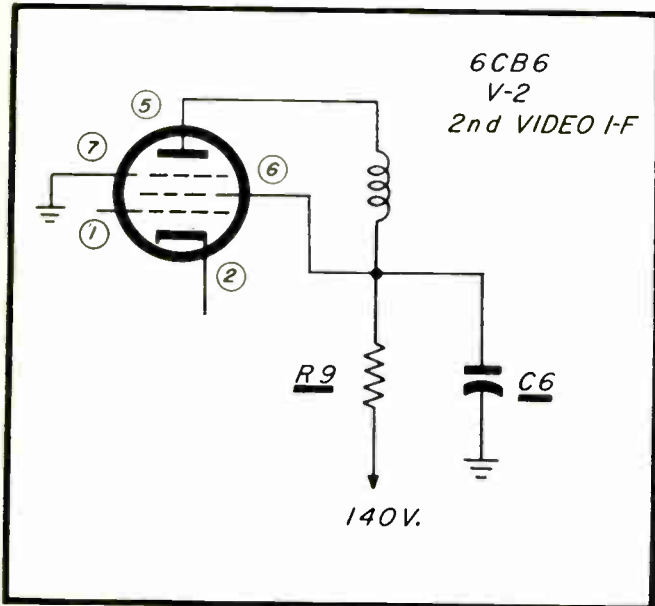
Section Affected: Pix and sound.

Symptom: No pix and sound.

Cause: Defective component.

What To Do:

Replace: R35 (1.2K), which is open.



Mfg: Emerson Chassis No. 120162-A

Card No. EM162-5

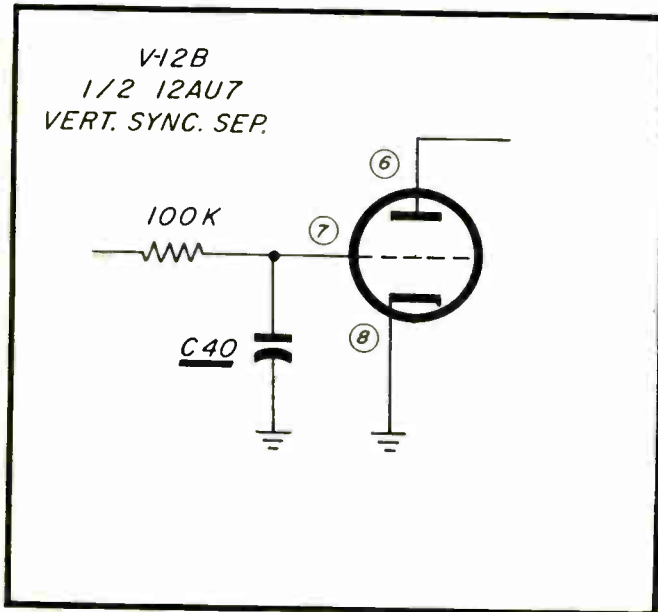
Section Affected: Pix and sound.

Symptom: No video, no sound.

Cause: Defective component.

What To Do:

Replace: C6 (1500 µµf), which is shorted, and R9 (470 ohms), which is burned.



Mfg: Emerson Chassis No. 120162-A

Card No. EM162-6

Section Affected: Sync.

Symptom: Horizontal pulling, and vertical rolling.

Cause: Defective component.

What To Do:

Replace: C40 (47 µµf), which is leaking.

Mfr. Emerson Chassis No. 120292

Card No. EM292-1

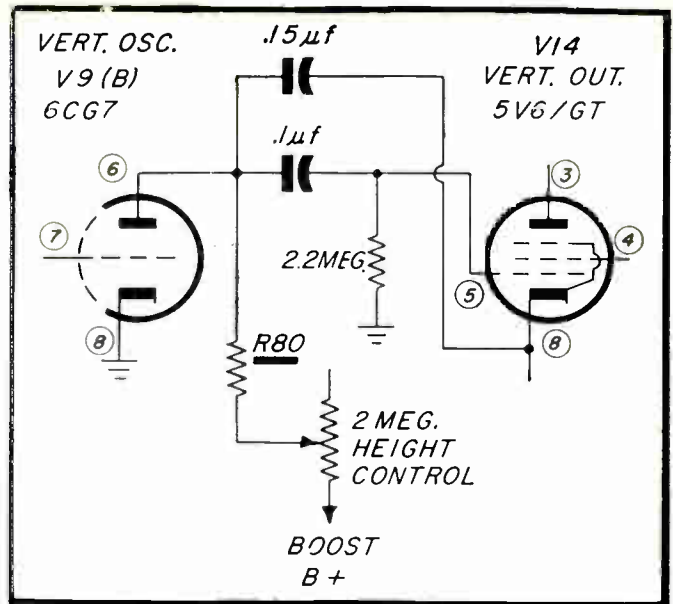
Section Affected: Pix and raster

Symptoms: Insufficient height.

Cause: Component failure. The series plate feed resistor from the height control has increased in value, reducing the plate voltage to the vertical oscillator tube.

**What To Do:**

Replace: (R80) 1.5 megohms.



Mfr. Emerson Chassis No. 120292

Card No. EM292-2

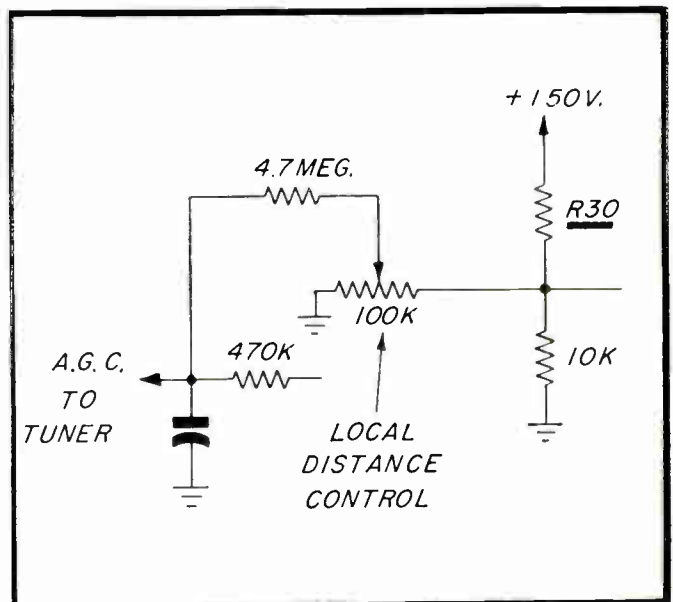
Section Affected: Pix

Symptoms: Snowy, weak pictures in semi-fringe and fringe areas.

Cause: Component failure. The B plus feed resistor has increased in value, supplying insufficient positive voltage to the local distance control, with the result that correct voltage is not applied to the agc line to the tuner. Sound is sometimes pronouncedly affected, also.

**What To Do:**

Replace: R30, 22K ohms, one watt.



Mfr. Emerson Chassis No. 120292

Card No. EM292-3

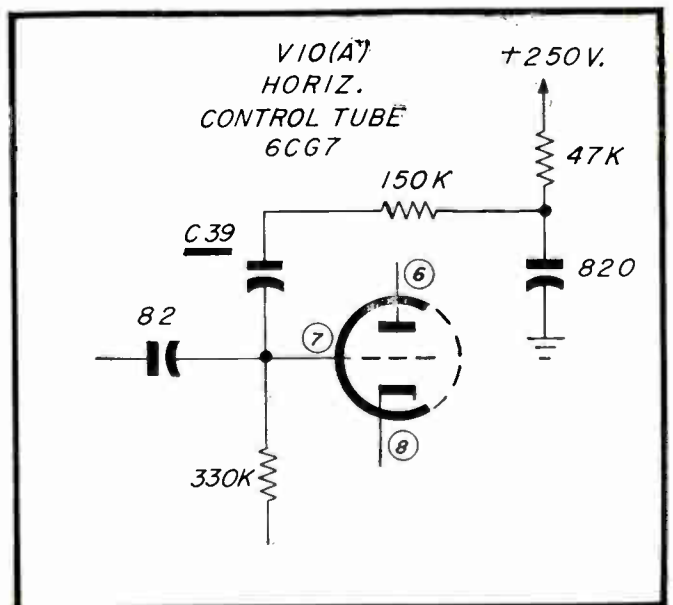
Section Affected: Pix

Symptoms: Critical horizontal hold, vertical hold normal.

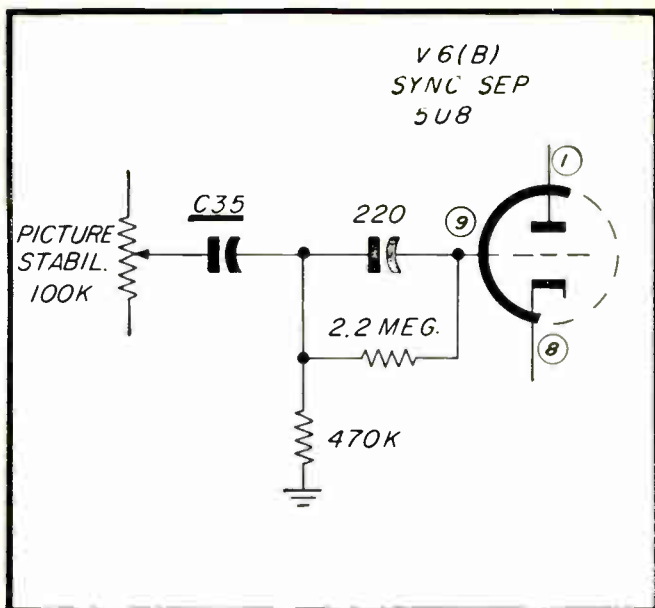
Cause: Component failure. The sawtooth feedback condenser has developed a leak, altering the bias as applied to the grid of the horizontal control tube, 6CG7.

**What To Do:**

Replace: C39 (82 μf).







Mfr. Emerson

Chassis No. 120292

Card No. EM292-4

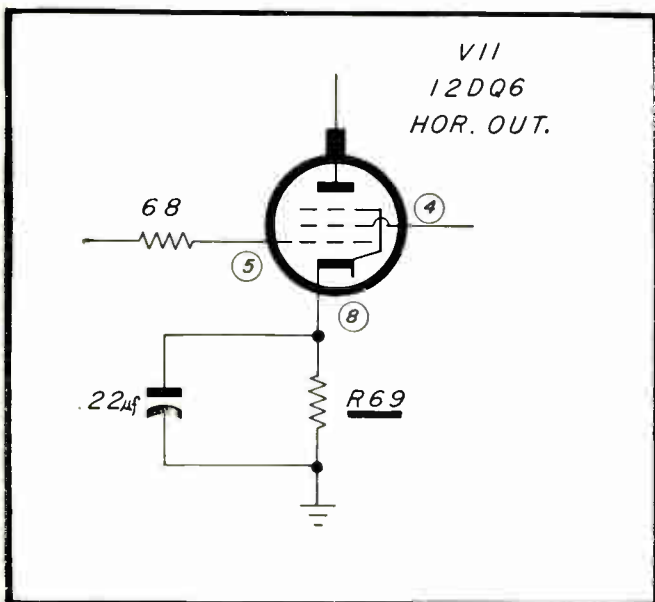
Section Affected: Pix

Symptoms: Critical horizontal and vertical sync, picture normal with some picture pulling.

Cause: Component failure. Coupling condenser from picture stabilizer control has developed leakage, applying positive voltage to the sync separator grid. This causes incorrect sync separation and video information in sync system.

What To Do:

Replace: C35 (.01  $\mu$ f).



Mfr. Emerson

Chassis No. 120292

Card No. EM292-5

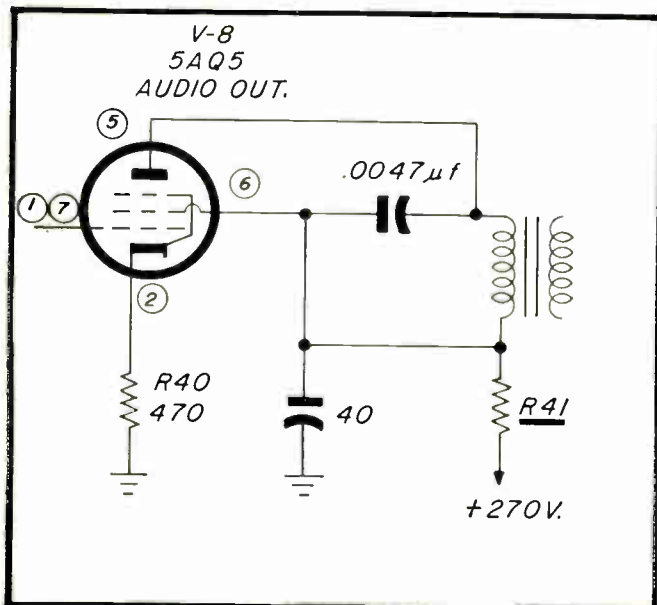
Section Affected: Pix and raster

Symptoms: Insufficient width and high voltage.

Cause: Component failure. The cathode resistor has increased in resistance, biasing back the horizontal output tube and preventing proper amplification of the grid signal.

What To Do:

Replace: R69 (100 ohm) with a two watt size.



Mfr. Emerson

Chassis No. 120292

Card No. EM292-6

Section Affected: Audio

Cause: Component failure. The B plus feed resistor supplying 270 volts to the primary of the audio output transformer has increased in resistance so that plate voltage is low.

What To Do:

Replace: R41 (1.5K) with a 2 watt size.

Mfr: Emerson Chassis No. 120140-B

Card No. EM 140-1 Model No. 680D

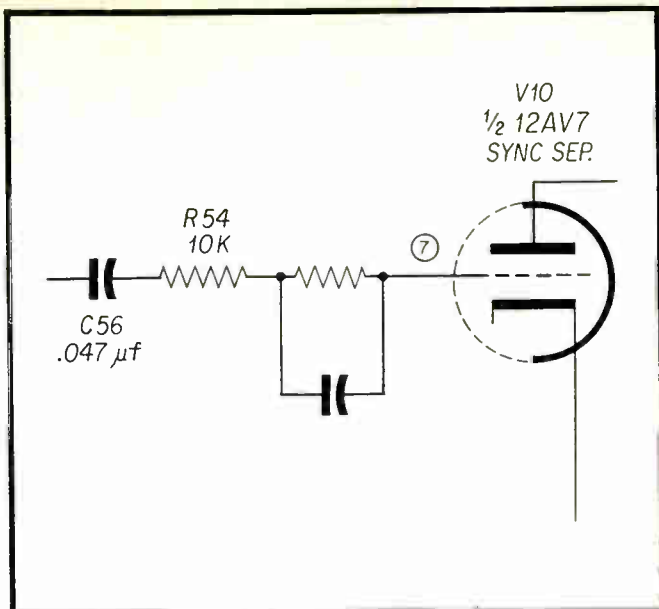
Section Affected: Sync

Symptom: Critical horizontal and vertical hold

Cause: Leaky condenser

What to Do:

Replace: C56 (.047  $\mu$ f)



Mfr: Emerson Chassis No. 120140-B

Card No. EM 140-2 Model No. 680D

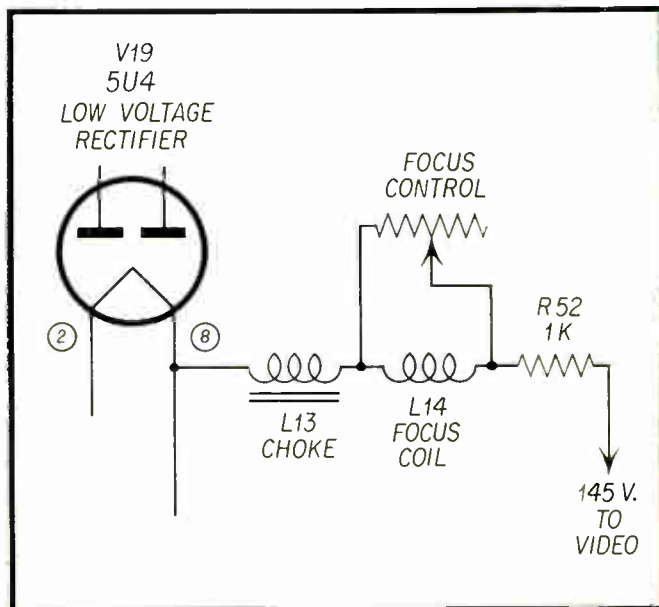
Section Affected: Pix and sound

Symptom: No pix or sound

Cause: Open resistor

What to Do:

Replace: R52 (1K)



Mfr: Emerson Chassis No. 120140-B

Card No. EM 140-3 Model No. 680D

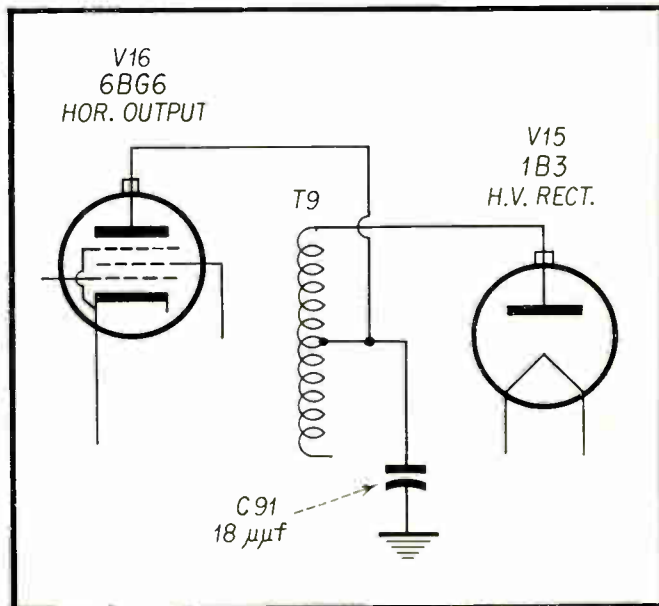
Section Affected: Raster

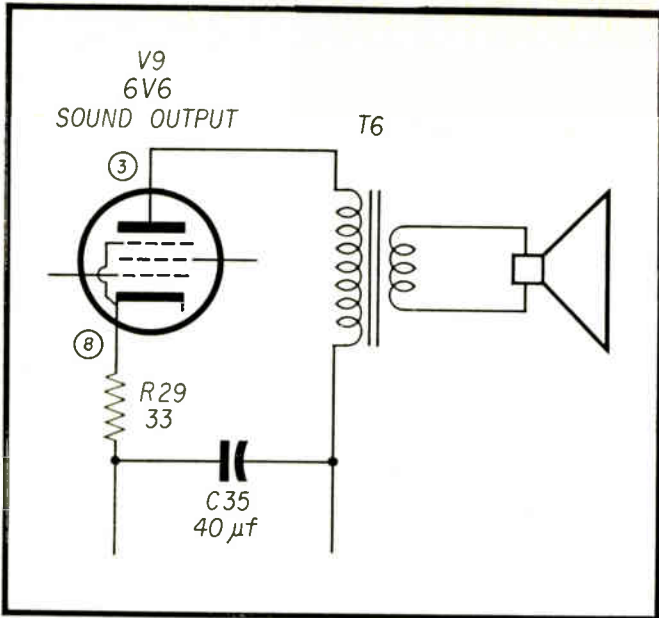
Symptom: Flashes in pix

Cause: Arcing condenser

What to Do:

Replace: C91 (18  $\mu$ f)





Mfr: Emerson Chassis No. 120140-B

Card No. EM 140-4 Model No. 680D

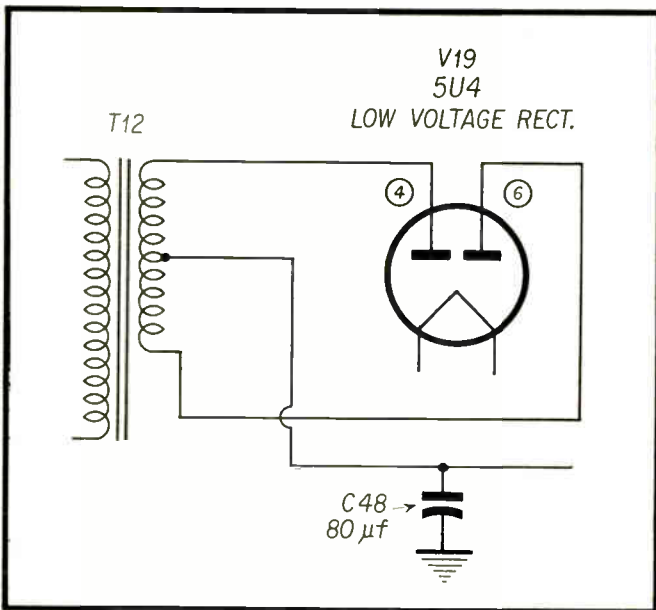
Section Affected: Pix

Symptom: Sound bars in pix

Cause: Leaky filter condenser

What to Do:

Replace: C35 (40  $\mu$ f)



Mfr: Emerson Chassis No. 120140-B

Card No. EM 140-5 Model No. 680D

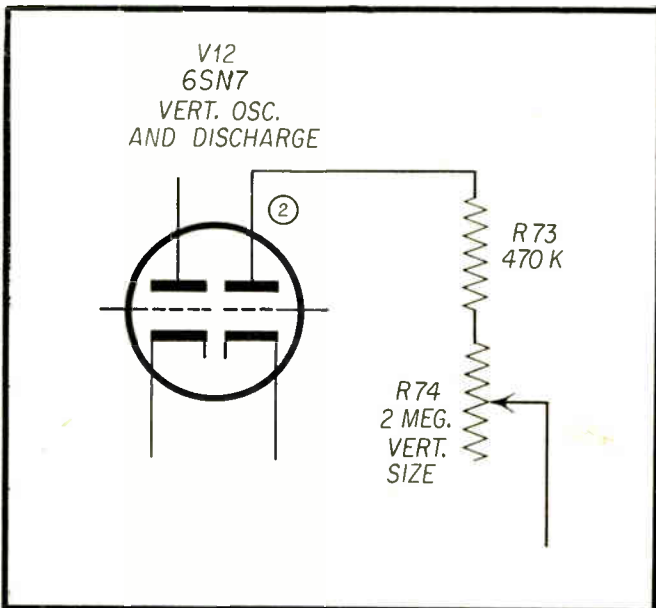
Section Affected: Sync

Symptom: Critical vertical hold and horizontal wiggle

Cause: Leaky filter condenser

What to Do:

Replace: C48 (80  $\mu$ f)



Mfr: Emerson Chassis No. 120140-B

Card No. EM 140-6 Model No. 680D

Section Affected: Pix

Symptom: Cannot reduce height properly

Cause: Vertical control changed in value

What to Do:

Replace: R74 (2 meg.)



Mfr: Emerson Chassis 120066B

Card No. EMO66-1 Model No. 571

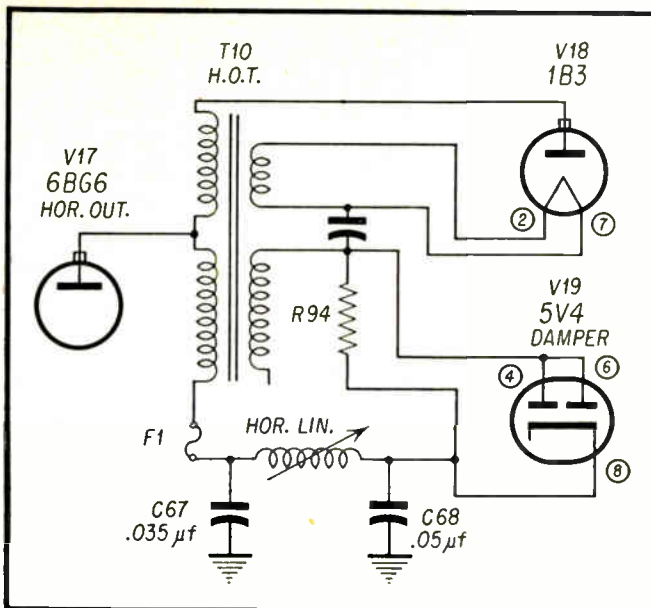
Section Affected: Raster

Symptom: White vertical lines on left side and horizontal linearity

Cause: Open resistor in damper circuit

What To Do:

Replace: R94 (7.5K)



Mfr: Emerson Chassis No. 120066B

Card No. EMO66-2 Model No. 571

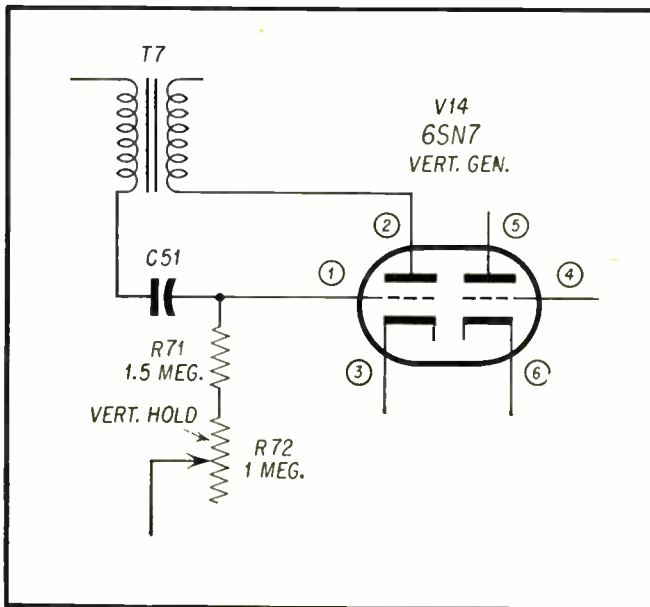
Section Affected: Sync.

Symptom: Vertical hold out of range

Cause: Leaky Condenser

What To Do:

Replace: C51 (.003 μf)



Mfr: Emerson Chassis No. 120066-B

Card No. EMO66-3 Model No. 571

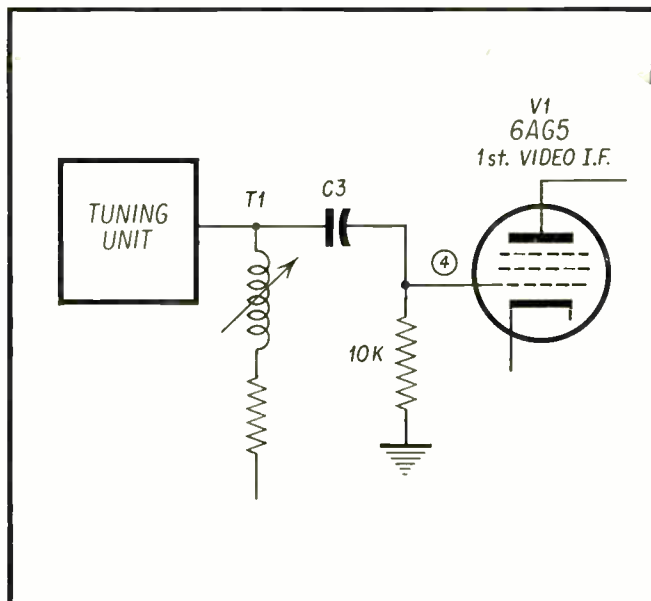
Section Affected: Pix

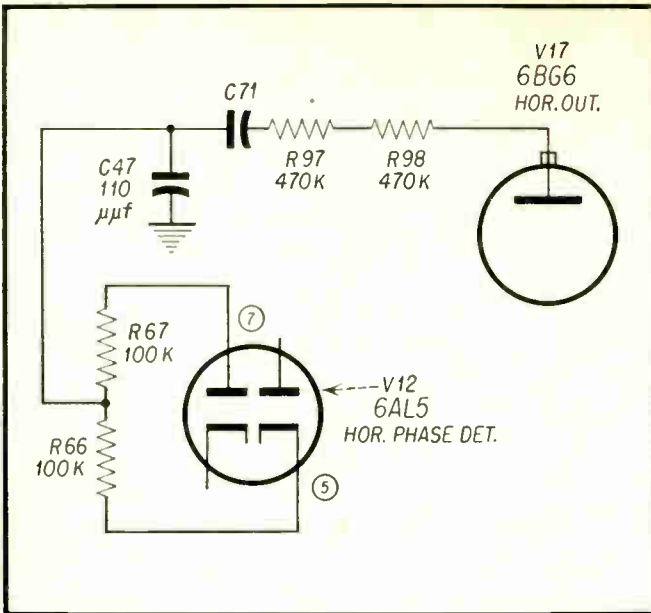
Symptom: Video overload

Cause: Leaky coupling condenser

What To Do:

Replace: C3 (270 μμf)





Mfr: Emerson Chassis No. 120066-B

Card No. EMO66-4 Model No. 571

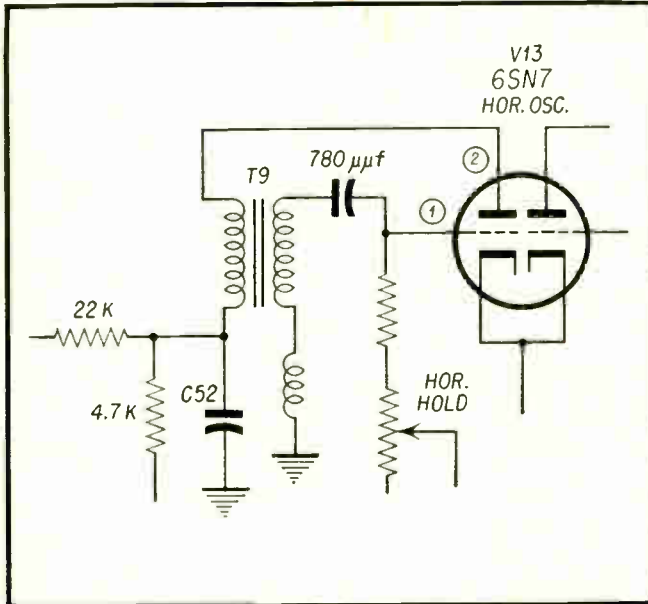
Section Affected: Sync

Symptom: Horizontal tearing

Cause: Defective component

What To Do:

Replace: C71 (.005 μf)—Leaky  
Also R97 (470K)—probably increased in value and burned



Mfr: Emerson Chassis No. 120066-B

Card No. EMO66-5 Model No. 571

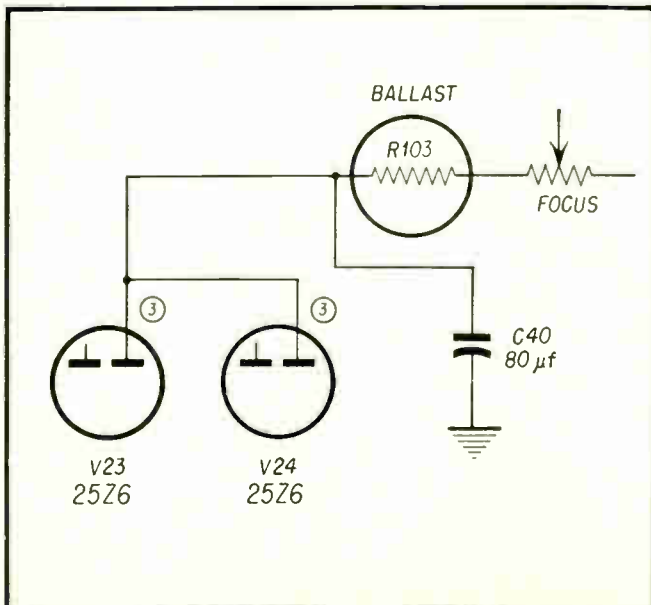
Section Affected: Sync

Symptom: Horizontal Frequency far out of range

Cause: Leaky condenser

What To Do:

Replace: C52 (8 μf)



Mfr: Emerson Chassis No. 120066-B

Card No. EMO66-6 Model No. 571

Section Affected: Raster

Symptom: No raster

Cause: Open filter condenser

What To Do:

Replace: C40 (80 μf)

Mfr: Fada Model No. S4C20

Card No: S4C20-1

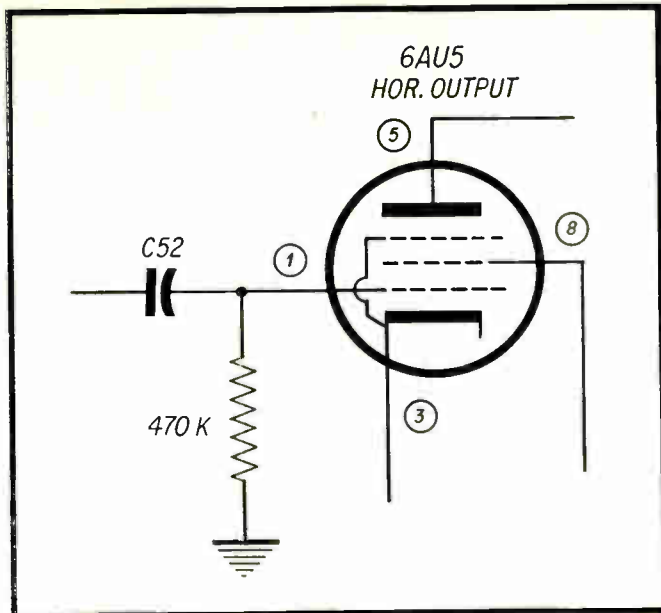
Section Affected: Raster

Symptom: No high voltage

Cause: Shorted condenser

What To Do:

Replace: C52 (.01  $\mu$ f)



Mfr: Fada Model No. S4C20

Card No: S4C20-2

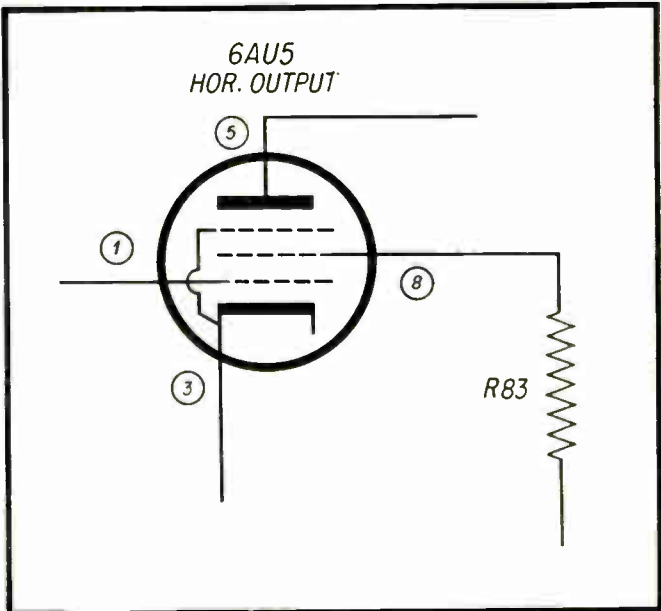
Section Affected: Raster

Symptom: Intermittent high voltage

Cause: Defective resistor

What To Do:

Replace: R83 (8.2K)



Mfr: Fada Model No. S4C20

Card No: S4C20-3

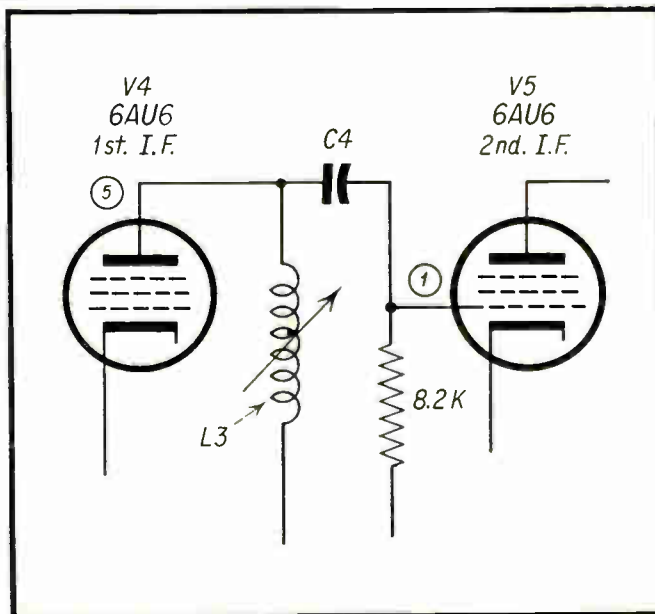
Section Affected: Pix

Symptom: Video Overload

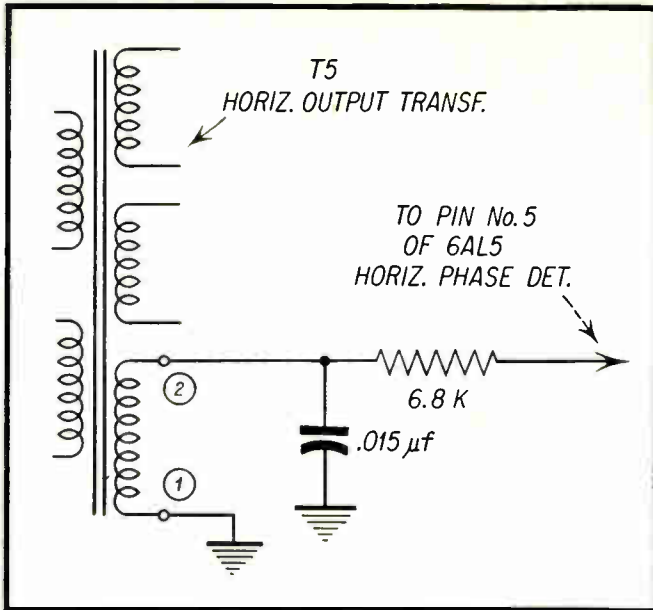
Cause: Leaky condenser

What To Do:

Replace: C4 (120  $\mu$ f)







Mfr. Fada

Model No. S4C20

Card No: S4C20-4

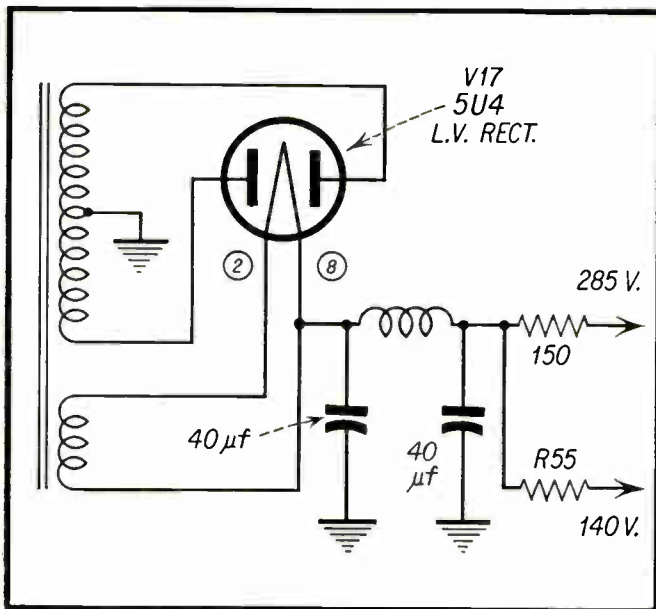
Section Affected: Sync

Symptom: No horizontal hold

Cause: Open H.O.T. feedback winding (terminals No. 1 and 2)

What To Do:

Replace: Horizontal output transformer (T5)



Mfr: Fada

Model No. S4C20

Card No: S4C20-5

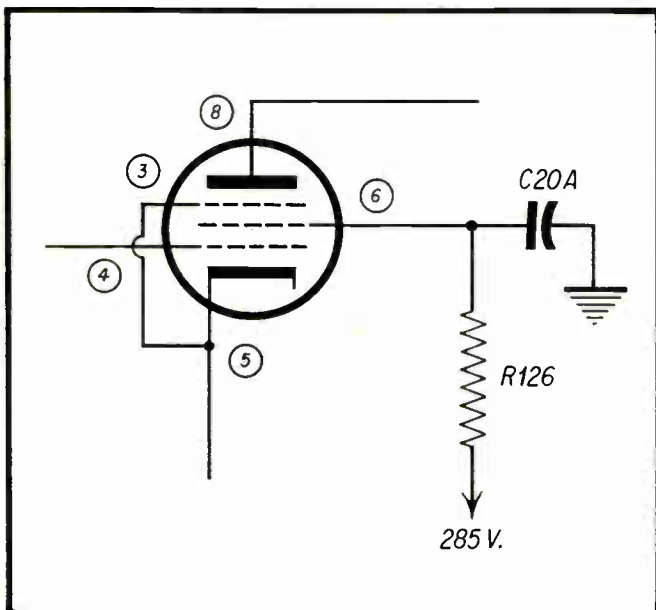
Section Affected: Pix and sound

Symptom: No pix, no sound

Cause: Open resistor

What To Do:

Replace: R55 (2K)



Mfr: Fada

Model No. S4C20

Card No: S4C20-6

Section Affected: Pix and sound

Symptom: No pix, poor sound

Cause: Open resistor (and/or) leaky condenser

What To Do:

Replace: R126 (56K)

Check: C20A (20 μf) for leakage

Mfr: Fada Model S1055

Card No: FAS55-1

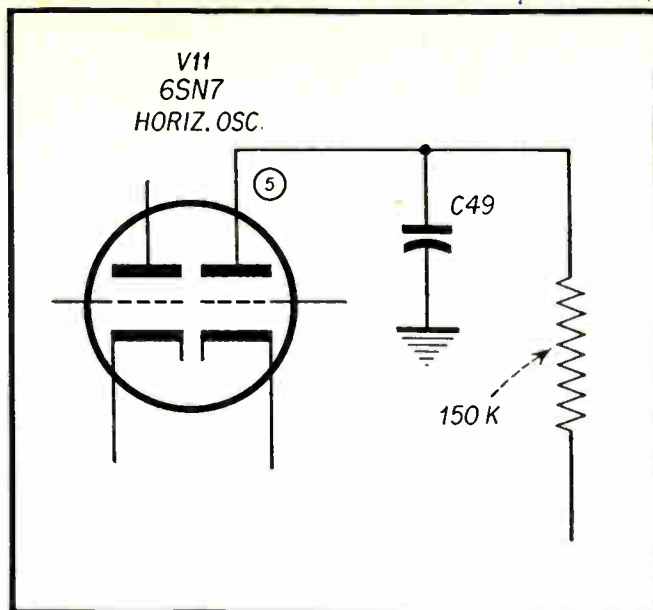
Section Affected: Raster

Symptom: No high voltage

Cause: Shorted condenser in horizontal discharge circuit

What to Do:

Replace: C49 (390  $\mu$ f)



Mfr: Fada Model S1055

Card No: FAS55-2

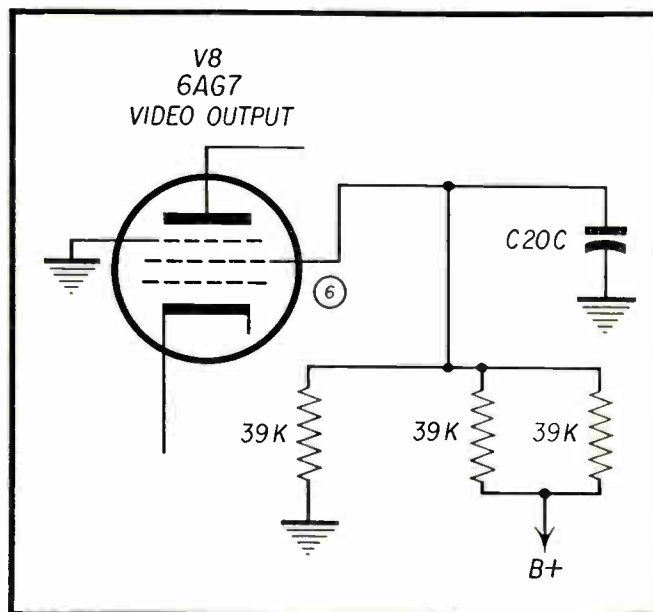
Section Affected: Pix

Symptom: No video

Cause: Shorted video screen condenser

What to Do:

Replace: C20C (10  $\mu$ f)



Mfr: Fada Model S1055

Card No: FAS55-3

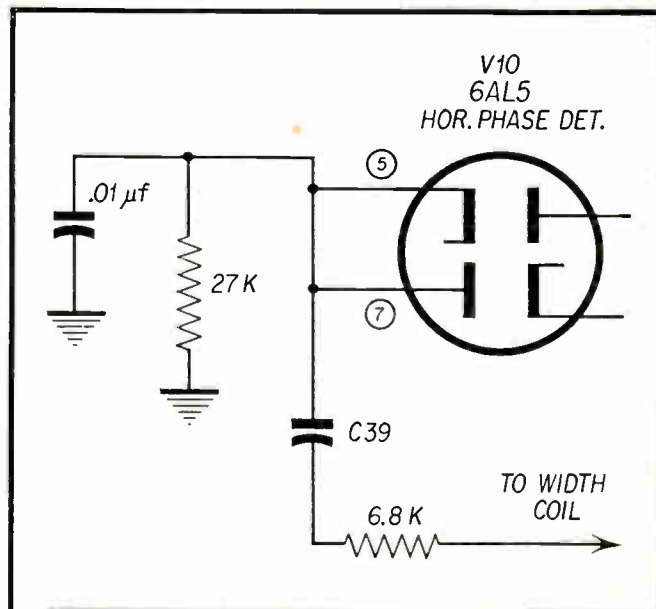
Section Affected: Sync

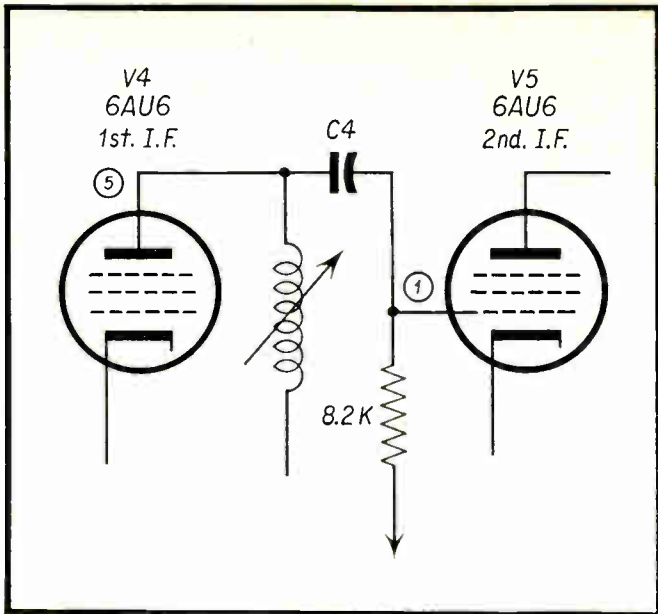
Symptom: Critical horizontal hold

Cause: Leaky condenser in phase detector

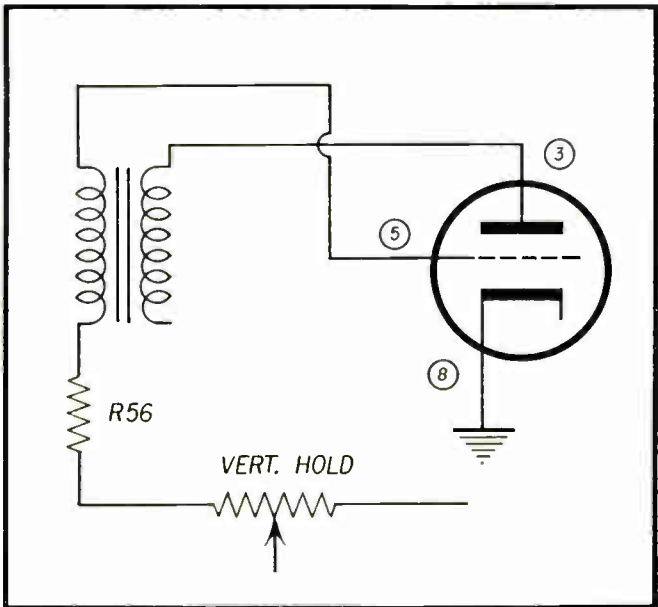
What to Do:

Replace: C39 (.05  $\mu$ f)

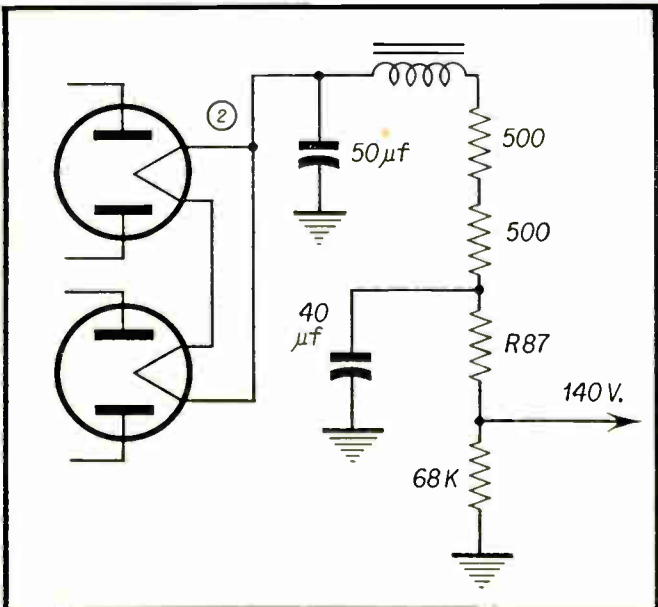




**Mfr:** Fada **Model** S1055  
**Card No:** FAS55-4  
**Section Affected:** Pix  
**Symptom:** Video overload on normal contrast control settings  
**Cause:** Leaky coupling condenser  
**What to Do:**  
 Replace: C4 (120  $\mu\text{f}$ )



**Mfr:** Fada **Model** S1055  
**Card No:** FAS55-5  
**Section Affected:** Sync  
**Symptom:** Vertical hold drifts out of range  
**Cause:** Vertical oscillator resistor increases in value  
**What to Do:**  
 Replace: R56 (1.5 meg)



**Mfr:** Fada **Model** S1055  
**Card No:** FAS55-6  
**Section Affected:** Sound & pix  
**Symptom:** No sound or pix  
**Cause:** Open voltage divider  
**What to Do:**  
 Replace: R87 (1750 ohms-20W)



Mfg: G. E. Model No. 21C119

Card No. GE 21C119-1

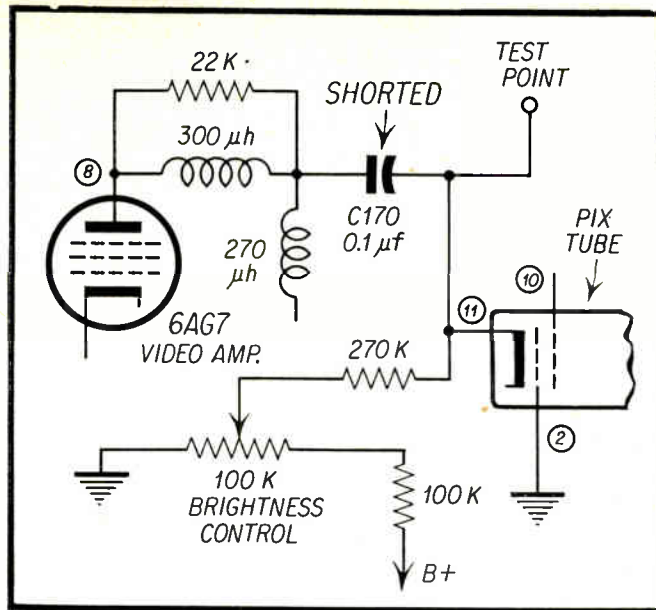
Section Affected: Pix and Raster

Symptom: No control over brightness

Cause: Shorted condenser

What to Do:

Replace: C170, .1 uf



Mfg: G. E. Model No. 21C119

Card No. GE 21C119-2

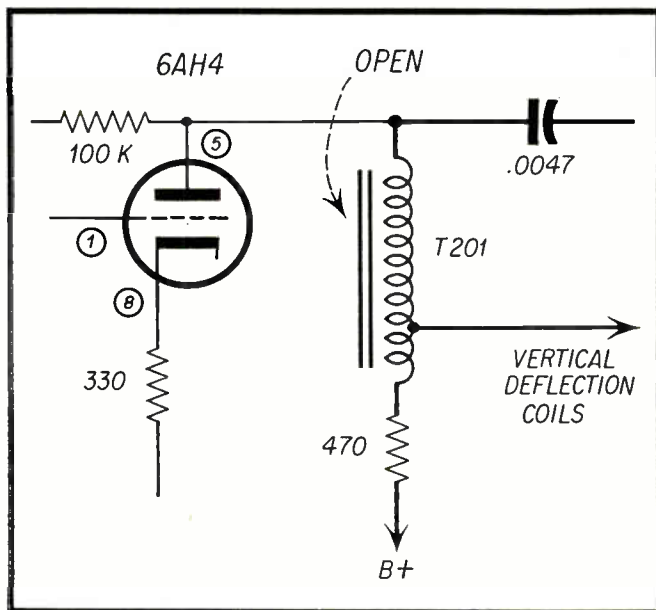
Section Affected: Raster

Symptom: Intermittent vertical sweep

Cause: Intermittently open transformer

What to Do:

Replace: T201, vertical output transformer



Mfg: G. E. Model No. 21C119

Card No. GE 21C119-3

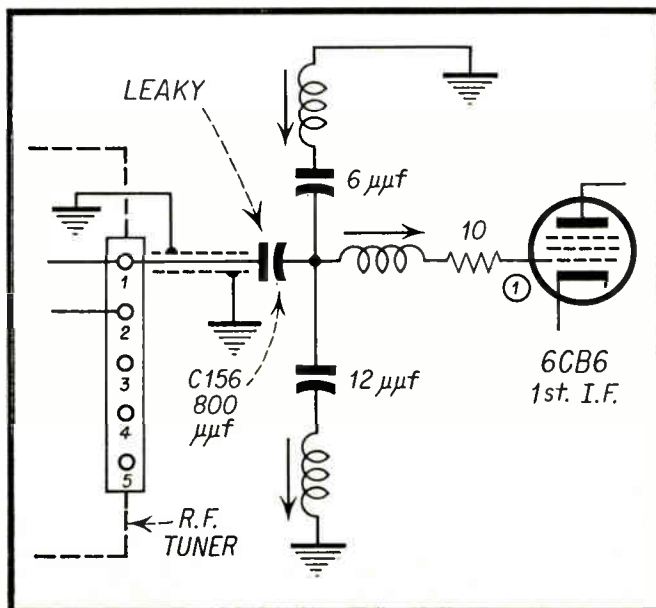
Section Affected: Pix and Sync

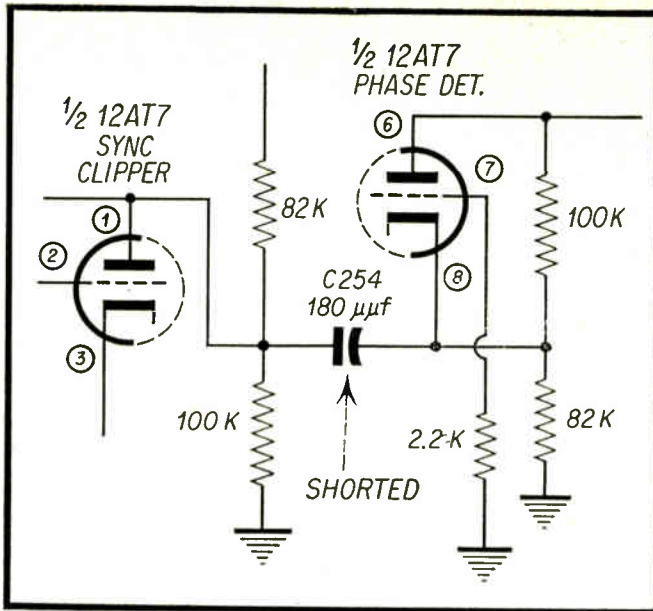
Symptom: Unstable sync, pix overload and buzz

Cause: Leaky coupling condenser

What to Do:

Replace: C156, 800 uuf





Mfg: G. E. Model No. 21C119

Card No. GE 21C119-4

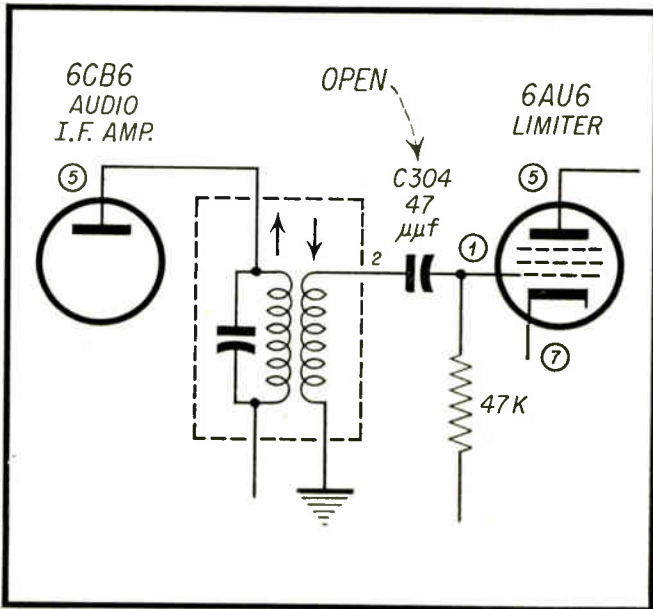
Section Affected: Sync

Symptom: Critical horizontal hold with horizontal jitter

Cause: Shorted coupling condenser

What to Do:

Replace: C254, 180 uuf



Mfg: G. E.

Model No. 21C119

Card No. GE 21C119-5

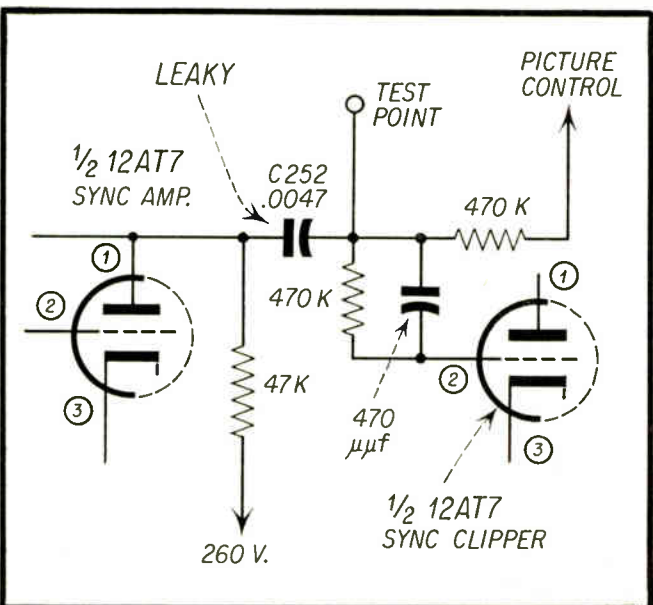
Section Affected: Sound

Symptom: No audio

Cause: Open coupling condenser

What to Do:

Replace: Open condenser C304, 47 uuf



Mfg: G. E.

Model No. 21C119

Card No. GE 21C119-6

Section affected: Picture and sync

Symptom: Pix overdriven with sync pulling

Cause: Leaky condenser

What to Do:

Replace: Leaky condenser C252, .0047 uf

Mfr: Majestic Model No. 121B

Card No. MAJ 121-1

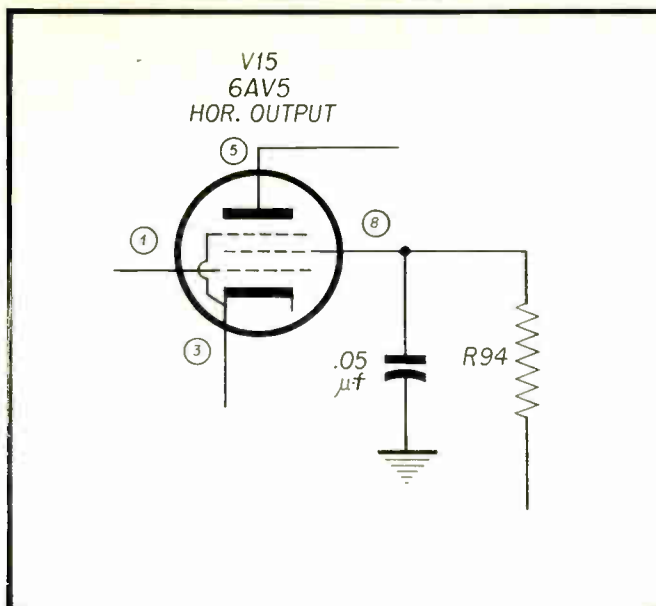
Section Affected: Raster

Symptom: No high voltage

Cause: Defective component

What to Do:

Replace: R94 (5K, 5 watt)—open



Mfr: Majestic Model No. 121B

Card No. MAJ 121-2

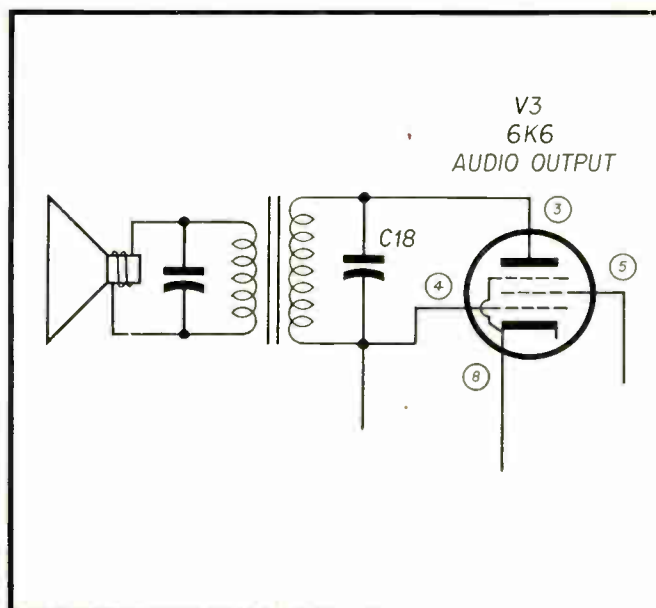
Section Affected: Sound

Symptom: No sound

Cause: Defective component

What to Do:

Replace: C18 (.005 μf)—shorted



Mfr: Majestic Model No. 121B

Card No. MAJ 121-3

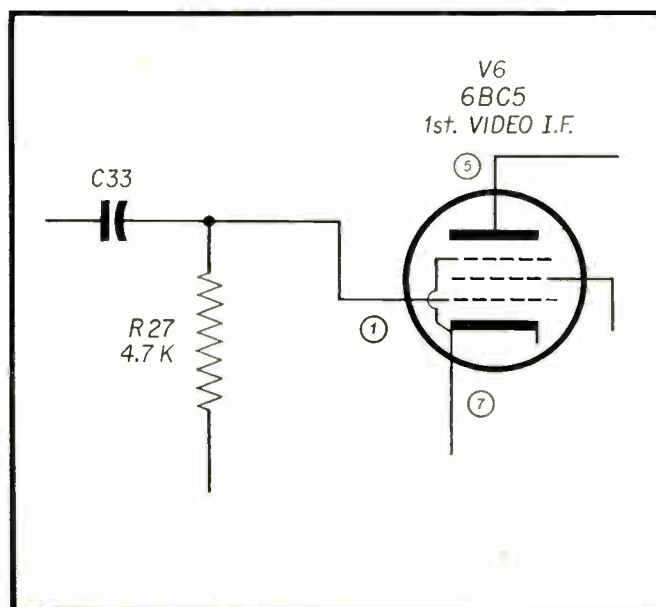
Section Affected: Pix

Symptom: Video overload

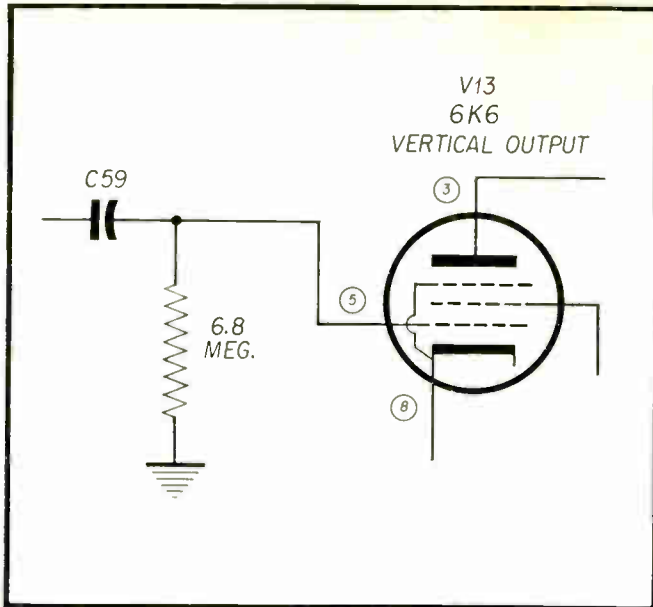
Cause: Defective component

What to Do:

Replace: C33 (100 μμf)—leaking







Mfr: Majestic Model No. 121B

Card No. MAJ 121-4

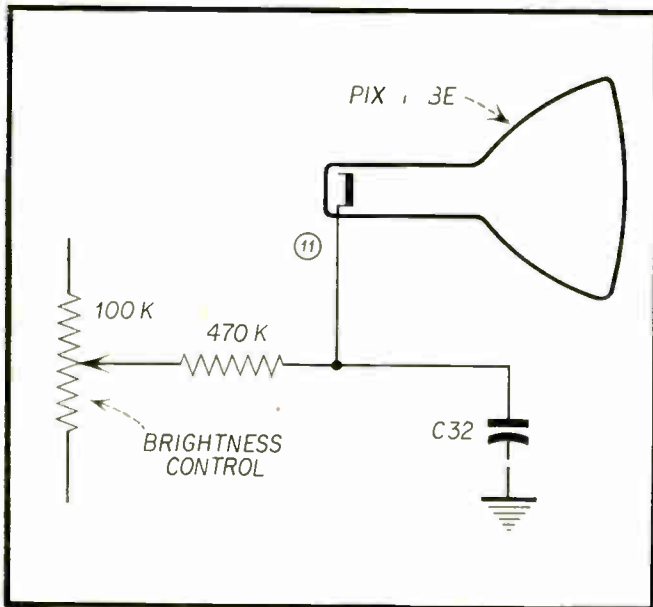
Section Affected: Raster

Symptom: Vertical foldover at bottom

Cause: Defective component

What to Do:

Replace: C59 (0.1  $\mu$ f)—leaky



Mfr: Majestic Model No. 121B

Card No. MAJ 121-5

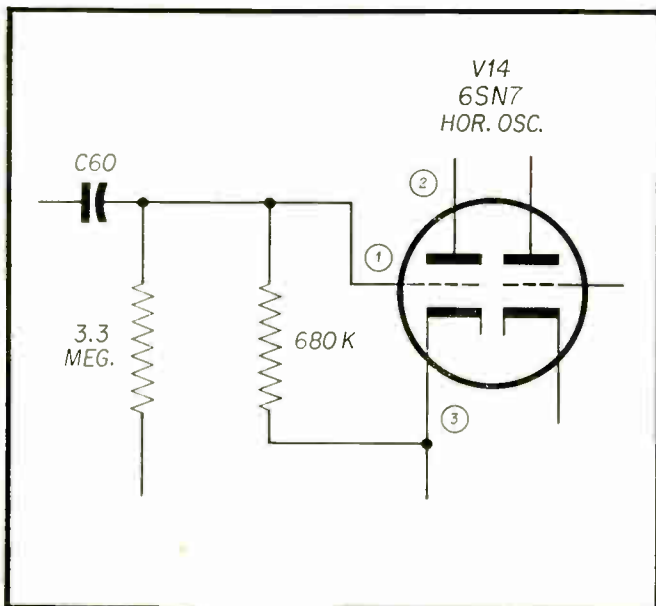
Section Affected: Raster

Symptom: No control of brightness

Cause: Defective component

What to Do:

Replace: C32 (.05  $\mu$ f)—shorted



Mfr: Majestic Model No. 121B

Card No. MAJ 121-6

Section Affected: Sync

Symptom: Horizontal frequency drift

Cause: Defective component

What to Do:

Replace: C60 (.002  $\mu$ f)—leaky

Mfr. Majestic Model No. 21C31

Card No. MAJ 21C31-1 Chassis No. 110

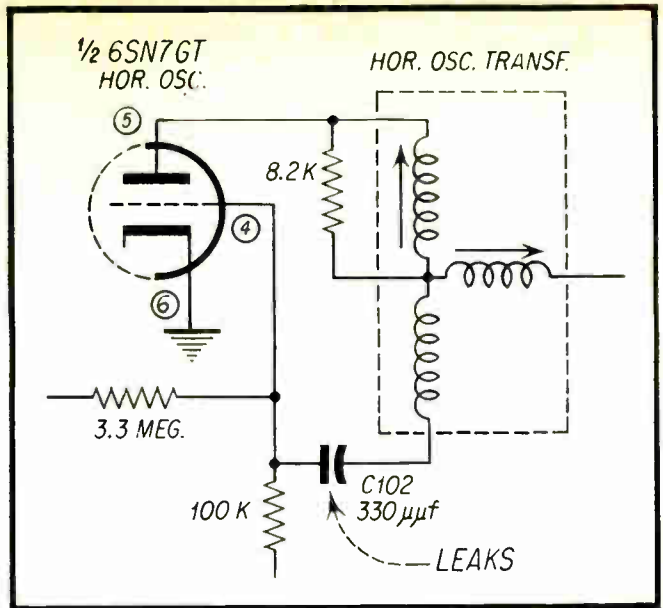
Section Affected: Sync

Symptoms: Horizontal oscillator drifts out of locked-in frequency

Cause: Leaky condenser

What to Do:

Replace: C102, 330  $\mu\text{f}$  condenser.



Mfr. Majestic Model No. 21C31

Card No. MAJ 21C31-2 Chassis No. 110

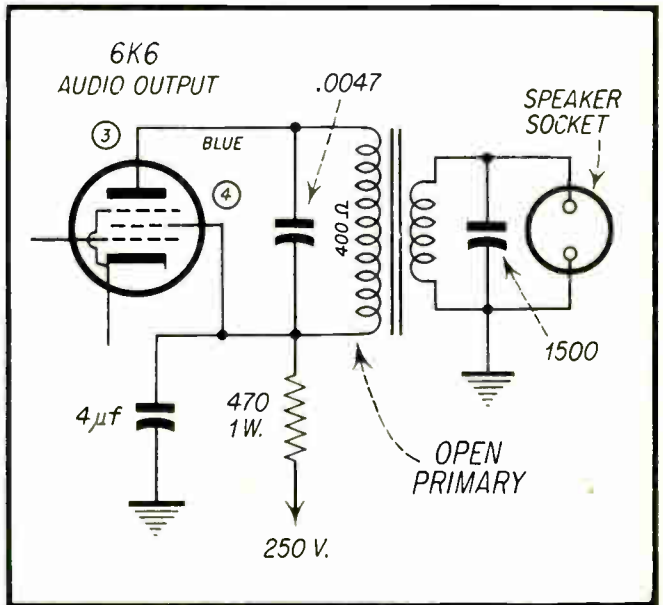
Section Affected: Audio

Symptoms: No sound

Cause: Audio output transformer primary, open

What to Do:

Replace: Audio output transformer, T11



Mfr. Majestic Model No. 21C31

Card No. MAJ 21C31-3 Chassis No. 110

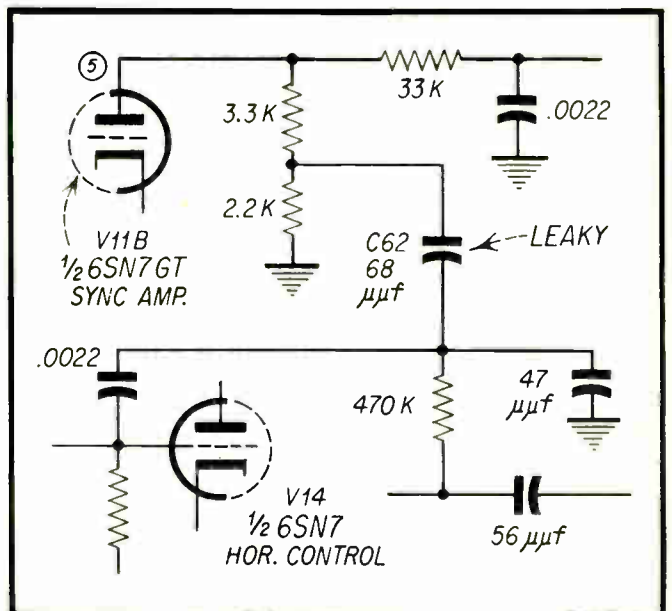
Section Affected: Sync

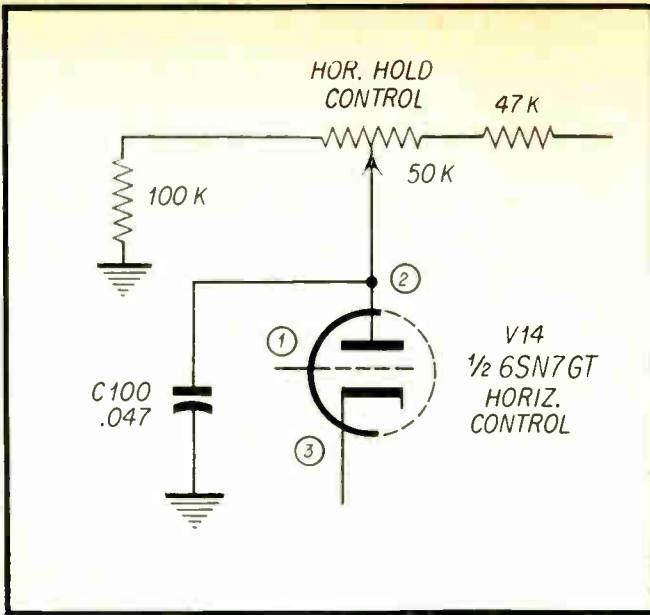
Symptoms: Critical horizontal lock-in action

Cause: Leaky condenser

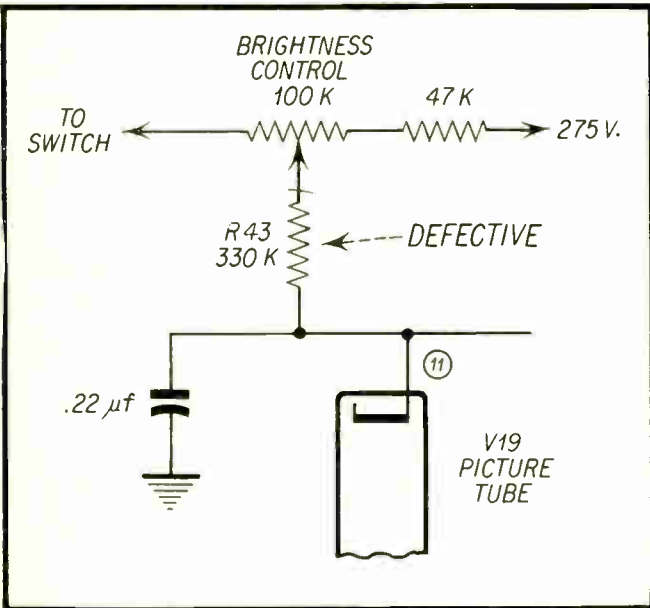
What to Do:

Replace: Condenser C62, 68  $\mu\text{f}$

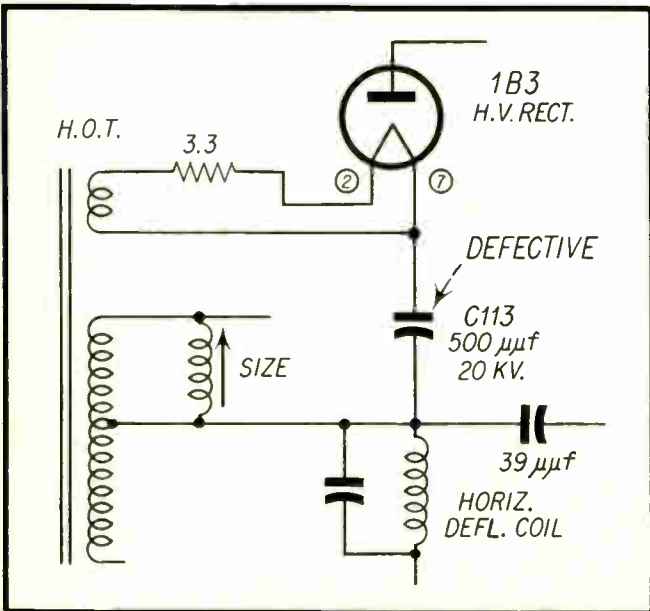




Mfr. Majestic      Model No. 21C31  
 Card No. MAJ 21C31-4    Chassis No. 110  
**Section Affected:** Raster and Picture  
**Symptoms:** No high voltage  
**Cause:** Shorted condenser  
**What to Do:**  
 Replace: C100, .047  $\mu$ f condenser



Mfr. Majestic      Model No. 21C31  
 Card No. MAJ 21C31-5    Chassis No. 110  
**Section Affected:** Pix and Raster  
**Symptoms:** Not able to cut off raster and picture  
**Cause:** Resistor changed in value  
**What to Do:**  
 Replace: R43, 330K resistor



Mfr. Majestic      Model No. 21C31  
 Card No. MAJ 21C31-6    Chassis No. 110  
**Section Affected:** Raster and Pix  
**Symptoms:** Flashing and tearing in raster and picture  
**Cause:** High voltage filter condenser breaking down  
**What to Do:**  
 Replace: C113, 500  $\mu$ f 20KV condenser



Mfg: Motorola Chassis No. TS-326B

Card No. MO326-1

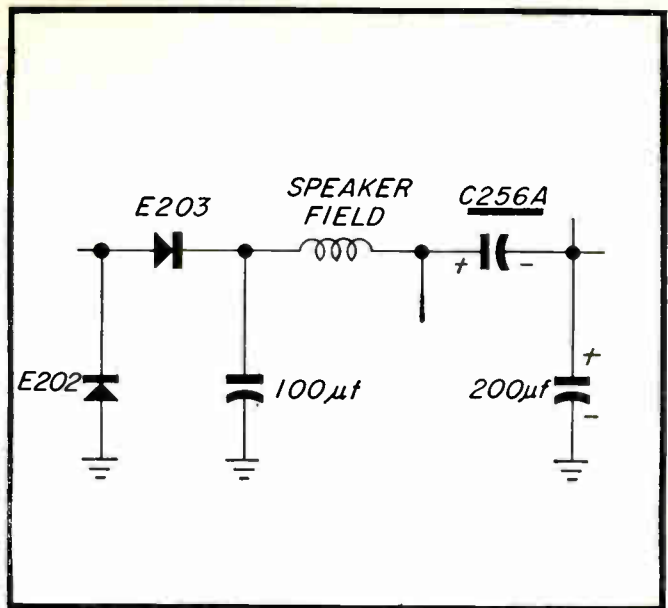
Section Affected: Raster

Symptom: Insufficient width, buzz, and vertical roll.

Cause: Defective component.

What To Do:

Replace: C256A (200), which is leaking.



Mfg: Motorola Chassis No. TS-326B

Card No. MO326-2

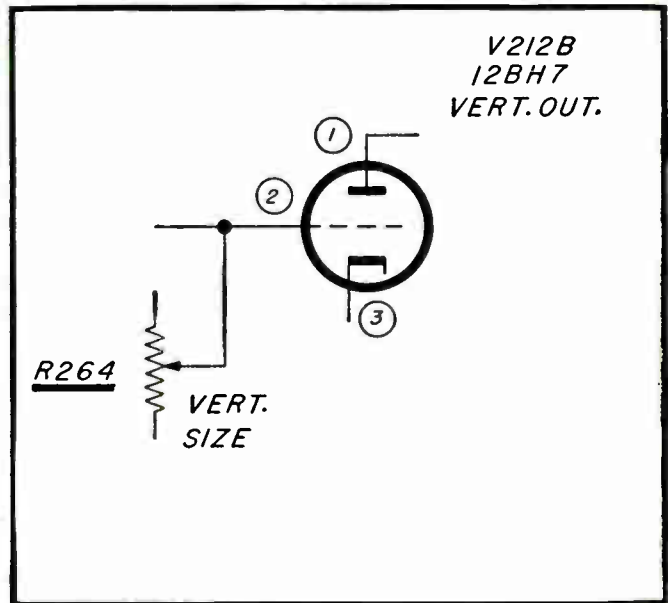
Section Affected: Raster

Symptom: Vertical jumps.

Cause: Defective component.

What To Do:

Replace: R264 (5 meg.), vertical size control; arcing.



Mfg: Motorola Chassis No. TS-326B

Card No. MO326-3

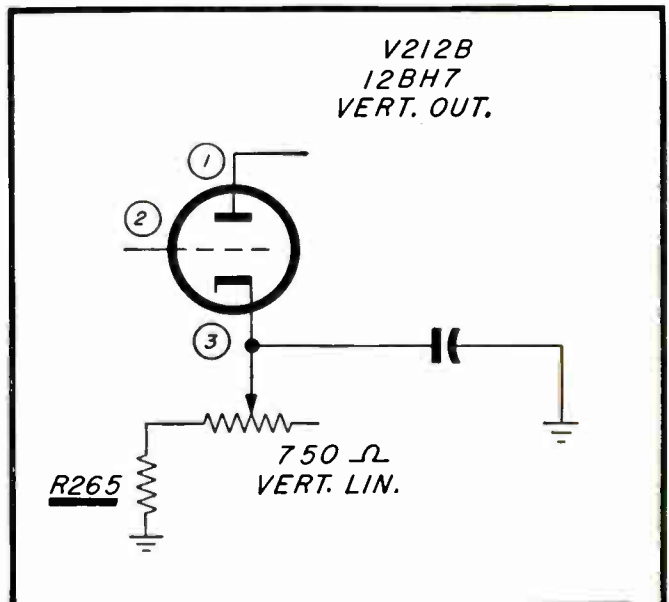
Section Affected: Raster

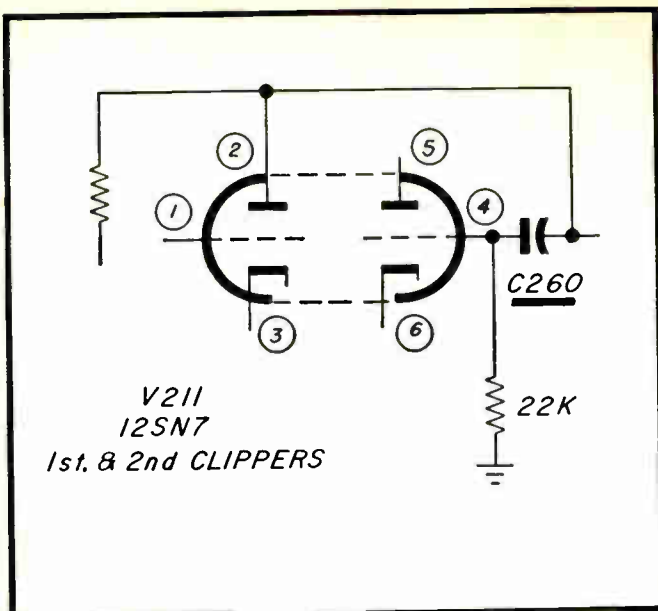
Symptom: Bad vertical sweep.

Cause: Defective component.

What To Do:

Replace: R265 (8.7K), which is open.





Mfg: Motorola Chassis No. TS-326B

Card No. MO326-4

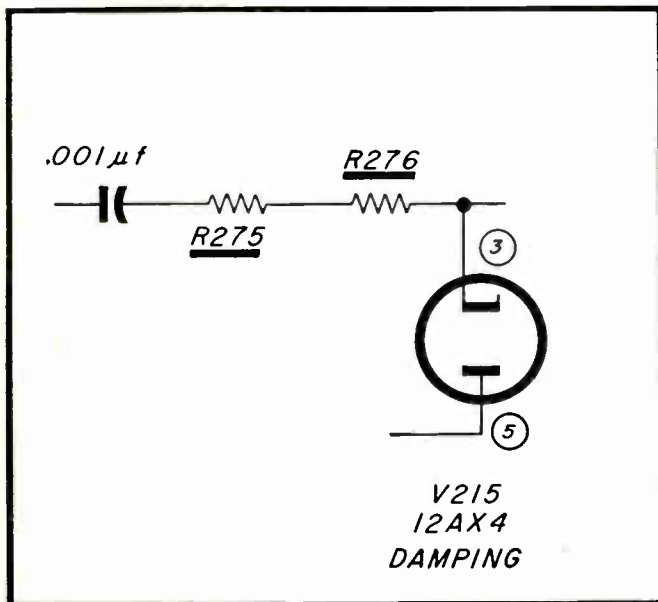
Section Affected: Sync.

Symptom: Critical vertical and horizontal hold.

Cause: Defective component.

What To Do:

Replace: C260 (.05  $\mu$ f), which is leaking.



Mfg: Motorola

Chassis No. TS-326B

Card No. MO326-5

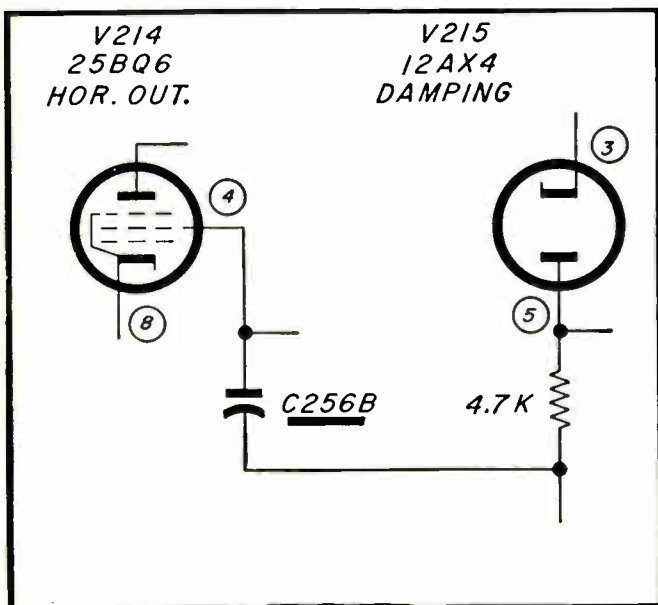
Section Affected: Sync.

Symptom: Critical horizontal sync.

Cause: Defective components.

What To Do:

Replace: R275 (150K), R276 (150K), which have increased in value.



Mfg: Motorola

Chassis No. TS-326B

Card No. MO326-6

Section Affected: Raster

Symptom: Insufficient width and sound distorted

Cause: Defective component.

What To Do:

Replace: C256B (5  $\mu$ f), which is shorted

Mfr: Motorola Chassis No. TS23B

Card No. MO23-1 Model No. 12VT13

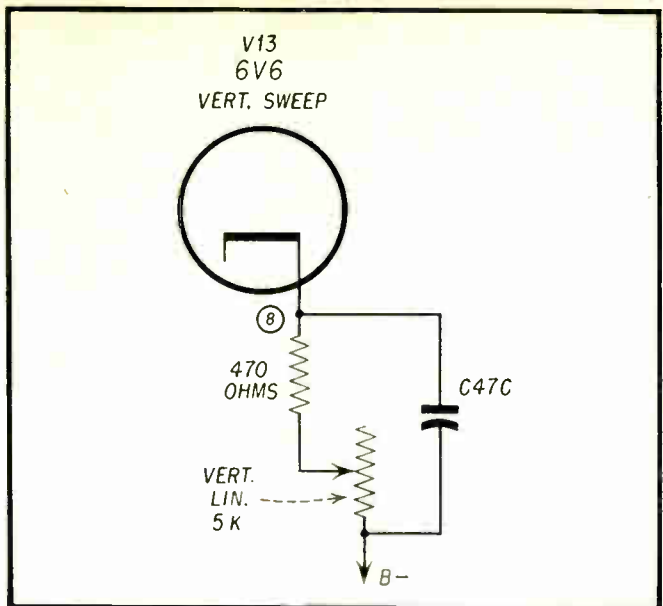
Section Affected: Raster and Pix

Symptom: Poor vertical linearity—not enough height

Cause: Defective component

What To Do:

Replace: C47C (100  $\mu$ f)—opens up



Mfr: Motorola Chassis No. TS23B

Card No. MO23-2 Model No. 12VT13

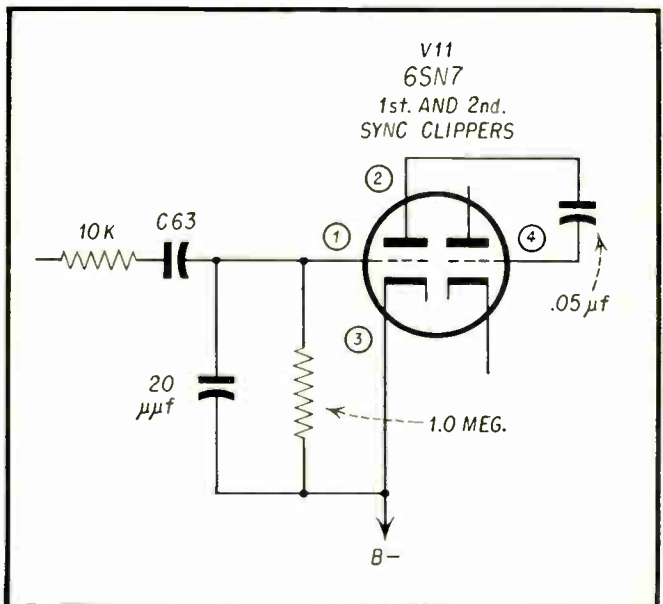
Section Affected: Sync

Symptom: Vertical and horizontal instability

Cause: Defective component

What To Do:

Replace: C63 (.001  $\mu$ f)—leaky



Mfr: Motorola Chassis No. TS23B

Card No. MO23-3 Model No. 12VT13

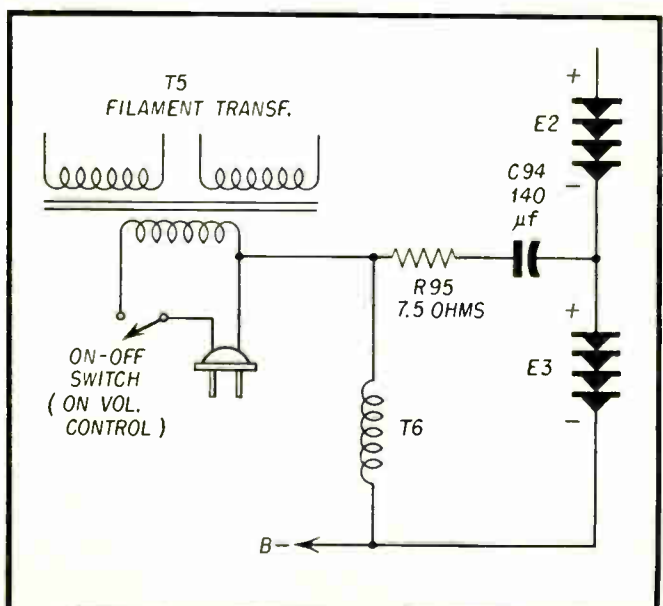
Section Affected: Raster

Symptom: Filaments light—No. B+

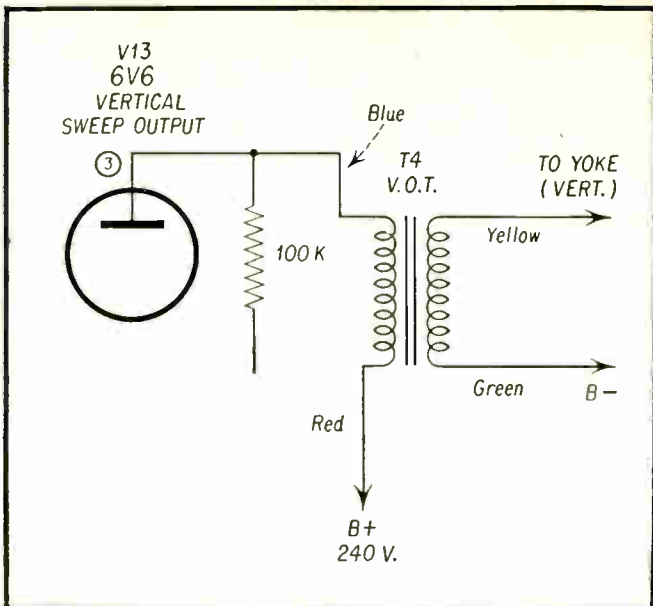
Cause: Defective component

What To Do:

Replace: R95 (7.5 ohms)—open







Mfr: Motorola Chassis No. TS23B

Card No. MO23-4 Model No. 12VT13

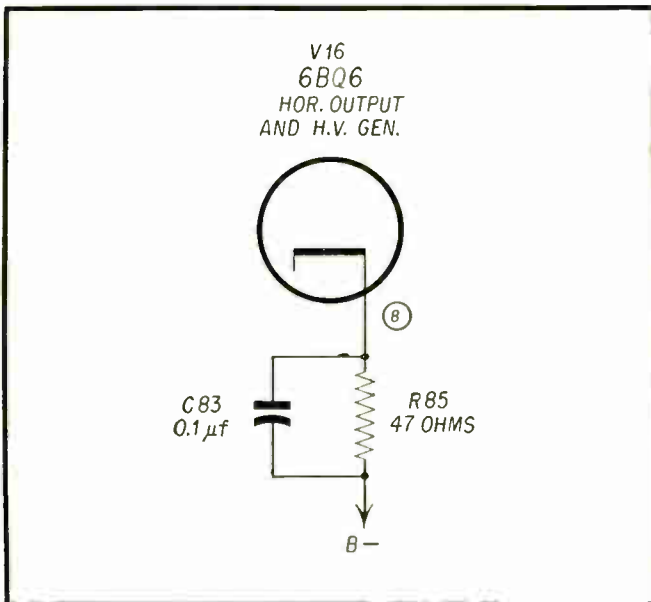
Section Affected: Raster

Symptom: Vertical shrinking

Cause: Defective component

What To Do:

Replace: Vertical output transformer (T4)



Mfr: Motorola Chassis No. TS23B

Card No. MO23-5 Model No. 12VT13

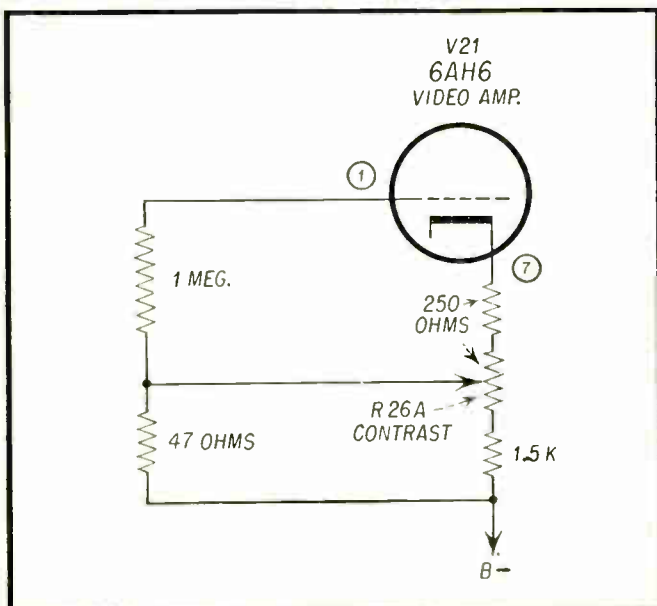
Section Affected: Raster

Symptom: Intermittent raster

Cause: Defective component

What To Do:

Replace: R85 (47 ohm— $\frac{1}{2}$  W) with 47 ohm—1 watt; opens intermittently



Mfr: Motorola Chassis No. TS23B

Card No. MO23-6 Model No. 12VT13

Section Affected: Pix

Symptom: No pix

Cause: Defective component

What To Do:

Replace: Contrast control R26A (250 ohms)—opens up

Mfr: Motorola Chassis No. TS-525

Card No: MO525-1

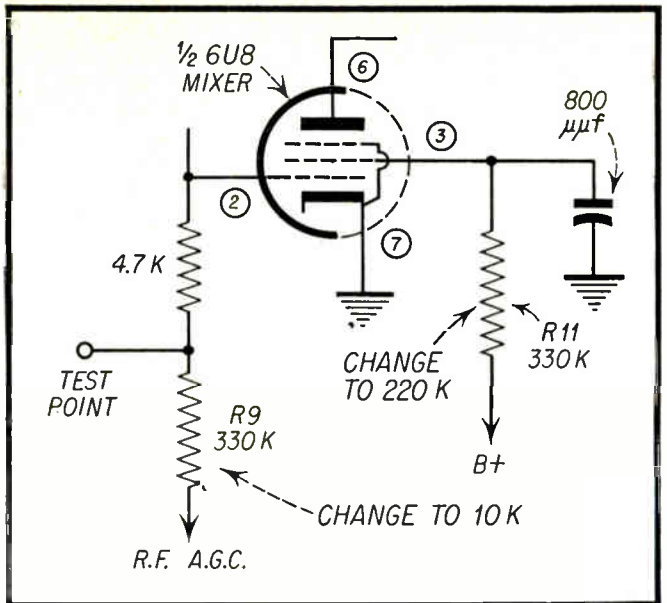
Section Affected: Pix and Sound

Symptoms: Excessive TVI

Reason for Change: Circuit improvement

**What to Do:**

Change: R9 from 330K to 10K also, R11 from 330K to 220K



Mfr: Motorola Chassis No. TS-525

Card No: MO525-2

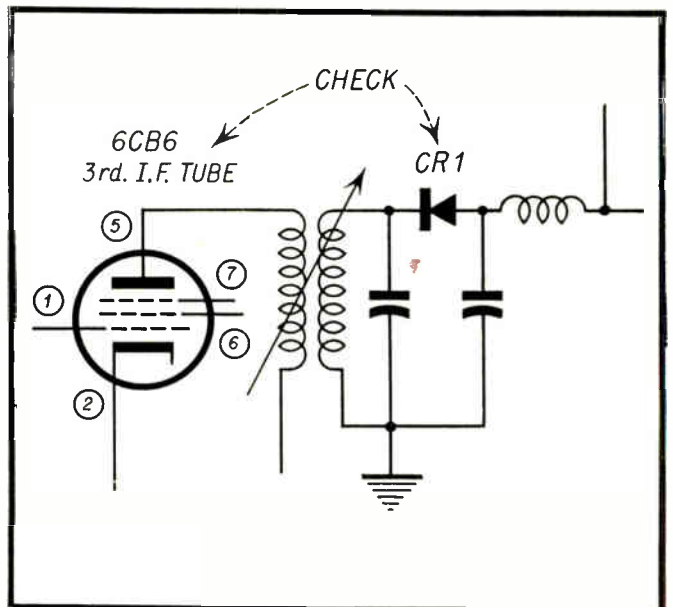
Section Affected: Pix

Symptoms: Horizontal Pulling

Cause: Component Failure

**What to Do:**

Change: 3rd if tube (6CB6) or video detector crystal (CR1)



Mfr: Motorola Chassis No. TS-525

Card No: MO525-3

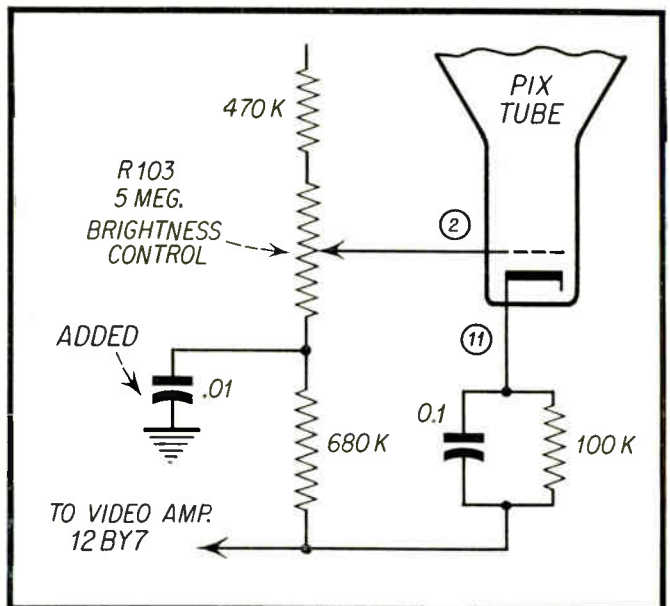
Section Affected: Pix

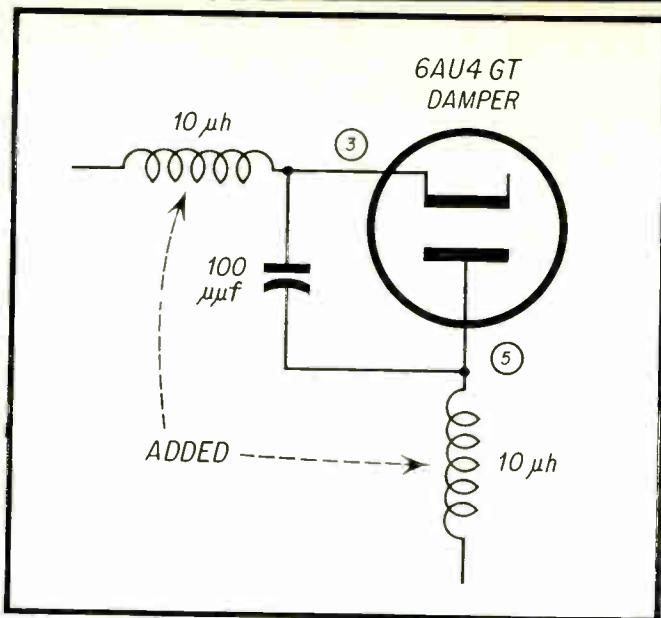
Symptoms: Picture Pulling

Cause: Coupling between horizontal hold control and brightness control leads

**What to Do:**

Add: .01 μf at brightness control





Mfr: Motorola Chassis No. TS-525

Card No: MO525-4

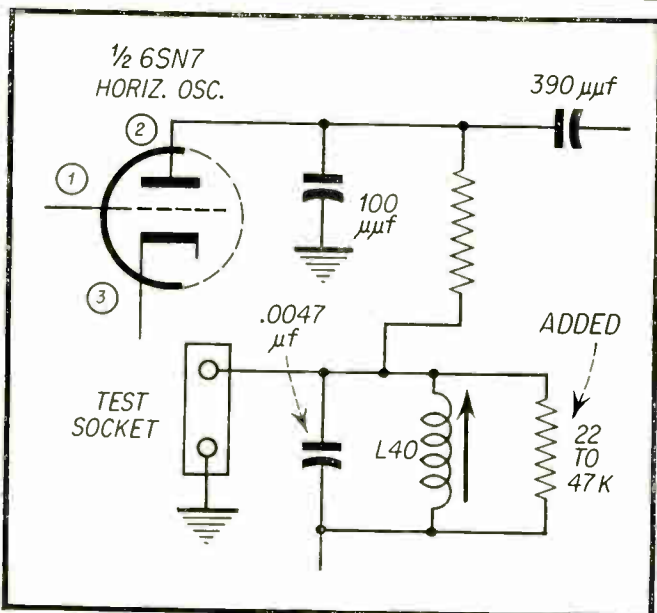
Section Affected: Pix

Symptoms: Horizontal Jitter

Reason for Change: Circuit Improvement

What to Do:

Add: 10 microhenry chokes in plate and cathode leads of damper tube



Mfr: Motorola Chassis No. TS-525

Card No: MO525-5

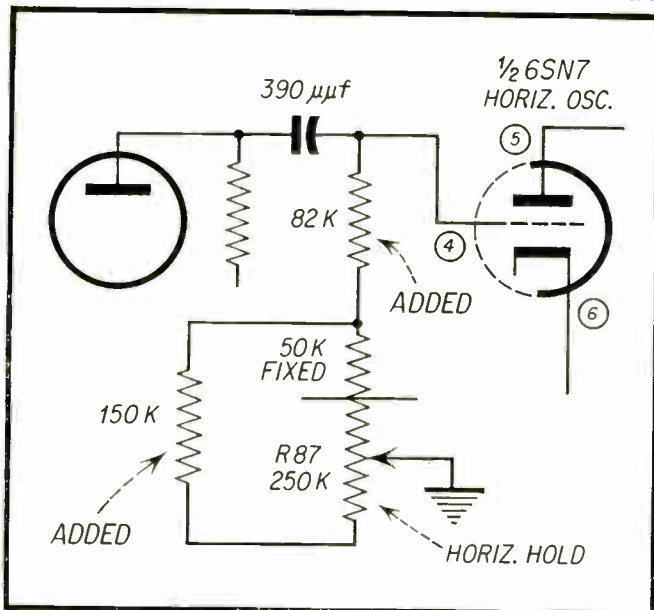
Section Affected: Pix

Symptoms: Horizontal jitter and hunting

Reason for Change: Circuit improvement

What to Do:

Add: 22K to 47K across horizontal osc. coil



Mfr: Motorola Chassis No. TS-525

Card No: MO525-6

Section Affected: Pix

Symptoms: Critical horizontal lock-in

Reason for Change: Circuit improvement

What to Do:

Check: Horizontal hold control

Add: 82K in series with hor. hold control

Also: 150K in shunt with hor. hold control



Mfr. Olympic Model No. 17K41

Card No. OLTK-1 Chassis No. TK

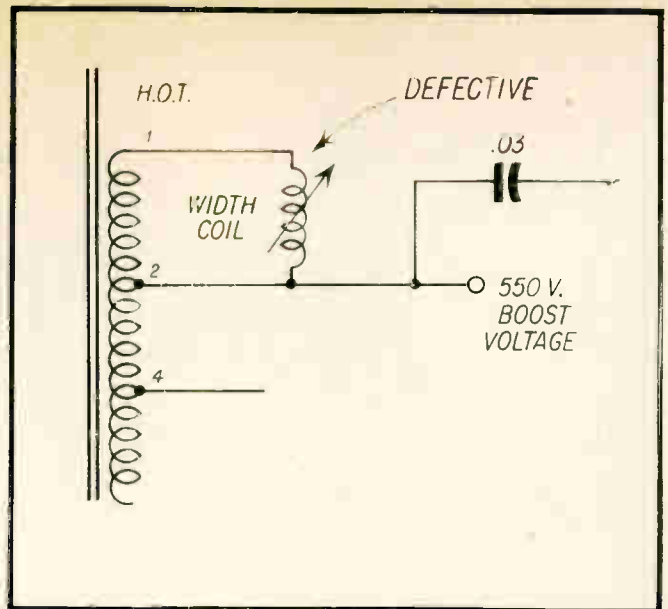
Section Affected: Raster

Symptoms: No high voltage

Cause: Width coil internally shorted

What to Do:

Replace: Width coil, L19



Mfr. Olympic Model No. 17K41

Card No. OLTK-2 Chassis No. TK

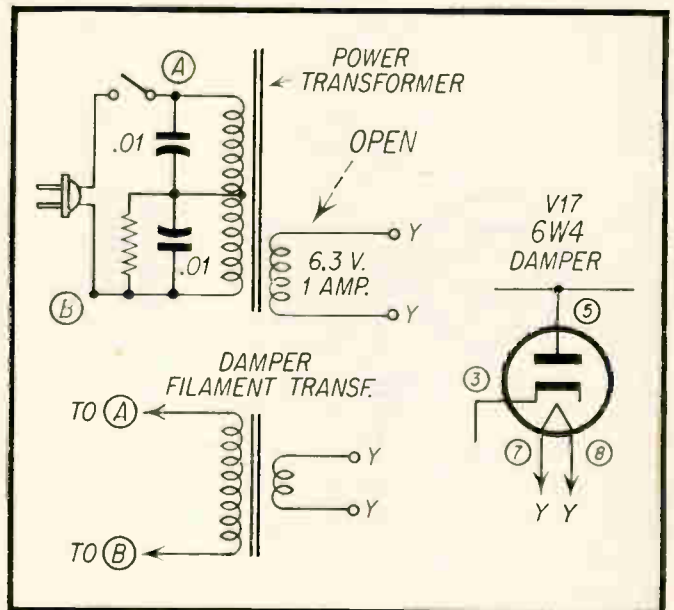
Section Affected: Raster

Symptoms: No high voltage

Cause: Open 6W4 Filament winding on power transformer

What to Do:

Add: 115 volt 6.3 volt filament transformer to operate the 6W4 tube



Mfr. Olympic Model No. 17K41

Card No. OLTK-3 Chassis No. TK

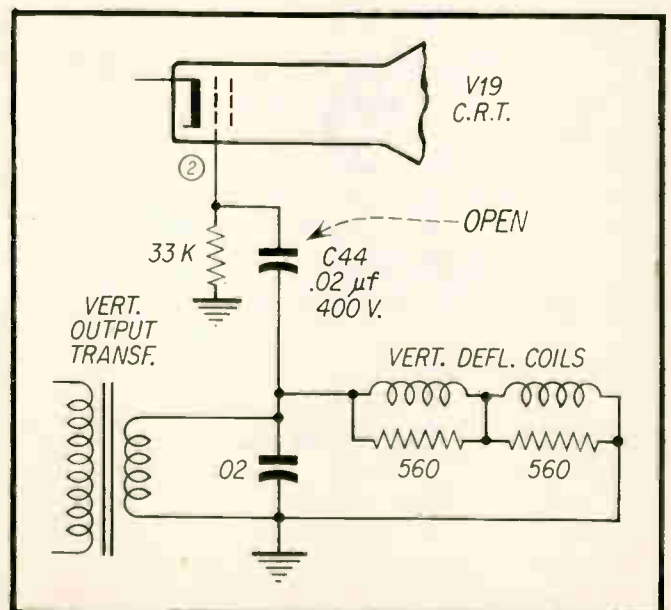
Section Affected: Raster and Picture

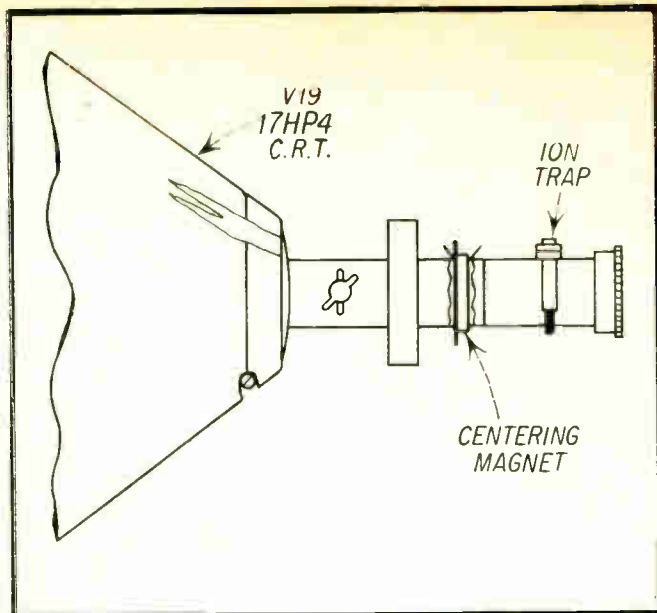
Symptoms: Visible retrace lines

Cause: Open condenser

What to Do:

Replace: C44, .02  $\mu$ f condenser





Mfr. Olympic Model No. 17K41

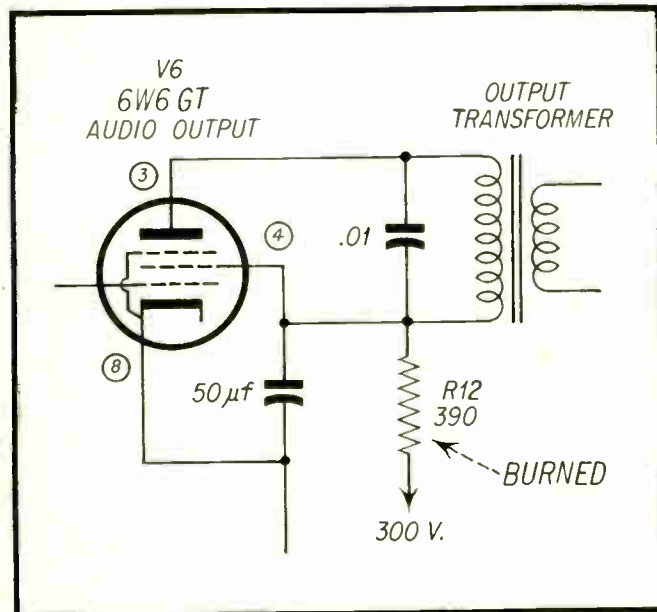
Card No. OLTK-4 Chassis No. TK

Section Affected: Picture and raster

Symptoms: Inability to center raster without corner shadows.

