ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

AN OJIBWAY PUBLICATION

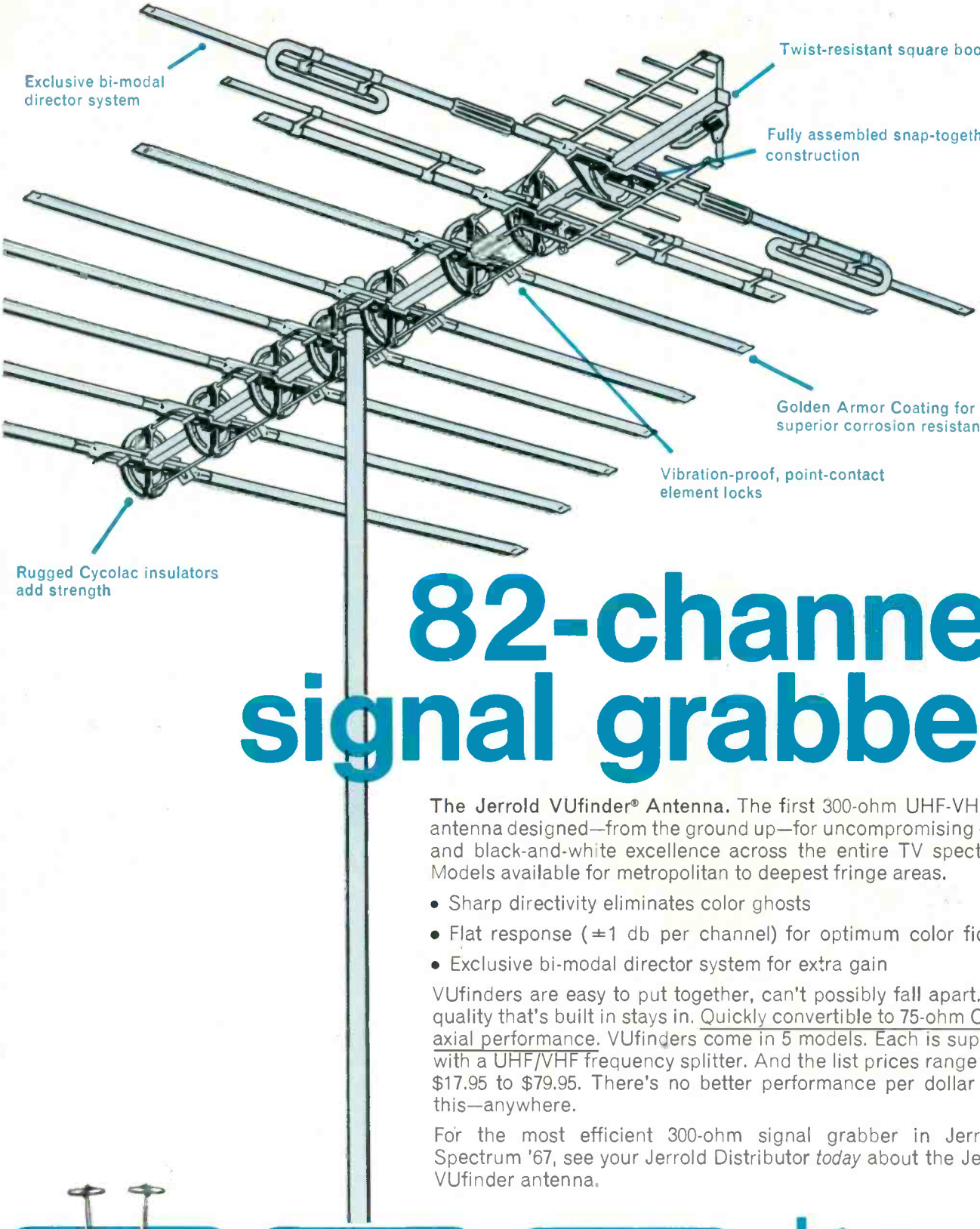
OCTOBER 1967

1968 Color TV Circuits

Test Instruments For Color

Tape recorders

Beginning: Dealer Fax



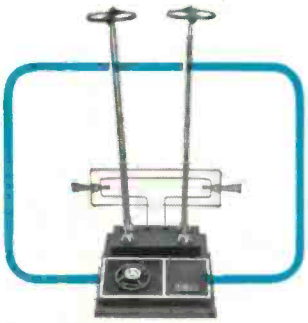
82-channel signal grabber

The Jerrold VUfinder® Antenna. The first 300-ohm UHF-VHF-FM antenna designed—from the ground up—for uncompromising color and black-and-white excellence across the entire TV spectrum. Models available for metropolitan to deepest fringe areas.

- Sharp directivity eliminates color ghosts
- Flat response (±1 db per channel) for optimum color fidelity
- Exclusive bi-modal director system for extra gain

VUfinders are easy to put together, can't possibly fall apart. The quality that's built in stays in. Quickly convertible to 75-ohm Coaxial performance. VUfinders come in 5 models. Each is supplied with a UHF/VHF frequency splitter. And the list prices range from $17.95 to $79.95. There's no better performance per dollar than this—anywhere.

For the most efficient 300-ohm signal grabber in Jerrold's Spectrum '67, see your Jerrold Distributor *today* about the Jerrold VUfinder antenna.



Indoor antennas

Home pre-amplifiers

Distribution equipment

JERROLD

Focusing on one thing... better reception

. . . for more details circle 101 on postcard

ELECTRONIC TECHNICIAN

TEKFAX

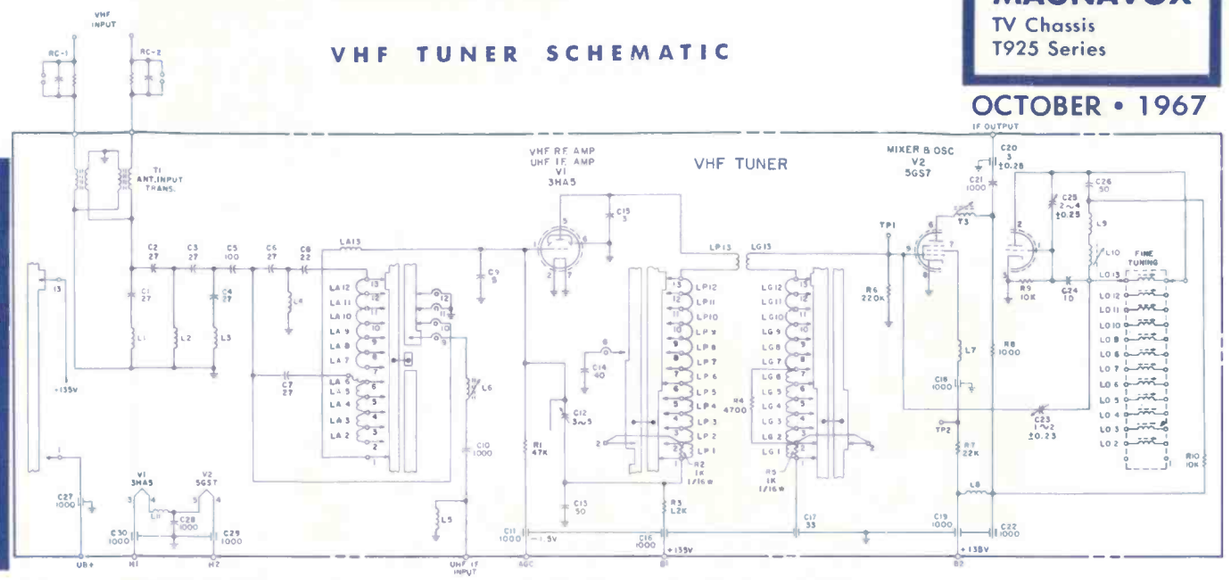
COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR 6 NEW SETS

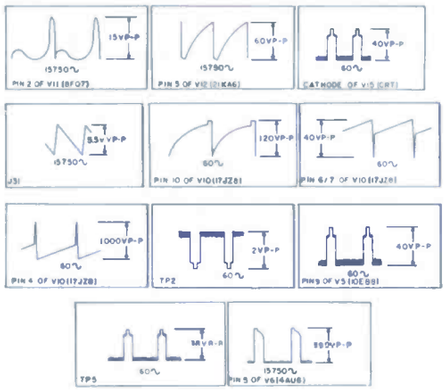
GROUP 182

1111
MAGNAVOX
TV Chassis
T925 Series

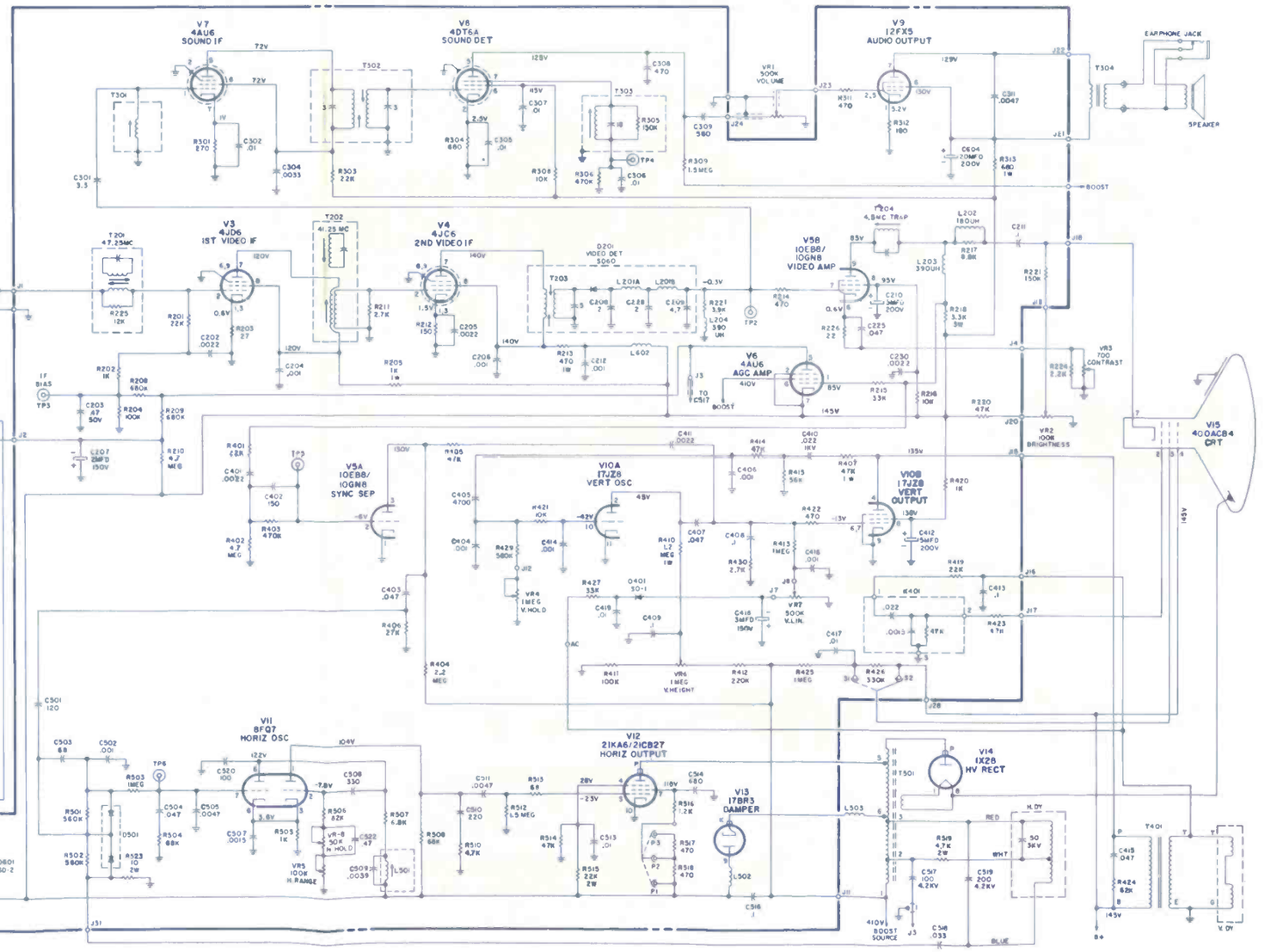
OCTOBER • 1967

VHF TUNER SCHEMATIC





NOTES: UNLESS OTHERWISE SPECIFIED,
1. CAPACITANCE VALUES OF 1 AND LESS ARE IN MICROFARADS.
2. CAPACITANCE VALUES GREATER THAN 1 ARE IN PICOFARADS.
3. VOLTAGES MEASURED WITH NO SIGNAL, CONTRAST CONTROL SET TO MAXIMUM, AND LINE VOLTAGE 120 VAC.



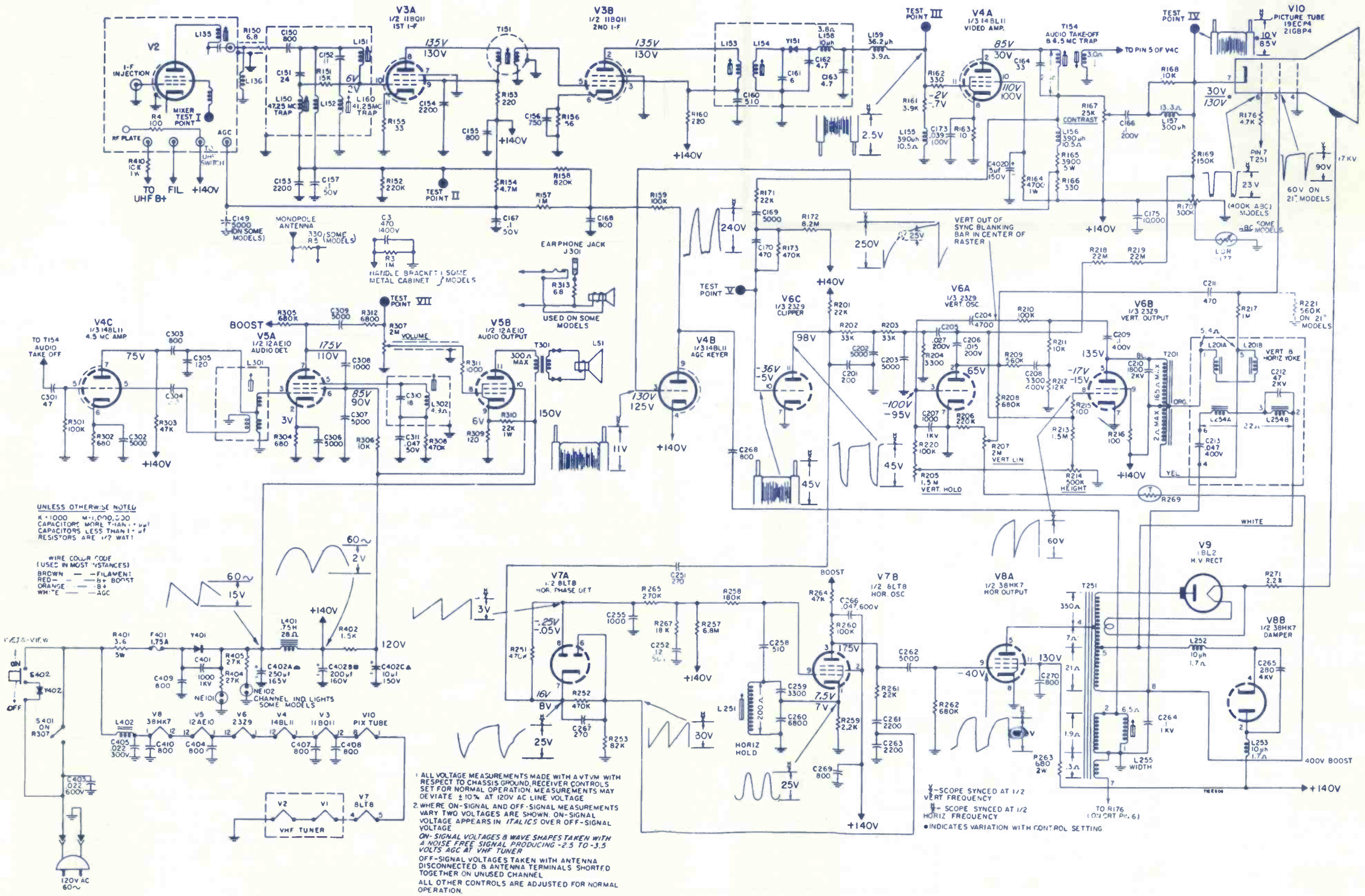
SYMBOL	DESCRIPTION	MAGNAVOX SERVICE PART NO.
CH601	ac Line Choke	320148-2
L201A	Tweet Choke	361050-23
L201B	Tweet Choke	361050-22
L202	180µh Peaking Coil	361050-24
L203	390µh Peaking Coil	361050-25
L204	390µh Penking Coil	361050-25
L501	Horiz Stabilizing Coil	361129-2
L502	Damper Plate Coil	361050-27
L503	Filter Choke	361050-20
L602	Line Choke	361050-21
T201	Video IF Input Coil & 47.25 MHz Trap	361049-31
T202	1st Video IF xformer & 41.25 MHz Trap	361049-32
T203	2nd Video IF xformer	361049-33
T204	4.5MHz Trap	361049-34
T301	4.5MHz Sound Take-Off Coil	361049-36
T302	4.5MHz Sound IF xformer	361049-37
T303	Quadrature Coil	361049-35
T304	Audio Output xformer	320144-2
T401	Vertical Output xformer	320147-2
T501	Horiz Output xformer	361048-4
	Deflection Yoke	361047-3
	VHF Antenna Input xformer	361049-38
C410	Oil Filled, 0.22µf 1 kv	250319-317
C517	Ceramic, 100pf, 4.2kv	250497-59
C519	Ceramic, 200pf 4.2 kv	250497-62
C603	Electrolytic, 200µf 250µf 250v	270075-5
C604	Electrolytic, 20µf 200v	270074-20
	Controls	
VR1	500K Volume W/AC Switch	220192-15
VR2	100K Bright	220192-17
VR3	700Ω Contrast	220192-16
VR4	1M Vertical Hold	220192-18
VR5	100K Horiz. Range	220191-4
VR6	1M Vertical Height	220191-4
VR7	500K Vertical Linearity	220191-4
VR8	50K Horiz. Hold	220191-4
	Miscellaneous	
	Fuse, 2 amp, 125v	180865-1200
FR601	Fusable Resistor, 2.5Ω 10w	240076-39
K401	Vertical Blanking Pac	250499-7
	VHF Tuner	340135-1
	UHF Tuner	340136-1

1112
CANADIAN GENERAL ELECTRIC
TV Chassis M687
OCTOBER • 1967

ELECTRONIC TECHNICIAN TEKFAX

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

SYMBOL	DESCRIPTION	CANADIAN GENERAL ELECTRIC PART NO.
C204	Capacitor-paper .0047µf 10% 1kv	R5684
C264	Capacitor-paper .1µf 1kv	R6745
C402A,B,C,D	Capacitor-elect 250µf 165v 200µf 160v 10µf 150v 5µf 160v	R7440
L150	Coil-link trap	R6735
L151	Coil-1st IF grid	R6736
L153	Coil-video det primary	R6738
L154	Coil-video sec assy	R6738
L155,6	Coil-choke 390µh	R4944
L157	Coil-choke 300µh	R7446
L158	Coil-choke 10µh	R7445
L159	Coil-choke 36.2µh	R6731
L160	Coil-link trap	R6824
L251	Coil-horz osc	R7448
L252,L253	Coil-choke 10µh	R7994
L301A,B	Coil-4.5MHz/s interstage	R8201
L302	Coil-quad	R7001
L401	Coil-filter reactor	R7451
L402	Coil-filament choke 100µh	R8567
L255	Coil-width	R7009
L201,L254	Yoke-deflection	R7434
R207	Control-vert lin 2M	R6995
R214	Control-height 500K	R6996
R269	Thermistor 150K	R7442
F401	Fuse 1.75a cup high voltage socket mount	R7573 R7008
T301	Xformer audio O.P.	R6851
T151	Xformer 1st IF plate	R7572
T154	Xformer audio take-off trap	R8568
T251	Xformer horiz output	R7575
T201	Xformer vert output	R8570



UNLESS OTHERWISE NOTED
K = 1000 M = 1,000,000
CAPACITORS MORE THAN 1 µf
CAPACITORS LESS THAN 1 µf
RESISTORS ARE 1/2 WATT

WIRE COLOR CODE (USED IN MOST INSTANCES)
BROWN — FILAMENT
RED — B+ BOOST
ORANGE — B+
WHITE — AGC

1. ALL VOLTAGE MEASUREMENTS MADE WITH A VTVM WITH RESPECT TO CHASSIS GROUND. RECEIVER CONTROLS SET FOR NORMAL OPERATION. MEASUREMENTS MAY DEVIATE ± 10% AT 120V AC LINE VOLTAGE.
2. WHERE ON-SIGNAL AND OFF-SIGNAL MEASUREMENTS VARY TWO VOLTAGES ARE SHOWN. ON-SIGNAL VOLTAGE APPEARS IN *ITALICS* OVER OFF-SIGNAL VOLTAGE.
ON-SIGNAL VOLTAGES & WAVE SHAPES TAKEN WITH A NOISE FREE SIGNAL PRODUCING -2.5 TO -3.5 VOLTS AGC AT VHF TUNER.
OFF-SIGNAL VOLTAGES TAKEN WITH ANTENNA DISCONNECTED & ANTENNA TERMINALS SHORTED TOGETHER ON UNUSED CHANNEL.
ALL OTHER CONTROLS ARE ADJUSTED FOR NORMAL OPERATION.

PHILCO-FORD

TV Model Q1054

ELECTRONIC TECHNICIAN TEKFAX

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

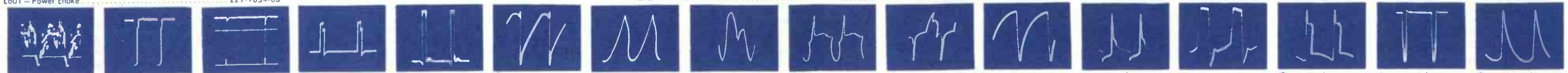
OCTOBER • 1967

SYMBOL — DESCRIPTION	PHILCO SERVICE PART NO.
C601 — 2000µf/15v filters	320-0279
C609 — 1500pf/1.4Kv	
Fuses	
F1 — .5a	45-2656-51
F2 — 2a	45-2656-65
J301 — Earphone	328-0300
L1 — 43.5MHz trap assy	229-1054-2
L2 — Balun coil	229-1054-3
L201 — 47.25MHz trap	229-1054-28
L202 — 41.25MHz trap	229-1054-29
L203 — 39.75MHz trap	229-1054-30
L204 — Video det choke	229-1054-31
L206 — Video det	322-0407
L207 — 4.5MHz trap	229-1054-32
L208 — 220mh peaking	229-1054-33
L401 — Horiz stab	322-0412
L402 — Yoke defl	328-0301
L501 — Vert defl choke	322-0418
L601 — Power choke	229-1054-83
L602 — Filter coil	229-1054-79
L603 — Filter coil	229-1054-79
R226 — Control, contr. & bright	229-1054-78
R234 — Control AGC	323-0164
R318 — 5K control volume	323-0171
R406 — Control horiz. hold (Part of R502)	323-0173
R407 — 82K control horiz. freq.	323-0169
R426 — 100K control, bright	229-1054-9
R502 — Control vert. hold (Part of R406)	323-1073
R506 — 100Ω, control vert. lin.	323-0169
R507 — Control vert. size	323-0170
R513 — Control vert. bias	323-0167
Switches	
S601 — Power on/off	422-0053
S602 — Power on/off	Part of S601
S603 — Operate/charge	229-1054-76
xformers	
T1 — Ant. Matching Coil	229-1054-60
T201 — Input VIF	229-1054-24
T202 — 1st VIF	229-1054-25
T203 — 2nd VIF	229-1054-25
T204 — 3rd VIF	229-1054-26
T301 — Sound IF	322-0401
T302 — Ratio Detector	322-0402
T303 — Audio Input	229-1054-27
T401 — Horiz. Osc.	322-0413
T402 — Horiz. Drive	322-0414
T403 — Horiz. Linearity	322-0413
T404 — Horiz. output	229-1054-1
T501 — Vert. Osc.	322-0415
T601 — Power	229-1054-84
THERMISTORS	
TH501 — D33a vert. osc.	323-0163
TH502 — D22a vert. out. base	323-0127
VARISTORS	
VR401 — YV3 horiz osc. base	323-0166
IF & AF Perma-ckt. panel w/comp.	229-1054-22
IDK29 HV rect.	29-0001
Tuner UHF	328-0299
Tuner VHF	328-0298

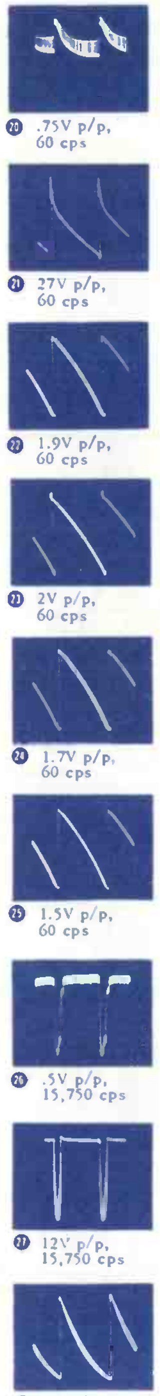
1 .55V p/p, 15,750 cps · 2 .55V p/p, 60 cps · 3 22V p/p, 15,750 cps

OSCILLOSCOPE WAVEFORM PATTERNS

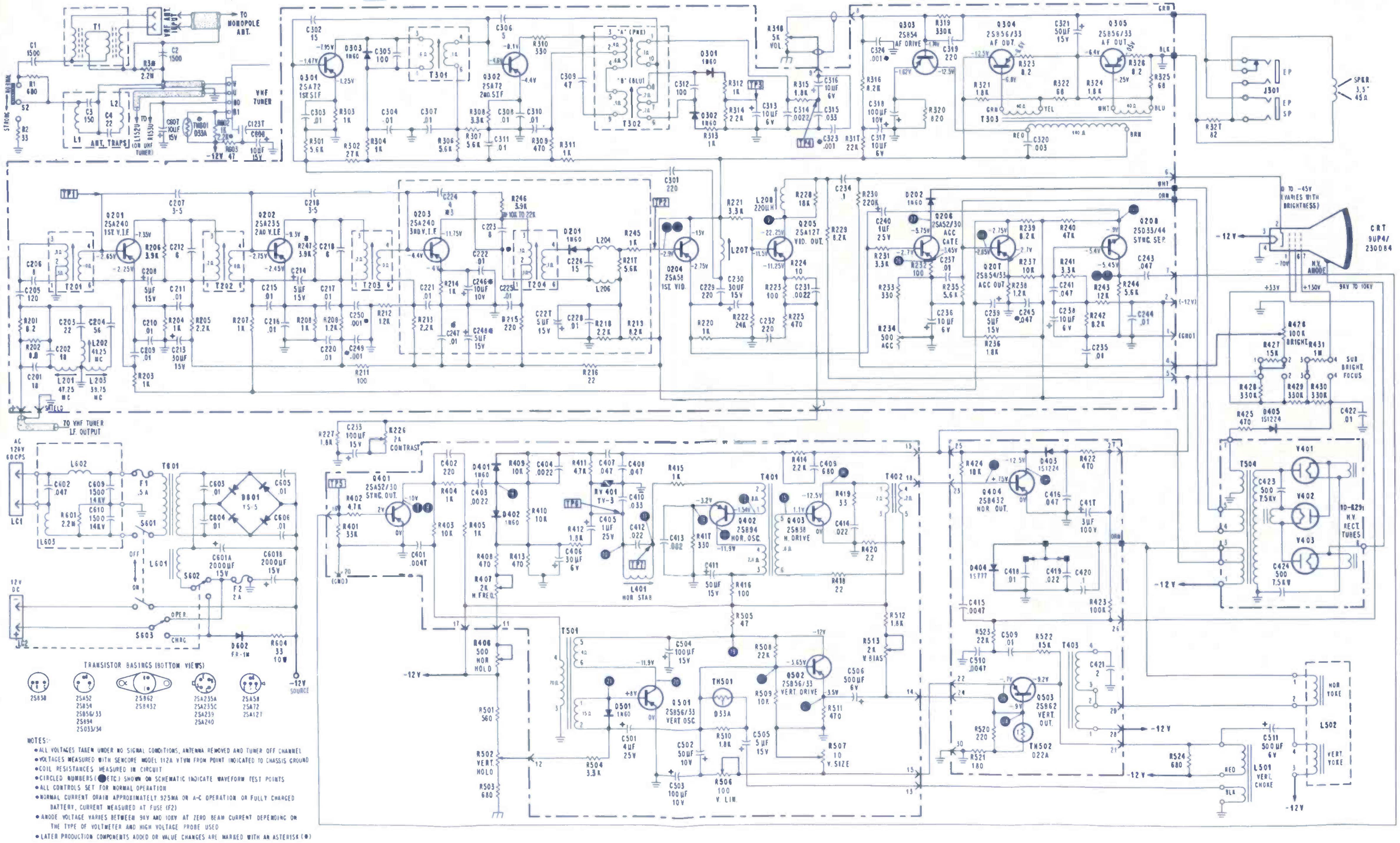
These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of .55 volts at the video detector. Voltage readings taken with the raster just filling screen and all controls set for normal picture viewing. The voltages given are approximate peak-to-peak values. The frequencies shown are those of the waveforms—not the sweep rate of the oscilloscope. All readings were taken with a Model PS-127 Sencore Oscilloscope.



4 .5V p/p, 15,750 cps · 5 5.5V p/p, 15,750 cps · 6 5.5V p/p, 60 cps · 7 11V p/p, 60 cps · 8 11V p/p, 15,750 cps · 9 5V p/p, 15,750 cps · 10 .6V p/p, 15,750 cps · 11 2.3V p/p, 15,750 cps · 12 10V p/p, 15,750 cps · 13 27V p/p, 15,750 cps · 14 5.5V p/p, 15,750 cps · 15 7V p/p, 15,750 cps · 16 35V p/p, 15,750 cps · 17 8V p/p, 15,750 cps · 18 85V p/p, 15,750 cps · 19 1.3V p/p, 60 cps



20 .75V p/p, 60 cps · 21 27V p/p, 60 cps · 22 1.9V p/p, 60 cps · 23 2V p/p, 60 cps · 24 1.7V p/p, 60 cps · 25 1.5V p/p, 60 cps · 26 .5V p/p, 15,750 cps · 27 12V p/p, 15,750 cps · 28 1V p/p, 15,750 cps



1114

SILVERTONE

Color TV Chassis
528.72280,81,82

ELECTRONIC TECHNICIAN **TEKFAX**

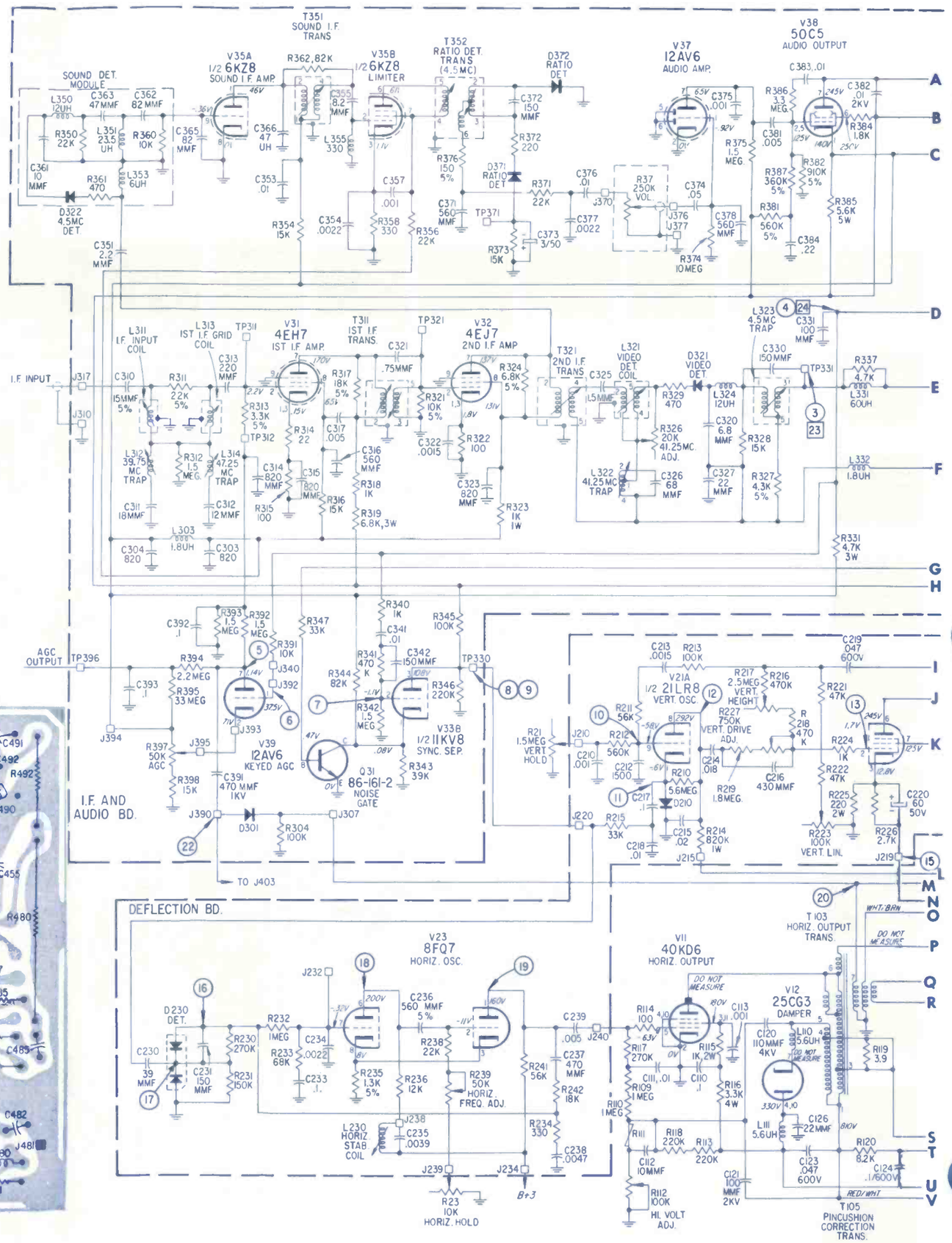
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

