

ELECTRONIC TECHNICIAN / DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

JUNE 1969  A HARBRAZ PUBLICATION

FRISEM10812392N869AD3A17966B4
WILLIAM W FRISE
7176 GALE RD
ATLAS MI
XX
48411



SOLID STATE DEFLECTION SYSTEMS
MODERN MARKER SWEEP ALIGNMENT
TUNER SERVICING

Color Power.

EICO gives you the most professional color power for your instrument dollar.



INTRODUCING THE VALUE LEADER IN BATTERY-OPERATED PORTABLE SOLID STATE COLOR GENERATORS — EICO 385!

Exclusive Features

- Compact "Tote-Easy" Design • Computer-Type Circuitry • Double Sided PC Board Construction • Low Price

The versatile "go everywhere" EICO 385 solid state color generator, packaged in an exclusive compact portable/storage case, has been designed to furnish the service technician with five essential functions. The generated patterns are the standard offset carrier-type 10 color bars, precision dots, crosshatch, and an individual series of vertical and horizontal lines.

Advanced computer-type circuitry, coupled with three temperature compensated crystals, provides the drift-free stability inherent in this instrument. A multipurpose color-coded gun killer with its convenient socket-adaptor assembly, (no more fumbling) stores in the case. Clips directly to TV antenna terminals (fast & sure!). The EICO 385 is powered by six long-life "C" cells or the AC adaptor accessory. The economical package contains all you need to enable you to do a fast yet reliable job.

Easy-to-assemble Kit: **\$79⁹⁵**
Wired: **\$109.95**



EICO's complete Color TV Lab for the pro

Praised by the pros for laboratory precision at lowest cost



Model 369 Sweep/Marker Generator. For easiest, fastest visual alignment of color or b/w TV and FM RF and IF circuits. Five sweep ranges from 3-220 MHz. Four marker ranges from 2-225 MHz. Crystal marker oscillator. Post injection of markers. **\$99.95 Kit, \$149.95 wired.**

Model 435 Direct-Coupled Wideband Scope. Top-quality DC-4.5 MHz scope with 3" flat-face. CRT Zener calibrator: Outperforms 5" scopes, facilitates on-location color TV and other servicing. **\$119.95 Kit, \$169.95 wired.**

New Model 235 Professional VTVM. Designed especially for solid-state servicing. Accurate to as little as 0.01 volts on its 1/2-volt scale. RMS/p-p/DS/ohms in 7 overlapping ranges. Big six-inch meter, 200 ua movement. **\$49.95 Kit, \$69.95 wired.**



NEW EICO 633 Portable All-Solid-State CRT Tester and Rejuvenator. Rapidly tests and rejuvenates color as well as black and white picture tubes. Line adjustment control, 12 different filament voltages, individual voltages applied to two of the grids, accurate meter — all insure precise measurements. Continuity and leakage checked through transistorized VOM, read directly on meter. **\$69.95 Kit, \$99.95 wired.**



NEW EICO 635 Deluxe All-Purpose Portable Tube Tester. Thoroughly professional, full-range modern versatility. Tests all standard tubes and even the new decals, magnovals, 7-pin nuvistors, and popular TV picture tubes. "Take-it-anywhere" design expressed in a modern, rugged, scuff-proof, luggage case. Compact (4"H, 12 1/2"W, 9"D) and lightweight, 4 1/2 lbs. Quick, accurate, dependable and the price is modest. **\$44.95 Kit, \$69.95 wired.**



NEW EICO PSI-1 Solid-State Signal Injector Probe. Perfect for on-the-spot signal tracing in the field. Pen-size, self-powered, self-contained signal generator from 1,000 Hz with harmonics to 30 MHz. Ideal for trouble-shooting audio, IF & RF circuitry in any electronic equipment, transistorized or vacuum tube. Use it once — you'll never want to be without it! **\$5.95 Kit, \$9.95 wired.**



FREE 1969 CATALOG

EICO Electronic Instrument Co., Inc.
283 Malta Street, Brooklyn, N.Y. 11207
 Send me FREE catalog describing the full EICO line of 200 best buys, and name of nearest dealer.

Name _____
Address _____
City _____
State _____ Zip _____

... for more details circle 114 on postcard

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR 6 NEW SETS

AIRLINE
TV Models
GHJ-14829A,
GHJ-14849B, 59B

JUNE • 1969

GROUP
202

SCHEMATIC NO.

SCHEMATIC NO.

AIRLINE.....1229
TV Models GHJ-14829A,
GHJ-14849B, GHJ-14859B

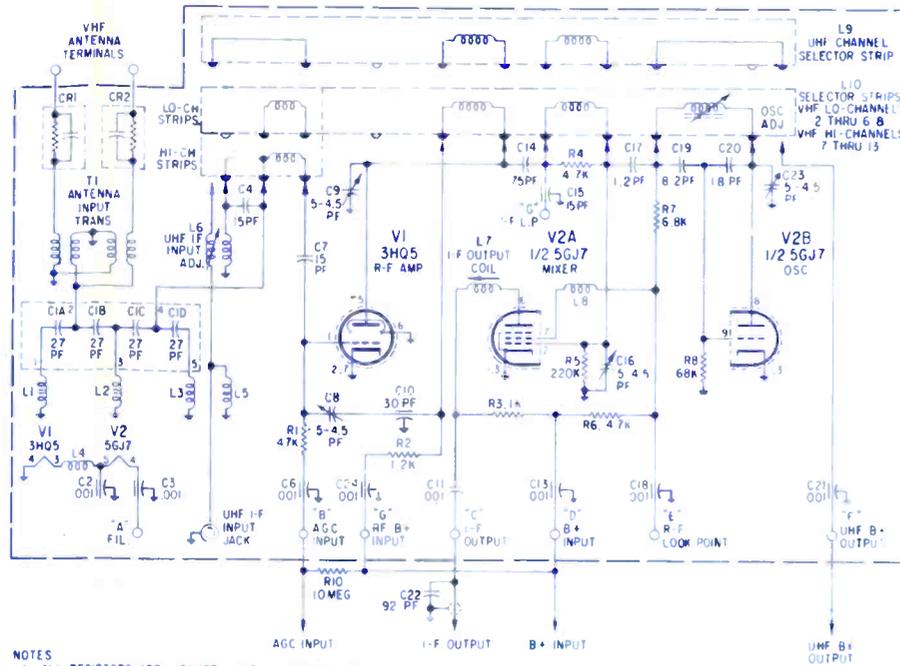
OLYMPIC.....1231
Color TV Chassis CTC31

DUMONT.....1230
Color TV Chassis 120926, 28

PHILCO-FORD.....1233
TV Chassis 19L21

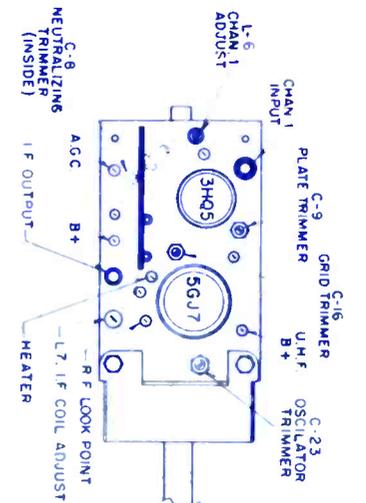
MOTOROLA.....1232
TV Chassis TS613 Series

SYLVANIA.....1234
TV Chassis A04-3



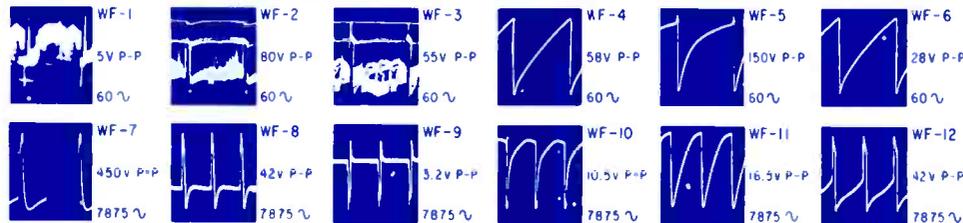
NOTES:
1. ALL RESISTORS ARE 1/2 WATT, UNLESS OTHERWISE NOTED.
2. CAPACITOR VALUES ARE IN MFD UNLESS OTHERWISE NOTED.
3. TUNER IS SHOWN IN VHF CHANNEL POSITION.

VHF Tuner Schematic Diagram

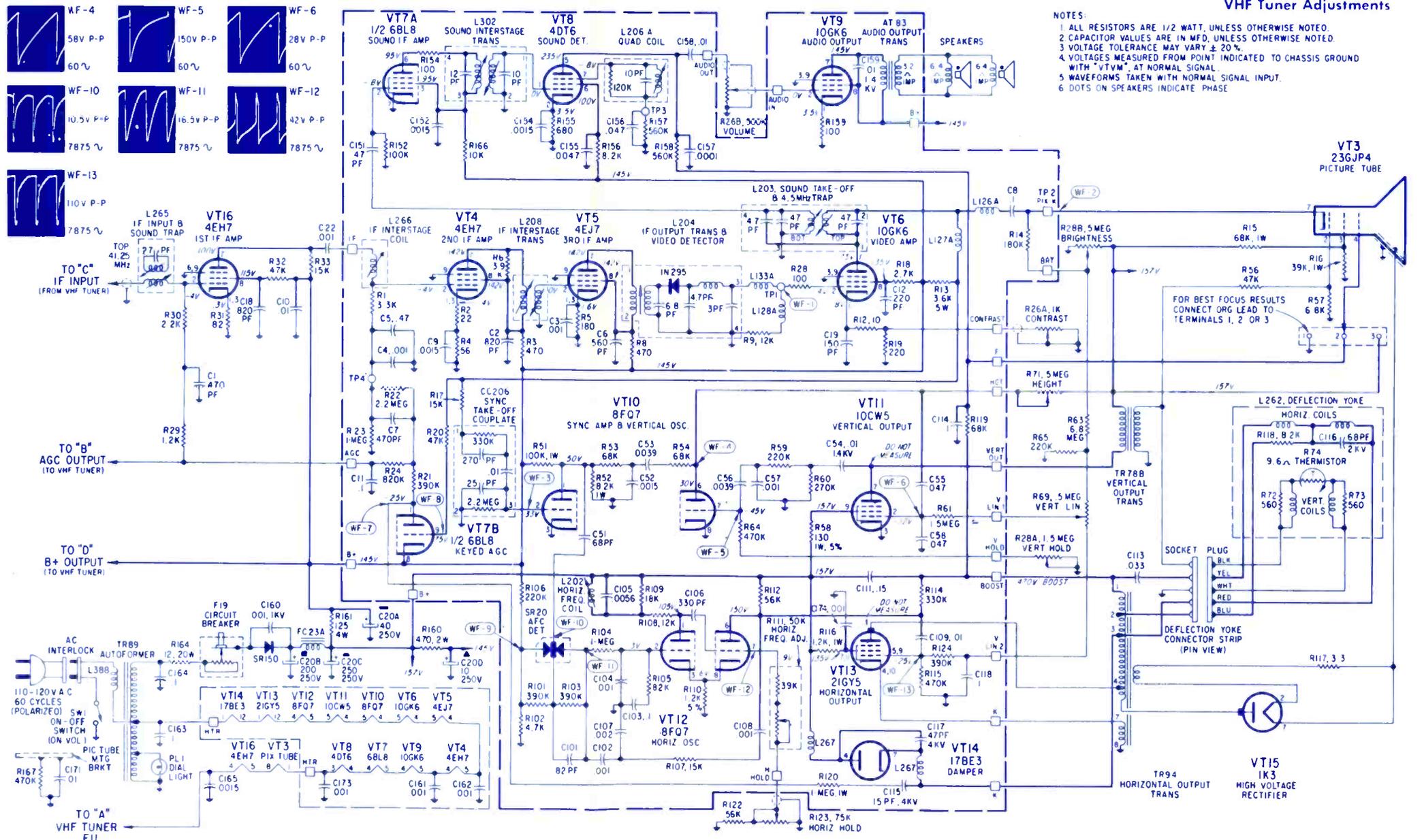


VHF Tuner Adjustments

NOTES:
1. ALL RESISTORS ARE 1/2 WATT, UNLESS OTHERWISE NOTED.
2. CAPACITOR VALUES ARE IN MFD, UNLESS OTHERWISE NOTED.
3. VOLTAGE TOLERANCE MAY VARY ± 20%.
4. VOLTAGES MEASURED FROM POINT INDICATED TO CHASSIS GROUND WITH "VTVM", AT NORMAL SIGNAL.
5. WAVEFORMS TAKEN WITH NORMAL SIGNAL INPUT.
6. DOTS ON SPEAKERS INDICATE PHASE.



SYMBOL	DESCRIPTION	AIRLINE PART NO.
C20A, B, C, D	40µf (A) 200µf (B) 250µf (C) 10µf (D) 250vdc	034-020000
C115	15pf 4kv 10% disc cer	825-150016
R13	3.6K 5w 10%	063-362610
R74	9.6Ω thermistor	057-056500
R164	12Ω 20w 10%	053-120310
R26A, B	contr vol w/switch SW1	055-067000
R28A, B	vert hld bright	055-067100
R69	vert lin 5M	055-035000
R71	height 5M	055-035100
R111	horiz freq adj 50K	055-041700
R123	horiz hold 75K	055-032000
SR20	diode sel horiz AFC	003-002000
SR150	rec sil 1.0a 900 PIV	004-003500
AT B3	xformer audio output	031-008301
FC-23A	filter choke	032-002301
L128A	coil peak	111-012800
L202	coil horiz freq	110-020200
L203	xformer sound take-off 4.5MHz trap	109-020300
L204	xformer IF output video det	109-020400
L206A	coil sound quad	109-020601
L262	def voke	027-026200
L265	coil IF input sound trap	109-026500
L266	coil IF interstage	109-026600
L267	coil choke 2 used	111-026700
L302	xformer sound interstage	109-030200
L388	coil line filter	111-038800
TR78B	xformer vert output	033-007802
TR89	autoformer	033-008900
TR94	xformer horiz output	033-009400
	printed circuit board	073-041200
F19	circuit brkr	099-001900
CC206	couplate, sync take-off	134-020600



ELECTRONIC TECHNICIAN/DEALER is published monthly by Harbrace Publications, Inc., Harbrace Building, Duluth, Minnesota 55802, a subsidiary of Harcourt, Brace & World, Inc. Subscription rates: One year \$5, two years \$8, three years \$10, in the United States and Canada. Other countries: One year \$9, two years \$14, three years \$18. Single copies 60c. Second class postage paid at Danville, New York and at additional mailing offices. Copyright 1969 by Harbrace Publications, Inc. POSTMASTER: Send Form 3579 to ELECTRONIC TECHNICIAN/DEALER, Harbrace Building, Duluth, Minnesota 55802.

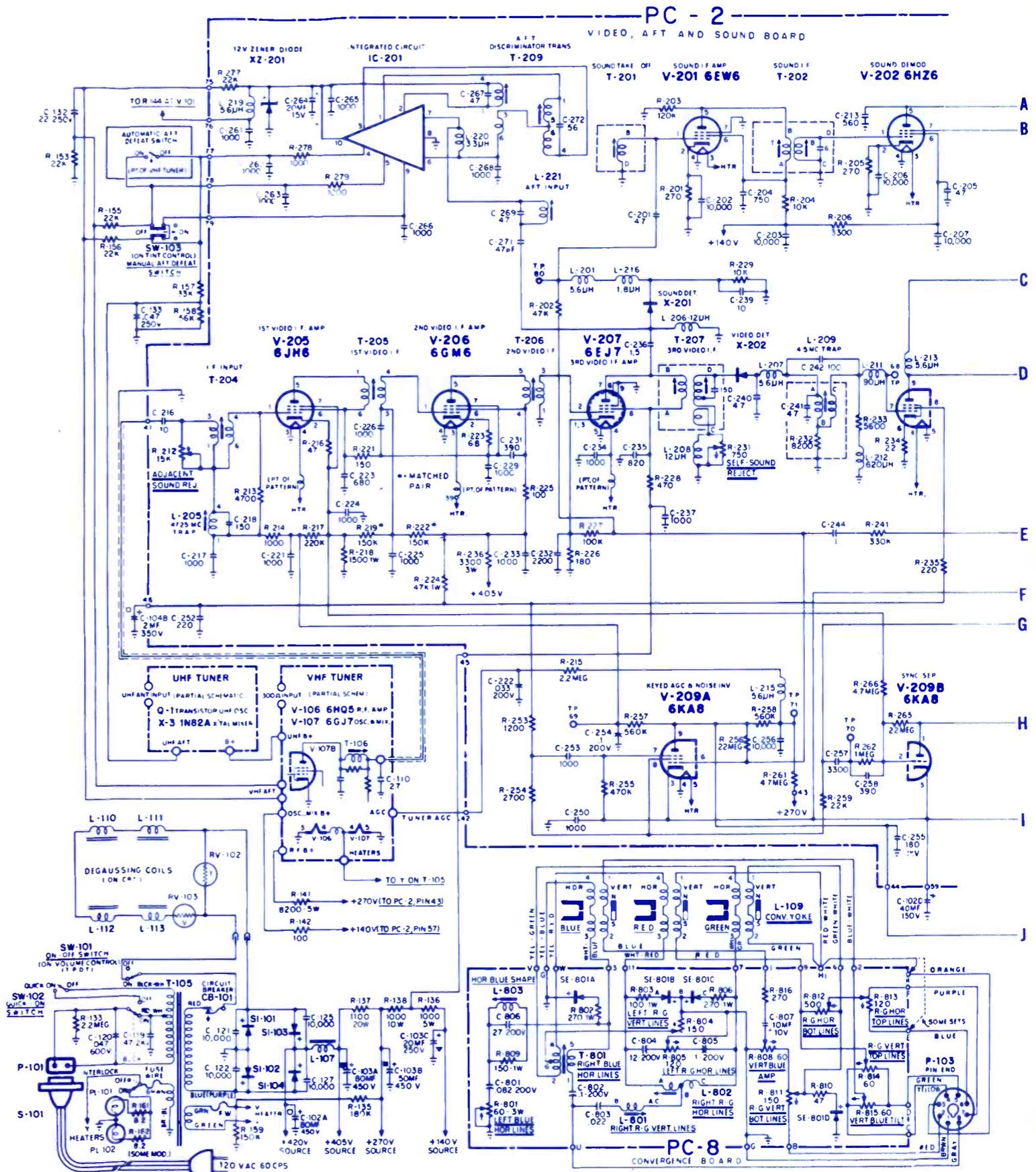
VOLTAGE MEASUREMENTS
T. V. CHASSIS 120926, 120928

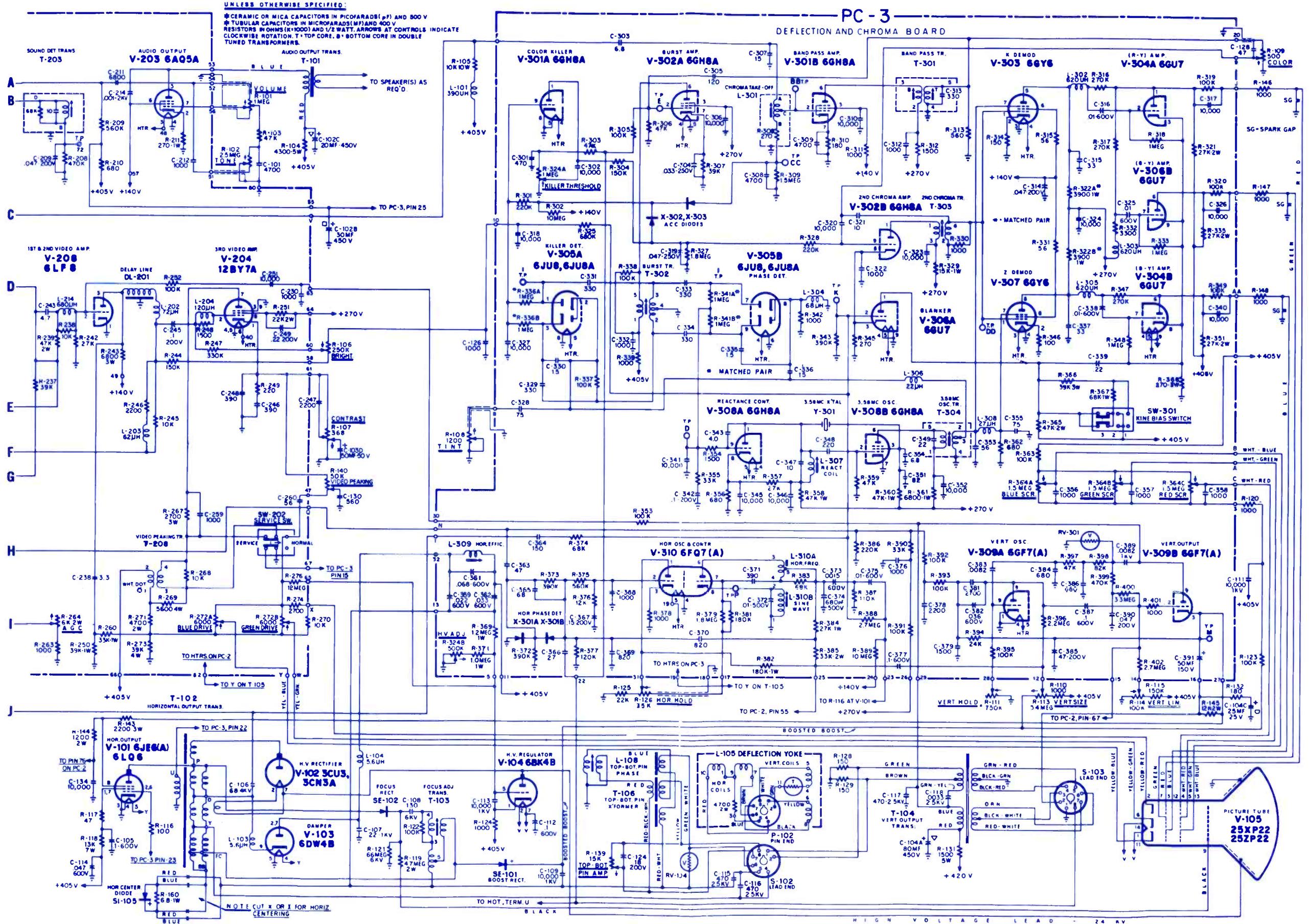
SYMBOL	TUBE TYPE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	
V-201	6EW6	0	1V	F11	F11	80V	80V	0			
V-202	6RZ6	0	2V	F11	F11	155V	100V	0			
V-203	6A05A		5.5V	F11	F11	300V	130V	0			
V-204	12BY7A	8V	6V	0	F11	F11	F11	210V	145V	0	
V-205	6JH6	*-3.5V	7V	F11	F11	190V	190V	7V			
V-206	6QM6	190V	193V	F11	F11	360V	370V	193V			
V-207	6EJ7	2V	0	2V	F11	F11	0	165V	180V	0	
V-208	6LF8	0	3.5V	25V	F11	F11	0	-2.5V	160V	185V	
V-209	6KA8	125V	-10V	15V	F11	F11	2V	13V	160V	-30V	
V-301	6GH8A	-1V	0.1V	135V	F11	F11	265V	1.8V	0	-2V	
V-302	6GH8A	200V	0	270V	F11	F11	425V	42V	3.5V	-1V	
V-303	6GY6	0	1V	F11	F11	250V	125V	0			
V-304	6QU7	170V	-1.5V	7V	F11	F11	170V	-1V	7V	F11	
V-305	6JUB(A)	-50V	0	35V	F11	F11	F11	-35V	0	35V	
V-306	6GU7	110V	-100V	3V	F11	F11	170V	-1V	7	F11	
V-307	6GY6	0	1V	F11	F11	250V	125V	0			
V-308	6GH8A	90V	-4V	110V	F11	F11	200V	0	2.5V	0	
V-309	6GF7A	0	40V	90V	F11	F11	350V	140V	-20V		
V-310	6FO7A	25V	-0.5V	0.6V	F11	F11	265V	-95V	0.5V	F11	
V-101	6JE6	150V	-50V	F11	F11	F11	-50V	150V	30V		
V-102	3CU3	Adjusted for 25kv Normal Picture									
V-103	6DW4		400V		F11	F11		400V		H. V. Pb. 900V	
V-104	6BX4B	370V	F11			340V		F11			
V-106	CRT	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	
		F11	270V	160V	820V	820V	270V	150V			5kv
		PIN 11	PIN 12	PIN 13	PIN 14						
		270V	150V	820V	F11						

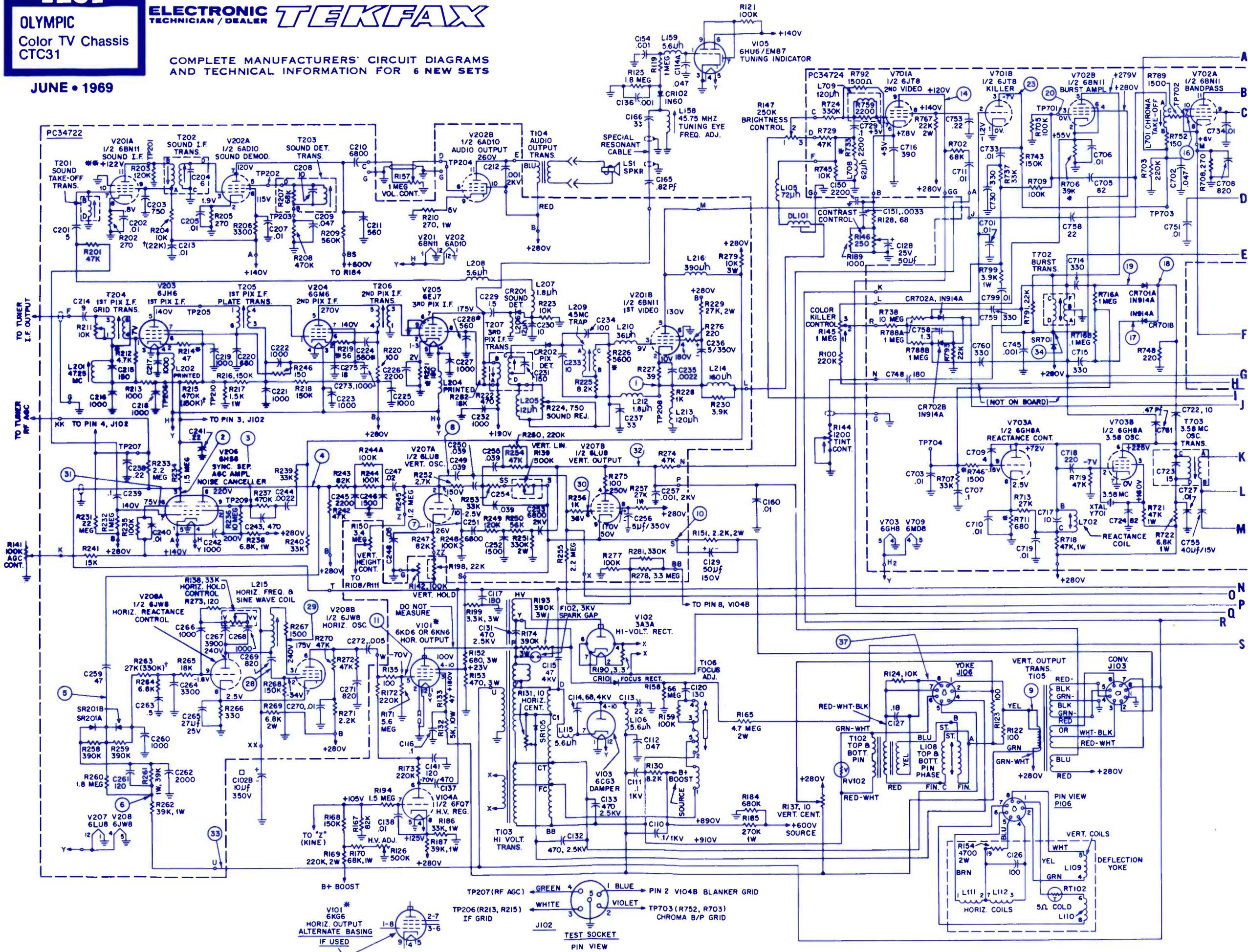
* Reading varies with T.V. signal strength.

SYMBOL	DESCRIPTION	PART NO.
C102	80/30/20µf	925686
C103	80/50/20/50µf	925586
C104	80/2/25µf	925650
C106	68µf 4K	929096
CB101	cir brkr	808252
DL201	delay lin	709011
IC201	integrated cir AFT	815215
L105	def yoke	708516
L107	filter choke	737057
L209	4.5MHz trap	708432
L221	AFT take-off coil	720576
L301	chroma take-off coil	708438
L305	reactance coil	708439
L307	horiz osc coils	708434
L309	horiz eff coil	708462
R101	vol cont 1M on-off switch (chassis 120926)	391035
R101	vol cont 1M on-off switch (chassis 120928)	391036
R102	tone/bright cont 2.5M/250K	390970
R105	10K 10w 10%	394260
R106	tone/bright cont 2.5M/250K	390970
R107	video peak/contr cont 50K/368	390963
R108	tint cont 1.2K	390965
R109	color cont 500Ω	390966
R111	vert/horiz hold cont 750K/35K	390962
R113	vert size cont 3.4M	390908
R114	vert lin cont 100K	390785
R118	13K 7w 10%	394255
R121	66M 4w 6KV	397176A

R126	vert horiz hold cont 750K/35K	390962
R140	video peaking/contr cont 50K/368	390963
RV102	thermistor	397187
RV103	voltage dep resistor	397186
RV104	voltage dep resistor	397191
R212	adj sound cont 10K	390954
R231	sound rej cont 750Ω	390983
R264	AGC cont 6K	390882
RV301	varistor	397171
R804	left rd/grn vert lin cont 150Ω	390795
R813	rd/grn horiz top lin cont 120Ω	390792
R815	vert blu tilt cont 60Ω	390793
SE102	sel rect (focus)	817123
SW103	AFT switch	510256
T101	audio output trans	734223
T103	focus adj trans	708461
T104	vert output trans	738207
T105	power trans	730157
T201	sound take-off trans	720558
T202	sound IF trans	720471
T203	sound quad trans	720472
T206	2nd video IF trans	720476
T208	video peak trans	708474
T301	bandpass trans	720515
T302	burst trans	720516
T303	2nd chroma trans	720575
T304	3.58MHz osc trans	720579
X301	horiz phase det	817126
Y301	3.58MHz crystal	817155







COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

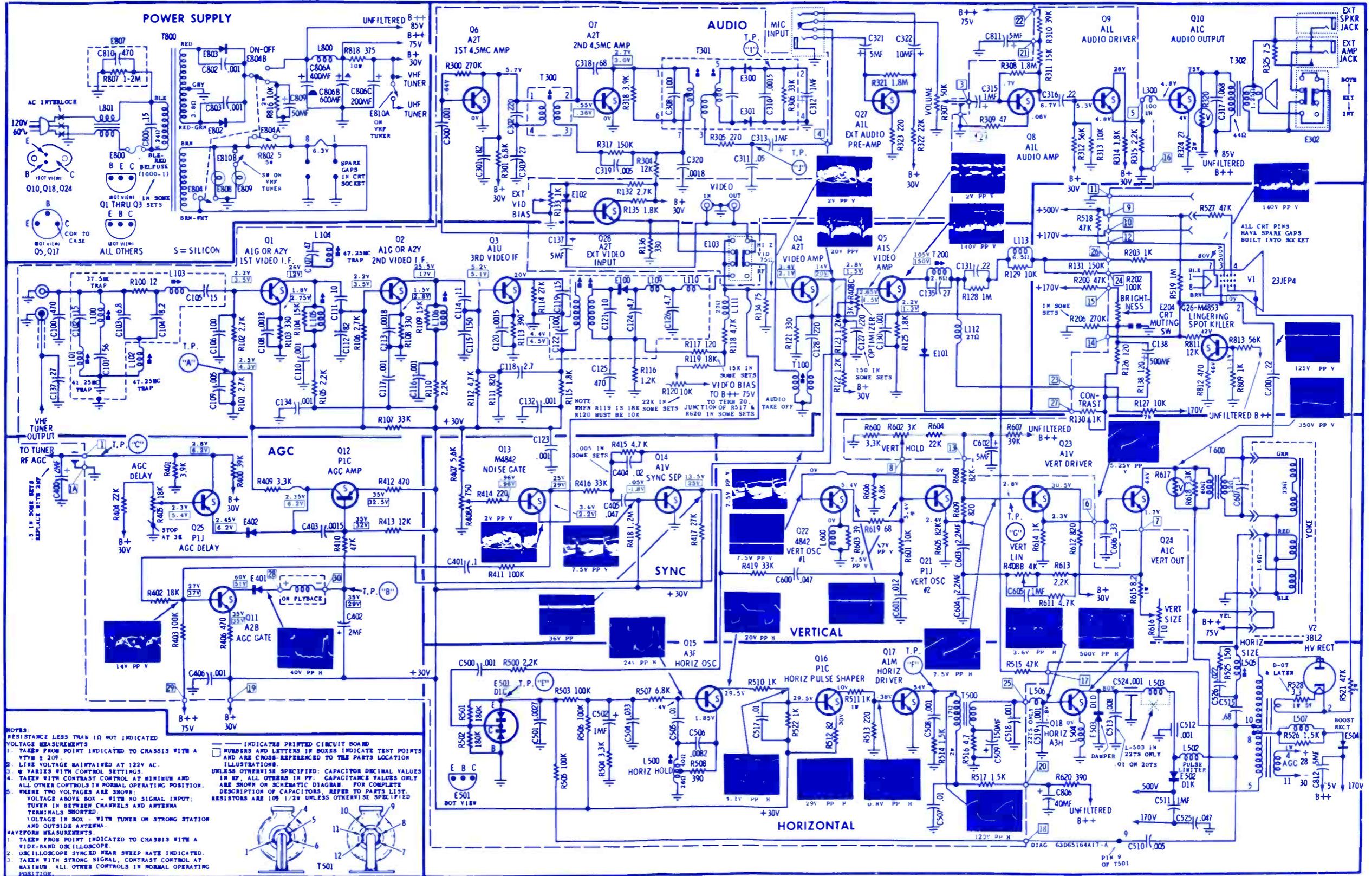
SYMBOL	DESCRIPTION	MOTOROLA PART NO.
C-806	400µ/125v 40µ/100v 600µ/100v 200µ/50v elec.	23C65807A33
E-102	diode, crystal video det.	48C65837A02
E-401	diode crystal AGC gate	48C67120A02

E-402	diode crystal AGC amp	48C6837A02
E-502	diode silicon D1K pulse limiter	48S134978
E-503	diode silicon D1D damper	48S134921
E-800	fuse	65C67985A03
E-804	switch on-off inclcs mtg brkt	1V68608A03
L-101	41.25MHz trap inclcs core	24D67754A23
L-104	1st IF & 47.25MHz trap inclcs C107 & core	24V68607A31
L-500	horiz osc inclcs core	24D68130A03

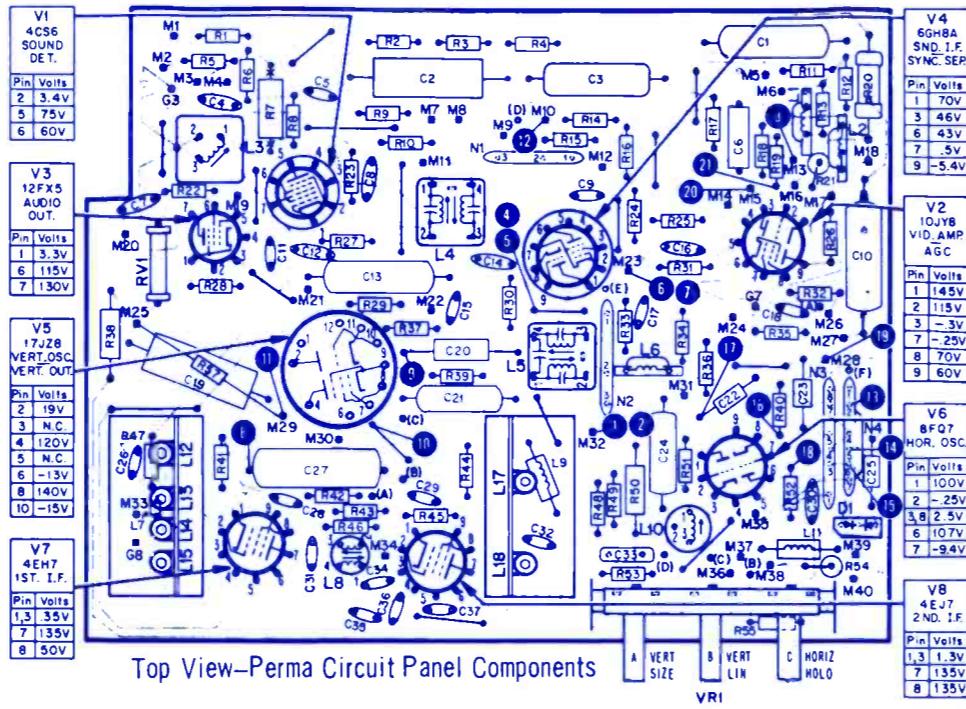
L-502	choke horiz suppressor	24D65947A86
L-505	horiz size	24D69163A01
L-506	horiz choke	24D69044A03
L-700	yoke, def 114deg	24D68523A03
L-800	choke filter	25D67554A12
Q-1	1st IF amp A2Y - use 48S134904	48S134981
Q-2	2nd IF amp A2Y - use 48S134904	48S134981
Q-3	3rd IF amp A1U	48S134932
Q-4	1st video amp A1T	48S134970
Q-5	video output A1A - use 48S137002	48S134927
Q-6	1st 4.5MHz amp A2T	48S134970
Q-7	2nd 4.5MHz amp A2T	48S134970
Q-8	audio amp A1L	48S134918
Q-9	audio driver A1L	48S134918
Q-10	audio output A1C	48S134900
Q-11	AGC gate A2B	48S134942
Q-12	AGC amp P1C	48S134910

Q-13	noise gate M4842 - use 48S134992	48S134842
Q-14	sync separator A1V	48S134933
Q-15	horiz osc A3F	48S134992
Q-16	horiz pulse shaper P1C	48S134910
Q-17	horiz driver A1M	48S134919
Q-18	horiz output A3H	48S134995
Q-21	vert discharge P1J	48S134843
Q-22	vert pulse inv M4842 - use 48S134992	48S134842
Q-23	vert driver A1V	48S134933
Q-24	vert output A1C	48S134900
Q-25	AGC delay P1J	48S134943
Q-26	spot killer M4853	48S134853
Q-27	microphone input A1L	48S134918
Q-28	video tape input A2T	48S134970
T-100	4.5MHz trap & ATO: inclcs core	24D68822A02
T-301	ratio det.	24V66550A80
T-302	audio output	25D67552A18

T-500	horiz driver	25D67440A03
	horiz output xformer	24D68804A07
	primary/sec winding only	24D67601A23
T-600	vert output	25D65840B23
T-800	power	25D68164A08
R-120	video bias 22K	18D68401A35
R-130	contrast: 1K	18D67637A70
R-133	external video bias: 1K	18D64401A21
R-202	bright: 100K	18D67637A69
R-307	volume: 50K	18D67562A10
R-405	RF AGC delay: 18K	18D66401A20
R-408	vert line: 4K noise gate 750Ω opt 3K	18D67678A05
R-602	vert hold: 3K	18D67637A68
R-616	vert size: 10 Ω	18D68447A02
R-320	varistor audio output	6C66263A16
R-617	varistor vert.	6C66263A16
	VHF tuner - DOPPT-411	