Cause: Defective raster centering assembly  
What to Do:

Replace: Raster centering Assembly



Mfr. Olympic Model No. 17K41

Card No. OLTK-5 Chassis No. TK

Section Affected: Audio

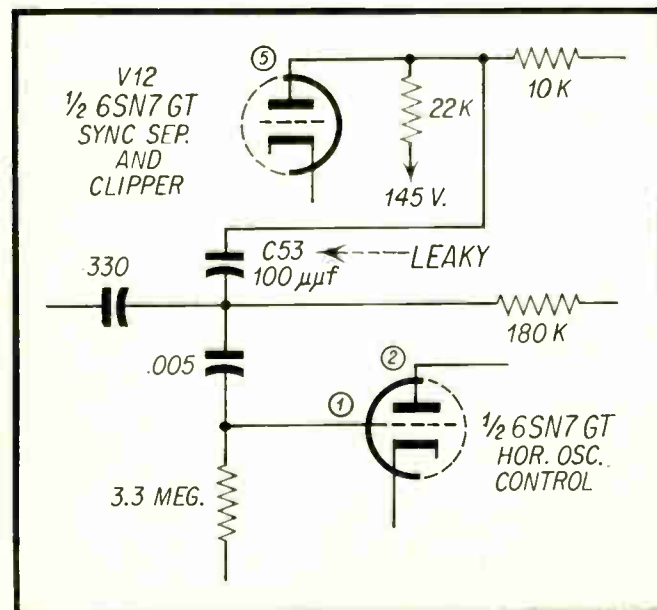
Symptoms: Frying noise in sound

Cause: Resistor burning

What to Do:

Replace: R12, 390 ohm resistor

Check: C11—50  $\mu$ f for short



Mfr. Olympic Model No. 17K41

Card No. OLTK-6 Chassis No. TK

Section Affected: Sync

Symptoms: Very unstable horizontal hold

Cause: Leaky condenser

What to Do:

Replace: C53, 100  $\mu$ f condenser

Mfr: Philco Chassis No. TV-400

Card No: PH 400-1

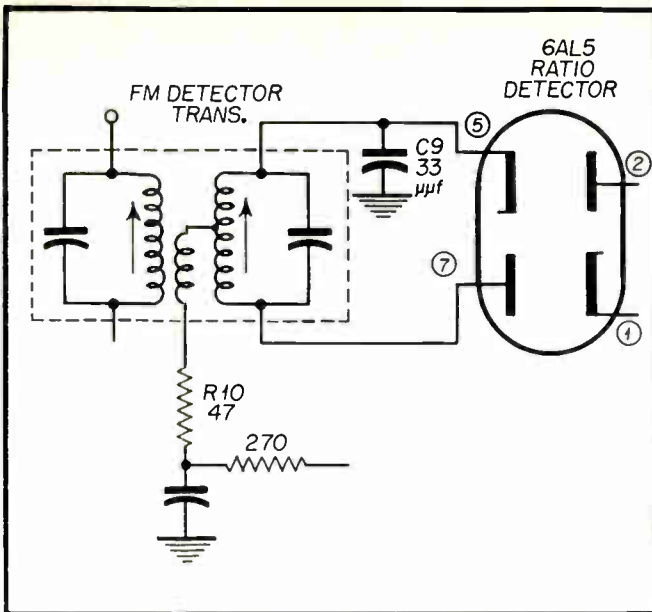
Section Affected: Sound

Symptom: Intermittent Audio

Cause: Component failure. Replace FM detector transformer which has become intermittently defective internally.

**What to Do:**

Replace: FM detector transformer, T1, which is Pt #32-4450-6. The New transformer, Pt #32-4633 is preferable when making this replacement, in which case condenser C9, 3.3  $\mu\text{mf}$  and resistor R10, 47 ohms are removed.



Mfr: Philco Chassis No. TV-400

Card No: PH 400-2

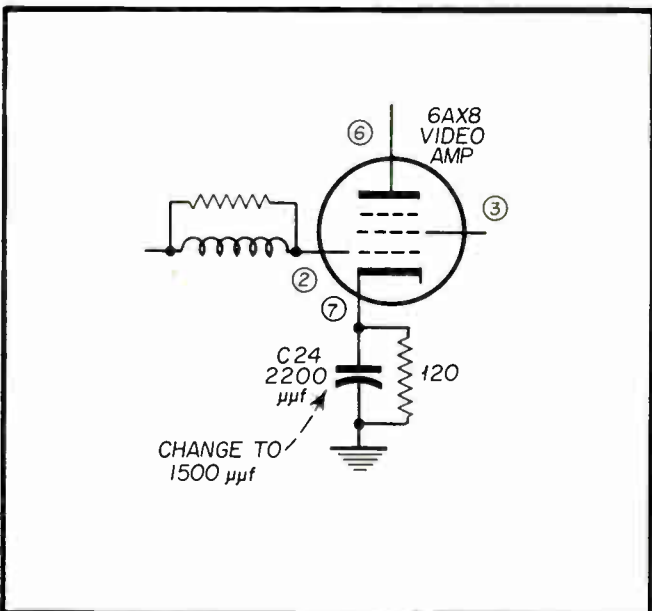
Section Affected: Pix

Symptom: Transient response occurring in the picture as trailing small ghosts on certain small edges.

Reason For Change: To improve transient response of circuit so as to eliminate above symptoms.

**What to Do:**

Replace: C24 from .0022  $\mu\text{f}$  to .0015  $\mu\text{f}$ .



Mfr: Philco Chassis No. TV-400

Card No: PH 400-3

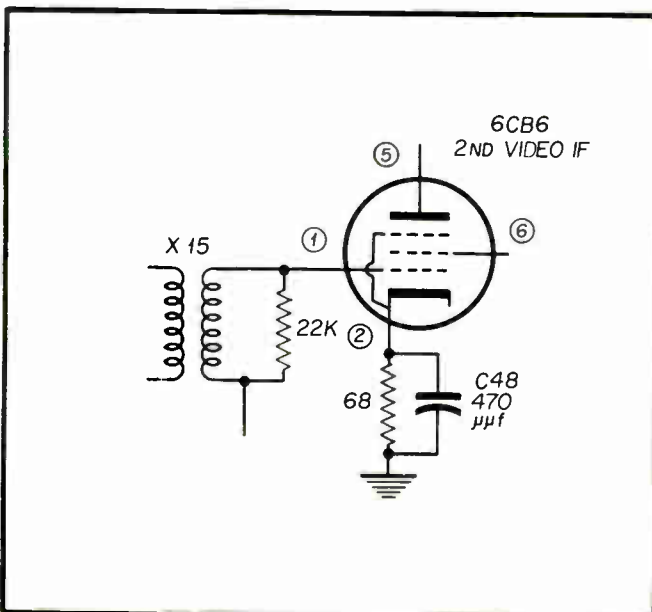
Section Affected: Pix and Sound

Symptom: The receiver adjusts to best picture and sound at two points of fine tuner range

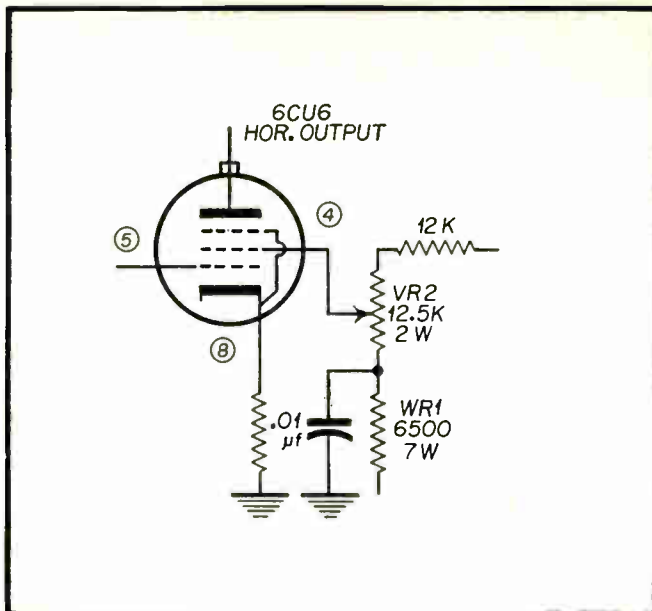
Reason for Change: To improve circuit so that best picture and sound occurs between these two mentioned points. This condition is most prevalent under weak signal conditions.

**What to Do:**

Replace: C48 condenser from 470  $\mu\text{mf}$  to 1500  $\mu\text{mf}$ . This condenser is located in 2nd Video if and is the cathode by-pass.







Mfr: Philco

Chassis No. TV-400

Card No: PH 400-4

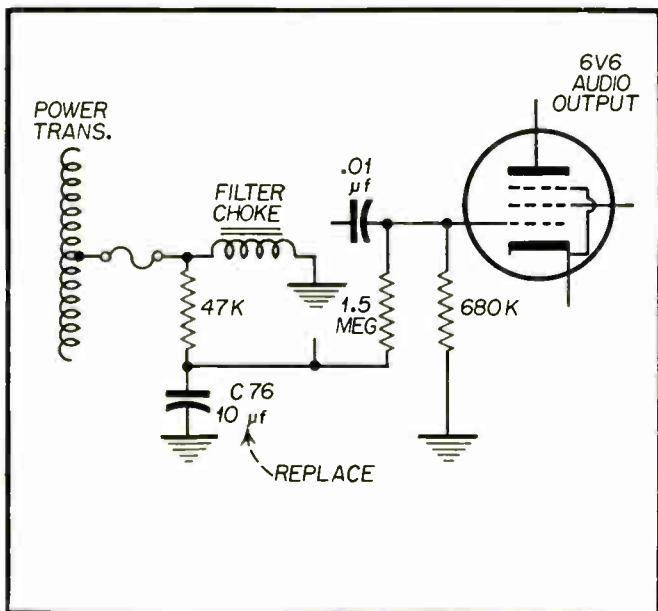
**Symptom:** Insufficient width, intermittent raster or no high voltage

**Cause:** Failure of the width control, in that it may have burned, become spotty or intermittently bad. It should be checked for resistance and rough spots when rotated.

**What to Do:**

Replace: Width potentiometer, VR2, 12.5K ohm, 2 watt.

Note: In case of insufficient width not due to the above cause the high voltage transformer can be changed from Pt. #32-8662 to #32-8662-1. This new transformer has been incorporated in chassis of run #3 or later.



Mfr: Philco

Chassis No. TV-400

Card No: PH 400-5

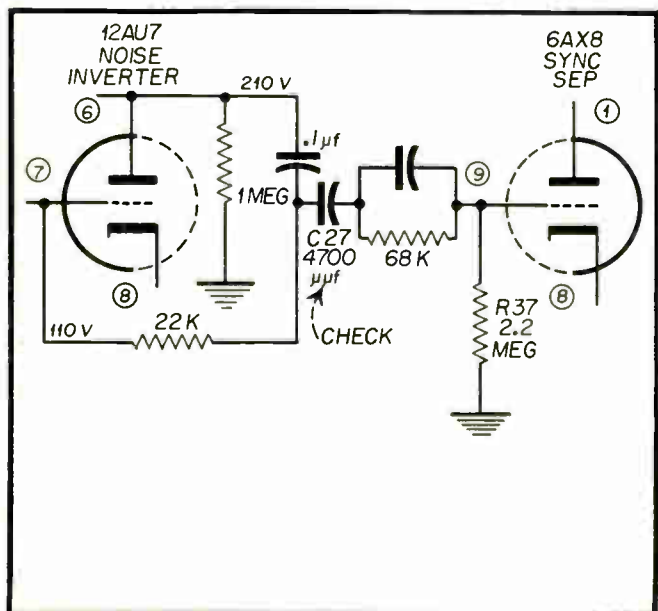
**Section Affected:** Audio

**Symptom:** Hum in sound when channel selector has been turned off channel or volume control rotated to minimum volume position

**Cause:** Failure of filter condenser in B minus supply, C76, 10 μf

**What to Do:**

Replace: Condenser C76, 10 μf with a 25 μf condenser of 25 volt rating or better.



Mfr: Philco

Chassis No. TV-400

Card No: PH 400-6

**Section Affected:** Pix

**Symptom:** Horizontal pulling throughout the picture caused by video information passing into the sync circuits

**Cause:** Component failure. C27 has developed a leak changing the bias at the grid of sync separator tube.

**What to Do:**

Replace: Condenser C27, 4700 μf.

Note: Resistor R37, 2.2 megohms may be changed to 5.6 megohms for better circuit action in completely preventing video from passing through the stage.

Mfg: Philco Chassis No. TV-354  
 Card No. PH 354-1

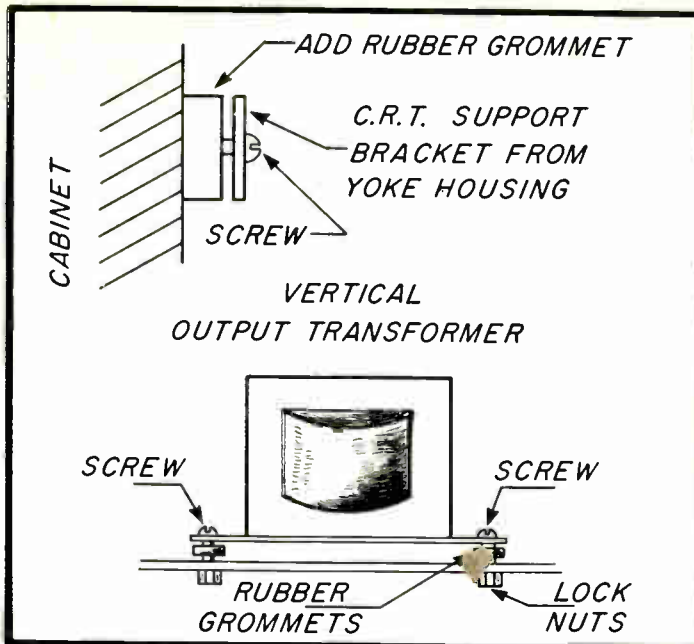
Section Affected: Audio

Symptoms: Mechanical hum emanating from components such as yoke, vertical output transformer, or power transformer.

Reason For Change: To improve, reduce or eliminate mechanical hum.

What to do:

Install rubber grommets at the item causing the hum. If it is associated with the yoke, install rubber grommets under the CRT support brackets. The cabinet side and top is acting as a sounding board for the buzz transmitted through the metal brackets. If the vertical output transformer is causing the hum install the grommets under the mounting brackets of the transformer. If the power transformer is the cause of the hum due to loose laminations correct by tightening cover and core holding screws.



Mfg: Philco Chassis No. TV-354  
 Card No. PH 354-2

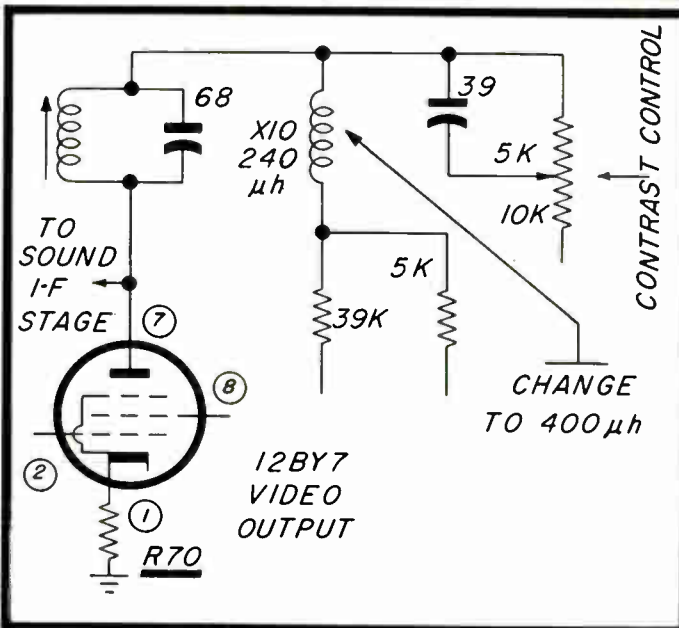
Section Affected: Pix

Symptoms: Trailing edges in certain portions of the picture due to undesirable oscillation.

Reason For Change: To improve the transient response of the video amplifier stage.

What to do:

Replace: X10, 240 microhenry coil with a 400 microhenry coil.  
 R70, 22 ohm resistor with a 33 ohm resistor.



Mfg: Philco Chassis No. TV-354  
 Card No. PH 354-3

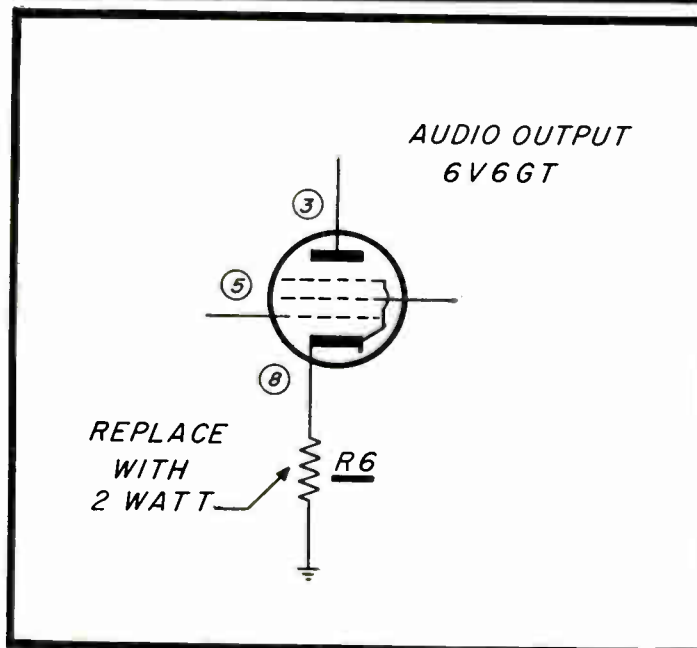
Section Affected: Audio

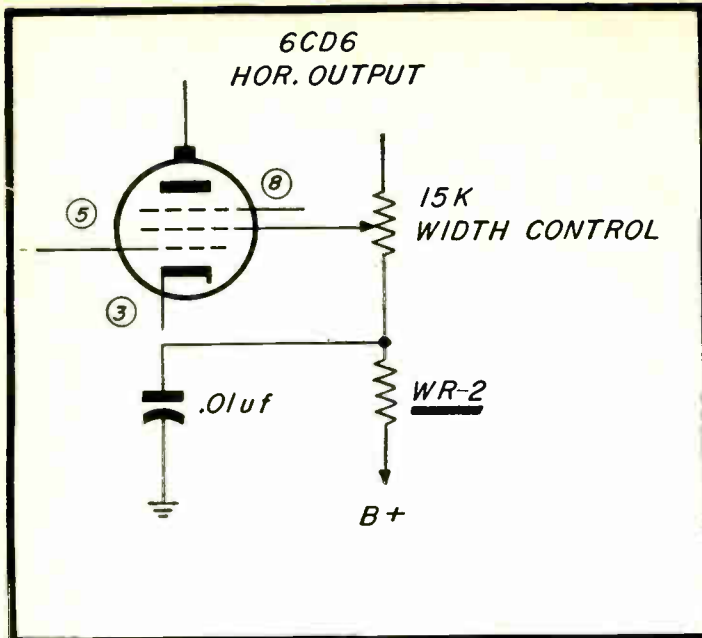
Symptoms: No sound or distorted sound

Cause: Component failure. The cathode resistor has increased in value or opened.

What to do:

Replace: R6, 270 ohm resistor. This resistor should be 2 watts.





Mfg: Philco

Chassis No. TV-354

Card No. PH 354-4

Section Affected: Raster and Pix

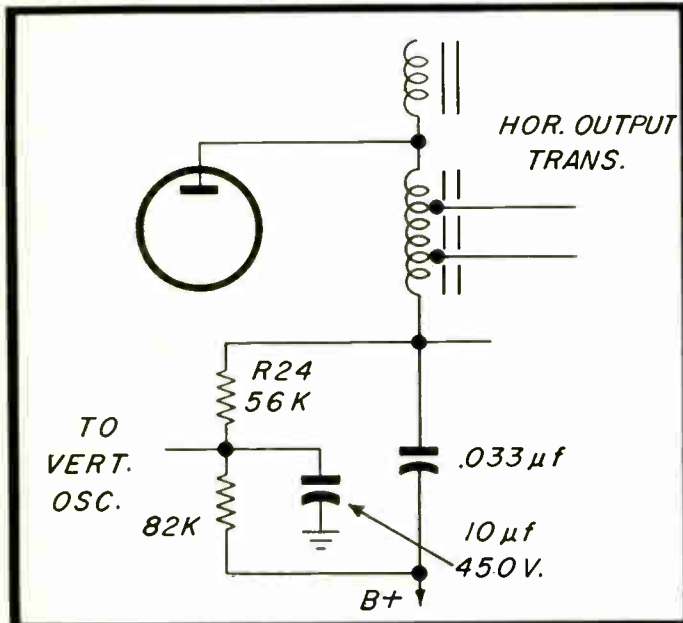
Symptoms: Insufficient width and poor horizontal linearity.

Reasons For Change: To improve circuit and make available a greater range of width control with better horizontal linearity.

What to do:

Change: WR-2 from 8200 ohms, 7 watts to 6500 ohms, 7 watts.

Note: This has been incorporated in chassis after run 6.



Mfg: Philco

Chassis No. TV-354

Card No. PH 354-5

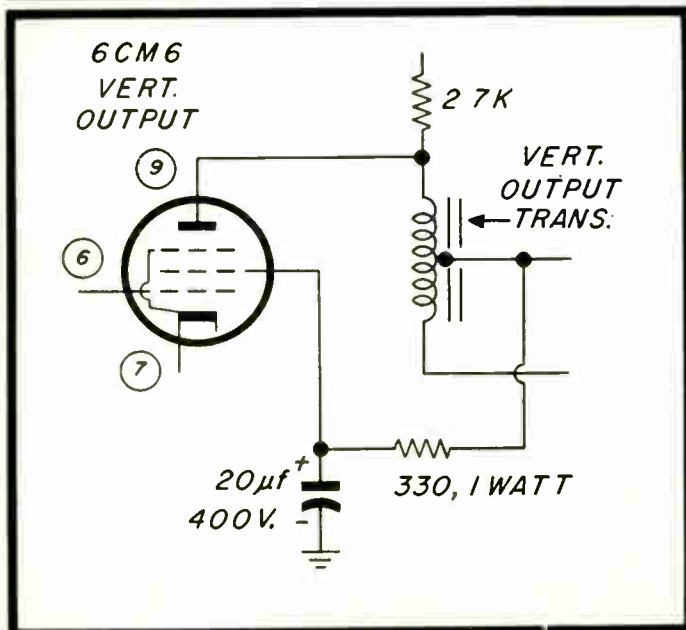
Section Affected: Pix and Raster

Symptoms: No vertical deflection

Cause: Component failure. Resistor R24 burned open or increased very high in value. This resistor can also be the cause of vertical shrinkage if it increases in value as the receiver warms up.

What to do:

Change: R24, from 56K to two resistors, 33K and 22K in series each having a wattage dissipation rating of 2 watts.



Mfg: Philco

Chassis No. TV-354

Card No. PH 354-6

Section Affected: Pix and Raster

Symptoms: Vertical shrinkage and squeezing at bottom of picture.

Reason For Change: To increase decoupling of B plus supply, provide additional filtering and effectively make the screen 10 volts higher.

What to do:

Add: 330 ohm resistor, one watt and 20 uf condenser, 400 volts.

Note: Under low line voltage conditions or in a hot climate the bottom of the picture may shrink up during the first three hours of operation. This is very frequently due to an increase in resistance in the yoke as its temperature increases.

If shrinkage still persists change yoke to part No. 32-9689-1.

If shrinkage is still objectionable change Vertical Output Transformer to 32-8686 from 32-8667.



**Mfr:** Philco **Model No.** 50-T1600, 51-T1600, etc.  
**Card No.:** PH1600-1 **Code No.** 121 and 122

**Section Affected:** Sync

**Symptom:** Critical sync action under difficult reception conditions

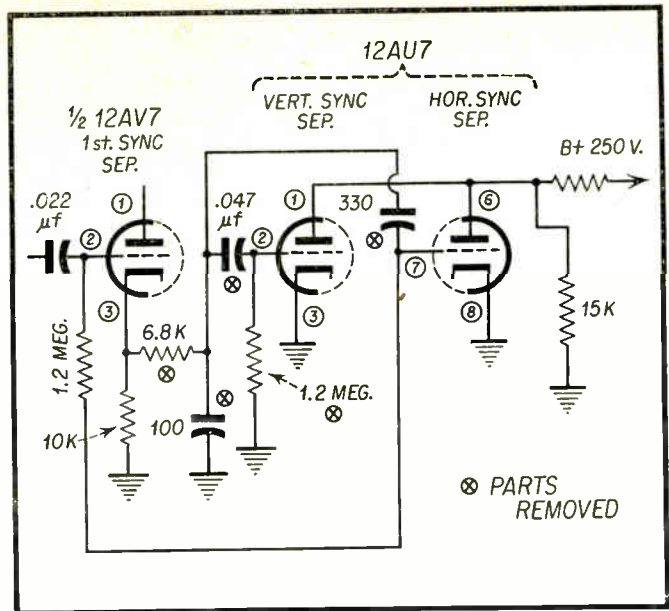
**Reason for Change:** Circuit improvement

**What to Do:**

Remove: 6.8K, 1.2 meg resistors as shown also 100  $\mu\text{f}$ , .047  $\mu\text{f}$  and 330  $\mu\text{f}$  condensers as shown

Install: Parts and rewire as shown in Card No. PH1600-2

(continued on Card No. PH 1600-2)



(continued from Card No. Ph 1600-1)

**Mfr:** Philco **Model No.** 50-T1600, 51-T1600, etc.  
**Card No.:** PH1600-2 **Code No.** 121 and 122

**Section Affected:** Sync

**Symptom:** Critical sync under difficult reception conditions

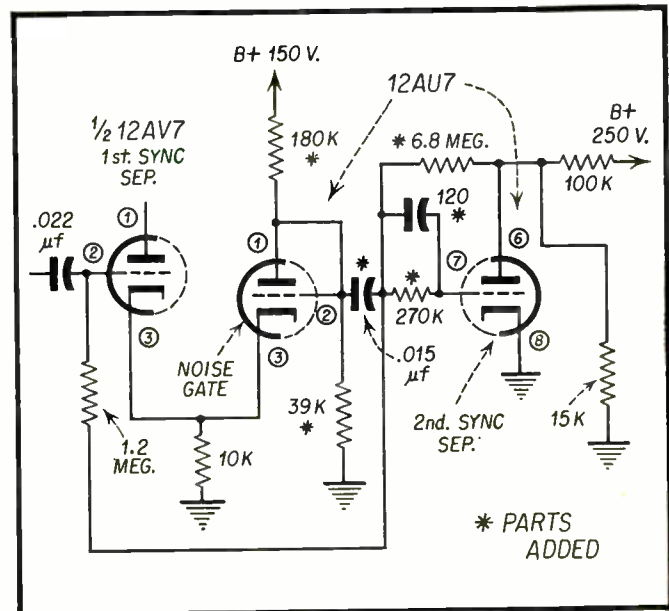
**Reason for Change:** Circuit improvement

**What to Do:**

Install: 39K, 180K, 270K, 6.8K, 100K, resistors as shown

Also, .015  $\mu\text{f}$ , 120  $\mu\text{f}$  condensers as shown

Rewire: As shown



**Mfr:** Philco **Model No.** 50-T1600, 51-T1600, etc.  
**Card No.:** PH1600-3 **Code No.** 121 and 122

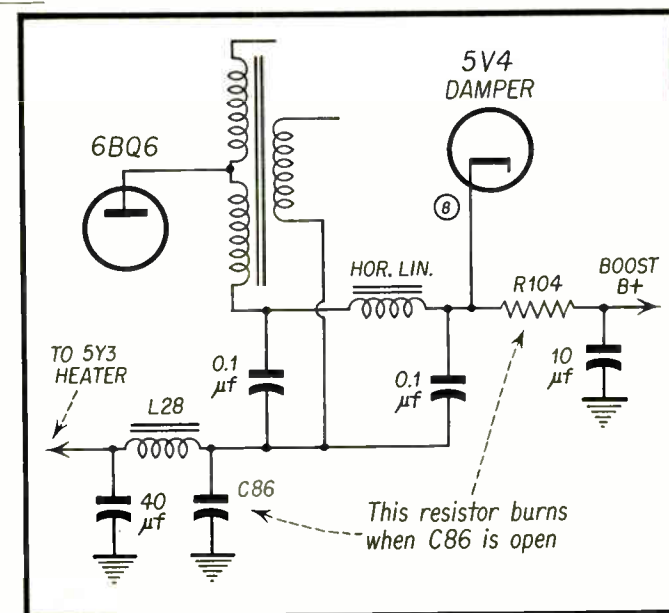
**Section Affected:** Raster

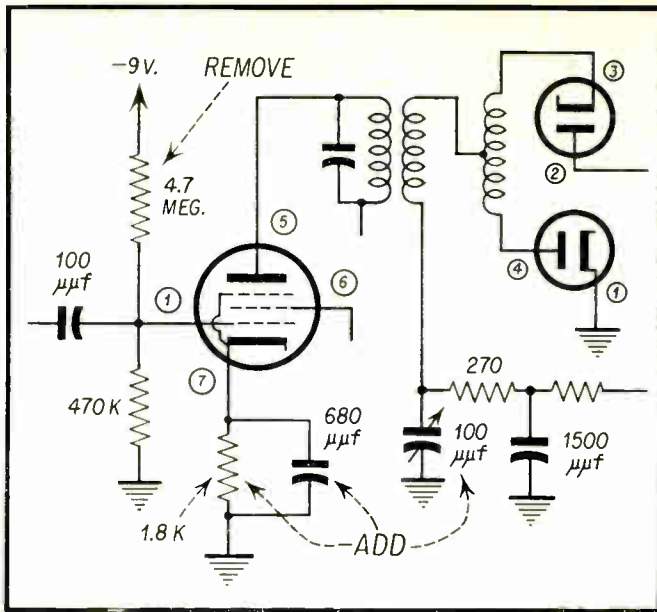
**Symptom:** No raster, no high voltage; R104 (4.7K) resistor burns

**Cause:** C86 (40  $\mu\text{f}$ ) is open, causing horizontal rf energy to flow completely through R104 (4.7K) which burns up.

**What to Do:**

Replace: C86 (40  $\mu\text{f}$ )  
 Also R104 (4.7K)





Mfr: Philco

Model No. 50-T1600,  
51-T1600, etc.

Card No: 50T-1600-4 Code No. 121 and 122

Section Affected: Audio

Symptom: Intercarrier buzz

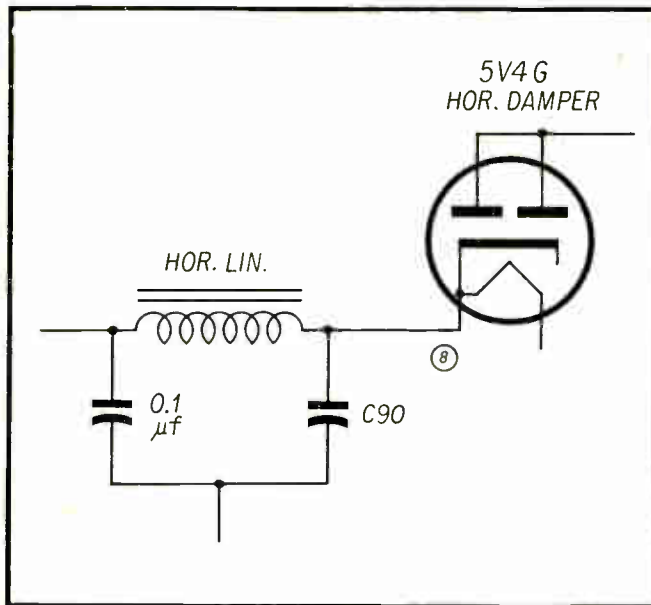
Cause: Insufficient AM rejection

What to Do:

Remove: 4.7 meg resistor

Add: 680 μmf condenser

Also, 100 μmf adjustable condenser and  
1.8K resistor



Mfr: Philco

Model No. 50-T1600,  
51-T1600, etc.

Card No: PH50T1600-5 Code No. 121 and 122

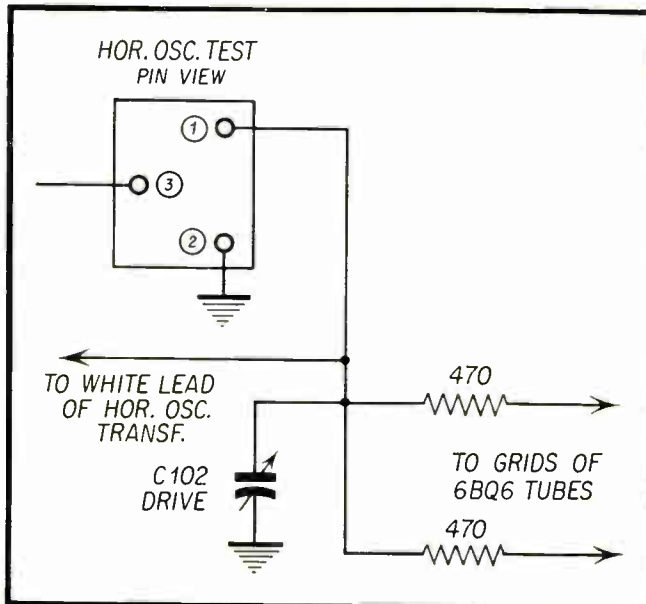
Section Affected: Pix

Symptom: Poor Horizontal linearity

Cause: Open condenser

What to Do:

Replace: C90 (.1 μf)



Mfr: Philco

Model No. 50-T1600,  
51-T1600, etc.

Card No: PH1600-6

Section Affected: Raster

Symptom: Intermittent raster, bias on 6BQ6GT  
intermittent

Cause: Defective drive capacitor (mica cracked)

What to Do:

Check: C102 (horizontal drive control), note  
condition of mica and replace

Mfr: Raytheon Chassis No. 24T3

Card No: RA 24T3-1

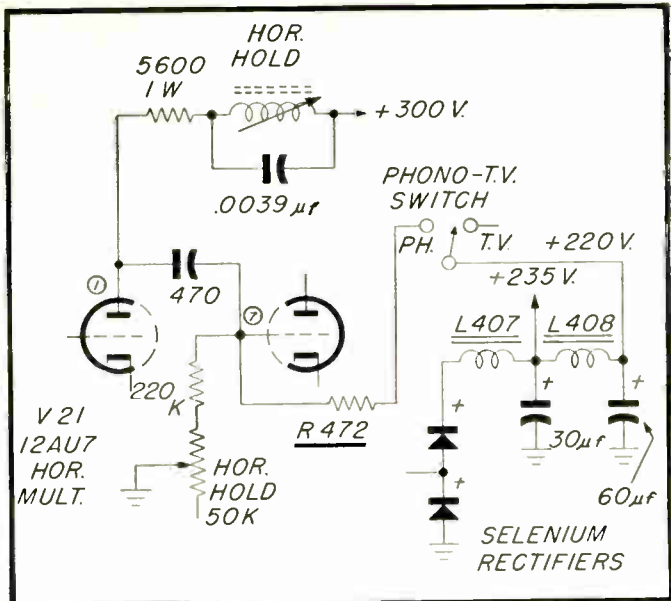
Section Affected: Sound

Symptom: Horizontal multivibrator squeal interference in "PH" position.

Reason for change: Circuit modification to eliminate horizontal multivibrator squeal interference in "PH" position.

What to do:

Add: R472 (3.3 megohm, 1/2 watt). (Chassis so modified are coded 133).



Mfr: Raytheon Chassis No. 24T3

Card No: RA 24T3-2

Section Affected: Raster & Pix

Symptom: Insufficient width and high voltage.

Reason for Change: Circuit modification to provide more width and maintain high voltage.

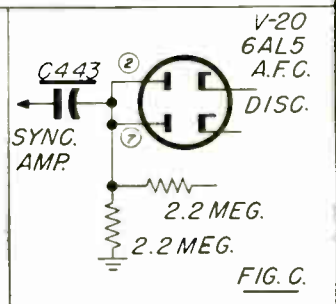
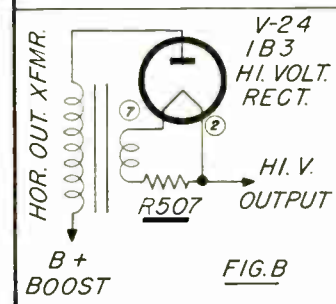
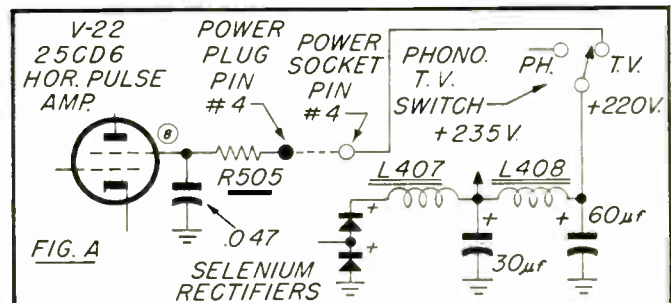
What to do:

Change: R505 (33K-2W) to 6.8K-2 watt, and wire to pin 4 of the power plug. (Fig. A).

Change: R507 (10-ohm-1 W) to 6.8 ohm-1 W. (Fig. B).

Change: C443 (4.7 microfarad) to 22 microfarad. (Fig. C).

Rewire: Pin 4 of power socket to Bt 220 volts (Fig. A) at Phono-TV Switch. (Chassis so modified are coded 333).



Mfr: Raytheon Chassis No. 24T3

Card No: RA 24T3-3

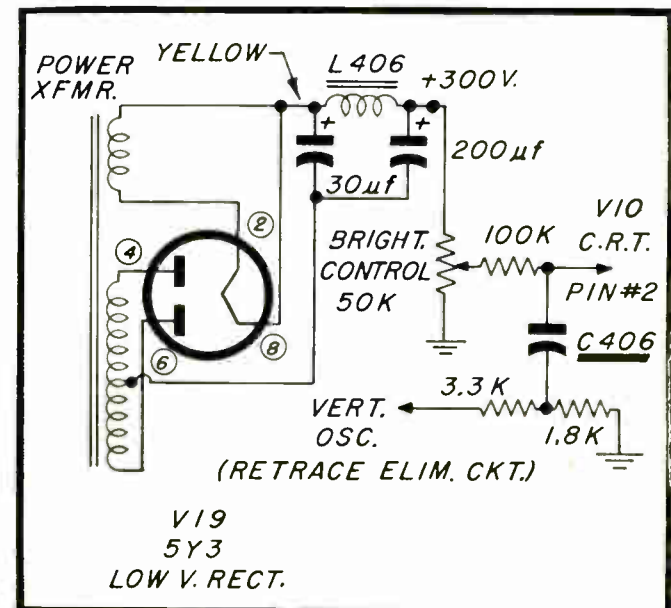
Section Affected: Raster and/or Pix

Symptom: Insufficient brightness.

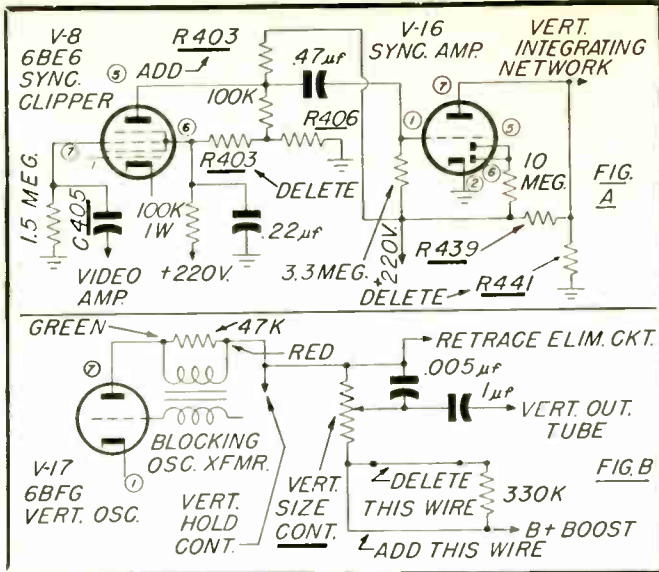
Reason for Change: Circuit modification to increase brightness.

What to do:

Change: C406, (.033 microfarad) to .047 microfarad. Reconnect brightness control to + 300 volt. (Chassis so modified are coded 433).







Mfr: Raytheon Chassis No: 24T3

Card No: RA 24T3-4

Section Affected: Pix

Symptom: Poor vertical sync stability.

Reason for Change: Circuit modification to increase vertical sync stability.

What to do:

Remove: R403 (15K, 1/2 watt). (Fig. A).  
Also: R441 (68K, 1/2 watt). (Fig. A).

Change: R406 (15K) to 33K, 1/2 watt. (Fig. A).

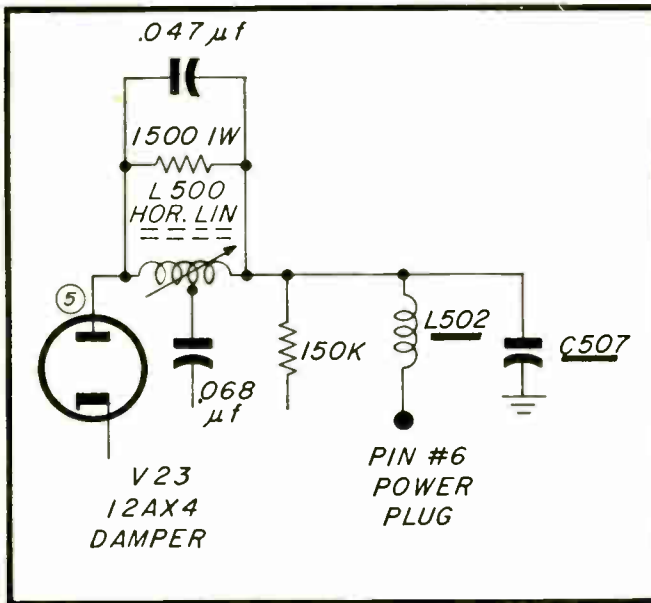
Also: C405 .047  $\mu$ f to .01  $\mu$ f. (Fig. A).

Also: V16 to 6BE6 (was 6AV6). (Fig. A).

Also: R439 (22K-1/2 W) to 22K, 2 watt. (Fig. A).

Rewire: Vertical size control to B+ boost. (Fig. B).

Add: R403 (1 megohm). (Fig. A).  
(Chassis so modified are coded 833).



Mfr: Raytheon

Chassis No. 24T3

Card No: RA 24T3-5

Section Affected: Pix

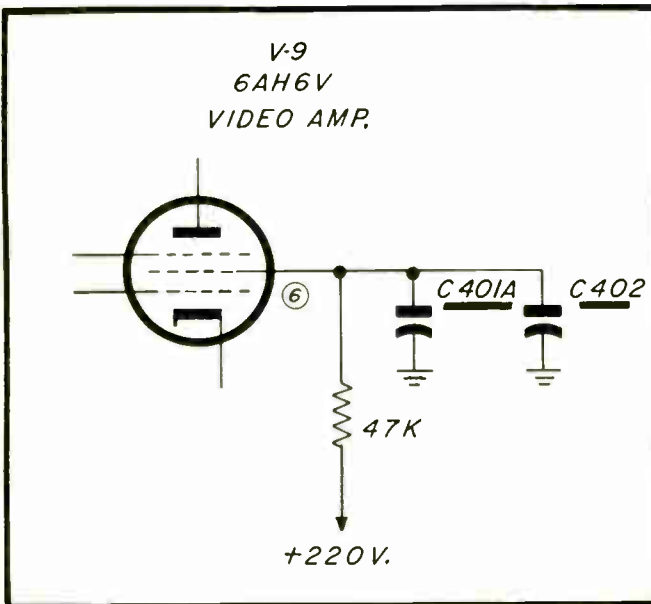
Symptom: Poor vertical and horizontal sync.

Reason for Change: Circuit modification to improve vertical and horizontal sync.

What to do:

Add: L502 choke coil to pin 6 of power plug as shown, (obtain from manufacturer—part #16A-23165).

Change: C507 (.005  $\mu$ f) to .22  $\mu$ f.  
(Chassis so modified are coded 043).



Mfr: Raytheon

Chassis No: 24T3

Card No: RA 24T3-6

Section Affected: Pix

Symptom: Smear in pix.

Cause: Open screen by-pass capacitors in video amplifier circuit.

What to do:

Change: C401A (10  $\mu$ f, 300 volt) and/or C402 (5000  $\mu$ f).

Mfr. RCA Chassis No. KCS97

Card No. RC 97-1

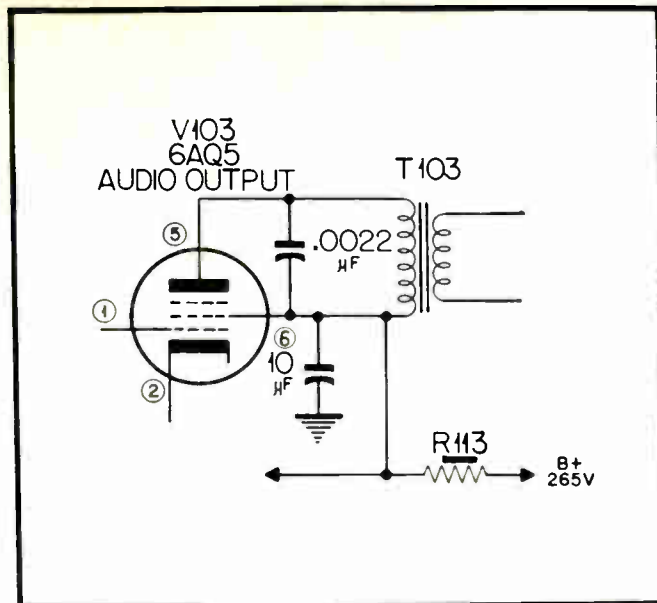
Section Affected: Sound

Symptoms: No audio, picture and raster normal.

Cause: Component failure. B plus feeding resistor supplying voltage to the audio output and amplifier system has opened.

What To Do:

Replace: R113 (3300 ohm) 2 watt resistor.



Mfr. RCA Chassis No. KCS97

Card No. RC 97-2

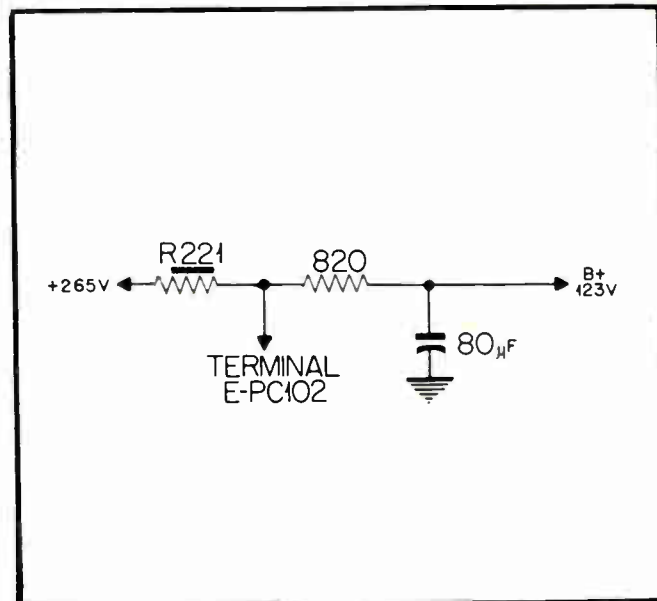
Section Affected: Pix and sound

Symptoms: No picture or sound, raster normal.

Cause: Component failure. Open B plus feeding resistor from 265 volts to terminal E of printed circuit panel and third if circuit.

What To Do:

Replace: R221 (4200 ohm) 7 watt resistor.



Mfr. RCA Chassis No. KCS97

Card No. RC 97-3

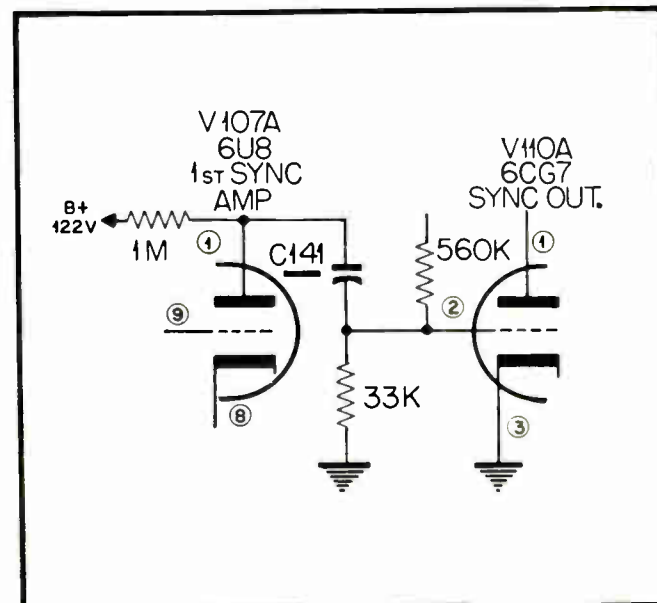
Section Affected: Pix

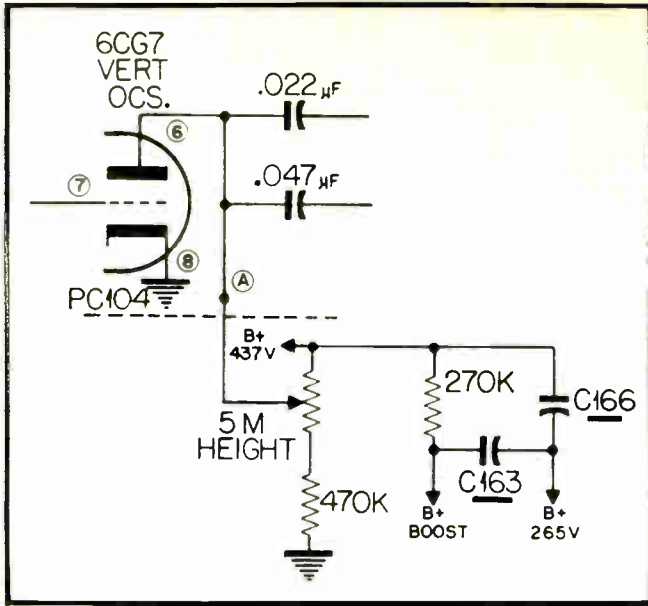
Symptoms: Jittery or poor horizontal and vertical sync, picture and sound otherwise normal.

Cause: Component failure. Coupling condenser from 1st sync amplifier to sync output circuit has shorted.

What To Do:

Replace: Coupling condenser C141 (.033 microfarad).





Mfr. RCA

Chassis No. KCS97

Card No. RC 97-4

Section Affected: Pix and raster

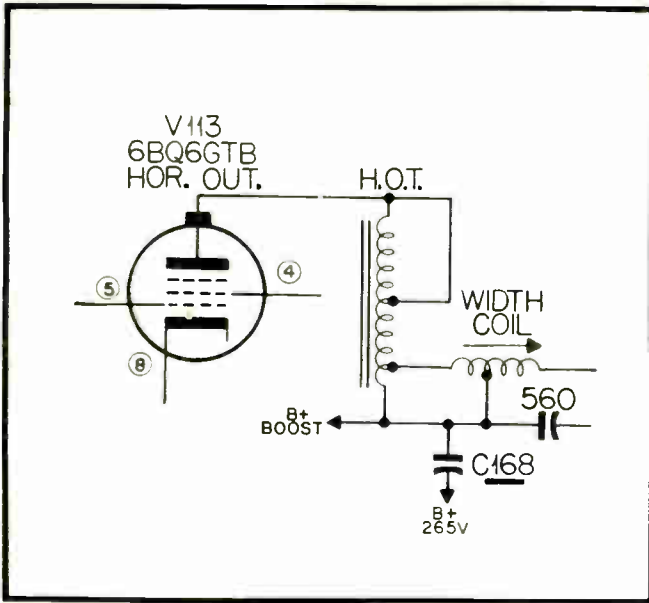
Symptoms: Insufficient height with possible slight vertical foldover.

Cause: Component failure. Leakage in condenser C166 .1 μf condenser has reduced B plus voltage to plate circuit of vertical oscillator so that insufficient voltage is applied to circuit producing small deflection voltage.

What To Do:

Replace: C166 (.1 μf).

Check: C163 (.1 μf) for excessive leakage.



Mfr. RCA

Chassis No. KCS97

Card No. RC 97-5

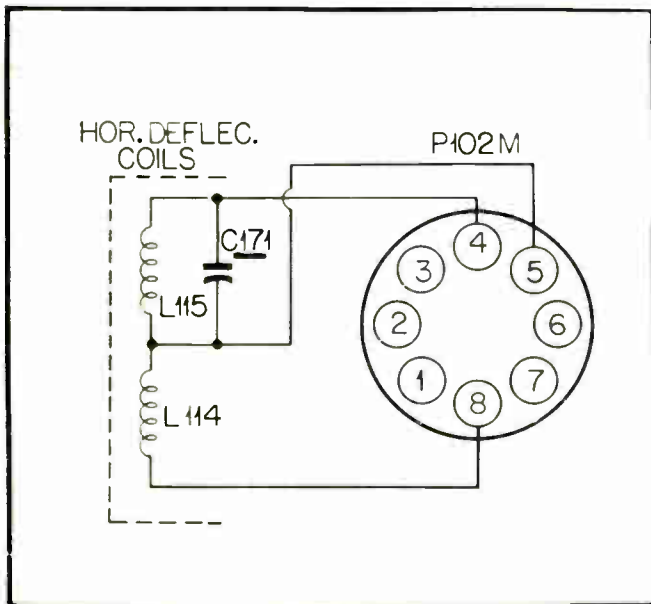
Section Affected: Pix and raster

Symptoms: No high voltage, picture or raster, sound normal.

Cause: Component failure. Boost charging condenser C168 has developed sufficient leakage to reduce the boost voltage below a point that will enable the generation of high voltage and sufficient amplitude horizontal deflection pulses in the transformer.

What To Do:

Replace: Boost charging condenser. C168 (.047 μf).



Mfr. RCA

Chassis No. KCS97

Card No. RC 97-6

Section Affected: Pix and raster

Symptoms: Trapezoidal picture and raster due to improper deflection system.

Cause: Component failure. Damping condenser across one horizontal deflection coil has shorted. A shorted deflection coil will produce the same symptoms.

What To Do:

Replace: C171 (150 μf).

Substitute or replace: Deflection coils.



Mfg: RCA Chassis No. KCS-72

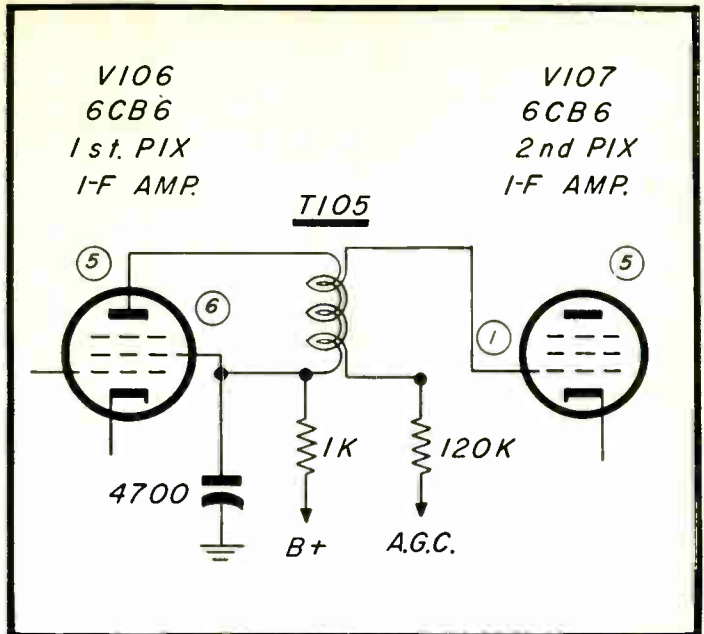
Card No. RC 72-1

Section Affected: Pix and sound

Symptom: No picture, No sound or weak sound. Brightness Okay.

Cause: Component Failure. Transformer T105 shorted primary to secondary

What to do:  
 Check: For a positive voltage on agc line;  
 if so:  
 Replace: IF transformer, T105



Mfg: RCA Chassis No. KCS-72

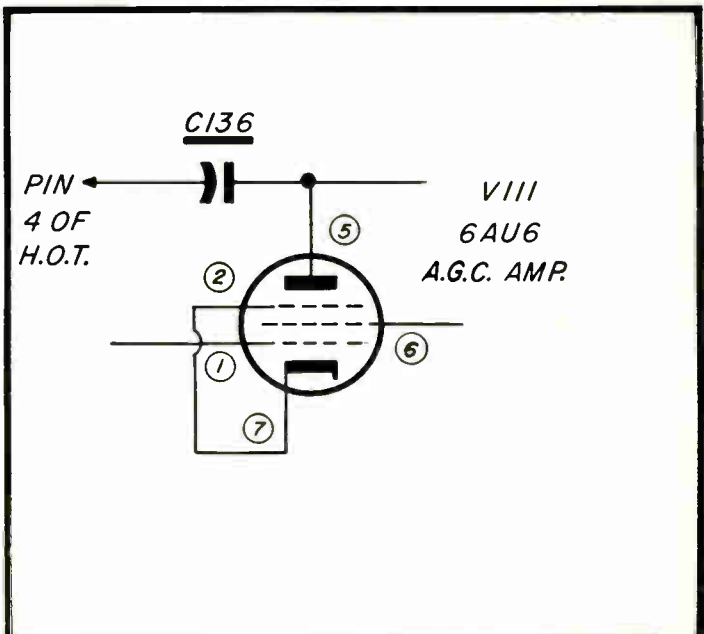
Card No. RC 72-2

Section Affected: Pix and Sound

Symptoms: No picture or sound on channel. Snow off-channel

Cause: Component failure. Open C136, 220 μmf condenser

What to do:  
 Replace: C136, 220 μmf condenser, 22000 volt rating.



Mfg: RCA Chassis No. KCS-72

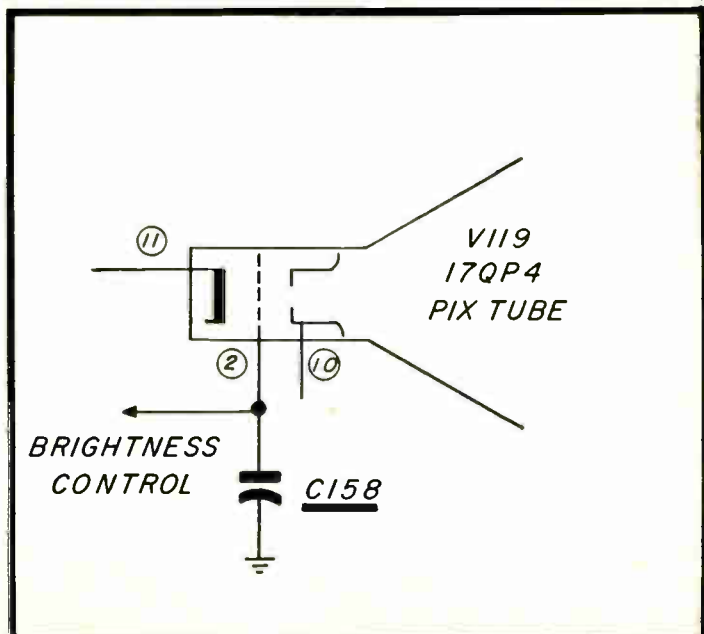
Card No. RC 72-3

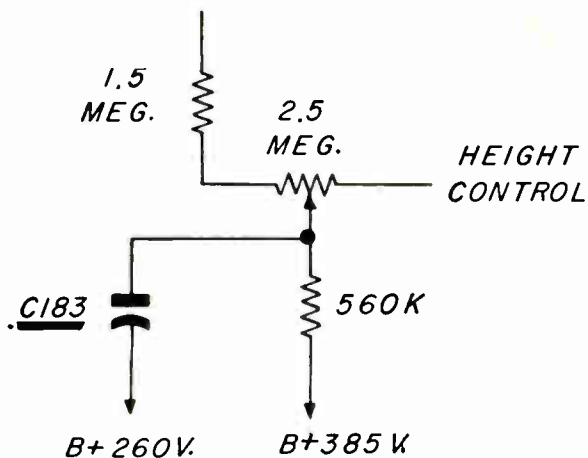
Section Affected: Pix and raster

Symptoms: No brightness or raster. High voltage normal.

Cause: Component failure. Condenser C158, .1 μf shorted.

What to do:  
 Check: Voltage variation at pin 2 of picture tube socket.  
 Replace: C158, .1 μf condenser.





Mfg: RCA

Chassis No. KCS-72

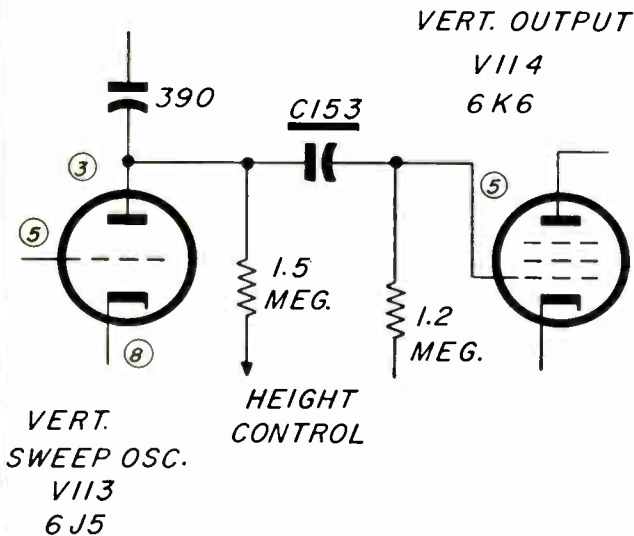
Card No. RC 72-4

Section Affected: Pix and raster

Symptoms: Insufficient vertical deflection. Low voltage on plate of V113, 6J5 vertical oscillator tube.

Cause: Component failure. Condenser C183, .1  $\mu$ f shorted.

What to do:  
Replace: Condenser C183, .1  $\mu$ f.



Mfg: RCA

Chassis No. KCS-72

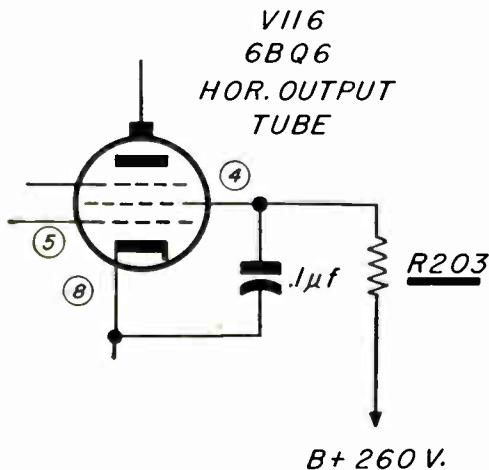
Card No. RC 72-5

Section Affected: Pix and raster

Symptoms: No vertical deflection

Cause: Component failure. Open C153, .1  $\mu$ f condenser.

What to do:  
Replace: Condenser C153, .1  $\mu$ f.



Mfg. RCA

Chassis No. KCS-72

Card No. RC 72-6

Section Affected: Pix and raster

Symptoms: Insufficient width. Width may shrink during operation.

Cause: Component failure. Screen dropping resistor has changed to higher resistance value or changes with operation. (R203)

What to do:  
Replace: Resistor R203, 6.8K ohms, 2 watts.

Mfr: RCA Chassis No. KCS 81

Card No: RC81-1

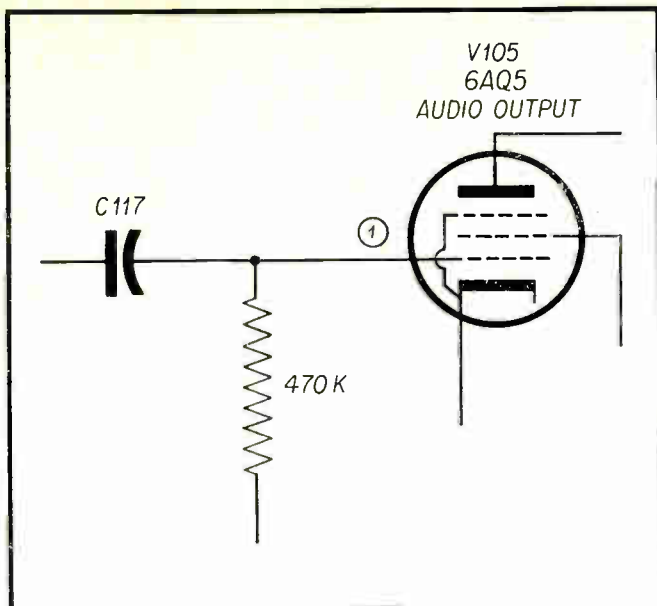
Section Affected: Sound

Symptom: Raspy sound

Cause: Leaky Condenser

What to Do:

Replace: C117 (.01  $\mu$ f)



Mfr: RCA Chassis No. KCS 81

Card No: RC81-2

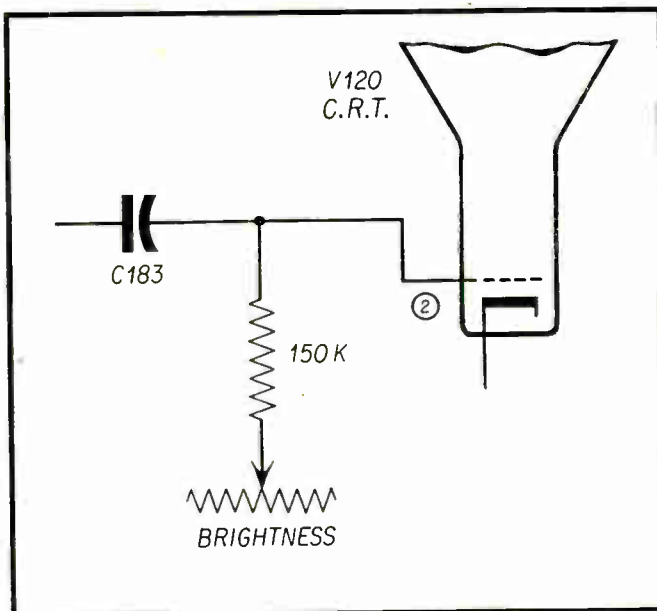
Section Affected: Raster

Symptom: No control of brightness

Cause: Shorted condenser

What to Do:

Replace: C183 (.1  $\mu$ f)



Mfr: RCA Chassis No. KCS 81

Card No: RC81-3

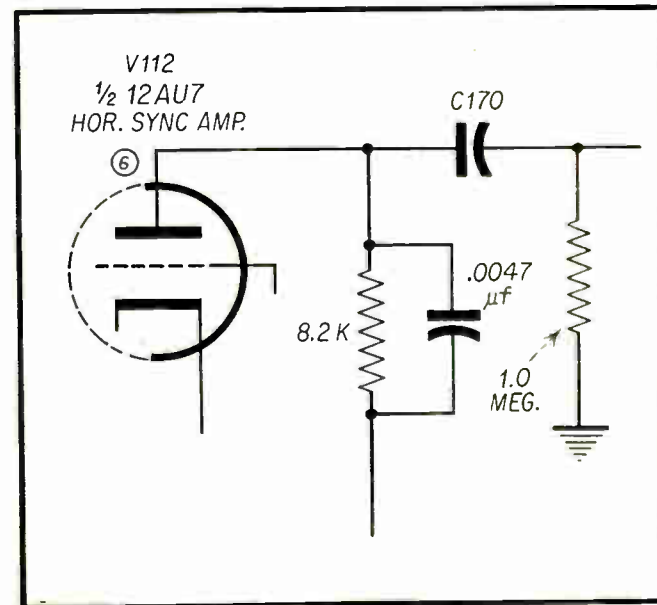
Section Affected: Sync

Symptom: Critical horizontal and vertical sync

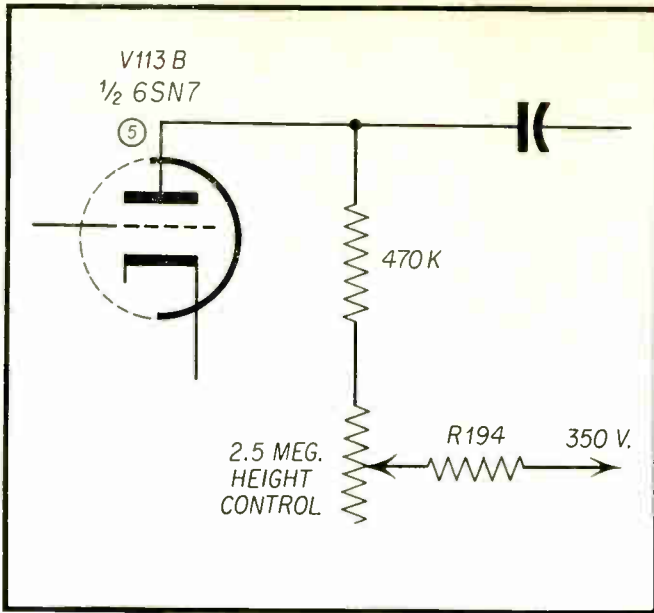
Cause: Shorted condenser

What to Do:

Replace: C170 (.01  $\mu$ f)







Mfr: RCA Chassis No. KCS 81

Card No: RC81-4

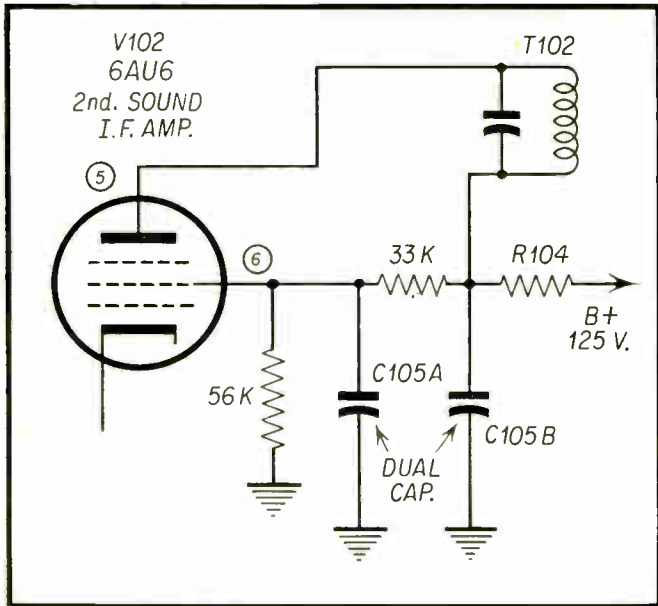
Section Affected: Raster

Symptom: Insufficient height

Cause: Resistor increases in value

What to Do:

Replace: R194 (220K)



Mfr: RCA

Chassis No. KCS 81

Card No: RC81-5

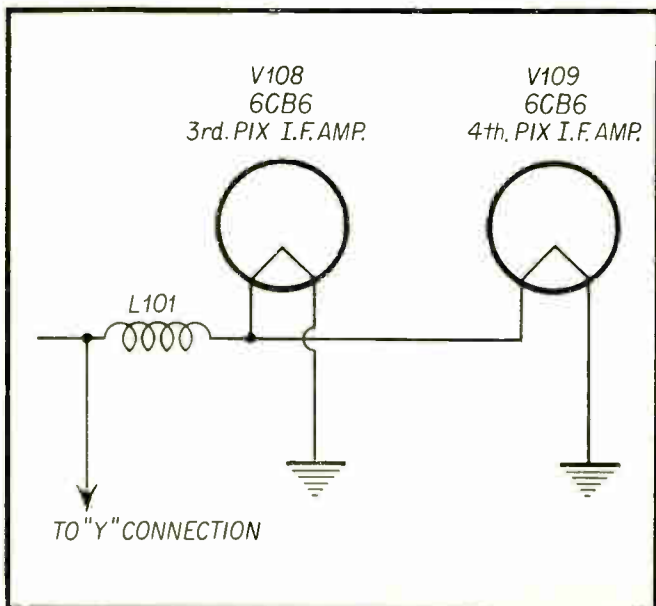
Section Affected: Audio

Symptom: No Audio

Cause: Shorted condenser; and resistor changed in value caused by shorted condenser

What to Do:

Replace: C105B (.01  $\mu$ f)  
Also, R104 (1K)



Mfr: RCA

Card No: RC81-6

Section Affected: Sound & pix; V108, V109

Symptom: No sound, no pix

Cause: Open filament choke

What to Do:

Replace: L101 (filament choke)

Mfr: Stromberg-Carlson Model No. 521 Series

Card No: SC 521-1

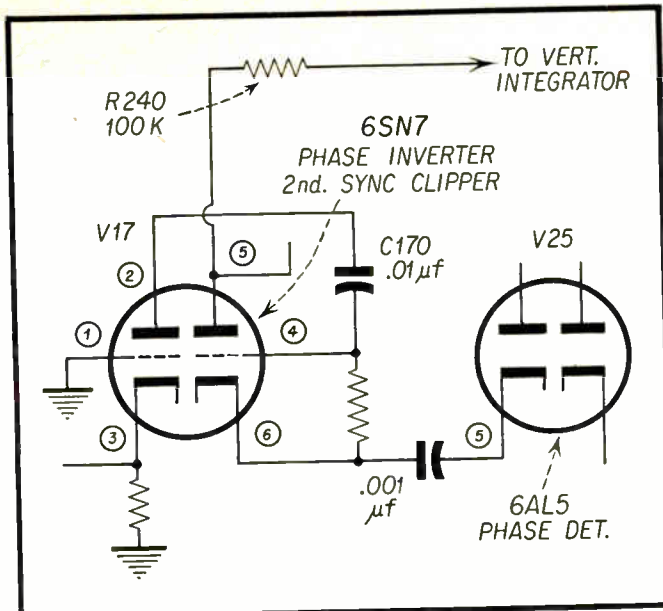
Section Affected: Sync

Symptom: Loss of vertical and horizontal sync.

Cause: Shorted capacitor

What To Do:

Replace: C170 (.01  $\mu$ f)



Mfr: Stromberg-Carlson Model No. 521 Series

Card No: SC 521-2

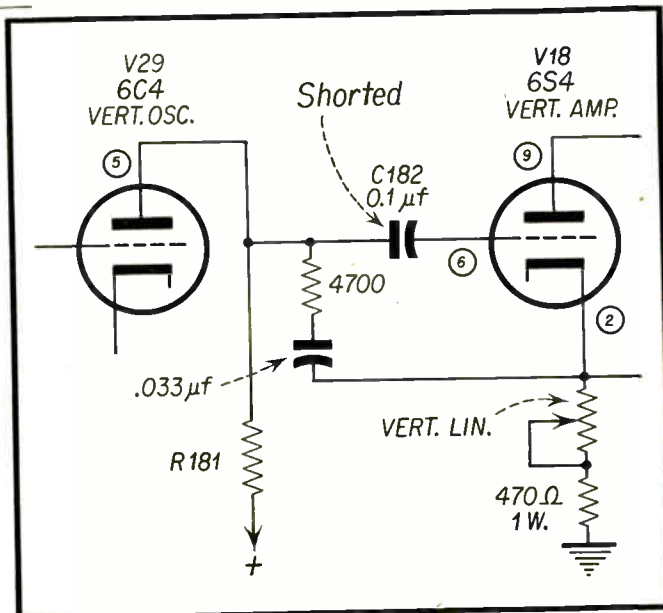
Section Affected: Raster

Symptom: No vertical sweep

Cause: Shorted capacitor

What To Do:

Replace: C182 (.1  $\mu$ f)



Mfr: Stromberg-Carlson Model No. 521 Series

Card No: SC 521-3

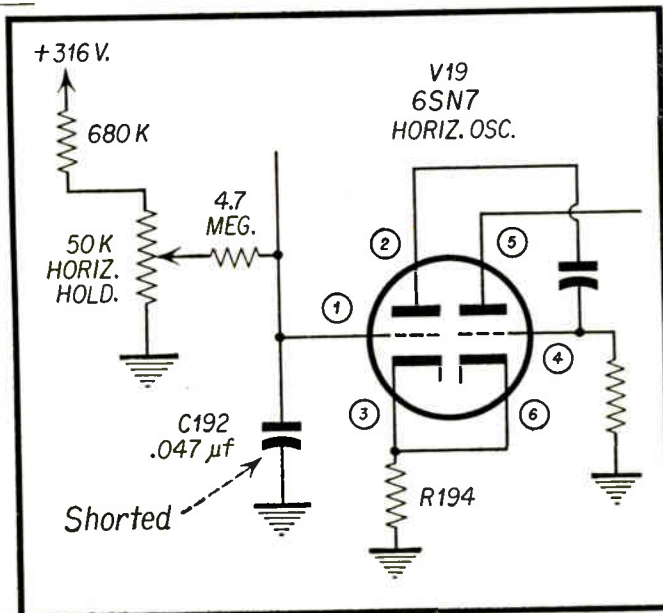
Section Affected: Raster

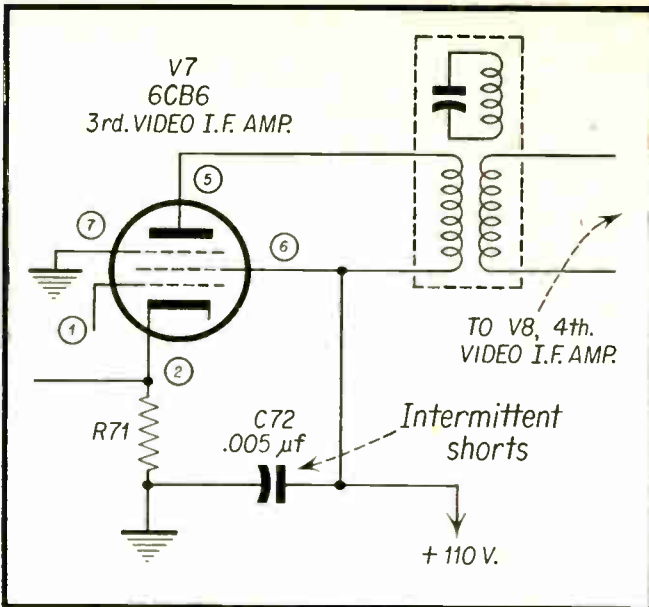
Symptom: Loss of raster

Cause: Shorted capacitor

What To Do:

Replace: C192 (.047  $\mu$ f)





Mfr: Stromberg-Carlson Model No. 521 Series

Card No: SC 521-4

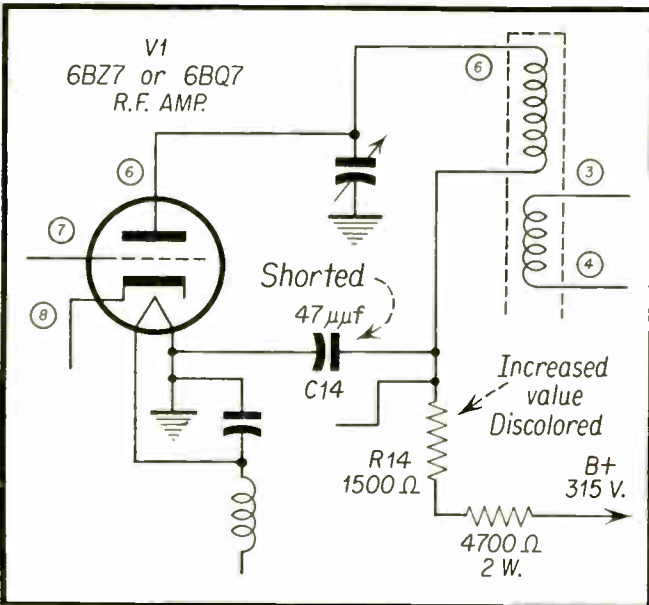
Section Affected: Sound and pix

Symptom: Intermittent video and sound

Cause: Intermittent capacitor short

What To Do:

Replace: C72 (.005  $\mu$ f)



Mfr: Stromberg-Carlson Model No. 521 Series

Card No: SC 521-5

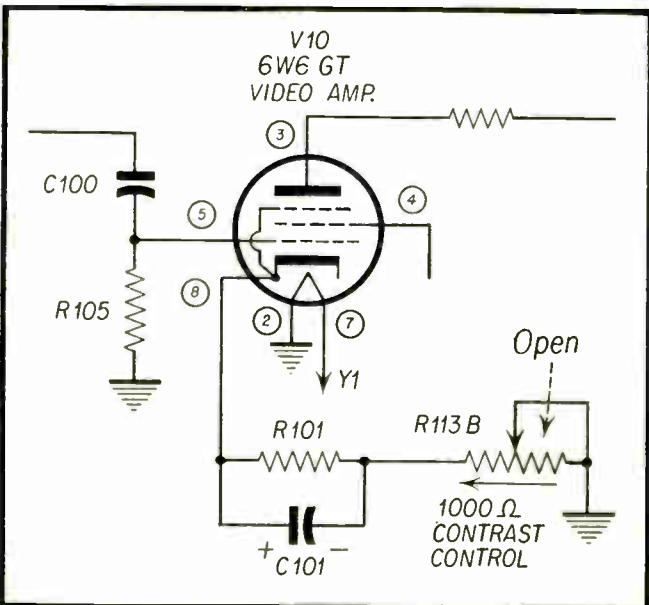
Section Affected: Sound and pix

Symptom: No sound or video

Cause: Shorted capacitor

What To Do:

Replace: C14 (47  $\mu$ f) and R14 (1.5K)



Mfr: Stromberg-Carlson Model No. 521 Series

Card No: SC 521-6

Section Affected: Pix

Symptom: No video

Cause: Open contrast control

What To Do:

Replace: R-113-A and R-113-B (1K) dual control (S.C. Part—145 140 brightness and contrast controls)



Mfr: Sylvania Chassis No. 1-533-1, -2

Card No: SY533-1

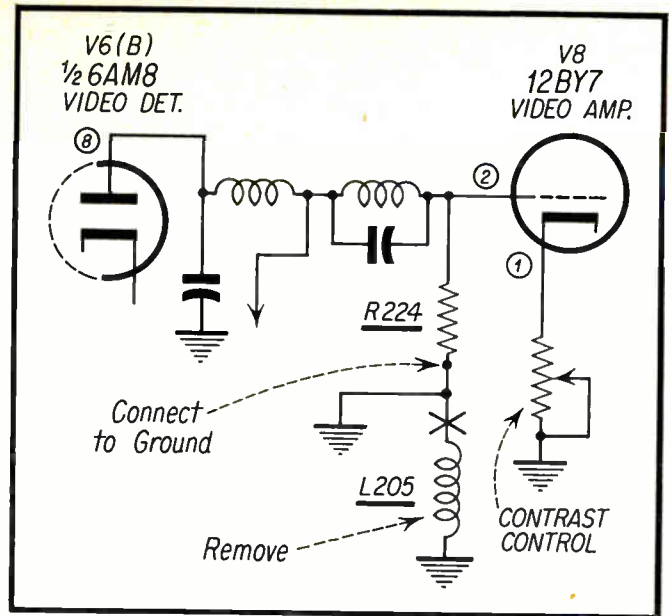
Section Affected: Pix

Symptom: Sound in pix

Reason for Change: To improve trap rejection  
(These revisions included in chassis beginning with serial number 533101-, 533201-).

What to Do:

- Remove: Peaking Coil L205
- Connect: Bottom of R224 (2.7K) to ground



Mfr: Sylvania Chassis No. 1-533-1, -2

Card No: SY533-2

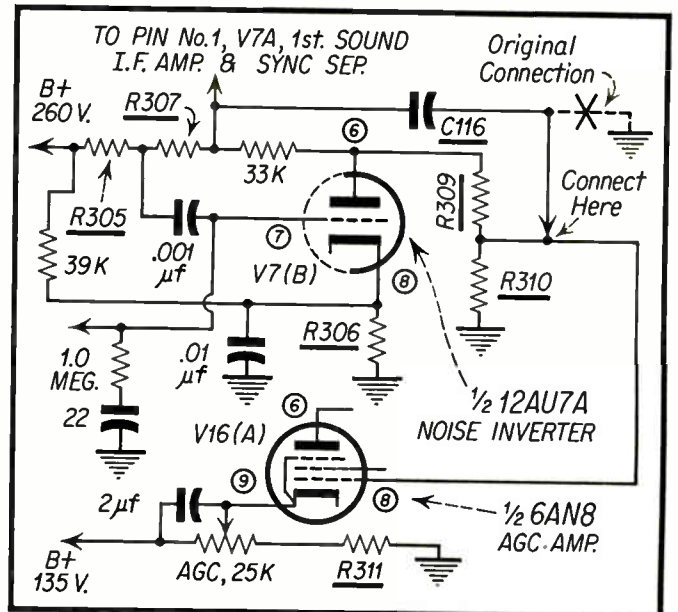
Section Affected: Pix

Symptom: Picture bending

Reason for Change: To reduce picture bending  
(These revisions included in chassis beginning with serial numbers 533102-, 533202-).

What to Do:

- Change: C116 (82  $\mu\text{f}$  to 47  $\mu\text{f}$  and reconnect between pin 1 of V7(A) 12AU7A and pin 8 of V16A 6AN8.
- Also, R305 (18K) to 4.7K, R306 (2.7K) to 3.9K, R307 (8.2K) to 2.2K, R309 (33K) to 100K, R310 (470K) to 220K, R311 (39K) to 33K



Mfr: Sylvania Chassis No. 1-533-1, -2

Card No: SY533-3

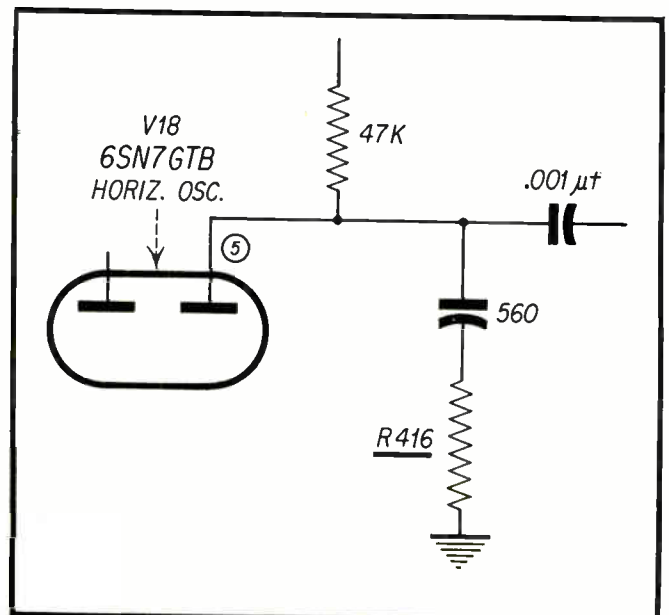
Section Affected: Pix

Symptom: Pix ringing

Reason for Change: Circuit improvement  
(This change was included in chassis beginning with serial numbers 533103-, 532203 -).

What to Do:

- Replace: R416 (4.7K) with 6.8K resistor.





Mfg: Silvertone Chassis No. 128-16

Card No. SI128-1

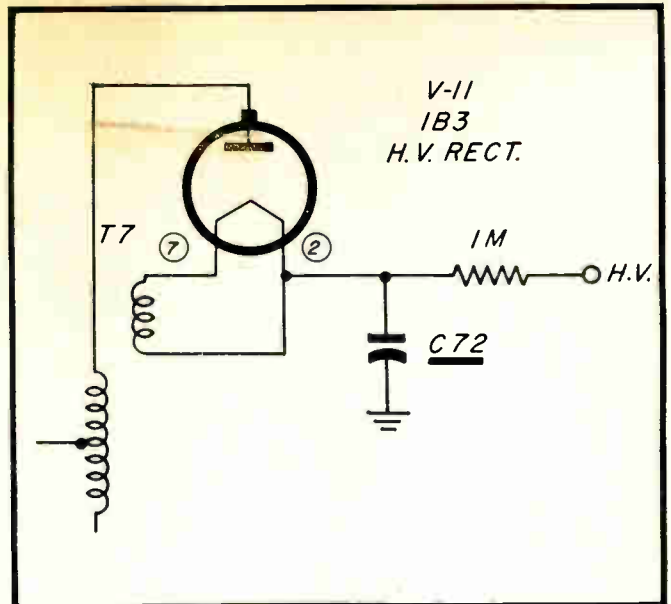
Section Affected: Raster

Symptom: Intermittent ticking noise in sound and in raster.

Cause: Defective component.

**What To Do:**

Replace: C72 (330  $\mu\mu\text{f}$ , 12.5KV), which is breaking down.



Mfg: Silvertone Chassis No. 128-16

Card No. SI128-2

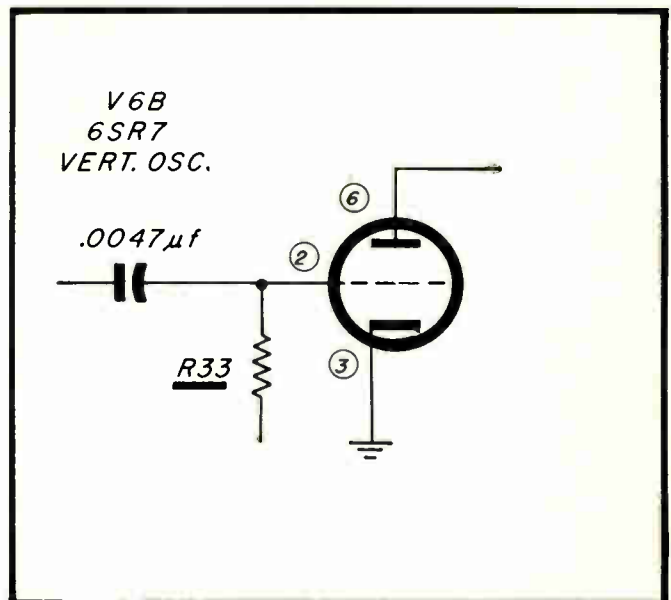
Section Affected: Sync.

Symptom: Vertical hold drifts out of range.

Cause: Defective component.

**What To Do:**

Replace: R33 (1 meg.), which has increased in value.



Mfg: Silvertone Chassis No. 128-16

Card No. SI128-3

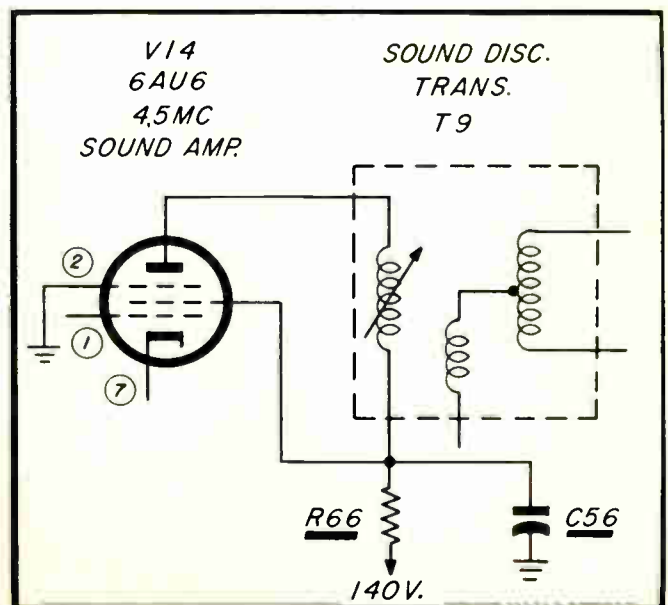
Section Affected: Sound

Symptom: No sound and R66 is burned.

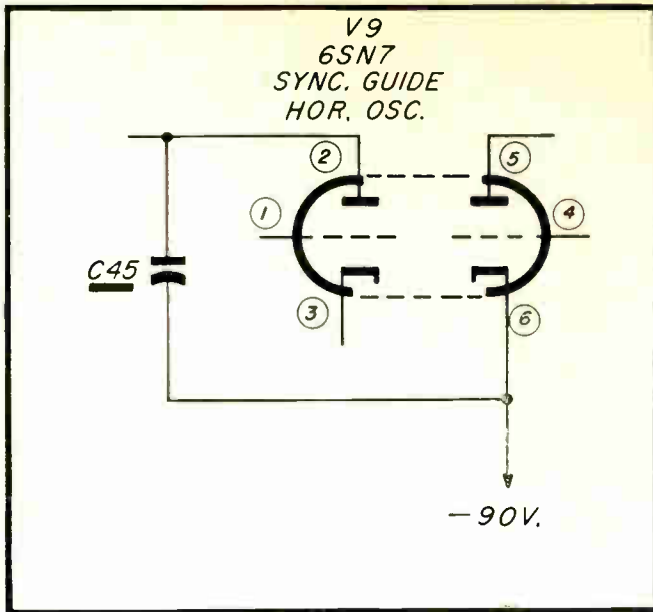
Cause: Defective component.

**What To Do:**

Replace: C56 (.01  $\mu\text{f}$ ), which is shorted and R66 (1K), which is burned.







Mfg: Silvertone

Chassis No. 128-16

Card No. SI128-4

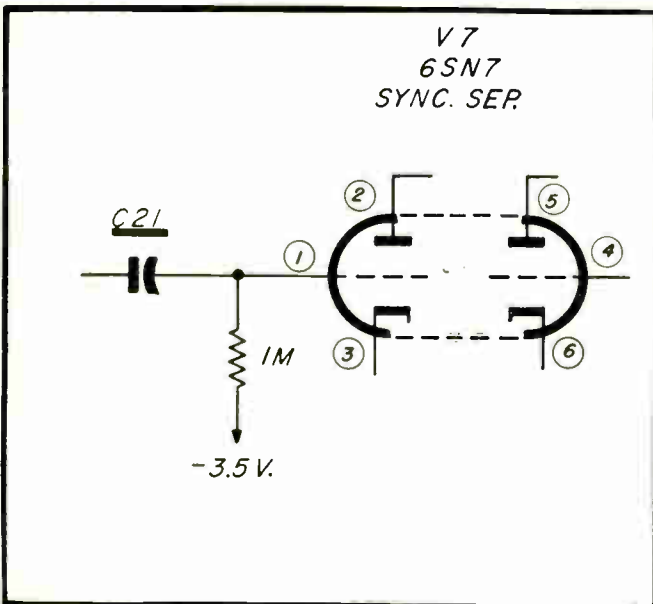
Section Affected: Sync.

Symptom: Horizontal frequency drifts intermittently.

Cause: Defective component.

What To Do:

Replace: C45 (.047  $\mu$ f), which is leaky.



Mfg: Silvertone

Chassis No. 128-16

Card No. SI128-5

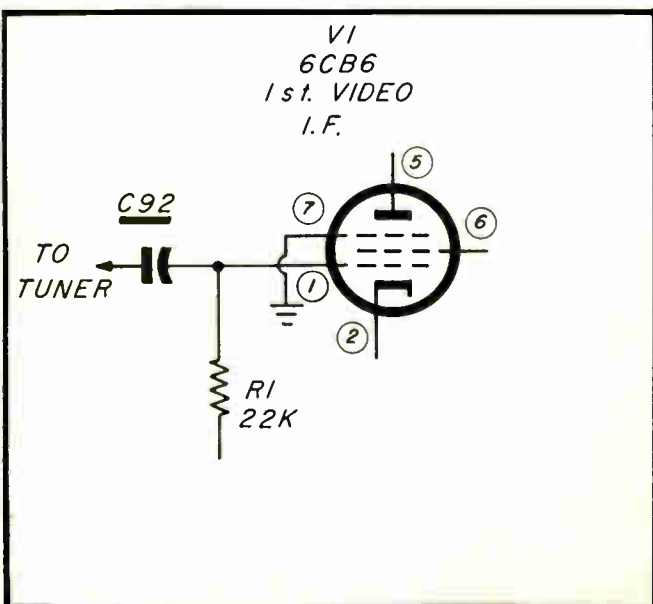
Section Affected: Sync.

Symptom: Poor vertical and horizontal hold.

Cause: Defective component.

What To Do:

Replace: C21 (.047  $\mu$ f), which is leaky.



Mfg: Silvertone

Chassis No. 128-16

Card No. SI128-6

Section Affected: Pix

Symptom: Video overload.

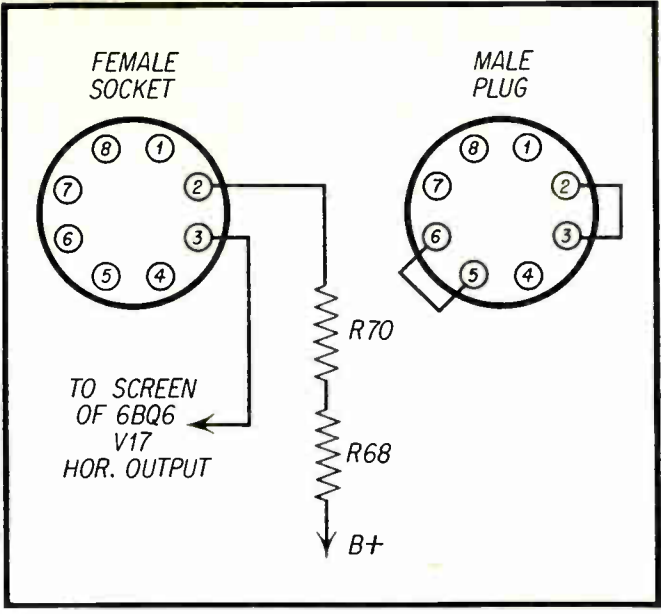
Cause: Defective component.

What To Do:

Replace: C92 (270  $\mu$ f), which is leaky.

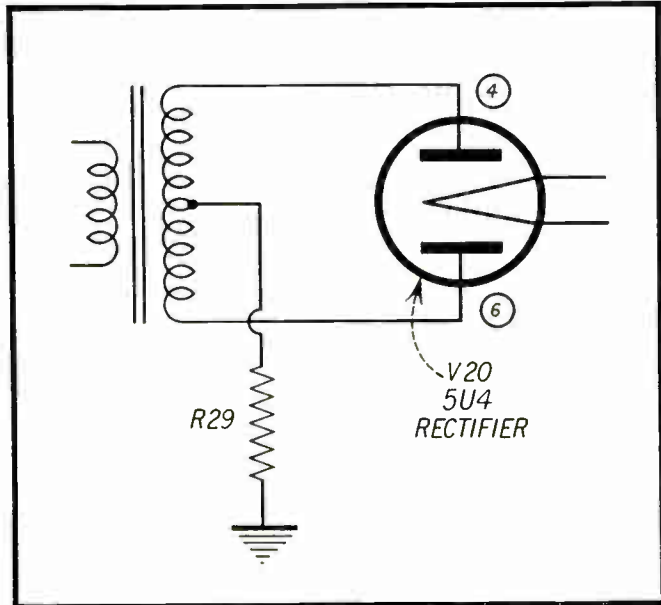
Mfr: Silvertone **Model No. 173-16**  
 Card No: SI 173-1  
**Section Affected:** Raster  
**Symptom:** Width collapses intermittently  
**Cause:** Resistors change in value

**What To Do:**  
 Replace: R68 (4.7 K), R70 (4.7 K),



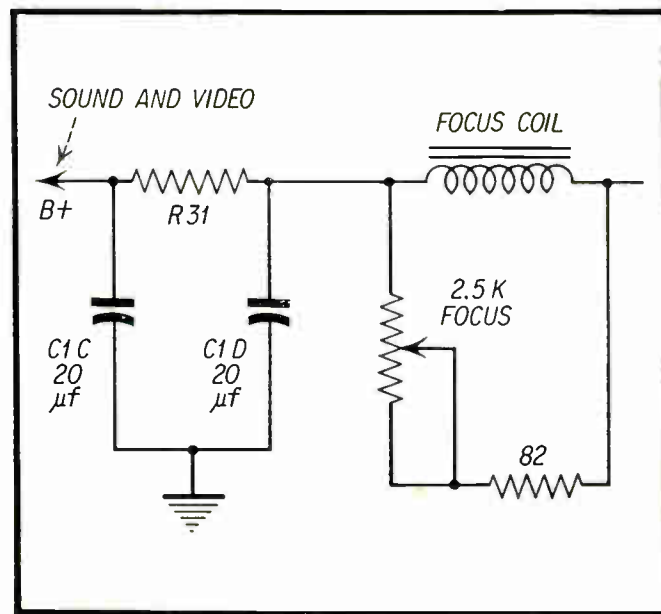
Mfr: Silvertone **Model No. 173-16**  
 Card No: SI 173-2  
**Section Affected:** Sound and raster  
**Symptom:** No sound, no raster (no B+)  
**Cause:** Open resistor in B- circuit

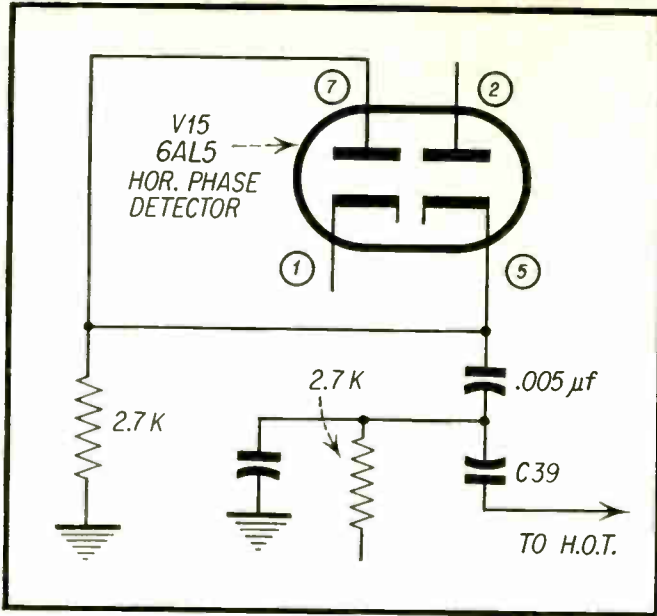
**What To Do:**  
 Replace: R29 (60 ohms)



Mfr: Silvertone **Model No. 173-16**  
 Card No: SI 173-3  
**Section Affected:** Sound and Pix  
**Symptom:** No sound, no pix  
**Cause:** Open resistor on B+ circuit

**What To Do:**  
 Replace: R31 (2.5 K)





Mfr: Silvertone

Model No. 173-16

Card No: SI 173-4

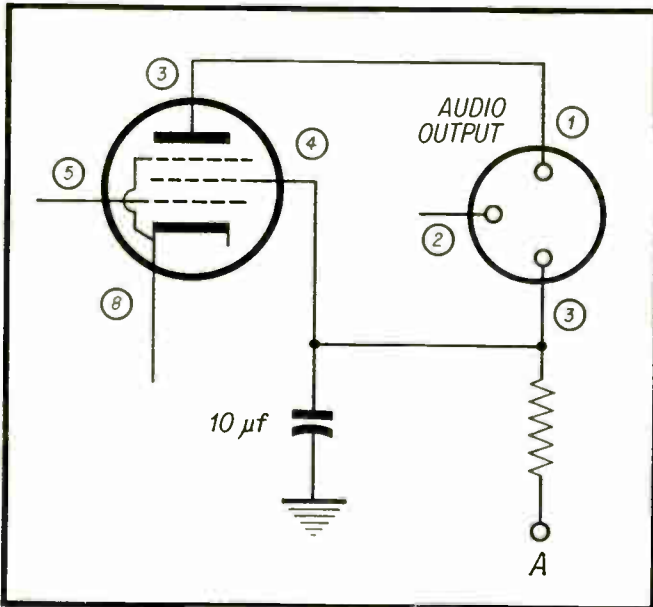
Section Affected: Sync

Symptom: Horizontal hold critical

Cause: Leaky phase detector coupling condenser

What To Do:

Replace: C39 (.005 μf)



Mfr: Silvertone

Model No. 173-16

Card No: SI 173-5

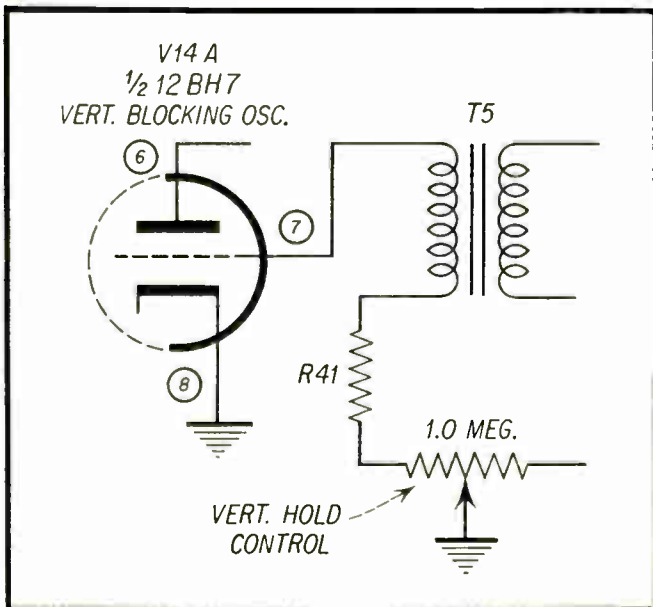
Section Affected: Sound

Symptom: No sound

Cause: Open B+ resistor

What To Do:

Replace: R50 (3250 ohms)



Mfr: Silvertone

Model No. 173-16

Card No: SI 173-6

Section Affected: Sync

Symptom: Vertical hold drifts out of range

Cause: Resistor increases in value

What To Do:

Replace: R41 (1.2 meg)



**Mfr:** Stewart Warner **Model No.** 21-9300 Series

**Card No.** SW 9300-1

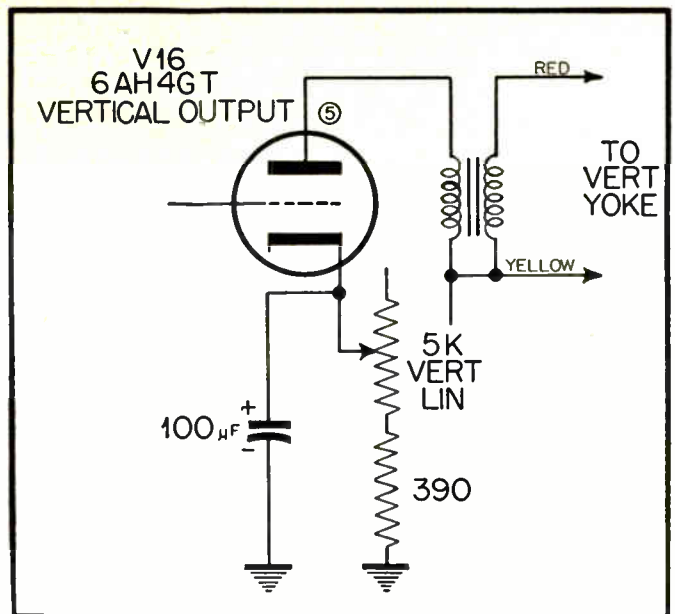
**Section Affected:** Raster

**Symptom:** Intermittent or no vertical height. Vertical linearity control and 390 ohm resistor burned out.

**Cause:** Shorted 6AH4 vertical output tube

**What To Do:**

Replace: Vertical linearity control, also 390 ohm resistor, also 6AH4 vertical output tube.



**Mfr:** Stewart Warner **Model No.** 21-9300 Series

**Card No.** SW 9300-2

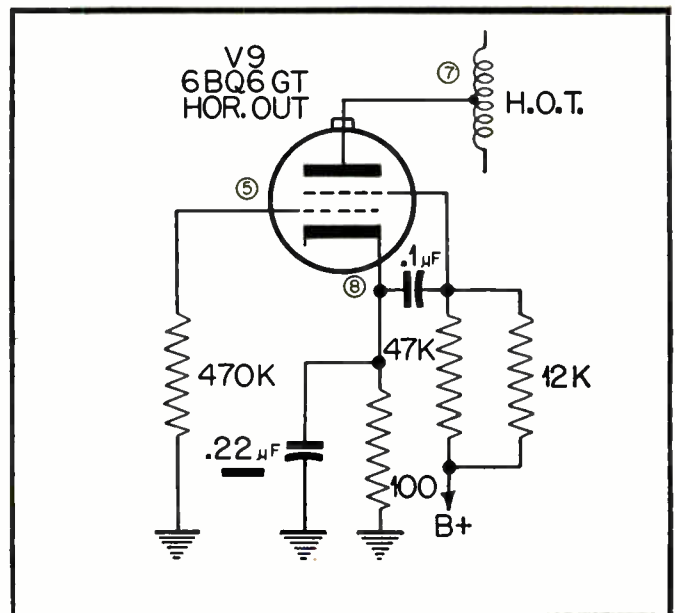
**Section Affected:** Sync

**Symptom:** Horizontal instability

**Cause:** Open by-pass condenser

**What To Do:**

Replace: .22 μf bypass condenser connected between pin 8 of 6BQ6GT and ground.



**Mfr:** Stewart Warner **Model No.** 21-9300 Series

**Card No.** SW 9300-3

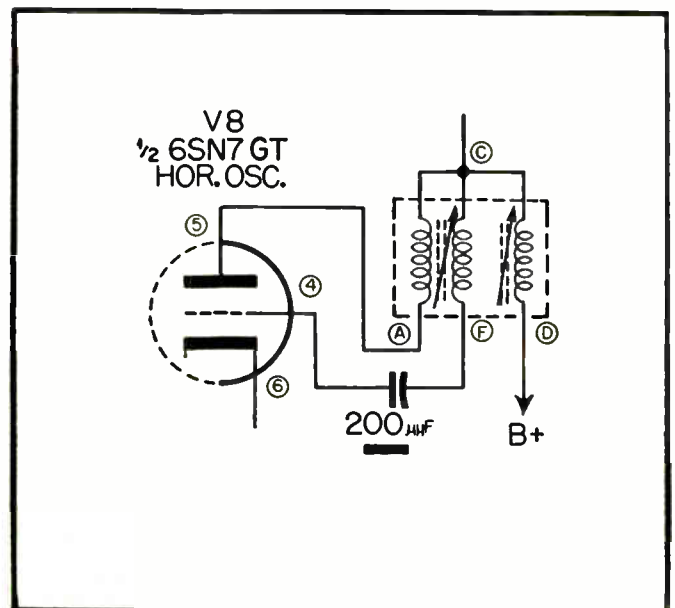
**Section Affected:** Sync

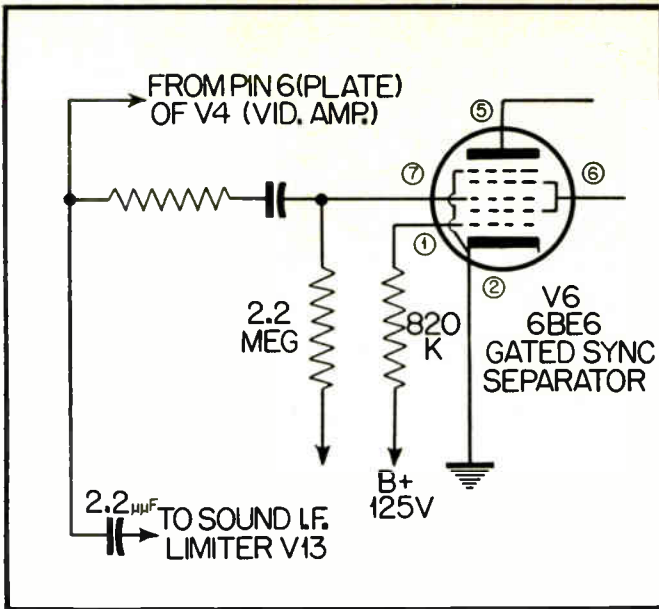
**Symptom:** Pix loses sync after a short time

**Cause:** Unstable capacitor

**What To Do:**

Replace: 200 μf capacitor connected between terminal "F" of syncroguide transformer and pin 4 of V8B, horizontal oscillator.





Mfr: Stewart Warner Model No. 21-9300 Series

Card No. SW 9300-4

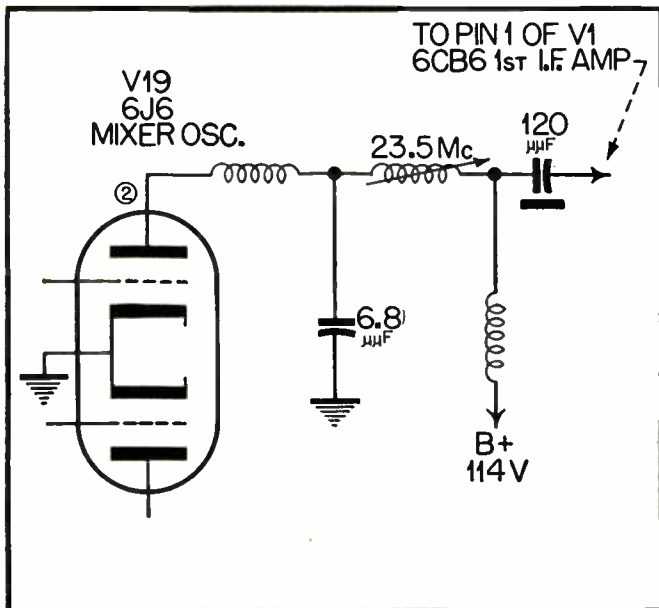
Section Affected: Sync

Symptom: Loss of horizontal sync and weakening of vertical hold.

