

ELECTRONIC TECHNICIAN / DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

XX
FRISEW10812392N869AD3A117966B
WILLIAM W FRISE
7176 GALE RD
ATLAS MI
48411

Teklab Report on Channel Master

Color Bar Generator Survey

Hybrid Color Problems

So what if you have to live with the old fear just a little longer? [It'll feel even better when you do get your 415!]



We recently announced the absolute end of the old color and black-&-white TV alignment fear. The end of separate marker generators, marker adders, sweep generators, and bias supplies and the beginning of all of them combined into one fearless instrument — the B&K 415 Sweep/Marker Generator.

Immediately, we were swamped with orders. The backlog started piling up.

And, then, to make matters worse (or maybe better), our bright engineers (in response to suggestions at Seminars) thought up some newer and even more sophisticated features to include in the unit. To make it even *more* efficient (without raising the price)!

For example, we added 100 KHz markers to permit aligning the new automatic fine tuning in new color receivers. We improved the

marker tilt feature to make markers especially easy to see. (Trap alignments are easier and more certain than ever before.) We made the leads and controls absolutely unaffected by body capacitance and movement. And, we now include *three* bias supplies.

So, if you're still waiting for your 415, be patient. Even if you *do* have to live with the old fear a little longer — think how good it will feel when it stops.

It won't be long now — the 415 Sweep/Marker Generators are in full production. Shipments are being made daily. Check your distributor to find out when you can expect yours.

Model 415. Net: \$349.95.

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



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

TEKFAX

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

GROUP
203

	SCHEMATIC NO.	PHILCO-FORD	SCHEMATIC NO.
AIRLINE	1238	TV Model GEN-13768B	1235
EMERSON	1239	TV Chassis 120904,911	1237
GENERAL ELECTRIC	1236	Color TV Chassis H-2	1240
		PHILCO-FORD	1235
		TV Chassis 19S32	
		RCA VICTOR	1237
		Color TV Chassis CTC38 Series	
		ZENITH	1240
		TV Chassis 14Z38,14Z43	

SYMBOL DESCRIPTION	PHILCO-FORD PART NO.
C48 - 240/240/160/5µf @200v B+ filter	30-2601-33
D1 - phase com	34-8037-1
D2 - 2nd det	34-8022-6
D3 - rect silicon	34-8054-7
L1 - 180µh plate series	32-4762-7
L5 - choke 60MHz damp cath	32-4112-62
L6 - 220µh noise inv	32-4762-25
L7 - quad snd det	32-4876-1
L8 - 4.5MHz trap & STO	32-4688-14
L10 - tuner cplg	32-4652-96
L12 - horiz stab	32-4754-3
L14 - 41.25MHz trap	32-4652-80
L17 - 40MHz trap 2nd det	32-4837-1
L18 - video det	32-4652-79
N1 - ret supp	30-8024-9
N3 - vert int	30-6030-12
N4 - horiz osc	30-8057-1
N5 - phase comp	30-8035-2
N6 - iso CRT	30-8058-2
R40 - varistor 560v @10ma	33-1373-6
R63 - 1.5x 7w fil drop	33-1363-134
AOT - audio output	32-10013-6
FC - B+ filter output	32-10010-11
HOT - horiz output	32-10008-7
VOT - vert output	32-10012-5
VR1 - 500K vert size 2/M vert lin 60K horiz aux	33-5595-8
VR3 - 3K width	33-5620-1
VR4 - 100K bright	33-5623-15
VR5 - 15K contr	33-5623-13
VR6 - 150K vert hold	33-5623-14
VR7 - 1M on-off vol w/cb	33-5625-8
VR8 - 40K horiz hold	33-5623-12
-tuner UHF TT152	76-13827-1
-tuner VHF TT215	76-14150-1
-yoke & cable assy	76-12942-14

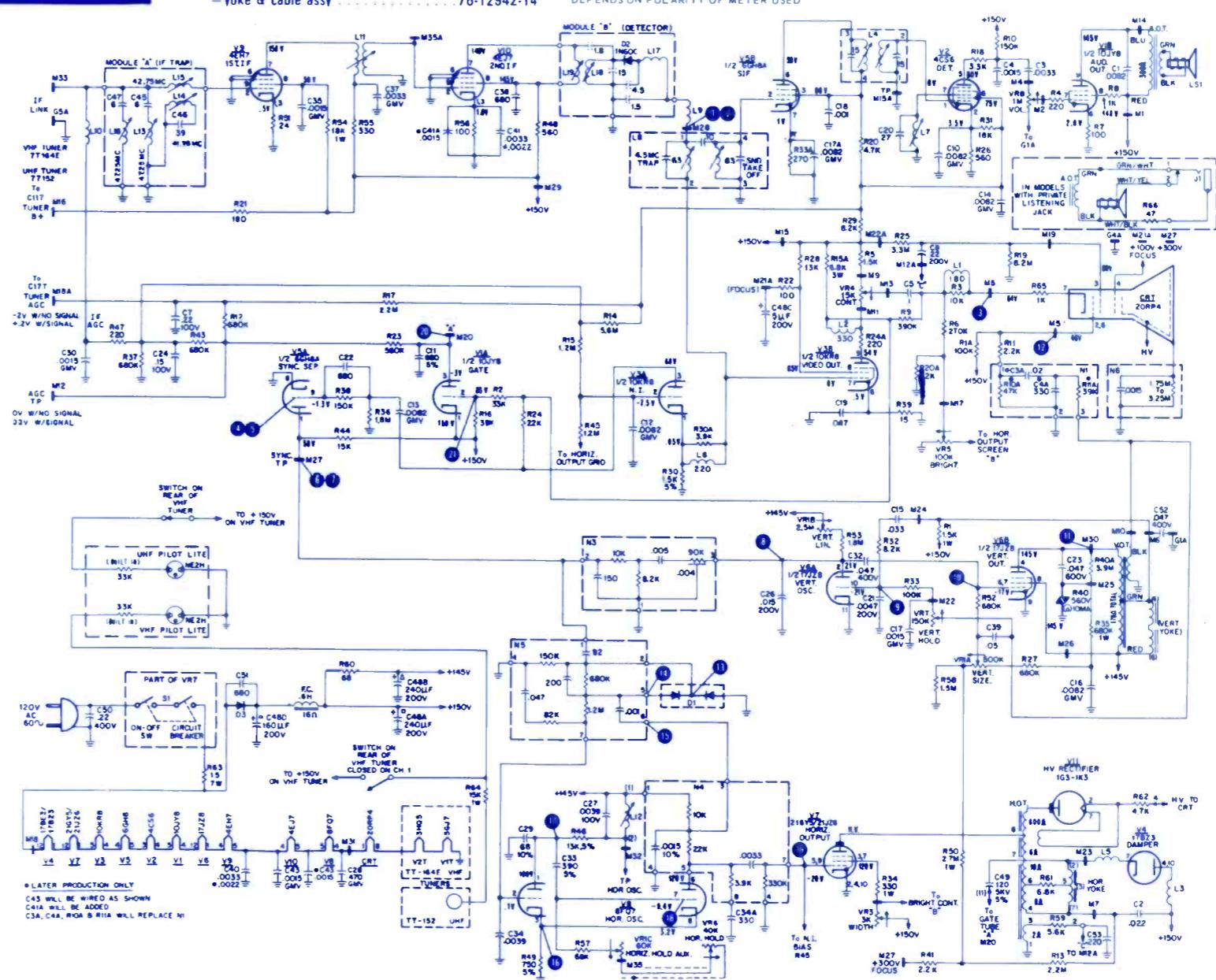
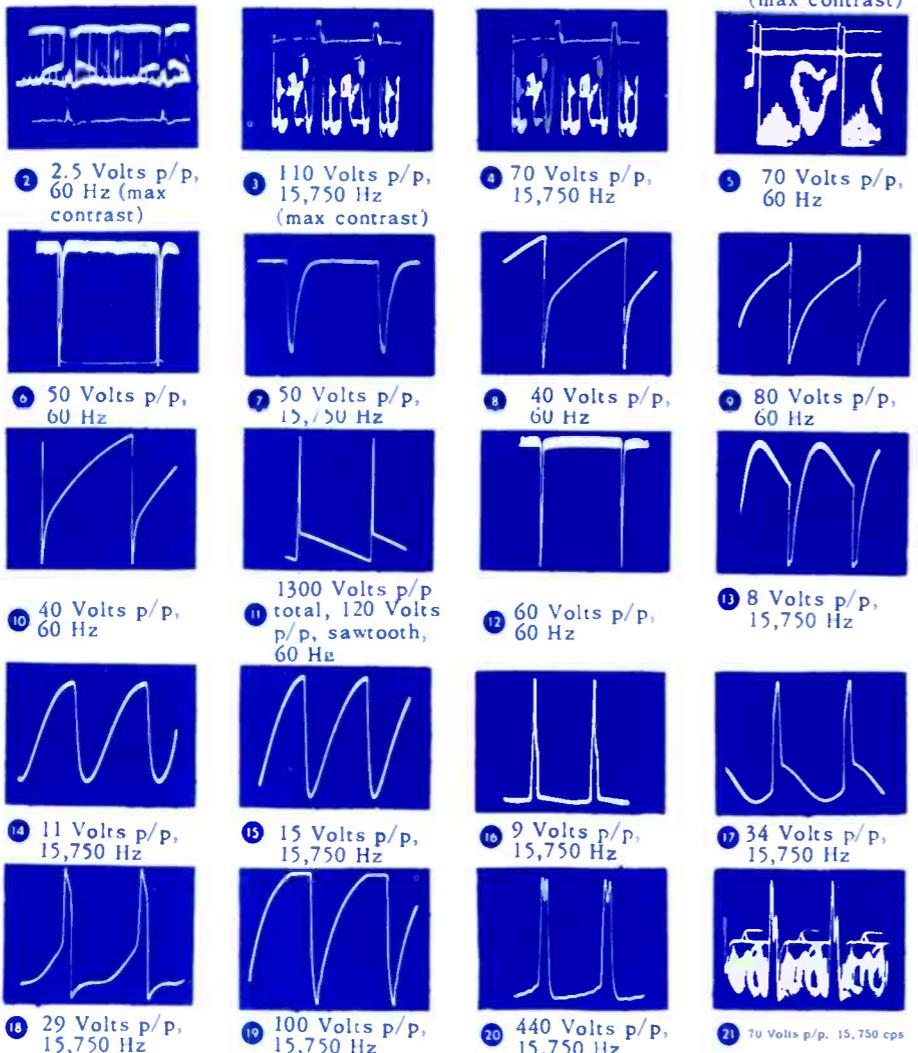
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VOLTAGE & RESISTANCE CHART

SYM. BOL	TUBE	USE	PIN NUMBERS														
			1	2	3	4	5	6	7	8	9	10	11	12			
V1	10JY8	Audio Out. & A.G.C.	12K	36K	1.3M	FIL	FIL	100	260	12K	12K						
V2	4C56	Sound Detector	6	50G	FIL	FIL	160K	12K	3.5								
V3	10KR8	Video Out. & Noise Inv.	*300	900K	35K	FIL	FIL	15	*300	25K	12K						
V4	17BE3 17BZ3	Damper	FIL	INF	INF	12K	INF	INF	9M	INF	INF	12K	INF	FIL			
V5	6GH8	Sound IF & Sync Sep.	12K	2	12K	FIL	FIL	12K	270	0	1.9M						
V6	17JZ8	Vert. Osc. & Output	FIL	3.8M	INF	12K	INF	1.8M	1.8M	12K	0	200K	0	FIL			
V7	21GY5 21JZ6	Horiz. Output	FIL	0	12K	0	300K	12K	12K	300K	0	12K	FIL				
V8	8FQ7	Horiz. Osc.	25K	2.2M	750	FIL	FIL	45K	95K	750	0						
V9	4EH7	1st Video IF	24	420K	24	FIL	FIL	0	12K	20K	0						
V10	4EJ7	2nd Video IF	100	0	100	FIL	FIL	0	12K	12K	0						

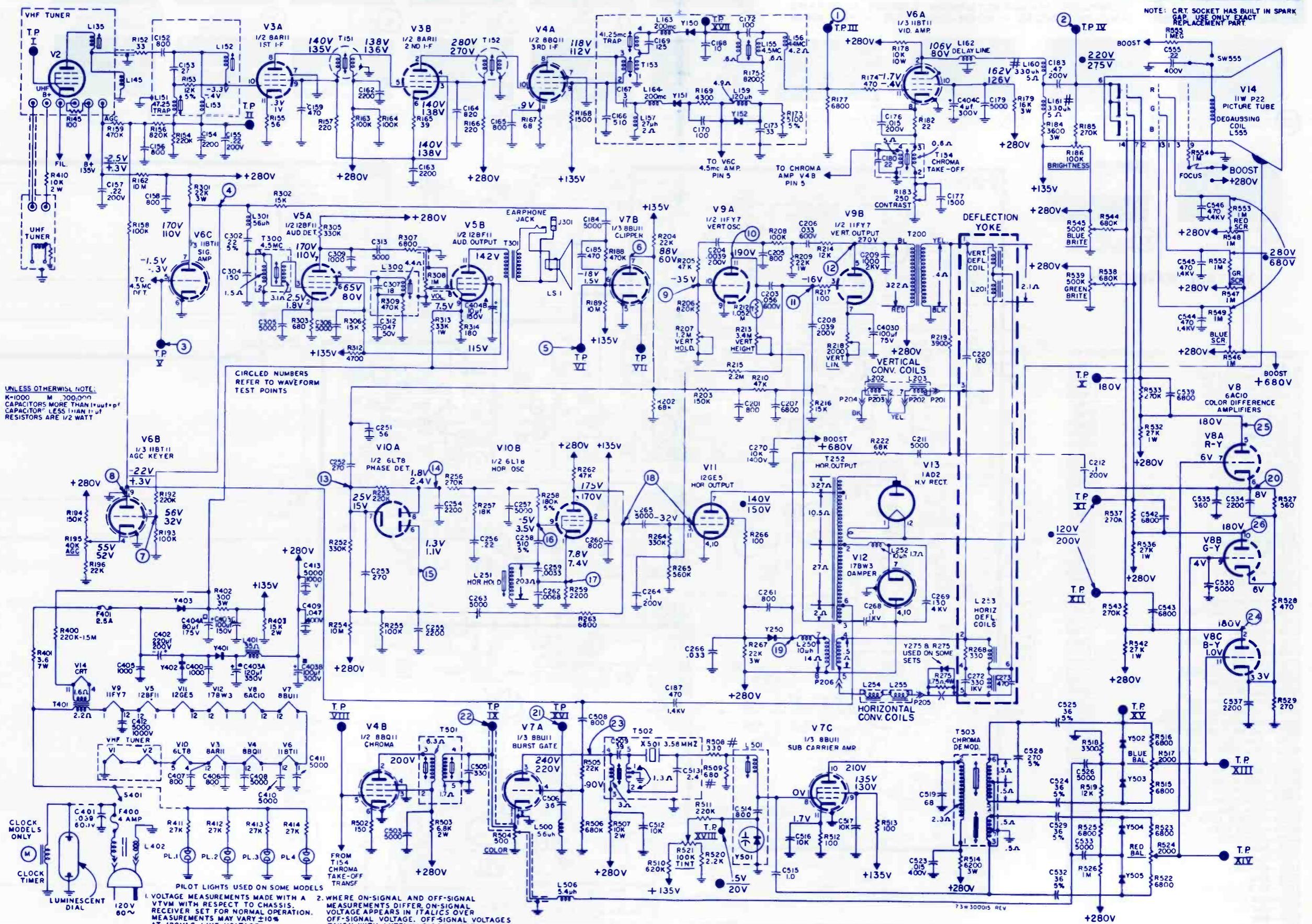
ALL RESISTANCES ARE MEASURED IN OHMS
*DEPENDS ON POLARITY OF METER USED

These waveforms were taken with the receiver adjusted for an approximate output of 2.5V p/p at the video detector. Voltage readings taken with raster just filling screen and all controls set for normal picture viewing except for photos 1, 2 and 3 where contrast was at maximum. The voltages given are approximate peak-to-peak values. The frequencies shown are those of the waveforms...not the sweep rate of the oscilloscope.



GENERAL ELECTRIC
Color TV Chassis H-2

NOTE: CRT SOCKET HAS BUILT IN SPARK GAP. USE ONLY EXACT REPLACEMENT PART.

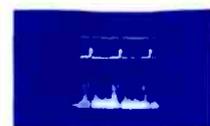


UNLESS OTHERWISE NOTE:
K=1000 M=100,000
CAPACITORS MORE THAN 1µF are of
CAPACITOR LESS THAN 1µF of
RESISTORS ARE 1/2 WATT

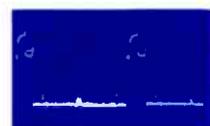
CIRCLED NUMBERS
REFER TO WAVEFORM
TEST POINTS

1. VOLTAGE MEASUREMENTS MADE WITH A
VTVM WITH RESPECT TO CHASSIS.
RECEIVER SET FOR NORMAL OPERATION.
MEASUREMENTS MAY VARY ±10%
AT 120VAC LINE VOLTAGE.
INDICATES PRODUCTION CHANGE
● VOLTAGE VARIES WITH CONTROL
SETTING

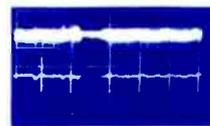
2. WHERE ON-SIGNAL AND OFF-SIGNAL
MEASUREMENTS DIFFER, ON-SIGNAL
VOLTAGE APPEARS IN ITALICS OVER
OFF-SIGNAL VOLTAGE. OFF-SIGNAL VOLTAGES
TAKEN WITH ANTENNA DISCONNECTED
AND ANTENNA TERMINALS SHORTED
TOGETHER.
ON-SIGNAL VOLTAGES AND WAVE SHAPES
TAKEN WITH NOISE FREE SIGNAL.



1 TP201
2nd Detector
2VPP Vert. Rate



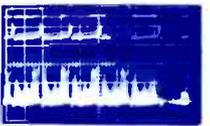
2 TP201
2nd Detector
2VPP Horiz. Rate



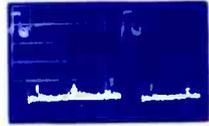
3 V202-1
Sync Sep. Plate
64VPP Vert. Rate



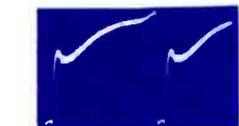
4 V202-1
Sync Sep. Plate
50VPP Horiz. Rate



5 V202-9
Sync Sep. Grid
46VPP Vert. Rate



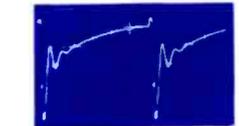
6 V202-9
Sync Sep. Grid
46VPP Horiz. Rate



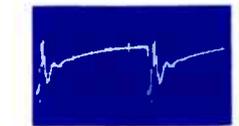
16 CR203 Cathode Junction
Horiz. Phase Detector
12VPP Horiz. Rate



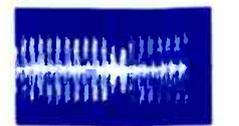
17 V204-1 (PW200-W)
Horiz. Osc. Plate
17VPP Horiz. Rate



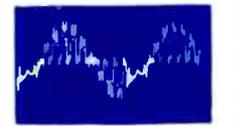
18 V204-7
Horiz. Osc. Grid
540VPP Horiz. Rate



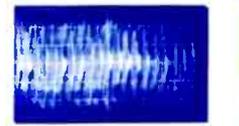
19 L215-C
Horiz. Osc. Coil
320VPP Horiz. Rate



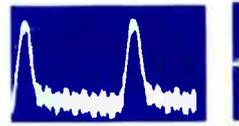
20 V701-2 (Color)
1st Bandpass Grid
3.8VPP Horiz. Rate



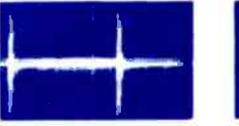
21 V701-9 (Color)
G-Y Amplifier Grid
2.1VPP Horiz. Rate



22 V701-6 (Color)
1st Bandpass Plate
30VPP Horiz. Rate



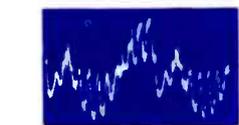
23 V702-1
Burst Grid
250VPP Horiz. Rate



24 V702-5
Burst Plate
250VPP Horiz. Rate



25 V703-1
Blanking Plate
175VPP Horiz. Rate



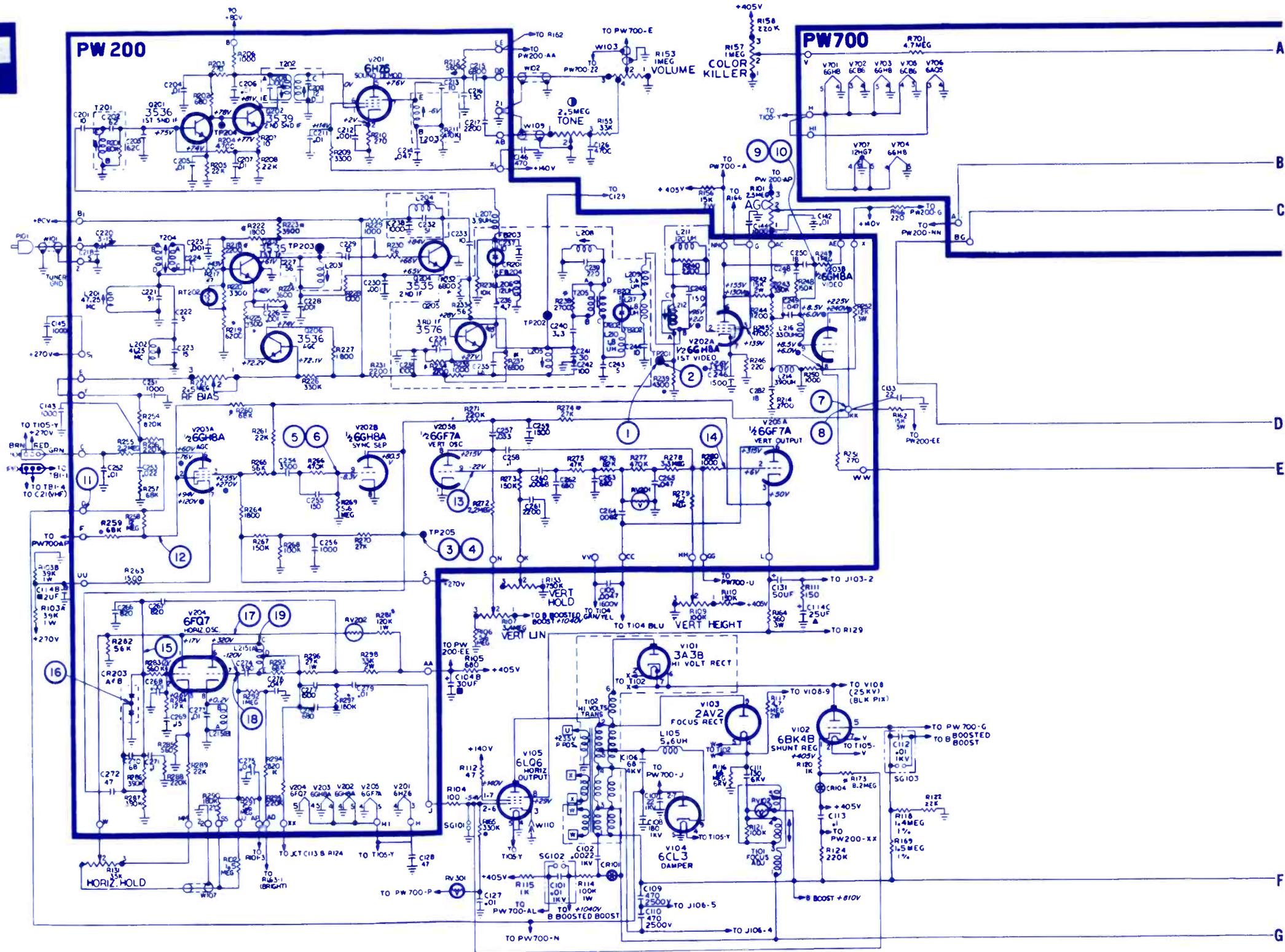
36 PW700-7 (Color)
'G-Y'
28VPP Horiz. Rate