C41	---240µF 240V/200V B+180µF 5µF filter	30-2801-33
D1	---dual phase comp	34-8037-1
D2	---1N60C 2nd det.	34-8022-6
L3	---quad snd det.	32-4876-1
L4	---sound IF	32-4745-12
L5	---4.5MHz & STO	32-4888-14
L7	---tuner cplg.	32-4852-101
L10	---horiz stab.	32-4754-3
L12	---47.25MHz trap	32-4852-78
L13	---41.25MHz trap	32-4852-80
L17	---video det coil	32-4852-79
L19	---60MHz damp cath.	32-4112-83
N1	---retrace suppression	30-8024-9
N2	---vert integrator	30-8030-12
N3	---horiz osc.	30-8057-1
N4	---phase comp.	30-8035-2
RV1	---varistor 580V @10ma vert out.	33-1373-6
F1	---5.6Ω fusistor	33-1386-22
AOT	---audio output	32-10013-5
FC	---filter choke 6hy	32-10075-1
HO	---horiz out	32-10008-8
VO	---vert out	32-10012-9
VR1	---500K size 2M lin 80K horiz hold	33-5595-18
VR2	---500K vol & on-off sw.	33-5819-22
VR3	---250K bright.	33-5819-21
VR4	---15K contrast.	33-5819-20
VR5	---135K vert hold.	33-5819-23
	---yoke & cable assy.	78-12942-9
	---tuner-VHF TT-152B.	78-13827-2
	---tuner-VHF TT-164CS.	78-13579-10



COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

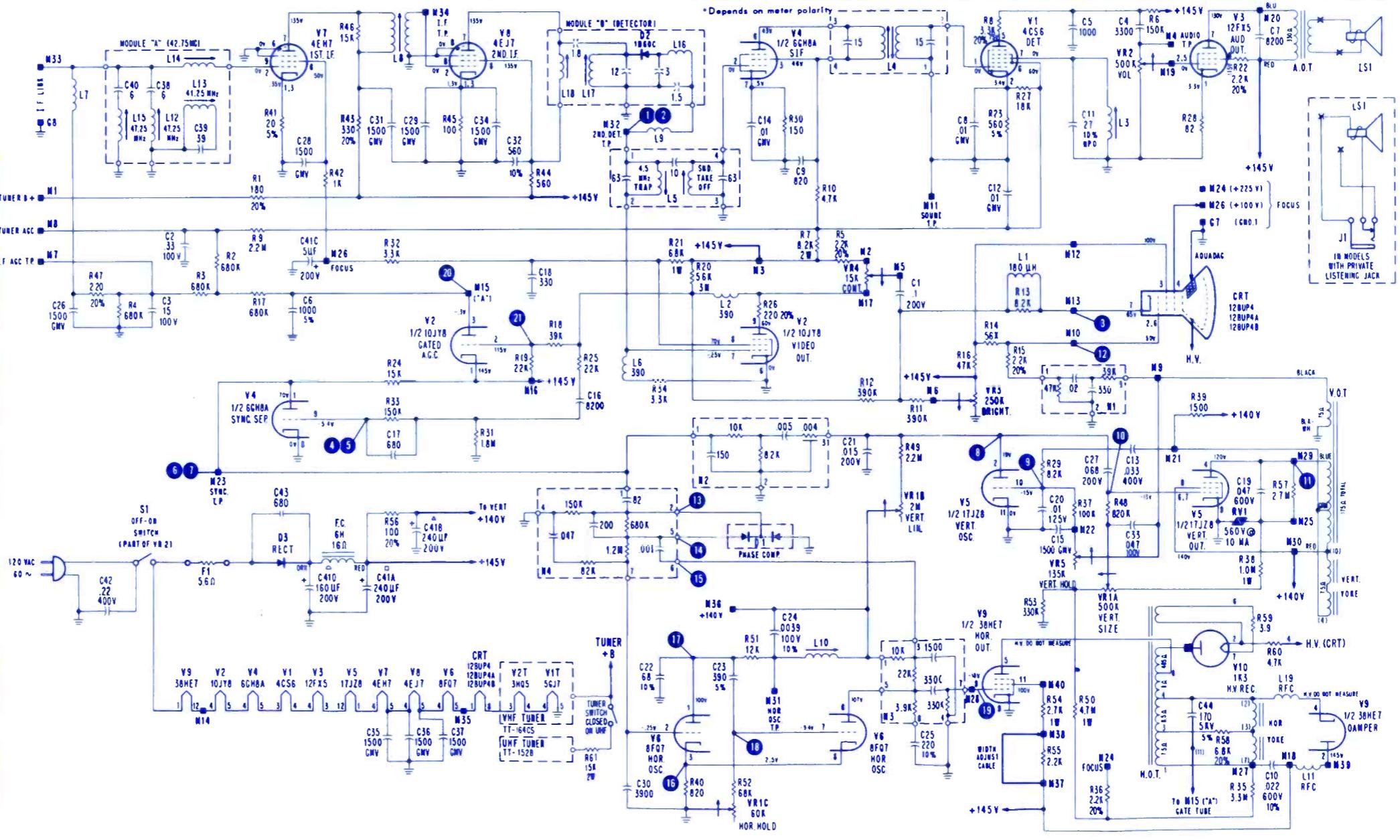
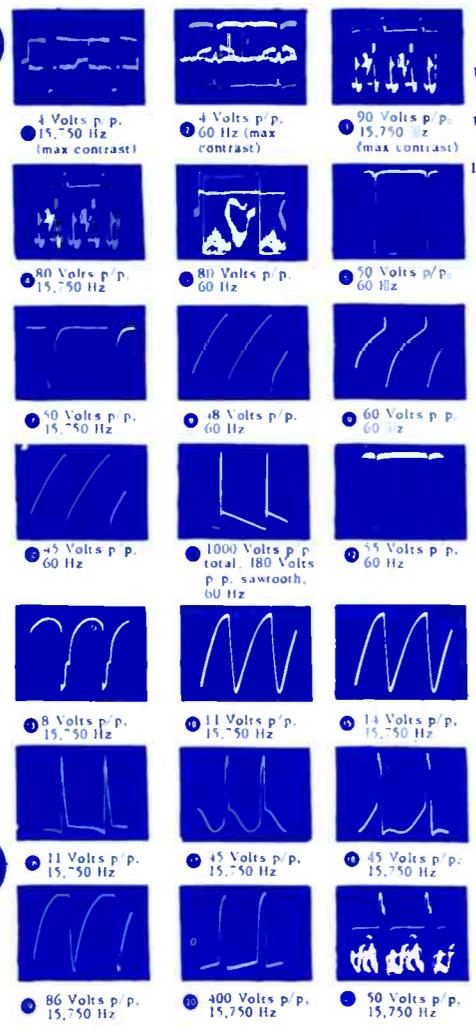
JUNE • 1969

RESISTANCE CHART

SYM-BOL	TUBE	FUNCTION	PIN NUMBERS												
			1	2	3	4	5	6	7	8	9	10	11	12	
V1	4CS6	Sound Detector	5.5Ω	560Ω	FIL.	FIL.	200K	12K	2.5Ω						
V2	10JY8	Video Amp. & Gated AGC	4.5K	25K	1.8M	FIL.	FIL.	0Ω	3.3K	14K	10K				
V3	12FX5	Audio Output	82Ω	0Ω	FIL.	FIL.	0Ω	16K	14K						
V4	6GH8A	Snd. IF & Sync. Sep.	15K	3Ω	13K	FIL.	FIL.	13K	150Ω	0Ω	1.9M				
V5	17JZ8	Vert. Osc.	FIL.	3.5M	INF.	14K	INF.	1.3M	1.3M	14K	0Ω	150K	0Ω	FIL.	
V6	8FQ7	Horiz. Osc.	23K	2.1M	820Ω	FIL.	FIL.	40K	120K	820Ω	0Ω				
V7	4EH7	1st Video IF	20Ω	600K	20Ω	FIL.	FIL.	0Ω	14K	26K	0				
V8	4EJ7	2nd Video IF	100Ω	0Ω	100	FIL.	FIL.	0Ω	14K	14K	0Ω				
V9	38EH7	Horiz. Out & Damp.	FIL.	13K	NC	8M	8M	NC	NC	0Ω	330K	NC	18K	FIL.	

OSCILLOSCOPE WAVEFORMS

These waveforms were taken with the receiver adjusted for an approximate output of 2.5V p/p at the video detector. Voltage readings taken with raster just filling screen and all controls set for normal picture viewing except for photos 1, 2 and 3 where contrast was at maximum. The voltages given are approximate peak-to-peak values. The frequencies shown are all readings taken with Model 1450 B&K Oscilloscope.



COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

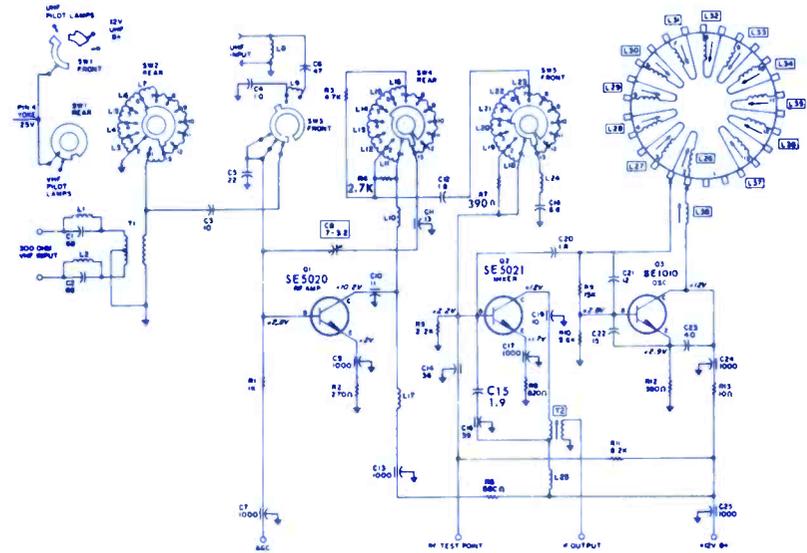
JUNE • 1969

SYMBOL DESCRIPTION SYLVANIA PART NO.

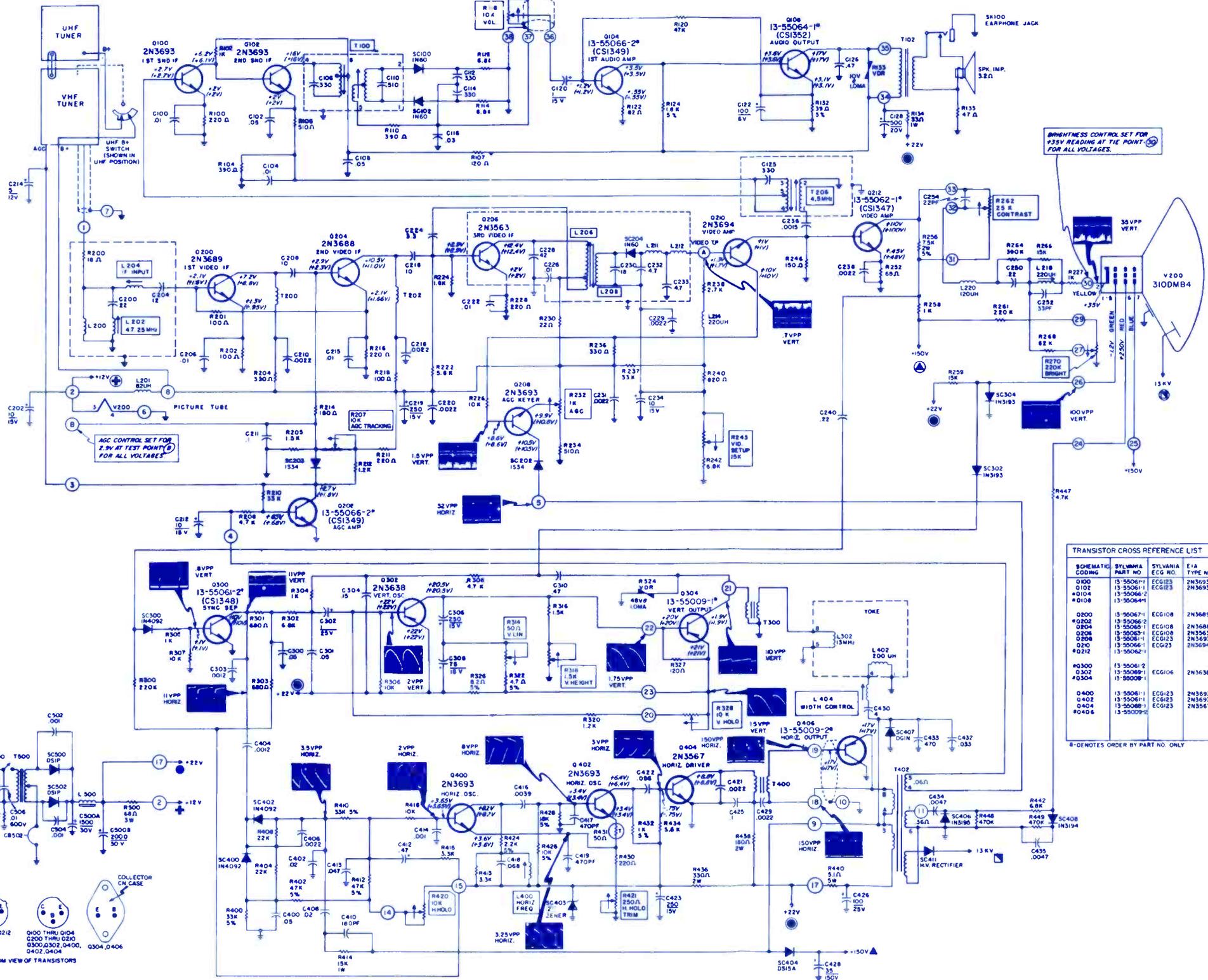
- C500---2 sec elect. 41-55012-1
- C500A---1500/30V 41-55012-1
- C500B---2000/30V 41-55012-1
- R133---VDR 38-55105-2
- R256---7.5K 2W 5%
- R324---VDR 38-55105-1
- R400---33K 5%
- R402---47K 5%
- R414---15K 1W
- R431---50 thermistor 38-55108-1

- L202---47.25MHz trap 57-55044-1
- L204---IF input 57-55045-1
- L211---filter 50-55040-1
- L214---220µh peak 50-15318-12
- L302---vert def. part of yoke
- L400---horiz freq. 50-55058-1
- L402---horiz def. part of yoke
- L404---width 50-55039-1
- T100---ratio det. 57-55057-1
- T102---audio output 58-55035-1
- T200---1st video IF 50-55043-1
- T202---2nd video IF 50-55043-1

- T208---sound take off 57-55058-1
- T300---vert output 58-55037-1
- T400---buffer 58-55038-1
- T402---high volt. 50-55033-1
- T500---power 55-55034-1
- R118---10K vol/on/off 37-55050-1
- R207---10K AGC track 37-55051-2
- R232---1K AGC 37-11832-12
- R243---15K video set-up 37-55051-3
- R282---25K cont. 37-55053-3
- R270---220K bright. 37-55053-2
- R314---50 vert lin. part of R232
- R318---1.5K vert height. part of R232
- R328---10K vert hold. 37-55053-1
- R420---10K horiz hold. 37-55007-1
- R421---250 horiz hold trimmer 37-55051-1
- CB502---cir brkr 29-17620-1
- SC302---diode vert blanking 13-55031-1
- yoke def. 51-55055-2
- tuner VHF 54-17907-3



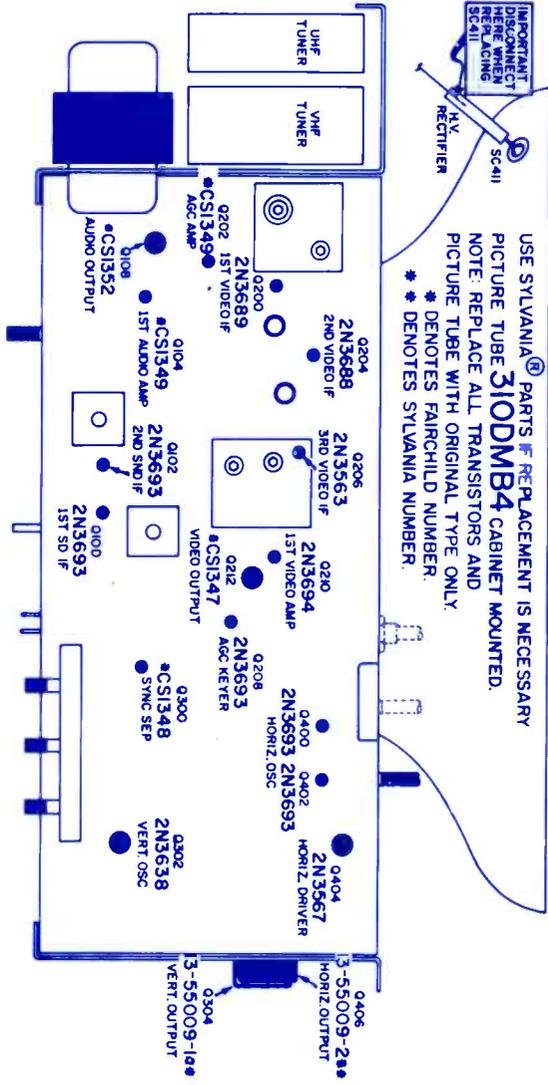
SCHEMATIC DIAGRAM VHF TUNER



TRANSISTOR CROSS REFERENCE LIST

SCHEMATIC CODING	SYLVANIA PART NO.	SYLVANIA ECG NO.	EIA TYPE NO.
Q100	13-55061-1	ECG123	2N3693
Q104	13-55062-2	ECG123	2N3693
Q108	13-55064-1		
Q200	13-55067-1	ECG108	2N3689
Q202	13-55066-2	ECG108	2N3689
Q204	13-55060-1	ECG108	2N3689
Q206	13-55061-1	ECG123	2N3693
Q210	13-55066-1	ECG123	2N3694
Q212	13-55062-1		
Q300	13-55061-2		
Q302	13-55089-1	ECG106	2N3638
Q304	13-55089-1		
Q400	13-55061-1	ECG123	2N3693
Q402	13-55061-1	ECG123	2N3693
Q404	13-55089-1	ECG123	2N3567
Q406	13-55009-2		

* DENOTES ORDER BY PART NO. ONLY



TRANSISTOR LAYOUT DIAGRAM

USE SYLVANIA PARTS IF REPLACEMENT IS NECESSARY
 PICTURE TUBE 310DMB4 CABINET MOUNTED.
 NOTE: REPLACE ALL TRANSISTORS AND PICTURE TUBE WITH ORIGINAL TYPE ONLY.
 * DENOTES SYLVANIA NUMBER.



BOTTOM VIEW OF TRANSISTORS



OVERHAUL

\$9.75

GUARANTEED for 1 Year

OVERHAUL \$9.75 • REPLACEMENT TUNERS... \$10.45

Nine-seventy-five buys you a complete tuner overhaul—including parts (except tubes or transistors)—and *absolutely no hidden charges*. All makes, color or black and white. UV combos only \$15.

Guaranteed means a full 12-month warranty against defective workmanship and parts failure due to normal usage. That's 9 months to a year better than others. And it's backed up by the only tuner repair service authorized and supervised by the world's largest tuner manufacturer—Sarkes Tarzian, Inc.

Four conveniently located service centers assure speedy in-and-out service. All tuners thoroughly cleaned, inside and out... needed repairs made... all channels aligned to factory specs, then rushed back to you. They look—and perform—like new.

SEND ORDERS FOR UNIVERSAL AND CUSTOMIZED REPLACEMENT TUNERS TO OUR OFFICE IN INDIANAPOLIS.

Prefer a universal replacement? Sarkes Tarzian will give you a universal replacement for only \$10.45. This price is the same for all models. The tuner is a new tuner designed and built specifically by Sarkes Tarzian for this purpose. It has memory fine tuning—UHF plug-in for 82 channel sets—universal mounting—hi-gain—lo-noise.

ORDER TUNERS BY PART NUMBER, AS FOLLOWS:

Part #	Intermediate Frequency	AF Amp Tube	Osc. Mixer Tube	Heater
MFT-1	41.25 mc Sound 45.75 mc Video	6GK5	6LJ8	Parallel 6.3V
MFT-2	41.25 mc Sound 45.75 mc Video	3GK5	5LJ8	Series 450 MA
MFT-3	41.25 mc Sound 45.75 mc Video	2GK5	5CG8	Series 600 MA

Prefer a customized replacement tuner? The price will be \$18.25. Send us the original tuner for comparison purposes, also TV make, chassis and model numbers.



TUNER SERVICE CORPORATION FACTORY-SUPERVISED TUNER SERVICE

MIDWEST	817 N. PENNSYLVANIA ST., Indianapolis, Indiana (Home Office)	TEL: 317-632-3493
EAST	547-49 TONNELE AVE., Jersey City, New Jersey	TEL: 201-792-3730
SOUTH-EAST	938 GORDON ST., S. W., Atlanta, Georgia	TEL: 404-758-2232
WEST	SARKES TARZIAN, Inc. TUNER SERVICE DIVISION 10654 MAGNOLIA BLVD., North Hollywood, California	TEL: 213-769-2720

WATCH FOR NEW CENTERS UNDER DEVELOPMENT

\$44,000,000

WILL BUY 1,000,000 TRIPLETT 310 VOM'S
BUT YOU ONLY NEED ONE...AT \$44⁰⁰ THAT'S A BARGAIN



MODEL 310
World's Largest Selling
Volt-Ohm-Milliammeter
(SHOWN ACTUAL SIZE)



MODEL 310-C
Volt-Ohm-Milliammeter

- 1** HAND SIZE V-O-M WITH PROVISION FOR ATTACHING AC CLAMP-ON AMMETER.
- 2** 20,000 OHMS PER VOLT DC SENSITIVITY; 5,000 AC.
- 3** ONE SELECTOR SWITCH MINIMIZES CHANCE OF INCORRECT SETTINGS AND BURNOUTS.

310-C PLUS FEATURES

- 1** Hand size V-O-M with provision for attaching AC Clamp-on Ammeter.
- 2** 15,000 OHMS per volt AC sensitivity; (20,000 DC same as 310).
- 3** Single fully enclosed Lever Range Switch, plus DC Polarity Reversing.

MODELS 100 AND 100-C

Comprehensive test sets. Model 100 includes: Model 310 V-O-M, Model 10 Clamp-on Ammeter Adapter; Model 101 Line Separator; Model 379 Leather Case; Model 311 leads. (\$83.20 Value Separate Unit Purchase Price.)

MODEL 100 — U.S.A. User Net. \$78.00

MODEL 100-C — Same as above, but with Model 310-C, Net. \$88.00



SELF-SHIELDED Bar-Ring instrument; permits checking in strong magnetic fields. FITTING INTERCHANGEABLE test prod tip into top of tester makes it the common probe, thereby freeing one hand. UNBREAKABLE plastic meter window. BANANA-TYPE JACKS—positive connection and long life.

Model 310—\$44.00

Model 310-C—\$56.00

Model 369 Leather Case—\$4.20

All Prices are Suggested U.S.A. User Net, Subject to Change

THE WORLD'S MOST COMPLETE LINE OF V-O-M's • AVAILABLE FROM YOUR TRIPLETT DISTRIBUTOR'S STOCK



DON'T FORGET TO ASK 'EM "WHAT ELSE NEEDS FIXING?"

TRIPLETT ELECTRICAL INSTRUMENT COMPANY, BLUFFTON, OHIO 45817

ELECTRONIC TECHNICIAN / DEALER

WORLDS LARGEST ELECTRONIC TRADE CIRCULATION

JUNE 1969 • VOL. 89 NO. 6

**HUGH "SCOTTY"
WALLACE**
Publisher

PAUL DORWEILER
Editor

JOSEPH ZAUHAR
Technical Editor

MORTON WARNOW
Field Editor

DONNA BUTLER
Production Editor

BOB ANDRESEN
Art Editor

LILLIE PEARSON
Circulation Manager

JOHN KESSLER
Manager, Reader Services

JUDI LeMAY
Advertising Production

OFFICES

71 Vanderbilt Ave.
New York, N.Y. 10017
Phone: (212) 686-2200
Telex: 01-26286

43 East Ohio St.
Chicago, Ill. 60611
Phone: (312) 467-0670
Telex: 02-53549

1901 West 8th Street
Los Angeles, Calif. 90057
(213) 483-8530

Harbrace Building
Duluth, Minn. 55802
Phone: (218) 727-8511
Telex: 02-94417

MARKETING REPRESENTATIVES

HUGH "SCOTTY" WALLACE
Chicago: (312) 467-0670

ALFRED A. MENEGUS
New York: (212) 686-2200

DONALD D. HOUSTON
Los Angeles: (213) 483-8530

ROBERT UPTON
Tokyo, Japan
I.P.O., Box 5056

HARBACE PUBLICATIONS, INC.

JAMES MILHOLLAND, JR.
President

DEAN MYHRAN
Executive Vice President

RICHARD MOELLER
Treasurer

LARS FLADMARK
Senior Vice President

HARRY RAMALEY
Vice President

BEN MARSH
Vice President

JAMES GHERNA
Art Director

WILLIAM SWAIN
Director of Marketing Services

DOUG HEDIN
Ad Production Manager

35 TEKLAB REPORT

This month's report discusses Setchell Carlson's all new hybrid color TV receiver U809 and U810 chassis, complete with circuit description and schematics

40 TV TUNER SERVICING

Many technicians are gun-shy of that little box called the tuner—and rightly so. It takes a certain amount of know-how and equipment to properly service one. This article tells you how to do basic cleaning tasks and what to look for in deciding whether or not a tuner is at fault

44 POST MARKER COLOR TV SWEEP ALIGNMENT

Technicians will find part one of this article of special interest as it explains the application of the post marker sweep instrument operating procedures as well as waveform examples indicating both normal and poor alignment in various circuits

48 SOLID STATE HORIZONTAL DEFLECTION SYSTEMS

The latest deflection circuit design using all solid state devices is explained in this timely feature which describes the actual circuit operation in an RCA-CTC40 chassis

52 SERVICE-DEALER PROMOTES TECHNICIAN TRAINING

One way to overcome the technician shortage is to help start a program for training them in your own area as explained by an enterprising group of Texas service-dealers in this month's Dealer Fax profile

55 TESTLAB REPORT

In this month's Testlab report our Electronic Technician/Dealer lab technicians review the new Darcy DM330 digital multimeter and the B&K all solid state 1077 television analyst

22 EDITOR'S MEMO

24 NEW AND NOTEWORTHY

26 LETTERS TO THE EDITOR

30 BOOK REVIEWS

32 TECHNICAL DIGEST

58 DEALER SHOWCASE

62 COLORFAX

68 NEW PRODUCTS

70 NEWS OF THE INDUSTRY

82 AD INDEX

COVER

The lovely Miss Arlington Texas promotes goodwill for her home town and reflects the goodwill of the local service-dealers such as West Part TV who show that no matter where the service call, they are ready.

TEKFAQ • 16 PAGES OF THE LATEST SCHEMATICS • GROUP 202

AIRLINE: TV Models GHJ-14829A, GHJ-14829B, GHJ-14859B

DUMONT: Color TV Chassis 120926, 28

MOTOROLA: TV Chassis TS613 Series

OLYMPIC: Color TV Chassis CTC31

PHILCO-FORD: TV Chassis 19L21

SYLVANIA: TV Chassis A04-3



HARBACE PUBLICATIONS, INC.

A subsidiary of Harcourt, Brace & World, Inc.

ELECTRONIC TECHNICIAN/DEALER is published monthly by Electronic Technician, Inc., Harbrace Building, Duluth, Minnesota 55802, a subsidiary of Harcourt, Brace & World, Inc. Subscription rates: One year \$5, two years \$8, three years \$10, in the United States and Canada. Other countries: One year \$9, two years \$14, three years \$18. Single copies 75¢ in the United States and Canada; all other countries: \$2.00. Second class postage paid at Dansville, New York, and at additional mailing offices. Copyright 1969 by Harbrace Publications, Inc.

POSTMASTER: Send Form 3579 to ELECTRONIC TECHNICIAN/DEALER, Harbrace Building, Duluth, Minnesota 55802.

Imagine
a doctor
without a
stethoscope



Imagine
an engineer
without a
slide rule



Imagine
a professional
service technician
without a Sencore
Mighty Mite V.



STANDARD OF A PROFESSION!

The Mighty Mite has become the standard of the industry with over 50,000 used daily by competent professional servicemen from coast to coast. The Mighty Mite checks them all; tubes large and small . . . and it checks them critically too. 100 megohm grid leakage sensitivity, individual tube element shorts test and cathode emission test at full rated current make the Mighty Mite really tough. It's tough on tube tests, tough in appearance with vinyl case and cover, and mighty tough on competition. But, it's not tough on your pocketbook at only

See your Sencore distributor today.
He has the TC142 Mighty Mite in stock.

\$84.50



SENCORE

NO. 1 MANUFACTURER OF ELECTRONIC MAINTENANCE EQUIPMENT
426 SOUTH WESTGATE DRIVE, ADDISON, ILLINOIS 60101

. . . for more details circle 130 on postcard

The Night People

The seemingly unanswered cries of shop owners for more technicians, and the technician's laments about money, are not exactly parallel problems. In fact, being "underpaid" doesn't appear to bother some technicians.

The procedure often referred to as "moonlighting" has a new twist. A service shop sends a technician on a house call. It turns out to be an expensive TV repair problem. The set owner, feeling a twinge in the pocketbook, wishes out loud that there was a less expensive way to enjoy his favorite color program.

The technician mentions that he sometimes repairs sets at home in his spare time. Since his overhead is low, the repair cost will be greatly reduced. To many a man with a sick color set, a family intent on watching TV and a moth-filled pocketbook, it's a deal. After all, the technician must be reliable; he works for a reputable service shop. If it means a smaller repair cost and (often) a faster job, why not?

The customer informs the shop owner that the repair is too costly and he will wait awhile. The shop owner may realize what's happening, but what can he do about it? Technicians claim that they need night work to subsidize their low salary, and shop owners take a soft attitude. They can't afford to lose the technician—some even feel lucky if the technician uses his own rather than the shop facilities. The situation is, of course, a product of increased service work and fewer men to do the job. The money is merely the clincher.

In today's TV business, a service technician might earn as much as \$100 a week in home repairs—most of it picked up through shop contacts. As one technician bluntly put it, "If I get fired, I'll stay home and earn as much as I do at the shop."



Paul A. Rovinsky

How to write a great ad.

Tell people what you will do for them. How you're different. This is most important.

Your services are more important than your name.

Be under the proper headings so people can find you fast. Maybe you should be under both "Heating" and "Plumbing."

Tell people about your special services...repairs...rentals.

Use your logotype to gain recognition. Give facts about your qualifications, reliability, etc.

List products you carry.

Tell how easy it is to deal with you... credit, parking, hours, delivery.

**Emergency Service
Day or Night**

BARRY'S HEATING & PLUMBING

Since **BHP** 1921

**COMMERCIAL,
INSTITUTIONAL, RESIDENTIAL,
INSTALLATION & REPAIRS**

<p><u>Complete line of:</u></p> <ul style="list-style-type: none"> • Kitchens • Laundries • Sewage Systems • Water Pumps • Heating Systems • Pipes and Drains 	<ul style="list-style-type: none"> ★ Master Lic. #103241 ★ References ★ Estimates ★ Delayed Payment Plans ★ Ample Parking
---	--

phone **555-2368**

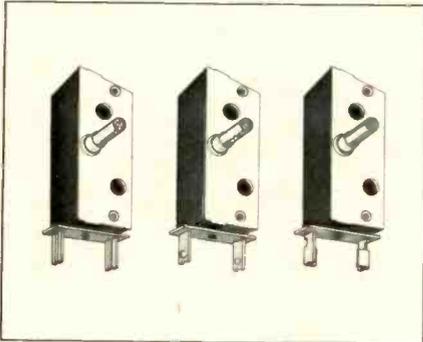
77 Locust Lane. (Between Main and Central, one mile from RR. Station).

Give telephone number and address, of course; and if you're hard to locate, directions and perhaps a map.

There...you've written a great ad. Now place it where people will be looking for you...in the Yellow Pages.



... for more details circle 101 on postcard



NEW PRODUCTS

Circuit Breaker/Fuse 700

Adaptable to chemical or amp fuse socket

Introduced are circuit breakers with amp fuse pins. In TV repair involving a blown chemical or amp fuse, several fuses can be blown before the trouble is found. This can be expensive and if a jumper is used, it can cause extensive damage. The FA fuse, which fits in the same socket as the chemical or amp fuse, can eliminate this problem because it can be reset as often as needed, or until the cause of breakdown is found. The FA fuse can be left in the set after the repair is made. Model numbers FA350-1, FA1000-1 and FA2000-1 have the same carry and break currents as the chemical fuses with the same model number. Workman.

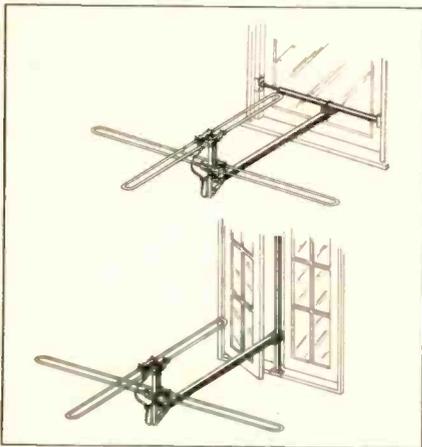


DEALER SHOWCASE

Indoor Clock-Sign 701

Internal illumination and built-in clock give additional life and utility

An animated indoor clock-sign is introduced to help dealers identify their home products. Dealer identification is given added impact by a "moving" home products logo and a stylized home and antenna. Bands of red, blue, green and white (suggesting color TV reception) flow from the antenna into the home. Internal fluorescent illumination and a built-in electric clock give the sign additional "life" and utility. Dealers add their individual messages to the signs using acetate letter sets inserted in a track on the panel. The sign, 15 x 37 in. in size, can be set up, suspended or wall-mounted. Jerrold.



NEW PRODUCTS

FM Window Antenna 702

Solves reception problems where a rooftop antenna is prohibited

Announced is a window-mounted FM turnstile antenna, a solution to reception problems in apartment buildings and other locations where a rooftop antenna cannot be installed. The all-direction antenna is designed for reception over the full FM band from 88 to 108 MHz without necessity for rotation. The two folded dipoles are matched with a quarter wave phasing stub for optimum gain and an approximately circular pick-up pattern. The all-aluminum antenna has a gold corrosion-proof finish and carries a list price of \$16.95. The antenna can be mounted either horizontally or vertically to fit any type of window with a span up to 42in. For wider or higher windows, two extension mount bars are available: the Model FCW-18, which extends the mounting an additional 18in. and carries a list price of \$2.97, and the Model FCW-30 which extends the mounting an additional 30in. and has a list price of \$3.25. Finney.

FOR MORE
DEALER SHOWCASE
SEE PAGE 58

FOR MORE
NEW PRODUCTS
SEE PAGE 68

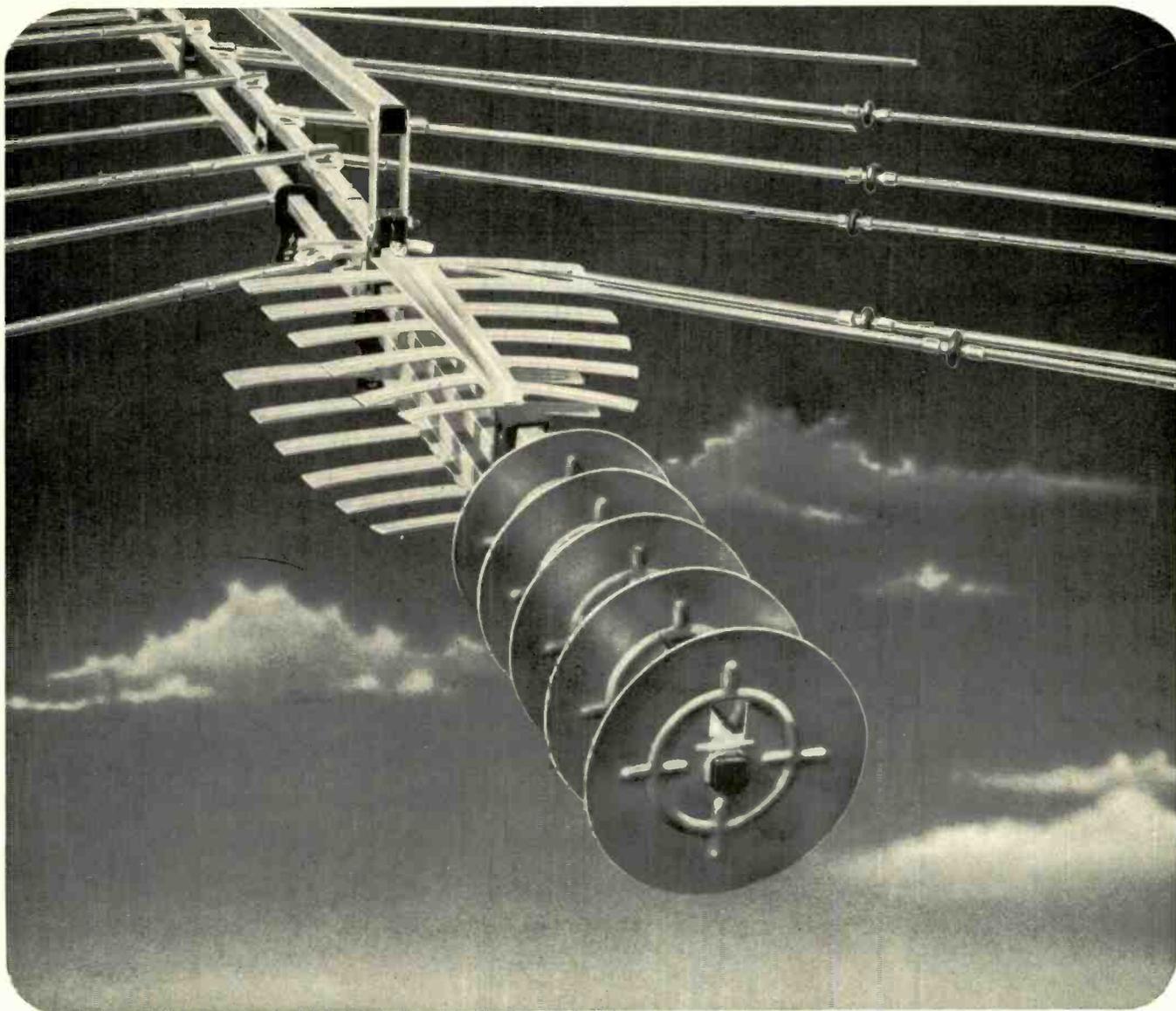


DEALER SHOWCASE

Component Merchandiser 703

Self-selling display holds 53 items

A new point-of-purchase display merchandiser offers a complete line of blister-packaged connector components. The new display contains 53 different items—from microphone connectors to lightning arrestors— attracting the customer's attention as well as telling the complete product story. Colorful, informative and to the point, it provides maximum component visibility and clean over-all package appearance. Amphenol.



There is a difference.

When our engineers designed our LPV Log Periodic antennas, they added something that made our antennas really different:

1. **Patented capacitor-coupled log periodic-V dipoles** that operate on both the fundamental *and harmonic* modes for higher gain and front-to-back ratios than other VHF antennas with more elements.

2. **Log Periodic trapezoid drivers** for amazingly high (but uniform) frequency response on all UHF channels.

3. **Radar-type disc-on-rod director system** that vastly increases signal capture across entire UHF band. Rejects multi-path reflections.

Is it any wonder JFD Color Laser and LPV Log Periodic TV antennas outperform antennas larger in size and number of elements?

Is it any wonder why professional installers who count on antenna gain (not the element numbers game) prefer JFD — the *scientifically* designed antenna with the college education?

Call your JFD distributor and see the difference in spectacular color and black-and-white.

And while you're at it, ask him about our versatile new solid state Program Center amplifier-distribution systems.

JFD[®]

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081, 2,985,819, 3,011,152, 3,108,293, 3,150,376, 3,210,767, RE 25,740 AND ADDITIONAL PATENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CO. UNDER LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION.