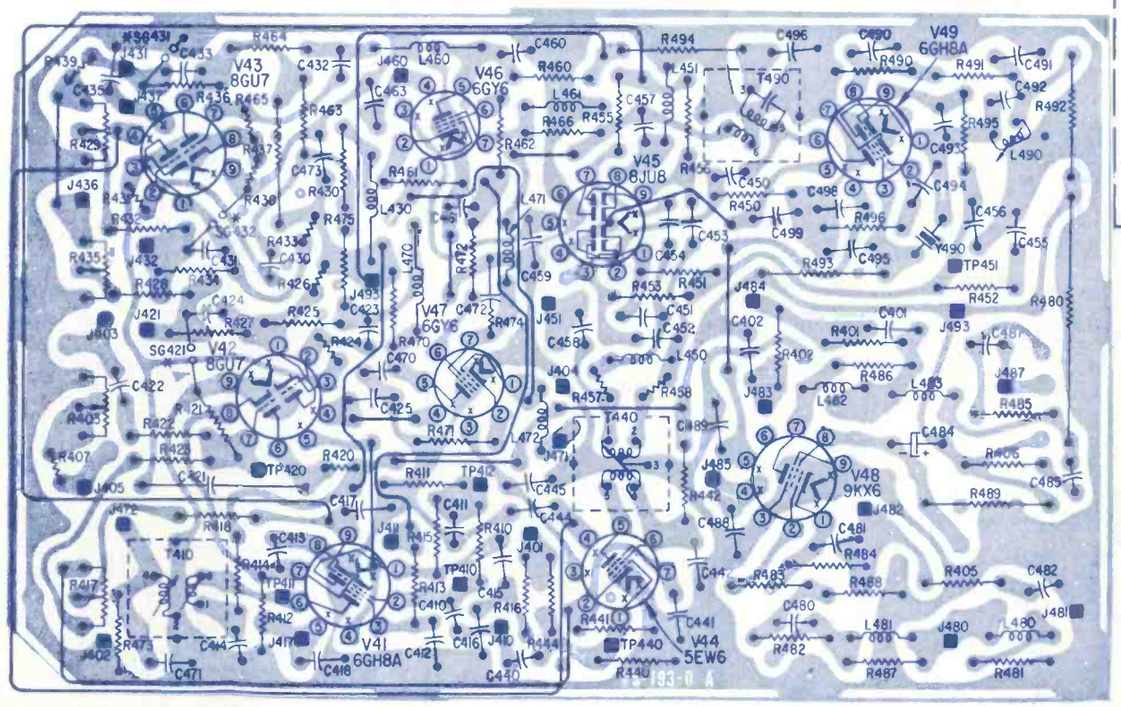
OCTOBER • 1967

SYMBOL	DESCRIPTION	SILVERTONE NO.
C101	Elec 200/175v	18-64-2
C102A,B,C	Elec 25µf 350v (A) 400 uf 350v (B) 80µf 350v (C)	18-105-3
C103A,B,C	Elect 300µf 200v (A) 250µf 350v (B) 100µf 350v (C)	18-106-3
C120	Disc 110pf 4 v N1500	20-653-0
R4	Thermistor	61-94-1
CR14	Control Chromix 1M	24-799
CR21	Control Bright 1M	24-930
CR23	Control Horiz Hold 10K	24-893
CR37	Control on/off Volume 250K	24-966
CR45	Control Tint 1.8K	24-988
CR47	Control Color 500Ω	24-958
CR48	Control Contrast 150Ω	24-983
CR49	Control Vert Hold 1.5Ω	24-1033
R100	4.5Ω 10w WW	61-191-0
R101	2.2Ω 10w	61-323-0
R102	70Ω 5w Dep Oxide	68-70051
R108	Thermistor (120Ω cold)	61-78-1
R111	Varistor	61-87-1
CR112	Control, High Voltage (Adjust)	24-951
CR121	Control Pincushion Corrector 10KΩ	24-821
CR131	Control Focus 15M	24-830
CR134	Control w.w. Vert Cent 10Ω	24-547
CR160	Control Red Screen 2M	24-957
CR161	Control Green Screen 3M	24-956
CR162	Control Blue Screen 2M	24-957
R200	Varistor	61-91-1
R201	300Ω 10w W.W. 5% (Chassis 72281, 72282 only)	61-299-0
CR217	Control 2.5Ω (Vert Height)	24-832
CR223	Control 100K (Vert. Lin.)	24-897
CR227	Control 750K (Drive Adj.)	24-902
R228	Varistor	61-95-1
CR239	Control 50K +30% (Horiz. Freq)	24-926
R303	13.5Ω 4w W.W.	61-270-0
R319	6.8Ω 3w Dep Oxide	68-68231
CR326	Control 20K 41.25MHz Trap)	24-987
R385	5.6K 5w W.W.	61-299-0
CR397	Control 50K (AGC)	24-833
CR403	Control Brite Limit 2.5M	24-976
CR417	Control 1M (Color Killer)	24-981
CR435	Drive Control (Blue)	24-976
R451, R453	1M (matched pair)	63-10501
R455, R456	1M (matched pair)	63-10501
R480	3.9K 7w Dep Oxide	68-39271
R510	60Ω 3w W.W.	24-880
T101	xformer (Audio Output)	80-246-1
T102	xformer (Vert Output)	80-42-2
T103	xformer (Horiz Output)	80-76-3
T104	xformer (Filament)	80-19-5
T105	xformer (Pincushion)	80-15-7
T311	Coil 1st I.F.	10-72-3
T321	Coil 2nd I.F.	10-73-3
T331	Coil, Chroma Take Off	10-109-3
T351	Coil, Sound I.F.	10-66-3
T352	Coil Ratio Detector	10-328-1
T410	xformer Chroma Drive	10-268-1
T440	Coil Burst Phase	10-250-1
T490	Coil 3.58 Oscillator xformer	10-258-1
T501	Coil Blue Horizontal	10-101-5
L14	Yoke Deflection	80-67-4
L101	Choke Filter	80-51-6
L102,L103	Choke, Line Radiation	10-149-1
L116,L117	Coil degaussing (Top)	10-98-5
L120	Coil Pincushion	10-125-5
L140	Coil Peaking 100µh	10-337-1
L230	Coil Horiz Stabilizer	10-34-5
L315	Choke, Filament	10-156-1
L322	Coil 41.25MHz Trap	10-101-3
L323	Coil 4.5MHz Trap	10-68-3
L324	Coil Tweet 12µh	10-65-1
L331	Coil Peaking 60µh	10-341-1
L351	Coil Peaking 23.5µh	10-333-1
L430,L460,L470	Coil Peaking 620µh	10-339-1
L472	Coil Peaking 5.6µh	10-272-1
L483	Coil Peaking 560µh	10-316-1
L501	Coil Horiz Convergence	10-126-5
L502	Coil Vert Convergence	10-102-5
D321,D322	Diode Germanium (Detector)	86-10-1
D371,D372	Diode Germanium (Ratio Detector)	86-15-1
Y490	Crystal	33-8-3
Q31	Noise Gate	86-161-2
CB101	Circuit Breaker (3.5a)	43-33-2
TD331	Delay Line	23-22-2

NOTES:

1. RESISTANCE IS SHOWN IN OHMS K=1000, MEG=1,000,000
2. ALL RESISTORS ARE 1/2 WATT, UNLESS OTHERWISE NOTED
3. CAPACITANCE VALUES ARE MFD, UNLESS OTHERWISE NOTED
4. VOLTAGES READ WITH "VTVM" FROM POINT INDICATED TO CHASSIS GROUND, NO SIGNAL INPUT. ANTENNA SHORTED TOGETHER BUT NOT TO GROUND, LINE VOLTAGE 120 V.A.C.
5. CHROMA VOLTAGES WERE TAKEN WITH AIR SIGNAL.
6. * THESE VOLTAGES MEASURED DURING COLOR RECEPTION.
7. † READING WILL VARY DEPENDING ON KILLER CONTROL SETTING.
8. NUMBERS WITHIN CIRCLES, SQUARES & HALF MOON REFER TO WAVEFORM NUMBERS.





NOTES:

1. WIRING DIAGRAM SHOWN FROM CIRCUIT SIDE OF BOARD.
2. SOLID LINES INDICATE WIRE JUMPERS.
3. (*) COMPONENTS MARKED WITH ASTERISK ARE LOCATED ON CIRCUIT SIDE OF BOARD.

SILVERTONE

Color TV Chassis 528.72280,81,82

T101 AUDIO OUTPUT TRANS.

V41A 1/2 6GH8A CHROMA BAND PASS AMP

T410 CHROMA DRIVE TRANS.

R47 500 COLOR CONTROL

V42A 1/2 8GU7 BLANKER

V42B 1/2 8GU7 (B-Y) AMP

V43A 1/2 8GU7 (G-Y) AMP

V43B 1/2 8GU7 (R-Y) AMP

V47 6GY6 "Z" DEMOD.

V46 6GY6 "X" DEMOD.

T331 CHROMA TAKE-OFF TRANS

V33A 1/2 11KV8 1ST VIDEO AMP.

T440 BURST TRANS.

V44 5EW6 BURST AMP.

V41B 1/2 6GH8A KILLER

V45A 1/2 8JU8 PHASE DET.

V45B 1/2 8JU8 KILLER DET.

TD331 DELAY LINE

V48 9KX6 2ND VIDEO AMP.

V49A 1/2 6GH8A REACTANCE

V49B 1/2 6GH8A 3.58 OSC.

T490 3.58 OSC. TRANS.

Y490 3.58 XTAL

L490 REACTANCE COIL

T102 VERT. OUTPUT TRANS.

V21B 1/2 21LR8 VERT. OUTPUT

V13 3A3 H. VOLT. RECT.

L120 PINCUSHION CORRECTOR PHASE COIL

L14 DEFLECTION YOKE

L503 BLU SHAPING COIL

T501 RIGHT HORIZ BLU

V14 PICTURE TUBE 19EXP22

T104 PICTURE TUBE FIL TRANS

L101 FILTER CHOKE

SW101 OFF-ON SWITCH ON VOL.

CB101 CIRCUIT BREAKER

POLARIZED A.C. INTERLOCK

120V A.C. 60 CYCLES 290 WATTS POLARIZED PLUG

CHROMA BD.

CONVERG. BD.

DEFLECTION BD.

VHF TUNER

IF AND AUDIO BD.

CHASSIS BRACKET

1115

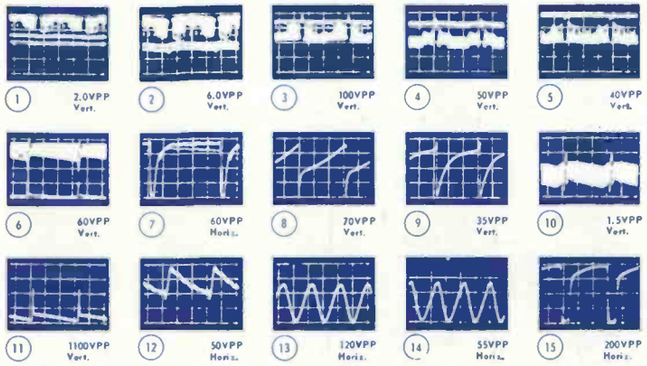
SYLVANIA

Color TV
Chassis D07-1,-2

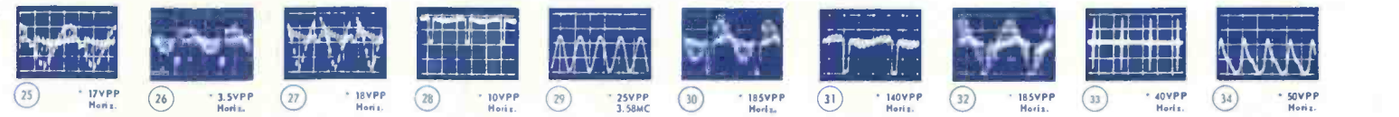
ELECTRONIC TECHNICIAN **TEKFAX**

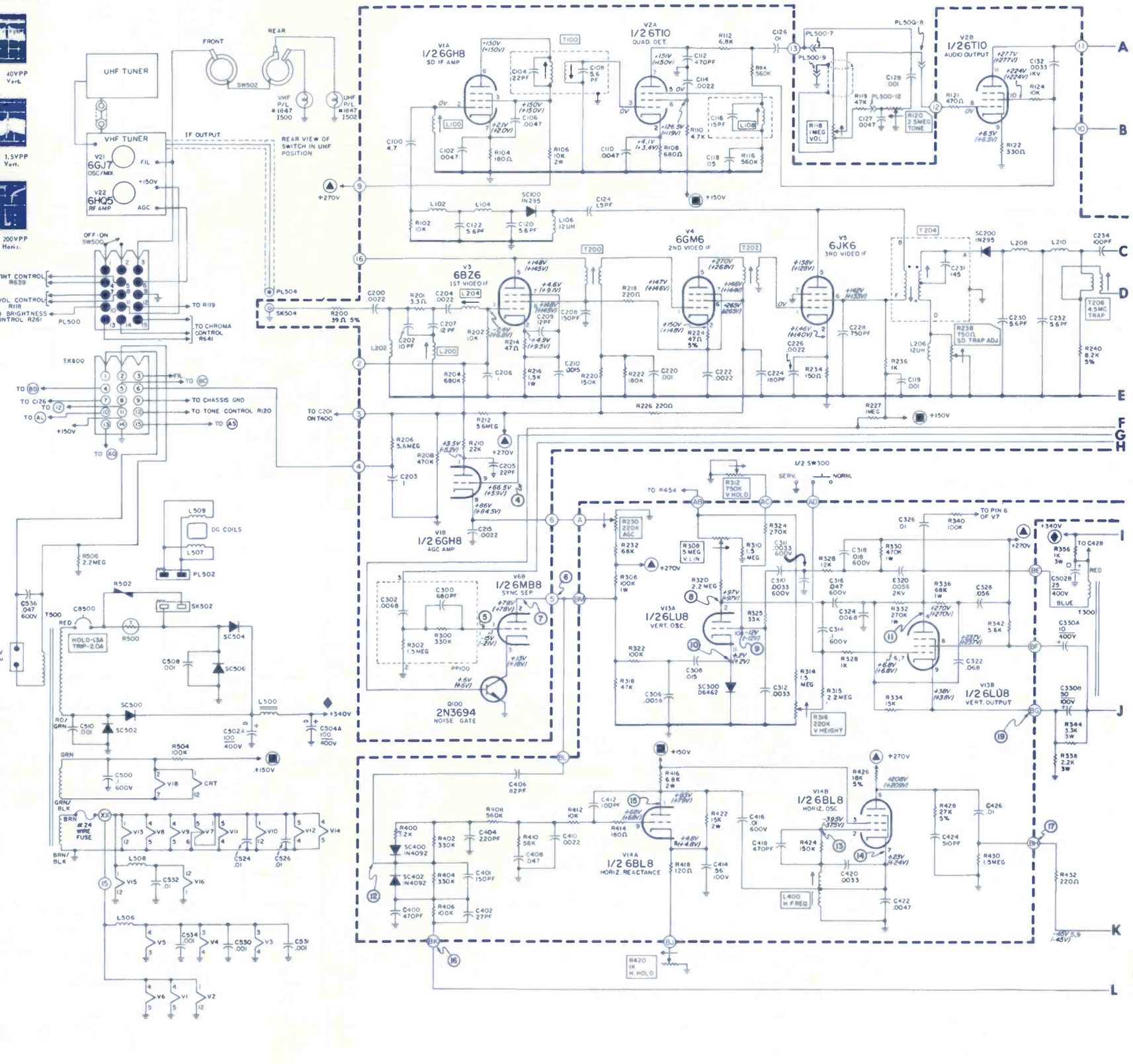
OCTOBER • 1967

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR

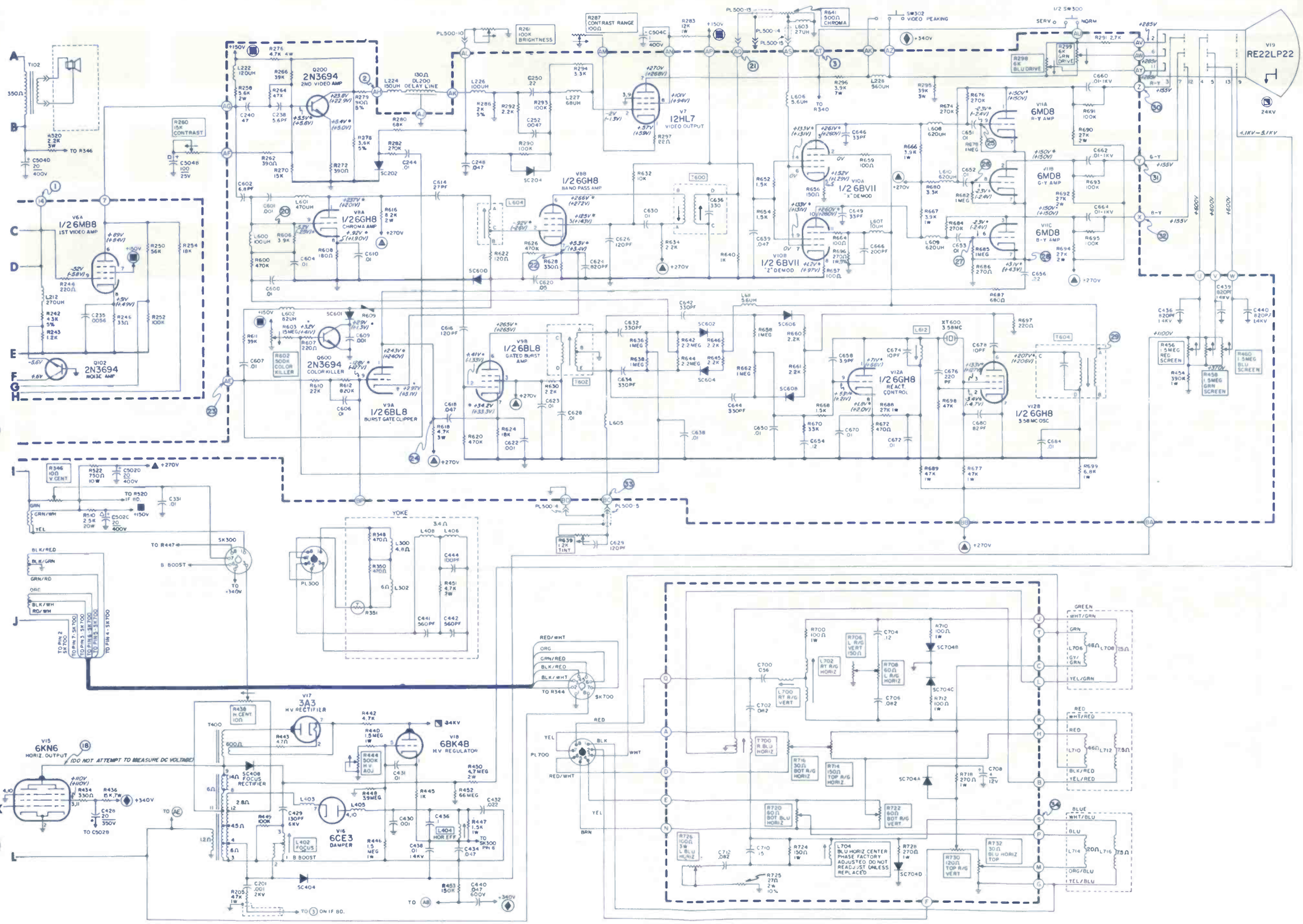


SYMBOL	DESCRIPTION	SYLVANIA PART NO.
C320	.0056 2kv	45-15907-4
C330	2 Section Electrolytic	41-23484-1
	A — 10/400v	
	B — 50/100v	
C428	20/350v-Electrolytic	41-96355-5
C429	130pf 6kv	43-84222-17
C502	4 Section Electrolytic	41-2348-1
	A — 100/400v	
	B — 25/400v	
	C — 20/400v	
	D — 20/400v	
C504	4 Section Elec.	41-23480-1
	A — 100/200v	
	B — 100/25v	
	C — 1/400v	
	D — 20/400v	
R500	Thermistor	38-17071-1
R502	VDR (Voltage Dependent Resistor)	38-17072-1
R609	VDR (Voltage Dependent Resistor)	38-15257-11
R118	1M Volume/On/Off (-1 CH only)	37-15536-5
R118	1M-Volume/On/Off (-2 CH only)	37-15536-6
R120	1.5M Tone (-1 CH only)	37-23479-4
R230	220K AGC	37-11632-7
R238	750Ω Sound Trap Adjust	37-17321-1
R260	15K Contrast	37-23479-3
R261	100K Bright	37-23479-6
R298	6K Blue Drive	37-11632-9
R299	6K Green Drive	Part of R298
R308	5M Vert. Lin	Part of R230
R312	750K Vert Hold	37-23479-2
R316	220K Vert Height	Part of B230
R346	10Ω Vert Centering	37-16021-7
R420	1K Horiz Hold	37-23479-1
R438	10Ω Horiz Centering	37-17539-1
R444	500K H.V. Adjust	37-16020-27
R456	1.5M Red Screen	37-11632-9
R458	1.5M Green Screen	Part of R456
R460	1.5M Blue Screen	Part of R456
R602	500K Color Killer	Part of R298
R639	1.2K Tint	37-23479-7
R641	500Ω Chroma	37-23479-5
R706	150Ω Left/R/G Vert.	37-16021-7
R708	60Ω Left/R/G Horiz.	37-16021-2
R714	150Ω Top/R/G Horiz.	37-16021-7
R716	30Ω Bottom/R/G Horiz.	37-16021-5
R720	60Ω Bottom/B Horiz.	37-16021-2
R722	60Ω Bottom/R/G Vert.	37-16021-2
L100	Sound Take Off	50-23213-1
L108	Quadrature	50-23213-2
L200	IF Trap	57-11637-1
L204	IF Input	57-23094-1
L400	Horiz Oscillator	50-23508-1
L405	RF Choke	50-92043-1
L500	Choke	56-17568-3
L604	Chroma Take Off	50-16184-4
L612	Reactance	50-16185-3
L700	Horiz. Convergence	50-16248-5
L702	Horiz. Convergence	50-16248-6
L704	Convergence	50-17850-1
T100	Sound Interstage	57-11606-1
T102	Audio Output	56-16018-6
T200	1st IF Interstage	57-23095-1
T202	2nd IF Interstage	57-15906-7
T204	IF Output	57-17517-1
T300	Vertical Output	56-17559-3
T400	High Voltage	50-23506-1
T500	Power xformer	55-23504-1
T600	Band Pass	50-16190-2
T604	3.58MHz Output	50-16192-3
T700	r/Blue Horiz. Convergence	50-16248-9
CB500	Circuit Breaker	29-23493-1
DL200	Delay Line	32-23216-1
PP1100	Plate Sync Take Off	32-23041-1
Q100	Transistor Noise Gate	13-23916-1
Q102	Transistor Noise Amp	13-23916-1
Q200	Transistor 2nd Video Amp	13-15840-1
Q600	Transistor Color Killer	13-15840-1
SC100	Diode	IN295
SC200	Diode Video Det.	IN295
SC500,SC502	Diode Silicon Rectifier	13-17174-1
XT600	Crystal 3.58MHz	26-16162-1
	Yoke Convergence	51-17083-3
	Yoke Deflection	51-23503-1





SYLVANIA
Color TV Chassis D07-1,-2



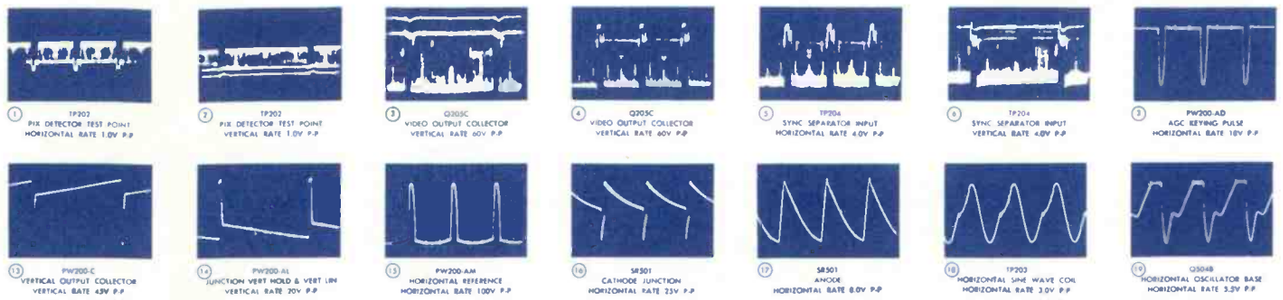
1116

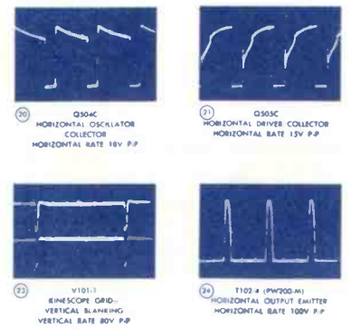
RCA VICTOR
TV Chassis
KCS157 Series

ELECTRONIC TECHNICIAN **TEKFAX**

OCTOBER • 1967

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





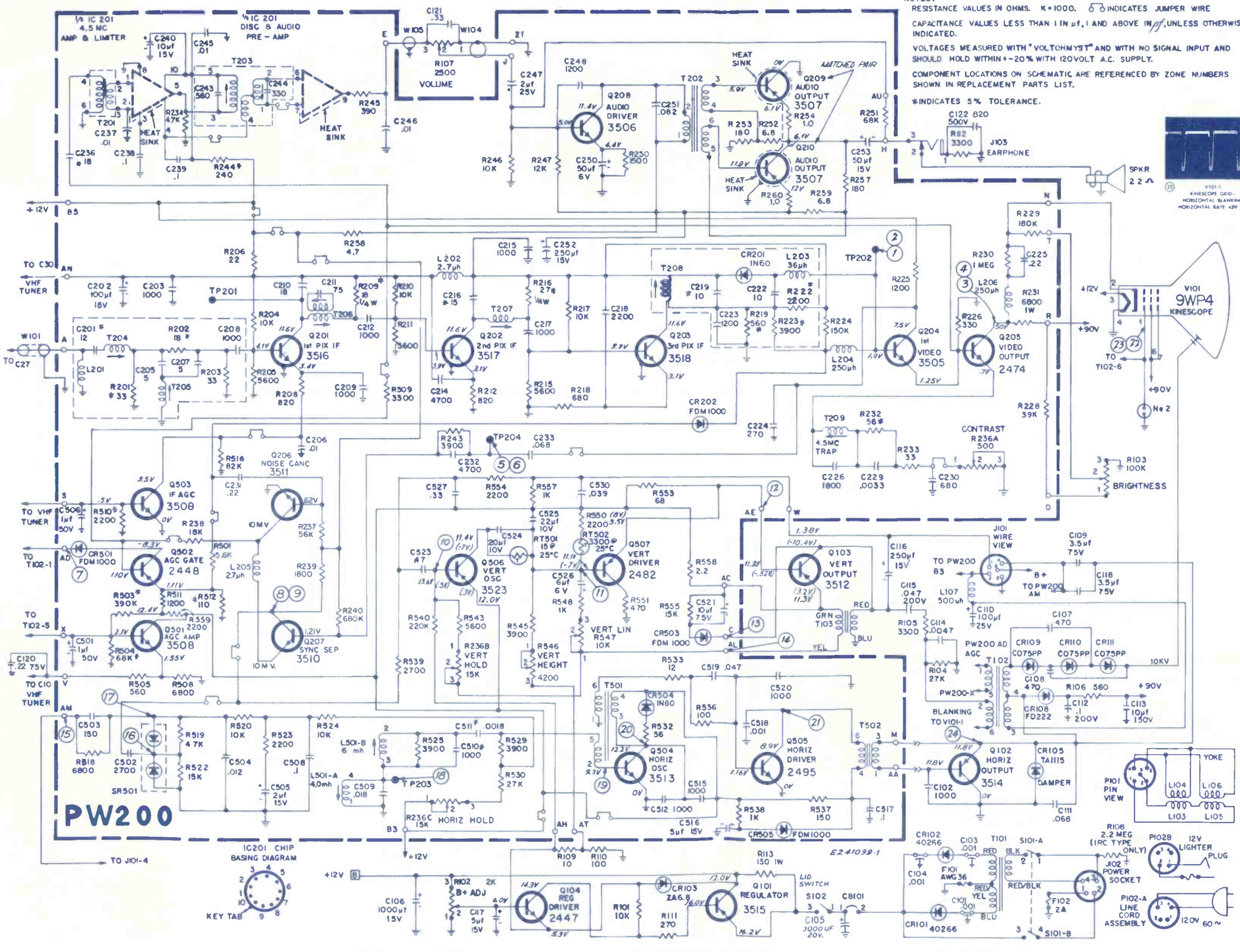
NOTES:
RESISTANCE VALUES IN OHMS. K = 1000. ⏀ INDICATES JUMPER WIRE

CAPACITANCE VALUES LESS THAN 1 IN μf, 1 AND ABOVE IN μμf, UNLESS OTHERWISE INDICATED.

VOLTAGES MEASURED WITH "VOLTOHMYST" AND WITH NO SIGNAL INPUT AND SHOULD HOLD WITHIN +-20% WITH 120 VOLT A.C. SUPPLY.

COMPONENT LOCATIONS ON SCHEMATIC ARE REFERENCED BY ZONE NUMBERS SHOWN IN REPLACEMENT PARTS LIST.

*INDICATES 5% TOLERANCE.



SYMBOL	DESCRIPTION	RCA CHASSIS NO.
C105	3,000μf 20v elec	119357
C106	1,000μf 15v elec	119360
C107	470pf ±20% 6kv ceramic	119353
C110	100μf 25v elec	108020
C116	250μf 15v elec	119359
C226	1800pf +5% 125v film	119349
C8101	Breaker-Circuit .95amp	119736
CR103	Diode — zener 400mw ZA6.8	119720
CR202	Diode — silicon FDM 1000	119597
F102	Fuse — glass 2a	102182
L107	Coil — choke 500μh	116058
L201	Coil — IF input	119743
L202	Reactor — 2.4μh	107463
L203	Coil — 36μh	116056
L204	Coil — peaking 250μh	119742
L205	Coil — peaking 2.7μh	109248
L206	Coil — peaking 250μh	119742
L501	Coil — 4.6mh/6mh	119745
Q101	regulator 3515	119721
Q102	horizontal output 3514	119722
Q103	vertical output 3512	119723
Q104	regulator driver 2447	116077
Q201	1st pix 3516	119823
Q202	2nd pix 3517	119824
Q203	3rd pix 3518	119825
Q204	1st video 3505	118713
Q205	video output 2474	116081
Q206	noise cancellation 3511	119725
Q207	sync separator 3510	119724
Q208	audio driver 3506	119726
Q209	audio output 3507 (Q209 & Q210 matched pair)	119727
Q210	audio output 3507 (209 & 210 matched pair)	
Q501	AGC amp 3508	119728
Q502	AGC gate 2448	116078
Q503	IF AGC 3508	119728
Q504	horiz oscillator 3513	119822
Q505	horiz driver 2495	116087
Q506	vertical oscillator 3523	119730
Q507	vertical driver 2482	116084
CR102	control B+ adjust	119365
CR103	control bright	119363
CR107	control volume — on-off (includes S101)	119364
A	(contrast	
CR236B	control (vertical hold	119362
C	(horiz. hold	
R510	2.2K ±5%	502222
R511	1.2K ±5%	502212
R512	1105Ω ±5%	502111
R516	82K	502382
CR546	control vert height	120917
Cr547	control vert linearity	119366
RT501	Thermistor — 15 @25 c	119737
RT502	Thermistor — 3300 @25 c	119738
	TRANSFORMERS:	
T101	power	119733
T102	high voltage	119734
T103	vertical output	119735
T201	4.5MHz input	119618
T203	ratio detector	119634
T204	IF input	119746
T205	IF input	119747
T206	1st pix IF	119750
T207	2nd pix IF	119748
T208	3rd pix IF	119749
T209	4.5MHz trap	119748
T501	horiz oscillator	119731
T502	horiz driver	119732
	Yoke — deflection	119060

$9.75

EFFECTIVE 8/1/67

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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.

Prefer a replacement? Sarkes Tarzian universal replacements are only $10.45, customized replacements $18.25. Shipped same day order received. Order custom tuners by TV make, chassis, and model number. Order universal replacement by part number:

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

Genuine Sarkes Tarzian universal replacement tuners with Memory Fine Tuning—UHF Plug In for 82-channel sets—Pre-set fine tuning—13-position detent—HI gain—Lo noise—Universal mounting

FOR FASTEST SERVICE, SEND FAULTY TUNER WITH TV MAKE, CHASSIS, AND MODEL NUMBER, TO TUNER SERVICE CENTER NEAREST YOU

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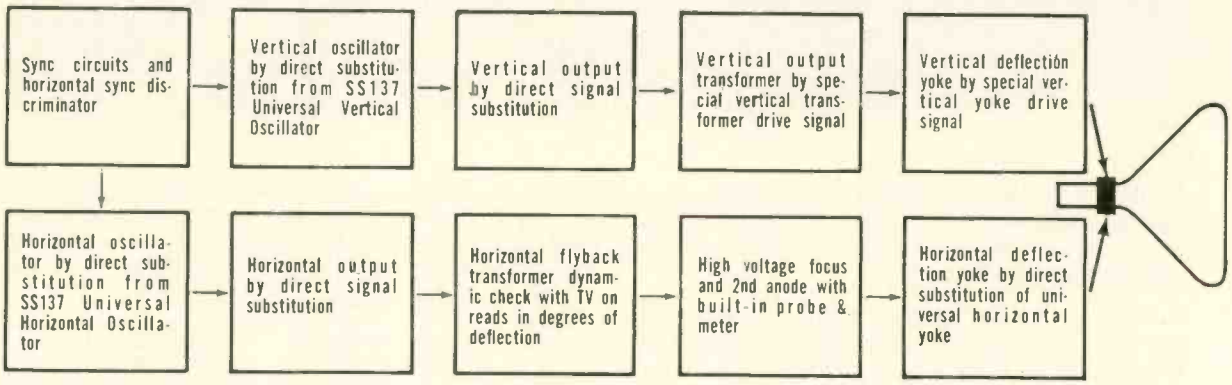
EAST .....547-49 TONNELE AVE., Jersey City, New Jersey .....TEL: 201-792-3730
SOUTH-EAST ..938 GORDON ST., S. W., Atlanta, Georgia .....TEL: 404-758-2232
WEST .....SARKES TARZIAN, Inc. *TUNER SERVICE DIVISION*
10654 MAGNOLIA BLVD., North Hollywood, California....TEL: 213-769-2720

ISOLATE ANY SWEEP PROBLEM IN SECONDS COLOR OR B/W

NEW!

ALL NEW SENCORE SS137 SWEEP CIRCUIT ANALYZER

Sweep circuit defects cause the toughest dogs, especially with color. Simplify them in seconds with the All New Sencore Sweep Circuit Analyzer. The only **complete** Sweep Circuit Analyzer available. The SS137 trouble shoots each and every stage in both the vertical and horizontal sweep sections of the receiver, by either signal injection or direct substitution of the entire stage. Using tried and proven methods, the Sencore SS137 takes the sweat out of sweep circuit trouble shooting. All tests are with the set on, dynamically in the circuit . . . to insure the most reliable and accurate check on each component.



In addition, a built-in VTVM and milliampere meter to back you up when setting regulator currents and measuring current through the horizontal output stage. Measures AC peak to peak and DC voltages up to 1000 volts. There is even a clip-on high voltage probe and a meter circuit for measuring and monitoring the second anode up to 30,000 volts in two ranges at the flick of a switch. An absolute MUST for color.