Cause: Open condenser

What To Do:

Replace: .047  $\mu$ f condenser connected between pin 7 of 6BE6 sync separation and 18K resistor.



Mfr: Stewart Warner Model No. 21-9300 Series

Card No. SW 9300-5

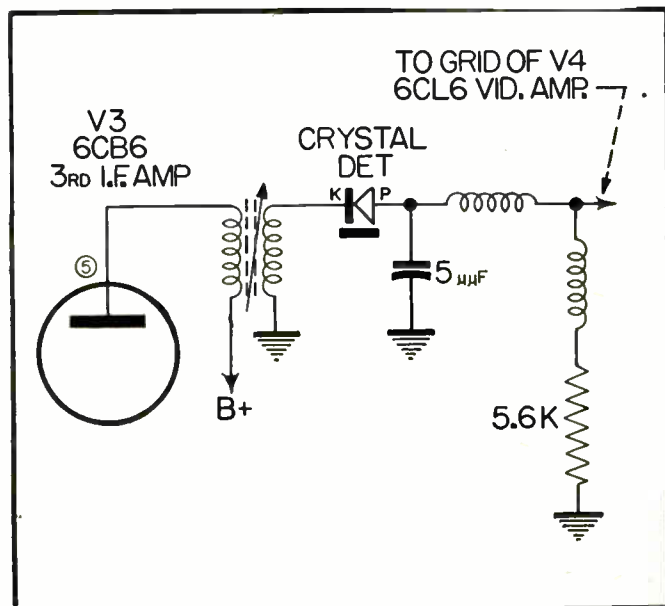
Section Affected: Sound and pix

Symptom: Loss of sound and pix on one or more channels

Cause: Shorted condenser

What To Do:

Replace: 120  $\mu$ f condenser connected between plate of V19-6J6 mixer-oscillator, and pin 1 of V1-6CB6 1st if amp.



Mfr: Stewart Warner Model No. 21-9300 Series

Card No. SW 9300-6

Section Affected: Sync and pix

Symptom: Loss of sync and blurred pix. AGC may fail as contrast control is increased.

Cause: Defective crystal detector

What To Do:

Replace: Crystal detector.

Mfr: Westinghouse Chassis No. V2150-101

Card No. WE2150-1

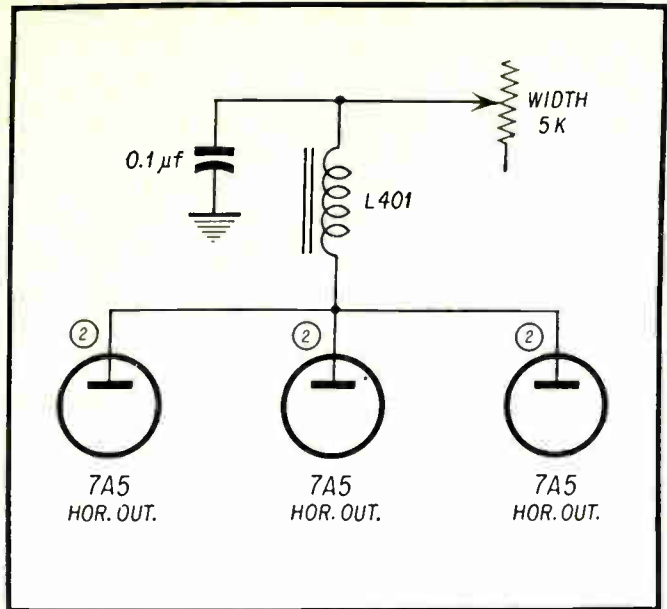
Section Affected: Raster

Symptom: No raster, no sound, 5U4's get red

Cause: Shorted condenser

What To Do:

Replace: C422 (.1  $\mu$ f)



Mfr: Westinghouse Chassis No. V2150-101

Card No. WE2150-2

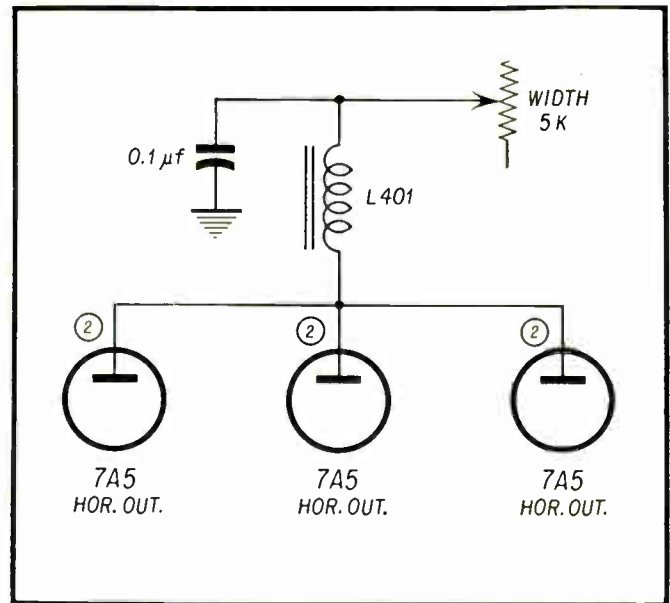
Section Affected: Raster

Symptom: Horizontal flashes—L 401 burning

Cause: L 401 arcs internally

What To Do:

Replace: L 401



Mfr: Westinghouse Chassis No. V2150-101

Card No. WE2150-3

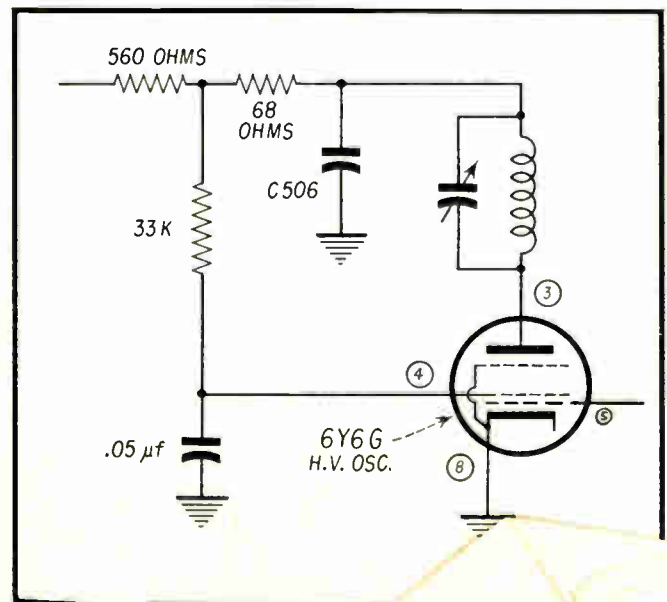
Section Affected: Raster

Symptom: No hi-voltage

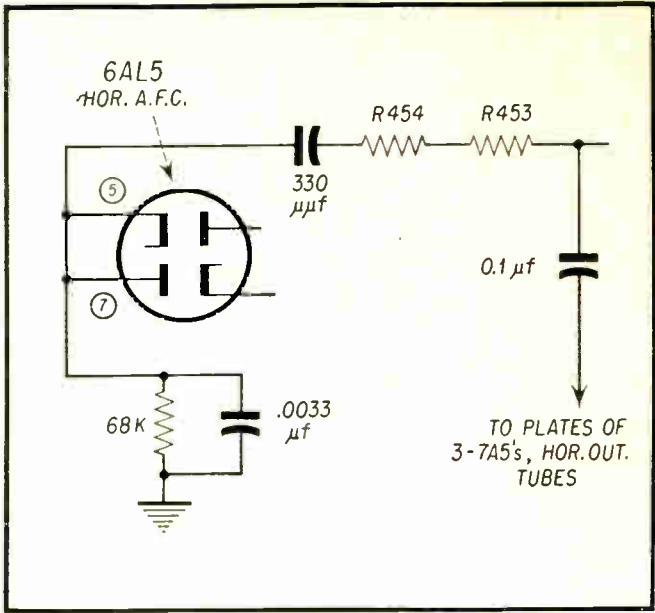
Cause: Shorted condenser

What To Do:

Replace: C506 (.05  $\mu$ f) also, R502 (68 ohms)—burned







Mfr: Westinghouse Chassis No. V2150-101

Card No. WE2150-4

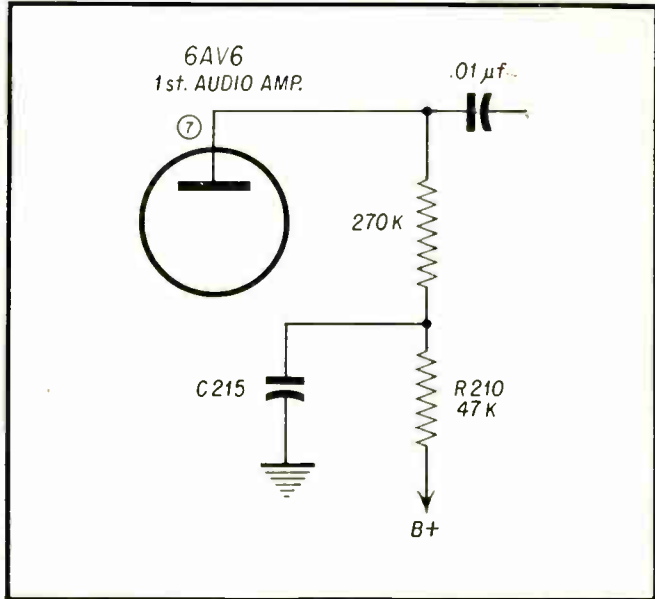
Section Affected: Sync

Symptom: Critical horizontal sync

Cause: Resistors increased in value

What To Do:

Replace: R453 and R454 (both 220K)



Mfr: Westinghouse Chassis No. V2150-101

Card No. WE2150-5

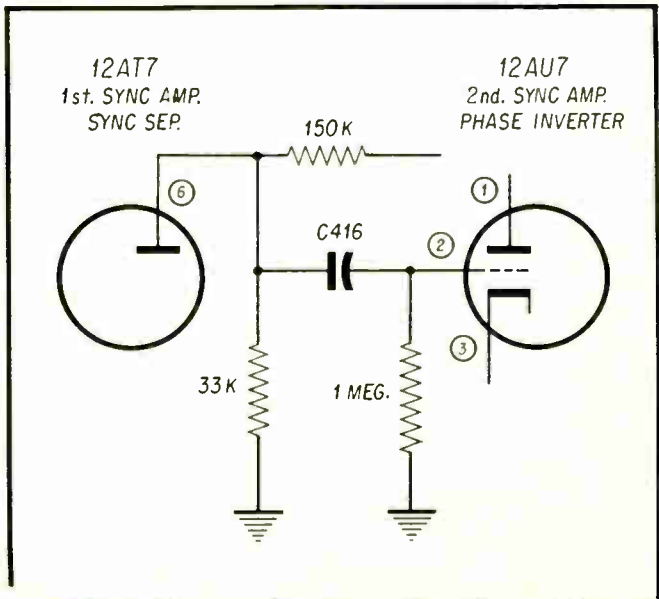
Section Affected: Sound

Symptom: No sound—R210 burned

Cause: Shorted condenser

What To Do:

Replace: C215 (.1 μf)



Mfr: Westinghouse Chassis No. V2150-101

Card No. WE2150-6

Section Affected: Sync

Symptom: No vertical and horizontal hold

Cause: Shorted condenser

What To Do:

Replace: C416 (.05 μf)

# PHILCO



# SERVICE

## New Product News

JULY, 1951

### RADIO

### PLASTICS IN RADIO

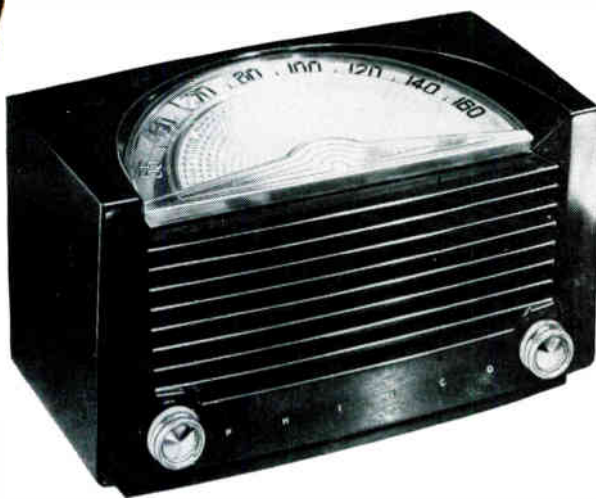


FIGURE 1



FIGURE 2

Plastics are the universally accepted modern materials. In recent years many diverse plastics have come into use in all forms of fabrications as replacements for wood and metal. This swing to the use of plastics has been brought about by the development of materials that are lighter, cheaper, easier to work, less affected by the elements, and more permanently and attractively colored than the woods and metals which they replace. The most obvious examples of this usage are in the modern table model radio cabinet such as is shown in Figure 1 and the portable cabinet shown in Figure 2. The cabinet, knobs and dial scale are the only plastic parts which are familiar as parts of a radio. However, plastics play a very important role throughout the construction of a radio. Some of the uses to which the plastic family has been put and the reasons for their choice are as follows:

**Beauty** — Colored, polished plastics are eye-catching. The color can be blended throughout the material for lasting appearance. Their sheen

and sparkle are more attractive than any painted surface.

**Light weight** — Comparing equal volumes, plastics will weigh from 1/2 to 1/10 that of wood or metal.

**Insulation** — Plastics are more easily formed than glass or porcelain and withstand mechanical abuse far better. Various plastics exhibit excellent resistive properties and very small moisture absorption. Plastics do not deteriorate as does rubber.

**Moisture proofing** — Plastics are used as coatings and impregnations to prevent moisture absorption by electrical components such as condensers, resistors, transformers and coils.

**Resistance to deterioration** — Plastics can be chosen that resist moisture, salt water, corrosive gases, acids, bases, solvents, oil and grease, fading of color in sunlight, cracking in cold, hardening through age and heat. No one plastic is resistant to all the above conditions but as with other materials one is picked which will stand up best under the expected conditions of its use.

**Sound Reduction** — It is often necessary to use plastic parts in mechanical devices to eliminate noise caused either by contact while operating or by vibration when in a static position. Along with the sound control idea it was found that a plastic tone arm provided better accoustics and less vibrational transfer than the formed or die cast metal ones previously used. Plastics are also used as dampers to cushion and prevent mechanical vibration. An example of this is the pyralin damper used in the M-20 tone arm.

**Light conduction** — Several materials such as polystyrene and methyl-methacrylate exhibit the property of conducting light, from a unit source at an edge, evenly through its volume and glowing at any point on the surface where the smooth finish is broken, as etched or molded designs and numerals on dial scales. This edge lighting has the advantage that the pilot lamp acting as the light source may be placed where convenient, and shielded when necessary so as to eliminate effects of heat, hum or light leakage from unwanted points.

**Strength** — Materials displaying either one or more of the following properties of hardness, elasticity, resilience, toughness, resistance to impact, etc., may be selected for a given application. As an example, nylon is used for the core of dial cords because it is unaffected by moisture, has great tensile strength and resistance to elongation (high elasticity). Where necessary, metal parts may be molded in to increase rigidity and improve fastenings. This is, in many cases, superior to using rivets or other mechanical fastenings, installed by hand, during assembly.

**Cost reduction** — All plastics are not inexpensive. In fact, many are considerably more expensive than the wood, glass or metal that they replace. However, in many applications a plastic is the best material and a saving in production cost is often attained, even when the plastic runs dearer than wood or metal, due to:

1. Fewer parts — Some plastics may be molded in very complex forms, thus saving time of assembly.
2. Longer mold or die life — initial cost saving, since plastics, being softer than metals, require fewer replacements of molds or dies.
3. Less material — Where a plastic is superior in mechanical properties in comparison to an alternate material.

4. Parts molded in — such as pins, fasteners, and ornaments — saves operation.
5. Complete coloring — saves an operation as painting, lowers assembly damage, and lowers customer replacement.
6. Good die or mold finish.
7. Does not corrode — saves plating.
8. Light weight saves shipping cost.

**PRODUCTION AND MOLDING**

Plastics may be divided into two general classifications:

**Thermosetting** — Those materials which set or harden upon heating and which cannot be reformed or reused. Once set heat has no temporary effect, such as softening, but will, when the temperature reaches a given point, break down the plastic, changing both its chemical and physical properties.

**Thermoplastic** — Those which soften or become plastic when heated and when cool, gain their physical properties with no change, either when heated or upon recooling, of the original chemi-

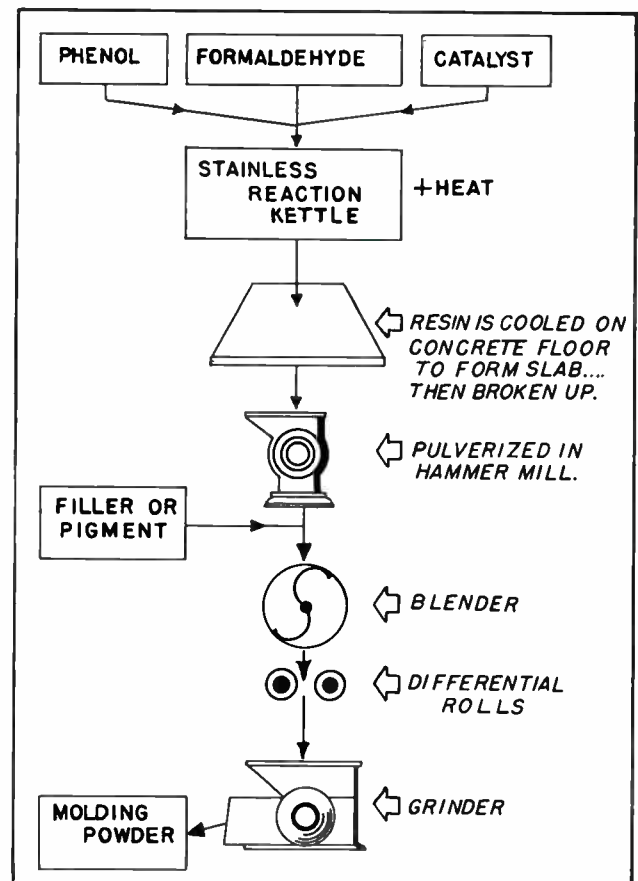


FIGURE 3



cal properties. These plastics can be reused and reformed.

The plastics are normally produced by a chemical or plastics company and then sold to the molder in the form of powder or granules. A block diagram, Figure 3, illustrates the processes required to manufacture phenol formaldehyde molding powder. In the case of the thermoplastics, such as polystyrene, the material, although ground, is finished as far as the material properties are concerned. However, the thermosetting plastics, such as phenol, or urea formaldehyde, are only partly polymerized. The remainder of the polymerization reaction, which is the reaction causing the formation of the plastic material, takes place in the mold itself under the heat and pressure used. This delayed completion of the reaction is necessary because once set, the plastic cannot be molded or reused.

The following is a brief description of the most used forming processes for making plastic parts used in radio manufacture.

**Compression molding**, (Figure 4) is performed by inserting a weighed charge of molding material (or a preformed brick, cake, pellet, etc. of the necessary weight) into a heated mold (between 280 and 350° F.) and then closing the mold under this heat and a pressure that may be from 2 to 4 tons. The part is then allowed to become rigid by heat polymerization when using thermosetting compounds or by cooling when using thermoplastic compounds. This method is most used for the thermosetting plastics. An average production cycle is about five minutes.

**Injection molding**, (Figure 5), is accomplished by feeding the material from a hopper, in measured quantities, to a heated cylinder and then forcing by hydraulic pressure the now viscous plastic through the sprues and gates into a closed mold. The presses used in this type of molding are usually automatically controlled and include means for closing the mold, holding it closed for a definite time, opening the mold, and ejecting the parts. The pressure and temperature normally used when injection molding the two commonly used plastics (polystyrene for portable cabinets, and methyl methacrylate for some dial scales) is between 10,000 and 30,000 pounds per square inch pressure and a temperature between 325-500 degrees Fahrenheit. This method lends itself to mass production due to an automatic press and the lack of curing time, since the piece is set in a matter of seconds.

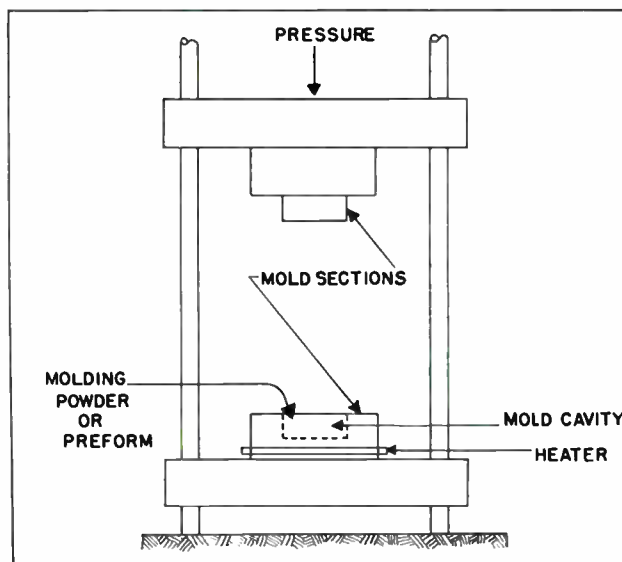


FIGURE 4

**Extrusion** is the process used to coat wires with a plastic insulation such as vinylchloride-acetate. The material is fed and heated as for injection molding, then forces out of an orifice through which the wire is running. This places a continuous coating of equal thickness over the wire.

**Lamination** is a process whereby sheets of paper or cloth are impregnated and/or layered with plastic under heat and pressure. The bakelite wiring panels and terminal boards are examples of this type of forming. Laminated sheets can be formed into tubes which are often used as coil forms. Where good strength of laminated sheets is required, a linen base is often used.

**PLASTIC PARTS AND THEIR MATERIALS**

The following table, on Page Four, gives an idea of the number of plastics used in radio construction and the variety of parts made from them. This is by no means complete as it is meant only as an illustration of the diversity of uses to which these modern materials can be placed.

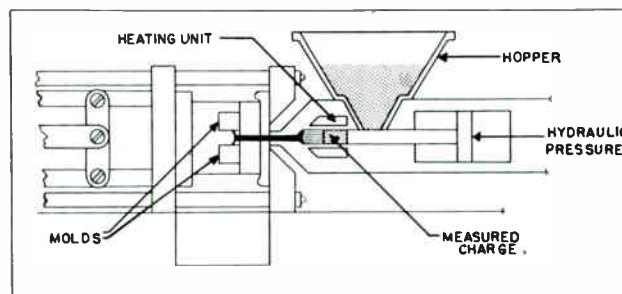


FIGURE 5



# PHILCO



# SERVICE

## Shop Practices and Service Techniques

### TELEVISION

JULY, 1951

## SIGNAL SUBSTITUTION IN BENCH SERVICING

### PART ONE

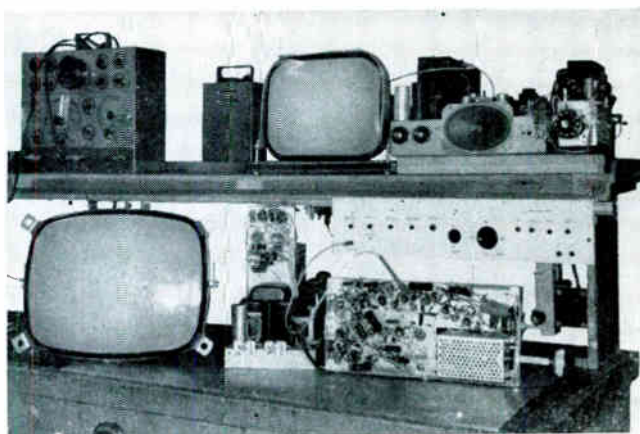


FIGURE 1

Many times the serviceman is puzzled by a particularly difficult television receiver trouble. He often suspects an individual stage, and in one way or another he is able to go through a trouble-shooting procedure which will isolate the stage suspected. This procedure of trouble isolation in many instances can be accomplished quite easily, but in other cases this isolation procedure may be much more difficult. Why not a simple system of substituting a known good signal from a test receiver so that a signal of the correct type can be furnished in place of one which is doubtful?

A bench setup where a receiver is wired to furnish the test signals is shown in Figure 1. The various signals are wired from the test receiver as shown in Figure 2, and connected to their respective jacks.

The jack on the extreme left hand side of the board is the point where the composite video signal may be obtained so that a complete video amplifier may be tested. An average value of 2 volts peak-to-peak is available at this point. The amplitude of the signal may be checked with a calibrated scope. For a complete description of oscilloscope calibration see the section at the end of this article next month.

### SIGNAL SUBSTITUTION BENCH

The back of the jack panel showing the wiring and cabling is shown in Figure 3. Notice that in this particular set-up a 50-T1400 type of television chassis was used. For the test picture tube a 14CP4 was used. This tube was picked because it can be mounted easily and is most adaptable as a universal type of test tube. Plugs and sockets are used for all the cabling so that the panel may be easily removed for service. The tuner test power supply is shown mounted on the right hand side of the bench. The AC power for this power supply may be switched on or off independently. A galvanized metal plate is used to cover the bench surface to provide a good common ground return.

The following jack and sockets are used:

- J1—Composite Video Signal (Negative as wired to Video Detector. A positive signal may be obtained from the first video amplifier plate.)
- J2—VIDEO IF Signal
- J3—HOR. & VERT. SYNC Signal



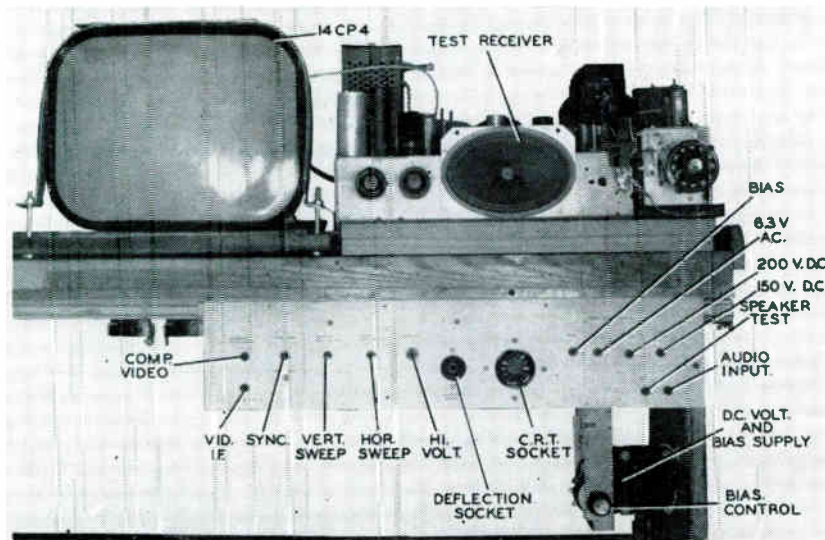


FIGURE 2

- J5—HORIZ. SWEEP
- J6—HI. VOLT.
- J7—SPEAKER TEST
- J8—AUDIO TEST
- J9—BIAS VOLT.
- J10—6.3V AC (Fil.)
- J11—200V DC
- J12—150V DC
- S1—DEFLECTION SOCKET
- S2—CRT SOCKET

Figure 4 shows a simplified schematic of the take off points in the chassis used. The following is a discussion of the individual jacks and their use.

### J1—COMPOSITE VIDEO

The composite video signal is tapped off from the video detector output, which is easily available at pin #1 of the Align Test Jack.

With the chassis used in this article, a 50-T1400, a video signal of 2 volts peak-to-peak is available at the video detector. This level of signal produces a normal useable picture on the screen. However in the present dual chassis series, a signal level of about 6 volts should be expected at the video detector output for normal operation. If a dual chassis model is used as the bench receiver, and an older chassis is subjected to test, the input

signal from the video detector should be attenuated to prevent overloading the video amplifier stage in the receiver under test. By the same token the 2 volt signal when injected into a dual chassis model cannot be expected to produce a high contrast level.

Since the signal from the video detector is normally of a negative polarity, if it is fed into a stage where the input is normally positive a reversed picture will result. As an added feature in this respect an extra jack may be wired to the first video amplifier plate circuit in the bench receiver. This will provide a video test signal of a positive polarity. It is suggested that this be done by dividing the first video plate load resistor into two sections so that approximately 2 volts of video will be obtained. The suggested values are shown in Figure 5.

### J2—VIDEO IF

Using an IF signal as a test source might seem a little far fetched and difficult to accomplish, however the IF test signal may be easily tapped off from the cathode of the video detector through a 150 mmfd. condenser. It will be noticed that when a lead is connected to this point the IF strip will act like a miniature transmitter. This is due to the high level of signal that is available at this

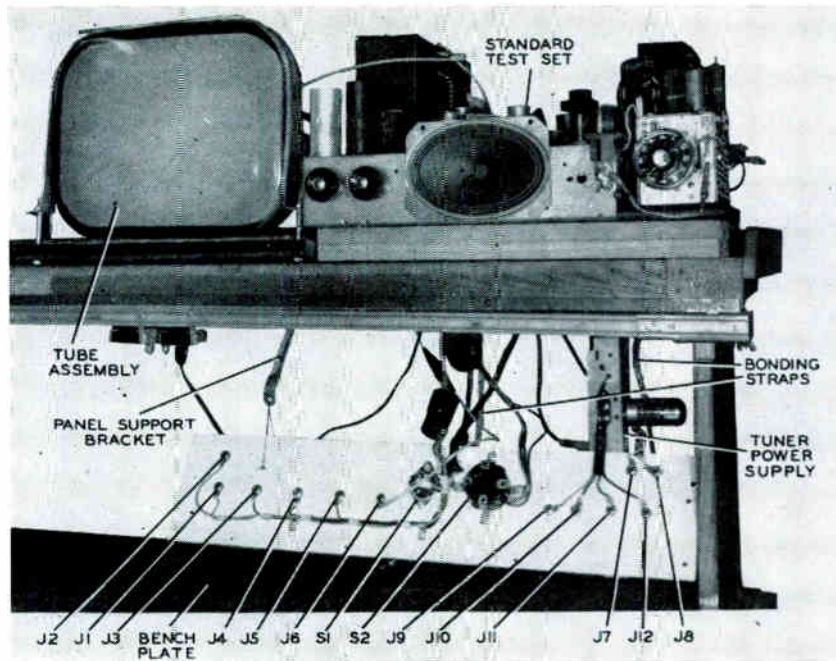


FIGURE 3

point, however this will not upset any of the indications since enough of the IF signal will enter the IF stage under test to give a good indication of IF amplification. It will be noticed that any of the 4 IF stages may be checked in the receiver under test. It should be borne in mind that the picture quality obtainable with this IF signal injection is not as good as a normal picture by any means; however, the picture obtained does give a good idea of the *amplification* of the stages involved.

### J3—HORIZONTAL AND VERTICAL SYNC

The amplified sync pulses are tapped off from the plate of the sync amplifier in the receiver through a .1 mfd. condenser. It should be remembered that the sync pulses at this point are of a positive polarity thus they should not be used to test sync stages which normally have a negative input, (for example, the sync amplifier stage). For testing the effects of the sync pulses on the sweep systems the pulses are injected by connecting to the sync amplifier plate of the receiver under test.

### J4—VERTICAL SWEEP INPUT

In order to test the vertical output circuit and vertical deflection coils of a receiver under test, a test vertical saw tooth may be tapped off from the grid of the vertical output tube through a 47K resistor. It will be noticed that some loading of the vertical circuits occurs when the lead is connected to the test receiver, however enough of the input saw tooth is still available so that a relative test can be made of the *amplification* of the vertical

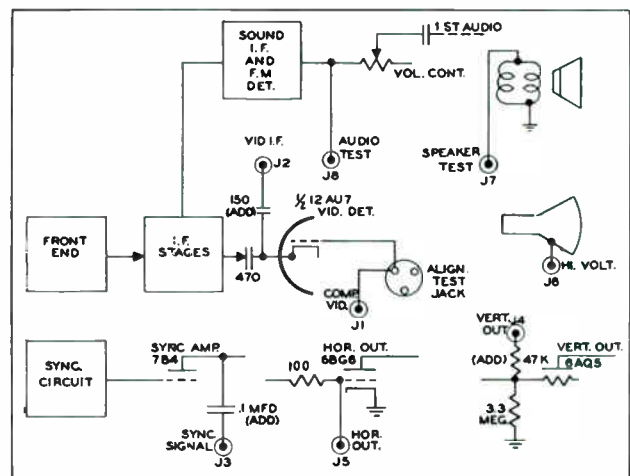


FIGURE 4

system under test. If it is desired to vary the vertical input in order to get more or less saw tooth, the height control may be varied. It should be remembered that this is not a qualitative test but merely an amplification test. For cases of poor vertical linearity this test will not show up the cause or causes of the poor linearity.

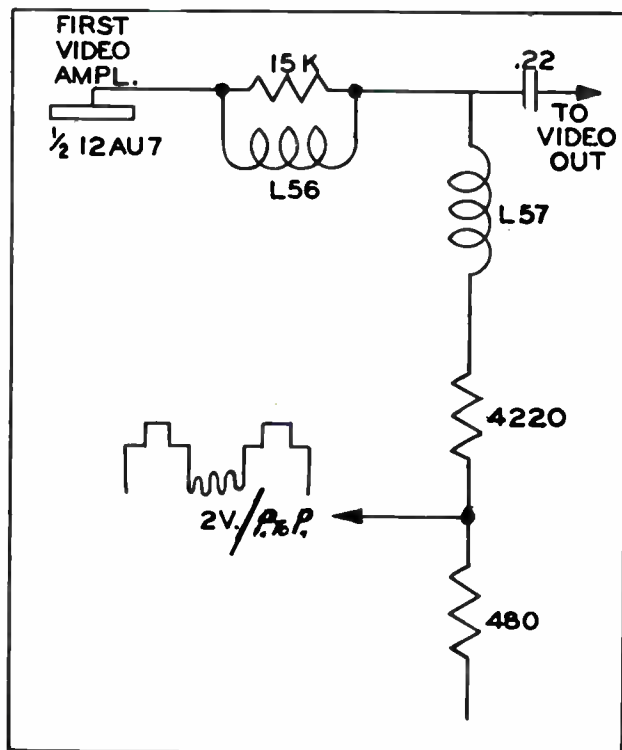


FIGURE 5

### J5—HORIZONTAL SAW TOOTH INPUT

In order to check the horizontal sweep system of a receiver, a horizontal saw tooth may be tapped off from the grid of the horizontal output tube. The horizontal oscillator tube of the receiver under test should be removed. Having this type of input signal available is invaluable in cases of *tough* horizontal circuit problems. The B supply voltages in the deflection circuits in our present series are dependent on the damper (boost) voltage, therefore the horizontal system must be working before any voltage is available. Supplying a test signal to the grid of the output tube will immediately determine if the trouble is in front of the

grid of the output tube or past it. **CAUTION:** The drive trimmer in the receiver under test must be turned out at least three turns counterclockwise. If the trimmer is in too far the input signal is divided down so far that the output circuit cannot operate correctly. A short warmup period should also be allowed before a raster will be noticed on the screen.

### J6—HIGH VOLTAGE

In order to facilitate testing of picture tubes the second anode supply voltage is wired to a test jack. It should be remembered that using the receiver in this article, a 50-T1400, about 8000 volts second anode voltage is available. In most cases 8000 volts is sufficient to test any picture tube, however normal brilliance and focus should not be expected when testing tubes larger than twelve inch. If another receiver is used as the signal source (a dual chassis model), the second anode voltage may be too high to test small size (10 in. and 12 in.) picture tubes safely. In this case the voltage may be reduced by rotating the drive trimmer clockwise, and measuring the voltage. **CAUTION:** A red button or tag should be placed around this jack (J6) for safety purposes.

### J7—SPEAKER TEST

In order to facilitate testing of speakers a jack is wired to the hot side of the voice coil in the bench receiver.

This jack may be used to test speakers of all types whether in television or AM broadcast receivers.

### J8—AUDIO TEST

In order to facilitate testing of audio systems a jack is wired to the hot side of the volume control in the bench receiver.

The audio signal available at this jack may be used to test not only television receiver audio circuits, but also record players, AM broadcast receivers, and even P.A. systems. To test audio circuits in television receivers the test signal may be fed to the 1st audio grid of the receiver under test.

**PART TWO OF THIS ARTICLE WILL APPEAR IN AUGUST ISSUE**



# PHILCO



# SERVICE

## *New Product News*

JULY, 1951

### TELEVISION

## PHILCO DUAL STANDARD ADAPTOR

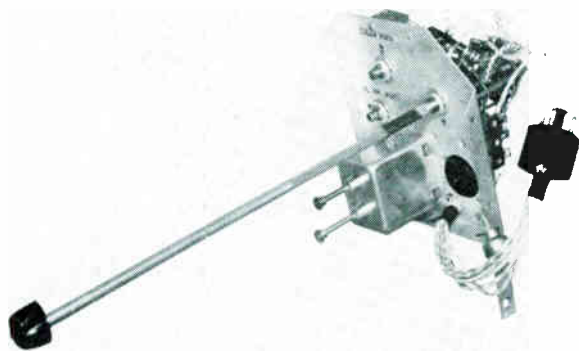


FIGURE 1

Philco's advanced design engineering has built into the Philco duplex chassis a reserve of power and efficiency which permits ready adaptation to the sweep rates required for reproduction of pictures transmitted on CBS Color Standards. This means that customers who have purchased any of Philco's '51 or '52 duplex chassis television receivers will be able to continue to enjoy black and white reception at very small added expense if and when transmissions on CBS Standards are commonplace. Adaptation of Philco duplex chassis to operate on either the present television standards or the standards authorized for the CBS field sequential color system is accomplished by installing an inexpensive adaptor which is illustrated separately in Figure 1 and is shown installed in Figure 2.

The present television standards for high definition black and white are that pictures will consist of 525 lines which are divided into odd and even fields, each consisting of 262½ lines. The fields occur at the rate of sixty times per second so the complete pictures are complete

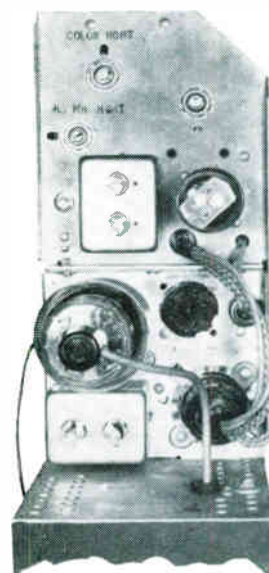


FIGURE 2

at the rate of thirty times per second. The present standards therefore result in a horizontal sweep rate of 15,750 cycles per second, and a vertical sweep rate of sixty cycles per second. The standards authorized for the CBS field sequential system are pictures consisting of 405 lines which are divided into alternating fields of 202.5 lines which thus present complete pictures at the rate of twenty-four times per second. The CBS television standards therefore result in a horizontal sweep rate of 29,160 cycles per second and the vertical sweep rate of 144 cycles per second. In order to work on CBS Standards a receiver must therefore be able to have its sweep system converted to operate on the higher sweep frequencies. Since the transmission of pictures in accordance with CBS Standards are limited at the present time to a few hours per week over only one station in any one city, the adaptation of television receivers to the new standards is not something which is to be expected over night.

We naturally would like to see a compatible system used so that consumers would not be required to spend money just to continue to receive black and white pictures of lower definition. On the other hand it is comforting to know, in the interest of the customer, that Philco receivers can be adapted easily and at little expense because of the extra care which has gone into the engineering of the Philco chassis. All Philco receivers produced to date would, without adaptation, continue to give high definition black and white if and when a compatible color television system is released and authorized for use.

The adaptability of the Philco duplex chassis to the new high sweep frequencies is made possible chiefly by the reserve of power available in the sweep system and the low loss components such as the horizontal sweep output transformer and the deflection yoke. These two components both use low loss cores of Ferrite, a ceramic bonded finely divided high permeability alloy. This means that increasing the sweep rates does not overload the sweep output system nor is there difficulty in sweeping the full width and height of the picture tube. The circuit changes effected by the adaptor kit are straightforward and can be followed easily from the step by step description and schematic given below.

### HORIZONTAL CIRCUIT

1. The oscillator transformer is switched to one of a higher frequency.
2. The width coil is shorted out.
3. The horizontal output tube blocking condenser is changed to 390 mfd.
4. A 120 mfd. condenser is connected from the "E" tap of the horizontal output transformer to the horizontal output tube grid.

That's all that is done in the horizontal circuit. This quick conversion is possible only because of the present versatile design. This quick easy conversion has the following advantage over other switched systems:

1. No change of *horizontal output* transformer is required.
2. No change of width, or linearity coils are required.
3. The brilliance remains the same due to maintenance of sufficient flyback energy.
4. The overall linearity is not affected.

### VERTICAL DEFLECTION SYSTEM

1. A 3300 ohm resistor is connected from the 6S4 vertical output tube cathode to ground.
2. The resistance in series with the vertical charging condenser is changed to a 3300 ohm and 6800 ohm resistor in series.
3. A 360K resistor is switched to parallel the existing vertical hold pot. and series resistor.
4. The existing height control is disconnected and a new control is switched in.

The vertical switching is accomplished with a minimum of parts, no change of oscillator transformers or output transformers. In short the vertical switching is accomplished easily and quickly with no loss in vertical height or linearity. Figure 4 shows the wiring connections for the dual standard adaptor. Notice that all the switching is accomplished by a four section wafer switch. To mount the kit, it is placed on top of the high voltage assembly and secured with one-quarter inch metal screws. The horizontal oscillator tube is removed and the octal plug is plugged into the tube socket. The tube is then plugged into the octal socket on the kit assembly. The three prong plug is plugged into the horizontal test jack.

A total of eleven wire connections are made to connect the unit into the chassis. Figure 3 shows a photo of the wiring looking at the back of the adaptor kit.

To sum up what the dual standard adaptor consists of and what it does. The dual standard adaptor is a small

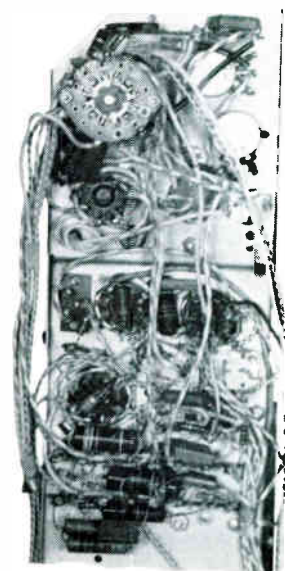


FIGURE 1





auxiliary unit which is mounted on top of the high voltage subassembly on the power chassis. It performs the task of switching in the correct circuit constants to enable the sweep circuits to operate at the higher rates required by the CBS Standard. After the adaptor is installed two separate controls are provided on the adaptor chassis to control independently, the picture height in black-and-white standard and color standard reception. All front controls remain exactly the same in either posi-

tion. This is a terrific advantage in uncomplicating the job of customer control.

In order to allow easy accessibility for customer control the Black and White Standard—Color Standard function switch is turned by means of an extension shaft and coupling. The extension shaft is inserted through a hole in the cabinet back, and a knob and label is placed on the shaft and back respectively. Figure 5 shows the shaft mounting details.

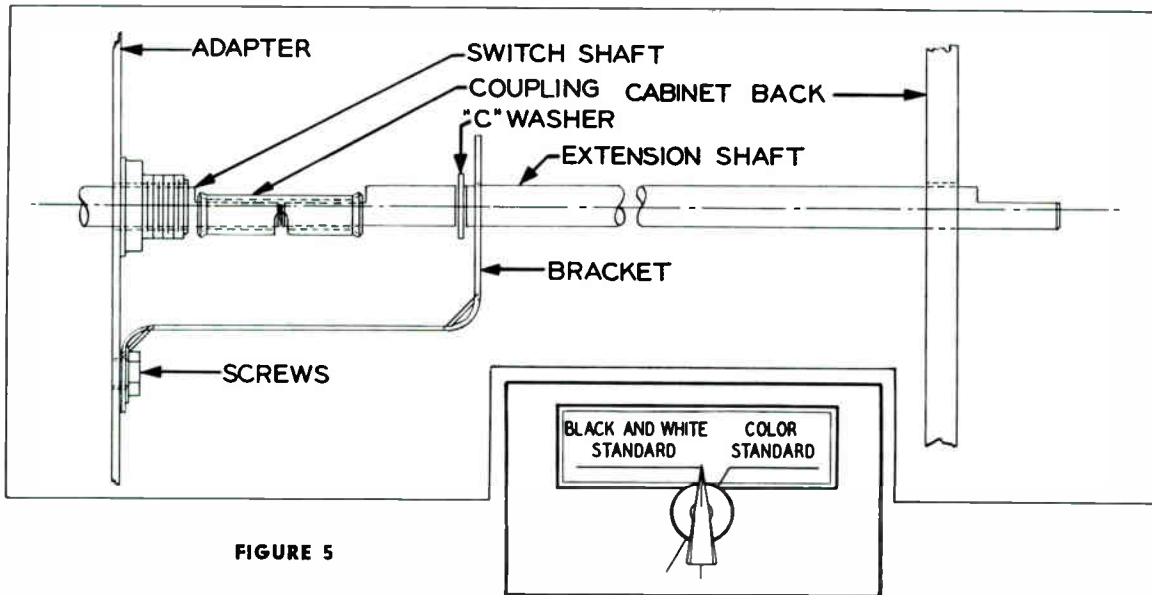


FIGURE 5

# PHILCO



# SERVICE

## Shop Practices and Service Techniques

### RADIO

JULY, 1951

## CABINET REFINISH AND TOUCHUP



FIGURE 1

Sooner or later every radio service man is confronted with the problem of having to handle the repair to a cabinet where the finish has been scratched, marred, burnt or otherwise damaged necessitating a touchup or a complete refinish.

Most repairs are not difficult to do but like all service work there are three requisites:

The right tools and materials.

The know how.

Experience.

Fortunately all three items are easy to obtain.

### THE TOOLS

An alcohol lamp, sterno heater, or electric hot plate.

Burn-in-knife

Felt rubbing block (2" x 1")

Brushes (1 pencil point touch-up brush No. 6)  
(1 free flow lacquer brush 1" width)

Spray gun and air supply (If complete refinishing is done)

### MATERIAL

Rubbing compound

Rubbing Oil

Sandpaper—wet or dry (No. 320)

Sealer

Stain

Clear lacquer (Brushing and, or, spraying)

Varnish remover

Lacquer thinner

Lacquer sealer

Burn-in-wax sticks (assorted shades)

Steel wool (Grade 4/0)

Spirit powders—nigrosene black, bismark brown, chrome orange

Shellac (white)

Cheesecloth (Soft or fine mesh)

The items on page one are those desirable for doing a complete refinishing or touch-up job of any kind. After reading this article, however, you may decide to engage only in certain phases of finish repair such as touching up, repairing scratches, etc.; therefore, the items purchased need only be those required for that phase of the work.

### EXPERIENCE

The experience needed to make a satisfactory repair can be had by practicing on an old cabinet. It will be found that a little experimenting on your part with the various types of repair following these instructions will result in your being able to do a satisfactory job.

### THE PROCEDURE

#### *Mixing Powder Stains*

Most radio cabinets are finished in either mahogany or walnut. For touchup work any shade of these two finishes can be produced by mixing spirit powders such as nigrosene black, bismark brown, chrome orange, etc., in right proportions with white shellac until the desired shade is produced. The stains are generally used to match the finish around sections of the cabinet that have been worn thru to the wood, matching the burn-in wax of filled in sections, or touching up small and inconspicuous injuries to the finish.

To produce any shade of brown walnut, place a small pinch of "chrome orange" powder on a piece of paper. Now, wet a pencil brush in shellac and dip it in the "bismark brown" powder. Then mix this color with the "chrome orange" powder on the paper until the desired shade is obtained. The small quantity that adheres to the brush when dipped in the powder should be sufficient for mixing. When mixing any of these powders use a very small quantity.

To obtain brown mahogany finish, the "nigrosene black" powder should be mixed with the "chrome orange" powder.

### TOUCHING UP BARE EDGES

To touch up edges of a cabinet that have become worn through, mix some powder stains as de-

scribed above for the type of wood and color to match. Thin this mix with shellac to a working consistency. Apply to the worn edges smoothly with a pencil brush.

### RENOVATING DULL FINISHES

In order to remove handling marks, slight packing marks and other surface imperfections due to objects being placed on surface proceed as follows:

Place a small amount of rubbing compound on a clean soft cloth. Rub the finish with the grain. Do not rub the edges of the cabinet too briskly, as it is easy to remove the finish from these points which would require retouching. Rub the surface until a smooth finish is obtained then wipe all traces of compound off the surface.

### METHOD FOR USING BURN-IN WAX AND KNIFE

Materials required: Assorted shades of burn-in wax; burn-in knife; alcohol torch; Sterno heater or an Electric Hot Plate.

The first step in filling holes, scratches and dents is to select the shade of burn-in wax that matches as closely as possible the color of the finish to be repaired. Do not select a stick of burn-in wax that is darker in color than the finish to be repaired. Always use a lighter wax, as it can be stained to match the finish.

To burn-in any injury, proceed as follows:

1. Heat the burn-in knife on the alcohol lamp. At the same time, hold the stick of shellac near the flame in order to warm it up, as it will then flow more freely when the knife is applied.
2. When the knife is hot, apply it to the stick wax and remove a small quantity of the wax.
3. Fill the spot to be repaired with the wax, pressing it in well and then smooth it out evenly. The knife may have to be reheated during the process. Care should be taken that the knife does not become too hot, as it will blister the finish around the spot being repaired and will also blister the wax.
4. After filling the section with wax and smoothing it as much as possible with the hot knife, the



surface should be rubbed down with fine sandpaper (320) then rubbing compound until the surface is smooth and level with the rest of the finish.

5. After filling a spot the wax may have to be grained to match the grain of the wood. To put a grain on the wax, mix a little "Bismark Brown" with "chrome orange" powder using a little brushing lacquer for mixing. These colors can be mixed to get the proper shade of brown to match the finish. The stain can then be put on the wax with a pencil brush to match.

### SCRATCHED SURFACES

Scratched finishes can be divided into two classes; i.e., "Deep" and "Surface" scratches. The procedure for repairing such damages differ.

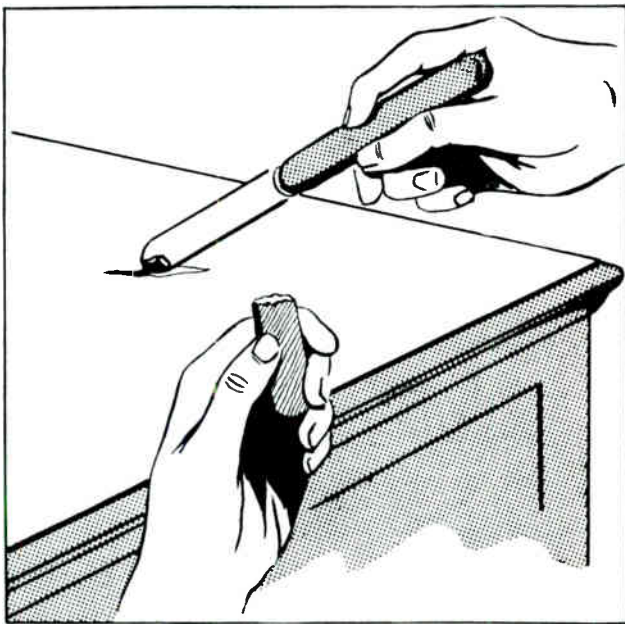


FIGURE 2

### DEEP SCRATCHES

This type of scratch is one which goes through to the wood. To repair this type of damaged surface:

1. Fill up the scratch with burn-in wax using the matching shade of wax stick. (See Fig. 2.)

2. After the wax surface is smoothed with the hot knife, place some rubbing compound on the filled section and rub down with fine sandpaper. CAUTION: When rubbing with sandpaper, it is ad-

visable to wrap the paper around a block of wood or felt to rub evenly.

3. Wipe repaired surface clean and polish with Philco polish. In the event that the scratch is very wide and deep, apply a coat of lacquer. Allow two hours drying time and apply a second coat.

4. After last coat of lacquer has dried for 24 hours, rub the area with sandpaper until the surface is level.

5. Clean, apply polish, and rub until a high luster is obtained.

### SURFACE SCRATCHES

This type of scratch is one in which the surface of the finish is not damaged deeply. To refinish this type of surface:

1. Rub the surface with rubbing compound until scratches on the surface are removed.

2. Clean, apply Philco polish and rub until a high luster is obtained.

### SCALED OR PEELING FINISHES

This type of finish trouble is generally found on the edges of panels and bases of cabinets. To repair such damages:

1. Sandpaper old finish off and wipe dust from surface with a clean cloth.

2. Stain surface with liquid stain (not powder stain) light or dark as required.

3. Apply one coat of sealer. Let dry for 3 hours.

4. Sand surface lightly with fine sandpaper.

5. Apply two coats of lacquer allowing 2 hours time between coats and 24 hours drying time after 2nd coat.

6. Sand with sandpaper and rub down with rubbing compound.

7. Clean and polish.

### CHECKED OR CRACKED LACQUER

This type of finish trouble may be described as one in which small cracks appear in the lacquer finish along the grain of the wood, or seams of the matched veneer panel sections. This trouble may be corrected and repaired as follows:

1. Sand down the entire section with No. 320 dry sandpaper. Always sand with the general run

of the grain of the wood. Sand until a smooth even base is obtained for the application of new lacquer finishing coats. Be careful not to sand through to the filler coat.

2. Wipe off the surface thoroughly with a clean dry cloth.

3. Apply a coat of spraying or brushing lacquer covering the entire section of the cabinet surface on which the checking has developed.

4. Allow the lacquer to dry for one full hour, and then again sand down lightly with dry sandpaper.

5. Again carefully wipe the cabinet surface clean and apply a second coat of lacquer.

6. Allow the second coat of lacquer to dry for 48 hours before sanding and rubbing. Saturate a clean cloth with rubbing oil and thoroughly wet the surface of lacquer to be sanded. With sandpaper and felt or wooden block, lightly sand the lacquered surface in the direction of the grain of the wood, the surface being kept wet by wiping with rubbing oil.

**CAUTION:** When sanding cabinet surface, extreme care should be taken to have the finish sanded evenly. Sometimes low spots in the wood will cause the lacquer to sink to a lower level. These spots will appear pitted and shiny when the surface is wiped clean and dry. These areas should be sanded until the shiny spots are removed. When sanding any wood surface or cabinet finish, always sand in the direction of the grain of the wood.

7. After sanding, wipe the cabinet surfaces with a clean cloth, then apply rubbing compound and rub down with a felt block until a smooth surface finish is obtained.

8. When the surface is smooth, use a clean cloth to remove all traces of rubbing compound, then polish to a high lustre.

### LACQUER SHRINKAGE

Lacquer shrinkage is due to the lacquer sinking into the pores of the wood. This type of finish trouble can be identified by the pitted appearance of the finish. The lacquer on a cabinet surface of this type, however, does not break and should not

be confused with a "checked" or cracked finish surface. In a "checked" or cracked finish surface, small breaks occur in the lacquer, whereas lacquer shrinkage merely sinks into the pores of the wood without breaking.

To refinish a lacquer shrinkage surface, proceed as follows:

1. Spread a small quantity of rubbing compound on the finish of the affected section of the cabinet and rub the surface evenly with the grain of the wood. Use the felt rubbing block moistened with cabinet or wax-base furniture polish. The rubbing operation should be continued until the surface finish appears smooth when the compound is wiped off.

2. Wipe the finish surface clean of the compound and then apply the polish, rubbing briskly to obtain a high lustre.

### USE OF THE SPRAY GUN

The most satisfactory way to apply sealer or lacquer is with a spray gun. It distributes the finish evenly, there are no brush marks to rub out, and the job can be done quickly. There are a few precautions to keep in mind that will help you learn to do a good job.

1. Adjust the gun for the right mixture of air and finish so that the spray is well atomized for the material used.

2. The material to be sprayed should be thin enough to atomize satisfactorily so it does not come out in beads instead of a mist. Suitable thinner should be added to the lacquer if too thick until the right consistency is reached.

3. Keep the gun in motion and held at right angles to the work so that the spray is applied evenly across the cabinet. Do not prescribe an "arc" by tilting the gun at each end of the stroke or the finish will be thin at each end. Also, not moving the gun will result in a spot becoming "flooded" and "runs" will start.

4. Spraying should be done in as dust-free an area as possible so that the finish can set without dust particles lodging in it while wet.

# PHILCO



# SERVICE

## *New Product News*

AUGUST, 1951

### RADIO

## NON-RADIATING FM TABLE MODEL



FIGURE 1. Philco Radio Model 52-944

Philco has just announced a new table model AM-FM receiver, Model 52-944 (Figure 1) that has several new quality features. In keeping with our policy of continual leadership, this new set has been considerably improved sensitivity wise. The new models sensitivity is two microvolts better than the preceding comparable model. This will be of particular advantage to fringe area users. However, the big advantage of this set is that the radiation from the FM local oscillator has been kept at an exceedingly low level. While this radiation can be measured with laboratory equipment, for all practical purposes this set does not radiate. It causes no interference to television reception nor to any of the other radio services. The radiation is well within the limits, proposed by the Federal Communications Commission, covering the allowable local oscillator radiation of receiving equipment.

The minimum radiation characteristic of this model has been accomplished by very careful engineering design. The factors contributing to the accomplishment of the non-radiating FM receiver are both electrical and mechanical. Shielding of under-chassis components is taken care of by the mounting of a metal base plate covering the entire length and width of the chassis. The oscillator tube is shielded to prevent any radiation from the tube itself and the tuning gang is completely enclosed to prevent any radiation from the associated oscillator circuits. The FM antenna tuning is both electrically and physically removed from the gang to prevent any coupling between the FM local oscillator and the antenna circuit so that the oscillator signal cannot appear on the FM antenna. The tuning of the antenna circuit is accomplished by means of a variable iron core geared to the gang but shielded from it. This is shown in Figure 2. The rotor shaft of the variable condenser tuning gang is grounded and the frame is bonded to chassis at several points. The absence of radiation from the radio is also effected by the careful selection of ground points and it should be noted that these grounds are critical. Whenever servicing this model or replacing parts, particular attention should be paid to maintaining the original lead length, lead dress, placement of components, and use of ground points. The appearance of the FM oscillator signal on the AM antenna is prevented by the strategic placement of an R-F choke, L8, between the loop and the AM antenna section of the tuning gang. It was also found necessary to add filtering in the B+ lead which goes above



chassis to the output transformer. This is done by a 220 MMF ceramic condenser, C44, in parallel with the electrolytic filter section. The reduction of radiation is further helped by by-passing both sides of the AC line to chassis ground by 100 MMF condensers at the point of entry of the line.

It is very interesting to note that, in spite of the shielding and by-passing required to maintain the non-radiating feature, both the sensitivity and the signal-to-noise ratio have been improved. This has been done by increasing the antenna stage gain by increasing the positive feedback between the cathode and the control grid. The cathode by-pass condenser, C5, has been lowered in value from a normal 100 MMF to 22 MMF. This value represents an optimum between gain and stability. From this established value, there are two possible effects, depending on whether the capacitance is increased or decreased. If the condenser value is decreased, the feedback will increase to a point where regeneration (and accompanying instability) begins. If, however, the condenser value is increased, the feedback is decreased so that the effective input voltage is also decreased with no improvement in stability. By using the value of 22 MMF for the cathode by-pass condenser a higher effective input voltage is attained (than when using a higher capacity cathode by-pass) which also raises the effective input impedance and  $Q$  of the antenna coil. In this way the antenna

stage gain is increased which accounts for the improvement in FM sensitivity. By the same manner, anything which increases the input signal strength will increase the signal-to-noise ratio. This is of importance in maintaining the quality expected of FM reception.

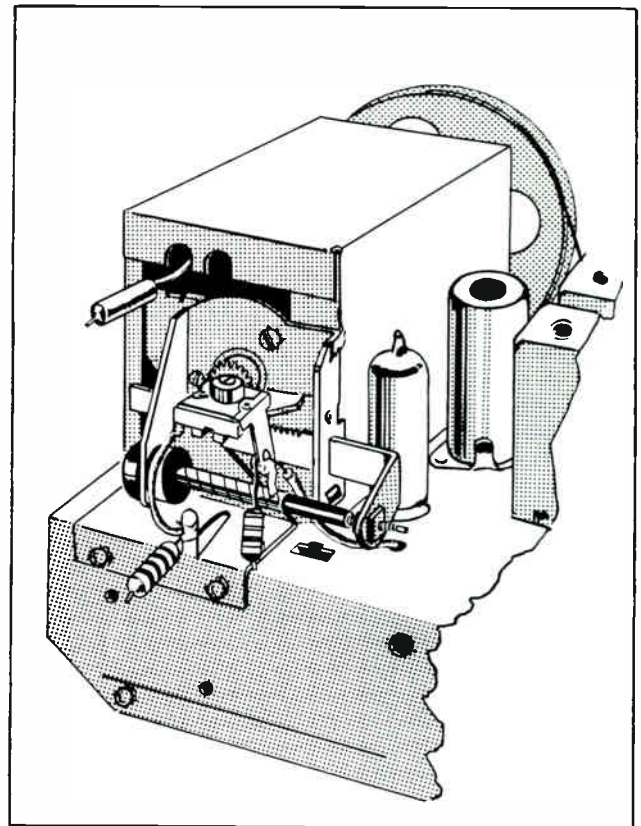


FIGURE 2

## RADIO-APPLIANCE CLOCK MODELS 51-538 and 52-544

Philco is now offering a radio-clock which not only supplies the features of a sensitive 5-tube superhetrodyne radio, an accurate electric clock, and automatic control of the radio by the clock, but also the additional convenience of automatic control of such external electric appliances as toasters, lamps, coffee-makers, heaters, television receivers, etc. The clock may be pre-set to turn on the radio (or an appliance if desired) at any selected time; it also has a delayed "off" feature which can be set to shut off the power at any other desired time up to sixty minutes. These automatic control features may be used singly or in combina-

tion, as for example: to turn the radio on automatically to avoid missing a favorite program, or to turn the radio off after the listener has retired and turn it on again at any desired time.

The appliance may be turned off and on in the same manner as the radio, simply by plugging the appliance cord into the receptacle provided on the rear of the radio. The radio covers the full broadcast band from 540 kilocycles (kc.) and is designed for operation on a power supply of 115 volts, alternating current (a.c.). The appliance receptacle has a maximum current-carrying capacity of 10 amperes (1100 watts).



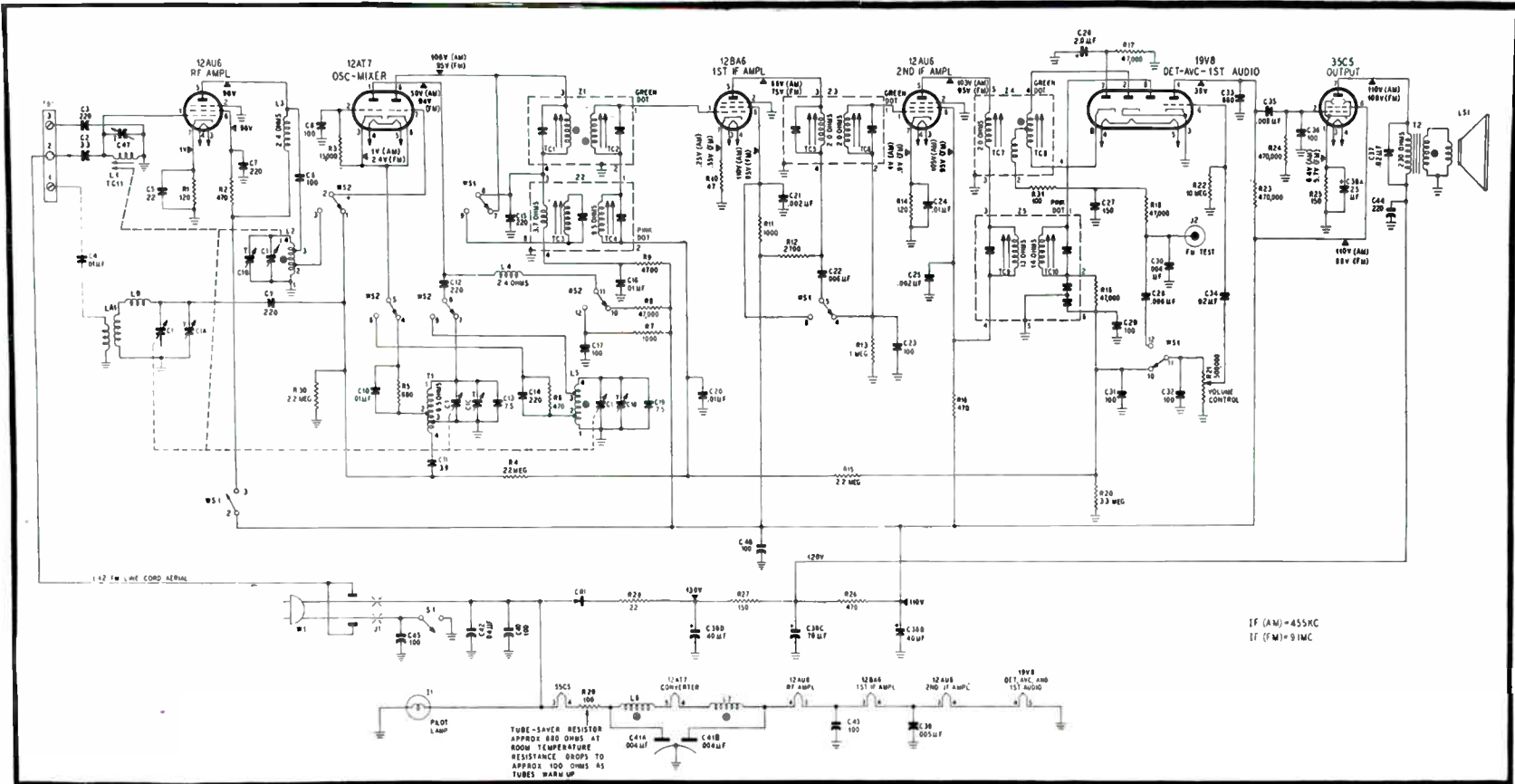


FIGURE 3. Philco Radio Model 52-944, Schematic Diagram

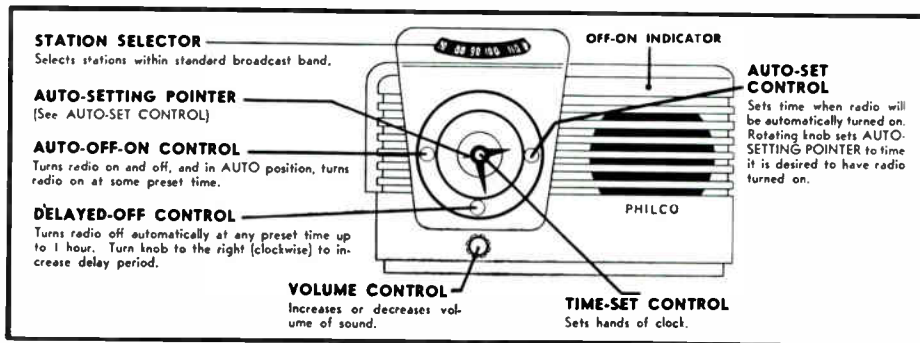


FIGURE 4

### TO OPERATE THE RADIO MANUALLY

1. Turn the AUTO-OFF-ON control to the ON position.
2. After the OFF-ON indicator is illuminated, wait a short time for the tubes to warm up.
3. Turn the VOLUME control to the right (clockwise) about halfway through its range.
4. Rotate the STATION SELECTOR to obtain the desired station.
5. Turn the VOLUME control to the left (counterclockwise) until the station can just be heard.
6. Adjust the STATION SELECTOR for the best tone quality and the least background noise.
7. Readjust the VOLUME control for the desired level of sound. If there is a slight hum when the volume is turned low, reverse the power-cord plug. **NEVER USE THE STATION SELECTOR TO ADJUST THE VOLUME.** If the above procedure is not followed, poor tone quality, increased noise, or station interference may result.

### AUTOMATIC OPERATION

If the radio is to be controlled, set the STATION SELECTOR and VOLUME control to the positions of the radio station and volume desired. If any appliance also is to be controlled, insert the appliance power-cord plug into the receptacle on the rear of the radio; if radio sound is not desired, turn the VOLUME control to the left (fully coun-

terclockwise). After setting radio controls or connecting appliance, automatic-control operation is as follows:

To automatically turn on the radio or appliance at a preset time, set the clock controls as follows:

1. Set the AUTO-SET control for the desired time.
2. Turn the AUTO-OFF-ON control to AUTO.

#### NOTE

For radio-alarm operation it is advisable to select a local station, because of the wide variation between daytime and night time reception.

To automatically turn off the radio or appliance within any time interval up to 60 minutes, set the clock controls as follows:

1. Set the AUTO-OFF-ON control to OFF.
2. Turn the DELAYED-OFF control to the right (clockwise) for the desired period of time. (for example: halfway for 30 minutes, fully clockwise for 60 minutes.)

To automatically turn off the radio or appliance within any interval of time up to 60 minutes, and then on again at a preset time, set the clock controls as follows:

1. Set the AUTO-OFF-ON control to AUTO.
2. Turn the DELAYED-OFF control to the right (clockwise) for the desired time interval.
3. Set the AUTO-SET control for the time at which it is desired to turn the radio or appliance on again.

## Shop Practices and Service Techniques

### RADIO

SEPTEMBER, 1951

Following last month's discussion of basic oscillator theory, an attempt will be made in this article to cover as many problems as possible that arise involving these circuits.

Fig. 1 shows two typical oscillator circuits used in recent models. The first, Fig. 1-A, is a parallel fed Hartley using one half of a 7F8 dual triode as the oscillator tube. The second, Fig. 1-B, is a tuned grid using two grids of a multi-grid converter tube, a 1R5, as the oscillator tube elements. Not only are these two oscillators dissimilar in circuit but they also differ in regards to method of injecting the oscillator voltage to the mixer. It is, of course, known that where two signals, differing in frequency, are fed into an amplifier, the output will contain the two original signals, the sum frequency, and the difference frequency. Thus, to obtain the IF of a superheterodyne receiver, it is only necessary to mix with the incoming signal a frequency that is either the IF above or below it, selecting the IF or difference frequency from the mixer output by a tuned circuit. In circuit 1-A the mixing action is accomplished by tying the cathodes of the oscillator and mixer sections together, thus modulating the mixer cathode with the oscillator signal while

feeding the incoming signal to the control grid. In circuit 1-B the oscillator uses two grids of a common tube. The control grid, which carries the incoming signal, lies between the two sections of the grid which acts as the oscillator plate. In this manner the tube current is then controlled by both signals as before.

Therefore, from the operation of the oscillator mixer, several quick and easy checks can be made to determine if the oscillator is working. If the static and noise level seems normal in tuning across the band, although there are no stations heard, and if an IF signal is passed by the mixer section with proper gain, the oscillator is immediately suspected. Also when the oscillator is operating properly, there will be a negative voltage developed at the grid across the grid leak resistor,  $R_g$ . This is the check for oscillator operation; using a suitable range, such as 0-10 volts dc, and connecting the positive lead to the cathode and the negative lead through a 100,000 ohm resistor to the oscillator grid, a negative voltage should be indicated for all positions of the tuning gang.

The causes of oscillator failure are as numerous as the components of the circuit. The tube may be at fault

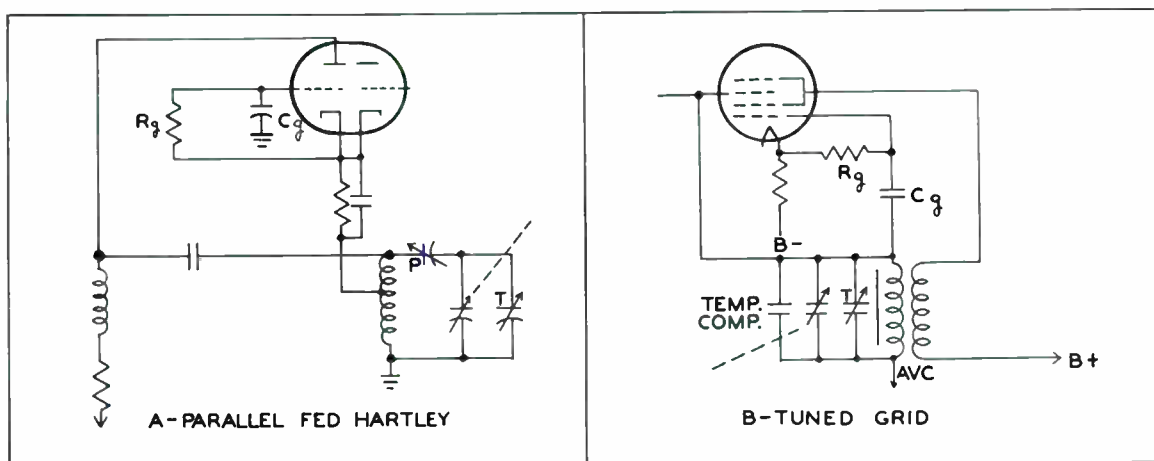


FIGURE 1

even though the mixer section works (in such tubes as the dual triode 7F8) and the tube tests good in a tube tester. The best test for a tube used in an oscillator circuit is whether or not it works in the circuit. Oscillator tubes are best checked by substituting one known to be good. The other circuit components can be checked by the usual voltage, resistance, and substitution methods. Having determined that the oscillator is not functioning, the following test can be made. Measure the B+ supply voltage and the oscillator plate voltage to see if there is a voltage drop across the decoupling network, thus showing that the tube is drawing current. The

cathode voltage (or absence of it) will also indicate whether or not the tube is conducting. An absence of plate voltage indicates an open in the plate B+ circuit. No cathode voltage would be caused by either an open in the cathode circuit, such as open coil or resistor, or a faulty tube. A continuity check (in case of Fig. 1-A) from cathode to ground will establish if the trouble is in the tube or the circuit. The rest of the circuit may be checked in a similar way.

The following chart outlines some of the possible types of faulty oscillator operation with the common causes of each.

TROUBLE		REMARKS	CAUSE
Drift	Initial	All sets drift to some degree after initial turn on.	Change of tube spacing and component values coming up to operating temperature.
	Operational	An excessive amount of drift which lasts for longer than is necessary for the set to heat up. This can be caused by blocking the ventilation holes, by a tube overheating, or by components of the tank being subjected to too much heat.	Heat causes continuing change of value in coil and condenser components of tank. Replace, or if none—add temperature compensating condenser.
	Long Term	Usually sufficient to realign. If tube shows a reduction in emission—replace. Clean plates of variable condenser.	Tube aging and change in value of tuning condensers due to dirt or of coil due to aging of form or insulation.
Partial Operation		This condition may be coupled with either a reduced or high oscillator voltage in the portion of the band that works. If the injection voltage is too high the tube will block—this is accompanied by low mixer gain in the operative portion of the band. Moisture or leakage in the coil is often accompanied by shift in frequency.	Tube may fail to operate at particular frequencies. Leakage in coil, condensers, or leads. Over or under coupling between grid and plate coils. Low emission of tube caused by either poor tube or low filament voltage.
Motor Boating		Oscillator starts and stops. The on-off cycle is quite rapid and normally regular.	Open grid return or increased grid capacitor. The time constant of Rg Cg is too large to allow the complete discharge of Cg during a cycle thus building up a charge which cuts the tube off.
Shift of Frequency		This is usually accompanied by a drop in sensitivity and poor tracking.	Shorted turns. Leakage in coil or condenser. Open condenser in tank.

Oscillator drift (a changing of oscillator frequency which results in a shifting of dial calibration) can be caused by either purely mechanical changes or expansion due to thermal changes. Any oscillator of the type normally used in receivers will exhibit drift to some extent immediately following the initial turn-on. This is thermal drift and is caused by the mechanical changes through which all the associated parts pass before reach-

ing their stable state of operating temperature. Following the turn-on the various supply voltages will, from an initial high value, decrease, due to the tubes increasing conduction as the filaments' temperature rises to normal thus raising the cathode's temperature and emission. The rising tube temperature also affects the spacing of the tube elements thus changing the various interelectrode capacitances. As the tube itself is reaching its final



temperature, the electrical components are then being heated both by current flow through them (as in the case of resistors and coils) and by radiation from the tubes. For good operation this drift should not last for more than a few minutes and should not affect the oscillator frequency by more than approximately 5KC at the high end. An example of mechanical drift is relaxation of the trimmer's plates. This can be caused by a gradual loss of the spring tension or by the plates having attained a "set" from a previous position and then tending to return to the original setting.

Thermal drift can be minimized by various methods such as reducing the heat within the cabinet and chassis by improving ventilation, relocating the effected parts to a cooler and more thermally stable position in the chassis, and by adding a negative coefficient condenser across that portion of the oscillator tank (whether coil or gang) that suffers the value change due to heat. These ceramic, temperature compensating condensers are the easiest and most common means of combating thermal drift. Their value of capacitance must be large enough to provide adequate compensation, and yet not so large as to shift the trimmer's setting outside of its usable range.

The coefficient of change versus temperature rise must be of such value as to stabilize the circuit without over-compensating and thus causing the circuit to drift in the opposite direction. These condensers should be wired directly across the terminals of the part being compensated so as to receive as nearly as possible an equal temperature variation.

Loss of calibration over a long period of time can be caused by tube aging, by accumulated dirt on the trimmer or gang, by gain or loss of moisture in the insulation of the condensers or coils, or by changes in position of the trimmer or gang plates caused by lessening of spring tension. These changes are usually small and can be corrected by realignment.

Motorboating is a condition where the oscillator alternately starts and stops in rapid and usually regular fashion. The cause of this trouble is either an open or greatly increased grid resistor or a grid condenser that has increased in value. As explained in last month's article, the grid condenser charges negatively on the positive portion of the grid swing thus limiting the positive swing and the grid current. During the rest of the cycle, this negative charge leaks off across the grid resistor. If, for any reason, this charge does not completely disappear before the next positive swing of the grid, the residual charge will add to the charge normally acquired during the cycle. This is continually additive until the charge across Cg equals cutoff. The tube is then blocked and oscillations cease until the charge leaks

off. The oscillator then starts, only to cut off again. It can be seen that the action at the oscillator grid is dependent upon the time constant of the combination of Cg and Rg.

Ocasionally, an oscillator will work for a period of time and then quit. There are several possible causes of this action; some part in the oscillator circuit may open, short, or change value sufficiently to prevent oscillation after warming up through operation, or the filament voltage may drop to such an extent as to lower emission below the value necessary to sustain oscillation.

These two possible causes are easily separated by applying the following tests. If the trouble is caused by component breakdown it will show up by supplying full rated supply voltage (or slightly more — such as 120 V. A.C. from a rheostat to supply an A.C. set which normally operates on 115 V.) and possibly adding heat to the suspected parts with a lamp or soldering iron. If the set is suspected to fail due to low filament voltage, the supply voltage can be reduced; the set should then quit. Measure the A.C. supply voltage at which the set just fails to operate to be sure that it is within the expected range of the service in the locality. The filament voltage should then be measured to ascertain if the voltage is below the level at which the tube should work or if the tube is at fault by requiring at least full filament voltage due to low emission. If the voltage across the oscillator tube is low, the voltage drop should be measured across the other tubes in series (in an AC-DC set) and any other components such as filament dropping resistors. This is a point to remember when portable radios require a new battery at very frequent intervals. Often the high voltage tubes will drop more than their share of the filament voltage. This may be caused by the tube itself or by a filament bypass that is leaking causing a higher current flow through one or more of the tubes.

Partial operation of the oscillator is characterized by reception of signals in only a portion of the tuning range. When a condition of this type exists, the oscillator voltage should be measured while tuning across the band. This voltage should be reasonably constant. Occasionally, a tube which checks good will refuse to oscillate on all or a portion of the band. If the oscillator voltage falls to zero or to a very low value in the portion of the tuning range that is inoperative, the trouble may be an open grid condenser, leakage in the coil, lowered oscillator plate current, or insufficient coupling between the grid and plate coils.

Overcoupling between the grid and plate sections of the oscillator transformer can also cause the circuit to be inoperative or partially so. This is due to the oscillator supplying sufficient injection voltage so that the mixer

blocks. This can be checked by measuring the oscillator voltage and also by measuring the mixer stage gain. The oscillator and mixer work together to such an extent that a rise of oscillator injection voltage raises the bias on the mixer which lowers the mixer gain. A final check can be made when this condition is suspected by checking the mixer stage gain, lowering the oscillator voltage by some means such as reducing the B+ voltage applied to the plate section of the coil, and then rechecking for improved mixer gain and continuous operation across the band.

Stoppage of the oscillator in a portion of the band may be due to nicks or foreign matter in the plates of the variable condenser. Moisture or leakage across the coil or the insulation of the variable condenser may cause increased power consumption in the tuned circuit to such an extent that the oscillator feedback will not make up the loss, thus causing the circuit to fail to oscillate. Cases of moisture absorption in the tank components are often accompanied by a change in frequency.

The following paragraphs deal with the checking of auto sets which intermittently blow fuses. Much of the information may be applied to the servicing of home sets as well. The check of operation using abnormal voltages (voltages which represent the high and low limits at which the set can be expected to operate) is very useful in any form of radio servicing. Many localities experience periods of high voltage (such as late at night when the load is least) and low voltage (such as the evening hours in residential neighborhoods or during the day in industrial locations). It will be noticed that often what appears to be an intermittent trouble is merely an inability on the part of the set to operate on other than normal voltage from the lines. As an example, the customer may complain that the radio shuts off for several minutes at irregular intervals during the evening. This may be a case of low supply voltage (or low oscillator emission) which is further lowered, below the set's operating point, by the added load of an electric refrigerator.

It is well known to all service stations and car dealers that a blown fuse is the complaint in a high percentage of auto radio repairs. A large number of these cases are remedied by the location and removal of a direct short to ground caused by a bit of solder or wire in the high voltage or B+ section or the replacement of a shorted filter section. Usually, these troubles will cause fuses to blow consistently as soon as voltage is applied.

Occasionally, however, a set will come in with a blown fuse and operation on the bench will be perfectly normal. At this point a great many servicemen make the mistake of replacing the vibrator and returning the set as repaired. This is laying themselves open for a subsequent

identical complaint and irritation on the part of the customer. The car dealer and customer both begin to have suspicions as to the competence of the serviceman which may soon lead to curtailment of his business.

During normal vibrator operation, the voltage to the set may vary from 5.2 volts to as high as 8 volts, depending on the condition of the car battery, the setting of the voltage regulator and the resistance in the car wiring. This is a variation of 2.8 volts and can cause the voltage at the secondary to range between 200 and 310 volts on a normal power supply designed to furnish 250 volts at 6.3 volts input.

In order to locate power supply troubles (as well as oscillator failure, regeneration and high voltage breakdown) it is of tremendous advantage to be able to simulate input voltage fluctuations between the above limits. As this cannot be done with a common storage battery, it is highly advisable to equip the test bench with a manually variable low voltage, DC power supply.

In bench testing a set which has blown a fuse, the input voltage should be set to the nominal value as given by the manufacturer (usually 6.3 volts) and the input current noted. If the current is more than 1 ampere greater than that set forth in the specifications, the set should be thoroughly checked before being returned.

- a. Replace temporarily the rectifier tube and see whether the current is reduced to normal.
- b. Check the secondary buffer condenser and replace if necessary, using a capacity voltage rating, and type as recommended by the manufacturer.
- c. Check by-pass condensers for shorts or leakage — especially in screen grid circuits.
- d. Check feed-through condenser on "A" circuit and hash condenser between B+ and ground if they are used.
- e. Check electrolytic condensers.
- f. Check all tubes, especially output tubes, for shorts or abnormal consumption of current.

If the current is normal at 6.3 volts, the voltage should be raised slowly meanwhile watching the input current for signs of a rapid increase indicating a breakdown. When this has been established, it is easy to check the set as previously outlined. **DO NOT EXCEED 8 VOLTS INPUT!**

When replacing vibrators and buffers, it is wise to remember that the capacitance of the buffer condenser and the inductance of the secondary plus the reflected inductance of the primary form a resonant circuit which must be matched to, or track with, the cycling period of the particular type of vibrator used in the circuit. Thus, it can be seen that proper buffer values are extremely important, as the life of a vibrator can be shortened by as much as 50% by incorrect buffering.

# PHILCO



# SERVICE

## New Product News

SEPTEMBER, 1951

### TELEVISION

## PHILCO TELEVISION ALIGNMENT JIGS AND THEIR USE

Alignment of the Television Receiver has always seemed mysterious and extremely difficult to many a Television Serviceman. As the expression goes: "Its only in the mind." For all practical purposes television alignment consists of injecting a signal of a known frequency and type, into a certain point and examining how the receiver amplifies the signal at some output point. Although the preceding statement sounds simple and *is* simple to accomplish, many servicemen are confused by the fact that apparently a good connection to the output and input spots in the receiver seems difficult to attain. The Philco Television Alignment Jigs are specifically designed to make this part of the job of alignment easy. An initial investment in a complete set of television alignment jigs will yield rich dividends in accurate and correctly aligned Philco Television Receivers accomplished (excuse the pun) in jig time.

A good positive connection at the input points takes the guess work out of television alignment. There is nothing more disconcerting than trying to align a receiver and having something go wrong with the connections every few minutes. Another good point to remember is that a good positive connection will minimize the tendency for instability in a Television Receiver during alignment. The following is a discussion of the Philco Television Alignment Jigs sold through your distributor, plus a discussion of a jig (the Bias Box), which may be pre-fabricated out of several ordinary parts.

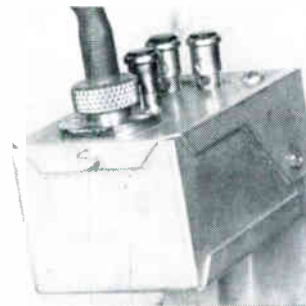


FIGURE 1

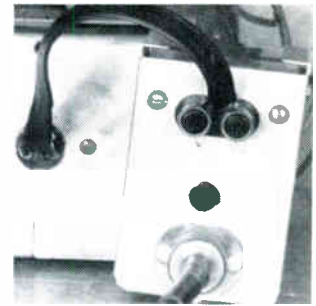


FIGURE 1A

### PHILCO TELEVISION ALIGNMENT JIGS

**Philco Television Antenna Jigs — Antenna Jig Part No. 45-1736 (See Figures 1 and 1A)**

When a signal generator which normally has an output impedance of approximately 72 ohms is connected to the aerial input terminals of a television receiver which usually has a 300 ohm impedance; an impedance matching device must be used. The reason for matching the output impedance of the generator to the input terminals of the receiver can be understood when referring to Figure 2. In Figure 2, the effects of a mismatch can be seen. Notice that there are standing waves around the connecting cable, thus this cable in common terms is said to be "hot". This means touching the cable at any point and introducing hand capacity, changes the positioning of the standing waves and upsets all alignment results. When using a sweep generator the effects of mismatch can be very easily seen since it can easily be noticed that the response curve shape changes when the connecting cable is touched.

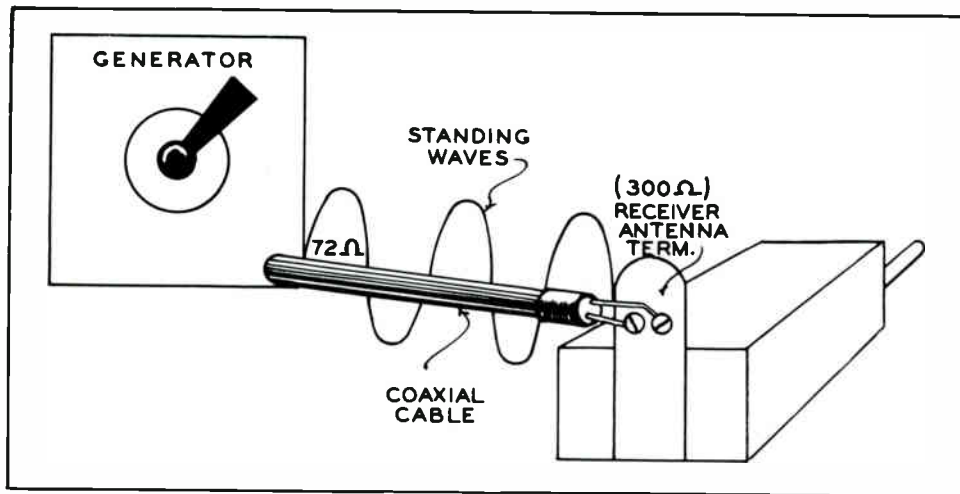


FIGURE 2

The antenna jig, Part No. 45-1736 uses 150 ohm line elevator coils which step the 72 ohm generator output impedance up to the 300 ohm receiver input impedance. In addition, an attenuator pad, having a loss of approximately 60DB, is incorporated in the circuit to level off any slight mismatch which might occur due to variations in input impedance between individual television receivers. This impedance matching network is mounted in a compact metal case. It can be used with any type of television receiver since it fits either the present two screw terminal type of aerial input, or with a short piece of 300 ohm line and 4 prong antenna plug it will fit the earlier 4 prong antenna sockets. This jig has a threaded, female, Jones receptacle for connecting to the cable assembly Part No. 45-1635.

**Antenna Jig, Part No. 45-1637**  
**(See Figures 3 and 3A)**

The antenna jig, part no. 45-1637 is an earlier type of jig which serves the same purpose as the 45-1736 jig and was used originally with the '48 and '49 series of receivers. However, impedance matching is effected by the use of carbon resistors instead of coils. The impedance matching network is mounted inside of a metal can, and a 4 prong antenna plug is mounted on one side. For more universal use the jig can be equipped with a braided ground lead and alligator clip. With a short piece of 300 ohm line and 4 pin antenna socket as shown in Figure 3A, it may be used with all Philco Television Receivers.

**PHILCO TELEVISION IF JIGS**

**IF Jig, Part No. 45-1670 (See Figures 4 and 5)**

The IF Jig, Part No. 45-1670 provides a positive connection to the mixer grid of the present day tuners, 76-5747 and 76-6440-1. It may be used for this application by slipping the jig over the mixer-oscillator tube and letting the spring loaded contact come up against the mixer grid connection. See Figure 5. It should be noted that on the 76-6440-1 type of tuner, there are 2 types of tube socket and tube shields used for the mixer

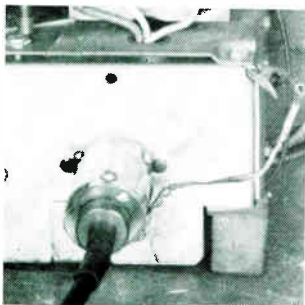


FIGURE 3

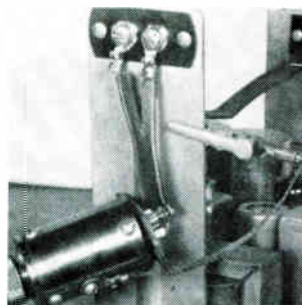


FIGURE 3A



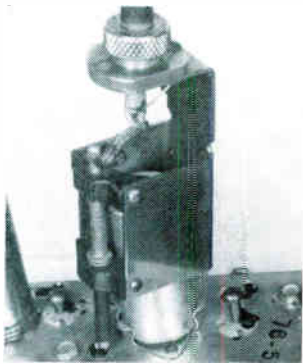


FIGURE 4

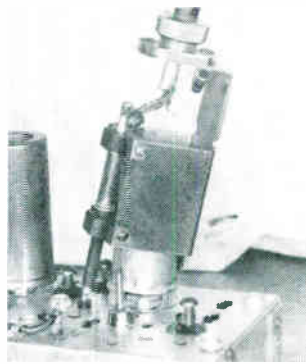


FIGURE 5

oscillator tube. If a tuner using a projection type socket and larger diameter tube shield is encountered, it is necessary to remove the larger tube shield and insert a smaller tube shield that will fit into the 45-1670 jig. Ground connection is made by the shield contacting the inner surfaces of the projection socket. See Figure 5.

This jig may also be used to contact the connection to the video i-f amplifier grids which are accessible from the top of the chassis through small holes near the i-f tube shields. This application can be used in those receivers in the 49-1150, 1450 series.



FIGURE 6

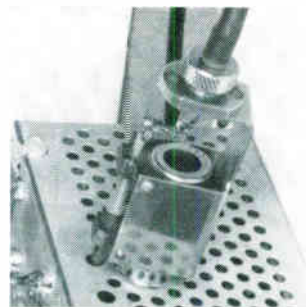


FIGURE 6A

**IF Jig Supplement, Part No. 1740**  
See Figures 6 and 6A

The IF Jig Supplement, Part No. 45-1740 consists of a tube shield to which a prong has been fastened. This part when used with Part No. 45-1670 as shown in Figure 6A, makes a jig to provide easy connection to the mixer grids of such tuners as the 76-5411, 76-5433, 76-4402.

The IF Jig Part No. 45-1670 when combined with 45-1740 modified as explained previously makes a jig which can be used to inject signals into the mixer grid of all Philco television receivers, except the '48 eight channel tuner type. For all practical purposes it is a *must* in alignment equipment.

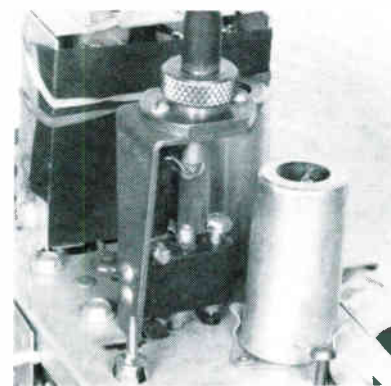


FIGURE 7

**IF Jig — Part No. 45-1739 (See Figure 7)**

The IF Jig, Part No. 45-1739 can be used in place of the 45-1670 to contact the mixer grids of the newer tuners, 76-5747, 76-6440-1. It can be also used to contact the i-f grid test points which are of the button type and protrude above the chassis; (in some models of the 50-T1600 series).

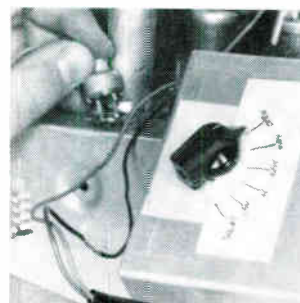


FIGURE 8

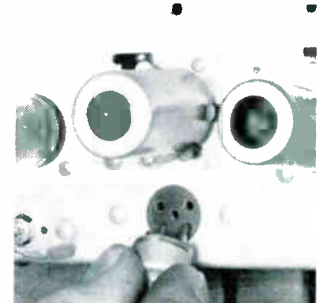


FIGURE 8A

**Pre-Fabricated Jigs — "The Bias Box"**  
(See Figures 8 and 8A)

Perhaps the most useful jig which can be made is the "Bias Box". This jig has proven to be a very versatile piece of equipment. The plug part

of the jig may be connected to the Video Test Jack of Philco receivers using either a 3 or 4 pin test jack. The plug fits both sockets because one of the pins is clipped off leaving 2 whole pins. On 3 pin test jacks the plug is inserted with the cut-off pin to the front. On 4 pin test jacks the plug is inserted with cut-off pin to the extreme right. See Figures 8 and 8A. The jig provides a lead from the video detector output, (Blue lead), and also provides access to the AGC bus (brown lead) so that various negative voltages can be applied.

A six volt battery is used so that the six volts can be used to simplify troubleshooting the AGC circuits as covered in the March, 1951 issue of Philco Shop Practices and Service Techniques Publication.

The parts required to make the Bias Box Jig are as follows: (See figure 9).

1. A 6 position switch — Philco Part No. 42-1594 (this is an 8 position switch, only 6 positions are used).

2. A 3 prong plug — Part No. 27-4787.
3. A metal shell for plug — Part No. 56-1146.
4. An alligator clip.
5. 4 small pen-lite batteries (1.5 volts).
6. A metal case of the following approximate dimensions. (The exact dimensions are not important since only a box of convenient size large enough to house the parts is required.)

LENGTH — 6 inches  
 WIDTH — 4 inches  
 DEPTH — 2 inches

The batteries may be securely fastened in place by using a thin metal strip (about 3/8") that is secured by metal screws on each side.

It is suggested that an insulating material such as thin cardboard be placed around the inside of the case near the batteries in order to minimize the likelihood for shorting out.

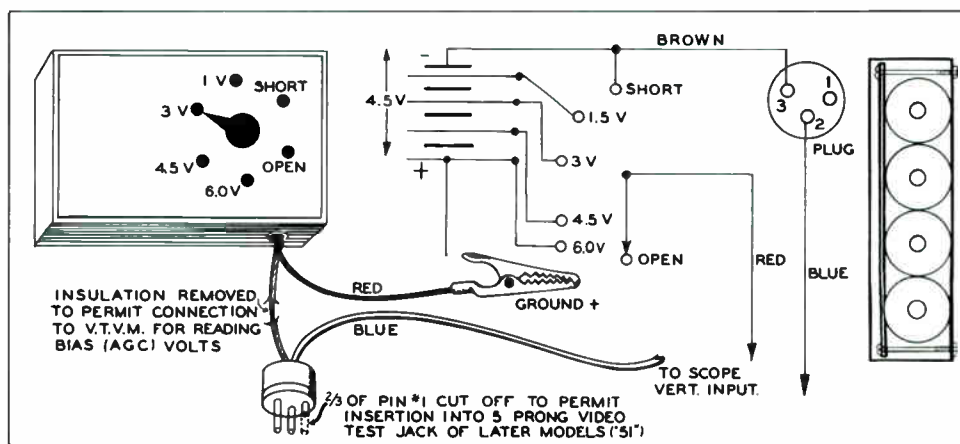


FIGURE 9

# PHILCO



# SERVICE

## Shop Practices and Service Techniques

### TELEVISION

SEPTEMBER, 1951

## TAKING THE MYSTERY OUT OF SYNC

### Part One

The purpose of this article is to illustrate and explain ways and means of tracking down sync troubles accurately and quickly. We know that most servicemen can lick any trouble eventually but we also know that the serviceman earns more money at less cost to the consumer when he knows the fastest service procedures.

It is not the purpose of this article to explain the sync signal in detail or how we happen to have the type of sync signal now in use. We will, however, briefly state the television standards so that we can have a beginning for our discussion of the composite video signal, the factors which affect this signal, the separation of sync from this signal, and the factors which are important in this process.

This article assumes that you know that television pictures are not transmitted all in one piece. Television pictures are created by sending thirty complete pictures per second consisting of 525 horizontal strips or lines, so that your eye has the illusion of continuous motion. The thirty complete pictures or frames are further divided into sixty fields of 262½ lines. Each field is made up of alternate lines; that is, the first field is the even lines and the second field is the odd lines. The division of pictures into sixty fields is done in order to prevent flicker which would be objectionable to many people if the complete picture were repeated at the relatively slow rate of thirty times per second.

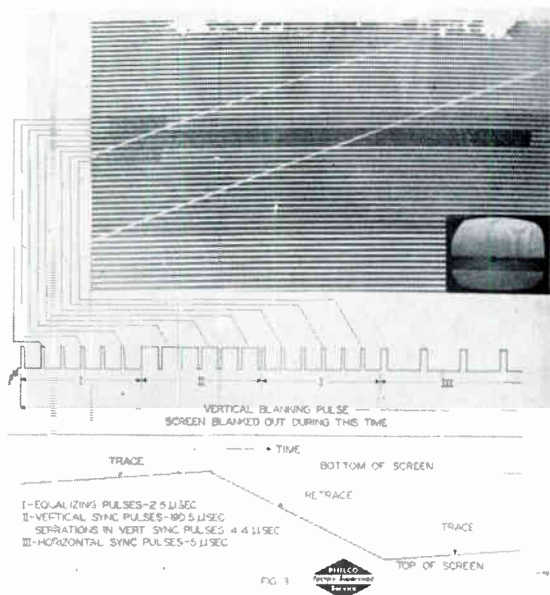
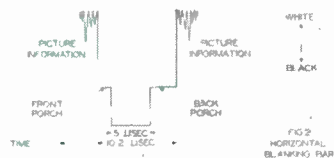
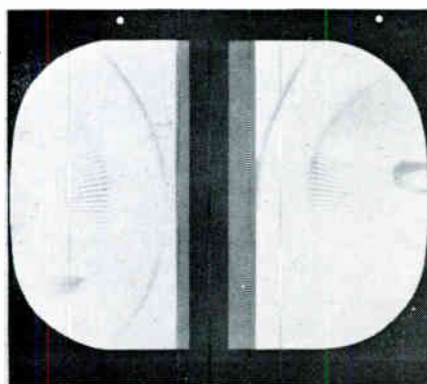


FIGURE 1

Having divided the picture into elements which can be transmitted over an electrical system we know that it is necessary to send along decoding information in the form of sync pulses which will permit the receiver to reassemble the picture with each element placed in the correct position on the proper line in the right field of the complete frame. See Figure 1. The electrical signal representing the picture elements and the sync pulses is known as the composite video signal. The video or picture element information is necessary to reproduce the picture in its original form. You, as an outstanding serviceman, can obtain more complete mastery of Television Trouble-Shooting by thoroughly understanding the composite video signal and the factors affecting its faithful transmission and reproduction. In this article we are specifically interested in the faithful transmission, reproduction, and separation of the sync signal.

To summarize then we have the video signal, the sync signal, and the combination or composite video signal. Since the composite video is distributed over the reception area by a transmitter we are also interested in the graphical representation of the transmitter carrier modulated by the composite video.

Another aspect of the transmitter signal is of interest because it enters into explanations of the important factors affecting the faithfulness of transmission and reproduction of the transmitter signal. The transmitter signal consists of two "carriers" — one for the picture signal, the other for the sound signal. Both of the carriers have associated with them a number of sidebands which represent the modulation or information part of the signal. Unless these sidebands are transmitted and reproduced faithfully the composite video signal delivered to the receiver system will not be an accurate reproduction of the original. See Figure 2.

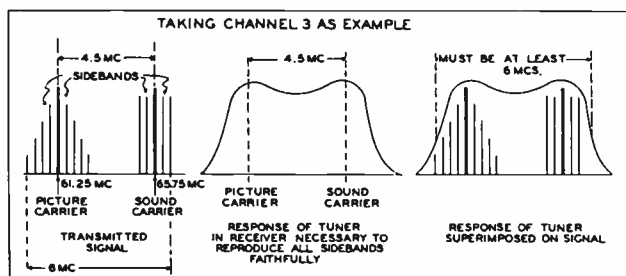


FIGURE 2

The transmitter signal travels from the transmitter aerial through the ether to the receiver aerial, down the transmission line to the receiver. In the receiver the signal is amplified, converted to a lower frequency, and amplified again; still as a carrier modulated with composite video. Next it is detected; that is, the composite video signal is recovered from the carrier. The composite video signal is then amplified and applied to the picture tube to modulate the intensity of the electron beam. At the same time a portion of the composite signal is amplified and then the sync is separated to lock-in or synchronize the travel of electron beam across the screen to place the picture elements in the right position. The motion of the beam is imparted by horizontal and vertical sweep oscillators and amplifiers which are controlled by the sync signal.

The path traveled by the signal from the transmitter to receiver aerial is the first hurdle to be overcome. Multi-path transmission resulting from the signal traveling two or more different paths to reach the receiver aerial can result in distortion or cancellation of the signal. Ghosts and airplane flutter are every day examples of the multi-path transmission. Multi-path transmission is seldom more than a temporary cause of sync trouble (airplane flutter) but it is possible to install an aerial in a critical position such that the signal is distorted or cancelled. This type of difficulty is usually avoided by aerial orientation during installation but must nevertheless be remembered as a possible cause of sync instability.

High gain aerials with their limited pass-band can lead to sync problems if they are not cut and adjusted properly to the channel being received. This type of trouble is most likely to occur if the receiver is tuned to the next lower channel so that aerial response is low at the carrier frequency and sidebands near the carrier. See Figure 3. Non-uniform response to the television carrier and sidebands will lead to distortion of the received signal. The serviceman should keep aware of the trouble which can be introduced by a sharply tuned aerial operated outside of the proper channel or improperly tuned. The variation in operation from one channel to another should help point to the trouble spot.

The aerial lead-in or transmission line can be a very troublesome source of sync trouble as a result of mismatching and poor installation. An aerial



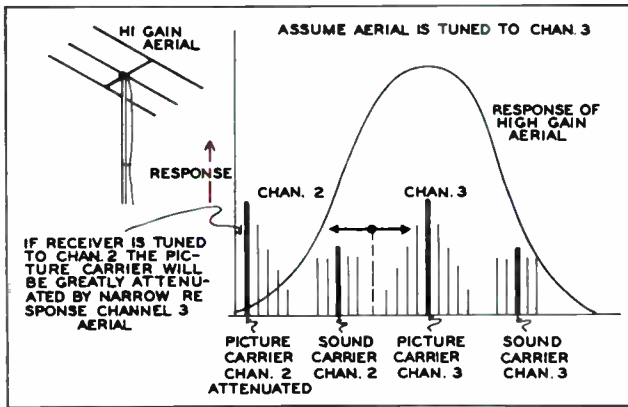


FIGURE 3

lead-in which is mismatched will become sensitive to motion with respect to surrounding objects. The picture may vary violently as the lead is moved or touched. Distortion or cancellation of the signal results in this case due to reflection of the signal up and down the transmission line which may not react as a uniform impedance for the many sidebands making up the television signal. Trouble caused by the lead-in can usually be detected by noticing the sensitivity of the lead-in to the touch. In all cases where the transmission line is the least bit sensitive, special care should be taken to fasten it securely.

Uniform amplification of the modulated RF signal must be maintained throughout the amplifier stages. As in the case of aerials and transmission lines incorrect frequency response can cause loss or distortion of sync information by discriminating against significant sideband frequencies. Correct alignment can be checked using regular procedures prescribed in Philco Television Service Manuals. Circuit misalignment severe enough to cause sync trouble will usually produce a very poor picture. Sync troubles associated with poor picture quality should suggest a check of alignment.

Amplifiers have signal level characteristics as well as pass band characteristics. A given amplifier design is expected to handle signals within a limited range of signal levels. Too large a signal can be applied to an amplifier causing overloading and distortion of the amplified signal. A signal of high amplitude may cause the amplifier tube to be cut-off and/or saturated at extremes of the signal excursion. The net effect of operating an amplifier at the wrong point on its ampli-

tude characteristics is a loss or clipping of part of the sync information because sync always represents the highest amplitude of the signal.

Circumstances leading to operation of the amplifier beyond its characteristic are the most common and likely causes of sync trouble. The major part of our interest is centered on methods for quickly and accurately locating troubles which result in clipping of sync information.

Let us examine some of the sync troubles which have occurred in the Philco Duplex models and what was done to correct the troubles.

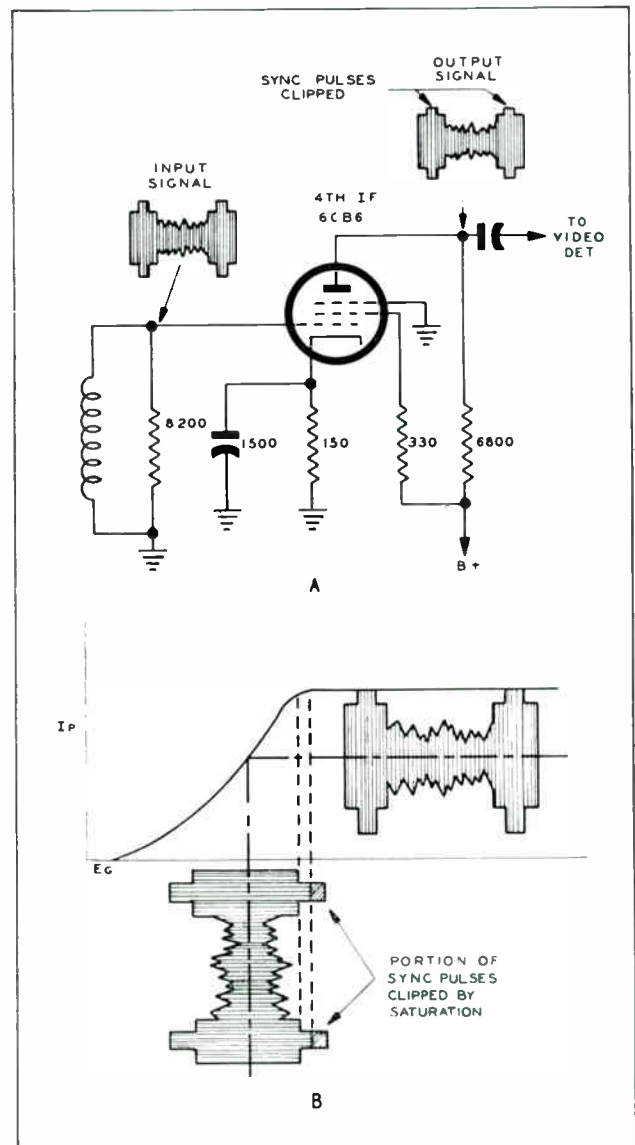


FIGURE 4

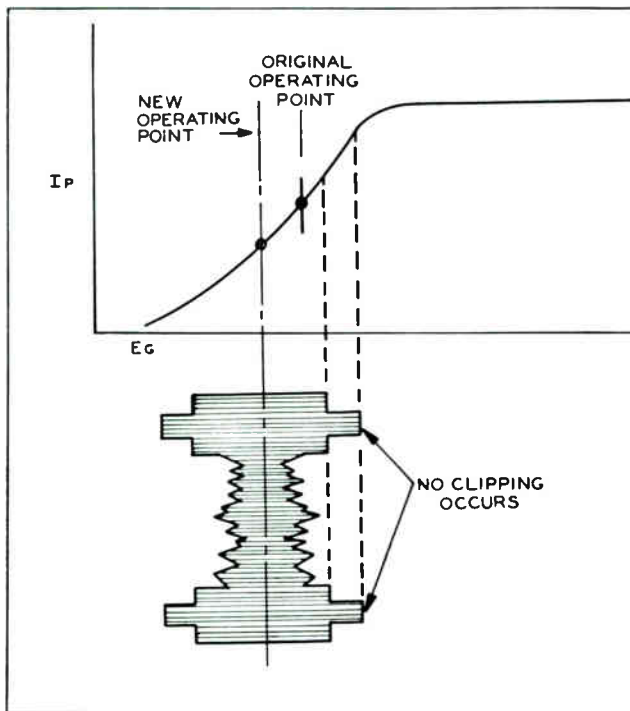


FIGURE 5

One of the major complaints of sync trouble was a rubbery or jittery effect under strong signal conditions. This condition was caused in most instances by some form of sync clipping.

In an otherwise normal receiver, the signal strength may be of sufficient amplitude to cause overloading. In Figure 4, B shows the  $I_p$ - $E_g$  characteristic curve of a typical amplifier, with video signal amplitudes such as those sometimes present at the 4th video i-f stage, when the receiver is used in a strong signal area. It can be seen from the curve that the sync pulses are being clipped due to plate saturation. The circuit of the amplifier is shown at A. In current Philco Duplex models, the tendency of this stage toward overloading can be reduced by changing the plate load resistor from 6800 ohms to 5600 ohms. This change increases the plate voltage so that the saturation point is higher. The bias should also be increased by changing the cathode bias resistor from 150 ohms to 220 ohms. These changes lower the operating point on the  $I_p$ - $E_g$  curve, as shown in Figure 5.

It was also found that even though the signal at the video detector output was normal, the first video amplifier might become overloaded under strong signal conditions. In order to correct this condition cathode bias was added by means of a 100 ohm resistor bypassed by a 4700 mmfd. condenser. The plate voltage was increased by changing one of the plate load resistors to 2700 ohms, and the shunting capacity was changed from 220 mfd. to 56 mfd. to improve the high frequency response. See Figure 6.