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,955,287 AND 3,015,871 AND ADDITIONAL PATENTS PENDING.

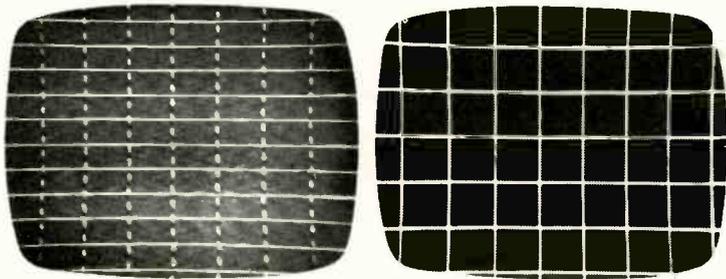
JFD ELECTRONICS CORP.

15th Avenue at 62nd Street, Brooklyn, N. Y. 11219

JFD International, 64-14 Woodside Ave., Woodside, N. Y. 11377 JFD Canada, Ltd., Toronto, Ontario, Canada
JFD de Venezuela, S.A., Avenida Los Haticos 125-97, Maracaibo, Venezuela

... for more details circle 119 on postcard

Make the wiggly test.



On the left, a pattern* produced by an ordinary color bar generator. On the right, the equivalent pattern* produced by Leader's LCG-388. Perfectly stable, the instant you turn the power on.

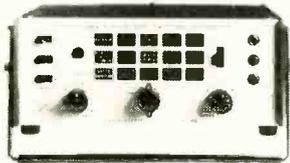
Flip the switch, and you can select from 15 patterns. Including the single dot, single cross, single horizontal and single vertical.

The magic is in Leader's binary counters and gates. Nobody else has them, and what a difference they make.

\$149.00, and you can make the wiggly test at your distributor's. For the one nearest you, just drop a line or call.

*As photographed.

Seeing is believing.



LEADER INSTRUMENTS CORP.

24-20 Jackson Avenue, Long Island City, N. Y. 11101/(212) 729-7411

... for more details circle 120 on postcard

New Coil Catalog

Catalog 170 gives specifications, prices and installation diagrams for the industry's most complete line of RF and IF coils.

Exact replacements are cross referenced for all known color and black and white TV sets, home radios and car radios.

New Replacement Directory

New Plant Address

J. W. MILLER COMPANY
19070 REYES AVENUE ■ P.O. BOX 5825
COMPTON, CALIFORNIA 90224



See your local distributor for your copy of Catalog 170

... for more details circle 123 on postcard

ET/D

**LETTERS
TO THE EDITOR**

Thanks

I am writing in regard to a letter from Arthur Clendenon of Tennessee which appeared in the October 1968 issue of *ELECTRONIC TECHNICIAN/DEALER*. His letter said he would give back copies of *ELECTRONIC TECHNICIAN/DEALER* to anyone who needed them. I went to Mr. Clendenon to get the magazines and told him I would write and let you know so you could thank the many readers who wrote him. I read and enjoy every issue.

WILLIAM R. ROSE

Kingsport, Tenn.

Multiple Ghosts

I am having a problem in my area with multiple ghosts. I am located in the flat lands of Louisiana right in the middle of two grain elevators. These buildings are approximately 300 ft. high and .4 mile apart. I have tried ghost killers, high and low gain antennas of every shape and form to no avail. I would appreciate any help from your readers or antenna manufacturers. I have approximately 150 customers with the same situation and if I could solve the problem, I could sell 150 antennas. I have been a faithful reader of *ELECTRONIC TECHNICIAN/DEALER* for years and enjoy it very much. Keep up the good work.

SALVADOR A. PORTERA, JR.

Jr.'s Sales & Service
102 Lorraine Ave.
Destrehan, La. 70047

Hot Chassis

Without going into the details of my near tragedy, I found out that a piece of equipment with a transformer power supply had a "hot" chassis. I was working on one of the better, higher-priced CB transceivers, but it could have been any brand. The unit was blowing fuses and yet B+, filaments and the 110vac circuits tested normal. The chassis was hot through the transformer laminations which provided a contact between the primary and secondary. The oxide and shellac on the laminations isolated the core from the chassis and caused the unit to act like an autotransformer. When I attempted to attach the antenna coaxial connector, I got the full jolt—certainly more than 110vac!

M. J. CAPRIOLI

Phoenix, Ariz.



ARC ENEMY

**SPRAGUE TYPE 302C
SPARK GAPS** keep
transient voltage surges
(caused by momentary
arcing or shorting) from
damaging TV picture
tubes. They're in stock
at your Sprague
distributor now.

P.S. Don't forget to ask 'em,
"What else needs fixing?"



'Sprague' and '2' are registered trademarks of the Sprague Electric Co.

FAST

COMPLETE SERVICE ON ALL MAKES OF TV TUNERS

Maximum Time In Shop 24 Hrs.

(90 Day Warranty)
**(WE SHIP C.D.D.)
YOU PAY SHIPPING
\$9.95**



Black &
White
or Color

VHF or
UHF

UV Combo's \$16.50

Price includes all labor and parts except Tubes, Diodes & Transistors. If combotuner needs only one unit repaired, disassemble and ship only defective unit. Otherwise there will be a charge for a combotuner. When sending tuners for repair, remove mounting brackets, knobs, indicator dial, remote line tuning arrangements, and remote control drive units.

EFFECTIVE AUGUST 1, 1989

All tuners must have remote control units and/or mounting brackets removed before tuner can be cleaned and repaired. If these accessories are left on tuner, there will be a \$2.00 charge for disassembly and reassembly.



All tuners are serviced by **FACTORY TRAINED TECHNICIANS** with years of experience in this specialized field. All tuners are **ALIGNED TO MANUFACTURER'S SPECIFICATION** on crystal controlled equipment and air checked on monitor before shipping to assure that tuner is operating properly.

GEM CITY TUNER REPAIR SERVICE

Box 6D Dabel Station
2631 Mardon Drive
Dayton, Ohio 45420

... for more details circle 117 on postcard

ET/D

LETTERS TO THE EDITOR

Wants Back Issues

I am interested in obtaining back issues of **ELECTRONIC TECHNICIAN/DEALER** starting from the first issue up to February 1963. No doubt one of your subscribers has these copies. If so, I would appreciate hearing from any reader who is willing to part with his back copies if he would write and advise me of the cost.

ANTONIO HERNANDEZ L
c/o La Villa de Paris
Nogales, Ariz. 85621

Readers' Aid

I need a schematic and instruction book for a Triplet Model 3434 TV-FM marker signal generator. I have written the manufacturer and was told the information is not available. I will gladly defray the cost if any **ELECTRONIC TECHNICIAN/DEALER** reader can supply me with the original or copies.

AVON BAUMAN

Bauman & Sons TV Service
3255 Mangum Lane S.W.
Atlanta, Ga. 30311

Schematics Not Available

Thank you for your help, but the reply from Candle American, Inc., was negative. I would appreciate help from your readers. My problem is poor sync causing pulling and rolling. I would like to know if any modifications were made. The set is a Candle Model MT-510.

SSGT EDWARD J. CORS

AF17360777
Box 575
57F15
FPO 09571, N.Y.

Editor's Note

Candle America, Inc., indicated in its reply to SSGT Cors that schematics are no longer available for Models MT-510 and MT-510A Candle and Valiant brands of micro TV. The supply was exhausted a year ago and since the firm discontinued TV manufacturing over five years ago, it will not have diagrams reprinted. However, Candle indicates that if the TV set has not been tampered with, one of the company's service technicians will repair it. Further information on this can be obtained by writing T. Kikuchi, Candle Corp. of America, 1457 Venice Blvd., Los Angeles, Calif. 90006 ... Ed.

Who needs a tuner wash? Save your money and use **QUIETROLE**

The product that cleans while it lubricates. Zero effect on capacity and resistance. Harmless to plastics and metals. Keeps color and black and white on the beam. Non-flammable.



manufactured by
QUIETROLE CO.
Spartanburg, South Carolina

... for more details circle 126 on postcard

WAVE FORM ANALYSIS & PEAK FM MODULATION



all for LESS MONEY!

The Lampkin 205A FM Modulation Meter accurately indicates PEAK modulation on mobile transmitters. To shoot trouble visually, use your own general-purpose oscilloscope at the 205A rear jack output. This makes a low-cost, highly effective test combo — and a well-rounded shop — all for less money.

Lampkin pioneered the PEAK voltmeter for FM modulation indication.

Like to see the complete specs? Mail coupon today!

Use this coupon for FREE booklet "How To Make Money in Mobile-Radio Maintenance" and information on Lampkin meters.

Name _____
Address _____
City _____ State _____ Zip _____

LAMPKIN LABORATORIES, INC.
Div. II, Bradenton, Fla. 33505

The prize you get depends on how many tubes you buy.

Every time you buy 20 Sylvania receiving tubes from your distributor, he gives you a certificate called a "Bright Buck," which works like a trading stamp. When you've collected enough Bright Bucks, you turn them in for prizes.

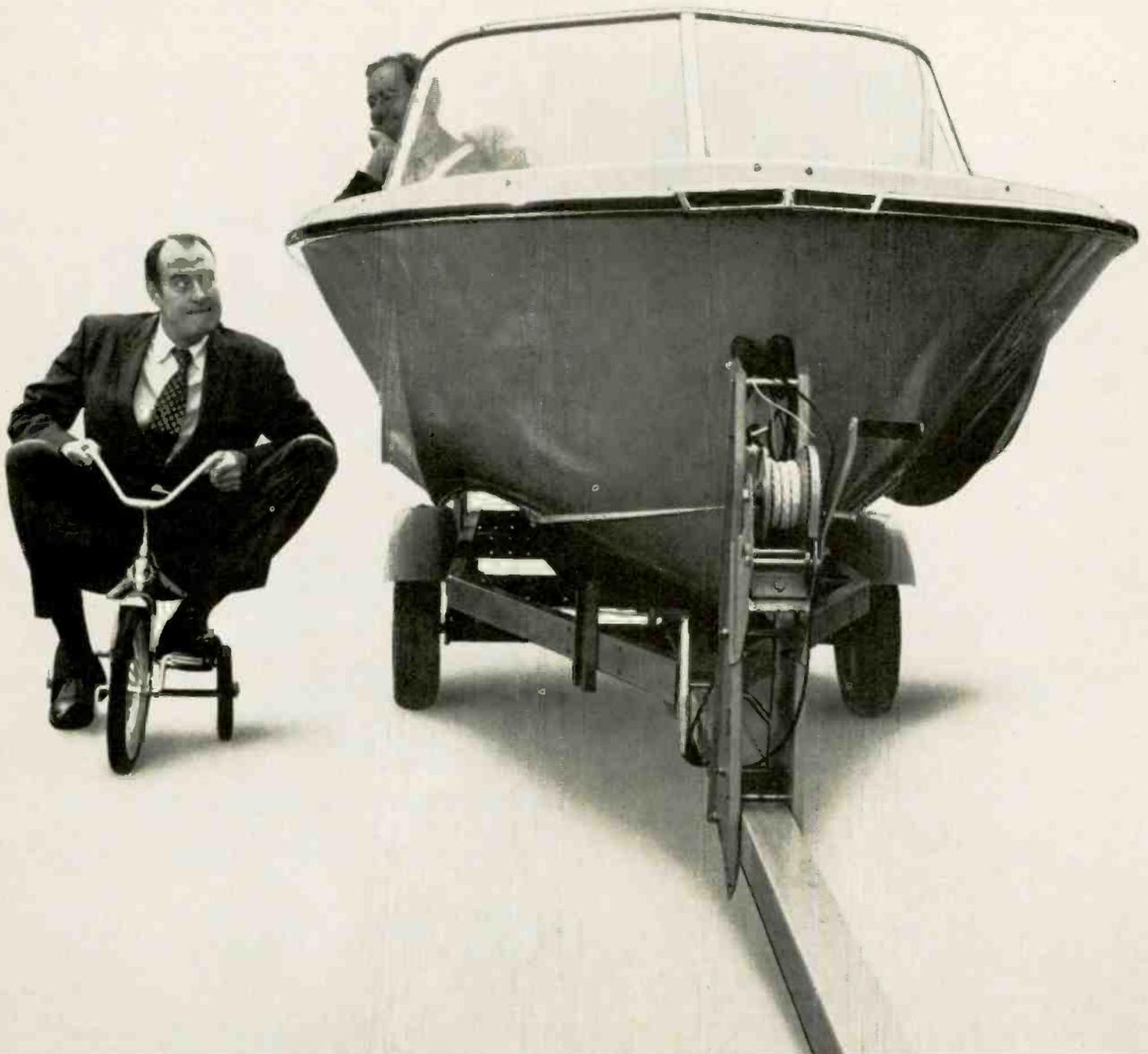
You can choose any prize, or any number of prizes from the catalog we send you. As long as you've got enough Bright Bucks. Naturally, the

more Bright Bucks you have, the more (or the bigger) prizes you get.

It's a good deal because you can't lose, and there are no chances to take. So when you buy tubes, just make sure they're Sylvania.

It's not exactly getting something for nothing. But it's close.

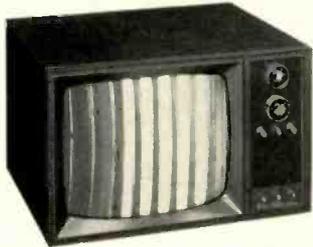
SYLVANIA
GENERAL TELEPHONE & ELECTRONICS



... for more details circle 134 on postcard

You're making money in electronics now.
RCA Offers 4 Ways to Make More.

Study at home...set your own pace.
**RCA Institutes has an easy approach
 to bring you bigger earnings.**



COLOR TV:

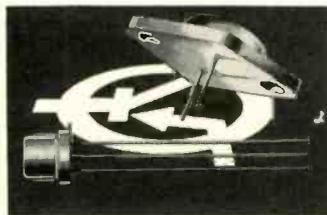
During this course you'll perform over 50 experiments—and receive all parts and instructions to build your own color TV.

The cost of the Color TV Kit is included in the tuition—in both the beginner's program and the advanced course in color TV servicing. (Picture tube optional)

Course is based on the latest receiver circuitry and equipment.

SOLID STATE TECHNOLOGY

New courses include the latest findings and techniques in this field. Information you must have if you are to service the multitude of solid state instruments and devices used in TV, Digital, and Communications equipment.



FCC LICENSE TRAINING:

Choose the course for the FCC License you want: third, second or first phone. If you need basic training first, apply for the complete License Training Program. Get your License—or your money back.

CATV TRAINING:

You'll receive two comprehensive lessons, covering the practical phases of CATV systems in either the Television Servicing or Communications courses.

Licensed by New York State Education Department. Approved for Veterans. Accredited Member National Home Study Council.



MAIL THE COUPON NOW FOR COMPLETE INFORMATION.

RCA INSTITUTES, Inc., Dept. ET-69
 320 West 31st Street, N.Y., N.Y. 10001

Please rush me FREE illustrated catalog. I understand that I am under no obligation, and that no salesman will call.

Name _____ Age _____
 (please print)

Address _____

City _____

State _____ ZIP _____

... for more details circle 128 on postcard

ET/D BOOK REVIEWS

TRANSISTOR-TV SERVICING GUIDE by Robert G. Middleton. Published by Howard W. Evans & Co., Inc., 128 pages, 8½x11 in. softbound. \$3.95.

This book is a revised edition of the first printing. It has eleven chapters which cover circuit troubles in every stage of a TV set including the tuner, AGC, picture tube and low voltage power supply. The first chapter gives a few pointers on general troubleshooting and information on typical transistorized circuits. This information will be especially useful to technicians who are not well acquainted with servicing transistor circuits. The book is profusely illustrated with supporting diagrams, waveforms, test instrument connections and video patterns. In most of the chapters, a general circuit discussion leads into a numbered outline of symptoms followed by an explanation of probable causes and cures. The book is a practical reference source for any technician involved in transistorized TV servicing.

RCA POWER CIRCUITS MANUAL, SP-51. Published by RCA Electronic Components, Harrison, N.J., 8¼ x 5¼, 448 pages, \$2.00.

This manual provides a valuable source of information on characteristics and applications of some of the latest devices with a brief theory of operation.

The manual is divided into ten main chapters explaining semiconductor materials, theory of silicon rectifier and thyristors (including SCK's, triacs, diacs), silicon power transistors, rectifier circuits, power conversion, regulation, thyristor ac controls and power amplifiers.



MOST SENSITIVE FET Volt-Ohm METER

- 11 Ranges
- 10 megohm input
- .001 volts AC
- .1 ohm
- 1 micro amp
- .01 volts DC

Full Line of Test Equipment

- 830-Transistor Tester
- 865-Color Bar Generator
- 840-Field Strength Meter
- 880-Stereo Test System
- 857-CRT Tester/Rejuvenator
- 870-FET Volt-Ohm Meter

133 N. Jefferson, Chicago 60606 312-346-2841

... for more details circle 111 on postcard

ELECTRONIC TECHNICIAN/DEALER

NEW FINCO®

**HOME ENTERTAINMENT
DISTRIBUTION WIRING
SYSTEM DESIGNED FOR
EASY INSTALLATION**



**PACKAGED IN A
SELF-SELLING
DISPLAY.**

HWK-75 75 ohm
HWK-300 300 ohm

● For Color TV
— UHF/VHF

● Black &
White TV

● FM/FM
Stereo

- Get in on the MATV boom in multiple set homes.
- A new business means more profits.
- Everything needed to wire a home for multiple set reception.
- Your service department can easily install this system.



**THE FINNEY
COMPANY**

34 WEST INTERSTATE STREET
DEPT. 110-6
BEDFORD, OHIO 44146

Please send free brochure 20-520 on
FINCO HOME TV DISTRIBUTION KIT.

Name _____

Address _____

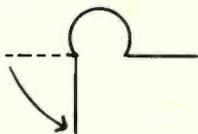
City _____ State _____ Zip _____

MAGNAVOX

Radio Model R10/C10—Installing Heat Sinks on Output Transistors

The output transistor in the R10 and C10 radios may fail because of excessive heat. It is recommended that a heat sink, part No. 730651-5, be installed on all 2SB178 and 2BS324 output transistors in these units. The heat sink must be reformed, as indicated in the illustration, by bending one of the flanges 90deg so that it will not interfere with the cabinet or output transformer.

730651-5



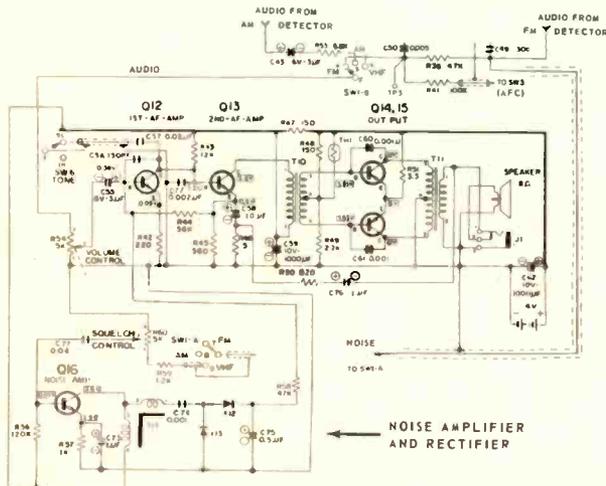
Bend one Flange 90 degrees

Remember to apply silicone grease between transistors and heat sinks.

WESTINGHOUSE

Radio Model 23S18B—"Squelch Circuit" Description

On this three-band radio, squelch is used for VHF only. The squelch control at the back of the radio is used to eliminate noise and to allow reception when a station transmits. Many times only one half of a conversation can be



heard because of the location and the power of the stations which are communicating with each other. The squelch circuit silences the radio when a large amount of noise is being received. The desired signal must be moderately strong, stronger than the noise. Example: if a police broadcast is being heard and the SQUELCH control is set to the point where disturbing background noises just disappear, the police broadcast will still be heard. When the station stops transmitting (standby) no noise or weak stations will be heard. This is possible because the SQUELCH control can be set so that when the station stops transmitting, the receiver "noise" increases and this "noise" is used to control the cutoff point of the audio amplifier.

The squelch control circuit can be used, only when the BAND SELECTOR is in the VHF position. When switch SW1-A is in the AM or FM position, "noise" cannot reach the noise amplifier to "cut off" the audio amplifier. When only

noise is present on the station, it will be amplified and fed to a rectifier circuit to provide bias voltages for the audio amplifiers. When an RF signal stronger than the noise is received, the noise will be blocked out. When noise is removed from the noise amplifier, the first audio stage current is reduced and the second audio stage is allowed to conduct normally.

The amount of noise received and the setting of the SQUELCH control determine the effectiveness of "squelch" action. The amount of noise amplified determines the rectified bias voltage to the first audio amplifier transistor. The bias voltage of course controls the amount of current through the collector to emitter circuit. Since the collector of the first audio amplifier and the base of the second audio amplifier are common, an increase in the first audio collector current will result in a voltage decrease at the base of the second audio amplifier. When the voltage at the base of the second audio amplifier is low enough, it causes "cut-off." There is no output and noise is "squelched" until a signal from a transmitting station is received.

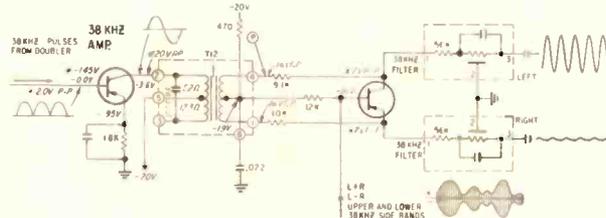
ZENITH

FM Multiplex Receiver Chassis 25Z1120—Biplex Detector Circuit Description

The 121-347 PNP transistor used in the Biplex detector circuit, although not a bilateral transistor, exhibits bilateral characteristics. As a result, its function can be best explained by the operation of a normal bilateral transistor.

A bilateral transistor is a special type in which the collector will serve as the emitter and the emitter will serve as the collector under certain conditions. When switched by a properly applied ac voltage, in push-pull, sufficient in value to overcome the cutoff bias normally applied, the bilateral transistor will pass current in both directions in accordance with the alternations of the switching voltage. The switching voltage in this case is the regenerated 38kHz sub-carrier signal.

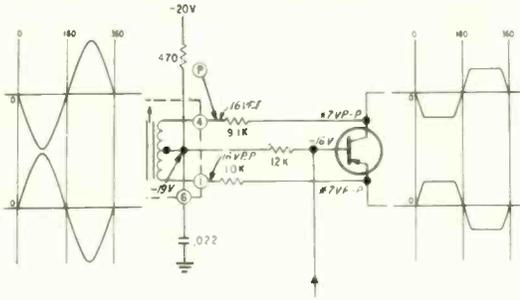
The transistor is not biased in the conventional manner. For the following refer to the illustration. The base is biased at $-16v$ while the collector and emitter are both



biased at $-19v$ (as shown at the center-tap, terminal No. 6 of transformer T12). The -19 and -16 are obtained from the voltage divider consisting of the $1.2K$ and 470Ω resistors and TR12. Note that the collector and emitter are connected to the opposite ends of the 38kHz output transformer secondary winding (part of T12). Under no-switching voltage conditions, the transistor is biased to cut off due to the $3v$ difference between the $16v$ at the base and the $19v$ at the emitter. To forward bias the transistor and cause current flow, the voltage at the emitter must be positive or less negative than the voltage at the base. The required forward bias is supplied by regenerated 38kHz sub-carrier (a CW signal) when the value of the 38kHz voltage

exceeds the reverse bias between base and emitter.

Referring to the illustration showing the input and output waveforms of the 38kHz switching signal only, note that



the upper 38kHz input wave supplies the positive bias from the emitter to the base on the first half-cycle. At the same time, the lower wave supplies the negative bias from the collector to the base. During the second half-cycle the reverse is true, but the action of the transistor is the same due to the bilateral effect.

MOVING?

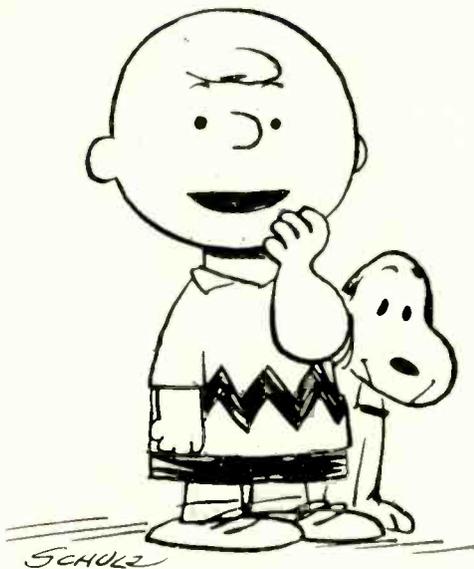
Be sure to let us know your new address.

Please enclose a complete address label

from one of your recent issues.

"IT'S GOOD BUSINESS
TO HIRE THE HANDICAPPED."

ISN'T THAT A GREAT IDEA, SNOOPY?



THE PRESIDENT'S COMMITTEE ON EMPLOYMENT
OF THE HANDICAPPED, WASHINGTON, D. C.

Yes, there's still a TV manufacturer that looks out for the "little guy."

Okay, so you don't have the biggest, plushest showroom in town.

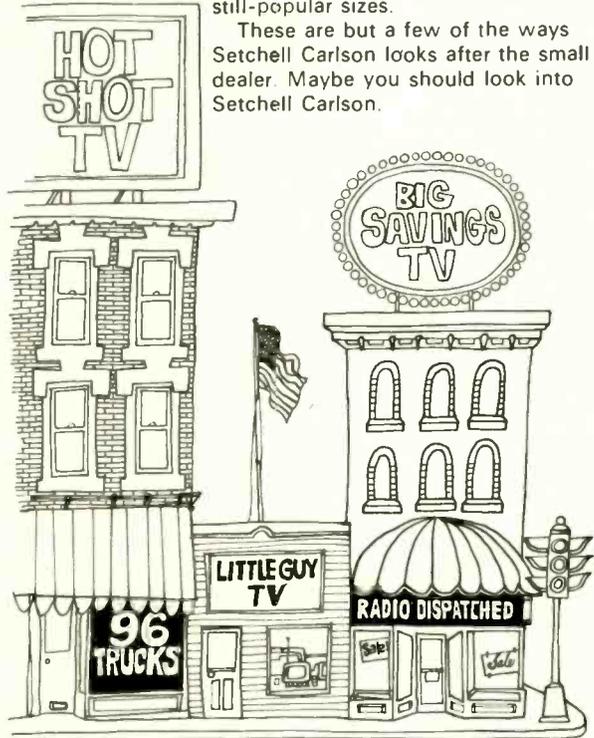
That's fine with Setchell Carlson. We'd be pleased to have you as a dealer. And we think you'll be pleased if you become a Setchell Carlson dealer.

Why? Because we make every effort to please both you and your customers. Ours is the most reliable brand you can find—ask any SC owner (or educational user or tv broadcast engineer). What's more, components in a Setchell Carlson exceed necessary capacities. This means your customers experience far fewer circuitry failures. And far more satisfaction.

However, even the best components sometimes fail. Should repairs become necessary, no other receiver is easier and faster to service. Because our Unit-Ized® chassis slips out for easy, quick repair or replacement. And since each of these units serves a single function, you can isolate trouble much faster. Best of all, Unit-Ized construction allows 99% of all Setchell Carlson service calls to be completed in the home! (How's that for a customer pleaser?) And there's no outlay for additional servicing equipment.

We offer a full line of color television in common size screens and cabinets. Plus black and white in still-popular sizes.

These are but a few of the ways Setchell Carlson looks after the small dealer. Maybe you should look into Setchell Carlson.



Setchell Carlson, Inc., 530 5th Ave. N.W.,
St. Paul, Minnesota 55112

Yes, I'd like to look into a Setchell Carlson dealership.
Send details.

NAME _____

ADDRESS _____

CITY/STATE/ZIP _____

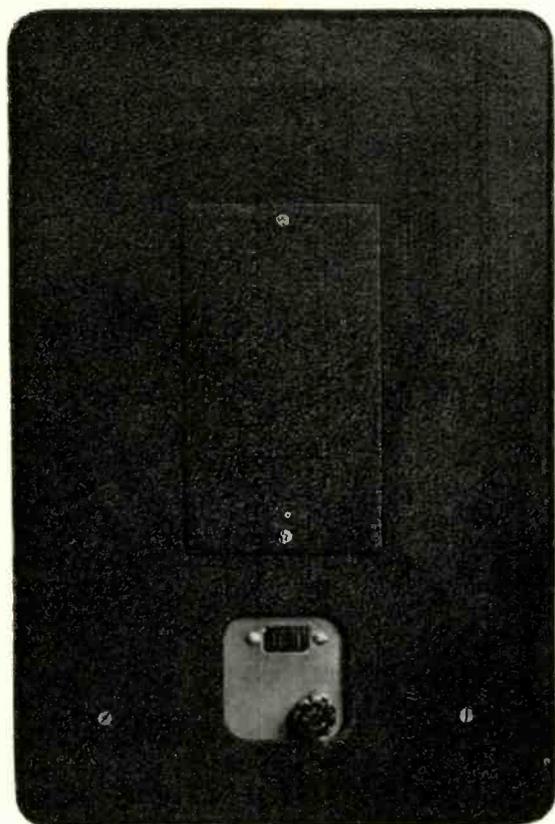


SETCHELL CARLSON
UNITIZED TELEVISION

VIDEO-ELECTRONICS DIVISION OF MARQUETTE CORP., 530 5TH AVE., N.W., ST. PAUL, MINN. 55112

... for more details circle 122 on postcard

The back.



The back of our B&K 1450 Oscilloscope/Vectorscope put us in front.

Notice the back. Clean, isn't it? That's because it's the back of the only oscilloscope/vectorscope with *front vector inputs and controls*.

Now you can troubleshoot with this one instrument as an ultra stable oscilloscope; or as a vectorscope with this important *exclusive* feature: the inputs are amplified! With the control available up *front*, you can troubleshoot at high level (the output of the color amplifiers), or at low level from the demodulator.

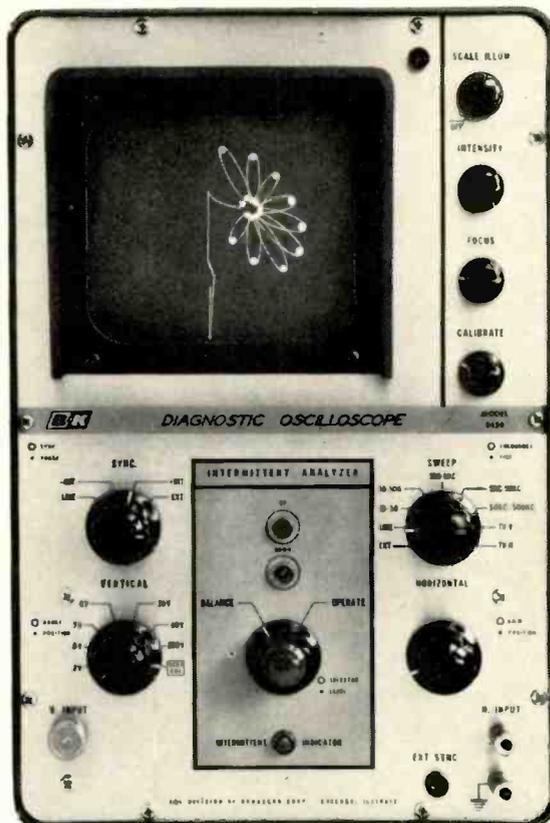
The 1450 shows vector patterns exactly as specified by color TV manufacturers. It also permits direct reading of peak-to-peak voltages from *two calibrated scales*. (Simply switching to the range you want lights up the appropriate scale.)

Any way you look at it, the 1450 Oscilloscope/Vectorscope means greater shop efficiency, more time for profit-making calls, and a lot more mileage from a very fine diagnostic oscilloscope. All from B&K—the company that put an end to ordinary test equipment (the kind that puts an end to your patience).

Of course, we've tried to show you our good side—both of them. Now it's up to *you* to side with *us*. See your B&K distributor soon—or drop us a note for more detailed information.

Model 1450. Net: \$279.95.

The front.



The front (and inside) of our B&K 1450 Oscilloscope/Vectorscope keeps us there.

Our scope has an exclusive diagnostic device called the *intermittent analyzer*, with electronic memory and optional audio/visual remote alarm (model MON-45).

With this sophisticated detection-reporting system, elusive intermittent conditions can be caught and identified in your absence. Just pre-set one control: if the stage is faulty, it will eventually be detected. And when it is, the intermittent indicator on the 1450 will turn on and stay on until you return from service calls. And all patterns are locked in at any signal level or frequency by *automatic synchronization*.



Product of DYNASCAN CORPORATION 1801 W. Belle Plaine, Chicago, Illinois 60613

B&K puts an end to test equipment. We've developed "Silent Partners"

... for more details circle 104 on postcard
ELECTRONIC TECHNICIAN/DEALER

ET/D TEKLAB REPORT

Setchell Carlson's Model 2900 Portable Color TV

Circuit study and plug-in construction can shorten troubleshooting time, making servicing more profitable

■ Every day we see more solid-state or hybrid circuitry on the market employing etched circuit boards. This particular receiver represents a balance between solid-state and vacuum tube technology.

Setchell Carlson is continuing its unitized concept and now employs an aluminum base chassis construction with ten etched "plug-in" circuit board units.

This type of construction provides the separation of circuit functions and aids in more economical servicing. The circuit board substitution method allows faster isolation of the trouble and most repairs can be accomplished in the home.

When we unpacked the Setchell Carlson Model 2900 for this Teklab report, the first thing

we noticed was the walnut cabinet. Another feature is the console-size 6 in. speaker, rare in portable models.

The front panel controls include: CHANNEL SELECTOR, UHF TUNING, FINE-TUNING, VOLUME, TINT, COLOR BRIGHTNESS and TV OFF/ON switch.

The controls on the back of the chassis which we feel should be more conveniently placed for ease of adjustment are: CONTRAST, VERTICAL HOLD and HORIZONTAL HOLD.

Antenna terminals are provided at the rear of the receiver to permit attachment of outdoor antennas. A slide switch on the antenna terminal board connects the receiver to the built-in VHF antenna or to an external VHF antenna which

Setchell Carlson's Model 2900 portable color television in a walnut cabinet.



Unitized circuit boards are changed without tools. Positive electrical connection is assured by nylon catches which hold the board firmly in place and allow quick removal.



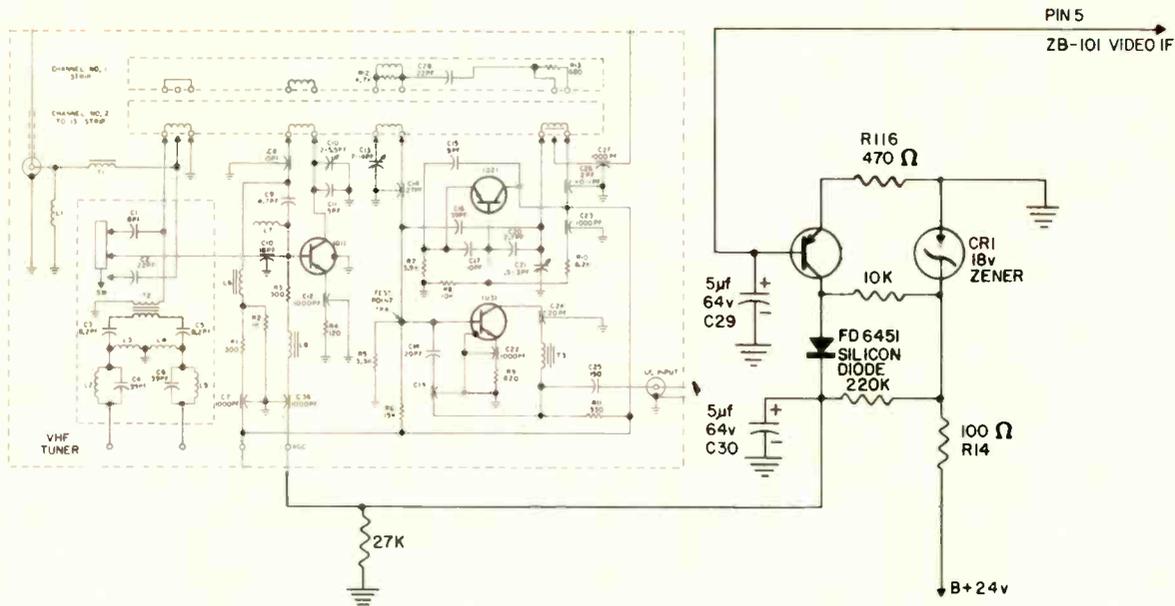


Fig. 1--Schematic showing the modification made to the tuner AGC circuitry.

attaches to terminals directly below the slide switch.

When an external UHF antenna is used, the internal UHF antenna must be removed.

When the set was first turned on, we were not overly impressed with the picture quality. It happened to be an early model lacking the AGC modifications to the tuner and other minor changes to several of the plug-in circuits. Once these modifications and the plug-in circuits from the manufacturer were installed, the set produced a good picture.

The modification made on the tuner AGC circuitry is provided here for comparison purposes and also as a point of interest to those with earlier production units. The tuner AGC circuitry shown in Fig. 1 is used on all Model 2900s and 2800s other than early production models. Optimum performance will be obtained from the new ZB-101 units with present tuner AGC circuitry. The tuner AGC circuitry can be checked without removing the chassis by observing the tuner through

the slots in the bottom of the cabinet. The tuner incorporates the latest AGC circuitry if the 27K resistor is present on the tuner. If not, it can be modified in the following manner: Check C29 and C30 for connection as shown in the schematic. Add the 220K resistor and silicon diode if required.

The chassis employed on this portable is divided into ten plug-in units and a common chassis into which they connect. Actually there are nine plug-in circuits, the tenth being the circular convergence adjustments and related solid-state circuitry in one complete package with electrical connections made through a plug and socket.

TUNER

The tuner shown in Fig. 1 is a conventional turret-type consisting of the RF amplifier (Q1), mixer (Q3) and the oscillator (Q2). With the VHF channel-selector in the "UHF" position, the UHF tuner is supplied with collector voltage through a segment of the channel strip.

Transistor Q31 is then activated as a UHF oscillator.

VIDEO IF AND AGC ZB-101

Because of gain/bandwidth requirements in many special applications for which this receiver is often used, four video IF amplifier stages are used instead of the usual two or three. The video IF and AGC schematic is shown in Fig. 2. Rather than the conventional keyed AGC, an amplified sync system was developed to permit employment in certain video tape applications. Transistors Q101, 102, 103 and 104 are video IF amplifiers. Signal for the 4.5MHz sound detector, D102, is taken from the collector circuit of transistor Q104. The secondary of the output IF transformer, T102, includes a 41.25MHz trap which removes practically all of the sound signal from the video detector, D101. The video detector signal passes to transistor Q106, an emitter follower which matches the impedance of the detector to the low impedance of the contrast control and following stages.