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ELECTRONIC TECHNICIAN

WORLDS LARGEST ELECTRONIC TRADE CIRCULATION

OCTOBER 1967 • VOL. 86, NO. 4

COVER:
As solid-state technology continues to shrink electronic circuitry, our photographers develop new techniques for enlarging it. Our cover shows a 1½ inch section of the chroma panel "S" used in Motorola's transistorized color receiver. The small section from the panel is enlarged approximately five times.

TEKFAX • 16 PAGES OF THE LATEST SCHEMATICS • **Group 182**

AIRLINE: TV Model GEN-11768A
MAGNAVOX: TV Chassis T925 Series
PHILCO: TV Model Q1054
RCA VICTOR: TV Chassis KCS157 Series
SILVERTONE: Color TV Chassis 528.72280,81,82
SYLVANIA: Color TV Chassis DO7-1,-2

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LETTERS TO THE EDITOR

Replacing OZ4s

If anyone is interested, an OZ4 rectifier can be replaced with a top-hat silicon rectifier. I not only found the change to be more efficient but there was also a lot less noise. An OZ4 can produce a lot of hum or hash in a car radio if all leads are not shielded. The top-hat rectifier eliminates the need for some of this shielding.

WILLIAM E. PROCTOR
Berrysburg, Pa.

Color Problem

Perhaps this may help some other ET readers.

A Motorola Color set, WTS907, had a short raster (up about 8in. at the bottom) and none of the controls and no vertical tube replacements would help. Changed the silicon rectifier (X5) on the convergence board and solved the problem.

ROY RANDALL
Hobe Sound, Fla.

A New Subscriber

I am a new subscriber who understands the tremendous value of your magazine and began with a three-year subscription. I need a schematic and operators manual for an Anchor CRT tester/rejuvenator, model T401 and also operators manual for a Heathkit Visual-Aural Signal Tracer, model T3. Can any reader help me?

WALLACE F. PETERSON
Box 248
Thompson, Conn. 06277

A Helping Hand

I have noticed frequent letters from readers who are in need of service information on Hi Fi and stereo equipment of European manufacture. I will, as far as time permits, assist anyone who sends specific symptoms and as much other info as possible along with a stamped self-addressed envelope.

EARL K. KIRKPATRICK
Delta Electronics
2042 Ft. Benning Road
Columbus, Ga. 31903

•*Because ET is published only for professionals, it does not run a "clinic" or engage in the amateurish game of "remote troubleshooting" which is a very dangerous endeavor at best. Articles in ET adequately cover practical problems which its readers confront*

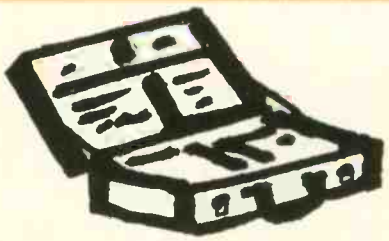
continued on page 24

SOME SHOP OWNERS DO MORE BUSINESS THAN OTHERS BY DOING BASIC THINGS LIKE THESE:

1 Reading what's new in leading technical magazines.

2 Keeping their trucks ready to roll at a moment's notice.

3 Arranging to have their phones answered promptly.



4 Making sure their caddies are organized and properly stocked.

5 Keeping accurate track of their time on each job.

6 Smiling . . . often . . . both on and off the job.

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The world's finest
radial-lead capacitor

DIFILM® BLACK BEAUTY®...
Ultimate in molded tubulars

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These two great Sprague capacitors are expressly made for men who are in the TV service business to do business . . . as it should be done. Both feature the ultimate in tubular capacitor construction to keep you out of call-back trouble:

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For complete listings, ask your Sprague distributor for Catalog C-617, or write to Sprague Products Company, 65 Marshall Street, North Adams, Massachusetts 01247.

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

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THE MARK OF RELIABILITY

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. . . for more details circle 144 on postcard

LETTERS TO THE EDITOR

continued from page 22

from day to day — even including much refresher material in electronic theory for both the professional and the apprentice. But many ET readers are sometimes confronted with the problem of finding information which the editors could not possibly locate if they worked 24 hours a day. In these cases, readers frequently volunteer to help other readers. Thanks, Earl. — Ed.

Tuning Indicator Tubes

Regarding Rudolf Natoli's need for a UM80, I have two on hand and he can have one. I am an ET subscriber and I like the good work of the whole staff. Keep it up on servicing.

BEN C. PROTASIO
Automotive Electrical Services
PO Box 1114
Agana, Guam 96910

Pleased

It was a pleasure to read your Editor's Memo in the June issue regarding the NEA resolution on the terms supplied to service technicians. We have been receiving favorable response to this resolution from many segments of the industry. I am sure that your editorial will do much to help the service industry upgrade itself by using proper terminology.

I would like to thank ELECTRONIC TECHNICIAN for publishing this resolution where it will be read by so many.

NEA has been accused of passing resolutions at the drop of a hat, but it is our way of taking a stand and making our feelings known on the various subjects that affect our industry.

I will see that you are put on our mailing list to receive copies of all the resolutions we adopt and if you think they have merit, you may want to pass them on through your fine magazine.

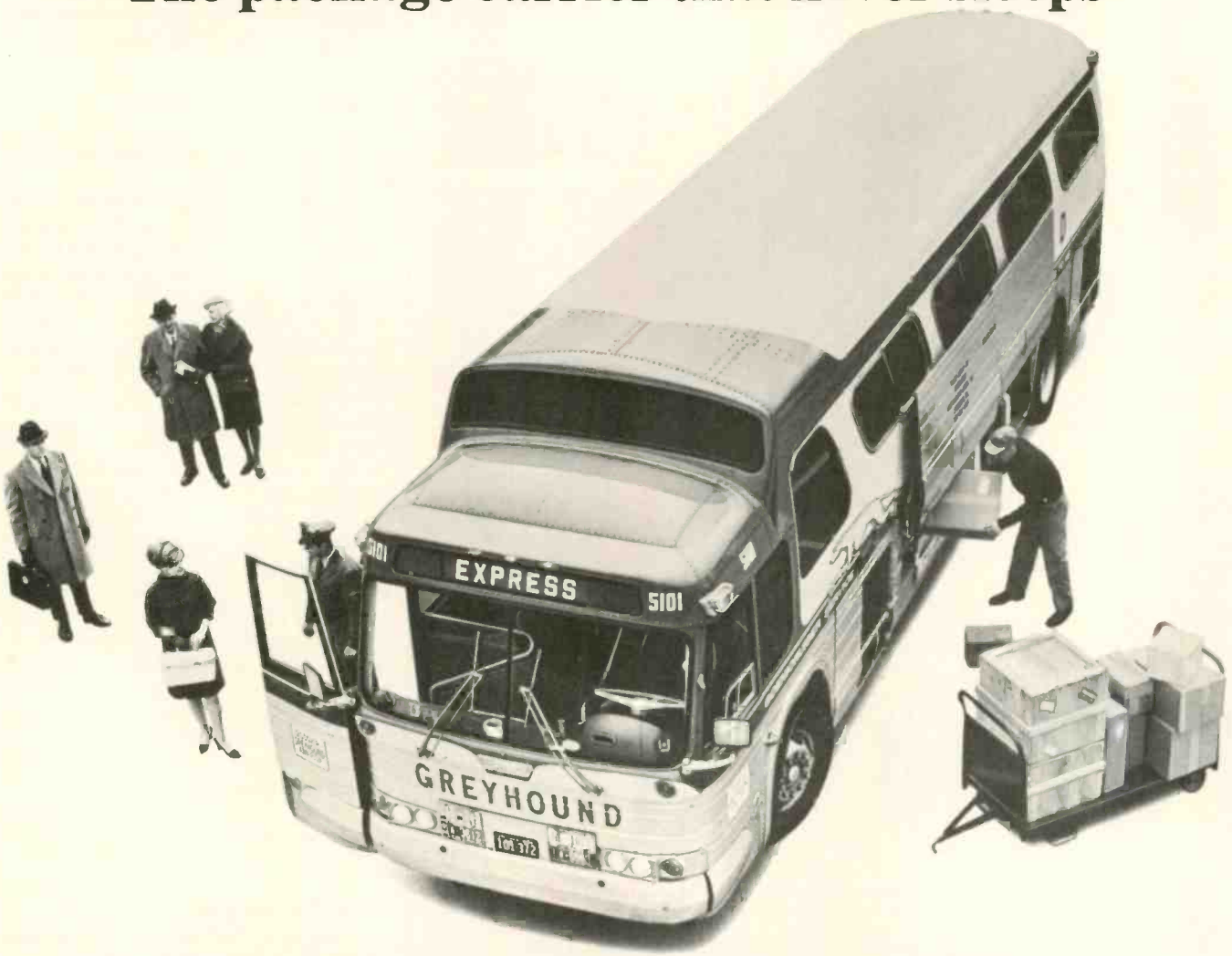
JOHN BETZ,
NEA President
211 West 18th
Waterloo, Iowa 50702

CRT Size Confusion

If we can correctly interpret news reports, then the sizes of CRTs have been determined by glassmakers to designate one pattern from another in their line of work. It appears the figures selected are quite adequate for

continued on page 26

The package carrier that never sleeps



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Los Angeles San Francisco	22	9 hrs. 15 min.	2.10	2.45	2.80
Pittsburgh Cleveland	12	2 hrs. 45 min.	2.00	2.25	2.65
Indianapolis Chicago	10	4 hrs.	2.10	2.45	2.85

*Other low rates up to 100 lbs. Lot shipments, too.

GPX
GREYHOUND PACKAGE EXPRESS

One of a series of messages depicting another growing service of The Greyhound Corporation.

. . . for more details circle 118 on postcard

LETTERS TO THE EDITOR

continued from page 24

both design and replacement practice of TV picture tubes.

No small amount of confusion and irritation has been caused to prospective buyers of TV receivers, due to the fact that while one group of receiver manufacturers refer to their CRT sizes in square-inch terms, another group favors a scaled-down diagonal face measurement mode. The latter conforms to practices recently made mandatory by an FTC ruling concerning a diagonal connotation.

For many years the lumber industry has referred to terms convenient to its use such as two-by-fours (2x4s); denoting inch measurements which have received consumer acceptance, but are not in fact the true sizes received by the consumer.

Since a discrepancy exists between actual sizes delivered and the sizes denoted, it would appear an injustice prevails. An over-sight on the part of receiver manufacturers could be a reason for not rebelling against the recent ruling by the FTC.

FLOYD N. STRONG
Chardon, Ohio

TEKFAX Available

Am out of the business. Will sell my TEKFAX which begin from June 1962.

JAMES H. FLICKINGN
PO Box 137
Holt, Calif. 95234

A Zipperoo

The Zip Code given for the Sprague Products Co. on Page 84 of your June issue is not correct. The correct Post Office Zip Code for North Adams is 01247. As you can note from this letterhead, the Zip Code at one time was 01248 but this has since been changed.

Incidentally, the label on which my checking copy comes and which carries the identification "Chert S 009 81081X" has the Zip Code for North Adams as 02147. Apparently someone transposed two digits in keypunching.

SIDNEY L. CHERTOK, Manager
Advertising and Sales Promotion
Sprague Products Co.
North Adams, Mass. 02147

•Note to all service-dealers: Correct this in your "Technician's Directory." — Ed.

Getting a hernia and not getting paid for it?

Switch to Elmenco dipped Mylar®-paper capacitors and you won't have to worry about call-backs, lost profits, broken reputations or broken anything else.

The only ordinary thing about them is their price.

You get capacitors that meet the requirements of high-reliability computer and missile systems. You get capacitors that hold their rating at 125°C continuous operation. Yet you get them at TV set prices.

Elmenco dipped Mylar-paper capacitors come in just about any value you need from .001 mfd to 1.0 mfd. And just about any TV rated voltage you need, too, from 100V through 1600V.

Ask your Authorized Arco Distributor to put them on your next order. Without fail.

Tell him you're counting on his support.

(While you're at it, ask about other Elmenco types: padders and trimmers; high voltage dipped micas.)

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EDITOR'S MEMO

Unalterable Change

To botch-up an old cliché, "nothing is more sure, more absolute, more unalterable than change itself." But change frequently has a tough time with natural human inertia. People have a natural affinity for soft-bottomed chairs.

ELECTRONIC TECHNICIAN has been fortunate in this respect, however. Although it does not believe in change just for the sake of change, it does believe in keeping up with the times. We don't sit on our "fannies" until progress demands a ton of TNT to move us. The magazine tolerates the status-quo only so long as it can produce results. Hence, many changes have been made over the years so the magazine could live up to its unequivocating purpose: "To provide the most up-to-date, practical technical and business information available for the service-dealers and technicians who work in the home-entertainment area of the electronics field."

And it has further been made clear that this coverage is concentrated in the sub-areas of color TV, radio, Hi Fi, two-way audio and radio communications and solid-state technology. Additional coverage is directed to service-dealers and technicians who have diversified into or who now specialize in certain electronic equipment used in business, industry, education and medical science. This additional coverage includes public address, video tape recording, medical electronic equipment, closed-circuit TV and other types of audio and audio-visual systems.

While the main editorial concentration in ET is technical — in the equipment installation and maintenance area — it also concentrates emphatically on the "how to" aspects of business management and merchandising.

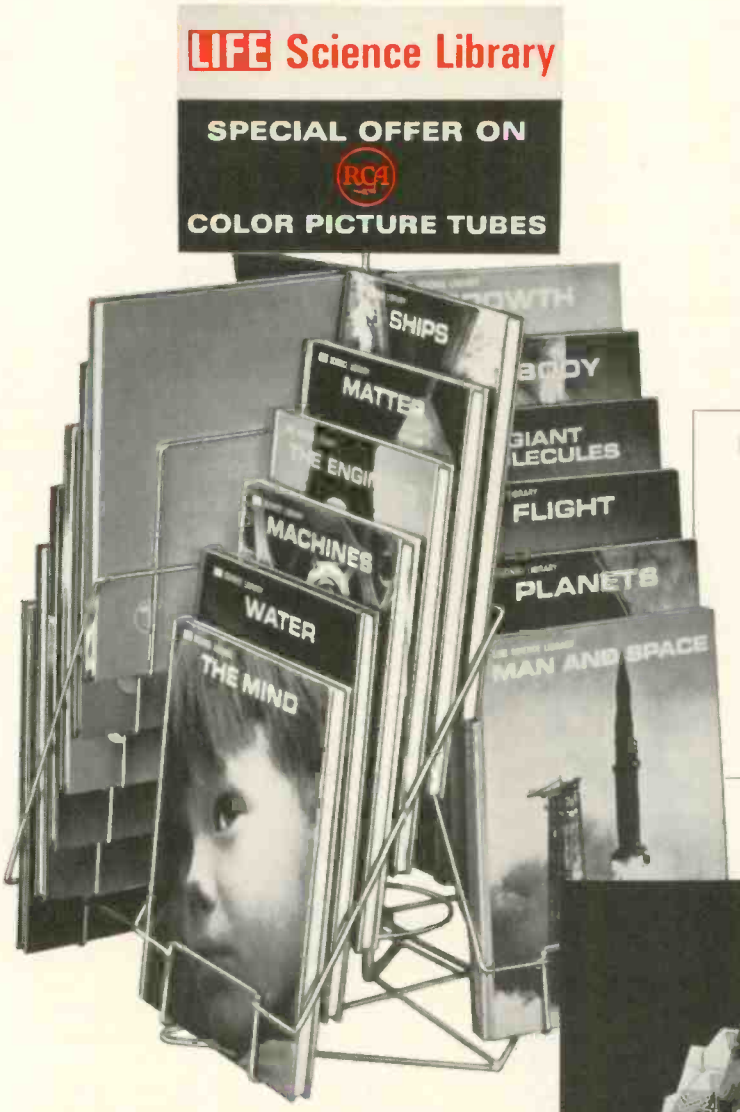
The latest change to be made in ET will become obvious in this issue. The DEALER FAX section which begins on page 60 will be expanded and made more useful in the months to come. And the plans which have already been projected for 1968 will include expanded coverage in the technical area which we believe will prove even more helpful to the service-dealers and technicians in this country.

Yes, we live in a changing world. Let's try to keep up with it and avoid the inevitable catastrophe which will result if we allow ourselves to be left behind.

Yours FREE with purchase of any RCA 21" color picture tube!*

In RCA's "VOLUMES OF VALUE" Program.

*Except test tubes.



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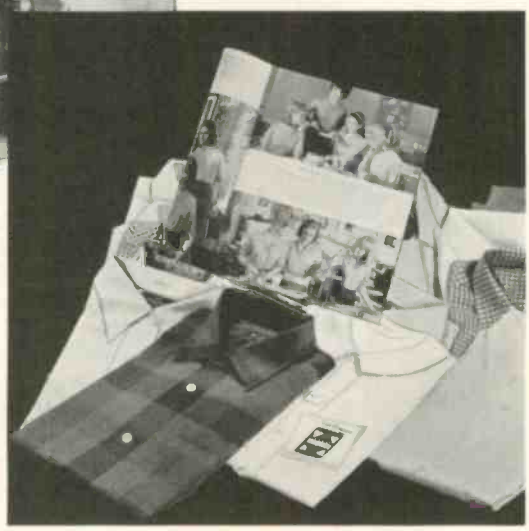

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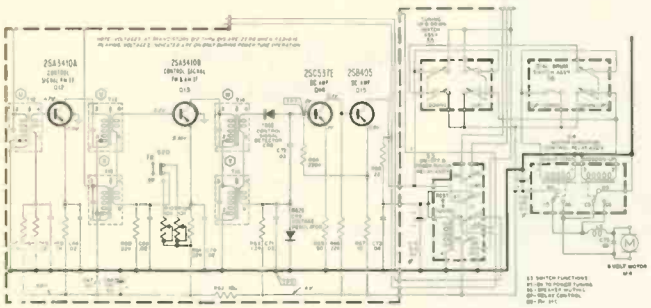
TECHNICAL DIGEST

ADMIRAL

Transistor Radio Model YK367 — Power Tuning Circuit Description

Push-button power tuning is a new feature for model YK367 AM/FM portable transistor radio. Just push the UP or DOWN button and the radio dial will rotate to the next operating station in the area. This feature operates on either the AM or FM band. A front-mounted LOCAL DISTANT switch provides increased sensitivity for selection of distant stations. Push buttons also control AM, FM, AFC and dial light. Knobs control volume, tone and manual tuning.

This radio can be viewed as a conventional AM/FM radio with a separate power-tuning section. Pushing the UP or DOWN button starts a dc motor with a planetary



transmission which drives the dial until stopped by the signal seeking circuit. A separate etched circuit picks up the AM or FM signal and amplifies it to drive a dc amplifier which opens a relay in the motor circuit, thus stopping power tuning right on station.

The radio can be viewed as a conventional AM/FM unit with an accessory power tuning or searching package. During normal operation B+ is disconnected completely from the power-tuning section.

The power-tuning section, itself, is divided into two basic sections; control and operate. The control section (see schematic), when activated, samples the IF signals, amplifies them and controls a power-tuning relay S3. FM IF sampling is achieved at the second FM IF collector Q4, while AM sampling is achieved at the transformer T7. In the control section, the FM IF signal receives an additional stage of gain with Q12 and Q13. Assume that the power tuning UP or DOWN button has been pressed. Q13 is maintained at a controlled bias by threshold controls, R103 or R104. IF signals will be amplified and presented to control detector CR8. This diode is in the bias circuit for Q14. Q14 has been forward biased during power tuning by the forward contact potential voltage of forward biased diode CR9. When CR8 detects a signal, a reverse-going bias will be presented to Q14, turning it off. This amplified turn-off signal will also turn off Q15, the relay driver transistor. Of course the relay will release, and motor will stop on station. Remember Q14 and Q15 draw current only when two simultaneous conditions exist: (1) power tuning from B5 B+ is present; (2) when no signal (or oscillation) is being detected by CR8.

The relay S3 has four sets of contacts which control various parts of the radio. At normal reception on station these are: (1. unmuting the radio by connecting the speaker to the audio amplifier via B6; (2. Increasing the sensitivity of the relay for better pull-in via B7; (3. feeding the AFC control through B8; (4. disconnecting the B+ from the power tuning and grounding out the disconnected line via B5. During the power tuning these contacts are respectively: (1. muting the radio by disconnecting the speaker; (2. reducing the relay current on hold by passing it through R68, a 22 Ω resistor; (3. disabling the AFC control voltage (Because the AFC diode is biased by a connection through the floating ratio detector, the AFC diode is reconnected to a secondary B+ line at C56 to avoid detuning); (4. Suplying B+ to the power-tuning section and power-tuning motor.

The operation section has a dc drive motor controlled by the direction relay S4, which is controlled by the dial drum direction sensing switch S6. Since it is a dc motor, merely reversing the power leads will reverse rotation. The direction relay. S4. has several unusual characteristics. It has two coils connected opposite each other. Secondly it has a permeable core. Once the direction switch, S5. or power tune UP or DOWN button has been pressed. the pulse of current through that respective coil will not operate the contacts. but will magnetize the core. The direction relay then behaves like a DPDT switch; the contacts staying in their last position until the core is magnetized oppositely by the other coil.

As mentioned previously, the relay, S3, applies B+ to the entire power-tuning section only during power tuning. Thus the search motor is controlled by S3 relay B+ contacts. A local-distant switch controls the AM and FM sensitivity of the radio and thus sensitivity of the power-tuning unit. The radio is approximately 15 times more sensitive in distant position.

CANADIAN GENERAL ELECTRIC

Color Chassis CTC21/25 — Audio Hum

Field reports include complaints of audio hum in some chassis and mentions one chassis may have more or less hum than another.

Investigation reveals this hum level is emphasized by the "Beta" of the output transistor, Q202. Corrective action is to add enough degeneration in the emitter circuit to reduce this hum to a minimum level, yet maintain good audio output. To provide this degeneration a 33 to 68Ω½w resistor is needed in this circuit. In most instances this resistor can be installed without removing the chassis from the cabinet.

TV Chassis M664/M687 — Operation of 'Electric Eye'

Some 1968 models using the M664 and M687 chassis, employ an "electric eye" feature. The purpose of this feature is to adjust picture brightness automatically in proportion to room brightness.

For proper operation of the light dependent resistor (LDR) unit, it should not be blocked off. nor should a lamp be placed near or in front of the unit. To check the operation of the electric eye, switch the set on and adjust

continued on page 32

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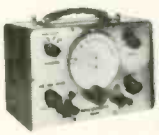

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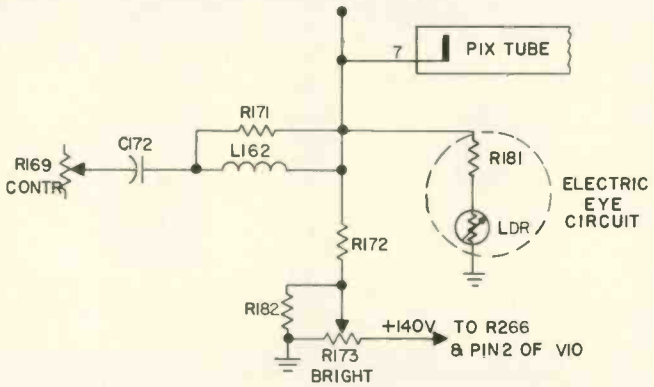
TECHNICAL DIGEST

continued from page 30

brightness and contrast for normal operation under normal viewing conditions. Cover the LDR window and note if the picture brightness decreases. If it does, the LDR is functioning correctly. If not, check the resistance of the LDR unit and check to see if the unit is properly connected to the circuit.

In chassis employing the LDR, a 400 Ω brightness potentiometer is used instead of the usual 300 Ω pot. The LDR is connected in parallel with a portion of the bright-



ness control through a tap on the pot. When the amount of illumination striking the LDR decreases (as the room darkens), the resistance of the LDR increases. The increased resistance raises the CRT cathode voltage with respect to ground, thereby increasing the potential difference between cathode and control grid of the CRT. The grid becomes more negative since it is connected to ground through the horizontal blanking winding of T251. Thus current flow is decreased, with lower brightness on CRT.

In the M664 chassis, the LDR is effectively placed in parallel with the brightness control. Again, when the amount of illumination striking the LDR decreases, the resistance of the LDR increases. The increased resistance raises the CRT cathode voltage and reduces brightness.

Color TV 25in. Models — New CRT Type

Presently there are two types of 25in. color tubes used; the only differences are as follows:

Characteristics	25AP22A	25SP22
Heater current	.8a	1.3a
G1 cut off at 440 G2	−95 to −190	−75 to −167v
Over-all length	20.924 ± .375	21.123 ± .375

Both tubes are interchangeable with only one small modification — R124 .08 Ω 3w resistor should be bypassed by a piece of buss wire when you use the 25SP22. The buss wire is removed if you replace a 25SP22 with a 25AP22A. The resistor is located under the chassis near the power transformer.

AM, FM, FM Stereo Tuner Model M671 — Change in T12

The inductance of coil T12 on the M671 chassis has been changed from 58mh to 61mh. The 58mh version is

continued on page 34

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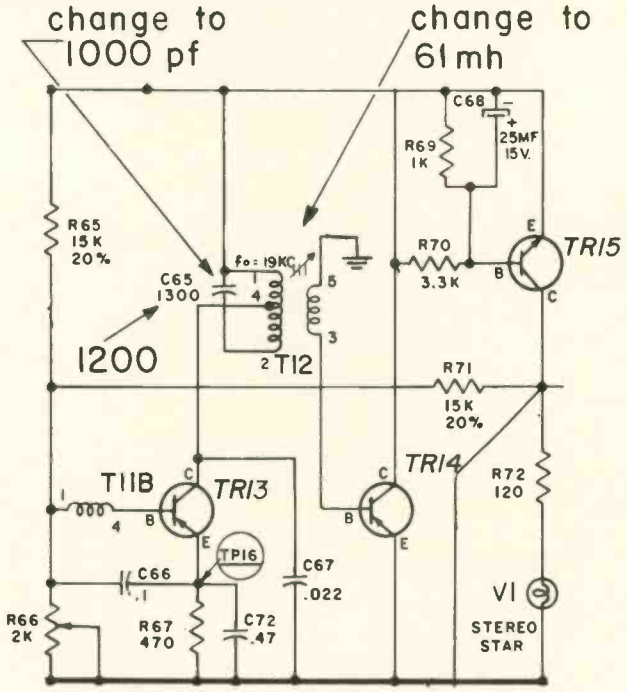
TECHNICAL DIGEST

continued from page 32

identified with a white dot, the 61mh with a yellow dot. This dot is located on the coil form between pin 1 and 5.

To compensate for this revision, the shunting capacitor, C65, has been changed from 1200pf to 1000pf.



Renewal parts is stocking only the "white dot" at this time. Therefore, if a "yellow dot" is replaced with the "white dot" (Cat.ER7878), C65 must be changed.

MAGNAVOX

Stereo Theatres — Remote Shut-Off Delay

Stereo theatre models equipped with remote control display a delay of approximately 2s in TV remote shut-off. When the TV picture does not disappear immediately after the set is switched off by the remote transmitter, some customers question the operation of the set. It should be explained that this delay is normal and intended to avoid unnecessary switching on and off of the TV chassis as the volume is adjusted by remote.

The delay results because the ac to the TV chassis is controlled by a relay which is actuated by the B+ supply in the radio chassis. The stepper relay is triggered by the remote signal and when it reaches the OFF position, it interrupts the ac supply to the radio chassis. Because the radio chassis B+ decays gradually there is resultant delay of about 2s before the TV is switched off.

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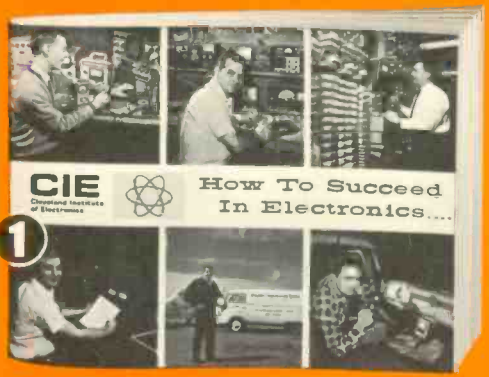

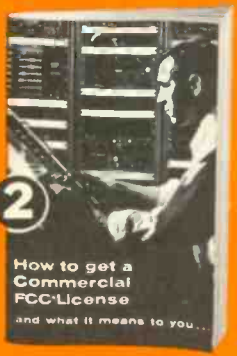

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Two-way radio is booming. Today there are more than *five million* two-way transmitters for police cars, fire trucks, taxis, planes, etc. and Citizen's Band uses—and the number is growing at the rate of 80,000 new transmitters per month.

This wildfire boom presents a solid gold opportunity for trained two-way radio service experts. Many of them are earning $5,000 to $10,000 a year *more* than the average radio-TV repair man.

Why You'll Earn Top Pay

One reason is that the U.S. Government doesn't permit anyone to service two-way radio systems unless he is licensed by the FCC (Federal Communications Commission). And there simply aren't enough licensed electronics experts to go around.

Another reason two-way radio men earn so much more than radio-TV service men is that they are needed more often and more desperately. A two-way radio user *must* keep those transmitters operating at all times, and *must* have them checked at regular intervals by licensed personnel to meet FCC requirements.

This means that the licensed experts can "write their own ticket" when it comes to earnings. Some work by the hour and usually charge at least $5.00 per hour, $7.50 on evenings and Sundays, plus travel expenses. Others charge each customer a monthly retainer fee, such as $20 a month for a base station and $7.50 for each mobile station. A survey showed that one man can easily maintain at least 15 base stations and 85 mobiles. This would add up to at least $12,000 a year.

Be Your Own Boss

There are other advantages too. You can become your own boss—work by yourself or gradually build your own fully staffed service company. Instead of being chained to a workbench, machine or desk, you'll move around, see lots of action, rub shoulders with important police and fire officials and business executives who depend on two-way radio for their daily operations.

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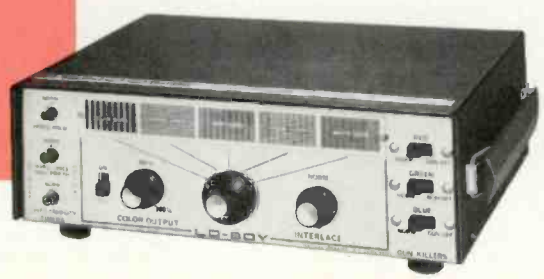

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TEKLAB REPORT
PART 1

ELECTRONIC TECHNICIAN
OCTOBER 1967

WHAT'S NEW in 1968 COLOR TV

Integrated circuits and more transistorized circuits will highlight the new color line for the coming year

■ More solid-state, more integrated circuit applications and a larger variety of color CRT sizes highlight the 1968 color TV line.

It should be noted that U.S. manufacturers sold $64.3 million worth of semiconductor integrated circuits during the first four months of 1967, increasing by 52 percent from sales of $42.2 million during this period last year, according to estimates released by the Electronic Industries Ass'n. (EIA).

Motorola developed a solid-state color TV set with 10 removable panels for easier servicing, in its top-of-the-line model.

One-third of Sylvania's previously tubed circuitry has been transistorized and uses integrated circuits.

Most 1968 color TV models will employ automatic fine tuning (AFT), tuning indicators, instant play and automatic chroma control.

ADMIRAL

Admiral will employ a new circuit on the H10 series chassis to adjust automatically the 1st chroma bandpass amplifier gain, providing a relatively constant chroma level at the CRT grids.

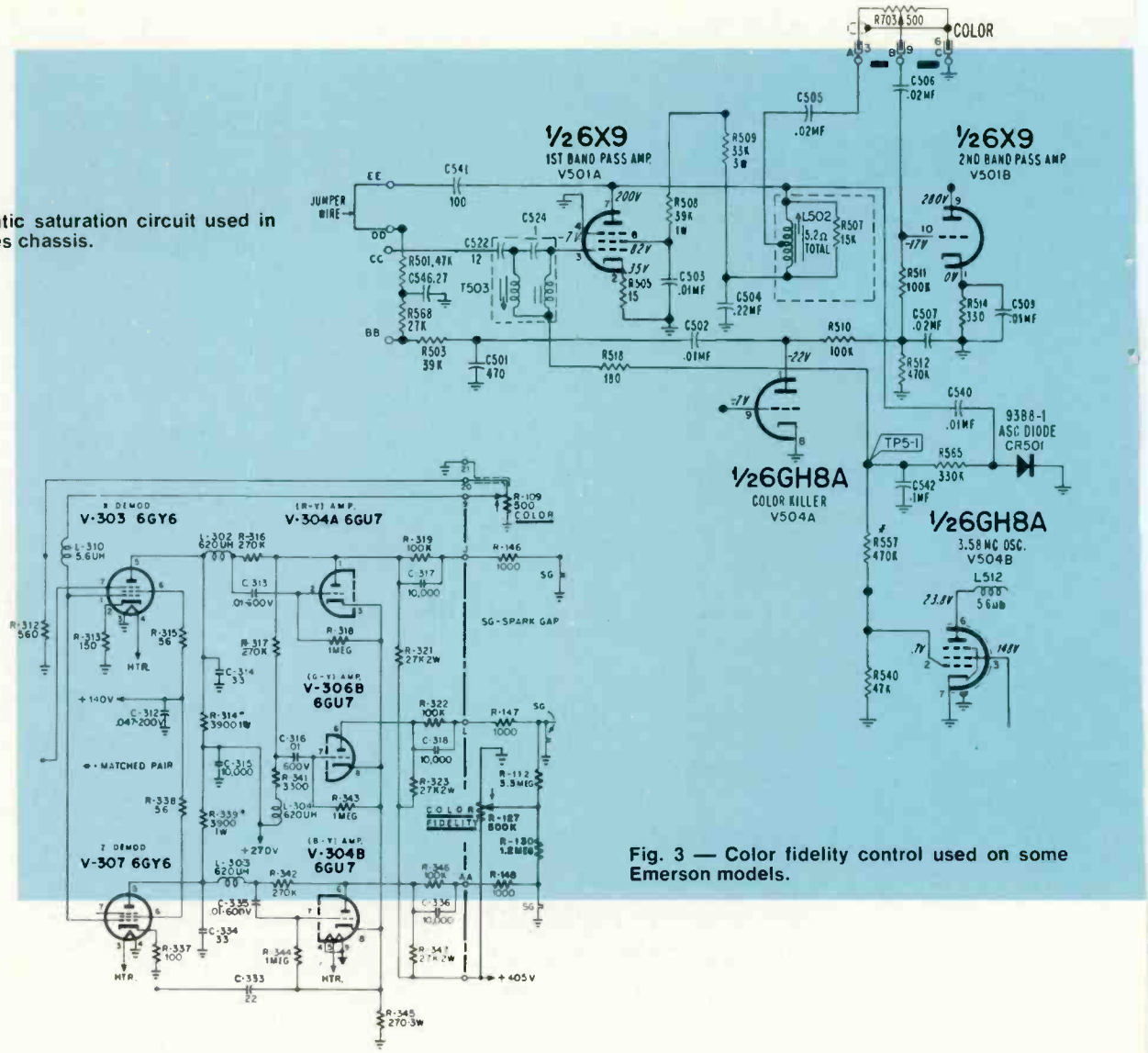


Fig. 1 — Automatic saturation circuit used in Admiral H10 series chassis.