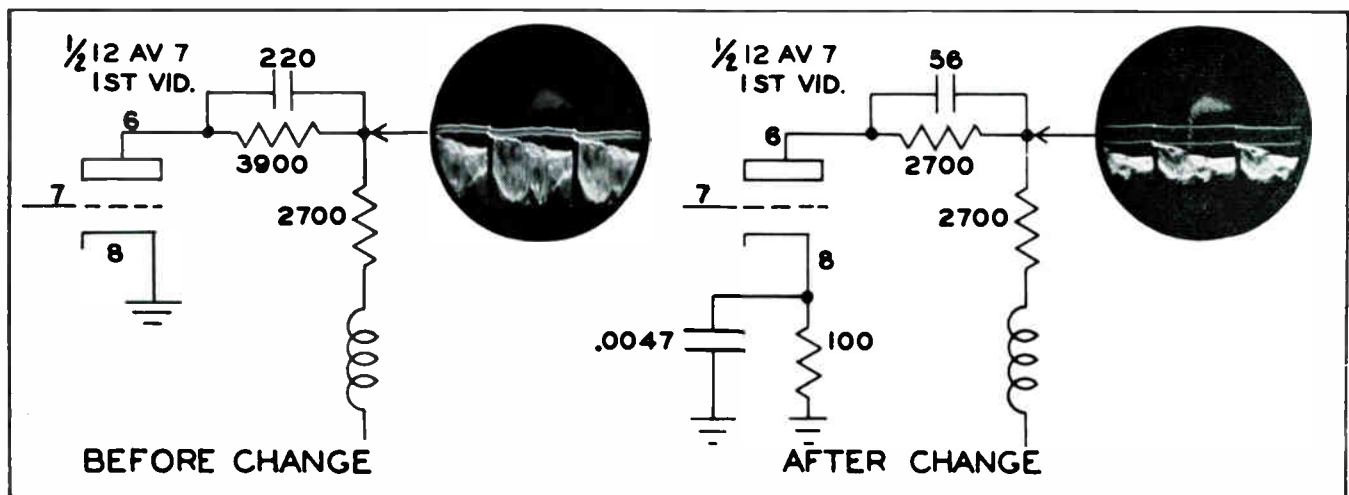
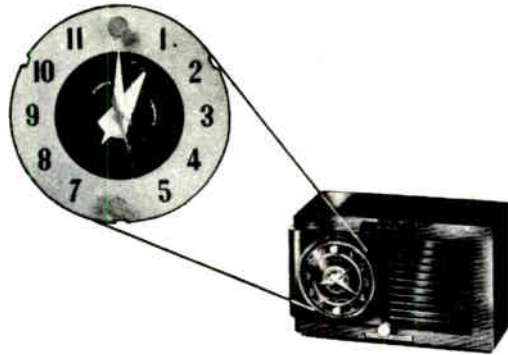


FIGURE 6

Continued Next Month



### CLOCK PARTS REPLACEMENT GUIDE

RSM-3 No. 59

OCTOBER, 1951

**INTRODUCTION:** This publication contains information regarding clock radio clock parts replacement. Data contained herein covers all models manufactured since 1945. Features of this manual are:

1. **A CROSS REFERENCE** between radio model numbers and their respective clock assembly catalog numbers. These clock assemblies are manufactured by the Telechron division of the General Electric Company and bear G.E. and Telechron Catalog numbers. The clock parts, however, are listed under Telechron Catalog numbers only, with a few exceptions.

2. **A GROUP OF PHOTOGRAPHS** needed for identification purposes.

3. **A PARTS LIST** for each clock assembly. Grouped on these pages are two series of clock assemblies used. The first section is concerned with the C51 timers which have no "sleep" feature. The second section deals with the C57 timers which have a "sleep" feature. Bracketed ( ) items refer to production changes which are elaborated upon at the end of each parts section.

Symbol numbers in the parts list refer to symbol numbers in the parts identification photographs.

4. **CLOCK RADIO CABINET REPLACEMENT GUIDE.** This section is devoted to data regarding cabinet considerations for late model clock radios which underwent production changes. Consult this section before attempting any clock radio cabinet replacements.

Inasmuch as radio parts and clock parts procurement procedures differ, we suggest that you contact your General Electric Distributor for assistance. In general, The Telechron service stations will be able to supply all clock parts as may be required for replacement purposes. However the complete clock assemblies are available from the General Electric Company as well as those few clock parts which are listed with G.E. catalog numbers only.

All clock assemblies are for 60 cycle, 105-125 volt operation unless otherwise noted.

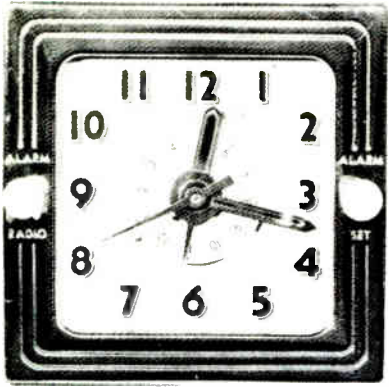
### CLOCK AND CLOCK RADIO CROSS REFERENCE LISTING

The following is a cross reference listing of Telechron Clocks used in G.E. radio receivers, including appearance item color identification.

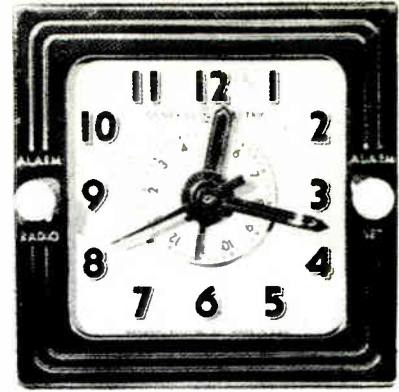
G. E. Clock No.	Telechron Model No.	Used on Radio Models	Dial	Outer Ring or Bezel	Hour & Minute Hands	Sweep Second Hand	Alarm Disc	Knobs
RZC-001	C51 G2	G.E. 50	Ivory	Gold	Gold	Gold	Ivory	Ivory
RZC-003	C51 G2 (50 cycles)	G.E. 50 (50 cycles)	Ivory	Gold	Gold	Gold	Ivory	Ivory
RZC-005	C51 G4	G.E. 60, 62, 66, 67	Blue	Red	Ivory	Ivory	Maroon	Ivory
RZC-006	C51 G4 (50 cycles)	G.E. 60, 62 (50 cycles)	Blue	Red	Gold*	Gold*	Maroon	Ivory
RZC-009	C57 G2	G.E. 64, 65, 505, 506, 507, 508, 530, 515, 516, 517, 521, 522 and early production 515F, 516F, 517F, 521F, 522F (brass bezel)	Blue-grey	Gold	Luminous	Gold	Maroon	Ivory
RZC-010	C51 G7	G.E. 500, 501	Blue-grey	Gold	Luminous	Gold	Maroon	Ivory
RZC-011	C57 G9	G.E. 509, 511, 518F	Blue-grey	Chrome	White	Chrome	Maroon	White
RZC-012	C51 G10	G.E. 510, 511, 510F, 511F	Ivory	Gold	Maroon	Red	Gold	Ivory
RZC-013	C57 G22	G.E. 535	Grey	Gold	Luminous	Red	Ivory	Fawn
RZC-014	C51 G16	G.E. 512F	Purple	Fawn	Ivory	Red	Maroon	Fawn
RZC-015	C51 G17	G.E. 513F	Ivory	Ivory	Gold	Red	Maroon	Ivory
RCZ-017	C57 G31	G.E. 515F, 516F, 517F, late production (plastic bezel)	Blue-grey	Gold	Luminous	Gold	Maroon	Ivory
RZC-018	C57 G36	G.E. 518F late production (plastic bezel)	Grey	Silver	Luminous	Chrome	Maroon	White
RZC-019	C57 G38	Late 535 (sprayed steel bezel)	Grey	Fawn	Luminous	Red	Ivory	Fawn

\*RZO-006 Hands may be supplied in either gold or ivory. When ordering, specify color.

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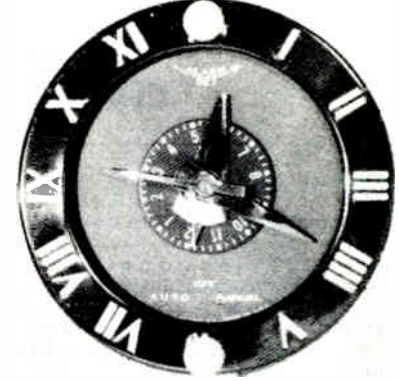
RZC-001—Page 4



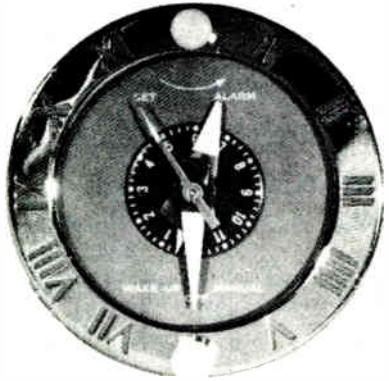
RZC-003—Page 4



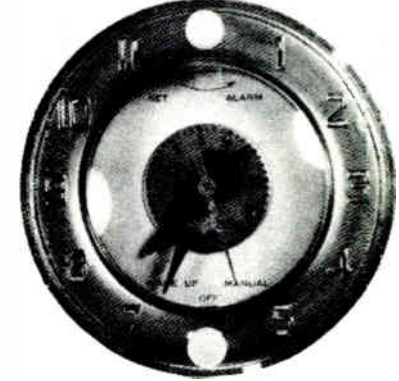
RZC-005—Page 4



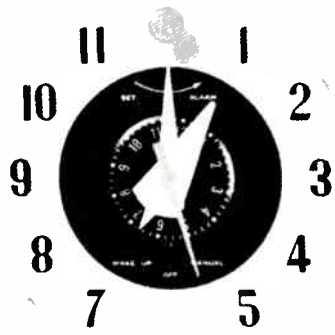
RZC-006—Page 4



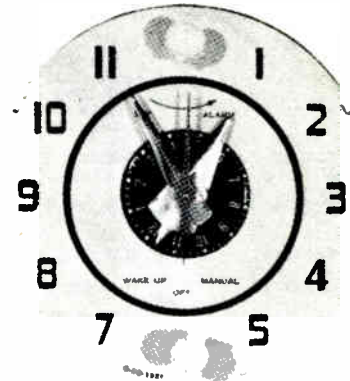
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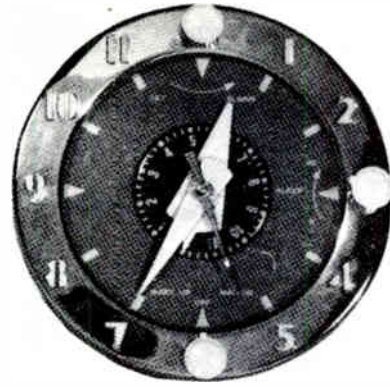
RZC-015—Page 6

Fig. 1. Front View of Clocks—"No Sleep" Feature (C51 Series)

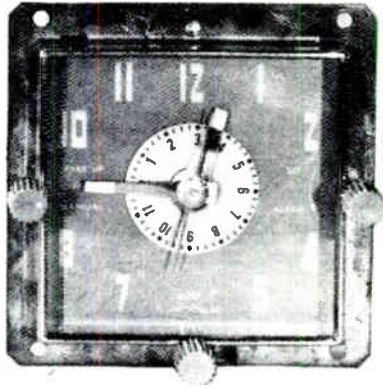




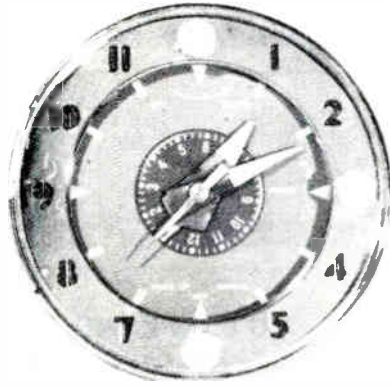
RZC-009—Page 6



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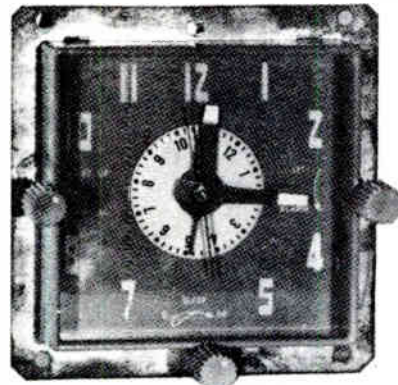
RZC-013—Page 7



RZC-017—Page 7



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RZC-019—Page 8

Fig. 2. Front View of Clocks with "Sleep" Feature (C57 Series)

**G.E. CAT. NO. RZC-001 (60 CYCLE) & RZC-003 (50 CYCLE)  
TELECHRON CAT. NOS. C51G2 & C51G2 (50 CYCLE)**

For Radio Model 50 (50 & 60 Cycle)

Description	Cat. No.	Symbol	Description	Cat. No.	Symbol
<b>APPEARANCE ITEMS</b>			<b>MOVEMENT PARTS (Cont'd)</b>		
Bezel—inner gold.....	53X107		Field & coil—50 cycle (.113 Hole) (A).....	45X130	23
Crystal 2 1/4" square.....	58X15		Field & coil—50 cycle (.128 Hole) (A).....	45X210	23
Dial.....	60X707		Front plate ass'y. (.113 Hole) (A).....	34X181	16
Alarm disc.....	55X3		Front plate ass'y. (.128 Hole) (A).....	34X229	16
Hour & minute hands—gold.....	32X129		Hour hand sleeve.....	13X11	18
Sweep second hand—gold.....	31X26		Intermediate gear ass'y.....	40X87	27
Alarm set knob—ivory (Threaded) (A).....	4X5		Minute Hand sleeve.....	14X17	19
Alarm set knob—ivory (Slotted) (A).....	59X716		Rotor unit (60' cycle).....	44X38	22
Switch knob—ivory.....	59X716		Rotor unit (50 cycle).....	44X39	22
Time set knob—bronze.....	3X49		Screw—front plate.....	64X1	24
<b>MOVEMENT PARTS</b>			Screw—field.....	1X117	13
Alarm set sleeve.....	15X3	17	Spreader post.....	40X201	14
Alarm set shaft (Old style) (B).....	11X8	29	Sweep second hand shaft.....	16X14	20
Alarm set shaft (Threaded) (A).....	11X11	30	Switch contact ass'y. (C1).....	40X76	2
Alarm set shaft (Slotted) (A).....	11X41	31	Switch contact ass'y. (C2).....	40X187	3
Base plate ass'y. (Friction) (C1).....	35X39	21	Switch contact ass'y. (C3).....	40X322	4
Base plate ass'y. (Friction) (C2).....	35X62	21	Switch index spring (C2).....	40X185	28
Cam shaft ass'y.....	17X10	26	Switch lever ass'y.....	40X88	12
Cam shaft washer.....	40X252	25	Switch shaft ass'y. (C1).....	59X699	6
Field & coil—60 cycle (.113 Hole) (A).....	45X73	23	Switch shaft ass'y. (C2).....	59X723	7
Field & coil—60 cycle (.128 Hole) (A).....	45X209	23	Switch shaft ass'y. (C3).....	59X776	8
			Switch shaft spacer.....	40X275	5
			Time set shaft.....	10X115	11
			Time set shaft spacer—long.....	40X222	9
			Time set shaft spacer—short.....	40X219	10
			Wire lead.....	59X707	

**G.E. CAT. NO. RZC-005 (60 CYCLE) & RZC-006 (50 CYCLE)  
TELECHRON CAT. NOS. C51G4 & C51G4 (50 CYCLE)**

For Radio Models 60, 62, 66, 67, 60 (50 Cycle) & 62 (50 Cycle)

Description	Cat. No.	Symbol	Description	Cat. No.	Symbol
<b>APPEARANCE ITEMS</b>			<b>MOVEMENT PARTS (Cont'd)</b>		
Bezel—numeral maroon.....	53X100		Field & coil—60 cycle (.128 Hole) (A).....	45X209	23
Bezel—outer gold.....	54X29		Field & coil—50 cycle (.113 Hole) (A).....	45X130	23
Bezel color ring—gold.....	59X234		Field & coil—50 cycle (.128 Hole) (A).....	45X210	23
Crystal 2 1/4" round.....	58X16		Front plate ass'y. (.113 Hole) (A).....	34X139	16
Dial.....	60X712		Front plate ass'y. (.128 Hole) (A).....	34X227	16
Alarm disk.....	55X11		Hour hand sleeve.....	13X11	18
Hour & minute hands—ivory*.....	32X205		Minute hand sleeve.....	14X17	19
Sweep second hand—ivory*.....	31X62		Intermediate gear ass'y.....	40X87	27
Alarm set knob—ivory (Threaded) (A).....	4X5		Rotor unit—60 cycle.....	44X38	22
Alarm set knob—ivory (Slotted) (A).....	59X716		Rotor unit—50 cycle.....	44X39	22
Switch knob—ivory.....	59X716		Screw—front plate.....	64X1	24
Time set knob—bronze.....	3X36		Screw—field.....	1X117	13
<b>MOVEMENT PARTS</b>			Spreader post.....	40X201	14
Alarm set sleeve.....	15X3	17	Sweep second hand shaft.....	16X14	20
Alarm set shaft (Old style) (B).....	11X8	29	Switch contact ass'y. (C1).....	40X76	2
Alarm set shaft (Threaded) (A).....	11X11	30	Switch contact ass'y. (C2).....	40X187	3
Alarm set shaft (Slotted) (A).....	11X41	31	Switch contact ass'y. (C3).....	40X322	4
Base plate ass'y. (Friction) (C1).....	35X39	21	Switch index spring (C-2).....	40X185	28
Base plate ass'y. (Friction) (C2).....	35X62	21	Switch lever ass'y.....	40X88	12
Cam shaft ass'y.....	17X10	26	Switch shaft ass'y. (C1).....	59X699	6
Cam shaft washer.....	40X252	25	Switch shaft ass'y. (C2).....	59X723	7
Field & coil—60 cycle (.113 Hole) (A).....	45X73	23	Switch shaft ass'y. (C3).....	59X776	8
			Switch shaft spacer.....	40X275	5
			Time set shaft.....	10X129	11
			Time set shaft spacer—long.....	40X222	9
			Time set shaft spacer—short.....	40X219	10
			Wire lead.....	59X707	

\*RZC-006 hands available in either ivory or gold—specify when ordering.

**G.E. CAT. NO. RZC-010 TELECHRON CAT. NO. C51G7**

For Radio Models 500, 501

Description	Cat. No.	Symbol	Description	Cat. No.	Symbol
<b>APPEARANCE ITEMS</b>			<b>APPEARANCE TIMES (Cont'd)</b>		
Bezel—numeral, gold.....	53X128		Crystal 2 1/4" round.....	58X16	
Bezel color ring—red.....	59X769		Dial.....	61X941	



# G.E. NO. RZC-015, TELECHRON NO. C51G17

For Radio Model 513F

Description	Cat. No.	Symbol	Description	Cat. No.	Symbol
<b>APPEARANCE ITEMS</b>			<b>MOVEMENT PARTS (Cont'd)</b>		
Crystal-bezel combination . . . . .	58X129		Front plate ass'y (A) . . . . .	34X235	16
Dial . . . . .	61X958		Hour hand sleeve . . . . .	13X11	18
Dial spacer . . . . .	59X772		Intermediate gear ass'y . . . . .	40X87	27
Alarm disc . . . . .	55X32		Minute hand sleeve (Friction) . . . . .	14X32	19
Hour & minute hands . . . . .	32X258		Rotor unit 60-cycle . . . . .	44X38	22
Sweep second hands—red . . . . .	31X81		Screw—front plate . . . . .	64X1	24
Alarm set knob—ivory (Slotted) (A) . . . . .	59X716		Screw field . . . . .	1X117	13
Switch—ivory . . . . .	59X716		Screw—switch contact . . . . .	64X1	1
Time set—bronze . . . . .	3X36		Spreader post . . . . .	40X201	14
<b>MOVEMENT PARTS</b>			Sweep second hand shaft . . . . .	16X14	20
Alarm set sleeve . . . . .	15X3	17	Switch contact ass'y (C2) . . . . .	40X187	3
Alarm set shaft (Slotted) . . . . .	11X43	31	Switch contact ass'y (C3) . . . . .	40X322	4
Base plate ass'y (Less friction) . . . . .	35X101	21	Switch index spring (C2) . . . . .	40X185	28
Cam shaft ass'y . . . . .	17X10	26	Switch lever ass'y . . . . .	40X88	12
Cam shaft washer . . . . .	40X252	25	Switch shaft ass'y (C2) . . . . .	59X773	7
Field & coil 60-cycle (A) . . . . .	45X209	23	Switch shaft ass'y (C3) . . . . .	59X782	8
			Switch shaft spacer . . . . .	40X275	5
			Time set shaft . . . . .	10X158	11
			Time set shaft spacer (Long) . . . . .	40X222	9
			Time set shaft spacer (Short) . . . . .	40X219	10
			Wire lead . . . . .	59X707	

## C51 PRODUCTION CHANGES

### (A)

On 1951 production of C51 timers a slotted alarm set shaft will replace the present threaded one. This change will affect the following parts:

- Alarm Set Shaft Assembly
- Alarm Set Knob
- Front Plate Assembly
- Coil and Field Assembly

The alarm set shaft and knob will be slotted instead of threaded. The hole accommodating the alarm set shaft on the front plate and field bracket will be enlarged from .113 to .128.

### (C1-2)

In 1948 the original switch shaft and switch contact assembly were redesigned to improve the switch indexing. The old style switch contact assembly (C-1) featured a bumped switch bracket which established contact with the copper locating springs on the switch shaft (C-1). The new style contact assembly (C-2) has a smooth surface switch bracket. A bronze index spring seated on the two base plate posts which support the switch

	New (C-2)	Old (C-1)
*Switch Shaft	59X723	59X699
Switch Contact	40X187	40X76
Switch Index Spring	40X185	
Base Plate	35X62	35X69

bracket, provides contact with the new switch shaft assembly (C-2). The following parts were affected:

### (C-3)

In 1951 still further changes were made affecting the various switch shafts and switch contact assemblies. The composition cam on the switch shaft was redesigned and reduced to  $\frac{1}{16}$  in. thickness or less than  $\frac{1}{2}$  of the original size. The original composition cam was of black bakelite, the replacing cam of white nylon. The fibre arm of the switch contact assembly was redesigned to correspond with the cam change on the switch shaft.

The various combination of parts affected by all changes in switch indexing are shown below. (C-1) refers to the original assemblies which featured copper locating springs on switch shaft assemblies. (C-2) indicates the first change in indexing wherein a nickel cam replaced the locating springs on the switch shaft assemblies. The composition cams on these switch shafts were black bakelite. (C-3) indicates those parts affected by recent changes as outlined above. The reduced composition cams on the switch shaft assemblies are currently manufactured of white nylon. Parts affected by these changes are:

	C1	C2	C3
*Switch Shaft	59X699	59X723	59X776
Switch Contact	40X76	40X187	40X322
Base Plate	35X69	35X62	
Index Spring		40X185	

\*Catalog number will vary in accordance with shaft length.

## C57 SERIES

### G.E. CAT. NO. RZC-009, TELECHRON NO. C57G2

For Radio Models 64, 65, 505, 506, 507, 508, 530, 515, 516, 517, 521, 522, and Early Production 515F, 516F, 517F, 521F, and 522F

Description	Cat. No.	Symbol	Description	Cat. No.	Symbol
<b>APPEARANCE ITEMS</b>			<b>MOVEMENT PARTS (Cont'd)</b>		
Bezel—numeral, gold . . . . .	53X117		Field & coil 60-cycle (.128 hole) (A) . . . . .	45X209	25
Bezel—outer gold . . . . .	54X31		Field screw . . . . .	1X117	12
Bezel color ring—red . . . . .	59X247		Front plate ass'y (.113 hole) (A) . . . . .	34X173	16
Crystal— $2\frac{1}{4}$ " round . . . . .	58X16		Front plate ass'y (.128 hole) (A) . . . . .	34X221	16
Dial . . . . .	61X937		Front plate screw . . . . .	64X1	26
Alarm disc . . . . .	55X15		Hour hand sleeve . . . . .	13X11	18
Hour & minute hands (Luminous) . . . . .	32X199		Intermediate gear ass'y . . . . .	40X87	29
Sweep second hand—gold . . . . .	31X26		Minute hand sleeve . . . . .	14X32	20
Alarm set knob—ivory (Threaded) (A) . . . . .	4X5		Rotor unit 60-cycle . . . . .	44X38	24
Alarm set knob—ivory (Slotted) (A) . . . . .	59X716		Sleep switch shaft . . . . .	40X277	35
Sleep switch—ivory . . . . .	59X716		Sleep switch booster spring . . . . .	40X302	31
Radio switch—ivory . . . . .	59X716		Sleep switch lever ass'y . . . . .	40X194	30
Time set—bronze . . . . .	3X36		Sleep switch friction ass'y . . . . .	40X196	34
<b>MOVEMENT PARTS</b>			Spreader post (2) . . . . .	40X201	13
Alarm set sleeve . . . . .	15X3	17	Sweep second hand shaft . . . . .	16X14	22
Alarm set shaft (Threaded) (A) . . . . .	11X11	32	Switch contact ass'y (Old) (A) . . . . .	40X198	6
Alarm set shaft (Slotted) (A) . . . . .	11X41	33	Switch contact ass'y (New) (B) . . . . .	40X322	7
Base plate ass'y . . . . .	35X93	23	Switch contact screw . . . . .	64X1	5
Cam shaft ass'y . . . . .	17X10	28	Switch index spring . . . . .	40X185	11
Cam shaft washer . . . . .	40X252	27	Switch lever ass'y . . . . .	40X197	4
Field & coil 60-cycle (.113 hole) (A) . . . . .	45X73	25	Switch shaft ass'y (Old) (A) . . . . .	59X723	2
			Switch shaft ass'y (New) (B) . . . . .	59X776	3
			Switch shaft spacer . . . . .	40X275	1
			Time set shaft . . . . .	10X144	8
			Time set shaft spacer . . . . .	40X276	9
			Wire lead . . . . .	59X707	15



## G.E. NO. RZC-011, TELECHRON NO. C57G9

For Radio Models 509, 518 and 518F

Description	Cat. No.	Symbol	Description	Cat. No.	Symbol
<b>APPEARANCE ITEMS</b>			<b>MOVEMENT PARTS (Cont'd)</b>		
Bezel—chrome numeral	53X134		Field & coil 60-cycle (.128 hole) (A)	45X209	25
Bezel—outer chrome	54X34		Field screw	1X117	12
Bezel color ring—white	59X750		Front plate ass'y (.113 hole) (A)	34X173	16
Crystal 2 1/2" round	58X116		Front plate ass'y (.128 hole) (A)	34X221	16
Dial	61X046		Front plate screw	64X1	26
Alarm disc	55X15		Hour hand sleeve	13X11	18
Hour & minute hands—white	32X227		Intermediate gear ass'y	40X87	29
Sweep second hand—chrome	31X70		Minute hand sleeve	14X32	20
Alarm set knob—white (Threaded) (A)	3X53		Rotor unit 60-cycle	44X38	24
Alarm set knob—white (Slotted) (A)	59X751		Sleep switch shaft	40X277	35
Sleep switch—white	59X751		Sleep switch booster spring	40X302	31
Radio switch—white	59X751		Sleep switch lever ass'y	40X194	30
Time set knob—bronze	3X36		Sleep switch friction ass'y	40X196	34
<b>MOVEMENT PARTS</b>			Spreader post (2)	40X201	13
Alarm set sleeve	15X3	17	Sweep second hand shaft	16X14	22
Alarm set shaft (Threaded) (A)	11X11	32	Switch contact ass'y (old) (A)	40X198	6
Alarm set shaft (Slotted) (A)	11X41	33	Switch contact ass'y (new) (B)	40X322	7
Base plate ass'y	35X93	23	Switch contact screw	64X1	5
Cam shaft ass'y	17X10	28	Switch index spring	40X185	11
Cam shaft washer	40X252	27	Switch lever ass'y	40X197	4
Field & coil 60-cycle (.113 hole) (A)	45X73	25	Switch shaft ass'y (old) (A)	59X723	2
			Switch shaft ass'y (new) (B)	59X776	3
			Switch shaft spacer	40X275	1
			Time set shaft	10X141	8
			Time set shaft spacer	40X276	9
			Wire lead	59X707	15

## G.E. CAT. NO. RZC-013, TELECHRON NO. C57G22

Early Model 535

Description	Cat. No.	Symbol	Description	Cat. No.	Symbol
<b>APPEARANCE ITEMS</b>			<b>MOVEMENT PARTS (Cont'd)</b>		
Bezel—plain gold	53X146		Field screw	1X117	12
Crystal—special	58X125		Front plate ass'y	34X218	16
Dial 61	61X049		Front plate screw	64X1	26
Dial spacer	59X758		Hour hand sleeve	13X11	18
Alarm disc	55X20		Intermediate gear ass'y	40X87	29
Hour & minute hands (Luminous)	32X241		Minute hand sleeve	14X32	20
Sweep second hand—red	31X76		Rotor unit 60 cycle	44X38	24
Alarm set knob			Sleep switch shaft	40X306	35
Sleep switch knob			Sleep switch booster spring	40X302	31
Radio switch knob			Sleep switch lever ass'y	40X194	30
Time set knob—bronze	3X36		Sleep switch friction ass'y	40X196	34
<b>MOVEMENT PARTS</b>			Spreader post (2)	40X201	13
Alarm set sleeve	15X3	17	Sweep second hand shaft	16X14	22
Alarm set shaft—slotted	11X35	33	Switch contact ass'y. (old) (A)	40X198	6
Base plate ass'y	35X93	23	Switch contact ass'y. (new) (B)	40X322	7
Cam shaft ass'y	17X10	28	Switch index spring	40X185	11
Cam shaft washer	40X252	27	Switch lever ass'y	40X197	4
Field & coil 60-cycle (A)	45X209	25	Switch shaft ass'y. (old) (A)	59X759	2
			Switch shaft ass'y. (new) (B)	59X781	3
			Switch shaft spacer	40X275	1
			Time set shaft	10X150	8
			Time set shaft spacer	40X276	9
			Wire lead	59X707	15

## G.E. NO. RZC-017, TELECHRON NO. C57G31

For Radio Models 515F, 516F, 517F (Late Productions)

The above clock assembly is identical to G.E. Cat. No. RZC-009, Telechron Cat. No. C57G2 with the following exceptions. \*Note that there are two additional items. Listed below are C57G31 part catalog numbers for comparable C57G2 items.

Description	Cat. No.	(Cont'd)														
Bezel—numeral, gold	53X123	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 80%;">Description</th> <th style="width: 20%;">Cat. No.</th> </tr> </thead> <tbody> <tr> <td>Dial</td> <td>61X983</td> </tr> <tr> <td>Sweep second hand</td> <td>31X81</td> </tr> <tr> <td>*Speed nut (A)</td> <td>1X119</td> </tr> <tr> <td>Front plate ass'y</td> <td>34X250</td> </tr> <tr> <td>Sleep switch shaft</td> <td>40X308</td> </tr> <tr> <td>Switch shaft ass'y</td> <td>59X780</td> </tr> </tbody> </table>	Description	Cat. No.	Dial	61X983	Sweep second hand	31X81	*Speed nut (A)	1X119	Front plate ass'y	34X250	Sleep switch shaft	40X308	Switch shaft ass'y	59X780
Description	Cat. No.															
Dial	61X983															
Sweep second hand	31X81															
*Speed nut (A)	1X119															
Front plate ass'y	34X250															
Sleep switch shaft	40X308															
Switch shaft ass'y	59X780															
*Bezel spacer	59X788															

## G.E. NO. RZC-018, TELECHRON NO. C57G36

For Radio Model 518F (Late Production)

The C57G36 timer is similar to the C57G31 with the exception of the bezel which is chrome finished plastic. This bezel number is 53X158.

## G.E. CAT. NO. RZC-019, TELECHRON CAT. NO. C57G38

Late Model 535

The C57G38 timer is similar to the C57G22 timer (RZC-013) with the exception of the polished brass bezel which was replaced by one of sprayed fawn, Catalog number 53X159.

### C57 PRODUCTION CHANGES

#### (A & B)

In 1951 the original switch shaft and switch contact assembly were redesigned. The original switch shaft (A) utilized a black bakelite cam, whereas the new switch shaft cam is made of white nylon. The cam on the new shaft (B) was reduced to  $\frac{3}{8}$  in. thickness or less than one half the original size. The fibre arm on the switch contact assembly was redesigned to correspond with the cam change on the switch shaft.

The parts affected by the above are:

	(A)	(B)
*Switch shaft	59X723	59X776
Switch contact	40X198	40X322

\* Catalog number will vary in accordance with shaft length.

### CABINET CONSIDERATIONS FOR VARIOUS TYPES OF CLOCKS

Some of the catalogued items are listed below for clarification and others are added, to conform with receiver production changes in regard to the clock assembly employed. Late production receivers use clocks RZC-017 and RZC-018 employing an outer bezel and numeral bezel molded in a one piece plastic unit, while earlier receivers use clocks RZC-009 and RZC-011 (listed in ER-S-510F) using separate items of brass for the outer clock mounting bezel and numeral bezel. It is to be noted that the detail in the clock mounting hole in the original cabinet for

each receiver model was also changed to accommodate the later clock using the plastic bezel. Therefore, the listing below should be carefully consulted for selection of the replacement part, in regard to the proper combination of cabinet and clock. All four clocks are 60-cycle, 105-125-volt assemblies having a round face and arabic numerals and employ an automatic alarm and sleep control.

Exercise care in removal of plastic bezels to prevent breakage of plastic tabs.

Cat. No.	Description	Cat. No.	Description
RAU-338	CABINET—Color, brown mottle; for Models 515, 515F; use brass bezel clock RZC-009	RAU-359	use plastic bezel clock, RZC-017
RAU-339	CABINET—Color, ivory; for Models 516, 516F; use brass bezel clock, RZC-009	CABINET—Color, white; for Model 518F; use plastic bezel clock, RZC-018	
RAU-340	CABINET—Color, maroon; for Models 517, 517F; use brass bezel clock, RZC-009	RZC-009	CLOCK—With polished brass bezels; for Models 515, 515F; 516, 516F; 517, 517F, using cabinets RAU-338, RAU-339, RAU-340
RAU-341	CABINET—Color, white; for Models 518, 518F; use chrome finish brass bezel clock, RZC-011	RZC-011	CLOCK—With chrome finished brass bezels; for Models 518, 518F using cabinet RAU-341
RAU-356	CABINET—Color, brown mottle; for Model 515F; use plastic bezel clock, RZC-017	RZC-017	CLOCK—With gold finished plastic bezel; for Models 515F, 516F, 517F using cabinets RAU-356, RAU-357, RAU-358
RAU-357	CABINET—Color, ivory; for Model 516F; use plastic bezel clock, RZC-017	RZC-018	CLOCK—With silver finished plastic bezel; for Model 518F using cabinet RAU-359
RAU-358	CABINET—Color, maroon; for Model 517F;		

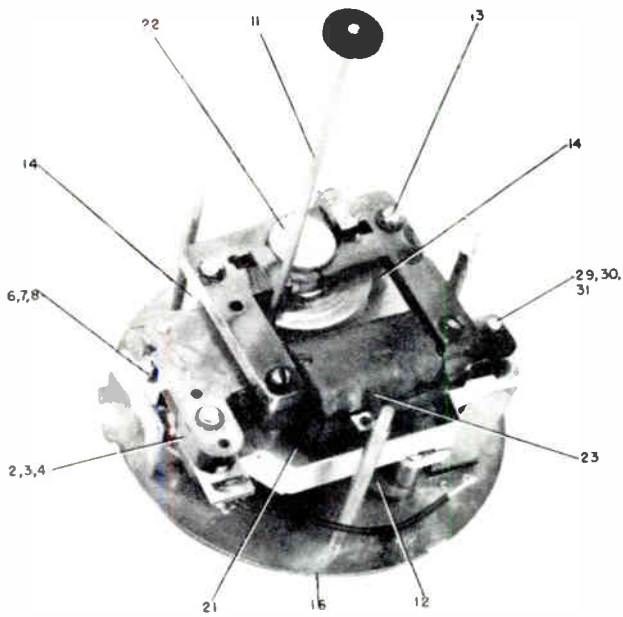
### ALARM AND SWITCH ADJUSTMENTS

1. Turn Wake-Up Manual shaft to WAKE UP position.
2. Slowly rotate Time Set shaft clockwise until the contacts of the Switch Assembly close.
3. Set all Hands so that they indicate 12 o'clock. Set figure 12 of the alarm dial to index with the smaller pointer of the hour hand. Make sure all Hands and Alarm Dial are tight on their respective shafts. Replace Dial Face.
4. With Alarm Set knob pulled out, continue to rotate Time Set shaft clockwise and note that the Alarm vibrator arm drops

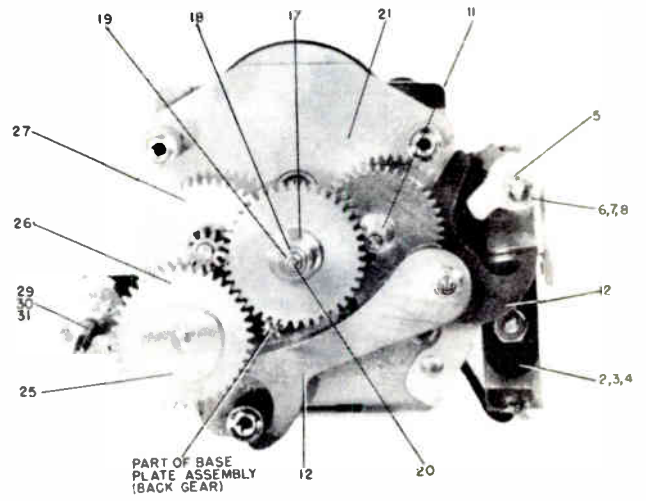
against field core approximately 7-10 minutes later.

5. Set alarm at some other selected position and make sure mechanism actuates within limits ( $\approx 1$  minute).
6. Check alarm tone of vibrator. This can be adjusted by either bending vibrator arm nearer or farther away from field core. Bend arm near anchor point.

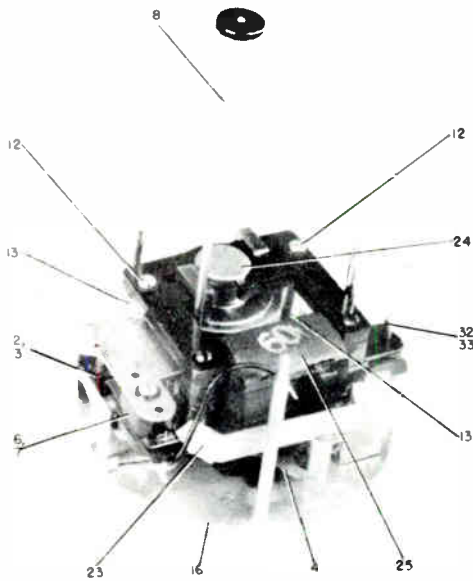
NOTE: When removing gears or other internal parts of clock mechanism, always start the disassembly process from the front (face) side of clock and work toward the rear.



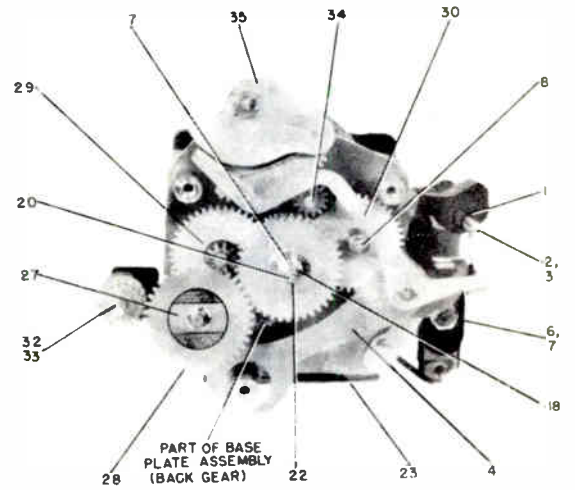
**Fig. 3. Back View of C51 Clocks**



**Fig. 4. Front View of C51 Clocks—Front Plate Removed**



**Fig. 5. Back View C57 Clocks**



**Fig. 6. Front View C57 Clocks—Front Plate Removed**

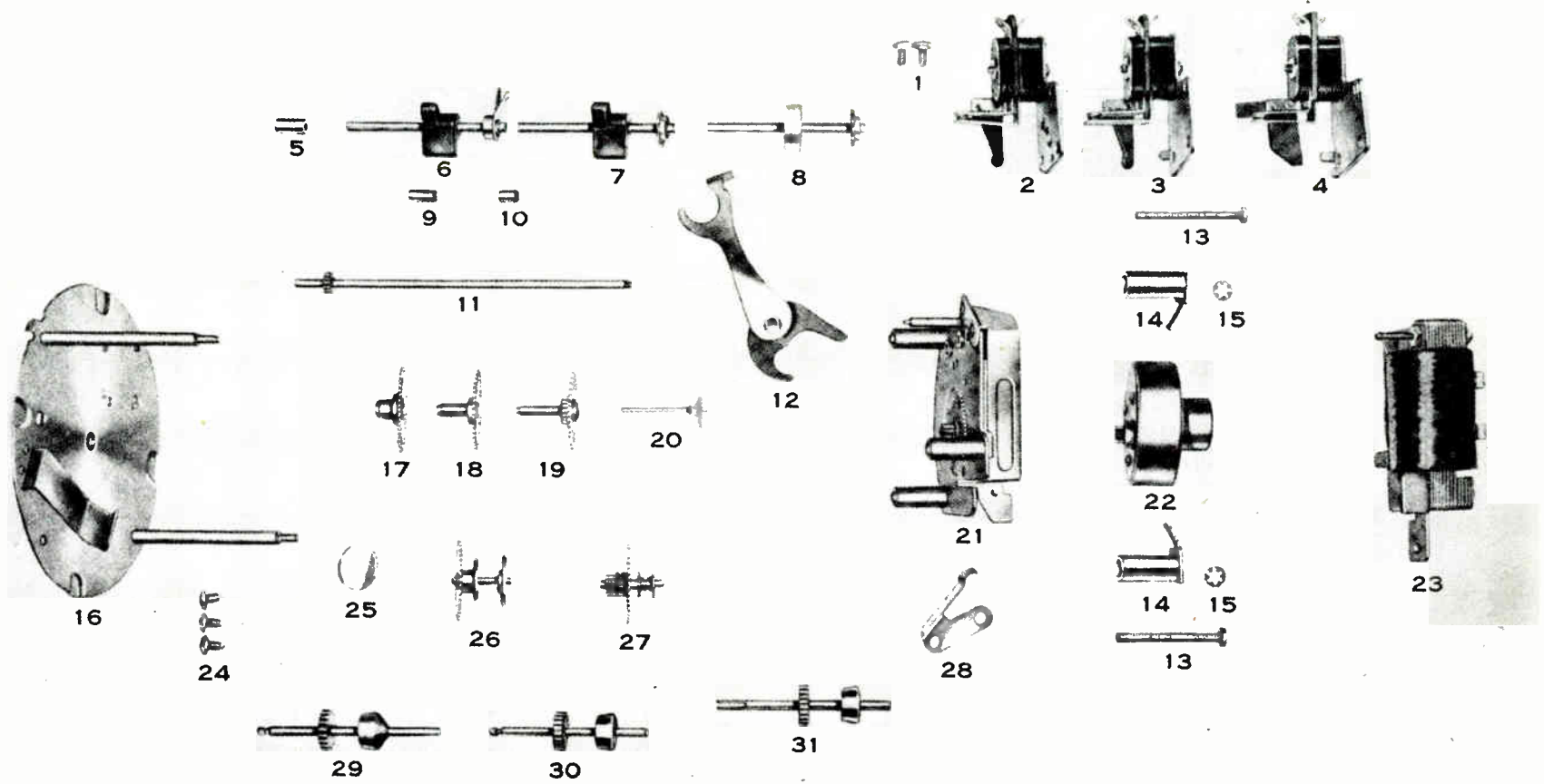


Fig. 7. Exploded View of C51 Series Clock Movement



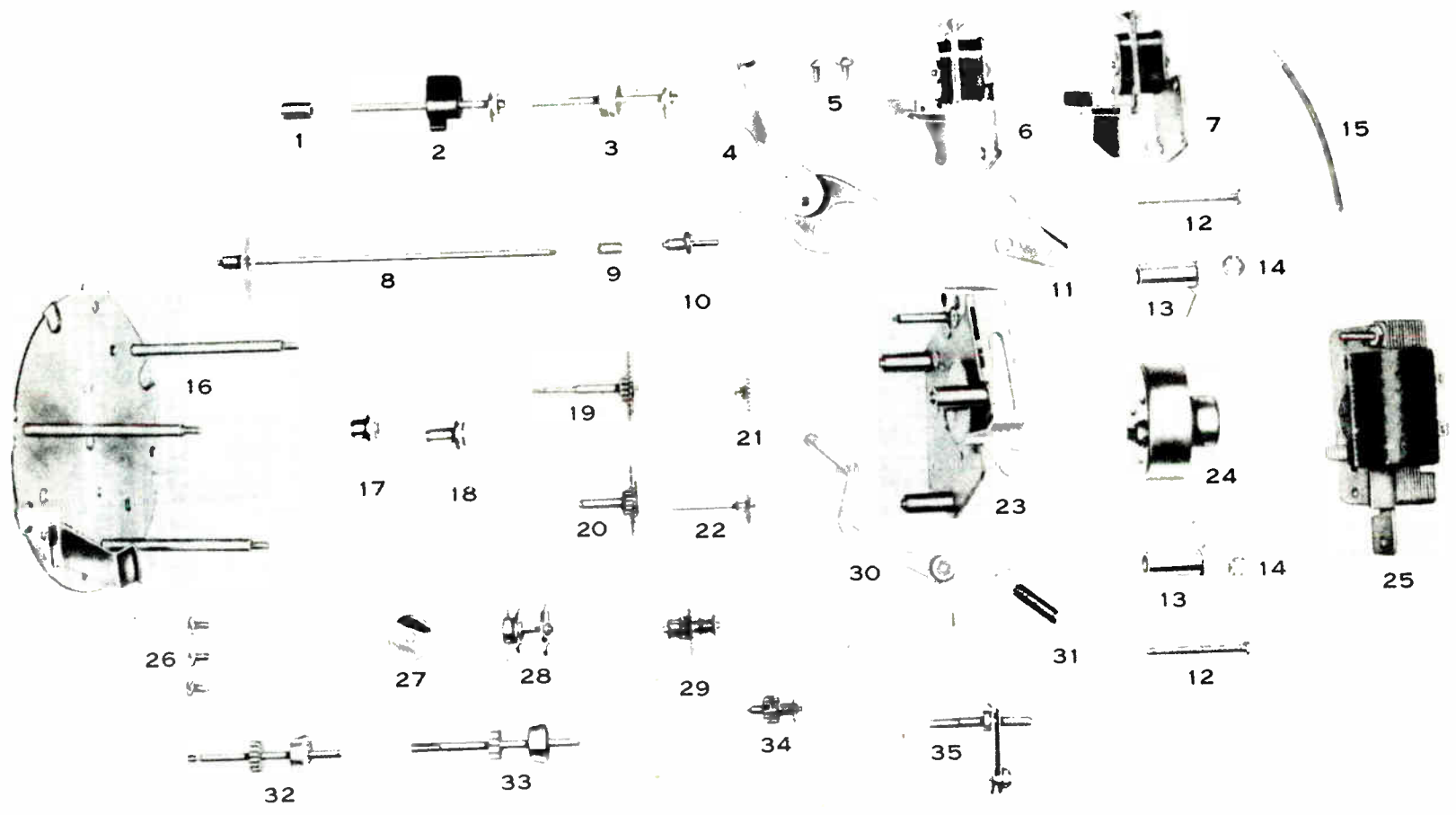


Fig. 8. Exploded View of C57 Series Clock Movement



**GENERAL ELECTRIC COMPANY**  
**RECEIVER DEPARTMENT**  
**ELECTRONICS PARK**  
**SYRACUSE, NEW YORK, U.S.A.**  
*PRINTED IN U.S.A.*

# PHILCO



# SERVICE

## Shop Practices and Service Techniques

### TELEVISION

NOVEMBER, 1951

## TAKING THE MYSTERY OUT OF SYNC

### Part Three

To illustrate let us review quickly the wave-forms which we should expect to see at key points in a typical television chassis: See Figure 13.

- A. Video Detector
- B. Video Amplifier Stages
- C. First Sync Separator
- D. Noise-Gate
- E. Sync Separator Plate
- F. Sync Inverter Plate
- G. Vertical Oscillator Grid
- H. Horizontal Control Tube Grid  
(Phase Comparer)

The normal wave-forms become a key to rapid localizing of sync troubles *only after* they have become *familiar to you on your oscilloscope*. Do not expect too much success the first time you use a new oscilloscope on a new chassis.

It is assumed during the tests which follow that a signal comparable to the signal at the operating location is used.

In the majority of sync problems the decision must be made as to whether the trouble occurs before or after the video detector. We therefore recommend that the first test with an oscilloscope be made at the video detector load resistor. In Philco receivers this point is brought out to a convenient test jack. A check of a normal indication at the detector jack requires that the effect of changing signal level on the wave-form be observed. There might be a defect in the ampli-

fier stages which might not produce a noticeable distortion of the composite video and yet by varying the signal level a change in the ratio of sync to video could be observed. In Philco sets where the contrast control has some effect on RF amplifier bias varying the contrast control while observing the wave-form is a good test method.

If an abnormal indication is obtained at the video test jack we would have to track down the cause by indirect methods since the oscilloscope cannot be used at the high radio frequencies of the IF system. Since faulty tubes are a common cause of clipping in the RF and IF amplifiers it would seem logical to substitute tubes, one at a time, as the first step. Our experience does not recommend this procedure because it results in many recalls. The serviceman in some instances thinks he has found a defective tube and replaces it only to have the same trouble recur after the tube has been in use for a short time.

The following method is recommended for checking the RF and IF stages for failure of the

AGC system and tubes: See Figure 14.

Trouble-shooting AGC circuits can be greatly simplified by use of the following procedure.

1. Trouble in the AGC system may give several effects. It may give the appearance of a very black picture with very bad horizontal tearing.

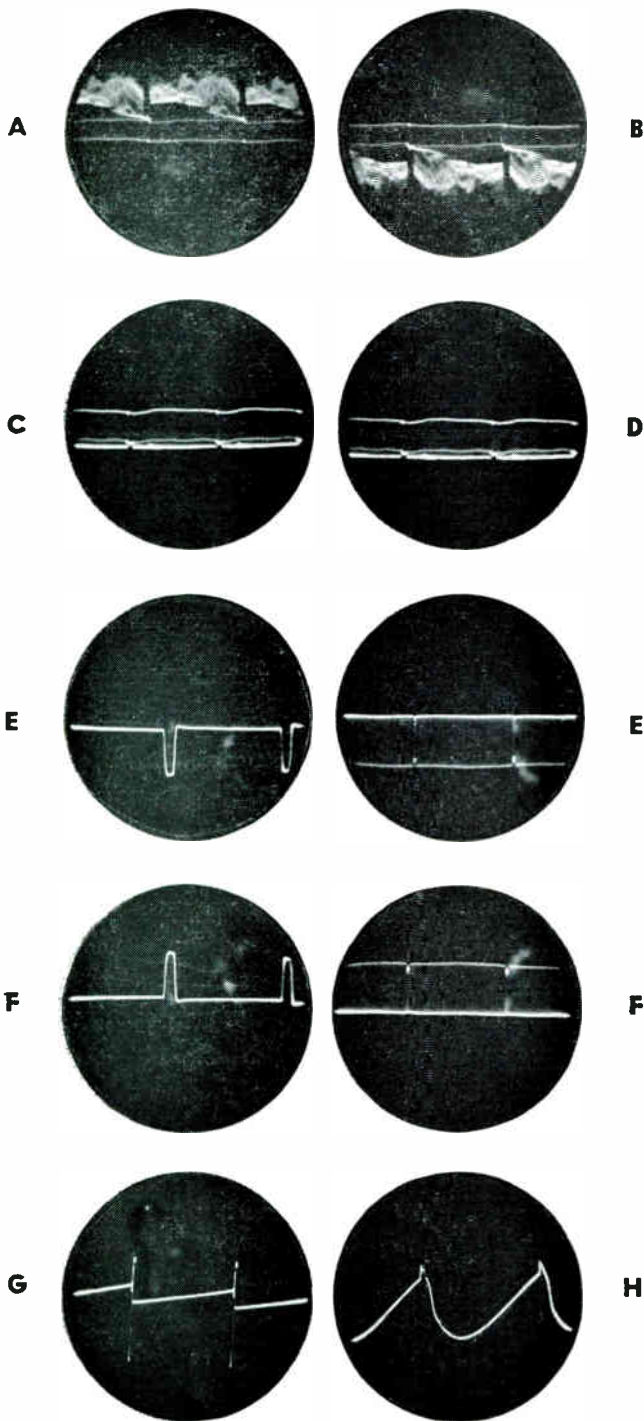


FIGURE 13

In severe cases the picture may even have a negative appearance, that is the blacker portions of the picture appear very white and the white portions look grayish. A voltmeter check at the AGC test point may or may not indicate the trouble. To readily isolate the AGC trouble to a stage, it is possible to substitute for the AGC voltage a fixed bias source. This procedure is done in the following sequence:

2. Turn the receiver off and connect a 6 volt battery; positive to the chassis and negative to the AGC test point (output of AGC rectifier). Remove AGC Rectifier tube.

3. Connect meter to any one of IF grids and check for negative voltage. The meter used should be a vacuum tube voltmeter having an input resistance of 10 megohms or more. If a negative voltage is present on the grids with the set off possibility of a dead short or open component in the grids to AGC bus is eliminated. If a short or an open component were present negative voltage would not be measured at the grids.

4. If negative voltage is measured, leave battery and meter connected and watch meter reading. If bias voltage goes down or disappears as the set warms up an IF or RF tube with a grid-short-after-heating is at fault. To isolate the tube remove one at a time.

5. If bias voltage remains normal with set turned on, the trouble is definitely in the AGC stage itself. Ohm-meter tests will show up the defective part.

Remember although a ceramic coupling condenser may leak slightly that plate voltage drop is negligible, it still might feed enough positive voltage over to the next IF control grid to cancel out the AGC voltage.

The above system is entirely independent of an external signal to provide a test AGC voltage; however, normal operation of the receiver while using this external bias method should not be expected.



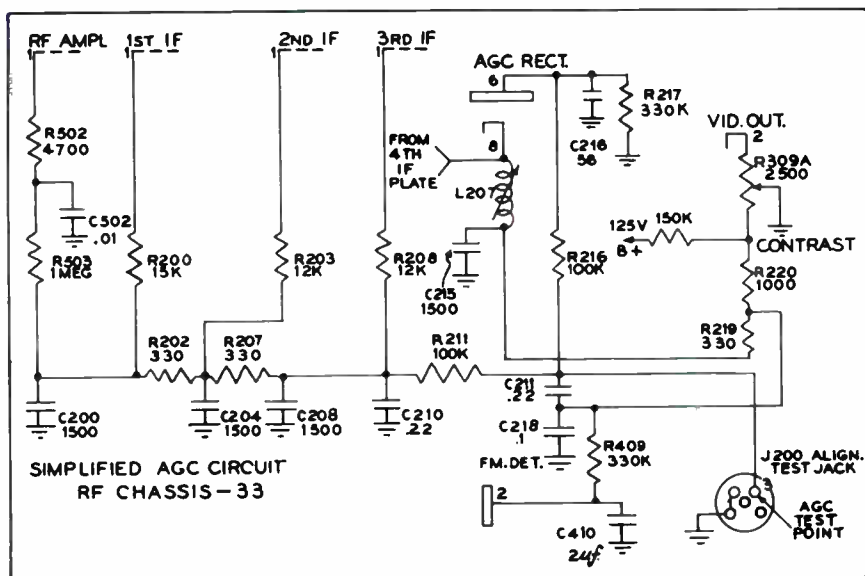


FIGURE 14

## AGC SYSTEM CHANGES

In the Philco RF chassis employing the Colorado Tuner there have been several changes in the AGC system. The original AGC system applied AGC voltage to the 6BQ7 RF amplifier from the same bus which supplied the IF amplifier stages. The second system modified the AGC circuit to provide an extra delay for the AGC supplied to the tuner. This was accomplished by connecting a small positive voltage from the contrast control through a 1.5 megohm resistor to the AGC feed point for the tuner. At this point the negative AGC voltage was connected through a 680,000 ohm resistor. The second circuit had the advantage that tuner sensitivity was maintained at maximum up to a signal level above 300 microvolts. As a result the signal to noise ratio of the tuner was kept high resulting in less snow in the picture.

The AGC system now being used in current sets provides the tuner AGC control voltage from the final sync separator rather than from the AGC rectifier in the video circuit. The latest AGC system has the advantage that it permits the receiver to operate without overloading in areas of very high signal strength. Signals of the order of .5 volts on the antenna leads will produce normal pictures without any signs of clipping or excessive contrast.

If you are servicing a receiver which suffers from either excessive snow on signals of approximately 300 microvolts or overloads on strong signals then you would want to examine the circuit and revise the AGC system to the tuner so as to correct either or both of these troubles. If the first problem is present it is only necessary to provide the delay voltage for the tuner from the contrast control. If the second trouble is present then it will be necessary to change the source of the tuner AGC voltage as well.

The changes made on the tuner AGC system are illustrated in figure 1A and B, and Figure 3. These show the original AGC circuit, the circuit with delay voltage added, and AGC control voltage supplied from the final sync separator. It is suggested that reference be made to the base layouts on pages 2 and 3 of PR-1928 and page 24 of PR-1943 and the associated schematics of the chassis using the Colorado Tuner.

NOTE: Slight variations of the physical layout of individual components may be encountered in different models. It is recommended that the wiring as outlined in this article be followed as close as possible.

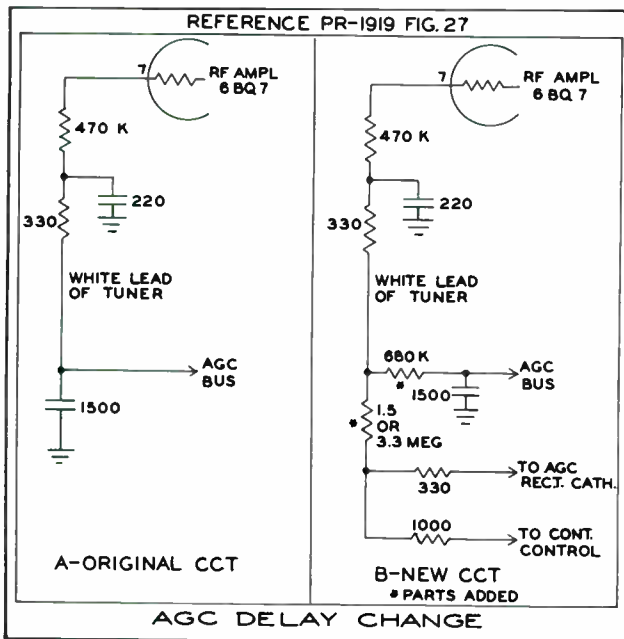
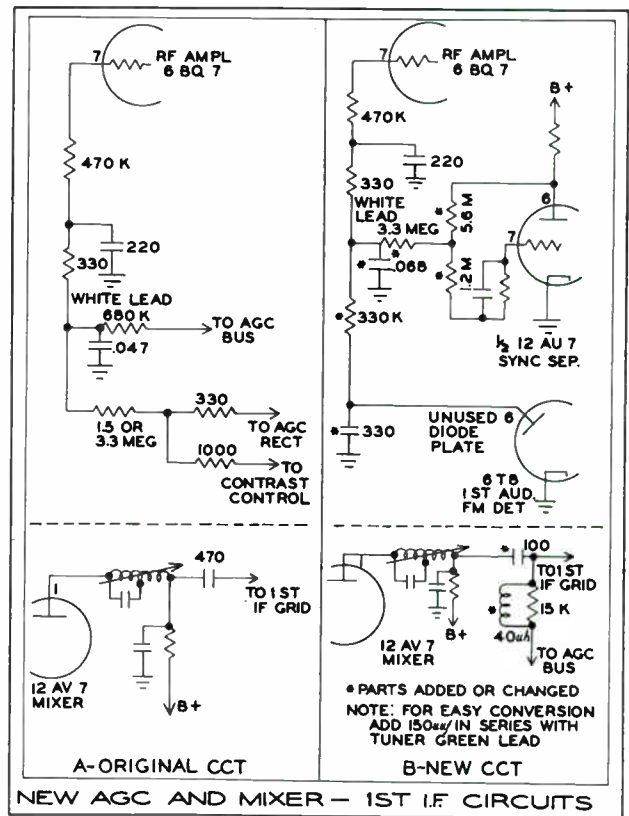


FIGURE 1

**AGC CHANGES (SEE FIGURES 2 and 3)**

1. Remove 6.8 meg. resistor R604.
2. Remove wire connected from term 2 of B-5 to pin 6 of 12AU7 sync separator noise gate.
3. Remove connection of R602 at term 2 of B-5 and reconnect to pin 6 of 12AU7 sync separator noise gate.
4. Remove connection of wire, which feeds sync signal to sync inverter in power chassis, from term 2 of B-5 and reconnect to pin 6 of 12AU7 sync separator noise gate.
5. Install a 1.2 meg. resistor between term 2 and 4 of B-5.
6. Install a 5.6 meg. resistor between term 2 of B-5 and pin 6 of 12AU7 sync separator noise gate.
7. Remove 680K resistor R223 and 1.5 meg. resistor R222. Remove wire connected from lug 3 of B-6 and lug 8 of B-7.
8. Install 3.3 meg. between term 8 of B-7 and term 3 of the 3 lug term panel adjacent to tuner.
9. Install 330K resistor between lug 4 and 8 of B-7.



FIGURES 2 and 3

10. Install .068 ufd condenser between lug 8 of B-7 and ground.
11. Connect AGC lead (white) from tuner to lug 8 of B-7.
12. Connect lead from lug 3 of the 3 lug term panel to lug 2 of B-5.
13. Connect lead from lug 4 of B-7 to pin 6 of 6T8 tube. Install 330 ufd condenser from pin 6 of 6T8 to a convenient ground point.
14. Replace the 470 ufd DC blocking condenser, connected from the mixer plate coil to the 1st IF grid, with a 100 ufd condenser, or add 150 ufd in series with the 470 ufd.
15. Install a 40 microhenry choke, part #32-4143-1, in parallel with the 15k grid load resistor of the first IF amplifier tube 6AU6.

NOTE: A slight touch up of the IF alignment may be necessary.

# PHILCO

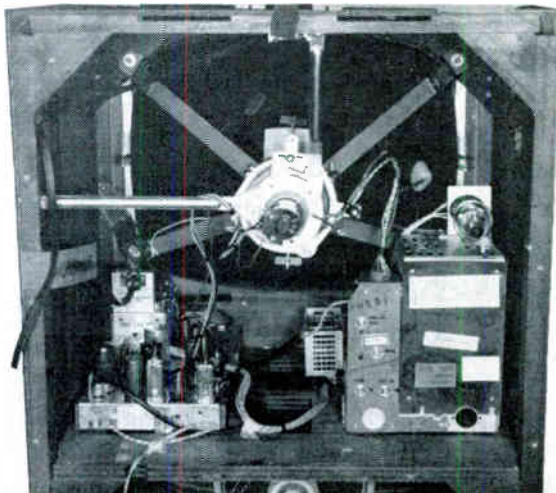


# SERVICE

## *New Product News* TELEVISION

NOVEMBER, 1951

### PHILCO LINE-CONNECTED DUPLEX CHASSIS Part One



**FIGURE 1 — Line Connected chassis in cabinet (back view)**

Early in 1950 Philco introduced the first of its famous line of duplex television chassis in the Model 1600. Since that time the Philco television chassis has become the standard of high performance — a goal which competitors have tried to reach.

It is the purpose of this article to discuss those circuit features of Philco's latest line-connected duplex chassis which will be of interest and value to servicemen. The new chassis are marked 41, and 44 for the RF and D1 and D4 for the power unit. See figure 1 and 2.

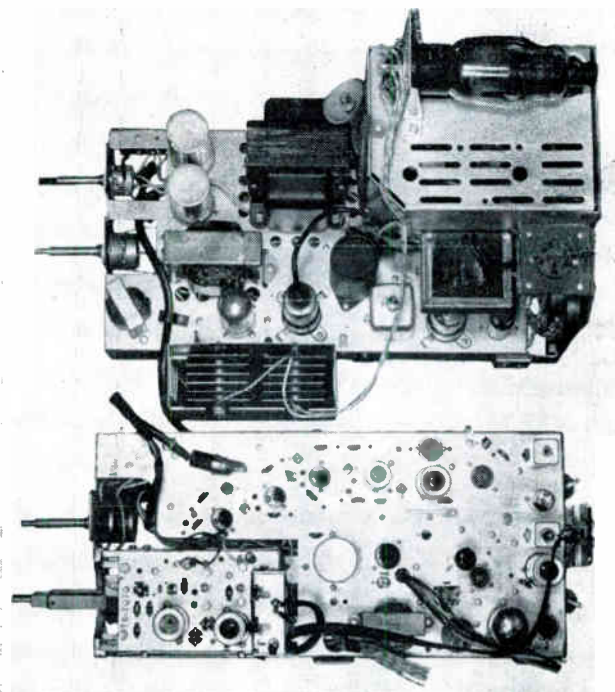
The logical place to start a discussion of a new chassis is the block diagram of the receiver.

A quick look at the block diagram (figure 3) will show you that the sequence and number of stages remains the same as used in the 1951 series of duplex chassis models. The sound system is the intercarrier

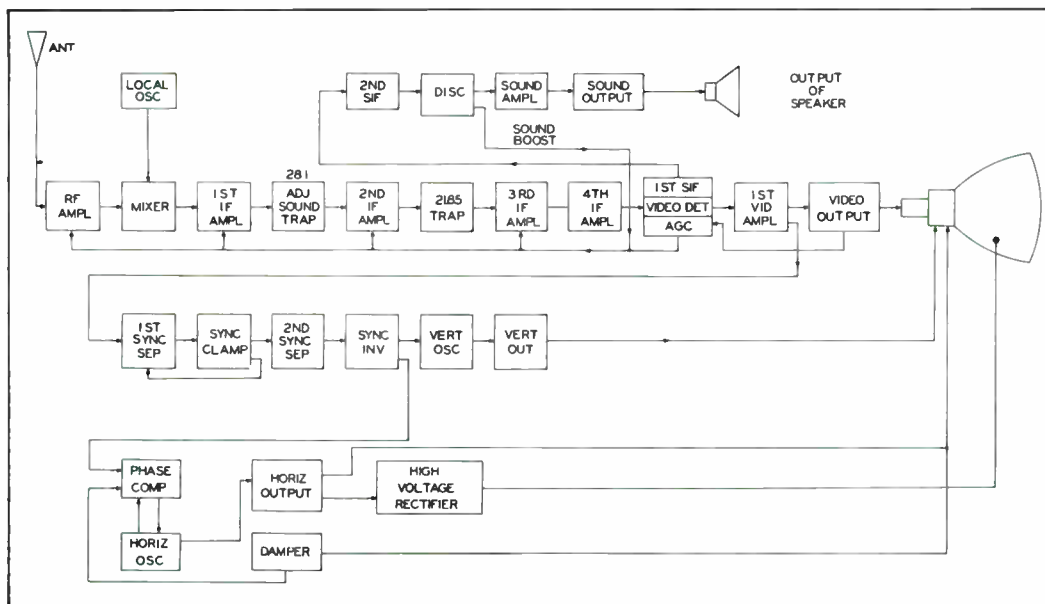
type. The changes which have taken place have occurred in the individual stages and in the physical arrangement of components. We will trace the signal path through the block diagram very quickly and will point out changes to be explained in detail later.

The television signal from the aerial transmission line is connected into the RF amplifier stage through a tapered line matching transformer as has been done in previous models. The RF tuner in this chassis is improved in performance and has lower local oscillator radiation than previous Philco tuners.

The amplified RF signal passes from the RF stage to



**FIGURE 2 — Line Connected chassis out of cabinet**



**FIGURE 3 — Block Diagram**

the mixer stage where it beats with the local oscillator to produce the IF frequencies which are applied to the common IF amplifier.

There are four tuned stages in the common IF amplifier providing high gain and wide-band response resulting in good picture quality and high sensitivity.

Output from the common IF is applied to the combined second detector and AGC tube.

At the output of the detector signals are selected for the 4.5 mc. sound IF and for the video amplifier. The 4.5 mc. signal is amplified, detected and then amplified again to provide the sound signal at the speaker.

The video signal passes through a 4.5 mc. filter, is amplified and applied to the picture tube grid to modulate the electron beam.

Going back now to the plate of the first video amplifier, a portion of the video signal is picked-off and applied to the first sync-separator or cathode follower. The signal with part of the video separated is then passed through a noise-gate diode to clip off noise pulses before applying the signal to the final sync-separator. Negative sync pulses from the sync separator are next passed through the sync-inverter to provide positive sync for both the horizontal and vertical sweep systems.

Positive sync pulses from the sync inverter are passed through an integrating network to the vertical oscillator, thus locking it in step with the transmitter signal. The vertical oscillator drives the new pentode vertical sweep output stage directly and this stage in turn sup-

plies driving current to the vertical coils of the deflection yoke.

The same positive pulses, from the sync inverter, are connected through a differentiating network to the grid of the phase-comparer. By comparing the sync pulses with the horizontal sweep voltage a voltage is obtained for controlling the phase of the horizontal oscillator and thus keeping it in step with the transmitter signal. A horizontal oscillator circuit with a new stabilization circuit is used. The saw tooth voltage from the horizontal oscillator drives the output tube which supplies current to the horizontal windings of the deflection yoke. A new type damper diode is connected across the deflection yoke to increase the efficiency of the deflection system. High voltages for the picture tube second anode is obtained by rectifying high voltage pulses from an auxiliary winding on the sweep transformer.

An outstanding feature of the new chassis is the power supply. Filament power and bias voltage are supplied through a step-down transformer but high B+ voltage is obtained through a dry disc voltage doubler circuit which has a return path through the power line. Both filament and B+ circuits are fused.

Having very briefly covered the block diagram illustrating the sequence and interconnection of stages we will next discuss the individual circuit features.

In external appearance the tuner used looks practically identical to the Philco Colorado Tuner made famous by previous Philco models. Circuit wise this tuner differs



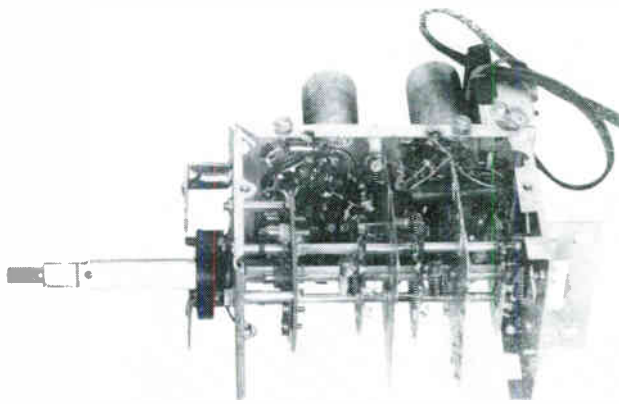


FIGURE 4 — New Tuner

in the neutralization circuit used in the RF stage, in the use of parallel tuned rather than series tuned circuit at the first grid, and in the oscillator circuit. Figure 4 shows quite clearly that the circuits are easily accessible for testing and repair.

A simplified schematic of the tuner is given in figure 5.

Signal from the aerial is coupled through a tapered-line transformer, Z500 to a parallel tuned circuit which resonates with the input capacity of the RF amplifier first triode section.

This first triode acts as an impedance transformer to match the relatively high impedance of the tuned circuit to the low cathode impedance of the second triode section, which is a grounded-grid voltage amplifier.

A special transformer, T500 is connected between the plate of the first triode and the cathode of the second section to neutralize the amplifier. This neutralization is fixed and is made to improve the signal to noise ratio of the amplifier; it is not needed to prevent instability. The special transformer is actually a section of 150 ohm, open wire, transmission line wound on a coil form. Neutralization is obtained because attenuation through the line in a forward direction is low since the line is terminated by the low cathode impedance of the second section. Attenuation in the reverse direction would be high because the plate impedance of the first triode would be relatively high resulting in a mismatch for transmission in that direction.

The amplified RF signal is next applied to the mixer section of a 12AZ7, dual triode, and combined with the local oscillator voltage from the other section of the 12AZ7. The 12AZ7 is a high amplification factor, dual triode. It is approximately equivalent to the 12AT7 but employs a higher heater current which provides ample cathode emission for good performance at high frequencies.

The 12AZ7 permits the use of a new oscillator circuit with the plate at RF ground potential and the feedback path from grid to cathode. The higher amplification factor of the 12AZ7 makes it practical to operate the local oscillator at a lower level and still get sufficient local oscillator voltage for efficient conversion in the mixer. An important dividend of this circuit is that it greatly reduces local oscillator radiation which might

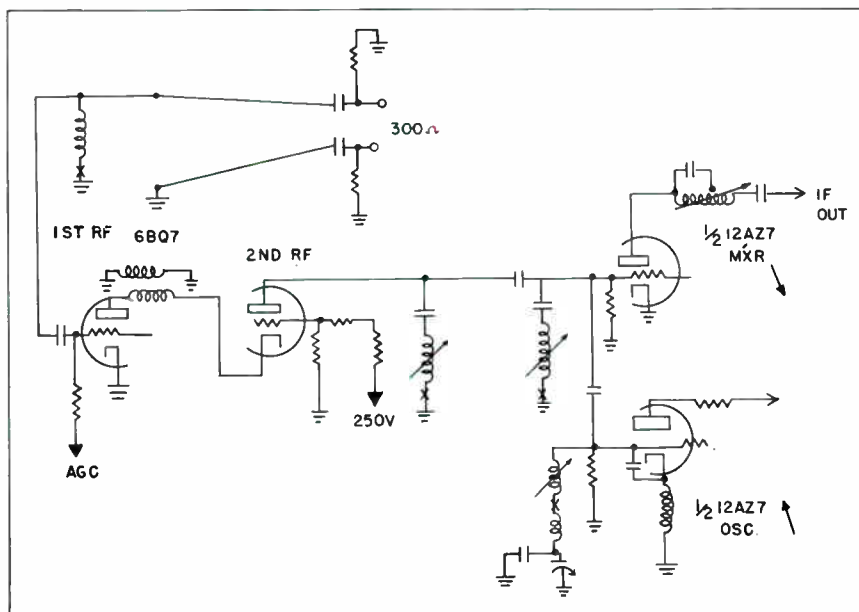
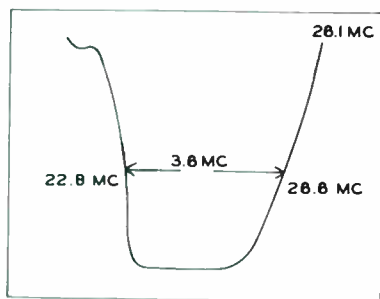


FIGURE 5 — Simplified Schematic of New Tuner



**FIGURE 6 — Response Curve IF Strip**

otherwise interfere with reception on other television receivers nearby. This tuner has a noise figure equal to the theoretical limit of signal to noise ratio on many channels and on some channels it actually exceeds the theoretically perfect tuner.

The output of the mixer is coupled through auto-transformer, L526, to the first IF amplifier grid.

The common IF amplifier used in the new duplex chassis is characterized by wide-band response. See figure 6. The bandwidth at the 50% response point averages about 3.8 mc. Rejection of adjacent channel signals is high as indicated by the high attenuation at 28.1 mc. Of special interest to the serviceman is the response in the vicinity of 22.1 mc., the sound carrier frequency. By use of a 21.85 mc. trap of the right characteristics in the second IF stage plate circuit a shelf is created in the response so that response at 22.1 mc., sound carrier, will increase if the local oscillator fine tuning control is adjusted to move the picture carrier high on the response curve. This action is desirable to prevent loss of sound output when the picture carrier is tuned high on the IF response curve as is normal in low signal areas.

The sound shelf shown in figure 6 will not be seen during normal visual alignment procedures because the

response at 22.1 mc. is very low and will normally be lost in the baseline. If there is any suspicion that response at the sound carrier is incorrect the sweep generator can be returned slightly and the scope gain increased.

The sound shelf should show up clearly in this case.

The stages are shown in Figure 7.

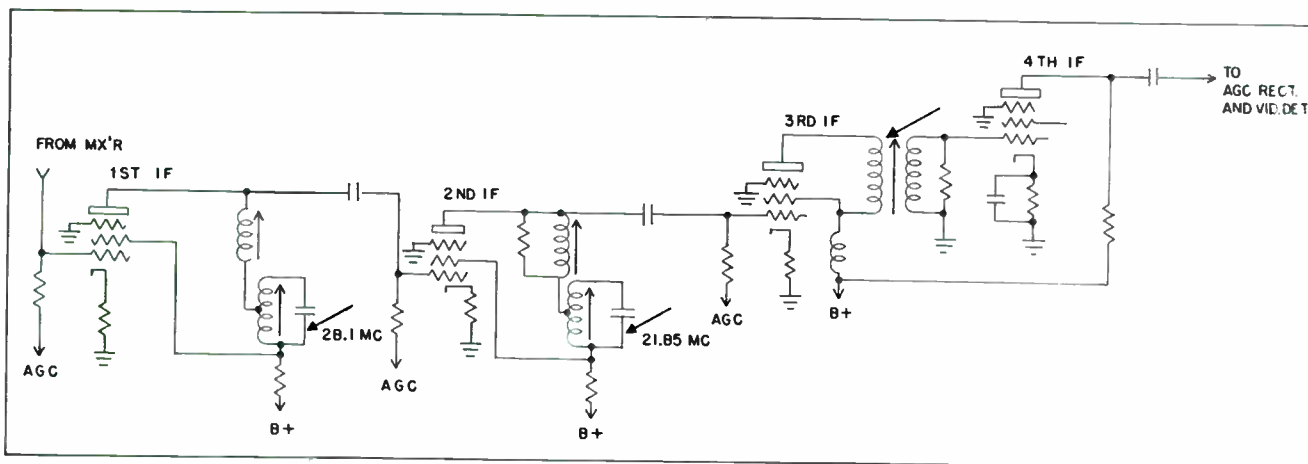
The 28.1 mc., adjacent sound trap, is in the plate of the first stage and the 21.85 mc. trap for the sound shelf is in the plate of the second stage.

A small amount of degeneration is provided by 68 ohm, un-bypassed, resistors in the cathodes of the i-f stages. 6AU6 tubes with separate suppressor grid leads are used for maximum freedom from regeneration. AGC voltage is applied to both of these stages.

An overcoupled transformer, Z200 is used between the third and fourth stages. Although this transformer has two maximum response points as in any over-coupled transformer, only the peak at 26.25 mc. is used. The second peak falls outside the IF band. The transformer provides a low impedance DC path in the grid of the fourth IF stage and thus tends to suppress noise pulses which would otherwise produce white noise specks by momentarily blocking the amplifier. Blocking produces white noise because minimum carrier signal corresponds to white picture elements.

Bias and plate voltage are so chosen in the 4th IF stage that noise pulses above the sync level are clipped off. This tends to minimize the deleterious effects of noise on sync performance.

**Continued Next Month**



**FIGURE 7 — Simplified Schematic IF System**

## Shop Practices and Service Techniques

RADIO

NOVEMBER, 1951

### SETTING DISCRIMINATOR TO EXACT CENTER FREQUENCY

There are two methods of using Model 7008 to set the discriminator to its proper center frequency. The first method described is recommended, for its more accurate and easily observed results. It consists of applying a modulated r-f signal of the correct center-frequency to the discriminator, and adjusting the discriminator secondary until the modulation disappears. In this method the modulation disappears because the output of the discriminator is zero at the center frequency. In the second method, a marker pip is made to appear on the discriminator response curve, and is set for the crossover point at the center frequency. However, the second method is less effective, because the marker pip disappears at the center frequency so that the center frequency is actually determined by noting when the marker disappears and where it reappears, and, because of the difficulty in observing the exact points of appearance of this pip, it sometimes leads to inaccurate results.

To employ the first method, connect the output of Model 7008 to the grid of the last i-f tube, and the oscilloscope input through the scope input leads to the sound-detector output (FM test jack in FM receivers). Set the MARKER FREQUENCY control for the correct center frequency, and the MASTER OSC. APPROXIMATE CENTER FREQ. control to the center frequency (MASTER OSC. BAND SWITCH to Band A). Adjust the HORIZ. GAIN control for a horizontal trace of about 20 crosshatch divisions, with the SWEEP WIDTH control at 1. Turn the FUNCTION switch to the AM RF position. Set the OUTPUT MULTIPLIER and the MASTER OSC. ATTEN. controls for a response curve covering at least 10 vertical crosshatch divisions, with the VERT. GAIN at position 2. Set the FUNCTION ATTEN. control to position 10.

If the discriminator secondary trimmer is correctly adjusted to the proper center frequency, only a typical S-shaped curve will appear. If it is not adjusted to

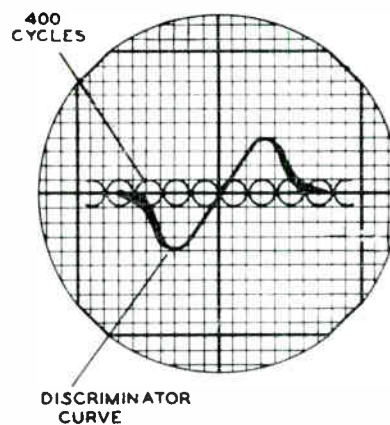


Figure 1. — Discriminator Center-frequency Pattern

the correct frequency, but close to it, a pattern similar to that in figure 1 will appear. Regardless of which pattern appears, adjust the secondary trimmer until figure 1 pattern appears, then vary the trimmer slowly in one direction, and then in the other direction, until the 400-cycle portion of the pattern disappears and then reappears with a further movement of the trimmer. Set the trimmer to the point at which the 400-cycle portion disappears and will reappear if the trimmer is moved slightly in either direction.

**NOTE:** The setting of the FUNCTION ATTEN. control is critical in this application. Too much marker signal input will make the center frequency hard to find.

The user should note that the MASTER OSC. ATTEN. controls the height of the discriminator curve, while the FUNCTION ATTEN. controls the height of the 400-cycle pattern, and the OUTPUT MULTIPLIER and VERT. GAIN controls affect the height of both the curve and the 400-cycle pattern. This check should be performed a few times to enable the user to become familiar with the setting of controls.

To employ the second method, using the marker pip on the response curve, connect Model 7008 as outlined above. Control settings are the same, except that the FUNCTION switch should be set to the MKR position.

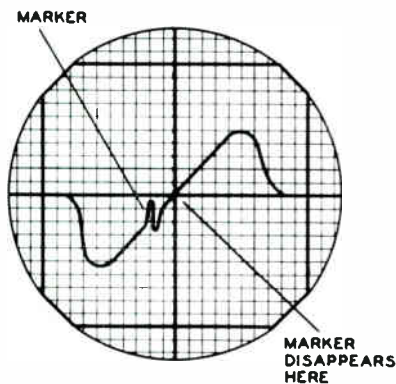


Figure 2. — Use of Marker for Locating Discriminator Center Frequency

Set the MARKER FREQUENCY control slightly off the center frequency, and adjust the controls until the marker pip is visible on the discriminator response curve. See figure 2. Then set the marker pip for the correct center frequency, and set the discriminator secondary trimmer until the pip disappears at the crossover point in the center of the response curve.

It will be found helpful to use the blanking circuit in both of the above checks, so that the crossover point can be easily determined. To use the blanking circuit, first adjust the PHASING control for a single image, then turn the BLANKING control clockwise until a single image appears with a horizontal line through the full width of the pattern retuning the MASTER OSC. APPROXIMATE CENTER FREQ. control slightly if necessary, to center the image on the scope. See figure 3.

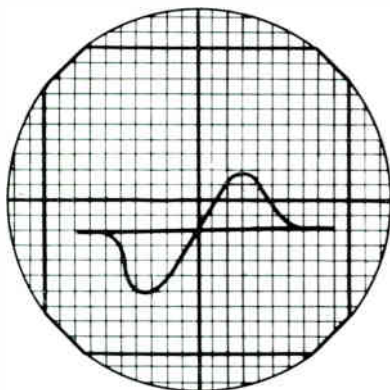


Figure 3. — Discriminator Curve—BLANKING Control Properly Set

### Aligning R-F and Oscillator Stages

1. Connect the output cable of Model 7008 to the aerial terminals of the FM receiver, using an appropriate matching network if the input impedance is other than 75 ohms. Leave the oscilloscope input cable connected to the output of the detector (FM test jack).

Page Two

### NOTE

If the radio is equipped with an external, all-purpose aerial-matching transformer, remove this transformer and feed the signal directly into the ANT. coil.

2. Set the MASTER OSC. APPROXIMATE CENTER FREQ. control and the FM radio dial for 105 mc., and set the SWEEP WIDTH control for a total deviation of approximately 200 kc.

3. Adjust the shunt (high-frequency) trimmer of the oscillator circuit for maximum output.

4. Set the FM radio dial to 88 mc., and adjust the MASTER OSC. APPROXIMATE CENTER FREQ. control to 88 mc. Use a tuning wand and observe the oscilloscope pattern. If the signal amplitude decreases when either end of the wand is inserted in the oscillator coil, the tracking is satisfactory. If the output increases with the brass end of the wand inserted, spread the turns of the oscillator coil; if the output increases with the iron end of the wand inserted, compress the turns of the coil.

### NOTE

Do not bend the coil excessively, as only a slight physical change is necessary at this frequency.

5. Repeat steps 3 and 4 until no further change is noted. The last adjustment made should be that of the shunt (high-frequency) trimmer.

6. Set the radio dial and Model 7008 to 105 mc., and adjust the shunt trimmer of the mixer grid circuit for maximum output. If an r-f stage is employed, also adjust the shunt trimmer of the r-f stage for maximum output.

7. Set the radio dial and Model 7008 to 92 mc., and check the tracking of the mixer and r-f grid circuits with the tuning wand. If the output increases with the brass end inserted in the coil, spread the coil turns; if the output increases with the iron end inserted, compress the coil turns. If the output decreases when either end is inserted, the tracking is correct. Do this for both the mixer and r-f coils.

8. Repeat the foregoing adjustments of the r-f and mixer circuits, both at 105 mc. and 92 mc., until no further improvement is noted. Make the 105-mc. adjustments last.

### CHECKING R-F AND MIXER RESPONSE

The response of the r-f and mixer sections of an FM receiver may be observed with Model 7008. Connect the output of Model 7008 to the receiver aerial input through an appropriate matching network, if the input impedance of the receiver is other than 75 ohms. Con-



nect the oscilloscope input of Model 7008 through the scope input leads to the mixer plate decoupling filter. Be sure to remove first i.f. tube. If a decoupling network is not supplied, connect the oscilloscope through the high-frequency probe to the plate of the mixer.

Set the MASTER OSC. APPROXIMATE CENTER FREQ. control to the center-channel frequency, and the FUNCTION switch to the MKR position. Adjust the SWEEP WIDTH control for the desired deviation (between 0 and 1 for FM receivers). Set the OUTPUT MULTIPLIER and MASTER OSC. ATTEN. controls for the desired pattern height, with the VERT. GAIN control at position 2. Use the MARKER FREQUENCY control to vary the marker pip along the response curve, to determine the cutoff points; the FUNCTION ATTEN. control determines the amplitude of the marker pip.

In some instances, it may be necessary to set the VERT. GAIN control to another position; it is generally good practice to keep this control near position 2, and adjust the output from Model 7008 so that the pattern is of a satisfactory height.

FM receivers will have a front-end response similar to figure 4. It will be found, generally, that the width of this front-end response curve will be from 150 to 200 kc., since it is more or less fixed by the "Q" of the circuit; that is, while alignment may change the shape of the response curve, it can vary considerably in amplitude and appear as a high narrow, peaked curve, and yet retain the band width for which it was designed.

Therefore, any adjustments of front-end response should be attempted with due consideration for both the r-f and i-f over-all response, rather than that of the r-f response alone, since it is only necessary that the frequencies within the i-f band pass are passed. The main purpose of the r-f stage is to provide good image rejection and to minimize any spurious responses which

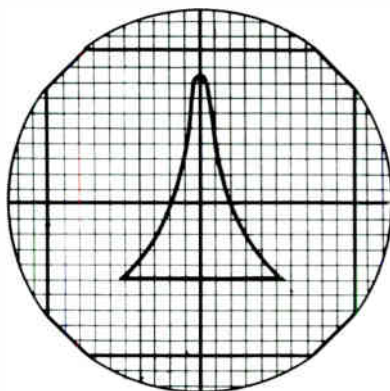


Figure 4. — R-F and Mixer Response of FM Receiver

can occur. It is important, however, that the r-f response be wide enough to prevent chopping off any signal; this can be easily checked by observing the front-end response curve, and running the marker along the curve to determine the cutoff points.

## MODERN RATIO DETECTOR

While the "locked-in" oscillator system, such as the Philco Advanced FM Detector, accomplishes FM detection without the necessity of first transforming the signal to AM, it has several limitations. It is sensitive to impulse noise to the extent that a noise pulse will upset the circuit for a short period until the oscillator can adjust itself. This effect by the AM pulse lasts only a portion of the total duration of the noise but is a factor that detracts from its performance.

There is a minimum signal (or threshold) value below which the locked-in oscillator slips out of control and returns to its free-running frequency. This is a good feature in view of the elimination of inter-station noise but its disadvantage lies in the failure to receive weak stations. However, this loss of weak stations was not a detriment to operation several years ago because the systems then in use gave rather noisy reception on weak signals.

Because of the additional oscillator, the circuit is that much less stable; such conditions as tube aging and temperature variations upset the circuit balance, causing noisy or distorted operation and requiring re-alignment. Trouble is sometimes encountered by a mis-matched tube and transformer — the circuit being critical enough that if the two components tend toward opposite ends of their allowable tolerances, the circuit either will not tune properly or will not stay in alignment over a long period. The alignment itself is considerably more critical than that of the now commonly used FM detector circuits.

At the time of its conception, the Advanced FM Detector offered several advantages over the balanced discriminator and the ratio detector. However, the action of the ratio detector has been improved to such an extent that it is now almost universally used as an FM detector.

The ratio detector circuit remains about the same as for the 1946 sets as shown in last month's article. The advancements are not readily apparent from the schematic since they are mostly in the design of the component parts. Noise rejection has been greatly improved by careful design of both the detector circuit and the discriminator transformer. The linearity of the discriminator response curve has been improved by the design and use of tubes having superior diode characteristics. The transformers require no loading networks when aligning, as the bandpass characteristics are de-

signed into the single peaked units. All that is required is the adjustment of the primary and secondary slugs (powdered iron cores) for maximum.

A typical, modern, ratio detector circuit is shown in Figure 5. To understand how this circuit operates, it is necessary to review the operation of the standard ratio detector. The two diodes are connected in series and a controlling voltage is established in the circuit which is dependent upon the average value of the incoming carrier. Due to the long time constant of the R-C filter in the network, instantaneous changes in signal amplitude are prevented from affecting the audio output voltage. Furthermore, this control voltage sets the limit to the maximum audio voltage that can be obtained. Thus, if a small condenser is connected in series with each tube, the voltage appearing across each will depend upon the input frequency. However, at all times, their sum is equal to the control voltage. Changes in signal frequency will merely alter the ratio of their voltages. Since the audio output is taken from across one of these condensers, the audio can vary in amplitude from zero to the value of the control voltage.

In the modified form of the above, see Fig. 5, the same control voltage is maintained, but the two condensers are replaced by one which is in series with both tubes. In order to understand the operation of the circuit without  $C_1$ , it must be kept in mind that the voltage across  $C_2$ , is determined by:

1. The potential of R & C. This in turn, is fixed by the average amplitude of the incoming FM signal.
2. The frequency of the incoming signal.

3. The relative currents flowing through  $V_1$  and  $V_2$ . This, of course, depends upon #2 above.

Referring to Figure 5, the voltage applied to  $V_2$  is the vector sum of  $E_{L4}$  and  $E_3$ . Similarly, the voltage active across  $V_1$  is composed of  $E_{L4}$  and from the mid-IF value at which point the voltages of  $V_1$  and  $V_2$  are  $E_2$ . As the frequency shifts equal and opposite in response to modulation, the total voltages at  $V_1$  and  $V_2$  will follow suit.

Consider, now, the current paths for each of the tubes.  $V_1$  is part of the complete path AFEDCBA. Its current can also flow through the path AFEDGBA. For  $V_2$ , the two paths are: GBAFEDG and ABCDGF. In other words, currents from each tube can flow around the outer path (GBAFEDG) or part of each can be diverted through  $L_4$  and  $C_2$  of the center path.

When the total voltages applied to each tube are equal (at mid-frequency), no current flows through  $L_4$  and  $C_2$  because of equal and opposite currents. This is true of all ratio detectors. At points other than mid-frequency the current of one tube is greater and a portion of it does pass through  $L_4$  and  $C_2$ . Hence, the voltage across  $C_2$  will be a function of frequency. Due to the fact that each tube is connected into the circuit in an opposite manner, their currents (from  $V_1$  and  $V_2$ ) flowing through  $L_4$  and  $C_2$  will likewise be opposite. Therefore  $E_{C2}$  will possess one polarity for frequencies below resonance and the opposite polarity for frequencies above resonance. An audio voltage is then obtained from across  $C_2$ .

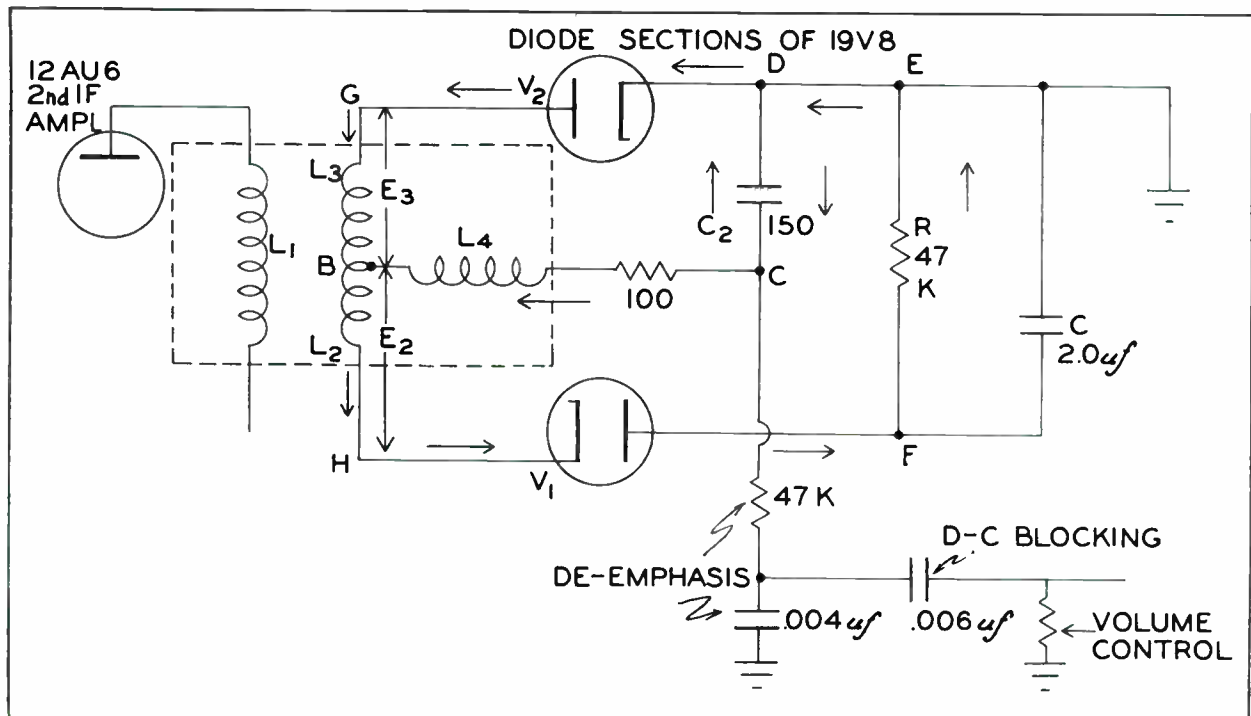


FIGURE 5.

# PHILCO



# SERVICE

## New Product News

### RADIO

NOVEMBER, 1951

## ALIGNMENT OF RECEIVERS

### FM RECEIVER ALIGNMENT

The following article is a discussion of the alignment of FM receivers using a sweep generator and an oscilloscope. A Philco Visual Alignment Generator, Model 7008 will be used to indicate the ease of operation of this unit. A complete alignment will be made to show the proper sequence of adjustments. This information can also be applied to the use of other comparable equipment.

There are three types of FM detectors that are in general use; other special types which are not generally used will not be discussed. The three general types are the limiter-type detector, the ratio detector, and the Philco Advanced FM Detector; the type of detector determines the procedure to be followed.

Model 7008 possesses high signal output and unusual oscilloscope sensitivity, together with more than sufficient sweep deviation. Therefore, it is not necessary in most cases to align the i-f stages before aligning the discriminator; instead, the discriminator may be aligned first, and the remainder of the set aligned to the discriminator. Since the effect of the adjustments are visible at all times, no guess work is involved. Regardless of whether the stages are single or double peaked, the adjustments are easily made for symmetrical response. While it may be found that the visual alignment produces less audio output than other previously employed methods of alignment, it will also be found that, after visual alignment for true symmetry, better sound quality and noise reduction are obtained.

The r-f (marker) generator should be used to check the maximum and minimum points of the response curve, but it is not good practice to leave it set to one of these points, because insertion of the marker signal produces some distortion of the response curve. Use the crosshatch screen as a graph, locating the desired change points at some easily determined crosshatch line. For example, the center or crossover point may be located at the intersection of the heavy horizontal and vertical crosshatch lines in the middle of the screen, and the peaks of discriminator response can be located 5 divisions either side of center. Thus true symmetry can be determined by counting the number of divisions to the right and left and above and below the center lines.

Use the blanking circuit to furnish a reference line, being certain to first adjust the PHASING control for a single image with the BLANKING control in the

OFF position, and to turn the BLANKING control clockwise until a single image with base line appears.

Adjust the SWEEP WIDTH and VERT. GAIN controls to keep the image on the c-r tube at a convenient size. Figure 1 shows insufficient sweep width, while

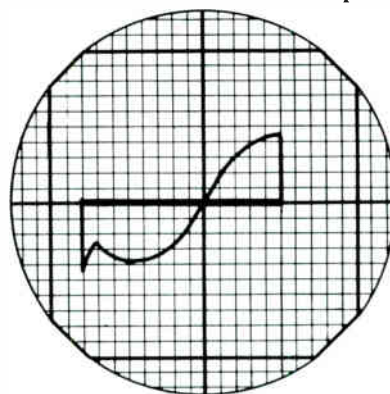


Figure 1. — SWEEP WIDTH Control Set Too Low

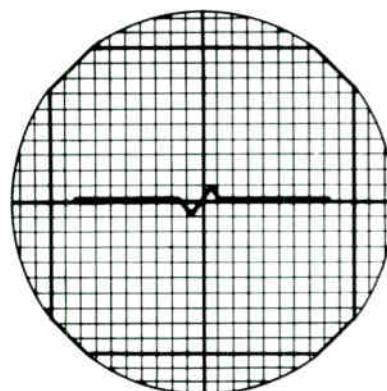


Figure 2. — SWEEP WIDTH Control Set Too High

figure 2 shows too great a sweep width. As a general rule, changes in symmetry may be more easily determined when the response curve is large than when it is small. Once proper sweep setting is obtained, blanking must be removed and the PHASING control reset for curve coincidence.

Connect the output cable of Model 7008 to the stage ahead of the one being checked, through a .01-mf. blocking condenser, and connect the input through the scope leads to the detector audio output (FM test jack in Philco receivers). Where it is desired to check individual stages ahead of the detector, connect the input of



Model 7008 through the high-frequency probe to the grid of the stage following the one being checked.

**NOTE**

Before starting the actual alignment, allow Model 7008 and the FM receiver to warm up for a period of at least 15 minutes.

**Limiter-Type Detector**

1. Referring to figure 3, connect the output cable of Model 7008 between test point B and ground; connect the input through the scope input leads between test point A and ground.

2. Set the MASTER OSC. APPROXIMATE CENTER FREQ. control to the desired center frequency; set the MASTER OSC. BAND SWITCH to position A.

3. Set the SWEEP WIDTH control for approximately 200 kc. total deviation, and adjust the discriminator primary condenser C2 for a curve of maximum amplitude, which will appear somewhat S-shaped if the secondary is not too far detuned. It will be necessary to keep the OUTPUT MULTIPLIER and MASTER OSC. ATTEN. controls set for an output below that at which limiting occurs.

4. Adjust the discriminator secondary trimmer condenser C1 for an S-shaped symmetrical response curve set to exact center frequency (see SETTING DISCRIMINATOR TO EXACT CENTER FREQUENCY).

5. Retune C2 for a symmetrical response curve with greater amplitude than in step 4, if possible.

6. Connect the output cable of Model 7008 to the grid of the last i-f stage preceding the limiter stage, and adjust trimmer C3 for a symmetrical response curve of maximum amplitude.

7. Connect the output cable of Model 7008 between the grid of the mixer tube and ground, and, if the output can be kept below the receiver limiting point, adjust each i-f secondary and primary in order, proceeding from the last i-f back to the first i-f stage, for a symmetrical response curve of maximum amplitude. Should limiting occur, that is, no change in amplitude occur as trimmers are adjusted, connect the input of Model 7008 through the high frequency probe between test point B and ground, and adjust each i-f stage as stated. Then, when C3 is reached, connect the scope input leads

to test point A, move the output cable of Model 7008 to the grid of the stage preceding C3, and adjust C3 and the discriminator as directed in steps 1 through 5 above.

**NOTE**

As each i-f trimmer is adjusted, the MASTER OSC. ATTEN., OUTPUT MULTIPLIER and VERT. GAIN controls should be retarded to keep the pattern within the limits of the screen.

8. Align the r-f and oscillator circuits as explained in the "Shop Practices and Techniques" of this month (r-f alignment is similar for all types of detectors).

**Philco Advanced FM Detector**

This type of FM detector requires that the i-f stages be adjusted first; then the detector is adjusted to the i-f center frequency. Any other procedure is not recommended.

1. Referring to figure 4, connect the output cable of Model 7008 to the grid of the last i-f stage, test point B; connect the oscilloscope input through the scope input leads to the detector output (FM test jack) test point A.

2. Set the MASTER OSC. APPROXIMATE CENTER FREQ. control to 9.1 mc., the MASTER OSC. BAND SWITCH to Band A, and the FUNCTION switch to the MKR position.

3. Short pin 2 of the FM1000 tube to ground, to render the oscillator inoperative. Set the SWEEP WIDTH control for approximately 200 kc. total deviation, and the OUTPUT MULTIPLIER, MASTER OSC. ATTEN., and VERT. GAIN controls for a pattern of desired height on the c-r tube.

4. Adjust the last i-f secondary trimmer C2 for a symmetrical i-f response curve of maximum amplitude and then adjust the last i-f primary trimmer C3 for a similar response. Move the output cable to the grid of the preceding i-f stage, and adjust the secondary and primary trimmers in order. Continue to move the output cable to the preceding stage and adjust each i-f transformer until all i-f transformers have been aligned.

5. Remove the short from pin 2 of the oscillator tube, and adjust trimmer condenser C1 for a hooked curve, as shown in figure 5.

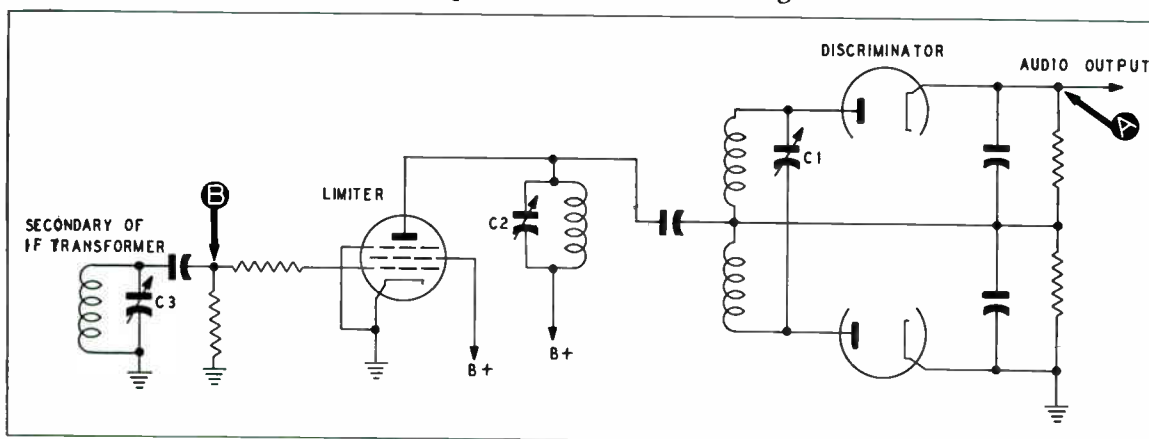


Figure 3. — Limiter-Type Detector Schematic



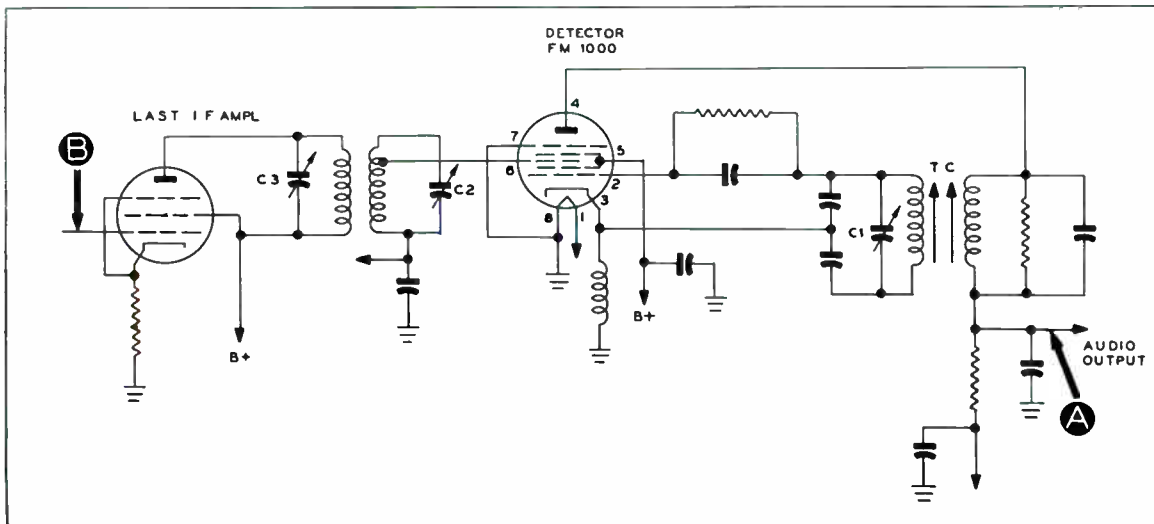


Figure 4. — Philco Advanced FM Detector Schematic

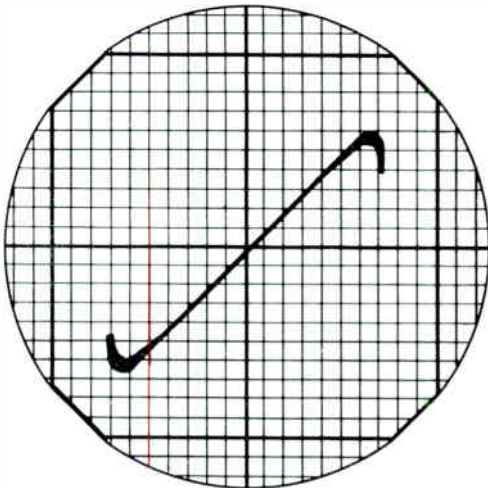


Figure 5. — Primary Set To Center Frequency

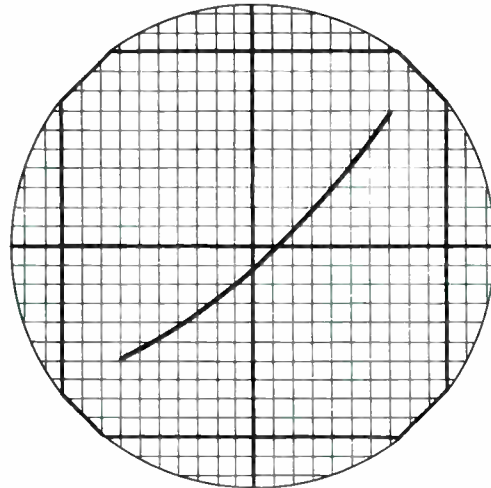


Figure 7. — Tuning Core Requires Turning Out

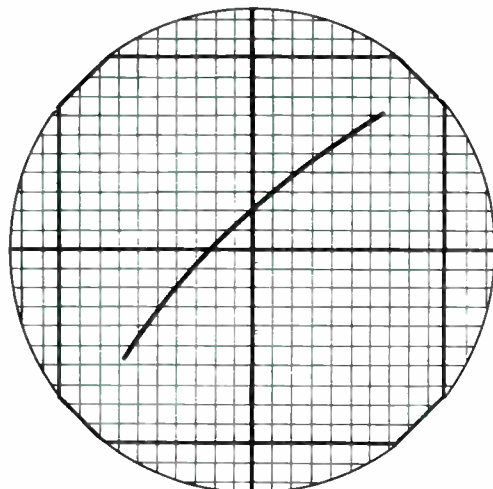


Figure 6. — Tuning Core Requires Turning In

**NOTE**

It will be necessary to decrease the receiver input to threshold value to secure the hooked curve. Be certain that the curve is symmetrical about the center.

6. Increase the output of Model 7008 until the hooked curve straightens out and becomes an almost straight line (see figures 6 and 7), then adjust the secondary tuning core TC (figure 4) for a straight line. Figures 8 and 9 indicate incorrect primary adjustments, while figures 6 and 7 indicate incorrect secondary adjustments.

**NOTE**

If the c-r tube pattern is not observed directly from the front of the oscilloscope, it is possible to adjust for what appears to be a straight line, which when checked with a straight-edge is found to be bowed.

If the blanking circuit is used, be sure to first adjust the PHASING control for a single image with the blanking circuit off, and then adjust the BLANKING control for a base line along the full width of the pattern.

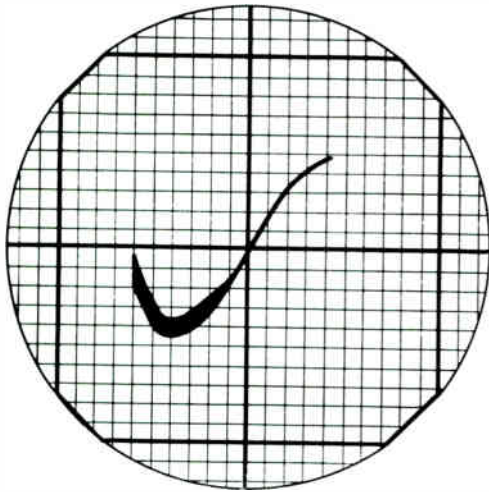


Figure 8. — Primary Set Below Center Frequency

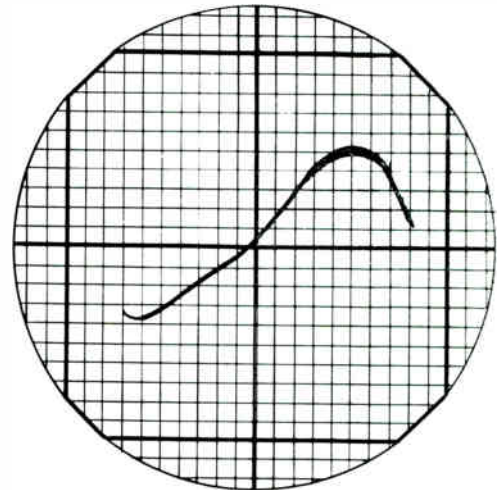


Figure 9. — Primary Set Above Center Frequency

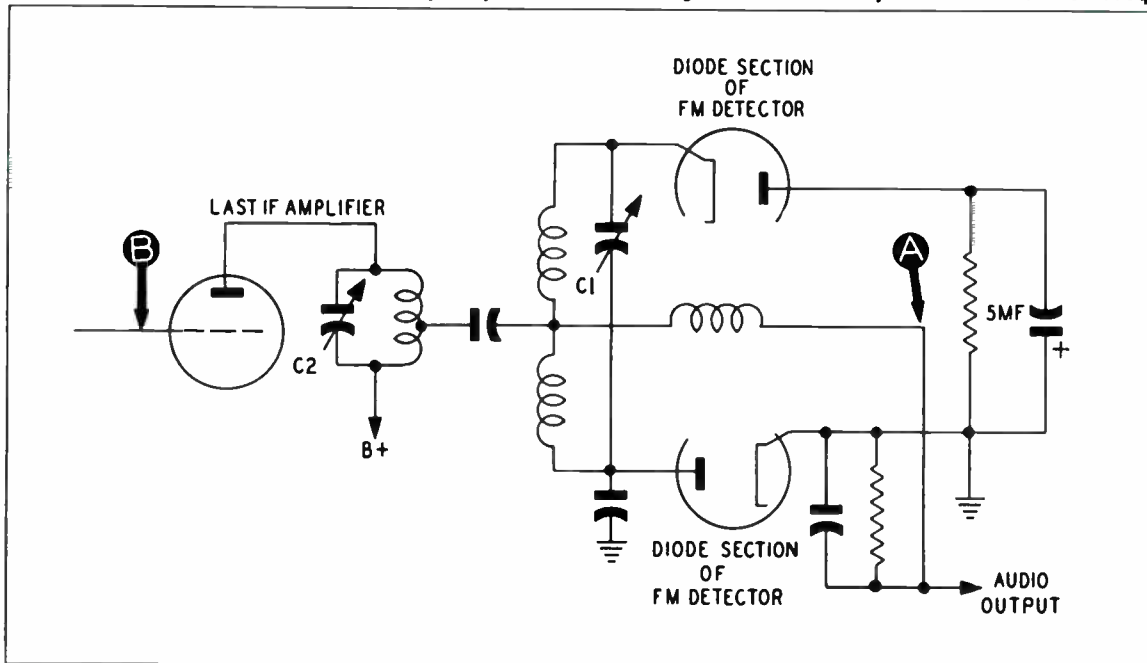


Figure 10. — Ratio Detector Schematic

**Ratio Detector**

1. Referring to figure 10, connect the output cable of Model 7008 between test point B and ground; connect oscilloscope input through the scope input leads between test point A and ground.

