

PHOTOFACT* Folder

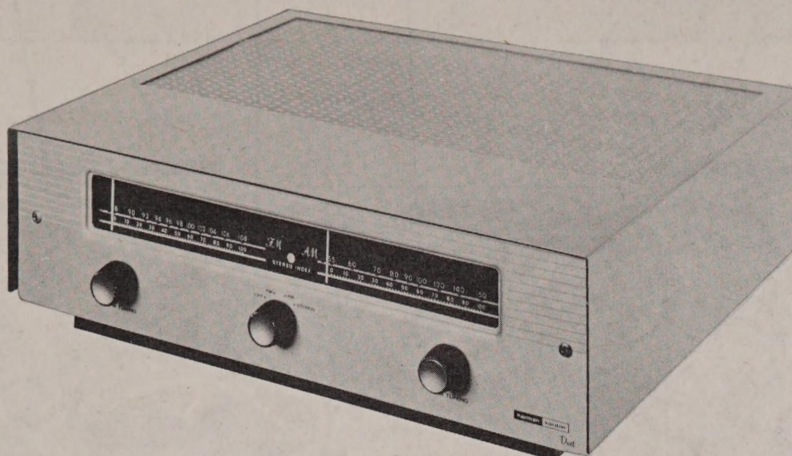


with CIRCUITRACE*

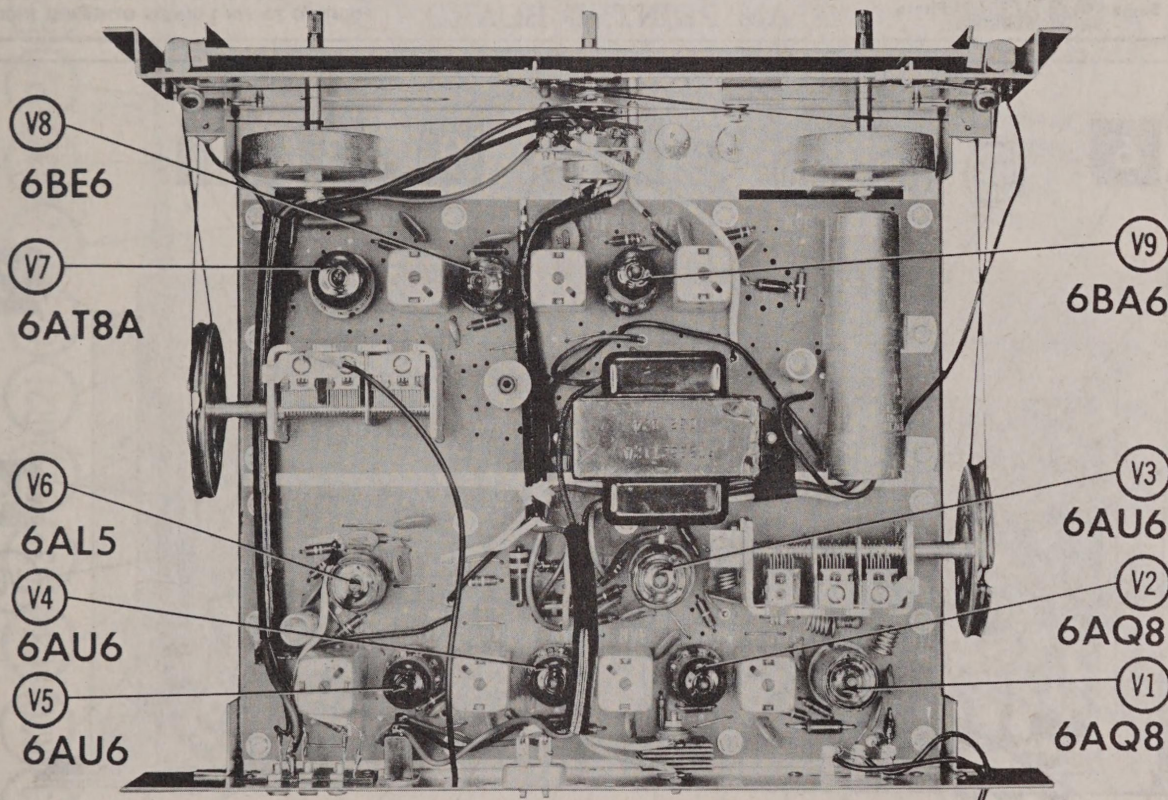


HARMAN-KARDON
MODEL T-224

HARMAN-KARDON
MODEL T-224



TRADE NAME	Harman-Kardon Model T-224 "The Duet"		
MANUFACTURER	Harman-Kardon, Inc., 520 Main St., Westbury, L. I., N. Y.		
TYPE SET	AC Operated FM-AM Tuner		
TUBES	Nine		
POWER SUPPLY	105 - 125 Volts AC, 60 Cycles	RATING	38 Watts, .40 Amp @ 117 Volts AC
TUNING RANGE-BROADCAST	535-1650 KC	FREQ. MOD.	88-108 MC