Fig. 3 — Color fidelity control used on some Emerson models.

Automatic saturation circuit (ASC) diode detection (CR501) is determined by the amount of chroma information at V501A bandpass amp plate (see Fig. 1). The chroma information between 3 and 4MHz is at a much higher level than the accompanying luminance information at this point. To prevent excessive color in scenes having only a small amount of color, a burst referenced dc voltage limits the amount of maximum gain of V501A. CR-501 conducts on the positive half of the chroma signal and the rectified dc signal is filtered by R565 and C542. R557 and C542 filters the dc from the chroma oscillator. The resulting varying dc correction voltage appears at the V501A grid through R518 and T503. The correction voltage will cause the gain of V501A to increase when the chroma level decreases, or decrease when the chroma level increases. Monitoring the bandpass amp grid with a VTVM will show about −1.5v with low chroma signal and −3.5v with high chroma level signal.

Another feature in models using the 4H12, 6H10 and 9H10 chassis is "instant play." The power transformer has a special primary winding, only a part of which is used during normal operation (see Fig. 2). When the ON/OFF volume switch is pushed to the OFF position, the ac line is connected across the entire primary, thus reducing the voltage and current in the secondary. At the same time, the B+ and dial light

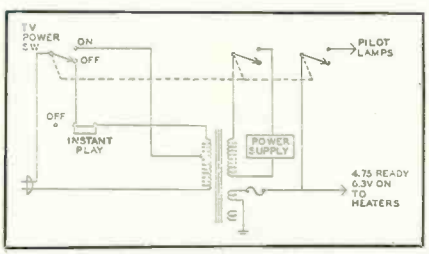


Fig. 2 — Admiral's "Instant Play" used in the 4H12, 6H10 and 9H10 chassis.

circuits are opened — leaving only the tube heater circuit in operation at the reduced voltage and current.

A separate switch in the ac line is located at the back of the cabinet so the set can be switched off completely.

The Admiral 4H12 color TV chassis employs an automatic frequency control system which completes the fine tuning once the

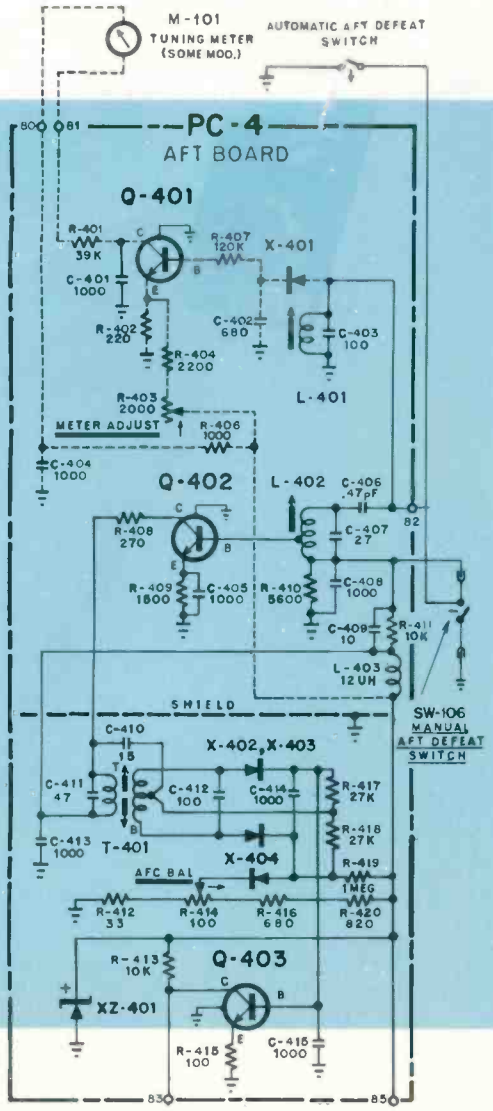


Fig. 4 — Emerson's AFT circuit employing a manual as well as an automatic defeat switch.

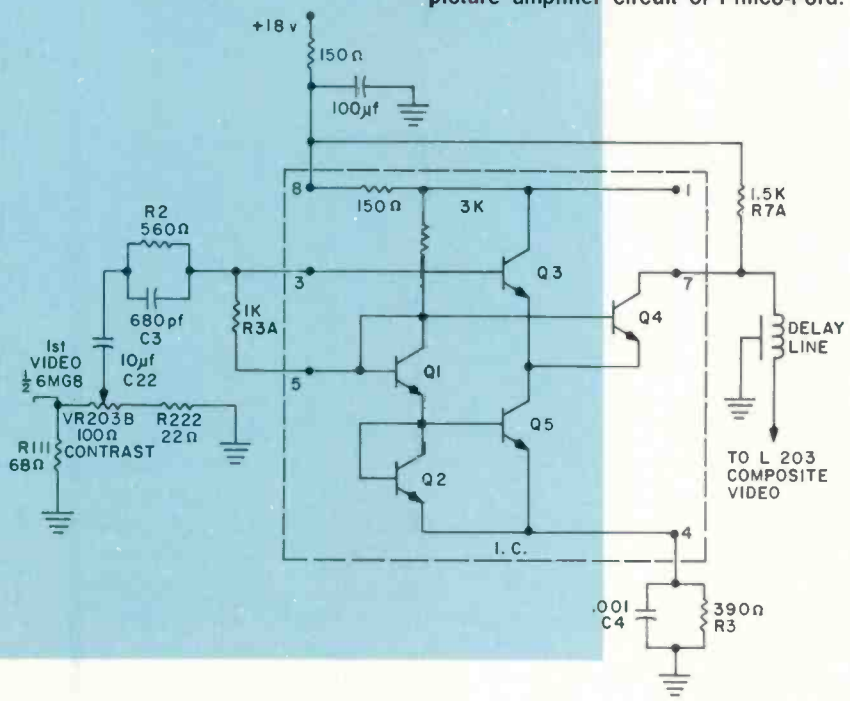


Fig. 5 — Integrated circuit used in the picture amplifier circuit of Philco-Ford.

customer has "roughed it in." Its operation is similar to the AFC used on FM tuners.

EMERSON

The Emerson line is the largest ever, consisting of models in all price and CRT size categories, from low cost leader-models to the deluxe top of the line which is now called the DuMont custom series by Emerson.

Some of the features will include "quick-on," timer, AFT and ACC.

A new video peaking control allows the customer to adjust the picture from very sharp to soft to suit his individual taste. In the extreme soft position, the effects of snow on extremely weak signals are reduced. The color fidelity control (Fig. 3), which is used on some models, allows the customer to make a very fine setting of gray scale. The AFT circuitry (Fig. 4) employs a manual defeat switch as well as an automatic defeat switch every time the "Perm-Lok" (permanent fine tuning control) is adjusted. This allows the customer to tune the picture as accurately as possible before the automatic fine tuning (AFT) circuits take over. In certain areas, the defeat switch would permit tuning in a stronger B/W picture as well as a color picture by positioning the video carrier higher up on the response curve.

MOTOROLA

The Motorola color line for 1968 includes a solid-state chassis in the top-of-the-line models. The chassis has ten removable panels for easier servicing and uses an integrated circuit in the audio panel. The only tube in the circuit is a 3BN2 HV rectifier.

Part one of a two-part article covering this one-of-a-kind set appeared in the September 1967 issue of ELECTRONIC TECHNICIAN.

PACKARD BELL

The new 1968 color TV models of this manufacturer are basically the same as last year.

An import color TV model, CRQ312, has been added to the line. A 90deg deflection, tri-gun CRT with 176 sq in. of viewing area will be used. Other features will include automatic degaussing,

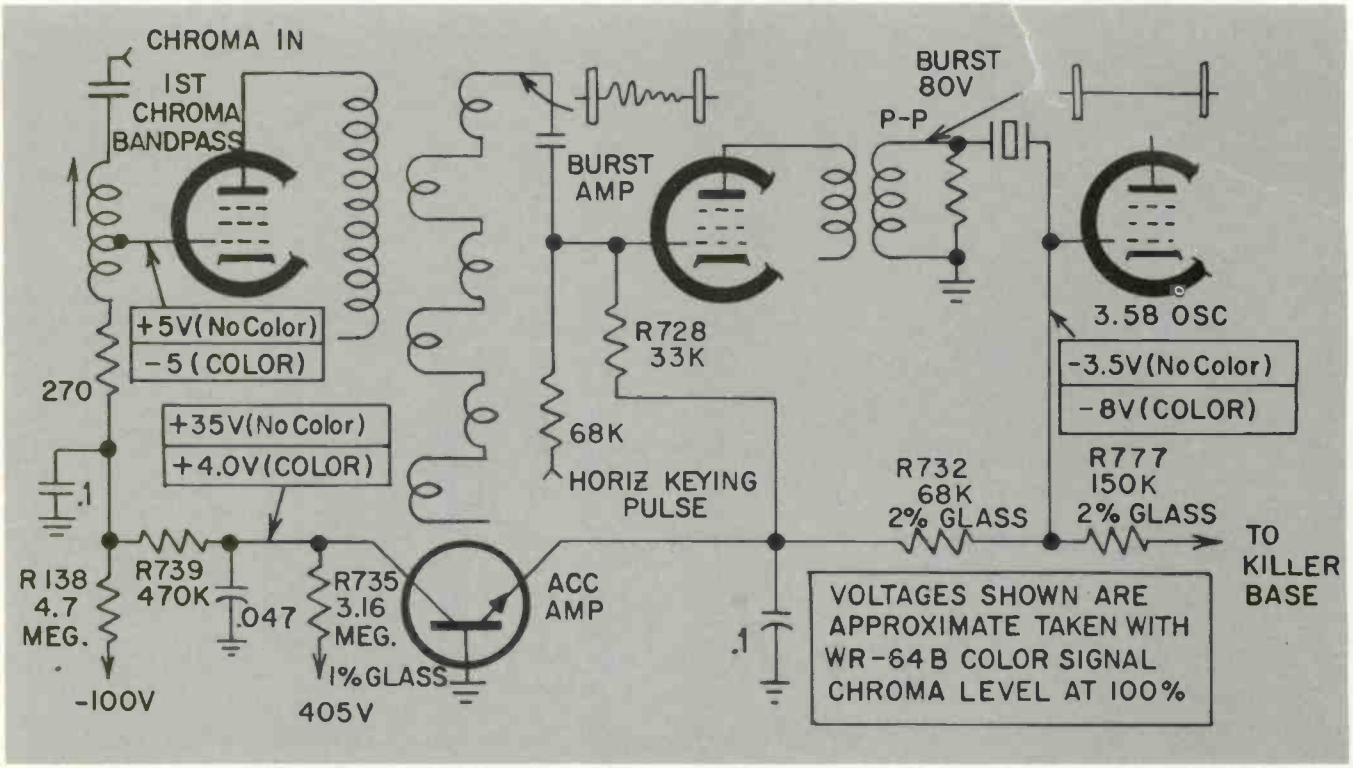


Fig. 6 — Simplified schematic of transistorized automatic chroma control used in the RCA Victor CTC31 series chassis.

hand wiring of major circuits, front mounted speaker, up-front controls and a new "set-and-forget" fine tuning.

PHILCO-FORD

The 1968 color line has a wider over-all selection — 37 compared to 32 previously. A 267 sq in. set, quoted at $229.95, is said to be the lowest suggested retail price in the company's history.

Integrated circuitry will be used in a color TV set, and a color TV/radio/phonograph home-theater combination has ICs in the picture amplifier circuits as shown in Fig. 5. All color sets are fully transistorized from the tuner through the IF amplifier stages.

RCA VICTOR

The chassis used in the 1968 RCA Victor color line are in many respects similar to last year's chassis (with the exception of the CTC-22). Specific new color chassis in the '68 line, introduced in June, include the CTC27, -28, -30, -31 and -35. The CTC22 color chassis introduced in March will be continued.

The complete color TV line will employ a new family of rectangular "Hi-Lite" color CRTs with a new red phosphor. The tubes offer an improvement over earlier color picture tubes.

The new red phosphor achieves a unity-current ratio — equal beam current from each electron gun.

Three drive controls — red, green and blue — are used in the new line and because of the new red phosphor CRT, it is possible for the blue phosphor to be less efficient than red or green. Previously, only red or green could be the least efficient.

The new line features several refinements to improve reliability in the horizontal sweep circuits. Changes are found in the horizontal oscillator, output, damper and efficiency circuits.

A new damper tube type 6CL3 will be employed in the CTC35, CTC30 and CTC28 series chassis. It is said that the tube offers increased damper efficiency over the 6DW4. As a result of this increased efficiency, screen dissipation of the 6JE6 horizontal output tube is reduced. This is done by increasing the 6JE6 screen resistance from 13K to 15K.

All new color chassis will employ an improved horizontal efficiency coil. This coil employs a new core which reduces the possibility of saturation and its resulting effect on 6JE6 cathode current. The efficiency coil tuning capacitors will be physically located next to the efficiency coil.

Increased horizontal grid drive is accomplished by supplying the horizontal oscillator plate from the B+ boost line, in addition to its regular B+ feed from the 450v supply.

This provides for an additional 20 to 30 volts increase in oscillator plate voltage which in turn increases the amplitude of the waveform applied to the grid of the output tube.

The CTC30 is the top-of-the-line, three IF, chassis featuring automatic chroma control, automatic fine tuning (AFT) and all channel motorized, detented channel selection. Integrated circuits are employed in the audio and AFT sections. This chassis is physically and electrically similar to the 1967

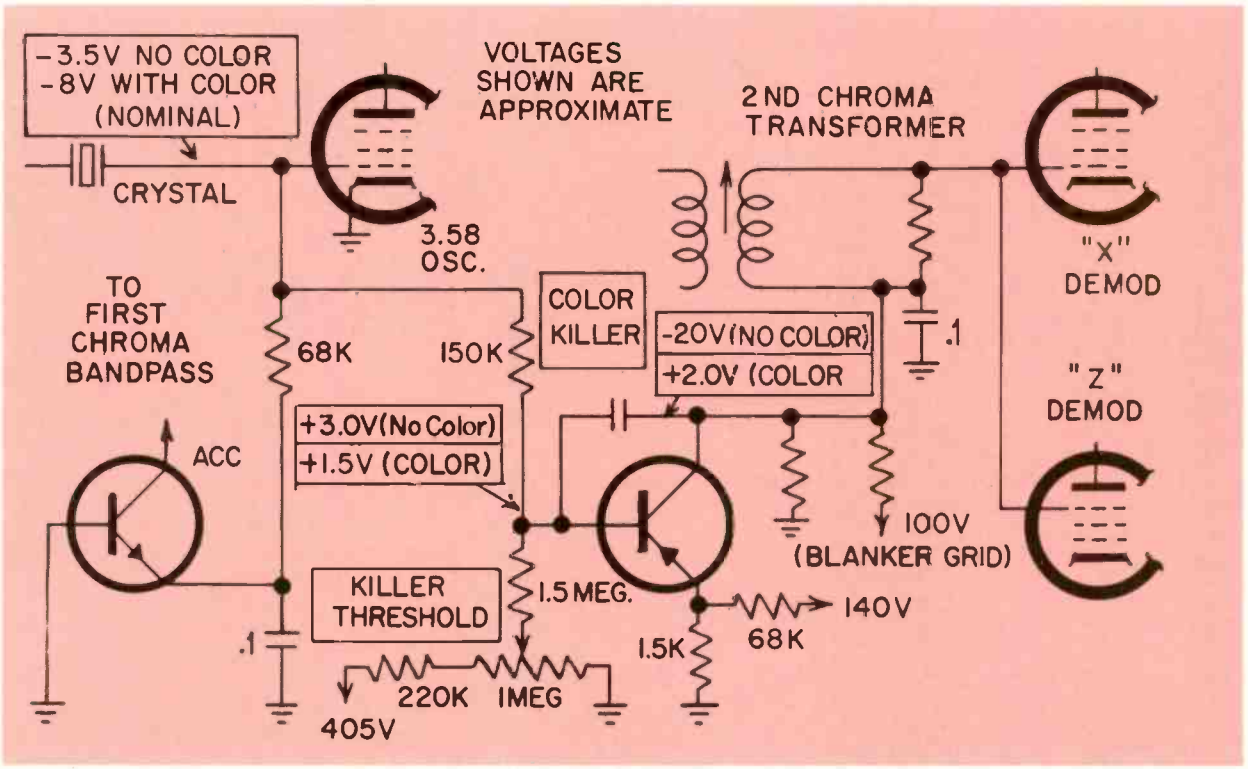


Fig. 7 — Simplified schematic of the transistor color killer used in RCA Victor CTC31 series chassis.

CTC21, Mark I series chassis. This chassis will employ an integrated circuit (IC) as an AFT amplifier/discriminator — said to be the industry's first employment of the circuit.

The new CTC31 chassis uses many of the circuits as in the 1967 CTC24 color chassis. There are some major differences in the color stages, however. This chassis has two chroma bandpass stages, transistorized automatic chroma control (ACC) circuitry (see Fig. 6) and transistor color killer. The color killer functions to render the demodulators inoperative unless a color signal is being received from a station. The simplified color killer circuit is shown in Fig. 7.

A new service control is used in the CTC31 chassis to limit the range of the brightness control. The control will limit the amount of brightness the customer can obtain on the CRT.

SYLVANIA

Sylvania's 1968 color TV line is said to be the largest in the company's history.

The new color sets include 8 models having 180 sq in. screens, 9 with 227 and 45 with 295 sq in. screens.

Transistorized remote control units are available on 6 home-entertainment centers and in the custom deluxe color models.

A newly designed chassis that has been transistorized and improved is used in 23 color consoles and six home-entertainment centers.

One-third of the previously tubed circuits have been transistorized and use integrated circuits.

The transistorized portions include the tuner, a three-stage IF amplifier, two-stages of the video driver, the automatic gain control and other components.

All sets are equipped with the "color bright 85" CRT with rare earth phosphors, automatic degaussing, automatic color level monitor, transistorized noise suppression circuits, dc picture restoration, horizontal blanking circuitry and gated automatic gain control.

ZENITH

Zenith has 42 models in three different screen sizes, AFC automatic fine tuning in over half of the receivers, a new three-function tuning control and a quicker more accurate way of adjusting color.

The triple function control on several models eliminates one channel selector knob. Using either a bar or ring, it allows the viewer to tune VHF stations, switch to UHF channels and fine tune each VHF channel individually.

A new convergence panel assembly that is installed just behind the speaker at the front of the set, together with improved convergence circuitry makes servicing easier.

Some models using the "Y" series chassis employ an "automatic fine tuning control" (AFTC) circuit. The circuit "locks-in" on the picture IF carrier and has sufficient "pull-in" range for satisfactory reception.

For circuit description and schematic of the AFTC circuit see TEKLAB report in the June 1967 article, "A Look at the 20X1C38 Zenith Color Chassis."

A forthcoming article will cover further changes made in both color and B/W sets for 1968. ■

Common COLOR Problems

Here are ten common problems and their causes — one could 'clear the road' for the set now on your bench

■ It has been estimated that about 80 percent of the color chassis now coming into service-dealer shops have the same basic electronic circuitry. Consequently, the problems in these chassis are often identical. And even those chassis using a radically different physical layout are often electronically similar and plagued by the same problems.

Although some of the problems that develop in these sets are "easy" to solve, others are downright tricky. But in either case, even the pro may have difficulty finding his way around the schematic or the chassis.

This is a "checklist" composed of common problems which arise in today's color receivers. The problems here are not those which *could* cause certain trouble symptom but those which do cause these symptoms every day in service shops everywhere. They are problems which frequently cause even the pro to tear his hair.

If the chassis which has you stumped does not have the typical physical configuration, check the schematic. Chances are good that the circuitry is the same and with only a little more effort you can pin-point the faulty part.

Tubes are not considered as a possible trouble here since it is assumed that all technicians understand that tubes can cause almost any conceivable trouble and that tubes have already been substituted with known-good tubes.

Color Only — Screen Blank On Monochrome

This is one which can cause technicians to waste a lot of time unless they are on-the-ball. In this case, it is easy to overlook the fact that the screen is not blank all the time — color programs do come through when the color control is advanced!

Although this fault can be caused by an open or short almost anywhere in the video circuit beyond the color takeoff point, the most common cause is an open delay line. Fortunately, an open delay line is easy to check out: simply jump it with a clip lead. Most delay lines have only three leads and one is grounded. Short the two that are not grounded together. If the delay line is open, the picture should appear *almost* normal when jumpered (see Fig. 1).

Delay lines can often be repaired since they are simply a single layer coil. Opens usually occur at or near terminals. The grounded terminal is connected to a cylinder of copper foil on which the coil is wound.

Poor Focus — No Focus Control

When the focus on a color set is poor but can be varied, it means that the CRT is bad or that the focus voltage is incorrect. It usually means the latter. When there is no control over focus, generally the focus voltage is nonexistent or is not reaching the CRT focus grids.

Focus voltage circuits are almost always the same and are quite simple (see Fig. 2). The pulse voltage at the horizontal output plate is simply passed through a transformer (the "focus coil"), rectified (sometimes a selenium stick, sometimes a tube), filtered with a 130pf capacitor and applied to the CRT focus grid.

If you suspect there's no focus voltage, give a light tug on the black wire to the CRT socket. There's a good possibility that the lead is loose and will pull out. Then all you have to do is replace the socket. If the lead doesn't pull out, try a continuity check just to be sure.

If the socket is good, then other checks are in order. First on the list should be a voltage check. You should measure about 5kv at the output end of the rectifier. Other problems in this area usually leave burned components so they aren't difficult to track down.

One caution: Don't try to measure the front-to-back resistance on the selenium focus rectifier. This unit is actually a stack of selenium cells and the front resistance is about the same as the back. A good "sniff" will usually tell you more about seleniums.

Insufficient Height and Width— Little or No Sync

Just as in B/W sets, this symptom is a clue that something is wrong in the B+ circuitry. And,

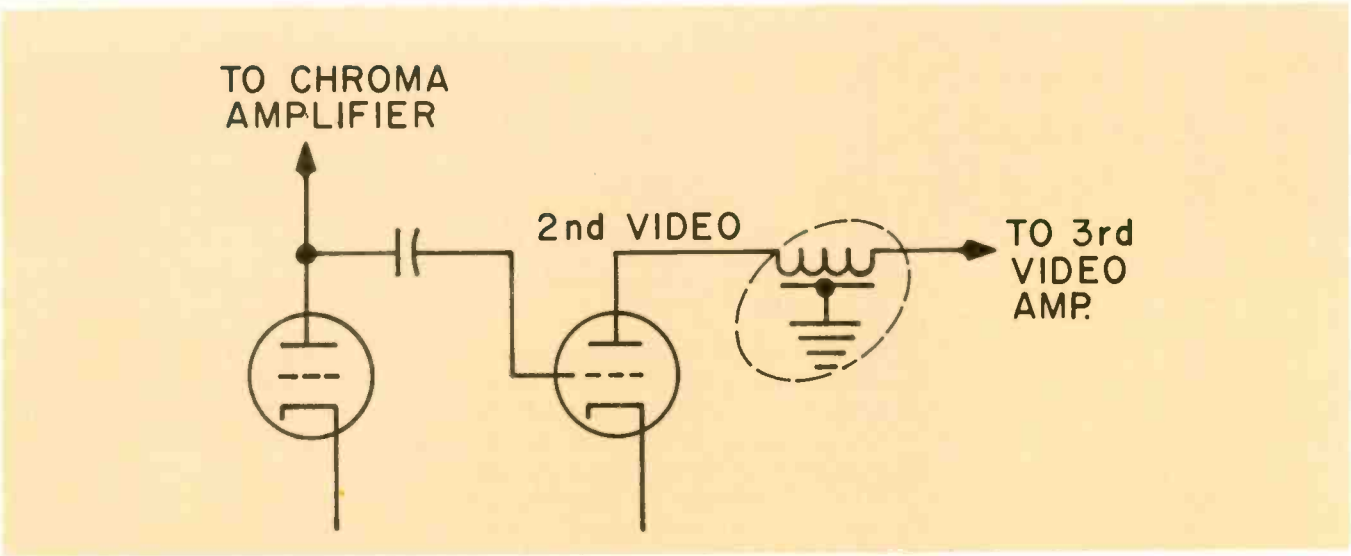


Fig. 1 — Simplified circuit of delay line.

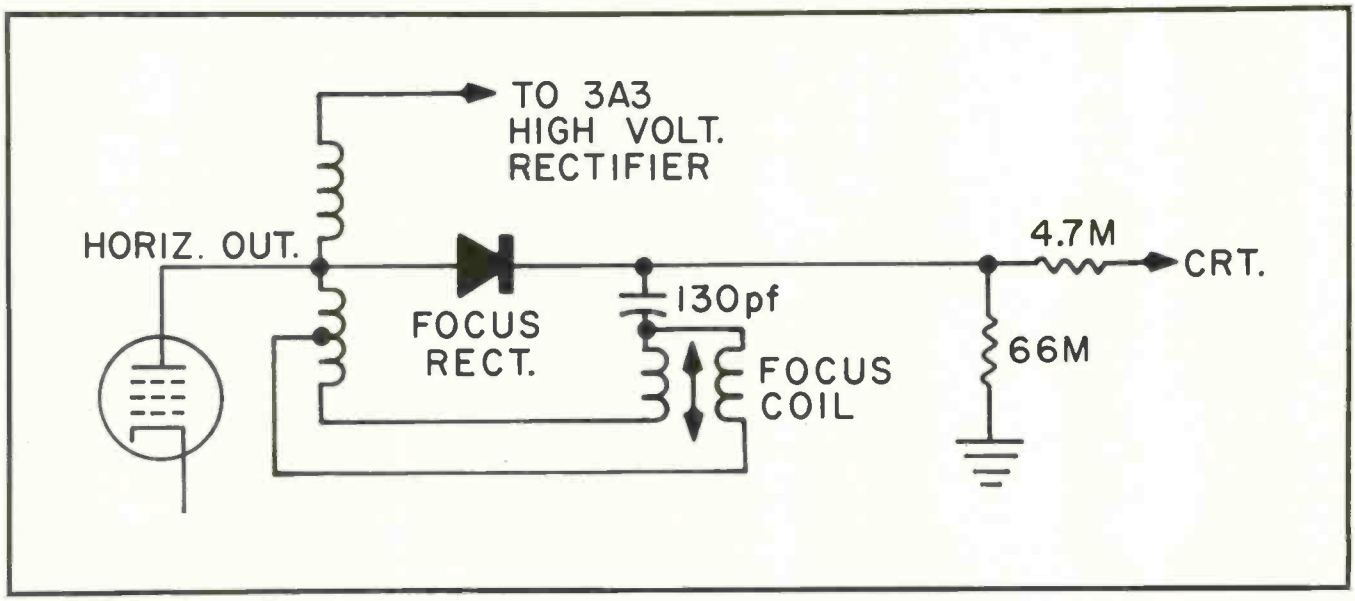


Fig. 2 — Typical focus-voltage circuit.

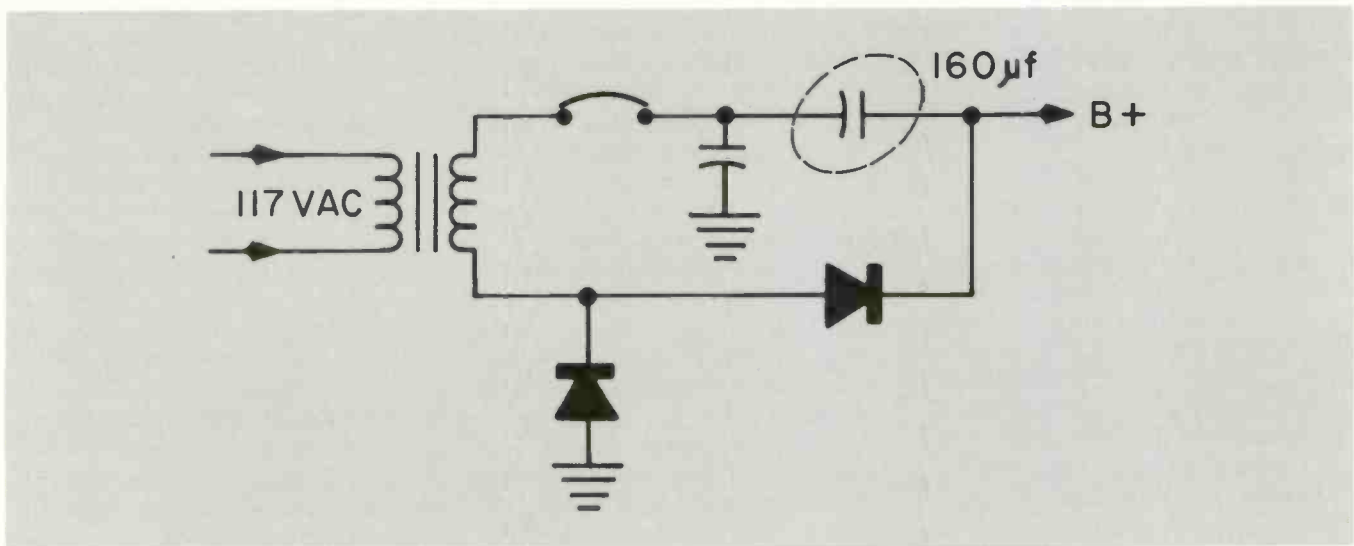


Fig. 3 — Schematic of typical power supply circuit.

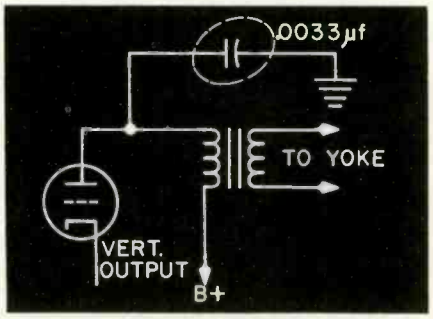


Fig. 4 — When the 0.0033μf capacitor shorts the circuit breaker will trip.

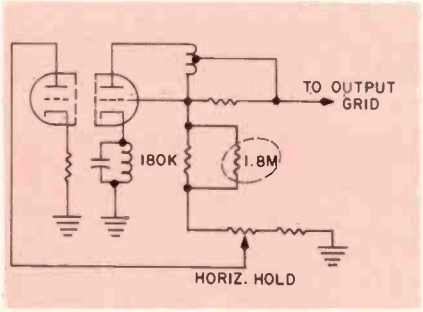


Fig. 5 — When the 1.8M resistor drifts out of tolerance the horizontal hold control will sync the oscillator on the extreme edge of its range.

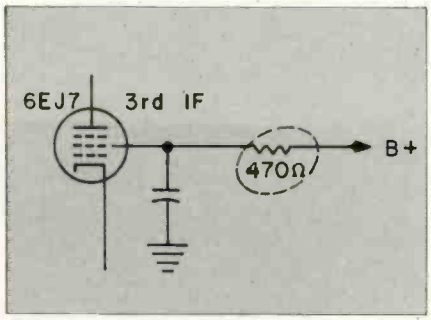


Fig. 6 — When the 6EJ7 shorts the 470Ω resistor will usually burn up.

as in B/W sets, the offending part is almost always the voltage doubling capacitor. In the typical color set this is a single-unit "can" rated at 160μf, 250vdc (see Fig. 3).

A capacitor of this type is used to bridge a suspected capacitor to confirm if it is open. Shorts rarely develop and they will open the circuit breaker when they do.

If the voltage doubler is completely open, the set will not function. A few quick voltage measurements will lead you to the faulty part and the same bridging technique will prove it. If you're looking for the screen to come to life or the speaker to sound off when the suspected capacitor is bridged, be sure the volume control is turned up and the brightness and screen controls are set to their normal positions.

To make sure the suspected capacitor is at fault, monitor the voltage while bridging the suspected component. Also, the set may have more than one faulty component.

No High Voltage—Burned Smell

When the flyback transformer overheats, it may be obvious or it may not be. It's not exactly an industry joke that every color TV manufacturer has, at some time or other, been embarrassed by being called in to "put out" a fire in one of its TV sets.

The demands placed on a color set flyback are great and the toll this demand takes is great.

Latest models often have the flyback "tire" made of silicon which does not burn under normal conditions. If you suspect the flyback has burned, feel the "tire" gently (when the set is switched off). If you feel a "crunchiness" underneath, peel the silicon back slightly. If the flyback is burned, it will become obvious.

Of course, all bad flybacks don't look bad nor are all bad-looking flybacks faulty. A few drops of wax which have dripped from a transformer are sometimes normal and are known as "tearing" (as in crying). When it is necessary to replace a flyback be sure the high voltage cup and associated wiring are in good shape. All tubes in the horizontal and high voltage section should also be replaced since any on of these parts could *intermit* and cause flyback failure. Heat may have damaged selenium focus rectifiers in extreme cases and these should also be replaced.

Circuit Breaker Trips

There can be many causes for a circuit breaker to trip open — either immediately or after the set has operated normally for a few seconds or a few minutes. Common causes in our typical set, however, are fewer.

If the circuit breaker trips as soon as the set is switched on, the most likely suspect is one of the B+ diodes. No need to disconnect the diodes — a quick check with the ohmmeter will determine if a short exists or not. Make sure you check the diode both ways.

Another common cause is the 0.0033μf, 1.6kv capacitor used in the vertical B+ section (see Fig. 4). This, too, sometimes goes off with a flourish and the convergence wiring may have to be replaced in the area of the capacitor and the resistor feeding the vertical circuit.

The slow-tripping circuit breaker is the toughest to troubleshoot because you have little time to take voltage readings. More often than not, a resistance reading will not be conclusive.

If the horizontal output tube begins to turn red, the trouble may be in the tube, the high voltage rectifier or the horizontal oscillator. A quick output tube grid voltage check should tell you where to begin. The voltage should be about −45 to −55v. A less negative voltage usually indicates oscillator trouble.

Another frequent offender, and last on many technician's list, is the circuit breaker itself. The only safe way to check it is to substitute.

Quickies

Poor sound, no sync? Check the sound/sync detector diode.

Very light picture with interference-like lines? Check the picture diode.

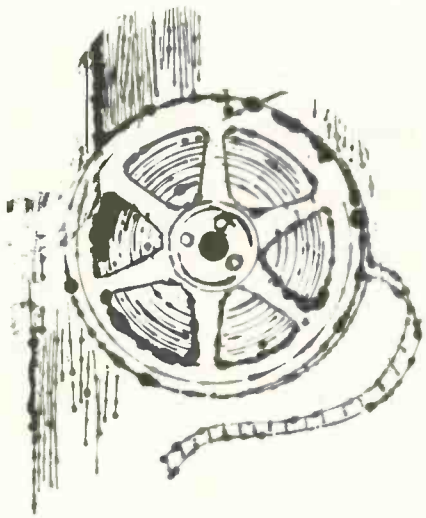
Horizontal hold control locks at one end? Locate the 1.8M resistor on the bottom of the board in the horizontal circuit (see Fig. 5). Replace resistor — remove or add resistance as necessary to center control. Readjust the sinewave coil when you're through with this one.