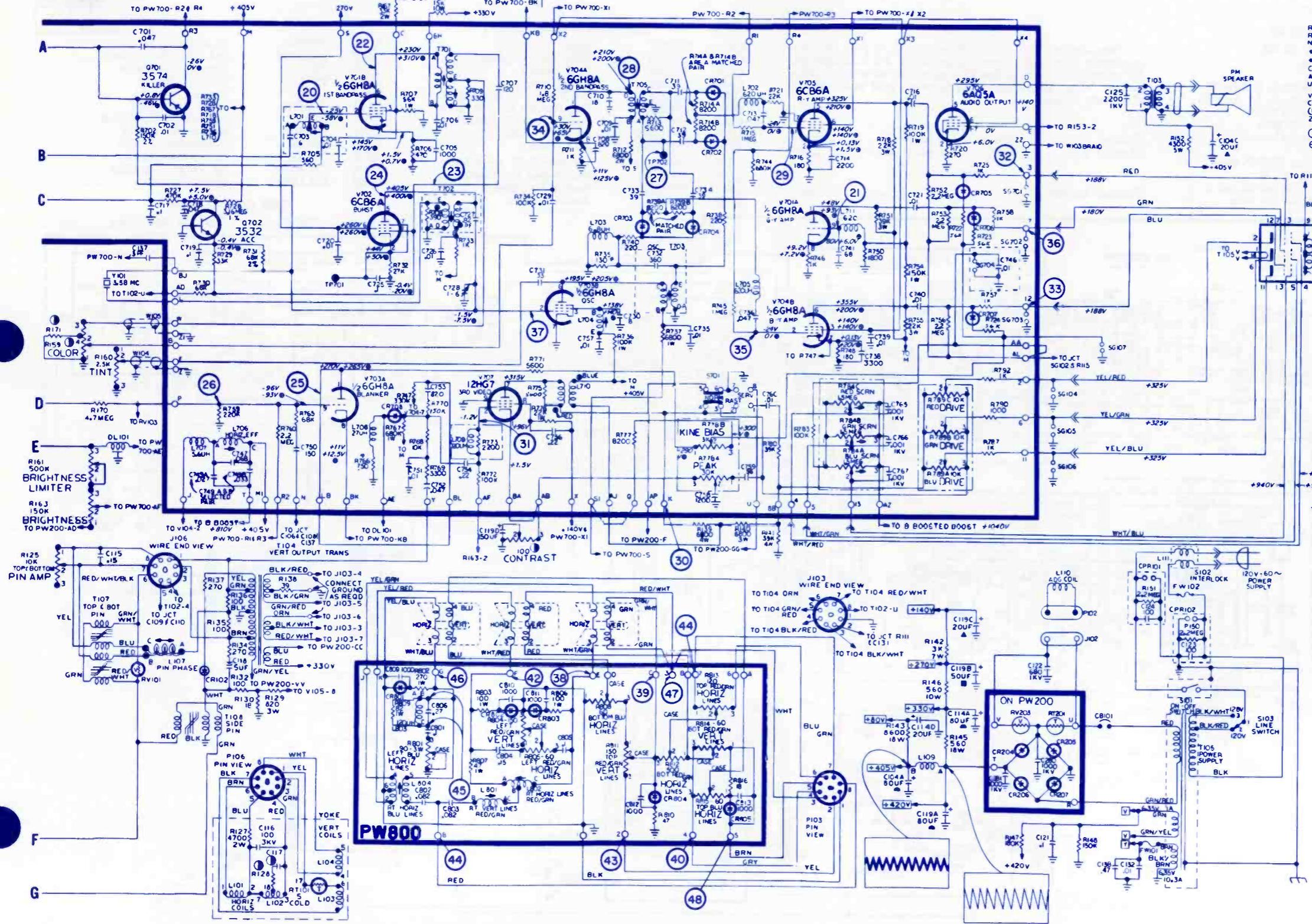
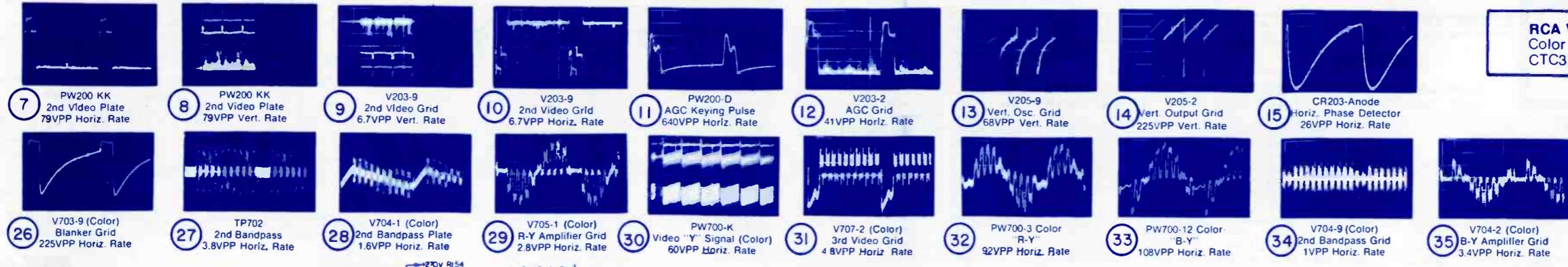
37 V703-2
Osc. Grid (Color)
12VPP Horiz. Rate

VOLTAGE WAVEFORMS

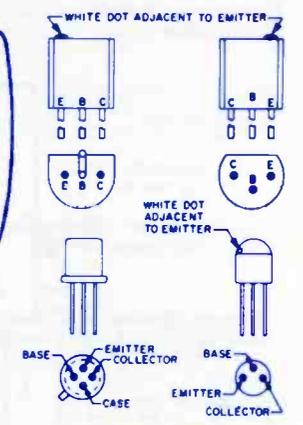
SYMBOL	DESCRIPTION	RCA VICTOR PART NO.
C114	- 4 sec elect	124685
C114A	- 4 sec 80µf 450v	124685
C114B	- 4 sec 25µf 25v	124685
C114C	- 4 sec 2µf 350v	124685
C114D	- 4 sec 20µf 150v	124685
C119	- 4 sec elect	123491
C119A	- 4 sec 80µf 450v	123491
C119B	- 4 sec 50µf 450v	123491
C119C	- 4 sec 20µf 250v	123491
C119D	- 4 sec 150µf 25v	123491
C220	- 3-15pf trim	116502
CB101	- brkr cir 1.75a	122207
DL101	- line delay	121554
FW101	- fuse 26 wire	102792
L107	- top & bottom pin	114594
L109	- choke	124807
L111	- choke	117526
L208	- 41.25MHz trap	124804
L212	- 4.5MHz trap	124810
L215	- horiz sine wave	116506
L706	- horiz eff	122918
L710	- video output	124809
R101	- contr AGC	124689
R107	- contr vert lin	114020
R109	- contr vert height	122176
R116	- 66m 20% 6000v film	114651
R131	- horiz hold	127880
R133	- vert hold	127881
R145	- 560Ω 10% 18w WW	124667
R149	- contr tone/cont	127879
R157	- contr color killer	112841
R160	- contr tint CTC38AV.XA	127473
R161	- contr bright limit	112842
R221	- contr RF bias	126667
R778	- contr kine bias peak	121588
R805	- contr left rd/grn horiz lines	105059
R812	- contr bottom rd/grn horiz lines	114623
R813	- contr top rd/grn horiz lines	106320
RT201	- therm 120Ω cold	107191
RF202	- therm 4300Ω at 25 deg cold	124813
RV101	- 175v at 1ma	114707
RV102	- 870v at 1ma	112876
RV103	- 250v at 1ma	124811
RV201	- 870v at 1ma	112876
RV202	- 110v at 1ma	114762
RV203	- 8v at 15ma	126424
SG103	- 10,000pf 1000v	117139
SG105	- 0.75pf 1000v	116636
SG701	- 0.5pf 1000v	120819
T101	- focus adj	113999
T102	- hi voltage	119834
T104	- vert output	119828
T105	- power	126489
T107	- top & bottom pin	121560
T201	- input sound IF	124710
T202	- input sound demod.	118738
T203	- quad	124709
T701	- bandpass	124761
T702	- burst	124764
T703	- 3.58 osc	121559
Y101	- crystal 3.58 MHz	105330



RCA VICTOR
Color TV Chassis
CTC38 Series



RESISTANCE VALUES IN OHMS K=1000
RESISTORS ARE 1/2 WATT EXCEPT AS NOTED.
 * INDICATES 5% TOLERANCE
 ** INDICATES 2% TOLERANCE
 CAPACITANCE VALUES 1.0 AND ABOVE ARE IN PF, THOSE BELOW 1.0 ARE IN UF EXCEPT AS INDICATED.
 VOLTAGES ARE MEASURED TO CHASSIS GROUND WITH A "VOLTMYST" (NO SIGNAL) AND SHOULD HOLD WITHIN 20% AT RATED SUPPLY VOLTAGE.
 (1) SEE REPLACEMENT PARTS LIST.
 (2) INDICATES VOLTAGE TAKEN WITH COLOR BAR GENERATOR INPUT AND +2V AT 2ND DETECTOR, TP201.

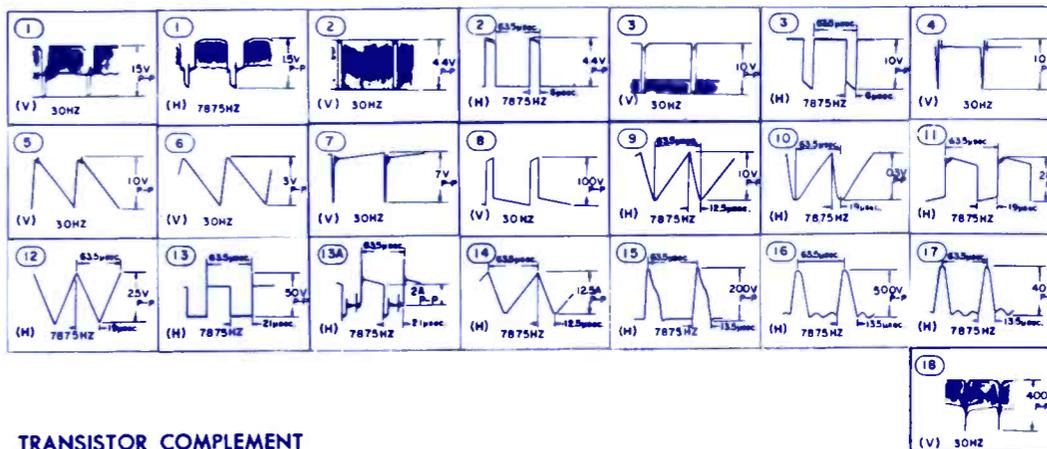


COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

SYMBOLS	DESCRIPTION	AIRLINE PART NO.
R711	560Ω 10w 10% oxide film	TV2396
R716	33Ω 6w 10% WW	TV2397
R720	2Ω 10w 10% WW	WF5002
R901A,B,C,D	5Ω / 5Ω / 5Ω / 5Ω 20w WW	TV2399
R244	500Ω pot AGC (8v-387)	TV2562
R316	10K pot vol cont on/off switch (8v0093)	TV25193
R622	500Ω pot vert aux (8v-387)	TV2562

R623	500Ω pot vert hold (8v-035)	TV25115
R625	10K pot vert lin	TV25114
R626	10K pot vert bias (assy)	TV25114
R624	20K pot vert size (8v-039)	TV25114
R733	5K pot horiz hold	TV25114
R735	270K pot bright (8v-348)	TV2573
R739	500Ω pot horiz pulse width (8v-387)	TV2562
R808	500Ω pot contrast (8v-171)	TV25141
L201	coil 41.25MHz trap (91f-493)	TV62313
L701	coil horiz lin (TL-73)	TV61370
L601	coil 4.5MHz trap (91f-477)	TV62258

L802	coil peak (9L-212)	TV61264
L803	coil peak (9L-210)	TV61265
T201	x-former 1st pix IF (91f-492)	TV62312
T202	x-former 47.25MHz trap (91f-494)	TV62314
T301	x-former 1st sound IF (91f-434)	TV62114
T302	x-former 2nd sound IF (91f-435)	TV62115
T303	x-former ratio det (91f-505)	TV62317
T401	x-former audio output (9T-197)	TV11197
T601	x-former vert osc (9T-192)	TV11192
T602	x-former vert output (9T-193)	TV11193
T701	x-former horiz ovc (9T-193)	TV11194
T702	x-former horiz dr (9T-195)	TV11195
T703	x-former horiz output bal (2TL-953)	TV11198
T704	x-former horiz output (8FT-624)	TV11199
T901	x-former power (5T-188)	TV11196
T902	x-former power choke (9T-200)	TV11200
M301	capristor (PRC-364)	TV3482
	tuner VHF (AT-233)	TV35147
	tuner UHF (UT6-2U2)	TV35148
	voke def (assy w/lead)	TV61398



ELECTRICAL SPECIFICATIONS

Power Supply	120 volts 60 Hz
Power Consumption	86 Watts
Power Output	1 Watt
Tuning Ranges	VHF-Channels 2 thru 13 UHF-Channels 14 thru 83
Intermediate Frequency	Picture-45.75 MHz Sound-41.25 MHz
Antenna Input Impedance	300 ohms balanced
Intercarrier sound system	4.5 MHz
Speaker Size & Type	7cm x 11cm (1107P-44A)
Voice Coil Impedance	8 ohm @ 400 Hz
Picture Size	Approx. 172 sq. in. on a 19DQP4 picture tube

SENSITIVITY

Sensitivity (To produce 20 volts peak to peak at input to picture tube. Measured according to I.R.E. standards. All controls, including fine tuning, set for maximum video output. Video signal measured between grid and cathode of picture tube.)

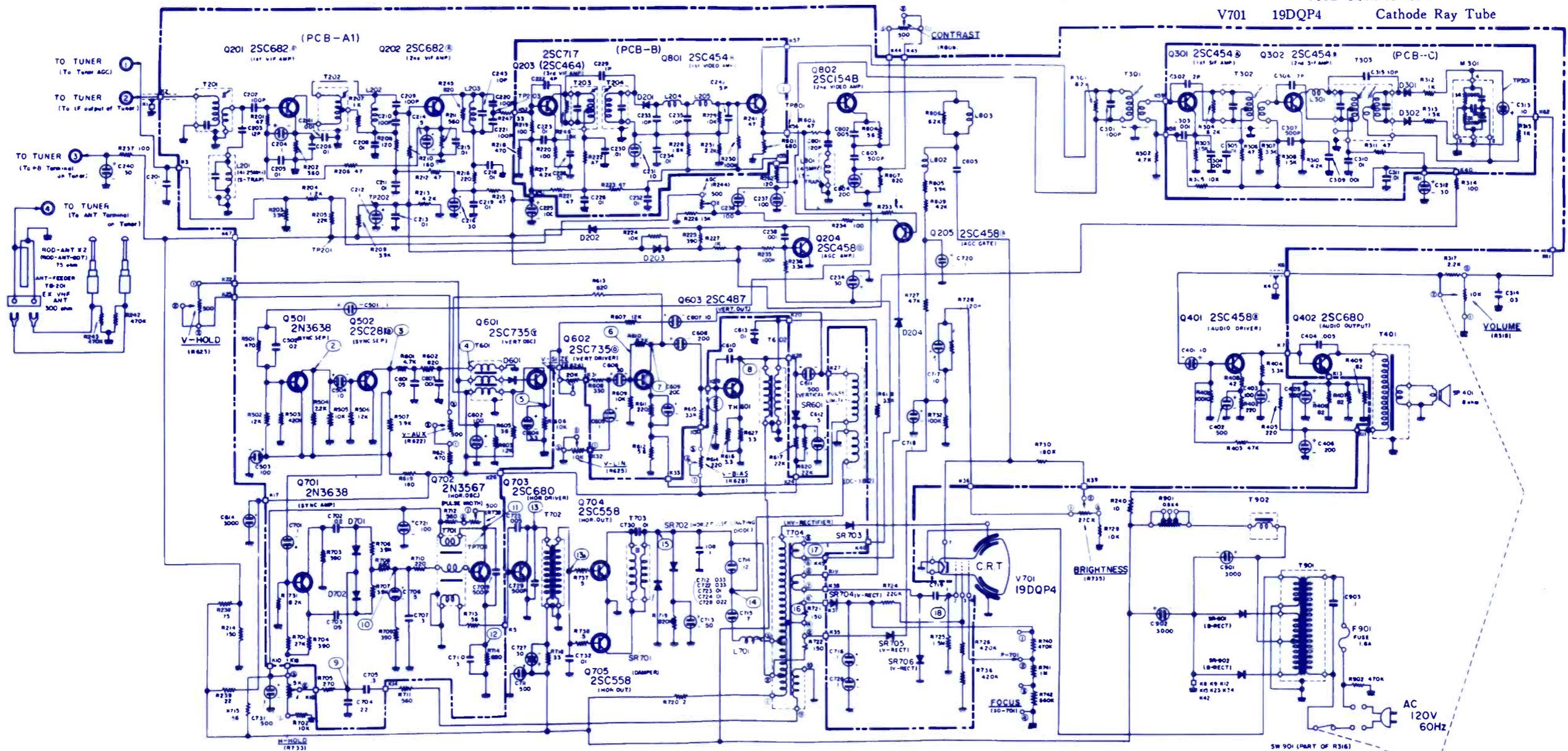
Channel	VHF	UHF
Channel 2	32μV	Channel 7..... 32μV
Channel 5	32μV	Channel 13..... 32μV
Channel 14~83		32μV

TRANSISTOR COMPLEMENT

Q1	2SC387	UHF Oscillator
Q101	SE5020	VHF RF Amplifier
Q102	SE5021	VHF Mixer
Q103	SE3001	VHF Oscillator
Q201	2SC682	1st Picture IF Amplifier
Q202	2SC682	2nd Picture IF Amplifier
Q203	2SC717	3rd Picture IF Amplifier
Q204	2SC458Ⓢ	AGC Amplifier
Q205	2SC458Ⓢ	AGC Gate
Q301	2SC454Ⓢ	1st Sound IF Amplifier
Q302	2SC454Ⓢ	2nd Sound IF Amplifier
Q401	2SC458Ⓢ	Audio Amplifier
Q402	2SC680	Audio Output

TUBE COMPLEMENT

V701	19DQP4	Cathode Ray Tube
Q501	2N3638	1st Sync Separator
Q502	2SC281Ⓢ	2nd Sync Separator
Q601	2SC735	Vertical Oscillator
Q602	2SC735	Vertical Driver
Q603	2SC487	Vertical Output
Q701	2N3638	Sync. Amplifier
Q702	2N3567	Horizontal Oscillator
Q703	2SC680	Horizontal Driver
Q704	2SC558	Horizontal Output
Q705	2SC558	Horizontal Output
Q801	2SC454Ⓢ	1st Video Amplifier
Q802	2SC154B	Video Output



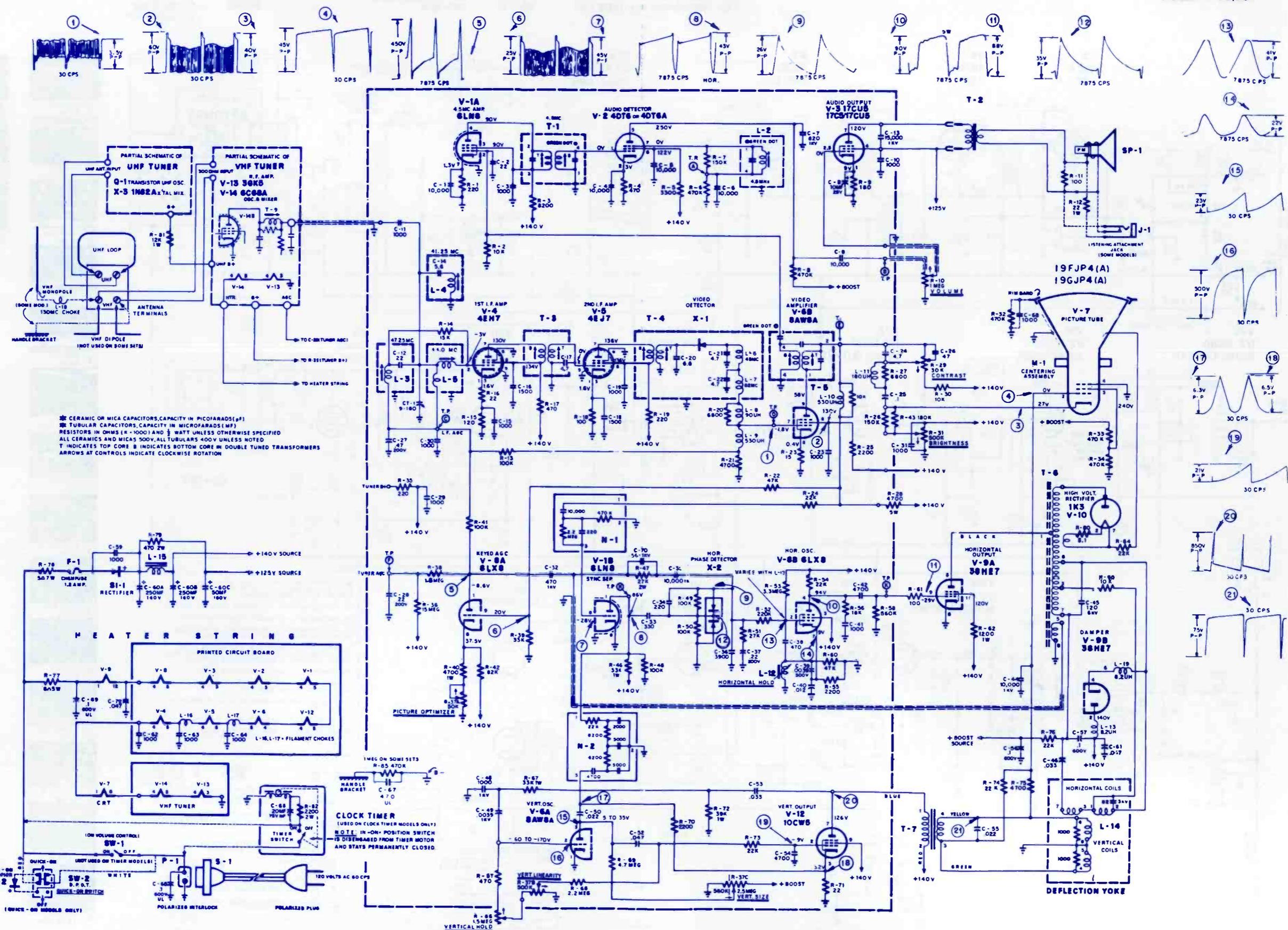
SYMBOL DESCRIPTION	EMERSON PART NO.
R-10 - vol contr 1M ch 120904	390928
R-26 - contrast cont 30K ch 120904,906,907	390886
R-29 - contrast cont 30K ch 120911	391002
R-31 - bright cont 500K ch 120904,906,907	390987
R-31 - bright cont 500K ch 120911	391001
R-37A - pic opt cont 50K	390997
R-37B - vert lin cont 500K	part of R-37A
R-37C - vert size cont 2.5M	part of R-37A