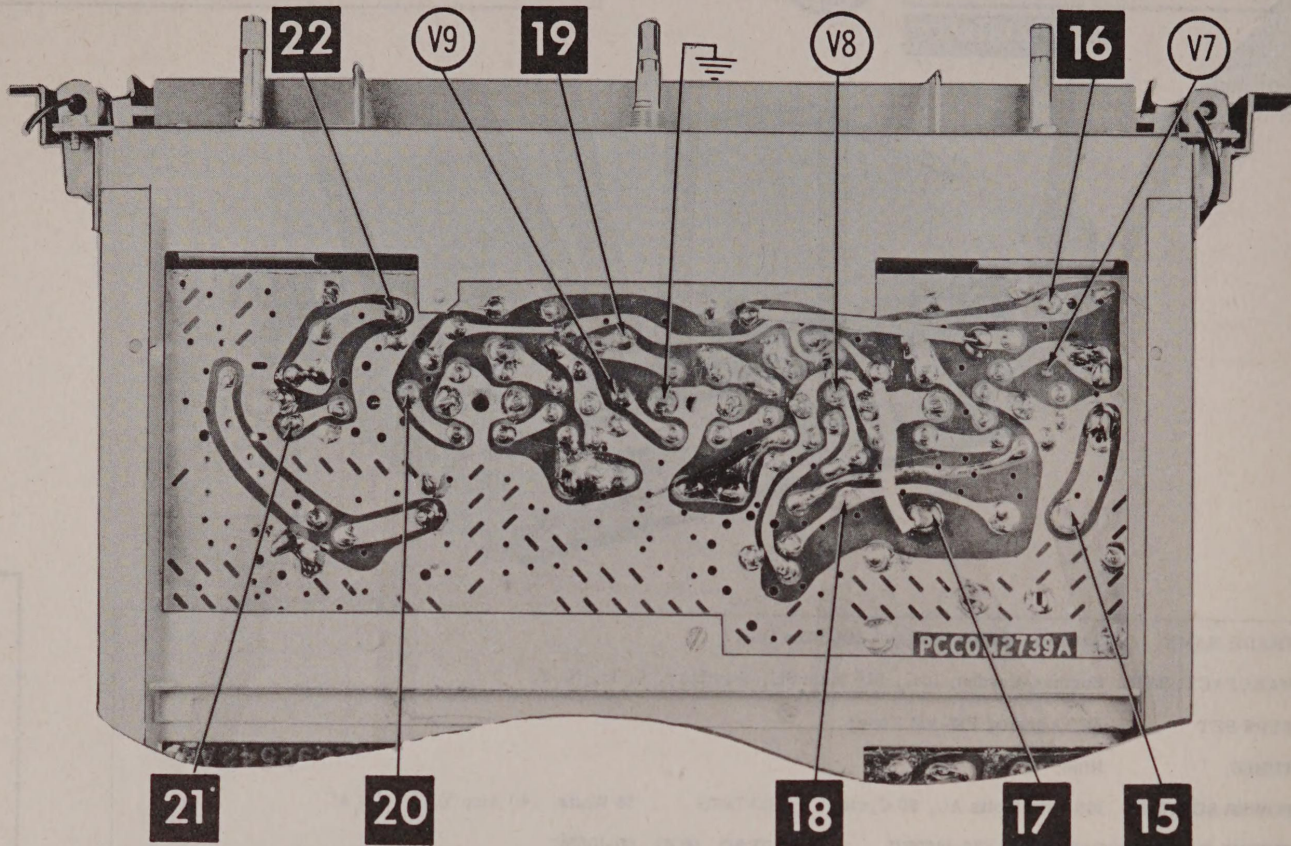


HOWARD W. SAMs & CO., INC. Indianapolis 6, Indiana

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of H889

the particular type of replacement part listed. Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein. © 1959 Howard W. Sams & Co., Inc., Indianapolis 6, Indiana. Printed in U.S. of America