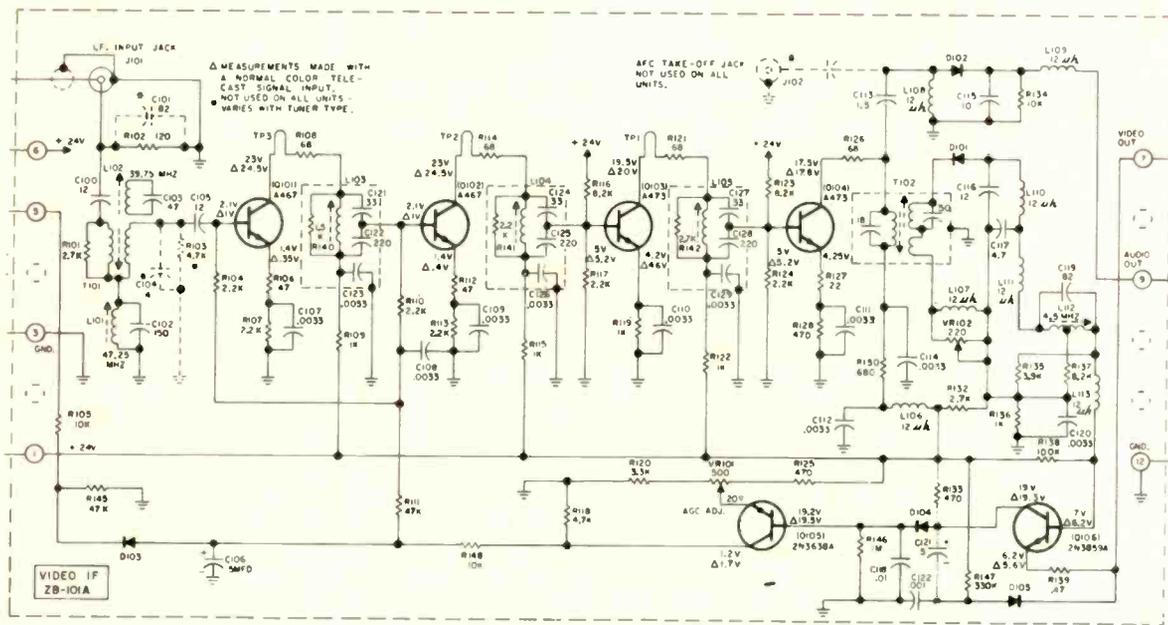
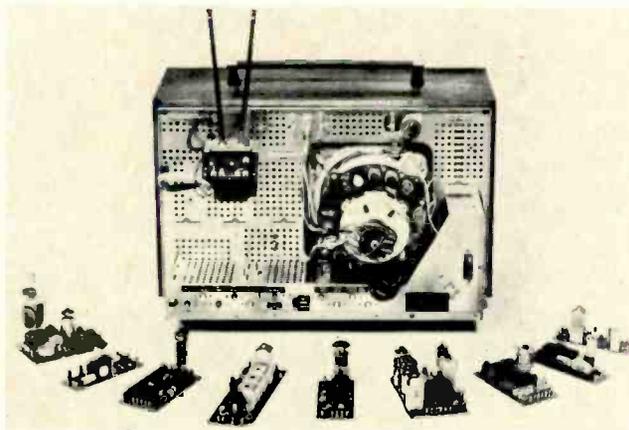


Fig. 2--Four stages of video IF are employed instead of the usual two or three. A special sync system permits certain video tape application.

Capacitor C121 and diode D105 comprise a very effective noise gate. All of the noise pulses in higher amplitude than the average determined by the sync pulse level will be shorted between collector and emitter of Q106 and thus prevent signal or AGC output. Positive-going sync signals are formed in the collector circuit of Q106, clipped by diode D104, amplified and inverted by transistor Q105 and applied as reverse AGC to the first two stages of the video IF amplifier. This signal is delayed by D103, amplified and inverted by Q4, further delayed by D1 and applied to the tuner RF stage as forward AGC. Forward AGC is used on the tuner for best cross-modulation characteristics, while reverse AGC is applied to the video IF stages to minimize impedance shift with varying signal levels. The AGC is adjusted to determine the detector output level on strong signals.

VIDEO SYNC UNIT ZB-201

The signal from the contrast



Over 90 percent of all circuit components are mounted on 10 plug-in units. Nine units plug into the chassis while the tenth mounts on the picture tube.

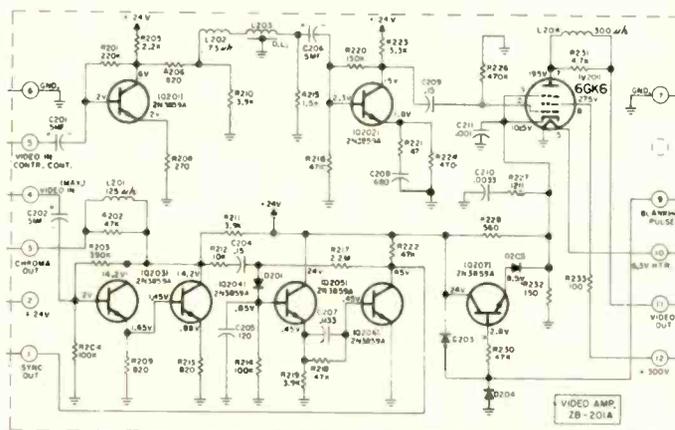


Fig. 3--Transistors Q203 and Q204 are connected as a Darlington pair and comprise the first chroma and sync amplifiers.

and Q404). Their output feeds a 16Ω speaker.

VERTICAL DEFLECTION UNIT ZB-601

The vertical deflection unit consists of V601, the multivibrator-amplifier tube and related components. Its function is conventional except for diode D601, which permits the vertical sync signal to be fed to the multivibrator cathode but prevents the vertical retrace pulse from feeding back into and upsetting the horizontal sync.

HORIZONTAL DEFLECTION UNIT ZB-501

Horizontal sync is fed to a conventional phase detector (dual diode DD501) and used to control the frequency of the horizontal multivibrator tube V501. (See Fig. 6.) The horizontal output tube V502 connects to the output transformer. The high voltage is regulated by taking a reference voltage from Boost B+ and using it to control the regulator transistor Q501. Together with diodes D501 and D502, transistor Q501 regulates the high voltage by shaping V502's grid drive waveforms thus controlling the rate of change of the output plate current.

HORIZONTAL EFFICIENCY UNIT ZB-551

This unit (shown in Fig. 7) contains the damper diode D551 and the efficiency control components. The horizontal efficiency coil L551 is adjusted for minimum 6JE6 cathode current.

POWER SUPPLY

The power supply components are located on the main chassis. Two separate full-wave supplies are included. The 300v supply feeds only the deflection circuits while the video output circuits are powered from the 24v supply. (See Fig. 8.) ■

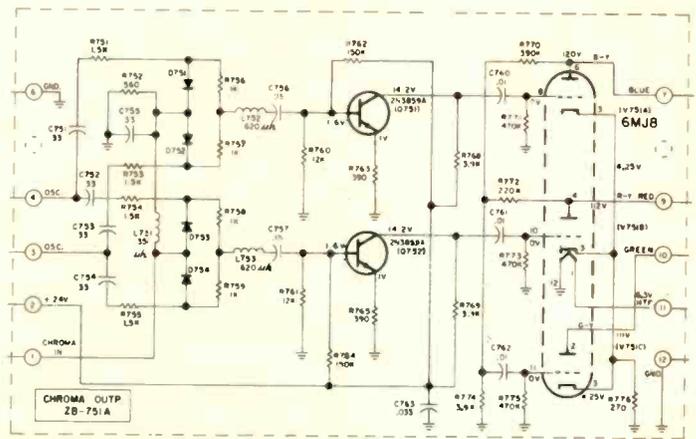


Fig. 5--Schematic showing the chroma output circuitry.

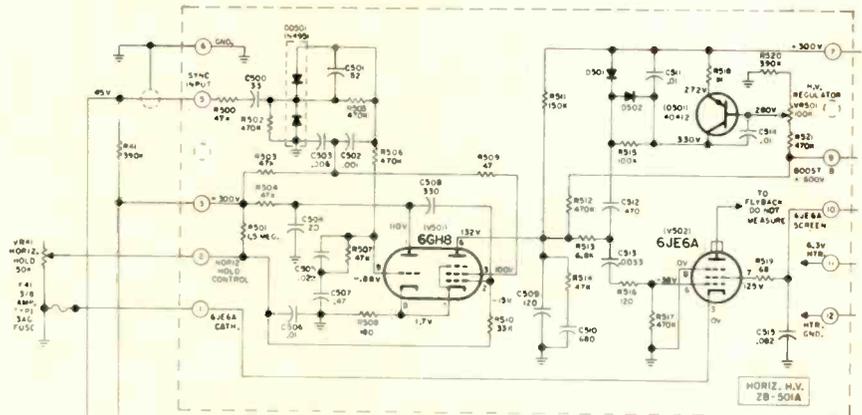
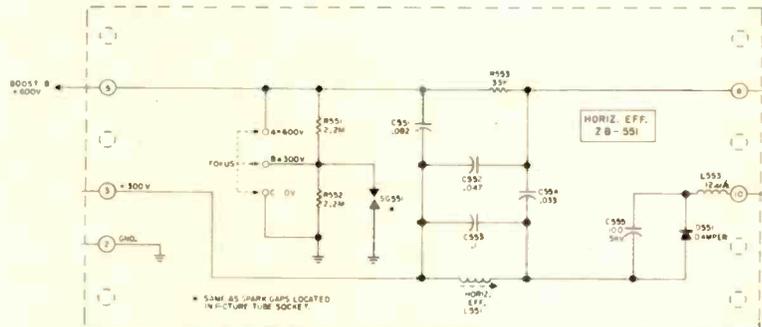


Fig. 6--The horizontal sync signal is fed to a conventional phase detector and is used to control the frequency of the horizontal multivibrator tube.



TV Tuner Servicing

There are times when it is profitable to repair a TV tuner, and times when it is more profitable to send it to a specialist--knowing the difference can save you a lot of headaches

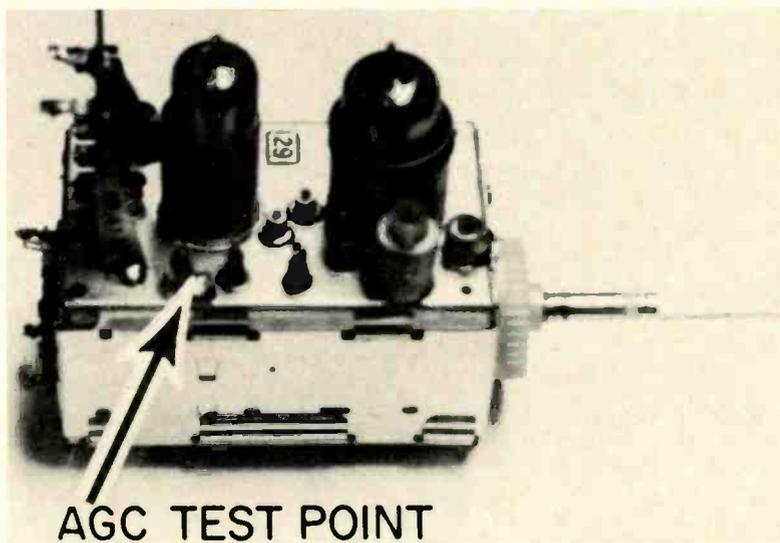


Fig. 1--The first step in isolating the trouble to a tuner is to check the AGC action by shorting the AGC test point to ground.

■ The tuner takes more of a beating than any other section in a TV set. With the average family watching TV 46 1/2 hours per week, it has been estimated that channels are changed 3000 to 4000 times per year! This puts quite a strain on the tuner and therefore they account for a fair percentage of TV troubles. The following symptoms are typical of problems often caused by a defective tuner:

- (1) "snowy" picture
- (2) raster, but no sound or picture
- (3) loss of UHF channels
- (4) loss of high or low VHF band channels
- (5) streaking or flashing in the picture
- (6) separation of sound and picture
- (7) picture pulling
- (8) picture distortion
- (9) partial blanking of the raster

FIX IT FAST OR FORGET IT

In addition to being one of the most common sources of trouble, the tuner is undoubtedly the most difficult to repair. For one thing, mechanical problems which don't apply to any other part of the TV set may be difficult or impossible for the average technician to correct, even if he knows precisely what is wrong. For another, few shops have the equipment to sweep and align a TV tuner properly. Finally, at the frequencies involved, strange things can happen. Just moving a critical part physically can make the tuner inoperative.

It is because of the difficulty of repairing tuners in the field that repair and rebuilding specialists have sprung up all over the country. (See list of specialists at end of this article.) For an average of \$10, these businesses will restore any tuner to top working order.

This brings us to the prime rule of tuner repair: If you can't

fix it fast, forget it! Don't waste a lot of time trying to do something you're not equipped to do. Remember, you are in business to make money and time is your most precious asset. It may give you satisfaction to lick a tough tuner after a couple of hours of struggling, but it also costs you money.

The professional way to handle tuner troubles is: (1) make sure it's the tuner that is causing the trouble, (2) clean the tuner thoroughly, (3) check the tuner quickly for obvious troubles, (4) if the trouble is easy to find and easy to fix, go ahead, (5) if you think the trouble may take more than an hour to find and repair, send it to a tuner specialist.

MAKE SURE IT'S THE TUNER

Before you start to troubleshoot a TV tuner, make sure it is really the tuner that's at fault. IF and AGC troubles often cause symptoms that appear to be tuner problems.

If the picture is snowy, for example, too much AGC voltage may be the problem. This is easy enough to check out. Simply short the AGC test point (see Fig. 1) to the tuner ground. This reduces the AGC voltage to zero, enabling the RF amplifier to operate at maximum gain.

If shorting out the AGC improves the picture significantly, the trouble is in the AGC. If not, it is probably in the tuner. AGC voltages normally measure about -1.5v. If the voltage goes below -3v, it often causes snow.

However, it is also possible for snow to be caused by the IF stages. This is rare, but you'd feel foolish sending a tuner in for repair only to find out it was really an IF trouble. Therefore, it pays to check this out.

If you have a good IF sweep generator and a scope, this is an ideal way to check the IF stages for proper gain.

If not, you can accomplish

approximately the same effect with a little improvising. Start with a known good TV receiver connected to an antenna and displaying a normal picture. Then, connect the IF cable from the tuner of the normal receiver to the IF input of the receiver you are repairing. Be sure that you connect the shield of the IF cable to ground and that the center conductor is isolated from the defective receiver by a coupling capacitor. Don't use an ac/dc or line connected TV set as your good receiver because there may be a difference in potential between grounds on the two chassis.

If substituting a good tuner via this method brings in a normal picture, you know your problem is in the tuner. If not, it's undoubtedly a chassis problem.

Substitution of a known good tuner, (preferably a similar tuner) as described above is, of course, an excellent method of isolating any tuner trouble, making sure the tuner is at fault.

START WITH A CLEAN TUNER

Technicians often forget that dirty tuners just don't work very well. Tuner specialists report that many of the units they receive for repair need nothing more than a thorough cleaning. Intermittent troubles, snowy pictures, streaking or flashing pictures, and poor color response are all troubles commonly caused by corrosion or dirt on contacts.

In fact, many troubles can be caused by dirty contacts. If a tube socket is dirty, for example, the tube pin fails to make contact and the circuit doesn't operate properly.

The best way to clean a tuner thoroughly is with a high pressure washing or degreasing spray as shown in Fig. 2. Don't use a spray that includes a lubricant. These sprays are fine for tuners that are working, but a pure cleaner is normally more effective than

a combination cleaner/lubricant.

Of course, you have undoubtedly tried new tubes in the tuner before starting your servicing procedure, but don't leave them in their sockets. Remove the tubes from the tuner and spray it thoroughly, including the tube sockets.

HINT: Never spray the neutralizing capacitor in a Nuvistor tuner. Even the best tuner spray can cause permanent detuning if used on this capacitor.

TUNER CHECKUP

Once the tuner is clean, give it a fast but thorough checkup. Remove the cover and start with a visual inspection. But be careful not to poke around inside the tuner or disturb the placement of components. Once a wire or coil is moved, it's almost impossible to get it back into the proper operating position without alignment equipment.

If your preliminary inspection reveals a shorted or gassy tube, chances are that excessive current has burned up or changed the value of a resistor. Burned resistors, of course, are easy to spot visually.

If your visual inspection reveals no problems, make voltage checks at the test points provided. B+ test points are most likely to reveal trouble (some tuners have two or three B+ test points). Check the schematic for proper voltages. Your readings should be accurate within $\pm 20\%$.

Then make voltage-resistance checks at the tube sockets. Since tuners are so compact, the easiest way to do this is with a test socket.

You can't expect the tuner to operate properly with test sockets in the circuit, but the voltage and resistance readings should be fairly accurate.

If you read a low plate or screen voltage it generally indicates that a series resistor has chang-

Tuner Servicing ...



Fig. 2-- Before troubleshooting the set, clean the tuner thoroughly.

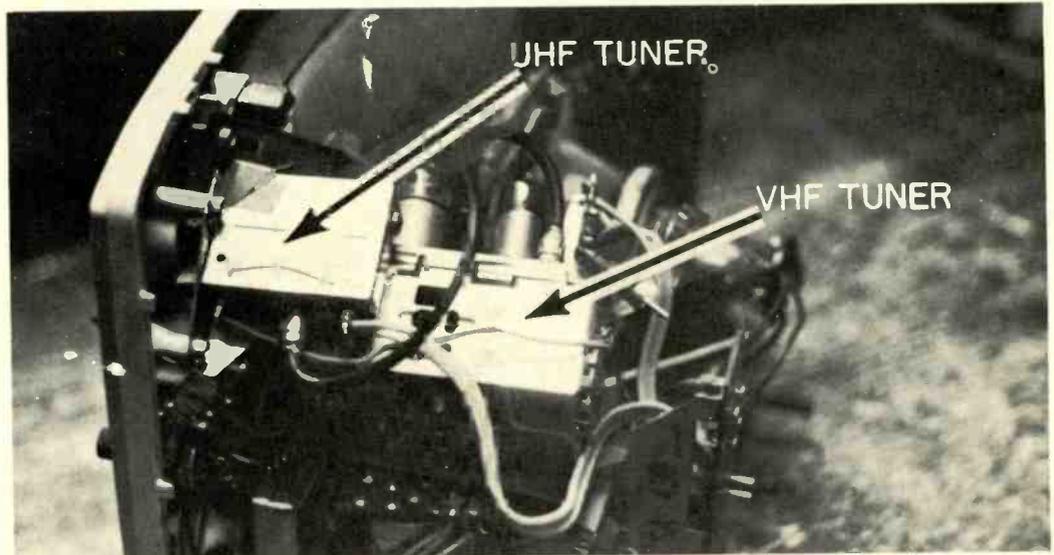
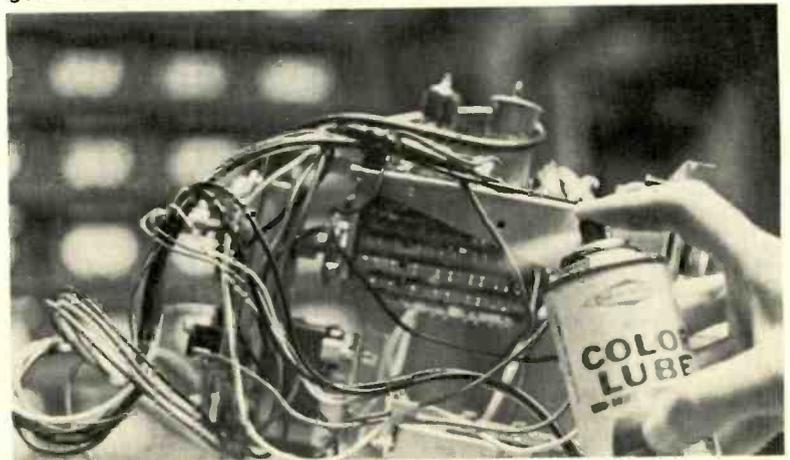


Fig. 3--In some sets, it may be necessary to remove the UHF tuner to get at the VHF.

Fig. 4--Once the tuner has been repaired, it should be sprayed with a good lubricant to keep it operating smoothly.



ed value or a capacitor going to ground is leaky or shorted. If the voltage change is intermittent, you can usually isolate the defective part by spraying components with freezing solution.

A dead oscillator is most often caused by a defective plate load resistor. You can tell whether the oscillator is working or not simply by checking the oscillator injector voltage at the mixer grid test point. In a tubed tuner, this voltage should be about -1.5 to -3.5v.

In a solid-state tuner, you can tell whether or not the oscillator is working by checking at the base of the oscillator. You should read about -1 or -2v. However, in many solid-state tuners it's difficult to take this reading and you may be better off sending the tuner to a specialist for repair.

In making resistance checks, don't overlook the balun coils. Defective baluns can often cause snow or loss of high and low VHF bands. Careful resistance tests will usually turn up balun problems quickly. Since there are such a wide variety of balun configurations, however, it is imperative that you check the schematic before jumping to any conclusions.

Internal tuner voltages and resistances can be very difficult to check. In many modern TV sets, for example, you have to take out the UHF tuner in order to get at the VHF tuner. (See Fig. 3). Some tuners, especially foreign made and solid-state tuners, are simply too compact to get at. In this case, you're usually better off sending the tuner out for repair.

REPLACING DEFECTIVE PARTS

Once you locate a defective component in a tuner, your problem is to reach it without disturbing a lot of wires. Tuner specialists use tiny soldering irons and slim tools.

Be sure you obtain an exact

replacement for the defective part if possible. Otherwise the tuner may work, but not properly.

Many of the problems you spot will not be easy to correct, especially mechanical problems.

If the defective part can be replaced with an exact replacement, be very careful. Cut lead lengths to the exact length of the original and substitute the new part for the old one without disturbing lead dress or coils. Lead dress is especially critical in UHF tuners.

HOW TO SEND A TUNER

Let's suppose that you've isolated the trouble to the tuner, given it a thorough cleaning, replaced the tubes, tested it and decided to send it out for repair. There is a right way.

You'll save yourself a lot of headaches if you follow this procedure:

(1) Disconnect the wires going to the tuner, but don't unsolder them. Clip them with a pair of diagonal cutters, leaving a little of each colored wire on the terminals. This will make it easy for you to reconnect the tuner to the chassis once you get it back, without relying on your memory or taking the time to make a drawing.

(2) Remove the mounting brackets from the tuner and fasten them to the chassis. This way they won't be lost. Lost brackets can take weeks or months to replace and impossible to explain to an irate customer.

(3) Do not remove the tubes. Leave them snugly in their sockets. Tuners should always be aligned with the tubes the customer is going to use, so tubes must be included. Make sure the tubes are in the center of the package and surround the entire tuner with at least 2 in. of other packing material.

You can make money with tuner repairs if you use a common sense, professional approach. ■

Tuners Inc.
6302 5th Ave.
Brooklyn, N. Y.

Castle TV Tuner Service, Inc.
5713 N. Western Ave.
Chicago, Ill. 60645

Castle TV Tuner Service (East)
41-92 Vernon Blvd.
Long Island City, N. Y. 11101

Tuner Service Corp.
817 N. Pennsylvania St.
Indianapolis, Ind.

Tuner Service Corp.
547-49 Tonnelle Ave.
Jersey City, N. J.

Tuner Service Corp.
938 Gordon St.
S. W. Atlanta, Ga.

Tuner Service Corp.
10654 Magnolia Blvd.
North Hollywood, Calif.

Mid-State Tuner Service
1504 So. College
Box 1141
Bloomington, Ind. 47401

Gem City Tuner Repair
Box 6, Dable Station
2631 Mardon Drive
Dayton, Ohio 45420

TV Tuner Service
118 Third St. W
P. O. Box 793
Twin Falls, Idaho 83301

Precision Tuner Service
P. O. Box 272
Bloomington, Ind. 47401

Superior Tuner
1377 N. Curry Pike
P. O. Box 368
Bloomington Ind. 47401

J. W. Electronics
1538 W. Jarvis
Chicago, Ill. 60626

POST MARKER COLOR TV SWEEP ALIGNMENT

Boost your efficiency in sweep alignment by reviewing some practical procedures using a post marker generator

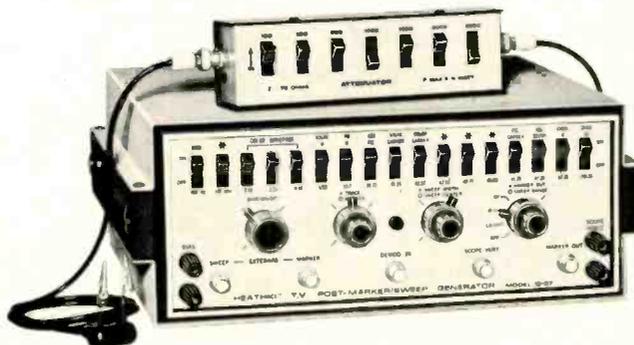


B&K Model 415 solid-state sweep/marker generator.



Sencore Model SM152 sweep and marker generator.

Heath Model IG-57 TV post-marker/sweep generator.



■ A tuned amplifier, such as the IF amplifier in a television receiver, is designed to pass a band of frequencies and reject frequencies outside of this band. For example, a color television IF amplifier is designed to pass frequencies between 41.67 and 46.75MHz and reject frequencies below 41.25 and above 47.25MHz. This wide passband is obtained by having several IF stages each tuned to a different part of the band -- stagger tuned.

Alignment of this amplifier using a standard signal generator is difficult because each stage has to be aligned individually and the over-all response checked laboriously recording the output as the input frequency is changed in small steps across the band. Plotting the output against frequency on a graph provides a response pattern.

If you were able to tune the frequency of the signal generator at a constant rate back and forth across the frequency band of interest, you could observe the output (after detection) on an oscilloscope and actually see the response of the amplifier. This is what a sweep generator does. The output signal from the generator is a constantly changing frequency over a selected range as determined by the tuning and sweep width settings of the generator. The rate at which the output is swept is low. For convenience it is normally set at the frequency of the ac line.

Markers are added to the response curve to show the frequency accurately at different parts of the curve. They are generated by amplifying the low frequencies on each side of the zero beat that develops when the frequency of the sweep signal passes through the marker oscillator frequency. Generating markers external to the amplifier under test and adding them to the response curve is called post injection. It is superior to a pre-injection system in which the marker signal is fed to the amplifier along with the sweep signal, because pre-injection markers can distort the

response curve or become lost in traps making sweep alignment more difficult.

THE COLOR TV IF RESPONSE CURVE

The ideal color TV IF response curve is shown in Fig. 1. You should become totally familiar with this curve because it can be an excellent troubleshooting aid. Note that the top of the curve shown is flat. However, some sets will have a dip in the top; others (the newer color sets) may have a rounded or "hay stack" top.

The shape of the response curve skirts is also very important. The picture carrier (45.75MHz) and the color sub carrier (42.17MHz) are approximately at the 50 percent points on the skirts. Color signal information 0.5MHz away (41.67MHz) must still pass through the amplifier, but the sound carrier (41.25MHz) must be trapped out so this skirt has a fairly steep slope. The opposite slope is not quite as steep, but should rise linearly for best recovery of low frequency video information. The upper adjacent channel picture carrier (39.75MHz) and the lower adjacent channel sound carrier (47.25MHz) must be trapped out to prevent interference. The amplifier has minimum or zero gain at these frequencies.

There are a number of things that will affect the response curve. For example, if a trap is misadjusted it will be impossible to get the correct curve and a lot of time can be wasted if this is not recognized. One or more weak stages will also give a poor curve, so the tubes should always be checked or substituted before alignment is attempted. The design of an amplifier takes into account the internal tube capacity. When tubes are replaced in an amplifier, a different internal capacity could upset the alignment.

TV RECEIVER ALIGNMENT HINTS AND PRECAUTIONS

Disable the HV applied to the

CRT. This can be done by removing the plate cap from the horizontal output tube. Then connect the load specified by the manufacturer from B+ to ground to apply the proper load to the low voltage power supply.

Another method of removing hash and interference on the response curve, sometimes called "grass" (Fig. 2), is caused by the horizontal output tube. One of the easiest ways to eliminate the radiation is to remove the tube from its socket. In series wired receivers a dummy tube may be used or a resistor placed across the filament pins on the socket. If a compactron tube is used, the filament pins are 1 and 12. The novar filament pins are 4 and 5. Connect a voltmeter across the resistor to be sure the voltage drop is equal to the filament voltage of the tube.

Interference from the vertical circuits is generally a spike that will drift through the response curve and cause distortion as it passes through. This type of interference is caused by the vertical frequency difference between the TV set and the sweep generator. Many sets have a "setup" switch that can be used to disable the vertical deflection system and eliminate the vertical interference.

Use care when adjusting a transformer or coil that has two slugs as each slug may have two positions that appear to tune to the correct frequency. The position farthest out from the center of the coil form is correct; the position near the center of the coil form is incorrect because of coupling from one coil to the other.

Use only the proper cables that are supplied with the generator. Be sure the RF cable is terminated with its proper impedance. Keep the leads from the terminated cable as short as possible at the point of connection to the receiver under test.

Check that there are no ground loops between the pieces of equipment. This is done by observing the trace on the oscilloscope while touching each piece of equipment. If the trace moves or changes

shape, check all ground connections. It may become necessary to ground all the cables at one common point.

Do not dress the sweep generator output leads or demodulation input cable leads over the IF board, IF coils or tubes as it may result in detuning or oscillation in the section under test.

Use bias voltages as specified by the set manufacturer of the receiver under test.

More accurate trap adjustments can be obtained by reducing the bias on the IF. Prevent overload of the IF circuits by reducing RF signal from the generator.

Set the oscilloscope vertical gain control near its most sensitive position and keep the sweep generator output as low as possible. This will prevent overloading the IF amplifiers with a sweep signal which may produce an improper curve.

POST MARKER GENERATOR FEATURES

The post marker generator produces accurate markers at the IF and RF frequencies specified by most manufacturers.

The generator mixes the marker signal with the demodulated signal from the circuit being tested or aligned. Markers are normally well defined and should not alter or distort the response curve of the circuits involved. Therefore, the oscilloscope will show the actual waveshape of the TV receiver being checked or aligned.

As many as eight markers may be made to appear simultaneously on an IF alignment scope trace. This enables you to adjust the IF circuits for proper waveshape and bandwidth in less time than would be possible if you were to use the old variable marker system which must be reset and calibrated for each marker frequency.

Additional post markers are provided for color bandpass alignment, picture and sound carrier frequencies, FM tun-

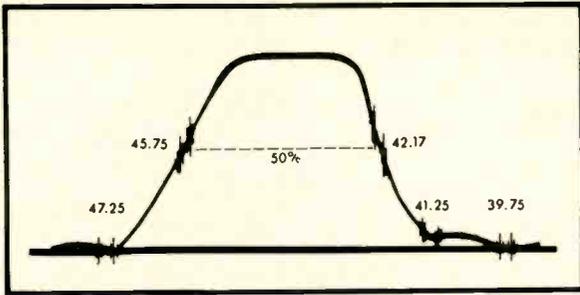


Fig. 1--The ideal response curve of a color TV receiver.

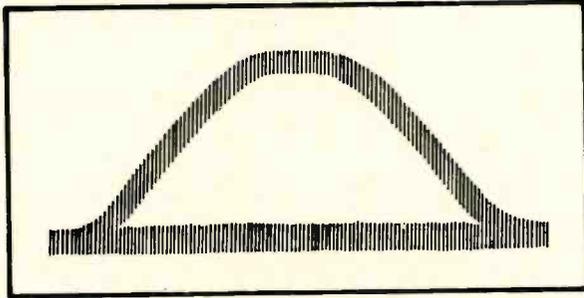


Fig. 2--Horizontal interference in the response curve caused by output tube radiation.

er, FM IF, discriminator alignment, and TV sound IF adjustments. Modulation is provided for trap adjustment as well as for checking and adjusting FM tuners.

ZENITH SPEED ALIGNER GENERATOR OPERATION

The heart of this typical generator is the sweep oscillator. A dual triode, operated in parallel to provide adequate power output, is connected in a modified colpitts arrangement with its tank circuit-center tuned to 43.5MHz. The tank includes a variable inductance shown in Fig. 3 whose reactance depends on the amplitude of current flowing through it. By providing a current of the proper phase, shape and amplitude, the inductance of the oscillator changes at a given rate, thus producing a frequency deviation which is used to provide the required sweep frequency output. This method is superior to sweep techniques using a synchronous motor and to a speaker system with a specially designed spider driving a sweep capacitor.

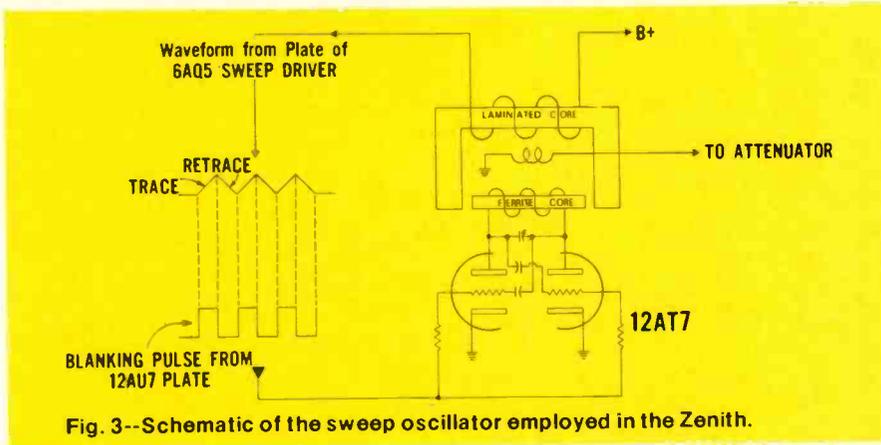


Fig. 3--Schematic of the sweep oscillator employed in the Zenith.

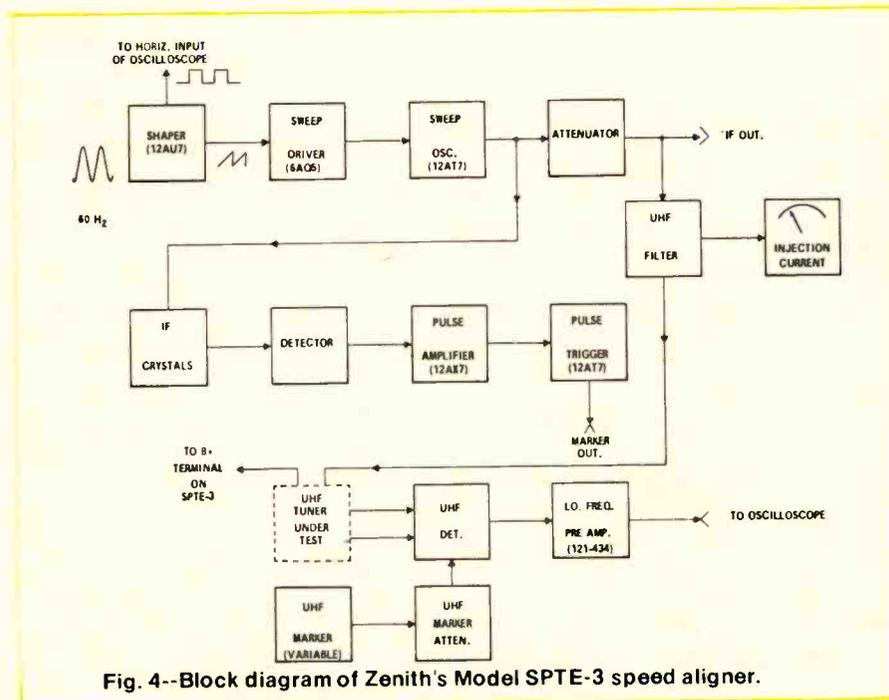


Fig. 4--Block diagram of Zenith's Model SPT-3 speed aligner.

Markers are produced by first supplying a sample of the swept oscillator voltage to a set of crystals. The sample voltage is of sufficient amplitude to allow the crystal to "ring," or oscillate at its natural frequency. The resultant oscillator voltage is then detected, amplified and shaped to provide the proper output marker "pip" display on the scope. A block diagram of this generator is shown in Fig. 4.

The 40MHz sweep oscillator is also used to provide the necessary signal for UHF tuner alignment. The principle of operation is similar to that encountered in a normal superheterodyne receiver: an oscillator frequency mixes with an RF sig-

nal to provide an IF output. The IF signal is then mixed with an oscillator frequency and the resultant RF frequency can be used as the signal source for the alignment of the UHF pre-selector circuits. The resultant output from the UHF tuner antenna terminals is detected and then amplified for proper oscilloscope display. A UHF marker at the channel sound carrier frequency is injected at the detector to provide a means of tracking the oscillator rotor to a given calibration standard. A 50-0-50 microammeter is provided to show injection voltage at all times when a UHF tuner is being swept or adjusted.

DETERMINING THE ACCURACY OF THE SCOPE FOR SWEEP ALIGNMENT

The oscilloscope is an important tool in sweep alignment. If it has poor low frequency response, a phase shift in the vertical amplifier or a phase shift between the horizontal and vertical amplifier, the response curve on the scope screen can be misleading as to the actual condition of the television receiver. Any of the above conditions can distort the response curve enough to give inaccurate results when the TV set is aligned. The Sencore SM152 provides an ultra linear sweep and a flat, automatically controlled output which allows a test of the scope before alignment is started. Once the scope is tested, the results can be taken into consideration during alignment to provide greater accuracy.

The following procedure illustrates the use of the SM152 to test an oscilloscope response:

1. Set the sweep marker generator to the 10-55MHz range and the tuning dial to about 43MHz. Set the sweep width to 15MHz.
2. Connect the RF cable us-

ing the 300Ω matching pad to the detector probe (blue lead) input and the scope vertical input to the SCOPE V jack on the generator.

3. Adjust the scope vertical gain until a usable pattern is achieved. If the scope has no phase shift and normal low frequency response, the pattern should appear as shown in Fig. 5.

If it has a poor low frequency response, the pattern will appear as shown in Fig. 6. The more the pattern bows or tilts, the more undesirable the low frequency response. Some bowing or tilting of the pattern is acceptable, but it should be taken into consideration when adjusting the television receiver. Other scope deficiencies are shown in Fig. 7 and 8. If any of these problems appear to excess, they will affect the response curve of the TV set.

The signal at the SCOPE H jack is about 60v P-P. This voltage is high enough to provide adequate horizontal drive for most scopes, but may overload some. This may be avoided by shunting the horizontal input terminals with a suitable resistor. Turn the horizontal gain control down about 1/3 from maximum gain and try a few values of shunt resistor until finding one which gives about full screen deflection. For the Sencore PS148, a suitable value would be about 330K. After the resistor is connected, the HORIZONTAL PHASE adjustment on the rear of the SM152 must be reset in accordance with the manufacturers instructions. This adjustment will be set once for the scope used.

The next article will cover actual applications of sweep marker generators in the alignment of the TV receiver tuner, IF, chroma bandpass and the RF and IF amplifiers in FM receivers. ■

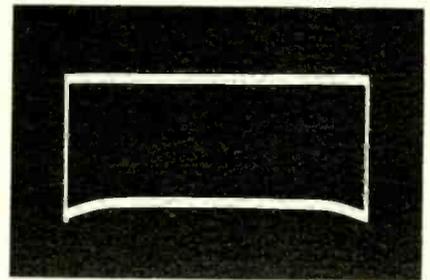


Fig. 5--A normal scope pattern with no phase shift and sufficient low frequency response.

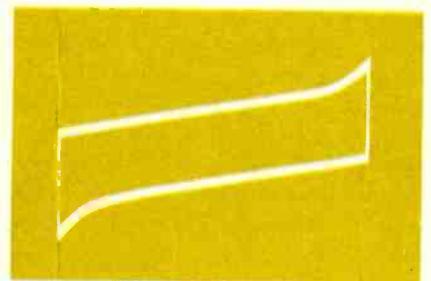


Fig. 6--The tilted or bowed pattern shows poor vertical low frequency response.

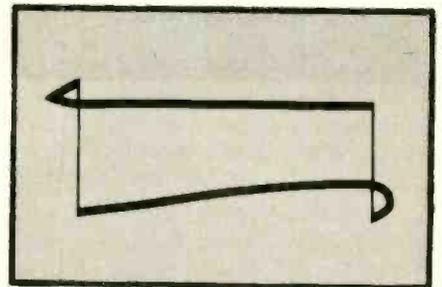


Fig. 7--Pattern showing phase shift in the horizontal amplifier.

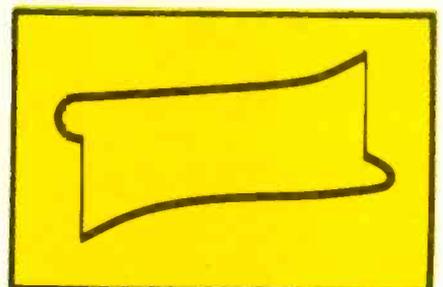


Fig. 8--Pattern showing phase shift and poor low frequency response.