R-66 - vert hold cont 1.5M ch 120904,906,907	390988
R-66 - vert hold cont 1.5M ch 120911	391000
C-60A,B,C - cap elec 250+250+50µf @180v	925698
C-66 - cap elec 20µf @75v non-pol	925656
some sets only	925656
L-2 - sound quad coil 4.5MHz	720404
L-12 - horiz osc coil	718185
L-14 - def yoke assy	708532
L-15 - filter choke power supply	737058

L-16,17 - filament choke	705031
T-1 - sound interstage xformer 4.5MHz	720513
T-2 - audio output xformer part of SP1	
T-5 - sound take-off xformer 4.5MHz	720712
T-6 - horiz output xformer	738210
T-7 - vert output xformer	738193
N-1 - couplate sync separator	923059
N-2 - couplate vert integrator	923159

ELECTRONIC TECHNICIAN / DEALER **TEKFAAX**

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



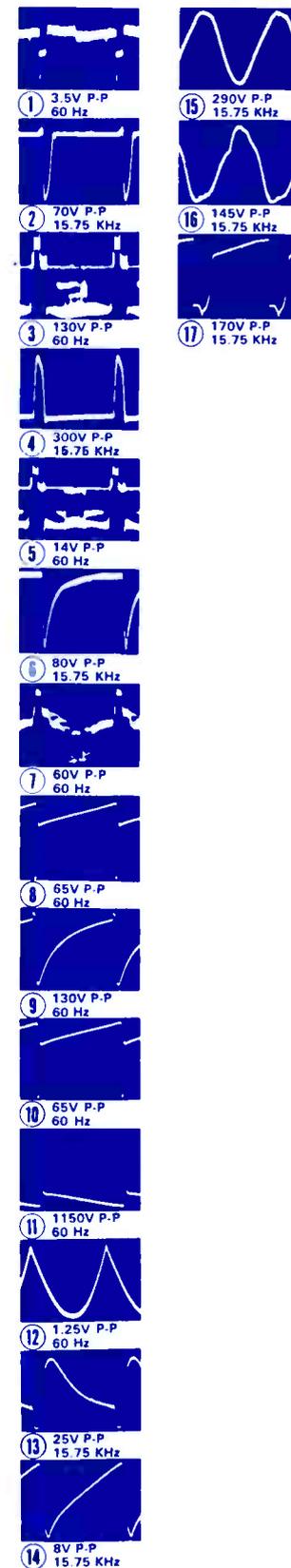
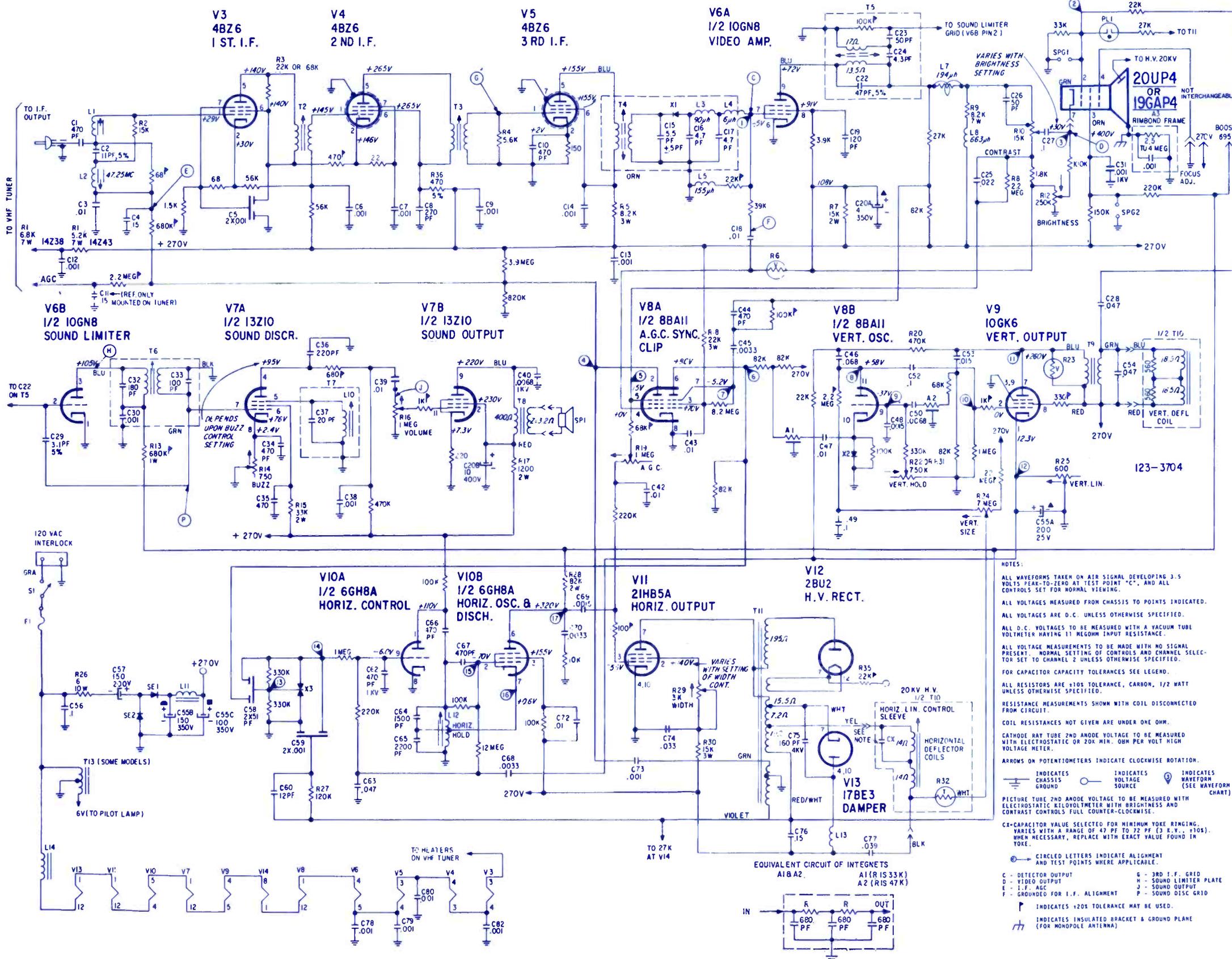
* CERAMIC OR MICA CAPACITORS, CAPACITY IN PICOFARADS (PF)
 * TUBULAR CAPACITORS, CAPACITY IN MICROFARADS (MF)
 RESISTORS IN OHMS (Ω), IN 1000S (K) AND IN 100,000S (M) UNLESS OTHERWISE SPECIFIED
 ALL CERAMIC AND MICA'S 500V, ALL TUBULARS 400V UNLESS NOTED
 T INDICATES TOP CORE & INDICATES BOTTOM CORE IN DOUBLE TUNED TRANSFORMERS
 ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION

CLOCK TIMER
 (USED ON CLOCK TIMER MODELS ONLY)
 NOTE: IN-OFF POSITION SWITCH IS DISENGAGED FROM TIMER MOTOR AND STAYS PERMANENTLY CLOSED.

SYMBOLS DESCRIPTION	ZENITH PART NO.
C55A - 200µf elect	22-5268
C55B - 150µf elect	22-5268
C55C - 1µf molded ±20%	22-5268
R6 - volt dep res	83-5314
R10 - 15K contr cont	83-8491
R12 - 250K bright cont	83-8489
R14 - 750Ω buzz cont	83-8487
R16 - 1M vol cont & ac switch	83-8349
R19 - 1M AGC	83-4833
R22 - 750K vert hold cont (14Z38 only)	83-7185

R23 - varistor	83-7447
R24 - 7M vert size cont	83-8433
R25 - 800Ω vert lin cont	83-8488
R29 - 3K width cont	83-5031
R31 - 750K vert hold cont (14Z43 only)	83-8490
T2 - 2nd IF xformer Assy (14Z38 only)	S-78278
T5 - sound take-off coil Assy	S-74448
T7 - quad coil Assy wiring	S-75409
T8 - audio output xformer	95-2875
T9 - vert output xformer	95-2333
T10 - yoke	95-2391

T11 - horiz sweep xformer	S-81959
T13 - fil auto xformer	95-2560
L2 - adj ch sound trap	20-8080
L4 - choke coil	20-2004
L10 - quad coil wind Assy	S-74882
L11 - filter choke	95-1805
L12 - horiz osc coil wind Assy	S-56878
A1 - integrator	87-4
A2 - integrator	87-5
A3 - R/C network	105-104
Fi - fuse 2 amp	138-88
S1 - on-off switch	pt of R16



NOTES:

ALL WAVEFORMS TAKEN ON AIR SIGNAL DEVELOPING 3.5 VOLTS PEAK-TO-ZERO AT TEST POINT "C", AND ALL CONTROLS SET FOR NORMAL VIEWING.

ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED.

ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.

ALL D.C. VOLTAGES TO BE MEASURED WITH A VACUUM TUBE VOLTMETER HAVING 11 MEGOHM INPUT RESISTANCE.

ALL VOLTAGE MEASUREMENTS TO BE MADE WITH NO SIGNAL PRESENT. NORMAL SETTING OF CONTROLS AND CHANNEL SELECTOR SET TO CHANNEL 2 UNLESS OTHERWISE SPECIFIED.

FOR CAPACITOR CAPACITY TOLERANCES SEE LEGEND.

ALL RESISTORS ARE ±10% TOLERANCE, CARBON, 1/2 WATT UNLESS OTHERWISE SPECIFIED.

RESISTANCE MEASUREMENTS SHOWN WITH COIL DISCONNECTED FROM CIRCUIT.

COIL RESISTANCES NOT GIVEN ARE UNDER ONE OHM.

CATHODE RAY TUBE 2ND ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC OR 20K MIN. OHM PER VOLT HIGH VOLTAGE METER.

ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.

INDICATES CHASSIS GROUND INDICATES VOLTAGE SOURCE INDICATES WAVEFORM (SEE WAVEFORM CHART)

PICTURE TUBE 2ND ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC KILOVOLTMETER WITH BRIGHTNESS AND CONTRAST CONTROLS FULL COUNTER-CLOCKWISE.

C2-CAPACITOR VALUE SELECTED FOR MINIMUM YOKE RINGING. VARIES WITH A RANGE OF 42 PF TO 72 PF (3 K.V. - 10K). WHEN NECESSARY, REPLACE WITH EXACT VALUE FOUND IN YOKE.

⊙ CIRCLED LETTERS INDICATE ALIGNMENT AND TEST POINTS WHERE APPLICABLE.

C - DETECTOR OUTPUT G - 3RD I.F. GRID
 D - VIDEO OUTPUT H - SOUND LIMITER PLATE
 E - I.F. AGC J - SOUND OUTPUT
 F - GROUND FOR I.F. ALIGNMENT P - SOUND DISC GRID

INDICATES +20% TOLERANCE MAY BE USED.

INDICATES INSULATED BRACKET & GROUND PLANE (FOR MONOPOLE ANTENNA)



OVERHAUL

\$9.75

GUARANTEED for 1 Year

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

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

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

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

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

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

ORDER TUNERS BY PART NUMBER, AS FOLLOWS:

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

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



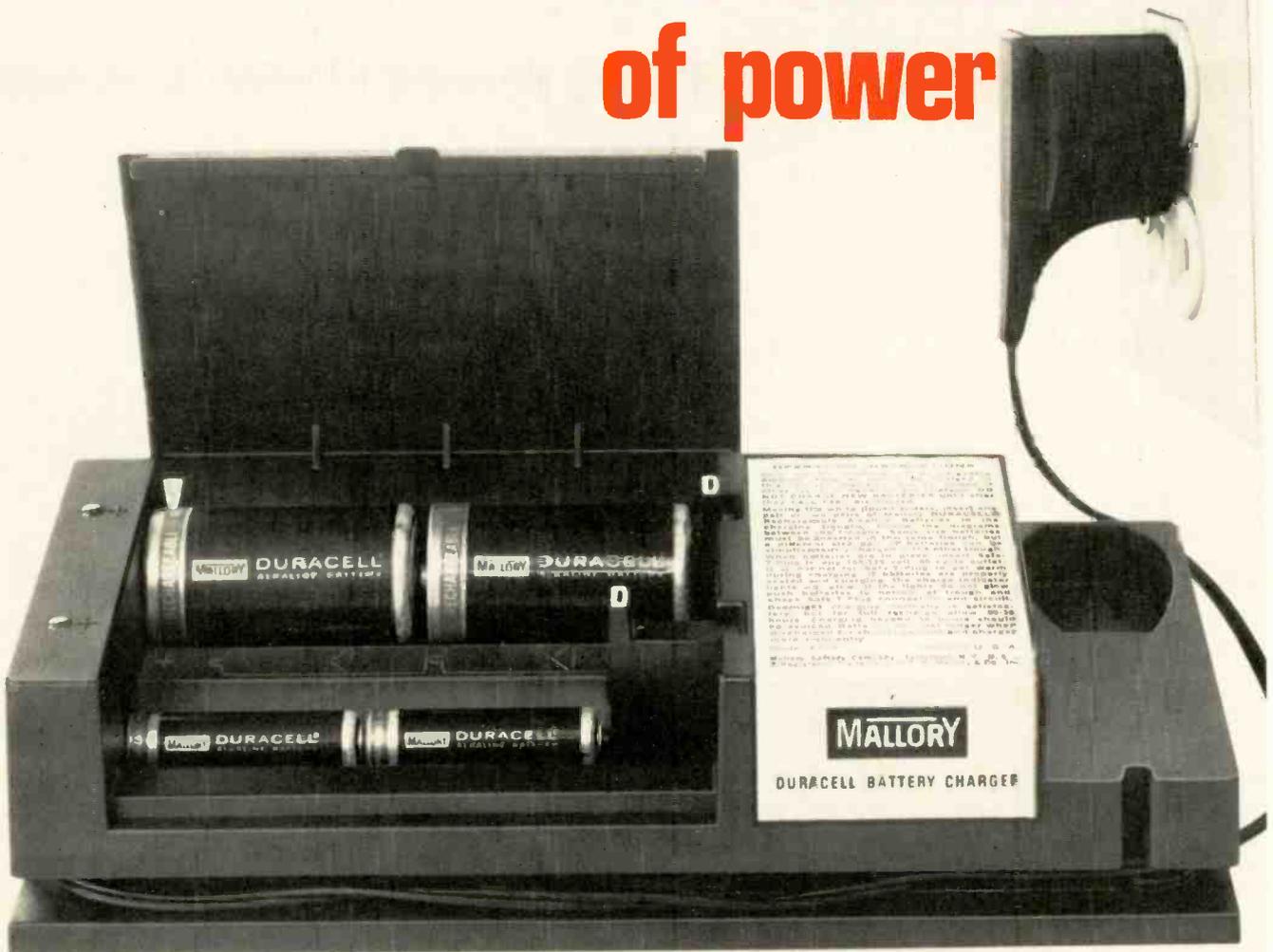
TUNER SERVICE CORPORATION FACTORY-SUPERVISED TUNER SERVICE

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

WATCH FOR NEW CENTERS UNDER DEVELOPMENT

... for more details circle 130 on postcard

The restoration of power



It's easy with Mallory's new BC-15 Charger. It restores original power to rechargeable alkaline Duracell® "AA", "C" and "D" batteries. And the BC-15 is the only way to recharge rechargeable Duracells.

It's only \$8.95. And considering the replacement costs of batteries, the BC-15 pays for itself after recharging just six batteries.

And when you figure that each rechargeable Duracell can be recharged up to 100 times, the savings are fantastic.

The BC-15 is simple to use. Just plug it in. It tells you whether the batteries are properly seated. And automatically selects the proper charging rate for each battery size. And two different sizes can be recharged at the same time.

The BC-15 is so rugged, electrically and mechanically, that we give it a one-year warranty.

If you use rechargeable alkaline Duracells, get the BC-15 charger now. It can restore their power again . . . and again . . . and again.

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ELECTRONIC TECHNICIAN / DEALER

WORLDS LARGEST ELECTRONIC TRADE CIRCULATION

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41 TEKLAB REPORT ON CHANNEL MASTER COLOR TV MODEL 6112

For the first time, our Electronic Technician/Dealer lab technicians evaluate a Channel Master color TV, model 6112, to present a complete circuit description with diagrams and pertinent service notes

45 ANTENNA TIME

Another in the humorously interesting Bob and Scoot series tells how to get a bigger slice of the TV antenna market with some profitable hints on installation practices

47 COLOR BAR GENERATOR SURVEY

This article is based on information obtained from test instrument manufacturers. It provides an interesting look at their attitudes, problems and their trend toward improving stability and reliability

51 HYBRID COLOR PROBLEMS

Many of the solid state-tube combination color sets today leave the technician with some doubts as to service procedures. This article deals with several circuit problems and explains methods of troubleshooting and repair

55 TESTLAB REPORT ON SENCORE SM 152 AND SECO 88A

Our lab technicians evaluate two new test instruments in this month's feature, the Sencore Model SM 152 Sweep Marker Generator and the SECO 88A Tube Tester complete with specifications

58 EMPHASIS ON SERVICE

A service-dealer business is not based on one-time sales, but on return customers. This month's dealer explains his policy of maintaining a permanent clientele

60 "ODD BALL" COLOR TV PROBLEMS

The really tough circuit problems are always worked out in time, but knowing where to start can save you some of that valuable time, which is the object of this timely feature outlining specific examples and solutions

22	EDITOR'S MEMO	68	COLORFAX
24	NEW AND NOTEWORTHY	70	NEW PRODUCTS
28	LETTERS TO THE EDITOR	75	NEWS OF THE INDUSTRY
34	TECHNICAL DIGEST	79	CATALOGS AND BULLETINS
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COVER

The handsome features of the Channel Master color console and its equally rich colors are portrayed on this month's cover as a technician checks the color bar patterns during initial set up in the customer's home.

TEKFAQ • 16 PAGES OF THE LATEST SCHEMATICS • GROUP 203

AIRLINE: TV Model GEN-13786B

EMERSON: TV Chassis 120904,911

GENERAL ELECTRIC: Color TV Chassis H-2

PHILCO-FORD: TV Chassis 19S32

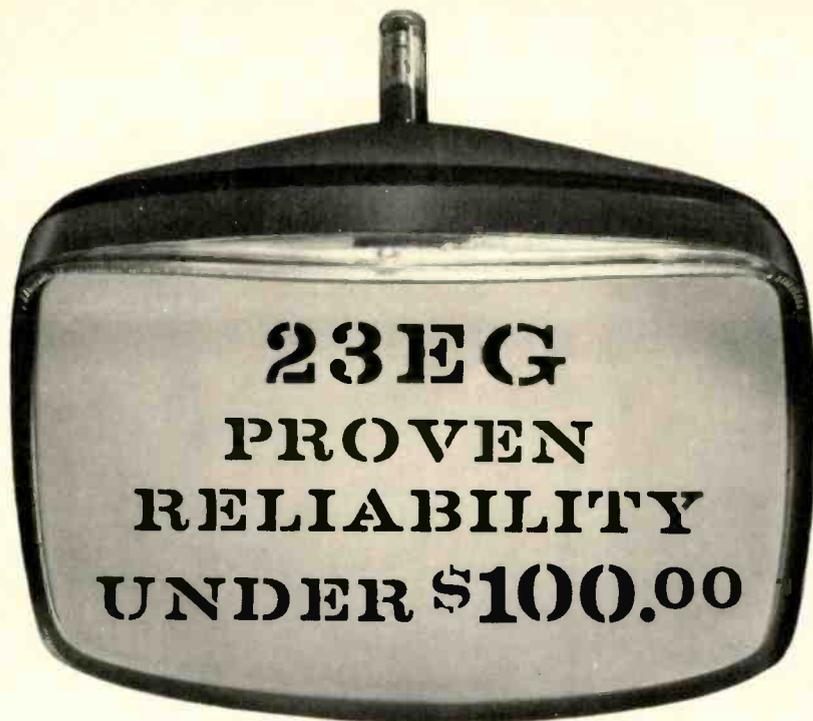
RCA VICTOR: Color TV Chassis CTC38 Series

ZENITH: TV Chassis 14Z38,14Z43

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



Only from Channel Master

At last ... a 23EG Rare Earth Replacement Color Tube with the proven reliability of the 25AP22.

... And under \$100 Net Exchange.

It took Channel Master, world's leading replacement tube manufacturer to achieve this price and performance breakthrough. Technological skills gained in producing OEM 25" Color Tubes — especially the new 25AJP22 — have resulted in a 23EG Color Tube with quality far surpassing the original.

Don't settle for poor quality 23EG's or clumsy conversion kits.

Note to Motorola Service Technicians: This tube is the exact replacement for Motorola Sets. Newly devised Channel Master mounting aid greatly reduces installation time.

Call your Channel Master Distributor ... He's your

Picture Tube Headquarters

CHANNEL MASTER DIV. OF AVNET, INC.,
Ellenville, N.Y.