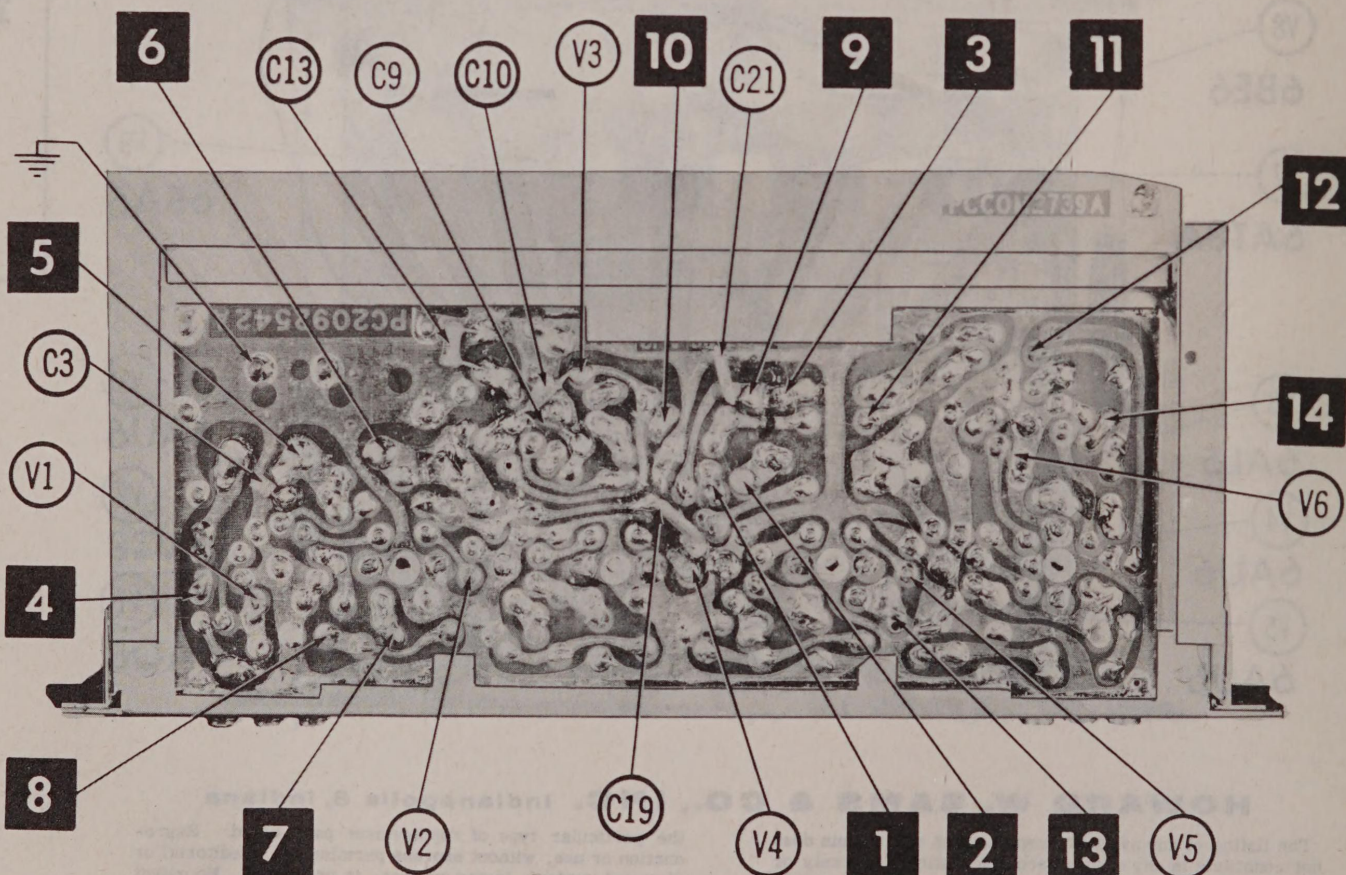
HARMAN-KARDON
MODEL T-224



A Howard W. Sams CIRCUITRACE[®] Photo

AM PRINTED BOARD

ARROWS INDICATING TUBE LOCATIONS ARE POINTING TO PIN 1 UNLESS OTHERWISE INDICATED

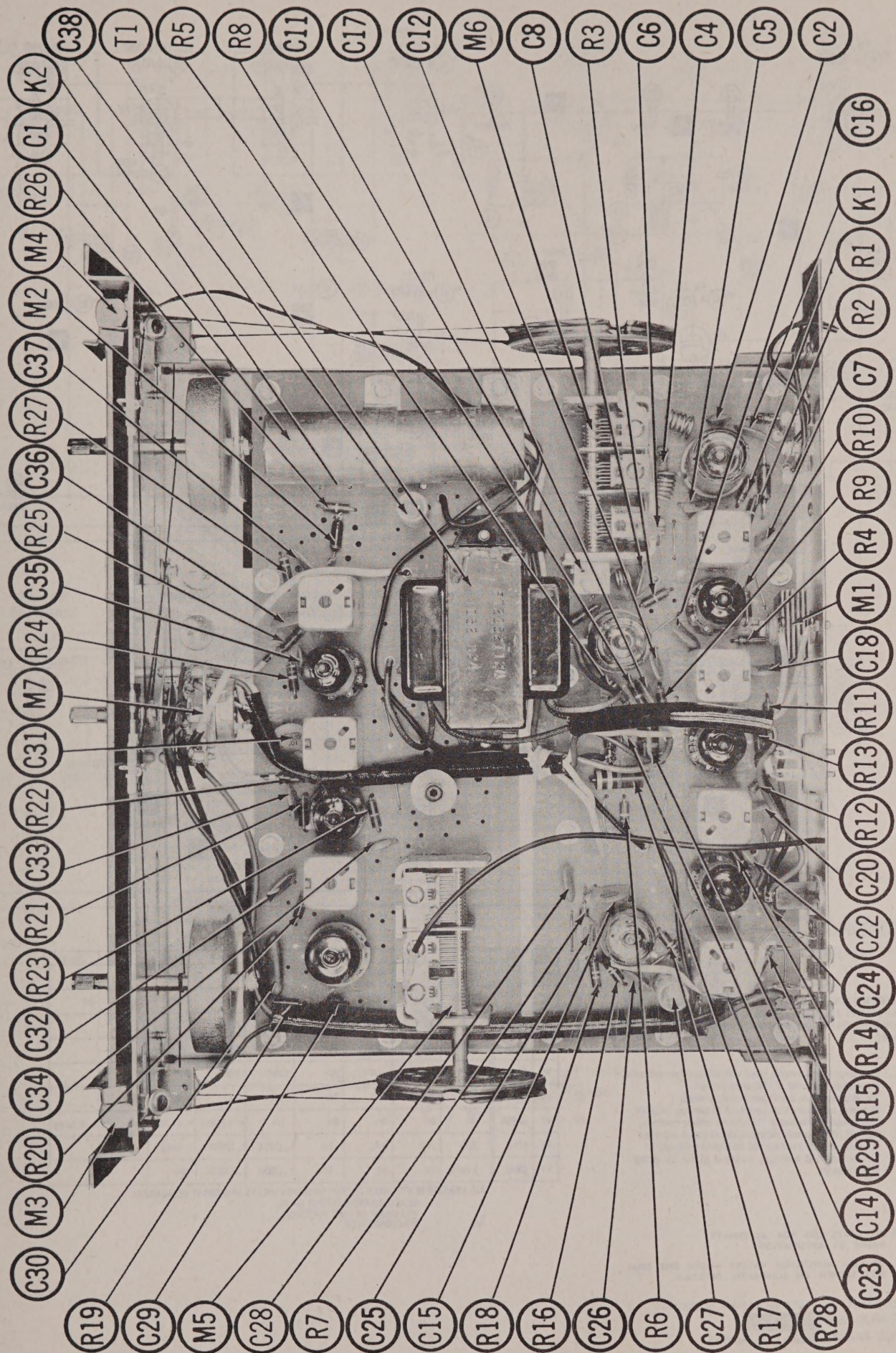


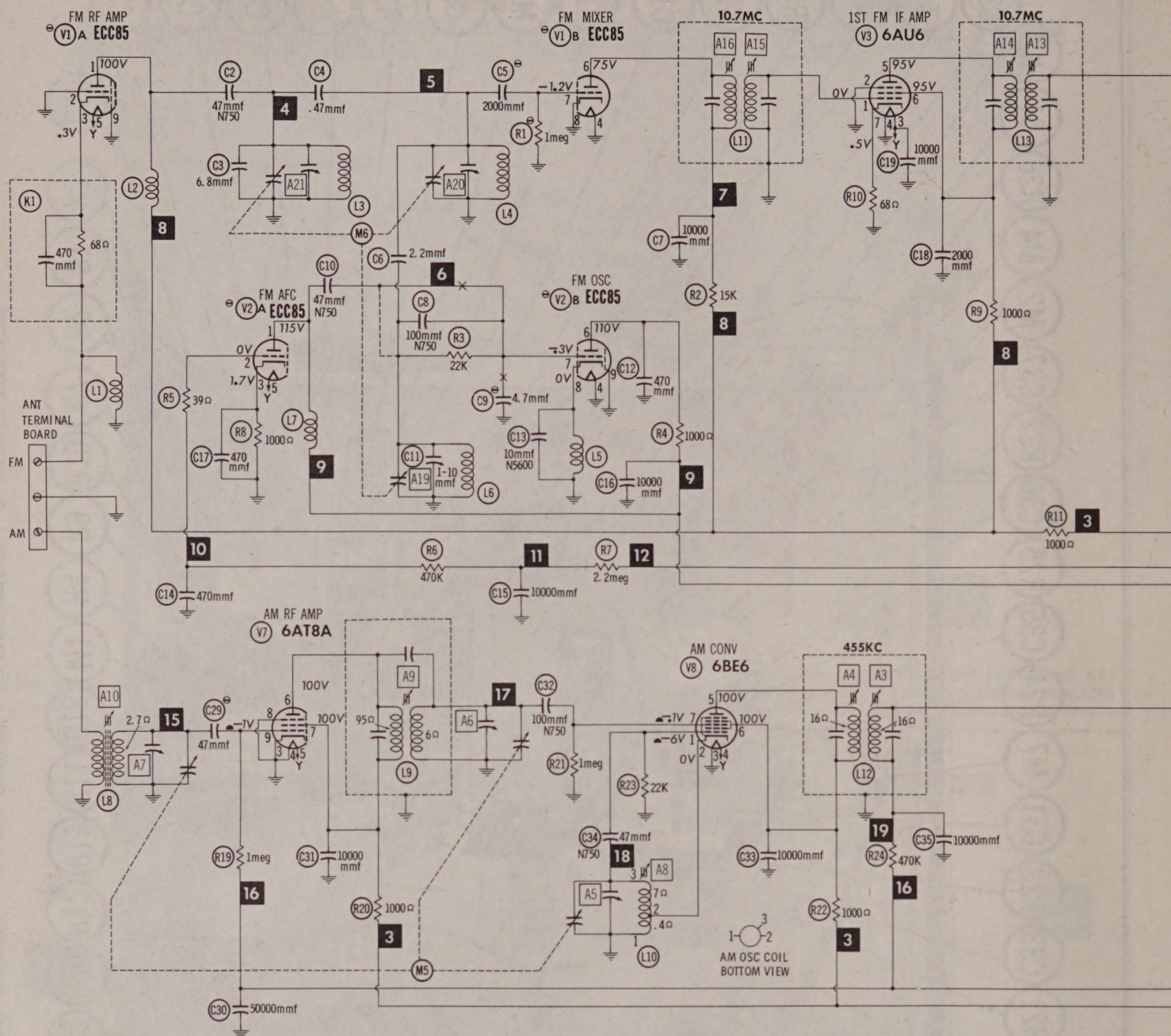
A Howard W. Sams CIRCUITRACE[®] Photo

FM PRINTED BOARD

ARROWS INDICATING TUBE LOCATIONS ARE POINTING TO PIN 1 UNLESS OTHERWISE INDICATED

CHASSIS TOP VIEW - CAPACITOR, RESISTOR, & MISC IDENT





NUMBERS ASSIGNED TO COILS, SWITCHES, PLUGS, SOCKETS, AND TRANSFORMERS ARE TO FACILITATE CIRCUIT TRACING OR COMPONENT REPLACEMENT AND MAY NOT NECESSARILY BE FOUND ON THE UNIT.