Solid-State Horizontal Deflection Systems

■ The horizontal-deflection system employed in the RCA CTC40 chassis is believed to be unique in television designs currently on the market. The switching action required to generate scan and retrace yoke current, as well as high voltage pulses, is accomplished by two bipolar switches, each consisting of an SCR and a fast-recovery diode. The essential components of the system, including the high-voltage regulator, are shown in Fig. 1.

By using resonant LC circuits in the design of the systems, switching transients, which might damage the solid-state devices, are avoided. Also, the total voltage across the combination of the yoke and C1 is very low (approaching zero) during trace, and rises to only about 400v during retrace.

The circuits will be thoroughly explained later but for the moment assume that the trace switch is closed during scan time and the retrace switch is closed

during retrace time. Therefore, during scan time, the yoke and C1 are connected together in a resonant circuit whose period is roughly twice one horizontal-retrace interval. During retrace, the retrace switch is closed and the trace switch is opened. In this configuration, the yoke and C1 become part of a resonant circuit whose period is about twice the horizontal-retrace interval.

RETRACE INTERVAL

At a point about $3\mu s$ before the end of a horizontal scan, near the right edge of the raster, SCR2 starts to conduct by a positive trigger from the horizontal blocking oscillator. The conditions which exist in the circuit just after SCR2 is triggered into conduction are shown in Fig. 2. The charge on C2, 270 to 300v, causes electron flow through the yoke and C1 to ground and then through SCR2 and

L1 to C2. Current also begins to flow from C3 to ground, up through SCR2, L1 and back to the opposite side of C3. Since each of these circuits is resonant, current rises sinusoidally rather than instantaneously. At the time SCR2 is driven into conduction, a current of about 4a already is flowing in the yoke, C1 and SCR1. As the current from C2 increases toward 4a, the current through SCR1 decreases toward zero. When the current from C2 exceeds the yoke current, the additional current from C2 passes through CR1, SCR2, L1 and back to C2. This conduction through CR1 removes forward bias from the anode of SCR1, causing cutoff.

The conditions at the start of retrace are shown in Fig. 3A. Current through the yoke has reached maximum at the moment retrace begins and therefore the field around it is maximum. Then the field begins to collapse,

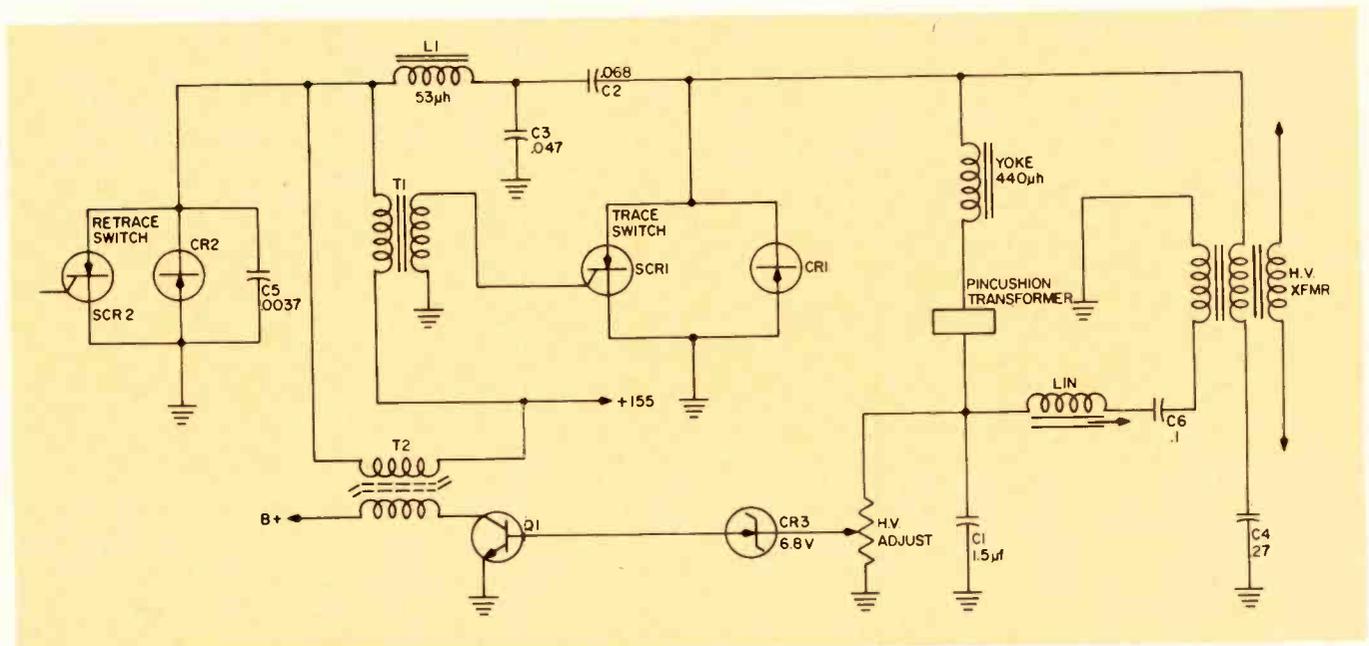


Fig. 1--Simplified schematic of the horizontal deflection system employed in RCA Victor's CTC40 chassis.

With this troubleshooting method, you should have no difficulty servicing SCR sweep systems

causing the yoke to be the energy source for retrace deflection. Since electron flow is from positive to negative within a source (as in a battery, for instance), the top of the yoke (junction of the yoke and C2) swings positive. This cuts off CR1, and SCR1 cannot conduct because no trigger pulse is present at its gate. The trace switch is open during retrace. The yoke current decreases from its maximum value at the beginning of retrace to zero about $5.5\mu\text{s}$ later, because of circuit resonance.

Once the yoke current has dropped to zero, it increases sinusoidally in the opposite direction and rises to a maximum value of about $4a$. This completes the retrace deflection of the CRT. The resonant circuit of which the yoke is a part during retrace consists of the yoke itself, capacitors C1, C2 and C3. The resonant frequency of this circuit is about 45.5kHz , so the time required for one cycle is about $22\mu\text{s}$. ($F = \frac{1}{2\pi\sqrt{LC}}$). During retrace, current in the yoke changed from maximum in one direction to maximum in the opposite direction—only one-half of a cycle $\frac{1}{M}$ requiring about $11\mu\text{s}$ retrace time.

During retrace time, a second resonant circuit Fig 3B also is of interest. This circuit consists of L1 and C3, resonant at about 100kHz . Since capacitor C3 is common to both resonant circuits, there is a continuing interchange of energy between the two during retrace.

The high-voltage transformer and capacitor C4 are not shown in Fig. 2 because the impedance of this branch is so high that it does not present a significant load on the deflection circuit during trace time. During retrace time, the transformer becomes a fairly well-matched load for the yoke and it ex-

tracts power from the deflection circuit. This power, of course, is ultimately used in high-voltage circuit.

At the end of retrace, shown in Fig. 4, the yoke current is at maximum and begins to decrease. The field around the yoke begins to collapse, and thus the yoke itself is the energy source. The yoke end connected to C2 and CR1 becomes negative, and electrons flow in the resonant circuit consisting of the yoke, CR1 and C1 resulting in current decay which is sinusoidal.

The current in the resonant circuit consisting of L1, C3 and CR2 reverses, cutting off CR2. SCR2 has no trigger pulse applied to its gate, so it remains cut off; therefore the retrace switch is opened by L1 and C3.

When the retrace switch was closed, C5 was effectively shorted but with the switch open it is in a resonant circuit with L1 and C3. This allows current to flow back into C2 and a positive pulse of voltage appears at the junction of C5 and L1. Again the current reverses, and CR2 conducts a second time. Because of resistance in series with C5, as well as the action of T1 and T2 (to be discussed), circulating current in L1, C3 and C5 drops to insignificance after the time shown in Fig. 4B. Therefore, the retrace circuit is inactive during the remainder of the trace interval.

TRACE INTERVAL

The circuit action during the scanning (or trace) interval is shown in Fig. 5. During the first half of this interval, yoke current decreases sinusoidally from about $4a$ to zero. During the second half of this interval, the current reverses and increases sinusoidally toward $4a$. This

half-sine-wave of current causes the beam to be deflected from left to right across the screen like reading a typed page.

In order to have current flow through SCR1 during the second half of the trace interval, this device must be gated on. A positive gate voltage is derived from the secondary of T1 during most of the trace interval. Thus when the anode of SCR1 becomes positive at mid-trace, the device can conduct. The positive gate is removed when retrace is initiated, and the positive anode voltage is removed shortly after.

LINEARITY CIRCUITS

The yoke current just described cannot produce a linear sweep, since it is essentially sinusoidal. Two circuits are used to provide linearity. One is not shown in this article. It consists of a 4.7Ω resistor shunted across one turn of the high-voltage transformer. This combination is connected between SCR1 and CR1 so that the instantaneous voltages on these devices are slightly different.

The second linearity circuit is shown in Fig. 1. The coil and capacitor connected between a winding of the high-voltage transformer and the junction of the yoke and C1 are tuned to approximately the second harmonic of the scan frequency. The circuit is shock excited during retrace time, and during scan time it adds a second-harmonic current to the yoke to make the total current nearly a sawtooth.

POWER INPUT CIRCUIT

To understand how energy from the power supply is supplied to the deflection system, it is necessary to consider the function of T1 and T2. During

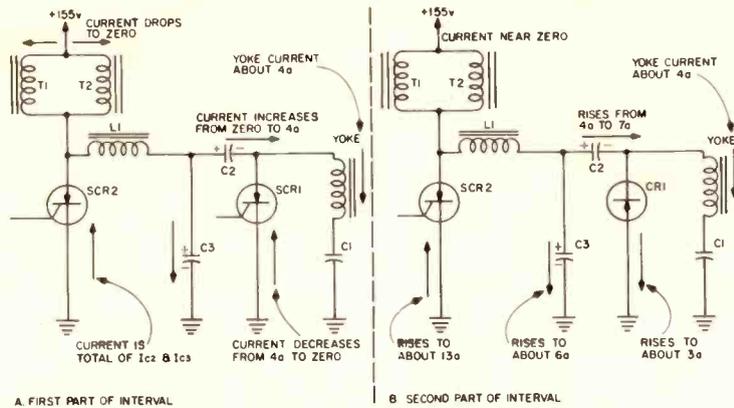


Fig. 2--Circuit action during the $3\mu\text{s}$ interval before retrace.

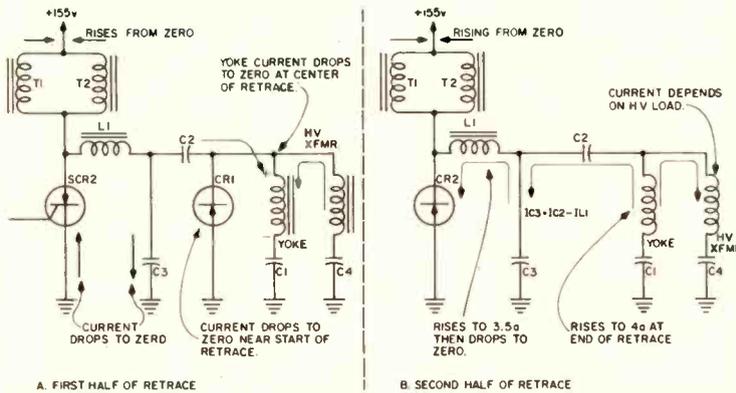


Fig. 3--Circuit action during retrace. First half of retrace is shown in Fig. 3A.

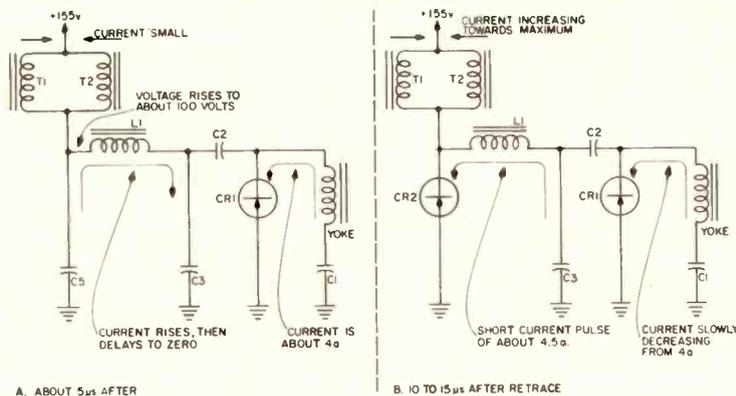


Fig. 4--Circuit action at start of trace interval.

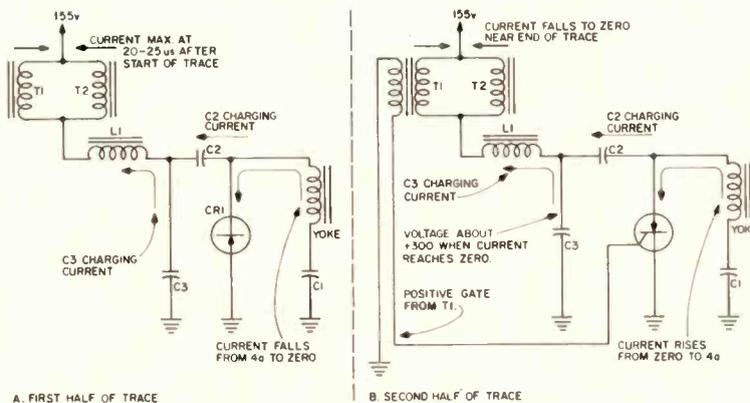


Fig. 5--Circuit action during trace interval.

retrace (Fig. 3) these transformers are connected between B+ and ground. This interval is so short that the current rises only to a small value. During scan time, the right end of C2 is connected to ground by the trace switch. A series resonant circuit exists between ground and B+. Starting from ground, the components are C2 and C3 in parallel, L1, and the parallel combination of T1 and T2. This circuit is resonant at about 5100Hz if no current flows in the control winding of T2, which is a saturable reactor.

At the start of trace, the voltage across C2 and C3 begins to rise, reaching a maximum in one-fourth of a cycle, or $49\mu\text{s}$. Since the scan interval is about $52\mu\text{s}$ and SRC2 begins conduction about $3\mu\text{s}$ before the end of the scan interval, the voltage across C2 and C3 is maximum at the moment when the retrace switch is closed. This voltage is slightly less than twice the supply voltage, or about 300v, and it is the energy which is supplied to the yoke and high-voltage circuits during retrace.

HIGH VOLTAGE REGULATION

If high voltage suddenly begins to increase, the voltage across C1 (Fig. 1) increases. This causes the regulator transistor, Q1, to conduct more, allowing a greater current to flow in the control winding of T2. This tends to saturate the core of T2, lowering the primary inductance.

But T2 is part of the resonant circuit through which C2 and C3 receive energy from the power supply. Reducing the inductance of T2 raises the resonant frequency of the charging circuit so that the voltage on C2 and C3 passes through at maximum and begins to decrease before retrace is initiated. This, of course, reduces the amount of energy available to the yoke during retrace, and stabilizes the HV.

SERVICING

From the servicing point of view, the design of the deflec-

tion system offers several distinct advantages. Possibly the most welcome of these is that the loss of drive (horizontal-oscillator failure) is not destructive as it is in vacuum-tube circuitry. No more incinerated 6JE6s and sockets are caused by oscillator failure. Also, since the yoke and the high-voltage transformer are effectively parallel loads on the deflection system, it is possible to isolate the high-voltage transformer without disabling the deflection system. This, of course, makes it a simple task to determine whether the fault is in the yoke or the transformer.

While space does not permit a description of the symptoms attending the failure of each component, it is possible to isolate faults into three general areas of the circuit quickly and accurately. Referring to Fig. 1, notice C2 isolates the trace

circuit from B+. Therefore, only shorted components in the retrace circuit can overload the powersupply if trigger is removed. By removing the lead to the gate SCR2 and observing whether or not the circuit breaker trips at switch-on, shorts may be isolated to the retrace circuit.

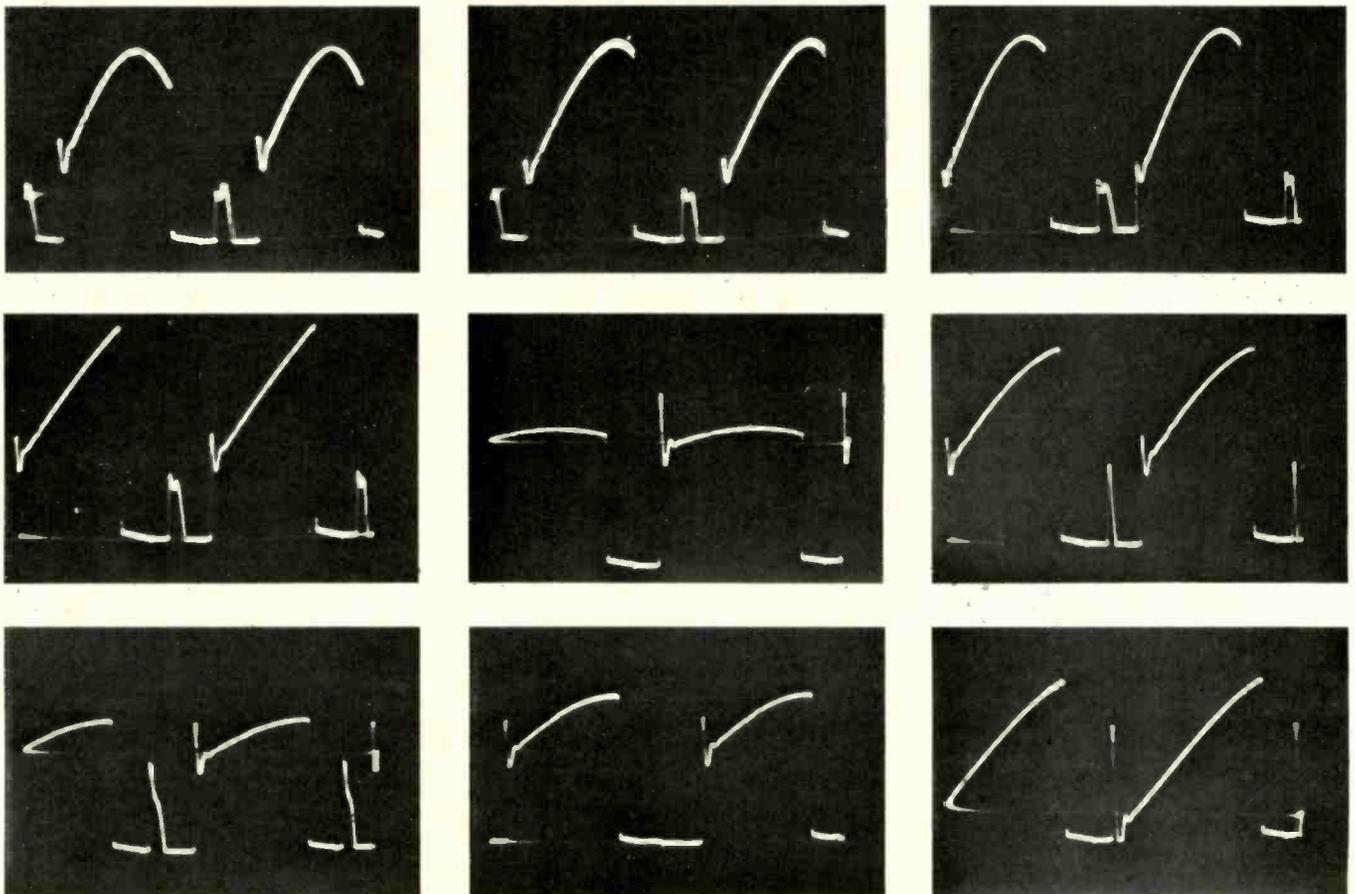
The second step in isolating faults is to short directly across the trace switch (SCR1 to ground). When the set is switched on with SCR1 shorted, the power supply will not be overloaded unless trouble is present in the retrace circuit, or the trigger pulse to SCR2 is at fault.

The next step in isolating trouble is to disconnect the high voltage transformer at its junction with C4. Before turning the instrument on with the transformer disconnected, reduce the line voltage to less than 100v to prevent exceeding the PIV or CR1, then turn the instru-

ment on. If the power supply overloads under these conditions, the fault is in the trace circuitry; if it does not overload, the problem is the high-voltage system. Observation of the waveform at the anode of SCR2 also is helpful in isolating faults. The appearance of the waveform under various circuit conditions is shown in Fig. 6.

This system simplifies rather than complicates servicing of the horizontal system. Because of the relatively low operating potentials and the absence of switching transients, it appears that this circuit or variations of it will become common in the not-too-distant future. With a minimum of effort in learning how the circuit works and a logical troubleshooting procedure, as outlined, the average technician should have no difficulty servicing SCR sweep systems. ■

Fig. 6--Waveform at anode of SCR2. (A) Normal operations, brightness minimum. (B) Normal operation, brightness maximum. (C) Q1 shorted, any brightness setting. (D) T2 primary open, any brightness setting. (E) SCR1 shorted. (F) Capacitor C3 reduced to .0022 μ f. (G) HV transformer disconnected, no circuit faults. (H) HV transformer disconnected, capacitor C3, reduced to .022 μ f. (I) HV transformer disconnected, C1 leaky (10 Ω).





Service-Dealers Promote Technician

Active recruiters engineered their own technician training program

■ If you lack good service men in your city, don't waste your time complaining--do something about it. Get together with other dealers who have the same problem and then interest a college in your area in establishing a training course.

"That's just what we did in Dallas," reports Tilman Babb, president of the Wilshire Television Sales and Service. Babb's partner, Gilbert Smith, is one of the five Dallas dealers serving on the Advisory Committee to the Television and Radio Repair Course at the El Centro College.

The course began in September and El Centro College's assistant dean, Dean Van Trease, says that the "response was amazing." There are now 26 men enrolled, ranging in age from 18 to 45 and the college

has invested \$105,000 to provide the students with the latest and most modern electronic equipment.

"The interest in this class has been so great that we are planning to offer it in our night school this coming fall," Van Trease indicates. He believes this course to be the only one of its kind in Texas, and one of very few in the country.

In addition to Smith, the Advisory Committee includes: "Dawes Skeen, Ace Television Sales and Service; Dee Sponsel, Sponsel Radio and TV Service; Doc Childers, Childers Radio and TV Service; and Richard Kozelski, Kozelski Electronics -- all dealers in Dallas. The purpose of this committee is to help establish curriculum and evaluate the program.

The course has already been



The Advisory Committee meets (left to right) with Dean Van Trease, assistant dean of El Centro College (standing) seated is Richard Kozelski, Kozelski Electronics with Dawes Skeen of Ace Television and Gilbert Smith of Wilshire Television at extreme right.



Training

pledged the support of the Texas Electronic Assn. and will soon be brought to the attention of high school students and their parents in the Dallas County area by the Second Annual Technarama which will be held in El Centro College.

However, before offering a pattern - that - your - community - can - follow, Van Trease offers this advice: "First, make sure that there is a need for such a class in your community. Secondly, make sure that you get a good advisory committee of dealers who have been successful because of their good service. There is no doubt that in most communities there is a strong need for such a course. And it will take educators a long time to saturate the present needs."

The El Centro College educator reveals that in addition to the night school class already being considered for the fall curriculum, serious thought is being given to an advanced course in electronics to be given to men already in the television and radio business.

Babb urges dealers in other communities to follow the Dallas example. "These courses will make more qualified technical people available and you owe it to your community. The electronic industry is changing so fast, that unless you have access to men with training on the latest and most modern of equipment, you as a dealer just cannot keep up with it."

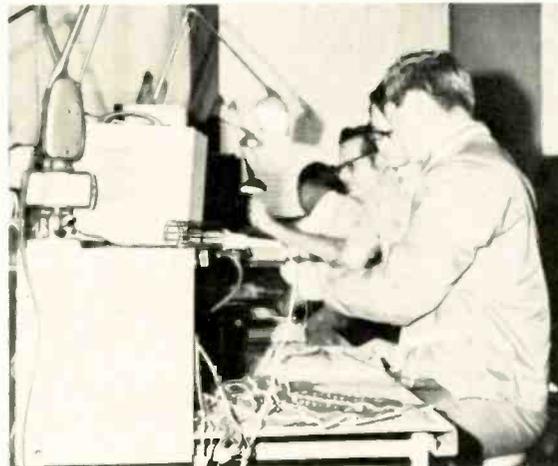
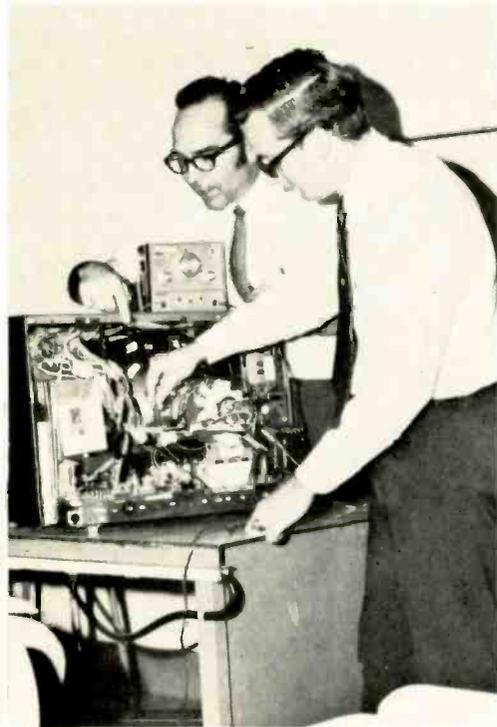
Babb outlines a few points

he feels necessary to a profitable and successful service business:

1. Have properly trained personnel.
2. Maintain excellent customer relations.
3. Make adequate charges for the work performed.
4. Maintain a proper volume.
5. Consider the possibility of selling service contracts.
6. Use the service department as an aid to sales.

The technicians at Wilshire Television receive constant training at monthly store meetings and by attending courses given by NARDA and by the Texas Electronics Assn. Babb indicates that technicians should be encouraged to take courses like the one Dale Carnegie offers so that they can meet the public well. "The sales ability they can gain from such courses will not only enable them to sell the service that the customer's set needs, but also to sell the customers on the limitations of the product," Babb stresses.

"This may sound negative, but many customers purchase a radio, TV or stereo and expect too much in the way of performance. This is not always their fault. Many times, from what the salesman or the advertisements have said, they expect a perfect picture at all times. And when the picture isn't perfect, they blame the technician. For this reason, the technician should be able to express



The class receives up-to-the-minute training with more than \$105,000 in modern electronic equipment at their disposal.



Students interested in television and radio service classes range in age from 18 to 45 years.

himself well so he can provide a proper explanation to the customer and maintain goodwill."

Keeping service records with 8000 customer cards in the files has also helped tremendously in achieving a periodic maintenance schedule on customer sets. As Babb points out, "These case histories enable us to give the customer a quick and accurate report on his set. If we didn't know the last time we serviced the product, what we did and what we charged for, we could lose both time and a customer. It takes work, but it is worth it.

"We do not attempt to do major repairs in the home. An auto mechanic will certainly not come to your home to overhaul the transmission of your car. The technician making home calls must be able to determine if a change of tubes will repair the set, and if not, be able to give the customer a reliable estimate of the work that has to be done in the shop."

Important, too, in a thriving service business is a good employee - employer relationship, Babb admitted. "We pay our men a salary and a small commission. We have found this to be best. We also have a profit-sharing plan for our employ-

ees. I don't know for sure if a profit-sharing plan works, but I am inclined to think so. We have men who have been with us for 6 to 14 years and we believe that long tenure breeds loyalty and loyalty pays off where the customer is concerned." Wilshire television also furnishes uniforms, white dress shirts, ties, wool trousers and even coveralls for the antenna men when they go under the house or on the roof. "Expensive yes, but we think it is worth it," Babb reports. "We also provide a hospitalization plan which gives an employee medical care in a hospital up to 70 days and an \$11,000 life insurance policy. Both insurance plans are unusual because we bear the entire cost, while many such plans expect the employee to pay part of it," he says.

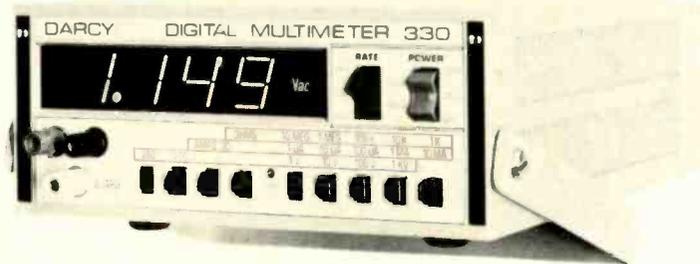
The technician training program, in which it is actively involved, and maintenance of its own highly trained staff has paid dividends for Wilshire Television. It sells its customers through better service and as Babb indicates, "Many of our new customers come to us as referrals. If you do a good job, you'll get additional business and a reputation that can't be beat." ■



Tilman Babb checks the repair records with one of his servicemen. The files contain 8000 cards.

Darcy DM330 Digital Multimeter

A low-cost digital multimeter combines the functions of a milliammeter, an ac-dc voltmeter and an ohmmeter to increase your service efficiency in today's space-age circuitry



Darcy Model DM330 digital multimeter.

for more details circle 900 on postcard

■ We ordered the Darcy DM330 digital voltmeter to evaluate it in test lab because more and more shops are purchasing units of this type for their versatility, speed and accuracy—especially for transistorized service. The unit came packed in a heavy box filled with cut cardboard which literally suspended it.

The first thing we noticed about the DM330 was its ease of operation and the sharp readout display. Packed with the unit is a service/operating manual which explains all of the operating ranges and contains complete maintenance procedures and replacement parts list.

The DM 330 is a transistorized digital multimeter for measuring dc volts, dc current, ac volts and ohms. It operates on either 117 or 220vac. The operating voltage must be specified when the unit is ordered, but it can be easily changed later by referring to the manual.

The instrument provides five resistance ranges from 1K to

10meg, ac and dc volts from 1v to 1kv and dc current from 1 μ a to 10ma. All operating controls are push-button operated and the readout display automatically indicates the type of measurement (vac, vdc, K Ω , ma, μ a) and the polarity. Decimal point positioning is also automatic.

The display provides a full three-digit readout with a 50 percent overrange on all ranges. This means if you measure a voltage on the 0-100vdc range, it is possible to actually read up to 150vdc. If the measured voltage goes over 150vdc, an overrange indicator will come on which tells you to go to the next higher range—in this case, 1000vdc.

Digital test instruments, of course, have several important features such as speed, accuracy and high input impedance. We first tested the DM330 on a transistor TV set to note the circuit loading effects.

The DM330 has three input terminals on the front panel

which are designed to accept standard voltmeter leads. Besides the normal black and red terminals found on most meters, the unit has a third "GUARD" terminal which is used when measuring with shielded test leads. The GUARD terminal is normally connected to the black ground terminal unless shielded leads are used.

The manual says to start with the unit on the highest range if the measured voltage is unknown, just as with a conventional meter. Since we already knew that the transistor circuit would read less than 20vdc, we started out on the closest range, 100vdc. The circuit voltages were less than 10vdc in this case and the manual says to reduce the range until the overrange indicator lights and then go back to the next higher range. We were reading voltages between 2.5 and 8vdc and the overrange indicator came on when we reached the 1vdc range, so we went

Continued on page 69



B&K Model 1077 television analyst, showing test pattern produced.

B&K Model 1077 Television Analyst

**Reduce service time
by employing signal
injection to isolate
circuit defects**

for more details circle
901 on postcard

■ With more transistorized television receivers to service, we must change our service techniques. We believe that one of the fastest methods is the use of signal injection to isolate a defective stage. The finger on the volume control method to check the output stage of a radio is a simple form of signal injection. Unfortunately it is only useful in limited applications.

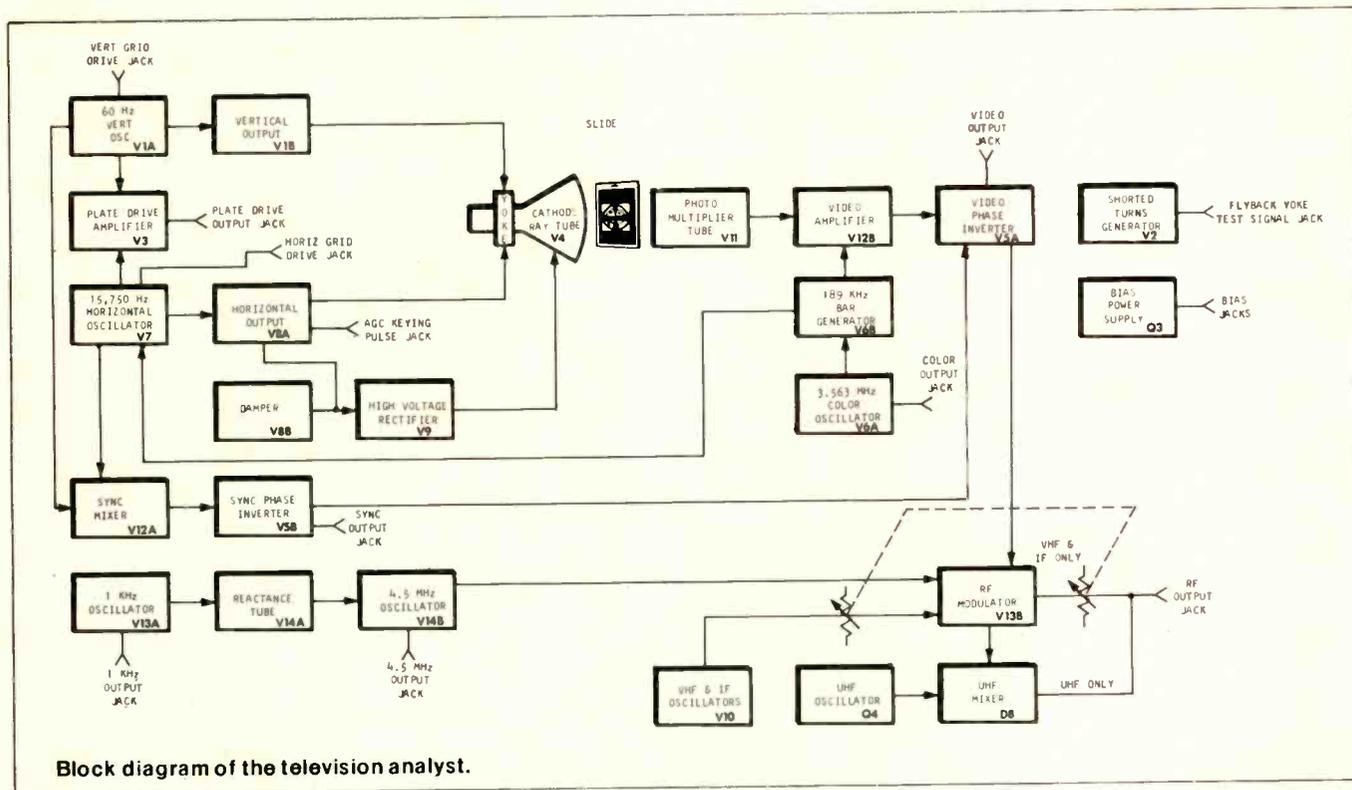
Actually, having a television analyst is like having a TV station of your own. You can inject your own TV signal at any time or point to isolate intermittent or general TV trouble while viewing the test pattern on the screen.

As we unpacked the analyst for this report, we compared it with the Model 1076 which has been a part of our test lab equipment for some time. There is some resemblance in size, but the 1077 has a more modern panel.

One of the panel features first noticed was the addition of a UHF output. And many of the earlier 1076 circuits were revised for testing transistorized

TV sets with complete safety by providing the proper impedance match for transistorized circuitry.

For those who are unfamiliar with the television analyst, here are a few of the signals the unit will generate. (1) All signals normally transmitted by a TV station and those produced within a TV receiver for point-by-point signal substitution. (2) UHF signals on channels 14 through 83, VHF channels 2, 3, 4, 6, 7, 8, 12 and 14 for testing tuners. (3) IF signals of 20 to 48MHz for testing IF amplifier stages. (4) A positive or negative composite video signal for injection into video stages. (5) A keyed color bar pattern which modulates the RF output for troubleshooting and adjusting color circuits. (6) A color rainbow signal for injection into color amplifiers and demodulators. (7) 4.5MHz sound channel test signal that is frequency modulated by 1kHz audio tone and a 1kHz tone for audio circuit testing. (8) Composite sync pulse signal of positive or negative polarity, adjustable in amplitude with var-



able impedance for troubleshooting sync circuits, picture tubes, blanking circuits and transistorized keyed AGC circuits. (9) Vertical and horizontal grid drive signal for troubleshooting sweep circuits. (10) Vertical plate drive signal for checking vertical output transformers. (11) Vertical yoke test signal to determine if vertical yoke windings are defective. (12) Horizontal plate drive signal for checking horizontal output transformers. (13) A high level keying pulse for testing keyed circuits, AGC, burst amplifiers and blanking.

There are a number of other uses for the analyst such as: generating a test pattern for color convergence adjustments; checking bandwidth resolution, shading and contrast capabilities of the TV receiver; displaying pictures on the TV screen for advertising and as a transmitter for video paging at conventions, hospitals and other gatherings.

One particular feature we would like to see added is a horizontal and vertical grid drive signal to drive transistorized

sweep circuits. We feel this would be of great value in servicing the smaller transistorized sets.

The scanning section is the heart of the analyst. It consists primarily of the CRT and the photo-multiplier tube. Basically, the scanning circuit provides the following functions: A dot of light scans the CRT. A slide masks the light which reaches the photomultiplier tube and the photomultiplier tube converts the light into a video signal that is equivalent to the image on the slide.

An electron beam scans the face of the CRT just as in a TV receiver. As the electron beam scans, it produces a flying dot of light. The light is directed toward a photomultiplier tube which produces an output signal proportional to the amount of light which strikes it. A positive transparency slide is inserted between the cathode ray tube and the photomultiplier tube. As the small spot of light sweeps across the slide from left to right, light passes through the transparent portions of the slide and an output voltage is produced by the photomultiplier tube. When

the spot passes behind the black parts of the slide, no light reaches the photomultiplier tube and no output voltage is produced.

Shades of gray in the transparency will produce some output voltage, but less than the fully transparent areas. Thus, as the entire slide is scanned, the photomultiplier tube will produce video signal voltages equivalent to the slide image.

After the repair is complete, the analyst can be used to test the over-all performance of the TV receiver. The receiver can be checked for RF sensitivity, AGC action, centering, size and linearity, shading, resolution, bandwidth and frequency response.

The manual supplied with the instrument is almost a complete television repair course in itself. It takes you step-by-step through the various stages of operation and covers procedures, symptom analyses and troubleshooting techniques. The troubleshooting procedure section with its condensed charts provides a quick reference to symptoms, causes and cures. Net price is \$379.95. ■



DEALER SHOWCASE

For additional information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly.

FM/AM Stereo Receiver 704

Deluxe receiver at a moderate price

The KR-100 stereo receiver features a silicon power transistor amplifier section with 140w of music power



(IHF) at 4Ω, 110w at 8Ω. It reportedly has distortion rated less than .5 percent and a frequency response of 13 to 70,000Hz. The inputs accommodate the most complex stereo system requirements including provision for two turntables. There is a separate preamp output as well as two pairs of stereo speaker outputs plus center channel. It also features a 1.8 μv RF section. Four integrated circuits and two field-effect transistors (FET) permit excellent FM selectivity and reception, and the low IM distortion delivers clear low-to-high-level listening. Additional features include: front panel jacks for dubbing/tape record and headphone; push-button controls to regulate interstation MUTING, LOUDNESS control, tape monitor and low and high filters. Price is \$299.95. Kenwood.