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CCTV for 'Horse-Watching'

Television service-dealers are becoming more and more involved with CCTV and for many, it's a natural addition to their business. However, the field is new, wide and virtually unlimited. In recent issues of *ELECTRONIC TECHNICIAN/DEALER* we have tried to give service-dealers a few ideas of some of the possible uses for CCTV systems, but we missed the boat on one very unique application — "horse-watching."

A booklet entitled "What's New in Electronics," published bimonthly by the Cleveland Institute of Electronics, brought it to our attention.

You might say that a CCTV system is an expensive way to watch a horse, but it all depends on how you look at it. These are not just "horses," they are mares expecting foals worth \$2000 apiece. In this particular installation, a CCTV camera is combined with an intercom system to monitor a mare while she is waiting to give birth to a foal. The stable is operated for breeding thoroughbreds for racing.

John DeMarni, who owns the stable, was plagued with sleepless nights running from the house to the stable to check on the "expectant mothers" and to help in the delivery if necessary. To eliminate his nocturnal trips, he installed an intercom system to carry the sounds from the foaling stables to his house. But the sounds turned out to be misleading and the rancher found himself just as sleepless answering too many "false alarms." He decided that the only cure was to install a CCTV camera and cable it to his living room TV set along with the intercom system. It solved his sleepless nights situation and now he can monitor an expectant mare in comfort. It just goes to show what a little ingenuity and a lot of sleepless nights can do.



Paul A. Horvath

... for more details circle 110 on postcard

**Each GE tube
must satisfy
this tough customer
14 different ways
before it gets to you!**



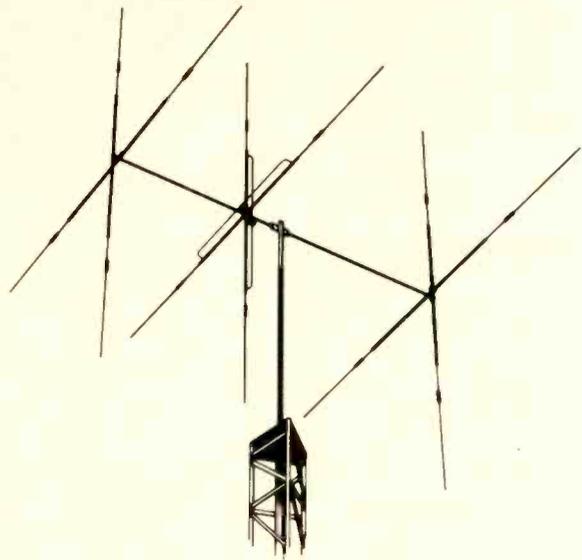
Reach for this when you ask,
"What else needs fixing?"

Each General Electric tube you buy gets the OK from John Snyder, our quality control chief. He's a real *tough customer* who puts GE tubes through the industry's roughest testing routine. He tests 100% for plate current, grid and heater voltage, seal and many other critical factors. Samples of every lot undergo life tests, some up to 2000 hours for lifespan performance evaluation. Actual TV set usage is simulated in a unique heater cycling test which imitates the on-off-on-off punishment tubes must take on the job. If a tube flunks just one test, it's fed to the grinder! No wonder you can stake your reputation on every GE tube from the "service designed" line for all your replacement needs. Stock up at your GE distributor today.

288-26

GENERAL  ELECTRIC



**CB ANTENNA 700***Choice of polarization*

The Model MS-3D is a miniaturized CB antenna with the construction of a beam plus the choice of polarization usually available only in the quad design. It features six miniature elements, three vertical and three horizontal, loaded by coils for full electrical length and power tolerance. A double "T" matching system provides balanced feed. The polarization switching control box permits change of polarization at the flip of a switch. Specifications and performance data: Electrical: Forward gain—9.6db over isotropic source; 7.5 db compared to reference dipole. Front-to-back ratio—25db. Polarization isolation—25db. SWR—1.5/1 or better. Matching system—T-Match. Feed impedance—52Ω from transceiver. Recommended transmission line—50 to 52Ω coax. Mechanical: Number of elements—3 in vertical position, 3 in horizontal position. Maximum element length—11 ft. 4½ in. Boom length—9ft. Recommended mast size—1¼ in. OD. Turning radius—7ft. 3in. Wind surface—2.7sq. ft. Wind load—(EIA Std. 80 mph) 54 lb. Assembled weight—14 lb. Approx. shipping weight—16 lb. Net price \$86.91. Mosley.

**MATV LINE AMPLIFIERS***Powered by the head-end amplifier 701*

Introduced is a series of cable-powered "Line Stretchers" for MATV systems. The size of an ordinary passive splitter, the units can be inserted anywhere in an MATV

trunkline. Their function is to reamplify the signal at the end of a long trunkline, thus handling additional TV outlets. Because they are small, they will fit behind any outlet plate in the system. No ac power source is required because they are powered from the head-end amplifier over the same coaxial cable that carries the signal. There are four models in the line extender series. The Model SL6300 is claimed to amplify all VHF and FM frequencies by 13.5db, plus providing 3 to 6.5db UHF gain. The SL6301 is similar except that it includes a 6db gain control range. The Model SL6310 is basically a UHF line extender, providing 12db gain across the UHF spectrum and passing VHF. The Model SL6311 is similar to the SL6310 except that it includes a 6db gain control. Line extenders without gain controls list for \$37.50, and units with gain controls list for \$47.50. JFD.

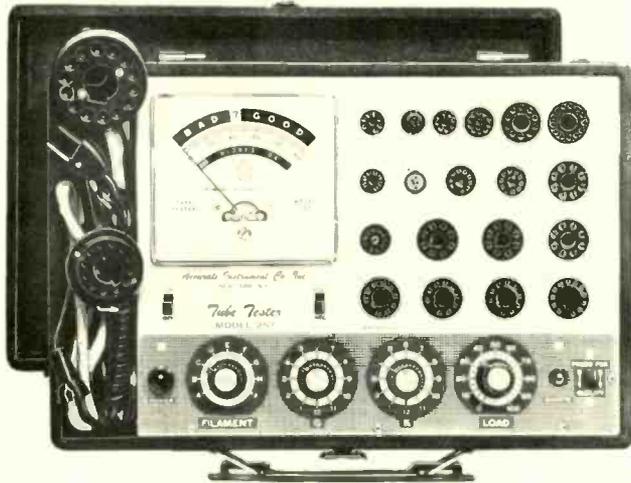
SOLDER GUN 702*Solid-state and weighs 5 ozs.*

A solid-state, transformerless soldering gun featuring a high/low temperature selector switch, is introduced. It weighs 5 ozs. exclusive of its three-wire cord set and, because of its solid-state design, requires no transformer. The gun is designed to assure damage-free soldering of integrated circuits and field effect transistors. This is achieved by electrically isolating the soldering tip from the heating element with a grounded three-wire cord set to render the tip electrically inert. The user has a choice of two tip temperature ranges. To select a tip temperature of approximately 500° or 900°F, the user simply slides a thumb-switch on the gun handle to LO or HI. Soldering tips are independent of the heating element for replacement purposes and tips can be replaced without changing the heat cartridge. The heat cartridge locks into the gun barrel by means of a knurled nut. Loosening the nut allows rotation of the entire cartridge to orient the thread-on tips. Included in the purchase price of the solder gun (# 6760) will be three interchangeable tips: a short chisel, pyramid and long chisel type. Ungar.



**FOR MORE NEW
PRODUCTS SEE
PAGES 64 AND 70**

The New 1969 Improved Model 257 **A REVOLUTIONARY NEW TUBE TESTING OUTFIT**



COMPLETE WITH ALL ADAPTERS AND ACCESSORIES, NO "EXTRAS"

STANDARD TUBES:

- ✓ Tests the new Novars, Nuvistors, 10 Pins, Magnovals, Compactrons and Decals.
- ✓ More than 2,500 tube listings.
- ✓ Tests each section of multi-section tubes individually for shorts, leakage and Cathode emission.
- ✓ Ultra sensitive circuit will indicate leakage up to 5 Megohms.
- ✓ Employs new improved 4½" dual scale meter with a unique sealed damping chamber to assure accurate, vibration-less readings.
- ✓ Complete set of tube straighteners mounted on front panel.

The Model 257 is housed in a handsome, sturdy, portable case. Comes complete with all adapters and accessories, ready to plug in and use. No "extras" to buy. Only

\$47⁵⁰

- Tests all modern tubes including Novars, Nuvistors, Compactrons and Decals.

- All Picture Tubes, Black and White and Color

ANNOUNCING...for the first time

A complete TV Tube Testing Outfit designed specifically to test all TV tubes, color as well as standard. Don't confuse the Model 257 picture tube accessory components with mass produced "picture tube adapters" designed to work in conjunction with all competitive tube testers. The basic Model 257 circuit was modified to work compatibly with our picture tube accessories and those components are not sold by us to be used with other competitive tube testers or even tube testers previously produced by us. They were custom designed and produced to work specifically in conjunction with the Model 257.

BLACK AND WHITE PICTURE TUBES:

- ✓ Single cable used for testing all Black and White Picture Tubes with deflection angles 50 to 114 degrees.
- ✓ The Model 257 tests all Black and White Picture Tubes for emission, inter-element shorts and leakage.

COLOR PICTURE TUBES:

- ✓ The Red, Green and Blue Color guns are tested individually for cathode emission quality, and each gun is tested separately for shorts or leakage between control grid, cathode and heater. Employment of a newly perfected dual socket cable enables accomplishments of all tests in the shortest possible time.

NOTICE

We have been producing radio, TV and electronic test equipment since 1935, which means we were making Tube Testers at a time when there were relatively few tubes on the market, way before the advent of TV. The model 257 employs every design improvement and every technique we have learned over an uninterrupted production period of 32 years.

Accurate Instrument Co., Inc.

SEND NO MONEY WITH ORDER PAY POSTMAN NOTHING ON DELIVERY

Try it for 10 days before you buy. If completely satisfied, you may remit \$47.50 plus postage and handling charge, or you may pay in easy monthly payments until the total price of \$47.50 plus postage, handling and budget charge is paid.

ACCURATE INSTRUMENT CO., INC.

Dept. 661, 2435 White Plains Road, Bronx, N.Y. 10467

Please rush me one Model 257. If satisfactory I agree to remit \$47.50 plus postage and handling charge or pay in easy monthly payments until the total price of \$47.50 plus postage, handling and budget charge is paid.

Name

Address

City

Zone

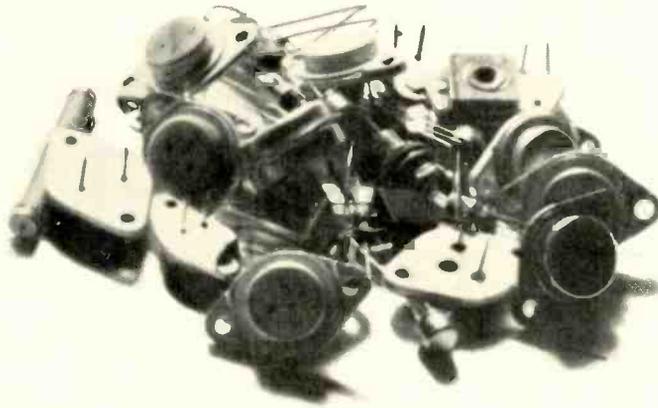
State

Save Money! Check here and enclose \$47.50 with this coupon and we will pay all shipping and charges. You still retain the privilege of returning after 10 day trial for full refund.

**This is 30,000
solid state replacement parts.**



So is this.



It used to be if you wanted to satisfy everyone, you had to stock over 30,000 different solid state replacement parts.

Well, everyone realized that was ridiculous. So some enterprising people came up with a bunch of universal replacements.

Then you only had to stock about eleven or twelve hundred.

That was a lot better, but we still thought it was a little ridiculous.

So two years ago (when we went into this business), we figured out how to replace all 30,000 with only 60.

Now all you have to do is stock 60 of our diodes, transistors, integrated circuits, etc., and you can replace any of the 30,000 parts now in use. Including

all JEDEC types, manufacturers' part numbers, and foreign designs.

That means you invest less money.

You don't tie up valuable space.

You do away with complicated inventory control.

And you operate more efficiently.

To make life even easier, we've got a new book that gives you all the cross references you need to figure out which part replaces which.

It's available from your Sylvania distributor.

If the whole thing sounds rather incredible, you're right. But why not give your distributor a call and let him narrow the incredibility gap.

SYLVANIA
GENERAL TELEPHONE & ELECTRONICS

FAST

COMPLETE SERVICE ON ALL MAKES OF TV TUNERS

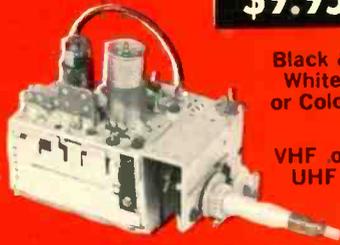
Maximum Time In Shop 24 Hrs.

(90 Day Warranty)

(WE SHIP C.O.D.)
YOU PAY SHIPPING
\$9.95

Black &
White
or Color

VHF or
UHF



UV Combo's, \$16.50

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

EFFECTIVE AUGUST 1, 1969

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



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

GEM CITY TUNER REPAIR SERVICE

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

... for more details circle 117 on postcard

ET/D

LETTERS TO THE EDITOR

Proper Terms

Now that the word "monaural" is nearly completely eliminated from the audio vocabulary (only a few recalcitrant retailers and advertisers are still using this incorrect and obsolete word), it is time that the audio professionals and enthusiasts do something about that other piece of jargon, "FM stereo."

The term "FM stereo" is backward. It should be *stereo FM*. The contrast is between mono FM and stereo FM, monophonic frequency modulation and stereophonic frequency modulation, not "frequency modulated stereophony" as implied by "FM stereo." The complete phrase is "stereo multiplex FM radio receiver/tuner/broadcast"; any of these words can be used *in this same order*, as in "stereo multiplex," and so on. Any other word order violates the normal word relationships, the order of modifiers and subordinates, of the English language.

Now is the time for the audio field to eliminate the jargon of "FM stereo" in favor of the good English of *stereo FM*. Let us begin.

PHILIP N. BRIDGES

Ashton, Md.

Retirement Sale

I recently discontinued my TV service business after 21 years and I have over 700 Sams Photofacts which I do not need. I would be willing to part with them for a fraction of their cost. I also have a nearly new Sencore TR139 transistor tester for sale and will consider any reasonable offer. I am an avid reader of **ELECTRONIC TECHNICIAN/DEALER** and like it very much.

LEON G. BROWN

128 E. St. Joseph
Coloma, Mich. 49038

Your January 1969 issue carried a letter from Paul A. Krager of Rochester, Minn., requesting information on a 304A Dumont scope. The Dumont is and has been a Bell Telephone Co. standard for years. If he will contact a local toll center office it may provide him with the information. I also have a request for a manual. I need information on an Army surplus frequency meter BC221 manufactured by Zenith. Can any of your readers help?

ROY W. ROWSON

1219 Fenwick Dr.
Lynchburg, Va. 24502

Readers Aid

I have an RCP Model 332AP tube tester and would very much appreciate the latest tube chart for it.

JERRY LINDEN, JR.

1991 Lakefield Rd.
Cedarburg, Wis. 53012

I recently acquired a used Precision CRT tester (Series CR30). I need an instruction manual or the special instructions called out on the setup chart. If someone would send me the information so I could make a copy and return it, I would appreciate it.

The Dynascan (B&K) company had no information on it.

JOSEPH SCHUMI

1055 Cumberland St.
St. Paul, Minn. 55117

Once again I must turn to the **ELECTRONIC TECHNICIAN/DEALER** readers for help. I have a VT volt-ohm-capacity meter Model 300 manufactured by Electronics Measurement Corp. of New York. I would like to borrow a schematic if any of your readers have one.

ED BALCER

105 Blackpoint Rd.
Rumson, N.J. 07760

I am in dire need of an instruction manual for a Model 620-A heterodyne frequency meter manufactured by General Radio Co. An original or copy will be fine.

G. JOHNSON

PO Box 41
South Bend, Ind. 46624

I am writing about a tube tester I purchased a few years back from Moss Electronics. It is a Model TV 11. I find that the company is now out of business, and this leaves me in a tough situation. I need a roll chart for this unit that will allow me to test the later tubes. Any attention you or your readers can give this request will be appreciated.

GEORGE DZIAK

Box 203
Cokeburg, Pa. 15324

I have a Radion field strength meter which was made in Chicago, Ill. I have been unable to contact the company for parts. Would it be possible that one of your readers can supply me with a 5050 Radion oscillator tube for this unit or let me know where I can get one? Also, I have some antenna rotators made in the United States called Superoter for which I am unable to get parts here. These are model SHD units.

GEORGE SWIFT

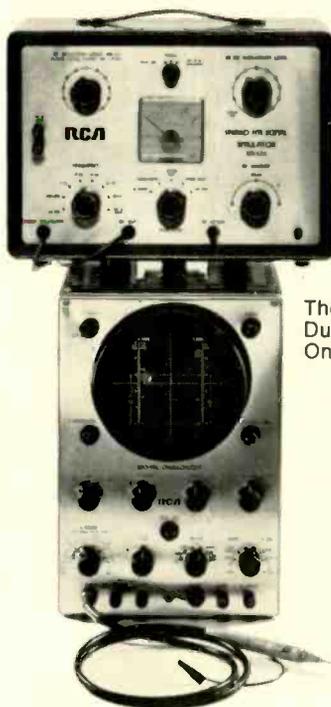
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Buy the WR-52A or WO-91C between April 15 and July 15. Mail us your warranty card and the blue label on the outside of the carton no later than July 31st and we'll ship the Copymate to you at once, freight prepaid!

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ET/D

**LETTERS
TO THE EDITOR**

GE Chassis Trouble

I am writing in regard to the Technical Digest article about Intermittent Horizontal Oscillator Startup (ET/D-April 1969) in the GE "S" and "V" chassis.

I had an "SB" chassis with this same trouble. After bringing it to the shop seven times only to have it play normal each time, I finally called the GE distributor in Boston for help. He told me to change two capacitors that bridge the horizontal oscillator coil, C255 and C256. I replaced them and the problem cleared up. Neither of these capacitors were mentioned in the article as being a problem. However, I wanted to bring it to your attention as they seemed to be the solution to a similar problem I had.

As an afterthought I would like to see ET/D start a small column devoted to polite gripes. The readers would be asked to contribute suggestions to it which you could forward to the manufacturers. These suggestions, for example, would be—put a removable panel on the bottom of all TVs to aid in servicing; put the tube layout chart in a place where we can read it and large enough so we don't get eyestrain. I'm sure ET/D readers could come up with a multitude of others.

RAY BURKE

Middleboro, Mass.

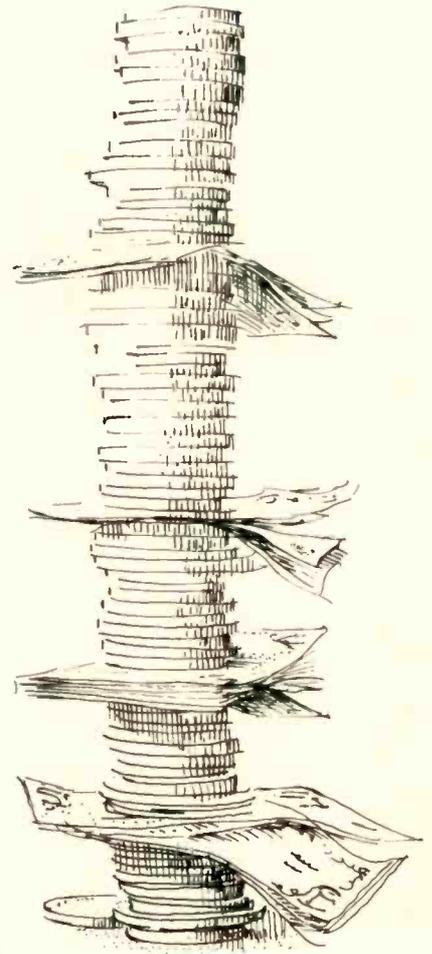
American Technician

A letter by Mr. Joseph Mann of Woodside, N.Y., in your April 1969 Letters-to-The-Editor column is, how you say, "veddy intuhesting."

Personal experience as well as information obtained from others leads me to state positively, though, that the dilemma facing him and other producers and distributors of foreign-made equipment (not *all* junk, by any means) is definitely of their own making. Mr. Mann himself must know that competent professional service is abundantly available in this great wide country of ours to anyone willing to pay a *fair* price to receive it. The trouble with most companies who are seeking servicing outlets to perpetuate their unrealistic extended warranties is that they expect to receive 1969 service at 1939 rates. In their quest for reduced production costs and a larger share of the market, they have not overlooked the fact that they must realize a generous profit, but they

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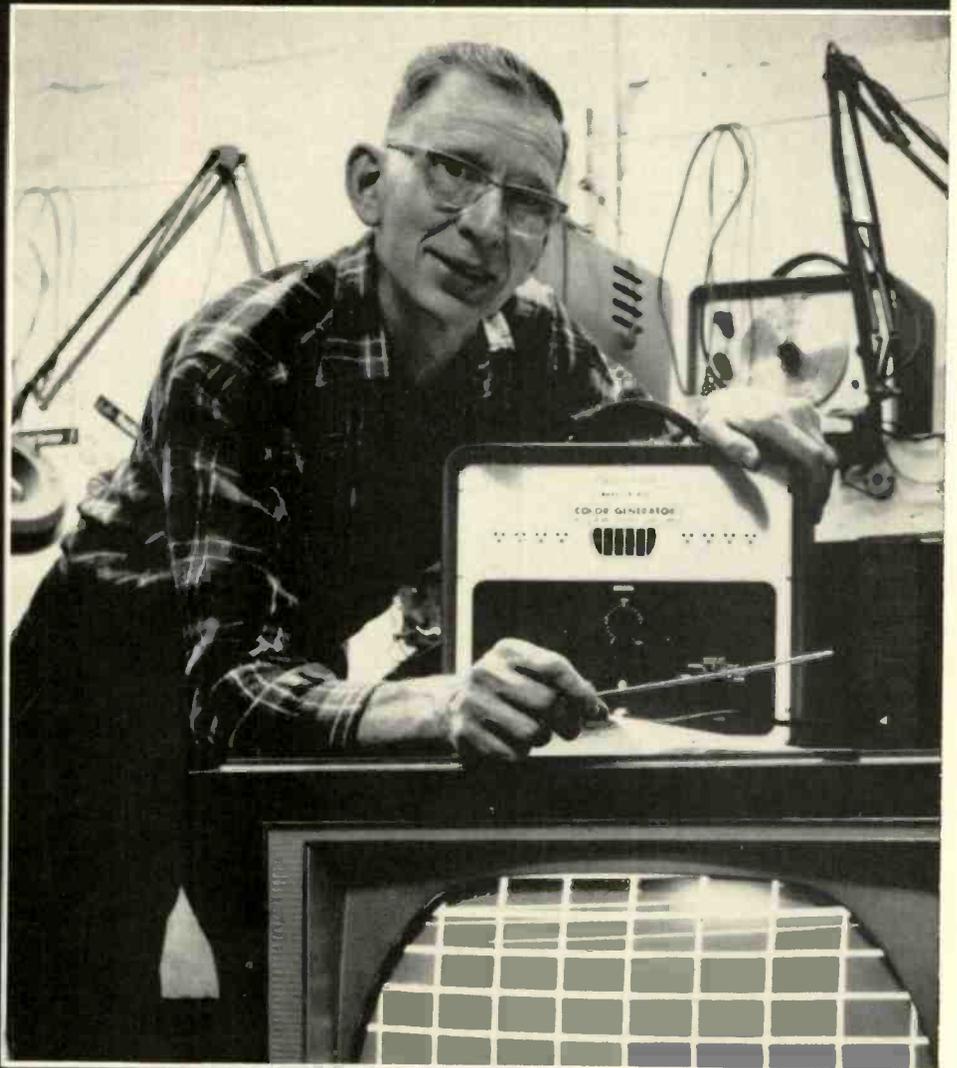
RCA Electronic Components,
Harrison, N. J.