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of $\pm 15\%$ in voltage and resistance readings.
6. Volume control at maximum, no signal applied for voltage measurements.

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

DC COIL RESISTANCE VALUES UNDER ONE OHM NOT SHOWN ON SCHEMATIC DIAGRAM

A PHOTOFAC STANDARD NOTATION SCHEMATIC

with **CIRCUITRACE**

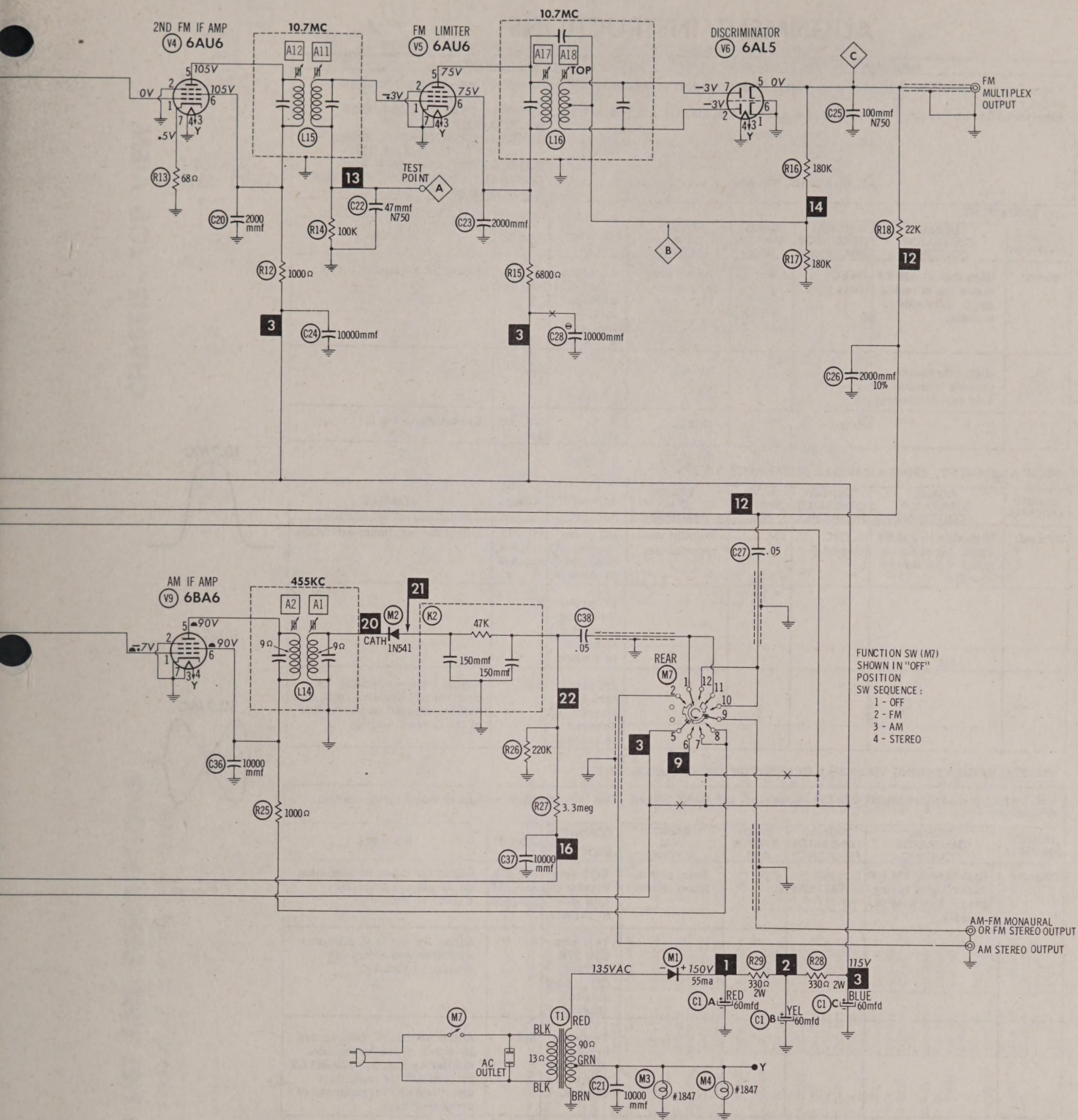
© Howard W. Sams & Co., Inc. 1959

RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	ECC85 6AQ8	†1700Ω	0Ω	68Ω	0Ω	.1Ω	†16K	1meg	0Ω	0Ω
V2	ECC85 6AQ8	†1700Ω	3meg	1000Ω	0Ω	.1Ω	†1600Ω	22K	.1Ω	0Ω
V3	6AU6	.6Ω	0Ω	.1Ω	0Ω	†2700Ω	†2700Ω	68Ω		
V4	6AU6	.6Ω	0Ω	.1Ω	0Ω	†1700Ω	†1700Ω	68Ω		
V5	6AU6	100K	0Ω	.1Ω	0Ω	†7400Ω	†7400Ω	0Ω		
V6	6AL5	0Ω	180K	.1Ω	0Ω	360K	0Ω	180K		
V7	6AT8A	NC	NC	0Ω	0Ω	.1Ω	†1700Ω	†1700Ω	0Ω	4.5meg
V8	6BE6	22K	.4Ω	0Ω	.1Ω	†1700Ω	†1700Ω	1meg		
V9	6BA6	3.8meg	0Ω	0Ω	.1Ω	†1700Ω	†1700Ω	0Ω		

ALL MEASUREMENTS TAKEN IN "FM" POSITION UNLESS OTHERWISE DESIGNATED.

† MEASURED FROM OUTPUT OF M1.
MEASURED IN "AM" POSITION.
NC NO CONNECTION.



ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain an output reading.

Suggested alignment tools: A1, A2, A3, A4, A10, A11, A12, A13, A14, A15, A16, A17. GENERAL CEMENT #5097, 8727
WALSCO #2515
A8. GENERAL CEMENT #8606, 8606L,
8282, 9295
WALSCO #2526, 2543, 2544, 2545
A5, A6, A7, A18, A19, A20. GENERAL CEMENT #5004, 5008, 5009
WALSCO #2520

AM ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
1.	.01mfd	High side to AM RF stator lug of tuning gang. Low side to chassis.	455KC (400% Mod.)	AM	Tuning gang fully open	AC probe to AM-FM monaural jack. Common to chassis.	A1, A2, A3, A4	Adjust for maximum output.
2.	"	High side to AM antenna terminal. Low side to chassis.	1400KC	"	1400KC	"	A5, A6, A7	"
3.	"	"	600KC	"	600KC	"	A8, A9, A10	Repeat Steps 2 & 3.

FM IF ALIGNMENT, USING AM SIGNAL GENERATOR & VTVM

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
4.	200mmf	High side to FM RF stator lug of tuning gang. Low side to chassis.	10.7MC (Unmod.)	FM	Point of non-interference	DC probe to point  A13, A14, Common to chassis.	A11, A12, A13, A14, A15, A16	Adjust for maximum deflection.