Speaker 705

Designed for solid-state components

Announced is the S20 controlled impedance speaker system designed for solid-state components. The systems' Mediterranean styling features an antiqued pecan finish with ornate scrollwork grills. A flamenco red grill cloth is supplied with the speakers, al-



though other colors may be substituted. Inside, the system includes a 10in. woofer and a 5in. dual-cone midrange/tweeter in a 22¾ in. x 11¾ in. x 11in. enclosure. S20 price is \$129.95. Scott.

Portable Phonograph 706

Portable stereo phonograph with built-in eight-track tape player

A portable stereo phonograph with a built-in eight track stereo tape cartridge player is introduced. The model CP500E features an eight-track stereo tape deck with automatic program ad-

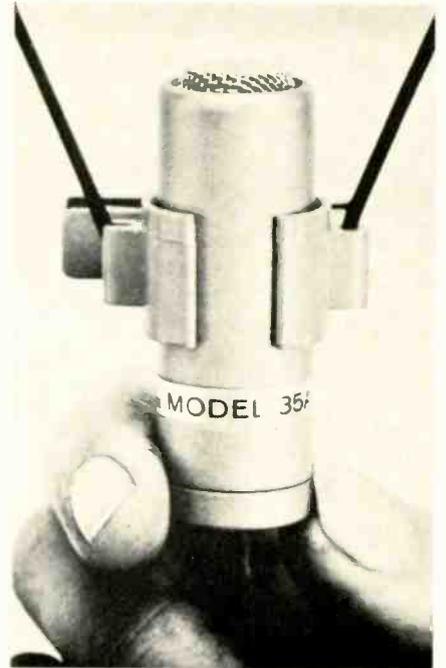


vance and manual program selector. The record changer, with diamond stylus, plays standard record sizes and speeds. Also included is a 45 rpm spindle. The solid-state amplifying system produces 8w peak or 4w EIA music power output. Two 6½in. detachable speakers, separate volume, balance and tone controls are among the features. The phonograph has a high impact polystyrene brown cabinet with walnut grained vinyl inlay. List price is \$159.95. Motorola.

Microphones 707

60db output and 50-12,000 Hz frequency range

"Mini-mike," a dynamic, omnidirectional microphone with a tailored frequency response over the entire speech range is announced. The microphone is designed for broadcast, recording and public address applications. The Model 35 is ¾in. in diameter, 3in. in length with a high-low impedance combination and a weight (less cable) of 41g. The model 35A is 2¼ in. in length, ¾in. in diameter with a 150Ω impedance and a weight of 29g. Both models reportedly feature a 60db output level and a 50-12,000Hz frequency range. They are finished in desert



gold with a chromium grill. A 25ft. shielded cable, lavalier cord and clothing clip are included with each microphone. The Model 35 has a list price of \$65; Model 35A, a list of \$75. Conrac.

Speaker 708

Wide range provides response from 40 to 15,000 Hz

Announced is a portable, weather-resistant, Hi Fi speaker system. Designated the 829A patio speaker, the system features the Model 755E 8in., wide-range speaker claimed to provide response from 40 to 15,000Hz. The





New Weller® TEMPMATIC®

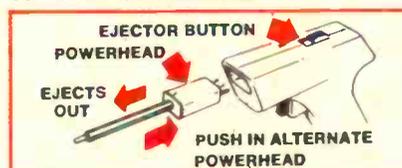
Temperature Controlled Soldering Tool
for light and heavy duty soldering.

Now one tool combines all the advantages of a lightweight pencil type iron, a fast heating soldering gun, and tip temperature control.

Features Weller's exclusive new POWERHEAD

The heart of this new tool is its long-life, high efficiency POWERHEAD . . . another great innovation from Weller. The POWERHEAD contains Weller's temperature control system (which has been so successful in Weller temperature controlled soldering irons). The result is maximum protection of components even in the most delicate work situations.

The integral points of the POWERHEAD have made over 30,000 solder connections in lab tests.



The points have a special premium plating which vastly extends life. And the POWERHEAD completely eliminates filing and frequent tip changes as encountered with conventional

non-temperature controlled tools.

Two POWERHEADS are available: A 700°F. 3/16" chisel point POWERHEAD or a 600°F. 1/8" conical point POWERHEAD. A convenient ejector button makes switching POWERHEADS easy.

The entire tool weighs only 7 ounces. Its trigger turns heat on and off. And the stainless steel barrel has long reach.

Ideal for service, repairs, PC boards, models and hobbies. Order these new Weller TEMPMATIC models now.

Weller®

WELLER ELECTRIC CORP., Easton, Pa. World leader in soldering tools

. . . for more details circle 139 on postcard

SKINNY, YES.

undernourished?

HARDLY!

This QUAM speaker is thinner and lighter than most, but there's nothing scrawny about its sound or emaciated about its performance.



It's one of 25 models in the Quam line that's being fed a special diet . . . an exclusive new high energy magnet material we call Q/8.

Q/8 provides more gap energy for less weight, so a .65 ounce magnet gives you the same performance as a full ounce of Alnico V. Ideally suited to Quam's high density cup-pot structure, Q/8 slims the speaker down in contour as well as weight—while delivering full, robust sound.

Q/8 magnets are exclusively available today on Quam speakers—part of our ongoing program of nourishing our customers first with the finest.

QUAM—always the Quality Line, for every speaker need.

QUAM-NICHOLS COMPANY
234 East Marquette Road
Chicago, Illinois 60637

. . . for more details circle 127 on postcard

ET/D DEALER SHOWCASE

cocoa brown cabinet is molded of high-impact-resistant Kydex. A chrome-plated stand is coupled to the cabinet using pivot bolts with knurled knobs to permit angular adjustment of the cabinet for standing on the ground or for wall mounting. Net price is \$71.50. Altec.

Tape Player 709

Adaptable to auto or home

A line of "Cartable" eight-track tape players is introduced. Six portable models designed for easy transfer



between auto, boat and home cover each price bracket. The top-of-the-line is the "Cartable 2800," a solid-state, woodgrain, eight-track stereo system adaptable to auto or home. The unit features four 5¼ in. speakers plus optional matching woodgrain speakers for indoor installation. Belle Wood.

Phone Stylus Cleaner 710

Consists of lint-free, treated pad

Introduced is a cleaner for the phonograph stylus. It features a lint-free, treated pad, and reportedly provides



easy mounting without causing damage to the stylus. Instructions indicate that it can be used either on radial or elliptical styli. The cleaner comes in a case to keep it free of dust and dirt. Elpa.

For more information on
DEALER SHOWCASE
See page 83
READERS SERVICE

TWO NEW "plastic view" screwdriver kits

EASY TO USE, CARRY & STORE

These neat, extremely compact kits fit hip pocket, tool box, boat kit, glove compartment . . . can also be hung on a wall. Durable "Plastic View" zipper case permits instant identification of tools.

Amber plastic (UL) Service Master handles are shockproof, breakproof, have patented spring holding device that accepts all Xcelite Series 99 blades — lets you add tools as needed at minimum cost.

Space saving, single-ended interchangeable blades . . . can be used with Xcelite extensions for extra reach.



99PV-6

Handle and 3 slotted screwdriver blades (3/8", 1/4", 5/16" tips), 2 Phillips (#1, #2)



99PV-4

Handle and 3 slotted screwdriver blades (3/8", 1/4", 5/16" tips)

WRITE FOR CATALOG 166

XCELITE

XCELITE, INC., 14 Bank St., Orchard Park, N.Y. 14127
In Canada contact Jos. St. Mars, Ltd.

. . . for more details circle 140 on postcard

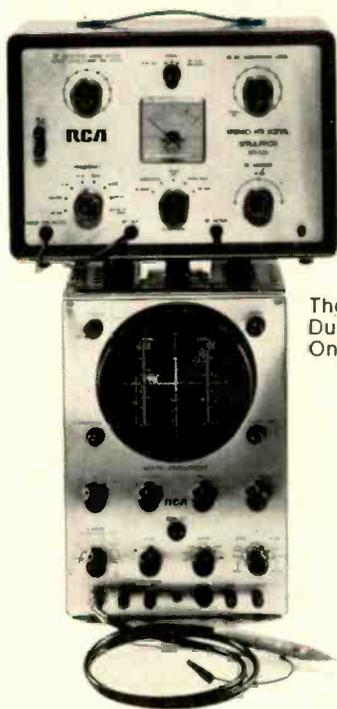
ELECTRONIC TECHNICIAN/DEALER

There's a reward

on their heads.



FREE:
The Copymate Dry Copier, with 20 sheets of copymate paper, with your purchase of the RCA WR-52A Stereo FM Signal Simulator or WO-91C oscilloscope!



The WR-52A Stereo FM Signal Simulator only \$248.00*

The WO-91C 5-Inch Dual Band Oscilloscope Only \$269.00*

Now you can own one of the fastest, most accurate trouble-shooters in the East (West, North and South), and receive, absolutely free, the new all-electric Copymate!

Copymate is the portable dry copier that copies anything — ... checks, invoices, schematics, photos, your children's drawings and school work — without liquids, chemicals or sprays!

The Copymate, with paper, has a retail value of \$31.94, but you can get it free . . . Here's how.

Buy the WR-52A or WO-91C between April 15 and July 15. Mail us your warranty card and the blue label on the outside of the carton no later than July 31st and we'll ship the Copymate to you at once, freight prepaid!

Good deal? You know it is.

Mail your card and label to: RCA Electronic Components, Test Equipment Headquarters, Bldg. 17-2, Harrison, N.J. 07029.

*Optional distributor resale price.

RCA

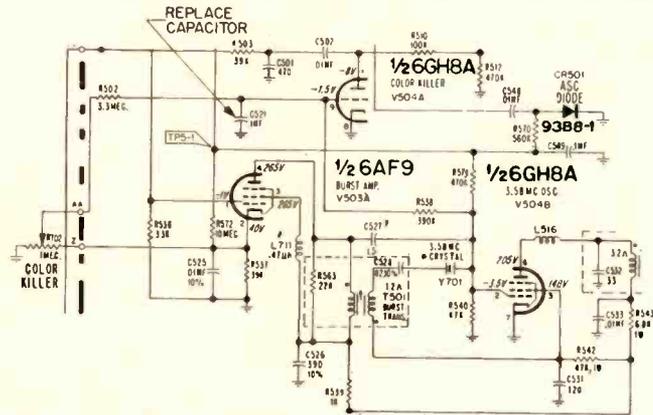


COLORFAX

ADMIRAL

Color TV Chassis G11/G13/H10/H12/K15 Series—Weak or No Color

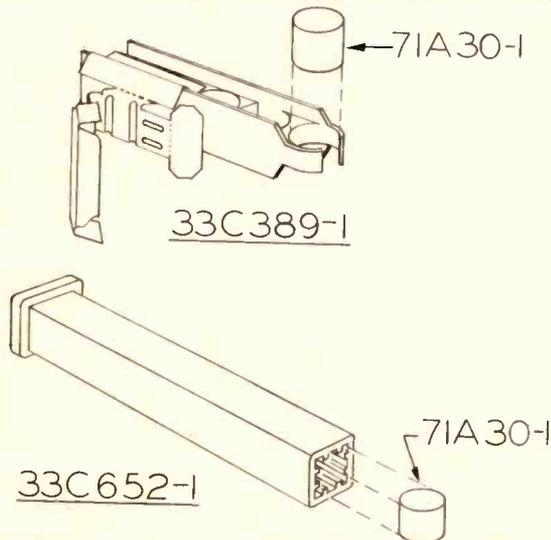
This problem can be caused by failure of disc capacitor C521 (.1 μ f, 50v). Failure of this capacitor permits a negative voltage to be produced at the plate (pin 9) of the color killer which will bias off the 2nd bandpass amplifier. Sub-



stitute this capacitor to determine if it has failed. Measuring it with an ohmmeter may not reveal a defective capacitor. Replace with a .1 μ f of higher working voltage such as 64C53-98 (.1 μ f, 200v) which is now used in production.

Color Convergence Magnets

The replacement parts pictured are available to replace the nylon slider (magnet holder) used on the convergence



assembly of earlier color TV models. Order the type shown in the drawing. The magnet (71A30-1) is not included with either type. The mounting clip shown with 33C389-1 is included.

Color TV Chassis G11/G13/H10/H12—Wrong Colors

If you encounter a complaint of chartreuse (yellow green) flesh colors which turn blue when the tint control is rotated, check the ECO transformer. Using the incorrect transformer will cause the 3.58MHz to be applied to the

color demodulators 180deg out of phase. A keyed rainbow from a color bar generator will show the blue and red bars reversed. They will also roll toward or away from each other when the tint control is rotated, instead of shifting to one side together.

The correct ECO transformer for the G11, G13 and H12 series chassis is 72B285-1. The correct transformer for the H10 series chassis is 72B285-2. Be sure you use the correct replacement—they look alike!

Color TV—Service Hint

Sound But No Picture, Except Briefly When Set Is Turned Off

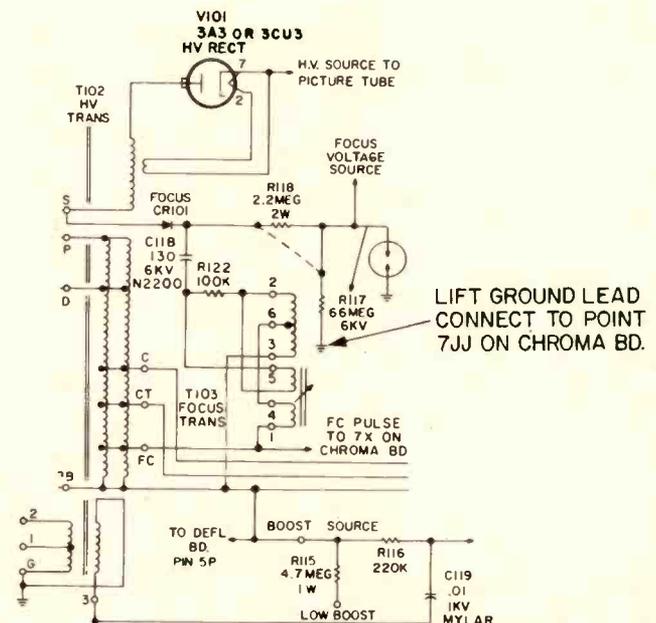
We have had several reports of this unusual condition which is not actually a fault but it can generate a service call. If the brightness control is accidentally used to try to turn the set off, the next time the customer turns it on with the regular on-off switch, he will get sound but no picture. If he then turns the set off, the picture will come on briefly and fade out. This causes him to think something is wrong when all he needs to do is turn the brightness up!

This condition occurs in models with the spot eliminator circuit. These models have an extra switch on the ON-OFF switch which causes the picture tube to conduct at full brightness as the set is turned off. This drains off the high voltage rapidly and prevents a lingering spot on the face of the picture tube.

MAGNAVOX

Color TV Chassis T924—Elimination of Afterglow on CRT Face

Afterglow on the face of a CRT used with a T924 chassis can be eliminated by lifting the ground end of resistor R117, the 66M 6kv focus resistor and soldering it to point



This little part plays a big role in radio.

This box gives you top revues.



The transistor is no bit player when it comes to radio performance. That's why Delco transistors are manufactured under controlled conditions that assure high reliability. And why they're thoroughly tested before being placed in the familiar blue and black box.

Delco Radio engineers are leaders in auto radio design and transistor technology.

Delco radios are original equipment on over half of the cars on the road.

That United Delco box is your guarantee of genuine OEM

quality replacement parts. And just 12 Delco transistors replace over 7,500 other types.

Doesn't it make good sense to stock the best?

Remember these facts when you re-order. And remember, too, that your United Delco supplier handles the most recognized name in the parts business.

Next time you think little, think big. Think Delco.

DELCO RADIO, Div. of General Motors, Kokomo, Ind.

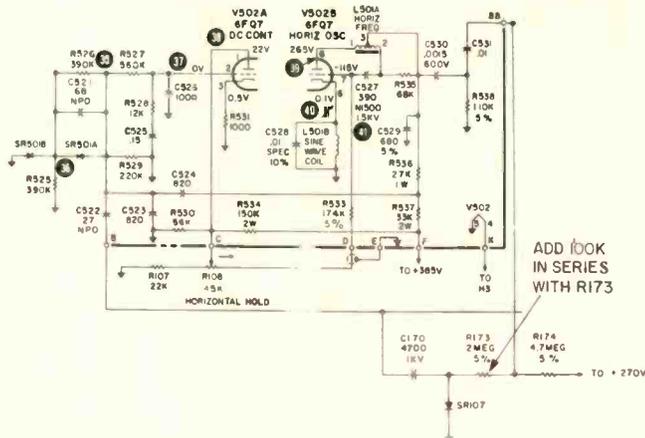


MARK OF EXCELLENCE



... for more details circle 113 on postcard

Resistor R173 (2M, 1/2 w, 5%) in the grid circuit of the 6JE6 horizontal output tube can cause horizontal jitter, low 6BK4 current and changing raster size as the brightness



ADD 100K IN SERIES WITH R173

control setting is changed, and when its value drops below 1.9M. If the value is indicated as being near the low tolerance limit and the ohmmeter is not known to be accurate, add a 100K resistor in series with R173. Recheck the circuit for elimination of the symptoms.

Minimum 6BK4 Current

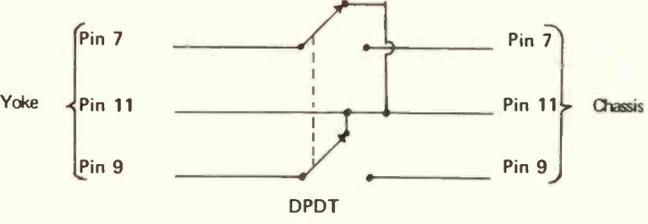
With CRT BIAS and BRIGHTNESS controls set for a dark screen (no CRT current) the 6BK4 current must be minimum of 1ma. This current can be checked by measuring

Continued on page 67

7JJ on the chroma board. This can be most readily accomplished by lifting the ground lead of R117 from its ground connection and moving the lead to one of the blank holes on the terminal board. Run the lead through the hole and bend it around the edge of the terminal board to minimize its movement. Solder a length of hookup wire to the resistor lead and route the wire to point 7JJ on the chroma board by the most convenient route. Solder it to this point.

Color TV Chassis T924—Modification of Color Test Fixture

Refer to Service Manual 7297, Sections 4.1 and 2. The test fixture yoke is wired as shown on the schematic for the T924-03, 07 and 09 versions. These chassis are directly



adaptable to the test fixture. However, the vertical yoke windings are connected internally in the T924-01, 02, 05, 06, 08 and 10 versions. These versions will have no vertical sweep when used with the fixture. A DPDT switch, such as part No. 160370-5, can be inserted in the yoke extension cable as shown to enable the fixture to be used with all T924 versions.

The brand for all reasons

BSR McDonald 600

Every BSR McDonald automatic turntable is precision made in Great Britain to the most exacting specifications. Upon their arrival in the U.S., every model is unpacked and re-tested under actual playing conditions. That's why BSR service calls are the lowest in the industry—and perhaps that also explains why BSR sells more turntables than anyone else in the world.

“S”
 BSR (USA) LTD.
 BLAUVELT, N.Y. 10913

Please send FREE detailed literature on all BSR McDonald automatic turntables.

Name

Address

City

State

Zip

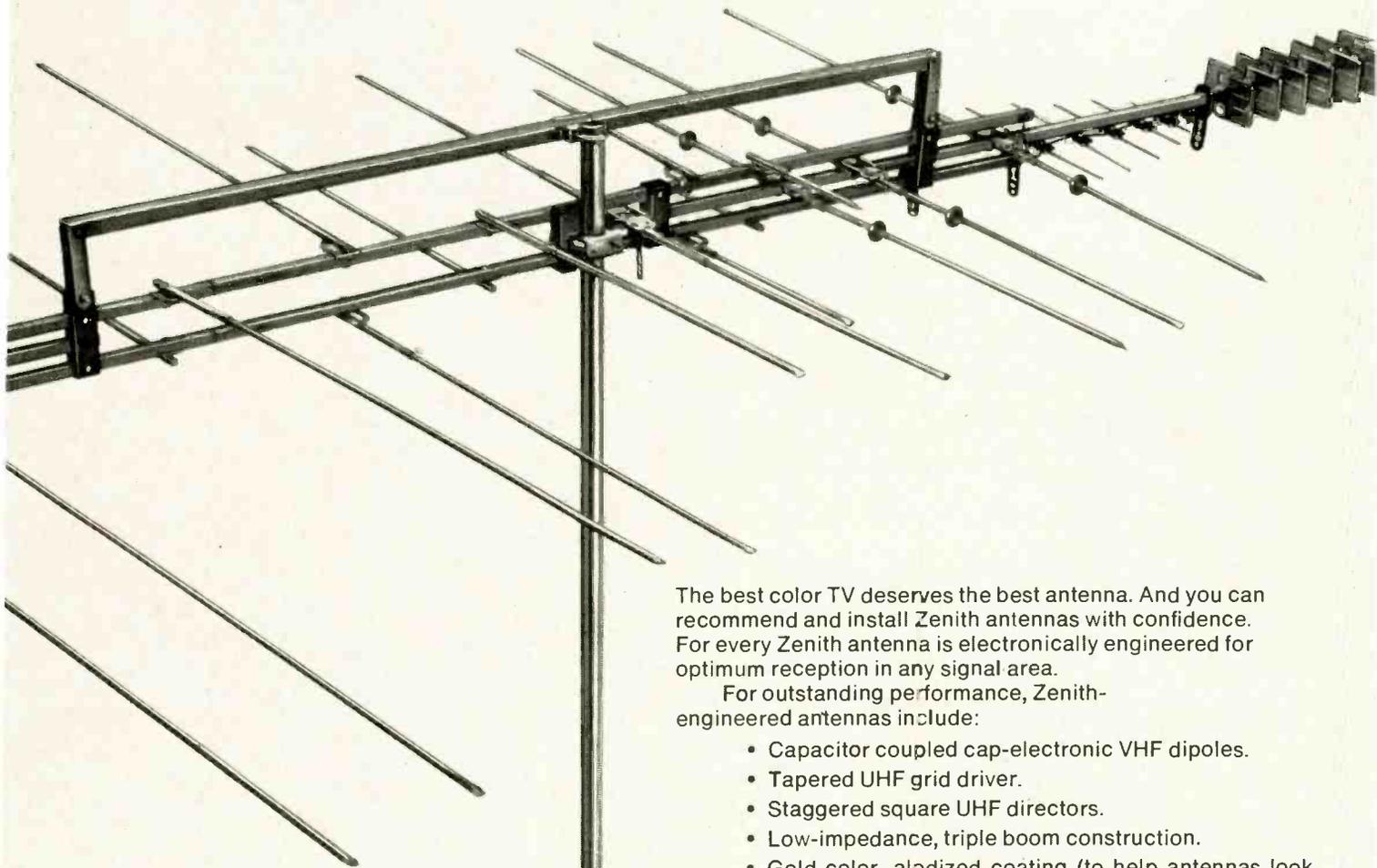
Did your mother take you for your last checkup?

What is it about grownups? Don't they know annual checkups are the first line of defense against cancer? It's nice to find out you're as healthy as you feel. See your doctor. You'll find peace of mind beats lollipops any day! Help yourself with a checkup. And others with a check.

American Cancer Society

THIS SPACE CONTRIBUTED BY THE PUBLISHER

Engineered for outstanding reception— Zenith outdoor antennas for Color TV!



The best color TV deserves the best antenna. And you can recommend and install Zenith antennas with confidence. For every Zenith antenna is electronically engineered for optimum reception in any signal area.

For outstanding performance, Zenith-engineered antennas include:

- Capacitor coupled cap-electronic VHF dipoles.
- Tapered UHF grid driver.
- Staggered square UHF directors.
- Low-impedance, triple boom construction.
- Gold-color alodized coating (to help antennas look better and last longer, with greater corrosion resistance and electrical conductivity).

Your Zenith Distributor has the complete line of Zenith quality-engineered TV antennas and antenna accessories. His staff has the technical experience and knowledge of your area to recommend the best antenna for any installation.

EXCITING SURPRISES FOR YOU—and Your Family!
Get the details at your Zenith *Distributor's Parts Department*.

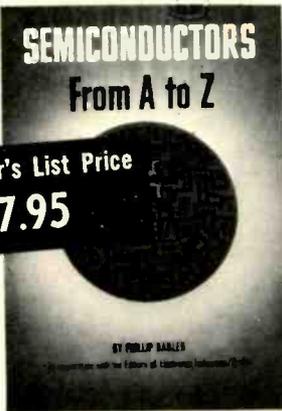
Why not sell the best

ZENITH[®]

*The quality goes in
before the name goes on*

ELECTRONIC TECHNICIAN'S BOOK CLUB INVITES YOU AS PART OF TRIAL MEMBERSHIP TO

Take This Brand-New Book for only 99¢



yours for only **99¢**

with Trial Membership in
Electronic Technician's Book Club.

May we send you this unique new book as part of an unusual offer of a Trial Membership in Electronic Technician's Book Club?

Now you can have, at your fingertips, this brand new, up-to-date 256-page working guidebook on all types of semiconductors.

This handsome, hardbound book is indicative of the many other fine offerings made to Members . . . important books to read and keep . . . volumes with your specialized interests in mind.

How the Club Works

Forthcoming selections are described in the FREE monthly *Club News*. Thus, you are among the first to know about, and to own if you desire, significant books. You choose only the main or alternate selection you wish (or advise if you want no book at all) by means of a handy form enclosed with the *News*. As part of your Trial Membership, you need purchase as few as four books during the coming 12 months. You would probably buy at least this many anyway . . . without the substantial savings offered through Club Membership.

How You Profit From Club Membership

This is just a sample of the help and generous savings the Club offers you. For here is a Club devoted *exclusively* to seeking out only those titles of interest to you as an electronic technician. Membership in the Club offers you several advantages:

- 1. Charter Savings:** *Semiconductors From A to Z* carries a retail price of \$7.95. But it can be yours for only 99¢ with your Trial Membership.
- 2. Continuous Savings:** The Club guarantees to save you 15% to 75% on all books offered through the *Club News*.
- 3. Wide Selection:** Members are annually offered well over 50 of the new and authoritative books on electronic servicing.

Limited Time Offer!

Here, then is an interesting opportunity to enroll on a trial basis . . . to prove to yourself, in a short time, the advantages of belonging to Electronic Technician's Book Club.

To start your Membership on these attractive terms, simply fill out and mail the Postpaid Trial Membership Coupon today. **SEND NO MONEY!** If you are not delighted with the book, return it within 10 days and your Trial Membership will be cancelled without cost or obligation. We take all the risk.

SEMICONDUCTORS FROM A TO Z contains all you need to know about the entire range of transistors and semiconductors used today. Written in language anyone can understand, this book explains how various semiconductor devices work and how they are used, with complete descriptions of all the common and unique circuits used in modern technology. With the wealth of knowledge incorporated in this book, you'll be eminently qualified to service any type of solid-state equipment.

The content begins with a review of how basic semiconductors work, including types and function, how a transistor conveys a signal, transistor biasing and self-biasing techniques, effects of temperature on operation, factors limiting transistor frequency response, etc. Succeeding chapters delve into the mystical arena of field-effect transistors by explaining the differences between FETs and regular transistors. You'll understand junction FET applications, frequency response, temperature effects, and the treatment given depletion-type and enhancement-type MOS FETs in the most down-to-earth explanation you'll ever find.

Considerable attention is given to integrated circuit applications—variable-current and constant-current sources, unbalanced differential amplifiers, IC applications in FM and TV receivers, TV sound circuits, discriminator circuits, and cascade amplifier networks. The use of varicaps is also covered, as well as unijunction transistors, field-effect diodes, zener diodes, SCR diodes, 4-layer diodes, diacs, and triacs. The final chapters deal with constant current and voltage regulating systems and DC-to-AC-to-DC converters.

CONTENTS: What Is a Semiconductor? — Semiconductor Characteristics — Determining Semiconductor Characteristics — Frequency Limitations — Field-Effect Transistors — MOS FETs — The Tunnel Diode — Tunnel Diode Applications — Integrated Circuits — IC Balanced Differential Amplifier — IC Applications in FM Circuits — IC Applications in TV — IC TV Sound Circuits — IC Time Constants & Cascade Amplifiers — The Varicap — Varicap Applications — Review of Capacitor & Coil Impedances — Photo-Sensitive and Photo-Emissive Devices — FET Light-Sensitive Devices — Principles of Optics — Optic-Electronic Couplers — Semiconductors for Power Supplies — Constant-Voltage Transformer — Power Conversion — Filter & Regulators. Index.

FIRST
CLASS
Permit No. 9
Blue Ridge Summit, Pa.

BUSINESS REPLY MAIL

No Postage Stamp Necessary If Mailed in The United States

Postage Will Be Paid By

ELECTRONIC TECHNICIAN'S BOOK CLUB

Monterey & Pinola Ave's.

Blue Ridge Summit, Pa. 17214

DO NOT CUT HERE JUST FOLD OVER, SEAL AND MAIL—NO STAMP OR ENVELOPE NECESSARY

Send No Money! Simply fill in and mail Trial Membership Coupon Today!

ELECTRONIC TECHNICIAN'S BOOK CLUB, Blue Ridge Summit, Pa. 17214

Please open my Trial Membership in Electronic Technician's Book Club and send me a copy of *Semiconductors From A to Z* (billing me only 99¢ plus a few cents postage and mailing expense). If not delighted, I may return the book within 10 days and owe nothing. Otherwise, to complete my Trial Membership, I agree to purchase at least four additional monthly selections or alternates during the next 12 months. I have the right to cancel my membership anytime after purchasing these four books.

Name _____ Phone No. _____
Address _____
NOTE: check if home or business address
City _____ State _____ Zip _____
Company _____

T-69

(The Club assumes postage on all prepaid orders. Foreign and Canadian prices 10% higher.)

THIS ENTIRE FOLD-OVER COUPON FORMS A NO-POSTAGE-REQUIRED BUSINESS REPLY ENVELOPE

Continued from page 64

the voltage across R121, the 1K cathode resistor of the 6BK4. This voltage must be a minimum of 1v ($I=E/R$).

Channel Eight Tweet Reduction

The following circuit modification is recommended for the reduction of channel eight tweet.

(1) Install a 15K, 2w resistor between the junction of R909 and R903 on the AFC board, and point VA(+270v) on the chroma board. This can be accomplished from the underneath side of the boards and will require an extension wire. (2) Remove and discard L905 and its extension lead. L905 is connected on the underneath side of AFC board between the junction of R909 and C913 on the AFC board and point YC(+140) on the chroma board. (3) Also remove and discard R909 on the AFC board.

Once this circuit modification has been completed the plate/screen supply for V901 will be the 270v source.

WESTINGHOUSE

Color TV Chassis V8001—Demodulator Circuit

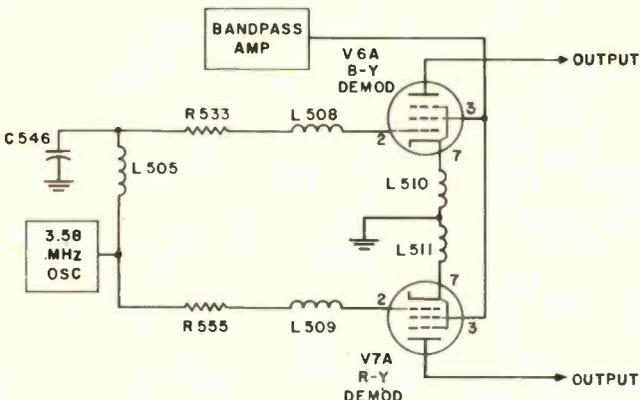
The demodulator system is a two stage circuit that consists of V7A called the R-Y demodulator and V6A called the B-Y demodulator, and their associated components. Both demodulators use 5GH8A tubes. Each demodulator requires two input signals. The two input signals are:

1. The output signal of V12A, the bandpass amplifier.
2. A 3.58MHz CW signal from V8A, the local oscillator.

The output of the bandpass amplifier is passed to the screen grids (G2) of the two demodulators.

Two signals from the 3.58MHz local oscillator, differing only in phase, are fed into G1, the control grids.

The purpose of the demodulator is to convert the phase



and amplitude differences of the two input signals into information that the color difference amplifier circuit can enlarge to magnitudes necessary for driving the CRT grids.

At the transmitter during a color telecast only the intelligence contained in the red information signal and the blue information signal has to be transmitted for color reproduction. Combining the R-Y and B-Y signals algebraically and electronically in the receiver will result in the reproduction of the green color. The R-Y and B-Y signals at the transmitter are fed into separate modulators and maintain a 90 degree phase relationship by the introduction of a signal from an oscillator at the transmitter into the two modulators that are 90 degrees apart in phase. In circuitry of receivers in the past the same relationship of 90 degrees was maintained by introducing the 3.58 MHz signal of the receiver's local oscillator into the R-Y and B-Y demodulators 90 degrees apart in phase.

To service Color TV you need:
 1. vectorscope
 2. color bar generator
**and you can't
 use one without
 the other!**



portable



One Year
 Warranty

for home
 or shop

only the V7 gives you both

- The only complete one unit color vectorscope/color-bar generator available anywhere!
- Completely portable for servicing color TV in the home . . . no need to bring set to the shop!
- The only one with detailed instructions on color circuit alignment and color adjustment. And, additional instructions are available as new sets are introduced!
- Recommended by leading TV manufacturers!
- Proven performance . . . over 4 years of use in field and shop by thousands of technicians . . . no other vectorscope manufacturer can make this claim!

- V7**
- Checks and aligns demodulators to any angle.
 - Checks and aligns bandpass-amplifier circuit.
 - Pinpoints troubles to a specific color circuit.

Exclusive Features: Self-Calibrating—adjust timing circuit without external test equipment, Dial-A-Line—adjust horizontal line to any width from 1 to 4. Plus: All Crosshatch, Dots, and Color Patterns; Voltage Regulated; Fully Enclosed Cable Compartment. Free copy of Wayne Lemon's Book, "Color TV Servicing Simplified with Vectorscope!"

Net **189⁵⁰**

Remember . . . V7—the complete one

See your distributor or write Dept. ET-6
LECTROTECH, INC.
 4529 North Kedzie Ave., Chicago, Ill. 60625

. . . for more details circle 121 on postcard

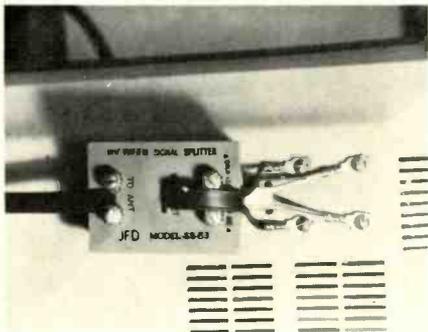
For additional information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly.

3-Way Signal Splitter

711

Provides three twinlead outputs from single input

A 3-way signal splitter capable of meeting the requirements of an 82 channel TV antenna installation is introduced. The Model SS83 signal



splitter provides separate twinlead outputs for UHF, VHF and FM from a single 82 channel twinlead input. Virtually all TV sets require separate inputs to their UHF and VHF antenna terminals. The splitter not only provides two separate inputs from a single all-channel antenna downlead, it also provides an extra input to an FM or stereo FM receiver and makes it possible for a single antenna to provide signal voltage to an all-channel TV set as well, without the need for a separate coupler. Splitting loss on the unit is negligible, reportedly less than 1db. Isolation between outputs is 18db and response is flat over the entire TV-FM spectrum ± 0.5 db. It is equipped with no-strip terminals for the input and FM output. Twinlead is simply inserted under these terminals and the screws are tightened down for positive mechanical and electrical connection. Appropriate lengths of twinlead with spade lugs are factory attached to the UHF and VHF TV output. The splitter can easily be attached to the back of any TV set by means of an adhesive. List price is \$4.95. JFD.

CB Base Antenna

712

Shorter radials with 4db omnidirectional gain

A half-wave, 4db gain, omnidirectional base station antenna is announced. The model M-227 is the third generation of the company's Magnum series introduced in 1961. Over-all configuration of the antenna

is similar to previous versions but with modifications in the loading static arrester assembly at the top of the five-section aluminum dipole and the radials. The static arrester is a diamond-shaped double loop designed to improve static drain-off, reduce noise and lower the radiation angle. The radials are shorter than on previous models to make them more rugged. This is accomplished by four small



loading coils which electrically lengthen the radials to a full $\frac{1}{4}$ wavelength thus producing a low radiation angle and a claimed 4db of omnidirectional gain. Other construction features include a waterproof coax connector jacket, chemically welded dual phasing coil jacket, and double-interlock dipole joints. The VSWR is rated at 1.05 to 1 at centerband and 1.4 to 1 at the band edges. List price is \$36.95. Antenna Specialists.

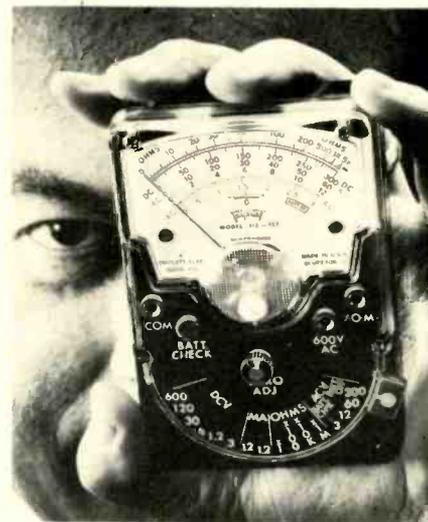
Solid-State VOM

713

Battery-operated VOM features field-effect-transistorized circuitry

Introduced is a battery-operated volt-ohm-milliammeter featuring a field-effect circuit with a 10M constant input resistance on all dc voltage ranges and sensitivity approximately ten times greater than the conventional bench-type VTVM. The unit, which slips easily into a shirt pocket, is $2\frac{3}{4}$ x $4\frac{1}{4}$ x $1\frac{1}{8}$ in. and weighs 14oz. It has a thumb switch on the side for reversing polarity, a single test/range selector switch on the front panel and provision for attaching an ac clamp-on ammeter adapter. Adding to its ease-

of-use in the field, the VOM has a battery-test provision as one of the selector-switch positions. The VOM reportedly performs with an accuracy of 3



percent on all dc ranges, 4 percent on all ac ranges and 3 percent on ohms. Available ranges in dc volts are: .3, 1.2, 6, 30, 120 and 600v with an input resistance of 10M constant on all ranges. In the ac position, the unit covers 3, 12, 60, 300 and 600v (for greater accuracy, a separate scale is provided for 0-3v), with input resistance of 5000 Ω per volt. DB measurements are .1 to 600v and dc current measurements in two ranges, 0-120 μ a, and 0- $\frac{1}{2}$ μ a at 300mv. Four resistance measurement ranges are available (all read on the 50 Ω center scale): X1, X100, X10K, and times 1M so that resistances from 1 Ω to 5000M can be conveniently measured. The VOM utilizes two batteries, a 7v type NEDA 1501 to power the FET bridge circuit, and a 1 $\frac{1}{2}$ v ASA type N for the ohms circuit. Net price complete with probes and insulated leads is \$70. Triplett.

**For more information
on these
NEW PRODUCTS**

**See page 83
READERS SERVICE**

DARCY...

Continued from page 55

back to the 10vdc range. The unit was used to measure critical circuits such as the sync and oscillator sections which continued to operate normally proving the absence of circuit loading.

Measurements on the other ranges for ac, ohms and amps also proved to be fast and accurate.

Since digital test instruments are just now really getting into the pricing category of the small shop, we were concerned with the warranty and repair situation. The manual that came with the DM330 we received was not up to date, according to the people representing Darcy, when we contacted them about it. They indicated that a new warranty was being printed which better explains their program. In essence it says that Darcy provides regional repair centers. The DM330 is warranted for one year and can be sent to the closest repair center. However, the manual is purposely complete enough to allow the technician to repair the DM330 in his own shop if he wishes. But like a fine watch, once the owner opens the unit for repair, the warranty is voided. If the technician wants to repair it, he can order parts from the factory but again, the parts will not be covered under warranty unless the unit is repaired by an authorized repair center. Darcy has repair centers in the East and Midwest regions. The factory handles the Western region.