2. Set the MASTER OSC. APPROXIMATE CENTER FREQ. control to the desired center frequency (9.1 mc. for Philco FM receivers, and 22.1 mc. for Philco television receivers); set the MASTER OSC. BAND SWITCH to position A.

3. Set the SWEEP WIDTH control for approximately 600 kc. deviation for TV receivers. Adjust the discriminator primary trimmer condenser C2 for a response curve of maximum amplitude; the curve will be S-shaped if the secondary trimmer is near the proper adjustment.

For a further discussion of FM alignment covering the RF and oscillator stages and the setting of the discriminator to exact center frequency; see this month's "Shop Practices and Techniques".

4. Adjust the discriminator secondary trimmer condenser C1 for an S-shaped symmetrical response curve set to the exact center frequency (see SETTING DISCRIMINATOR TO EXACT CENTER FREQUENCY).

5. Remove the output cable from test point B, and advance it one stage toward the mixer, tuning the secondary and then the primary of the last i-f transformer for a symmetrical S-shaped response curve of greater amplitude than in step 4.

6. Proceed to adjust each i-f stage in order until the mixer is reached, adjusting the OUTPUT MULTIPLIER, MASTER OSC. ATTEN., and VERT. GAIN controls to retain the pattern on the screen.

7. Align the r-f and oscillator stages as explained in this month's "Shop Practices and Techniques."

# PHILCO



# SERVICE

## Shop Practices and Service Techniques

### RADIO

## PRINCIPLE AND SERVICE OF PHILCO SCRATCH ELIMINATOR

Although the Philco scratch eliminator is no longer used in Philco radio-phonographs, a description of its operation and service procedures will be in order, since this circuit was used in the deluxe models of a few years ago. Due to the quality of the sets incorporating the device, it is reasonable to expect that service men will be called upon to handle these models for many years to come.

The Philco scratch eliminator is designed to eliminate the scratch noise inherent in ordinary phonograph reproduction. Basically, this device is, in effect, a variable condenser across the audio circuit or phonograph input into which the pick-up is operated.

### USES SIMPLE PRINCIPLE

Because the impedance of a capacitor decreases with an increase in frequency, or in other words, because a condenser offers less impedance to high frequencies than it does to low frequencies, the condenser across the audio line will tend to bypass the higher frequencies to ground. Generally speaking, by varying the capacitance of this condenser across the line, we can control the high frequency response of the amplifier into which the audio line feeds.

Since scratch, in common with most other forms of noise, is of a relatively high-frequency nature, it was determined that if a variable capacitance could be designed to vary with the amplitude and high-frequency content of the input signal, it

could effectively eliminate scratch without noticeably impairing the high frequency response.

By referring to the block diagram, Figure 1, we can follow the signal through a high-pass filter consisting of a resistor-condenser network, into an audio frequency amplifier — then into another high-pass filter, and to another amplifier. The third high-pass filter removes all remaining low frequencies, before the signal is rectified, to produce a d-c control voltage. The schematic of this circuit is shown in Figure 2.

This control voltage varies with, and is proportional to, the amount of high frequencies in the input signal, since the high-pass filters remove all except the high frequencies. In other words, as the high frequency content of the input signal increases, the control voltage increases. This control voltage is negative, since it is developed from a diode plate, and acts as a variable bias. The bias is applied to the variable capacitance, and as the

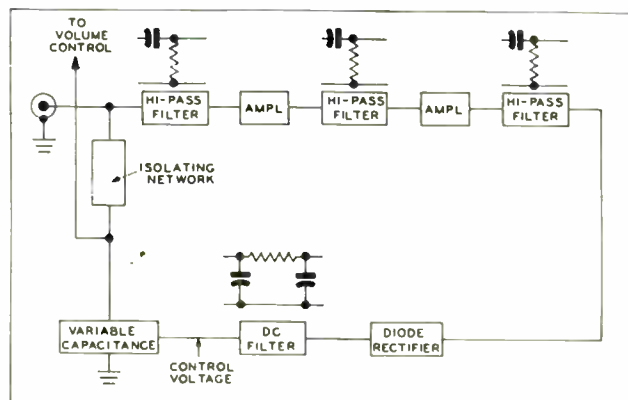


FIGURE 1

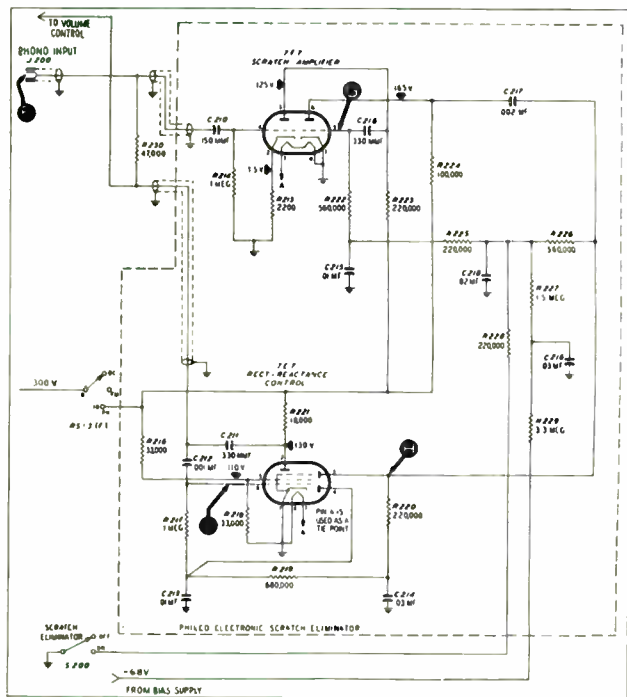


FIGURE 2

voltage increases negatively (as the bias voltage increases), the effective value of the capacitance decreases, or becomes smaller, and allows more high frequencies to pass through the line to the audio amplifier.

**LESS HF – LESS BIAS**

Conversely, as the high-frequency content of the input signal decreases, the amount of bias voltage developed becomes smaller, and the capacitance increases in value.

This variable capacitance is nothing more than a variable - mu pentode acting as a reactance tube, controlled by the variable bias. At low volume, when needle scratch is noticeable, the bias is small, causing the capacity to increase, and by-passing the scratch noise to ground. At high volume, the bias is great, causing the capacity to decrease, since there is no need for by-passing as the input signal tends to swamp the scratch noise.

**VARIABLE Mu NECESSARY**

The thing that actually happens when a variable bias is applied to the grid of the tube is that the amplification factor (mu) of the tube is varied.

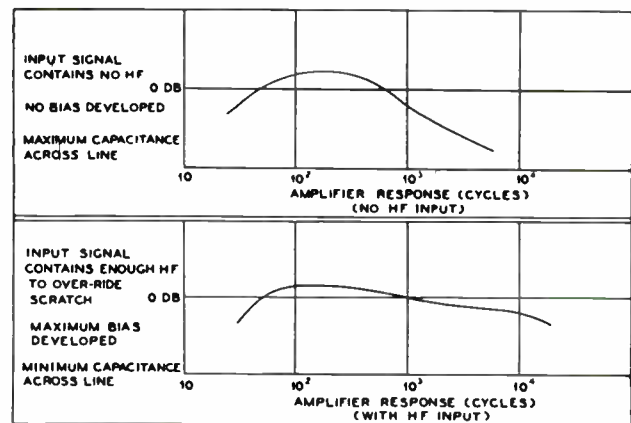


FIGURE 3

It is interesting to see how this takes place. The grid of a variable-mu tube is wound with varied spacing of the grid wires. The wires are spaced closely together at the top of the tube, and the spacing gradually increases toward the bottom. This means that each part of the grid has a different controlling effect on the electron flow between the cathode and the plate. Each part of the grid may be cut off, that is, the electron flow may be stopped, by a different value of negative bias applied to the grid, as shown in Figure 4.

**BIAS CONTROLS TRANSCONDUCTANCE**

When the bias is zero, the entire grid acts, and has the greatest control over the flow of electrons to the plate. When the bias is increased to a point where part of the grid is cut off, the balance of the grid, because the average spacing between the wires is greater, has less control over the electron flow. In other words, it requires a greater change in grid voltage to cause a given change in plate current.

Considering the tube factors given above under varying bias conditions, we will notice that, as the bias increases, the transconductance decreases. Transconductance is the ratio of the increments of change of plate current to bias voltage. Therefore, transconductance is an indication of stage gain, since stage gain, M, is equal (approximately) to transconductance, gm, times the load resistance, R(Load); (M=gm RL). When the entire grid has been cut off, the transconductance becomes zero,



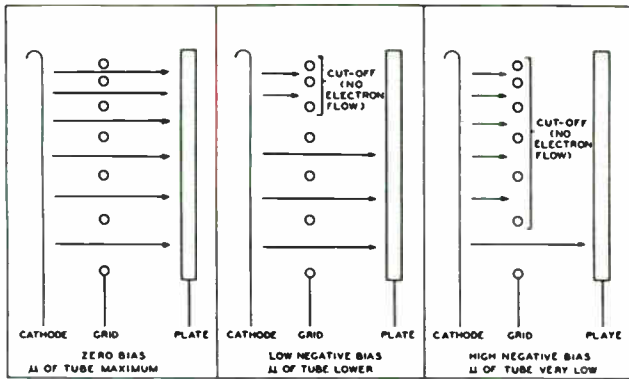


FIGURE 4

since no plate current flows and  $gm = \frac{di(\text{plate})}{de(\text{grid})}$  Going back to the calculation of stage gain,  $M=0$  when  $gm=0$ .

**INPUT "REFLECTS" LOAD**

The character of the input impedance of a tube is determined by the character of the output (load) impedance of the tube. When the load impedance of the tube is an inductance or a capacity, the input impedance will be equivalent to that of a capacitance and a resistance in parallel from grid to cathode. When the load impedance is a resistance, the input impedance is a capacity.

In the case of the scratch eliminator, the load impedance is a resistance.

**MILLER EFFECT USED**

The "Miller Effect", determined by a Mr. J. M. Miller in 1919, is that the input capacity (between grid and cathode) of a tube is not equal to just the internal (or inter-electrode) capacity between grid and cathode. It was found that the input capacity is equal to the grid-cathode capacity plus the stage gain times the grid-plate capacity. This is shown in the equation:

$$C_{\text{input}} = C(\text{grid-cathode}) + (M+1)C(\text{grid-plate})$$

Thus, by varying the value of the stage gain we have an effective means of varying the value of the shunt capacitance across the phono input as shown in Figure 5. This value of shunt capacitance will, under conditions of strong high-frequency input, approach the value of the grid-

cathode inter-electrode capacity which at audio frequencies has no appreciable effect; while with no high-frequency input the shunting effect is sufficient to by-pass all scratch, leaving the reproduced music free of noise.

**SERVICING THE PHILCO SCRATCH ELIMINATOR**

The following chart will be found helpful in testing and repairing the scratch eliminator. Included with the trouble-shooting chart is a base view identifying the parts replacement. The symbolization is correlated with the schematic shown in Figure 2.

**SCRATCH-ELIMINATOR TESTS**

Set the tone control fully counterclockwise. Turn the band (wafer) switch to the phono position. For all steps except 1(b), set the volume control to maximum; for this step, adjust the volume control as directed in the chart.

Turn the scratch eliminator on or off as indicated in the chart. (The scratch eliminator is on when the two-position switch is turned clockwise.)

Connect an output meter across the *primary* of the output transformer.

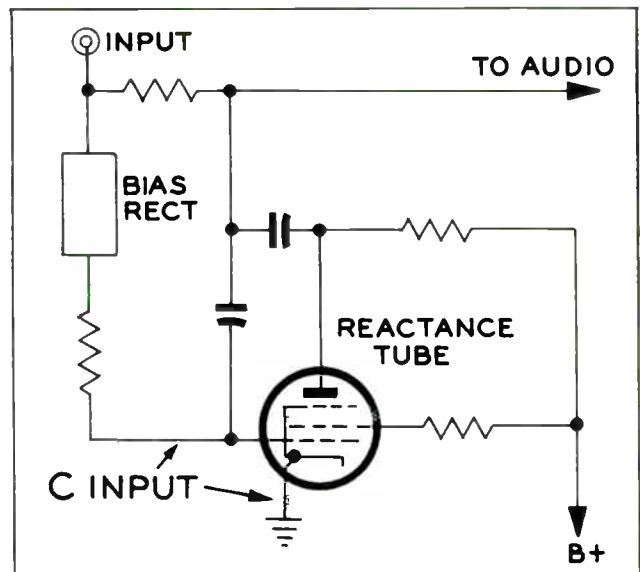
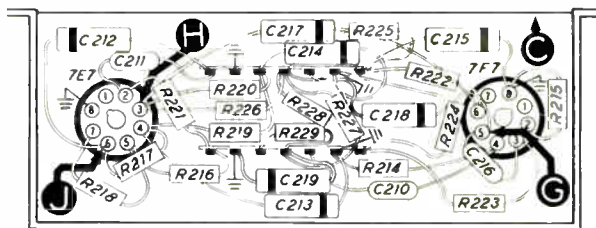


FIGURE 5

**IMPORTANT!** For all steps except step 4, use the 0—10-volt output meter range; for step 4 only, use the 0—50-volt range. If the proper ranges are not used, erroneous readings will result.

Connect the ground lead of an audio signal generator to the chassis, test point C, and connect the output lead through a .1-mf. condenser to the test points indicated in the chart. Set the generator for 5000 cycles. Adjust the generator output as directed in the chart.

**NOTE:** For steps 2, 3, and 4, connect the positive



lead of a 20,000-ohms-per-volt, d-c voltmeter to the chassis, test point C; connect the prod end of the negative lead through a 100,000-ohm isolating resistor to the "VOLTMETER" test points indicated in the chart.

STEP	TEST POINT	SIG. GEN. OUTPUT	VOLT-METER	SPECIAL INSTRUCTIONS	POSSIBLE CAUSE OF ABNORMAL INDICATION
1(a)	F	Adjust for 10v output-meter reading, with scratch-eliminator off.		Turn scratch eliminator on; output voltage should drop to 6.5v (approx.).	Trouble in scratch-eliminator circuits. Isolate by the following tests.
1(b)	F	Same as for 1(a).		Reduce volume control to obtain output-meter reading of 1v. Increase generator output for output-meter reading of 10v. Turn scratch eliminator on; output voltage should not drop below 8.8v (approx.).	
2	G	See SPECIAL INSTRUCTIONS.	H	With scratch eliminator on, increase generator output for voltmeter reading of 8.8v, negative; failure to obtain this value indicates trouble.	Defective: 7F7, 7E7 (diode section), WS-3(R). Open R224, R222, R226, R228, C217, S200.
3	G	Same setting which produced 8.8v reading in step 2, with scratch eliminator on.	J	With scratch eliminator on, voltage at point J should be 2v, negative.	Open: R220, R219, R217. Shorted: C213, C214, C212.
4	F	Same as step 2.	H	With scratch eliminator on, voltage at point H should be approx. 28v, negative.	Defective: 7F7. Open C210, C216, R214, R215, R223. Shorted or leaky: C216.
5	F	Adjust for 10v output-meter reading, with scratch eliminator off.		Turn scratch eliminator on; output voltage should drop to 6.5v (approx.).	Defective: 7E7 (pentode section). Open: R221, R216, R218, C211, C212. Shorted: C211, C212.

# PHILCO



# SERVICE

## *New Product News*

### HOME RADIO

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It is not a coincidence that you are missing two copies of New Product News for 1951. We have been working on information which we feel is so important that we have compiled these two missing months into this bulletin which, we are sure, you will find very valuable to have with your reference library.

A few months ago, we had returned to us one of our "Mystery Control" radios that we made before the war. The customer arbitrarily shipped the radio to us because he said none of his local radio repairmen knew anything about the set, and he could not find anyone that could service it. We were amazed to find upon checking his statement that this was true, and we also found that in checking with various Philco Distributors that experience on this model was decidedly lacking among a good many radio servicemen. We, therefore, felt it was very important to give you all the information possible on the models that we made prior to the war.

The reason for this is that first, a customer who bought this radio had made quite an investment, and, therefore, should be in a position to obtain service on this instrument as long as he continued to use it; second, we felt that this is one of the finest radios that was ever made, and we know that very few people who ever bought one have disposed of it so that many of these radios are still gracing the fine homes of America; third, there are no remote control radios being manufactured at the present time and these sets, therefore, provide a service which a customer cannot presently replace.

The operation of the remote control set is very simple. There are two components — one, the wireless remote control unit which is basically an oscillator that is used as a selector and the receiver which translates these impulses received from the transmitter into motion. This oscillator emits pulses of signal at a given frequency which triggers a thyratron tube in the radio proper thus putting into operation motors which regulate the volume control, the selection of stations or will turn off the radio. In the radio, the impulses operate the motors by means of what we call a stepper unit. With each impulse received, the stepper unit advances an armature one point — each point being a particular operation in the receiver. At the end of the complete cycle or number of points stepped up, the remote control returns to zero position.

Complete specifications for the Model 40-205 and 40-216 are listed below along with Schematics, Adjustment Procedure, Production Changes and other pertinent information for these two models. There were five other "Mystery Control" sets — Model 39-55, 39-116, 40-215, 40-217 and 41-316. Technically, they were quite similar as far as information on the remote control equipment is concerned.

The parts list gives the number of the stepper unit as a replacement part. It is no longer available, but we have a repair exchange plan thru your Philco Distributor at a reasonable price where service on this part is required.

## WIRELESS REMOTE CONTROL

### SPECIFICATIONS

#### MODEL 40-205

*Type Circuit:* Model 40-205, code 121, is a 12-tube wireless remote control and dial tuned receiver employing a superheterodyne circuit for reception of standard broadcast stations. Eight broadcast stations can be automatically tuned in from the remote control unit. The wireless remote control unit also increases and decreases volume and turns off the set without any connections between the receiver and the control unit.

#### MODEL 40-216

*Type Circuit:* Model 40-216, code 121, is a 14-tube wireless remote control and dial tuned receiver employing a superheterodyne circuit with three tuning ranges for reception of standard and short wave broadcast stations. Eight broadcast stations can be automatically tuned in from the remote control unit. The wireless remote control unit also increases and decreases volume and turns off the set without any connections between

**SPECIFICATIONS—(Cont'd.)**

**MODEL 40-205**

*Philco Built-In Super Aerial System:* A new type aerial system which eliminates an outside aerial is also incorporated in this model. Included in the built-in super aerial system is a statically shielded loop for broadcast band reception. The feature of the built-in broadcast band statically shielded loop is that it may be turned to the position in which it picks up a minimum amount of interference or if interference is not present, the loop may be set in the position where best reception is obtained.

In addition, other features of design are automatic volume control, continuously variable tone control, base compensation, degenerated push-pull pentode audio output.

*Power Supply:* 115 Volts, 50 to 60 Cycles, A. C.

*Power Consumption:* 180 watts.

*Tuning Ranges:* 540 to 1600 K. C.

*I. F. Frequency:* 470 K. C.

*Philco Tubes Used:* Receiver—7C7, F. R. Amplifier; 6J8G, First Detector Oscillator; 78, I. F. Amplifier; 6Q7G, Second Detector A. V. C. and First Audio; two (2) 42 Audio Output, and one 80 Rectifier.

Wireless Remote Control Amplifier — 78, First Control Amplifier; 6J7G, Second Control Amplifier, A. V. C.; 6ZY5G, A. V. C. and a 2A4G Thyatron Rectifier.

Wireless Remote Control Unit — One type 30.

*Audio Output:* 10 watts.

<i>Cabinet Dimensions:</i>	Height	Width	Depth
Console .....	38	30	15½
Wireless Remote Control ..	5½	7½	9½

*Schematic and Parts List:* The Schematic Diagram and Replacement Parts List for Model 40-205 will be found on pages 9 and 4 respectively.

**ADJUSTING WIRELESS REMOTE CONTROL FOR RECEPTION OF STATIONS**

The procedure for setting up stations on the wireless remote control receivers is similar to the procedure in setting up Philco electric automatic tuning models. The eight push buttons, however, are automatically dialed by the remote control unit instead of by pushing buttons. To set up stations on these models for best reception, a signal generator, Philco Model 7070 and a vacuum tube voltmeter Philco Model 7001 should be used. With this equipment proceed as follows:

1. Select and remove the desired eight station call letters from the large station tab card supplied with the receiver. Insert the station tabs in the apertures (windows) of the bezel. The lowest frequency station is placed in the first window on the left and the remaining station tabs in the order of increasing frequency. Turn "on" power switch.

2. Remove from the small call letter card the tab of

**MODEL 40-216**

the receiver and the control unit. A Philco wireless record player can also be set up for use with this receiver.

*Philco Built-In Super Aerial System:* A new type aerial system which eliminates an outside aerial is also incorporated in this model. Included in the built-in super aerial system is a statically shielded loop for broadcast band reception and a short wave receiving loop. The feature of the built-in broadcast band statically shielded loop is that it may be turned to the position in which it picks up a minimum amount of interference or if interference is not present, the loop may be set in the position where best reception is obtained.

In addition other features of design are automatic volume control, continuously variable tone control, base compensation, degenerated push-pull pentode audio output. Outside aerial connections are also provided for remote localities where station signal strength is exceptionally weak.

*Power Supply:* 115 Volts, 50 to 60 Cycles, A. C.

*Power Consumption:* 190 watts.

*Tuning Ranges:* 540 to 1600 K.C., 1.6 to 4.5 M.C., 6.0 to 18.0 M.C.

*I. F. Frequency:* 470 K. C.

*Philco Tubes Used:* Receiver — 6J7G, R. F. Amplifier; 6A8G, Converter; 78, I. F. Amplifier; 6Q7G, Second Detector, A. V. C. and First Audio; 37, Phase Inverter; two 42 Audio Output, and one 80, Rectifier.

Wireless Remote Control Amplifier — 78, First Control Amplifier; 6J7G, Second Control Amplifier; 6J5G, A. V. C., 6ZY5G and 2A4G, Rectifier.

Wireless Remote Control Unit — 1 type 30 tube.

*Audio Output:* 10 watts.

<i>Cabinet Dimensions:</i>	Height	Width	Depth
Console .....	36½	35	14½
Wireless Remote Control ..	5½	7½	9½

the first low frequency station. Insert the tab in the third aperture on the right side of the bezel on the remote control unit dial. Transparent tabs are also supplied to be placed over each call letter. The remaining call letter tabs are then placed in the order of increasing frequency around the bezel from right to left (counter clock-wise).

3. Insert the loud and soft tabs in the first and second windows respectively on the right hand side of the bezel.

4. Connect the negative terminal of the vacuum tube voltmeter through a 2 meg. resistor to the grid of the 78 I. F. tube. The resistor must be connected directly to the grid of the tube and the voltmeter attached to the resistor at this point. Connect the positive terminal to the chassis ground terminal.

5. Attach a loop consisting of a few turns of wire to the output terminals of the Model 7070 signal generator.



Turn the signal generator modulation control to "mod on". Turn the receiver range selector switch to "Broadcast" and manually tune in the lowest frequency station desired. This station should be between 540 and 1030 K. C. The signal generator is then tuned to the frequency of the station being received. A beat note should then be heard when the volume control is turned on.

6. Turn the range selector disc of the receiver to "remote". Dial first low frequency station on the right side of the bezel of the remote control unit.

7. Using a padding screw driver, adjust the first 540 to 1030 K. C. "Osc" padder (bottom row of holes) at the left rear of the chassis, until the station identified by the modulated signal of the generator is tuned in to maximum on the vacuum tube voltmeter. Next adjust the first 540 to 1030 K. C. "Ant" padder (top row of holes) for maximum indication on the voltmeter.

8. Turn the signal generator off the station frequency and readjust the "Ant" and "Osc" padders with the station signal for maximum reading on the voltmeter. This should be done with the volume control of the receiver adjusted for low volume. This procedure is repeated for each of the remaining stations to be set up. The next station to be set up should be within the frequency range of 540 to 1030 K. C. of the second set of padders. The third station is tuned in by the third set of padders and should be within a frequency range of 670 to 1160 K. C. The remaining stations are then set up in the order of increasing frequency.

**PRODUCTION CHANGES**

When operating the model 40-216 on 25 cycle power supply, the volume control motor assembly, motor condenser and wave switch link must be changed in addition to the parts shown in Service Bulletin for 25 cycle operation. Part numbers of these parts are as follows:

	115 V., 25 cyc.
Volume Control Motor (80)	35-1152
Motor Condenser (88)	30-2377
Wave Switch Link	56-1295

In addition a resistor Part No. 33-3368 is connected in series with the low side of the Choke Coil (96) in the plate of the 2A4G tube and the Stepper Unit Coil (81).

(See Figures 1, 2, 3 and 4 for location of parts)

**REPLACEMENT PARTS — MODEL 40-216**

(See Figures 1, 2, 3 and 4 for location of parts)

SCHE. No.	DESCRIPTION	PART No.
1	Loop Assy. (Broadcast)	38-9882
1A	Resistor (10,000 ohms, 1/2 watt)	33-310339
1B	Mica Cond. (250 mmfd.)	61-0033
2	Loop Assy. (Short Wave)	38-9933
2A	Compensator	31-6326
3	Ant. Series Trans. (Broadcast)	32-3291
3X	Compensator	31-6212
4	Ant. Series Trans. (Short Wave)	32-3293
5	Ant. Trans. (Police Shunt)	32-3292
6	Mica Cond. (250 mmfd.)	61-0033
7	Resistor (2.0 meg., 1/2 watt)	33-520339
8	Tubular Cond. (.05 mfd.)	30-4123
9	Resistor (150,000 ohms, 1/2 watt)	33-415339
10	Resistor (12,000 ohms, 1/2 watt)	33-312339
11	Tubular Cond. (.05 mfd.)	30-4123
12	R. F. Trans. (Broadcast, Pushbutton and Police)	32-3230

SCHE. No.	DESCRIPTION	PART No.
12X	Mica Condenser (35 mmfd.)	30-1141
13	R. F. Trans. (Broadcast Manual)	32-3227
13X	Compensator	31-6212
14	R. F. Trans. (Short Wave)	32-3046
14X	Mica Cond. (5 mmfd.)	30-1097
15	Tubular Cond. (.1 mfd.)	30-4455
16	Tubular Cond. (.05 mfd.)	30-4519
17	Tubular Cond. (.1 mfd.)	30-4455
18	Resistor (51,000 ohms, 1/2 watt)	33-351339
19	Oscillator Trans. (Broadcast)	32-3231
20	Oscillator Trans. (Police)	32-3294
21	Oscillator Trans. (Short Wave)	32-3051
22	Compensator (3 section, oscillator)	31-6266
23	Compensator (Broadcast, Low Frequency)	31-6230
24	Tracking Cond. (1230 mmfd.)	31-6262
25	Tracking Cond. (3425 mmfd.)	31-6263
26	Mica Cond. (250 mmfd.)	61-0033
27	Resistor (32,000 ohms, 1/2 watt)	33-332339
28	Resistor (10,000 ohms, 1/2 watt)	33-310339
29	Resistor (18,000 ohms, 1/2 watt)	33-318339
30	Resistor (5,000 ohms, 2 watt)	33-250539
31	Electrolytic Cond. (4 mfd., 250 V.)	30-2334
32	Mica Cond. (250 mmfd.)	61-0033
33	1st I. F. Trans. Assy.	32-3089
34	Tubular Cond. (.01 mfd.)	30-4572
35	Resistor (1.0 meg., 1/2 watt)	33-510339
36	Resistor (330,000 ohms, 1/2 watt)	33-433339
37	Resistor (330,000 ohms, 1/2 watt)	33-433339
38	2nd I. F. Trans. Assy.	32-2645
39	Mica Cond. (110 mmfd.)	30-1031
39X	Tubular Cond. (.004 mfd.)	30-4578
40	Tubular Cond. (.01 mfd.)	30-4479
41	Mica Cond. (50 mmfd.)	30-1029
42	Volume Control	33-5300
43	Resistor (70,000 ohms, 1/2 watt)	33-370339
44	Tubular Cond. (.004 mfd.)	30-4334
45	Resistor (2.0 meg., 1/2 watt)	33-520339
46	Tubular Cond. (.015 mfd.)	30-4529
47	Resistor (1.0 meg., 1/2 watt)	33-510339
48	Tubular Cond., (.1 mfd.)	30-4527
49	Resistor (99,000 ohms, 1/2 watt)	33-399339
50	Tubular Cond. (.01 mfd.)	30-4169
51	Resistor (490,000 ohms, 1/2 watt)	33-449339
52	Resistor (5,000 ohms, 1/2 watt)	33-250339
53	Resistor (45,000 ohms, 1/2 watt)	33-345339
54	Tubular Cond. (.02 mfd.)	30-4481
55	Tone Control (3.0 meg.)	33-5287
56	Tubular Cond. (.01 mfd.)	30-4572
57	Tubular Cond. (.01 mfd.)	30-4572
58	Resistor (51,000 ohms, 1/2 watt)	33-351339
59	Resistor (490,000 ohms, 1/2 watt)	33-449339
60	Resistor (490,000 ohms, 1/2 watt)	33-449339
61	Resistor (240,000 ohms, 1/2 watt)	33-424339
62	Tubular Cond. (.1 mfd.)	30-4499
63	Tubular Cond. (.01 mfd.)	30-4501
64	Output Trans.	32-7996
65	Cone and Voice Coil Assy.	
	(Spkr. Part No. 36-1450-2)	36-4089
	(Spkr. Part No. 36-1450-4)	36-4111
66	Tubular Cond. (.01 mfd.)	30-4501
67	Resistor (3,000 ohms, 1/2 watt)	33-230339
68	Resistor (1.0 meg., 1/2 watt)	33-510339
69	Electrolytic Cond. (25 mfd., 300 V.)	30-2360
70	Electrolytic Cond. (18 mfd., 475 V.)	30-2200
71	Field Coil (Replace Spkr. Part No. 36-1450)	
72	Resistor (Wirewound, Bias)	33-3364
73	Power Trans. (115 V., 50-60 cycles)	32-8001
	Power Trans. (115 V., 25-40 cycles)	32-8017
74	Bypass Cond. (.05 mfd., 110 V. Plug)	30-4576
75	Pilot Lamp (Bullseye)	34-2210
76	Pilot Lamp Resistor (16 ohms)	33-016339
77	Pilot Lamps (Dial)	34-2064
78	Filament Trans. (115 V., 50-60 cycles)	32-7993
	Filament Trans. (115 V., 25-40 cycles)	32-8016
78X	Choke Coil	32-1281
79	Motor Trans. (115 V., 50-60 cycles)	32-7990
	Motor Trans. (115 V., 25-40 cycles)	32-8015

SCHE. No.	DESCRIPTION	PART No.
80	Motor Assy. (Volume Control)	35-1151
81	Stepper Unit (Complete)	38-9689
81X	Rotary Switch (Stepper Unit)	42-1468
82	B. C. Resistor (Wirewound, 10 ohms)	33-3363
83	Pilot Lamp Assy. (Station Indicator)	34-2064
84	Switch (Volume Control-Motor)	42-1469
85	Resistor (150 ohms, 1/2 watt)	33-115339
86	Tubular Cond. (.1 mfd.)	30-4499
87	Tubular Cond. (.1 mfd.)	30-4499
88	Electrolytic Cond. (30 mfd., 30 V.)	30-2361
89	Padder Strip (Pushbuttons)	31-6264
89A	Compensator No. 1	
89B	Compensator No. 2, 540-1030 K.C., Part of 89	
89C	Compensator No. 3	
89D	Compensator No. 4, 670-1160 K.C., Part of 89	
89E	Compensator No. 5	
89F	Compensator No. 6, 900-1470 K.C., Part of 89	
89G	Compensator No. 7	
89H	Compensator No. 8, 1100-1600 K.C., Part of 89	
90	Elec. Pushbutton Trans. Assy. (8 Trans.)	32-3091
90A	Osc. Trans. No. 1	
90B	Osc. Trans. No. 2, 540-1030 K.C.	32-3042
90C	Osc. Trans. No. 3	
90D	Osc. Trans. No. 4, 670-1160 K.C.	32-3042
90E	Osc. Trans. No. 5	
90F	Osc. Trans. No. 6, 900-1470 K.C.	32-3041
90G	Osc. Trans. No. 7	
90H	Osc. Trans. No. 8, 1100-1600 K.C.	32-3041
91	Silver Mica Cond. (370 mmfd.)	30-1110
92	Silver Mica Cond. (370 mmfd.)	30-1110
93	Bakelite Cond. (.05 mfd.)	36-15SG
94	Resistor (150 ohms)	33-3362
95	Electrolytic Cond. (16 mfd., 200 V.)	30-2356
96	Choke Coil	32-1281
97	Tubular Cond. (.05 mfd.)	30-4123
98	Tubular Cond. (.05 mfd.)	30-4123
99	Tubular Cond. (.1 mfd.)	30-4499
100	Tubular Cond. (.5 mfd.)	30-4551
101	Resistor (4000 ohms, 1/2 watt)	33-240339
102	Resistor (51,000 ohms, 1/2 watt)	33-351339
103	No. 3 Control Amp. Trans.	32-3275
104	Tubular Cond. (.02 mfd.)	30-4516
105	Resistor (750,000 ohms, 1/2 watt)	33-475339
106	Resistor (2700 ohms, 1/2 watt)	33-227339
107	Tubular Cond. (.1 mfd.)	30-4455
108	Resistor (120,000 ohms, 1/2 watt)	33-412339
109	Tubular Cond. (.05 mfd.)	30-4123
110	Resistor (99,000 ohms, 1/2 watt)	33-399339
111	Tubular Cond. (.05 mfd.)	30-4123
112	Resistor (150,000 ohms, 1/2 watt)	33-415339
112X	Tubular Cond. (.05 mfd.)	30-4123
113	Resistor (1.5 meg., 1/2 watt)	33-515339
114	Tubular Cond. (.05 mfd.)	30-4519
115	No. 2 Control Amp. Trans.	32-3087
116	Tubular Cond. (.05 mfd.)	30-4444
117	Sensitivity Control	33-5295
118	Resistor (300 ohms, 1/2 watt)	33-130339
119	No. 1 Control Amp. Trans.	32-3086
120	Silver Mica Cond. (130 mmfd.)	30-1122
121	Compensator (Secondary Inductor)	31-6268
122	Secondary Inductor (Mystery Tuning)	40-6415
123	Wave Switch	42-1537
124	Tuning Cond.	31-2417

**WIRELESS REMOTE CONTROL UNIT**

125	Primary Inductor	32-3097
126	Silver Mica Cond. (200 mmfd.)	30-1115
127	Tubular Cond. (.05 mfd.)	30-4519
128	Air Padder	31-6268
129	Resistor (500 ohms, 1/2 watt)	33-150339
130	Mystery Pack (Battery)	41-8023
131	Dial Unit (Pulser)	38-9704
132	Spark Filter Assy. (Inside of Stepper Unit)	38-9898
132A	Spark Filter Choke	32-3276
132B	Resistor (100 ohms, 1/2 watt)	33-110339
132C	Tubular Cond. (.05 mfd.)	30-4444
132D	Tubular Cond. (.05 mfd.)	30-4444

SCHE. No.	DESCRIPTION	PART No.
	Bezel	56-1509
	Bezel Gasket and Staple Assy.	38-9734
	Cabinet	1043A
	Cable (Power Supply)	L-2176
	Dial	27-5535
	Drive Cord (Tuning Cond.)	31-2315
	Drive Cord (Pointer)	31-2320
	Disc (Tuning)	27-4766
	Disc (Volume)	27-4765
	Disc (Wave Switch)	27-4767
	Disc (Tone Control)	27-4764
	Pilot Lamp Assy. (R. H. Bracket)	38-9694
	Pilot Lamp (L. H. Bracket)	38-9711
	Pilot Lamp Assy. (Station Lights)	38-9709
	Pilot Lamp Assy. (Cabinet Bullseye)	38-9712
	Pilot Light Jewel (Bullseye)	27-4777
	Socket (4 prong, type 80 tube)	27-6044
	Socket (5 prong, type 37 tube)	27-6035
	Socket (6 prong, type 42 and 78 tubes)	27-6036
	Socket (Octal, type 6J5G, 6Q7G tubes, etc.)	27-6086
	Socket (Octal, type 6J7G tube)	27-6057
	Socket (Octal, type 6A8G tubes)	27-6099
	Speaker	36-1450
	Spring (Drive Cords)	28-8913
	Tab (Television)	27-9447
	Washer (Keyed Washer Tuning Disc)	56-1029
	Washer (Spring Washer Tuning Disc)	6717

**REPLACEMENT PARTS—MODEL 40-205**

(See Figures 5, 6 and 7 for location of parts)

1	Resistor (1.0 meg., 1/2 watt)	33-510339
1X	Tubular Cond. (.05 mfd.)	30-4519
1Y	Resistor (330,000 ohms, 1/2 watt)	33-433339
2	Mica Cond. (200 mmfd.)	30-1078
2X	Tubular Cond. (.05 mfd.)	30-4123
3	R. F. Trans.	32-3282
3A	Resistor (12,000 ohms, 1/2 watt)	33-312339
4	Mica Cond. (250 mmfd.)	30-1032
5	Resistor (32,000 ohms, 1/2 watt)	33-332339
6	Oscillator Trans.	32-3278
7	Compensator	31-6230
7X	Mica Cond. (15 mmfd.)	30-1139
8	Resistor (10,000 ohms, 1/2 watts)	33-310339
9	Resistor (5,000 ohms, 2 watts)	33-250539
10	Resistor (13,000 ohms, 1 watt)	33-313439
11	Electrolytic Cond. (4 mfd., 250 v.)	30-2334
12	Tubular Cond. (.05 mfd.)	30-4123
13	1st I. F. Trans. Assy.	32-3089
14	2nd I. F. Trans. Assy.	32-2645

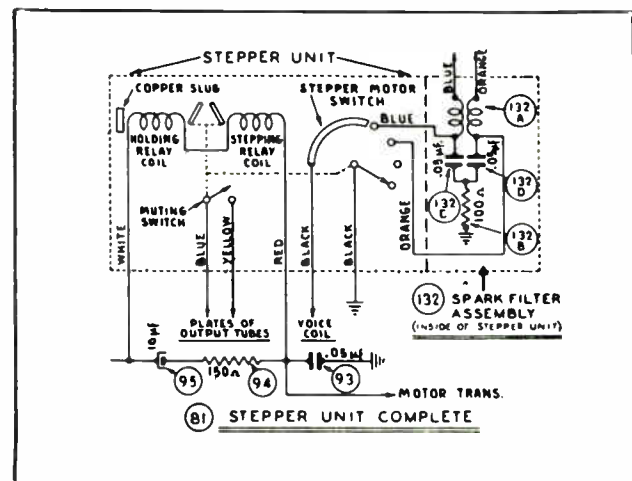


Fig. 1—Internal Wiring of Stepper Unit. Numbers Correspond to Schematic, Pages 6 & 7.

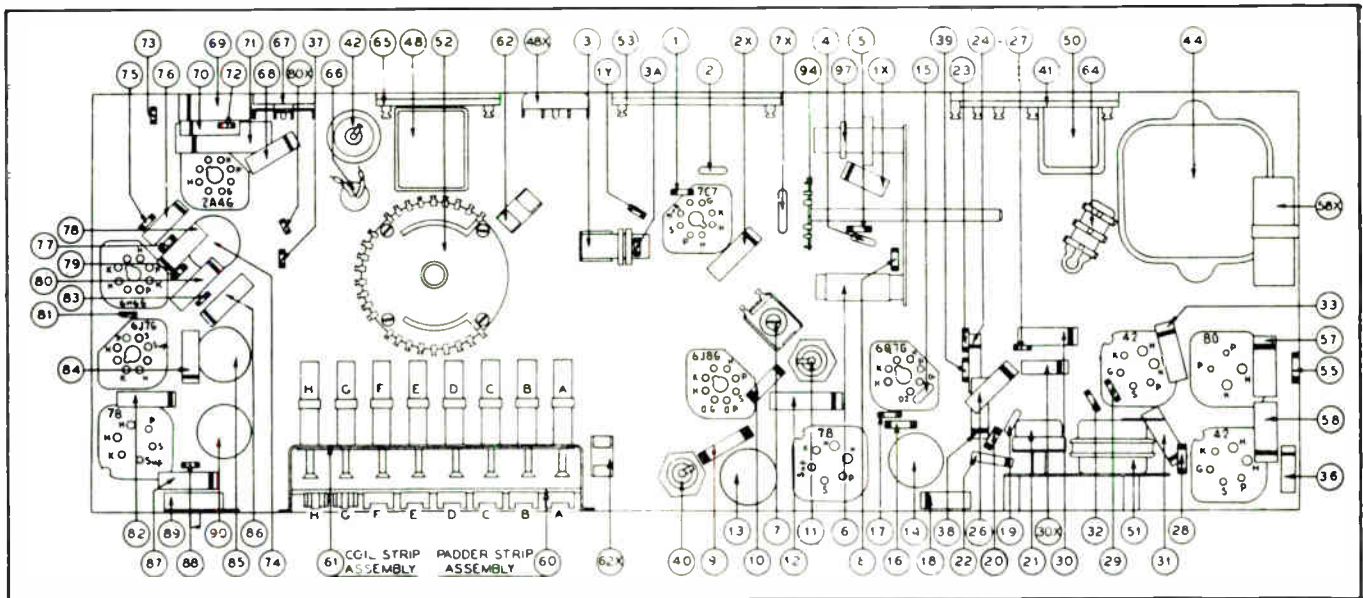


Fig. 2—Model 40-216 Part Locations, Underside of Chassis.

\* To operate this model on 220 volt, 60 cycle current, use Stepdown Transformer, Part No. 32-8035.

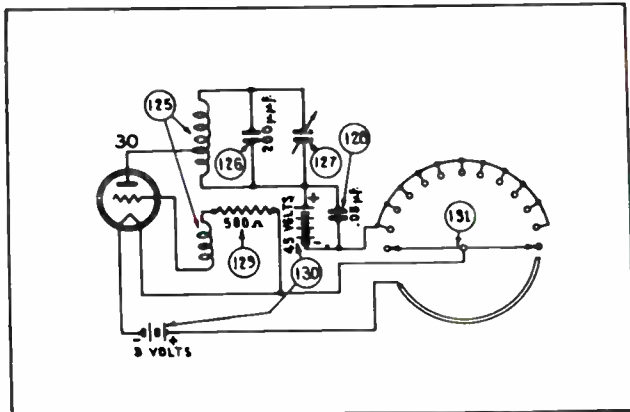


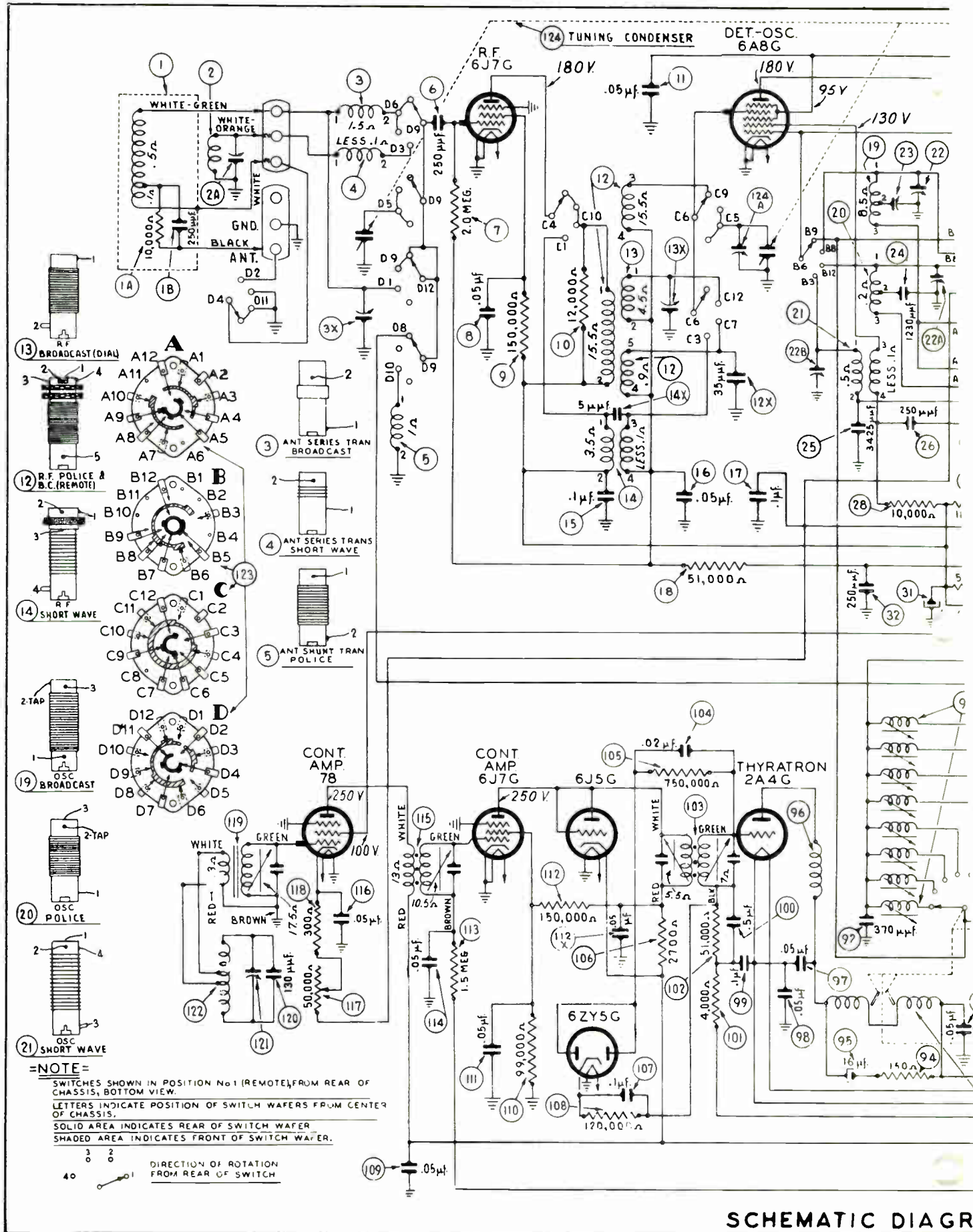
Fig. 3—Wireless Remote Control Schematic Diagram.

SCHE. No.	DESCRIPTION	PART No.
15	Mica Cond. (110 mmfd.)	30-1031
16	Resistor (2.0 meg., 1/2 watt)	33-520339
17	Resistor (1.0 meg., 1/2 watt)	33-510339
18	Tubular Cond. (.01 mfd.)	30-4479
19	Mica Cond. (50 mmfd.)	30-1029
20	Resistor (70,000 ohms, 1/2 watt)	33-370339
21	Volume Control (2.0 meg.)	33-5300
22	Tubular Cond. (.004 mfd.)	30-4334
23	Resistor (1.0 meg., 1/2 watt)	33-510339
24	Tubular Cond. (.015 mfd.)	30-4358
25	Tone Control (3.0 meg.)	33-5287
26	Tubular Cond. (.02 mfd.)	30-4481
27	Resistor (99,000 ohms, 1/2 watt)	33-399339
28	Resistor (330,000 ohms, 1/2 watt)	33-433339
29	Resistor (490,000 ohms, 1/2 watt)	33-449339
30	Tubular Cond. (.03 mfd.)	30-4517
30X	Tubular Cond. (.006 mfd.)	30-4445
31	Tubular Cond. (.01 mfd.)	30-4501
32	Resistor (3500 ohms, 1/2 watt)	33-235339
33	Tubular Cond. (.01 mfd.)	30-4501
34	Output Trans.	32-7997

SCHE. No.	DESCRIPTION	PART No.
35	Cone and Voice Coil Assy. (Spkr. Part No. 36-1450-2)	36-4089
	(Spkr. Part No. 36-1450-4)	36-4111
36	Tubular Cond. (.01 mfd.)	30-4501
37	Resistor (3000 ohms, 1/2 watt)	33-230339
38	Tubular Cond. (.1 mfd.)	30-4499
39	Resistor (1.0 meg., 1/2 watt)	33-510339
40	Electrolytic Cond. (25 mfd., 300 v.)	30-2360
41	Bias Resistor (Wirewound)	33-3361
42	Electrolytic Cond. (18 mfd., 475 v.)	30-2200
43	Field Coil (Replace Spkr. Part No. 36-1450)	
44*	Power Trans. (115 v., 50-60 cycles)	32-7999
	Power Trans. (115 v., 25-40 cycles)	32-8013
45	Condenser (.05 mfd., 115 v. Plug)	30-4576
46	Pilot Lamp (Bullseye)	34-2210
47	Pilot Lamp Resistor (16 ohms, 1 watt)	33-016431
48	Filament Trans. (115 v., 50-60 cycles)	32-7993
	Filament Trans. (115 v., 25-40 cycles)	32-8016
48X	Choke Coil	32-1281
49	Pilot Lamps (Dial)	34-2064
50	Motor Trans. (115 v., 50-60 cycles)	32-7990
	Motor Trans. (115 v., 25-40 cycles)	32-8015
51	Volume Control Motor Assy.	35-1151
52	Rotary Switch	42-1468
53	Bias Resistor (Wirewound, 10 ohms)	33-3363
54	Pilot Lamps (Station Indicator)	34-2064
55	Resistor (150 ohms, 1/2 watt)	33-115339
56	Volume Control Switch (Motor Control)	42-1469
57	Tubular Cond. (.1 mfd.)	30-4499
58	Tubular Cond. (.1 mfd.)	30-4499
58X	Electrolytic Cond. (30 mfd., 30 v.)	30-2361
59	Stepper Unit Complete	38-9689
60	Compensator Strip (Pushbutton)	31-6264
60A	Compensator No. 1	
60B	Compensator No. 2	
	540-1030 K.C., Part of 60	
60C	Compensator No. 3	
60D	Compensator No. 4	
	670-1160 K.C., Part of 60	
60E	Compensator No. 5	
60F	Compensator No. 6	
	900-1470 K.C., Part of 60	
60G	Compensator No. 7	

(Continued on Page Eight)



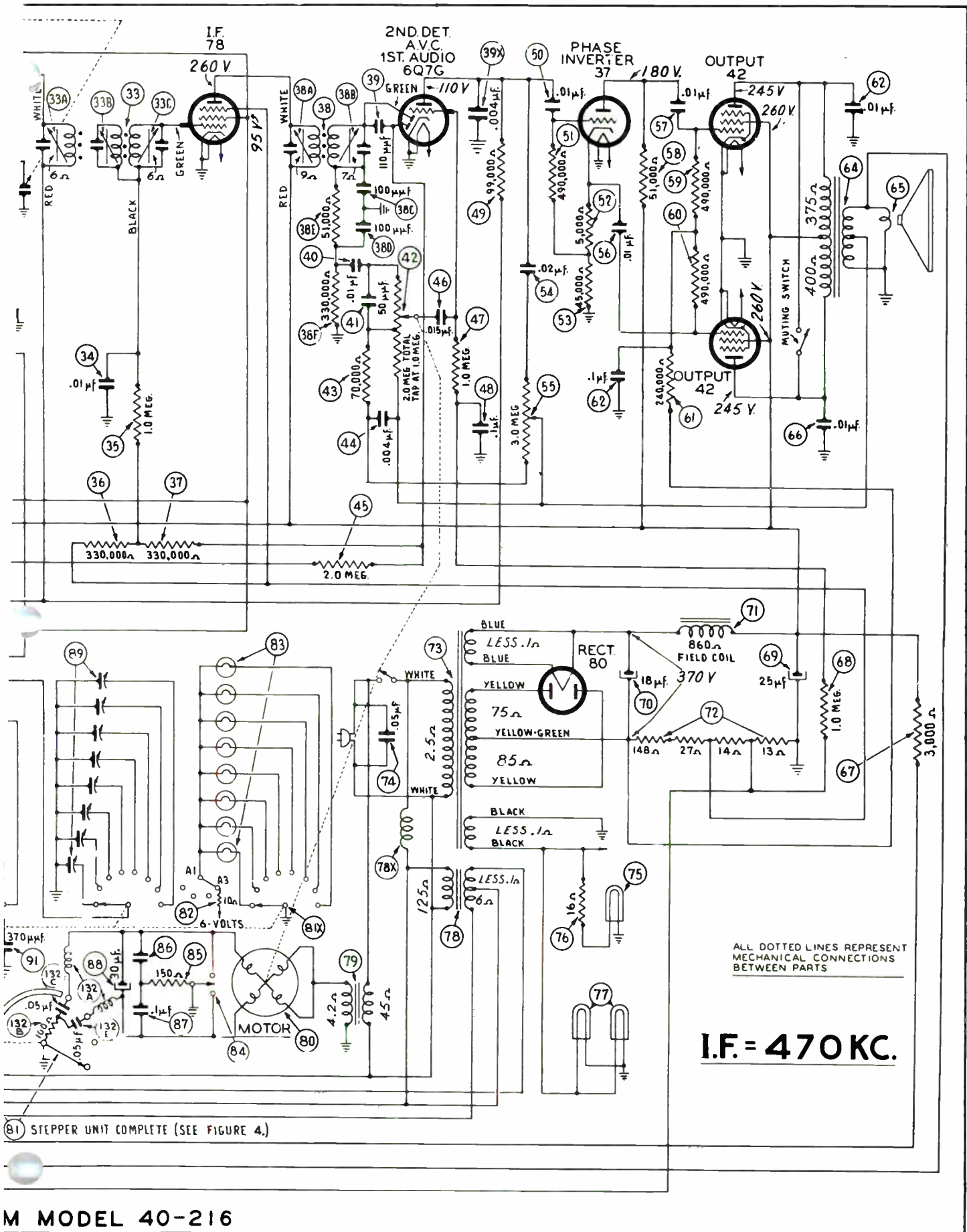


**SCHEMATIC DIAGR**

**FIG. 4—MODEL 40-216**

**VOLTAGES MEASURED FOR SOCKET CONTACTS TO CHASSIS, LINE VOLTAGE 115 VOLT A.**





**M MODEL 40-216**

**SCHEMATIC DIAGRAM**  
**VOLUME MINIMUM, RANGE SELECTOR (BROADCAST), NO STATION BEING RECEIVED.**

**REPLACEMENT PARTS—MODEL 40-205 (Cont'd.)**

SCH. No.	DESCRIPTION	PART No.
60H	Compensator No. 8 1170-1600 K.C., Part of 60	
61	Coil Assy. (Pushbuttons)	
61A	Oscillator Coil No. 1	
61B	Oscillator Coil No. 2 540-1030 K.C.	32-3042
61C	Oscillator Coil No. 3	
61D	Oscillator Coil No. 4 670-1160 K.C.	32-3042
61E	Oscillator Coil No. 5	
61F	Oscillator Coil No. 6 900-1470 K.C.	32-3041
61G	Oscillator Coil No. 7	
61H	Oscillator Coil No. 8 1170-1600 K.C.	32-3041
62	Silver Mica Cond. (370 mmfd.)	30-1110
62X	Silver Mica Cond. (370 mmfd.)	30-1110
63	Spark Filter Assy.	
63A	Spark Filter Choke	32-3276
63B	Resistor (100 ohms, 1/2 watt)	33-110339
63C	Tubular Cond. (.05 mfd.)	30-4444
63D	Tubular Cond. (.05 mfd.)	30-4444
64	Bakelite Cond. (.05 mfd.)	3615-SG
65	Resistor (150 ohms, Wirewound)	33-3362
66	Electrolytic Cond. (16 mfd., 150 v.)	30-2387
67	Choke Coil	32-1281
68	Tubular Cond. (.05 mfd.)	30-4123
69	Tubular Cond. (.05 mfd.)	30-4123
70	Tubular Cond. (.1 mfd.)	30-4499
71	Tubular Cond. (.5 mfd.)	30-4551
72	Resistor (51,000 ohms, 1/2 watt)	33-351339
73	Resistor (4,000 ohms, 1/2 watt)	33-240339
74	No. 3 Control Amp. Coil	32-3275
75	Resistor (750,000 ohms, 1/2 watt)	33-475339
76	Tubular Cond. (.02 mfd.)	30-4516
77	Resistor (120,000 ohms, 1/2 watt)	33-412339
78	Tubular Cond. (.1 mfd.)	30-4455
79	Resistor (150,000 ohms, 1/2 watt)	33-415339
80	Tubular Cond. (.05 mfd.)	30-4123
80X	Resistor (2700 ohms, 1/2 watt)	33-227339
81	Resistor (99,000 ohms, 1/2 watt)	33-399339
82	Tubular Cond. (.05 mfd.)	30-4123
83	Resistor (1.5 meg., 1/2 watt)	33-515339
84	Tubular Cond. (.05 mfd.)	30-4519
85	No. 2 Control Amp. Coil	32-3087
86	Tubular Cond. (.05 mfd.)	30-4123
87	Tubular Cond. (.05 mfd.)	30-4444
88	Resistor (300 ohms, 1/2 watt)	33-130339
89	Sensitivity Control (50,000 ohms)	33-5295
90	No. 1 Control Amp. Coil	32-3086
91	Silver Mica Cond. (155 mfd.)	30-1121
92	Air Padder (Secondary Inductor)	31-6268
93	Secondary Inductor	40-6414
94	Wave Switch	42-1454
95	Tuning Cond.	31-2311
96	Loop Assembly	38-9882
96A	Mica Cond. (250 mmfd.)	61-0033
96B	Resistor (10,000 ohms, 1/2 watt)	33-310339
97	Ant. Series Trans.	32-3226

**MISCELLANEOUS PARTS**

Bezel	38-9931
Bezel Gasket and Staple Assy.	38-9734
Bezel Screws	W-1834
Cable and Plug (Power Supply)	L-3176
Cabinet	10402A
Drive Cord (Tuning Cond.)	31-2350
Drive Cord (Pointer)	31-2320
Dial	27-5537
Disc (Tuning)	27-4766
Disc (Tone Control)	27-4764
Disc (Volume Control)	27-4765
Disc (Wave Switch)	27-4767
Pilot Lamp Assy. (R.H. Bracket)	38-9694
Pilot Lamp Assy. (L.H. Bracket)	38-9711

SCH. No.	DESCRIPTION	PART No.
	Pilot Lamp Assy. (Station Lights)	38-9709
	Pilot Lamp Assy. (Cabinet Bullseye)	38-9712
	Pilot Lamp Jewel (Bullseye)	27-4777
	Socket (4 prong, type 80 tube)	27-6044
	Socket (6 prong, type 42 and 78 tubes)	27-6036
	Socket (6 prong, Octal, 6J5G, 6Q7G tubes, etc.)	27-6086
	Socket (7 prong, Octal, 6J7G tubes)	27-6057
	Socket (7 prong, Octal, 6A8G tube)	27-6099
	Speaker	36-1450
	Spring (Drive Cords)	28-8913
	Tab (Television)	27-9447
	Washer (Keyed Washer, Tuning Disc)	56-1029
	Washer (Spring Washer, Tuning Disc)	6717

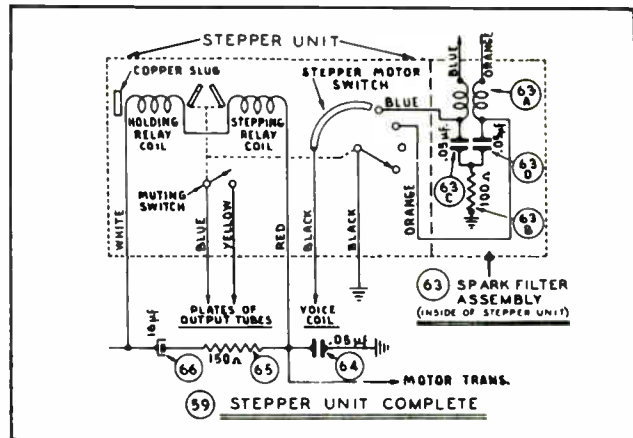


Fig. 5—Internal Wiring of Stepper Unit. Numbers Correspond to Schematic, Page 9.

**ALIGNING OF COMPENSATING CONDENSERS  
MODELS 40-205, 40-216**

**EQUIPMENT REQUIRED**

(1) *Signal Generator.* In order to properly adjust this receiver a calibrated signal generator such as Philco Model 7070 is required. This signal generator covers a frequency range of 100 K.C. to 110 M.C.

(2) *Indicating Device.* To obtain maximum signal strength and accurate adjustment of the padders a vacuum tube voltmeter and circuit tester such as Philco Model 7001 is recommended. This tester also contains an audio output meter which may be used as an indicating device.

(3) *Aligning Tool.* Fiber handle screw driver Philco Part No. 45-2610.

**CONNECTING ALIGNING INSTRUMENTS**

**VACUUM TUBE VOLTMETER:** To use the vacuum tube voltmeter as an aligning indicator it should be connected to the A.V.C. circuit as follows:

1. Connect the negative (—) terminal of the voltmeter through a 2 meg. resistor to the converter grid (6J8G) Model 205; (6A8G) Model 216. The resistor must be connected directly to the grid of the tube and the voltmeter wire attached to the resistor.

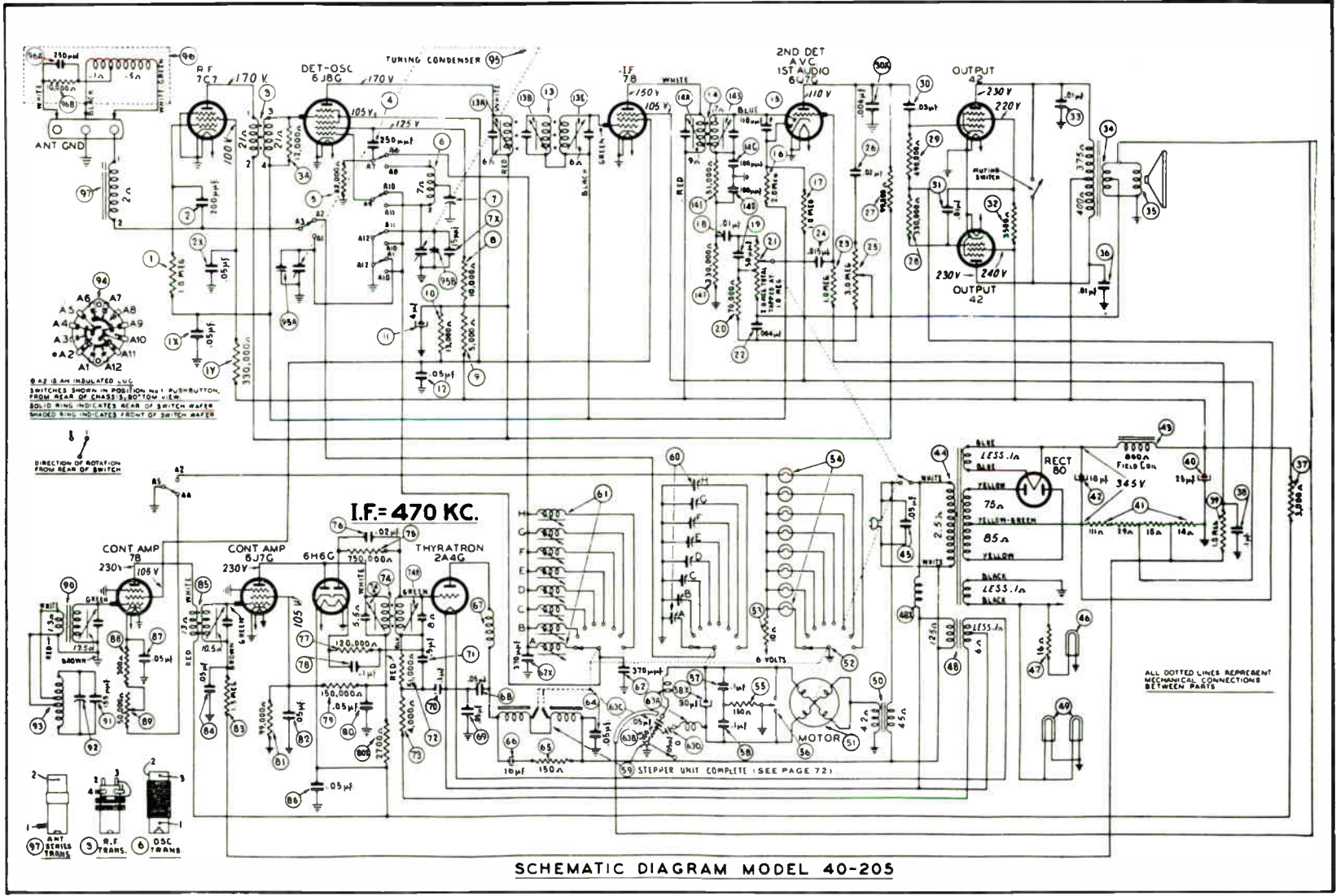


FIG. 6—Voltages measured for socket contacts to chassis, line voltage 115 volt A.C., volume minimum, range selector (broadcast), no station being received.



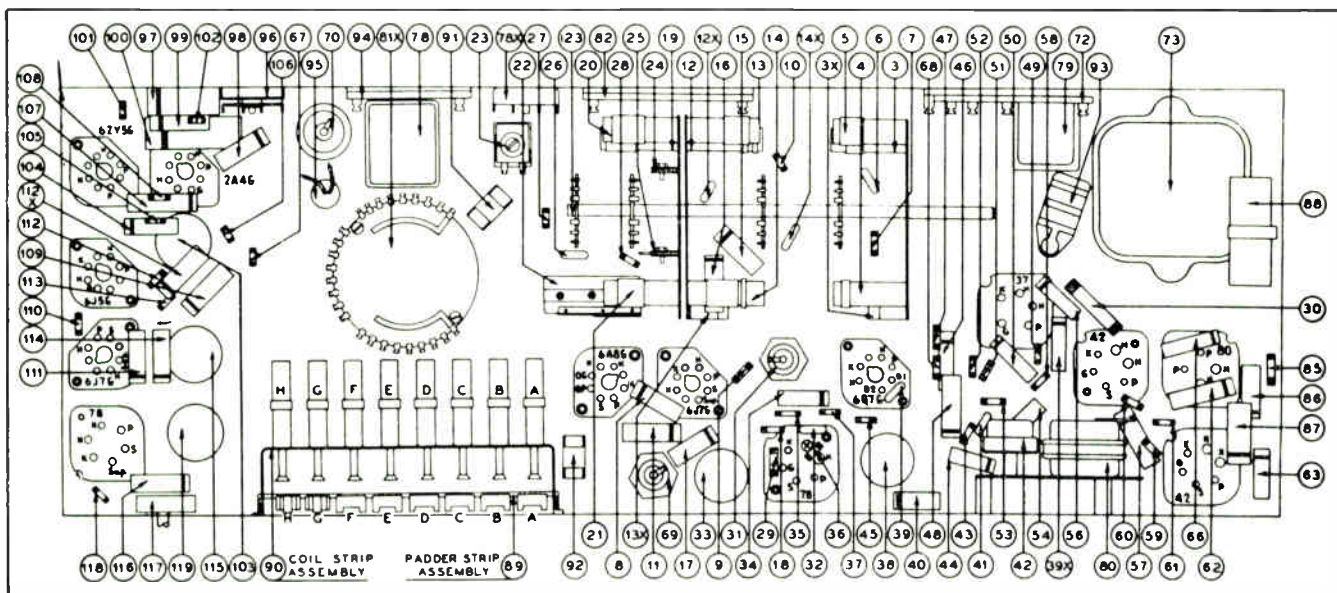


Fig. 7—Model 40-205. Locations of Parts, Underside of Chassis.

2. Connect the positive (+) terminal to the chassis ground terminal.

**AUDIO OUTPUT METER:** If this type of meter is used as an aligning indicator, it should be connected to the plate terminals of the 42 tubes. Adjust the meter for the 0 to 30 volt A.C. scale.

After connecting the aligning meter, adjust the compensators in the order as shown in the tabulation below. Locations of the compensators are shown on page 12. If the output meter pointer goes off scale when adjusting the compensators, reduce the strength of the signal from the generator.

**SIGNAL GENERATOR:** When adjusting the I.F. padders, the high side of the signal generator is connected through a .1 mfd. condenser to terminal No. 1 of the loop terminal panel at the rear of the chassis. The ground or low side of the signal generator is connected to the chassis of the receiver.

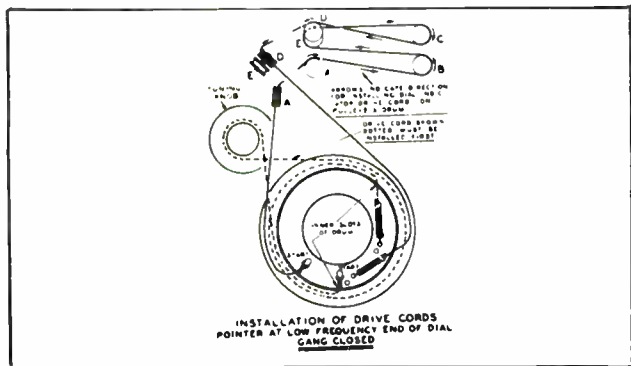


Fig. 8—Dial Pointer and Cable Arrangement, Models 40-205, 40-216.

When aligning the R.F. padders a loop antenna is made from a few turns of wire and connected to the signal generator output terminals; the loop is then placed two or three feet from the loop in the cabinet. Do not remove the receiver loop from the cabinet. It is necessary when adjusting the padders, that the receiver be left in the cabinet.

**Notes Below Refer to Tables on Next Page**

**NOTE A — Dial Calibration:** In order to adjust the receiver correctly the dial must be aligned to track properly with the tuning condenser. To adjust the dial, proceed as follows: With the tuning condenser closed (maximum capacity), set the dial pointer on the extreme left index line at the low frequency end of the broadcast scale. The arrangement of the drive cable and dial pointer is shown in Fig. 8.

**NOTE B —** See page 12 for Remote Control Amplifier adjustments.

**NOTE C —** If two peaks (signals) are observed on the aligning meter when adjusting the oscillator padder No. 22A tune the padder to the second peak from the maximum capacity position (screw all the way in).

**NOTE D —** If two peaks (signals) are observed on the aligning meter when adjusting the R.F. and loop padders 124A and 2A, tune the padders to the first peak signal from the maximum capacity position (screw all the way in). When adjusting the padders to this first peak roll the tuning condenser (rock) slightly back and forth to obtain the maximum readings on the aligning meter.



**RECEIVER CIRCUIT ADJUSTMENTS — MODEL 40-216**

Operation	SIGNAL GENERATOR		RECEIVER			SPECIAL INSTRUCTIONS
	Output Connections to Receiver	Dial Setting	Dial Setting	Control Setting	Adjust Compensators	
1	78 I. F. Grid	470 K.C.	580 K.C.	Vol. Max. Range Switch "Brdest"	38A, 38B	Turn out 33B Full
2	6A8G Det. Osc. Grid	470 K.C.	580 K.C.	Vol. Max. Range Switch "Brdest"	33C, 33A, 33B	Note A
3	Use Loop on Generator	18.0 M.C.	18.0 M.C.	Vol. Max. Range Switch "Short Wave"	22B, 124A, 2A	Note C, Note D
4	Use Loop on Generator	1500 K.C.	1500 K.C.	Vol. Max. Range Switch "Brdest"	22, 13X, 3X	Note A
5	Use Loop on Generator	580 K.C.	580 K.C.	Vol. Max. Range Switch "Brdest"	23	Roll Gang
6	Use Loop on Generator	1550 K.C.	1550 K.C.	Vol. Max. Range Switch "Brdest"	22	
7	Use Loop on Generator	3.5 M.C.	3.5 M.C.	Vol. Max. Range Switch "Police"	22A	Note B

**RECEIVER CIRCUIT ADJUSTMENTS — MODEL 40-205**

Operation	SIGNAL GENERATOR		RECEIVER			SPECIAL INSTRUCTIONS
	Output Connections to Receiver	Dial Setting	Dial Setting	Control Setting	Adjust Compensators	
1	78 Grid	470 K.C.	580 K.C.	Vol. Max. Range Switch "Brdest"	14A, 14B	Turn out 13B Full
2	6J8G Grid	470 K.C.	580 K.C.	Vol. Max. Range Switch "Brdest"	13A, 13C, 13B, 14A	
3	Loop	1500 K.C.	1500 K.C.	Vol. Max. Range Switch "Brdest"	95B, 95A	Note A
4	Loop	580 K.C.	580 K.C.	Vol. Max. Range Switch "Brdest"	7	Roll Gang when Adjusting Padder
5	Loop	1500 K.C.	1500 K.C.	Vol. Max. Range Switch "Brdest"	95B, 95A	Note B

**ADJUSTMENT OF WIRELESS REMOTE CONTROL CIRCUITS**

**MODELS 40-205, 40-216**

**ADJUSTING CONTROL FREQUENCY AMPLIFIER**

The wireless remote control models are shipped with 5 different control frequencies which range from 350 to 400 K.C. These frequencies are identified by code numbers appearing on the serial number ticket and on the rear of the chassis. The code numbers and frequencies are as follows: Code 5—355 K.C.; Code 6—367 K.C.; Code 7—375 K.C.; Code 8—383 K.C.; Code 9—395 K.C.

The purpose of the different control frequencies is to prevent interaction between two or more wireless remote control models which are on the same floor or exception-

ally close together. When several wireless remote control models are to be located close together, it will be necessary to use different control frequencies. These frequencies should be 20 K.C. apart. For example, if three models are to be operated at the same time and are closely situated, it will be advisable to adjust the control frequency of the first set to 355 K.C., the second set to 375 K.C., and the third set to 395 K.C.

In order to realign or change the control frequency of these models, the following equipment is required:

1. Philco Model 7070 signal generator with a loop attached to the output terminal. (A few turns of wire 12 inch in diameter).
2. Philco wireless remote control aligning adapter. Part No. 45-2769.

3. Philco aligning screw driver. Part No. 45-2610.

With this apparatus the control frequency is adjusted as follows:

1. Remove the 2A4G control tube from its socket and replace with the aligning adapter. Connect the red lead of the aligning adapter to the positive terminal of the vacuum tube voltmeter. The black lead of the adapter is connected to the negative terminal of the vacuum tube voltmeter.

2. Remove the 78 control amplifier tube, its shield and the shield of the 6J7G tube. Apply power to the set and turn the range selector disc to "remote".

3. Attach the "high" side of the signal generator output to the grid of the 6J7G tube. Set the generator modulation control to "mod on" and turn the attenuator control about one-fourth on.

4. The control frequency to which the control amplifier is tuned can now be determined by tuning the signal generator between 350 and 400 K.C. When the signal generator is tuned to the control frequency, the vacuum tube voltmeter will show maximum deflection. If this frequency is to be used, leave the signal generator at this point or turn the indicator to any other frequency desired between 350 and 400 K.C.

5. After the control frequency has been found or changed, compensators (103A), (103B) Model 40-216; and (74A), (74B) Model 40-205 are adjusted for maximum indication on the vacuum tube voltmeter.

6. After adjusting this circuit, replace the 78 tube and shields in their sockets and remove the signal generator lead from the grid of the 6J7G tube.

7. Place the small loop mentioned above into the "high" and "ground" of the signal generator output terminals and place the signal generator near the secondary inductor loop in the bottom of the cabinet. When doing this, do not disturb the setting of the signal generator indicator. Turn the sensitivity control located on the right rear of the chassis toward the position marked "extreme" then adjust compensators (119), (115) Model 40-216; (90), (85) Model 40-205 for maximum reading on the vacuum tube voltmeter.

8. Next adjust the secondary inductor loop compensator (121) in the Model 216 and (92) Model 205 located in the bottom of the cabinet. This compensator is encased in a cardboard container that is attached to one corner of a loop. Extreme care should be used in adjusting the compensator to the exact point of resonance as the secondary inductor is a very sharply tuned circuit.

9. If the vacuum tube voltmeter pointer goes off scale when adjusting the compensators, turn the attenuator control of the signal generator toward the "off" position. After these compensators are adjusted to maximum, the control amplifier is tuned to the frequency selected.

### ADJUSTING WIRELESS REMOTE CONTROL UNIT

The wireless remote control unit is now adjusted to the control frequency of the amplifier as follows:

1. Turn off the signal generator, then dial any one of the stations indicated on the remote control unit by pulling the selectors to the stop position; release the selector and at the same time press the stop down and hold it in this position.

2. Now bring the wireless remote control unit close to the receiver. Using a padding wrench, Philco Part No. 7696, tune the compensator (127) Fig. 3, located on the bottom of the remote control unit until a maximum voltage is indicated on the vacuum tube voltmeter. When tuning this compensator, it should be done very slowly so as not to pass over the frequency to which the control amplifier is tuned.

3. After adjusting the compensator with the sensitivity control on the receiver in the "extreme" position, the remote control unit is adjusted for maximum sensitivity by setting the sensitivity control in the "near" position and placing the remote control unit a few feet away from the receiver. The compensator (127) Fig. 3, is then adjusted again for maximum voltage reading of the vacuum tube voltmeter.

4. After making these adjustments, remove the aligning adapter from the socket and replace the 2A4G tube. The wireless remote control unit should now be adjusted to the same frequency as the control frequency in the receiver.

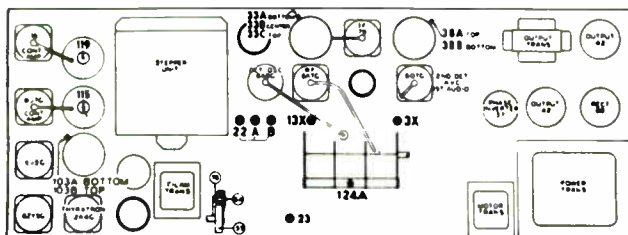


Fig. 9—Locations of Compensators, Model 40-205.

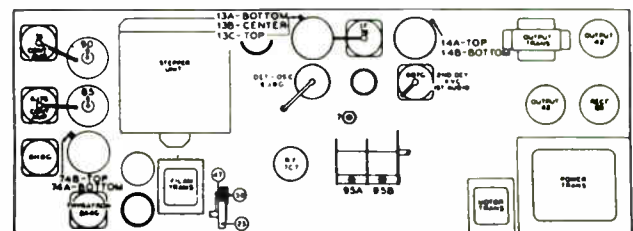


Fig. 10—Locations of Compensators, Model 40-216.

# PHILCO



# SERVICE

## *New Product News*

### RADIO

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## ELIMINATING RADIO NOISE INTERFERENCE

### KINDS OF NOISE INTERFERENCE:

The class of noise interference with which we are concerned in this booklet is man-made static. This is the type of radio interference which is produced by any kind of electrical apparatus which causes sparking. This might be a motor, a defective light, or faulty electrical wiring, either within the house or on the street. When going after an interference problem, the serviceman must bear in mind the various other types of noises similar to man-made static which can also produce faulty radio reception. Natural static is usually evident, and we need not give detailed consideration to this type of interference. An internal noise within the radio set can often produce interference which is sometimes hard to distinguish from outside man-made static. Such a noise can be readily detected, however, by disconnecting the aerial from the set and shorting the aerial post to the ground post. If the intensity of the noise decreases, it can be safely assumed that the source is external to the radio set. If the noise remains the same, or is still evident, it is being produced in all probability by a faulty part or connection within the chassis. The exact location of the noise within the set must be determined by a process of elimination as follows:

1. Remove the second detector tube or in AC-DC sets kill the detector. If the noise continues it will be known that the trouble is in the audio or speaker circuit. If the noise stops—
2. Disconnect the control grid from the first detector. If the noise continues, it will be known that the trouble is in the first detector or I. F. portion of the chassis. If the noise stops—
3. The source of trouble is in the R. F. end of the chassis.

### INTERFERENCE PRODUCING DEVICES:

Most man-made static is produced by small motors or defective electrical wiring. Electrical devices such as vacuum cleaners, electric fans, oil burners, mixers, automatic heaters, and irons are the worst offenders. Defective electrical wiring is often a source of noise, and it is usually possible to locate a loose fuse or a loose wire contact in a socket or plug of some of the household fixtures or switches.

Larger motors often cause interference in those cases where the radio set is located in the neighborhood of a factory or any large building containing heavy electrical equipment.

Electric power lines and equipment, and trolley lines and cars are also bad offenders in many cases.

### TRANSMISSION OF INTERFERENCE:

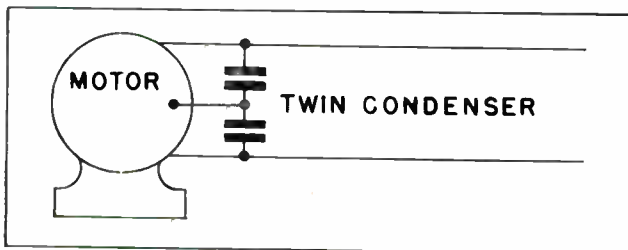
Man-made static is carried from the source of disturbance to the radio receiver in two ways: part of it is radiated in exactly the same way that a radio signal is radiated from a transmitting station; another part is carried along the electrical wiring which is common to the source of interference and to the receiver. In addition to the interference being carried along the line in this manner, the line also acts as a radiating antenna so that interference is radiated from the line which carries the interference, as well as being transmitted directly on the line itself. For example: if an aerial is run parallel to heavy electrical power lines in which interference is present, the interference will be picked up in the aerial. A certain amount of the interference will be carried through the step-down transformer on the pole and along the line into the house on the regular house wiring circuit, but the built-in line filter condenser of the radio set will usually eliminate this incoming noise. When the aerial is run at right angles to the interfering lines, and is placed back as far as possible away from them, the amount of interference picked up will be a minimum.

Since interference is radiated from the electric lines which go to the source of interference, the only correct way to establish complete elimination is to kill the interference at its source. For example: if the interference is being produced by an electric fan, small interference condensers should be connected to the fan at the motor. If the interference eliminating condensers are connected across the two wires at the baseboard plug, interference will be radiated from the power line between the baseboard and the motor itself. For this reason, *we do not recommend the use of interference eliminating devices which for convenience are connected at the baseboard plug instead of immediately at the source of interference. This is one of the most important facts to remember when doing interference elimination work of all kinds.*

**NATURE OF INTERFERENCE AND HOW IT IS ELIMINATED**

Man-made static is a radio signal which has no particular basic frequency, but is broad over a large portion of the broadcast and short wave bands. Different sources of interference may cover comparatively large bands, but might not cover the entire band. For example, a small motor may be heard louder at the high frequency end of the broadcast band than at the low frequency end. Another small motor may be located sufficiently far away from the receiver so that it does not produce any interference on the broadcast band, but might be heard on a portion of the short wave band. In general, man-made static interference is stronger on the short wave band than on the standard broadcast band.

The noise signal is a complicated radio frequency disturbance made up of R. F. and audio components. Like any high frequency electrical current, it can be carried off from a given point through condensers. The circuits in Figures 1 and 2 show how interference can be corrected. Also, a single condenser may be connected across the terminals of a motor which is producing interference. Interference which would normally be carried out through the lines, finds an easy path through the condenser, and thus circulates around through the condenser and motor windings instead of going out into the lines. This simple filter is often used on small appliances for noise elimination, a .1Mfd tubular condenser such as employed in radio sets can be used.

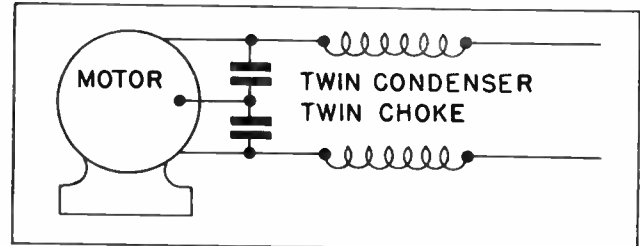


**FIGURE 1**

In Figure 1, there are two condensers employed with their common center point connected back to the frame of the motor. In this type of circuit, the path of the interference is from one motor terminal through one condenser back to motor frame and from the other motor terminal, through the other condenser and back to frame. This type of interference-eliminating circuit has been found to be more satisfactory than a single condenser, because it has a better effect of confining the interference to the source. The size of the condenser units to be used is dependent upon the intensity of the interference.

An R. F. choke is connected in one side of the line from the motor. Remembering that interference is principally an R. F. signal, it is evident that a choke, which merely impedes the passage of R. F. will tend to stop the interference signal from going out through the line.

If this choke is connected immediately at one of the terminals, there will be little radiation from the line. If another choke is connected in the other side of the line, there will likewise be no radiation from this line. It is, therefore, recommended that one of these chokes be used in each side of the line. The size and current rating is dependent upon the type of motor used.



**FIGURE 2**

In Figure 2, we have a combination of condensers and twin chokes to eliminate interference. The condensers provide an easy path for the interference and make it possible to hold down the signal to the source, which is the motor itself. A certain amount of the interfering noise may still go beyond the condensers however, in which case the effect of the chokes is to block this additional interference, and thus afford more positive noise elimination.

**NECESSARY EQUIPMENT FOR NOISE ELIMINATION WORK:**

A good assortment of filters and condensers is the first requisite for interference elimination work. As stated above, the exact type of filter to use for any given case of interference must be determined experimentally. In general, the twin condenser arrangement with center point grounded to the frame of the interfering equipment will produce satisfactory interference elimination. In many other cases, however, chokes in addition to the condensers must be employed.

In addition to the filters, it is desirable to have a portable battery operated receiver for locating the interference. A PHILCO portable receiver is highly suitable for this purpose. A receiver of this kind will enable the serviceman to locate practically any kind of radio interference, including that which may be present in public utilities equipment.

A loop aerial having approximately 20 turns of stranded hook-up wire and a cross sectional diameter of 15 inches should be constructed and mounted on the end of a wood pole 1/2 inch in diameter and 3 feet long. A piece of twisted pair aerial transmission line 8 feet long, inserted within flexible shielding is then connected to the two ends of the loop and the opposite end of the transmission line connected to the loop antenna terminals on the battery receiver. The shielding over the transmission line should be grounded to the chassis.



### HOW TO LOCATE NOISE INTERFERENCE:

The interference locating receiver described above can be used to advantage in practically all cases for locating the source of interference. One of the first things to do is to determine if the interference is inside the house or outside. This can be done by placing the interference receiver in operation, and then pulling the main switch at the fuse box. Any interference which is present within the house will immediately stop as soon as all power has been disconnected. If the interference continues, then it is known that the source is external.

Two actions are necessary in determining the source of external interference. The first is to get a general idea from which direction the noise is coming. The second is to locate the apparatus causing the noise after having determined the general location of the offending apparatus. The PHILCO battery operated receiver works out very nicely in both these respects.

A pair of headphones may be connected through two .5 Mfd. Condensers, Part No. 45-3500-10 to the plate of the Output Tube. The Speaker is unnecessary for this type of work.

With the receiver and loop aerial connected in this manner, tune the receiver to the point on the dial that gives maximum interference with a given setting of the volume control. Then rotate the loop aerial until a point of maximum interference is indicated. By drawing an imaginary line horizontally through the loop, this line will point in two directions. Follow this line in one direction for a short distance and observe if the intensity of the interference increases. If it increases, you are proceeding in the right direction. If it decreases, go in the opposite direction.

When the general location of the interference source is reached, the loop aerial will have very little directional effect. It will then be necessary to replace the loop with a small coil. The coil consists of 6 turns of wire wound on a piece of bakelite tubing 2 inches in diameter. This coil may be mounted separately on a 3 foot pole in the same manner as the loop, if desired, having the same type of shielded twisted pair lead-in down the pole. With this arrangement to change from one to the other it would only be necessary to disconnect the one in use, at the set, and connect the other.

After the pick-up coil has been connected to the set, the next action will be to explore around the power apparatus and power wires in the vicinity. If this equipment is radiating interference, the noise will be indicated by a gradual intensity increase when the pick-up coil is brought near the offending apparatus or wiring. The motor or power apparatus may be turned off, noting the change in noise picked up by the receiver. If the noise ceases when the apparatus is turned off, it is evident that the source has been located.

In the case of interference which is traced to electric

power wiring on the street, the cooperation of the local electric light and power company should be secured. It will be found in all cases that the public utilities companies will be glad to cooperate. Radio interference makes people shut off their radio sets, and this means that the electric company is not selling power to these consumers, hence, it is to the advantage of the utility company to do everything possible to eliminate interference, from the sales standpoint, and it is also to their advantage from a maintenance economy standpoint. The important thing to bear in mind when going after an electric company or trolley company is to be sure you are right in your deductions that the interference is coming from the utilities equipment.

### HOW TO ELIMINATE INTERFERENCE FROM HOUSEHOLD APPLIANCES:

(a) SMALL MOTORS, AUTOMATIC ELECTRIC HEATERS AND IRONS: The great majority of interference which originates in household appliances can be eliminated by connecting the twin condenser-type filter across the line to the interfering equipment, and connecting the common center point or case back to the frame of the equipment. The leads from the motor terminals to the condenser should be as short as possible. The condenser interference eliminator should be mounted inside the motor frame, if possible, or at least on the outside of the frame. The center point of the condensers is connected to the case.

The necessary capacity of the condensers will be determined by the strength of interference which is present. In the case of small equipment, a small twin condenser filter will be satisfactory, but for larger equipment, a larger twin filter condenser of greater capacity and power rating should be used. In the case of small Universal motors, which are sparking badly, it may be desirable to first clean the commutator with fine sand-paper in order to reduce the sparking to a minimum. Connection of the filter across the terminals of the motor will then eliminate all of the residual interference. Remember in all cases that the filter leads must be kept as short as possible and *must be connected directly at the motor terminals and not across the line at a distance from the motor.*

In some appliances, it will be found necessary to use the combination of condensers and choke in order to fully eliminate all interference. Included in this general classification of appliances would be such items as electric fans, electric mixers, vacuum cleaners, washing machines, sewing machines.

In some cases it may be desirable to employ an actual ground connection to the motor frame for improved noise elimination or for the sake of removing the A.C. voltage (low current) which is present because of the condenser being connected to the line.

(b) **ELECTRIC REFRIGERATORS:** Most A.C. operated electric refrigerators employ an induction motor which does not ordinarily introduce interference except when starting. In occasional cases, however, it may be found that one side of the line to the motor or inside the motor will be grounded to the frame. In this event, it will be necessary to eliminate the grounded line before this interference can be corrected. This ground may be of comparatively high resistance or it may be a direct ground. Care must be observed not to blow fuses when experimenting. In some cases, induced interference may be present in an electric refrigerator frame, in which case condenser filters should be connected experimentally:

- (1) Twin condenser filter across the motor terminals with common point (case) mounted on the frame;
- (2) One condenser .5Mfd. from the frame to a water pipe ground;
- (3) One condenser .5Mfd. from one side of the line to the frame.

In the case of an electric refrigerator which is operated on 110 volts direct current, the line can be filtered by means of the condenser and choke filter unit connected across the terminals of the motor and mounted on the frame near the motor. In extreme cases, particularly on D.C. motors, the use of the heavy duty filter may be required.

(c) **DEFECTIVE FIXTURES AND WIRING:** Loose wire contacts in a lamp socket or plug will often cause interference. Likewise, a loose contact in a wall switch will cause trouble. The various circuits should be checked by a process of elimination until the particular source of interference is located. This can be done simply by turning on all of the lights, switches and fixtures at one time; then start turning them off until the particular circuit is located where the interference stops as the circuit is turned off. An old electric light bulb which is about ready to burn out will often cause an extremely loud noise.

#### **HOW TO ELIMINATE INTERFERENCE FROM VIOLET RAY MACHINES AND THERAPEUTIC EQUIPMENT:**

In most cases, violet ray machine interference can be eliminated at the source by means of small condensers across the power line. In the case of some of the more elaborate therapeutic equipment used by doctors, it may

be necessary, in addition to having the various line filters, to use complete shielding of the equipment. Most equipment of this type is large, and the entire wiring as well as the body of the patient becomes a radiating antenna for the interference. The only effective way to eliminate this interference entirely is to provide a completely shielded room made of carefully bonded copper screening grounded at various points.

#### **HOW TO ELIMINATE INTERFERENCE FROM NEON SIGNS AND FLASHING SIGNS:**

Neon signs offer the serviceman one of the hardest problems in noise elimination. The elimination of interference from this source is comparatively simple, however, once the cause of this disturbance is understood.

The usual Neon sign installation has a step-up transformer connected to a series of glass tubes that are filled with the Neon gas. The voltage necessary to illuminate the gas in these tubes will vary from 5,000 to 20,000 volts, the exact value depending on the size of the sign. A leakage termed "Corona discharge" usually exists in this high voltage circuit causing the radiation of a continual buzzing noise. This noise is radiated in two ways; through the transformer, out into the power line, and from the high voltage circuit itself. A leakage in the high voltage circuit can exist at either or both of two places, the first being leakage between the high voltage leads coming out of the transformers, and the case; the second, leakage between the tubes of a letter where they cross. For example: If a tube is folded into the letter "O", there will be a crossing of the tubing at the bottom of the letter. The spacing between the tubes at this cross is only about 1/8 inch, which in high voltage circuits would permit a corona leakage to exist. In extreme cases where the spacing between the tubes crossing is this close, the serviceman should contact the neon sign people and have them heat the tubing and separate it at least 1/4 inch.

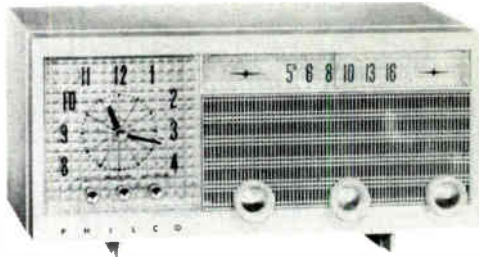
Care should be taken in the installation of supports for Neon signs since any leakage will result in the terrific noise mentioned above. To prevent the noise from going out into the power lines and radiating from them, it will be necessary to install a twin condenser filter in the 110-volt line circuit as near the transformer as possible.

Interference from flashing type signs can be eliminated by connecting twin condensers across the line with the common center (case) of the filter connected to the frame.

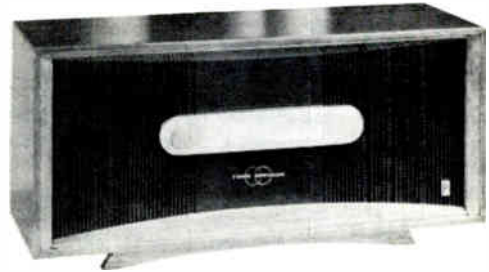
# PHILCO HOME RADIO

## SERVICE MANUAL

E-748 and E-818



Model E-748



Model E-818

### SPECIFICATIONS

<i>Cabinet</i>	E-748 — Plastic Table Model with Slide-Rule Dial Scale. E-818 — Wood Table Model (plastic front panel) with One-Way, Mirror, Slide-Rule Dial Scale. Dial Lighting in both Models.
<i>Circuit</i>	6 Tube Superheterodyne (including rectifier).
<i>Frequency Range</i>	540KC to 1620KC.
<i>Intermediate Frequency</i>	455KC.
<i>Audio Output</i>	1.2 watts from push-pull audio output circuit.
<i>Operating Voltage</i>	E-478 — 105 to 125 volts, 60 cycle, A.C. E-818 — 105 to 125 volts, A.C./D.C.
<i>Aerial</i>	High Impedance Loop mounted on cabinet back.
<i>Phono Input</i>	A Phono Input Jack is mounted in the rear.
<i>Tone Compensation</i>	A tone switch (bass-treble) is incorporated in Model E-818.
<i>Timer</i>	E-748 — A fully automatic Telechron (type C99S) internal timer and clock. Includes Sleep-Switch, Timed Appliance Outlet, Buzzer Alarm, Lighted Clock Dial and "Lullaway" Slow Shut-Off.
<i>Philco Tubes</i>	12BE6 Converter-Oscillator, 12-BA6 I-F Amplifier, 12AV6 2nd Detector - AVC - 1st Audio, (2) 25F5 Audio Output and 35W4 Rectifier.
<i>Speakers</i>	E-748 employs one 4-in. pm speaker. E-818 employs two 4x6-in. oval pm speakers.

### RUN CHANGE — MODEL E-748

RUN 2 — R8, the feedback resistor was changed in value to 2200 ohms, part number 66-2228340. This change was made to improve the audio feedback characteristics. When replacing, use the new value, 2200 ohms.

### SPEAKER PHASING (Model 818 Only)

When replacing or reconnecting the two paralleled speakers, it is possible that an out-of-phase condition may exist. This is readily apparent by weak output and serious distortion. To correct, interchange the leads to one of the speakers.

### CHASSIS REMOVAL — MODEL E-748

1. Remove knobs. Remove (2) 1/4-in. hex head drive screws from cabinet back. Disengage A.C. interlock. Remove back by freeing clock time set shaft and then swivel back around left side.
2. Remove (2) 1/4-in. hex head drive screws from top corners of dial back plate.
3. Remove (2) 1/4-in. hex head drive screws from cabinet bottom.
4. Remove (2) 1/4-in. hex head drive screws from rear bottom of chassis frame.

### CHASSIS REMOVAL — MODEL E-818

1. Remove knobs. Remove (6) Phillips head wood screws from back. Disengage A.C. interlock. Remove back by swiveling toward left.
2. Remove (2) 1/4-in. hex head screws and washers holding A.C. interlock bracket.
3. Unsolder the two leads, from receiver panel, from the right hand speaker.
4. Remove (4) 1/4-in. hex head drive screws that mount set to cabinet front from the chassis bracket.

### ALIGNMENT PROCEDURE

*Radio Controls* — Set volume control to maximum. Set tuning control as indicated in chart.

*Output Meter* — Connect across voice coil terminals.

*Signal Generator* — Connect generator and set frequency as indicated in chart. Use modulated output, 30%.

*Output Level* — During alignment, adjust signal-generator output to hold output-meter reading below .5 volts.

HOME RADIO MODELS E-748 and E-818

PR-3035

## REPLACEMENT PARTS LIST

Reference Symbol	Description	Service Part No.	Reference Symbol	Description	Service Part No.
C1	Condenser, tuning, E-748 .....	31-2735-8	R4	Volume control, 500,000 ohms, E-748 .....	33-5565-49
	Condenser, tuning, E-818 .....	31-2735-12		Volume control, 500,000 ohms, E-818 .....	33-5566-10
C2	Condenser, A-V-C by-pass, .047 mfd .....	30-4685-45	R5	Resistor, output cathode bias, 100 ohms, 1 watt .....	66-1104340
C3	Condenser, oscillator coupling, .01 mfd, disk .....	30-1262	R6	Resistor, output plate, tone compensation, E-818, 6800 ohms .....	66-2688340
C4	Condenser, osc. temp. compensating, 7.5 mfd, N2200, ceramic .....	30-1224-83		Resistor, output plate, tone compensation, E-748, 8200 ohms .....	66-2828340
C5	Condenser, output grid by-pass, 220 mfd, ceramic disk .....	30-1262-22	R7	Resistor, feedback output grid, 2200 ohms .....	66-2228340
C6	Condenser, tone compensation, E-748, .047 mfd .....	30-4650-62	R8	Resistor, feedback, E-818, 1500 ohms .....	66-2158340
	Condenser, tone compensation, E-818, .1 mfd .....	30-4650-64		Resistor, feedback, E-748, 2200 ohms .....	66-2228340
C7	Condenser, line by-pass, E-748, .1 mfd, moulded .....	30-4650-64	R9	Resistor, B- $\downarrow$ filter, 3300 ohms .....	66-2338340
	Condenser, line by-pass, E-818, .047 mfd, vertical moulded .....	30-4685-45	R10	Resistor, B- $\downarrow$ filter, 2200 ohms .....	66-2228340
C8	Condenser, electrolytic, 3 section, 50/40/30 mfd, 150 WVDC .....	30-2585-10	R11	Resistor, parasitic suppression, output grid, 100,000 ohms .....	66-4108340
C9	Condenser, B- to ground, .047 mfd .....	30-4650-45	R12	Resistor, tone control, Model E-818 only, 2200 ohms .....	66-2228340
I1	Pilot lamp, E-748, 6-8 volts, type 47 .....	34-2068	S1	Switch, tone control, Model E-818 only .....	42-1796-11
	Pilot lamp, E-818, 7 watts, 115V .....	34-2605	S2	Switch, clock light on-off switch .....	42-2055
I2	Pilot lamp, clock lighting, type 43, 2.5 volts .....	34-2031-11	T1	Transformer, oscillator .....	32-4693-2
J1	Phono input jack .....	27-6149-2	T2	Transformer, audio output, E-748 .....	32-8782-1
LA1	Loop antenna .....	Part of Back and Loop Assy.		Transformer, audio output, E-818 .....	32-8763
LS1	Speaker, E-748 .....	36-1654-16	W1	Line cord, E-748 .....	41-3865-4
	Speaker, E-818 (2 used), 4x6" oval .....	45-9750		Line cord, E-818 .....	41-4230
N1	Resistor-condenser network, audio coupling .....	30-6006-1	Z1	Transformer, 1st I-F .....	32-4583-12
R1	Resistor, oscillator grid return, 22,000 ohms .....	66-3228340	Z2	Transformer, 2nd I-F .....	32-4583-13
R2	Resistor, I-F cathode bias, 68 ohms .....	66-0688340			
R3	Resistor, A-V-C filter, 2.2 megohms .....	66-5228340			

## CABINET PARTS LIST

Description	Service Part No.	Description	Service Part No.
<b>MODEL E-748</b>		<b>MODEL E-818</b>	
Cabinet, Ivory .....	11075-4	Cabinet, Blonde .....	11217-2
Back and loop assy. ....	76-9985-2	Cabinet, Fruitwood .....	11217-1
Crystal, radio dial .....	54-6235-1	Cabinet, Mahogany .....	11217
Dial scale .....	54-6238-1	Back and loop assy. ....	76-11175-1
Grille .....	54-6234-3	Bezel .....	28-11396
Knobs, volume and tuning .....	54-4773-26	Dial scale .....	54-6311-1
Knob, clock light .....	54-4773-27	Feet, 4 used .....	W2190
Clock .....	41-2063-1	Grille .....	54-6309-1
Crystal, clock .....	54-6236	Knobs, 2 used .....	54-6310-1
Face .....	54-6237	Clip, pilot lamp shield .....	56-3545FA3
Knobs, 3 used .....	54-6223-1	Pointer .....	56-8774-8
Connector, appliance outlet .....	76-3931	Shaft, tuning .....	56-7931-6
Dial backplate .....	28-11577	Socket assy., pilot lamp .....	27-6233-21
Pointer .....	56-8774-7		
Shaft, tuning .....	28-10349-1		
Hairpin, shaft retaining, 2 used .....	57-1468FA3		
Socket assy., pilot lamp .....	27-6233-6		
Spring, drive cord .....	28-9430		

### MISCELLANEOUS PARTS

Printed Panel .....	54-6295-2
Connector, A-C interlock, E-748 .....	27-6240-7
Connector, A-C interlock, E-818 .....	27-6240-3
Socket, 7 pin miniature, 6 used .....	27-6309-1

Printed in U.S.A.

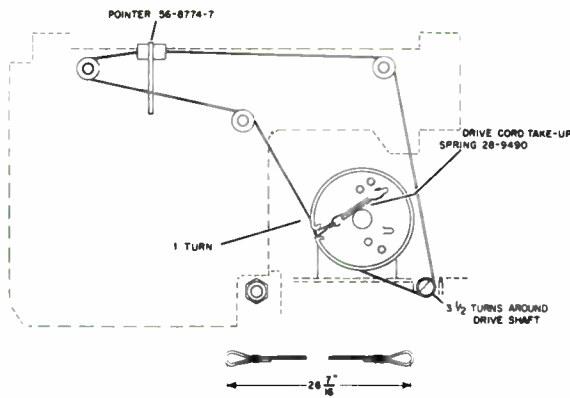


## ALIGNMENT CHART

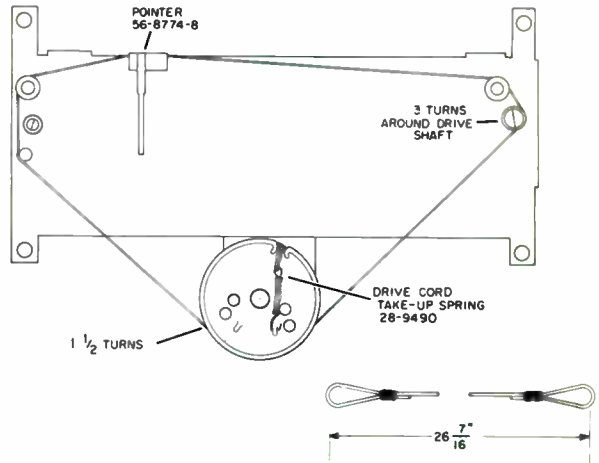
STEP	SIGNAL GENERATOR		RADIO		ADJUST
	CONNECTION TO RADIO	DIAL SETTING	DIAL SETTING	SPECIAL INSTRUCTIONS	
1	Ground lead to 8-; output lead through a .1 mf condenser to grid (pin 7) of 12BZ6.	455 kc.	Tuning gang fully open.	Adjust tuning cores, in order given, for maximum output. TC1 and TC3 are located on top of transformers.	TC4—2nd i-f sec. TC3—2nd i-f pri. TC2—1st i-f sec. TC1—1st i-f pri.
2	Radiating loop. (See note below).	1620 kc.	1620 kc. *	Adjust for maximum output.	C1-B—osc.
3	Same as Step 2.	1500 kc.	1500 kc.	Adjust for maximum output.	C1-A—aerial.

Note: Make up a 6-8 turn, 6 inch diameter loop from insulated wire, connect to signal-generator leads, and place near radio loop.

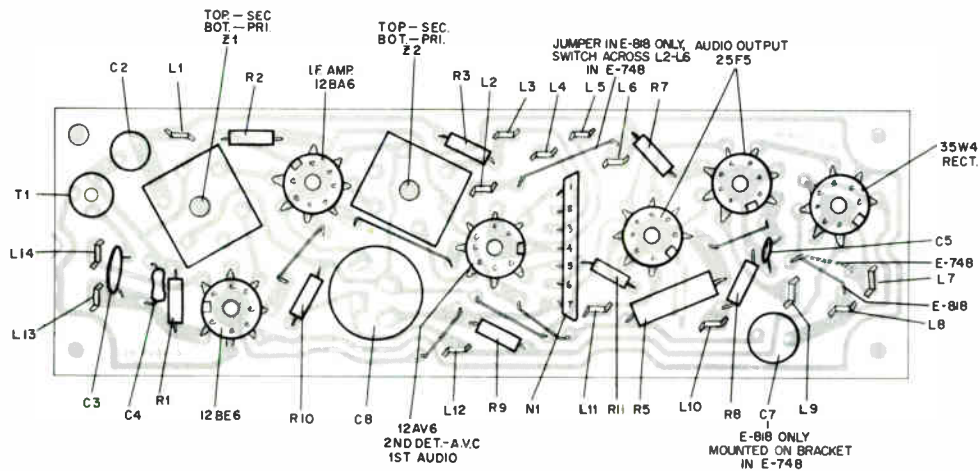
\* For proper adjustment of the oscillator trimmer, fully open the tuning gang and insert a .006 inch non-metallic shim between the heel of the rotor and the top of the stator plates. Close the tuning gang sufficiently to hold the shim in place, and then remove the shim without disturbing the gang setting.



*Dial Cord Stringing — Model E-748*



*Dial Cord Stringing — Model E-818*



*Composite Base View — Models E-748 and E-818*

**Tie Lug No.    E-748 Connection**

- L1 ..... A-G-C to Ant. and Gang
- L2 ..... Filament side of A-C Switch
- L3 ..... Detector Output to J1
- L4 ..... Arm of Volume Control
- L5 ..... Volume Control Return to B—
- L6 ..... A-C line, line side of A-C Switch, and Black lead from T2
- L7 ..... One side of Pilot Lamp
- L8 ..... A-C line and one side of Pilot Lamp
- L9 ..... Blue lead to T2, Output Transformer
- L10 ..... Orange Lead to T2
- L11 ..... Brown lead to T2
- L12 ..... Red lead to T2
- L13 ..... Oscillator section of Gang
- L14 ..... Ant. and Ant. section of Gang

**E-818 Connection**

- A-G-C to Ant. and Gang
- Not used
- Detector Output to J1
- Arm of Volume Control
- Volume Control Return to B—
- Set side of A-C Switch, one side of Pilot Lamp, and Black lead from T2
- A-C line
- Not used
- Red lead to T2, Output Transformer
- Brown lead to T2
- Blue lead to T2
- Yellow lead to T2
- Oscillator section of Gang
- Ant. and Ant. section of Gang



# PHILCO SERVICE SUPERVISOR



PUBLISHED MONTHLY BY THE  
PHILCO CORPORATION, SERVICE  
DIVISION, IN THE INTERESTS OF  
INDEPENDENT PHILCO SERVICE-  
MEN THROUGHOUT THE NATION

September, 1952

Philco Rushes TV Training  
Facilities to Denver  
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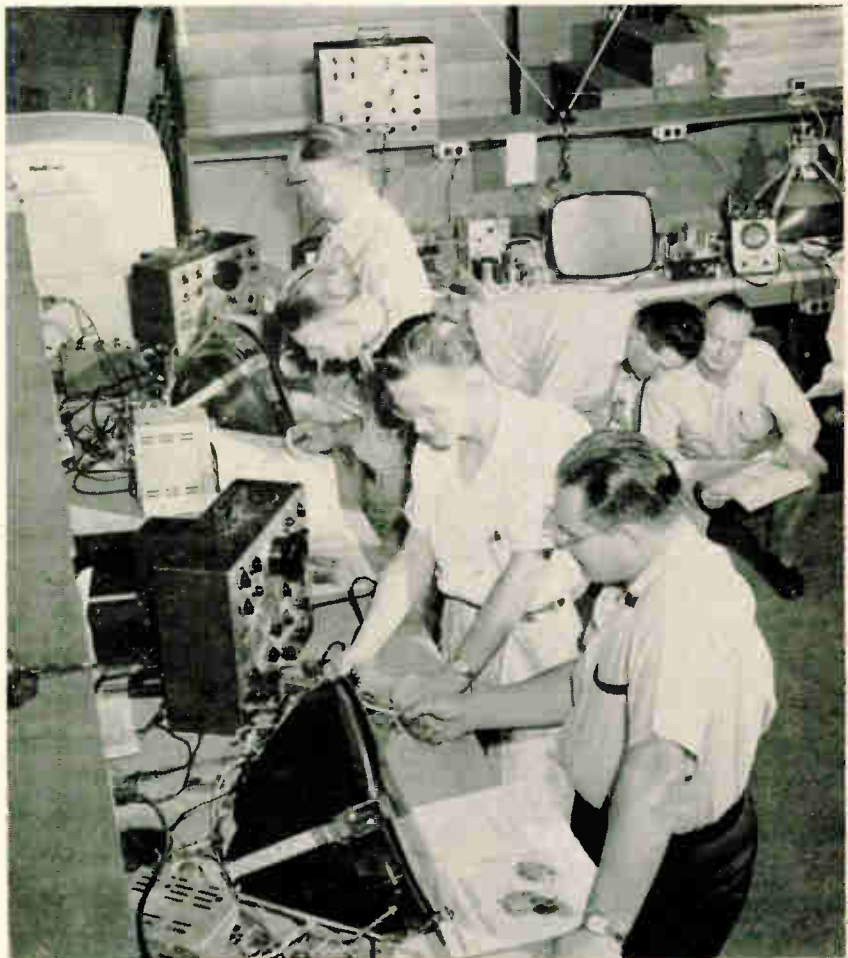
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## PHILCO RUSHES TELEVISION TRAINING FACILITIES TO DENVER!



Members of the Philco Television Service School in Denver working "in tandem" as they learn the intricacies of Television servicing through actual bench work.