5.	"	"	"	"	"	DC probe thru lmeq to point  Common to chassis.	A17	"
6.	"	"	"	"	"	DC probe thru lmeq to point  Common to chassis.	A18	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting.

10.7MC

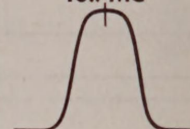


FIG. 1

10.7MC

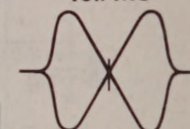


FIG. 2

FM IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Use frequency modulated signal with 60% modulation and 450KC sweep. Use 120% sawtooth voltage in scope for horizontal deflection.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT SCOPE	ADJUST	REMARKS
4.	200mmf	High side to FM RF stator lug of tuning gang. Low side to chassis.	10.7MC (450KC SWP)	FM	Point of non-interference	Vert amp to point  A13, A14, Low side to chassis.	A11, A12, A13, A14, A15, A16	Adjust for curve of maximum amplitude and symmetry similar to Fig. 1.
5.	"	"	"	"	"	Vert amp thru 27K to point  . Low side to chassis.	A17	Adjust for curve of maximum amplitude and symmetry similar to Fig. 1.
6.	"	"	"	"	"	Vert amp to point  . Low side to chassis.	A18	Adjust so that 10.7MC occurs at center of crossover lines similar to Fig. 2. SLIGHTLY retouch A17 for maximum amplitude and straightness of crossover lines.

FM RF ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
7.	270Ω carbon resistor	High side to FM antenna terminal. Low side to chassis.	106MC (Unmod.)	FM	106MC	DC probe to point  . Common to chassis.	A19, A20, A21	Adjust for maximum output.
8.	"	"	90MC	"	90MC	"	L6, L4, L3	Adjust for maximum output by compressing or expanding coil turns. Repeat Steps 7 & 8.

PARTS LIST AND DESCRIPTIONS TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	ITEM No.	USE	TYPE
V1	FM RF Amp. - FM Mixer	ECC85/8AQ8	V6	Discriminator	6AL5
V2	FM Osc. - AFC	ECC85/8AQ8	V7	AM RF Amplifier	6AT8A
V3	1st FM IF Amplifier	6AU6	V8	AM Converter	6BE6
V4	2nd FM IF Amplifier	6AU6	V9	AM IF Amplifier	6BA6
V5	FM Limiter	6AU6			

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	REPLACEMENT DATA				
		CAP.	VOLT.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.
C1A	60	200		PR3-020	C0234	
B	60	200				
C	60	200				

* Not normally in distributors stock. Available thru distributor on order to manufacturer.