As we mentioned earlier, digital test instruments are getting closer to the price a technician and service shop can afford. The service business today is more demanding and time is more valuable so test instruments become a most important asset. Because of this, we will continue in future Testlab reports to bring you the latest designs in test instruments.

Next month's Testlab will review the Seco 88A tube tester, Sencore Model SM152 sweep and marker generator. ■



STANDARD SIGNALS OF A PROFESSION

Standard vector pattern for fast color servicing

Standard video wave forms of a quality broad band scope

With just a flick of a switch—you get either waveform on the



SENCORE PS148 Combination Broad Band Scope and Vectorscope

The Sencore PS148 is the only scope on the market that takes you all the way. It is sensitive enough to view the small signals from the TV tuner but broad band enough, without time-consuming band switching, to hold any video or color waveform steady as a rock. It's almost impossible to knock out of sync, and waveform presentation is so near textbook exhibits that you'll have no difficulty in identifying circuit trouble. Exclusive direct readout of peak to peak voltages makes work even faster. That's not all... flip two slide switches on the rear and you have a complete and modern vectorscope. Rear plate instructions and detailed instructions how to read and interpret vectors insures you of a job made easy. See your Sencore distributor today... he has the PS148 in stock. **\$229.50**



SENCORE

NO. 1 MANUFACTURER OF ELECTRONIC MAINTENANCE EQUIPMENT
426 SOUTH WESTGATE DRIVE, ADDISON, ILLINOIS 60101

... for more details circle 131 on postcard

Sylvania Plans Introduction of Three Color CRTs in 1970

The Electronic Tube Div. of Sylvania Electric Products, Inc. has revealed plans for the introduction of three new color television tube types in 1970, including the industry's largest tube and the first 110deg. color tube. Sylvania is a subsidiary of General Telephone & Electronics Corp.

George Konkol, vice president-operations, said the new tubes will consist of a new large screen, 25in. viewable 90deg. square corner; a 21in. viewable 90deg. square corner tube, and an 18in. viewable 110deg. tube.

Preliminary drawings for these tubes will be distributed to manufacturers of color television sets this month. Production schedules for the new tubes are predicated entirely on the availability of the new glass sizes and shapes required, Konkol said. However, plans call for the 25 and 21in. tubes to be sampled in January 1970.

Konkol said the square corner feature of the 25 and 21 in. tubes will provide a flatter and more pleasing appearance than current tubes.

Admiral Reports Profit in 1968

Admiral Corp. reported 1968 earnings after taxes of \$494,430 or 10 cents a share, compared with a loss of \$3,770,061 or 74 cents per share in 1967. Profits before

taxes were \$894,430 in 1968, while in the preceding year there was a loss of \$7,707,061. The electronics-appliance manufacturer said consolidated sales were \$377,013,813 in 1968, which compares with \$380,941,526 in 1967.

Fourth quarter sales were \$96,071,068, contrasted with \$108,230,891 in 1967. The drop in volume was attributed to a later-than-usual introduction of appliances—December against August—which prevented sizable shipments in the fourth quarter, lower sales by the government electronics division, and changeover to the new 4-4-5 weeks per quarter accounting periods ending on the Sunday nearest Dec. 31.

Profits before taxes in the quarter were \$1,891,707 against a profit of \$1,505,315 in 1967. Net profits were \$781,306 or 16 cents per share, compared with \$622,266 or 12 cents per share.

EIA Reports FM Radio Growth Up Constituting 37.1 Percent of Radios

The FM share of the radio market continued to grow in 1968, registering increases and new highs in all categories, according to the Electronic Industries Assn. Consumer Products Div. and based on EIA Marketing Services Dept. statistics.

FM radios constituted 37.1 percent of domestic-label radios (table, clock, portable) in 1968, compared to 33.5 percent in 1967. In numbers, FM radios grew from 4.21 million table, clock and portable units in 1967 to 4,322,000 units in a total domestic-label radio market that decreased from 12.6 million units in the previous year to 11.7 million in 1968. These statistics are increased to 47 percent and 42.3 percent, respectively, for 1968 compared to 1967 when TV and phonograph combinations are included.

Measured in dollars, however, FM accounted for 56.4

Zenith "Royal Crest" Tubes... with unrivaled dependability

Zenith "Royal Crest" replacement circuit tubes are engineered to the same exacting standards as original Zenith circuit tubes in new sets. With the same unrivaled dependability and "new set" performance.

Zenith "Royal Crest" circuit tubes are life-tested under actual operating conditions for more than 1,500,000 hours every month!

The "Royal Crest" line is broad and comprehensive. Over 900 different types, all built to Zenith rigid quality standards.

Insist on Zenith quality. Choose Zenith's "Royal Crest" circuit tubes and assure customer satisfaction.

EXCITING SURPRISES FOR YOU—and your family!
Get the details at your Zenith Distributor's Parts Department.

Why not sell the best

ZENITH

The quality goes in
before the name goes on



percent of the factory value of all domestic-label table, clock and portable radios in 1968 compared to 55 percent in 1967. Table, clock and portable units all registered increased percentages in FM saturation, while portables showed a decrease in dollar sales. The average value of an FM home radio decreased from \$26.55 in 1967 to \$24.92 in 1968.

NEA'S Certified Electronic Technician Program Now International

In March and April of this year NEA's certification committee issued certificates to electronic technicians in several countries outside the United States, including Guam, Canada, South Vietnam, Argentina and Germany. Other technicians are attempting to qualify in Brazil, Spain, Puerto Rico and Mexico.

To become registered by NEA as a CET, a technician must successfully complete a 126-question technical test offered by NEA's CET committee. He must have completed four years of schooling and experience in consumer electronics service. Successful passage of the test entitles him to a framed wall certificate, a wallet identification card and the use of CET following his name.

Presently, the Raytheon Co. Tube Div. is presenting CETs with lapel pins. Also, in the coming months the CET committee is offering CET patches for use on blazers which many of the professional technicians now wear.

Dick Glass, CET, president of NEA, stated that "The CET Program has reached the point where it is now recognized by the entire industry. It has registered close to 800 CETs."

Technicians may take the CET test in various locations. In California, New York and Pennsylvania the majority of tests are given in two-hour sessions at association meetings. Military service personnel have their tests monitored by base education officers. Several vocational schools and some radio stations have been used as test monitors. In Nebraska, five area vocational colleges hold test sessions regularly each month in various places in the state.

International Correspondence Schools, Scranton, Pa., has been grading the CET test papers. Due to increased volume, however, the CET Committee has designed new tests for computer grading to speed up the program.

Sony Produces Braille Manuals For Tape Recorders

Superscope Inc., exclusive U.S. distributor of Sony tape recorders and related equipment, has started producing braille instruction manuals for three tape recorders. The manuals will be available free upon request.

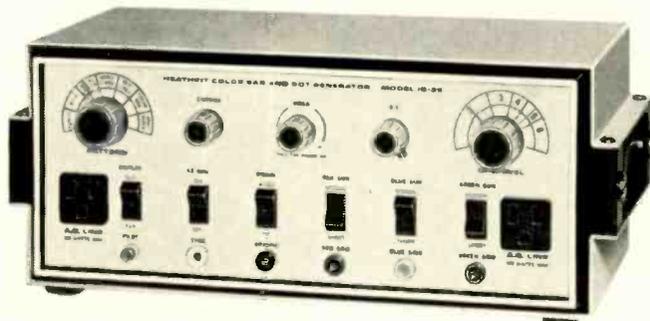
"With the increasing use of tape recorders by the blind as one of their primary sources of education, entertainment and relaxation, we believe that these people should have the dignity of self-sufficiency in being able to operate and care for their recorders without help," the firm said.

The 10- by 12in. instruction manuals will be for the Sony models 100, 104 and 105 tape recorders that are most frequently used by the blind because of their simplicity of operation. They will be produced by Boston-based National Braille Press, Inc.

The entire braille alphabet can be printed from a combination of six dots. A special stereotype machine punches the dots onto a thin 9- by 28in. zinc printing plate. After the plates are proofed (by a blind person), they are run on an inkless cylinder press which prints four pages to a sheet at the rate of 3000 copies an hour.

"To the best of our knowledge, no other tape recorder company provides this service," the company noted.

NEW Heathkit® Solid-State Color Bar - Dot Generator



Kit IG-28
Only \$79.95*

**Advanced Integrated Circuitry
Delivers 12 Patterns Plus
Clear Raster ... No Divider
Chain Adjustment ... No
Flicker, Bounce or Jitter**

Standard
9x9 Displays
plus
Exclusive
Heath
"3 x 3" Display



3x3 Dot



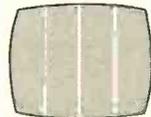
3x3 Cross Hatch



3x3 Shading



3x3 Color Bars



3x3 Vertical



3x3 Horizontal

- All solid-state construction using Integrated Circuitry
- No divider chain adjustments
- Stable pattern display — no flicker, bounce or jitter
- Produces 12 patterns plus clear raster
- Instant switch selection of all functions
- Exclusive 3x3 display plus standard 9x9 display of all patterns
- Horizontal lines only one raster thick for added accuracy
- Variable front panel tuning for channels 2 through 6
- Variable front panel positive and negative video output
- Front panel negative going sync output
- Two handy AC outlets on front panel
- Built-in gun shorting circuit with lead piercing connectors
- Front panel switchable crystal controlled sound carrier
- Copper-banded transformer to reduce stray fields
- Safe three-wire line cord
- Fast, easy construction with two circuit boards and two wiring harnesses

Advanced Design. The new Heathkit IG-28 is one of the most stable, versatile Color and B&W TV service instruments available. In addition to the exclusive Heath "3 x 3" display of patterns illustrated, it also produces the familiar 9 x 9 displays ... plus a clear raster for adjusting purity without upsetting the AGC. Fifteen J-K Flip-Flops count down from a crystal controlled oscillator to eliminate divider chain instability and adjustment.

Time-Saving Versatility ... gives you front panel tuning for channels 2 thru 6 ... front panel variable plus and minus video output ... front panel sync output ... two convenient AC outlets ... built-in gun shorting circuits and grid jacks ... vectorscope capability ... crystal controlled sound carrier ... banded transformer to eliminate stray fields ... zener-regulated power supply ... safe three-wire line cord ... fast circuit board-wiring harness assembly. For the versatility you couldn't get before ... put the new IG-28 on your bench now.

Kit IG-28, 8 lbs. \$79.95*

HEATH COMPANY, Dept. 24-6
Benton Harbor, Michigan 49022



Please send my FREE 1969 Heathkit Catalog.
 Enclosed is \$_____ plus shipping.

Please send model (s) _____

Name _____

Address _____

City _____ State _____ Zip _____

Prices & specifications subject to change without notice.

*Mail order prices; F.O.B. factory.

TE-200

... for more details circle 118 on postcard

1969 DIRECTORY

ELECTRONIC TECHNICIAN / DEALER

A

AC Electronics Div. GMC, 1925 E.
Kenilworth, Milwaukee, Wis. 53202
ATR Electronics, 300 E. 4th St.,
St. Paul, Minn. 55101
Acme Electric Corp., 31 Water St.,
Cuba, N.Y. 14727
Acme Lite Products Co.,
Congers, N.Y. 10920
Acoustic Research, 24 Thorndike St.,
Cambridge, Mass. 02138
Acro Products, 369 Shurs Lane,
Philadelphia, Pa. 19127
ADC, Inc., 2833 13th Ave. S.,
Minneapolis, Minn. 55407
Adler TV Specialties, PO Box 2005,
Atlantic City, N.J. 08406
Admiral Corp., 903 Morrissey Drive,
Box 845, Bloomington, Ill. 61701
Advance Relay, 2435 N. Naomi St.,
Burbank, Calif. 91504
Aerovox Corp., 740 Belleville Ave.,
New Bedford, Mass. 02745
Akro-Mills, 820 Market St., Akron, Ohio
Alco Electronic Products, Inc., PO Box
1346, Lawrence, Mass. 01843
Allen-Bradley, 136 W. Greenfield Ave.,
Milwaukee, Wis. 53204
Alliance Mfg. Co., Alliance, Ohio 44601
Allied Radio, 100 N. Western Ave.,
Chicago, Illinois 60680
Almo Industrial Electronics, Inc.,
412 N. 6th St., Philadelphia, Pa. 19123
Alpha Wire Corp., 180 Varick St.,
New York, N.Y. 10013
Altec-Lansing, 1515 S. Manchester,
Anaheim, Calif. 92802
American Concertone, 9449 W. Jefferson
Blvd., Culver City, Calif. 90230
American Electronic Labs., Inc.,
Colmar, Pa. 18915
American Gelsco Electronics, 251 Park
Ave., New York, N.Y. 10010
American Microphone Div., see Electro
Voice
American Telephone & Telegraph,
195 Bdwy, New York, N.Y. 10007
American Trading Co., Blaustine Bldg.,
Baltimore, Md. 21201
Amp, Inc., 3822 Eisenhower Blvd.,
Harrisburg, Pa. 17111
Amperex Electronic, 230 Duffy Ave.,
Hicksville, L.I., N.Y. 11802
Ampex Audio, Inc., 934 Charter St.,
Redwood City, Calif. 94063

Ampex Corp., 25564 Willow Pond Lane,
Los Altos Hills, Calif. 94022
Amphenol Distributor Div., 2875 S.
25th Ave., Broadview, Ill. 60153
Amprobe Instrument, 630 Merrick Rd.,
Lynbrook, N.Y. 11563
Analab Instrument, 30 Canfield Rd.,
Cedar Grove, N.J. 07009
Anasphone Corp., 10912 La Cienega
Blvd., Inglewood, Calif. 90304
Andrea Radio, 27-01 Bridge Plaza N.,
Long Island City, N.Y. 11101
Antennacraft, 1215 Agency St.,
Burlington, Iowa 52601
Antenna Designs, Inc., 802 Washington
St., Burlington, Iowa 52601
Antenna Products Co., Box 110,
Mineral Wells, Tex. 76067
Antenna Specialists, 12435 Euclid Ave.,
Cleveland, Ohio 44115
Antronic Corp., 4942 W. Div. St.,
Chicago, Ill. 60651
Arco Electronics, Community Dr.,
Great Neck, N.Y. 11021
Arcturus Electronics, 420 Kearny Ave.,
Kearny, N.Y. 07032
Argos Products, 600 S. Sycamore,
Genoa, Ill. 60135
Arkay Int'l, 88-06 Van Wyck Expressway,
Richmond Hill, N.Y. 11418
Armco Steel Corp., 703 Curtis St.,
Middletown, Ohio 45042
Arrow Fastener Co., 201 Mayhill St.,
Saddle Brook, N.J. 07662
Arrow-Hart & Hegerman, 103 Hawthorn
St., Hartford, Conn. 06105
Artisan Organs, 2475 N. Lake Ave.,
Altadena, Calif. 91001
Arvin Industries, Columbus, Ind. 47201
Astatic Corp., Jackson & Harbor Sts.,
Conneaut, Ohio 44030
Astron Corp., 255 Grant Ave. E.,
Newark, N.J.
Atlas Sound Corp., 10 Pomeroy Rd.,
Parsippany, N.J. 07054
Audax, Inc., 109-01 37th Ave.,
Corona, N.Y. 11368
Audio Devices, 444 Madison Ave.,
New York, N.Y. 10022
Audio Dynamics, 1677 Cody Ave.,
Ridgewood, N.J.
Audio Empire Div. Dyna Empire, 1075
Steward Ave., Garden City, L.I.,
N.Y. 11530
Audio Corp., 514 Bdwy.,

New York, N.Y. 10012
Audio-Master Corp., 17 E. 45th St.,
New York, N.Y. 10017
Audio Wave, Inc., 4541 Furman Ave.,
Bronx, N.Y. 10470
Audiotex Mfg., 400 S. Wyman St.,
Rockford, Ill. 61101
Audiotex Mfg., 3225 Exposition Pl.,
Los Angeles, Calif. 90018
Auricord Corp., 34-43 56th St.,
Woodside, N.Y. 11377
Automatic Electric Co.,
Northlake, Ill. 60164

B

B & B Electronic Products, 2120 S. Platte
River Dr., Denver, Colo. 80223
B & K Instruments (Bruel & Kjaer),
3006 W. 106 St., Cleveland, Ohio 44111
B&K Mfg. Co., 1801 W. Belle Plaine,
Chicago, Ill. 60613
BSR (Birmingham Sound Reproducers),
Ltd., College Point, L.I., N.Y. 11356
Ballantine Labs, Boonton, N.J. 07005
Barber-Colman Co., Rockford, Ill.
Barker & Williamson, Bristol, Pa. 19007
Barry Electronics, 512 Bdwy.,
New York, N.Y. 10012
Bauchaine Sales Corp., 584 Union Ave.,
Laconia, N.H. 03246
Beckman Instruments Berkeley Div., 220
Wright Ave., Richmond, Calif. 94804
Belden Corp., 415 S. Kilpatrick,
Chicago, Ill. 60644
Bell & Howell, 7100 McCormick Rd.,
Chicago, Ill.
Bell PA Products, 1209 N. 5th St.,
Columbus, Ohio 43212
Bell Telephone Labs, 463 West St.,
New York, N.Y. 10014
Benco TV Assoc., 27 Taber Rd.,
Rexdale, Ont., Canada
Bendix Radio Div., Industrial Electronic
Prods., Baltimore, Md.
Berns Mfg., 9853 Chalmers,
Detroit, Mich. 48213
Bird Electronics Corp., 30303 Aurora Rd.,
Solon, Ohio 44139
Birnbach Radio, 435 Hudson,
New York, N.Y. 10014
Bliley Electric, Union Station Bldg.,
Erie, Pa.
Blonder-Tongue Labs, 9 Alling St.,
Newark, N.J. 07102
Bogen-Presto, PO Box 500,

Paramus, N.J. 07652
 Boonton Radio, Boonton, N.J. 07005
 Bosco Elec., Inc., Don Littell Rd.,
 Hanover, N.J. 07936
 Bourns Labs, Box 2112,
 Riverside, Calif. 92506
 Bozak Co., Rt. Box 1166,
 Darien, Conn. 06820
 Brach Mfg. Corp., 899 Main,
 Sayreville, N.J. 08872
 Bright Star, Ind., Clifton, N.J.
 British Ind., Port Washington, L.I.,
 N.Y. 11050
 Browning Labs, 100 Union Ave.,
 Laconia, N.H. 03246
 Brush Instruments, 37 St. & Perkins,
 Cleveland, Ohio
 BSR (USA), Ltd., Route 303,
 Blauvelt, N.Y. 10913
 Bud Radio, 4605 E. 355 St.,
 Willoughby, Ohio 44094
 Burgess Battery, Exchange St.,
 Freeport, Ill. 61032
 Burroughs Corp., 6072 2nd Ave.,
 Detroit, Michigan 48202
 Bussman Mfg., W. University St.,
 St. Louis, Mo. 63107

C

Cabinart, Inc., 35 Geyer St., Haledon, N.J.
 Cadre Ind., Box 150, Endicott, N.Y. 13760
 Calbest Electronics, 4801 Exposition
 Bldg., Los Angeles, Calif.
 Cannon Electric, 3208 Humboldt St.,
 Los Angeles, Calif. 90031
 Castle TV Tuner Service, 5710 N. Western
 Ave., Chicago, Ill. 60645
 Castle TV Tuner Service, 41-92 Vernon,
 Long Island City, N.Y. 13476
 Centralab, 900 E. Keefe Ave.,
 Milwaukee, Wis. 53212
 Channellock, Inc., S. Main St.,
 Meadville, Pa. 16335
 Channel Master Corp.,
 Ellenville, N.Y. 12428
 Charles Engineering, Inc., 3421 N. Kroll
 Dr., Los Angeles, Calif.
 Chem Spray Corp., 67-27 Cadillac St.,
 Houston, Tex. 77021
 Chemical Electronic Engineering, Jackson
 & Ravine Dr., Matawan, N.J. 07747
 Chemtronics, Inc., 1260 Ralph,
 Brooklyn, N.Y. 11236
 Cinch Jones Div., Cinch Mfg.,
 1026 Homan Ave., Chicago, Ill.
 Cisin Co., Harry G.,
 Amagansett, N.Y. 11930
 Clairex Corp., 19 W. 26th St.,
 New York, N.Y. 10010
 Clarostat Mfg., Dover, N.H. 03820
 Clear Beam Antenna Corp., 9754 Deering
 St., Chatsworth, Calif. 91311
 Cletron, Inc., 1974 E. 61 St.,
 Cleveland, Ohio 44103
 Cleveland Institute of Electronics, 1776

E. 17th St., Cleveland, Ohio 44114
 Cohu Electronics Massa Div.,
 5725 Kearney Villa Rd.,
 San Diego, Calif. 92123
 Coe Inst. Div., 2034 Placenta,
 Costa Mesa, Calif.
 Colman Tool & Electric Products,
 PO Box 2965, Amarillo, Tex. 79105
 Colson Corp., 395 LaSalle,
 Chicago, Ill. 60603
 Colorgrams, Inc., 58 Old Steward Ave.,
 New Hyde Park, L.I., N.Y. 11040
 Columbia Products Co., Rt. 3,
 Columbia, S.C. 29206
 Columbia Wire & Supply Co., 2850 Irving

Park Rd., Chicago, Ill. 60618
 Commander, 133 North Jefferson,
 Chicago, Ill. 60606
 Communications Co., 300 Greco Ave.,
 Coral Gables, Fla. 33146
 Communications Electronics, PO Box
 1272, Scottsdale, Ariz. 85252
 Communications Prod. Co., Rt. 79,
 Marlboro, N.J. 07746
 Components Specialties, Inc., 101 Buffalo
 Ave., Freeport, N.Y. 11520
 Conar Instrument, 3939 Wisconsin Ave.,
 Washington, D.C. 20016
 Conrac, Inc., 19217 Foothill Blvd.,
 Glendora, Calif. 91740

ANNOUNCING SPACE AGE

FOAMING ACTION TUN-O-FOAM

**CLEANS, POLISHES,
& LUBRICATES CONTACTS
EACH TIME CHANNEL
IS CHANGED**



**SPACE AGE
LUBRICANT
DOESN'T DRY OUT
FOAMS AWAY
DIRT AND CORROSION**

TUN-O-FOAM is a new generation of tuner sprays. It is not simply a cleaner with a little residue of lubricant. It is a space age lubricant that cleans as it lubricates. Ordinary lubricants are hydrocarbon compounds which dry out rapidly. TUN-O-FOAM is a space age lubricant in which the carbon has been replaced by a rugged, synthetic element. The result is a long-lasting lubricant capable of withstanding extremes of temperature and maintaining lubricity over thousands of channel changes. Thus, no matter how hot the chassis runs, TUN-O-FOAM will not cake up or dry out. Especially well suited to silver and gold plated contacts, it is the same type of lubricant used in today's spacecraft — the finest ingredients ever put into a can. Each time the tuner is rotated, the contacts are cleaned, polished and lubricated. Yet TUN-O-FOAM is non-abrasive. It will not wear away contacts, and it cannot cause detuning.

TRY TUN-O-FOAM. IT'S GUARANTEED TO BE THE BEST TUNER LUBRICANT/CLEANER YOU'VE EVER USED OR YOUR MONEY REFUNDED.

CHEMTRONICS

1260 RALPH AVENUE BROOKLYN, N.Y. 11236

FOR EXPORT: ROBURN AGENCIES INC., NEW YORK, N.Y. 10013
 IN CANADA: PERFECT MANUFACTURING LTD., MONTREAL 9, CANADA

Continental Electronics, 1050 N. Central Expressway, Dallas, Texas 75201
 Courier Communications, Inc., 56 Hamilton Ave., White Plains, N.Y. 10601
 Cornell-Dubilier Electronics, 50 Paris St., Newark, N.J. 07105
 Creative Products, Inc., 8120 Blue Ash Rd., Cincinnati, Ohio 45236
 Crescent Enterprises, 7301 Mission Rd., Prairie Village, Kan. 66208
 Crown Int'l, Box 261, Elkart, Ind. 46514
 CRT Equipment Co., Inc., 2740 Old Lebanon Rd., Nashville, Tenn. 37214
 Cush Craft, 621 Hayward St., Manchester, N.H. 03103

Cutler-Hammer, 436 N. 12th St., Milwaukee, Wis. 53233

D

Dale Electronics, 1378 28th Ave., Columbus, Neb. 68601
 Davies Molding Co., Harry, 1428 N. Wells St., Chicago, Ill. 60610
 Darcy Industries, 1723 Cloverfield Blvd., Santa Monica, Calif. 49104
 Daystrom, Inc., Archbald, Pa. 18403
 DeJur-Amsco, 45-01 Northern Blvd., Long Island City, N.Y. 11101
 Delco Radio Div., GMC, Kokomo, Ind. 46901

Delmonico Int'l, 120-20 Roosevelt, Corona, Ill.
 DeWald Radio, 35-15 37th Ave., Long Island City, N.Y. 11103
 Dialight Corp., 60 Steward Ave., Brooklyn, N.Y. 11237
 Diamond Tool, 4602 Grand Ave., W., Duluth, Minn. 55807
 Dickey, Inc., D. F., 4863 Rivoli Dr., Macon, Ga. 31204
 Drake Mfg., 4826 N. Olcott, Chicago, Ill. 60656
 DuKane Corp., St. Charles, Ill. 60174
 DuMont Labs, Allen B., 750 Bloomfield, Clifton, N.J. 14431
 Du Pont de Nemours, Wilmington, Del. 19801
 Doutone Co., Locust St., Keyport, N.J. 07735
 Dutch Brand Div., Johns-Manville, 78 S. Woodlawn Ave., Chicago, Ill.
 Dymo Ind., 2725 10th St., Berkeley, Calif. 94710
 Dynaco, Inc., 3912 Powelton Ave., Philadelphia, Pa. 19104
 Dyna-Empire, 1075 Steward Ave., Garden City, L.I., N.Y. 11530

E

ECI Electronics Communications, 56 Hamilton Ave., Mount Vernon, N.Y. 10552
 ELPA Ind., Ortofon Div., New Hyde Park, Ill.
 E-Z Hook Products, 1536 Woodborn Ave., Covington, Ky.
 E-Z Way Towers, Inc., PO Box 5797, Tampa, Fla. 33605
 Eby Sales, 148-05 Archer Ave., Jamaica, L.I., N.Y. 11435
 Eitel-McCullough, 301 Industrial Way, San Carlos, Calif. 94070
 Eico Corp., M St., below Erie, Philadelphia, Pa.
 Eico Electronic Instrument Co., 283 Malta St., Brooklyn, N.Y. 11207
 Electric Auto Lite, 3529 24th St., Port Huron, Mich. 48060
 Electric Storage Battery, 1717 E. 9th St., Cleveland, Ohio 44114
 Electro Acoustic Prods., 2135 Beuter Rd., Fort Wayne, Ind.
 Electro Products Labs, 6125 W. Howard St., Chicago, Ill. 60648
 Electro-Voice, Inc., 663 Cecil St., Buchanan, Mich. 49107
 Electronic Chemical Corp., 813 Communipaw Ave., Jersey City, N.J. 07304
 Electronic Communications, Inc., 56 Hamilton Ave., White Plains, N.Y. 10601
 Electronic Measurements, Lewis St. & Maple Ave., Eatontown, N.J. 07724
 Electronic-Missiles & Communications, Inc., 262 3rd St., Mount Vernon, N.Y.
 Electronic Organ Arts, 4949 York Blvd., Los Angeles, Calif. 90042
 Electronic Prods. Div., Victoreen

The Ins and Outs of FET's.



New Silent Partner Model 162 FET Transistor Analyst...Fastest Method of Checking Transistors In-Circuit/Out-Of-Circuit.

B&K has done it again! We've made the ins and outs of transistor analysis the fastest, most streamlined operations ever.

Now, for the first time, you can accurately check both bi-polar and FET transistors in-circuit or out-of-circuit, using the same simple testing procedure. It's like having an entire electronics laboratory in one compact package!

The Model 162 checks DC Beta from 1 to 5,000! Gm readings to 50,000 umhos. It checks FET's for Gm, I_{gss}, and I_{oss} leakage. And tests gates 1 and 2 separately. Regular transistors are checked for Beta gain, I_{cbo}, I_{ces} and I_{ceo} leakage. Unique DC injection provides more accurate in-circuit tests in low-impedance circuits. A flick of the switch tells you if an unknown

transistor is NPN or PNP type. Special safety circuits protect the Model 162 from internal damage even if wrong settings or leads are used.

All this comes complete with a concealed-handle compartment with storage and protection for test leads. A flip-top, programmed guide speeds and simplifies testing with B&K's exclusive step-by-step instructions.

Why not contact your nearest B&K distributor for complete details on how the 162 can show you the ins and outs of transistor servicing. In time and work saved, the Silent Partner Model 162 will be a real profit booster!
**FET Transistor Analyst
 Model #162. Net: \$99.95.**

Product of Dynascan Corporation
 1801 W. Belle Plaine
 Chicago, Illinois 60613

**B&K puts an end to test equipment.
 We've developed Silent Partners.**



... for more details circle 105 on postcard

ELECTRONIC TECHNICIAN/DEALER

Instrument, 111 E. 3rd St.
Mount Vernon, N.Y. 10550
Electronic Publishing, 133 N. Jefferson
St., Chicago, Ill. 60606
Electronic Technician/Dealer, Harbrace
Bldg., Duluth, Minn. 55802
Electrovert, Inc., 86 Hartford Ave.,
Mount Vernon, N.Y. 10553
Electro-Voice, Inc., 663 Cecil St.,
Buchanan, Mich. 49107
Elgin Advance Relays, 2435 W. Naomi St.,
Burbank, Calif.
Epha Marketing, Thorens Building,
New Hyde Park, N.Y. 11040
Eltec, 14 Alsop Ave.,
Middletown, Conn. 06457
EMC, 625 Bdwy., New York, N.Y. 10012
Emerson Radio & Phono, 14 & Coles,
Jersey City, N.J. 07302
Empire Scientific, 1075 Steward Ave.,
Garden City, L.I., N.Y. 11530
Enterprise Development Corp., 5123 E.
65th, Indianapolis, Ind. 46220
Entron, 2141 Industrial Pkwy.,
Silver Spring, Md. 20904
Ercona Corp., 16 W. 46 St.,
New York, N.Y. 10036
Essex Wire, 1601 Wall St.,
Indianapolis, Ind.
Euphonics Corp., PO Box 2746 Rio
Piedras, Puerto Rico, USA 00926
Eveready Batteries, see Union Carbide Co.
Exide Ind. Div., Electric Storage Battery,
52 S. 15 St., Philadelphia, Pa. 19102

F

Fanon-Masco, 439 Frelinghuysen Ave.,
Newark, N.J. 07114
Fidelitone, Inc., 6415 Ravenswood Ave.,
Chicago, Ill. 60626
Finney Co., 34 W. Interstate St.,
Bedford, Ohio 44146
Fischer Special Mfg. Co., 446 Morgan St.,
Cincinnati, Ohio 45206
Fisher Radio, 21-2444 Dr.,
Long Island City, N.Y. 11101
Foxboro Co., New Ponset Ave.,
Foxboro, Mass. 02035
Freed Transformer, 1718 Weirfield St.,
Brooklyn, N.Y. 11227

G

GAM Electronics, 138 Lincoln St.,
Manchester, N.H. 03103
G&W Electric Specialty Co., 3500 W. 127
St., Blue Island, Ill. 60406
Gator Probe Corp., 2751 San Juan Rd.,
Hollister, Calif. 95023
GC Electronics, 400 S. Wyman St.,
Rockford, Ill. 61101
Garrard Sales, 80 Shore Rd.,
Port Washington, N.Y. 11050
Gavin Instruments, Depot Sq. & Division
St., Somerville, N.J. 08876
Gem City Tuner Repair, Box 6, Dabel

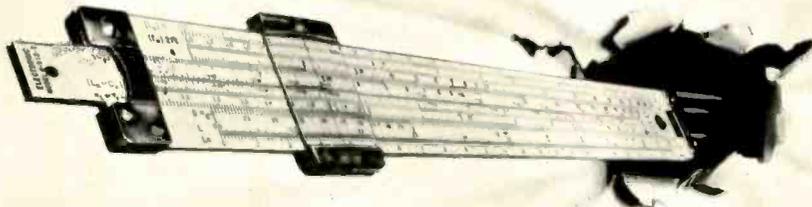
Station, 2631 Mardon Drive,
Dayton, Ohio 45420
General Dynamics/Electronics, 1407 N.
Goodman St., Rochester, N.Y. 14609
General Electric Audio Products Div.,
Decatur, Ill.
General Electric Communications
Products Div., Lynchburg, Va.
General Electric Receiving Tube Dept.,
Owensboro, Ky. 42301
General Electric Receiver Div.,
Utica, N.Y.
General Instrument, 65 Gouveneur St.,
Newark, N.J. 07104
General Precision GPL Div.,
Mount Kisco, N.Y. 10549
General Radio, West Concord, Mass. 01742
General Radiotelephone Co., 3501 W.
Burbank Blvd., Burbank, Calif. 91505
Gertsch Products, 3211 S. La Cienega
Blvd., Los Angeles, Calif. 90016
Grantham School of Engineering, 1505 N.
Western Ave., Hollywood, Calif. 90027
Greyhound Package Express, 140 S.
Dearborn, 10 S. Riverside Plaza,
Chicago, Ill. 60606
Griffiths Electronics, 1301 E. Linden,
Linden, N.J. 07036

H

H & H Equipment Co., Laotto, Ind. 46763

Hallamore Electronics, 714 N. Brookhurst
St., Anaheim, Calif. 92801
Hallicrafters Co., 4401 W. 5 Ave.,
Chicago, Ill. 60624
Hallmark Electronics, 436 N. 31 St.,
Philadelphia, Pa. 19104
Hallmark Instruments, 2620 Freewood
Dr., Dallas, Tex. 75220
Hammarlund Mfg., 53 W. 23 St.,
New York, N.Y. 10010
Harman-Kardon, Inc., 55 Ames Crt.,
Plainville, N.Y. 11803
Hartley Products, 521 E. 162 St.,
Bronx, N.Y. 10451
Hathaway Instrument, 5800 E. Jewell Ave.,
Denver, Colo. 80222
Heath Co., 305 Territorial Rd.,
Benton Harbor, Mich. 49022
Heintz & Kaufman Ltd., 3650 Hayden Ave.,
Culver City, Calif. 90230
Hewlett-Packard, 1501 Page Mill Rd.,
Palo Alto, Calif. 94304
Hickok Electrical Instrument, 10523
Dupont Ave., Cleveland, Ohio 44108
Hi-Lo Mfg., 1122 Newport St., Chicago, Ill.
Hitachi, see Sampson Co.
Hoffman Electronics Consumer Prods.
Div., 3761 S. Hill St.,
Los Angeles, Calif. 90007
Hollywood Television Wuerth Surgitron
Div., 1949 Moffett St., Hollywood, Fla.
Holub Industries, Inc., Sycamore, Ill.

BREAKTHROUGH



IN ELECTRONICS CALCULATING

Still plodding through math and electronics problems the slow pencil-and-paper way? Smash the paperwork barrier with this new Electronics Slide Rule.

Even if you've never used a slide rule before, you can whiz through resonant frequency calculations and inductive or capacitive reactance problems. You can find reciprocals for resistance formulas instantly. You can even locate tricky decimal points in a jiffy.

You can also work regular math problems in a flash: multiplication, division, square roots, logarithms, trigonometry.

Anyone can use this sturdy 12-inch, all-metal slide rule. We show you how with our complete 4-lesson instruction course. Slide rule, course, and handsome leather carrying case deliberately priced low as our way of making friends with men in Electronics. FREE booklet gives full details. Mail coupon below today.

MAIL THIS COUPON FOR FREE BOOKLET

CIE Cleveland Institute of Electronics
1776 E. 17th St., Cleveland, Ohio 44114

Please send me, without charge or obligation, your booklet describing the Electronics Slide Rule and 4-lesson instruction course. Also FREE if I act at once—a handy, pocket-sized Electronics Data Guide.