Less than five months after FCC approval of new TV station construction became effective, Denver, Colorado, became the first new area telecasting on its assigned VHF television frequency.

Introduction of television to Denver paves the way for a situation that will undoubtedly set the pattern in hundreds of new TV markets soon to be open to new vistas of entertainment — 25 of them during the next two months.

*Continued on Page Two*



## PHILCO RUSHES TV TRAINING FACILITIES TO DENVER!

*Continued from Front Cover*



Bush Clinton, Philco Service Representative, taking some of the mystery out of Television servicing for the first class of the Philco Television Service School held in Denver, Colorado.

Denver, "The Mile High City" has become a post-freeze sounding board for community reaction to the introduction of television communications. Already Denverites are clamoring for more and more television receivers. Everywhere in the area TV aerials are emerging skyward on every street to pluck the signals from the air. The impact of new cultural and entertainment possibilities has been unprecedented.

In Denver today and in the immediate future in areas from Maine to California, electrical appliance servicemen are faced with a dilemma. These new stations will literally create boom conditions for service technicians . . . men who are trained in the latest methods for servicing television. However, in most of these communities there are few servicemen available to meet the forthcoming demand by the public for television servicing. For example, in Denver the majority of servicing dealers and independent servicemen were equipped to handle radio service calls but were not familiar with television procedures. It was imperative that this group learn quickly and thoroughly the art of television servicing in order that they be prepared for the influx of service calls to come.

While negotiations were still being made on station construction in Denver, PHILCO FACTORY-SUPERVISED SERVICE Headquarters was preparing television service school facilities for the radio servicemen in Colorado. And this school inaugurated its first lesson just as the Denver station KFEL went on the air!

Thus, during the first hectic days of TV reception, Denver's Philco Factory-Supervised Servicemen were

laying the ground work for future business opportunities — wisely preparing themselves for a big share of the vast new potential television has created.

Philco's first Television Training School was welcomed enthusiastically by all members in the Colorado area. They have come from as far north as Cheyenne to enroll and enough classes have been set up to insure Coloradans of an adequate pool of qualified, efficient television technicians.

Denver servicemen are participating in practical, down-to-earth training in every detail of television servicing they will possibly encounter in the field. The entire technical staff of Walter Slagle Co., Philco Distributor in Colorado, is working with enrollees of the school. It is through this close supervision while working on receivers in actual operation that members are trained in the latest and best factory methods of repair. This comprehensive on-the-spot training course in television servicing conducted by PHILCO FACTORY-SUPERVISED SERVICE is another important contribution to the servicemen of America by Philco.

What has happened in Denver can well happen in every one of the innumerable cities that will follow with Television. Public acceptance will be quick and enthusiastic. The sale of receivers will be tremendous as television blankets every section a signal can reach. Then the service calls will start pouring in! And the services of only the farsighted, alert serviceman who gets in on the ground floor will be in constant demand.

*Continued on Page Twenty*



## SHOP PRACTICES AND SERVICE TECHNIQUES—HOME RADIO

# SCREEN-ROOM CONSTRUCTION

By FREDERICK S. MOHR  
*Headquarters Technical Staff, TechRep Division*

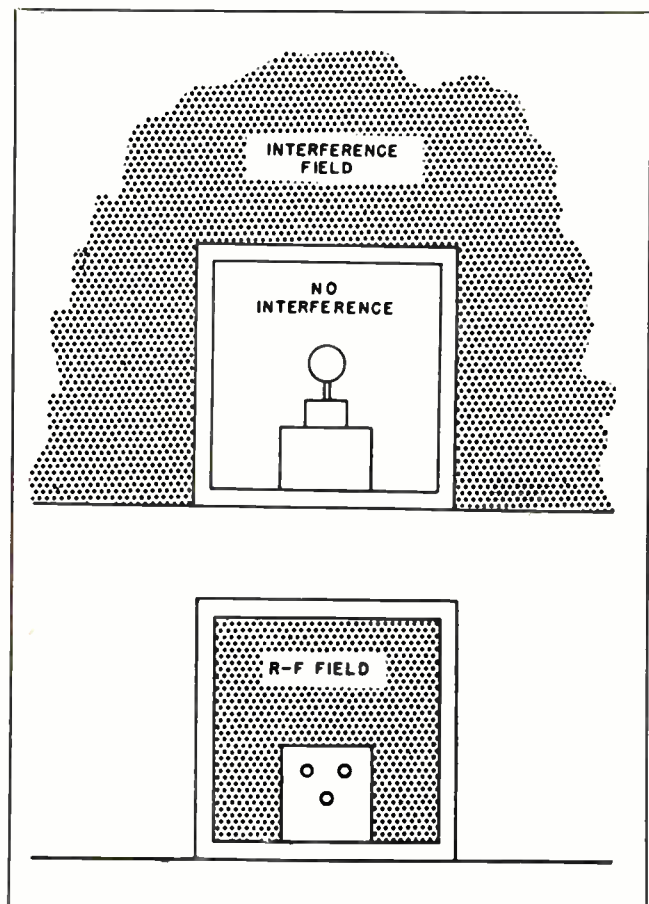
## A discussion of the theory and important construction details involved in building a shielded room.

The principles of shielding are not new to the electronics industry, as practically every piece of electronic equipment employs some form of shielding. At times, though, it is necessary to place a shield around the operating area of the equipment, either for the purpose of performing tests on the equipment or to confine the r-f field radiated by the equipment (figure 1). This article deals with shielded rooms built for testing and aligning radio, television and communication receivers.

Since the purpose of such a shielded room is to provide a space free from external electromagnetic fields, the theory underlying the methods of doing this might well be briefly considered. The shield eliminates the electromagnetic field by reflection and by attenuation. Electromagnetic waves tend to be reflected when they strike a medium that has an impedance different from the impedance of the medium through which the waves have been traveling. Some waves are thus reflected when they strike the metal shield, while others tend to penetrate the metal, and, in doing so, are attenuated. Since the waves which seek to penetrate the shield constitute the larger percentage, the effectiveness of a shielded room primarily depends upon how much attenuation the shielding provides.

Ideally, the greatest attenuation would be provided by plates of copper, but, for reasons of economy, rooms are not so constructed. Instead, copper foil or copper screen, such as is used for door or window screens, is used to provide the shielding; this is a compromise between optimum attenuation and economical construction. The use of screen greatly simplifies the problems of ventilating and lighting the room, keeping the costs of these items down. Whereas the use of only one shield might provide an attenuation of 50 db, due to the thickness of the wire, a second shield placed approximately 4 inches from the first will double the attenuation. Therefore, rooms are usually constructed with an inner and an outer shield. In cases of excessive interference, modifications are made to the basic room to meet the special conditions.

Maximum attenuation results if the two shields are not connected at any point. Since it is generally necessary to provide a duct through which power lines can be run into the room, the next best condition is obtained if connection between the shields is limited to this one point. Connecting the two shields at more



**FIGURE ONE—Shielded Room Provides an Interference-Free Area for Performing Tests, or Confines an R-F Field**

than one point would lower the total attenuation provided by the shields because reflection from the inner shield would be reduced (any currents flowing on the inner surface of the outer shield would also flow on the outer surface of the inner shield). However, attenuation of the electromagnetic waves, caused by flow through the metal, would still be present, and since the thickness of metal is greater when two shields are used, the total attenuation of a two-shielded room is therefore greater than that of a room employing only one shield. This principle is used in screen rooms employing cell-type construction. Cell-type screen rooms

are so named because they are made up of a number of sections, or cells, bolted together to form a room (figure 2). Each cell is usually 4 inches thick, 32 inches wide and of a length equal to the height or width of the completed room (figure 3). The inner and outer screens of each cell are lapped around the sides so that when two cells are bolted together, four screens are in contact. Care must be taken to see that the bolts draw the two sections together tightly enough so that no gap is left between the screens of each section. The advantage of this type of room is that it may be easily assembled or disassembled, and it can therefore be moved from one location to another without any difficulty.

### DESIGN FACTORS

In the construction of any shielded room, certain basic factors must regularly be considered. These factors include shielding material, access, lighting, ventilation, and power-supply filtering.

The use of foil or of solid metal plate for shielding complicates the lighting and ventilation factors; for this reason, copper screen is the most commonly used material. When selecting the screen to be used, a mesh should be selected which is small compared to the thickness of the metal surrounding the hole. An electromagnetic field sets up currents which flow in parallel lines on the surface of the metal. If the mesh is large, the holes will interrupt the current flow, and cause it to flow around the surface of the break to the other face of the screen, where a new field will be set up by re-radiation. This, of course, reduces the effectiveness of the room. A screen between a 16-mesh and a 22-mesh will give good results; a 22-mesh screen is preferred.

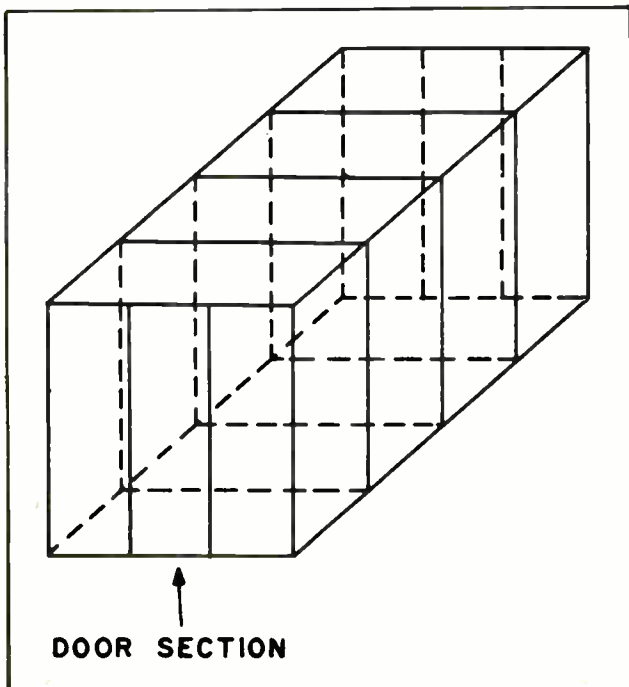


FIGURE TWO—Diagram showing how cells make up a Shielded Room

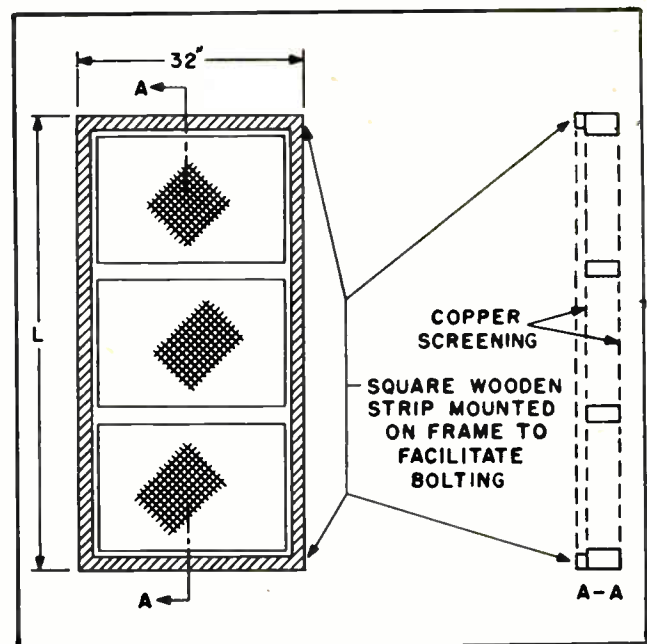


FIGURE THREE—Construction of a typical cell

Another factor to be considered is that of providing adequate access to the room. If the room is to serve the purpose for which it was constructed, it must be possible to move tools, equipment, and test instruments in and out of the room easily. This requires a door of adequate size, but a door means a discontinuity in the shield, and a consequent reduction in the attenuation of the interfering field. This difficulty, however, may be overcome by providing contacts around the edges of the door so that when it is closed, the inner and outer screens of the door make contact with the respective shields of the room. Strips of phosphor bronze or of copper weather-stripping are ideal for this purpose.

Adequate filtering of the power lines entering the room is very necessary. These lines will have a voltage induced in them by the fields outside the shield, and, if adequate filtering is not provided, similar fields will be established inside the room by re-radiation. Each power line will require a pi-type filter inserted into the line immediately before it enters the room (figure 4). These filters should be capable of handling the power requirements of the equipment in the room, and should be designed to attenuate the interference. Equally important is the proper shielding of the filter, and of the lines as they enter the room. This shielding of the lines must make direct connection with each screen through which it passes, if the effectiveness of the shielding is to be maintained (figure 5).

### CONSTRUCTION

Before starting the actual construction of the room, there are several things to be decided, such as how much space is available for the room, whether the test area is to be used solely for testing one type of equipment or for many types, and whether the screen room is to be a permanent or a temporary fixture.

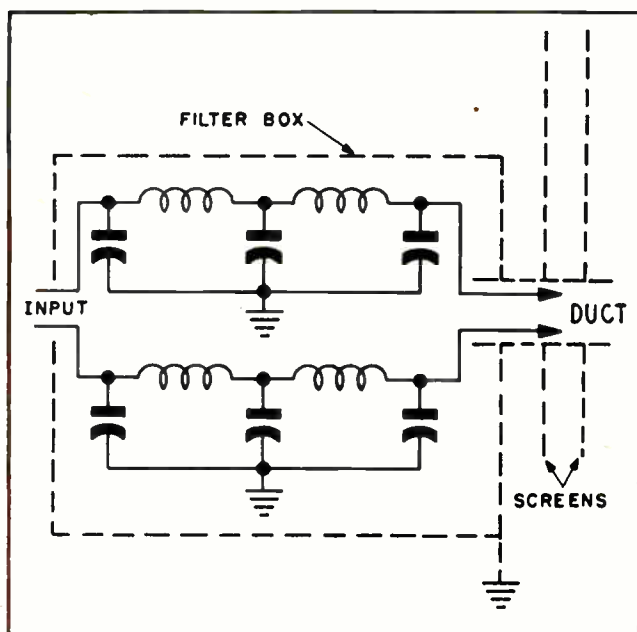


FIGURE FOUR—Typical Power-Line Filter

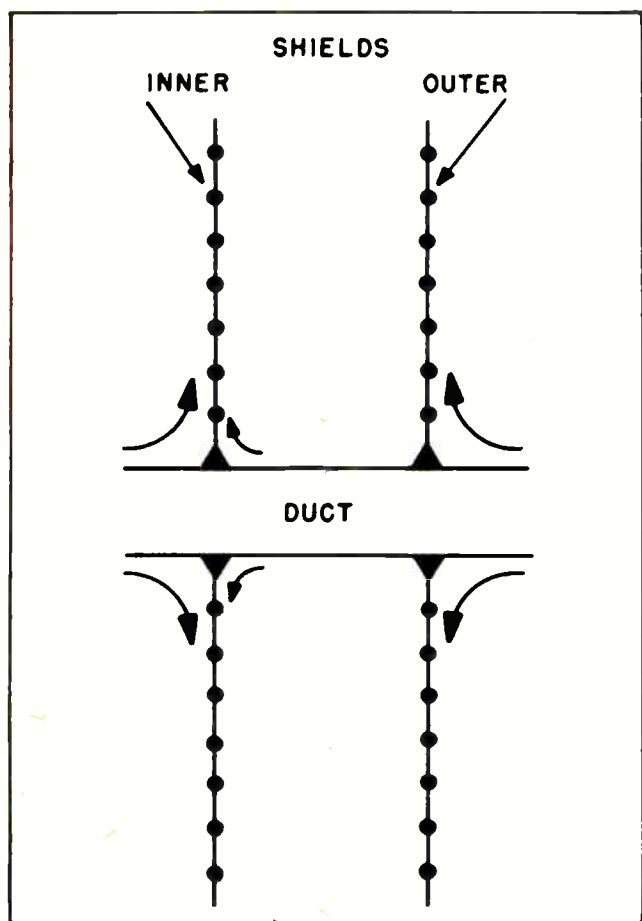


FIGURE FIVE—Paths taken by interference when Duct for Power Line is soldered to both shields

Upon these decisions will depend the type of room that is built. If the installation is to be permanent, and there is adequate space available, the conventional double-shield type of room is best. However, if it is desirable to move the room occasionally, even though adequate space exists, then the cell-type room is best.

One point which often bothers the technician who has never built a screen room is the choice of the size of the room. Size of the screen room is not critical. This point is well illustrated by the many different sizes which have been built in the past. One radio-compass manufacturer specifies a room 12 feet 8 inches long, 9 feet wide, and 12 feet high. A company that sells screen rooms provides them in three different heights, two widths, and in a variety of lengths. The "poor man's screen room" (figure 6), which is a fairly new type designed for situations where space cannot be made available for the usual screen room, is only 4 feet long, 2 feet wide, and 2 feet 6 inches high. All of these rooms provide good attenuation of unwanted interference. The main point is to provide sufficient room for all equipment required, plus sufficient working space, without having excess space.

In designing the screen room, the space available will dictate the maximum possible dimensions. This is particularly true of the height, as many shops may not have a 12 foot ceiling. Also to be considered is the layout of all of the equipment involved in the tests. If the length and width chosen are multiples of the screen width, extra work can be avoided in cutting the screening material. A suggested screen room for testing radio compasses is one which is 12 feet long, 9 feet wide, and, if possible, 12 feet high.

The framework of the room should be constructed of well-seasoned, 2-by 4-inch white-pine lumber. This lumber will provide a sturdy frame for the room, and maintain a 4-inch space between the two screens, which is desirable (figure 7). In building a double-shielded room, normal room-construction practices are followed in setting up the framework. When nails or screws are used in construction, care should be taken to see that there is no possibility of shorts between inner and outer screens, and that any nails or screws which pierce either screen are soldered to the screen.

Once the framework is built, the screen is cut to fit the various sides of the room. Panels for the walls are cut to fit vertically from the ceiling to the floor. For the ceiling or floor, the panels are cut to fit across the width of the room. The individual panels are then laid out on the shop floor to form a large panel for each wall, floor, and ceiling. This makes soldering much easier, and a better job results. Each section of screen should overlap the next section by  $\frac{1}{4}$  of an inch. If it is necessary to use soldering flux, a noncorrosive flux should be used, and all excess flux should be carefully cleaned off to prevent any possible corrosion.

Angles made from strips of sheet tin greatly facilitate making joints between each wall, floor, and ceiling. Cut the tin into strips  $3\frac{1}{2}$  inches wide, the width of each panel, and bend them into right angles  $1\frac{3}{4}$  inches on each leg. The angles are then carefully soldered to the top and bottom ends of each wall panel (figure 8).



When this has been done, each wall panel is rolled up, carried into the room, and the metal angle on the outside of the roll is tacked to the top edge of the framework. The roll is then unrolled, and the bottom edge is also tacked down. It may be advisable to tack the screen at several other points on the framework. Every tack head must be soldered to the screen; otherwise radiation will leak through at these points. The angles are then soldered to the ceiling and floor panels, and additional angles are used to connect each wall to the adjacent walls. Of course it is possible to erect the screen without using the angles, but they have been found to simplify the job greatly, and to insure a room with no holes through which the interference field may leak.

The door should be located in the center of one end wall. It is important that, when the door is closed, good contact is made between the screens on both faces of the door and the respective screens of the room. Any discontinuity of the shields will allow interference to leak through, and will lower the total attenuation factor of the room. As mentioned before, copper weatherstripping can be used for the purpose of connecting the shields on the door to the room shields.

**THE DOOR LATCH**

A means of latching the door should be provided which fulfills the following requirements. The latch should be operable from either side of the door, it should force the door closed, compressing the metal contact strips between door and frame and it should be easily operated. One type of latch which answers the above requirements is shown in figure 9. This may be constructed from scraps of rod and strap stock obtained from a local metal working company.

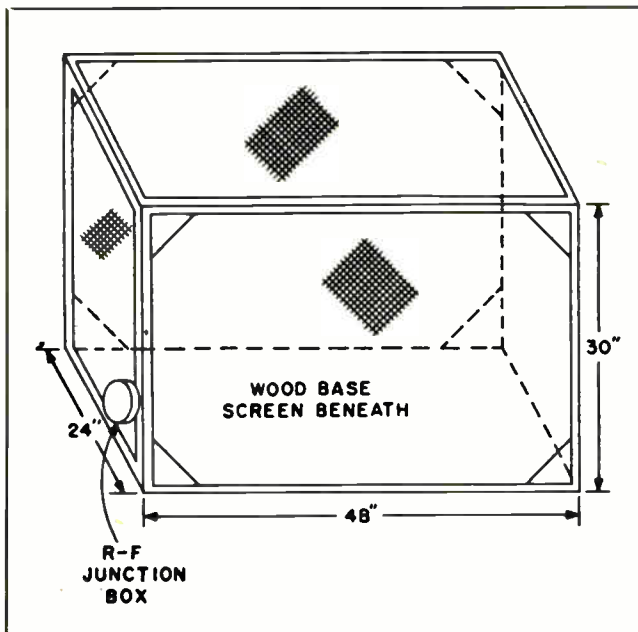


FIGURE SIX—Poor Man's Screen Room

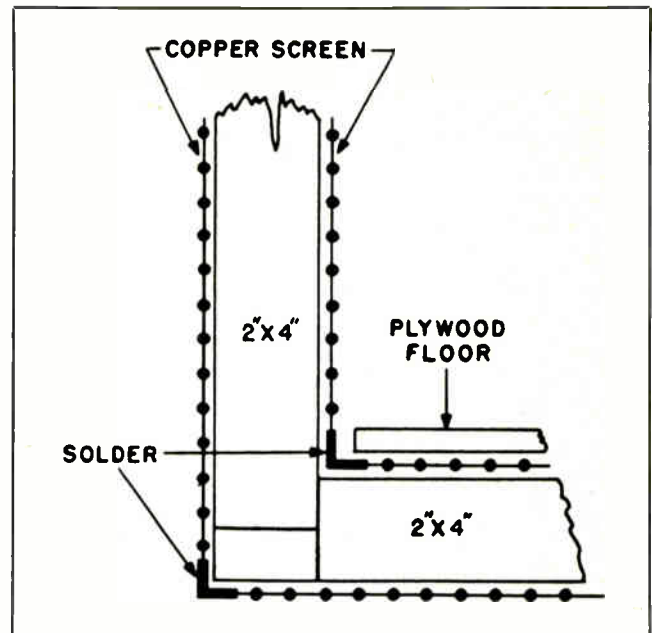


FIGURE SEVEN

**FILTERING THE POWER SUPPLY**

One of the most difficult parts in the construction of a good screen room is the bringing of the necessary power into the enclosed area (figure 10). It will be necessary to bring 110-volt 60-cycle power, 110-volt 400-cycle power, and 28-volt d-c power into the room. Each of these power lines should have a suitable low-pass filter inserted into each side of the line. Commercial filters can be purchased for this purpose, or filters can be made from parts on hand. If the filters are constructed in the shop, be sure that the chokes are made of wire large enough to carry the power used in the room.

These filters should be mounted next to the point of entry of the power lines into the room. A suitable metal box with a tight-fitting hinged cover should be provided for shielding these filters. The size of the box will depend upon the size of the filters used; ample

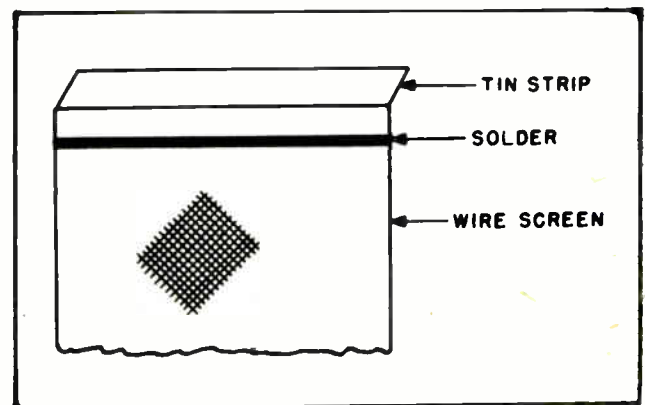


FIGURE EIGHT—Tin Strip Fastened to End of Screen Panel



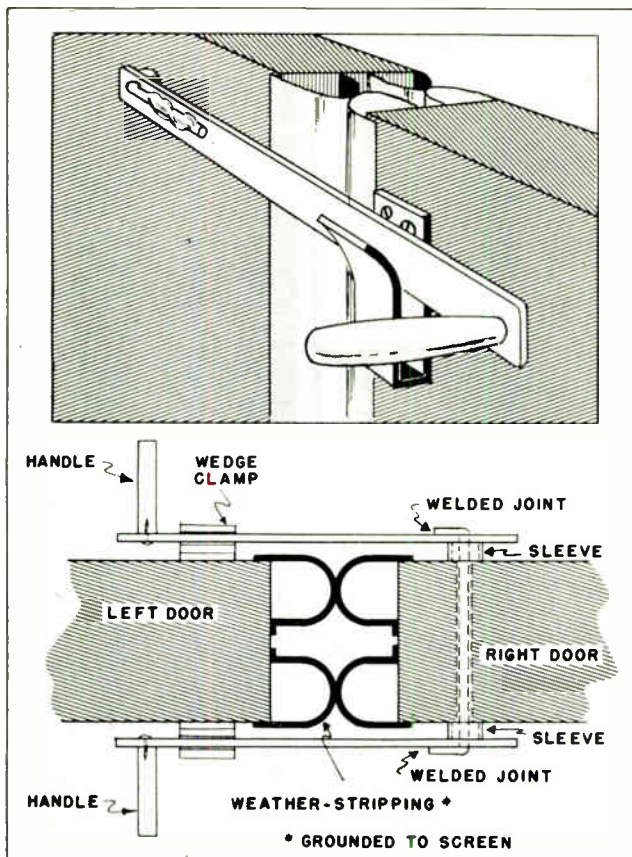


FIGURE NINE

room should be provided for making the electrical connections without undue crowding. It should also be kept in mind when designing the box that the duct carrying the wires into the screen room should also enter the box.

The duct may be any suitable metal pipe, conduit, or waveguide. When the length of the duct is at least three times its diameter, the duct will attenuate all frequencies below its cut-off frequency. The formula for determining the cut-off frequency is  $f = \frac{6820}{d}$ , where  $f$  is the frequency in mc., and  $d$  is the diameter expressed in inches. Ducts which have cut-off frequencies higher than the interference frequencies are also useful for the entrance of various services, such as compressed air, water, or gas, that might be needed in the room. These ducts are also a means of providing ventilation in rooms having solid walls.

**GROUNDING**

If the room has been well constructed, the addition of an external ground will not affect the attenuation of the room. This is because the shielding provided by the room occurs as a result of reflection and attenuation of the waves by the metal of the shields. Additional attenuation of the interference field by grounding the

shield is difficult to provide over a wide range of frequencies. Such attenuation is only provided when a low-impedance path is provided to ground. (When the distance between a point and ground is an odd multiple of a quarter wavelength, a high-impedance path is shown, and no additional attenuation results.) However, the "poor man's room" requires an external ground for best results. The point at which to attach this ground is found experimentally by sliding the ground connection over the bottom of the cage until a point of minimum noise is found. Usually this point will be located at the center of the bottom panel.

Even though an external ground is not essential for attenuation purposes, it should be used to prevent the screen's rising from above a-c ground owing to the power-line filters. A No. 6 (AWG), or larger, wire should be fastened to the screen, preferably near the power-line filters, and to either a cold-water pipe or to a pipe driven into the ground adjacent to the room.

**SUMMARY**

The most important points to remember to insure the maximum shielding when building a screen room are to practice good workmanship, to make sure there are no breaks or gaps in the shields, and to filter and shield the power lines completely at the point of entry into the room. If these precautions are followed, an attenuation of at least 100 db can be reasonably expected from a double-shield room.

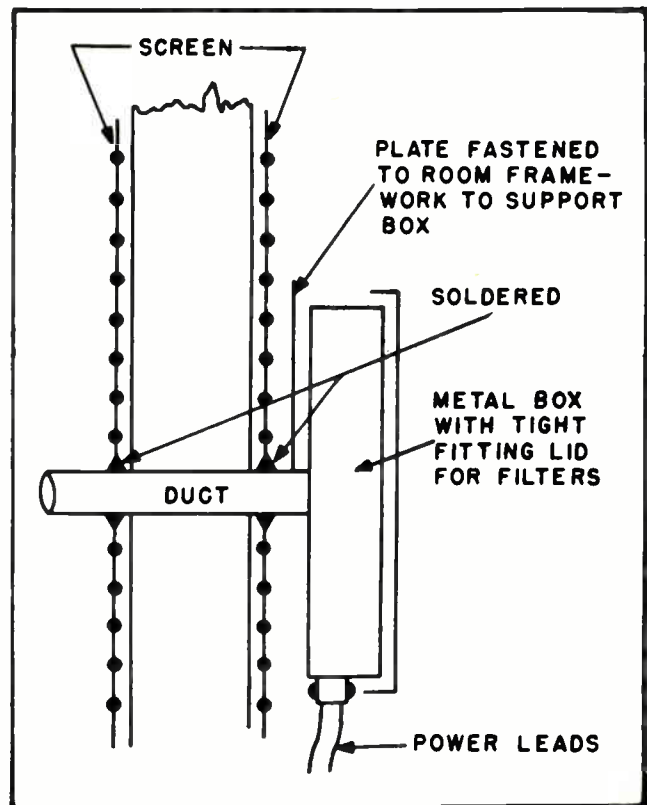


FIGURE TEN—Details of power entrance to Screen Room

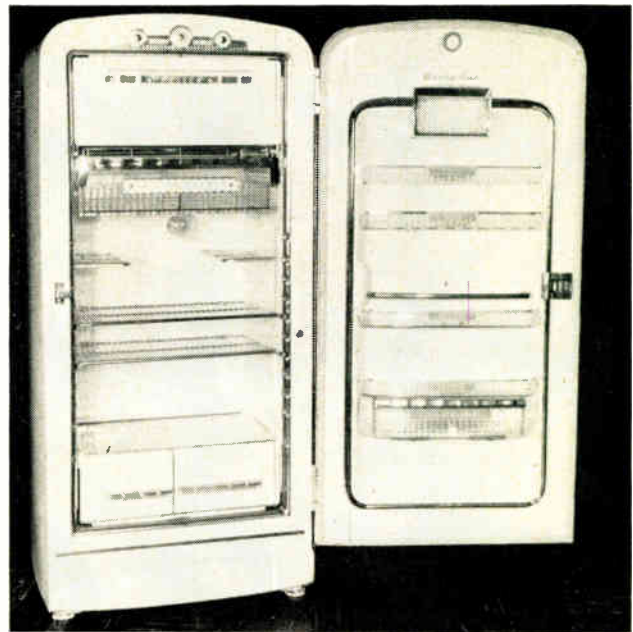
**NEW PRODUCT NEWS—REFRIGERATION****A CLOSER LOOK AT THE MODEL G-928**

The model G-928 is the latest addition to the 1952 Philco Refrigerator line. This refrigerator is a single door automatic defrost model, with the recessed space in the door utilized by the Philco Dairy Bar. It has a storage capacity of 8.7 cubic feet; freezer compartment and cold storage temperature are maintained through the use of a 1/6 horse power sealed unit assembly, part number 5250-292. The automatic defrost is timer controlled. All controls are conveniently located on the cabinet top breaker strip for ease of adjustment, as can be seen in figure 1.

The automatic defrost equipment in the model G-928 is similar to that used in the duplex models, but the operation is slightly different. At approximately 1:00 A.M. each night the clock-operated timer switch opens the motor compressor control circuit, and at the same time energizes the automatic defrost circuit. With heaters energized and the evaporator temperature set at a predetermined level, the heater thermostat opens the heater circuit and immediately operates the refrigeration system.

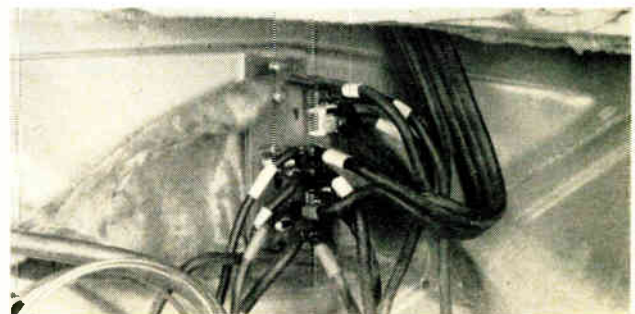
This refrigerator has been engineered with the serviceman in mind. The major portion of the electrical components utilize spade type connectors in place of screws and eyelets to secure the defrost components and the wiring harness to the various terminals. The heater thermostat and the timer mechanism are incorporated into a single unit. Power is supplied to the sealed unit assembly and the individual circuits of the refrigerator through a central wiring panel, which is located on the rear side of the evaporator inner cover plate. (Figure 2). When checking the leads at this terminal strip, there is no chance of making an error for the strip is coded "Y"—yellow, "B"—black, "R"—red, "W"—white; and all leads are coded with a colored dot which corresponds to the terminal to which they are to be secured.

The thermal damper, which is a food compartment heater consists of a length of heater wire taped to the rear of the food compartment liner immediately below the rear evaporator cover plate cut-out. This thermal damper makes the mechanical damper more efficient. It is connected in parallel with the temperature control, so that it is energized only when the refrigeration unit is not operating. The thermal damper, when energized, sets up an air block immediately under the

**FIGURE ONE**

rear portion of the evaporator. The purpose of this air block is to cause a greater temperature differential between the freezer and the food compartment. This permits the freezer to operate at a colder temperature without the possibility of foods freezing in the refrigerator compartment. Therefore, it can be seen that this thermal damper would not be effective for this purpose if it were located in any other place on the food liner.

The heater thermostat, which is an integral part of the timer clock assembly, has been designed to better control the termination of the automatic defrost heat

**FIGURE TWO**



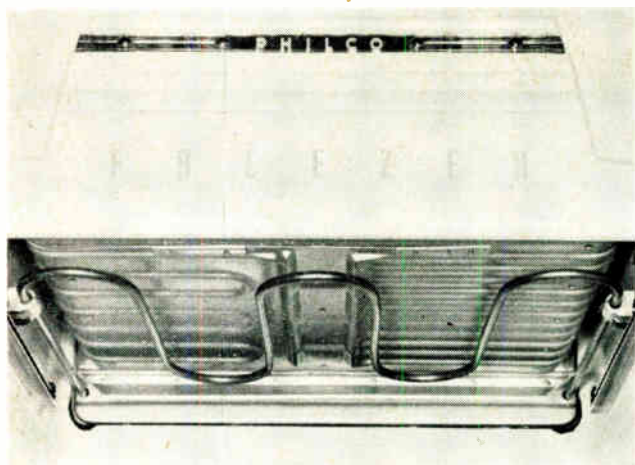


FIGURE THREE

cycle. Formerly, the feeler tube of the heater thermostat made contact with a few inches of the rear portion of the evaporator. The new control feeler tube is dressed down the left hand side wall and along two-thirds of the leading edge on the bottom plate of the evaporator, as can be seen in figure 3. This feeler tube is temperature sensitive over its entire length, and is in contact with approximately twenty-two inches of evaporator surface; so it will not activate the heater thermostat cut-off switch until all frost formations have been melted.

The defrost timer thermostat has been preset at the factory for the thermostat to open at a temperature 50° to 55° Fahrenheit at sea level. For each 1000 feet in elevation, the thermostat will open and close at one degree lower than the rated values. To compensate for altitude differences, there is a five point adjustment on the front of the timer thermostat housing. Each point is a 1000 foot adjustment. A number "3" or "4" Allen set screw wrench should be used to make this adjustment. The timer knob shaft has a ratchet gear and stop to prevent the customer from turning the control

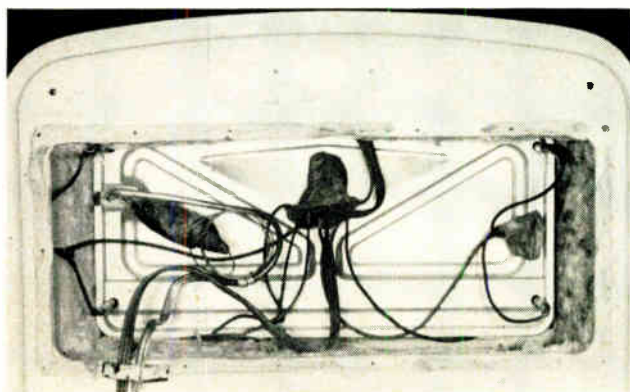


FIGURE FOUR

in a clockwise direction. This timer shaft turns 1 revolution every twenty-four hours in a counter-clockwise direction.

When the evaporator is cleared of all ice formations and the temperature rises to 50° to 55° the heater thermostat trips the timer operated switch to supply power to the sealed unit assembly. The temperature control then maintains the normal cooling cycle until the next defrost period.

### G-928 ELECTRICAL SYSTEM

A ground for the refrigerator electrical system is necessary due to the added electrical devices. This ground lead is provided as the third wire in the appliance service cord — one end of it is secured to the relay bracket screw. The other end of the lead, which protrudes from the molded rubber male plug, is connected to wall receptacle mounting screw.

To gain access to the various electrical components for check purposes is quite simple. The sealed unit assembly is similar to the units used in the standard models. Remove the condenser mounting screws and the unit mounting screws. The sealed unit assembly may be partially removed from its mounting cavity to remove the motor compressor terminal box cover.

To gain access to the refrigerator wiring panel, remove all the screws from around the edge of the cabinet rear cover plate. Take out all the insulation that seals off the evaporator inner cover plate (figure 4). The no-oxide cloth may now be removed from the terminal panel.

The timer mechanism and temperature control may be exposed for service by removing the three uppermost mounting screws from the two cabinet side breaker moldings. Remove the top molding and then extract the escutcheon mounting screws. The side breaker strips and trim molding may now be pressed in a fraction of an inch to allow clearance to slide the top breaker strip down and out. Figure 5 illustrates the complete breakdown of this assembly.

As previously mentioned, the electrical circuit of this refrigerator is quite similar to that of the double door models. By referring to figure 6, the difference may be noted. For example, the heater thermostat does not show in the electrical circuit, for it is a mechanical device that operates the timer switch, which is common to the timer and the heater thermostat.

The wiring panel, which is the distribution point for current supplied to all components of the refrigerator, is shown as the blocked out portion of figure 6. The source voltage is supplied through the service cord and unit wiring harness to terminals "B" (black) and "W" (white). Power is taken directly off of these two ter-

minals for the timer clock motor and the cabinet light circuit. Power is supplied from terminal "W" through terminals 3 and 4 of the timer switch when it is in the unit position. From there it passes through the temperature control to terminal "Y" (yellow) of the wiring panel, and on to the starting relay of the motor compressor. It then passes through the motor windings to return to the source.

When the timer switch is in the defrost position, current flows from terminal "W" through the timer switch terminals 3 and 2 to binding post "B" (black) of the terminal strip. From there on through the temperature limiter, at which point the current takes a parallel path through the upper and lower defrost heaters. On leaving the heaters, the path is through terminal "R" of the wiring panel and back to the source.

The food compartment heater (thermal damper) is connected to terminals "Y" and "W" of the wiring panel. This effectively places the cabinet heater in parallel with the refrigerator temperature control. Therefore, this heater element is only energized when the temperature control contacts are open.

#### TEST AND INSPECTION OF THE DEFROST TIMER THERMOSTAT

To determine if the timer motor is operating, its motion may be observed through the inspection window, which is located in the front right hand corner of the

top panel. The direction of rotation is counter-clockwise.

To check the switch action, a wattmeter may be plugged into the power outlet and with the refrigerator drawing power through the wattmeter, manually rotate the timer indicator knob in a counter-clockwise direction. As the timer passes through the period of 1:00 A.M. the wattmeter will show a large wattage reading of between 750 and 1000 watts. Continuing the rotation, the switch will be tripped to the unit position, which will be indicated on the wattmeter by a reading of between 175 and 225 watts. If the sealed unit is in the "off" cycle, the wattmeter will read approximately 15 watts for the cabinet heater will be drawing current.

The gear train may be checked by noting the position of the timer indicator knob, and then permitting the timer to operate for a short period to check the knob movement. No movement would indicate a defective drive train or an inoperative motor. Therefore, the timer assembly would have to be replaced.

A bench check of the timer may be made by connecting a 115 volt supply to terminals 1 and 3 in order to operate the timer. Connect two 115 volt lamps to terminals 3 to 2 and 3 to 4, respectively, as indicators of operation. To check the timer switch, turn the knob slowly in a counter-clockwise direction. Lamp 3-2, which represents heater operation, will light at approximately 1:00 A.M. Continue turning the indicator knob slowly until lamp 3-2 goes out and lamp 3-4, which

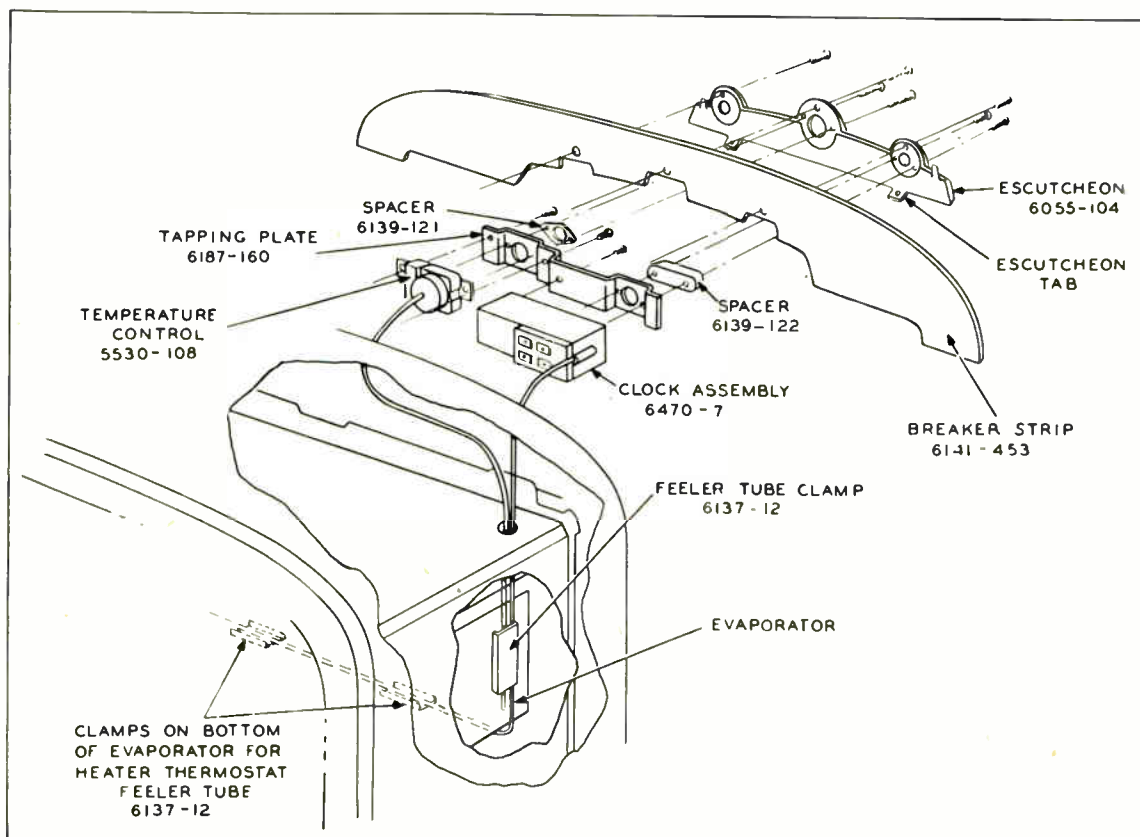


FIGURE FIVE



is the unit circuit, is illuminated. This lamp will be lighted for approximately nine-tenths of the rotation. To check for accuracy, the timer dial rotation should be checked against a standard clock. This check should be made over a period of at least 24 hours.

**DEFROST HEATERS**

Insert the refrigerator power cord into a wattmeter that has been connected to the wall outlet. Turn the temperature control to position 1. Rotate the timer indicator knob in a counter-clockwise direction until 12:00 P.M. is reached and read the wattage. The wattage, which indicates correct motor operation, should be shown. This wattage will be between 175 and 225 watts. The timer should then be rotated to 1:00 A.M. The motor compressor should continue to operate with no appreciable change in wattage. Continue to rotate the timer knob towards 2:00 A.M. until the unit stops and the heaters are energized. This will be evident by a large increase in wattage. After the heaters have been operating for a few minutes there should be a wattage indication of approximately 750 watts. If the meter reads 600 watts, it would show that the top heater is inoperative. A reading of 150 watts would show an open bottom heater. After the check is completed, set the timer indicator to the correct time of day.

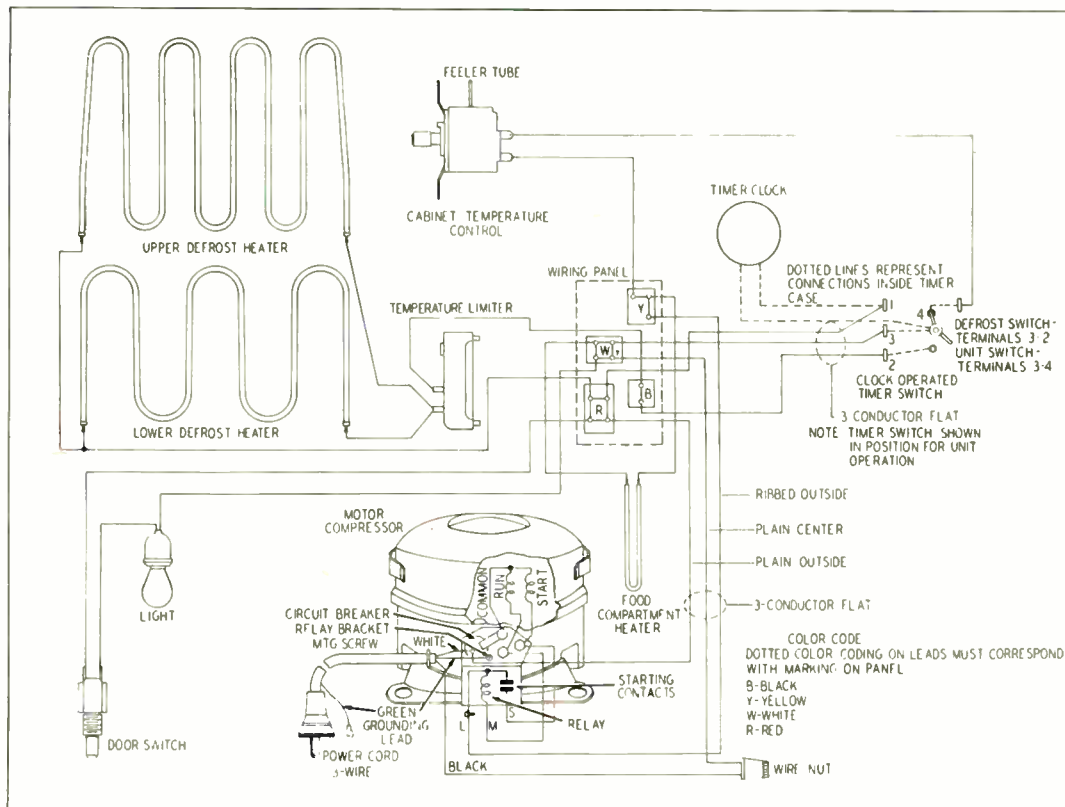
**CHECKING THE TEMPERATURE LIMITER**

The temperature limiter is incorporated in the defrost-heater circuit to open the circuit if the temperature of the evaporator becomes excessive. It is a mechanical

circuit breaker which resets itself after a short cooling interval, and should remain closed during the normal defrost period. To check the temperature limiter, proceed as follows:

1. Connect a wattmeter to measure the power used by the refrigerator.
2. Set the temperature control to position 1, and allow the unit to operate until it stops automatically.  
NOTE: Step 2 may be omitted if the evaporator temperature is sufficiently cold (below 20°) to assure that the heater-thermostat contacts are closed.
3. Remove all but the four corner screws on the outer cover plate, so that the cover may be quickly removed when desired.
4. Turn the clock indicator knob in a counter-clockwise direction until the defrost heaters are energized (as indicated by a large increase in wattmeter readings).
5. As soon as the defrost-heater circuit is opened by the thermostat, take out the remaining cover mounting screws, and remove the cover.
6. Disconnect the leads from the limiter, and check for continuity. The limiter contacts should be closed at defrost temperature. If the limiter is found to be open, or otherwise defective, remove it by taking off the two speed nuts, one at each end of the limiter.

The limiter is adjusted at the factory to open its contacts at a temperature between 80° Fahrenheit and 95° Fahrenheit.



**FIGURE SIX**

## SHOP PRACTICES AND SERVICE TECHNIQUES—AUTO RADIO

## CHECKING FOR IGNITION INTERFERENCE

Checking for causes of reception of ignition interference with the auto radio chassis itself is not usually a standard practice when servicing an auto radio, but should a customer complain of noisy performance that could be interpreted as ignition interference, two circuits of the auto radio should always be checked. These circuits are the input electrical sources through which ignition interference may be fed into the radio. Unfortunately, also the components may be defective, as far as spark suppression is concerned, yet will have no effect on the operation of the radio that would bring their condition to your attention.

1. The circuit including the antenna choke as shown in figure 1.

This choke is usually of special design in order to be most effective at the peak frequency known to be produced by the ignition system of the automobile. It, therefore, is self-tuned to a definite frequency and anything changing this frequency response by the choke will, therefore, make it less effective.

While equipment is not usually available to determine that the choke is actually 3 micro-henries or similar figure, a rough determination can be made with an ohmmeter as the impedance is usually about 3 ohms. Therefore, if there is a great variance from this figure,

say to less than one ohm, the choke should be considered defective and must be replaced.

Again considering the purpose and design of this coil it is important that replacement be made with the same part number coil, not with a similar coil, or it will not be effective.

2. The "A" lead by-pass condenser and choke circuit shown in figure 2. The condenser is sometimes referred to as a "spark plate" from the style of its construction.

Most condensers of this type have the case, as one plate of the condenser, riveted to the auto radio housing—the other plate being "fed through" the case. Poor grounding of the condenser case, such as loose riveting, etc., will make the condenser ineffective. This is sometimes abused if the radio is picked up by the "A" lead as a convenient handle. Even though anchored it may move the condenser internally some—to the extent of changing capacity and could result in a shorted "A" lead.

Due to the heavy construction of the choke about all that generally happens to it is a secondary result of an internal short causing so much current to flow that the coil heats up and chars the insulation. Watch for this condition and replace the choke if this has happened.

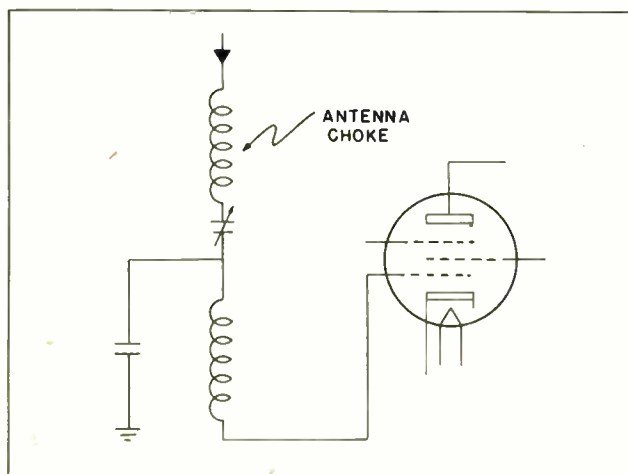


FIGURE ONE

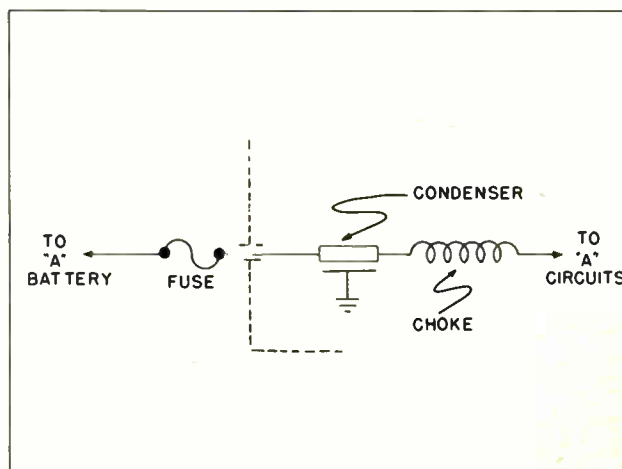
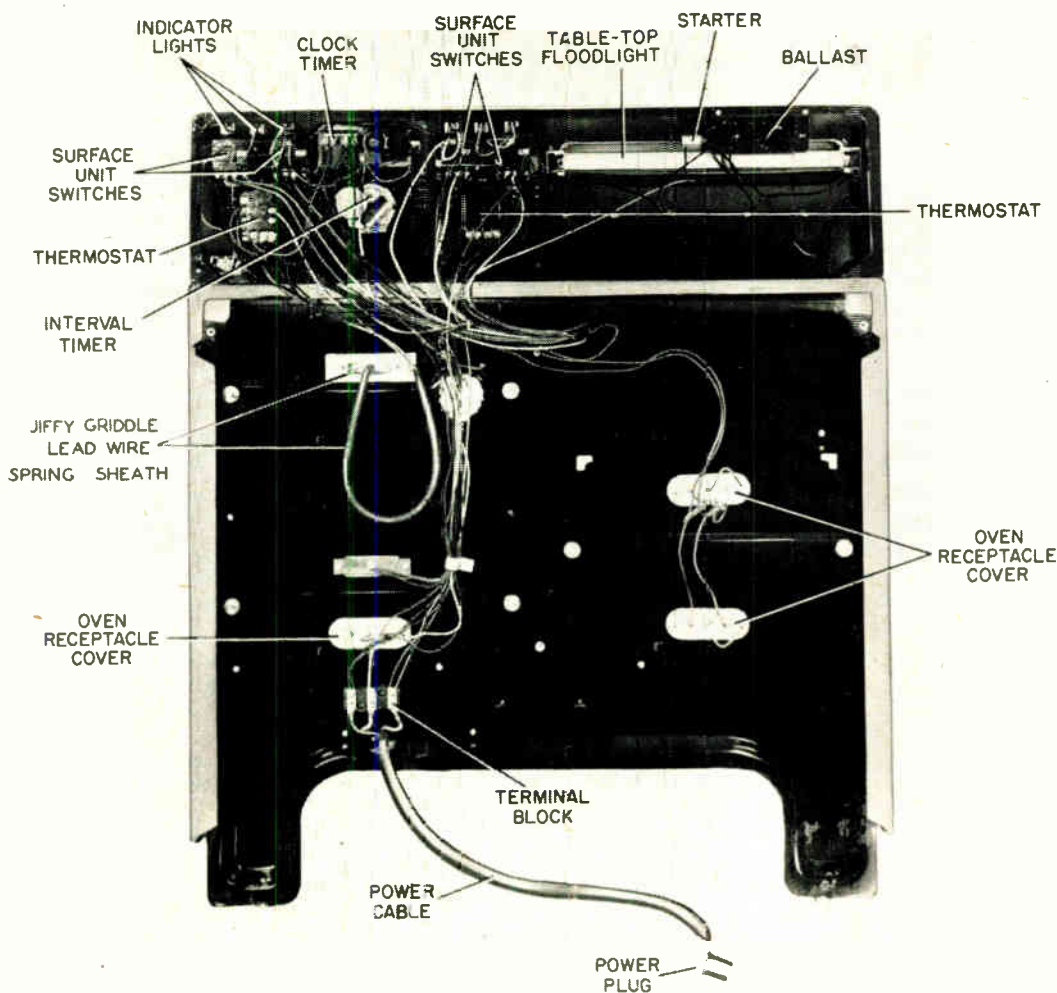


FIGURE TWO

**SHOP PRACTICES AND SERVICE TECHNIQUES—ELECTRIC RANGE**

# REVIEW OF CHANGES AND MATERIALS



**FIGURE ONE—Rear View of Philco Electric Range, Model 428**

Our 1952 line of Philco Electric Ranges have been on the market for over seven months and we feel that any minor problems have been ironed out in our production at the factory in Mount Clemens, Michigan. A review of the changes we have made and of the material that is available to you will complete your 1952 service files.

It is a fact that all of the service information concerns those electric ranges that include a Jiffy Griddle. Figure 1 shows you the back of a model 428 range and points out the parts that are involved in the article to follow.

We have never been able in our tests at the factory to duplicate a condition that we know exists in the field, that is, the buckling Jiffy Griddle spring sheath.

When this condition occurs, the buckled sheath prevents the Jiffy Griddle from sliding all the way back into its storage position. This in turn prevents the oven door from closing properly. When we do find this condition in the field, there is usually a badly connected spring sheath terminating wire. Proper fastening will prevent this problem from reoccurring.

We recommend that the spring sheath be replaced and that the replacement be fastened to the back of the range as shown in figure 2. It is important that the sheath be hung as indicated and that the part which is fastened to the screw is lined up as shown.

In addition to the spring sheath difficulty, Philco Electric Range customers might have had another difficulty with their range "Jiffy Griddle" operation, as in-

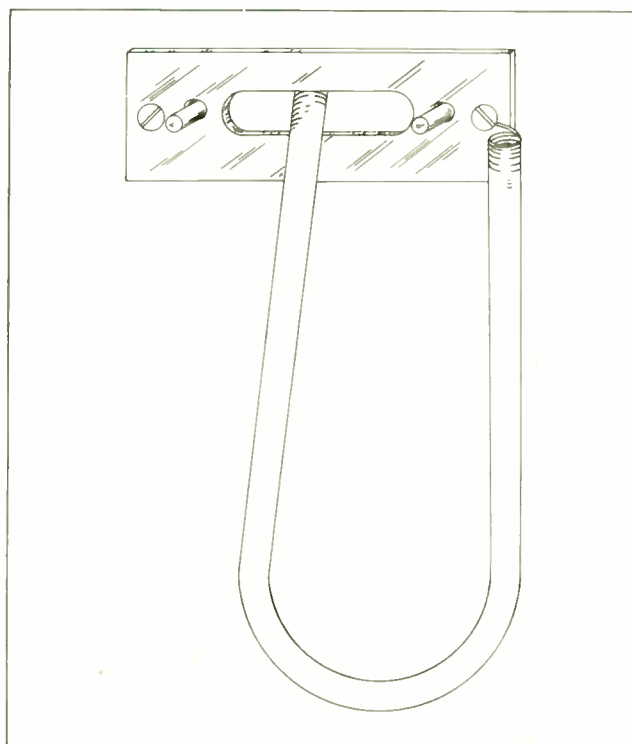
cluded in models B-417 and B-418, and in early production of models C-423D, C-425, C-427, and C-428. Production since February has included this part. It occurs because of the fact that constant heating and cooling of the oven causes the griddle contacts to lose their temper or spring and, therefore, fail to hold the griddle terminal block and female receptacle together when the griddle is in the "use" position. In other words, when the griddle is pulled out the power to the broil unit is cut off.

Here's how to correct this condition:

Order one part number 3403-8 Jiffy Griddle terminal block retaining clip from Philco.

To install the retaining clip, see figure 3, follow the steps listed below:

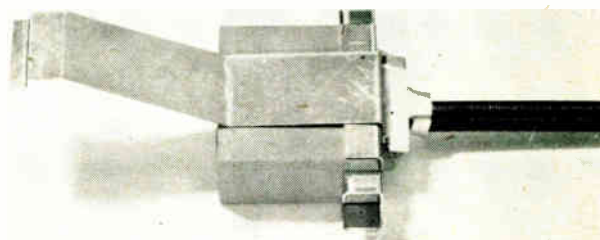
1. Disconnect range from power source.
2. Remove broil glass.
3. Remove Jiffy Griddle.
4. Remove broil unit.
5. From the rear of the range, pull back female receptacle so that contact housing can be removed.
6. Remove contact housing cover.
7. Pull out housing and contacts from the rear.
8. Examine contacts and wire for burning and replace if necessary.
9. Reassemble but leave two securing nuts loose.
10. Insert clip on the bottom of contact housing between the nuts and the back of the receptacle. See figure 4.
11. Tighten two nuts.



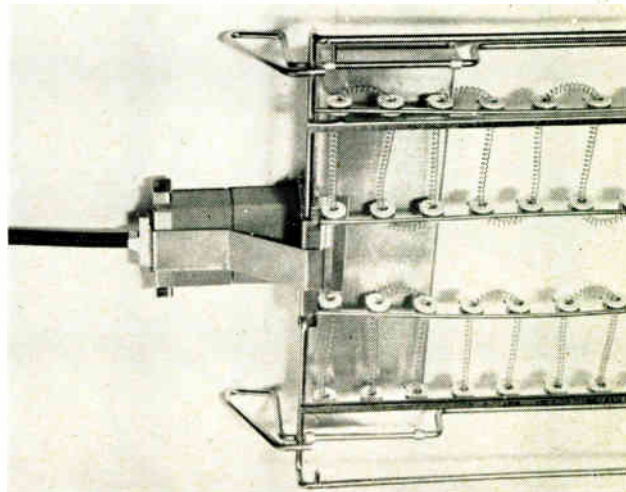
**FIGURE TWO—Proper Alignment of Jiffy Griddle Spring Sheath**

12. Reassemble housing cover, replace broil unit, griddle, broil glass and check to see that retaining clip is performing its function. It should slide up under front of terminal block and prevent terminal block and its receptacle from parting.
13. Show customer how to remove broil unit so that she will be able to clean oven.

We have also found that steam leaks out of the back of the range through the Jiffy Griddle spring sheath opening in the back of the oven when that oven is being used for roasting or baking moist food. The steam leakage condenses on the back of the control panel glass surface making it difficult to read the indicators. To correct this, a kit has been devised which prevents this escape of steam. It was answered in your May mailing of the "Philco Serviceman." The installation directions will be found there and when or if you order



**FIGURE THREE—Jiffy Griddle Retaining Clip (Part No. 3403-8) Mounted on Receptacle**



**FIGURE FOUR—Retaining Clip in Position**



these parts from your Philco Distributor please ask for the following:

- 1—208530 Baffle
- 1—208540 Baffle
- 1—solid wire 5 inches long
- 1—8653-5 wire nut

In an effort to get our customers better service with respect to repairing or exchanging oven control clocks, we are changing our policy on this item.

Up to this time these clocks have been sent back directly to General Electric at Somersworth, New Hampshire.

In the future all oven control clocks which become defective, should be sent transportation charges prepaid to the Philco Distributor in your area.

The clock should be tagged with a standard PR-1126 tag, properly filled out. Special attention should be paid to the length of time the clock has been in use. Clocks should be returned in adequate packing so that they will not be damaged in transit.

The clocks will be repaired or exchanged free of charge if they are in warranty. If not, then a charge will be made.

Another bit of valuable information is found in the fact that the surface units are now sealed against the possibility of grease or other foreign matter getting up into the unit, through the terminal block and, in turn, causing shorts.

A compound of silicon and rubber is placed between the two halves of the terminal block before it is fastened together by the two nuts and bolts. The com-

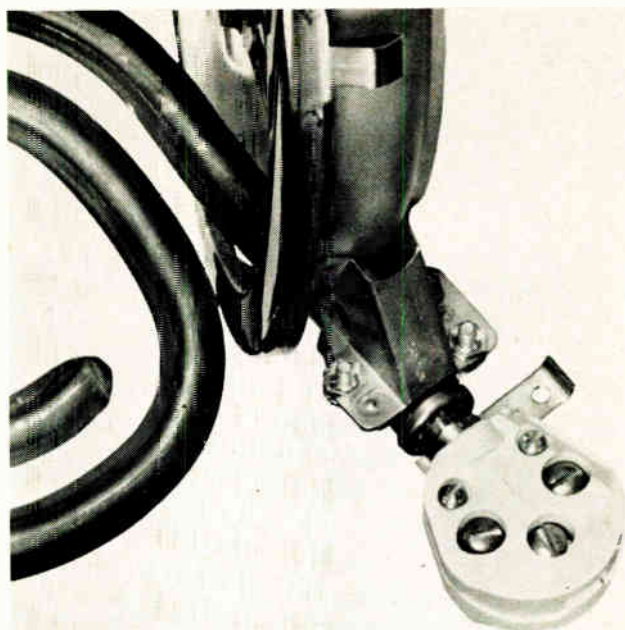


FIGURE SIX—The Surface Unit Terminal Block Is Now Sealed

pound stays soft until it is cured by the heat of the unit and experience shows that it takes about a week's use before it will harden, see figure 6.

You will find that if you are aware of the few service techniques applicable to the Philco Electric range, then you will be adequately equipped to handle the jobs you will encounter. All of the other servicing jobs on Philco ranges are handled in a straightforward way with no special skill or information necessary.

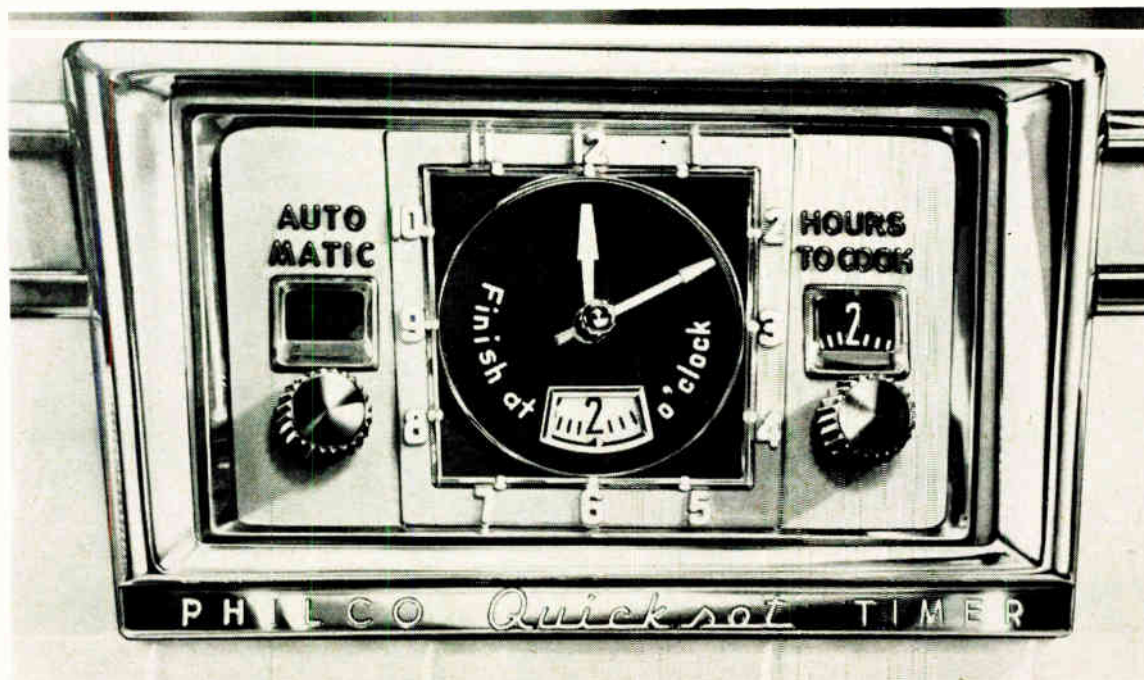
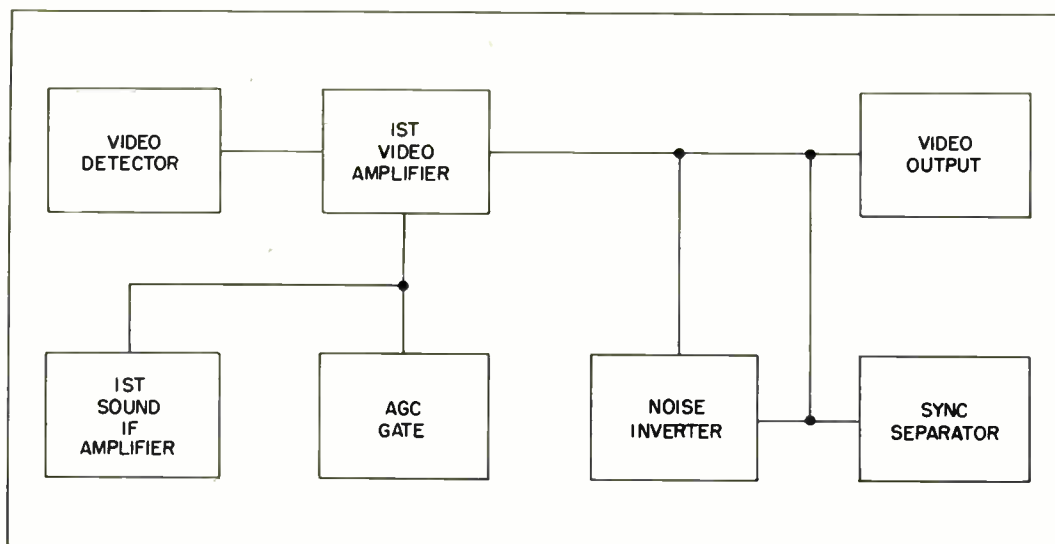


FIGURE FIVE—Oven Control Clock

**SHOP PRACTICES AND SERVICE TECHNIQUES—TELEVISION****AGC AND NOISE INVERTER CIRCUITS****FIGURE ONE**

"Gated AGC" and the "noise inverter" are two of the new circuits included in the TV-90 receiver. For complete understanding of these circuits and their operation it will be well to start circuit description with the video detector circuit.

The output from the fourth video IF stage is detected in the crystal video detector circuit. The video detector is direct coupled to the first video amplifier. The output of the first video amplifier feeds several circuits, the video output tube, the gated leveler, the sync separator. The first video amplifier and first sound IF tubes are connected in series creating a voltage divider network. This supplies a regulated source of voltage to be applied to the AGC gate tube. The current path through this divider network is from the cathode of the video amplifier to the plate, through the plate load resistors and the cathode resistor of the sound IF and on to B+ from the plate of the first sound IF tube.

A 10K resistor has been placed in the screen grid circuit of the AGC gate tube to prevent damage to the circuit components in the advent of failure of the 1st sound IF tube. This tube failing would cause all bias to be removed from the AGC gate tube permitting it to conduct heavily. During line time when there is no plate voltage on the gate tube an excessive current would flow through the 1st video amplifier tube and on through the screen grid circuit of the gate tube. This 10K resistor limits the current flow thus protecting the circuit components.

The video detector is a 1N64 crystal and is direct coupled to the 1st video amplifier tube. The composite video signal is of negative polarity as it is fed to the grid of the video amplifier tube. Thus, all variations in grid voltage will be from zero volts toward a negative direction. The 6U8 tube, which is used as the video amplifier, has characteristics such that with certain operating voltages on the plate and screen, variations of the grid voltage near zero volts will produce no change in plate current. This would result in compression of the white portion of the composite video signal. To eliminate any possibility of this, a resistor has been inserted into the cathode circuit of this tube to maintain a minimum bias above this point.

In order to supply the noise inverter circuit with sufficient amplitude of signal for efficient operation a special voltage divider network has been inserted in the grid circuit of the AGC gate tube.

When the receiver is first turned on, there is no AGC developed and the large amplitude of composite video signal applied to the grid of the 1st video amplifier tube cuts this tube off. Because of no current flowing through the tube the plate voltage of this tube will rise to B+ value. The cathode of the AGC gate tube has a fixed voltage of 125 volts while the grid voltage varies from this 125 volt value depending upon the current flowing through the plate load resistor of the 1st video amplifier as these two tubes are direct coupled. With the plate voltage of the video amplifier at B+

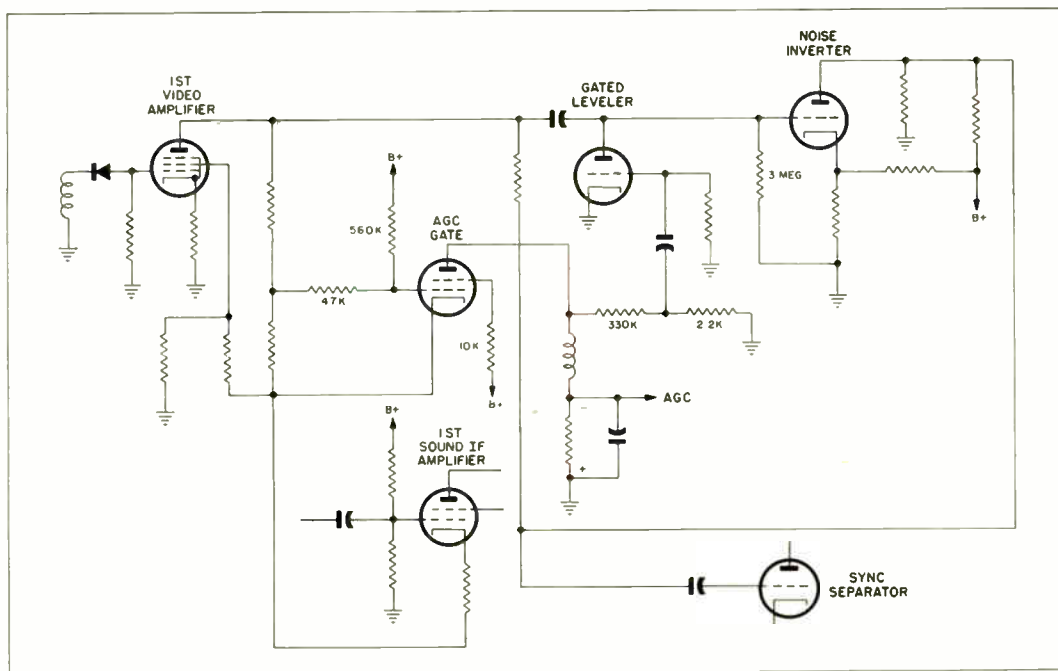


FIGURE TWO

value and, therefore, the gate tube grid at B+ value, the gated AGC tube conducts heavily developing AGC voltage. The gain of the receiver is cut back and the 1st video amplifier tube is brought out of cut-off allowing plate current to flow reducing the plate voltage, hence, the gated AGC tube grid voltage. This action continues until a state of equilibrium is reached. When equilibrium is reached, the AGC gate tube is operating just above cut-off developing the required AGC voltage. At this time, the sync tips of the composite video signal on the plate of the video amplifier tube occur at approximately 15 volts below B+ value, thus permitting the circuit to pass noise pulses up to 15 volts in amplitude at the video amplifier. The cut-off level of the 6AU6 AGC gate tube is a negative 5 volts and would normally operate the system with the sync tips at 5 volts below B+ level at the plate of the video amplifier so it is necessary to introduce a corrective voltage which will increase this distance between the sync tips and B+ level. This corrective voltage is obtained by the voltage divider network in the grid circuit of the AGC gate tube. A 560K resistor is tied from the B+ supply to the grid of the AGC gate tube and a 47K resistor is tied from the grid to the plate load resistor of the video amplifier tube. This resistor network results in an approximate 10 volt drop across the 47K resistor. This 10 volt added to the normal 5 volt operating condition will result with a 15 volt difference between sync tip level and B+.

To understand the manner by which the sync tips of the composite video signal at the plate of the video am-

plifier tube are maintained at approximately 15 volts below B+ level, examine these circuits again. With a very large signal input from the video detector to the video amplifier grid the video amplifier tube would be cut off because its grid is driven very negative. This would result in no plate current through the tube and the plate would assume B+ potential. See figure 5.

If the signal input was reduced in amplitude so as not to drive the video amplifier to cut-off, the plate of this tube would not reach B+ value. See figure 6.

Therefore, the distance that the sync tips lie from B+ is determined by the input to the video amplifier stage and input to the video amplifier is determined by the gain of the preceding stages which are controlled by AGC. Thus by predetermining the level at which the AGC gate tube functions, the distance from B+ that the sync pulses will occur, can be set.

The gated AGC system provides an AGC voltage completely independent of, or affected by changes in the video leveler or by insertion of noise.

The plate of the AGC gate tube obtains its voltage from a pulse developed in a special winding on the horizontal output transformer. This pulse is approximately 500 volts peak to peak in amplitude and occurs at a rate of 15,750 times per second. That is, they occur during horizontal sync pulse time. Hence, the AGC gate tube conducts only when plate voltage is present on the tube which is during horizontal sync pulse time. The relative bias on the AGC gate tube at this time will determine the amount of conduction of the tube



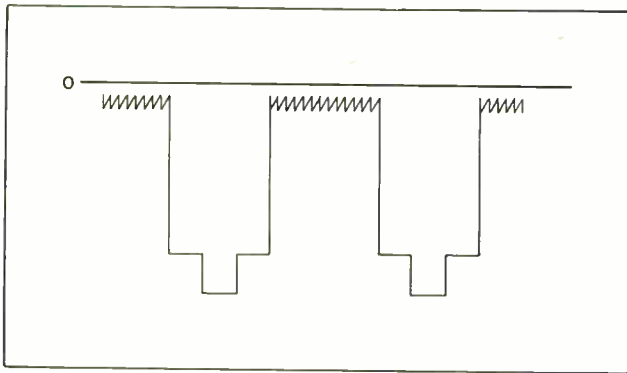


FIGURE THREE

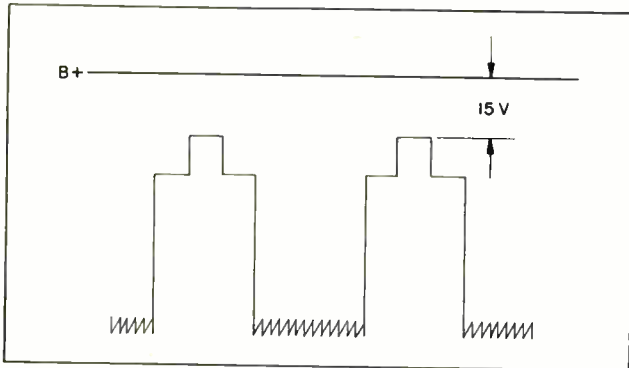


FIGURE FOUR

and, therefore, the amount of AGC voltage developed. Since this conduction takes place only during horizontal sync pulse time, any variation of bias on the AGC gate tube during line time has absolutely no affect on the AGC voltage developed. The possibility of noise occurring repeatedly at horizontal sync time is so remote and the RC time constant in the AGC filter network so chosen that any chance of this causing an upset to the AGC can be completely disregarded. The current flow for the AGC system is through the AGC tube and down through the AGC resistor network to ground. This produces a negative voltage that can be utilized to control the gain of the RF and IF stages.

The composite video signal from the 1st video amplifier tube is coupled through a coupling condenser to the plate of the gated leveler tube and the grid of the noise inverter stage which are direct coupled. The gated leveler tube could be referred to as a gated DC restorer circuit. Its purpose is to adjust the DC level of the incoming composite video signal so that the sync tips are at approximately zero voltage, thus, any signal greater than sync tip level would drive the grid of the noise inverter tube positive.

When the receiver is first turned on, the DC zero level of the signal on the grid of the noise inverter tube is at the mean average between the positive and negative extremes of the signal. The positive portion of this signal, when applied to the plate of the gated leveler tube, will cause it to conduct causing a voltage to be developed across the noise inverter grid resistor and charging the coupling condenser. This action will continue until the coupling condenser has charged up to a sufficient value that the sync tips just slightly exceed

the negative charge. Thus, the gated leveler has changed the DC zero reference level from the mean average position to approximately sync tip level. The gate pulse that is applied to the plate of the AGC gate tube is also fed through a voltage divider network resulting with a pulse output from 2 to 3 volts peak to peak. This pulse is applied to the grid of the gated leveler tube. The gated leveler, therefore, will only function during horizontal sync time and variation in signal amplitude, during line time, will not upset or change the zero level position in respect to the composite video signal.

The noise inverter tube has a fixed cathode bias supply of 8 volts. The cut-off level of this tube is approximately 3.5 volts. This means that the grid must go 4.5 volts positive before the tube will conduct. Actually, the sync tips rise approximately one volt above the zero level due to some voltage being necessary to maintain a stabilized condition in the gated leveler circuit. Therefore, any signal, such as noise pulses, greater than 3.5 volts in amplitude above the sync tips will cause the noise inverter tube to conduct. The noise pulses that reach above the cut-off level will be amplified and inverted by the noise inverter stage. This amplified signal is mixed with the composite video signal as it enters the 1st sync separator tube and being inverted and greater in amplitude will completely cancel out all noise present in the signal at the grid of the sync separator.

What of noise pulses less than 3.5 volts above sync tip level? This condition rarely occurs but if it should the sync separator circuit has a certain immunity to noise and therefore there would be no detrimental affect to sync stability.

The trouble shooting procedures for the noise inverter and gated AGC circuits are relatively simple.

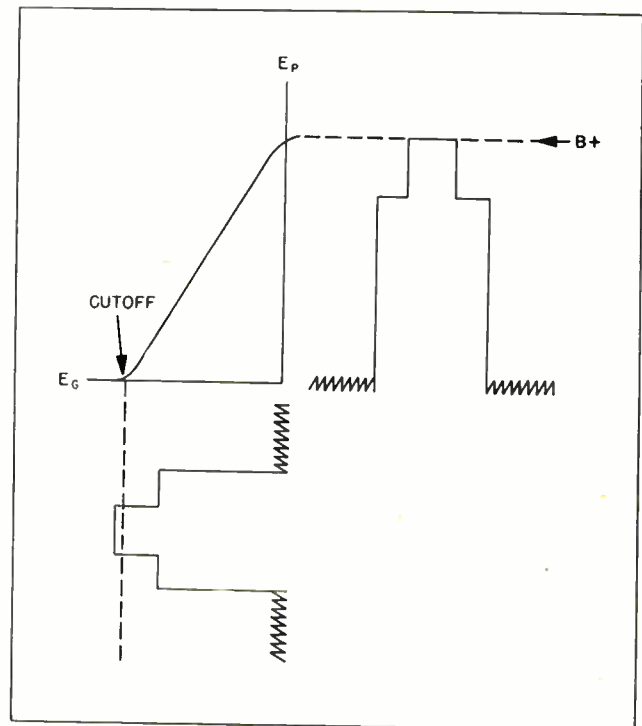


FIGURE FIVE



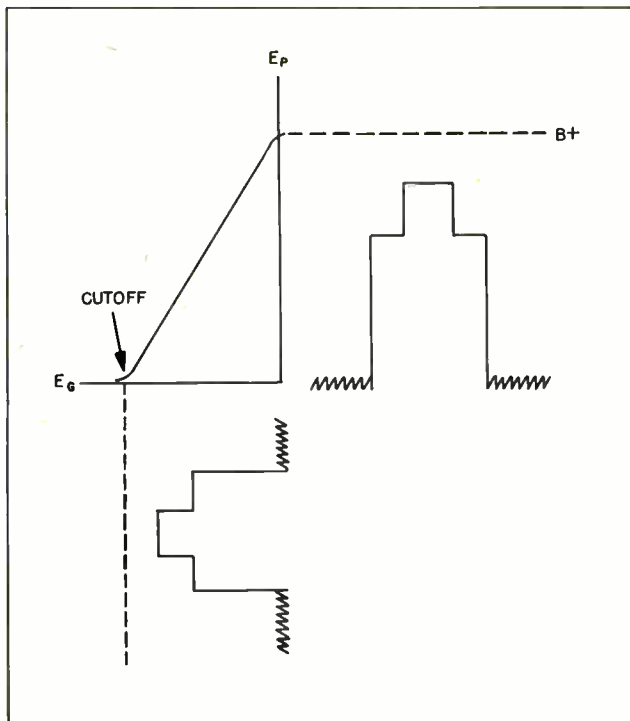


FIGURE SIX

The easiest and most efficient method of trouble shooting these circuits is by use of an oscilloscope. The noise inverter circuit has one key check point. That is the cathode of the noise inverter tube. With noise present in the received signal to the receiver and the oscilloscope connected to the cathode of the noise inverter tube, noise information should appear on the face of

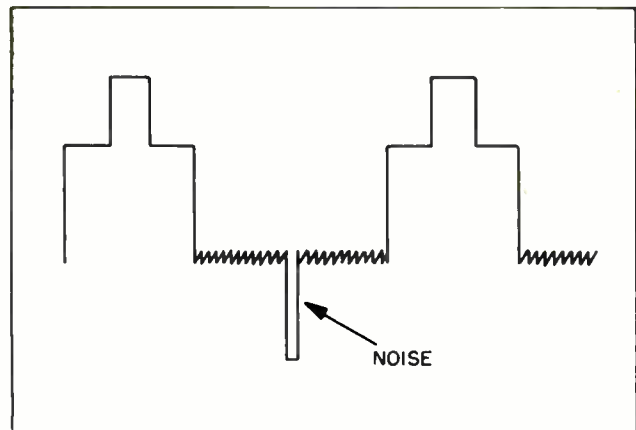


FIGURE EIGHT

the oscilloscope if the noise inverter circuit is functioning normally. If no signal is present at the cathode, the noise inverter circuit is abnormal. Change the tube and use the volt ohmmeter method of trouble shooting.

For the AGC gate circuit, check the wave form at the plate of the AGC gate tube. This should be a pulse approximately 500 volts peak to peak and a frequency of 15,750 cps. Present on the grid of the gate tube should be the composite video signal. For isolating trouble within the AGC gate circuit, apply a fixed bias to the AGC buss so that the remainder of the receiver can function normally. Then use the volt ohmmeter method of trouble shooting this circuit. Remember that the gate tube obtains its bias from the series set up of the first sound IF and first video amplifier tubes. Trouble in these circuits can upset the divider network.

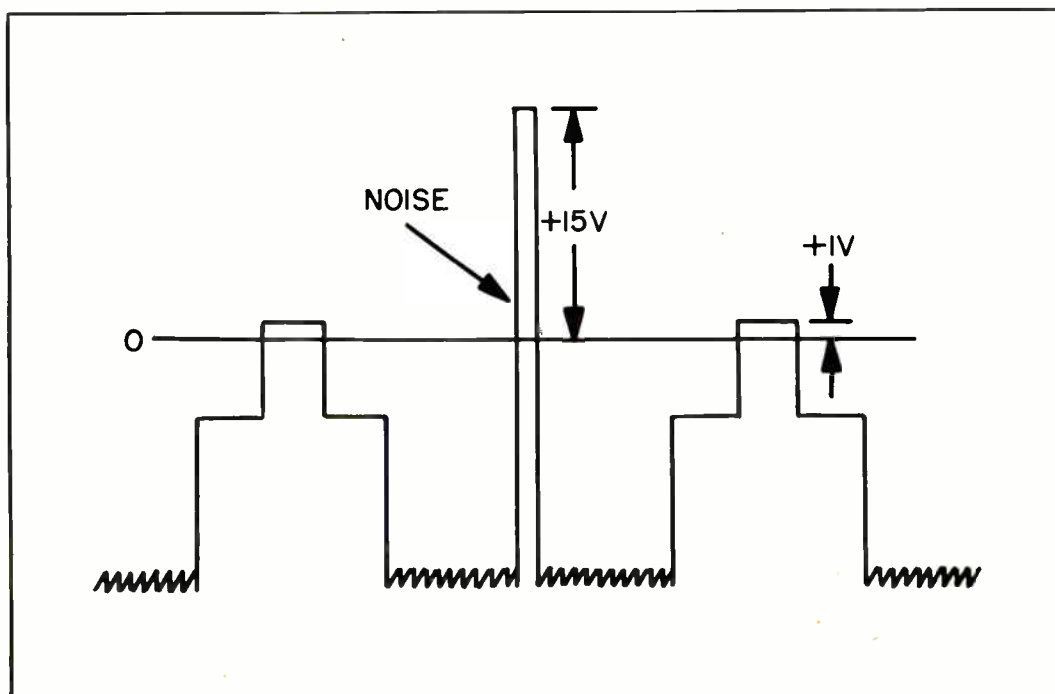


FIGURE SEVEN

## PHILCO RUSHES TELEVISION TRAINING FACILITIES TO DENVER!

*Continued from Page Two*

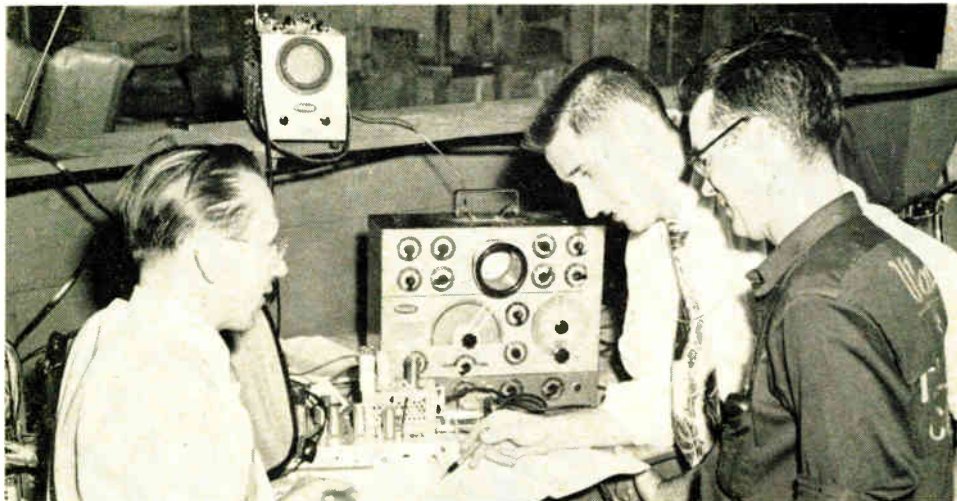
Wherever new station construction is being planned today Philco Distributors in co-operation with Philco Service Headquarters are assembling the facilities, the personnel and the knowledge to conduct television service schools on behalf of their PHILCO FACTORY-SUPERVISED SERVICE Members.

If you have not had television experience, upon enrollment you will be classified as an Associate Member of PHILCO FACTORY-SUPERVISED SERVICE for Television and will begin a concentrated period of study under the auspices of your local Philco Distributor. The Distributor's staff of servicing experts conducts this phase of training in new Television markets, and the Philco Television Service School maintains a schedule of eight hours a day, five days a week. This concentrated study you will undergo is a combination of 80 hours film and recorded lectures, plus practice through actual bench work.

At your disposal will be the finest facilities available in television today; a complete line of test equipment, bench facilities and television receivers for the application of all theory and visual aids presented throughout the course. Philco's scientists and engineers have worked endlessly on a theory for rapid instruction in this complex field, and have produced a formula for training second to none. This course is the most modern, hard-hitting, extensive training program available to you today!

Never before in the entire history of radio and television have you been offered an opportunity to participate in a program of this type. Not only do you benefit by increased knowledge of television servicing, but your business and profits will expand immeasurably through these efforts.

Philco extends an invitation to you, the independent serviceman, to become part of one of the world's leading television servicing organizations. Philco Distributors all over the country are eager to acquaint you with the complete details concerning this program — contact the one in your territory!



An instructor and two Denver servicemen solve a tough circuit problem using the bench facilities provided for Philco's Television Service School by Distributor — Walter Slagle Company.

# PHILCO *Electronic* SUPERVISOR

**PHILCO**  
**Factory-Supervised**  
**Service**

**DECEMBER, 1956**

## COLOR TELEVISION

Frequency Interleaving ... 2

## TELEVISION

Oscilloscope Waveforms  
of Television Chassis ..... 5

## HOME RADIO

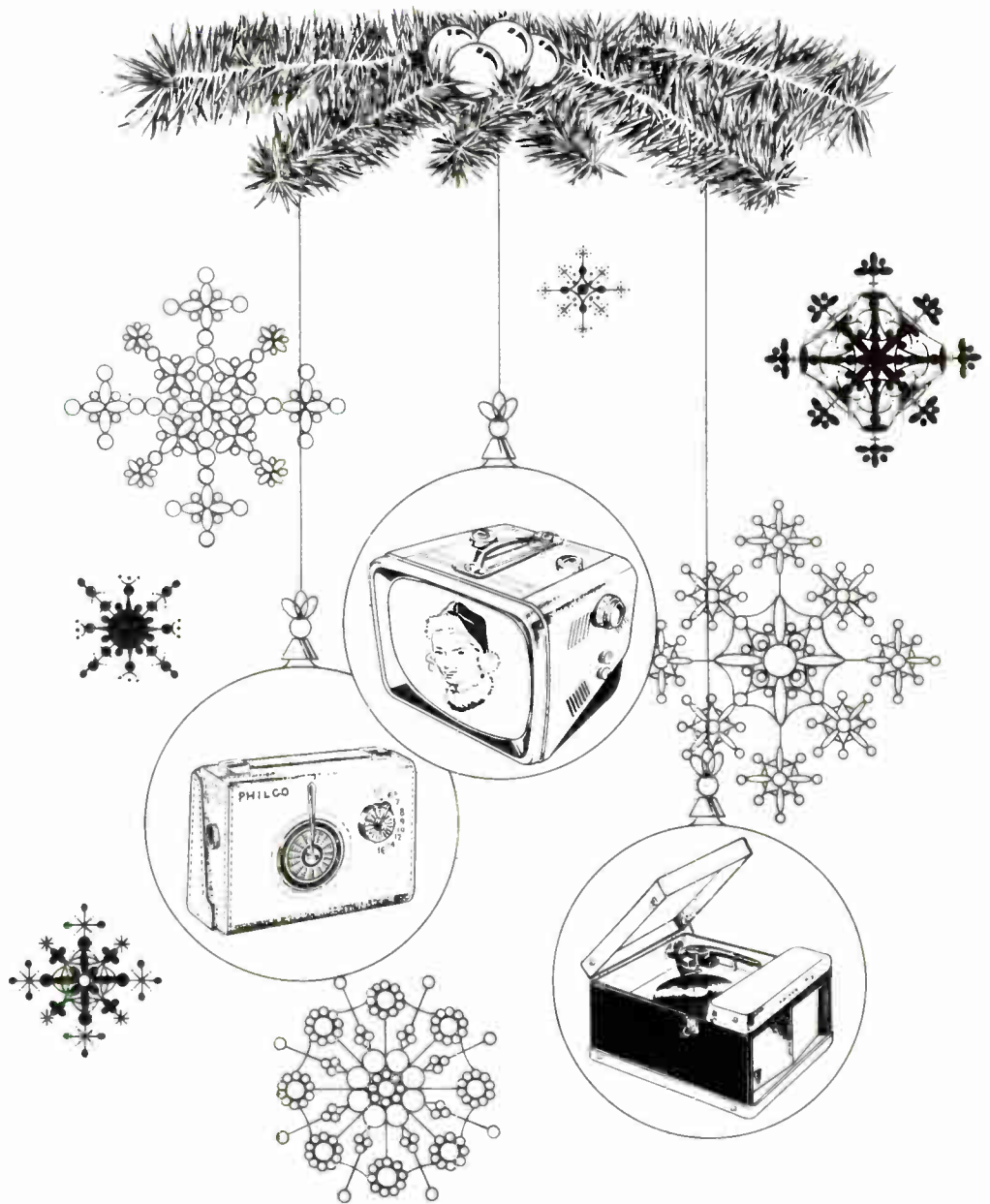
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*Seasons Greetings*



# FREQUENCY INTERLEAVING IN COLOR TV

Frequency interleaving is an essential factor in color television transmission. Therefore, its basic principles should be understood.

All of the brightness and chroma information, for color television, must be transmitted within the frequency limits of the monochrome television channel. The brightness signal requires a full 4.2 megacycle band-width, which is the same frequency width allocated for video information. The chroma signal is combined with the brightness signal and shares a portion of this 4.2 megacycle band.

Frequency interleaving is made possible by the fact that the monochrome system is inefficient in its use of the frequency spectrum and many gaps are caused to exist, in which no information is transmitted. The reason for these gaps is in the scanning process used.

In the method used for scanning, video signals are caused to group about the horizontal and vertical scanning frequency harmonics. This grouping, about the harmonics of the horizontal frequency, is of particular importance. In figure 1, the second through the fifth harmonic, is illustrated, with their associate side frequencies. From this illustration the unoccupied region between the groupings of energy can be noted. These spaces are used for transmission of the chrominance signal by frequency interleaving. So as to obtain the most efficient use of these spaces, the F.C.C. has revised the Television Signal Standards for color and monochrome transmission to provide a horizontal sweep frequency of 15.734 cps and a vertical frequency of 59.94 cps. The operation of the monochrome

receiver is not affected by this slight change, as it is within tolerance.

For ease of explanation and comprehension, the signal components to follow, will be expressed in terms of half the horizontal line frequency as the reference point (7,867 cps).

It can now be observed in figure 2, that the video information signals fall in groups of even multiples of half the horizontal line frequency, 450th, 452nd, 454th, 456th, 458th, etc. The unoccupied spaces fall at the odd multiples of half the horizontal line frequency, 451st, 453rd, 455th, 457th, etc. The chrominance carrier is of a specific frequency (3.579545 mc.) so that the color information consists of an odd multiple of half the line frequency and is, therefore, interleaved between the monochrome information.

In order to thoroughly understand why the video signal information groups about the harmonic frequencies of these horizontal and vertical scanning frequencies, the derivations of a rectangular and sawtooth wave will be reviewed.

Within a rectangular wave there is contained a multitude of sinusoidal waves. The fundamental or lowest frequency component included in a rectangular wave is determined by the repetition rate of the wave. Each succeeding higher frequency component is a harmonic of the fundamental frequency. Theoretically, a perfect rectangular wave contains all harmonics of the fundamental frequency. Illustrated in figure 3, is a fundamental fre-

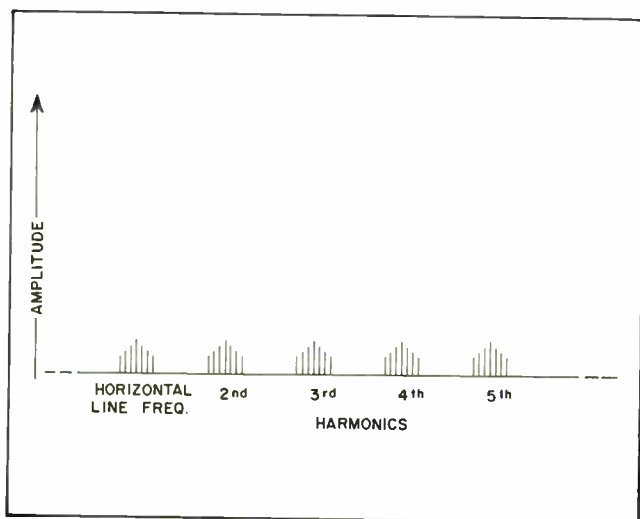


Figure 1

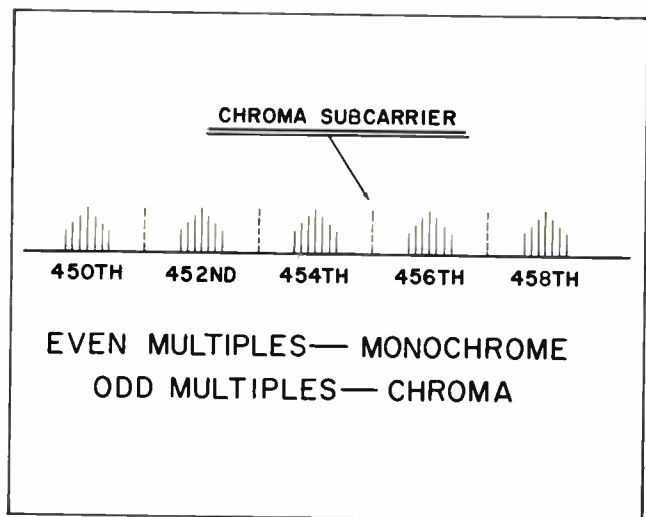


Figure 2



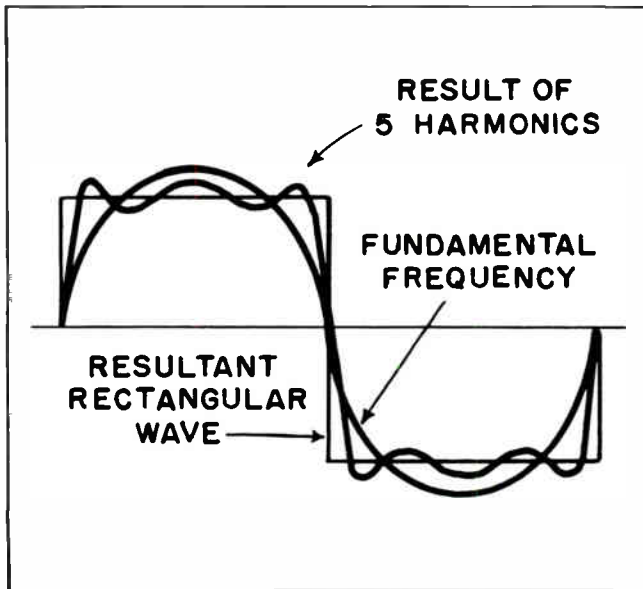


Figure 3

quency and the result of five of its harmonics. Examination will reveal the fact that if more harmonics are added to the resultant wave in figure 3, its sides would become steeper and its top flatter.

Illustrated in figure 4, is a sawtooth wave and the results of five of its harmonics. Its fundamental frequency, as in a rectangular wave, is its repetition rate. Examination shows that a sawtooth wave contains all harmonics of the fundamental frequency.

Of primary interest at this time is the horizontal scanning rate. Assuming that a vertical black bar centered on a white field, as in figure 5-A, is being scanned. The video voltage developed when scanning one line of this scene is plotted in figure 5-B. This video voltage is a rectangular

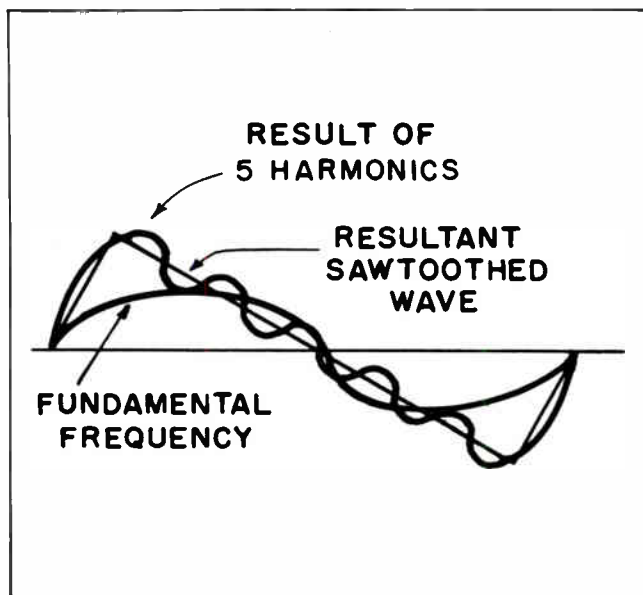


Figure 4

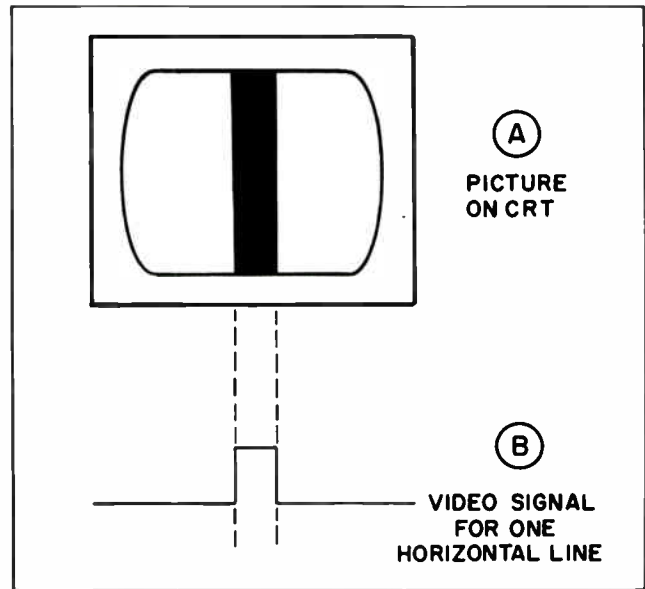


Figure 5

wave. Since the same shaped video voltage is developed for each horizontal scanning line and has a repetition rate of 15,734 cps, the output signal contains a series of rectangular waves which have a repetition rate of the scanning frequency. This repetition rate is considered the fundamental frequency of the rectangular wave. Thus, the video information frequency components for this recur at 15,734 cps and its harmonics.

Assuming next, that a gradual shading of from white through gray to black is being scanned, as illustrated in figure 6-A. The video voltage developed during one horizontal scanning line, of this scene, is a sawtooth wave, and is plotted in figure 6-B. Video voltage for each scanning line will be of a similar wave form. Therefore, the

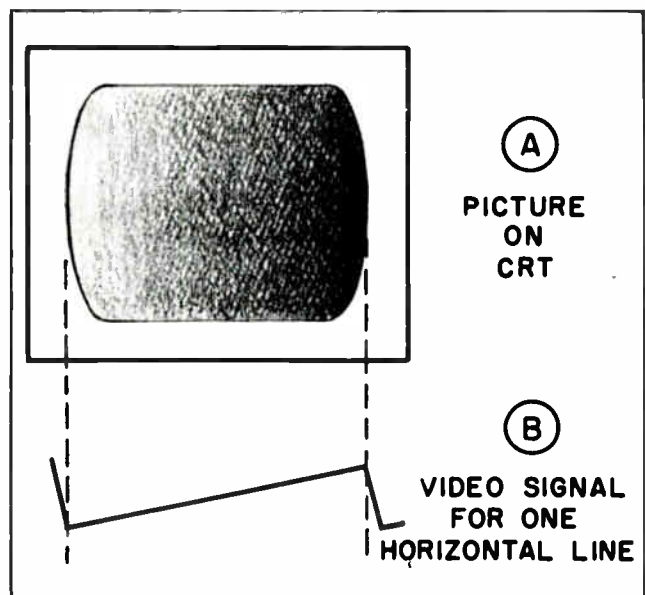


Figure 6

video information will consist of a series of sawtooth waves with a repetition rate or fundamental frequency of 15,734 cps. Since the frequency components of a sawtooth wave are the fundamental frequency and its harmonics, the video voltage of this scene contains frequencies of 15,734 cps, and all harmonics of 15,734 cps.

The more complexed wave shapes occurring in the video modulation are comprised of the basic rectangular wave and the sawtooth wave. Therefore, due to the method of line scanning used in television, it can be stated that all video modulation has a fundamental frequency of 15,734 cps. It is now evident why the video signal is illustrated as appearing at 15,734 cps intervals in figure 1.

The side frequencies, which are above and below the harmonics of the horizontal scanning frequency, are spaced 59.94 cycles apart. These are the result of the changes in video information from one field to the next. These field changes are occurring at the vertical scanning rate, thus resulting in frequencies that are harmonics of the vertical scanning frequencies. A small quantity of energy is produced at the vertical frame rate, but is so small that it is disregarded.

In an average telecast, portions of the picture are moving, developing any frequency within the video spectrum. Thus, the fundamental frequency of the video information may vary around 15,734 cps. This variation is proportional to the rapidity of the motion. This will cause some interference between the interleaved monochrome and chroma signals by a slight discontinuity along the edges of the moving portion of the scene. However, this effect is negligible.

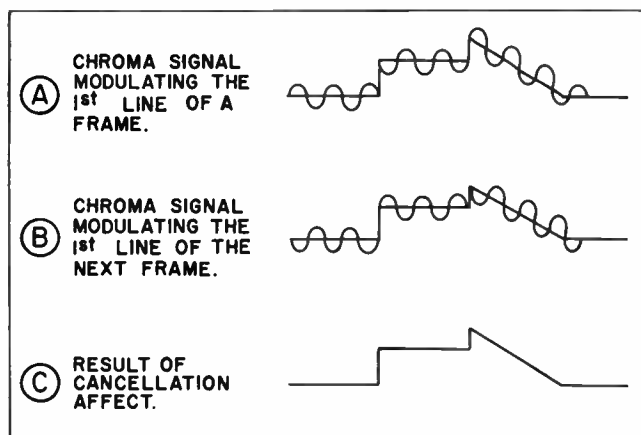


Figure 7

The chroma signal which is varying about the brightness signal and is modulating each horizontal scanning line, is inverted 180 degrees with each frame. By inverting this signal, the chroma subcarrier is prevented from producing an objectionable black and white interference pattern throughout the picture. This inversion of the chroma signal occurs because it passes through a whole number, plus one-half cycles each frame. A portion of one modulated horizontal scanning line is illustrated in figure 7-A. 525 horizontal lines or 1/30th of a second later (the corresponding line in the next frame), the modulation is inverted 180 degrees as in figure 7-B. These two signals being equal and opposite, essentially cancel each other as in figure 7-C. This apparent cancellation is due to the persistence of the human vision, by which the eye retains the brightness sensation of the horizontal scanning line from one frame to the next.

## SERVICE NOTES

Correction to the October issue of the Electronic Supervisor:

On page four of the October issue of the Electronic Supervisor, figure 5 has been incorrectly drawn.

Illustrated below, is the corrected diagram.

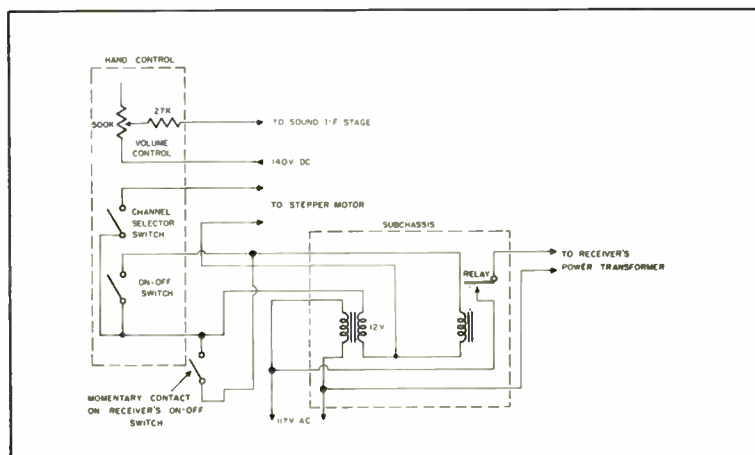


Figure 1

# OSCILLOSCOPE WAVEFORMS OF THE 7L40 AND 7L70 TELEVISION CHASSIS

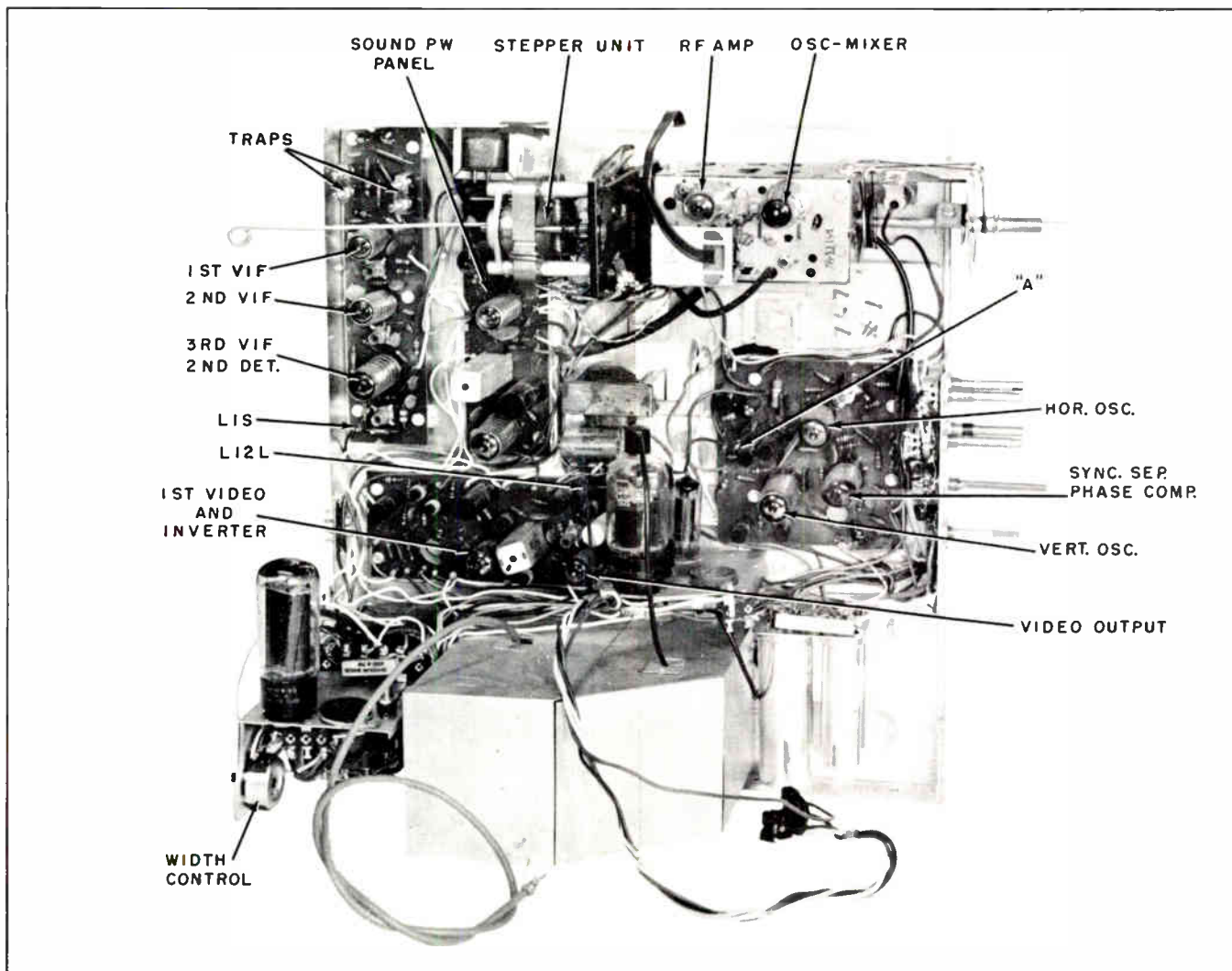


Figure 1

The complex circuit arrangement used in television circuitry may make servicing difficult unless the proper servicing techniques are employed. Of these techniques, the proper use of an oscilloscope and by knowing what waveforms and amplitudes to expect, can save the technician hours of servicing time.