RCA

. . . for more details circle 106 on postcard

“The Yellow Pages is my top salesman.”

“Most of our customers come to us in one of two ways; either from word-of-mouth, or the Yellow Pages,” says Mr. Irwin Grim, owner, Oak Lawn TV Service Center, Oak Lawn, Illinois. “Our Yellow Pages ad is there 24 hours a day working for us. We’re an authorized dealer for Motorola and Zenith. In one particular instance, a man called me up and asked me what model television I had on the floor. I happened to have a 23” console and he asked me to bring it right over. As a result of this one sale, we got about five or six new customers. That’s what the Yellow Pages and word-of-mouth advertising working together can do. Our ad also tells people



looking for repairs that we’ve been in business 22 years. It helps give a customer confidence in us. Without our Yellow Pages ad, we couldn’t

exist. It’s what is keeping us in business.”



An effective way to build business.

continue to search for service people who will toil for antiquated wages and who don't mind the extra, uncompensated chores of filling out endless forms, stocking numerous parts that won't be resold at a profit, and packaging and returning in-warranty defects to the supplier.

There are, of course, some servicers around who *will* work for inadequate

wages because of deficiencies in book-keeping and knowledge of operating costs. There are some who will accept a questionable proposition on the tired promise that the eventual demand for out-of-warranty service will more than justify it. The good ones usually wake up, sooner or later, or they gradually tire of being the fall guy for the manufacturer/distributor as the purchasers begin to blame the service agency for the long tie-up of a new product because of a two-week to six-month wait for a special part (if it hasn't been discontinued). What is left, then, for Mr. Mann and some others is the very small percentage of

service companies gullible enough to believe that the factories *are* doing *them* a favor, even though most factory reps will freely state that "you aren't supposed to make money on warranty service." These remaining are obviously the people who gave Mr. Mann's products the service they deserved.

Mr. Mann's contention that "the American servicemen who, if they were really any good, would be working for a manufacturer" is not only off base, it is completely out of the ball-park. Without belittling the many skilled and proficient technicians employed by the many American (or even Japanese) factories, there is no comparison between the time-card man at the factory and the consumer-product servicing electronic technician who must keep pace with all the technological advances (or regressions) of the entire industry, but must also be brainy, brawny, agile, neat *and* an expert in public relations. Though factories and their agencies have, on occasion, paid relatively high starting wages to some who couldn't make the grade as a tube caddy carrier, there are many well-paid technicians who consider our profession to be one of the most challenging and satisfying careers available and would not consider exchanging the personal rewards for the hum-drum of clock-watching, assembly-line, one-make servicing offered outside of this field. More and more of these professionals are also finding that the consumer, faced with increasing complexity and numbers of electronic units at a time when too few new people are entering the field, has begun to realize the value of good service and is becoming evermore willing to pay a properly realistic fee.

Maybe the manufacturers could learn a lesson from the consumer.

W. S. HARRISON

Zone Governor, NATESA

I need an instruction manual or schematic for a Simpson signal generator Model 340. I will be glad to pay for an original or copy and will be glad to send them something from Hawaii if they so desire.

A. D. SARGENT

PO Box 143
Volcano, Hawaii 96785

I have enjoyed your magazine for many years and found it to be very helpful. I hope one of your readers can tell me where I might obtain a record and playback head for an Air King wire recorder, Model A-725.

CLAUDE FURCHER

Route 2, Box 336
Montgomery Woods
Hockessin, Del. 19707

CB BASE STATION ANTENNA

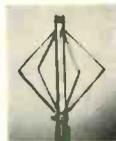
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Whatever your testing needs, wherever you're working, there's a Triplett portable tester to meet the requirements — as perfectly as the skills of dedicated craftsmen can guarantee. For example, here are four winners from Triplett's great 630 Series:



**MODEL 630-A
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- 1 $\pm 1\frac{1}{2}\%$ DC, $\pm 3\%$ AC accuracy.
- 2 One selector switch minimizes chance of incorrect settings and burnouts.
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\$71⁰⁰



**MODEL 630-APL
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- 2 One selector switch minimizes chance of incorrect settings and burnouts. Polarity reversing for DC.
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**MULTI-PURPOSE V-O-M
MODEL 630-PL**

- 1 One selector switch minimizes chance of incorrect settings and burnouts. Polarity reversing for DC.
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- 3 Meter movement diode protected against instantaneous overloads.

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**MULTI-PURPOSE V-O-M
MODEL 630**

- 1 One selector switch minimizes chance of incorrect settings and burnouts.
- 2 4.4 Ohm center scale, reads from 0.1 ohm up to 100 megohms resistance in 4 ranges.
- 3 20,000 ohms per volt DC sensitivity; 5,000 AC.

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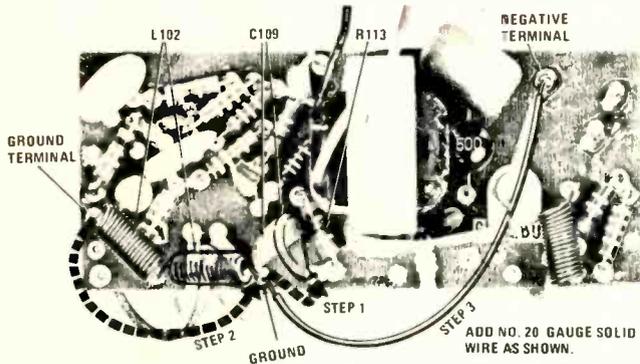
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MOTOROLA

FM/AM Table and Clock Radio Models HS-67250/CHS-67250/DHS-67250
—Intermittent Hum after a Short Period of Time

Cause: The heat sink on the power supply-audio amplifier assembly is mounted to the board by two screws. If either or both screw connections develop a high resist-



ance or open, a ground loop develops and produces a hum. Correction: By repositioning the ground terminals of two components and adding a ground strap, hum-producing ground loops are avoided. See diagram for details.

1. Unsolder and remove ground terminal of C109 from present terminal and reground as shown. 2. Remove ground terminal of L102 and reconnect to ground as shown. (Same point previously occupied by C109.) 3. Connect a 3 in. length of number 20 insulated wire between the ground terminal of L102 and the negative terminal (outside can) of C107.

OLYMPIC

TV Chassis NDP—Horizontal Pulling and Bending under Certain Signal Conditions

This chassis, used in models 7C133, 7C134, 7C135 and in some "7K" series, has a pair of long yellow and orange wires connecting the front control panel to the CRT socket and connecting point "E" on the chassis board respectively. These wires should be gathered in a flat loop and taped together so that they run "direct," the shortest possible distance between connecting points. In some models they were stapled to the top of the cabinet, thereby running near the deflection yoke. This may cause an induction of the horizontal sweep frequency into the wire resulting in horizontal pull. When this happens, the two wires should be "hanked" and taped.

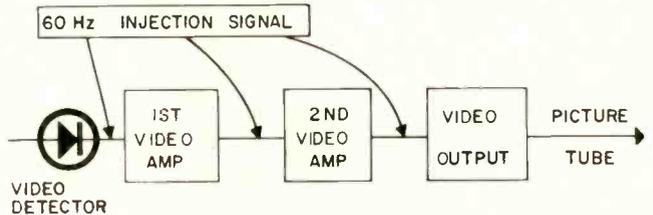
RCA VICTOR

Troubleshooting Video Stages

Experienced radio technicians use a signal injection technique for troubleshooting audio amplifiers that can be readily adapted to servicing video stages. This technique is a simple and quick method for troubleshooting either transistor or tube type video amplifier circuits.

The troubleshooting procedure begins by injecting a

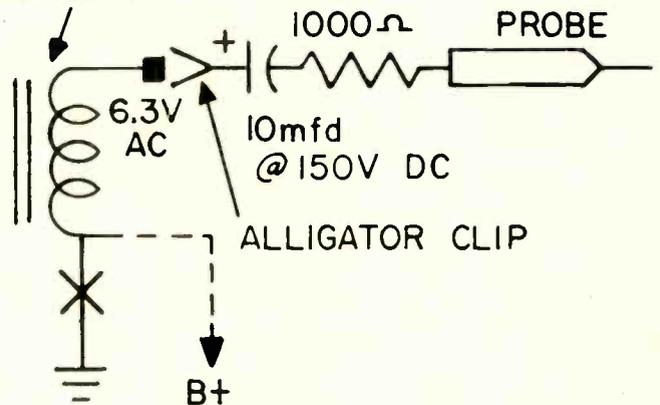
60Hz test signal at the input of the first video amplifier stage as illustrated. The absence of a hum-bar on the screen indicates a video amplifier problem. Next inject the signal



at the input of each following stage until a hum-bar is produced on the screen. Obtaining a hum-bar indicates that the stages following the injection point are passing signal and the problem is located in the stage preceding the injection point.

The filament winding of transformer-powered sets provides a handy point to obtain a 60Hz injection signal

**POWER
TRANSFORMER
FILAMENT
WINDING**



of the necessary amplitude. When servicing series filaments chassis, a 5-8v 60Hz signal can be obtained by selecting a point near the chassis common end of the filament line. (The tuner filament point is at this potential in many sets.)

The test signal should be coupled to the chassis by using an electrolytic capacitor and a resistor as illustrated. The values of these components are not critical—a good combination is a 10μf capacitor and a 1000Ω resistor. A word of caution, however: The picture tube filament winding of many color sets operates at a relatively high dc potential, and since an electrolytic capacitor is used to couple the injection signal, polarity must be observed. Also the dc voltage rating of the capacitor should be at least 150v.

WESTINGHOUSE

Radio Model RTF3030A—Hum

To eliminate hum in some radios of this model, add one .01μf 500v ceramic capacitor across D104 and another one across D102 at the terminal board adjacent to the power transformer, see illustration, page 36.

"My shop's been loaded since I got my FCC License... and I could kick myself for not getting it sooner. I'm pulling in all kinds of mobile, marine and CB business that I couldn't touch before; have even had some calls to work on closed-circuit television. I've hired two new men to help out and even with them, I'm two weeks behind."

And so it goes. Once you have that FCC ticket, you open the door to all kinds of new business. And that's not all. The knowledge you need to pass the FCC exam gives you a fundamental understanding of *all* electronics. You'll find you can do more work in less time...work on almost *any* kind of electronics gear.

What's the best way to get a Commercial FCC License...and still keep up with your work? Thousands of men will tell you, "Cleveland Institute of Electronics."

Men like August E. Gibbemeyer, for example. He was in radio-TV repair work before studying with CIE and getting his 1st Class FCC License. Now, he writes, "We are very happily in the marine and two-way radio business...servicing police and fire departments in three communities, as well as cab

companies...and our trade has grown by leaps and bounds."

Ed Dulaney is another example. He started his own part-time service business after training with CIE and passing the FCC License exam. This worked out so well that he then opened a full-time business. Today, he reports, "I manufacture my own two-way radio equipment, with dealers who sell it in seven states, and have seven full-time employees."

CIE has been preparing men like these for FCC License exams since 1934. What's more, CIE backs its Home-Study Licensing Programs with this remarkable money-back offer:

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Send bound-in postpaid card today for CIE's FREE informative book "How To Get A Commercial FCC License." With it, we'll include a second FREE book, "How To SUCCEED IN ELECTRONICS." If card is missing, use the coupon below. Cleveland Institute of Electronics, 1776 East 17th Street, Cleveland, Ohio 44114.

NEWS FOR VETERANS: New G.I. Bill may entitle you to Government-paid tuition for CIE courses if you had active duty in the Armed Forces after Jan. 31, 1955. Check box in coupon for complete information.

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Please send FREE book, "How To Get A Commercial FCC License." Also include your second FREE book, "How To Succeed In Electronics."

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ET-52

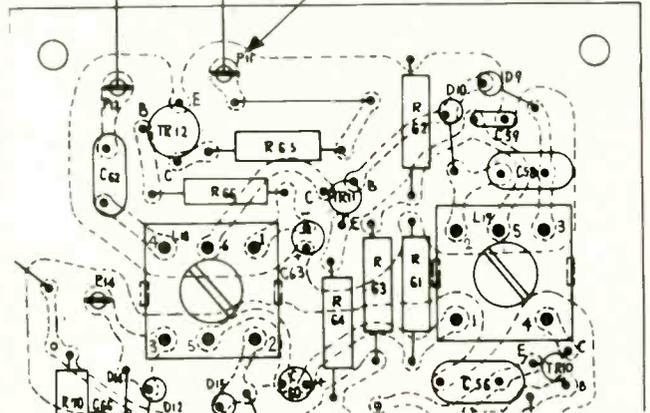


"My shop's
been loaded...
since
I got my
FCC
License."

To prolong the life and to protect the FM stereo indicator lamp, LA 1, add a 47Ω, ¼w resistor in series with the lamp.

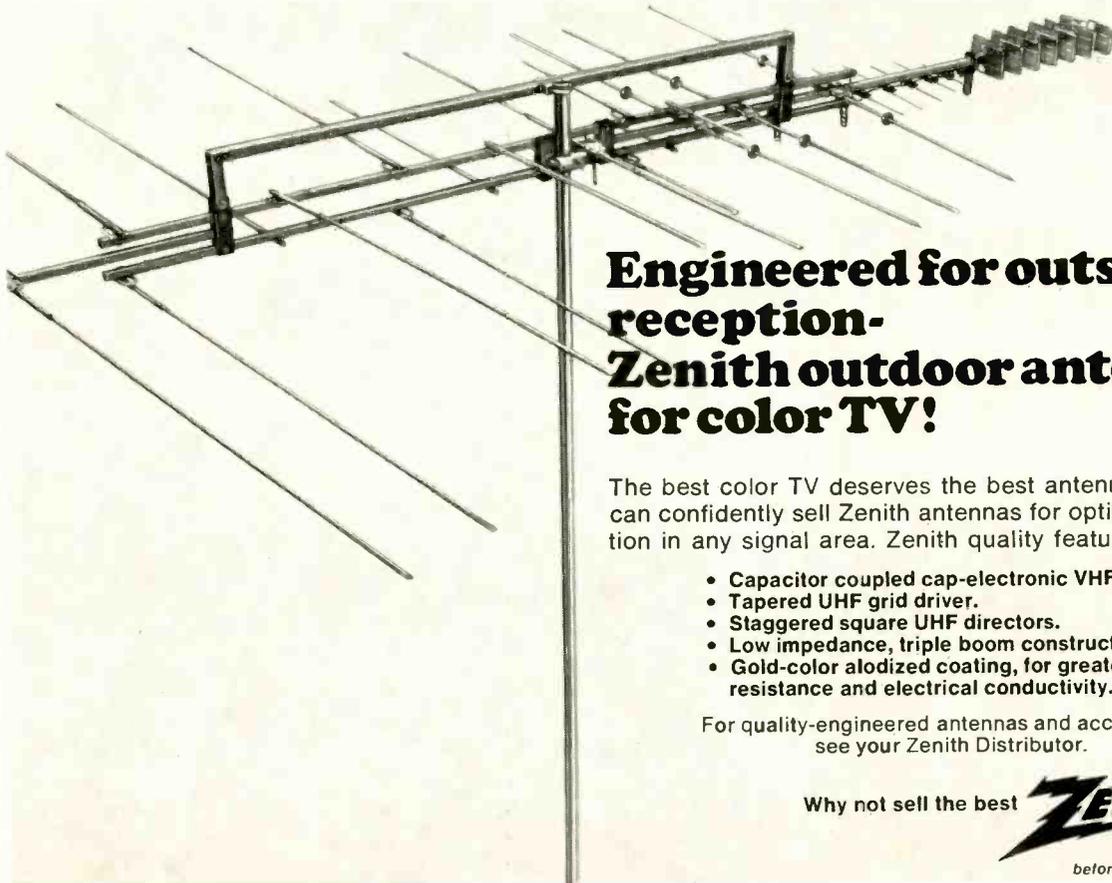
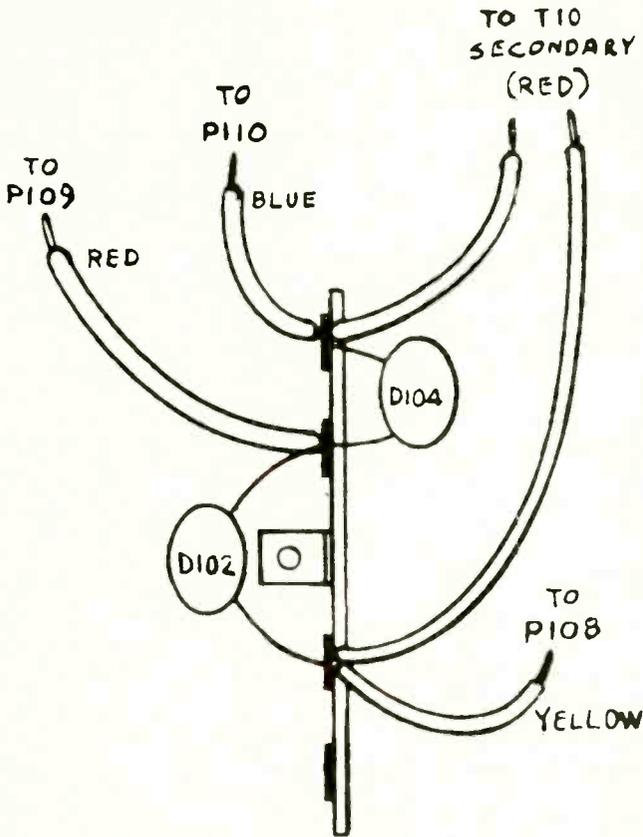
To add this resistor to the circuit, open the radio

back cover to expose the top of the PC board. Disconnect the wire located at the point designated P11 on the PC board, or at the callout "To LA 1." Solder one end of the resistor to the wire and the other end of the resistor to P11. Tape the exposed connection.



back cover to expose the top of the PC board. Disconnect the wire located at the point designated P11 on the PC board, or at the callout "To LA 1." Solder one end of the resistor to the wire and the other end of the resistor to P11. Tape the exposed connection.

For more information on ads and new products, see Reader's Service, page 83.



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The best color TV deserves the best antenna. And you can confidently sell Zenith antennas for optimum reception in any signal area. Zenith quality features include:

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Why not sell the best



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ELECTRONIC TECHNICIAN/DEALER

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Zenith Chromacolor is a revolutionary new color television system . . . featuring a revolutionary new patented color picture tube . . . pioneered, researched and developed exclusively by Zenith.

Five important engineering advances make Zenith Chromacolor the most dependable color TV ever made. And by far the easiest to service.

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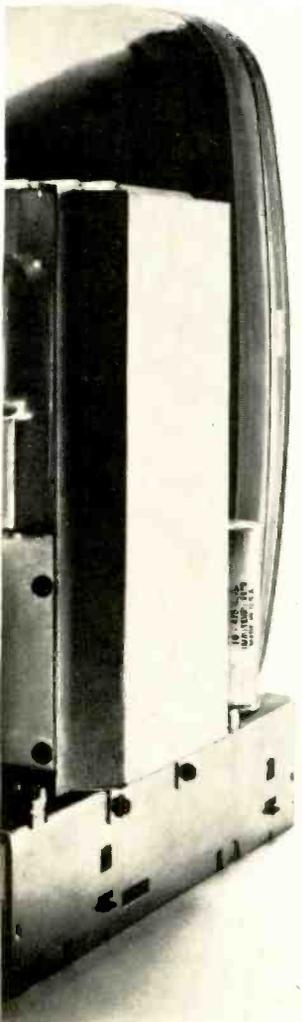
New Titan Color Chassis combines Handcrafted dependability with solid-state performance. All transistors are either plug-in or part of a plug-in assembly. All test points are flagged or coded for easy identification.

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Exclusive Chromatic Brain introduces TV's first integrated circuit in a color demodulator . . . for the purest reds, greens, and blues. 100% of the color demodulator circuitry is in the easily accessible plug-in Dura-Module.

Take a good look at new Zenith Chromacolor. Designed with both you and your customer in mind. The best giant-screen color picture! The easiest to service!



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The quality goes in
before the name goes on

This little part plays a big role in radio.

This box gives you top revues.



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

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

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

That United Delco box is your guarantee of genuine OEM

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

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

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

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

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



MARK OF EXCELLENCE



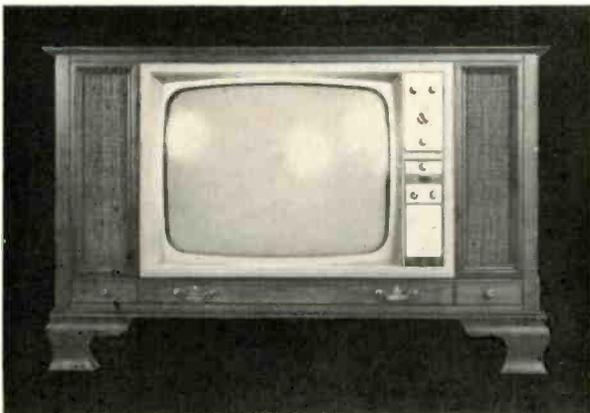
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ELECTRONIC TECHNICIAN/DEALER

ET/D TEKLAB REPORT

Teklab presents its first in-depth report on Channel Master's color TV chassis

Introducing Channel Master's New Color Television



Channel Master's Model 6112 color television.

■ Color TV set sales were up 13 percent in the first quarter of 1969, with 1,529,000 units sold compared with 1,353,000 sets sold during the same period last year, according to EIA figures.

There were 20,600,000 color television households, or 35.5 percent of all homes with TV in this country as of April 1; according to preliminary estimates compiled by the National Broadcasting Co.

With a great demand for color TV, Channel Master introduced its first color TV line which includes various console models with 23in. (292sq. in.) screen.