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING	REPLACEMENT DATA					NOTES
		CAP.	VOLT.	Harman-Kardon PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	
C2	47					DTN-47	
C3	6.8					TCZ-6R8	
C4	.47					DD-202	
C5	2000					BPD-002	
C6	2.2					TCZ-S12.2	
C7	10000					BPD-01	
C8	100					DD-103	
C9	4.7					DTN-100	
C10	47					DTZ-4R7	
C11	1-10					DTN-47	
C12	470					DD-471	
C13	10					DD-471	
C14	470					DD-471	
C15	10000					DD-103	
C16	10000					DD-103	
C17	470					DD-471	
C18	2000					BPD-002	
C19	10000					BPD-01	
C20	2000					BPD-002	
C21	10000					BPD-01	
C22	47					DTN-47	
C23	2000					DD-202	
C24	10000					DD-103	
C25	100					DTN-100	
C26	2000					BPD-002	
C27	.05					DD-103	
C28	10000					DD-103	
C29	47					DD-470	
C30	50000					DD-470	
C31	10000					DD-470	
C32	100					DD-103	
C33	10000					DTN-100	
C34	47					DTN-47	
C35	10000					DD-103	
C36	10000					DD-103	
C37	10000					DD-103	
C38	.05					DD-503	

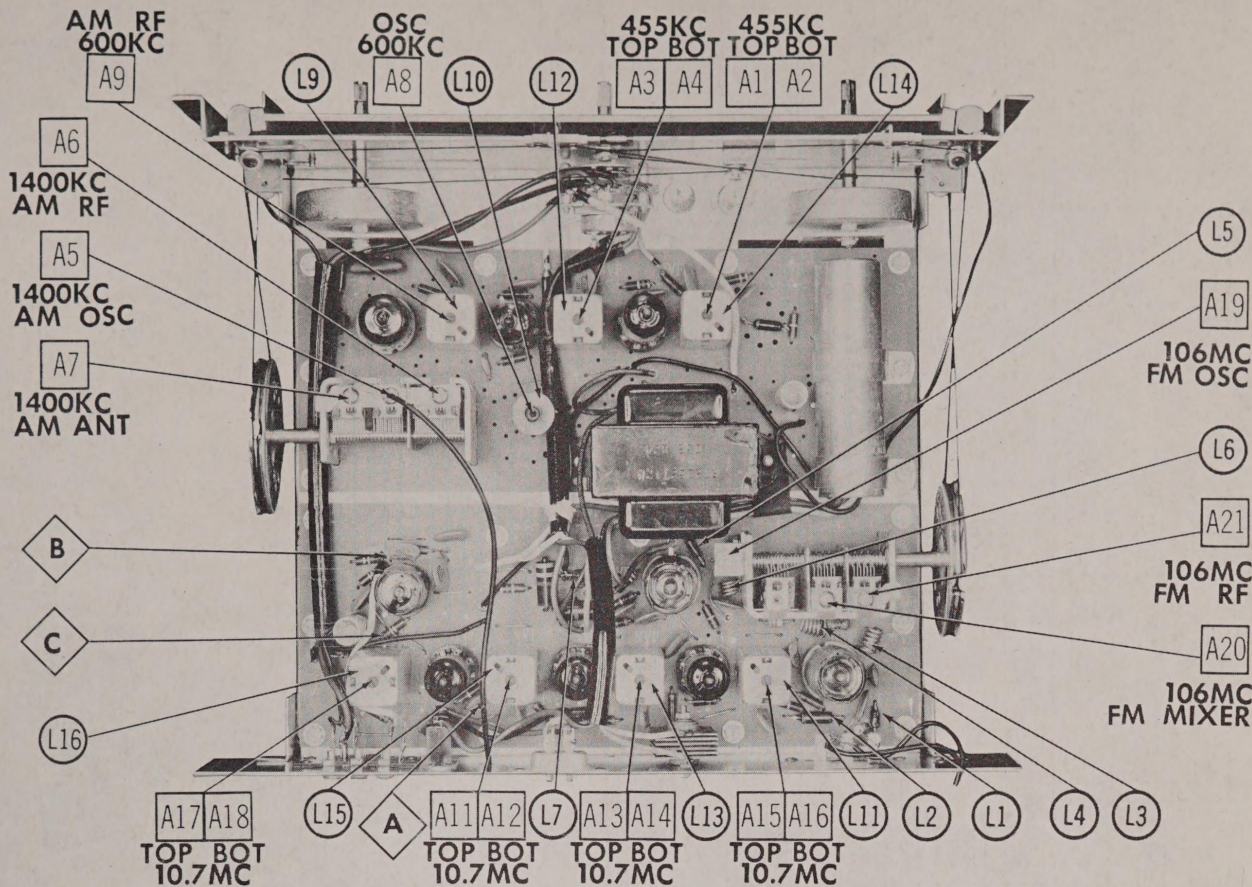
Some versions may use 10000mmf in this application.
May not be used in some versions.
Some versions may use 100mmf in this application.