On printed wire panels, such as Philco has employed on their 1957 "E" line, 7L40 and 7L70 chassis, servicing can be simplified if advantage is taken of the available test points and connections for obtaining scope and meter readings. Also, defective components can more readily be found and replaced, by the fact that all component parts

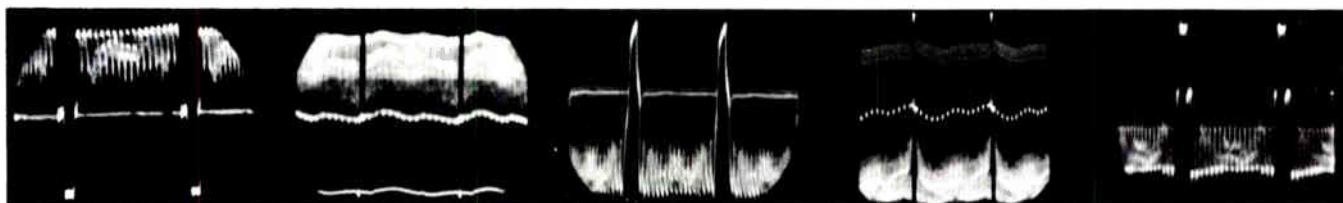


Figure A

Figure B

Figure C

Figure D

Figure E

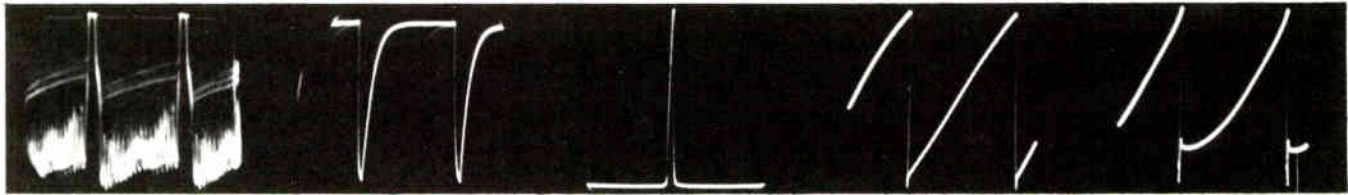


Figure F

Figure G

Figure H

Figure J

Figure K

are mounted on one side of the chassis. When servicing either of these chassis, standard servicing procedure should be followed.

It is hoped that this article will more thoroughly familiarize the technician with the test points, connections, voltages and waveforms that may be found in the 1957 television chassis. Also included are instructions for removing the chassis and picture tube from the cabinet.

To be described first, from an oscilloscope viewpoint, will be the 7L71 chassis, illustrated in figure 1. By referring to this illustration, the physical location of test points and connections, to be mentioned, may be observed.

The diode portion of the 3rd I-F tube is employed as the video detector and its output may be checked at point L1S. Figures A and B illustrate the composite video signal, with negative sync, that should be seen at this point. This signal should be approximately 2.5 volts P/P and any undesirable oscillation or sync clipping which may be occurring in the tuner or I-F section will cause distortion in the waveshape and isolate the possible trouble to one of these stages. Assuming this waveform is undistorted, the composite video signal can be traced in steps, directly to the picture tube, by placing the scope lead, first at the plate, pin 6, of the first video amplifier and observing its waveform and amplitude. This should be similar to figures A and B except it will be inverted and approximately 30 volts P/P. The next point to check is at the plate, pin 5, of the video output tube. Here the negative sync waveforms, as in figures A and B should be seen, but at 100 volts P/P. Next, the scope lead can be placed at point L12L, which is connected directly to the grid of the picture tube. The same waveform as on the video output plate should be observed. The over-all gain, for the two stages of video amplification should be approximately 40.

The sync take-off point, in the plate circuit of the first video amplifier, applies the composite signal to the noise inverter and the sync separator. A normal signal is bypassed around the inverter to the separator. Only on large

noise pulses will the inverter operate, as it is biased to conduct only above sync tip level. At the plate, pin 1, of the inverter the waveforms as in figures C and D, should appear, while on pin 9, the grid, figure E, may be observed (with the range switch in a normal position). All of these waveforms are between 28 and 30 volts P/P.

The grid of the sync separator, pin 2 or L9J, is the next point from which observation of a waveform might be helpful. This waveform, figure F, should be approximately 17 volts P/P and have good clean sync pulses of positive polarity. Normal sync separation takes place within this stage and its output may be observed at its plate, pin 1. At this point, only negative sync pulses of approximately 40 volts P/P, figure G, should be seen. From here, the sync signals are fed to their respective circuits.

The pulses fed to the vertical oscillator are applied through an integrator circuit, which permits only the vertical sync pulses to activate the multivibrator type oscillator. At the first plate, pin 1, of the oscillator, an 82 volts P/P pulse will appear, figure 4, and a 105 volt P/P sawtooth wave, figure J, should be seen at the output plate, pin 6, when this oscillator is functioning properly. The next point of observation is the junction of the coupling capacitor (C3J) and the grid limiting resistor (R1J). At this junction "A" of figure 1, peaking is added and the result is the 45 volts P/P waveform, as in figure K. This waveform is fed to the vertical output circuit, which is located on a shelf with the horizontal output and damper circuits. Pin 9, the plate of the vertical output tube will produce, on the scope, a 1490 volts P/P waveform, as in figure L, which is coupled by the vertical output transformer to the vertical deflection coils.

The first point in the horizontal circuits from which observation of a waveform would be helpful, is the cathode, pin 8, of the phase comparer. Here, the sync pulses and a sampling of the horizontal oscillator are compared and if a phase difference between the two exists,

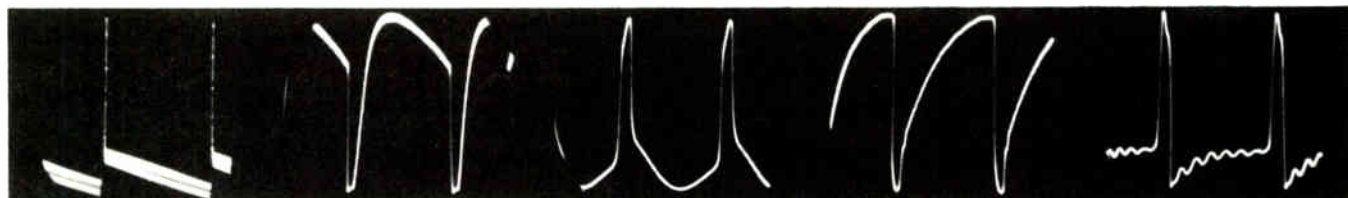


Figure L

Figure M

Figure N

Figure O

Figure P



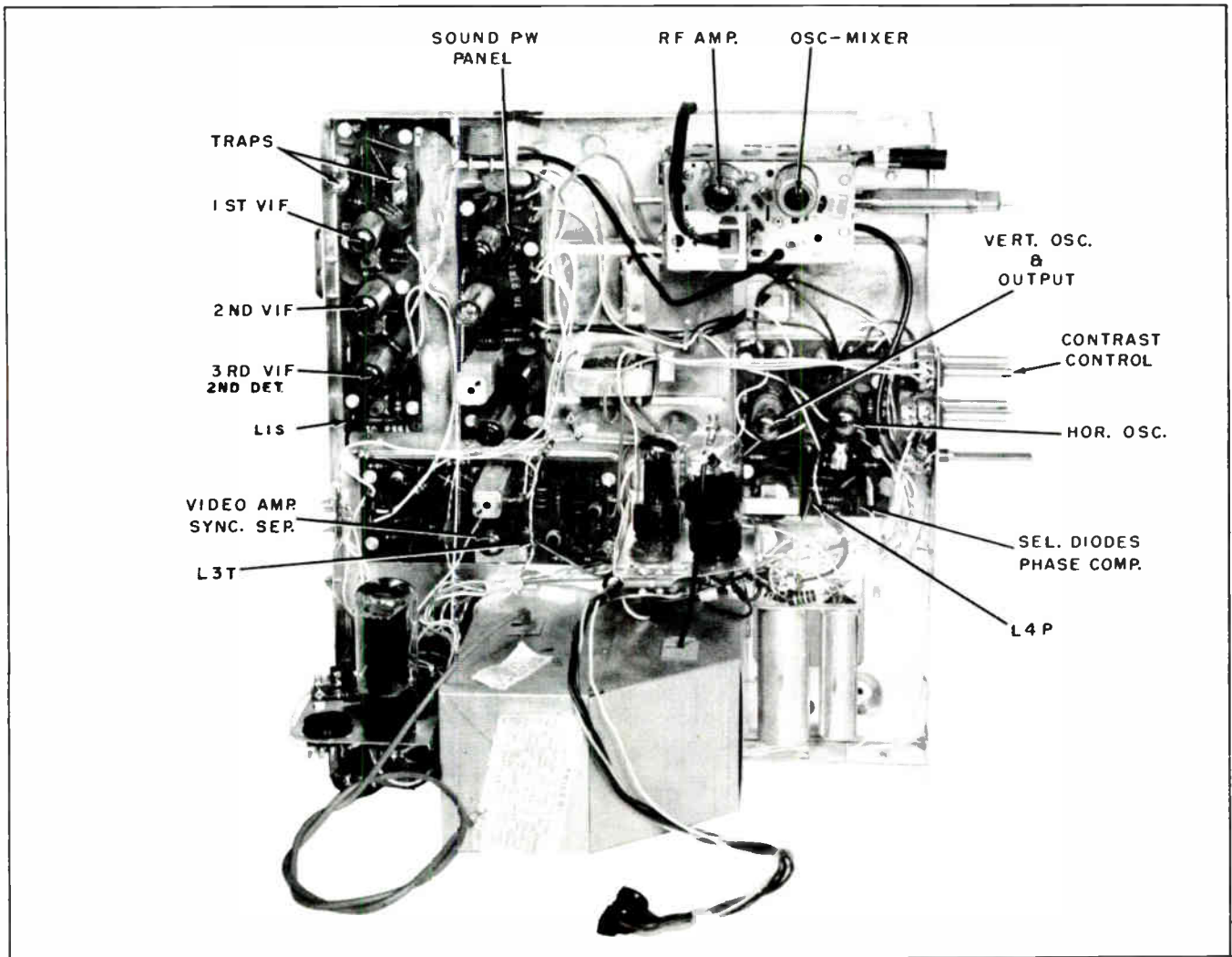


Figure 2

a DC correction voltage is applied to the horizontal oscillator to correct the frequency. The waveform which will appear at the phase comparer cathode is illustrated in figure M and is approximately 8 volts P/P. Tracing the signal further, the first plate, pin 1, of the horizontal multivibrator will show a 68 volts P/P waveform, figure N, which is coupled to the grid of the output section. On the output plate, pin 6, of this oscillator will appear a 200 volts P/P sawtooth wave, as in figure O, which is coupled to the output tube. To observe the results of the output tube, loosely couple the scope lead to the plate cap. Figure P should be seen at this point.

Normal B plus voltage after filtering should be approximately 270 volts and the voltage applied to the I-F section and tuner is reduced to 140 volts. In the damper circuit a B plus boost voltage of 550 volts is developed and used as the 1st anode voltage, which is an important factor in the decatron video system.

The 7L40 series chassis, figure 2, is very similar in appearance to the 7L70 chassis with the major differences between the two chassis in the video and sweep circuits.

Using a scope in the same manner as on the 7L70 chassis, the first waveform is obtained from the output of the video detector at point L1S. This will be a composite video signal, with negative sync, as in figure AA, and will be approximately 4 volts P/P. This signal is coupled to the one stage of video amplification and produces a 90 volts P/P signal at its plate, pin 9, as in figure BB. With the scope lead placed on the center arm of the contrast control, this same signal should vary from 20 volts, P/P minimum to a maximum of 90 volts P/P. From here, the signal is coupled to the cathode of the CRT.

Figure CC illustrates the video signal, as it should appear at the grid of the sync separator. This is a 55 volts P/P signal. At point L3T on the video PW panel or L4P

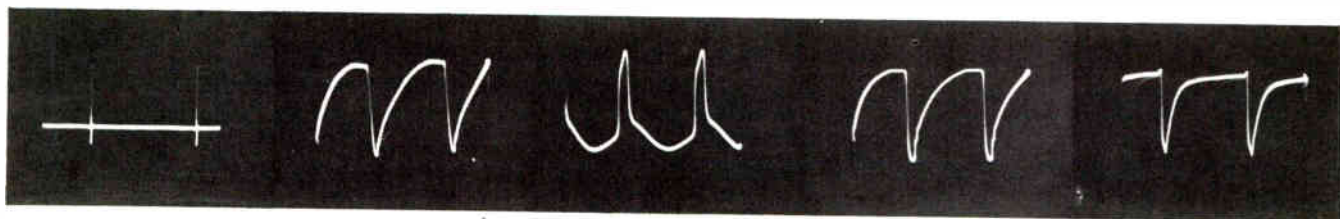


Figure AA

Figure BB

Figure CC

Figure DD

Figure EE

on the oscillator PW panel, the sync separator output may be checked. This waveform, as in figure DD, is of 40 volts P/P and is fed to its respective circuits.

The vertical sync is fed to the center tap of the vertical oscillator transformer where large positive overshoots are formed on this signal, figure EE, and coupled to the grid, pin 2. These overshoots are approximately 310 volts P/P. The output of this oscillator is coupled to the grid, pin 3, of the vertical output tube, which is one half of the twin triode, 6CS7. From this point, a 120 volts P/P saw should be obtained. At point L2P, the result of the output stage may be checked, figure FF. These pulses are fed to the vertical output transformer and then to the vertical deflection coils.

A dual selenium diode is employed in this chassis, as the phase comparer and its operation is exactly the same as the vacuum tube in the 7L70 chassis. At the input of this selenium, the center lead, a waveform of 9 volts, P/P should be received as in figure GG. Its output is fed through an R-C network to the grid of the horizontal multivibrator. On the first plate of this oscillator there should be 60 volts P/P pulses, similar to figure HH. In checking the output of the oscillator, point L10P which connects directly to the grid of the horizontal output stage, there should be a sawtooth wave of approximately 180 volts, P/P, as in figure JJ.

The last check point is the plate cap on the output tube. By loosely coupling the scope lead to this point, figure KK, a high voltage pulse should be seen. This is coupled to the high voltage rectifier and also to the horizontal deflection coils by the fly-back transformer.

The filtered B plus voltage on this chassis is approximately 260 volts. At the cathode of the damper a B plus boost voltage of 580 volts is developed and applied to both the horizontal and vertical output plates. The cathode of the audio output tube is designed as a bleeder network from which 140 volts is obtained and applied to the I-F amplifier plates and tuner.

The next step is to remove the four screws holding the chassis to the cabinet. Two of these screws are located underneath the cabinet while the other two are on the side of the chassis near the top. The chassis can now be removed from the cabinet.

At times, removal of the picture tube is also necessary. This is accomplished by removing the four nuts holding the picture tube frame to the front of the cabinet. This frame is securely tightened around the front edge of the picture tube.

When taking the chassis out of the cabinet in both the 7L40 and 7L70 series, remove the front escutcheon plate, all control knobs and the back cover. With the chassis now exposed, remove all the external leads coming to the chassis, such as the speaker leads, yoke leads and on models containing top-touch-tuning, the stepper unit leads. For ease of servicing, these leads connect to the chassis either by pin connections or plugs. The second anode lead and the picture tube socket must be disconnected at the picture tube, as these wires are soldered to the chassis.

It is recommended that the lower two nuts be removed first and then supporting the neck of the picture tube with one hand, proceed to remove the top two nuts. When returning the tube to the cabinet, these top two nuts should be tightened up first. This procedure will help prevent possible damage.

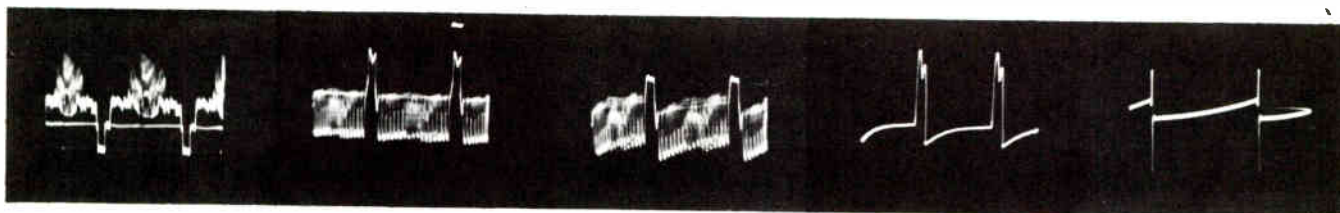


Figure FF

Figure GG

Figure HH

Figure JJ

Figure KK

# SERVICING THE M-39 AUTOMATIC RECORD CHANGER

Due to mishandling or after years of continued use, some readjustment or replacement of parts may become necessary on the Model M-39 four speed record changer, figure 1. When this need for service occurs, the technician should have the knowledge and ability to correct the defect and return the unit in proper working order, in a minimum of time.

In order for the technician to become familiar with some of the possible service needs of this unit, a summary has been made of the symptoms which will occur, their cause and their remedies. Also included are the major adjustment instructions.

The operation cycle, of the record changer, may be obtained from the November issue of the Service Supervisor.



Figure 1

## TROUBLE ANALYSIS

Intermittent sound may be caused by a loose wire or cold solder joint. The most efficient way to remedy this trouble is to check all wires for possible breaks and by touching all solder joints with a hot iron.

A worn or defective stylus, insufficient stylus pressure or a defective cartridge will cause distortions in the sound output. The stylus pressure should be checked as per adjustment instructions. If the pressure is normal, replace the stylus. If output is still distorted, replace the cartridge.

No sound output from the changer may possibly be caused by any of the previously mentioned troubles and also by an incorrectly installed stylus. By disconnecting

the leads from the cartridge lugs, the output may be checked directly at the cartridge. When the output is normal, the trouble is in the wiring and can be located by a continuity check. Where there is no output from the cartridge, the stylus should be checked and that it is riding in the grooves of the record. If these are in proper working order, the cartridge should then be replaced.

In a case where the tone arm slides, that is the needle will engage the record lead-in groove, but will jump grooves either forward or backward while the record is being played, may be caused by an incorrect stylus tip, defective stylus or insufficient stylus pressure. Check stylus pressure first and if condition still exists replace

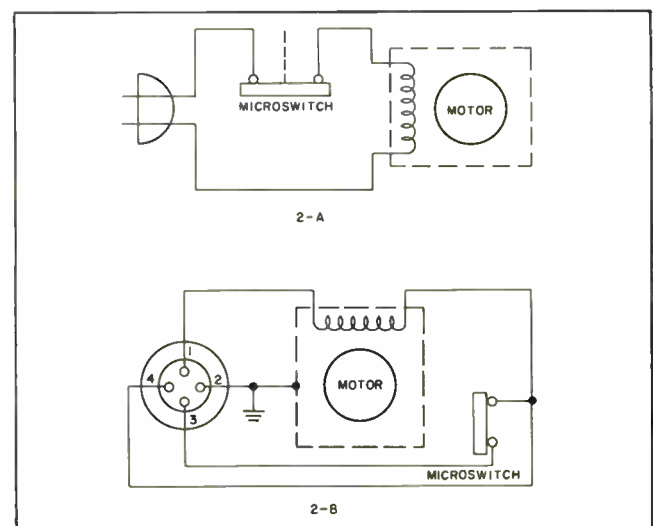


Figure 2

stylus. This trouble may also cause the change cycle to begin too soon and should be handled by the above procedure.

A defective microswitch, motor, line cord or plug may be cause for the motor not starting. If this trouble is suspected, place the control knob in the "N" position and lift the tone arm from the tone arm rest and place it on the turntable near the spindle. In doing this, the microswitch is closed and will permit a continuity check to be made of the electrical circuit. When the a-c power is supplied separately to the changer, the unit will be wired as in figure 2-A. Illustrated in figure 2-B, is the schematic of the unit when the amplifier and the record changer are wired together, with the microswitch con-



trolling the a-c power to both units. This will be found in the Phonorama III, Model E-1766.

In not all cases must there be an open circuit for the motor not to start. This trouble may also be caused by the microswitch plunger not being released, when the reject knob is depressed. If this trouble is suspected, manually lift the tone arm from its rest and swing it towards the spindle. At this point the motor should start. If not, check-out the circuitry as outlined previously. Assuming the motor does start when the tone arm is swung towards its spindle, the tone arm should then be returned to its rest and the microswitch action, as the reject knob is depressed, should be observed. This should reveal that the microswitch is not being pushed out from under the stop plate and allowing the plunger to be released. To correct this trouble, check the tone arm assembly and then adjust this assembly as per instructions.

When the motor does not shut off, a bent switch bracket, a loose or defective tone arm assembly, a defective switch or a defective torsion spring (on the switch bracket shaft) may be the cause. Leaving the line voltage applied to the changer, place the tone arm on its rest and observe the position of the stop plate over the switch plunger. If the switch plunger is depressed by the stop plate, but the turntable continues to rotate, a check for a defective switch or short circuit should be made. When the switch plunger is not depressed, check for a missing or broken torsion spring. If there is spring tension, the tone arm assembly is the next thing to check. If this is assembled correctly and is tight, but the switch plunger is directly beneath the stop plate and not making contact, bend the switch bracket upward sufficiently so as to permit the stop plate to depress the plunger. Caution should be used in this step, as excessive bending of the switch bracket will prevent the switch plunger

from being disengaged from the stop plate when the tone arm is raised, and thus preventing the motor from starting. For the location of the switch bracket and its related parts refer to figure 3.

Slow or erratic turntable speeds may be caused by a defective motor or idler wheel and also by dirt, grease or oil on the idler wheel or drive shaft. Using alcohol, the idler wheel, drive shaft and turntable rim should be wiped clean. Also check the idler wheel for a shiny surface which may cause slippage. A very fine sandpaper may be used to remedy this shiny surface, if not, replace the idler wheel. If the above does not correct the trouble, check the idler wheel's position against the drive shaft. If the wheel is tilted so that only the edge is pressing against the drive shaft, the idler wheel stud may be bent, and should be straightened so that the entire surface of the idler wheel rim is contacting the drive shaft. If slow or erratic speeds are still encountered, replace the motor.

A loose set screw in the speed selector link or binding in the speed change mechanism of the motor assembly may possibly be the cause for the selector-reject knob not to select the proper speeds. Check the speed selector link and set screw, to make certain that it does not slip as the reject control shaft is turned. Binding of a part, or parts, in the speed change mechanism may be located by careful observation when the selector-reject knob is turned, and then the trouble is eliminated by an adjustment or replacement of the part which caused the binding.

Correct spindle pressure is important. With insufficient pressure, the record will drop on the tone arm as the arm moves toward the spindle, during the change cycle, and possibly damage the stylus. To increase this pressure, turn the spindle adjusting nut (refer to figure 3) counter-clockwise. Excessive pressure will drop the record on the tone arm as the arm moves away from the spindle during

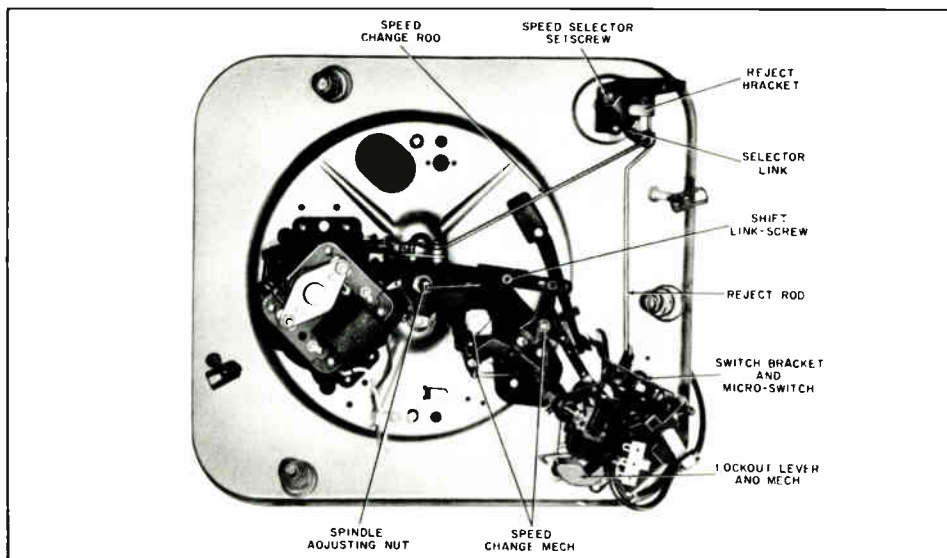


Figure 3



the change cycle. To decrease this pressure, turn the adjusting nut clockwise.

Improper or erratic indexing will result from a misadjusted or defective semaphore or a loose semaphore link. In correcting this trouble, check the semaphore for nicks or warpage and replace if necessary. If this is not the trouble or doesn't relieve the trouble, check the semaphore adjustment.

If the tone arm sets down on its rest during the change cycle, even when a stack of records is on the spindle, it may possibly be caused by a defective tone arm assembly, dirt, oil or grease in the lockout mechanism or by a defective or missing tension spring, in the lockout mechanism. Check the tension spring and make certain the lockout lever pivots freely about its rivet, if not, clean the mechanism with alcohol. If the lockout lever is operating satisfactorily, check the tone arm assembly to make certain it is assembled properly. Refer to figure 3, for the position of the lockout lever mechanism.

After the last record is played, the Model M-39 should automatically shut off. When the trouble arises where the last record keeps repeating, binding of the over-arm plate at the maximum outward swing of the tone arm may be the cause. Remove all records from the spindle and lift and release the overarm in the play position (across the turntable). If overarm does not set down on the overarm housing, check for a bent shaft or dirt inside the shaft housing. Check the lockout lever to see that it is not setting on the pivot bracket lever. Also, check the action of the lockout pawl during the change cycle. If the lockout pawl does not disengage the stop plate during the outward swing of the tone arm, check the tone arm assembly. If it is correct, check the tab of the stop plate. This should be bent sufficiently to permit the lockout pawl to drop down and engage the edge of the stop plate.

A bent overarm or defective spindle causes the dropping of more than one record. If the overarm holds the records in a tilted position (not parallel with main plate) try bending the overarm back to its original position or replace the overarm. If the spindle is found defective, it should be replaced and the new spindle adjusted for the correct pressure.

When the automatic speed mechanism does not change speed from 45 to 33 $\frac{1}{3}$  rpm, a possible cause may be the screw holding the shift link and extension together, is loose. To correct this trouble, set the selector-reject knob at the 45 rpm position. Adjust the shift link and extension to the maximum length and tighten the screw. Depress selector-reject knob and rotate the turntable, by hand, one cycle of operation. Keep decreasing the length of the shift link and extension until the selector-reject knob turns automatically to the 33 $\frac{1}{3}$  rpm position and the turntable revolves at 33 $\frac{1}{3}$  rpm.

## ADJUSTMENT INSTRUCTIONS

To check or to correct the adjustment of the velocity trip mechanism proceed in the following manner: Place the tone arm on its rest and remove the turntable. Then move the slide plate lever backwards, away from the stop, as far as possible and rotate the trip bracket until its bottom portion (under main plate) contacts the reject trip lever. In this position, the clearance between the top portion of the trip bracket and the slide plate ear should be  $\frac{1}{8}$  inch. If this spacing is incorrect, bend the reject trip lever (attached vertically to the end of the switch bracket) until the proper clearance is obtained. After this adjustment, check the movement of the trip bracket to make sure that it does not rub against the main cam or the main plate. Refer to figure 4 for the above parts location.

To adjust the semaphore, loosen the set screw in the semaphore link and permit the link to ride on top of the record size bracket. Hold the semaphore firmly against the overarm housing and rotate the record size bracket so that its stop ear is tightly pressed against the size bracket stop. At this time, lift the semaphore link until it is raised to within  $\frac{1}{64}$  inch of the underside of the main plate and tighten the set screw securely to the semaphore shaft. Refer to figure 5 for this adjustment.

**NOTE:** This link must not be tightened against the main plate as this will cause binding and prevent free movement of the semaphore during the change cycle.

When adjusting the tone arm for its set down position, place the selector-reject knob in the "N" position and place a 7-inch record on the turntable. Depress the reject knob and rotate the turntable manually, thereby starting the change cycle, and observe the needle set down point. If the needle tends to set down outside of the record, turn the adjusting screw (located in the tone arm assembly) in a counter-clockwise motion. This will move the tone arm towards the spindle. A clockwise rotation, will

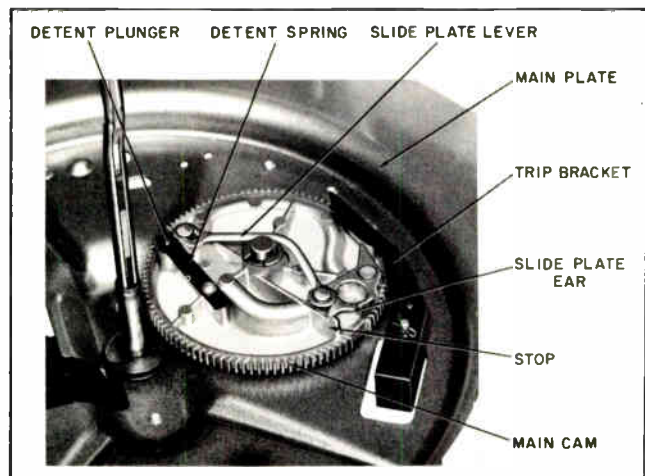


Figure 4

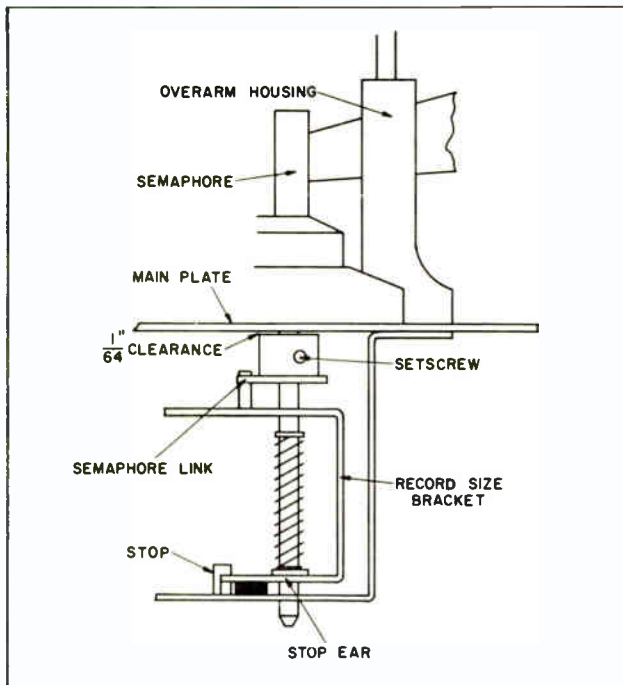


Figure 5

move the tone arm towards the edge of the record when the set down is in other than the lead-in groove.

The stylus pressure, unless otherwise stated by the cartridge manufacturer, should be between 8 and 11 grams for maximum efficiency. This pressure is adjusted by inserting a thin steel rod or spline key in the mounting stud hole and rotating the stud in an up or down rotation. This stud is located on the lower portion of the tone arm hinge assembly. By rotating the stud upward, the pressure is decreased and a downward rotation for an increase in pressure. When adjusting this pressure, an accurate pressure gauge should be used.

**Note:** A slight rotation in either direction of the stud has a relatively large effect on the stylus pressure.

The operation of the changer mechanism depends largely upon the correct assembly of the tone arm shaft parts and their adjustment. The improper positioning of these parts will cause troubles which might be misleading and cause the adjusting of other assemblies and serve only to further misadjust the changer.

Of all the parts assembled on the tone arm shaft, figure 6, only the stop plate assembly (A) is securely fastened to the shaft (B), by using a set screw (C). Therefore, any up or down or lateral movement of the stop plate is transferred to the tone arm. All the other parts assembled

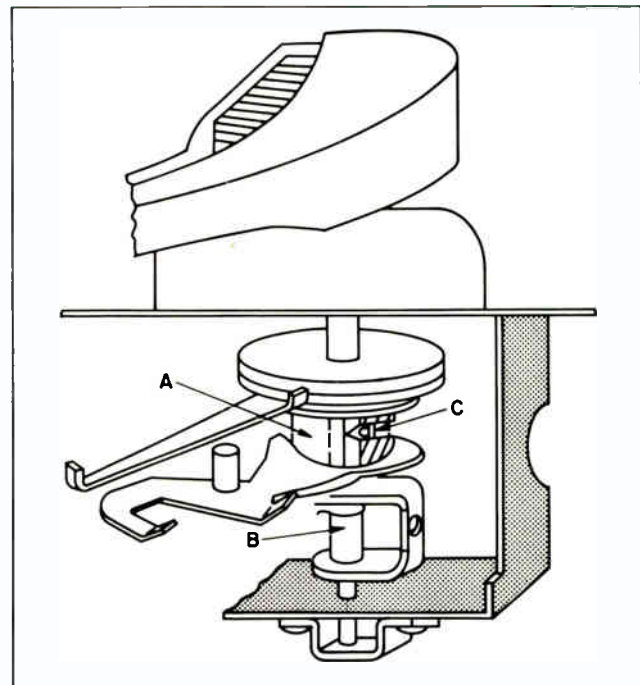


Figure 6

on the shaft, rotate freely. The position and height at which the stop plate assembly is fastened to the tone arm shaft is of great importance. Improper positioning of this assembly could result in many of the troubles that have been mentioned previously.

To simplify the correct positioning of the stop plate assembly, a small indentation has been drilled into the tone arm shaft. It is important, that when tightening the set screw, the screw engage with the indentation securely.

#### LUBRICATION

The Model M-39 record changer should be lubricated, under normal conditions, after approximately one year, or 1000 hours of operation. However, under extreme conditions of dust or heat the unit may require lubrication more frequently.

The following parts should be lubricated with one drop each, of a light machine oil:

Motor Bearings	Main Cam Bearings
Overarm Shaft	Turntable Bearing Race

A high temperature, non-fluid grease should be applied to the following parts:

Main Cam Groove "Steps" on Cam & Pin Assy.

Further information and part numbers may be obtained from the Service Manual, PR-3056, which covers this unit.

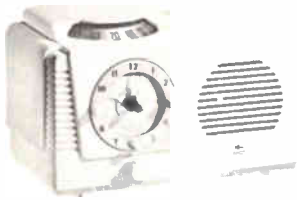
# PHILCO



# SERVICE

## HOME RADIO

### PHILCO RADIO-CLOCK MODELS 52-543, 52-545, 52-547, AND 52-550



MODELS 52-543\* AND 52-545



MODEL 52-547



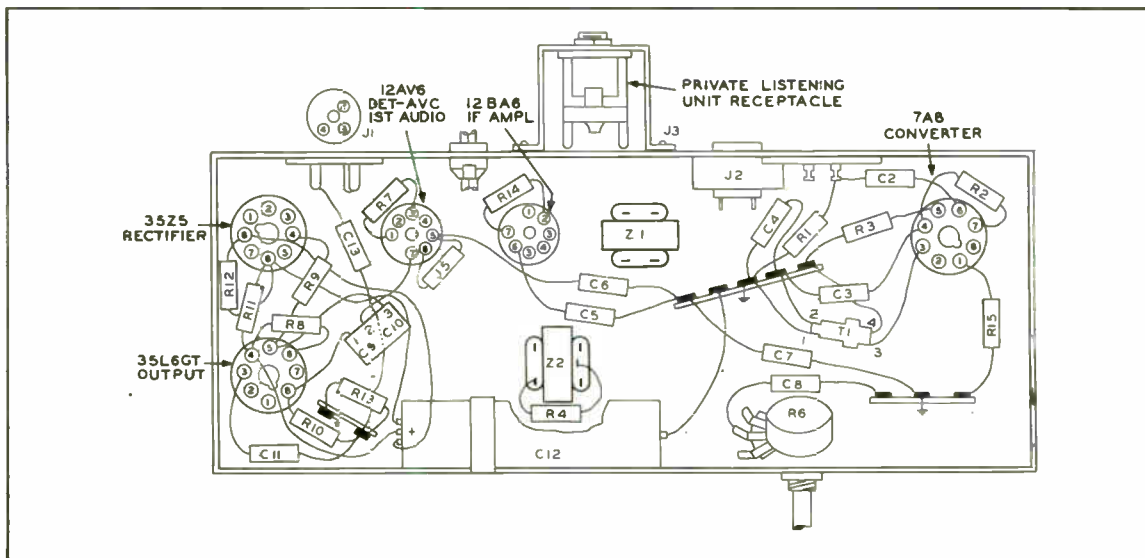
MODEL 52-550

#### SPECIFICATIONS

FREQUENCY RANGE	540—1600 kc.	AERIAL	High-impedance loop; connector for external aerial
AUDIO OUTPUT	.1 watt	INTERMEDIATE FREQUENCY	455 kc.
OPERATING VOLTAGE	117 volts, a.c.	PHILCO TUBES (5)	7A8, 12BA6, 12AV6, 35L6GT, 35Z5
POWER CONSUMPTION	30 watts		

\*The clock of Model 52-543 has TIME SET control only.

PHILCO RADIO-CLOCK MODELS 52-543, 52-545, 52-547, AND 52-550; PR-2380



TP2-1326

Figure 1. Model 52-550, Base View, Showing Symbolized Chassis

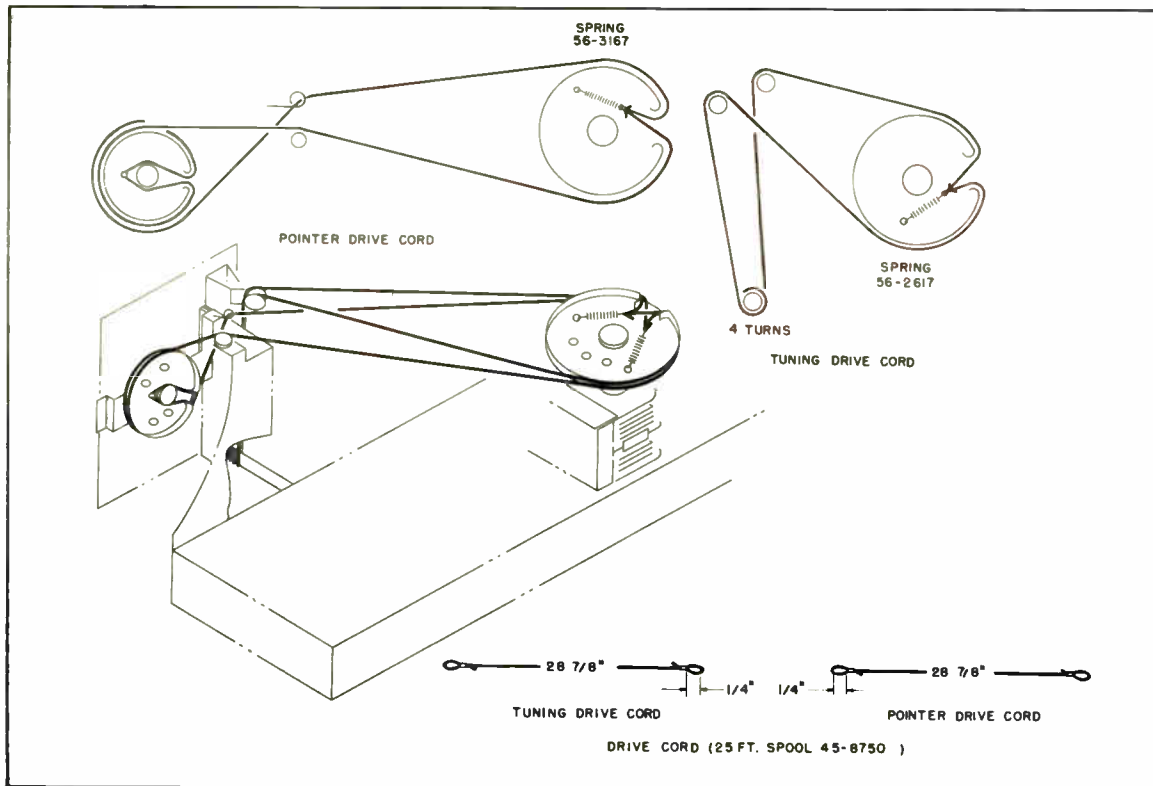
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**PRELIMINARY INFORMATION**

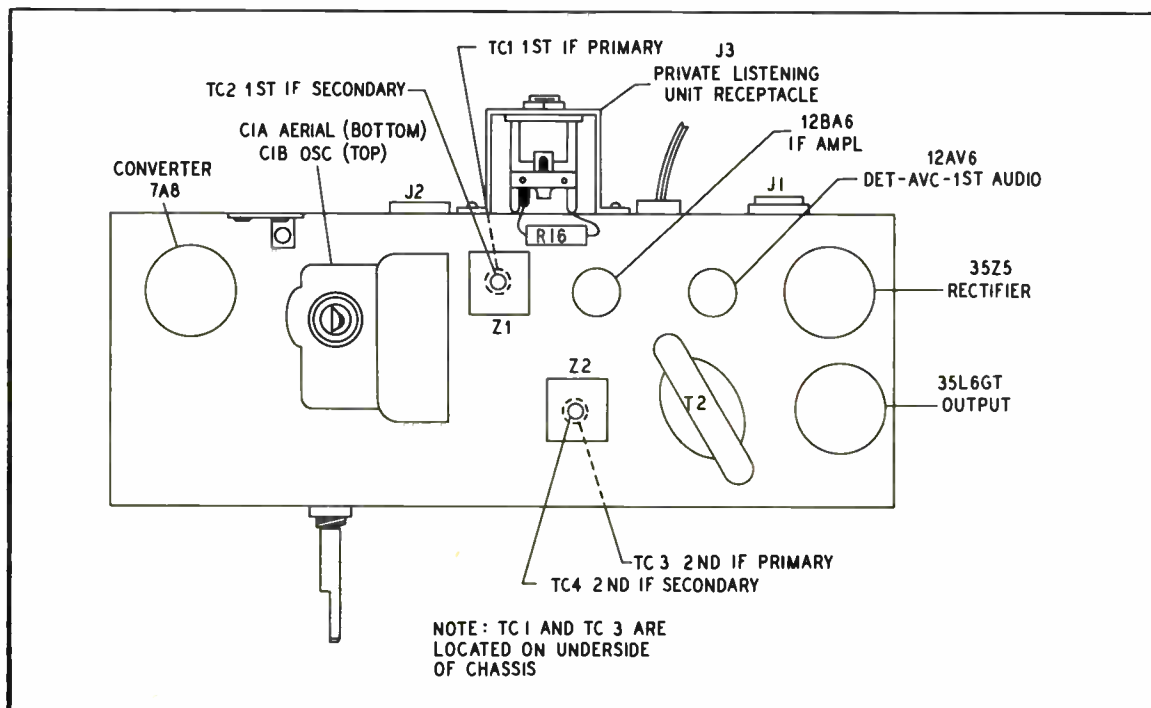
Models 52-543, 52-545, 52-547, and 52-550 are electrically similar to Model 52-544, but they are housed in different style cabinets, and incorporate certain circuit refinements over Model 52-544.

The following diagrams and the Service Information and Parts List given on page 4 of this Service Manual are for Models 52-543, 52-545, 52-547, and 52-550 only. For Alignment Procedure and the basic Schematic Diagram and Parts List for all models, refer to PR-1950.



**Figure 2. Model 52-550, Drive-Cord Installation Details**

TP2-1325



**Figure 3. Model 52-550, Top View, Showing Trimmer Locations**

TP2-1327



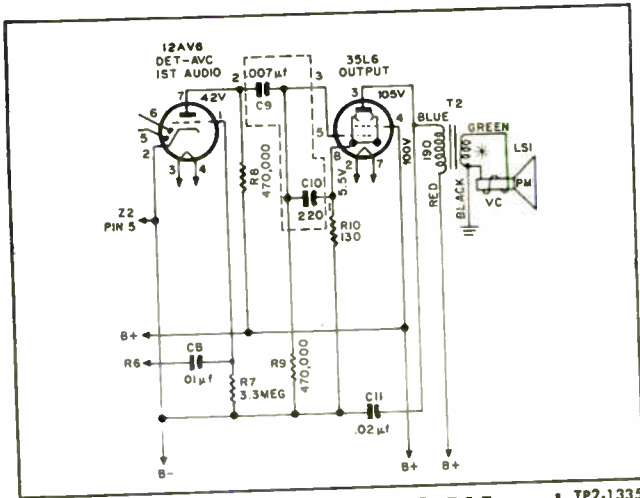


Figure 4. Models 52-543, 52-545, and 52-547, Output Circuit TP2-1335

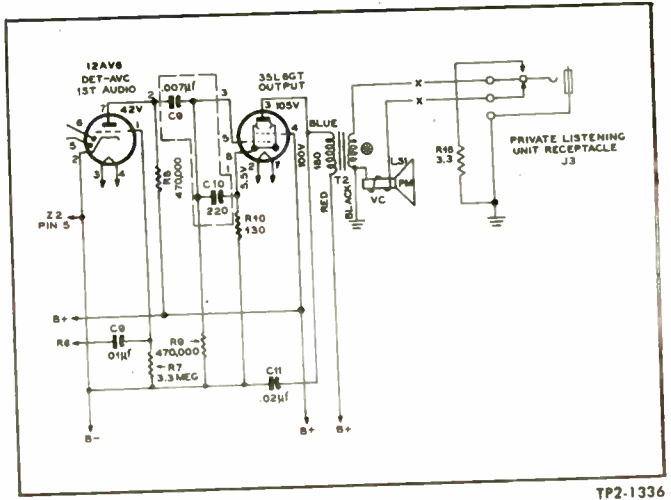


Figure 5. Model 52-550, Output Circuit TP2-1336

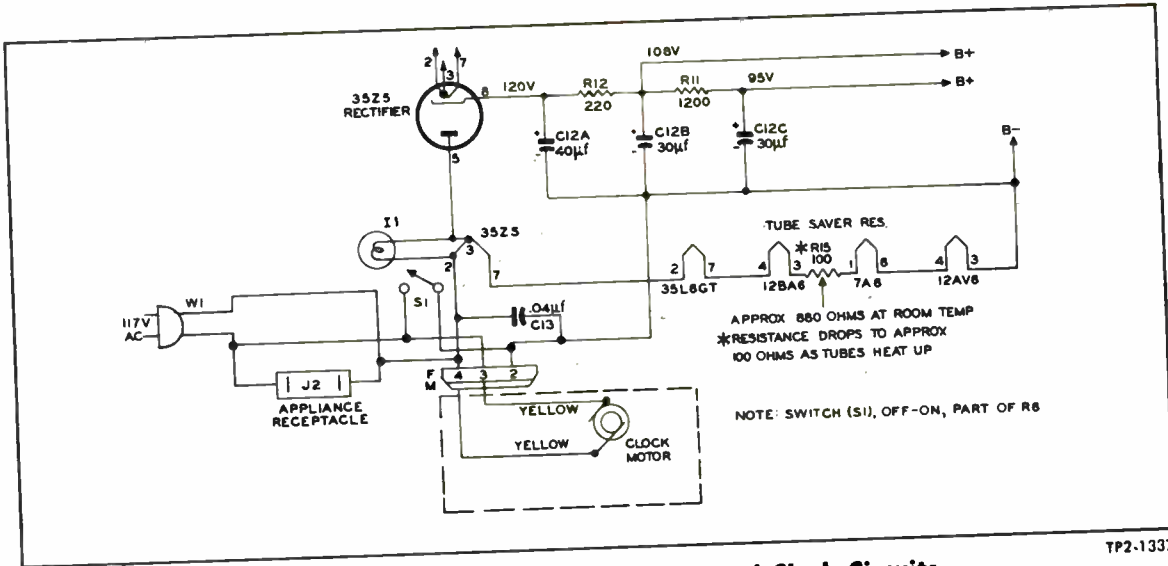


Figure 6. Model 52-543, Power and Clock Circuits TP2-1337

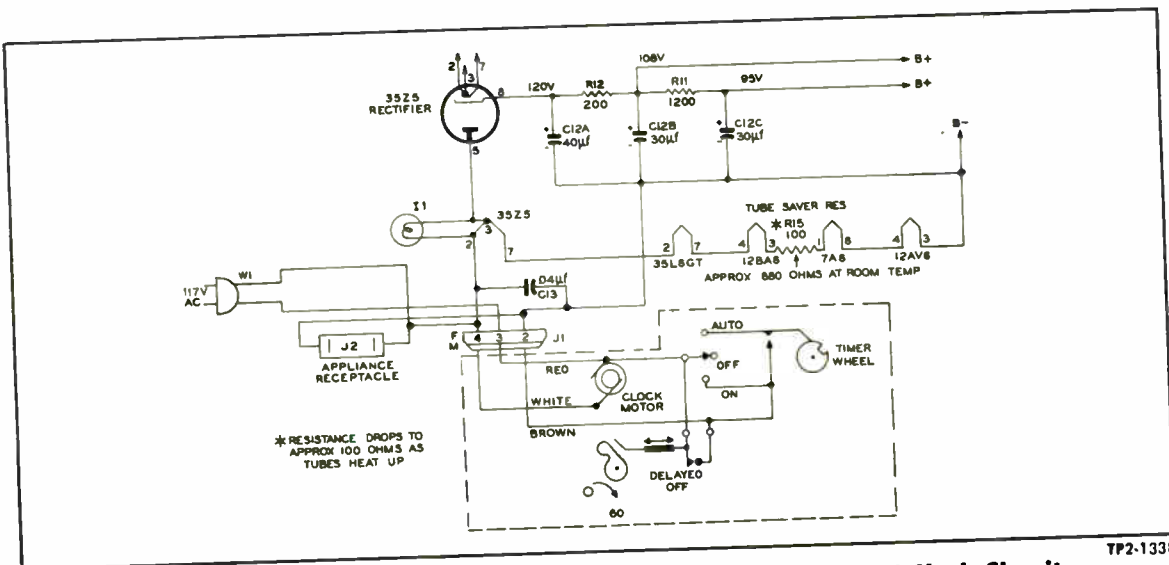


Figure 7. Models 52-545, 52-547, and 52-550, Power and Clock Circuits TP2-1338

**SERVICE INFORMATION**

**MODELS 52-543, 52-545, 52-547, AND 52-550**

Dual condenser, C9 and C10, Part No. 30-1239-4, used for audio coupling (.007  $\mu$ f.) and grid by-pass (220  $\mu$ f.) respectively. Output tube changed from 50L6GT to a 35L6GT.

Isolating condenser, C7, Part No. 61-0113; from 7A8 converter-tube cathode to ground, was changed from a .2  $\mu$ f. condenser to a .1  $\mu$ f. condenser.

**MODELS 52-543, 52-545, AND 52-547**

Pilot light and bracket are mounted on rear of clock cover.

**MODEL 52-543**

Clock is nonautomatic; has TIME SET control only.

Appliance receptacle on rear of chassis is connected directly to a-c line. Appliance capacity is 1100 watts. OFF-ON switch is part of VOLUME control, R6.

**MODEL 52-547**

Loop assembly, LA1, is Part No. 32-4052-64.

**MODEL 52-550**

Included with this model is Philco Private Listening unit receptacle, J3, Part No. 42-1975-2. A shunt resistor, R16, has been provided from J3 to ground. This shunt resistor reduces volume to level required for Private Listening. R16 is a 3.3-ohm resistor, Part No. 66-9334540.

Loop assembly, LA1, is Part No. 32-4052-64. Speaker, p.m., LS1, is Part No. 36-1627-11.

**REPLACEMENT PARTS LIST**

**FOR MODELS 52-543, 52-545, 52-547, AND 52-550**

For all parts not listed in this Service Manual, refer to PR-1950.

**MISCELLANEOUS**

Description	Service Part No.	Description	Service Part No.
<b>Cabinet</b>			
Models 52-543M and 52-545M .....	10745-9	TIME SET .....	54-4736-11
Model 52-545I .....	10745-10	VOLUME .....	54-4773
Model 52-547L .....	10908-1		
Model 52-547M .....	10908	<b>Models 52-550M and 550L</b>	
Model 52-550L .....	10907-1	AUTO SET .....	54-4736-10
Model 52-550M .....	10907	AUTO-OFF-ON .....	54-4736-9
<b>Back, cabinet</b>		DELAYED OFF .....	54-4736-9
Models 52-543M, 52-545M, and 52-545I .....	54-8391	TUNING .....	54-4718-6
Models 52-547L and 52-547M .....	54-8634	TIME SET .....	54-4736-11
Models 52-550L and 52-550M .....	54-8637	VOLUME .....	54-4718-6
<b>Baffle-and-cloth assembly</b>		<b>Bracket-and-pulley assembly</b>	
Models 52-543M and 52-545M .....	40-7730	Models 52-550M and 52-550L .....	76-7580
Model 52-545I .....	40-7730-1	<b>Clock cover-and-clip assembly</b>	
<b>Knobs</b>		Models 52-543M, 52-545M and 52-545I .....	76-7547
Model 52-543M		Models 52-547M and 52-547L .....	76-7638
DIAL SCALE .....	54-5055-5	Models 52-550M and 52-550L .....	76-7625
TIME SET .....	56-9656	<b>Clock and plug assembly</b>	
VOLUME-OFF-ON .....	27-4815-9	Model 52-543M .....	76-7559
<b>Models 52-545M and 52-545I</b>		Models 52-545M, 52-545I, 52-547M, and 52-547L .....	76-7544
AUTO SET .....	54-4736-10	Models 52-550M and 52-550L .....	76-7596
AUTO-OFF-ON .....	54-4736-9	<b>Dial-and-backplate assembly</b>	
DELAYED OFF .....	54-4736-9	Models 52-550M and 52-550L .....	76-7579
DIAL SCALE .....	54-5055-5	<b>Socket, clock</b>	
TIME SET .....	54-4736-11	Models 52-543M, 52-545M, 52-545I, 52-547M, and 52-547L .....	27-6273
VOLUME .....	27-4815-9	Models 52-550M and 52-550L .....	27-6273
<b>Models 52-547M and 52-547L</b>		<b>Plug, clock</b> .....	54-4878-2
AUTO SET .....	54-4736-10	<b>Tuning shaft</b> .....	56-9659
AUTO-OFF-ON .....	54-4736-9	<b>Shaft assembly, pointer</b> .....	76-7581
DELAYED OFF .....	54-4736-9		
DIAL SCALE .....	54-5055-5		

# PHILCO



# SERVICE

## HOME RADIO

### PHILCO RADIO-CLOCK MODELS 53-702, 53-706 AND 53-707

#### SPECIFICATIONS

MODEL 53-702 ..... Molded plastic  
 MODELS 53-706, 53-707 ..... Wood  
 CIRCUIT ..... Five-tube Superheterodyne (plus rectifier)  
 FREQUENCY RANGES  
 Standard Broadcast ..... 540—1620 kc.  
 Special Services ..... 1700—3400 kc.  
 AUDIO OUTPUT ..... 1 watt

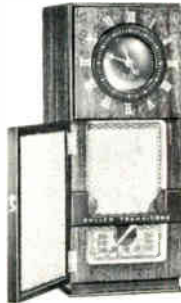
OPERATING VOLTAGE ..... 117 volts, a.c.  
 POWER CONSUMPTION ..... 30 watts  
 AERIAL ..... High-impedance loop  
 INTERMEDIATE FREQUENCY ..... 455 kc.  
 PHILCO TUBES ..... 12BE6 converter, 12BA6 i-f amplifier,  
 12AV6 det.—a.v.c.—1st audio,  
 35C5 output, 35W4 rectifier



MODEL 53-706



MODEL 53-702



MODEL 53-707

PHILCO RADIO-CLOCK MODELS 53-702, 53-706, AND 53-707

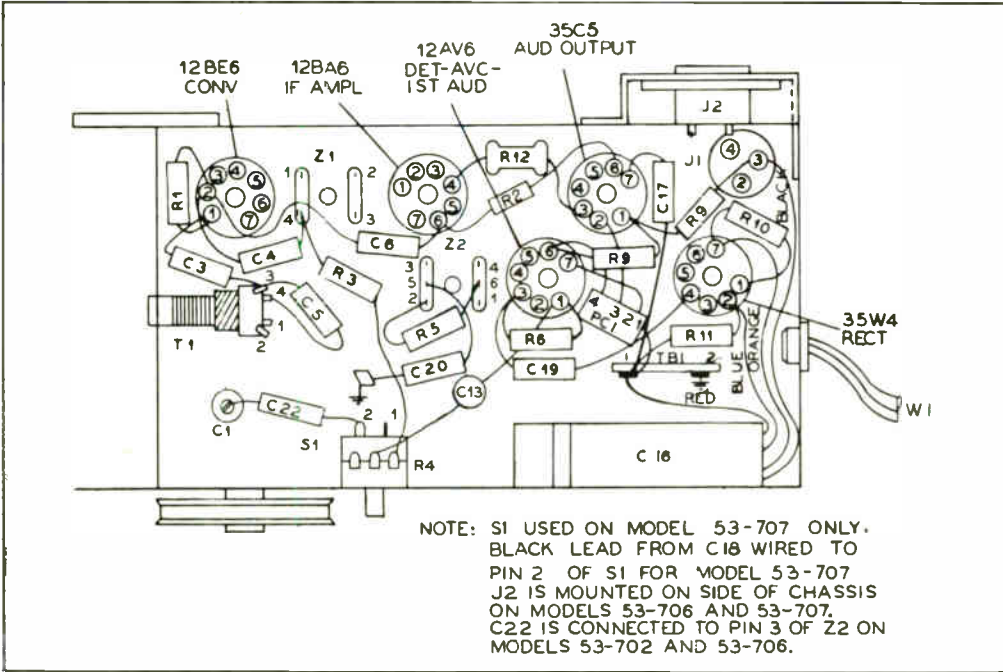


Figure 1. Base View, Showing Parts Placement

TP2-2277

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PR-2418

## ALIGNMENT PROCEDURE

**RADIO CONTROLS**—Set volume control to maximum. Set tuning control and band switch as indicated in chart.

**OUTPUT METER**—Connect across voice-coil terminals.

**SIGNAL GENERATOR**—Connect generator and set frequency as indicated in chart. Use modulated output.

**OUTPUT LEVEL**—During alignment, adjust signal-generator output to hold output-meter reading below 1.25 volts.

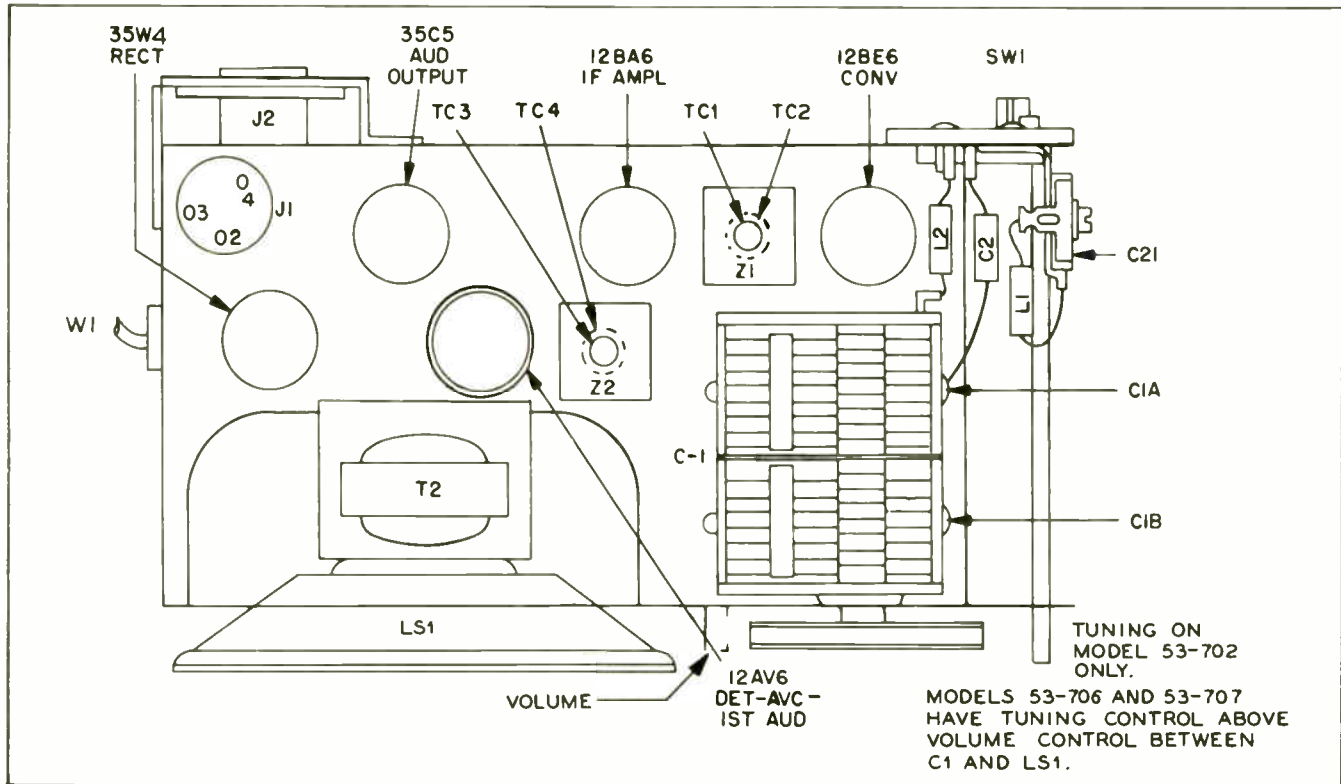


Figure 2. Top View, Showing Trimmer Locations

TP2-2278

## ALIGNMENT CHART

STEP	SIGNAL GENERATOR		RADIO			ADJUST
	CONNECTION TO RADIO	DIAL SETTING	DIAL SETTING	BAND SWITCH SETTING	SPECIAL INSTRUCTIONS	
1	Ground lead to B-; output lead through a .1- $\mu$ f. condenser to grid (pin 7) of 12BE6.	455 kc.	Tuning gang fully open	Broadcast	Adjust tuning cores, in order given, for maximum output. (TC1 and TC3 are located at top of transformers.)	TC4—2nd i-f sec. TC3—2nd i-f pri. TC2—1st i-f sec. TC1—1st i-f pri.
2	Radiating loop (See note below).	1620 kc.	$\approx$ 1620 kc.	Broadcast	Adjust trimmer for maximum output.	C1-B—osc.
3	Same as step 2.	1500 kc.	1500 kc.	Broadcast	Adjust trimmer for maximum output.	C1-A—aerial (broadcast)
4	Same as step 2.	3200 kc.	3200 kc.	Special Services	Adjust trimmer for maximum output.	C21—aerial (special services)

**NOTE:** Make up a 6–8 turn, 6-inch-diameter loop from insulated wire; connect to signal-generator leads, and place near radio loop.

$\circ$ For proper adjustment of the oscillator trimmer, fully open the tuning gang and insert a .006-inch, non-metallic shim between the heel of the rotor and the top of the stator plates. Close the tuning gang sufficiently to hold the shim in place, and then remove the shim without disturbing the gang setting.





REPLACEMENT PARTS LIST

NOTE: Part numbers identified by an asterisk ( \* ) are general replacement items. These numbers may not be identical with those on factory parts. Also, the electrical values of some replacement items may differ from the values indicated in the schematic diagram and parts list. The values substituted in any case are so chosen that the operation will be either unchanged or improved. When ordering replacements, use only the "Service Part No."

Reference Symbol	Description	Service Part No.
C1	Condenser, tuning gang	31-2751-14
C1A	Condenser, r-f trimmer	Part of C1
C1B	Condenser, oscillator trimmer	Part of C1
C2	Condenser, aerial series tracker, 944 $\mu\text{f.}$	30-1220-65
C3	Condenser, oscillator grid, 47 $\mu\text{f.}$	30-1230-4
C4	Condenser, a-v-c by-pass, .05 $\mu\text{f.}$	30-4650-45*
C5	Condenser, drift compensation, 7.5 $\mu\text{f.}$	30-1224-83
C6	Condenser, screen by-pass, .05 $\mu\text{f.}$	30-4650-45*
C7	Condenser, i-f tuning	Part of Z1
C8	Condenser, i-f tuning	Part of Z1
C9	Condenser, i-f tuning	Part of Z2
C10	Condenser, i-f tuning	Part of Z2
C11	Condenser, detector filtering	Part of Z2
C12	Condenser, detector filtering	Part of Z2
C13	Condenser, audio coupling, .005 $\mu\text{f.}$	30-1238-1*
C14	Condenser, plate by-pass	Part of PC1
C15	Condenser, audio coupling, .005 $\mu\text{f.}$	Part of PC1
C16	Condenser, compensating	Part of PC1
C17	Condenser, tone compensation, .022 $\mu\text{f.}$	30-4650-43*
C18	Condenser, electrolytic, 3-section	30-2573
C18A	Condenser, filter, 30 $\mu\text{f.}$ , 150v.	Part of C18
C18B	Condenser, filter, 25 $\mu\text{f.}$ , 150v.	Part of C18
C18C	Condenser, filter, 20 $\mu\text{f.}$ , 150v.	Part of C18
C19	Condenser, line by-pass, .047 $\mu\text{f.}$	30-4650-45*
C20	Condenser, B minus to chassis, .1 $\mu\text{f.}$	30-4650-47*
C21	Condenser, trimmer, special services	31-6473-29
C22	Condenser, a-v-c decoupling, 220 $\mu\text{f.}$	62-122001001*
I1	Lamp, pilot	34-2068
J1	Jack, clock	27-6273
J2	Jack, appliance receptacle, a-c	76-3931
L1	Coil, aerial, special services	32-4561-3
L2	Coil, oscillator shunt	32-4562-2
LA1	Loop, antenna	Part of back-and-loop ass'y
LS1	Speaker, p-m	36-1627-8
PC1	Coupling network	30-6001
PL1	Plug, clock assembly	54-4878-2
R1	Resistor, oscillator grid, 22,00 ohms	66-3228340*
R2	Resistor, i-f screen dropping, 4700 ohms	66-2478340*
R3	Resistor, a-v-c filter, 2.2 megohms	66-5228340*
R4	Resistor, volume control, .5 megohm Model 702	33-5565
	Model 706	33-5565-50
	Model 707	33-5566-49
R5	Resistor, diode load, 47,000 ohms	66-3478340*
R6	Resistor, grid return, 10 megohms	66-6108340*
R7	Resistor, plate load, 500,000 ohms	Part of PC1
R8	Resistor, grid return, 500,000 ohms	Part of PC1
R9	Resistor, cathode bias, 150 ohms	66-1158340*
R10	Resistor, B plus filter, 220 ohms, 1 watt	66-1224340*
R11	Resistor, B plus filter, 1000 ohms	66-2108340*
R12	Resistor, tube saver, 100 ohms	33-1343-3
S1	Switch, off-on	Part of R4
SW1	Switch, broadcast-special services	42-1796-2
T1	Transformer, oscillator	32-4453-6
T2	Transformer, output	32-8384*
W1	Line cord	L-2183*
Z1	Transformer, 1st i-f	32-4161A
Z2	Transformer, 2nd i-f	32-4240A

Reference Symbol	Description	Service Part No.
<b>MISCELLANEOUS</b>		
<b>PARTS COMMON TO ALL MODELS</b>		
<b>Description</b>	<b>Service Part No.</b>	
Shield, tube	56-5629FA3	
Shield, tube base	56-3978FA3	
Socket, tube (5)	27-6265	
Socket assembly, pilot lamp	27-6233-6	
Spring, drive cord	56-2617	
Spring, retaining	28-8610	
Drive cord, 25-ft. spool	45-8750*	
<b>MODEL 53-702</b>		
Cabinet		
Maroon	10940	
Biege	10940-2	
Knobs		
Maroon		
Clock (3)	54-4983	
Tuning and volume	54-4986	
Biege		
Clock (3)	54-4983	
Tuning and volume	54-4986-1	
Clock	41-1042-1	
Back-and-loop assembly		
Maroon	76-7807	
Biege	76-7807-1	
Backplate and clip assembly, pilot lamp	76-7808	
Scale		
Radio	54-4985	
Clock	54-4984	
Pointer	56-9846	
Clock cover	54-4989	
Shaft, tuning	56-9807	
<b>MODEL 53-706</b>		
Cabinet		
Mahogany	10952	
Blond	10952-1	
Knobs		
Mahogany		
Clock (3)	54-4983-3	
Tuning and volume	54-4557-6	
Blond		
Clock (3)	54-4983-3	
Tuning and volume	54-4557-7	
Clock	41-2043	
Back-and-loop assembly	76-8004	
Lamp attachment	40-8916	
Scale, radio	54-5160	
Pointer		
Mahogany	56-10043	
Blond	56-10043-1	
Clock cover	54-4989	
Shaft, tuning	56-10012	
<b>MODEL 53-707</b>		
Cabinet	10953	
Knobs		
Clock (3)	54-4983-3	
Tuning and volume	54-4557-6	
Clock	41-2042-2	
Back-and-loop assembly	76-8004	
Scale, radio	54-5160	
Pointer	56-10043	
Shaft, tuning	56-10012	
Door, cabinet	45-6735	
Hook, door	56-10049	
Hinge, door (2)	56-10048	

# PHILCO

## PHILCO Factory-Supervised Service

# SERVICE

### HOME RADIO

## PHILCO RADIO MODELS 53-950, 53-952, AND 53-954

### SPECIFICATIONS

<b>Cabinet</b>		<b>Audio Output</b> .....	1 watt
Model 53-950 .....	Phenolic, brown or ivory	<b>Operating Voltage</b> .....	105—120 volts, a.c. or d.c.
Model 53-952 .....	Phenolic, brown	<b>Power Consumption</b> .....	30 watts
Model 53-954 .....	Wood, mahogany or blond	<b>Antenna</b> .....	Built-in, high-impedance loop
<b>Circuit</b> .....	Five-tube superheterodyne (plus rectifier)	<b>Intermediate Frequency</b> .....	455 kc.
<b>Frequency Range</b>		<b>Philco Tubes</b> .....	6BJ6 r-f ampl.; 12BE6 converter; 6BJ6 i-f ampl.; 6AQ6 det., a.v.c., 1st audio; 35C5 output; 35W4 rectifier
Broadcast .....	540—1620 kc.		
Special Services .....	1700—3400 kc.		



MODEL 53-950



MODEL 53-952



MODEL 53-954

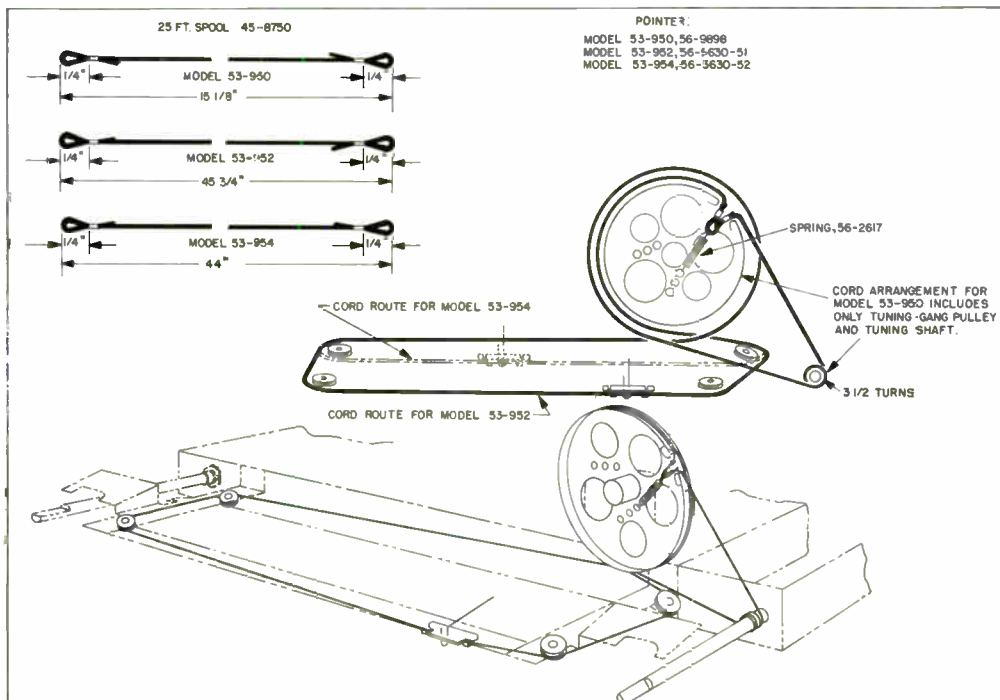


Figure 1. Drive-Cord Installation Details

TP2-2656

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WorldRadioHistory

SERVICE MANUAL FOR PHILCO RADIO MODELS 53-950, 53-952, AND 53-954

PR-2419



ALIGNMENT PROCEDURE

GENERAL

**RADIO CONTROLS**—Set volume control for maximum output and tuning control as given in the alignment chart. Set band switch to broadcast position for first 5 steps, and to special services position for steps 6 and 7.

**OUTPUT INDICATOR**—Connect output indicator (either on oscilloscope or a 1000-ohms-per-volt, a-c voltmeter) across voice-coil terminals.

**SIGNAL GENERATOR**—Use an AM r-f generator, connected as indicated in the alignment chart.

**OUTPUT LEVEL**—During alignment, attenuate signal-generator output to maintain output indication below 1 volt.

**DIAL POINTER**—Before the alignment is started, the dial pointer should be set to coincide with the dial scale mark to the left of “55” when the tuning gang is fully meshed.

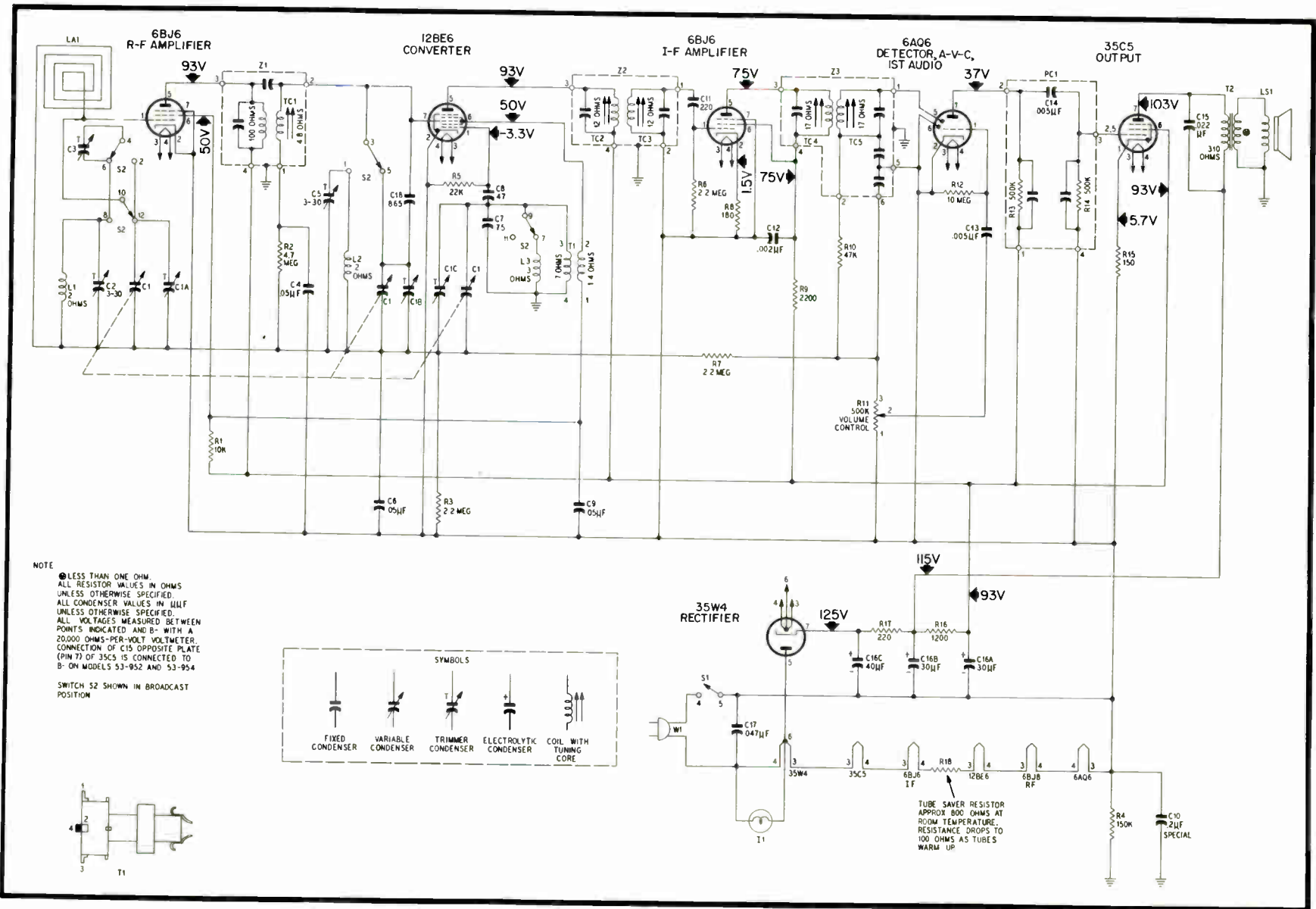
ALIGNMENT CHART

STEP	SIGNAL GENERATOR		RADIO		ADJUST
	CONNECTION TO RADIO	DIAL SETTING	DIAL SETTING	SPECIAL INSTRUCTIONS	
1	Ground lead to B—. Output lead through a .01- $\mu$ f. condenser to pin 7 (mixer grid) of 12BE6, converter.	455 kc.	Tuning gang fully open.	Adjust, in order given in next column, for maximum output.	TC5—2nd i-f sec. TC4—2nd i-f pri. TC3—1st i-f sec. TC2—1st i-f pri.
2	Radiating loop. See Note 1 below.	1620 kc.	1620 kc. See Note 2 below.	Adjust for maximum output.	C1C—osc. trimmer
3	Same as step 2.	1520 kc.	Tune radio to generator signal.	Adjust for maximum output. (High-frequency adjustment)	C1B—mixer-grid trimmer C1A—r-f trimmer
4	Same as step 2.	580 kc.	Same as step 3.	Adjust for maximum output. (Low-frequency adjustment)	TC1—r-f transformer
5	Repeat steps 3 and 4 until no further improvement is obtained.				
6	Same as step 2.	3200 kc.	Same as step 3.	Adjust for maximum output.	C5—special-services mixer-grid trimmer C2—special-services r-f trimmer
7	Same as step 2.	1800 kc.	Same as step 3.	Adjust for maximum output.	C3—special-services r-f padder

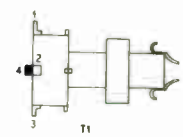
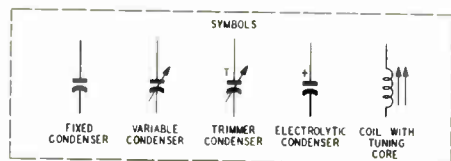
**NOTE 1:** Make up a 6–8 turn, 6-inch-diameter loop from insulated wire; connect to signal-generator leads and place near radio loop antenna. The loop antenna must be connected to the radio.

**NOTE 2:** To set the tuning gang to 1620 kc., place a piece of 6-mil flat shim stock beneath the heel of the rotor, and turn the rotor until it holds the shim firmly in place. Then remove the shim.





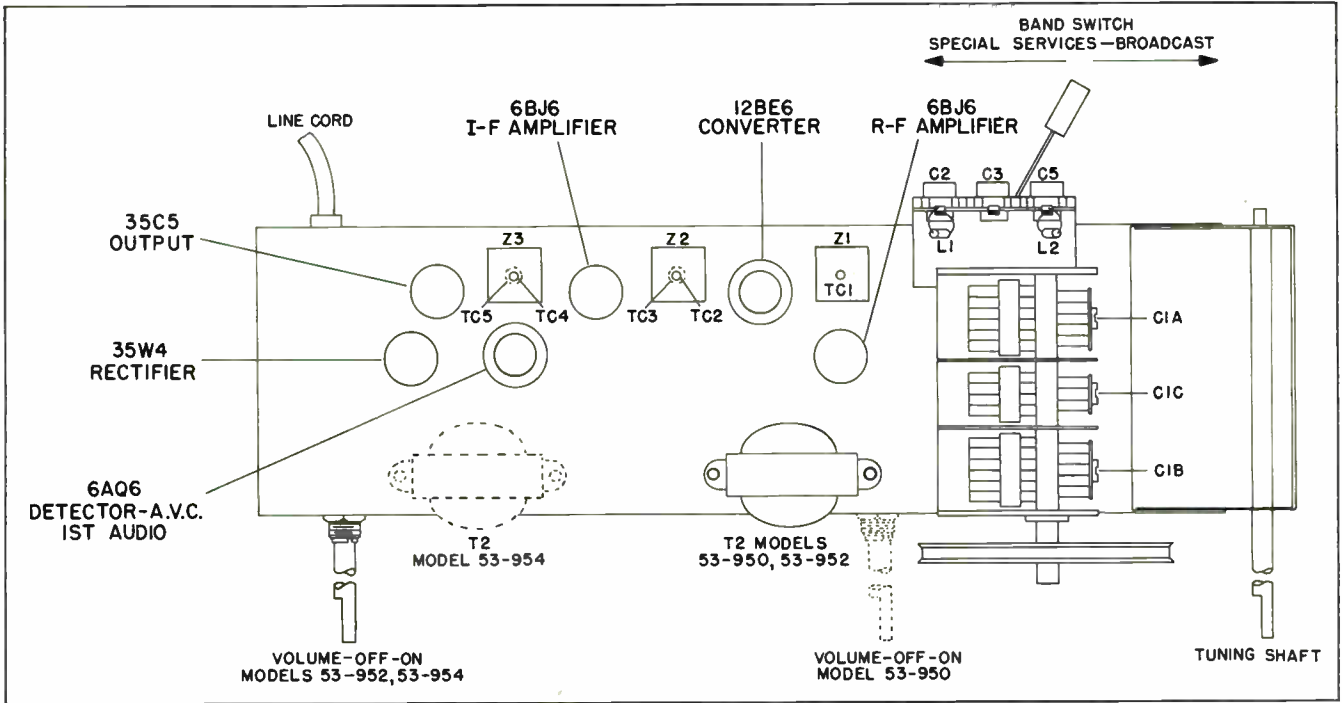
NOTE  
 ● LESS THAN ONE OHM.  
 ALL RESISTOR VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.  
 ALL CONDENSER VALUES IN  $\mu$ UF UNLESS OTHERWISE SPECIFIED.  
 ALL VOLTAGES MEASURED BETWEEN POINTS INDICATED AND B- WITH A 20,000 OHMS-PER-VOLT VOLTMETER. CONNECTION OF C15 OPPOSITE PLATE (PIN 7) OF 35C5 IS CONNECTED TO B- ON MODELS 53-952 AND 53-954.



TUBE SAVER RESISTOR  
 APPROX 800 OHMS AT ROOM TEMPERATURE. RESISTANCE DROPS TO 100 OHMS AS TUBES WARM UP

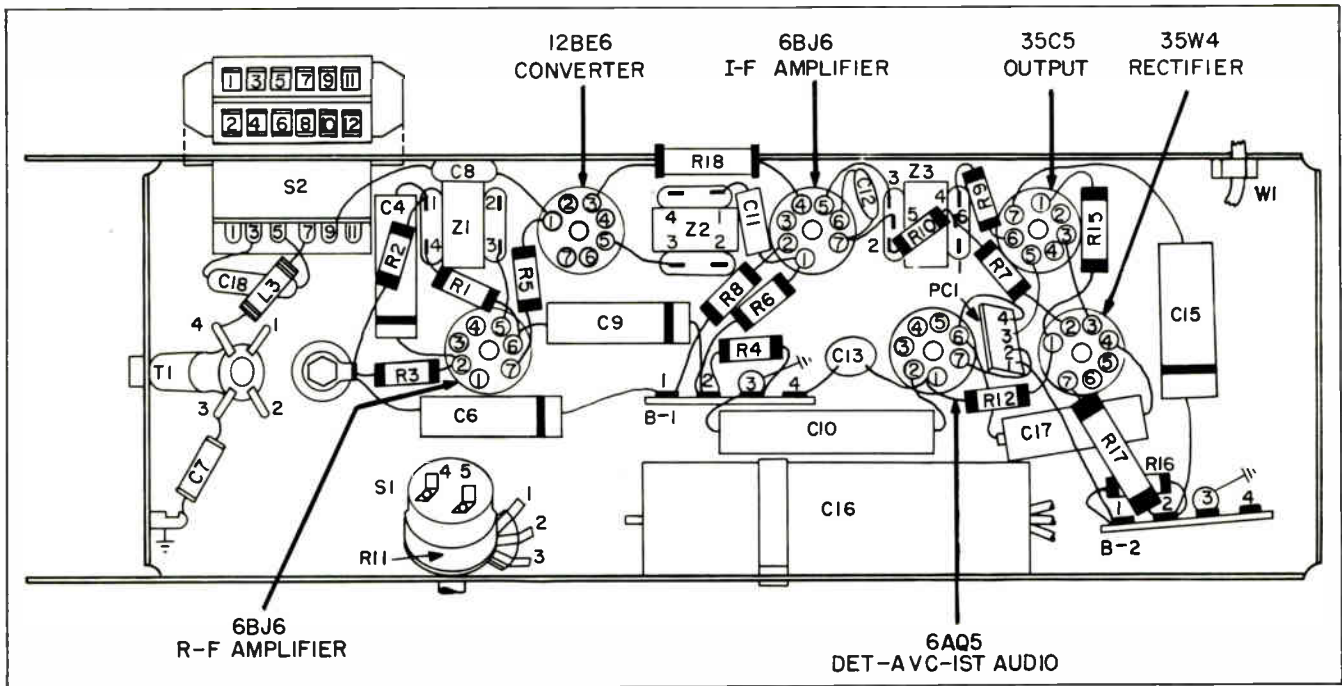
Figure 5. Philco Radio Models 53-950, 53-952, and 53-954, Schematic Diagram

TP2-2652



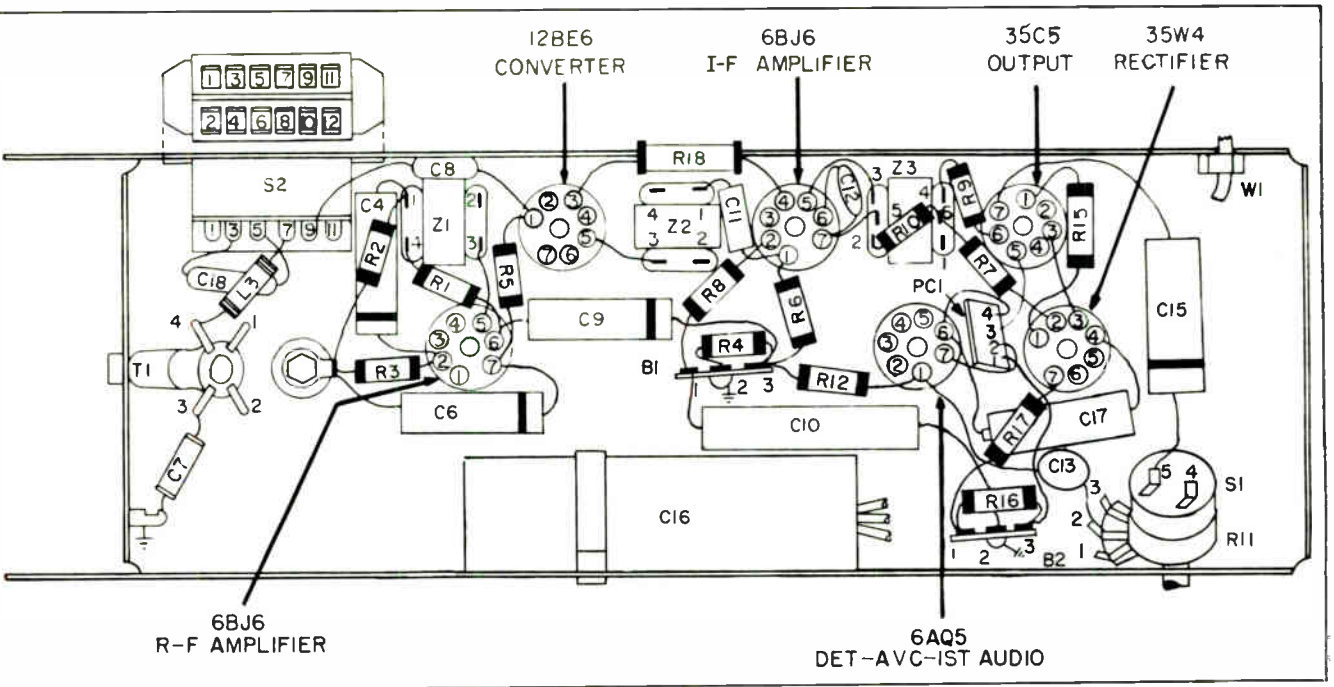
TP2-2655

Figure 2. Top View, Showing Tuning Adjustments



TP2-2653

Figure 3. Base View, Model 53-950, Showing Parts Placement



TP2-2654

Figure 4. Base View, Models 53-952 and 53-954, Showing Parts Placement

REPLACEMENT PARTS LIST

NOTE: Part numbers identified by an asterisk (\*) are general replacement items. These numbers may not be identical with those on factory parts. Also, the electrical values of some replacement items may differ from the values indicated in the schematic diagram and parts list. The values substituted in any case are so chosen that the operation will be either unchanged or improved. When ordering replacements, use only the "Service Part No."

Reference Symbol	Description	Service Part No.	Reference Symbol	Description	Service Part No.
C1	Condenser, tuning gang, 3 section Model 53-950 .....	31-2771	C13	Condenser, audio coupling .005 $\mu$ f. ....	30-1238-1*
	Models 53-952, 53-954 .....	31-2771-1	C14	Condenser, d-c blocking, .005 $\mu$ f. ....	Part of PC1
C1A	Condenser, trimmer, antenna .....	Part of C1	C15	Condenser, tone compensation, .022 $\mu$ f. ....	30-4650-43*
C1B	Condenser, trimmer, r-f .....	Part of C1	C16	Condenser, electrolytic filter .....	30-2575-27
C1C	Condenser, trimmer, oscillator .....	Part of C1	C16A	Condenser, filter, 30 $\mu$ f., 150v .....	Part of C16
C2	Condenser, trimmer, special services r-f .....	Part of CA1	C16B	Condenser, filter, 30 $\mu$ f., 150v .....	Part of C16
C3	Condenser, padder, special services r-f .....	Part of CA1	C16C	Condenser, filter, 40 $\mu$ f., 150v .....	Part of C16
C4	Condenser, r-f by-pass, .05 $\mu$ f. ....	30-4650-45*	C17	Condenser, line by-pass, .047 $\mu$ f. ....	30-4650-45*
C5	Condenser, trimmer, special services mixer-grid .....	Part of CA1	C18	Condenser, fixed padder, 865 $\mu$ f. ....	30-1220-68
C6	Condenser, a-v-c by-pass, .05 $\mu$ f. ....	30-4650-45*	CA1	Condenser assembly, trimmer .....	31-6477-17
C7	Condenser, fixed trimmer, 7.5 $\mu$ f. ....	30-1224-65	I1	Lamp, pilot .....	34-2068
C8	Condenser, d-c blocking, 47 $\mu$ f. ....	60-00475420	L1	Coil, special services r-f .....	32-4561-4
C9	Condenser, screen by-pass, .05 $\mu$ f. ....	30-4650-45*	L2	Coil, special-services mixer-grid .....	32-4561-4
C10	Condenser, special, B- to chassis, .2 $\mu$ f. ....	30-4644	L3	Coil, oscillator shunt .....	32-4562-1
C11	Condenser, i-f coupling, 220 $\mu$ f. ....	62-122001001*	PC1	Printed circuit .....	30-6001
C12	Condenser, screen by-pass, .002 $\mu$ f. ....	30-1238-8*	R1	Resistor, screen dropping, 10,000 ohms .....	66-3108340*
			R2	Resistor, a-v-c load, 4.7 megohms .....	66-5478340*
			R3	Resistor, a-v-c load, 2.2 megohms .....	66-5228340*
			R4	Resistor, B- to chassis, 150,000 ohms .....	66-4158340*

REPLACEMENT PARTS LIST (Continued)

Reference Symbol	Description	Service Part No.	Description	Service Part No.
R5	Resistor, grid leak, 22,000 ohms .....	66-3228340*	Socket, tube (2) .....	27-6203-14
R6	Resistor, grid leak, 2.2 megohms .....	66-5228340*	Socket, tube (4) .....	27-6265
R7	Resistor, a-v-c load, 2.2 megohms .....	66-5228340*	Speed nut (4) .....	1W56920FE7
R8	Resistor, cathode bias, 180 ohms .....	66-1188340*	<b>MODEL 53-950</b>	
R9	Resistor, screen dropping, 2200 ohms .....	66-2228340*	Cabinet, mahogany .....	10938
R10	Resistor, i-f filter, 47,000 ohms .....	66-3478340*	Cabinet, ivory .....	10938-2
R11	Volume control, 500,000 ohms Models 53-950, 53-954 .....	33-5566-43	Cabinet back and loop assembly .....	76-7881
	Model 53-952 .....	33-5566-46	Scale, mahogany .....	54-5152
R12	Resistor, grid leak, 10 megohms .....	66-6108340*	Scale, ivory .....	54-5152-1
R13	Resistor, plate load, 500,000 ohms .....	Part of PC1	Knob (2) .....	54-4718-39
R14	Resistor, grid leak, 500,000 ohms .....	Part of PC1	Knob, band switch .....	54-4998
R15	Resistor, cathode bias, 150 ohms, 1 watt .....	66-1154340*	Pointer .....	56-9898
R16	Resistor, B+ filter, 1200 ohms .....	66-2128340*	Shaft, tuning .....	56-9807-1
R17	Resistor, B+ filter, 220 ohms, 1 watt .....	66-1224340*	Spring, retaining .....	28-8610
R18	Resistor, tube saver, 100 ohms .....	33-1343-3	Speaker .....	45-9731
S1	Switch, off-on .....	Part of R11	<b>MODEL 53-952</b>	
S2	Switch, broadcast-special services Model 53-950 .....	42-1893-3	Cabinet .....	10963
	Model 53-952 .....	42-1893-5	Cabinet back and loop assembly .....	76-8068
	Model 53-954 .....	42-1893-4	Knob (2) .....	54-6025
T1	Transformer, oscillator .....	32-4453-2	Knob, band switch .....	54-4998
T2	Transformer, output .....	32-8310-3	Panel, diffusing .....	54-8819
W1	Line cord .....	L-2183*	Clip, panel diffusing .....	56-3587-1
Z1	Transformer, r-f .....	32-4399-7A	Pointer .....	56-5630-51
Z2	Transformer, 1st i-f .....	32-4160A	Pointer rail assembly .....	76-8067
Z3	Transformer, 2nd i-f .....	32-4240A	Scale, dial .....	54-5163
			Shaft, tuning .....	56-9807-2
			Spring, retaining .....	28-8610
			Speaker .....	45-9736
			<b>MODEL 53-954</b>	
			Cabinet, mahogany .....	10959
			Cabinet, blond .....	10959-1
			Back assembly, mahogany cabinet .....	76-8063
			Back assembly, blond cabinet .....	76-8063-10
			Loop assembly, antenna .....	76-2127-13
			Metal grille .....	56-10034
			Knob (2), mahogany .....	54-6019
			Knob (2), blond .....	54-6019-1
			Knob, band switch .....	54-4998
			Panel, diffusing .....	54-8817
			Clip, diffusing panel .....	56-3587-1
			Pointer .....	56-5630-52
			Pointer rail assembly .....	76-7981
			Shaft, tuning .....	56-9807-1
			Spring, retaining .....	28-8610
			Speaker .....	36-1626-5
<b>MISCELLANEOUS</b>				
<b>PARTS COMMON TO ALL MODELS</b>				
Description		Service Part No.		
Drive cord, 25-ft. spool .....		45-8750*		
Spring, drive cord .....		56-2617		
Rubber mount, gang mtg. (3) .....		27-4596		
Shield, tube (2) .....		56-5629FA3		
Socket assembly, pilot lamp .....		27-6233-6		



# PHILCO



# SERVICE

## HOME RADIO

### PHILCO RADIO MODEL 53-956

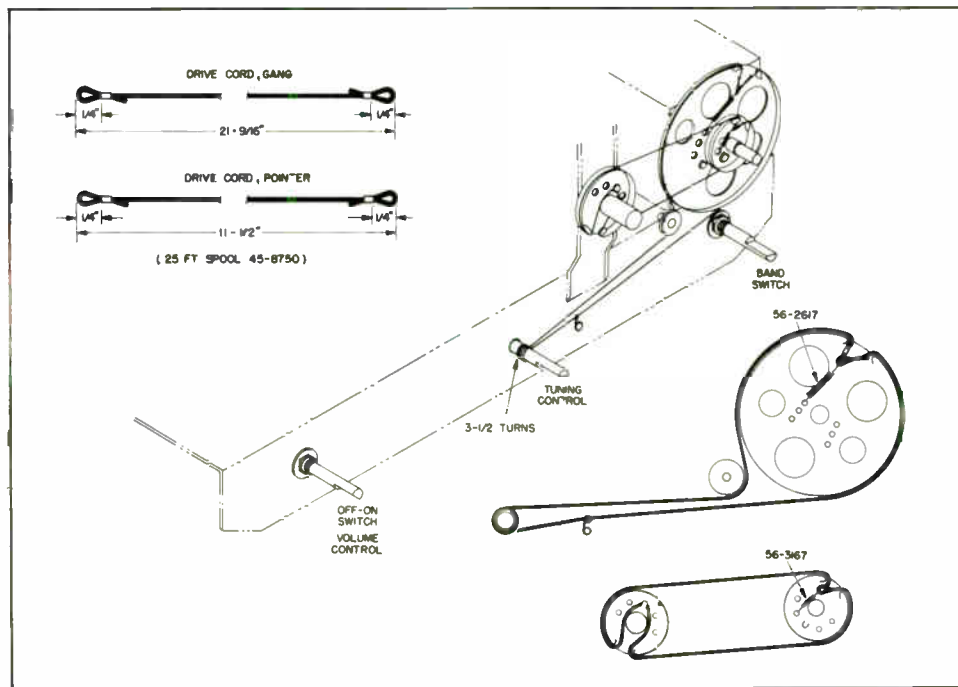
#### SPECIFICATIONS

CABINET .....	Plastic table model
CIRCUIT .....	Six-tube superheterodyne plus selenium rectifier
FREQUENCY RANGES	
Broadcast .....	540—1620 kc.
FM .....	88—108 mc.
AUDIO OUTPUT .....	1 watt
OPERATING VOLTAGE .....	105—125 volts, a.c./d.c.
POWER CONSUMPTION .....	45 watts
AERIAL .....	Built-in pancake loop for AM, line cord for FM; provision for connecting external aerial
INTERMEDIATE FREQUENCY	
AM .....	455 kc.
FM .....	9.1 mc.
PHILCO TUBES (6) .....	12AU6 r-f ompl., 12AT7 converter, 12BA6 1st i-f ompl., 12AU6 2nd i-f ompl., 19V8 det.-a.v.c.-1st audio, 35C5GT output



MODEL 53-956

PHILCO RADIO MODEL 53-956



TP2-2260

Figure 1. Drive-Cord Installation Details

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PR-2420

## AM ALIGNMENT PROCEDURE

**Make alignment with loop aerial connected to radio. The AM alignment should be completed before the FM alignment is made.**

**DIAL POINTER**—With tuning-condenser plates fully meshed, adjust pointer to coincide with index mark at low-frequency end of dial backplate.

**RADIO CONTROLS**—Set volume control to maximum, set band switch for broadcast reception, and set tuning control as indicated in chart.

**OUTPUT METER**—Connect across voice-coil terminals.

**SIGNAL GENERATOR**—Use AM r-f signal generator, with modulated output. Connect generator and set frequency as indicated in chart.

**OUTPUT LEVEL**—During alignment, signal-generator output must be attenuated to hold output-meter reading below 1.25 volts.

### AM ALIGNMENT CHART

STEP	SIGNAL GENERATOR		RADIO		ADJUST
	CONNECTION TO RADIO	DIAL SETTING	DIAL SETTING	SPECIAL INSTRUCTIONS	
1	Ground lead to chassis. Output lead through a .1- $\mu$ f. condenser to junction of LA1 and L8.	455 kc.	Gang fully open.	Adjust for maximum output, in order given.	TC10—2nd AM i-f sec. TC9—2nd AM i-f pri. TC4—1st AM i-f sec. TC3—1st AM i-f pri.
2	Radiating loop (see note below).	1620 kc.	1620 kc. (2nd index mark from right).	Adjust for maximum output.	C1C—osc. trimmer.
3	Same as step 2.	1500 kc.	1500 kc.	Adjust for maximum output.	C1A—aerial trimmer.

**RADIATING LOOP:** Make up a six-to-eight turn, 6-inch-diameter loop from insulated wire; connect to generator terminals, and place near radio loop aerial. Radio loop aerial must be connected.

## FM ALIGNMENT PROCEDURE

### Make AM alignment first

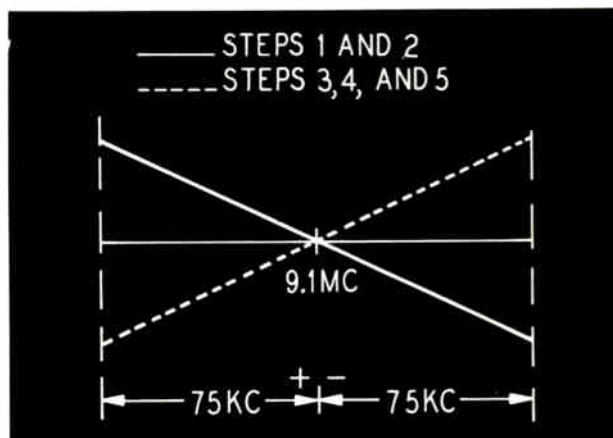
**RADIO CONTROLS**—Set volume control to maximum, set band switch for FM reception, and set tuning control as indicated in chart.

**OSCILLOSCOPE**—Connect ground lead to chassis. Connect vertical input to FM TEST jack, J2; connect horizontal input to horizontal sweep output of sweep generator. (Oscilloscope is used for steps 1 and 2.)

**SWEEP GENERATOR**—Use FM r-f sweep signal generator. Connect output lead as given in chart. Set frequency and sweep width as indicated in chart.

**OUTPUT METER**—Connect across voice-coil terminals.

**NOTE:** Before starting FM alignment, allow radio and signal generator to warm up for 15 minutes.



TPI-2111

**Figure 2. Characteristic Curve of FM Detector**

### FM ALIGNMENT CHART

STEP	SIGNAL GENERATOR		RADIO		ADJUST
	CONNECTION TO RADIO	DIAL SETTING	DIAL SETTING	SPECIAL INSTRUCTIONS	
1	Ground lead to chassis. Output lead through a .01- $\mu$ f. condenser to control grid (pin 1) of 12AU6 2nd i-f amplifier.	9.1 mc. (75-kc. deviation).	88mc. (gang meshed).	Balance and adjust detector for maximum indication on scope, as shown in figure 2.	TC8—detector sec. TC7—detector pri.

REPLACEMENT PARTS LIST (Cont.)

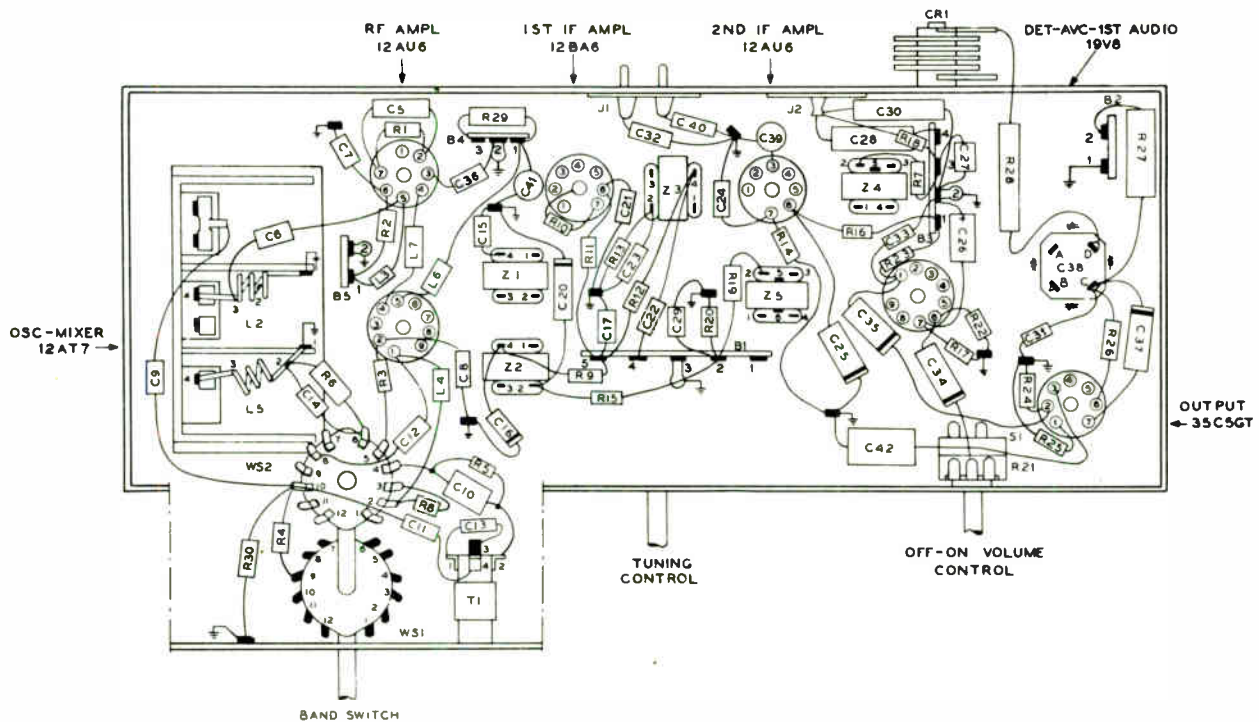
Reference Symbol	Description	Service Part No.
R25	Resistor, cathode bias, 150 ohms	66-1158340°
R26	Resistor, filter, 470 ohms, 1 watt	66-1474340°
R27	Resistor, filter, 150 ohms, 2 watts	66-1155360°
R28	Resistor, current limiting, 22 ohms, 2 watts	66-0225360°
9	Resistor, current limiting, 100 ohms	33-1343-3
10	Resistor, grid return, 2.2 megohms	66-5228340°
	Switch, off-on	Part of R21
	Transformer, AM oscillator	32-4569-1
	Transformer, output	Part of LS1
	Line cord	41-3865-3
	Cable, FM aerial, 72-ohm twin lead	41-3987
	Switch, band, 2-wafer	42-1924-1
	Transformer, FM, 1st i-f	32-4518A
	Transformer, AM, 1st i-f	32-4516A
	Transformer, FM, 2nd i-f	32-4518-1A
	Transformer, FM, detector	32-4310-4A
	Transformer, AM, 2nd i-f	32-4517A

MISCELLANEOUS (Cont.)

Description	Service Part No.
Fastener, back mtg. (4)	W-2235-FA9
Dial scale	54-4987
Knob, FM-AM	54-4774-28
Knob, tuning	54-4774-26
Knob, volume-off-on	54-4774-27
Clip, pilot lamp	56-3545-FA3
Drive cord, 25-foot spool	45-8750°
Pointer	56-9906
Shaft, drive	56-7931FA11
Spring, gang drive	56-2617
Spring, pointer drive	56-3167
Rubber mount, speaker (2)	54-4651-1
Socket, 12BA6 (i-f ampl.)	27-6265
Socket, 12AU6 (i-f ampl.)	27-6265
Socket, 12AU6 (r-f ampl.)	27-6275-1
Socket, 12AT7	27-6203-6
Socket, 19V8	27-6203-6
Socket, 35C5	27-6203-12
Shield, tube (2)	56-5629-3
Shield, tube base (1)	56-3978-1FA3
Shield, tube base (2)	56-5628-1FA3
Socket, assembly, pilot lamp	27-6233-21
Spring, hairpin	28-8610

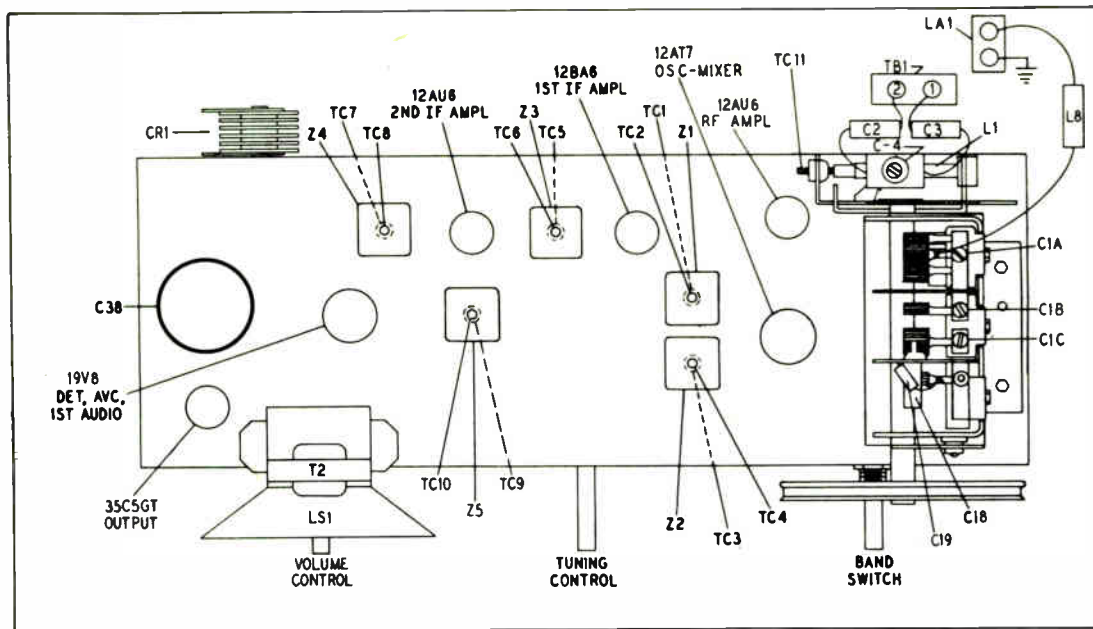
MISCELLANEOUS

Description	Service Part No.
Pinet	10941
Back, flange, and socket assembly	76-7829



TP2-2263

Figure 5. Base View, Showing Parts Placement



TP2-2261

Figure 3. Top View, Showing Trimmer Locations

FM ALIGNMENT CHART (Cont.)

STEP	SIGNAL GENERATOR		RADIO		ADJUST
	CONNECTION TO RADIO	DIAL SETTING	DIAL SETTING	SPECIAL INSTRUCTIONS	
2	Ground lead to chassis. Output lead through a .01- $\mu$ f. condenser to FM tuning gang stator lug, junction of C1 and pin 4 of L2.	Same as step 1.	Same as step 1.	Adjust for maximum indication on scope, as shown in figure 2.	TC6—FM 2nd i-f sec. TC5—FM 2nd i-f pri. TC2—FM 1st i-f sec. TC1—FM 1st i-f pri.
3	Ground lead to lug 3 of TB1. Output lead to lug 2 of TB1. See note 1 below.	108.5 mc.	108.5 mc. (1st index mark from right).	Adjust for maximum indication on output meter.	C18—FM osc.
4	Same as step 3.	88 mc.	88 mc. (1st index mark from left).	Adjust for maximum indication on output meter. See note 2 below.	L5—FM osc.
5	Same as step 3.	105 mc.	105 mc. (3rd index mark from right).	Adjust for maximum indication on output meter while rocking tuning condenser.	C1B—FM r-f.
6	Same as step 3.	105 mc.	105 mc.	Adjust for maximum indication on output meter.	C4—FM aerial.
7	Same as step 3.	92 mc.	92 mc. (3rd index mark from left).	Adjust for maximum indication on output meter. See note 3 below.	L2—FM r-f coil.
If FM aerial coil, L1, is replaced, it should be adjusted as directed in step 8, below.					
8	Same as step 3.	92 mc.	92 mc.	Adjust for maximum indication on output meter.	TC11—FM aerial.