The complete line is produced in the United States by an independent TV manufacturer and incorporates all the latest features.

Being the first entertainment product received from this company, we did not waste any time unpacking the set and giving it the once over.

The first thing noticed was the attractive cabinet styling with all of the customer controls conveniently on the front panel.

Also included on the front panel is a BALANCE control, not found on most sets, which allows adjustment of both color and B/W pictures. During color reception the controls enable selection of shades and hues to satisfy personal desires. During B/W reception the picture can be balanced between a cool blue and a warm brown (sepia).

The INSTANT ON incorporated in this model is a push-pull switch on the rear apron of the chassis (part of tone control). The purpose of this switch is to furnish a "keep alive" voltage of approximately 4.4vac to the filaments of the tubes at all times to facilitate the "instant on" feature. When the set is turned off and not to be used for considerable time, the vacation switch should be placed in the OFF position allowing the filaments to be disconnected from the "keep alive" voltage until such time that the set is returned to service.

The set will operate with the INSTANT ON switch in either of its positions; however, in the OFF position the set will require a normal warmup period.

The set produced good picture quality and required only a minimum of setup adjustments. All installation and service adjustments are standard. Prior to adjustment of the color controls or checking the operation of the chroma section, the BALANCE control should be placed in the mechanical center of its range.

The basic chassis employed is similar to the RCA Victor CTC15 chassis with all the latest additional new features and circuitry.

There are a number of features on this chassis which may not seem important, but will reduce service time: wing type fasteners on

back panel, a tuner mount on the chassis for transportation purposes and a cathode lead disconnect for cathode current measurement. A 500ma fuse is placed in the cathode of the horizontal output tube protecting the output components.

Most of the circuits employed were used in previous RCA Victor chassis but we will review the new and important ones.

AUTOMATIC FINE TUNING CIRCUIT

The Automatic Fine Tuning (AFT) circuit (shown in Fig. 1) shifts the local oscillator

frequency of the tuner to compensate for incorrect tuning and provides the best overall tuning point similar to the AFC in an FM receiver. The output of the AFT circuit is a dc bias voltage proportional to the tuning error. This dc bias voltage is applied to a varactor diode within the VHF and UHF tuner. The capacity of the varactor diode changes with applied bias voltage and, since the diode is located in the oscillator tank circuit, the frequency of the oscillator is shifted to pull the RF response to the optimum tuning point.

Power is supplied to the AFT circuit through

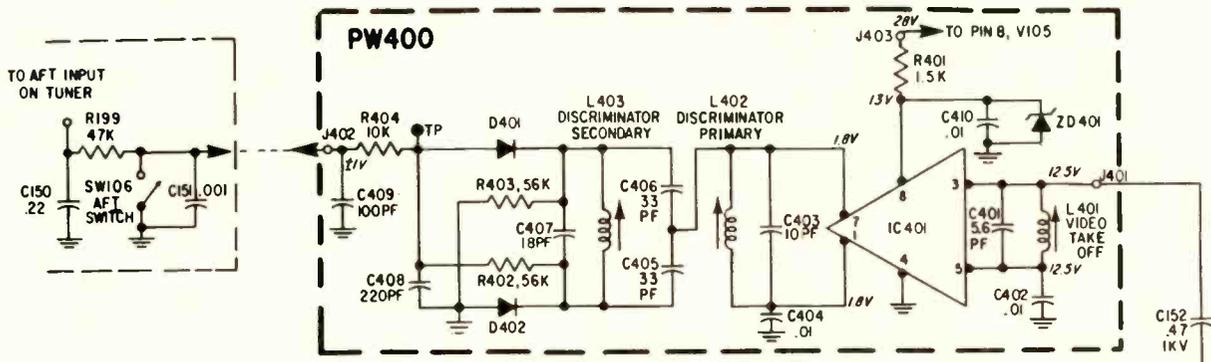
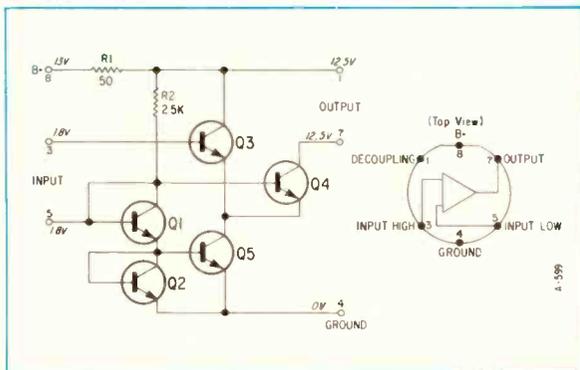
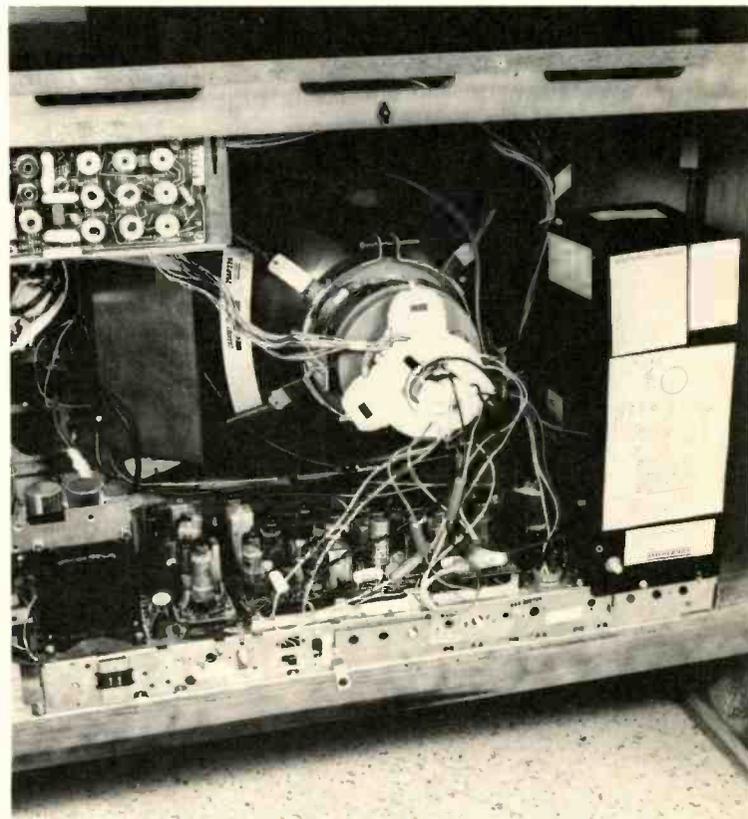


Fig. 1—Schematic of the AFT circuit.



Schematic and connection diagram of AFT integrated circuit.



Rear view of the chassis showing service adjustments and setup controls.

three filter components, R401, C410 and D401, from the cathode circuit of the vertical deflection amplifier.

The AFT circuit features a linear differential integrated circuit amplifier which receives its signal through capacitor C152 from the 3rd IF amplifier. Plate coil L401 and capacitor C401 are tuned to 45.75Hz. The signal is applied to pins 3 and 5 of IC401, both points being the inputs of a typical differential amplifier. Pin #5 is at ac ground potential through bypass capacitor C402.

The output of IC401 drives the primary winding of L402, the discriminator transformer,

which is tuned to 45.75MHz with a ± 150 MHz bandwidth in an "S" curve. The secondary is tuned to 45.75MHz and in turn drives discriminator diodes D401 and 402. The dc voltage is then detected and drives the varactor diodes in the tuner. If the signal at the input is exactly 45.75MHz, no voltage is developed at the output and no correction voltage is fed to the tuner. If a signal at the input deviates above or below 45.75MHz, a corresponding dc voltage is developed which shifts the tuner local oscillator frequency higher or lower as required.

Resistor R404, capacitors C408 and C409

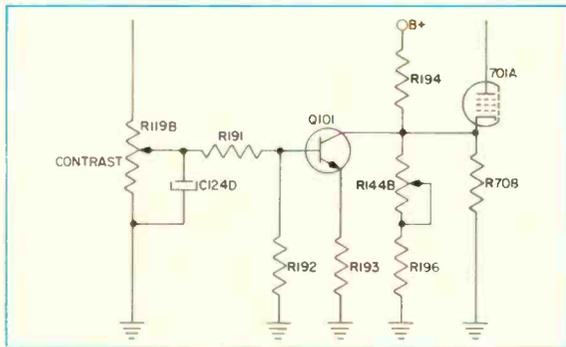
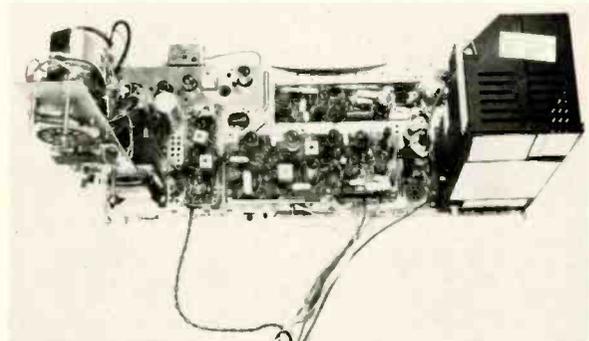


Fig. 2--Diagram of the color-trac circuit.



Top view of chassis No. 913-222708 which is similar to an early RCA Victor chassis.

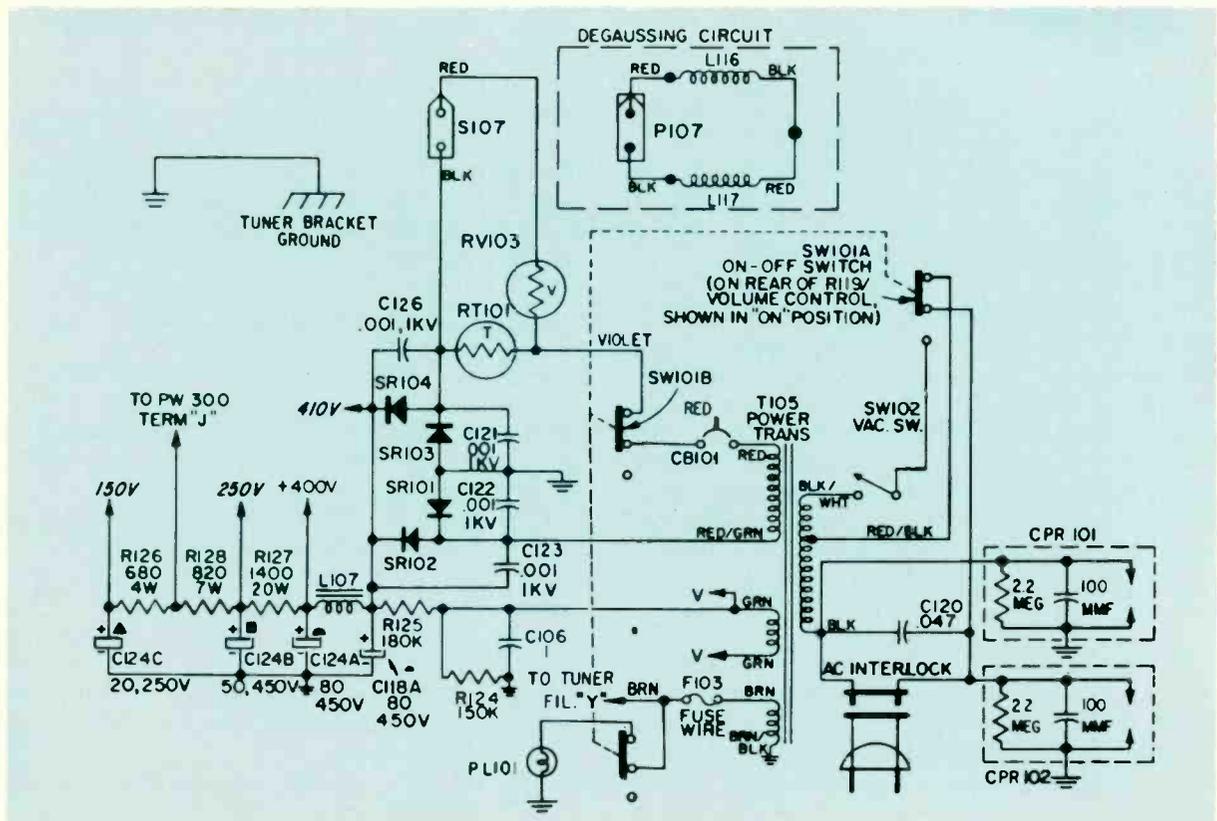
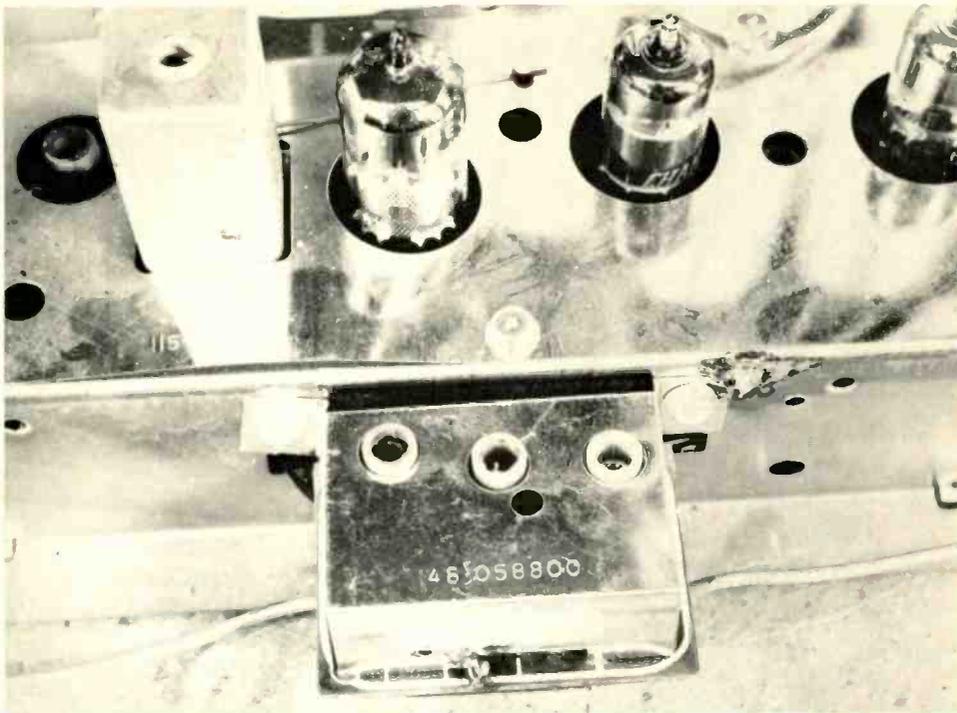


Fig. 3--Schematic of the instant-on and power supply circuit.



AFC unit mounted on the front apron of the chassis.

are filter components for the dc output voltage as is capacitor C151 at the tuner. Resistor R199 and capacitor C150 form a long time constant network so the tuner will ignore noise and momentary frequency shifts caused by interference signals and channel change intervals.

The AFC switch SW106 allows the customer to short circuit the dc output correction voltage if desired for manual fine tuning of the receiver.

COLOR-TRAC CIRCUIT

The color trac circuit (shown in Fig. 2) provides dynamic chroma gain dependent on the setting of the contrast control. Dynamic control is achieved because transistor Q101 is connected in parallel with the cathode resistor R708 of the chroma bandpass amplifier V701A. This circuit decreases the total cathode resistance, thereby increasing chroma gain. Total cathode resistance becomes smaller as the transistor collector current increases and the effective collector to emitter resistance of the transistor decreases.

The color trac transistor base bias voltage is obtained from the voltage divider network resistors R191 and R192. The voltage varies with the voltage across capacitor C124D which, in turn, varies with the setting of the contrast control R119B. Through transistor action, the collector current of transistor Q101 increases and decreases in step with the set-

ting of the contrast control. Since increasing contrast causes greater conduction of the transistor and increasing transistor conduction causes chroma gain to increase, the color output then tracks with the contrast control setting. Color trac can also be varied by adjusting the color trac control R144B. As the resistance of R144B is increased, the voltage divider network of resistors R194, R144B and R196 supplies more collector voltage to transistor Q101. The transistor gain is thus increased and color trac action becomes more effective.

INSTANT-ON CIRCUIT

The "instant-on" feature eliminates the normal warmup period. The circuit (shown in Fig. 3) consists of a push/pull switch, the power transformer and the filament wiring of the electron tubes.

With the ON-OFF switch in the OFF position and the INSTANT-ON switch in the ON position, the 120vac line voltage is applied across the two end primary windings of the power transformer. A voltage of approximately 4.8vac is induced from the two sets of secondary filament windings of the power transformer and applied to the filaments of the electron tubes.

In the ON position, the 120vac line voltage is applied across one end and the center tap primary windings of the power transformer. ■

■ Bob's new outside man was out. Both Bob and Scoot were busy at the benches.

"The antenna season is here again Scoot," Bob announced suddenly.

"Well, I'll admit the silence was almost too much, but what brought that on?"

"Apparently you haven't seen the orders Sharon has written today. We didn't get a single antenna call last week and we've had three already today."

"Oh boy! Back to the roofs I guess, huh Bob?"

"I hope not, Scoot. Of course, we'll have to take the mess off the roofs, but I hope to sell more 'ground up' installations."

"I thought the super-tower stuff was out. We used to have a lot of them around several years ago, but when channels 6 and 10 came in, the tall ones faded away."

Status Symbol

"True Scoot. But it's becoming important again. When TV first hit this area, you *had* to have a tower to get even one station. Now you can get three with an ordinary roof-top conical. A good antenna installation, however, will add three more. There's a lot of independent broadcasting going on now and the people want a better selection to pick from. Not only that, it's becoming a status symbol. It's a big deal to be among the first in town to get all six channels. Also, it will boost our technical stance."

"Excuse me for being slow, Bob, but has that contraption on the back of the truck got anything to do with what you're talking about?"

"I wouldn't say you're slow, Scoot; it sure has. I had 'Smitty' weld that bracket on the truck so we could fasten a crank-up tower on the truck, pick up a signal and feed it right to the customer's set."

"Hey, that's not bad. In other words, when we go out on these antenna calls, we run the truck out, crank up the tower and *show* the customer what a good antenna installation can do for him."

"Right, Scoot. Either that or we'll find out that it's not that simple. In some cases we've found we couldn't deliver the signal as easily as we thought. With the truck antenna, we'll know ahead of time."

"Using the customer's set sounds like a

good idea, too. That way we can show the customer exactly what he'll get with the installation," Scoot said.

The Preamplifier

"What about preamps and stuff like that, Bob?"

"Scoot, we're bound to run into places where the preamp is necessary. I'm going to mount a preamp on the mast so it can be connected easily if necessary. Then all we'll have to do is connect the power supply at the receiver."

"Why not just leave the preamp connected all the time? If you don't need the preamp, just don't connect the power supply."

"Hold it, Scoot. The signal that goes through the preamp when it's switched on goes through a couple of transistor amplifiers. When it's switched off, the only signal that goes through is purely a 'leakage' signal."

"You hold it, Bob. Maybe you've got an excuse for this, but the other day I put a fuse in McGhee's power supply. They had lost the distant stations but were still getting the local ones just like the preamp unit wasn't there."

"If you'd used a field strength meter, Scoot, you'd have found that the signal was actually weaker than with a direct connection. The leakage signal was still strong enough to keep the set out of the noise. In other words, you were lucky."

"On some of the older installations where we had to use preamps, we had a tough time getting rid of interference caused by strong local stations going through the preamp. How are we going to get around that one, Bob?"

"It's not as bad as it used to be, Scoot. Preamp manufacturers have made great strides in reducing the possibility of overload on strong signals. If we do run into trouble, however, we'll use traps."

"Traps are a good bit like preamps, Scoot. The state of the art has also advanced."

"Furthermore, I've come across a couple of traps the CATV people sometimes use and they're almost unbelievable. They have a rejection of almost 40db and an insertion loss of only 1db. On top of that, they are tunable to both sound and picture carriers."

"Holy smoke, that sounds almost too good to be true."

"Well, it almost is. I didn't give you the

whole story. They cost us about \$40 each! But I'm convinced that if we need them to give the customer a good picture, he'll buy them. Besides, I've seen the time when we wasted more than \$40 fooling around to get a good picture when a trap like that would have taken care of it. When it comes to a slim profit or a loss, I'd rather cut the profit a little thin and spend the \$40."

Coax or Twin Lead?

"Are you going to use coax or twin lead, Bob?"

"That depends, Scoot. I intend to use coax on the truck but we may use twin lead—depending on conditions existing on a particular job."

"I was reading an ad the other day — I forgot whose. It claimed about the same loss for coax as for twin lead. Why not give it a try?"

"Actually, Scoot, the line losses are only a part of the story in a coax installation. With a short run, the matching transformers at both ends of the line cause far more loss than the line itself."

Scoot and Bob had both continued to work at their benches during their discussion but Scoot had slowed down as their discussion progressed. Now he had stopped and was obviously upset.

"Darn it, Bob, where in the world do you get all this information? I've been in this business long enough that I should be up on the newer stuff at the same time you do. But you keep turning up things I don't know about. What's the story?"

Programed Learning

Bob laughed. "We've been through this before, Scoot. I buy subscriptions to four different trade magazines for the shop. I keep the whole magazine for a year and then throw it out. The schematics in ELECTRONIC TECHNICIAN/DEALER are filed permanently — as you know. Articles that I think are useful for the future are torn from the magazine and filed separately."

"Now, I don't think I've told you one new thing today that can't be found in one of those magazines over there."

"OK, OK. I remember the rest of the speech. I just don't have time to read them, Bob. We don't get any more than caught up and another load comes across the bench."

"Don't give me *that* nonsense, Scoot. Do you see me reading at the bench? If you really want to go somewhere in this business you have to keep up on your own. I buy the material but it's up to you to keep up with it."

"Look at those hard-backs over there. Did you ever crack one of them? There's video, IF, sweep, color and you name it. I've invested hundreds of dollars in service literature for the shop—not just for me."

"Bob, I can't spare that kind of time at home. If I'd go off in the corner for a couple of hours my wife would knock my head off."

"I don't believe it, Scoot, but even so, that's not what I'm asking for. I'm not asking you to read and study hours on end each day — just minutes. In fact, it has been determined by educational experts that more study material is retained when it has been learned in short periods."

"Scoot, in 20 minutes a day you could read all the magazines I buy, from cover to cover, plus several hard-backs a year. Then you'd be able to challenge me."

"I doubt that I'll ever be able to do that, Bob."

"I keep a magazine or a book in the truck and in the car. You never know when you'll be tied up in a traffic jam and you can kill some time with a book."

"I keep a supply of books on my nightstand, too. Sometimes I can't get to sleep and I find reading a perfect cure. And I learn at the same time."

"I've got personal subscriptions to several of the newsstand magazines at home to break the routine. I even read the hobby articles. Although I don't build anything anymore, I frequently pick up some tips on repair or a new circuit idea."