① ② ③

FOLDER 4

HARMAN-KARDON
MODEL T-224

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		Harman-Kardon PART No.	NOTES	ITEM No.	RATING		Harman-Kardon PART No.	NOTES
	OHMS	WATT				OHMS	WATT		
R1	1meg			Note 1	R16	180K			
R2	15K				R17	180K			
R3	22K				R18	22K			
R4	1000Ω				R19	1meg			
R5	39Ω				R20	1000Ω			
R6	470K				R21	1meg			
R7	2.2meg				R22	1000Ω			
R8	1000Ω				R23	22K			
R9	1000Ω				R24	470K			
R10	68Ω				R25	1000Ω			
R11	1000Ω				R26	220K			
R12	1000Ω				R27	3.3meg	2		
R13	68Ω				R28	330Ω	2		
R14	100K				R29	330Ω			
R15	6800Ω								

Note 1. Some versions may use 3.3meg in this application.

COILS (RF-IF)

ITEM No.	USE	REPLACEMENT DATA				NOTES
		Harman-Kardon PART No.	Meissner PART No.	Miller PART No.	Ram PART No.	
L1	Ant. Coil					
L2	RF Choke			4584		24 Microhenry 3.3 Microhenries
L3	FM RF Coil					
L4	FM Mixer Coil					
L5	Cathode Choke					
L6	FM Osc. Coil					1 Microhenry
L7	RF Choke					3.3 Microhenries Note 1
L8	Loopstick	GL2352740				
L9	AM RF Coil	GL2352751				
L10	AM Osc. Coil	GL2352738				
L11	1st FM IF Trans.	GT2092595				
L12	1st AM IF Trans.	GT2092752				
L13	2nd FM IF Trans.	GT2092596				
L14	2nd AM IF Trans.	GT2092753				
L15	3rd FM IF Trans.	GT2092597				
L16	Discriminator	GT2092598				

Note 1. Tuning ring Part #p481329.

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA			
	SEC. 1	SEC. 2	SEC. 1	SEC. 2	Harman-Kardon PART No.	Halldorson PART No.	Merit PART No.	Ram PART No.
T1	117V @ .40A	135V @ .40A Tap @ 6.3V @ 3.3A			FT2352712			

COMPONENT COMBINATIONS

ITEM No.	USE	DESCRIPTION	Harman-Kardon PART No.	REPLACEMENT DATA
K1	Ant. Coupling	470mmf, 68Ω	STCOM2553	
K2	Diode Filter	150mmf, 150mmf, 47K	PC781599	Aerovox PA-98 Centralab PC-51 Cornell-Dubilier 111TM2 Sprague D-2

SELENIUM RECTIFIER

ITEM No.	REPLACEMENT DATA				NOTES
	RATING	Harman-Kardon PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	
M1	.056A	Z1122134	1234AH	T075 SD-94 ①	① Silicon Type

CRYSTAL DIODES

ITEM No.	ORIG. TYPE	REPLACEMENT DATA		NOTES
		Harman-Kardon PART No.	Sylvania PART No.	
M2	1N541 *	1N636	1N295	AM Detector (Pigtail)

* Some versions may use 1N542 in this application (Part #GC1041698).

MISCELLANEOUS

ITEM No.	PART NAME	Harman-Kardon PART No.	NOTES
M3	Lamp		#1847
M4	Lamp		#1847
M5	Tuning Cap.	JV2352725	AM, 3 Section
M6	Tuning Cap.	JV2092541	FM, 3 Section
M7	Switch	ER2352693	Function (4 Position, Rotary, Wafer, Snap Type)
	Printed Board	PCCOM2739A	AM
	Printed Board	PC2092542A	FM

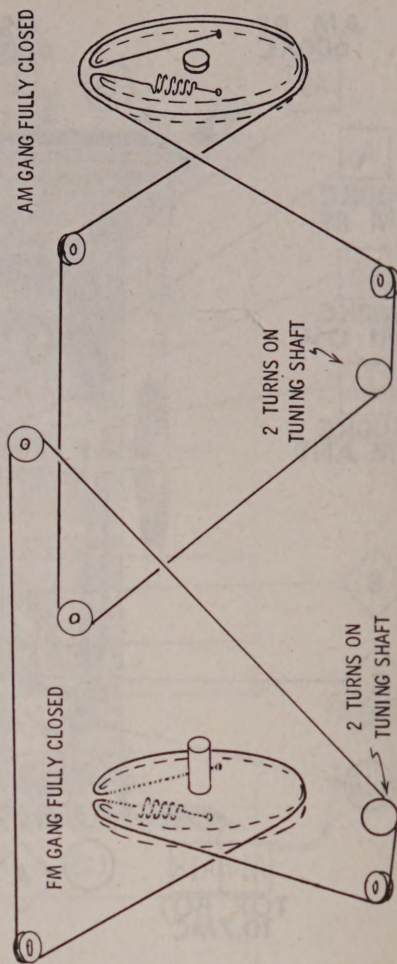
CABINETS & CABINET PARTS

(When Ordering Cabinets & Cabinet Parts, Specify Model, Chassis & Color)

NAME	PART No.	DESCRIPTION
Knob	PCOM2840	
Dial Glass	P2352742	3 Used

WIRING DATA

General-use Unshielded Hook-up Wire Use BELDEN No. 8530 (Solid) Available in Ten Colors
Power Cord (Interlock Type) Use BELDEN No. 8874



DIAL CORD STRINGING