Horizontal hold tends to lock-out when adjusting? Several manufacturers have added a 0.1uf capacitor across the 0.03uf capacitor on the tuner AGC line. This capacitor is located right on top of the tuner.

There is still no substitute for the thorough visual inspection. Although the raster-only malfunction causes some technicians to shirk at what could be wrong, the commonest cause is pretty obvious.

The 6EJ7 often shorts out and takes a 470Ω resistor with it (see Fig. 6). By "craning" your neck properly, this resistor can be viewed alongside its IF can. If the resistor is burned, use a long-nose plier and finish it off by crushing. You can then jumper the stubs on the bottom side of the board.

Another, but less common cause of the raster-only syndrome is a B+ dropping resistor on the tuner. This is sometimes obvious but more often obvious only by the clear, snow-free raster that presents itself.■



Tape Recorders Tape Decks and Cartridge Players

Part One of a Series

Learn how to get your share of this steadily expanding market

■ Despite the growing-pains suffered by tape recorders, tape decks and cartridge players, the business is steadily expanding and it is estimated that total sales will be near 5 million units in 1967 (including foreign made recorders). Although many of these units will rank in the "toy" class because of their low initial cost (less than $50) — hardly worth bothering with in the repair shop unless delayed service and "assembly line" repair methods are employed — an increasingly larger number of quality units are being sold.

Since tape recorders moved from recording studios and broadcasting stations into many areas of our society, including the home, industry, business and education, sales have grown steadily.

Selling and maintaining this equipment is worth the effort if you take the necessary measures to turn out expert, quality work and build the business. At the same time, the service-dealer who can do this can also build the sales end into a profitable department in his home-entertainment electronic equipment business. Other service-dealers have done it and so can you.

Understanding the Basic Tape Recorder

Because tape recorders, like phonographs, are electromechanical, you have to develop a special facility for both mechanical and electronic work. But more than in phonographs, radios and TVs, many mechanical defects in tape recorders will show up as electronic trouble symptoms. At the same time, many trouble symptoms can also be caused by either mechanical or electronic defects. For example, an old or misaligned record/playback (R/P) head — mechanical faults — can cause poor high-frequency response and low output level. At the same time, these symptoms can also be caused by the record-bias being too high — an electronic fault.

Be this as it may, we will divide tape recorders into two sections — the electronic and the mechanical. And we will refer to the over-all mechanical section as the "tape transport." Chances are, you will have more trouble with the mechanical section than with the electronic section.

The electronic components of a simple tape recorder are shown in the block diagram of Fig. 1. But it should be emphasized at this point that when a tape recorder has only one R/P amplifier, a single section R/P head and a single section erase head, it is a *monophonic* unit — not a "monaural" unit. (Monaural literally means "one-eared" and is a meaningless definition used even by some manufacturers to describe single-channel audio.)

Before discussing stereophonic tape recording and reproducing

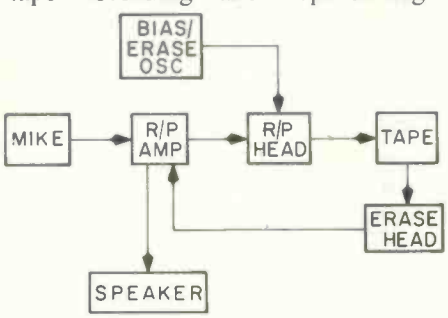


Fig. 1 — Block diagram of a simple tape recorder.

equipment in general, we will first cover basic principles from the monophonic viewpoint.

Record-Playback and Erase Heads

Erase and R/P heads are essentially electromagnets. And from the technician's viewpoint, R/P and erase heads will probably be two very important components in the typical tape recorder — mono or stereo. On the typical home or general-use tape recorder we are concerned with a combination R/P head and an erase head. The heads may be mounted together in one shell or mounted separately. Commercial grade equipment will usual-

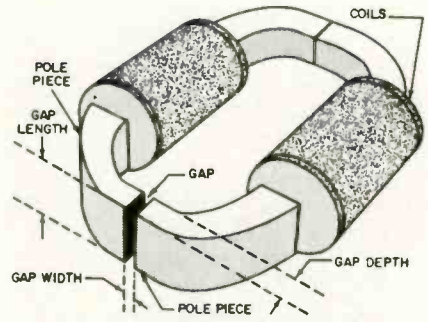


Fig. 2 — Typical "ring" type, double-pole R/P head. Courtesy Ampex.

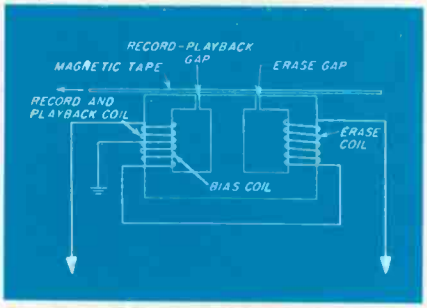


Fig. 3 — R/P Head with three-leg laminated core having two gaps — one for R/P and one for erase.

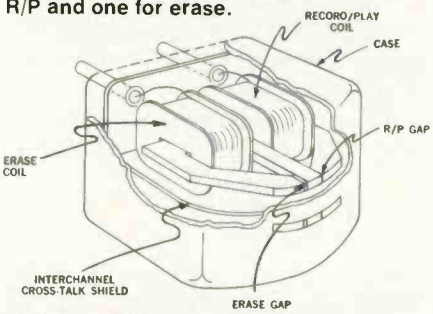


Fig. 4 — Cutaway view of a section of an R/P head which uses the three-leg concept. It is designed for 8-track stereo. Courtesy Nortronics.

ly have separate record, play-back and erase heads.

Because tape-head structures are designed in various shapes and configurations, we will not go into details regarding various designs. We are primarily concerned here with basic electromechanical functions, troubleshooting and maintenance techniques. Details will be covered only when they aid maintenance and repair procedures.

A typical "ring" type double-pole R/P head is shown in Fig. 2. The quality of heads varies and a high quality head may use thin pieces of magnetically "soft" metal to form a laminated core, around which the coils are wound. Laminating reduces electrical losses in the core.

Another type combination head uses a three-leg laminated core having two gaps — the R/P gap and erase gap. This basic arrangement is shown in Fig. 3.

The R/P coil is wound over one leg of the core and the erase coil is wound on another leg. Note that bias voltage is supplied to the erase coil, part of which is wound on the same core-leg used for the R/P coil — hence bias is also supplied to this coil during the recording process. The blank third leg of the core serves a common magnetic path.

On those commercial grade recorders which use a separate playback head, a double-pole core is frequently used and the two windings are generally connected in series to cancel stray hum pickup. But when a double-pole core is used for a combination R/P head, the two windings are usually connected in parallel to obtain higher current-carrying capabilities while recording.

Because the record process calls for a different width headgap than the gap width used in the playback process — to obtain best results in each case — the combination monophonic R/P head is a compromise arrangement, since one gap is involved in both record and playback.

A combination R/P head with erase and R/P gaps interlocked on a three-leg core is shown in Fig. 4. This head is designed for 8-track stereo operation.

The Preliminary Service Approach

As every experienced service-dealer and technician knows, the least expensive approach to over-all electromechanical equipment servicing involves preventive maintenance concepts. But the public does not adjust normally to this concept. The average tape recorder owner waits until the equipment breaks down and stops functioning in some apparent way before asking for service.

The public has to be sold on the idea of preventive maintenance. At any rate, when a tape recorder comes in for any type of repair, the repair estimate must include a certain amount of preventive maintenance. Otherwise, you will have dissatisfied customers and you'll find it impossible to establish a solid reputation for providing high-quality service work.

You can generally arrive at a close estimate, including preventive maintenance work, by removing the head cover and inspecting the tape transport. One such arrangement as seen under the head is shown in Fig. 5. Of course, variations of this arrangement exist.

Inspect and determine the condition of tape guides, pressure pads, capstan, pressure roller and the heads. Observe how dirty the various components are. Ask the customer how many hours the equipment has operated since it was last cleaned and lubricated. On most equipment, heads will need cleaning and demagnetizing after about 15 or 20 hours of use. Heads pick up residual magnetism while they are being used. This normally decreases frequency response at the high end and increases noise and harmonic distortion.

Also observe how much the heads and various moving parts are worn. Inspect the head-gaps with a good magnifying glass. If the heads are worn perceptibly or the gaps have widened, you may have to include head replacements in your estimate. If the heads are not worn and the gaps look OK, but the recorder's output is distorted and noisy, you may have to demagnetize the heads.

We will go into greater detail regarding servicing and replacing R/P and erase heads in a forthcoming article. In the meantime, let's begin digging into one important electronic circuit used in tape recorders.

Bias-Erase Oscillators

Undesirable hysteresis effects that develop when a magnetizing force is applied to a magnetic material (the iron oxide deposited on the dull side of magnetic tape) creates a need for corrective measures. The magnetization of the oxide does not increase in a linear manner. To obtain undistorted output in magnetic recording, a supersonic bias voltage is added to the audio voltage which is applied to the head during the recording process. The amplitude of this voltage is about 10 times the average audio voltage. The frequency of this supersonic voltage is also im-

portant from the designer's viewpoint. It may range upward to 100kHz or more.

It would not prove helpful, from the troubleshooting viewpoint, to cover biasing theory in detail. Suffice it to say that the bias/erase oscillator performs two separate functions during recording: It drives the erase head to eliminate previous recordings from the tape and it biases the recording head to compensate for the non-linear tape response. If we used no bias on the recording head, we would get harmonic and intermodulation distortion on playback. The erase/bias oscillator does not function on playback.

The simplified schematic of an electron tube bias/erase oscillator which is used in the Westinghouse H22RS and H24RS monophonic tape recorders is shown in Fig. 6. This is a balanced, plate-coupled multivibrator having a parallel-resonant output circuit. The circuit, in effect, operates as push-pull. The LC circuit composed of L1, C3, 4 and 5, establishes a frequency near 60kHz. C4 and 5 serve as feedback capacitors and if either of these capacitors fails, the oscillator fails.

Bias failures to the record section of the R/P head and erase-head signal failures can occur because of improper operation of the erase/bias oscillator, defects in the heads or defects in the coupling circuits between the oscillator and the heads. Failure of the oscillator can cause a complete loss of both bias and erase signals or erratic and intermittent record bias and erase signals. When the oscillator fails, of course, previous recordings will not be erased.

Most tape recorders made today use solid-state components. The schematic of a transistorized bias oscillator circuit is shown in Fig. 7. The oscillator functions at a frequency of 35kHz and furnishes bias to the R/P head when the switch is in the RECORD position. C23, a 0.001μf capacitor, couples the 35kHz voltage to the R/P head. A dc bias of −9v is applied to the erase head when the R/P switch is in the RECORD position.

A forthcoming article will cover problems of tape recorder troubleshooting and repair.■

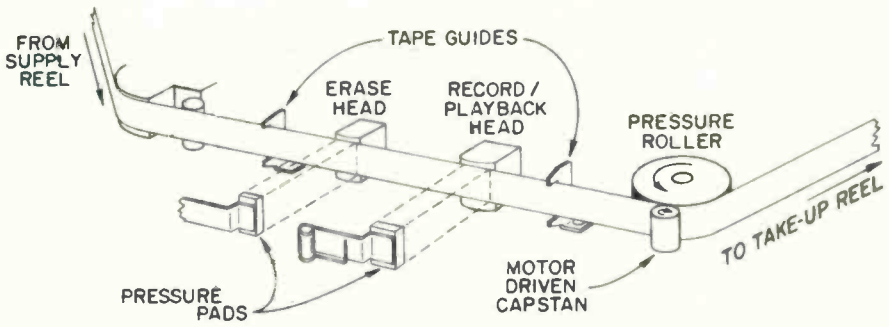


Fig. 5 — Tape transport section of a tape recorder. Courtesy Westinghouse.

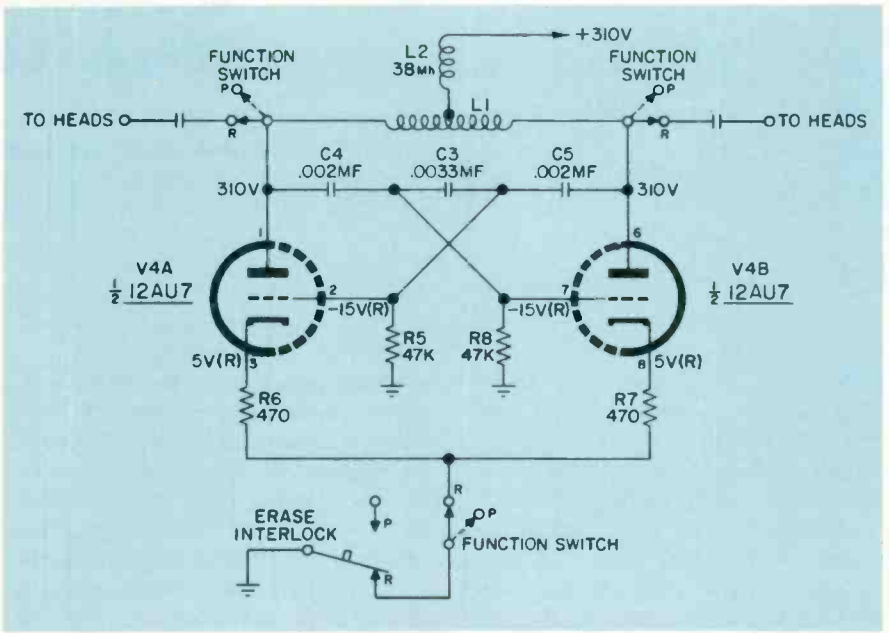


Fig. 6 — Schematic of plate-coupled multivibrator bias/erase oscillator used in Westinghouse tape recorders H22RS and H24RS.

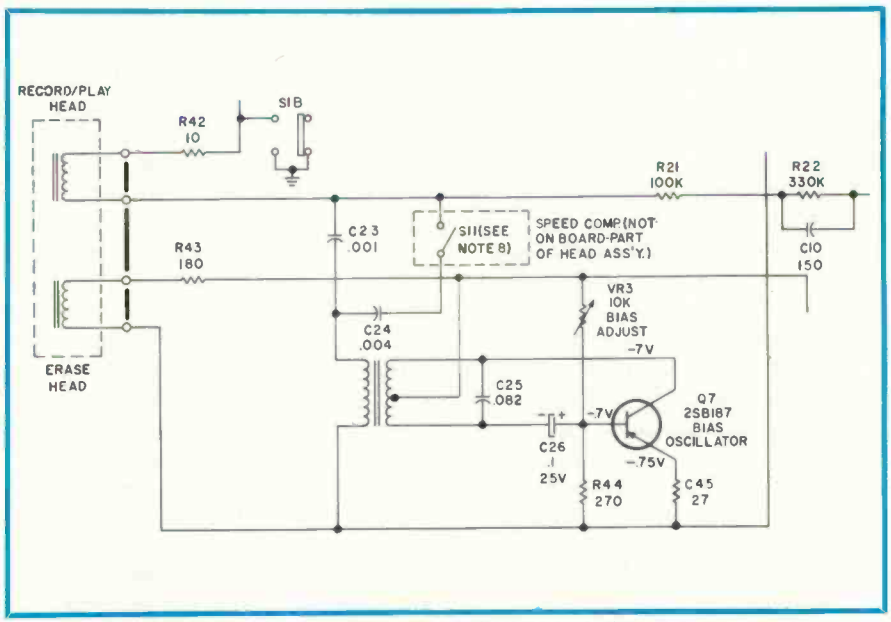


Fig. 7 — Transistorized bias oscillator used in Magnavox TR107M tape recorder.

Semiconductors

Technicians who understand how diodes can be used for tuning

The Fifteenth Article in a Continuing Series

■ Previous articles in this series describe how diodes are used to rectify alternating currents, supply temperature compensating bias voltages and amplify signals. Still another type of diode is gaining prominence in the electronics industry. Voltage-variable capacitance diodes, varicaps, have been used in the past for microwave tuning (as varactors) and in some FM and TV AFC circuits. With recent improvements, these diodes can now substitute for mechanical variable capacitors to tune AM and FM radios.

General Capacitor Characteristics

The basic principles of nonvariable capacitors also apply to varicaps. These principles may be merely a review for experienced technicians.

The study of capacitor time constants in the September 1967 article of this series indicated that electrons enter or leave a capacitor as the potential drop across it changes. The number of electrons that enter or leave the two portions of the capacitor is dependent on the ac potential across the capacitor and the value of the capacitor.

The material that separates the two portions of some capacitors virtually prohibits the flow of electrons between the two portions of the capacitor. Although electrons are not flowing from one capacitor lead to the other, the concentration of electrons in one portion of the capacitor increases when a negative potential is applied to it, and the concentration of electrons in the other portion of the capacitor decreases when a positive potential is applied to it. When an ac voltage is applied to the capacitor, the potential across each side of the capacitor alternates between negative and positive, and electrons enter and leave each side of the capacitor. This results in an alternating current flow in the two capacitor leads.

Since, in some capacitors, virtually no electrons pass from one portion of the capacitor to the other, virtually no current can pass from one capacitor lead to the other. After the capacitor has been charged or discharged, virtually no current will flow through its leads. In the process of charging and discharging, however, electrons enter and leave the two portions of the capacitor. The resulting current flow through the capacitor leads is not from one capacitor lead to the other, but between the capacitor leads and the portions of the capacitor gaining and losing electrons.

The ac potential applied across a capacitor results in ac currents through the capacitor leads. This ac current only appears to flow between the two leads, and no dc current flows between the leads of a capacitor that contains a perfect insulator between its two portions.

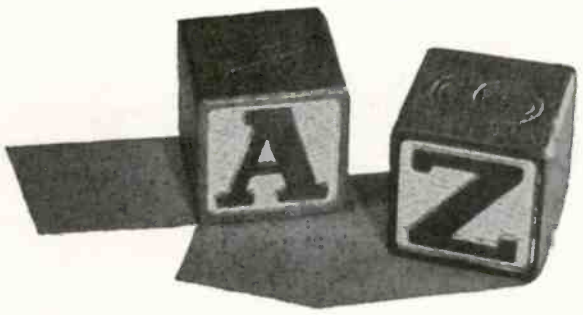
The apparent ability of a capacitor to conduct an ac current increases with the frequency of the ac voltage applied across it and is expressed in terms of the capacitor's reactance

$$(I \approx \frac{X}{X_C}).$$

This relationship is illustrated in Fig. 11 on page 51 of the November 1966 article and is shown in the equation

$$X_C = \frac{1}{2\pi fC}.$$

The material separating the two portions of a capacitor is usually not nearly a perfect insulator, and some electrons may pass through it. These capacitors experience a "leakage" of electrons and some current may "leak" through capacitors at frequencies from dc up. The amount of current resulting from the capaci-



from A to Z

circuits are better prepared to service receivers of the future.

tor's leakage, unlike the current resulting from the capacitor's reactance, is not dependent on the frequency of the ac voltage applied to the capacitor. It depends instead on the composition and quality of the capacitor.

If a manufacturer increases the resistance (R_P) of the material that is used to separate the two portions of a capacitor, he reduces the leakage current. This resistance (R_P) has the same effect as a resistor connected in parallel with the capacitor. By reducing the leakage curent, the manufacturer produces a higher quality (Q_P) capacitor, since the capacitor's reactance is then a greater factor in determining the total current conducted. This quality factor (Q_P) can be calculated if the leakage resistance (R_P) and capacitor reactance (X_C) is known

$$(Q_P = \frac{R_P}{X_C}).$$

The two portions of the capacitor that gain and lose electrons, the leads connected to them and the connections all resist the flow of electrons. They have the same effect as a resistor (R_S) connected in series with the capacitor. This resistance (R_S) reduces the ac current that results from the capacitor's reactance (X_C), and by reducing the resistance the manufacturer produces a higher quality (Q_S) capacitor. This quality factor (Q_S) can be calculated if the effective series resistance (R_S) and the capacitor reactance (X_C) is known

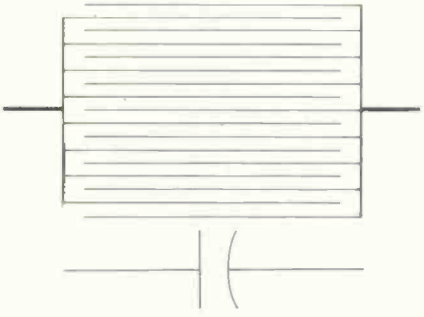


Fig. 1 — The basic structure of most capacitors (above) and a conventional diagram of a capacitor (below).

$$(Q_S = \frac{X_C}{R_S}).$$

The over-all quality (Q) of a capacitor is reduced by both its leakage resistance (R_P) being too low and its effective series resistance (R_S) being too large. This over-all quality factor (Q) must, therefore, be less than the two quality factors (Q_P and Q_S) already calculated

$$(\frac{1}{Q} = \frac{1}{Q_P} + \frac{1}{Q_S} = \frac{X_C}{R_P} + \frac{R_S}{X_C}),$$

but equally dependent on both.

The over-all quality factor (Q) of a capacitor depends on the relationship of the capacitor's leakage resistance (R_P) and effective series resistance (R_S) with its reactance (X_C). This factor (Q) changes as the capacitor's reactance (X_C) changes with the frequency of the applied ac voltage

$$(X_C = \frac{1}{2\pi fC}).$$

Most circuit applications require capacitors with loaded Q's exceeding 20 and often 100 or more. The low unloaded Q's of the previously available voltage-variable capacitors limited the application of these components.

Most capacitors basically resemble the one shown as the top illustration in Fig. 1. The lower illustration in that figure is, of course, a conventional diagram of a capacitor. The ground side (right side) is the same for both.

Capacitors are constructed so that the maximum area of the conductive surfaces attached to their two leads are exposed to one another. The capacitor functions by gaining and losing electrons in these surfaces. The greater the number of surfaces and the greater the area of these surfaces, the more electrons they can

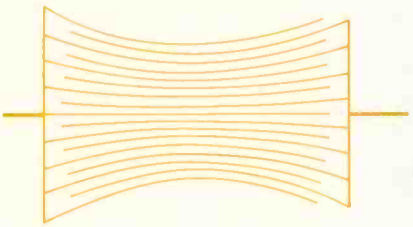


Fig. 2 — Reducing the spacing between the surfaces in a capacitor increases the capacitance.

Fig. 3 — Reducing the area of each set of surfaces, adjacent to another set, reduces the capacitance.

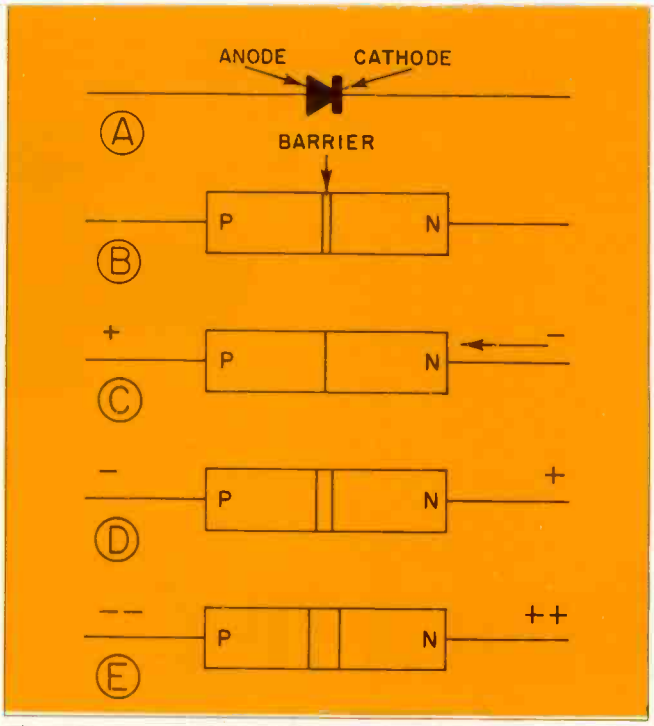


Fig. 4(A) — A diode's anode contains P-type material while its cathode contains N-type material. (B) — The junction of P- and N-type material forms a barrier blocking the flow of electrons. (C) — Current will flow through a diode when its cathode is more negative than its anode. (D) — The junction resists the flow of current when the anode is more negative than the cathode. (E) — The barrier becomes greater as the reverse bias increases.

gain or lose and the greater the value of the capacitor.

The capacitor shown in Fig. 1 contains 32 surfaces exposed to one another. Only the bottom surface of the material represented by the top line is exposed to another surface and only the top surface of the material represented by the bottom line is exposed to another surface, while both surfaces of the material represented by the other lines are exposed to other surfaces.

The right side of the capacitor shown in Fig. 1 is the ground side since the outer material connected to the right side shields the material connected to the left side.

As you may know, unlike electrical charges attract each other just as unlike magnetic poles attract each other. As one set of surfaces loses electrons, when a voltage is applied across a capacitor, its charge becomes more positive — the charge of the remaining protons contained in the atoms of material that the conductive surfaces are made of. The excess electrons in the other set of surfaces have a negative charge and are attracted by the surfaces containing the positive charge. The greater the attraction of electrons for the positive surface, the more electrons the negative surface can contain.

Each proton in an atom has a positive charge virtually equal to the negative charge of an electron. If the proton's positive charge is attracting excess electrons on the negative surface, the proton has less energy to attract electrons on its own positive surface. The greater the proton's attraction for the negative surface, the more electrons the positive surface can lose.

When the negative surfaces are close to the positive surfaces, their unlike charges have a greater attraction toward one another than when the negative and positive surfaces are further apart. The spacing of the conductive surfaces, like their surface areas, is a factor that determines their capacitance.

The capacitance of some capacitors, such as mica trimmer capacitors, is changed by increasing or reducing the spacing between the two sets of surfaces. When this spacing is reduced (Fig. 2), the component's capacitance increases.

In some other capacitors, like the mechanical ones generally used to tune AM or FM radios, the spacing of the two sets of surfaces remains the same while the area of each set, adjacent to the other set, is increased or decreased. When the area of adjacent surfaces is reduced (Fig. 3), the capacitance is also reduced.

As has been indicated, the resistance of the material separating the charged surfaces in a capacitor determines the amount of "leakage" in the capacitor and its quality (Q_P and Q). The separating material also effects its capacitance.

Just as a magnet's ability to attract objects varies with the material its field must travel through, the attractive force of unlike electrical charges varies with the material this force must travel through. The material that seperates the two sets of charged surfaces in a capacitor is called the dielectric. The dielectric's ability to transmit the attractive force of unlike charges is called the dielectric constant. The dielectric constant of air or a vacuum is 1.0, paper is 4.0, pyrex glass is 4.2, clear indian mica is 7.5, aluminum oxide is 10.0 and tantalum oxide is 11.0.

The value of a capacitor can be calculated using the factors that have been described in the equation

$$C = 2.235\frac{KA}{d}(N - 1)\ 10^{-11},$$

where:

C = capacitance in Farads

K = dielectric constant

A = average area of effective surfaces (described with Fig. 3)

d = distance between plates

N = number of surfaces exposed to one another described with Fig. 1)

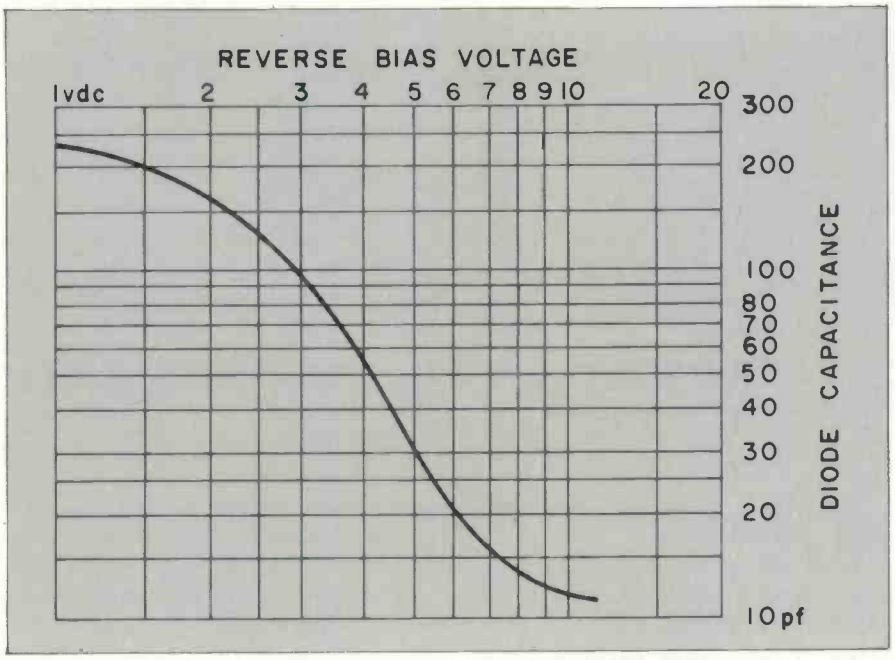


Fig. 5 — The relationship between reverse bias voltage and capacitance in a voltage-variable capacitance diode recently developed for tuning AM radios. Courtesy of Motorola.

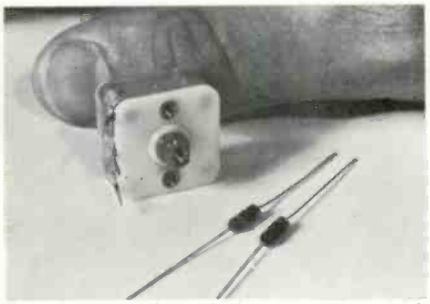


Fig. 6 — Tuning diodes are compared to a miniature mechanical tuning capacitor they can replace.

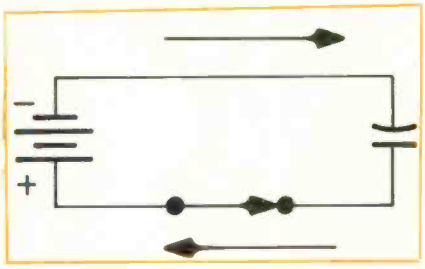


Fig. 7 — The greatest dc current flows through a capacitor when the switch is first closed.

Diode Capacitors

The P-type material in a diode's anode (Fig. 4A) forms a junction with the N-type material in its cathode. This junction of P- and N-type material normally resists the flow of electrons (Fig. 4B). As first described with Fig. 3 on page 61 of the August 1966 article and then described in more detail with Fig. 13 in the August 1967 article of this series, a diode will conduct current (Fig. 4C) when a negative voltage is applied to its cathode and a positive voltage is applied to its anode. When a positive voltage is applied to its cathode and a negative voltage is applied to its anode, the junction of P- and N-type material has a relatively high resistance and functions as a barrier to current flow (Fig. 4D). The greater the amount of this reverse bias, the greater the barrier developed (Fig. 4E).

The P- and N-type material forms the two portions of the voltage-variable capacitance diode that gain or lose electrons. When the diode is reverse biased (its anode more negative than its cathode) a barrier separates the two portions of the diode. Like the capacitors described earlier in this article, the ac current then flowing through the diode's leads is basically the result of electrons gained or lost in the P- and N-type portions of the diode, rather than the result of an ac current "leaking" between the two portions of the diode.

As the reverse bias is increased, the barrier between the two portions of the diode becomes greater and the diode's capacitance is reduced. As the reverse bias is reduced, the bias barrier becomes smaller and the diode's capacitance increases. This relationship between diode capacitance and reverse bias voltage is shown in Fig. 5 for a voltage-variable capacitance diode recently developed for tuning AM radios. Two of these diodes are shown (Fig. 6) next to a two-stage mechanical tuning capacitor they replace.

Voltage-Current Phases

A review of voltage-current phase relationships may help some technicians understand the application of voltage-variable capacitance diodes in resonant circuits for tuning receivers.

A relationship between electron flow (current) and the voltage across a capacitor was described in the September 1967 article of this series. The circuit shown in Fig. 7 is used to explain this relationship in greater detail. When the switch is closed in the circuit, electrons flow from one portion of the capacitor to the battery and from the battery to the other portion of the capacitor. The largest current (electron flow) occurs just after the switch is closed, before the voltage first appears across the capacitor. The smallest current occurs as the voltage across the capacitor becomes as large as the voltage across the battery. This voltage-current relationship is shown in Fig. 8.

Sinewaves were described with Fig. 7 and 8 in the August 1967 article. There the various portions of a sinewave were compared with the angles of a rotating line. The height of a rotating line increases and decreases more rapidly when it is nearly horizontal than when it is nearly vertical up or down. Sinewave voltages change more rapidly

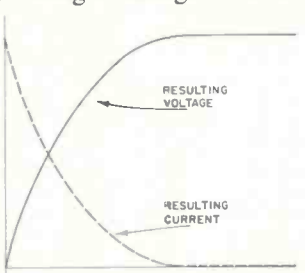


Fig. 8 — The voltage-current relationship that occurs when a dc voltage is applied across a capacitor.

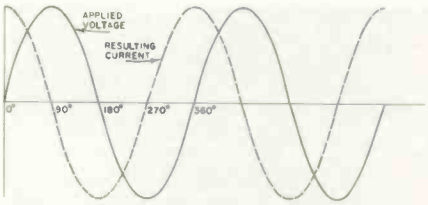


Fig. 9 — The voltage-current relationship that occurs when an ac voltage is applied across a capacitor.

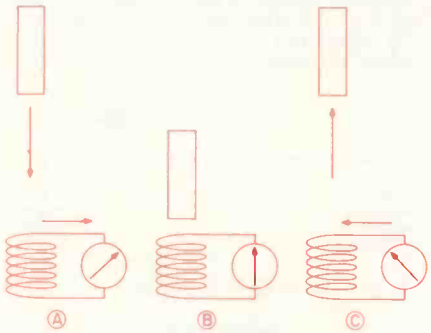


Fig. 10 (A) — A current is induced when a permanent magnet approaches one end of a coil (B) — No current is induced when the magnet remains stationary near the coil (C) — A current is induced in the opposite direction when the permanent magnet moves away from the coil.

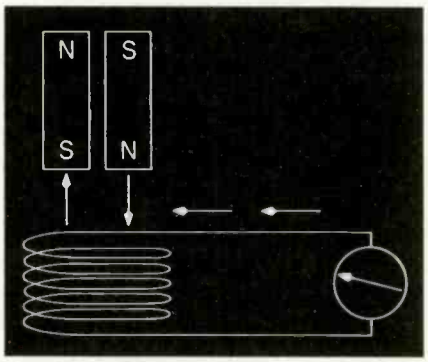


Fig. 11 — The same current is induced when the north pole of a magnet approaches a coil as when the south pole of a magnet is moved away from that end of the coil.

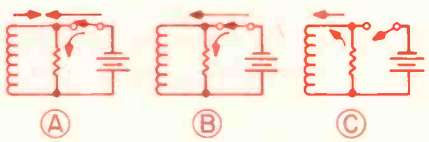


Fig. 12 (A) — When the switch is first closed, an induced current impedes any current flow from the battery through the coil. (B) — Once the coil's magnetic field has reached its maximum strength, no current is induced through the coil to impede any current from the battery through the coil. (C) — When the switch is opened, an induced current flows through the coil in the same direction as the battery current.