"Great. What's your wife have to say about all this reading?"

"Scoot, I don't read *that* much. *That's* what I'm trying to impress on you. It takes only a few minutes a day. Only once or twice, I've had to explain that I needed to get some information for something we were working on at the shop. That was when I couldn't watch a special on TV with her. Actually, I didn't want to anyway."

"But most of the time she's reading, too. She gets all the house, home, garden, lawn, furniture, decorator and food magazines. If anything, she's worse than I am."

"You know, Bob, I've never thought of it that way. I'll try it. I probably waste a good 30 minutes a day just waiting for a show to come on TV. I've always figured that a guy really had to put on the steam to pick up this stuff. I guess I was comparing 'keeping up' with 'learning from scratch.'"

"Egads, Bob. Do you see what time it is? We've gone past our coffee break. Do you think Freddie will think we're nuts if we just sit silently and read with our coffee?"

"Scoot, don't run it in the ground. Sometimes we *do* have to take a break." ■

Color Bar Generator Survey

Careful selection of any shop test instrument is necessary to efficiency and economy. To this end, we recently queried the manufacturers of color bar generators and obtained some interesting comments which may guide you in future purchases.

■ Color bar generators are becoming more popular because people are buying more color sets and the need for service is that much greater. As proof of this, one test instrument manufacturer made a survey of service shops and found that in 1965, 50 percent of the service technicians had *not* been exposed to color generators. Today that figure is reduced to only 1 percent. However, in the same period, color TV sales climbed from one and one-half million to nearly seven million sets, while the number of technicians available to service them *dropped* by approximately 10,000 men. What does this all prove? It simply proves that more color sets are sold every year and the number of units each technician has to repair is increasing. Consequently, a technician's servicing time is more valuable and test instruments are more important. It also means that a great many shops will be buying new color generators as first-time purchases or to upgrade older equipment. The average cost per shop for this equipment will vary from \$100 to \$300.

What you expect and what you get in a color generator can vary depending on the price and model, but there are certain features you should consider basic necessities: stability, pattern capability, ease of operation, lightweight and compactness. The last three features are obvious considerations, especially if the unit is to be used on home service calls. Pattern capability simply means selecting a unit which will provide the type and number of displays you need. Stability is probably the most important requirement of a color generator. If price is a factor, don't sacrifice stability for a cheaper unit.

In making this survey, we wrote to 13 manufacturers and asked them to comment on 11

questions concerning the design, use and future of these instruments. We received nine replies. Many of them were quite complete and somewhat surprising.

What percentage of technicians use color bar generators?

Every manufacturer agreed that 90 percent of the technicians servicing color sets use a color generator. However, there were some conflicting thoughts as to how many technicians actually own an instrument. This is normal because a shop may have three or more technicians and only one generator. More than one manufacturer also indicated that he had witnessed or knew of technicians claiming to be able to properly converge a color set strictly by eye—no generator at all. Most claimed that this is a "dangerous" practice. It might not be "dangerous," but we can say that without an accurate, stationary pattern as a reference, convergence by the "eyeball" method is rough at best.

What percentage of generators in use are tube type and more than two years old?

The number ranged from 40 to 80 percent. Many manufacturers claimed that the reason for the large number of tube type generators is because owners of tube models bought them at a low price and are reluctant to part with them as long as they did the job.

What are your views on the use of 90 and 105 degree modulation?

There was quite a variation in answers to this one, but most agreed that 105 degrees is the predominate type of modulation and

90 degrees is becoming obsolete. The reasons: it provides better flesh tones and it is easier for the customer to set the tint range. Two of the manufacturers (Sencore and Lectrotech) indicated that either angle could be set accurately using the vectorscope technique, but again, 105 degrees was preferred. All of the replies stated that their present equipment is compatible with either angle.

Does your present color bar generator provide a standard 10-bar pattern? Do all color bar generators normally provide a 10-bar pattern, and if not, is yours unique in pattern capabilities?

All of the responding manufacturers said that their generators do provide a standard 10-bar pattern but felt that some of the units made by other manufacturers do not. None of the companies claimed that their respective generators were unique in pattern capabilities.

What is being done about stability problems? Do you feel that stability is of prime interest to the user, and if not, what are the user's requirements?

The answers varied considerably. Sencore, for example, indicated that stability is one of the biggest problems in color bar generators and in some cases is caused by faulty timing adjustments made to the equipment by technicians. Sencore incorporates a heating element in one of its transistorized units to provide stability because transistors change characteristics under extreme temperatures. They also indicated that some manufacturers are using unijunctions which these manufacturers claim are not susceptible to changes in temperature. Sencore says it has found unijunctions to be extremely susceptible to any temperature change and to cause instability problems to the user.

On the other hand, Mercury uses unijunction transistors which it claims do compensate for stability problems. Lectrotech uses solid-state timing circuits and claims that this method is most stable. RCA simply indicated that voltage and temperature are factors in stability and that the user should be aware of this and follow the manufacturer's recommendations for operation. Allied Radio and B&K stated that they have no serious stability problems. Amphenol said that the practical approach to the stability problem is to use transistorized timing circuits and



Amphenol Model 860 (transistorized).



Heath Model IG-28 (transistorized).



EICO Model 385 (transistorized).



Sencore Color Cadet Model CG18.

MANUFACTURERS

Allied Electronics
100 N. Western Ave.
Chicago, Ill. 60680

Dynascan Corp.
B&K Div.
1801 W. Belle Plaine Ave.
Chicago, Ill.

Electronic Instrument Co. (EICO)
283 Malta St.
Brooklyn, N.Y. 11207

Heath Co.
Benton Harbor, Mich. 49022

Hickok Electrical Instrument Co.
10514 Dupont Ave.
Cleveland, Ohio 44108

Leader Instruments Corp.
24-20 Jackson Ave.
Long Island City, N.Y. 11101

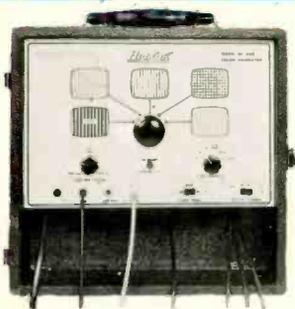
Lectrotech
1221 W. Devon Ave.
Chicago, Ill. 60626

Mercury Electronics Corp.
315 Roslyn Rd.
Mineola, N.Y. 11501

RCA, Electric Components
415 S. Fifth St.
Harrison, N.J. 07029

Sencore
426 S. Westgate Dr.
Addison, Ill. 60101

Tripp Manufacturing Co.
Commander Div. (now has Amphenol test instr.)
133 N. Jefferson
Chicago, Illinois 60606



Hickok Model GC660 (tubes).



Leader Model LCG-389 (transistorized).



RCA Chro-Bar Generator
Model WR-502A (transistorized).



Allied Model KG-685 (transistorized).



Mercury Model 1900 (transistorized).



Lectrotech Model V6-B.

Survey ...

temperature compensating diodes. Replies also indicated that tube units require a warm-up time and the addition of a heater leaves something to be desired because of the time lag to bring the unit up to the ambient temperature.

So there is quite a difference of opinion among the manufacturers as to what stability means and how it is best remedied. However, the general trend seems to be the use of solid-state devices in some type of timing circuit. From there on it looks like the choices are: buy a unit with a built-in heater and live with the time lag to bring the generator up to ambient temperature; buy a unit using unijunction transistors from a manufacturer that will stand behind its claim that it is stable; or, buy a transistorized generator using temperature compensating diodes which also claims stability. Then there are the tube models which have been in use for some time and are doing a good job. If the generator is going to be operating on the shop bench where it has a change to stabilize, it cannot be ruled out as an unlikely choice, especially if you believe that stability is caused by temperature and voltage variations. One thing that all the manufacturers do agree on, however, is that stability is of prime concern to the user.

What does the user expect from a color bar generator?

The unanimous reply was stability, portability and accuracy. Some of the manufacturers carried this a little further and said that immunity to temperature change and shock were important, but this goes along with stability. Others added that well-defined patterns with sharp leading and trailing edges were essential.

Do you provide replacement unit to a user if his is tied up for repair? Do you provide field service centers? Do you provide factory service and how does this compare with your service policy of two or three years ago?

These questions brought out some interesting comments. None of the companies provided a loaner as a backup unit for one that is tied up in a lengthy repair. They all claim that lengthy repair time is an unusual situation. RCA, Amphenol, Mercury and B&K indicated that they have service centers avail-

able across the country as well as factory service so the problem of repair time and the need for loaner units is virtually eliminated. Sencore and Lectrotech provide factory service only. All of the replies indicated no changes on service policy in the past few years.

Do you provide test instrument training seminars? How often? How does this compare with previous years?

Allied, Mercury, Lectrotech and RCA replied that they have no test instrument training seminars. Most, however, did say that their distributors will allow a prospective customer to evaluate a unit before purchase. Amphenol, B&K and Sencore said that they do have training seminars on test instruments on a continual basis and this has been their policy for years. Sencore also indicated that their number of people in the field devoted to these seminars has been substantially increased.

Do most TV shops provide color service? Can adequate alignment be done without a color generator and if not, why?

Every manufacturer's reply stated that the percentage of TV shops now servicing color falls somewhere between 80 and 90 percent. As to the question of alignment or convergence of a color set without the use of a generator, all but one company gave a flat no—it can't be done accurately. The reasons given for not being able to correctly align the color set without a test instrument are that a received station signal is not reliable enough (presumably they mean color levels, tint range, etc.), that the color information for adjustments has to be properly and accurately balanced and that convergence without a test generator is far too time consuming. The one company saying that alignment was possible without a test unit gave no reasons for the statement.

What about IC circuits for color generators in the future? Will the use of these devices affect stability, size, cost and reliability?

The responses to this question also reflect some very different points of view. One manufacturer said that IC circuits are rather high in cost and the reliability rather low, which

continued on page 78

Hybrid Color Problems

Understanding hybrid receivers is only part of the technician's required ability for troubleshooting--the real trick in hybrid circuitry is knowing where to look first

■ There are several causes for a loss of video, and for each, a different symptom. We'll concentrate on the most prevalent one.

For this particular problem we will use an RCA CTC-38 chassis as an example.

No doubt many of you have already resolved this problem by replacing the video detector diode. But what lead you to this "post-repair" technique? In other words, simply replacing the defective diode is not enough. It cures the problem but it doesn't remove the chance of recurrence. Of course, this does not necessarily affect only hybrids; it also applies to tube-type receivers.

If several of these chassis show up in a short time with the identical symptom and cure--replacement of the crystal diode--there has to be a reason.

Since the sound diode, like the video detector, is a 1N60 and gives no trouble, it means something has to be damaging the video diodes. A little in-depth investigation sheds some light on the case.

FLASH-OVER

A study of the circuitry reveals the possible cause for video diode break down. (See Fig. 1.) The schematic shows that the grid of the 1st video amplifier is directly coupled to the video diode (CR202) through coil L211, the 4.5MHz trap, L212, then through L209. Note that the diode will pass only a positive-going signal.

In this circuit, if the 1st video amplifier (6GH8) flashes over internally, it can momentarily cause excessive grid current. Flash-over may possibly occur between the screen and grid. In either case, an instantaneous current flow is set up in the grid circuit of 6GH8. Since R239 offers only a high dc resistance path, the current must pass through

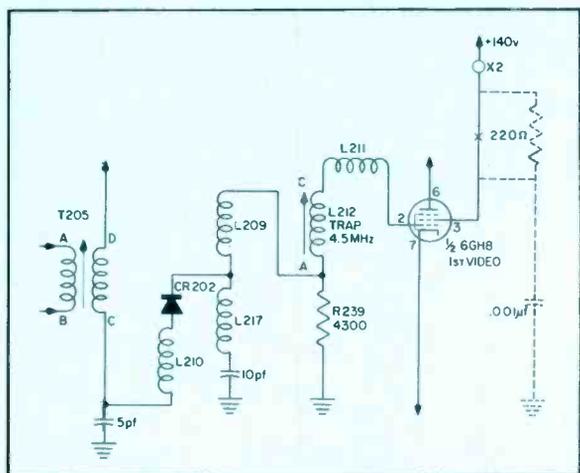


Fig. 1--Flash-over of the 1st video IF screen grid will damage video diode CR202. Add a decoupling resistor in the screen grid circuit to prevent future diode failure.

the diode to reach a low dc path to ground through L210, the secondary of T205 and L204. When this happens, the diode, opposing the current flow, will either open or short out. More likely, it will short out.

THE CAUSE

Going a step further we note that pin #3, the 1st video amplifier screen, is tied directly to point X2, the 140v B+ leg, which is capacitively loaded by a 20 μ f capacitor at the power supply. An arc-over within the 6GH8 itself could place from 6 to 25v on the grid and cause current flow through the circuit. The germanium diode is ruined, replaced and the 6GH8 settles back to normal until the next flash-over, possibly a month or so later.

Of course, a simple and immediate preven-

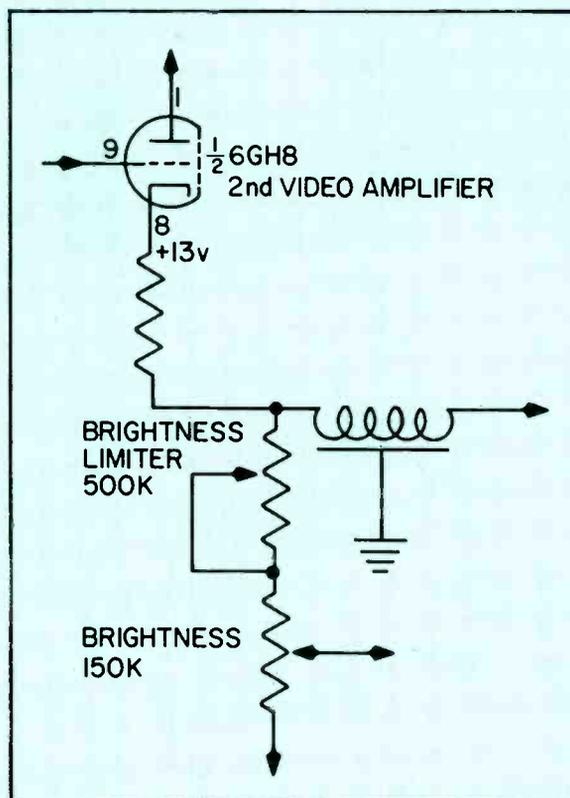


Fig. 2--The cathode follower feeds the delay line. If this stage is cut off by an open blanking diode, the luminance component of the picture will be smeared and the "Y" amplifier will remain in a semi-cut-off condition resulting in dim raster.

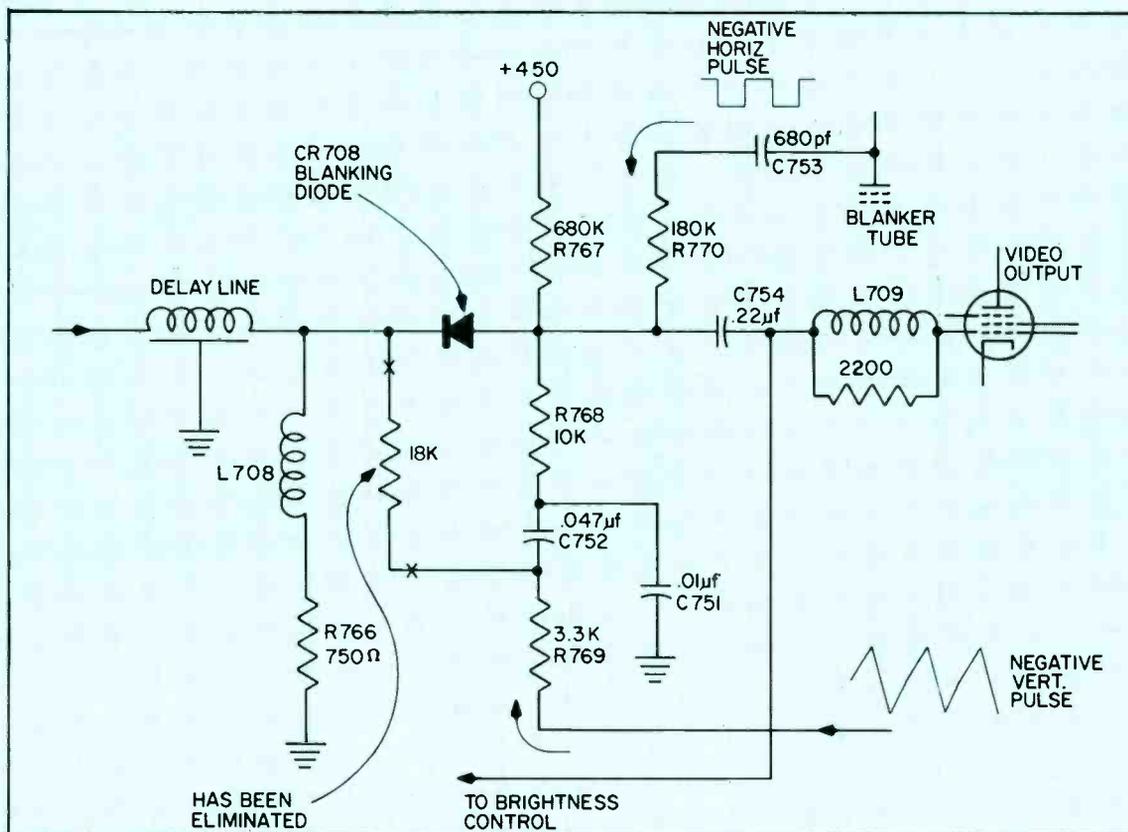


Fig. 3--Vertical and horizontal blanking of the video output stage.

tative might be to replace the offending 6GH8 as insurance. But this will only guarantee against any recurrence until the next flash-over.

Engineers do not design circuits to function intermittently, but sometimes circuit defects do not show up until after the unit has been on the market for some time. Even the automobile industry has its problems and they have been at it a long time. The circuit in Fig. 1 was designed to provide as much gain as possible for several reasons-burst and sync amplification, with enough luminance signal to drive the 2nd video amplifier. The circuit in Fig. 2 shows that the 2nd video stage is a cathode follower with the cathode feeding the delay line. The luminance information has to be obtained without signal inversion and with sufficient strength to activate

the grid of the "Y" amplifier. It could also have been a case of amplification versus competitive economy using the tube with broad frequency response and gain.

SCREEN SUPPRESSION

Replacing the 1st video amplifier tube and the diode repaired the video problem, but after this comes a post-repair guarantee that recurrence will not take place. Referring to Fig. 1, there is nothing in the output of this stage we would want to disturb. However, since the screen is tied directly to the 140v B+, we have a means of suppressing the screen so it has far less tendency to flash over. Cutting the "land" or circuit material at contact #3 of the 1st video amplifier tube socket, we can insert a 220Ω 1/2w decoupling resistor

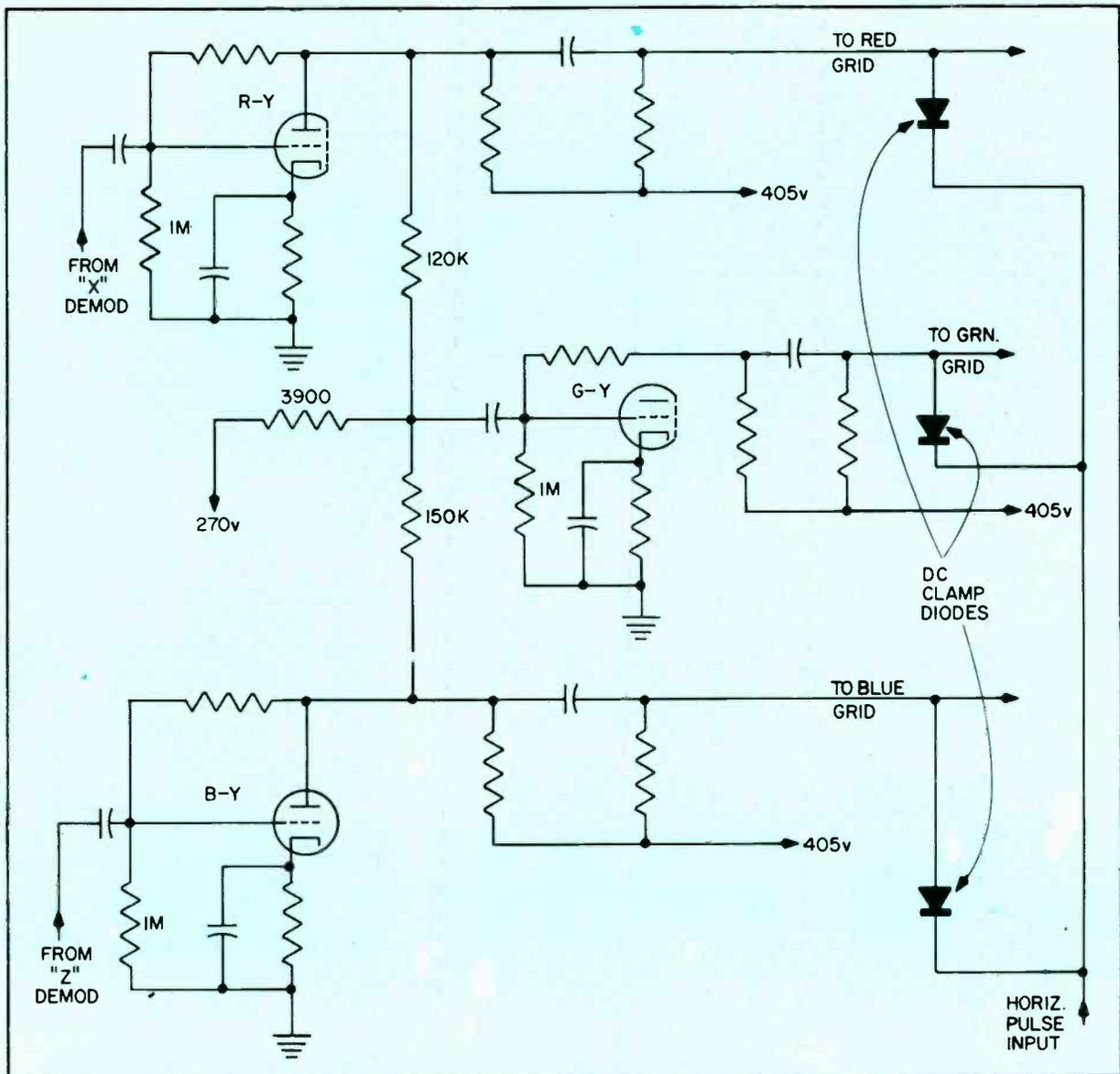


Fig. 4—DC clamping of the CRT grids with diodes.