Name _____
(please print)
Address _____
City _____ State _____ Zip _____

Accredited Member National Home Study Council • A Leader in Electronics Training... Since 1934 ET-130

... for more details circle 110 on postcard

Honeywell Commercial Residential Div.,
2753 4th Ave., Minneapolis, Minn.
Hudson Lamp Company, 528 Elm St.,
Kearny, N.J. 07032
Hunter Sales R.N., 9851 Alburto Ave.,
Santa Fe Springs, Calif. 90670
Hycon Electronics, 1030 Arroyo Pkwy.,
Pasadena, Calif. 91105
Hy-Gain Electronics, 8473 N.E. Hwy. 6,
Lincoln, Neb.
Hysol Co., 322 Houghton,
Olean, N.Y. 14760

I

I E H Manufacturing Co., 102 Prince St.,
New York, N.Y. 10012
IERC Div., Box 271, Burbank, Calif. 91503
Illumitronic Engineering, 680 E. Taylor St.,
Sunnyvale, Calif.
Injectorall Co., 4 N.,
Great Neck, N.Y. 11024
Institute of Electrical & Electronic
Engineers (IEEE), 72 W. 45th St.,
New York, N.Y. 10036
Int'l Business Machines, 590 Madison
Ave., New York, N.Y. 10022
Int'l Correspondence Schools,
Scranton, Pa. 18515
Int'l Crystal Mfg., 18 N. Lee,
Oklahoma City, Okla. 73102
Int'l Electronics, 316 S. Service Rd.,
Melville, L.I., N.Y. 11746
Int'l Rectifier, 233 Kansas St.,
El Segundo, Calif. 90245
IRC Inc., 401 N. Broad,
Philadelphia, Pa. 19108
I-T-E Circuit Breaker, 601 E. Erie Ave.,
Philadelphia, Pa. 19134
IT&T, 320 Park Ave., New York, N.Y. 10022
IT&T Components, 100 Kingsland Rd.,
Clifton, N.J. 07013
IT&T Distributor Products, 250 Broadway,
New York, N.Y. 10007

J

Jackson Electrical Instrument,
124 McDonough St., Dayton, Ohio 45402
J-B-T Instruments, 61 Hamilton,
New Haven, Conn. 06511
Jensen Industries Div. Electrovoice,
633 Cecil St., Buchanan, Mich. 49107
Jensen Mfg., 6601 S. Laramie,
Chicago, Ill. 60638
Jensen Tools, 3630 E. Indian School Rd.,
Phoenix, Ariz. 85018
Jerrold Electronics, 401 Walnut St.,
Philadelphia, Pa. 19132
Jersey Specialty Co., Box 576,
Mountain View, N.J.
Jetric Industries, 4312 Main St.,
Philadelphia, Pa. 19127
JFD Electronics, 1462 62 St.,
Brooklyn, N.Y.
Johnson Co. E. F., 6516 10th Ave. S.W.,
Waseca, Minn. 56093

Jonard Industries Corp., 3047 Tibbett
Ave., Bronx, N.Y. 10463
Jones & Laughlin, 401 Liberty,
Pittsburgh, Pa. 15222
Jones Div. Cinch Mfg., 1026 S. Homan,
Chicago, Ill. 60624
J W Electronics, 1538 W. Jarvis,
Chicago, Ill. 60626
J W Electronics, PO Box 51,
Bloomington, Ind. 47401

K

KLH Research & Devel, 30 Cross St.,
Cambridge, Mass. 02138
KTV Tower & Com. Equip. Co.,
PO Box 294, Sullivan, Ill. 61951
Karg Laboratories, 162 Ely Ave. S.,
Norwalk, Conn. 06854
Karlson Assoc., 1610 Neck Rd.,
Brooklyn, N.Y. 11229
Kaar Engineering Co., 2998 Middlefield
Rd., Palo Alto, Calif. 94306
Kay Electric, 14 Maple,
Pine Brook, N.J. 07058
Kay-Towens Antenna Co., PO Box 593,
Rome, Ga. 30162
Kenwood Electronics, 3700 S. Broadway
Pl., Los Angeles, Calif. 90007
Kepco Inc., 131-38 Sanford Ave.,
Flushing, N.Y. 11355
Kester Solder, 4201 Wrightwood,
Chicago, Ill. 60639
Klipsch & Assoc., PO Box 96,
Hope, Ark. 71801
Kinematix Inc., 2040 W. Washington,
Chicago, Ill. 60612
Knob Corp. of America, 469 Jericho Tpk.,
Mineola, N.Y. 11501
Koss Inc., 2227 N. 31 St.,
Milwaukee, Wis. 53208
Kraeuter Tools, 332 South Michigan Ave.,
Chicago, Ill. 60604
Krylon Inc., Ford & Washington St.,
Norristown, Pa.
Kwikheat Mfg., 3731 San Fernando Rd.,
Glendale, Calif. 91204

L

LA Turner Exchange, 4611 W. Jefferson,
Los Angeles, Calif. 90016
Lafayette Radio Electronic, 111 Jerico
Tpk., Syosset, L.I., N.Y. 11791
Lakeside Industries, 5234 N. Clark St.,
Chicago, Ill. 60640
Lambda Electronics, 515 Broad Hallow,
Huntington, N.Y. 11743
Lampkin Labs, Bradenton, Fla. 33505
Lance Antenna, 1730 1st St.,
San Fernando, Calif. 91340
Lansing Sound James B., 3249 Casitas
Ave., Los Angeles, Calif. 90039
Larsen Electronics Inc., 11611 N.E. 50th
Ave., Vancouver, Wash. 98665
Lavoie Labs, Morganville, N.J. 07751
Leach Corp., 18435 Susana Rd.,
Compton, Calif. 90221

Leader Instruments Corp., 24-20 Jackson
Ave., Long Island City, N.Y. 11101
Lectrotech Inc., 1221 W. Devon Ave.,
Chicago, Ill. 60626
Ledex Inc., 123 Webster,
Dayton, Ohio 45402
Leeds & Northrup, 4907 Stenton,
Philadelphia, Pa. 19144
Lesca of America, 11 W. 42 St.,
New York, N.Y. 10036
Littlefuse Inc., Des Plaines, Ill.
Litton Industries, 336 N. Foothill,
Beverly Hills, Calif. 90210
Loral Distributor Products, Pond Hill
Industrial Park, Great Neck, N.Y. 11022
Los Angeles Turner Exchange, 4611 W.
Jefferson, Los Angeles, Calif. 90016

M

3M, 2501 Hudson Rd.,
St. Paul, Minn. 55119
Macdonald & Co., 213 So. Brand Blvd.,
Glendale, Calif. 91204
McIntosh Labs, 2 Chambers St.,
Binghamton, N.Y. 13903
Magnavox Co., 2131 Bueter Rd.,
Ft. Wayne, Ind.
Magnecord Div. Midwestern Instrument,
PO Box 7186, Tulsa, Okla. 74105
Magnetrack Box, 147 Caroline,
Puerto Rico, U.S.A.
Majestic Int'l, 743 LaSalle St.,
Chicago, Ill. 60605
Mallory & Co. P. R., PO Box 1558,
Indianapolis, Ind. 46206
Marantz, 25-14 Bdwy.,
Long Island City, N.Y. 11106
Marconi Instruments, 111 Cedar Lane,
Englewood, N.J. 07631
Mark Products, 5439 W. Fargo,
Skokie, Ill. 60076
Master Mobile Mounts, 4125 W. Jefferson
Blvd., Los Angeles, Calif. 90016
Matsushita Electric Co., 200 Park Ave.,
New York, N.Y. 10017
Mercury Electronics, 315 Roslyn Rd.,
Mineola, N.Y. 11501
Mercury TV Tuner Service, 890 River,
Bronx, N.Y.
Merit Coil & Transformer, Merit Plaza,
Hollywood, Fla.
Metex Corp., 970 Durham Rd.,
Edison, N.J. 08817
Methode Mfg., 7447 W. Wilson Ave.,
Chicago, Ill. 60656
Metrex (UXL Corp.), 819 Blake Ave.,
Brooklyn, N.Y. 11207
Metritape Controls, 33 Sudbury Rd.,
Concord, Mass. 01742
Michigan Magnetics,
Vermontville, Mich. 49096
Microflame Inc., 7800 Computer Ave.,
Minneapolis, Minn. 55424
Midland Int. Corp., 1519-21 Atlantic N.,
Kansas City, Mo. 64116
Midland Industries Inc., 8219 W. Irving

3 GUN SALUTE



Only the Sencore CRT Champion has three gun control . . . Just like the color TV set.

Only Sencore has automatic color tracking to make your job easier.

Only Sencore has the simplified instructions in the cover so that you can analyze any color CRT tube in seconds. Just flip the "Color Gun" switch from red to green to blue (after setting the three G2 controls) and the CR143 Champion will tell you if the tube has adequate emission and if it will track in the TV set.

Why don't you salute the Sencore Champion today by marching in and asking your distributor to try one. You won't bring it back because it is 100 percent.



SENCORE

NO. 1 MANUFACTURER OF ELECTRONIC MAINTENANCE EQUIPMENT
426 SOUTH WESTGATE DRIVE, ADDISON, ILLINOIS 60101

. . . for more details circle 132 on postcard

Blvd., Wichita, Kansas 67209
Mid-State Tuner Service, 1504 So. College,
Box 1141, Bloomington, Ind. 47401
Milgray/N.Y., 136 Liberty St.,
New York, N.Y. 10006
Millen Mfg. James, 150 Exchange,
Malden, Mass. 02148
Miller Co. J. W., 5917 S. Main,
Los Angeles, Calif. 90003
Milo Electronics, 530 Canal,
New York, N.Y. 10013
Monarch Elec. Int'l Inc., 7035 Laurel
Canyon Blvd. N., Hollywood, Calif.
90028
Monitoradio Div. Idea, 7900 Pendleton
Pike, Indianapolis, Ind. 46226
Mosley Electronics, 4610 N. Lindberg,
Bridgeton, Mo. 63044
Moss Electronics, 2435 White Plains Rd.,
Bronx, N.Y. 10467
Motorola Communications Div., 4501 W.
Augusta, Chicago, Ill. 60651
Motorola Consumer Prods., 9401 W.
Grand Ave., Franklin Park, Ill. 60131
Motorola Semiconductor Products,
PO Box 955, Phoenix, Ariz. 85001
Motorola Training Int., 4545 W. Augusta,
Chicago, Ill. 60651
Mueller Electric, 1583 E. 31 St.,
Cleveland, Ohio 44114
Mullard, see Int'l Electronics,
New York, N.Y.
Multicore Sales Corp.,
Westbury, N.Y. 11590
Multitron Corp., 309 Queen Ann Rd.,
Teaneck, N.J. 07666
Mura Corp., 380 Great Neck Rd.,
Great Neck, N.Y. 11021
Muzak Co., 220 4 Ave.,
New York, N.Y. 10003

N

National Radio Institute, 3939 Wisconsin
Ave., Washington, D.C. 20016
Neshaminy Electronics, Neshaminy, Pa.
Newark Electronics, 223 W. Madison,
Chicago, Ill. 60606
Newcomb Audio Products Co., 12881
Bradley Ave., Sylmar, Calif. 91342
Newtronics Corp., 3455 Vega Ave.,
Cleveland, Ohio 44113
North American Phillips (Norelco),
100 E. 42 St., New York, N.Y. 10017
Nortronics Co., 8133 10th Ave. N.,
Minneapolis, Minn. 55427
Nutone Inc., Cincinnati, Ohio

O

Oak Mfg. Co., Crystal Lake, Ill. 60014
Oaktron Industries, Monroe, Wis. 53566
Oelrich Publications, 4308 Milwaukee
Ave., Chicago, Ill. 60641
Ohmite Mfg., 3673 Howard St.,
Skokie, Ill. 60076
Olson Electronics, 464 S. Forge,

**This new E-V
phono needle
package helps you
buy, sell,
then sell
again!**



E-V On every new E-V needle package you'll find the model number printed three extra times on pressure sensitive tabs. Here's why:

The tabs can help you order replacements. Or keep track of sales. Or you can stick one on a file card in a follow-up system that tells you what and when a customer last bought (so that you can tell him when to buy again)! Or put a tab on the customer's tone arm to simplify service on the next call.

But don't be surprised if one of the tabs is missing. Your E-V distributor may be using one to keep track of his stock —so that you always have the needle you want, when you want it.

Smart ideas in packaging of the world's finest phono service parts help make Electro-Voice your best buy. Available only from the parts distributor with much more than parts to offer!

Ask for your copy of the latest Electro-Voice phono needle/cartridge combined catalog. It's free at your E-V distributor's.

ELECTRO-VOICE, INC., Dept. 697-T
663 Cecil Street, Buchanan, Michigan 49107



... for more details circle 115 on postcard

Akron, Ohio 44308
Olympic Radio & TV, 34-01 37 Ave.,
Long Island City, N.Y. 11101
Ortron Electronics, 29 Lincoln Ave.,
Orange, N.J.
Oxford Transducers, 3911 S. Mich. Ave.,
Chicago, Ill. 60653

P

Packard Bell Electronics, 12333 W.
Olympic Blvd., Los Angeles, Calif. 90064
Pace Communications Corp., 24049
Frampton Ave., Harbor City, Calif. 90710
Palmer Electronics Laboratories, Lowell
Rd., Carlisle, Mass. 01741
Parker Metal Goods Co., 85 Prescott St.,
Wooster, Mass.
Parts Unlimited Inc., 1 State St.,
Bloomfield, N.J. 07003
Pearce-Simpson, PO Box 800 Biscayne
Annex, Miami, Fla. 33152
Perma-Power Co., 5740 N. Tripp Ave.,
Chicago, Ill. 60646
Peterson Radio Company, Inc., 2800 West
Broadway, Council Bluffs, Iowa 51501
Phaostron Instruments & Electronics,
151 Pasadena Ave. S.,
Pasadena, Calif. 91105
Phelps Dodge Communications Products
Div., Route 79, Marlboro, N.J. 07746
Philco Corp., "C" and Tioga Sts.,
Philadelphia, Pa. 19134
Philharmonic Radio & TV, 235 Jersey Ave.,
New Brunswick, N.J. 08901
Pickering & Co., Sunnyside Blvd.,
Plainview, N.Y. 11803
Pilot Radio, 100 Electra Lane,
Yonkers, N.Y.
Pioneer Electric & Research,
Forest Park, Ill. 60130
Planet Mfg. Corp., 225 Belleville Ave.,
Bloomfield, N.J. 07003
Pocket Socket Inc., 17415 Ecorse,
Allen Park, Mich. 48101
Polytronics Laboratories Inc., 900
Burlington Ave., Silver Spring, Md.
Pomona Electronics Co., 1500 E. 9th St.,
Pomona, Calif. 91766
Potter & Brumfield, 107 N. 10th St.,
Princeton, Ind. 46017
Precise Electronics, 76 E. 2 St.,
Mineola, L.I., N.Y. 11501
Precision Apparatus Div. of Dynascan,
1801 W. Belle Plaine Ave.,
Chicago, Ill. 60613
Precision Electronics Inc., 9101 King Ave.,
Franklin Park, Ill. 60131
Precision Tuner Service, PO Box 272,
Bloomington, Ind. 47401
Pyramid Electronic Co.,
Darlington, S.C. 29532

Q

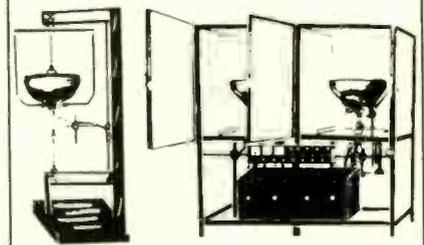
Qualitone Industries, 102 Columbus Ave.,
Tuckahoe, N.Y. 10707

Quam-Nichols, 234 E. Marquette Rd.,
Chicago, Ill. 60637
Quan-Tech Labs, 60 Parsippany Blvd.,
Boonton, N.J. 07005
Quietrole Co., 395 St. John St.,
Spartanburg, S.C. 29302

R

Radar Devices Mfg. Corp., 22003 Harper
Ave., St. Clair Shores, Mich. 48080
RCA Components and Devices Div.,
415 S. 5 St., Harrison, N.J. 07029
RCA Semiconductor Dist. Prod. Div.,
415 S. 5 St., Harrison, N.J. 07029
RCA Parts and Accessories,
2000 Clements Bridge Rd.,
Deptford, N.J. 08096
RCA Set Div., 600 N. Sherman Dr.,
Indianapolis, Ind. 46201
RFS Industries, 102 Harbor Rd.,
Port Washington, N.Y. 11050
RMS Electronics Inc., 50 Autin Place,
Bronx, N.Y. 10462
Radiart Co., 2900 Columbia,
Indianapolis, Ind. 46205
Radio Receptor, 240 Wythe,
Brooklyn, N.Y. 11211
Radio Shack, 730 Commonwealth,
Boston, Mass.
Rauland Corp., 4245 N. Knox,
Chicago, Ill. 60630
Rawn Co., Spooner, Wis. 54801

**REBUILD
YOUR OWN
PICTURE TUBES?**



With Lakeside Industries precision equipment, you can rebuild any picture tube!

EASY TO OPERATE!

Requires only 4 x 8 ft. of space.
Your cost to rebuild black and white—\$1.50.
Your cost to rebuild Color—\$5.80.
For complete details, mail coupon.

LAKESIDE INDUSTRIES
5234 N. Clark St.
Chicago, Ill. 60640
Phone: 312-271-3399

Free demonstration appointment
 Send me more information

Name

Address

City State

... for more details circle 102 on postcard
ELECTRONIC TECHNICIAN/DEALER

ATR PRODUCTS FOR MODERN LIVING



ATR UNIVERSAL INVERTERS

A.C. Household Electricity Anywhere . . . In your car, boat or plane!

To Operate • Tape Recorders • TV Sets • Dictating Machines • Radios • Public Address Systems • Electric Shavers • Record Players • Food Mixers • and Emergency Lighting.

NET 12U-RHG (12 V.) 175-200 W. Sh. Wt. 27 lbs. 79.66
28U-RHG (28 V.) 150-175 W. Sh. Wt. 27 lbs. 96.66



ATR "A" BATTERY ELIMINATOR

For Demonstrating and Testing Auto Radios—TRANSISTOR or VIBRATOR OPERATED!

Designed for testing D.C. Electrical Apparatus on Regular A.C. Lines.

MAY ALSO BE USED AS A BATTERY CHARGER
MODEL 610C-ELIF . . . 6 volts at 10 amps. or 12 volts at 6 amps. Shipping weight 22 lbs.

USER NET PRICE \$59⁸²

ATR AUTO RADIO AND COMMUNICATION LONGER-LIFE VIBRATORS

"The Best by Test!"



ATR ELECTRONICS, INC.

Quality Products Since 1931

St. Paul, Minnesota 55101—U.S.A.

. . . for more details circle 103 on postcard

After just 1 year it's THE INDUSTRY STANDARD



BLUE STUFF, the one that doesn't just foam and fizzle out — the thick coating cleans, polishes and re-lubricates each time the channel is changed.

TECH SPRAY Box 949 Amarillo, Texas 79105
Canada: Wm. Cohen, Montreal
Export: Singer Products NYC

. . . for more details circle 135 on postcard

JUNE 1969

- Ray-O-Vac Co., 212 E. Washington St., Madison, Wis. 53703
- Raytheon Communications Prod., 213 Grand S., San Francisco, Calif.
- Raytheon Distributor Products, Div., 55 Chapel, Newton, Miss. 39345
- R-Columbia Products, 305 Waukegan Ave., Highwood, Ill. 60040
- Recoton Corp., 52-35 Barnett, Long Island, N.Y. 11104
- Record-O-Phone Div., Electrospace Corp., 408 Concord Ave., N.Y., N.Y. 10451
- Reeves Soundcraft, Great Pasture Rd., Danbury, Conn. 06810
- Regency Electronics, 7900 Pendleton Pike, Indianapolis, Ind. 46226
- Rego Insulated Wire, 830 Monroe, Hoboken, N.J. 07030
- Rek-O-Kut Co., 38-19 108 St., Corona, N.Y. 11368
- Robert Electronics, 829 N. Highland Ave., Hollywood, Calif. 90028
- Robert Bosh Corp., Blaupunkt Car Radio Div., 40-25 Crescent, Long Island City, N.Y. 11101
- Robins Industries, 1558 127 St., College Pt., N.Y. 11356
- Rockbar Corp., 650 Halstead, Mamaroneck, N.Y. 10543
- Rohm Mfg., 1116 Limestone St., Peoria, Ill.
- Rustrak Instrument, 130 Silver, Manchester, N.H. 03103

S

- S&A Electronics, 204 W. Florence St., Toledo, Ohio 43605
- Sadelco Inc., 601 W. 26th St., New York, N.Y. 10001
- Salch & Co., Herbert Marketing Div., Tompkins Radio Prod., Woodsboro, Texas 78393
- Sampson Co., 2244 S. Western Ave., Chicago, Ill. 60608
- Sangamo Electric, 1301 N. 11st, Springfield, Ill. 62702
- Sansui Electronics Corp., 34-43 56th St., Woodside, N.Y. 11377
- Sargent Gerkhe Co., 323 W. 15th St., Indianapolis, Ind. 46202
- Sarkes Tarzian Tuner Service, 537 S. Walnut, Bloomington, Ind. 47401
- Sarkes Tarzian Tuner Service, 547-49 Tonnele, Jersey City, N.J. 07307
- Sarkes Tarzian Tuner Service, 10654 Magnolia N., Hollywood, Calif. 90028
- Schematic Library, 809 N. 7th St., Phoenix, Ariz. 85006
- Schober Organ, 43 W. 61, New York, N.Y. 10023
- Scott Inc., HH 111 Powdermill Rd., Maynard, Mass. 01754
- Seco Electronics, 1201 W. Clover Dr., Minneapolis, Minn.

INTRODUCING

The Ultimate In Tuner Washes..



BLUE SHOWER washes and degreases all tuners—safely and quickly because BLUE SHOWER is 30% more powerful than other cleaners of this type — literally floods away the dirt and contamination that caused tuner drift and trouble for you. BLUE SHOWER leaves no residue and can't contaminate even the most sensitive parts of the tuner such as neutralizing and RF coils. After using BLUE SHOWER we recommend treating the contacts with BLUE STUFF FOR TUNERS which will clean the contacts each time the channel is changed.

SPECIAL INTRODUCTORY OFFER

Buy 1 can of BLUE SHOWER and 1 can of BLUE STUFF and get a second can of BLUE STUFF ——— FREE
Offer good for a limited time at participating jobbers everywhere

TECH SPRAY

Box 949 Amarillo, Texas 79105
Canada: Wm. Cohen, Montreal
Export: Singer Products NYC

. . . for more details circle 136 on postcard

Seco Electronics, 1001 Second Street
 South, Hopkins, Minn. 55343
 Semitronics Corp., 265 Canal St.,
 New York, N.Y. 10013
 Sercore Inc., 426 S. Westgate Rd.,
 Addison, Ill. 60101
 Sentinel Inc., PO Box 336,
 Garland, Texas 75040
 Sentry Electronics Inc., 707 S.
 Okfuskee, Wewoka, Okla. 74884
 Setchell-Carlson, 530 5th Ave. N.W.,
 St. Paul, Minn. 55112
 Sherwood Electronic Labs, 4300 N.
 California Ave., Chicago, Ill. 60618
 Shure Brothers, 22 Hartrey Ave.,
 Evanston, Ill. 60202
 Signalite, Inc., Neptune, N.J.
 Simpson Electric, 5200 W. Kinzie St.,
 Chicago, Ill. 60644
 Singer Co., 3211 So. La Cienega Blvd.,
 Los Angeles, Calif. 90016
 Step Electronic Co., Automotive Div.,
 PO Box 178, Ellenton, Fla. 33532
 Smith Inc., Herman H., 2326 Norstrand,
 Brooklyn, N.Y. 11210
 Snyder Mfg., 22 Y Ontario,
 Philadelphia, Pa.
 Sola Electric, 1717 Busse Rd.,
 Elk Grove Village, Ill.
 Sonar Radio, 73 Westman Ave.,
 Brooklyn, N.Y.
 Sonotone Corp., Elmsford, N.Y. 10523
 Sony Corp. of America, 580 5th Ave.,
 New York, N.Y. 10036
 Sorensen Prods. Div., Raytheon S.,
 Norwalk, Conn.
 Soundolier Inc., PO Box 3848,
 St. Louis, Mo.
 South River Metal Products, 377 Tpk. Rd.,
 South River, N.J. 08882
 Sprague Products, 65 Marshall St. N.,
 Adams, Mass. 01247
 Sprayon Products Inc.,
 Bedford Heights, Ohio 44146
 Stockpole Carbon Electronics Div.,
 St. Marys, Pa.
 Stancor Electronics, 3501 W. Addison,
 Chicago, Ill. 60618
 Standard Instrument Corp., 657 Broadway,
 New York, N.Y. 10012
 Standard Kollsman Industries, 2085 N.
 Hawthorne, Melrose Park, Ill. 60160
 Stromberg-Carlson Div., General
 Dynamics, 1400 N. Goodman St.,
 Rochester, N.Y. 14609
 Sturtevant Co., PA, Addison, Ill. 60101
 Superex Electronics Corp., 4 Radford
 Place, Yonkers, New York
 Superior Electronics, 208-212 Piaget Ave.,
 Clifton, N.J. 07011
 Superior Tuner, 1377 N. Curry Pike,
 PO Box 368, Bloomington, Ind. 47401
 Swing O Lite Inc., 13 Moonachie Rd.,
 Hackensack, N.J.

Switchcraft Inc., 5555 N. Elston,
 Chicago, Ill. 60603
 Sylvania Electronic Products, 730 3rd
 Ave., N.Y., N.Y. 10017
 Sylvania Electronic Tube Div.,
 Seneca Falls, N.Y. 13148
 Symphonic Radio & Electronic,
 10 Columbus Circle N.,
 New York, N.Y. 10023

T

Tab Books, Monterey & Pinola Ave.,
 Blue Ridge Summit, Pa. 17214
 TACO, Sherburne, N.Y. 13460
 TRX Electronic Corp., 200 Park Ave. S.,
 New York, N.Y. 10003
 TV Tuner Service, 2103 W. 3rd St.,
 Bloomington, Ind. 47401
 TV Tuner Service, 118 3rd St., W.,
 Twin Falls, Idaho 83301
 Talk A Phone Co., 5013 N. Kedzie Ave.,
 Chicago, Ill. 60625
 Tandberg of America, 83 Ave.,
 Pelham, N.Y. 10803
 Tap A Line Mfg., PO Box 563,
 Pompano Beach, Fla. 33061
 Tech-Master, 75 Front St.,
 Brooklyn, N.Y. 11201
 Techni-Parts Corp., 156 Hempstead Tpk.,
 W. Hempstead, L.I., N.Y. 11552
 Techpress Inc., Brownsburg, Ind. 46112
 Tektronix Inc., PO Box 500,
 Beaverton, Ore. 97005
 Telerad Div., Lionel Corp., Route 69-202,
 Flemington, N.J. 08822
 Telex Inc., 3054 Excelsior,
 Minneapolis, Minn. 55416
 Telex/Aemco Div., Telex Inc.,
 Mankato, Minn. 56001
 Teleonic Industries, 60 N. 1st Ave.,
 Beech Grove, Ind. 46107
 Telvac Instrument Co., 18531 Ventura
 Blvd., Tarzana, Calif. 91356
 Tenatronics Ltd., 1011 Power Ave.,
 Cleveland, Ohio 44114
 Tenna Mfg., 19201 Cranbrook Pkwy.,
 Cleveland, Ohio
 Tennialab, 10 & State St.,
 Quincy, Ill. 62301
 Terado Co., 1068 Raymond Ave.,
 St. Paul, Minn. 55108
 Texas Crystals, 1000 Crystal Dr.,
 Ft. Myers, Fla. 33901
 Thomas & Betts Co., Inc., 36 Butler St.,
 Elizabeth, N.J. 07207
 Thomas Electronic Organs,
 8345 Hayvenhurst Ave.,
 Sepulveda, Calif. 91343
 Thordarson-Meissner, 7 & Belmont,
 Mt. Carmel, Ill. 62863
 Thorens Div., Atlantic & Steward Aves.,
 ELPA Mktg., Ind.,
 New Hyde Park, N.Y. 11040
 Toshiba Mitsu & Co., 530 5th Ave.,
 New York, N.Y. 10036

Tram Electronics, Lower Bay Rd.,
 PO Box 187, Winnisquam, N.H. 03289
 Trav Ler Radio, 571 W. Jackson,
 Chicago, Ill. 60606
 Triad Transformer, 4055 Redwood Ave.,
 Venice, Calif. 90291
 Trio Mfg., Griggsville, Ill. 62340
 Triplett Electrical Instrument, 286 Harmon
 Rd., Bluffton, Ohio 45817
 Trippe Electronics, 133 North Jefferson,
 Chicago, Ill. 60606
 Tuner Inc., 6302 5th Ave., Brooklyn, N.Y.
 Tuner Service Corporation, 817 N.
 Pennsylvania St., Indianapolis, Ind.
 Tuner Service Corporation,
 547-49 Tonnele Ave., Jersey City, N.J.
 Tuner Service Corporation, 938 Gordon
 St., S.W., Atlanta, Georgia
 Tuner Service Corporation, 10654
 Magnolia Blvd., North Hollywood, Calif.
 Tung-Sol Electric, 1 Summer Ave.,
 Newark, N.J. 07104
 Turner Co., 918 17th St. N.E.,
 Cedar Rapids, Iowa 52401

U

Ullman Devices, Ridgefield, Conn. 06877
 Ungar Co., Sid, 1880 Rayford Dr.,
 Los Angeles, Calif. 90045
 Ungar Electric Tools, 2701 W. El Segundo
 Blvd., Hawthorne, Calif. 90250
 Union Carbide, 270 Park Ave.,
 New York, N.Y. 10017
 Useco Div., Litton Industries, Inc.,
 13536 Saticoy St.,
 Van Nuys, Calif. 91402
 Utah Electronics, 1123 E. Franklin St.,
 Huntington, Ind. 46750
 U Test M Mfg., 4325 W. Lincoln,
 Milwaukee, Wis. 53219
 United Transformer, 150 Varick St.,
 New York, N.Y. 10013
 University Loudspeakers Div.,
 Ling Temco Vought, 9500 W. Reno St.,
 Oklahoma City, Okla.
 Up Right Towers, 1013 Pardee St.,
 Berkeley, Calif. 94710
 Utah Radio & Service Corp., 1123 E.
 Franklin St., Huntington, Ind. 46750
 Utica Drop Forge & Tool,
 2415 Whitesboro, Utica, N.Y. 13502
 Utica Electronic Communications, 2714
 W. Irving Pk., Chicago, Ill. 60618

V

V-M Corp., Territorial Rd.,
 Benton Harbor, Mich. 49022
 Vaco Products, 510 N. Dearborn,
 Chicago, Ill. 60610
 Valley TV Tuner Service, 5641 Cahuenga
 Blvd. N., Hollywood, Calif. 90028
 Vector Electronic, 1100 Fowler St.,
 Glendale, Calif.
 Victoreen Instrument, 5806 Hough Ave.,
 Cleveland, Ohio 44103

Vidaire Electronics, 365 Babylon Tpk.,
Roosevelt, L.I., N.Y. 11575
Video Industries Co., 242 Madison Ave.,
Port Chester, N.Y. 10573
Viking Cable Co., 400 9th St.,
Hoboken, N.J. 07030
Viking of Minnesota, 9600 Aldrich St.,
Minneapolis, Minn.
Viking Electronics, 830 Monroe,
Hoboken, N.J. 07030
Vitramon Inc., Box 544,
Bridgeport, Conn. 06601
Vocaline Co. of America, 133 Colter St.,
Old Saybrook, Conn. 06475
Volkswagen of America, 476 Hudson
Terrace, Englewood Cliffs, N.J. 07632

W

Waber Electronics, 200 N. 2nd St.,
Philadelphia, Pa. 19106
Walco Electronics, 60 Franklin St.,
East Orange, N.J. 07017
Waldom Electronics, 4625 W. 53rd St.,
Chicago, Ill. 60623
Wall Mfg. Co. P, Grove City, Pa. 16127
Waller Corp., Crystal Lake, Ill. 60014
Wallin-Knight Industries, 3321 McKinley
St. N.E., Minneapolis, Minn. 55108
Walsco Electronics, S. Wyman St.,
Rockford, Ill. 61101
Ward Leonard Electric, 115 McQueston
Pkwy., Mt. Vernon, N.Y.

Ward Products, Edsom St.,
Amsterdam, N.Y. 12010
Weathers Industries, 66 E. Gloucester
Pike, Barrington, N.Y. 08007
Webcor Inc., 5626 Bloomingdale Ave.,
Chicago, Ill. 60639
Weller Electric, 601 Stone Crossing Rd.,
Easton, Pa.
Wells-Gardner, 2701 N. Kildare Ave.,
Chicago, Ill. 60639
Wen Products, 5810 Northwest Hwy.,
Chicago, Ill. 60631
Western Electric Co., Inc., 195 Bdwy.,
New York, N.Y. 10007
Western Tuner Rebuilders, 1140 N.
Vermont Ave., Los Angeles, Calif. 90029
Westinghouse Electric Radio TV Dept.,
Metuchen, N.J. 08840
Westinghouse Electric Corp., Tube Div.,
PO Box 284, Elmira, N.Y. 14902
Wilco Co., 4425 Bandini Blvd.,
Los Angeles, Calif. 90023
Windsor Electronics, 999 N. Main St.,
Glen Ellyn, Ill. 60137
Winegard Co., 3019 Kirkwood,
Burlington, Iowa 52601
Wire Products Co., 1215 South Ave.,
Syracuse, N.Y. 13207
Workman Electronic Products, Box 5297,
Sarasota, Fla. 33579
Worner Electronic, Rankin, Ill. 60960
Wuerth Tube Saver Corp., PO Box 66,

Hollandale, Fla.
Wurlitzer Co., N. Tonawanda, N.Y. 14150

X

Xacto, Inc., 48-41 Van Dam St.,
Long Island City, N.Y. 11101
Xcelite, Inc., 12 Bank St.,
Orchard Park, N.Y. 14127

Y

Yeats Appliance Dolly Sales Co., 2124 N.
12th St., Milwaukee, Wis. 53205

Z

Zenith Sales Corp., 6001 W. Dickens,
Chicago, Ill. 60639

Keep our leaders coming!
GIVE TO THE COLLEGE
OF YOUR CHOICE.



advertising contributed for the public good

AID TO HIGHER EDUCATION CAMPAIGN

GREAT REPAIR TOOL

(HAND-SIZED)

**Gas Welding
Torch**

**5000° Pinpoint
Flame Welds,
Brazes, Solders**

(Self Contained.
No wires or
connections needed.)



Ideal for workshop, electrical/
electronic repair, labwork, miniature
gasblowing, wiring, jewelry making.

FREE LITERATURE

MICROFLAME, INC.

Division of Printed Circuits, Inc.
7800 Computer Avenue, Dept. ET-2
Minneapolis, Minnesota 55424
Area 612 - 927-5681

**MATV DISTRIBUTION
AMPLIFIER KITS**

for Color/B&W TV



For the TV serviceman who has avoided amplified distribution systems as too involved, Mosley has developed four simple and easily installed MATV Distribution Amplifier Kits for VHF Color/B&W TV. Each kit contains all the components necessary for a two-outlet amplified system, designed for easy expansion with additional outlets. Four models for four widely-used types of lead-in: two coax, two twin-lead. Instructions offer suggestions for system planning and simple block diagrams with coax loss factors already figured. Write Dept. 180A for details.

Mosley Electronics Inc. 4610 N. Lindbergh Blvd.,
Bridgeton Missouri 63042

... for more details circle 125 on postcard

... for more details circle 124 on postcard

MAKE YOUR OWN TUNER TEST!

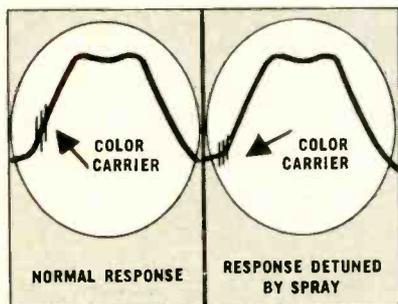
If you're like most professional TV technicians, you clean the tuner of every chassis you service.

But how careful are you in choosing your tuner spray? The wrong spray can cost you a lot in aggravation and callbacks.

That's why we ask you to

MAKE THIS TEST YOURSELF

1. Tune in a good color picture on any color set.
2. Spray the tuner with anything but a Chemtronics Spray.
3. You will see the color fade and disappear almost immediately, due to the changes of capacitance in tuned circuits caused by the spray.



4. Wait about 10 minutes for the spray to dry. Unfortunately, the color will not come back.
5. Spray the tuner with Chemtronics TUN-O-WASH.
6. Wait about two minutes and color will be restored.

WHAT THIS TEST MEANS TO YOU

Most tuner sprays leave a residue of slow drying, petroleum base lubricant. This saturates the coils and other components causing a shift in response as shown in illustration.

To compensate for this shift, you often adjust oscillator slugs. Then, when the set has played in your customer's house for a week or two, the residue dries out, shifting the oscillator back toward its original frequency. If the customer can't compensate for this drift with the fine tuner, you have a callback on your hands. Even if the drift is not too severe, the remaining residue picks up dirt and eventually "gunks up" the tuner.

TUN-O-WASH IS LIKE NO OTHER SPRAY ON THE MARKET

TUN-O-WASH is a powerful, high pressure spray designed to do just one job superlatively well. It melts away grease, oil, dirt and corrosion quickly and completely. It leaves absolutely no residue behind. Tests show that TUN-O-WASH is at least 10 times as effective as any other tuner spray in degreasing gunked up tuners.

Use TUN-O-WASH as your first step in repairing any tuner. It gives you a clean start in much the same way as the ultrasonic bath used by tuner specialists — but without harmful vibration. You'll be surprised at how many tuners you can repair the TUN-O-WASH way.

Then, once the tuner is restored to good working condition, you can lubricate it with a light spray of Chemtronics famous COLOR-LUBE, guaranteed not to detune, attack plastic parts or "gunk up." COLOR LUBE uses a unique synthetic lubricating formula developed specifically for color TV tuners.



Giant 24 oz. can only \$3.25 dealer net.

1260 RALPH AVENUE • BROOKLYN, N.Y. 11236

... for more details circle 109 on postcard

ET/D AD INDEX

American Telephone & Telegraph	23
Associated Industries (Div. Lakeside)	78
ATR Electronics	79
B & K Division	34, 74
BSR (USA) LTD.	64
Centralab	82
Chemtronics	73, 82
Cleveland Institute	75
Commander Electronics	30
C.R.T. Equipment	3rd Cover
Delco Radio Div.	63
EICO Corp.	2nd Cover
Electro-Voice	78
Finney Company	31
Gem City Tuner Service	26
Heath Company	71
JFD Electronics	25
Lampkin Labs	26
Leader Instruments	28
Lectrotech	67
Marquette Corp.	33
J. W. Miller	28
Mosley Electronics	81
Printed Circuits	81
Quam Nichols	60
Quietrol Company	26
Radio Corporation of America	4th Cover
RCA Institute	30
RCA Test Equipment	61
Sencore	22, 69, 77
Sprague	27
Sylvania	29
Tech Spray	79
Triplett	20
Tuner Service Corp.	19
Weller Electric	59
Xcelite Inc.	60
Zenith Sales Corp.	65, 70

Packaged and priced for you



Look for the Centralab Capacitor Carousel . . . 166 of the most requested capacitances. Extra value in every pack, each pack priced to you at \$1.05

You've never been able to select and buy capacitors so easily. Centralab's new Capacitor Carousel proves that better packaging and better pricing can increase your profits from service work. Bubble packs of ceramic, low-voltage semiconductor type, electrolytic and polystyrene capacitors are identified by type, capacitance, tolerance and voltage. They provide a package that makes for better housekeeping. Capacitor Carousels are at your Centralab Distributor.

DISTRIBUTOR PRODUCTS



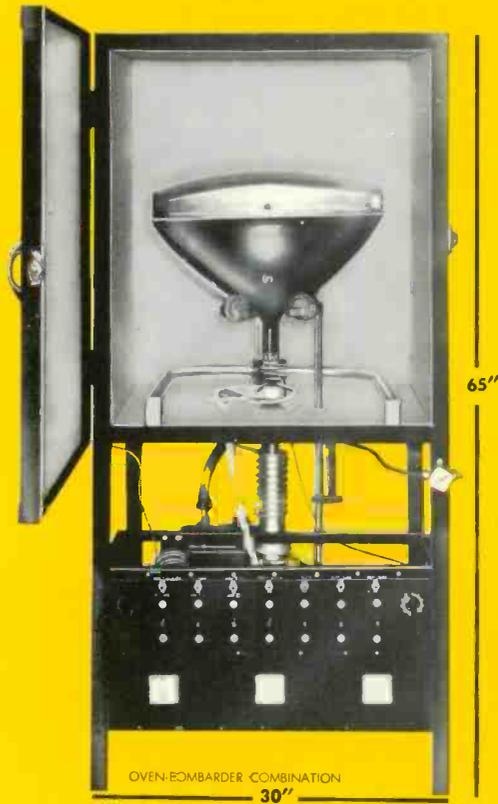
CENTRALAB
Electronics Division
GLOBE-UNION INC.

DON'T FORGET TO ASK
"WHAT ELSE NEEDS FIXING?"

... for more details circle 107 on postcard

ELECTRONIC TECHNICIAN/DEALER

THE PROFIT-MAKER!



- REBUILDS ANY SIZE ROUND OR RECTANGULAR COLOR PICTURE TUBES . . . AVERAGE COST PER TUBE \$7.80
- REBUILDS ANY SIZE BLACK AND WHITE PICTURE TUBE . . . AVERAGE COST PER TUBE \$1.80
- FREE INSTALLATION AND TRAINING ANYWHERE IN THE CONTINENTAL U.S.A.
- FREE SUPPLIES FOR REBUILDING YOUR FIRST 50 PICTURE TUBES
- EXTREMELY EASY TO OPERATE
- INCLUDES LAMINATING AND DELAMINATING EQUIPMENT FOR REBUILDING BLACK AND WHITE AND COLOR BONDED-FACE PICTURE TUBES.
- INCLUDES ALL TOOLS FOR REBUILDING ROUND AND RECTANGULAR COLOR PICTURE TUBES
- INCLUDES ALL TOOLS FOR REBUILDING BLACK AND WHITE PICTURE TUBES

RT COLOR CHAMPION

CRT COLOR CHAMPION . . . \$2,875.00

Mail Coupon Today for FREE CATALOG

C.R.T. Equipment Company, Inc.
 2740 Old Lebanon Road
 Nashville, Tennessee 37214

Telephone (615) 883-0215

(Please Print)

Name _____

Firm Name _____

Address _____

City _____

State _____ Zip _____

. . . for more details circle 112 on postcard

Confidence builder RCA HI-LITE color picture tubes

When does a component contribute more to a service call than simply the solution to your customer's problem? *When it also contributes to your service reputation!* Such is the case with HI-LITE picture tubes where RCA's experience in Color TV truly shows its hand.

When you install a HI-LITE replacement picture tube you know . . . and your customers can be told . . . that here is the same quality . . . the same tube . . . that goes into original equipment sets. That it's all new—glass, gun, the works! And that it incorporates the latest technical advancements of the world's most experienced color picture tube manufacturer, such as PERMA-CHROME and Unity Current Ratios. All this . . . plus the broadest line of types in the industry.

See your Authorized RCA Distributor for your tube needs. Install the brand that instills confidence.

RCA Electronic Components, Harrison, N.J.

RCA