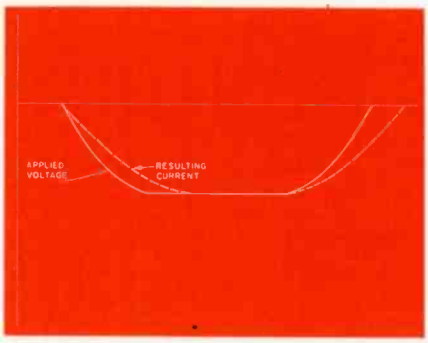


Fig. 13 — The negative current lags behind the increase and decrease in negative voltage.

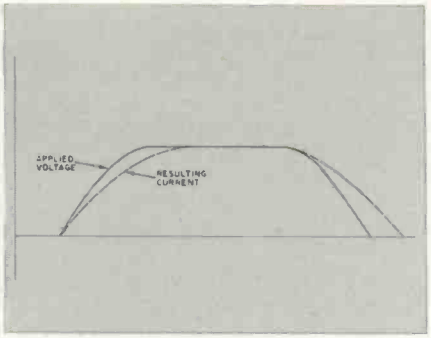


Fig. 14 — The positive current lags behind the increase and decrease in positive voltage.

at around 0 and 270deg than they do around 90 and 270deg.

When an ac voltage, resembling a sinewave, is applied across a capacitor, the voltage alternates between positive and negative. The slowest change in voltage occurs when portions of the capacitor are at nearly the maximum positive or negative voltage (90 or 270deg) and the fastest change occurs at the lower voltages or when portions of the capacitor shift between positive and negative polarities (0 and 180deg).

In Fig. 9 we see that as the voltage in one portion of a capacitor becomes positive (0 to 90deg), that portion of the capacitor loses electrons and a current flows out of the connecting lead. As it becomes less positive and then negative (90 to 270deg), electrons return through the lead. Electrons again reverse their direction and flow out of the connecting lead as this portion of the capacitor becomes less negative and then positive (270 to 360deg).

Since the greatest change in voltage occurs when the voltage shifts between positive and negative, the maximum flow of electrons (current) out of the capacitor lead (the same lead described in the preceding paragraph) occurs at 0 and 360deg, while the maximum flow of electrons into the lead occurs at 180deg.

Coil Impedances

Resonant circuits are equally dependent on the impedance of capacitors and the impedance of coils. Unless the impedance of coils and their related voltage-current phase relationships are clearly understood, the function of voltage-variable capacitance diodes, as well as mechanical diodes, are beyond the scope of the average technician. Although coils are not semiconductors, a review of their function is important for a clear understanding of semiconductor circuits.

The function of coils in electronic circuits is dependent on the magnetic fields they produce. Similar magnetic fields can be produced by a permanent magnet.

When a permanent magnet approaches the end of a coil (Fig. 10A), it induces a current through the coil's windings, and one end of the coil becomes more negative than the other. While the magnet remains stationary near the coil (Fig. 10B), no current is induced in the coil. As the magnet moves away from the coil (Fig. 10C), a current is again induced through the coil's winding. This current, however, flows in a direction opposite that of the current induced by the approaching magnet, and the coil's other lead is now more negative.

When the south pole of a magnet moves away from a coil (Fig. 11), the induced current flows through the coil in the same direction as a current induced when the north pole of a magnet approaches the coil.

The circuits shown in Fig. 12 help explain the function of a coil. When the switch is first closed (Fig. 12A), an electrical current flows through both the coil and the resistor connected in parallel with it. As the current begins to flow through the coil, it produces a magnetic field in the coil corresponding to a permanent magnet approaching the coil. Just as an approaching permanent magnet induces a current in the

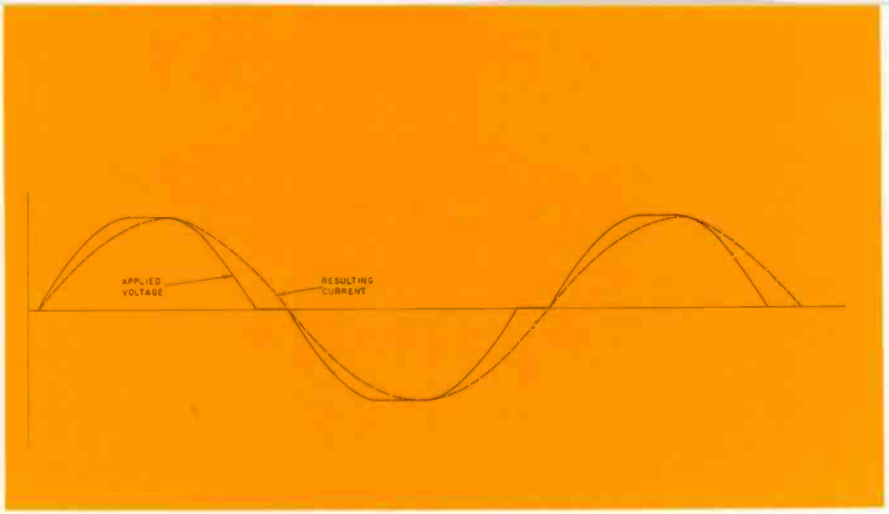


Fig. 15 — As a dc voltage is switched between positive and negative, the resulting current lags behind the voltage.

Fig. 16 — When an ac voltage is applied across a coil, the current lags 90deg behind the voltage.

coil, the increasing magnetic field induces a current opposing the current from the battery.

Once the magnetic field has attained its maximum strength and ceases to increase (Fig. 12B), it, like a permanent magnet remaining stationary near a coil, no longer induces a current. The maximum amount of current can then flow from the battery through the coil.

When the switch is opened (Fig. 12C), no voltage from the battery is applied across the coil and the magnetic field decreases. Just as a receding permanent magnet induces a current through a coil, the depleting field also induces a current through the coil, which flows through the resistor. The current now induced flows in a direction opposite that of the current previously induced. The induced current flows in the same direction as the current that had been flowing from the battery.

The increasing negative current (Fig. 13) in the circuit described lags behind the increasing negative voltage, and the decreasing negative current lags behind the decreasing negative voltage. If the polarity of the battery is reversed in the circuit (Fig. 12), the increasing positive current (Fig. 14) lags behind the increasing positive voltage and the decreasing positive current lags behind the decreasing positive voltage.

By combining the curves shown in Fig. 13 and 14 we see the current that results when a positive voltage is applied to the circuit, until the maximum positive current flows through the coil (Fig. 14); the voltage drops to zero, until the current ceases to flow through the coil; a negative voltage is applied, until the maximum negative current flows through the coil; etc. The positive and negative changes in current always lag behind the positive and negative changes in voltage.

If the permanent magnet shown in Fig. 10 approaches the coil and departs from it at a more rapid rate, the induced current becomes greater. As indicated earlier in this article, sinewave voltages do not change at a uniform rate. With an ac sinewave voltage applied across a coil, there is a more rapid change in the magnetic field when the applied voltage changes polarity than when the voltage reaches its maximum positive or negative value. The coil's induced current is therefore the greatest, further impeding or enhancing the current from the power source (Fig. 16), when the applied voltage changes polarity. Measurements indicate that when an ac voltage is applied across a coil, the current always lags 90deg behind the voltage.

When comparing the voltage-current phase relationship for a capacitor (Fig. 9) with the voltage-current phase relationship for a coil (Fig. 16), we see that in a capacitor the current leads the voltage 90deg while in a coil the voltage leads the current 90deg. The greatest amount of ac current passes through the capacitor's leads and the coil as the applied voltage changes polarity.

The amount of ac current flowing through a coil is dependent on the coil's reactance

$$(I \approx \frac{V}{X_L}),$$

just as the amount of apparent ac current through a capacitor is dependent on the capacitor's reactance

$$(I \approx \frac{V}{X_C}).$$

Although a capacitor appears to have less resistance to ac currents at higher frequencies, a coil's resistance to ac currents increases as the applied voltages and magnetic field fluctuate at higher frequencies. The coil's reactance can be calculated with the equation $X_L = 2\pi fL$, where L is the inductance of the coil.

The coil's inductance (L) is dependent on the magnetic field it produces. The greater the field's concentration, the greater the coil's inductance and the smaller the ac current it will conduct.

An iron core can concentrate a magnetic field more than an air core can. Iron has a greater permeability (μ) than air. The greater a core's permeability, the greater the coil's resistance to ac currents.

The strength of a magnetic field also depends on the core's cross-sectional area (A), the number of turns of wire (N) around the core and the coil's length (l). When the core's area (A) is expressed in square inches and its length (l) in inches, we can use this data to calculate the coil's inductance (L) in henries,

$$L = \frac{\mu N^2 A 10^{-8}}{l}.$$

The next article in this series will describe the operation of series-resonant and parallel-resonant circuits, and show how varicaps can be used to vary the resonant frequency of the parallel-resonant circuits used to tune receivers.■

Use specialized testers to troubleshoot and align color sets faster and more accurately

Unique Test Instruments for Color TV Servicing

■ About 10 years ago, Bob Middleton demonstrated some magic techniques for aligning and troubleshooting color TV sets by using an oscilloscope and rainbow generator (ELECTRONIC TECHNICIAN August 1957). Since then, a more convenient, compact scope/generator combination instrument has been designed and manufactured which employs the principles outlined by Mr. Middleton.

The Vectorscope

The Lectrotech, Model V7 color generator and vectorscope combination can provide a highly significant amount of practical data, in a single waveform display, regarding chroma circuit operation. The vectorscope is a hybrid — electron tube/solid-state instrument. In addition to the vectorscope display, the instrument also provides five normal crosshatch, dot, vertical line, horizontal line and color bar patterns. The instrument's RF output is tuned for channel 4 at the factory but it is also adjustable to either channel 3 or channel 5. It has a self-contained CRT, internally connected to receive and reproduce the color signal on the CRT's face. And the screen of the CRT is marked to indicate where the individual color signals should appear. Any variation from these markings, of course, indicates troubles in the color section.

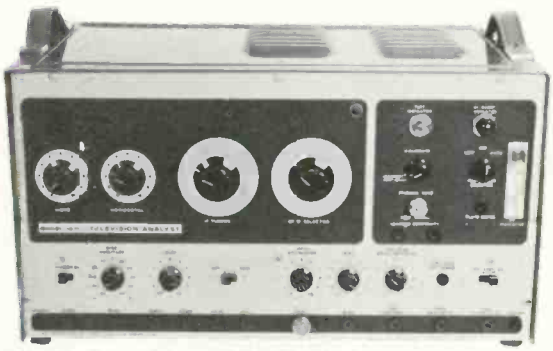
As described by Bob Middleton in the previously mentioned article which was written 10 years ago, the vectorscope screen shows the phase of each color bar with respect to the burst signal — including the important R-Y and B-Y signals. Thus, the hue range control can be accurately centered and the demodulator alignment can be checked or adjusted to provide equality between the red and blue amplifier gain. In effect, complete information regarding the performance of the color circuits can be obtained.

The color signals, R-Y and B-Y, are applied at a 90deg angle to the deflection plates. The R-Y signal falls at the top of the vectorscope screen when the hue control is correctly set and the B-Y signal falls at 90deg (3 o'clock) when the color demodulator is properly adjusted. G-Y is automatically developed on the scope screen because of the natural matrixing of the B-Y and R-Y signals which takes place within the tube and produces green on the color set screen. Then, a signal which is part R-Y and part B-Y — for example, a magenta signal — appears between the red and blue signals because both the B-Y and R-Y voltages act upon it. This holds true of all the 10 bars — each bar is displayed on the vectorscope in its proper order and phase angle. The vectorscope principle, because it conforms totally with compatible color TV basics, is perhaps the most logical approach to color TV troubleshooting and alignment.

Perhaps it would be helpful at this point to reiterate: The G-Y voltages on the color set's CRT grid are not used to produce the vectorscope pattern.

It may also prove helpful to point out that the rainbow generator in this instrument is a crystal controlled oscillator which operates at the normal frequency of 3.563795MHz — and provides the color signal. The color TV receiver being checked automatically phase-locks on this signal during the horizontal blanking period. Since the receiver's oscillator frequency is normally 3.579545MHz, you will recall that the difference between this frequency and that of the rainbow generator used in the vectorscope is 15.75kHz — which, of course, is the set's scanning frequency. Since phase-lock occurs at the beginning of each horizontal

Lectrotech Model V7 vectorscope.



B&K Model 1076 television Analyst.

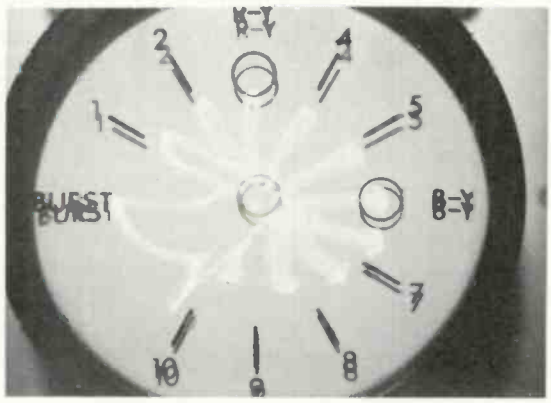


Fig. 1 — Correct vector display from a Zenith color circuit.

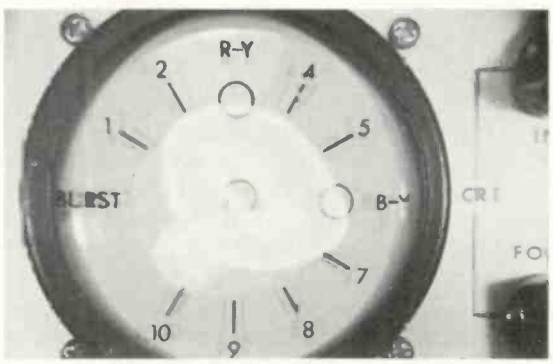


Fig. 2 — Vector display showing all colors present but out of color sync.

line, the offset color signal "appears" to the receiver as a color signal which undergoes a phase change of 360-deg during each horizontal scanning period.

For some time now, ET's editor/technicians have been using the vectorscope on a Zenith color chassis (a 20X1C38 chassis) to simulate various practical problems which may arise at any moment during the technicians normal working day.

Vector display photographs taken directly from the model V7 CRT in ET's TEKLAB are shown in Figs. 1 through 4. A Zenith color chassis 20X1C38 was used to simulate the troubles shown.

The vector pattern may vary slightly from set to set, particularly between different brands — but the specific areas of importance on the vector patterns are the ends of the vectors which must be placed into the center circle of the graph on the face of the instrument's CRT by adjusting the horizontal and vertical controls on the front of the V7.

Vectors on RCA sets all have approximately the same length. This is not true of Motorola and Zenith sets. The R-Y vector on Motorola is longer than the B-Y vector, while Zenith is just opposite, as shown in the following vector display patterns.

A correct vector display is shown in Fig. 1, with the ends of the vectors dropping into the R-Y and B-Y circles and the 3rd bar is in the middle of the R-Y circle. The 6th bar should occur within the confines of the B-Y circle or lie along a line connecting the B-Y circle to the center.

The vector display showing all colors present, but out of sync, is shown in Fig. 2. The rotating vector which appears as a solid mass of green results when there is no color sync.

If the receiver does not have enough color gain — all the vectors reduced by the same amount — then the trouble is in a stage common to all colors as shown in Fig. 3.

If the bandpass amplifier is in need of alignment, the vector pattern crosses over on itself and again opens into a loop — this also indicates poor color amplifier alignment. This condition is shown in Fig. 4.

The Analyst

The B&K TV Analyst is a flying spot scanner video signal generator coupled with an RF transmitter. Many of the circuits used in this instrument are familiar to service technicians because they are similar to those used in most TV sets today.

Loss of color, weak color or distorted color can occur in the RF or IF sections of a receiver as well as in chroma circuits. The Analyst is useful in quickly troubleshooting these symptoms since either the RF or IF signal may be modulated with the rainbow color signal which is injected into the RF or IF stage to localize the fault.

A chroma signal is also available and may be injected directly into the video detector, video amplifier, bandpass amplifier or to the grids of low level demodulators. These checks localize phase errors by showing the wrong sequence of color.

Phase errors arise in the chroma, or in the IF section. It is possible for the RF section or video section to cause phase errors, but not common. If you inject the chroma signal into the bandpass amplifier and get a normal color pattern, the next step is to inject an IF signal modulated with chroma information at the input of the IF amplifier.

When a phase error is found in the latter check, it is indicated that the IF amplifier is in need of proper alignment.

By referring to Fig. 5, you will see the vector display of the color information that can be obtained for a phase shift of any given number of degrees. For example, 60deg represents a +(I) signal. A 90deg phase shift represents +(R-Y). And 180deg represents +(B-Y) and a +300deg represents (G-Y). To change a color rainbow signal to a color bar signal, we electronically blank out with the 189kHz oscillator those portions of the rainbow display that we do not want and allow the portion of the rainbow that we do want to come through. You will note there are ten light intervals and nine dark intervals equally spaced. Each bright interval or bar, represents a color phase shift of 30deg and is so placed to give the colors as indicated in Fig. 6. You will note, for example, the 2nd bar is indicated as orange and its color corresponds to +(I) since it is 60deg from the reference signal. The 6th bar, for example, is a blue color and corresponds to +(B-Y) since it is 180deg from reference signal. The color pattern will be extremely useful in servicing color TV receivers since it will enable you to check the range of the hue control and will provide a simple method of color demodulator alignment.

Since most of the color TV receivers in use today demodulate a +(R-Y) and a +(B-Y) signal, the following demodulator alignment will refer to this condition only.

Connect the TV Analyst to the receiver under test and set up and adjust for a proper picture on the TV receiver. Be sure the horizontal frequency of the generator is adjusted to the correct frequency. Turn the color signal on and insert the R-Y, B-Y slide into the

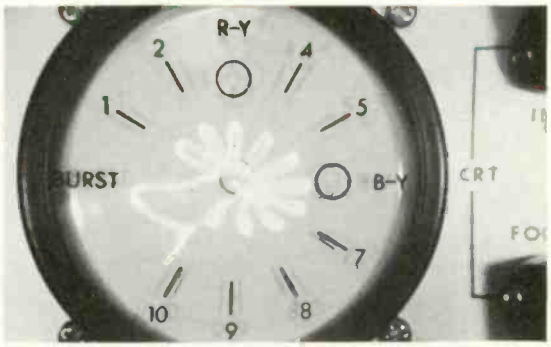


Fig. 3 — Vector showing receiver lacking color gain.

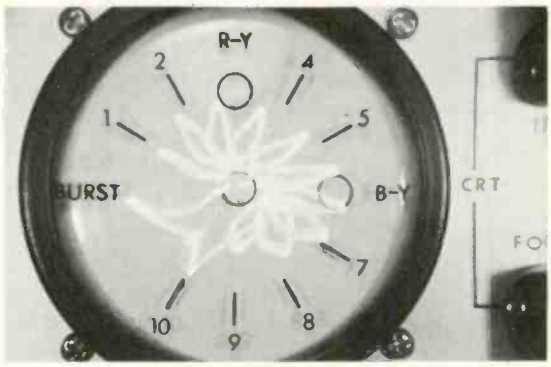


Fig. 4 — Vector showing bandpass amplifier out of alignment.

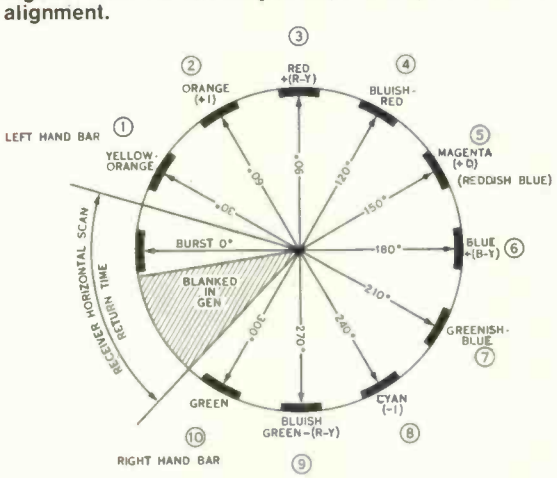


Fig. 5 — Color vector diagram showing relative phase relations of color signals. Shaded area represents duration of horizontal sync pulse.

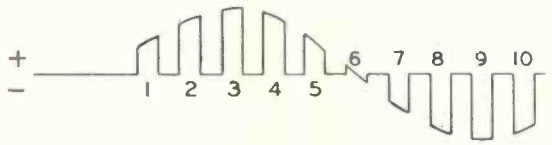


Fig. 7 — R-Y demodulator output as seen on scope.

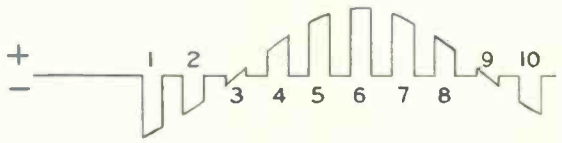


Fig. 8 — B-Y demodulator output as seen on scope.

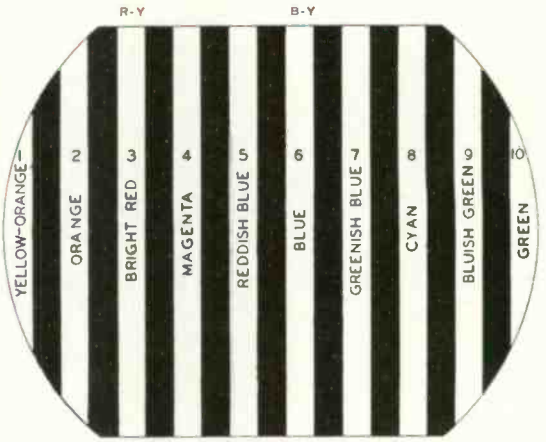


Fig. 6 — Color pattern showing each bar, the number and its color.

Analyst. Adjust the video control on the generator to get good reproduction of the bars and adjust chroma and hue controls for the proper color signal level so the color bars occur in the proper sequence as shown in Fig. 6. If the color bars do not fall into the proper sequence, the coarse adjustment of the hue range located inside the receiver will center the range of the hue control. At this point it is well to indicate that the horizontal width of the receiver under test should be reduced to ten bars.

We know the output of the +(R-Y) demodulator, if properly adjusted, should have zero +(B-Y) output and the output of the +(B-Y) demodulator should have zero output of +(R-Y) signal.

Since our color bar pattern has both a +(R-Y) signal which is the 3rd bar and a +(B-Y) signal which is the 6th bar, we can use these signals to check and align color demodulators.

Connect a scope of adequate bandwidth to the output of the +(R-Y) demodulator. You will see a waveform similar to that shown in Fig. 7. This is viewed at a 15.75kHz sweep on the scope. The 6th bar which is +(B-Y) should be at zero amplitude as (shown in Fig. 7). If this condition is not met, set the hue control to its center position and adjust the coarse hue control adjustment which is located within the TV receiver so that the 6th bar is at zero amplitude. Now connect the scope to the output of the +(B-Y) demodulator and adjust the quadrature transformer driving the +(B-Y) demodulator so the 3rd bar which is +(R-Y) is at zero amplitude (Fig. 8).

The color demodulators are now properly aligned so no +(R-Y) signal gets through the +(B-Y) demodulator and also no (B-Y) signal gets through the +(R-Y) demodulator. ■

Good Service Promotes Steady

Service-dealer operation shuns discount business and technician

■ When Grant and Grant, 586 Bank Lane, Lake Forest, Ill., took over the radio repair department of a retail operation on Western Avenue in 1947, they bought a lot of "service goodwill" which has helped it grow steadily over the years. In the beginning its annual gross was around $50,000. But business has increased with neighborhood growth.

By 1957, business had expanded to such an extent that the father-and-son team decided to open another store in Highland Park. The new operation was an immediate success, partly because of a promotional deal involving personal appearances of recording stars, including Homer and Jethro, Pearl Eddie and Tommie Leonetti. Phonograph record sales spurted and people began buying phonographs and Hi Fi equipment, and this added impetus to the store's business growth.

"But, when color TV began to boom," the senior Mr. Grant says, "we ran into a problem. We needed better antennas on the store roof to provide higher gain for good color TV reception from Chicago. And the landlord wouldn't let us put the kind of antennas we needed on the roof. So we moved to another location a few blocks down the street. We were able to put up adequate antennas at our present location on Bank Lane."

Today, the Grants employ five people in Lake Forest, three in Highland Park and last year's gross was around a quarter million dollars. Eighty percent of this came from sales and about 20 percent came from service operations.

Advertising and Sales Promotion

"We spend between $5000 and $6000 a year on newspaper ads around Christmas time," the senior Mr. Grant says. And this covers an area extending south to Wilmet and west to Northbrook.

"Our records indicate that our old customers repeat steadily," Mr. Grant declares. "And besides, because of our past customer relations efforts in the direction of top-level service, we obtain a lot of new customers through word-of-mouth advertising.

"We do have some competition from discount houses that moved into nearby communities recently," he admits. "With large-volume, low-overhead sales, these stores are able to undercut us on color TV sets. But they can't compete with us on service."

Mr. Grant points out that he could compete with the discount houses if he had enough technicians.

"But if we went out to get the discount business we would have to give good service on the sets. And with the present shortage of service technicians, we'd probably get into trouble. We're servicing all the sets we can handle right now."

Mr. Grant indicates, even if the company wanted to expand its operations and push sales upward, it would be difficult to hire additional technicians to handle the service on any large increase in color sales.

Mr. Grant understands that the apprentice training programs now under way throughout the country will eventually help solve this problem and make it possible for small and medium-sized service-dealer operations to continue expansion at a higher rate.

The senior Mr. and Mrs. Grant handle sales in the Lake Forest store while their son operates the Highland Park store. Mr. Grant handles the payroll and accounting for both stores.

Service Setup

The service shop is located in the basement of the Lake Forest store and any service originating in the Highland Park store is processed in the Lake Forest shop. This store is open to the public 44 hours a week while the Highland Park store is open 52 hours weekly. The service manager, with 25 years' industry experience, is in charge of service for the areas served by both stores and he, with another technician, concentrate mainly on home calls.

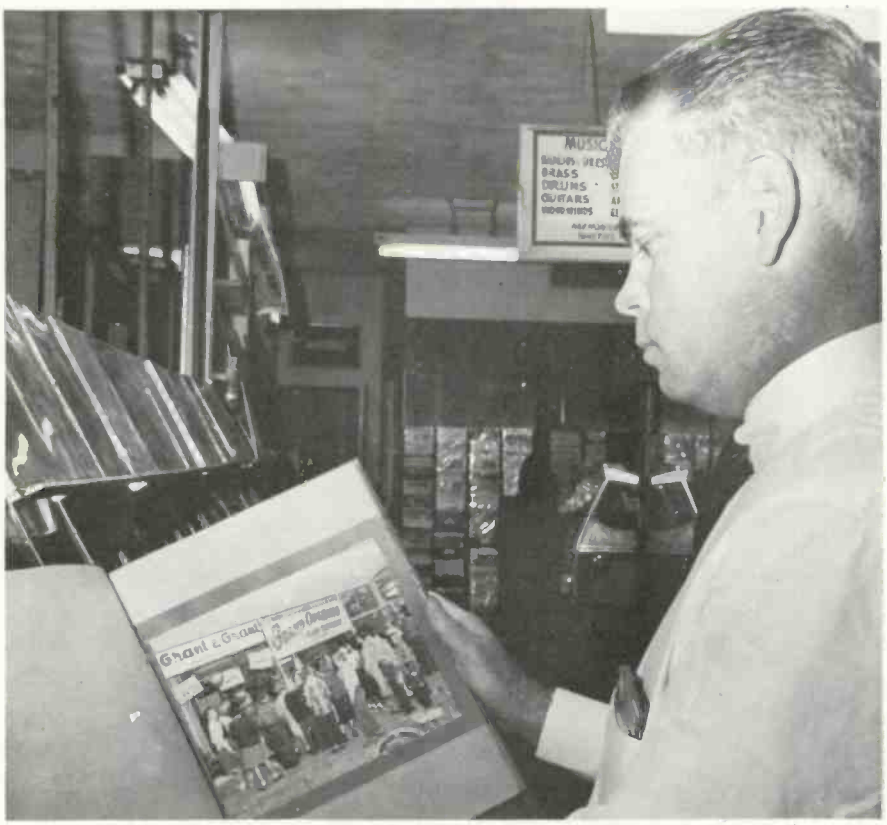
A part-time technician, who is also an electronic technician First Class at the s.s. Great Lakes Training Center, also helps with service work. There's one benchman that works in the shop all the time.

Front of Lake Forest Store.

Technician working in shop at Lake Forest store.

Sales Growth

shortage slows expansion of color TV sales



Young Mr. Grant looks over photo album covering promotion using recording stars.

Salesman demonstrates TV set in sales room.

Senior Mr. Grant takes telephone call from customer.

Mr. Grant says that solid-state equipment is a lot harder to service than tube equipment, and most of it has to be done in the shop.

"We average around 125 house calls a month and repair 50 or 60 portable radios, about 10 home radios and about 20 to 25 Hi Fi units and tape recorders. We also sell and install 8-track cartridge players for cars."

Mr. Grant estimates that color sets are replacing B/W sets at the rate of about 75 percent in his area.■

WHO'S SELLING

Thousands of small-to medium-sized service-dealer operations are boosting sales by giving the public better service and paying commissions to house-call technicians who provide leads and close sales

▪ Figures released by the Electronic Industries Ass'n. (EIA) reveal that the consumers of this country spent over $6.5 billion for electronic equipment in 1966 — including TVs, phonographs, radios, Hi Fi equipment and antennas. This doesn't include electronic replacement parts nor equipment bought by industry and government. The entire bundle amounted to over $20.2 billion!

But $6.5 billion is a lot of "clams," too.

And who do you think sold all this equipment to the purse-powered public? The discount houses? The hardware stores? The home-furnishing stores? Or the drug chains? Not by a long shot!

Dick Weber of Weber's Television in Pasadena, Calif., says he sold $300,000 worth of it last year. And this figure includes $90,000 for services which he sold to *keep the equipment sold*. This is something the discount houses and the hardware stores and the home furnishing stores and the drug chains can't do. And Mr. Weber makes no bones about the fact that service is the bedrock on which sales rest.

"We once leaned in the direction of a 'chain operation,' " Mr. Weber says. "But we closed the second store we had opened and decided to maintain a 'personal business' relationship with the public."

According to Dick Weber, this idea paid off. His business has shown a steady increase of more than 15 percent annually during the past few years. Mr. Weber has been running this business for the past 15 years — he's no fly-by-night, quick-buck operator.

Now Weber's has one store in South Pasadena, concentrating on service within a 5-mile radius.

About seven years ago Dick Weber went exclusive on one brand of TV, selecting a top brand after considering the possibilities carefully.

"That's the best single business decision I ever made," he says.

"First, we got to know the product thoroughly and

WHAT, WHERE AND HOW?

became experts on the product in our territory. Then, according to our agreement, the distributor won't place the line with others in our territory as long as we do the sales job for them."

Except for service advertising in the yellow pages, Weber's does not presently do any advertising. Discount prices, he says, seem to be the only thing that get any newspaper attention in his hotly competitive area and he doesn't intend to take that road.

"One thing we've found important in building a personal identity is free telephone advice. In this respect, being a service technician is something like being a doctor. People want to be reassured. Most people understand less about their TV and Hi Fi equipment than they do about their own bodies. When something goes wrong, they need expert consultation.

"Telephone consultation keeps our customers from coming down to the shop or prevents our having to make a useless service call.

"Another way we build our image is not to write out a job ticket every time a radio is brought in. We average about 15 customers each day who bring in a radio that's not working. In more than 20 percent of the cases the radios need only batteries or a tube or some small adjustment. We fix them right in front of the customer at no charge for labor.

"A little free radio repair and service advice brings in the big repair jobs and boosts sales. We've had customers so impressed with this that they've come back and bought a color TV from us. If you take care of their little problems, chances are they'll purchase their major home-entertainment items from you."

Tom Carmichael, TV and stereo manager of Balcom & Vauhan, Seattle, Wash., grossed over $750,000 in TV and stereo sales and service last year.

"I believe our sales figures strongly indicate that the specialty dealer can compete effectively with leading department stores and quality home furnishers who have previously had more or less a corner on selling TV and stereo as both home decor and entertainment," Mr. Carmichael says.

This reminds us that not all change is taking place in technology alone. Merchandising is no longer in the "hot-shot" area. The "ma" and "pa" operations are growing up.

"It's our experience that the small- to medium-sized dealer has a considerable advantage since the general public believes the small dealer will give better personal attention and follow-up on service after a sale than will department stores and home furnishing stores," he emphasizes.

Gearing to the booming TV market begins with a strong advertjsing campaign, Mr. Carmichael believes. The follow-through depends on the proper kind of sales setup — and the bedrock of this merchandising struc-

Byron Napper's Hampton TV Service in St. Louis is typical of the tens of thousands of "mama" and "papa" service-based TV-radio sales organizations that have grown up in recent years.

WHO'S SELLING WHAT, WHERE AND HOW?

ture rests on the quality of service rendered by the shop.

To bring in the traffic, Mr. Carmichael budgets approximately 3 percent of gross sales to advertising. The company is a one-brand dealer and uses co-op advertising exclusively — which gives a fat budget for presenting color and stereo equipment to the public.

A full-page ad goes in the Sunday TV supplement of Seattle's leading newspaper every week. Approximately half of this is on color TV and half on color TV stereo "theaters." Four column wide by 10in. deep ads are also used in both local daily newspapers for a mid-week exposure — increasing to three ads a week during the fall selling season.

Selling color TV is fundamentally no different from selling B/W, Mr. Carmichael emphasizes, but color TV offers a prime opportunity to upgrade the market. The company's sales technique is to stress furniture, tone and picture, in that order. The demonstration begins by showing the top of the line.

"The basis of salesmanship is product knowledge, including some knowledge of competitive lines," Mr. Carmichael points out, "and then an orderly demonstration procedure."

"The majority of our sales are running in the $300 to $750 price bracket," he says. "With the color TV stereo theater hitting around 30 percent of the sales, I believe we're doing a considerable job in upgrading the home entertainment market.

"Like most dealers, we think there are too many models and too much inventory required, even in a one-line dealership. But the market is on the boom and we must have the broadest possible selection to close the sales. The dealer who gets his color customers now is laying the foundation for increased service and sales in the future."

Over in St. Louis, Mo., owner Byron Napper of Hampton Radio and TV Service believes that selling color is the best way for his service-based business to thrive.

"Don't get me wrong," he says. "I realize that the biggest profit dollar for me is in the service end. But the swing to color sales increases your chances of making more regular service customers."

Although sales-oriented, this operation is service-based. Service accounts for about 60 percent of gross, which was somewhat above $100,000 last year.

Fast, priority service keeps Hampton color TV owners happy. "Color always gets priority over B/W service here," Mr. Napper says. "We make every effort to get the ailing set in proper operation the same day, even if the customer has a second B/W set."

Mr. Napper, like many other service-dealers, offers incentive pay to his technicians who furnish leads and close sales on home-entertainment equipment.