NOTE 1: For accurate results, the signal-generator output impedance must be 300 ohms, to match the input impedance of TB1. If the generator impedance is less than 300 ohms, a resistor of the proper value may be used in series with the output lead to make the impedance correct. For example, if the output impedance is 150 ohms, place a 150-ohm resistor in series with the output lead.

NOTE 2: If oscillator does not tune as low as 88 mc., compress the turns on the oscillator coil. If oscillator tunes too low, spread the turns slightly. After coil is adjusted, repeat step 3.

NOTE 3: Check resonance of coil L2 by inserting end of a tuning wand, such as Philco Part No. 56-6100, in the coil. If output increases when iron end is placed in coil, compress turns slightly. If output increases when brass end is placed in coil, spread the turns. If output decreases when either end is placed in coil, no adjustment is necessary. After the coil is adjusted, readjust trimmer C1B and repeat steps 3 through 8 until no further improvement is obtained.



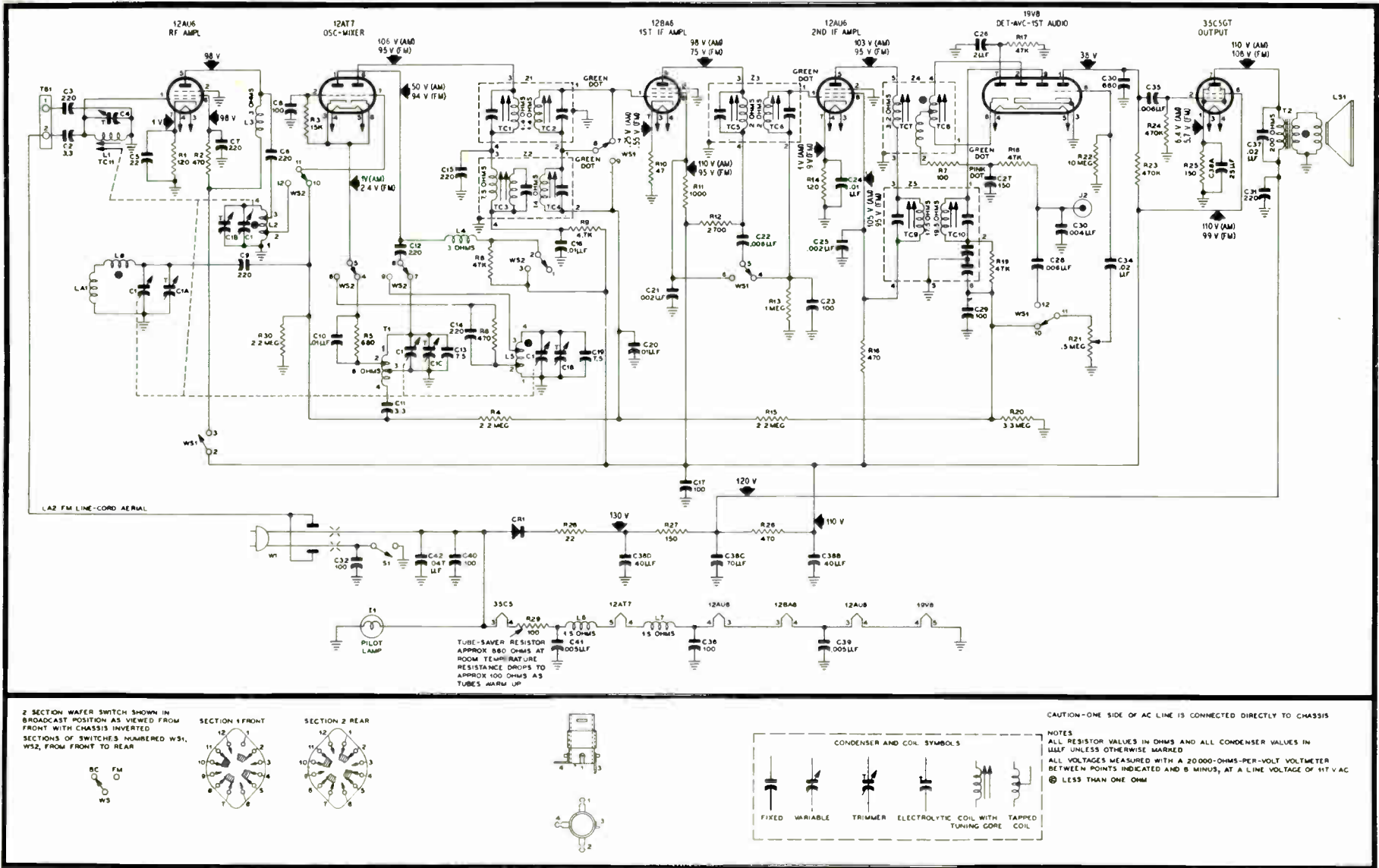


Figure 4. Philco Radio Model 53-956, Schematic Diagram

REPLACEMENT PARTS LIST

NOTE: Part numbers identified by an asterisk (\*) are general replacement items. These numbers may not be identical with those on factory parts; also, the electrical values of some replacement items may differ from the values indicated in the schematic diagram and parts list. The values substituted in any case are so chosen that the operation of the radio will be either unchanged or improved. When ordering replacements, use only the "Service Part No."

Reference Symbol	Description	Service Part No.	Reference Symbol	Description	Service Part No.
C1	Condenser, tuning gang, 5-section	31-2762-1	C38D	Condenser, filter, 40 $\mu$ f., 150v	Part of C38
C1A	Condenser, trimmer, BC aerial	Part of C1	C39	Condenser, filament by-pass, .005 $\mu$ f.	30-1238-1*
C1B	Condenser, trimmer, FM r-f	Part of C1	C40	Condenser, line by-pass, 100 $\mu$ f.	62-110001021*
C1C	Condenser, trimmer, BC oscillator	Part of C1	C41	Condenser, filament by-pass, .005 $\mu$ f.	30-1238-1*
C2	Condenser, aerial isolating, 3.3 $\mu$ f.	30-1221	C42	Condenser, line by-pass, .047 $\mu$ f.	30-4650-45*
C3	Condenser, aerial isolating, 220 $\mu$ f.	62-122001001*	CR1	Selenium rectifier, 100 ma., 117v.	34-8003-1
C4	Condenser, FM aerial trimmer	45-3034	I1	Pilot lamp, frosted, 117v, 7 watts	34-2605
C5	Condenser, cathode by-pass, 22 $\mu$ f.	62-022009001	J1	Jack, male, a-c	27-6240-5
C6	Condenser, d-c blocking, 220 $\mu$ f.	30-6002	J2	Socket, FM test	27-6180
C7	Condenser, screen by-pass, 220 $\mu$ f.	62-122001001*	L1	Coil, FM aerial, complete with grommet	32-4532A
C8	Condenser, oscillator grid, 100 $\mu$ f.	62-110001021*	L2	Coil, FM r-f	32-4415-2
C9	Condenser, d-c blocking, 220 $\mu$ f.	62-122001001*	L3	Choke, r-f, 3.3 $\mu$ h.	32-4422-10
C10	Condenser, cathode by-pass, .01 $\mu$ f.	30-4650-58*	L4	Choke, r-f, 3.3 $\mu$ h.	32-4422-10
C11	Condenser, neutralizing, 3.3 $\mu$ f.	30-1224-49	L5	Coil, FM oscillator	32-4414-5
C12	Condenser, d-c blocking 220 $\mu$ f.	62-122001001*	L6	Choke, filament, 2.2 $\mu$ h.	32-4422-8
C13	Condenser, fixed trimmer, 7.5 $\mu$ f.	30-1224-65	L7	Choke, filament, 2.2 $\mu$ h.	32-4422-8
C14	Condenser, cathode by-pass, 220 $\mu$ f.	62-122001001*	L8	Choke, r-f, 4.1 $\mu$ h.	32-4061-3
C15	Condenser, r-f by-pass, 220 $\mu$ f.	62-122001001*	LA1	AM loop and support assembly	76-7836
C16	Condenser, plate decoupling, .01 $\mu$ f.	30-4650-58*	LA2	Line-cord aerial, FM	Part of W1
C17	Condenser, r-f by-pass, 100 $\mu$ f.	62-110009001*	LS1	Speaker, 4" p-m, including output transformer	36-1625-14
C18	Condenser, trimmer, FM oscillator	31-6511-10	R1	Resistor, cathode bias, 120 ohms	66-1128340*
C19	Condenser, fixed trimmer, 7.5 $\mu$ f.	30-1224-8	R2	Resistor, screen decoupling, 470 ohms	66-1478340*
C20	Condenser, a-v-c decoupling, .01 $\mu$ f.	30-4650-58*	R3	Resistor, grid return, 15,000 ohms	66-3158340*
C21	Condenser, screen by-pass, .002 $\mu$ f.	30-4650-54*	R4	Resistor, grid return, 2.2 megohms	66-5228340*
C22	Condenser, neutralizing, .006 $\mu$ f.	30-4650-57*	R5	Resistor, parasitic suppressor, 680 ohms	66-1688340*
C23	Condenser, i-f by-pass, 100 $\mu$ f.	62-110001021*	R6	Resistor, parasitic suppressor, 470 ohms	66-1478340*
C24	Condenser, cathode by-pass, .01 $\mu$ f.	30-4650-58*	R7	Resistor, loading, 100 ohms	66-1108340*
C25	Condenser, screen by-pass, .002 $\mu$ f.	30-4650-54*	R8	Resistor, plate dropping, AM, 47,000 ohms	66-3478340*
C26	Condenser, electrolytic, diode-load filter, 2 $\mu$ f., 50v	30-2417-7	R9	Resistor, plate dropping, 4700 ohms	66-2478340*
C27	Condenser, i-f by-pass, 150 $\mu$ f.	62-115001011*	R10	Resistor, cathode bias, 47 ohms	66-0478340*
C28	Condenser, d-c blocking, .006 $\mu$ f.	30-4650-57*	R11	Resistor, screen decoupling, 1000 ohms	66-2108340*
C29	Condenser, i-f by-pass, 100 $\mu$ f.	62-110001021*	R12	Resistor, plate decoupling, 2700 ohms	66-2278340*
C30	Condenser, de-emphasis, .004 $\mu$ f.	30-4650-56*	R13	Resistor, grid return, 1 megohm	66-5108340*
C31	Condenser, plate decoupling, 220 $\mu$ f.	62-122001001*	R14	Resistor, cathode bias, 120 ohms	66-1128340*
C32	Condenser, line by-pass, 100 $\mu$ f.	62-110001021*	R15	Resistor, a-v-c filter, 2.2 megohms	66-5228340*
C33	Condenser, plate by-pass, 680 $\mu$ f.	62-168001001*	R16	Resistor, decoupling, 470 ohms	66-1478340*
C34	Condenser, d-c blocking, .02 $\mu$ f.	30-4650-60*	R17	Resistor, FM diode load, 47,000 ohms	66-3478340*
C35	Condenser, d-c blocking, .006 $\mu$ f.	30-4650-57*	R18	Resistor, de-emphasis, 47,000 ohms	66-3478340*
C36	Condenser, filament by-pass, 100 $\mu$ f.	62-110001021*	R19	Resistor, i-f filter, 47,000 ohms	66-3478340*
C37	Condenser, tone compensation, .02 $\mu$ f.	30-4650-60*	R20	Resistor, a-v-c load, 3.3 megohms	66-5338340*
C38	Condenser, electrolytic, 4-section	30-4650-46	R21	Volume control (with off-on switch) 500,000 ohms	33-5566-20
C38A	Condenser, cathode by-pass, 25 $\mu$ f., 25v	Part of C38	R22	Resistor, grid return, 10 megohms	66-6108340*
C38B	Condenser, filter, 40 $\mu$ f., 150v	Part of C38	R23	Resistor, plate load, 470,000 ohms	66-4478340*
C38C	Condenser, filter, 70 $\mu$ f., 150v	Part of C38	R24	Resistor, grid return, 470,000 ohms	66-4478340*

(Continued on next page)

# PHILCO

**PHILCO**  
**Factory-Supervised**  
**Service**

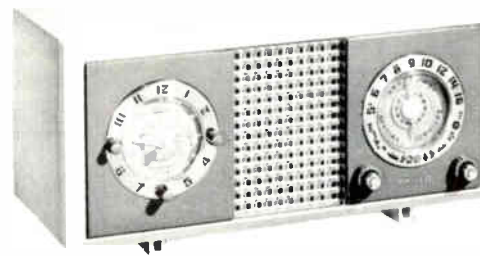
# SERVICE

## HOME RADIO

### PHILCO RADIO-CLOCK MODEL 53-804

#### SPECIFICATIONS

CABINET ..... Molded plastic  
 CIRCUIT ..... Five-tube superheterodyne (plus rectifier)  
 FREQUENCY RANGE  
   Broadcast ..... 540 kc. to 1620 kc.  
   Special Services ..... 1700 kc. to 3400 kc.  
 AUDIO OUTPUT ..... 1 watt  
 OPERATING VOLTAGE ..... 105—120 volts, a.c.  
 POWER CONSUMPTION ..... 30 watts  
 ANTENNA ..... Built-in, high-impedance loop  
 INTERMEDIATE FREQUENCY ..... 455 kc.  
 PHILCO TUBES ..... 6BJ6 r-f ampl.; 12BE6 converter;  
   6BJ6 i-f ampl.; 6AQ5 detector, a.v.c., 1st  
   audio; 35C5 output; 35W4 rectifier



MODEL 53-804

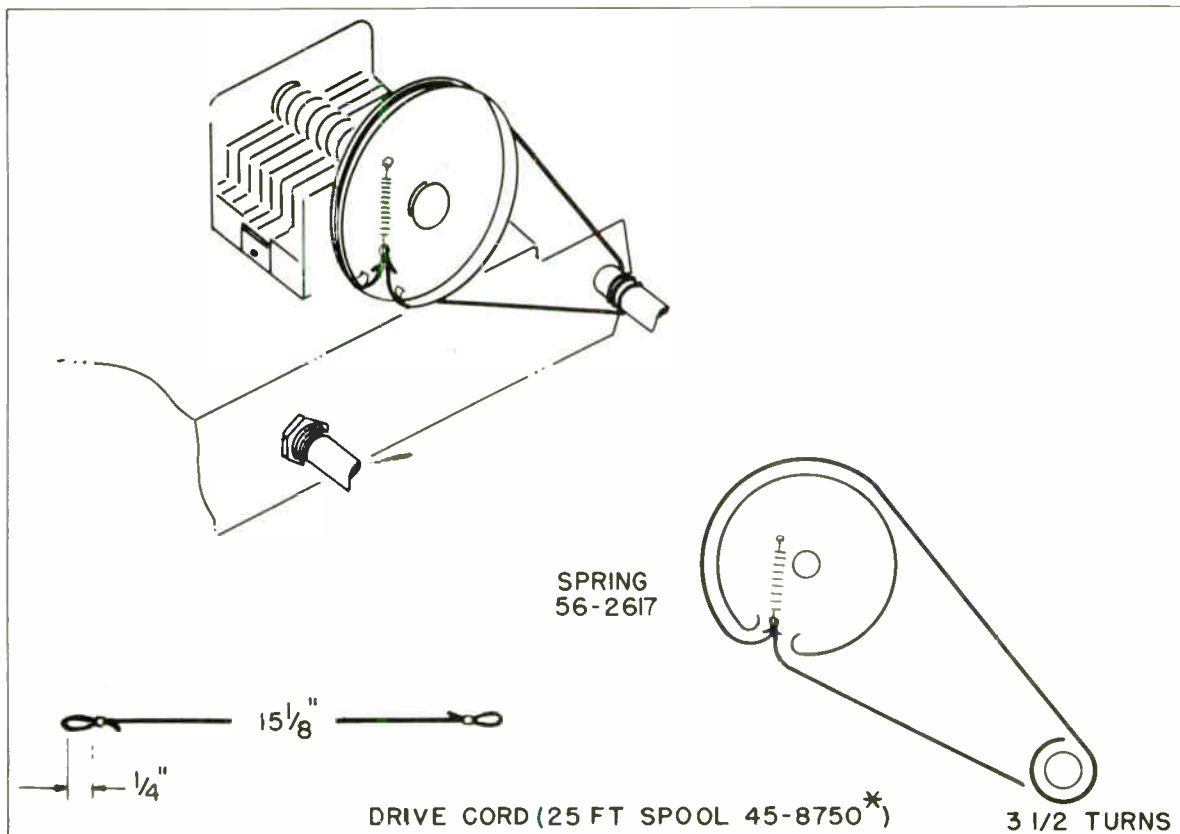


Figure 1. Drive-Cord Installation Details

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WorldRadioHistory

SERVICE MANUAL FOR PHILCO RADIO MODEL 53-804

PR-2424

ALIGNMENT PROCEDURE

GENERAL

**RADIO CONTROLS**—Set volume control for maximum output and tuning control as given in the alignment chart. Set band switch to broadcast position for first 5 steps, and to special services position for steps 6 and 7.

**OUTPUT INDICATOR**—Connect output indicator (either on oscilloscope or a 1000-ohms-per-volt, a-c voltmeter) across voice-coil terminals.

**SIGNAL GENERATOR**—Use an AM r-f generator, connected as indicated in the alignment chart.

**OUTPUT LEVEL**—During alignment, attenuate signal-generator output to maintain output indication below 1 volt.

**DIAL POINTER**—Before the alignment is started, the dial pointer should be set to coincide with the dial scale mark to the left of "55" when the tuning gang is fully meshed.

ALIGNMENT CHART

STEP	SIGNAL GENERATOR		RADIO		ADJUST
	CONNECTION TO RADIO	DIAL SETTING	DIAL SETTING	SPECIAL INSTRUCTIONS	
1	Ground lead to B-. Output lead through a .01- $\mu$ f. condenser to pin 7 (mixer grid) of 12BE6, converter.	455 kc.	Tuning gang fully open.	Adjust, in order given in next column, for maximum output.	TC5—2nd i-f sec. TC4—2nd i-f pri. TC3—1st i-f sec. TC2—1st i-f pri.
2	Radiating loop. See Note 1 below.	1620 kc.	1620 kc. See Note 2 below.	Adjust for maximum output.	C1C—osc. trimmer
3	Same as step 2.	1520 kc.	Tune radio to generator signal.	Adjust for maximum output. (High-frequency adjustment)	C1B—mixer-grid trimmer C1A—r-f trimmer
4	Same as step 2.	580 kc.	Same as step 3.	Adjust for maximum output. (Low-frequency adjustment)	TC1—r-f transformer
5	Repeat steps 3 and 4 until no further improvement is obtained.				
6	Same as step 2.	3200 kc.	Same as step 3.	Adjust for maximum output.	C5—special-services mixer-grid trimmer C2—special-services r-f trimmer
7	Same as step 2.	1800 kc.	Same as step 3.	Adjust for maximum output.	C3—special-services r-f padder

**NOTE 1:** Make up a 6–8 turn, 6-inch-diameter loop from insulated wire; connect to signal-generator leads and place near radio loop antenna. The loop antenna must be connected to the radio.

**NOTE 2:** To set the tuning gang to 1620 kc., place a piece of 6-mil flat shim stock beneath the heel of the rotor, and turn the rotor until it holds the shim firmly in place. Then remove the shim.



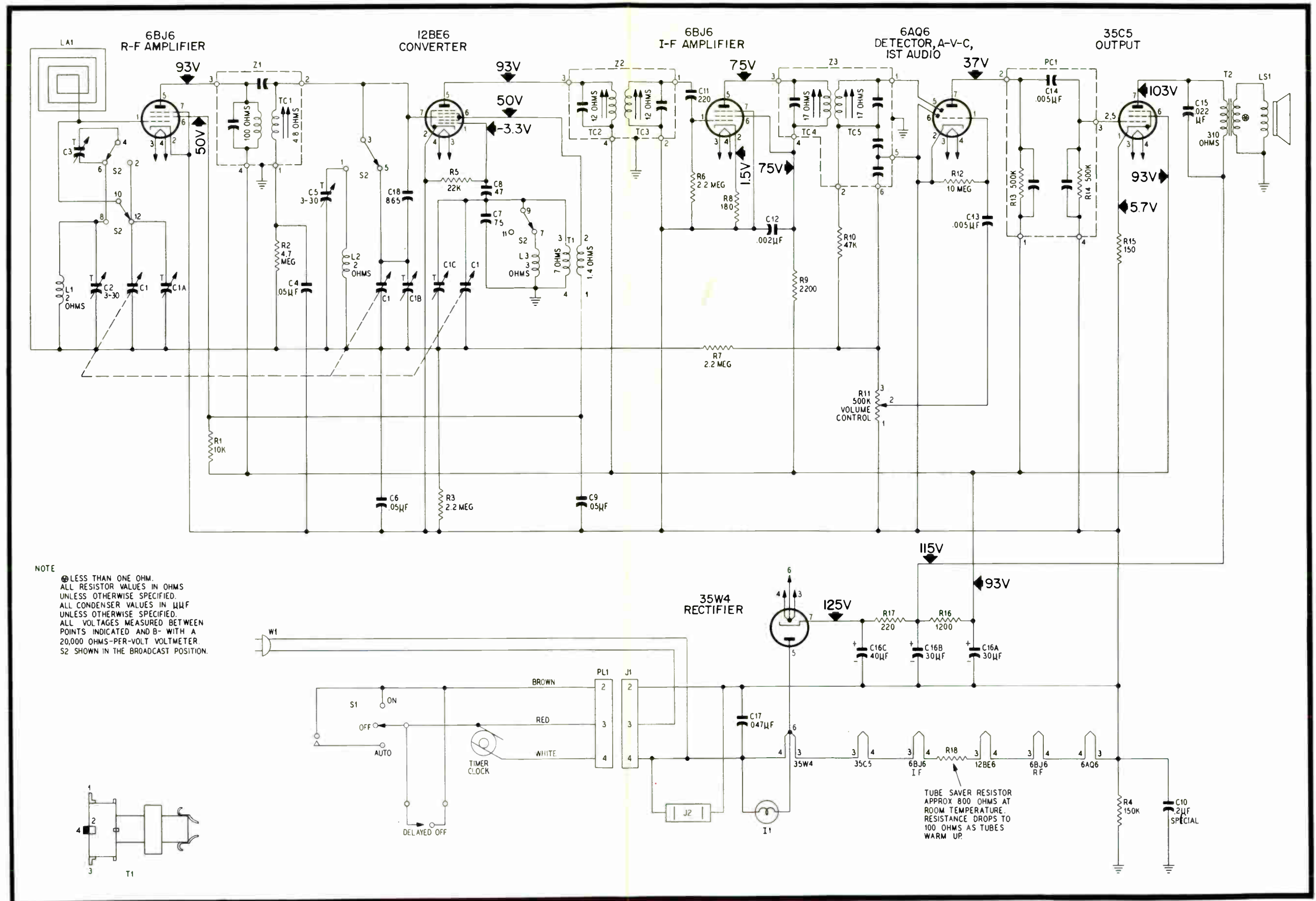


Figure 4. Philco Radio Model 53-804, Schematic Diagram

TP2-2652A



# PHILCO



# SERVICE

## TELEVISION

PHILCO TELEVISION SERVICE MANUAL  
FOR  
AM RADIO TUNER RT-8  
USED IN 1953 PHILCO TELEVISION RECEIVERS



PHILCO AM RADIO TUNER RT-8

SERVICE MANUAL FOR AM RADIO TUNER RT-8

PR-2376

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**TUBE COMPLEMENT**

NUMBER OF TUBES	TUBE TYPE	FUNCTION
1	6BA6, miniature	R-F amplifier
1	7A8	Converter
1	6AU6, miniature	I-F amplifier
1	6AV6, miniature	Detector, phono preamplifier

**RADIO ALIGNMENT**

**GENERAL**

Remove the receiver from the cabinet by removing the securing bolts. It is not necessary to remove the cables from the chassis in order to remove the chassis from the cabinet. Before starting the alignment, allow the receiver to warm up for fifteen minutes.

**TEST EQUIPMENT REQUIRED**

The following equipment is recommended for aligning the radio:

1. Philco Signal Generator Model 7170, or equivalent.

2. Output indicator (either a 20,000-ohms-per-volt voltmeter or an oscilloscope).

**RADIO ALIGNMENT PROCEDURE**

Follow the procedure in the alignment chart, and also observe the following instructions:

1. Set the function switch to the AM position.
2. Set the volume control for maximum output.
3. During the alignment, adjust the signal generator to keep the output indication below 1 volt peak-to-peak.

**ALIGNMENT CHART**

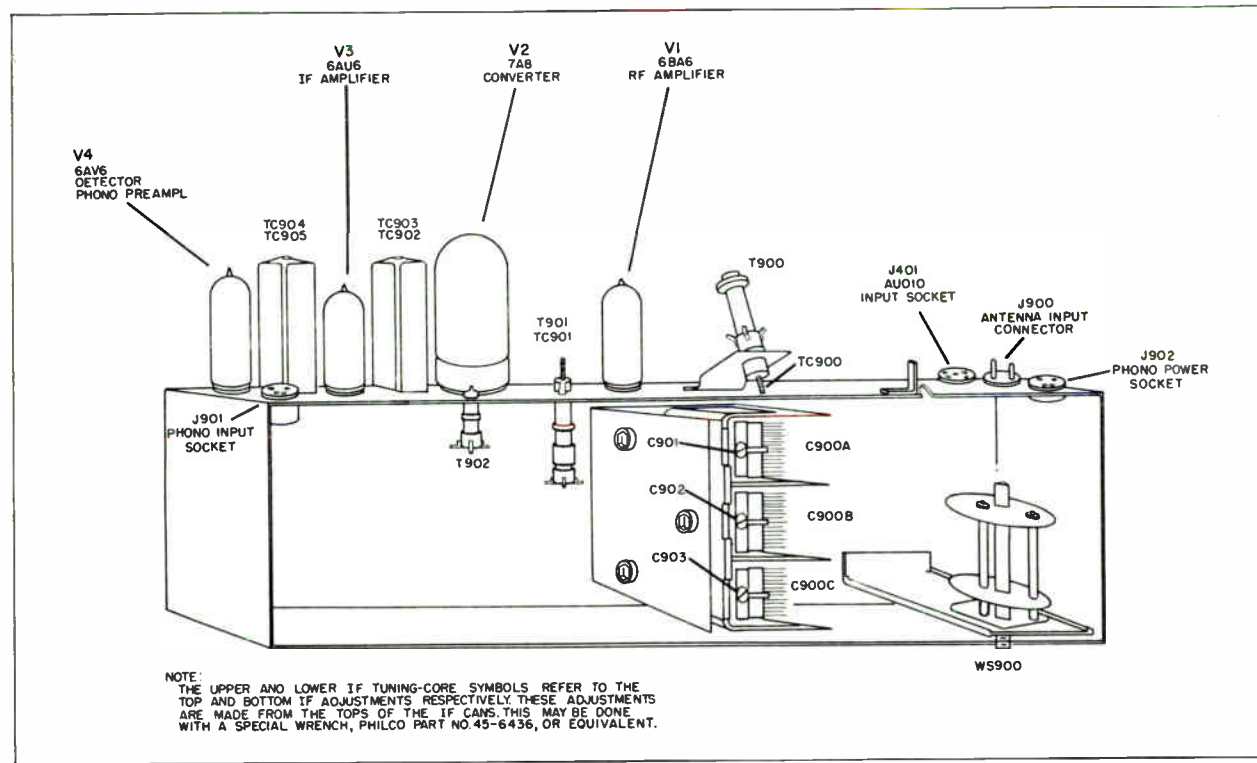
STEP	SIGNAL-GENERATOR CONNECTION	OUTPUT-INDICATOR CONNECTION	SIGNAL-GENERATOR SETTING	RADIO-DIAL SETTING	ADJUSTMENT INSTRUCTIONS
1	Connect signal generator through a .1- $\mu$ f. condenser to pin 6 of 7A8.	Connect vertical input of oscilloscope (or meter leads) to voice-coil terminals of speaker.	Set signal generator (modulated) to 455 kc.	Condenser fully meshed (540 kc.).	Adjust TC904, TC905, TC903, and TC902 for maximum output indication.
2	Same as step 1.	Same as step 1.	Set signal generator (modulated) to 1630 kc.	Set radio dial to 1630 kc. (See NOTE 3.)	Adjust C903 for maximum output indication.
3	See NOTE 1.	Same as step 1.	Same as step 2.	Same as step 2.	Adjust C901 and C902 for maximum output indication.
4	Same as step 3.	Same as step 1.	Set signal generator (modulated) to 580 kc.	Tune radio to 580 kc.	Adjust TC900 and TC901 for maximum output indication.
5	Repeat steps 3 and 4 until no further improvement is observed.				

NOTE 1: The adjustments given should be made with the loop aerial connected to the receiver. The signal generator should be coupled to the receiver by means of a radiating loop. This radiating loop should be made up of 6 to 8 turns of insulated wire formed into a 6-inch-diameter loop. Connect the signal generator to the radiating loop, and place the radiating loop near the loop aerial of the receiver.

NOTE 2: If it should ever become necessary to replace the antenna transformer, T900, step 4 should be performed.

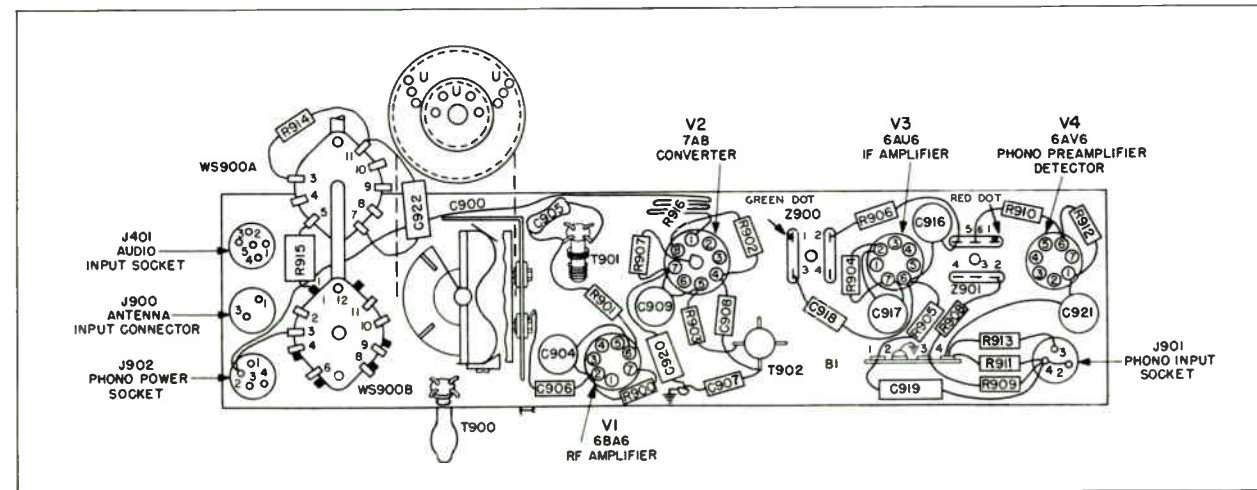
NOTE 3: The radio dial can be set to 1630 kc. by opening the condenser gang until the rotor rests against a piece of 6-inch flat shim stock temporarily placed between the stationary and movable sections of the tuning gang. Remove the shim.





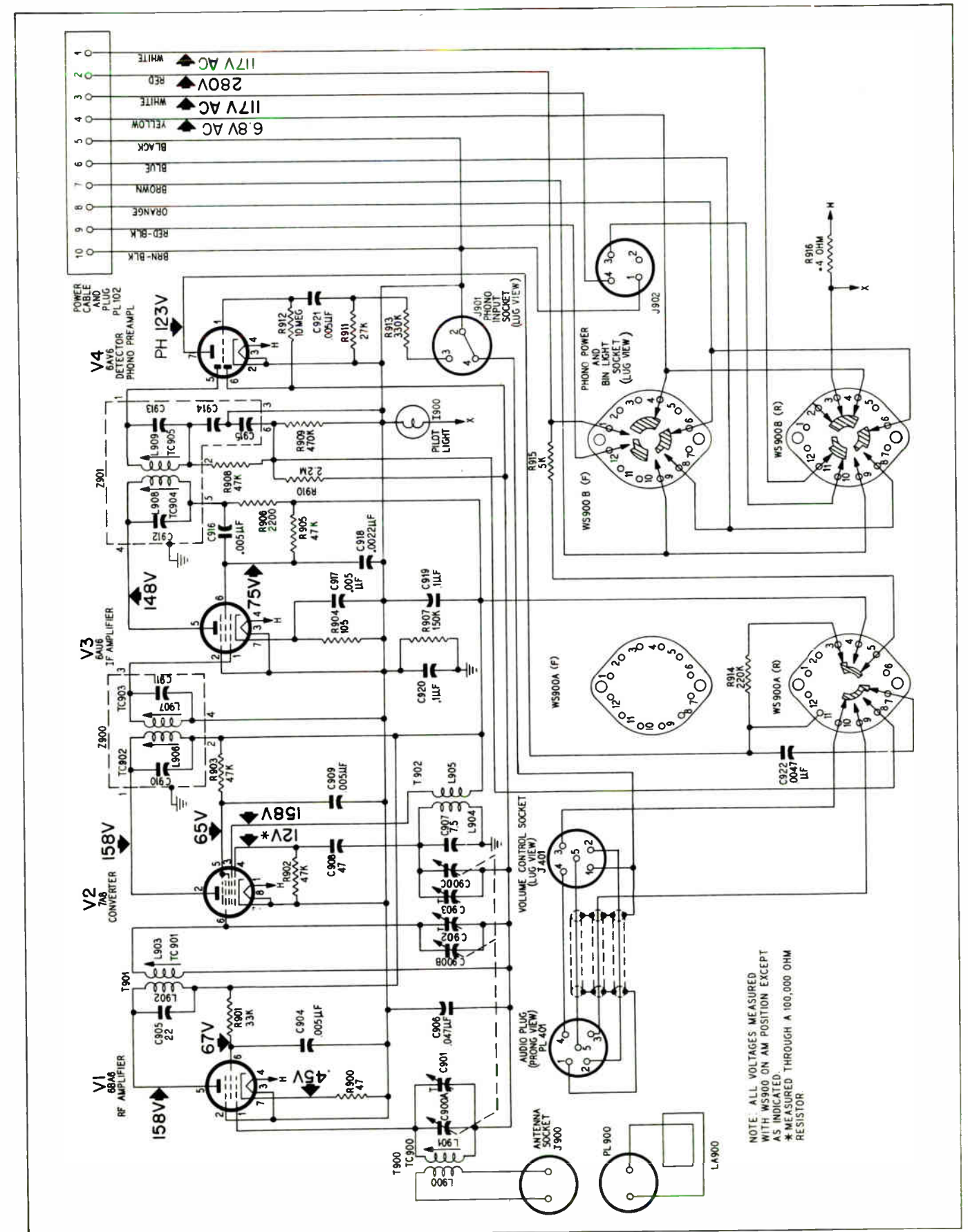
TP2-2044

Figure 1. AM Radio Tuner RT-8, Bottom View, Showing Location of Tuning Adjustments



TP2-2043

Figure 2. AM Radio Tuner RT-8, Base Layout



TP2-2042

Figure 3. AM Radio Tuner RT-8, Schematic Diagram

REPLACEMENT PARTS LIST

IMPORTANT

General replacement items commonly stocked by the servicemen are omitted from this parts list. These include Philco molded-bakelite condensers with a rating of 600 volts or less, and 1/2-watt resistors with a 10% or 20% tolerance rating. All parts (whether included in this parts list or not) are symbolized in the schematic diagram and base layouts, for identification purposes.

REFERENCE SYMBOL	DESCRIPTION	SERVICE PART NO.	REFERENCE SYMBOL	DESCRIPTION	SERVICE PART NO.
C900	Condenser, tuning gang, 3-section	31-2766-1	J902	Connector, phono power, female, chassis type	27-6273
C900A	Condenser, tuning, antenna	Part of C900	L900	Coil, antenna primary	Part of T900
C900B	Condenser, tuning, r-f grid	Part of C900	L901	Coil, antenna secondary	Part of T900
C900C	Condenser, tuning, oscillator	Part of C900	L902	Coil, r-f primary	Part of T901
C901	Condenser, trimmer, antenna	Part of C900A	L903	Coil, r-f secondary	Part of T901
C902	Condenser, trimmer, r-f	Part of C900B	L904	Coil, oscillator secondary	Part of T902
C903	Condenser, trimmer, oscillator	Part of C900C	L905	Coil, oscillator primary	Part of T902
C904	Condenser, screen by-pass, .005 $\mu$ f.	30-1238-1	L906	Coil, 1st i-f primary	Part of Z900
C905	Condenser, fixed trimmer, 22 $\mu$ f.	62-022009001	L907	Coil, 1st i-f secondary	Part of Z900
C907	Condenser, fixed trimmer, 7.5 $\mu$ f.	30-1224-65	L908	Coil, 2nd i-f primary	Part of Z901
C908	Condenser, oscillator grid, 47 $\mu$ f.	60-00475420	L909	Coil, 2nd i-f secondary	Part of Z901
C909	Condenser, screen by-pass, .005 $\mu$ f.	30-1238-1	PL102	Connector, interchassis	See Misc.
C910	Condenser, fixed trimmer, 1st i-f	Part of Z900	PL401	Connector, volume control	See Misc.
C911	Condenser, fixed trimmer, 1st i-f	Part of Z900	R915	Resistor, B+ dropping, 5000 ohms, 5 watts	33-1335-118
C912	Condenser, fixed trimmer, 2nd i-f	Part of Z901	R916	Resistor, filament dropping, .4 ohm	46 inches of No. 26 copper weld wire
C913	Condenser, fixed trimmer, 2nd i-f	Part of Z901	T900	Transformer, antenna	32-4519
C914	Condenser, i-f by-pass	Part of Z901	T901	Transformer, r-f	32-4572-1
C915	Condenser, i-f by-pass	Part of Z901	T902	Transformer, oscillator	32-4453-4
C916	Condenser, plate by-pass, .005 $\mu$ f.	30-1238-1	Z900	Transformer, 1st i-f	32-4537A
C921	Condenser, d-c blocking, .005 $\mu$ f.	30-1238-1	Z901	Transformer, 2nd i-f	32-4517-1A
I900	Lamp, pilot	34-2064			
I401	Connector, volume control, female, chassis type	27-6273			
J900	Connector, antenna, male, chassis type	54-4878-8			
J901	Connector, phono input, female, chassis type	27-6273			

MISCELLANEOUS

DESCRIPTION	SERVICE PART NO.
Band, rubber	54-4064
Cable-and-plug ass'y., audio	41-3974-11
Cable-and-plug ass'y., power	41-4146-7
Lever ass'y., switch operating	76-8049
Lever, switch	56-9999
Mount, rubber	27-4596
Shaft, tuning	56-10004
Socket, tube, Loktal	27-6207
Socket, tube, 7-pin miniature	27-6265
Spring, drive-cord	56-2617
Switch, wave (WS900)	42-1992
Ring, retaining, "E"	1W60980FES

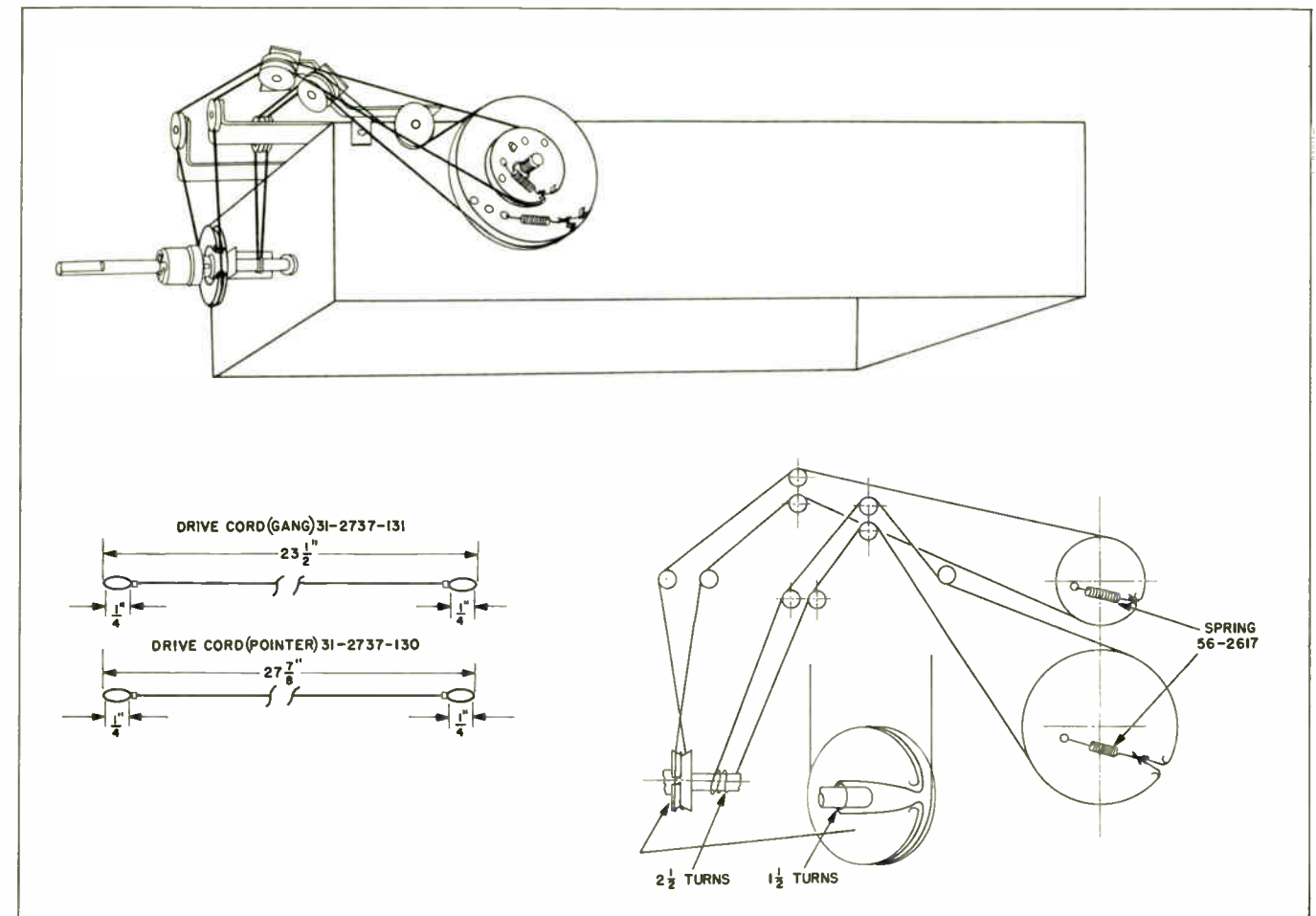


Figure 4. AM Radio Tuner RT-8, Drive-Cord Installation Details

TP2-2045

# PHILCO



# SERVICE

## TELEVISION

### SERVICE BULLETIN 52-T3 SERVICING PHILCO TELEVISION RECEIVERS

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## SERVICE REFERENCE CHART FOR 1953 PHILCO TELEVISION RECEIVERS

MODEL NO.	CODE NO.	R-F CHASSIS TYPE	DEFLECTION CHASSIS TYPE	TV TUNER PART NO.	RADIO TUNER TYPE	RECORD-CHANGER MODEL	PICTURE-TUBE TYPE	SERVICE MANUAL
53-T1824	123	81	H-1	76-7664	—	—	17YP4	PR-2374
53-T1825	123	81	H-1	76-7664	—	—	17YP4	PR-2374
53-T1826	123	81	H-1	76-7664	—	—	17YP4	PR-2374
53-T1852	123	81	H-1	76-7664	—	—	17YP4	PR-2374
53-T1852-L	123	81	H-1	76-7664	—	—	17YP4	PR-2374
53-T1852-L	124	71	G-1	76-7427	—	—	17YP4	PR-2105
53-T1854	123	81	H-1	76-7664	—	—	17YP4	PR-2374
53-T1883	123	84	H-4	76-7664	—	M-24	17YP4	PR-2402
53-T1884	123	84	H-4	76-7664	RT-9	M-24	17YP4	PR-2402
53-T1886	123	84	H-4	76-7664	RT-9	M-24	17YP4	PR-2402
53-T2125	123	81	H-1	76-7664	—	—	20DP4A	PR-2374
53-T2125	124	71	G-1	76-7427	—	—	20DP4A	PR-2105
53-T2125-L	123	81	H-1	76-7664	—	—	20DP4A	PR-2374
53-T2125-L	124	71	G-1	76-7427	—	—	20DP4A	PR-2105
53-T2152	123	81	H-1	76-7664	—	—	20DP4A	PR-2374
53-T2152-L	123	81	H-1	76-7664	—	—	20DP4A	PR-2374
53-T2152-L	124	71	G-1	76-7427	—	—	20DP4A	PR-2105
53-T2183	123	84	H-4	76-7664	RT-9	M-24	20DP4A	PR-2402
53-T2227	123	81	H-1	76-7664	—	—	21EP4A	PR-2374
53-T2228	126	91	J-1	76-7600	—	—	21EP4A	PR-2200
53-T2260	123	81	H-1	76-7664	—	—	21EP4A	PR-2374
53-T2264	123	81	H-1	76-7664	—	—	21EP4A	PR-2374
53-T2266-L	126	91	J-1	76-7600	—	—	21EP4A	PR-2200
53-T2272	123	81	H-1	76-7664	—	—	21EP4A	PR-2374
53-T2272-L	123	81	H-1	76-7664	—	—	21EP4A	PR-2374
53-T2285	126	94	J-4	76-7600	RT-8	M-24	21EP4A	PR-2395
53-T2285-L	126	94	J-4	76-7600	RT-8	M-24	21EP4A	PR-2395
53-T2286	126	94	J-4	76-7600	RT-8	M-24	21EP4A	PR-2395
53-T2287	126	94	J-4	76-7600	RT-11	M-24	21EP4A	PR-2395



CABINET PARTS LIST FOR 1953 PHILCO TELEVISION RECEIVERS

DESCRIPTION	53-T1824 Code 123	53-T1825 Code 123	53-T1826 Code 123	53-T1852 Code 123	53-T1852-L Code 123	53-T1852-L Code 124	53-T1854 Code 123
<b>Built-in Aerial Parts:</b>							
Coil .....			32-4560	32-4560	32-4560	32-4560	32-4560
Foil .....			56-9790	56-9790	56-9790	56-9790	56-9790
Foil .....			56-9790-1	56-9790-1	56-9790-1	56-9790-1	56-9790-1
Knob and Bracket ass'y .....			76-7710	76-7710	76-7710	76-7710	76-7710
Shaft .....			54-4974	54-4974	54-4974	54-4974	54-4974
Switch .....			42-1979	42-1979	42-1979	42-1979	42-1979
Cabinet, Light (L) .....					10929-7	10929-7	
Cabinet, Mahogany (M) .....			10936	10929-4			10929-8
Cabinet, Metal .....	10841-18	10841-17					
Cabinet, Birch (B) .....							
<b>Cabinet Doors (matched pair):</b>							
<b>Cabinet Hardware and Parts:</b>							
Bullet Catch .....							
Casters (4) .....							76-7143
Caster Socket (4) .....							56-9288
Caster Washer (4) .....							27-7467
Channel, Rubber .....							
Clip, Light .....				56-3545-6	56-3545-6	56-3545-6	56-3545-6
Dome .....			27-4911-1	45-6190	45-6190	45-6190	45-6190
Door Catch, Record Changer .....							
Door Pull (LH) .....							
Door Pull (RH) .....							
Door Pull, Record Changer .....							
Frame Ass'y., Picture Tube .....	318-3370	318-3370	318-3370	318-3370	318-3370	318-3370	318-3370
Frame, Record Changer .....							
Hinge, Butt .....							
Hinge, Knife (LH) .....							
Hinge, Knife (RH) .....							
Knob, Brightness .....	54-4768	54-4799	54-4799	54-4799-1	54-4799-3	54-4799-3	54-4799
Knob, Channel Selector .....	76-6863-30	76-6863-18	76-6863-14	76-6863-18	76-6863-15	76-6863-15	76-6863-14
Knob, Contrast .....	54-4797	54-4797	76-6048	54-4797	76-6048-1	76-6048-1	76-6048
Knob, Fine Tuning .....	54-4803	76-6104	76-6104-1	76-6104	76-6104	76-6104	76-6104
Knob, Function Switch .....							
Knob, Horizontal Hold .....	54-4797	54-4797	76-6048	54-4797	76-6048-1	76-6048-1	76-6048
Knob, Tone .....							
Knob, Tuning, Radio .....							
Knob, Vertical Hold .....	54-4768	54-4799	54-4799	54-4799-1	54-4799-3	54-4799-3	54-4799
Knob, Vol-Off-On (TV) .....	54-4804-3	76-6166	76-6581-1	76-6166	76-6581-2	76-6581-2	76-6581-1
Mask .....				54-8645-2	54-8645-1	54-8645-1	54-8645-1
Mounting Foot .....	W2570-1	W2570-1					
Strike Plate .....							
Strike Plate, Record Changer .....							
Window .....	54-8293-2	54-8293-2	54-7943-41	54-7943-57	54-7943-57	54-7943-57	54-7943-57
Cable and Plug ass'y., Speaker .....	41-4082-8	41-4082-8	41-4082-8	41-4082-11	41-4082-11	41-4082-7	41-4082-11
<b>Continuous Hinge, Record Changer:</b>							
Line Cord, A.C. ....	41-3865	41-3865	41-3865	41-3865	41-3865	41-3865	41-3865
Shield, Pilot Lamp .....	54-8228-2	54-8228-2	54-8228-2				
Speaker .....	36-1641-10	36-1641-10	36-1641-10	36-1646-8	36-1646-6	36-1646-5	36-1646-6

CABINET PARTS LIST FOR 1953 PHILCO TELEVISION RECEIVERS (Cont.)

DESCRIPTION	53-T1883 Code 123	53-T1884 Code 123	53-T1886 Code 123	53-T2125 Code 123	53-T2125 Code 124	53-T2125-L Code 123	53-T2125-L Code 124
<b>Built-in Aerial Parts:</b>							
Coil .....	32-4560	32-4560	32-4560	32-4560	32-4560	32-4560	32-4560
Foil .....	56-9790	56-9790	56-9790	56-9790	56-9790	56-9790	56-9790
Foil .....	56-9790-1	56-9790-1	56-9790-1	56-9790-1	56-9790-1	56-9790-1	56-9790-1
Knob and Bracket ass'y .....	76-7710	76-7710	76-7710	76-7710	76-7710	76-7710	76-7710
Shaft .....	54-4974	54-4974	54-4974	54-4974	54-4974	54-4974	54-4974
Switch .....	42-1979	42-1979	42-1979	42-1979	42-1979	42-1979	42-1979
Cabinet, Light (L) .....						10943-1	10943-1
Cabinet, Mahogany (M) .....	10933-2	10933-3	10915-2	10943	10943-3		
Cabinet, Metal .....							
Cabinet, Birch (B) .....							
Cabinet Doors (matched pair) .....			45-6721				
<b>Cabinet Hardware and Parts:</b>							
Bullet Catch .....			45-6002				
Casters (4) .....	76-7143	76-7143	76-7143				
Caster Socket (4) .....	56-9288	56-9288	56-10017				
Caster Washer (4) .....	27-7467	27-7467	27-7467				
Channel, Rubber .....							
Clip, Light .....	56-3545-6	56-3545-6					
Dome .....	45-6190	45-6190	45-6190	27-4911-1	27-4911-1	27-4911-1	27-4911-1
Door Catch, Record Changer .....	56-9719	56-9719	56-9719				
Door Pull (LH) .....			56-9915-1				
Door Pull (RH) .....			56-9915				
Door Pull, Record Changer .....			56-8496				
Frame Ass'y., Picture Tube .....	318-3370	318-3370	318-3370	76-6530	76-6530	76-6530	76-6530
Frame, Record Changer .....			76-6600				
Hinge, Butt .....							
Hinge, Knife (LH) .....			56-9922-1				
Hinge, Knife (RH) .....			56-9922				
Knob, Brightness .....	54-4799	54-4799	54-4799	54-4799	54-4799	54-4799-2	54-4799-3
Knob, Channel Selector .....	76-6863-18	76-6863-18	76-6863-14	76-6863-18	76-6863-18	76-6863-19	76-6863-15
Knob, Contrast .....	54-4797	54-4797	54-4799	54-4797	54-4797	54-4797-1	76-6048-1
Knob, Fine Tuning .....	76-6104	76-6104	76-6104	76-6104	76-6104	76-6104	76-6104
Knob, Function Switch .....	54-4799* 54-4797-6†	54-4799-12	54-4799-12				
Knob, Horizontal Hold .....	54-4797	54-4797	54-4799	54-4797	54-4797	54-4797-1	76-6048-1
Knob, Tone .....	76-5794-2	76-6213	76-6213				
Knob, Tuning, Radio .....		76-6048-3	76-6048-3				
Knob, Vertical Hold .....	54-4799	54-4799	54-4799	54-4799	54-4799	54-4799-2	54-4799-3
Knob, Vol-Off-On (TV) .....	54-4817-1	54-4799	54-4799	76-6166	76-6166	76-6166-1	76-6581-2
Mask .....	54-8645-5	54-8645-5	54-8645-4				
Mounting Foot .....							
Strike Plate .....			45-6003				
Strike Plate, Record Changer .....			56-9720				
Window .....	54-7943-60	54-7943-60	54-7943-59	54-7943-61	54-7943-61	54-7943-61	54-7943-61
Cable and Plug ass'y., Speaker .....	41-4082-7	41-4082-7		41-4082-8	41-4082-8	41-4082-8	41-4082-8
Continuous Hinge, Record Changer .....	56-3627-12	56-3627-12	56-3627-12				
Line Cord, A.C. ....	41-3865	41-3865	41-3865	41-3865	41-3865	41-3865	41-3865
Shield, Pilot Lamp .....				54-8228-2	54-8228-2	54-8228-2	54-8228-2
Speaker .....	36-1651	36-1651		36-1641-10	36-1641-10	36-1641-10	36-1641-10

\*Inner. †Outer.

CABINET PARTS LIST FOR 1953 PHILCO TELEVISION RECEIVERS (Cont.)

DESCRIPTION	53-T2152 Code 123	53-T2152-L Code 123	53-T2152-L Code 124	53-T2183 Code 123	53-T2227 Code 123	53-T2228 Code 126	53-T2228-R Code 126
<b>Built-in Aerial Parts:</b>							
Coil .....	32-4560	32-4560	32-4560	32-4560	32-4560	32-4560	32-4560
Foil .....	56-9790	56-9790	56-9790	56-9790	56-9790	56-9790	56-9790
Foil .....	56-9790-1	56-9790-1	56-9790-1	56-9790-1	56-9790-1	56-9790-1	56-9790-1
Knob and Bracket ass'y .....	76-7710	76-7710	76-7710	76-7710	76-7710	76-7710	76-7710
Shaft .....	54-4974	54-4974	54-4974	54-4974	54-4974	54-4974	54-4974
Switch .....	42-1979	42-1979	42-1979	42-1979	42-1979	42-1979	42-1979
Cabinet, Light (L) .....		10930-1	10930-1				
Cabinet, Mahogany (M) .....	10930			10934	10955	10956	10956
Cabinet, Metal .....							
Cabinet, Birch (B) .....							
Cabinet Doors (matched pair) .....							
<b>Cabinet Hardware and Parts:</b>							
Bullet Catch .....							
Casters (4) .....				76-7143			
Caster Socket (4) .....				56-9288			
Caster Washer (4) .....				27-7467			
Channel, Rubber .....							
Clip, Light .....	56-3545-6	56-3545-6	56-3545-6	56-3545-6	56-3545-6	56-3545-6	56-3545-6
Dome .....	45-6190	45-6190	45-6190	45-6190	27-4911-1	27-4911-1	27-4911-1
Door Catch, Record Changer .....				56-9719			
Door Pull (LH) .....							
Door Pull (RH) .....							
Door Pull, Record Changer .....							
Frame Ass'y., Picture Tube .....	76-6530	76-6530	76-6530	76-6530	318-3345	318-3345	318-3345
Frame, Record Changer .....				76-6600			
Hinge, Butt .....							
Hinge, Knife (LH) .....							
Hinge, Knife (RH) .....							
Knob, Brightness .....	54-4799	54-4799-3	54-4799-3	54-4799	54-4799	54-4799	54-4799
Knob, Channel Selector .....	76-6863-14	76-6863-15	76-6863-15	76-6863-14	76-6863-18	76-6863-12	76-6863-26
Knob, Contrast .....	54-4797	76-6048-1	76-6048-1	54-4797	54-4797	76-6048	76-6048
Knob, Fine Tuning .....	76-6104	76-6104	76-6104	76-6104	76-6104	76-6104	76-6104
Knob, Function Switch .....				54-4799-12			
Knob, Horizontal Hold .....	54-4797	76-6048-1	76-6048-1	54-4797	54-4797	76-6048	76-6048
Knob, Tone .....				76-6213		76-6213	76-6213
Knob, Tuning, Radio .....				76-6048-3			
Knob, Vertical Hold .....	54-4799	54-4799-3	54-4799-3	54-4799	54-4799	54-4799	54-4799
Knob, Vol-Off-On (TV) .....	76-6166	76-6581-2	76-6581-2	54-4799	76-6166	54-4799	54-4799
Mask .....		54-8567-7	54-8567-7	54-8567-7	54-8573-12	54-8573-1	54-8573-1
Mounting Foot .....							
Strike Plate .....							
Strike Plate, Record Changer .....				56-9720			
Window .....	54-7943-38	54-7943-38	54-7943-38	54-7943-38	54-7943-49	54-7943-49	54-7943-49
Cable and Plug ass'y., Speaker .....	41-4082-11	41-4082-11	41-4082-7	41-4082-7	41-4082-7	41-4082-7	41-4082-7
Continuous Hinge, Record Changer .....				56-3627-12			
Line Cord, A.C. .....	41-3865	41-3865	41-3865	41-3865	41-3865	41-3865	41-3865
Shield, Pilot Lamp .....						54-8228-1	54-8228-1
Speaker .....	36-1646-6	36-1646-6	36-1646-5	36-1646-6	36-1641-10	36-1641-10	36-1641-10

CABINET PARTS LIST FOR 1953 PHILCO TELEVISION RECEIVERS (Cont.)

DESCRIPTION	53-T2260 Code 123	53-T2264 Code 123	53-T2266-L Code 126	53-T2266-R Code 126	53-T2269-R Code 126	53-T2270-R Code 126	53-T2271-R Code 126
<b>Built-in Aerial Parts:</b>							
Coil.....	32-4560	32-4560	32-4560	32-4560	32-4560	32-4560	32-4560
Foil.....	56-9790	56-9790	56-9790	56-9790	56-9790	56-9790	56-9790
Foil.....	56-9790-1	56-9790-1	56-9790-1	56-9790-1	56-9790-1	56-9790-1	56-9790-1
Knob and Bracket ass'y.....	76-7710	76-7710	76-7710	76-7710	76-7710	76-7710	76-7710
Shaft.....	54-4974	54-4974	54-4974	54-4974	54-4974	54-4974	54-4974
Switch.....	42-1979	42-1979	42-1979	42-1979	42-1979	42-1979	42-1979
Cabinet, Light (L).....			10923-2				
Cabinet, Mahogany (M).....	10916	10922		10923	10951	10947	
Cabinet, Metal.....							
Cabinet, Birch (B).....							10935
Cabinet Doors (matched pair).....		45-6720			45-6723	45-6724	45-6725
<b>Cabinet Hardware and Parts:</b>							
Bullet Catch.....		45-6002			45-6002	45-6002	45-6002
Casters (4).....	76-7143	76-7143	76-7143	76-7143	76-7143	76-7143	76-7143
Caster Socket (4).....	56-9288	56-9288	56-9288	56-9288	56-9288	56-9288	56-9288
Caster Washer (4).....	27-7467	27-7467	27-7467	27-7467	27-7467	27-7467	27-7467
Channel, Rubber.....							
Clip, Light.....	56-3545-6	56-3545-6	56-3545-6	56-3545-6	56-3545-6	56-3545-6	56-3545-6
Dome.....	45-6190	45-6190	45-6190	45-6190	45-6190	45-6190	45-6190
Door Catch, Record Changer.....							
Door Pull (LH).....		56-9730			56-9916	56-9159	56-9827 †
Door Pull (RH).....		56-9730			56-9916	56-9159-1	56-9828 ‡ 56-9829 ‡
Door Pull, Record Changer.....							
Frame Ass'y., Picture Tube.....	318-3345	318-3345	318-3345	318-3345	318-3345	318-3345	318-3345
Frame, Record Changer.....							
Hinge, Butt.....							
Hinge, Knife (LH).....		56-9922-1			56-9922-1	56-9922-1	56-9922-3
Hinge, Knife (RH).....		56-9922			56-9922	56-9922	56-9922-2
Knob, Brightness.....	54-4799	54-4799	54-4799-3	54-4799	54-4799	54-4799	54-4799
Knob, Channel Selector.....	76-6863-14	76-6863-14	76-6863-13	76-6863-26	76-6863-26	76-6863-26	76-6863-26
Knob, Contrast.....	76-6048	76-6048	76-6048-1	76-6048	76-6048	76-6048	76-6048
Knob, Fine Tuning.....	76-6104	76-6104	76-6104	76-6104	76-6104	76-6104	76-6104
Knob, Function Switch.....							
Knob, Horizontal Hold.....	76-6048	76-6048	76-6048-1	76-6048	76-6048	76-6048	76-6048
Knob, Tone.....			76-6213-3	76-6213	76-6213	76-6213	76-6213
Knob, Tuning, Radio.....							
Knob, Vertical Hold.....	54-4799	54-4799	54-4799-3	54-4799	54-4799	54-4799	54-4799
Knob, Vol-Off-On (TV).....	76-6581-1	76-6581-1	54-4799-3	54-4799	54-4799	54-4799	54-4799
Mask.....	54-8573-6	54-8573-11	54-8573-11	54-8573-11	54-8573-1	54-8573-1	54-8573-1
Mounting Foot.....							
Strike Plate.....		45-6003			45-6003	45-6003	45-6003-1
Strike Plate, Record Changer.....							
Window.....	54-7943-56	54-7943-56	54-7943-56	54-7943-56	54-7943-49	54-7943-49	54-7943-49
Cable and Plug ass'y., Speaker.....	41-4082-11	41-4082-11	41-4082-11	41-4082-11	41-4082-11	41-4082-11	41-4082-11
Continuous Hinge, Record Changer.....							
Line Cord, A.C.....	41-3865	41-3865	41-3865	41-3865	41-3865	41-3865	41-3865
Shield, Pilot Lamp.....	54-8228-1	54-8228-1	54-8228-1	54-8228-1	54-8228-1	54-8228-1	54-8228-1
Speaker.....	36-1646-6	36-1646-6	36-1646-6	36-1646-6	31-1646-6	31-1646-6	31-1646-6

†Main door. ‡Center rail.



CABINET PARTS LIST FOR 1953 PHILCO TELEVISION RECEIVERS (Cont.)

DESCRIPTION	53-T2272 Code 123	53-T2272-L Code 123	53-T2285 Code 126	53-T2285-L Code 126	53-T2286 Code 126	53-T2286-R Code 126	53-T2287 Code 126	53-T2287-R Code 126
<b>Built-in Aerial Parts:</b>								
Coil.....	32-4560	32-4560	32-4560	32-4560	32-4560	32-4560	32-4560	32-4560
Foil.....	56-9790	56-9790	56-9790	56-9790	56-9790	56-9790	56-9790	56-9790
Foil.....	56-9790-1	56-9790-1	56-9790-1	56-9790-1	56-9790-1	56-9790-1	56-9790-1	56-9790-1
Knob and Bracket ass'y.....	76-7710	76-7710	76-7710	76-7710	76-7710	76-7710	76-7710	76-7710
Shaft.....	54-4974	54-4974	54-4974	54-4974	54-4974	54-4974	54-4974	54-4974
Switch.....	42-1979	42-1979	42-1979	42-1979	42-1979	42-1979	42-1979	42-1979
Cabinet, Light (L).....		10948-1		10931-1				
Cabinet, Mahogany (M).....	10948		10931		10958	10958	10957	10957
Cabinet, Metal.....								
Cabinet, Birch (B).....								
Cabinet Doors (matched pair).....			45-6730	45-6731	45-6733	45-6733	45-6732	45-6732
<b>Cabinet Hardware and Parts:</b>								
Bullet Catch.....	45-6002	45-6002-1	45-6002	45-6002-1			45-6002	45-6002
Casters (4).....	76-7143	76-7143	76-7143	76-7143	76-7143	76-7143	76-7143	76-7143
Caster Socket (4).....	56-9288	56-9288	56-9288	56-9288	56-9288	56-9288	56-9288	56-9288
Caster Washer (4).....	27-7467	27-7467	27-7467	27-7467	27-7467	27-7467	27-7467	27-7467
Channel, Rubber.....								
Clip, Light.....	54-3545-6	56-3545-6	56-3545-6	56-3545-6	56-3545-6	56-3545-6	56-3545-6	56-3545-6
Dome.....	45-6190	45-6190	45-6190	45-6190			45-6190	45-6190
Door Catch, Record Changer.....			56-9719	56-9719-1				
Door Pull (LH).....	56-9896			56-9916			56-7062	56-7062
Door Pull (RH).....	56-9896			56-9916			56-7062	56-7062
Door Pull, Record Changer.....							56-9965	56-9965
Frame Ass'y., Picture Tube.....	318-3345	318-3345	318-3345	318-3345	318-3345	318-3345	318-3345	318-3345
Frame, Record Changer.....			76-6600	76-6600				
Hinge, Butt.....							56-6491	56-6491
Hinge, Knife (LH).....	56-9909	56-9909-1	56-9922-1	56-9922-3			56-9922-1	56-9922-1
Hinge, Knife (RH).....	56-9909	56-9909-1	56-9922	56-9922-2			56-9922	56-9922
Knob, Brightness.....	54-4799	54-4799-3	54-4799	54-4799-3	54-4799	54-4799	54-4799	54-4799
Knob, Channel Selector.....	76-6863-14	76-6863-15	76-6863-12	76-6863-13	76-6863-12	76-6863-26	76-6863-12	76-6863-26
Knob, Contrast.....	76-6048	76-6048-1	76-6048	76-6048-1	76-6048	76-6048	76-6048	76-6048
Knob, Fine Tuning.....	76-6104	76-6104	76-6104	76-6104	76-6104	76-6104	76-6104	76-6104
Knob, Function Switch.....			54-6022	54-6022-1	54-6022	54-6022	54-4798-20	54-4798-20
Knob, Horizontal Hold.....	76-6048	76-6048-1	76-6048	76-6048-1	76-6048	76-6048	76-6048	76-6048
Knob, Tone.....			76-6213	76-6213-3	76-6213	76-6213	76-6213	76-6213
Knob, Tuning, Radio.....			54-4798-9	54-4798-10	54-4798-9	54-4798-9	54-4798-19	54-4798-19
Knob, Vertical Hold.....	54-4799	54-4799-3	54-4799	54-4799-3	54-4799	54-4799	54-4799	54-4799
Knob, Vol-Off-On (TV).....	76-6581-1	76-6581-2	54-4799	54-4799-3	54-4799	54-4799	54-4799	54-4799
Mask.....	54-8573-1	54-8573-1	54-8573-11	54-8573-11	54-8573-1	54-8573-1	54-8573-11	54-8573-11
Mounting Foot.....								
Strike Plate.....	45-6003	45-6003-1	45-6003	45-6003-1			45-6003	45-6003
Strike Plate, Record Changer.....			56-9720	56-9720-1				
Window.....	54-7943-49	54-7943-49	54-7943-56	54-7943-56	54-7943-49	54-7943-49	54-7943-56	54-7943-56
Cable and Plug ass'y., Speaker.....	41-4082-11	41-4082-11	41-4082-7	41-4082-7	41-4082-7	41-4082-7	41-4082-7	41-4082-7
Continuous Hinge, Record Changer.....			56-3627-12	56-3627-13				
Line Cord, A.C.....	41-3865	41-3865	41-3865	41-3865	41-3865	41-3865	41-3865	41-3865
Shield, Pilot Lamp.....	54-8228-1	54-8228-1		54-8228-1	54-8228-1	54-8228-1		
Speaker.....	36-1646-6	36-1646-6	36-1646-9	36-1646-9	36-1646-9	36-1646-9	36-1650	36-1650

## PRODUCTION CHANGES IN 1952 AND 1953 PHILCO TELEVISION MODELS

Since the printing of Service Bulletin 52-T1 (PR-2153), the production changes given in the following charts were made on the chassis types listed. For run changes preceding those given in the charts, and for model numbers of the television receivers in which these chassis were used, refer to the charts in Service Bulletin 52-T1 and in this Bulletin.

### PRODUCTION CHANGES IN 41 R-F CHASSIS

REASON FOR CHANGE	DESCRIPTION OF CHANGE	NEW OR ADDED PART NO.	OLD OR REMOVED PART NO.	RUN NO.
To provide for vertical retrace suppression.	A lead was added in the chassis interconnecting cable (pin 10 of PL100 to the picture-tube cathode).	41-4086-19	41-4086-1	9
To facilitate production.	C406, ratio detector buzz by-pass condenser, was changed from 390 $\mu$ f., mica, to 330 $\mu$ f., ceramic type.	62-133001001	60-10395417	10
To improve picture-tube cutoff.	R314, picture-tube cathode resistor, was changed from 82K, $\frac{1}{2}$ w., to 68K, 1 w. R313, picture-tube cathode resistor, was changed from 120K, $\frac{1}{2}$ w., to 100K, $\frac{1}{2}$ w.	66-3684340 66-4108340	66-3828340 66-4128340	11
To improve strong-signal low percentage sync performance.	Noise-gate divider resistor, R606, was changed from 240K to 180K. Noise-gate divider resistor, R607, was changed from 220K to 39K.	66-4188240 66-3398240	66-4248240 66-4228240	12

### PRODUCTION CHANGES IN 42 R-F CHASSIS

REASON FOR CHANGE	DESCRIPTION OF CHANGE	NEW OR ADDED PART NO.	OLD OR REMOVED PART NO.	RUN NO.
To improve strong-signal low percentage sync performance.	Noise-gate divider resistor, R606, was changed from 240K to 180K. Noise-gate divider resistor, R607, was changed from 220K to 39K.	66-4188240 66-3398240	66-4248240 66-4228240	2

### PRODUCTION CHANGES IN 44 R-F CHASSIS

REASON FOR CHANGE	DESCRIPTION OF CHANGE	NEW OR ADDED PART NO.	OLD OR REMOVED PART NO.	RUN NO.
To provide for vertical retrace suppression.	A lead was added in the chassis interconnecting cable (pin 10 of PL100 to the picture-tube cathode).	—	—	5
To facilitate production.	C406, ratio detector buzz by-pass condenser, was changed from 390 $\mu$ f., mica, to 330 $\mu$ f., ceramic type.	62-133001001	60-10395417	
To improve picture-tube cutoff.	R314, picture-tube cathode resistor, was changed from 82K, $\frac{1}{2}$ w., to 68K, 1 w. R313, picture-tube cathode resistor, was changed from 120K, $\frac{1}{2}$ w., to 100K, $\frac{1}{2}$ w.	66-3684340 66-4108340	66-3828340 66-4128340	
To improve strong-signal low percentage sync performance.	Noise-gate divider resistor, R606, was changed from 240K to 180K. Noise-gate divider resistor, R607, was changed from 220K to 39K.	66-4188340 66-3398340	66-4248340 66-4228340	6

PRODUCTION CHANGES IN 71 R-F CHASSIS

REASON FOR CHANGE	DESCRIPTION OF CHANGE	NEW OR ADDED PART NO.	OLD OR REMOVED PART NO.	RUN NO.
To eliminate possible shock hazard due to breakdown in tapered line ass'y.	Two 470- $\mu$ f. blocking condensers, C522 and C523, were added, in series with 300-ohm antenna leads (in tapered line ass'y.). Two 1-megohm resistors, R512 and R500, were added, one from each side of antenna input to ground.	62-147001001 66-5108340	— —	6
To facilitate production.	Electrolytic filter condenser, C418, was changed.	30-2570-57	30-2570-70	7
To provide increased capacitance required to peak 47.25-mc. trop.	Value of trimmer condenser, C203, was changed from .5 to 3 $\mu$ f. to 1 to 5 $\mu$ f.	31-6250-9	31-6250-5	8
To improve sync performance under heavy duty cycle noise.	a. 6AT6 noise-gate tube, V12, was replaced with type 6BF6 tube. b. Plate supply of 6BF6 tube was reduced from 240v to 200v (pin 7 of V12 reconnected to junction of C309, R306, and R311). c. Bias on 6BF6 tube, V12, was changed by disconnecting 3.3-megohm resistor, R600, from junction of R609, R605, and R606, and reconnecting it to junction of R604, R605, C602, and C603.	6BF6 tube — —	6AT6 tube — —	
To provide for vertical retrace suppression.	A lead was added in the chassis interconnecting cable (pin 10 of PL100 to the picture-tube cathode).			9
To facilitate production.	C409, ratio detector buzz by-pass condenser, was changed from 390 $\mu$ f., mica, to 330 $\mu$ f., ceramic type.	62-133001001	60-10395417	
To improve video amplifier operation.	Video output bias resistor, R309, was changed from 1.2 megohms to 680K.	66-4688340	66-5128340	10
To improve picture-tube cutoff.	Picture-tube cathode resistor, R313, was changed from 82K, 1 w., to 68K, 1 w. Picture-tube cathode resistor, R314, was changed from 120K, 1/2 w., to 100K, 1/2 w.	66-3684340 66-4108340	66-3824340 66-4128340	11
To improve frequency response.	Video detector peaking coil, L210, was changed from 180 $\mu$ h. to 220 $\mu$ h.	32-4480-15	32-4480-9	12
To reduce sound buzz and beat in picture.	a. Sound i-f screen resistor, R401, was changed from 12K, 1 w., to 33K, 1 w. Screen supply was reduced by disconnecting R401 from junction of C418C and R403, and reconnecting it to junction of R411, R417, and C418A. b. Sound i-f screen by-pass condenser, C404, was removed. c. Sound i-f plate resistor, R402, was removed.	66-3334340 — —	66-3124340 62-215001001 66-1108556	13
To improve fringe-area performance.	A 120K, 1/2 w. resistor was added, from pins 5 and 6 (plates) of noise-gate tube, V12, to lug 4 of video test socket, J200.	66-4128340	—	14
To facilitate production.	Second video i-f trimmer, C208, was changed from lug type to lead type.	31-6520-10	31-6520-9	

PRODUCTION CHANGES IN D-1 AND D-1A DEFLECTION CHASSIS

REASON FOR CHANGE	DESCRIPTION OF CHANGE	NEW OR ADDED PART NO.	OLD OR REMOVED PART NO.	RUN NO.
To improve horizontal sync performance.	Horizontal oscillator grid blocking condenser, C808, was reconnected between the green lead from T800 and pin 4 of the horizontal oscillator tube. The white lead from T800 is now grounded.	—	—	9
To provide for vertical retrace suppression.	High-voltage oss'y. was changed.	76-6850 Run 4	76-6850 Run 3	10
	A .022- $\mu$ f. condenser was added, from pin 11 of J800 to pin 10 of J100.	30-4650-43	—	

**PRODUCTION CHANGES IN D-1 AND D-1A DEFLECTION CHASSIS (Cont.)**

REASON FOR CHANGE	DESCRIPTION OF CHANGE	NEW OR ADDED PART NO.	OLD OR REMOVED PART NO.	RUN NO.
To facilitate production.	Value of current-limiting resistor, R102, was changed from 7.5 ohms, 15 w., to 5 ohms, 16 w.	33-3448-5	33-3448	11
To improve horizontal-oscillator performance and recent horizontal-oscillator frequency control.	Value of horizontal phase comparator voltage-divider resistor, R809, was changed from 390K to 330K. Value of horizontal-oscillator grid blocking condenser, C808, was changed from 270 $\mu$ f. to 390 $\mu$ f.	66-4338240 60-10395417	66-4395244 60-10275337	12
To eliminate hum pickup from the a-c leads.	The horizontal lockin trimmer, C804, was relocated, from the rear to the side of the chassis.	—	—	13

**PRODUCTION CHANGES IN G-1 DEFLECTION CHASSIS**

REASON FOR CHANGE	DESCRIPTION OF CHANGE	NEW OR ADDED PART NO.	OLD OR REMOVED PART NO.	RUN NO.
To remove horizontal foldover.	A 27K, 1/2 w. resistor was inserted in series with R804 to the junction of C800 and C803. An 82- $\mu$ f. condenser was added, from the junction of the above part and R804 to ground.	66-3278340 60-00825317	— —	4
To recenter horizontal-oscillator frequency control.	Value of horizontal phase comparator voltage-divider resistor, R809, was changed from 390K to 330K.	66-4338240	66-4395244	5
To improve interlace.	C701 and C702 were interchanged. Value of C700 was changed from .033 $\mu$ f. to .022 $\mu$ f. Value of R703 was changed from 8200 ohms, 1/2 w., to 3300 ohms, 1/2 w. Value of R700 was changed from 220K, 1/2 w., to 180K, 1/2 w. NOTE: These changes were incorporated in Run 6 chassis only.	— 30-4650-43 66-2338340 66-4188340	— 30-4666-27 66-2828340 66-4228340	6
To improve vertical linearity.	A 680-1/2 w. resistor was added from the junction of R704 and C703, to the center lug of the vertical linearity control (R707).	66-4688340	—	7
To improve horizontal sync performance.	Horizontal-oscillator grid blocking condenser, C808, was reconnected between the green lead from T800 and pin 4 of the horizontal-oscillator tube. The white lead from T800 is now grounded.	—	—	8
To provide for vertical retrace suppression.	A .022- $\mu$ f. condenser was added, from pin 11 of J800 to pin 10 of J100. Chassis marking G-1A identifies the use of a 500K volume control in place of the 2-megohm tapped control. Also, G-1A does not use bass compensation (R408 and C413).	30-4650-43	—	9
To remove vertical white lines from picture.	220K resistor, R814, was removed. Value of R803 was changed from 2.2 megohms to 680K.	— 66-4688340	66-4228346 66-5228340	9P and 10

**PRODUCTION CHANGES IN G-2 DEFLECTION CHASSIS**

REASON FOR CHANGE	DESCRIPTION OF CHANGE	NEW OR ADDED PART NO.	OLD OR REMOVED PART NO.	RUN NO.
To remove vertical white lines from picture.	220K resistor, R814, was removed. Value of R803 was changed from 2.2 megohms to 680K.	66-4688346 66-4688340	66-4228346 66-5228340	2



### PRODUCTION CHANGES IN G-4 DEFLECTION CHASSIS

REASON FOR CHANGE	DESCRIPTION OF CHANGE	NEW OR ADDED PART NO.	OLD OR REMOVED PART NO.	RUN NO.
To improve operation of width control.	Value of width control, R817, was changed from 20K, 4 w., to 10K, 4 w.	33-5546-49	33-5546-43	2

### PRODUCTION CHANGES IN J-1 DEFLECTION CHASSIS

REASON FOR CHANGE	DESCRIPTION OF CHANGE	NEW OR ADDED PART NO.	OLD OR REMOVED PART NO.	RUN NO.
To eliminate shadow on 21-inch tubes.	A .5- $\mu$ f. condenser was added, in series with horizontal yoke winding (between terminal 1 of T800 and pin 8 of J800).	61-0137	—	2 and 2Z
To improve insulation of 1B3GT tube socket.	The black phenolic 1B3 socket was replaced with a melamine (light-colored) socket.	—	—	2Z
To reduce possibility of part failure.	The two 3900-ohm, 2 w. resistors, R819 and R820, were replaced with a single 8200-ohm, 7 w. unit.	33-1335-119	66-2395346	3 and 3Y
To reduce possibility of part failure.	The 3900-ohm, 2 w. resistor, R816, was replaced with either a wire-wound 4200-ohm, 5 w. unit, or two 7200-ohm, 2 w. resistors in parallel.	33-1335-101	66-2395346	4
To remove picture distortion.	A 470-ohm resistor was added, across the .5- $\mu$ f. horizontal yoke blocking condenser.	66-1478340	—	5

## REVISIONS TO PHILCO TELEVISION RECEIVER SERVICE MANUALS

### CORRECTIONS TO SERVICE MANUAL PR-1908

On page 13 of Service Manual PR-1908, Replacement Parts List, the part number for R101 is listed as 33-3435-3. The correct number for this part is 33-3445-3.

### CORRECTIONS AND ADDITIONS TO SERVICE MANUAL PR-2200

On page 21 of Service Manual PR-2200, under Miscellaneous A, the part number of Cable Assembly, high voltage, 41-4664-6\* should be 41-4064-6\*.

On page 2, 13 lines up from bottom of left-hand column, R213 and R212 should be R219 and R218, respectively.

In the Replacement Parts List, Section 2—Video I.F., the following item should be listed:  
CD200 Crystal, video detector—type 1N64, Service Part No. 34-8022.

At the time of printing of Service Manual PR-2200, L801 was supplied as part of T800, Horizontal output transformer. L801 is now available separately under Service Part No. 32-4112-43.



# PHILCO



# SERVICE

## TELEVISION

### PHILCO TELEVISION SERVICE MANUAL FOR DEFLECTION CHASSIS J-2 AND J-5 USED IN ALL 1953 CODE 128 TELEVISION RECEIVER MODELS (SUPPLEMENT TO PR-2200 AND PR-2395)

#### GENERAL INFORMATION

The Philco 1953 Code 128 television receivers use two sets of chassis: the r-f chassis 91 and deflection chassis J-2 in the models having 3 watts audio output, and the r-f chassis 94 and deflection chassis J-5 in the models having 5 watts audio output.

The r-f chassis contain the r-f, video, audio, and sync circuits, and the deflection chassis contain the power and deflection circuits.

All information concerning the circuit description, adjustment, alignment, parts lists, etc., for the 91 chassis may be found in service manual PR-2200, and for the 94 chassis in service manual PR-2395.

The J-2 and J-5 deflection chassis are similar to the J-1 and J-4 chassis, respectively, except for some small circuit changes. The circuit description and the adjustment and alignment procedures remain the same as that for the J-1 and J-4 chassis and may be found in PR-2200 for the J-2 chassis, and in PR-2395 for the J-5 chassis.

This supplement includes the parts lists and schematic diagrams for the J-2 and the J-5 deflection chassis.

#### REPLACEMENT PARTS LIST IMPORTANT

General replacement items commonly stocked by the serviceman are omitted from this parts list. All condensers are molded-bakelite Philco condensers, with a 600-volt rating, and all resistors are 1/2 watt, unless otherwise indicated. Parts are listed according to chassis type and should be ordered in this way rather than by model number. A miscellaneous listing is given at the end of the parts list for each chassis type. All parts are symbolized in the schematic diagram and base layout, for identification purposes.

NOTE: Part numbers identified by an asterisk (\*) are general replacement items. These numbers may not be identical with those on factory parts. Also, the electrical values of some replacement items may differ from the values indicated in the schematic diagram and parts list. The values substituted in any case are so chosen that the operation will either be unchanged or improved. When ordering replacements, use only the "Service Part No."

#### DEFLECTION CHASSIS J-2

##### SECTION 1—POWER SUPPLY

Reference Symbol	Description	Service Part No.
C100 and C101	Condenser, filter, electrolytic, 120 $\mu$ f., 150v	30-2568-51
C102	Condenser, filter, electrolytic, 10 $\mu$ f., 25v	30-2584-27
C103	Condenser, filter, electrolytic, 100 $\mu$ f., 300v	Part of C102
CR100 and CR101	Rectifier, selenium, 350 ma.	34-8003-7
F100	Fuse, line, 1.6 amperes	45-2656-23
J100	Socket, a-c line	27-6240-3
J101	Socket, chassis connecting	27-6274-1
L100	Choke, 1 henry	Speaker field
PL100	Plug, a-c line	Part of a-c line cord ass'y. (See Misc.)
PL101	Plug and cable ass'y., chassis connecting	(See Misc.)
R100	Resistor, current-limiting, 5 ohms, 10 watts	33-3448-5
R101	Resistor, filter, 47,000 ohms, 1 watt	66-3474340
R102	Resistor, voltage dropping (J-2 chassis)	.20 inches No. 24 wire
R103	Resistor, voltage dropping, 4.7 ohms, 1 watt	66-9473340
S100	Switch, off-on	Part of VOLUME control
T100	Transformer, filament (J-2 chassis)	32-8573-1
		32-8574-1 (Optional)

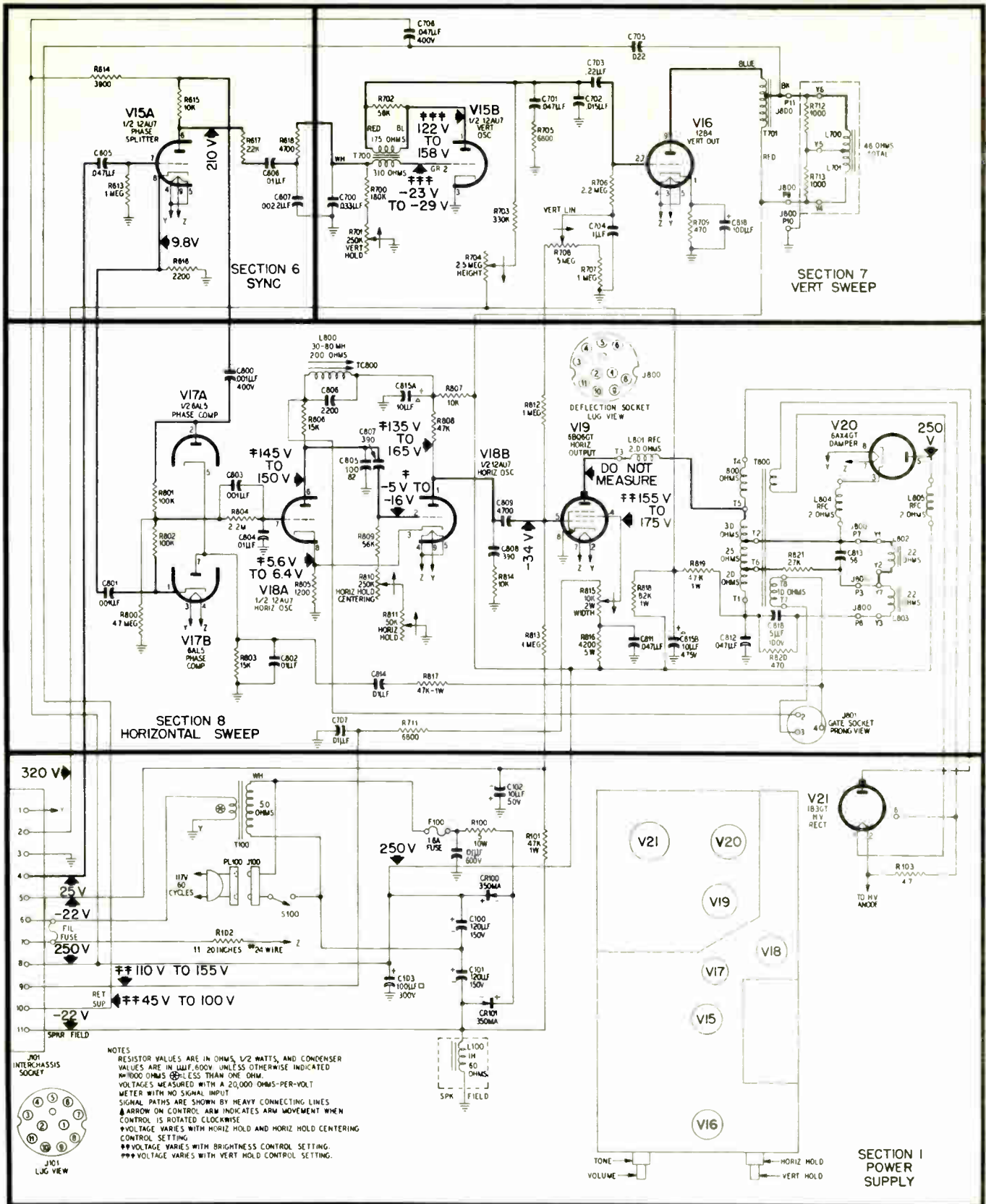
##### SECTION 7—VERTICAL SWEEP

Reference Symbol	Description	Service Part No.
L700 and L701	Coils, vertical deflection	Part of deflection yoke (See Misc.)
R701	Potentiometer, VERT HOLD control, 250,000 ohms	Part of R811
R704	Potentiometer, HEIGHT control, 2.5 megohms	33-5565-32
R708	Potentiometer, VERT LIN control, 5 megohms	33-5565-31
T700	Transformer, vertical oscillator	32-8431-2*
T701	Transformer, vertical output	32-8539

##### SECTION 8—HORIZONTAL SWEEP

Reference Symbol	Description	Service Part No.
C803	Condenser, by-pass, .005 $\mu$ f.	30-1238-1
C804	Condenser, grid blocking, .01 $\mu$ f.	30-1238-2
C805	Condenser, by-pass, 100 $\mu$ f., $\pm$ 5%	60-10105417*

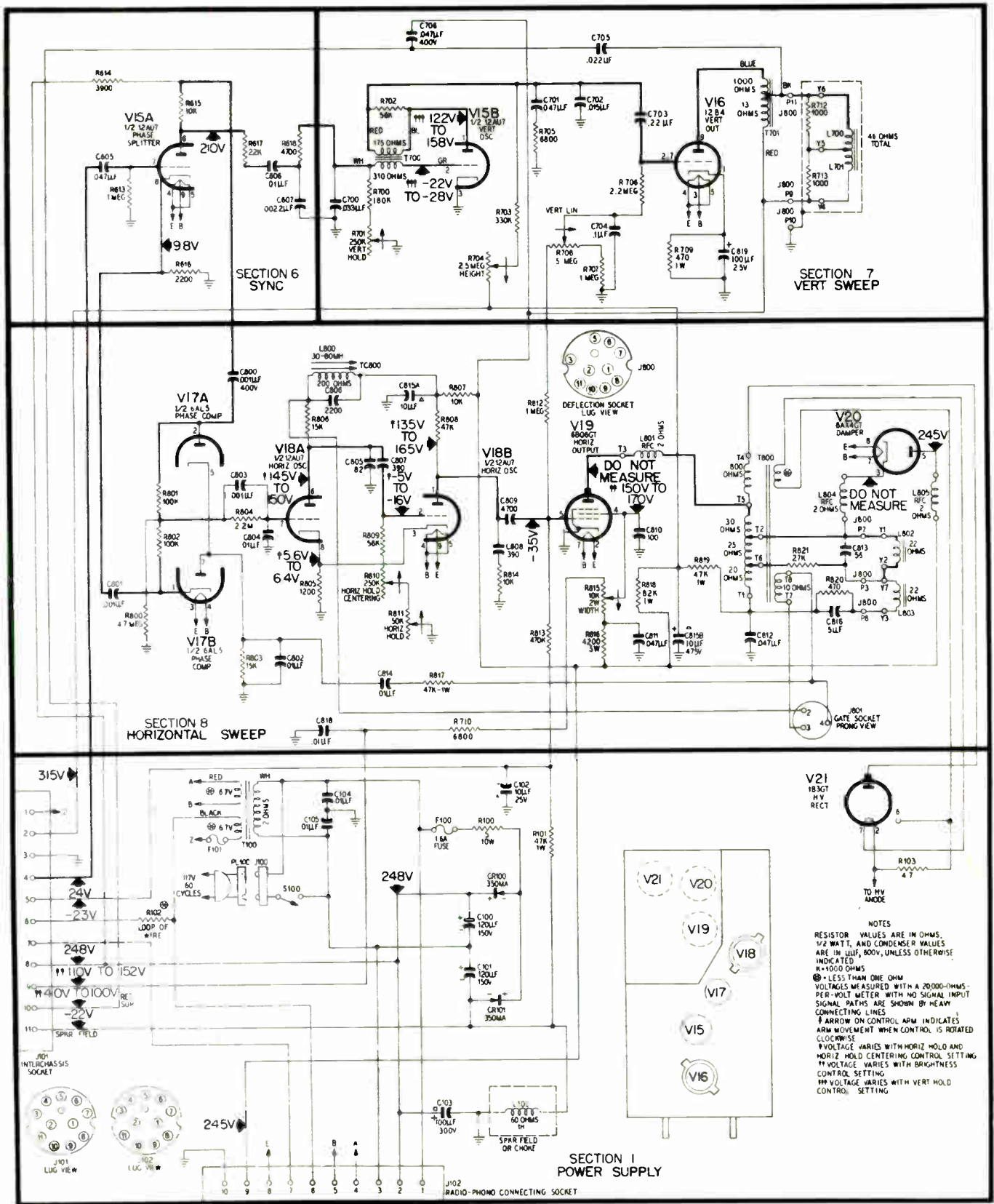
(Continued on page 4)



J-2 Deflection Chassis, Schematic Diagram

TP2-3218





J-5 Deflection Chassis, Schematic Diagram

TP2-3219

REPLACEMENT PARTS LIST (Continued)

SECTION 8—HORIZONTAL SWEEP (Continued)

Reference Symbol	Description	Service Part No.
C807	Condenser, d-c blocking, 390 $\mu$ f.	60-10395417
C808	Condenser, charging, 390 $\mu$ f.	60-10395417
C810	Condenser, screen by-pass, 100 $\mu$ f.	60-10105417*
C813	Condenser, anti-ringing, 56 $\mu$ f.	30-1243-5
C815	Condenser, electrolytic	Part of C102
C815A	Condenser, by-pass, 100 $\mu$ f., 300v	Part of C102
C815B	Condenser, by-pass, 10 $\mu$ f., 475v	Part of C102
J800	Socket, deflection	27-6274-7
J801	Socket, gate pulse	27-6273
L800	Coil, stabilizing, 30—80 mh.	32-4557
L801	Coil, r-f choke, horizontal-output plate	Part of T800
L802 and L803	Coils, horizontal deflection	
L803	Part of deflection yoke (See Misc. )	
L804	Coil, r-f choke, damper cathode	32-4112-24
L805	Coil, r-f choke, damper plate	32-4112-24
PL800	Plug, deflection	Part of cable ass'y. (See Misc. )
PL801	Plug, gate pulse	Part of cable ass'y. (See Misc. )
R810	Potentiometer, HORIZ. HOLD CENTERING	33-5565-17
R811	Potentiometer, HORIZ. HOLD control, 200,000 ohms	33-5563-50
R815	Potentiometer, WIDTH control, 10,000 ohms, 2 watts	33-5546-41
T800	Transformer, horizontal output	32-8565

MISCELLANEOUS

Description	Service Part No.
Arm and magnet ass'y., picture tube	76-6594
Beam bender	76-6077-2
Cable assembly, high voltage	41-4664-6*
Cable and plug assembly, deflection	41-4086-25
Cable and plug assembly, VOLUME control (J-2 chassis)	41-4136-4
Cord, line	41-3865
Focus assembly	76-6126-4
Insulator, electrolytic, condenser mounting	27-9508-1
Shield, corona	56-9684
Socket, damper tube	27-6174-7
Socket, high-voltage rectifier	27-6290-1
Socket, miniature, 7-pin	27-6203-6*
Socket, miniature, 9-pin	27-6203-6*
Socket, octal	27-6174
Socket, 12BH7 and 12AU7 tubes	76-6115
Yoke, deflection	32-9648
Cable and plug assembly, chassis connecting (91 chassis)	41-4146-4
Cable and plug assembly, gate pulse	41-4141
Cable and socket assembly, CRT	41-3964-19
Cable and socket assembly, pilot light	27-6233-5*
Shield, 6CB6 tube	56-5629FA3
Shield, 6T8 tube	56-5629-5
Socket and base assembly, 6CB6 tube	27-6203-14
Socket and base assembly, 6T8 tube	27-6203-18
Socket, miniature, 6AU6, 6AQ5, and 6BA6 tubes	27-6203

DEFLECTION CHASSIS J-5

SECTION 1—POWER SUPPLY

Reference Symbol	Description	Service Part No.
C100 and C101	Condenser, filter, electrolytic, 120 $\mu$ f., 150v	30-2568-51*
C102	Condenser, filter, electrolytic, 10 $\mu$ f., 25v	30-2584-27
C103	Condenser, filter, electrolytic, 100 $\mu$ f., 300v	Part of C102
CR100 and CR101	Rectifier, selenium, 350 ma.	34-8003-7
F100	Fuse, line, 1.6 amperes	45-2656-23
J100	Socket, a-c line	27-6240-3
J101	Socket, television chassis connecting	27-6274-1
J102	Socket, radio chassis connecting	27-6274-4
L100	Choke, 1 henry (part of EM speaker)	Speaker field
L100	Choke, 1 henry (used with PM speaker)	32-8605
PL100	Plug, a-c line	Part of line cord ass'y. (See Misc. )
PL101	Plug and cable ass'y., television chassis connecting	(See Misc. )
PL102	Plug and cable ass'y., radio chassis connecting	See parts list of radio tuner used
R100	Resistor, current limiting, 5 ohms, 10 watts	33-3448-5
R101	Resistor, filter, 47,000 ohms, 1 watt	66-3474340

SECTION 1—POWER SUPPLY (Continued)

Reference Symbol	Description	Service Part No.
R102	Resistor, voltage dropping, .24 ohm	41-4149
R103	Resistor, voltage dropping, 4.7 ohms, 1 watt	66-9473340
S100	Switch, off-on	Part of VOLUME control
T100	Transformer, filament	32-8575

SECTION 7—VERTICAL SWEEP

Reference Symbol	Description	Service Part No.
L700 and L701	Coils, vertical deflection	
L701	Part of deflection yoke (See Misc. )	
R701	Potentiometer, VERT. HOLD control, 250,000 ohms	Part of R811
R704	Potentiometer, HEIGHT control, 2.5 megohms	33-5565-32
R708	Potentiometer, VERT. LIN. control, 5 megohms	33-5565-31
T700	Transformer, vertical oscillator	32-8431-2*
T701	Transformer, vertical output	32-8539-1

SECTION 8—HORIZONTAL SWEEP

Reference Symbol	Description	Service Part No.
C803	Condenser, by-pass, .005 $\mu$ f.	30-1238-1
C804	Condenser, grid blocking, .01 $\mu$ f.	30-1238-2
C805	Condenser, by-pass, 100 $\mu$ f. $\pm$ 5%	60-10105417*
C807	Condenser, d-c blocking, 390 $\mu$ f. $\pm$ 5%	60-10395417
C808	Condenser, charging, 390 $\mu$ f.	60-10395417
C810	Condenser, screen by-pass, 100 $\mu$ f.	60-00825317
C813	Condenser, anti-ringing, 56 $\mu$ f.	30-1243-5
C815	Condenser, electrolytic	Part of C102
C815A	Condenser, by-pass, 100 $\mu$ f.	Part of C102
C815B	Condenser, by-pass, 10 $\mu$ f., 475v	Part of C102
J800	Socket, deflection	27-6274-7
J801	Socket, gate pulse	27-6273
L800	Coil, stabilizing, 30—80 mh.	32-4557
L801	Coil, r-f choke, horizontal-output plate	Part of T800
L802 and L803	Coils, horizontal deflection	
L803	Part of deflection yoke (See Misc. )	
L804	Coil, r-f choke, damper cathode	32-4112-24
L805	Coil, r-f choke, damper plate	32-4112-24
PL800	Plug, gate pulse	Part of cable ass'y. (See Misc. )
PL801	Plug, deflection	Part of cable ass'y. (See Misc. )
R810	Potentiometer, HORIZ. HOLD CENTERING	33-5565-17
R811	Potentiometer, HORIZ. HOLD control, 200,000 ohms	33-5563-50
R815	Potentiometer, WIDTH control, 10,000 ohms, 2 watts	33-5546-41
T800	Transformer, horizontal output	32-8565

MISCELLANEOUS

Description	Service Part No.
Arm and magnet ass'y., picture tube	76-6594
Beam bender	76-6077-2
Cable assembly, high voltage, picture tube	41-4664-6*
Cable and plug assembly, deflection	41-4086-25
Cable and plug assembly, VOLUME control	41-4136-2
Cord, line	41-3865
Focus assembly	76-6126-4
Insulator, electrolytic condenser mounting	27-9508-1
Shield, corona	56-9684
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Socket, miniature, 7-pin	27-6203-6*
Socket, miniature, 9-pin	27-6203-6*
Socket, octal	27-6174
Socket, 12BH7 and 12AU7 tubes	76-6115
Yoke, deflection	32-9648
Cable and plug assembly, television chassis connecting	41-4146-5
Cable and plug assembly, gate pulse	41-4141
Cable and socket assembly, picture tube	41-3964-19
Cable and socket assembly, pilot light	27-6233-5*
Shield, 6CB6 tube	56-5629FA3
Shield, 6T8 tube	56-5629-5
Socket and base assembly, 6CB6 tube	27-6203-14
Socket and base assembly, 6T8 tube	27-6203-18
Socket, miniature, 6AU6, 6AQ5, and 6BA6 tubes	27-6203

**PRODUCTION CHANGES IN D-194 DEFLECTION CHASSIS**

REASON FOR CHANGE	DESCRIPTION OF CHANGE	NEW OR ADDED PART NO.	OLD OR REMOVED PART NO.	RUN NO.
To eliminate picture bend.	Condenser C803 was changed from .001 $\mu$ f. to .002 $\mu$ f.	30-1238-12	30-1238-3	2
To center range of vertical hold control.	Resistor R703 was changed from 220K $\pm$ 10% to 240K $\pm$ 5%.	66-4248240	66-4228340	
To eliminate hum in radio operation.	Two .047- $\mu$ f., 600-volt condensers were added, one across each rectifier, CR100 and CR101.	30-4650-62		3
To eliminate hum in radio operation.	All chassis were reworked to add two .047- $\mu$ f., 600-volt condensers, one across each rectifier, CR100 and CR101.	30-4650-62		1Z and 2Z
To increase rectifier life.	Selenium rectifiers CR100 and CR101 were changed from 350-ma. to 450-ma. rating.	34-8003-8	34-8003-7	4
To reduce 1B3GT tube filament voltage.	Resistor R102 was changed from 4.7 ohms to 5.6 ohms.	66-9563240	66-9473340	5

FILE 88 PRODUCTION CHANGES IN D-194 DEFLECTION CHASSIS

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# PHILCO



# SERVICE

## TELEVISION

**PHILCO**  
**ALIGNMENT CHART SUPPLEMENT**  
**TO**  
**TELEVISION SERVICE MANUAL**  
**FOR**  
**R-F CHASSIS R-181 AND**  
**DEFLECTION CHASSIS D-181**

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**TABLE 1—TUNER OSCILLATOR ALIGNMENT**

**AM GENERATOR:** Connect to receiver antenna-input terminals. (No matching network is required.) Use unmodulated r-f output.

**OSCILLOSCOPE:** Connect the vertical-input lead, in series with a 1000-ohm resistor, to the mixer plate test point, G2. Connect the scope ground lead to the chassis, near G2.

**RECEIVER CIRCUIT ALTERATIONS:** Disconnect tuner a-g-c (white) lead from main chassis, and connect a 1.5-volt bias battery, with negative terminal to white lead from tuner, and positive terminal to chassis.

STEP	AM GENERATOR DIAL SETTING	RECEIVER TUNING	ADJUST	REMARKS
1	257 mc.	Channel 13	TC506 for zero beat on scope.	a. If regeneration occurs, increase bias; bias may be increased up to 4 or 5 volts, if necessary.  b. Preset and mark position of Fine Tuning Cam as shown in figure 4. (Position cam-stop between Channel 7 and 8, and mark for use in step 8 of video i-f alignment.)
2	245 mc.	Channel 11	TC507 for zero beat on scope.	
3	233 mc.	Channel 9	TC508 for zero beat on scope.	
4	257 mc.	Channel 13	TC506	Repeat steps 1, 2, and 3 until channels 13, 11, and 9 are within 500 kc. of their correct respective frequencies.
	245 mc.	Channel 11	TC507	
	233 mc.	Channel 9	TC508	
5	221 mc.	Channel 7	TC509 for zero beat on scope.	
6	129 mc.	Channel 6	TC510 for zero beat on scope.	
7	113 mc.	Channel 4	TC511 for zero beat on scope.	

NOTE: The symbols and figures referred to in the charts are those given in Service Manual PR-2506.

**TABLE 2—TUNER BANDPASS ALIGNMENT**

**SWEEP (FM) GENERATOR:** Connect to antenna-input circuit through antenna-input matching network. (See figure 1.)

**OSCILLOSCOPE:** Connect the vertical-input lead, in series with a 1000-ohm resistor, to the mixer plate test point, G2. Connect scope ground lead to the chassis, near G2.

**RECEIVER CIRCUIT ALTERATIONS:** Disconnect tuner a-g-c (white) lead from main chassis, and connect a 1.5-volt bias battery, with negative terminal to white lead from tuner, and positive terminal to chassis. Disconnect tuner link from terminal board B-11, and connect a 40 to 70-ohm carbon resistor across the link.

STEP	SWEEP (FM) GENERATOR		RECEIVER TUNING	ADJUST	REMARKS
	Sweep Dial Setting	Marker Dial Setting			
1	Channel 13 (213 mc., with 10-mc. sweep width.)	Set first to 210 mc. and note position of marker on response curve. Then set to 216 mc. and note position of marker on response curve.	Channel 13		Use oscilloscope gain as high as possible with respect to hum level and "bounce". Pips fix channel limits on curve. Response curve should be flat between limits (see figure 5). If not, proceed with step 2.
2	Channel 13	213 mc.	Channel 13	TC504 counter-clockwise until single peak appears.	CAUTION: Care must be taken not to unscrew core far enough to make it drop out of the coil.
3	Channel 13	213 mc.	Channel 13	TC502 until peak falls on 213-mc. marker.	It may be necessary to increase sweep-generator output.
4	Channel 13	213 mc.	Channel 13	TC500 for maximum curve height and symmetry of single peak.	After adjusting TC500, recheck as in step 1.
5	Channel 7 (177 mc., with 10-mc. sweep width.)	Set first to 174 mc. and note position of marker on response curve. Then to 180 mc. and note position of marker on response curve.	Channel 7		Note curve with respect to tilt and center frequency. Curve should be centered in pass band and symmetrical. If not, proceed with step 6.

**TABLE 2 (Cont.)**

STEP	SWEEP (FM) GENERATOR		RECEIVER TUNING	ADJUST	REMARKS
	Sweep Dial Setting	Marker Dial Setting			
6	Channel 7	174 mc. and 180 mc.	Channel 7	C508 and C512 to obtain correct tilt on top of curve.	C508 and C512 compensate for the tuning effect of Channel 13 adjustment upon Channel 7. (See figure 6.)
7	Channel 13	213 mc.	Channel 13	Retouch TC502 and TC504 for symmetrical response, centered about 213-mc. marker.	To retouch, only turn cores slightly.
8	Channel 7	117 mc.	Channel 7	Repeat step 6.	Check response curve for correct center frequency and symmetry.
9				Repeat steps 7 and 8.	Repeat Channel 13 and Channel 7 adjustments, alternately, until favorable curves are obtained on both.
10	Channel 6 (85 mc., with 10-mc. sweep width.)	Set first to 82 mc. and note position of marker on response curve. Then set to 88 mc. and note position of marker on response curve.	Channel 6		Curve should be symmetrical and centered in pass band. If not, proceed with step 11.
11	Channel 6	85 mc.	Channel 6	TC505 counter-clockwise until single peak appears.	CAUTION: Care must be taken not to unscrew core far enough to make it drop out of the coil.
12	Channel 6	85 mc.	Channel 6	TC503 until peak falls on 85-mc. marker.	It may be necessary to increase sweep-generator output.
13	Channel 6	85 mc.	Channel 6	TC501 for maximum curve height and symmetry of single peak.	After adjusting TC501, recheck as in step 10. If necessary, reduce sweep-generator output to avoid overloading.
14	Channel 6	85 mc.	Channel 6	Retouch TC503 and TC505 for symmetrical response, centered about 85-mc. marker.	To retouch, only turn cores slightly.

NOTE: The symbols and figures referred to in the charts are those given in Service Manual PR-2506.

TABLE 3—VIDEO I-F ALIGNMENT

**AM GENERATOR:** Connect to mixer test point, G1, through a mixer jig, and adjust the generator for approximately 30 percent modulation at 400 cycles. Adjust the output of the generator during alignment, to keep the output at the second detector below .6 volt, peak to peak.

**SWEEP (FM) GENERATOR:** After step 7, connect to antenna-input circuit through antenna-input matching network. (See figure 1.)

**OSCILLOSCOPE:** Connect the vertical-input lead to the 2200-ohm resistor of the video i-f alignment jig. Connect scope ground lead to the ground lead of the jig. (See figure 2.) Plug jig into J200.

**PRESET:** Contrast and Brightness controls fully counterclockwise, and Channel Selector to Channel 4.

**BIAS:** Apply 3 volts of negative bias to pin 1 of video i-f alignment jig; ground positive side of bias supply to pin 3 of jig. (See figure 2.)

**NOTE:** If the i-f shield has been removed for repairs, it must be replaced before proceeding with the alignment.

STEP	AM GENERATOR DIAL SETTING	SWEEP (FM) GENERATOR		ADJUST	REMARKS
		Sweep Dial Setting	Marker Dial Setting		
1	28.1 mc.	Not used.	Not used.	TC200 for minimum indication on scope.	It is necessary to keep the generator output sufficiently high that a null indication may be observed on the oscilloscope; however, avoid overloading of the receiver by excessive signal.
2	22.1 mc.	Not used.	Not used.	TC203 for minimum indication on scope.	
3	24.0 mc.	Not used.	Not used.	TC512 for maximum indication on scope.	
4	25.7 mc.	Not used.	Not used.	TC201 for maximum indication on scope.	
5	23.6 mc.	Not used.	Not used.	TC202 for maximum indication on scope.	
6	26.4 mc.	Not used.	Not used.	TC204 for maximum indication on scope.	
7	24.5 mc.	Not used.	Not used.	TC205 for maximum indication on scope.	
8	Not used.	Channel 4 (69 mc., with 6-mc. sweep width.)	Run marker along curve, checking against the curve limits given in figure 8.	If necessary, retouch TC201, TC204, TC205, and TC202 as directed in RE-MARKS column. CAUTION: Do not touch settings of TC200 and TC203.	

NOTE: The symbols and figures referred to in the charts are those given in Service Manual PR-2506.

TABLE 4—SOUND I-F ALIGNMENT

**AM GENERATOR:** Connect "hot" lead through a 2200-ohm resistor to pin 2 of J200, using the video i-f alignment jig. Connect ground lead of generator to ground lead of jig.

**VOLTMETER:** Use v.t.v.m. or 20,000-ohms-per-volt voltmeter. Connect to sound i-f alignment jig. (See figure 3.) NOTE: In this procedure, disregard the oscilloscope connections shown in figure 3.

**OSCILLOSCOPE:** Connect through crystal probe to cathode (pin 11) of picture tube.

STEP	AM GENERATOR DIAL SETTING	ADJUST	REMARKS
1	4.5 mc.	TC400 for maximum indication on voltmeter.	Remove 1st video i-f tube, and adjust the Volume control for moderate speaker output.
2	4.5 mc.	TC401 for maximum indication on voltmeter.	
3	4.5 mc.	TC402 for maximum indication on voltmeter and minimum speaker output.	The point of maximum meter indication for TC402 should also be the point of minimum speaker output.
4	4.5 mc.	TC300 for minimum indication on oscilloscope.	If scope and crystal probe are not available, TC300 may be adjusted for minimum beat pattern on picture tube, using station signal.
5	Use station signal.	TC402 for minimum AM (noise or buzz), using speaker output for indication.	Replace 1st video i-f tube, and tune in a station, setting fine tuning control to obtain a crisp picture, with a small amount of beat.

NOTE: The symbols and figures referred to in the charts are those given in Service Manual PR-2506.