A technician gets 15 percent commission on any sales he makes whether in the home or on the sales floor.

Hampton has a color-oriented sales floor — a daytime-viewing booth has been made especially for color TV viewing. Located in a dramatic spot at a corner of the salesroom facing the entrance, this is simply constructed of colorful drapes and a small platform on which the set is placed. When open, as it usually is, the booth spotlights the color set. When closed simply by a tug on the drapes, it shuts out almost all light — to provide good viewing.

The advertising budget of Hampton is heavily influenced by the emphasis on color. Amount and type of advertising is decided by the color situation. Most is co-op and runs about 5 percent of gross sales.

Hampton is also one of the largest car radio and cartridge tape installation and repair shops in St. Louis.

The outside Hampton technician is an excellent customer relations man. He keeps tabs on work flow in the shop and tells any customer when to expect delivery on a set which is in the shop for repair. His promise is usually one to two days, but if it's a big job, he says, "We'll call you." Hampton religiously follows a policy of never promising what it can't deliver.■

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COLORFAX

Westinghouse Introduces 'On Screen Tuning Bar' Feature

Proper fine tuning of the local oscillator in a color television is as important and much more critical, than for monochrome receivers. The reason being that all color information can be lost if the fine tuning is misadjusted. Therefore, some means of indicating proper fine tuning for color, as well as for B/W reception, would be an aid to the viewer.

This method employs the CRT screen as the indicating device. The presentation is to display the degree of mistuning, to show the necessary direction of adjustment for correction and to indicate when correct tuning has been achieved. See screen illustration.

The object is to display two vertical lines on the CRT screen when the viewer desires to check or adjust the fine tuning. The lines are superimposed with the received picture and provides simultaneous viewing of picture quality and fine tuning indication. A switch is provided so the viewer can remove the vertical lines when he completes the adjustment.

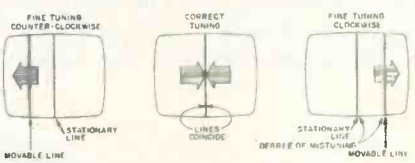
One of the lines is stationary and acts as a reference. The other line is movable with fine tuning adjustment and can move to either side of the reference line. Correct fine tuning is indicated when the lines coincide. The direction of mistuning is indicated by the position of the movable line with respect to the stationary line. Also, the degree of mistuning is indicated by the spacing between the two lines. The larger the spacing, the greater is the degree of mistuning.

The circuits responsible for developing the two dark vertical lines on the CRT are shown in the block diagram. These circuits will provide two sets of gating pulses sufficient to cut off the video amplifier for approximately 1 or 2μs. This results in two dark vertical lines appearing on the screen of the CRT. Two dc voltages are also developed to control the pulse forming circuits.

One voltage, referred to as the reference voltage, is developed across a voltage dividing network consisting of resistors, R921, R922 and R923. This voltage develops the stationary or reference line. The other voltage, referred to as the control voltage, can be varied by adjusting the fine tuning control. This voltage develops the movable vertical line.

The circuits to be described, except for the video gate circuit, are combined on one small separate PC board and attached to the main color TV chassis. Three sources of voltage are required for the added circuits. Two of the voltage sources are obtained directly from the chassis power supply. The third source is developed in the cathode circuit of the audio section.

A push-on/off type switch, located on the control panel, is provided to activate or deactivate the multicircuits so the generated lines on the CRT screen can be turned on/off. The control signal portions of the circuitry are continuously activated. The reason for this is, if these transistors were switched off there would be detrimental loading on the video circuitry of the main chassis and also the possibility of harmonic generation (tweet) in the slope detector portion.



The lines are generated in a time-sharing system in which the reference line is generated during one picture field and the movable line is generated during the next field. The required signals needed to generate the lines are a series of narrow video gating pulses of about 1 or 2μs duration and synchronized to the horizontal scan rate. These video gating pulses as shown in waveshape "A", are sent to the grid of the video amplifier, cutting the amplifier off. Diode X203 acts as a closed gate during these pulses allowing them to be applied to the grid. At the same time, diode X204 acts as an open gate, preventing any video information from arriving on the grid of the video amplifier.

The 1 or 2μs video gating pulses are generated in the monostable multivibrator. This circuit consists of a pair of transistors, Q907 and Q908.

The pulses necessary to operate the monostable multivibrator are shaped by the differentiator, as shown in waveshape "B". The input to the differentiator is provided by the comparator.

The comparator is also a monostable multivibrator and its purpose is to provide trigger pulses (waveshape "C") to the differentiator.

The timing of these trigger pulses, in reference to the horizontal retrace pulses, (waveshape "D") will determine the position of the generated line on the CRT.

The name comparator is chosen because the circuit essentially compares the level of an input voltage to the level of an internally generated saw tooth voltage, to determine when the multivibrator will change state.

The purpose of this circuit is to allow the comparator to monitor two

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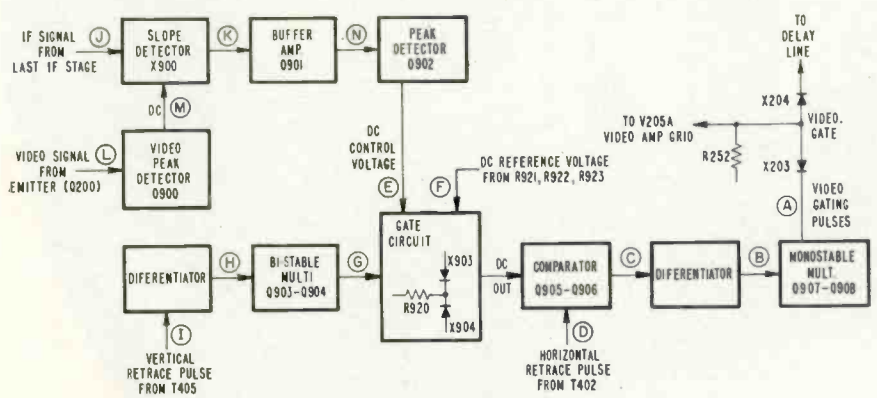
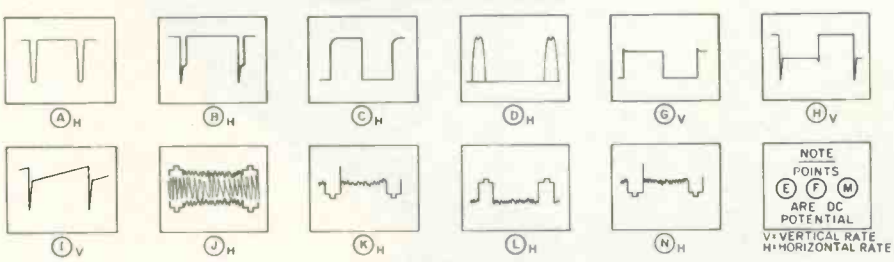


ON SCREEN TUNING BAR BLOCK DIAGRAM



WAVESHAPES ASSOCIATED WITH BLOCK DIAGRAM

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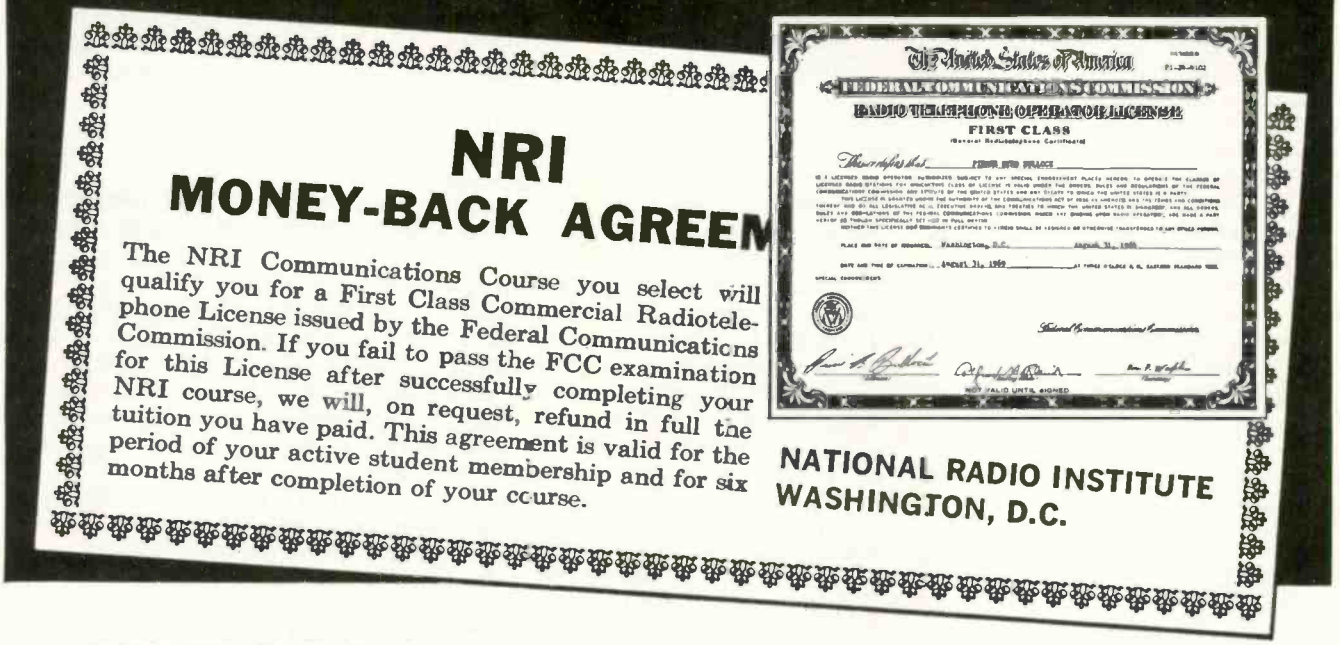

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continued from page 66

different signals in a particular time sharing mode. During the first time period (one picture field) the gate presents to the comparator a reference voltage (point "F"). During the next field the gate presents to the comparator a control voltage (point "E"), which is a function of the fine tuning. The gate has two diodes and a suitable biasing scheme to provide the switching of either signal. These diode switches are controlled from a bistable multivibrator.

The bistable multivibrator changes state on each vertical pulse so the switching rate of each gate signal is 30Hz. The vertical retrace pulse from transformer T405, shown in waveshape "I", is shaped into a usable pulse by the differentiator (waveshape "H") and passed onto the bistable multivibrator.

An IF signal is taken from the last IF stage (waveshape "J") and sent to the slope detector.

The slope detector has the responsibility of converting frequency variations into voltage variations. As the fine tuning is varied, the IF picture carrier moves higher or lower in frequency, resulting in a varying output voltage from the slope detector.

This signal is then detected and filtered, resulting in a negative going video signal of about 3v P-P.

The video peak detector is used to compensate for signal level changes at the last IF stage. If the compensation were not used, the dc control voltage would not only be a function of the IF picture carrier frequency, but also of its amplitude. For strong moderate received signals the AGC system of the receiver maintains the IF picture carrier level relatively constant at the input to the slope detector. However, for received signals below the threshold of operation of the AGC system, the IF picture level will decrease and so will the dc control voltage. To compensate for this, the level of IF picture carrier is monitored by taking the video signal from the emitter of the first video amplifier, Q200, and sending it to the video peak detector (waveshape "L"). The video peak detector dc output voltage (Point "M") is then added in opposite polarity to the slope detector output. Relatively good tracking is achieved so the dc control voltage remains constant at correct tuning for strong to zero received signals.

The buffer is needed to isolate the peak detector from the slope detector, otherwise there would be loading on the tuned circuit of the slope detector. The output of the buffer amplifier is shown in waveshape "N".

Following the buffer amplifier is a peak detector for the video signal developed by the slope detector. The output of the peak detector is a dc potential at Point "E".

Field Adjustment of AFC Circuit In Admiral 4H12 Color Chassis

1. Remove cabinet back and power with cheater cord.
2. Properly adjust preset fine tuning for each active VHF channel. (Fine tune until you observe familiar "diamond" pattern color/sound beat, then back off until pattern just disappears. This is the only correct fine tuning point.
3. Turn on AFC — if AFC is not properly adjusted, receiver will detune, do not try to retune.
4. The AFC subassembly is located below the chassis, between power transformer and IF strip. However, adjustments can be made from top of chassis through adjustment holes in chassis pan. Secondary coil L803 is the AFC coil having a yellow form.

continued on page 70

COLORFAX

continued from page 68

5. Adjust L803 slightly (no more than ⅛ turn) until detuning ceases. Do not adjust any other coil in this area. If AFC will not respond with this slight adjustment, do not attempt further adjustment — repair is indicated. If L803 is not severely misajusted it will be easy to restore proper operation when the trouble is found and repaired.

6. Check operation of AFC on UHF channels, if any, in a similar manner (tune with AFC off — turning AFC on should not detune). It may be necessary to compromise L803 adjustment slightly between VHF and UHF.

Warranty Returns of Philco 'P' and 'Q' Line Color-TV Horizontal Output Transformers

Engineering evaluation of a large percentage of horizontal output transformers returned in warranty has shown that those tested were good and had no defects. Technicians have been returning the transformers because of wax drippings which appear on the base of the transformers. These wax drippings are normal and are caused by heat generated by the transformer.

An excess amount of wax drippings may be more apparent on "Q" line transformers because they have been double-impregnated with wax. Therefore, any transformers that are suspected of being bad, should be checked to ascertain if they are bad.

The following checks should be made:

1. Using a VOM or VTVM check for open windings, making sure the dc resistance of the windings agree with the schematic.

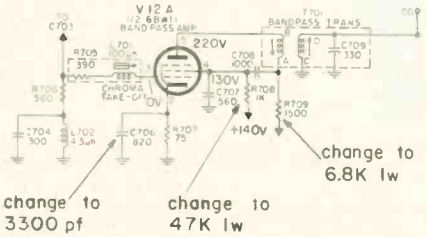
2. Although a VOM or VTVM will not indicate one shorted turn, a shorted turn can be found by using a a flyback tester or a B&K Analyst.

3. Check the two 430K resistors (R218 and R219) which are mounted on the transformer. Also, check the 0.0027μf, 2.5kv capacitor (C210) mounted on the transformer. The resistors and capacitors are replaceable and are carried by the accessory division under the following part numbers.

430K resistor 33 - 1363 - 145
0.002μf. 2.5kv capacitor 30-4712-2

Increasing Chroma Gain on Canadian G-E M678/M679 Color Chassis

There may be instances, in some locations, where additional chroma gain is desirable.



The following modification has been developed which provides considerable additional chroma gain.

1. Change bandpass V12A cathode bypass capacitor, C706, 820pf to a 3300pf (ET22X127).

2. Change bandpass V12A screen resistor, R708 1K to 47K, 1w.

3. Change bandpass V12A plate resistor, R709 1.5K to 6.8K, 1w.

4. Connect dc supply to R708 from 140v to 270vdc. This can be accomplished by connecting the supply end of R708 to the supply end of R724 (junction of R724 and R709) on top of the board.

5. Make certain the CRT leads to pins 3, 7 and 12 are dressed vertically from the board. Excess length should be dressed forward underneath the yoke.

This is not intended as an instruction to rework sets, but is to be used as a cure if this complaint is encountered.

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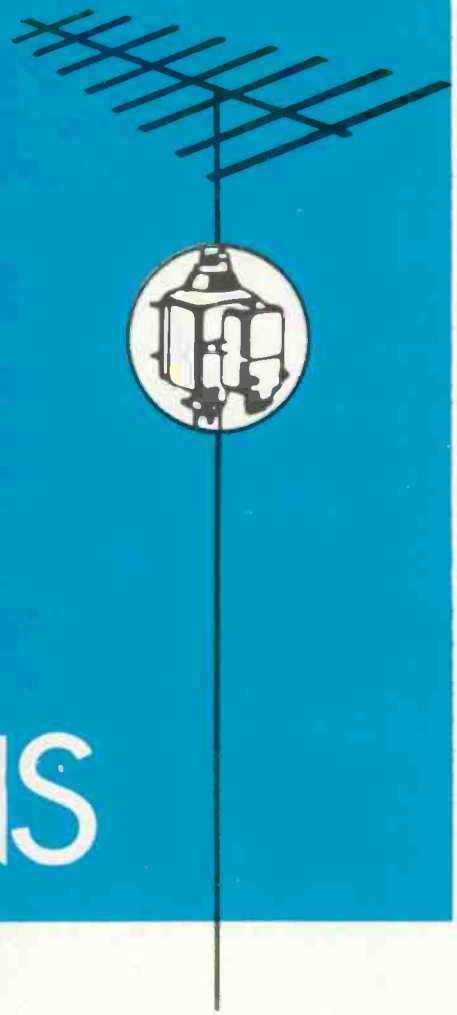

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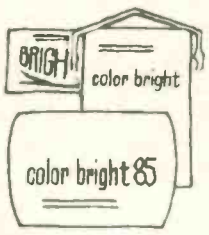

Sylvania Electronic Tube Division, Electronic Components Group, Seneca Falls, New York 13148.

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NEW PRODUCTS

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

Substitution Box 700

Announced is a resistor-capacitor substitution box that is reportedly designed to offer 684 combinations of

capacitors, resistors, or the two in series or parallel with each other. The box measures 7⅛ x 5 x 3½ in. Olson.

All-Wave Stereo Receiver 701

A 30w IHF, all-transistor receiver is designed to cover the 185 to 400kHz longwave band, 550kHz to 1.6MHz standard AM broadcast band and the 2 to 4MHz, 5.9 to 10.2MHz and 11.4 to 18.2MHz shortwave bands plus the 88 to 108MHz FM/FM-stereo broadcast band. An illuminated rotary-drum band selector shows only the band selected. A BFO is provided for code and single sideband reception. Specifications indicate that the receiv-

er can accommodate ceramic or magnetic phono cartridges, tape or auxiliary equipment inputs and will easily drive most 8Ω speaker systems. Price $269.95. Hallicrafters.

Paging System 702

A paging system is designed to enable a calling party to use a remote location telephone in a company's phone system to call a paging unit rather than having all calls encoded from a central keyboard encoder location. The system reportedly op-

erates through dial telephones connected with a "Dial 9"-type switchboard through an applique unit furnished by the telephone company. Specifications indicate that the radio paging system can handle up to 400 individual receivers. E. F. Johnson.

Field-Strength Meter 703

Announced is a solid-state field-strength meter designed primarily to serve the CATV field. It reportedly comes with an illuminated meter and can operate from self-contained rechargeable batteries or 110vac. Specifications indicate that it can cover TV

channel 2 through FM and channel 7 through 13, has a 1.5db maximum error, 75Ω "F" type input connector, four nearly linear db scales that range from −30dbmv to +60dbmv, 55db adjacent channel rejection and a 32MHz IF. The manufacturer indicates that the instrument comes in a leather carrying case that measures 4¼ x 6½ x 7in. and weighs 5⅛ lb. Price $330. Vikoa.

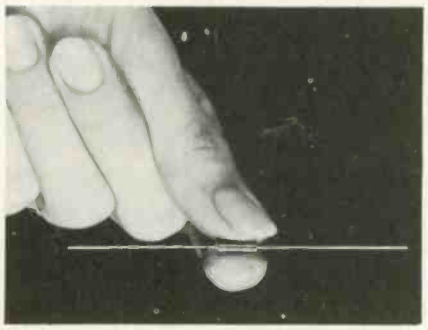
CB Transceiver 704

A 23 channel CB two-way radio reportedly contains 18 transistors plus three integrated circuits. Specifications indicate that it features dual conversion, a mechanical filter, variable squelch and automatic noise limiter.

It is designed to operate from 12vdc with either positive or negative ground and measures 2⅜ x 6¼ x 8in. Price $189.95. Lafayette.

Film Resistors 705

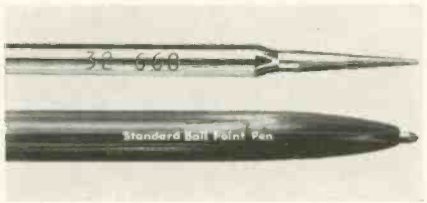
A series of metal film resistors is announced that is rated at ¼w at 70°C and ⅛w at 125°C. Specifications indicate that the change in resistance after 1000 hours load life is less



than ±0.5%. They reportedly have a 100PPM/°C temperature coefficient. Mallory.

Soldering Iron Tips 706

Announced is a soldering iron tip that is reportedly iron plated to increase service life. Specifications indi-



cate that the core of the tip is made of high purity copper. The manufacturer says that the tips are being made in ⅛, 3/32, 3/16 and ¼ in. diameters to fit all plug type pencil soldering irons. Plato.

New low cost.
New ease of operation.
No waiting. No warm-up.
No adjustments.
Brightest patterns in the industry.

The B&K 1242 Color Generator is all bu$ine$$!

There's nothing else like it. The all-new B&K 1242 represents the highest state of the art today. Go ahead and compare it; it's unique.

Ultrastable solid-state circuits make antiquated heating elements unnecessary. The 1242 works instantly in all service environments — no waiting, no warm-up, no adjustments. Other units have up to 3 times as many front panel controls. For ease of operation, the 1242 has just two: color level and selector switch. It provides dots, crosshatch, horizontal or vertical lines, and color bars. And these are the sharpest, brightest patterns in the industry.

The 1242 handles easily, too. It's the smallest, lightest-weight color generator! Rugged, too; it's all steel, with storage space for leads. It's transformer powered and complete with leads. Calls take less time and you make more money, because you can go from a cold or hot truck into a home and get right to work.

On every count, the new B&K 1242 is amazing. In time saved, it will pay for itself in just a few weeks — especially at this low price: $99.95

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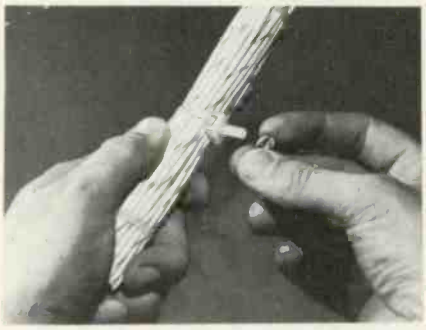
NEW PRODUCTS

Mounting Clamps 707

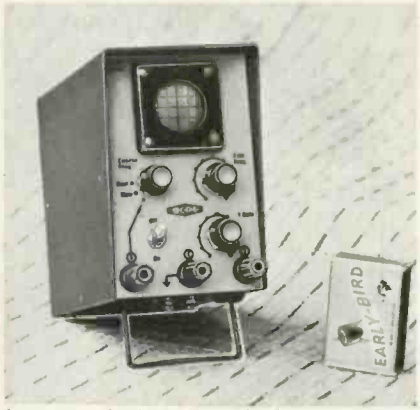
Announced are two mounting clamps with integral threaded stud for mounting wire bundles against a struc-



ture. One mounting clamp reportedly has a ¼-28 thread and the other a 10-32 thread. Specifications indicate that they have a 3/16 to 3½in. bundle range and are 13.3in. long and 0.3in. wide. Thomas & Betts.

Oscilloscope 708

Announced is a miniature scope designed to operate for limited periods from dry batteries or automobile batteries. Specifications indicate that it



has a 1v/cm vertical sensitivity, 10v/cm horizontal sensitivity, 17μsec/cm to 133msec/cm time base speed in two ranges and 10Hz to 50kHz bandwidth. It reportedly has a 3.1 x 4.6 x 5.8in. cabinet. Itonra.

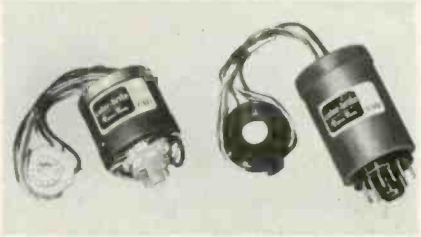
Stereo Receiver 709

An FM receiver reportedly contains 2 RF stages with five tuned circuits for selectivity and sensitivity in the front end, plus a 4-stage double-tuned

IF for interference rejection. Specifications indicate that the receiver provides 70 to 50w of IHF power respectively with 4 or 8 speakers. Kit price $159.95. Eico.

CRT Transformers 710

Announced is a color CRT isolation transformer designed to correct for color CRT filament-to-cathode shorts



and restore the B/W picture information lost. It can be plugged in between the color tube and socket. List price $11.95. Perma Power.

Power Supply 711

A transistorized zener-reference regulated power supply reportedly has a continuously variable output between 0.5 and 25v at currents to 200ma. Specifications indicate that the 4½ x 2½ x 4in. power supply

continued on page 78

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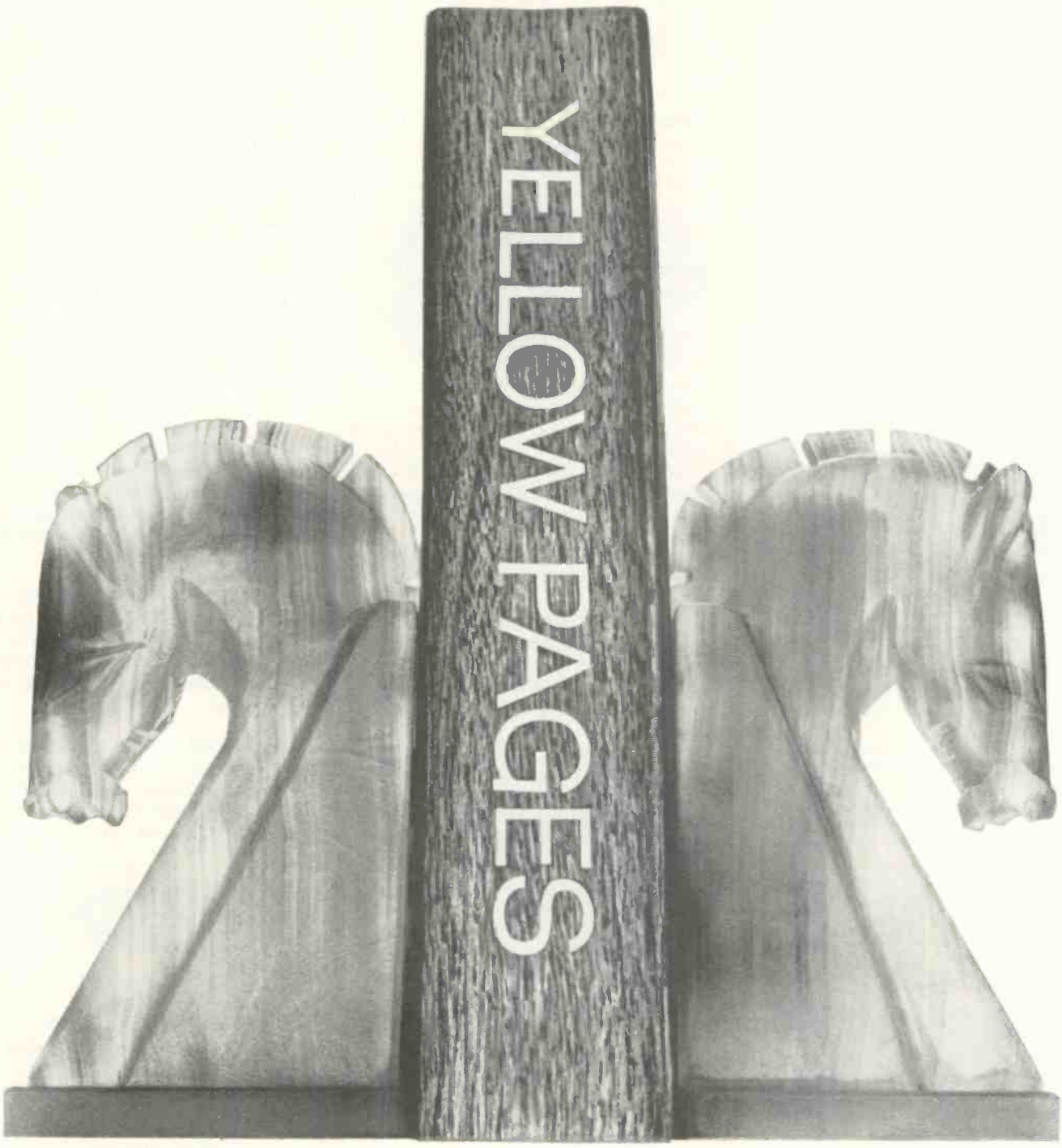


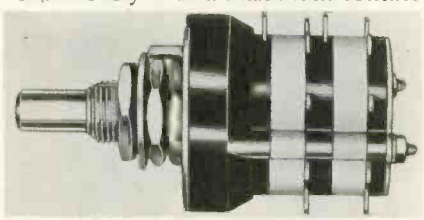
NEW PRODUCTS

continued from page 76

provides better than 100mv load regulation, and less than 2mv of ripple and noise at full load. Price $34.95. Viking.

Rotary Switch 712

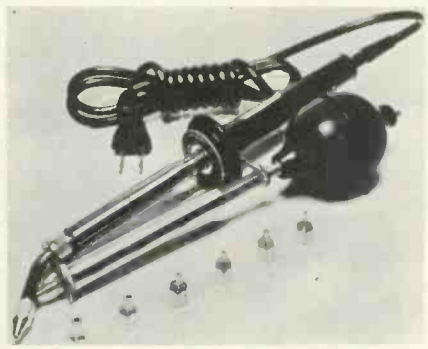
Announced is a 45deg angle of throw switch designed to carry 10a continuously with a maximum contact



temperature rise of 20°C. Specifications indicate that the rotary switch's contact resistance is 0.005 Ω, increasing to a maximum of 0.020 Ω after 25,000 cycles of operation. Prices range from $7.70 to $17.50, depending on the number of poles and decks. Grayhill.

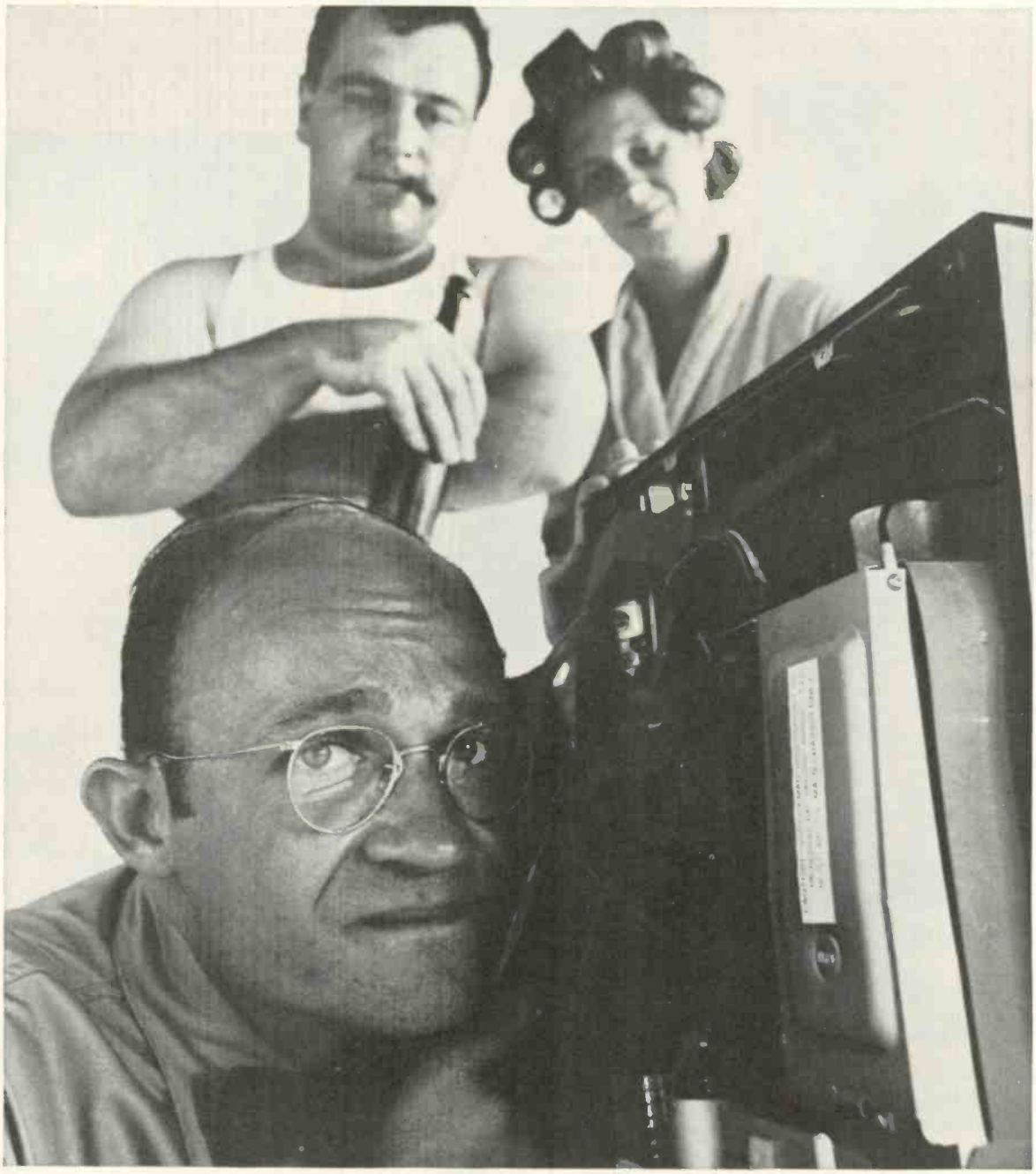
Desoldering Iron Tips 713

Two tips have been designed to increase the line of replaceable tips for desoldering irons. The tips are in the intermediate size range and reportedly come with 0.046 and 0.067in. open-



ings. Specifications indicate that the tips fit over heads or around connections to vacuum off all solder, leaving terminals and mounting holes clean. Enterprise.

If you're looking for trouble,



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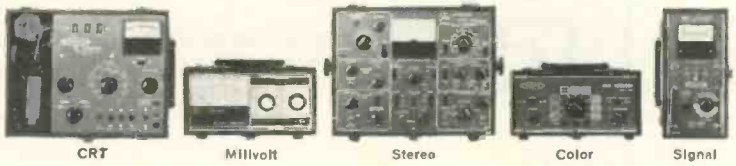

AMPHENOL

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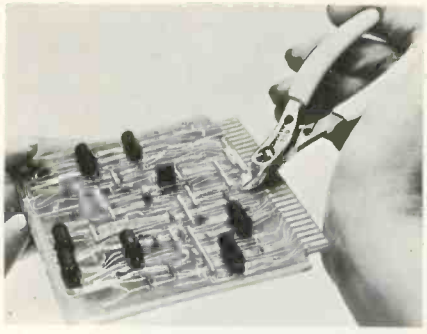
NEW PRODUCTS

Cutting Plier 714

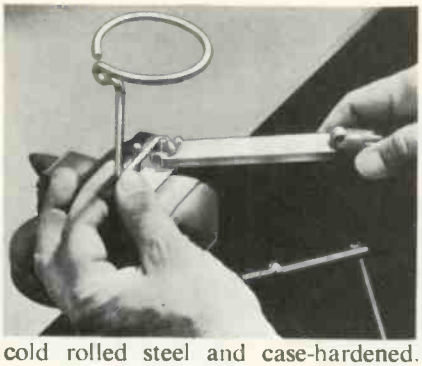
A stainless steel diagonal plier has been developed for full-flush cutting at points where wires emerge from



circuit boards and in other component wiring applications. List price $15. Crescent.

Wireformer 715

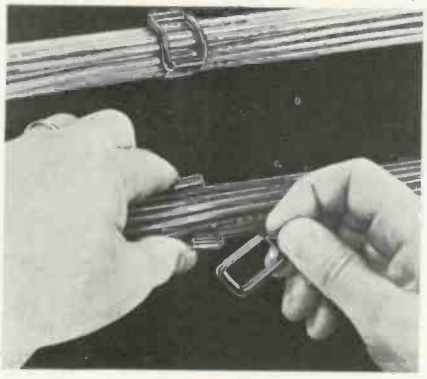
Announced is a wireformer designed to bend, straighten and cut any size wire up to 5/32in. diameter in steel, copper, aluminum, cold rolled rod and coat hanger wire. All parts of the wireformer are reportedly made of



cold rolled steel and case-hardened. Price $3.98. Winkemulder.

Cable Harness 716

A cable harness is announced that reportedly requires no special tools and permits "on-the-spot" wiring



changes when necessary. Specifications indicate that it can withstand a temperature range of approximately −76° to 212°F. Electrovert.

Wire Markers 717

A line of clip-on markers has been designed for applications where identification is required after electrical connections have been made. These markers can reportedly be removed

for recoding without breaking the terminal connection. The manufacturer indicates that they are made in an assortment of colors; come with numerical, letter or electrical symbols; and fit 0.080 to 0.570in. wire and cables. Electrovert.

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"the ANTENNA that captures the RAINBOW"

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There is a model scientfically designed and engineered for your area.

Check this chart for the FINCO® "Signal Customized" Antenna best suited for your area.

STRENGTH OF UHF SIGNAL AT RECEIVING ANTENNA LOCATION ▼	Strength of VHF Signal at Receiving Antenna Location				
	NO VHF ▼	VHF SIGNAL STRONG ▼	VHF SIGNAL MODERATE ▼	VHF SIGNAL WEAK ▼	VHF SIGNAL VERY WEAK ▼
NO UHF →		CS-V3 $10.95	CS-V5 $17.50 CS-V7 $24.95	CS-V10 $35.95	CS-V15 $48.50 CS-V18 $56.50
UHF SIGNAL STRONG →	CS-U1 $9.95	CS-A1 $18.95	CS-B1 $29.95	CS-C1 $43.95	CS-C1 $43.95
UHF SIGNAL WEAK →	CS-U2 $14.95	CS-A2 $22.95	CS-B3 $49.95	CS-C3 $59.95	CS-D3 $69.95
UHF SIGNAL VERY WEAK →	CS-U3 $21.95	CS-A3 $30.95	CS-B3 $49.95	CS-C3 $59.95	CS-D3 $69.95

NOTE: In addition to the regular 300 ohm models (above), each model is available in a 75 ohm coaxial cable download where this type of installation is preferable. These models, designated "XCS", each come complete with a compact behind-the-set 75 ohm to 300 ohm balun-splitter to match the antenna system to the proper set terminals.

THE FINNEY COMPANY

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NEWS OF THE INDUSTRY

Audio Devices Joins Magnecord In Promoting Magnetic Tape

Audio Devices announces a special promotion to introduce 8¼-in. reels of magnetic tape.

Designed for all transports capable of using reels larger than 7in., the reel reportedly contains 2400ft of 1-mil Milar — enough to provide a full hour of uninterrupted recording at 7½ ips or two hours at 3¾ ips.

Through a joint promotion, owners of Magnecord tape recorders are being invited to purchase a reel of the tape at $1 off the regular retail price. The discount is allowed only on the initial order and upon presentation to the dealer of either the promotion mailing or discount card now being included with the latest Magnecord tape recorders.

Electronic Industries Assn. Recommends Highway Channel

The Citizens Band Section of the Electronic Industries Assn. has sent a recommendation to the Federal Communications Commission suggesting "that through cooperative industry effort channel 9, provided in the CB radio frequency, be reserved primarily for obtaining emergency assistance by the operators of equipment within this service."

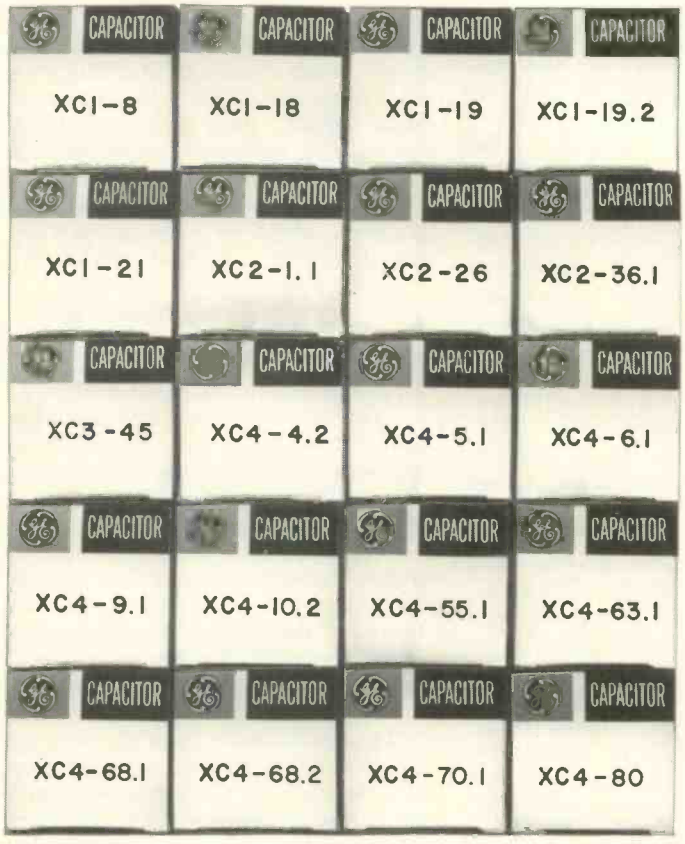
The section pointed out that the use of channel 9 would provide a communications link between motorists equipped with two-way CB radio and sources of information and assistance across the country.

Premium Program Offered To TV Service-Dealers

A new premium program offers TV service-dealers their choice of a permanently pressed Van Heusen shirt or two "Life Science Library" books with the purchase of any replacement-type RCA 21-in. color TV picture tube. The 24 books available cover topics that include mathematics, machines, the body, flight, the engineer and man and space.

To qualify for his premium, all a dealer need do is complete the registration section of the warranty card as well as indicate his gift selection on the "Volumes of Value" coupon. Both the card and coupon must be mailed to RCA at the address shown on the warranty registration postcard. The program has already begun and is expected to continue until Jan. 31, 1968.

As part of this color TV tube promotion program, RCA will also launch an extensive network-TV advertising program. A new 60sec commercial, featuring Dave Garroway, will be scheduled for American League professional football telecasts.



20 ways to break the exact replacement capacitor habit:

Stock only 20 General Electric Service-Designed replacement capacitors and meet over 70% of your replacement needs.

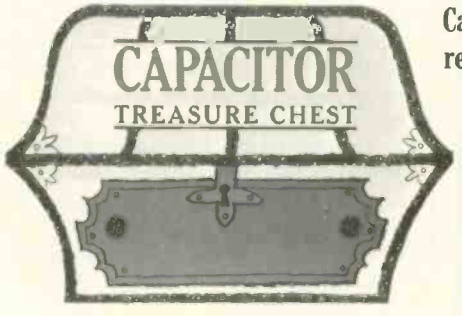
Use General Electric extended-range replacement capacitors. Just 20 General Electric Service-Designed replacement units will meet over 70% of all TV can style needs!

"Extended-range" means that fewer General Electric types are needed to meet your requirements. Every GE aluminum capacitor meets not just one, but a range of capacitance and voltage requirements. And, to make selection easier, the application range of every General Electric capacitor is shown clearly on the unit, and on the carton.

You can quickly see, for example, that the GE capacitor rated 50-60 mfd up to 450 VDC will replace any unit between 50 and 60 mfd at any voltage up to 450 VDC. You save time and money in making replacements because General Electric capacitors are Service-Designed with you in mind!

Your local GE electronics distributor carries a complete line of replacement capacitors from General Electric, a leader in supplying capacitors to the radio and television industry. Call him today for full details. 430-31

GENERAL ELECTRIC



Call your GE distributor now for a special offer on replacement capacitors for COLOR TV!

It's a Treasure Chest loaded with 12 of the most popular General Electric replacement capacitors for COLOR TV! Your distributor's offering it at a special low, low price. And to make it more appealing, you get an Xcelite® nut driver set with each Treasure Chest. Don't delay, call today! Offer is limited.

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NEWS OF THE INDUSTRY

Hugo Gernsback, Inventor, Author, Publisher Dies

Hugo Gernsback, pioneer in electronic invention, author, publisher and called the father of modern science-fiction, died on Saturday, Aug. 19. He was 83 years old and resided in New York City.

Mr. Gernsback sponsored New York's first TV broadcast in 1928. He was editor-in-chief of the monthly magazine RADIO-ELECTRONICS and editor-in-chief and publisher of the magazine SEXOLOGY. At his death Mr. Gernsback held 80 scientific patents.

His improved dry battery invention brought Mr. Gernsback to New York from his native Luxembourg in 1904. There in 1925 he founded radio station WRNY and three years later, with the help of Pilot Radio Corp. engineers, started TV broadcasts. Postage-stamp-size images were received on crude scanners owned by 2000 amateurs in the New York area.

Mr. Gernsback is widely credited with having written the first true science-fiction story, published in 1911, and with coining the term itself. In this story he accurately predicted radar, microfilm, stainless steel and numerous other now commonplace things, even including night baseball. In his honor, science-fiction writing awards are called "Hugos."

Mr. Gernsback's family said that his body would be given to the Cornell University Medical School for scientific purposes.

FTC Initiates Regulation Regarding Transistor Count

The Federal Trade Commission has announced that it has initiated proceedings for the adoption of a trade regulation rule governing the count of transistors in radios.

The proposed rule would make it unfair competition to count transistors that perform a function other than the usual detection and amplification of radio signals. Transistors performing auxiliary functions could not be included.

The commission said it initiated this proceeding because it has reason to believe that with the present emphasis on the number of transistors both in advertising and labeling a substantial portion of the purchasing public believes that the greater the number of transistors in a radio the greater its sensitivity and audio output. The report made no reference to any customer concern for the voltage or signal stability additional transistors might provide.

Interested parties may present their views by writing in duplicate to the Chief, Div. of Trade Regulation Rules, Bureau of Industry Guidance, Federal Trade Commission, Pennsylvania Ave. at Sixth St. N.W., Washington, D.C. 20580, not later than Nov. 3, 1967.

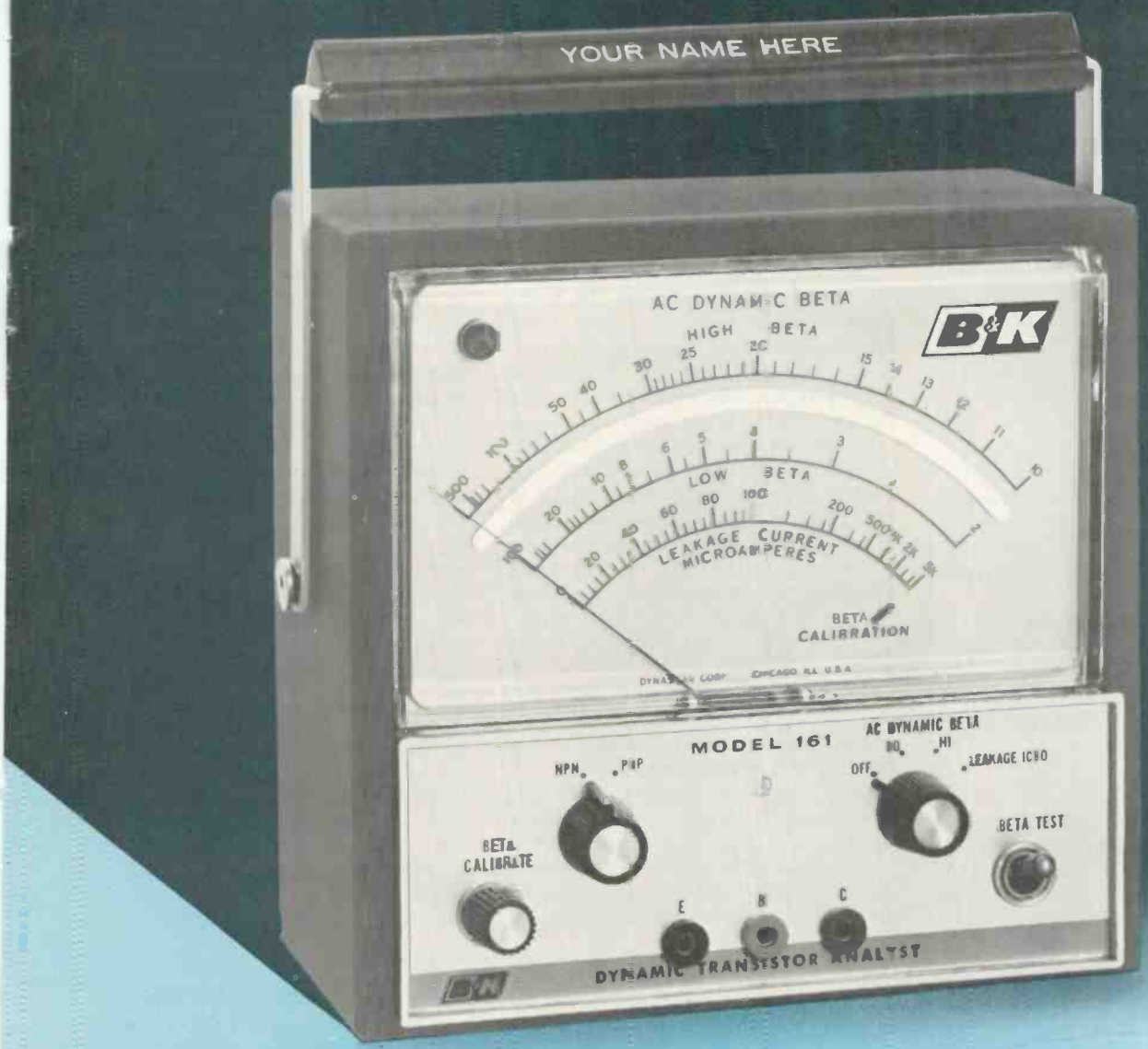
First Color-TV Sets Manufactured in Latin America

Philco S.A. de C.V., Philco-Ford Corp.'s electronic subsidiary in Mexico City, has begun marketing the first line of color-TV sets manufactured in Latin America.

The three models offered are of contemporary Mexican design and feature wood veneers and a polyester finish. Their prices range from 11,795 pesos ($944.78) to 11,295 pesos ($904.73). These prices are approximately 17 percent above those for comparable U.S. made color-TV sets.

The Mexican Broadcasting Co. has begun scheduling a total of 7 to 8 hours of color telecasts a week and is expected to increase this to 16 hours a week by the end of 1967 in preparation for the 1968 Olympic Games in Mexico City.

New B&K Dynamic Transistor Analyst



Simple to operate... fast ... safe to use. In-Circuit Transistor Tester. Personalized for professional pride.

B&K ends the mystery, fears and misunderstanding surrounding transistor servicing, application and theory. With every Model 161 Transistor Analyst, you get *two free reference manuals:* the new edition of Howard W. Sams' Transistor Specification Handbook, plus the all-new, years-ahead B&K Basic Course on Transistors — everything you need to know to test and service unfamiliar solid-state sets. You get ahead of your competition and stay ahead of the market.

The new B&K 161 means fast, accurate, *in-circuit* testing of transistors for AC Beta. With the same simple procedures, the 161 makes out-of-circuit tests, too, including Icbo (current leakage) and front-to-back conduction of diodes and rectifiers. There's no chance of damaging transistors or components; special circuitry protects all parts, even if leads are connected incorrectly
The huge 7" mirrored meter insures accurate readings on three separate scales. Two ranges check AC Beta: 2 to 100; 10 to 500. For leakage tests, Icbo range is 0 to 5000 microamps on an expanded scale for better readability. A flick of the switch checks polarity. It's so simple, you don't need any set-up book.

To stay ahead of the game, get the B&K Model 161 with a scuff-proof case and the two exclusive B&K Transistor reference manuals. A complete transistor service package with all leads included and your personalized name plate — for only **$89.95.**

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NEWS OF THE INDUSTRY

RCA Expands into Common Market

RCA Colore S.p.A. has been formed in Italy to manufacture and sell color-TV picture tubes in the European Common Market.

Several European countries are expected to begin color-TV broadcasting before the end of this year, including West Germany, Great Britain, France, Monaco, Spain and the Netherlands.

"RCA's expansion program is based on our belief that color TV will develop in Europe along the same lines as in the United States, where color is already a major growth industry. Sales of color sets in the United States alone have increased from around 400,000 sets in 1962 to almost 5 million sets in 1966," Robert Sarnoff, RCA president, said.

Mr. Sarnoff forecast color sales in Great Britain and Western Europe at approximately 300,000 sets in 1968, rising to nearly one million in 1970, two million in 1972 and nearly 3.5 million by 1975.

Elpa Marketing Industries Appoints California Reps

David H. Ross Co. is selected to represent the Tape Products Div. of Elpa Marketing Industries. The products handled include ReVox tape recorders, Beyer microphones and Edital tape splicing equipment.

Channel Master To Supply Training Films

The Channel Master Co. has made arrangements to supply educational films for the training projects of the National Electronic Assn's., Inc. Apprenticeship upgrading classes and local association training groups are advised by the association to use these films.

The free training film library includes regular product information plus films on antenna theory, CRT building processes, rotators, transmission lines and other topics directly related to the electronics service industry.

TV System Can Broadcast Printed Copy into Homes

An experimental system that can broadcast printed copy into the home along with standard TV programing is ready for on-the-air testing by RCA.

Dr. James Hillier, vice president of RCA Laboratories, said the system has the potential to bring about a dramatic advance in home information services by making it possible to print information of a newsworthy nature right in the living room or elsewhere in the home without affecting the TV program also transmitted on the same channel. He emphasized, however, that it will be a few years before an operating system might be available to the public.

To evaluate the system's technical performance under actual operating conditions, an application has been filed with the Federal Communications Commission for permission to make on-the-air tests between New York City and Princeton, N.J.

Astatic Files Patent Infringement Suit

The Astatic Corp. of Conneaut, Ohio, has filed a suit for patent infringement against Rivertone Co.; U. S. Electroton, Inc.; American Phono-Ton, Inc.; and William Adamson. The suit, a civil action, was filed in the U.S. District Court for the southern district of N. Y. It alleged that the defendants have violated Astatic's patent rights by the sale of certain phonograph styli and pickup cartridges under the "Rivertone" label.

Astatic owns a number of U. S. patents and alleges that seven of them are being infringed by Rivertone. Astatic's complaint seeks an injunction against future sales and an accounting and assessment of treble damages against the defendants.

New Tabulations Indicate Shift in Semiconductor Sales

New statistics compiled by the Electronic Industries Assn. indicate a 26.9 percent drop in germanium transistor dollar sales and a 7 percent drop in silicon transistor dollar sales during the first five months this year as compared to last year. Despite the lower total quantity of semiconductors produced and the lower average value of these components, the accompanying table indicates that the increased use of integrated circuits has offset any dollar losses, and there has actually been a $6,321,000 increase.

FACTORY SALES OF SEMICONDUCTORS

	First Five Months 1966			First Five Months 1967		
Description	Units	Dollars	Average Value	Units	Dollars	Average Value
Germanium Transistors	163,774,000	73,024,000	.45	124,985,000	53,359,000	.43
Silicon Transistors	171,420,000	111,957,000	.65	184,798,000	104,147,000	.56
Dual Transistors	1,214,000	9,734,000	8.02	1,950,000	10,983,000	5.63
Field Effect Transistors	617,000	2,809,000	4.55	1,785,000	4,899,000	2.74
Digital Integrated Circuits	8,715,000	42,470,000	4.87	18,731,000	63,509,000	3.39
Analog Integrated Circuits	571,000	10,192,000	17.85	2,567,000	19,610,000	7.67
Total	346,311,000	250,186,000	.72	334,816,000	256,507,000	.77

The '10 Most Wanted' Receiving Tubes

A list of the "10 most wanted" entertainment receiving tubes in the electronic-parts-distribution market is compiled by the G-E tube department. Statistics are based on industry sales to distributors.

The most popular types are: 5U4GB/5AS4A, 50C5, 6CB6A/6CF6 6DW4B 6JE6A 6AQ5A 6HG5 6DQ6B/6DM4A, 35W4, 6AX4GTB and 6BQ7A/6BZ7.

Conversion Factors Listed On Free Wall Chart

Precision Equipment Co. has published a wall chart of conversion factors. This reference table is designed

to help electronic technicians locate factors occasionally used, but which seem to slip our minds. Included are common conversions such as inches to centimeters, watts to horsepower and other conversions that are difficult to locate in reference manuals.

This free wall chart can be obtained by writing Precision Equipment Co., 4409G Ravenswood Ave., Chicago, Ill. 60640.

Ling-Temco-Vought May Acquire Allis-Chalmers in Transaction

Ling - Temco - Vought, Inc. has made a proposed tender offer to acquire all the outstanding common and preferred stock of Allis-Chalmers Manufacturing Co. for cash and an exchange of LTV securities in a transaction that could total some $590 million.

Arista Introduces Exact Replacements For Japanese Phonos

Artista Enterprises announces the introduction of 14 exact-replacement Japanese phonograph cartridges for many brands including Singer, Lloyd, Mastercraft, Channel Master and G-E "Show & Tell." They reportedly already market a line of over 650 exact-replacement phonograph cartridges.

NEWS OF THE INDUSTRY

Free Barbecue Grill Designed to Generate Sales

An attention-getting new battery display from Mallory uses a free barbecue grill to attract customers and generate impulse sales.

Two free batteries power the spit to spin an action display sign. A battery assortment is displayed in a colorful carton that fits into the grill.

G-E Offers Programed Instruction in Transistors

A three-volume, programed-instruction (self-teaching) course is being offered by the General Electric Co. to help technicians learn the sophisticated skills and techniques needed for transistor-circuit troubleshooting.

The programed instruction is based on learning bits of information at a time instead of large chunks, and learning these bits in a logical, carefully planned sequence.

G-E indicates that a group of technicians were tested on the subject of transistorized circuits, and the average score was 23.4 percent. After spending an average of seven hours with the programed instructions, their post-study scores reportedly averaged 96.8 percent.

ITT and Rayonier Discuss Possible Association

International Telephone and Telegraph Corp. and Rayonier, Inc. have announced that discussions are under way leading to the possible association of Rayonier with the ITT System.

MOVING?

Be sure to let us know your new address. Please enclose a complete address label from one of your recent issues.

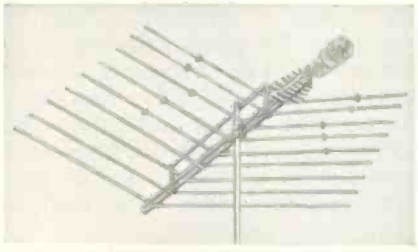
"I like the results . . .

. . . when I install the JFD Color Laser," comments Elmer Whitmore, Hill's Antenna Service, Saginaw, Michigan, who has made over 13,000 antenna installations in the 14 years he has been in business.

" 'That's a real good color picture!' is what I like to hear after I put up a new antenna because to me a pleased customer is like money in the bank. So I don't take chances—I install JFD Color Lasers for top color pictures.

"I like the way the Color Lasers work on all the VHF and UHF stations here. They rig up fast and give us better results in the form of precise color and ghost-free images."

Elmer Whitmore prefers JFD engineered-for-color Color Lasers, like many other professional antenna installers, for best possible performance.



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☐ **PATENTED W-I-D-E BAND LOG PERIODIC DESIGN** — the most efficient ever developed — provides higher gain, better signal-to-noise ratios, needle-sharp directivity. Eleven patents cover its revolutionary space-age design.

☐ **MORE DRIVEN ELEMENTS.** Harmonically resonant capacitor coupled design makes dual-function elements work on both VHF and UHF frequencies. *Entire* antenna (not just part of it as in other log periodic imitations) responds on every channel.

☐ **LUSTROUS, ELECTRICALLY CONDUCTIVE GOLD ALODIZING** promotes signal transfer, protects against corrosion, enhances appearance.

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BOOK REVIEWS

TRANSFORMERS FOR ELECTRONIC CIRCUITS. *By Nathan R. Grossner. Published by McGraw-Hill Book Co., 336 pages, hard cover. $14.*

The characteristics of nearly linear transformers are described in this book to assist the reader in applying the proper transformer to the proper electronic circuit. The author assumes that the reader has an understanding of trigonometry, but uses graphs to help simplify calculations. The book ranges from a discussion of transformer weaknesses (where we learn that many failures result from defects that accumulate during storage and installation — usually becoming apparent in the first 10 to 20 hours of operation) to a study of the tail oscillations that occur in pulse transformers. This book may be of interest to the advanced technician who wonders why transformers of a certain size or with special cores or windings are selected for the circuits where they are used.

FIELD EFFECT TRANSISTOR PROJECTS. *Written and published by the Semiconductor Products Div. of Motorola, Inc., 96 pages, soft cover. $1.*

In the first chapter there are one and one-half pages of basic FET theory and two pages of related-term definitions. Components and good construction techniques are illustrated in the second chapter. The balance of the book describes circuits, their operation and construction. These projects include a vibrato circuit for musical instruments, audio mixer, timer, crystal oscillator, preamplifier and dc voltmeter. The construction check list resembles those frequently accompanying electronic kits. This book should be of interest to the apprentice technician who needs to learn basic construction techniques and to inexperienced technicians who wish to learn more about FETs.

A COMMON SENSE APPROACH TO SMALL BUSINESS ANALYSIS. *Compiled and edited by Jerry I. Reitman. Published by Business and Financial Publications, 84 pages, soft cover. $4.95.*

At first glance most service-dealers may feel this book does not apply to them — it may appear more appropriate for a small owner-manager factory. A large portion of the material, however, can be applied to the needs

continued on page 92

BOOK REVIEWS

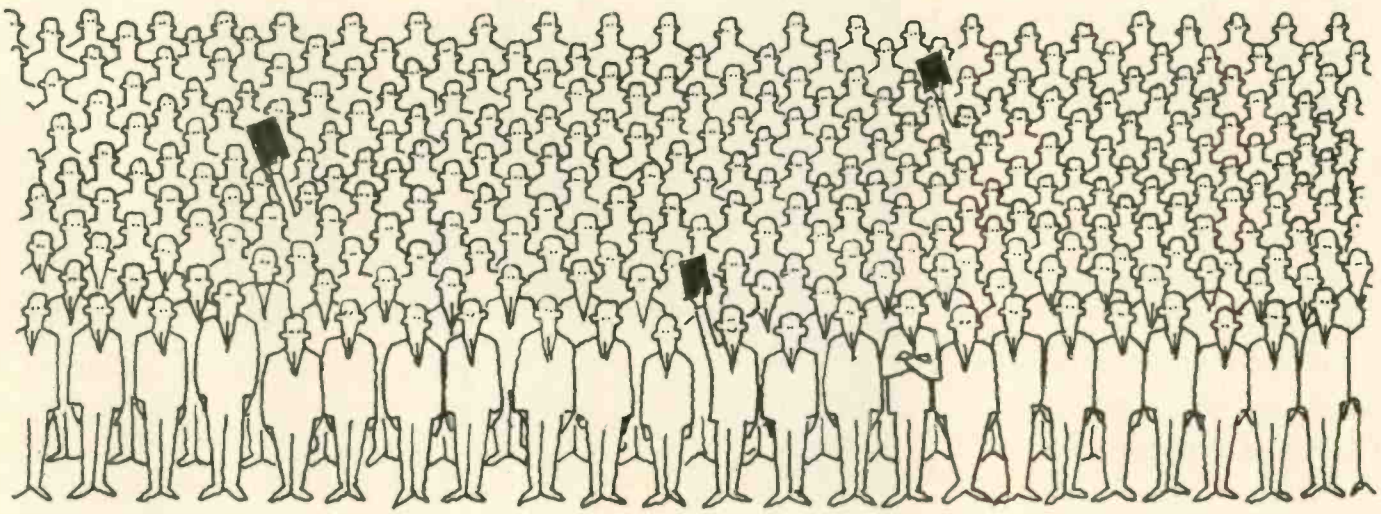
of all shops that sell and repair electronic equipment. Included are helpful hints for maintaining stock, suggestions for developing useful ideas to improve a company, and several self-check lists are discussed which will help the owner-manager see if business has actually improved and what is needed to make the business even better. This book should be of value to any service-dealer operation, whether large or small.

ELECTRICAL CHARACTERISTICS OF TRANSISTORS. *By Robert L. Pritchard. Published by McGraw-Hill Book Co., 737 pages, hard cover. $19.50.*

The author, presently Professor of Electrical Engineering at Stanford University, goes into great detail describing the valence electron characteristics of semiconductor materials, the fabrication of transistors and their electrical characteristics. The book contains a portion of the periodic table to illustrate the atomic relationship of elements used in transistors; equations to describe the drift of electrons and holes; illustrations showing the various methods of fabricating P-N junctions; a description of how an ideal transistor differs from a pair of diodes; and graphs, equivalent circuits and equations to describe a wide range of transistor ac and dc characteristics. A 69-page bibliography lists additional sources of transistor information. This book may be of interest to advanced electronic engineering students and engineers who are concerned with a detailed study of transistors.

BROADCAST ANTENNA SYSTEMS HANDBOOK. *By Harry Etkin, John Battison, Ward Yelverton, Herman Gihring and M. S. Siukola. Published by Tab Books, 160 pages, soft cover. $7.95.*

Tables, charts and equations are used in describing the design and radiation of AM, FM and TV transmitting antennas. Many references are made to relevant FCC regulations. This book should be of interest to technicians who are engaged in the design of commercial broadcast antennas, particularly the last portion of the book, which includes a detailed description of recent FM dual polarization studies.



No, 4693 isn't a very large circulation.

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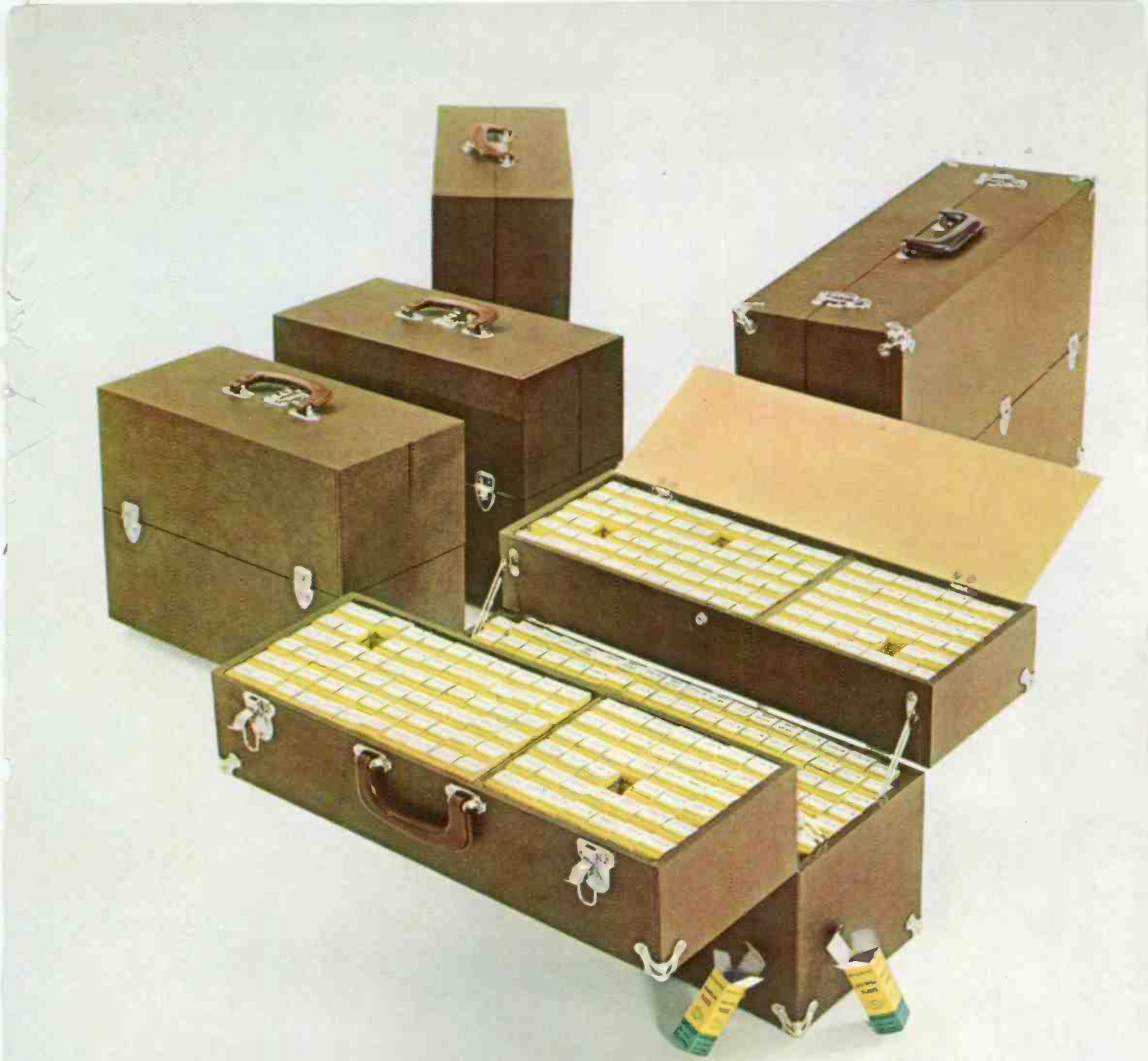

One out of every five professional servicemen has switched to Amperex TV replacement tubes

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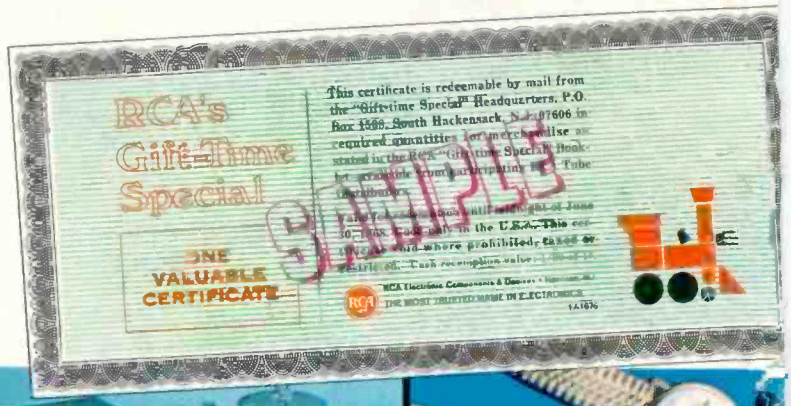

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