Hybrid Color Problems...

between X2 and the screen grid. This will isolate and suppress the screen. Also, install a .001 μ f NPO disc-type capacitor between contacts 3 and 4 of the tube socket to bypass any screen grid RF to ground. Do not remove the twist-lug at X2. However, if it does not hold firmly, solder a single "tie-point" to the socket contact #4 and transfer the wiring to this point. It will make a more rigid and neater-appearing job.

THE BLANKING DIODE

A study of Fig. 3 will reveal several new items in this circuit of the hybrid RCA Victor CTC38 chassis. (This chassis is used in at least 23 RCA Victor models.) Two other chassis, the CTC22 and the CTC36, in the 14 and 18 in. ac-dc portables have essentially the same circuitry. In the CTC38 chassis the video output stage is a 12HG7 tube driven by a 5GH8 tube. Because of this similarity, and to make it less confusing, we'll review the CTC38 chassis.

First, we will cover the function of the blanking diode. In the past, horizontal retrace blanking was accomplished at the CRT grids by applying a strong negative-going pulse from the blanker stage to the cathodes of the matrixing (color difference) amplifiers. By employing diode clamping circuits, the CRT grids are no longer available for this function. (See Fig. 4.)

Vertical retrace blanking was obtained in most color receivers by applying a positive-going vertical pulse to the CRT cathodes through the plate circuit of the "Y" amplifier. This method was unsatisfactory, especially with the arrival of the rectangular color tube. Several applications were employed by the various TV manufacturers to feed a vertical pulse into the 2nd video amplifier grid for retrace blanking. Those receivers using a cathode follower 2nd video amplifier simply had to switch the vertical pulse feed line to the grid of this tube. But those receivers using only a single stage of video amplification were confronted with a signal inversion problem requiring a negative-going pulse to be fed to the video amplifier grid. The result was a separate injection point for horizontal and vertical pulses which increased production cost because of the added parts.

By a simple circuit innovation, RCA Victor picks a negative-going vertical pulse from the yoke and applies it to a .047 μ f "wavyshap-

ing" capacitor, C752 in Fig. 3. This large capacitor differentiates the waveform coming from the yoke by removing the sawtooth portion while retaining the retrace component. The resulting waveshape is then slightly integrated by both the .01 μ f capacitor, C751, and the 330 Ω resistor, R769, to widen and delay the retrace portion. Applied to the same junction point are the negative-going horizontal pulses from the plate of the blanker tube through the 180K resistor, R770, and the 680pf capacitor, C753.

DIODE FUNCTION

During active scanning intervals, the blanking diode, CR708, is biased "on" by the 680K resistor, R767, connected to the B+ supply. The diode now directly couples the output of the delay to the .22 μ f capacitor, C754, which feeds the grid of the video output stage. Under this condition, luminance information is passed. However, during the negative-pulse portions of the blanking waveforms the diode is turned off. This "switches off" the output of the delay line during the time negative pulses are being impressed on the "Y" amplifier grid. Regardless of settings of the contrast and brightness controls, these pulses are more than enough to cut off the video output stage, thereby cutting off the beam current in the CRT.

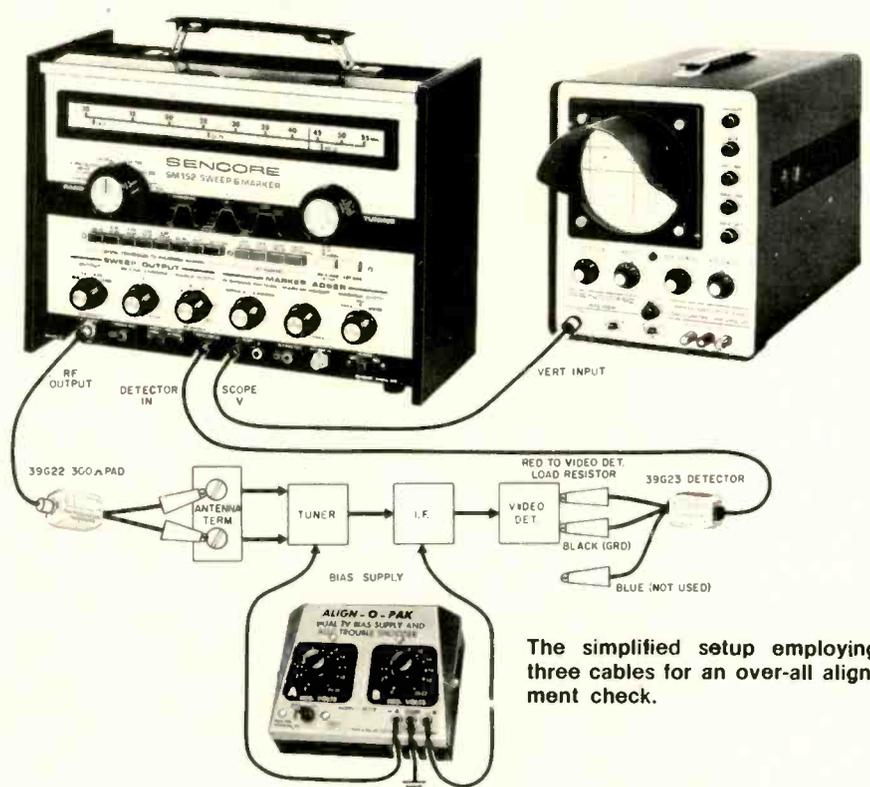
NO RASTER

In all three of these RCA Victor chassis the low-level signal is fed from a cathode follower into the delay line. Note that the cathode circuit reaches ground only after arriving at the junction of the blanking diode, CR708, and a choke coil, L708, where the choke feeds into a 750 Ω 1/2w resistor, R766. This L-R assembly effectively blocks the ac signal component while giving the cathode of the cathode follower a low resistance dc path to ground.

Naturally, failure of either the choke or resistor will cut off the cathode follower function. When this happens there can be no signal transfer and the video output stage remains in a semi cut-off state, thus greatly reducing the CRT beam current. Result: either no raster at all, or a very dimly illuminated CRT screen even at high brightness setting.

There are several possibilities for failure

continued on page 78



The simplified setup employing three cables for an over-all alignment check.

for more details circle 900 on postcard

Sencore's Model SM152 Sweep and Marker Generator

Align the TV chassis and do a professional job with a simplified sweep/marker generator

■ Too many television sets that require component replacement in the tuner, Video IF or chroma section, are leaving the shop without alignment.

In the past, the large number of test instruments and the complexity of connections made technicians fearful of TV alignment.

Recently, we received the Sencore SM152 Sweep and Marker Generator for Testlab evaluation.

The separate sweep and marker generators of the past are combined into this one instrument with crystal controlled markers for accuracy.

On the front panel the instrument has

an 11 in. illuminated slide-rule dial for easy frequency readings. Three curves of the RF, IF and chroma with marker locations are displayed, eliminating the need to refer to the manual for the ideal curve shape. Also, there are 19 markers available by push buttons.

The portable unit is housed in a vinyl covered steel case with carrying handle.

The generator comes with a special 300Ω matching pad No. 39G22. This pad is used to match the 75Ω output of the generator to the 300Ω input of the TV and FM receivers and to terminate the RF cable to prevent standing waves and distortion.

The special video detector probe, N. 39G23,



Sencore Model SM152 sweep/marker generator.

has a built-in isolation resistor and a video detector, making the unit complete for all types of alignment.

We found a number of important features on this instrument including; (1) linear sweep for all TV and FM alignment from 10MHz to 920MHz; (2) calibrated sweep width from .3MHz to 15MHz (calibration is not affected by frequency generated on either VHF or UHF); (3) the sweep frequency generator is calibrated in MHz and also in TV channel numbers; (4) the swept 3.58MHz chroma signal is added to the RF output to check chroma response in the over-all system through the IF and bandpass amplifiers (chroma is also available at the chroma output jack for direct injection into the bandpass amplifiers); (5) crystal controlled markers for IF and RF by just pushing a button--a crystal controlled marker will appear on the sweep response curve. Marker frequencies available are 39.75, 41.25, 41.67, 42.17, 42.67, 44.25, 45.75, 47.25, 4.5, 4.08, 3.58 and 3.08MHz. Markers at the RF Video carrier on channels 4,5,10 and 13 are also available. The sound RF carrier is obtained by pushing the 4.5MHz crystal push button on any RF channel. Extra push-buttons and a crystal jack enables adding other crystal marker points if necessary; (6) special FM crystal marker frequencies of 10.7, 10.6 and 10.8MHz are generated simultaneously so that you can view the "S" curve during FM alignment; (7) a special variable marker generator for IF spot alignment of older sets is available using a variable oscillator to generate frequencies from 39MHz to 48MHz.

The oscilloscope is important in sweep alignment. If the scope has poor low frequency response, a phase shift in the vertical amplifier or a phase shift between the horizontal and vertical amplifier, the response curve can be misleading.

This sweep and marker generator has an

ultra linear sweep and a flat automatically controlled output which can be used to check the scope before any alignment is started.

The instrument is easy to connect and requires only three cables for the alignment of a color TV receiver. The setup is shown in the illustration.

The RF cable is connected to the antenna terminals, the mixer tube in the tuner or to the individual IF stages depending upon the alignment instructions of the particular manufacturer. The 39G22 matching pad is used in most cases as it not only acts as a 300 Ω match for the antenna terminals on the TV set or FM tuner, but it terminates the cable so that no standing waves are present. When using the RF frequencies of channel 2 and above, or for 88 to 108MHz for FM, the RF cable is connected to the antenna terminals of the set. If IF alignment is being performed, the RF cable with the matching pad is either connected to the mixer test point or capacity coupled to the mixer tube. The test point is easy to find as it is located next to a square hole on the tuner. On some solid-state tuners the test point is on top of the tuner as in tube models, in others it is located on the side of the tuner. To capacity couple to the mixer tube, you can use an ungrounded tube shield in the older tuners, or use a conductive foil wrapped around the mixer tube if the shield is not removable. The foil should be covered with tape to prevent it from shorting to the shield. In either case, the hot lead of the matching pad is connected to the shield or foil and the other lead to ground. When using the matching pad for injection of the IF signal into individual stages, a capacitor is not needed as it is already built into the pad. The matching pad is not used for 75 Ω systems. The detector cable is connected from the generator detector IN jack to the various points as described in the individual alignment procedures. The scope VERTICAL INPUT cable is connected from the scope V jack on the generator to the vertical input of the scope. The scope H jack may also be used if the scope has no line position on the horizontal amplifier.

Complete alignment of the RF and IF amplifiers in FM receivers can also be performed with the sweep marker generator. The generator will provide an RF signal from 88 to 108MHz when the range switch is set on the 50 to 120MHz band, and will provide the 10.7MHz swept signal for IF alignment on the 10 to 55MHz band. The 10.7MHz marker has automatic 100kHz side markers at 10.6MHz and 10.8MHz when the button is depressed. A nonswept 10.7MHz crystal controlled signal is also available from the 10.7MHz jack on the front panel. Alignment of the FM stereo

continued on page 81

ET/D TEST LAB REPORT



Seco Model 88 tube tester.

Seco Model 88 Tube Tester

This lightweight unit in the low price range will test most B/W and color picture tubes

for more details circle 901 on postcard

■ The Seco Model 88 Tube Tester is attractively housed in an anodized 16 gage aluminum molded Royalite case. It is lightweight and an ideal unit to carry on service calls.

It will check all popular tubes including novars, nuvistors, 10 pin types, compactrons, decals, magnovals and most B/W and color picture tubes. This unit will make up to 11 simultaneous tests for leaks, shorts, grid emission, tube merit and filament continuity.

The circuitry in this tester employs a vacuum tube meter and the test results are amplified by a 12AU7 tube. Low test voltages and currents reduce shock hazards or damage to the tester or tube under test.

The tester also employs an index flip-over card system for setup data and describes additional tests on individual tubes. New setup information is available periodically and free of charge to all registered owners.

There are five controls which are designed to speed setup time from one tube to another. The FIL VOLTS control selects the proper heater voltage (1-50v). SWITCH R--element pin selector and isolation switch. SWITCH L--heater pin arrangement selector remains in "normal" position for tubes using pins three and four as filaments. FUNCTION SWITCH--selects desired test. LOAD control provides proper load impedance for tubes under test.

Next month's Testlab report will cover the B&K Model 415 Marker/Sweep Generator.

CIRCUIT SPECIFICATIONS

A. METER 1.0ma, 2 percent full scale accuracy. Read-out for all test information. B. AMPLIFIER CIRCUIT--two-stage dc amplifier incorporating a 12AU7 tube. 1. In the "GCT" position, the amplifier is biased to 1.0ma (near cut-off). Presence of positive grid conditions or other leakages causes rise in plate current. 2. Provides amplification of test information for protection of tube under test. Current is limited so meter cannot be pegged. C. GCT SHORTS AND LEAKAGE SENSITIVITIES produces deflection to "?" on meter scale. 1. Reverse Grid Current-- $0.6\mu\text{a}$ current in a 1.0M resistance. 2. Grid to Cathode Equivalent Resistance--50M. 3. Cathode to Heater Emission-- $12.5\mu\text{a}$ at 25v. 4. Cathode to Heater Equivalent Resistance--2M. D. TUBE MERIT TEST--1. Average good tube reads 100. 2. Emission reading to "?" is 70 percent of tube manufacturer's specifications at rated heater power. 3. Multi-sectioned tubes: each section checked independently. Power supplies--140vdc plate supply for amplifier circuit; 22vdc Merit Test Supply; 1-50v Heater Supply and 25vdc for GCT Supply. Input--110-125v, 50-60Hz ac. Size--12.5 x 9 1/2 x 5 in. Weight 6 lb 11 oz. Price--\$74.50 net. ■

Emphasis on Service

Turning a prospect into a buying customer is not the toughest job. Making him a permanent customer is the difficult and necessary task of any successful business

■ "The best way to keep a prospect as a customer," according to Ben H. Goedeker, 16-year television repairman and dealer in St. Louis, "is to make him a believer."

It takes excellent service to make believers, so Goedeker TV Sales & Service puts most of its effort into the shop rather than the sales floor. That's pretty surprising because this prospering St. Louis firm did three times as much dollar volume in sales as in service last year.

Reliability is the cornerstone in a customer's faith in your service. "The biggest thing is to do what you promise to do," Goedeker states. "For instance, I notify the customer ahead of time if I have a conflict and if I cannot get out there Tuesday as I promised, I call by Monday to let him know."

Willingness To Serve

Willingness to make recalls is another element in creating service believers at Goedekers. "Too many shops discourage customers from a recall hoping they will call somebody else because there is no money left in the job," Goedeker observes.

Goedeker TV in St. Louis has been remodeled twice in the past six years and reflects the neat, uncluttered atmosphere of a well-run ship Ben Goedeker takes pride in.



"But we always make the recall graciously, even if it's a nuisance, because sometimes all he needs is some personal assurance that his set is all right."

This service-minded dealer will also make a second call if a customer requires it. But when it isn't justified, he has a standard technique for preventing a repeat. "We just tell the customer that if this last adjustment doesn't satisfy him, then we will have to take the set into the shop and he realizes that the free servicing is at an end."

Part of the Goedeker customer convenience and reliability is a willingness to pinpoint service of delivery appointments. Delivery or service calls are scheduled to within one hour if a customer requires it. For those who want to take as little time from work as possible, Goedeker will schedule a lunch hour delivery.

Service Policy

A concrete example of how service builds sales at Goedeker's is seen in the popularity of the shop's nine-month service policy for color sets. Of the 250 to 300 color sets sold this year, 70 percent carried the Goedeker nine-month policy which, when added to the industry's three-month program, protects the customer for a full year.

"This nine-month service for a flat \$19.95 is a real sales clincher for us," Ben Goedeker says. "When a customer is on the fence about whether to buy a new set, I close the deal by telling him that he can consider taking our nine-month policy after the first three months have elapsed. Half of our policies are sold this way."

Flat Rates

"The customer who is concerned about service after the sale is our best sales prospect because he isn't nearly as worried about the purchase price. He isn't a 'haggler.' "

Goedeker does a great deal of "flat rating" his





Approximately 1400 sq. ft. of the building is used for the service shop and warehouse. It is a policy at Goedecker's for the technicians to start each day with a general clean up as Ben Goedecker believes that customers judge the kind of service they get by the appearance of the shop.

service charges. For instance, it is \$1 for a minor repair of an AM transistor radio brought to the counter, such as resoldering a battery clip. If the radio has to be left, then a flat fee of \$4.95 plus parts is charged whether repair time required is a half an hour or four hours.

The firm also has some minimum-maximum rates. For instance, AM/FM transistor radio repair is quoted from a \$4.95 minimum to a \$10 maximum plus parts.

Television rates are \$3.50 for a B/W set carried in and \$6.95 for a service call. Color is \$8.95.

Goedecker's service charges have been raised only in line with its increased costs. "And this ultimately is the only way any price can hold up," Goedecker believes. "Hiking rates because customers

won't complain eventually creates a situation that is tempting to the price-cutting, fly-by-night operator. If we do a job worth \$40 of labor, then we charge exactly \$40."

The policy at Goedecker TV is to do any tube part replacement in the home, if possible. He stocks his truck with a sizable tube inventory and the repairman carries a tube checker into the home. If he does not have a particular tube, there is no extra charge for his time in returning with it.

"But we do not try to have our outside man troubleshoot in the home. This takes too much time and we keep him moving as his time is the most productive and profitable service product we have."

The Goedecker TV staff includes the owner, who services and sells; three full-time and one part-time serviceman. In the last six years, sales at Goedecker's have increased six times while service volume rose 2 1/2 times. "But it's service that pays the overhead--the most profitable dollar that we take in. So we are going to continue a strong service policy," Goedecker declares. ■

"We keep our promises with service and that makes our selling job easy," Ben Goedecker smiles as he explains the features of a new TV in his beautifully decorated 1800 sq. ft. showroom.



The technicians on house calls use fully equipped vans with a tube caddy and tube tester as part of their equipment. The technician has an ample stock of parts and is encouraged to repair the set in the home if possible but not if it involves time-consuming troubleshooting.



'Oddball' Color TV Problems



Fig. 1 — Out-of-focus picture caused by defective focus element in the CRT.

■ Almost all the color TV problems you'll ever have to solve can be categorized on the fingers of your two hands. But you'll bump into one occasionally that you never saw before. When you do, it is advisable to keep a detailed record on it. Chances are it will show up again later. The record will save you time.

Here are some seldom-seen problems that have been encountered over the years. Make a record of them, too.

'Hokus Pokus' — No Focus

A blurred, out-of-focus picture (Fig. 1) appeared on the screen of a CTC17 RCA color chassis which had been brought to the shop for observation. Like most of these unusual "dogs," the job looked easy at first glance. But this one held true to its "canine character."

Tubes were checked and substituted — and a VTVM assured us that all voltages were normal at the CRT socket. The CRT anode voltage also checked normal. The VTVM, with HV probe attached, read 4.8kv at terminal 9 of the CRT and the focus control would also vary focus voltage correctly through its range. The CRT socket

was removed from the tube, pin 9 was closely inspected and cleaned but nothing unusual was noted.

The one big item left was the CRT. But the tester we used gave the CRT a clean bill of health.

Only one thing left — substitute the CRT or connect the chassis to a color test jig. The set worked fine on the jig, we substituted the CRT and this was the end of the problem. Evidently the focus element in the CRT had opened. A very expensive break.

HV Pulse Regulation Problems

On this one, let's first take a look at Zenith's pulse HV regulator circuitry as used in the 20X1C36 chassis (see Fig. 2).

The flyback transformer receives a strong pulse at the horizontal rate, after which the windings "ring" during the remainder of the horizontal scanning.

A 6HS5 regulator tube is used in this chassis. Its control grid (element 2) receives a 40v P-P flyback pulse (Fig. 3) from the horizontal oscillator cathode at the beginning of each cycle and then "drifts" during the remainder of the cycle.

The circuit works as follows: With an added load on the 3A3A

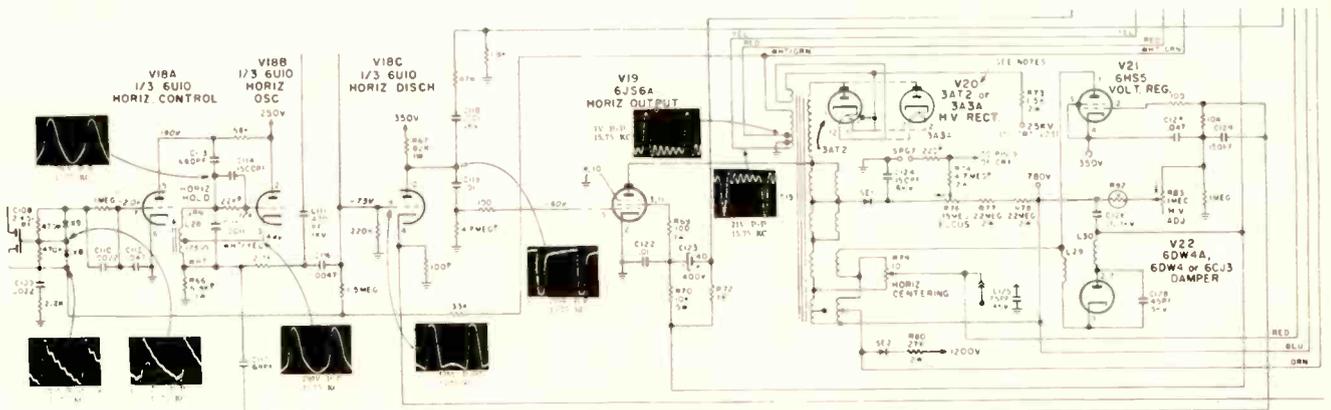


Fig. 2 — Horizontal sweep and HV section of Zenith 20X1C36 chassis.

Make your job easier by keeping a record of frustrating encounters

HV rectifier (more current being drawn), this loads the tertiary HV winding. This action lowers the HV output which subdues ringing. The tertiary winding load is reflected back into the primary through mutual coupling — causing a voltage drop in the primary as does the ringing.

Now when the primary winding recovers and brings back the ringing level, this is reflected back into the tertiary, or HV winding, bringing up its ringing and thus its voltage level — which pushes the HV to the original 25kv level. The correct waveform on the cathode (terminal 4) is shown in Fig. 4.

Additional loading by the CRT during brightness level will load the tertiary through the 3A3A, which cuts down the ringing, then by mutual coupling reduces ringing in the primary; this lowers damper output, reducing regulator control, lightens the primary load and brings the pulse, ringing, and HV at the 3A3A up to 25k.

One added advantage of this circuit is the focus voltage derived from the primary. When the tertiary loading increases and drops the primary voltage, focus voltage also drops. When regulator action is reduced, raising the primary and focus voltage, the focus recovers to bring back the correct HV.

Thus, we can see that focus voltage is always "tracking" HV — resulting in improved focus during varying amounts of brightness level. Positive pulses occurring at retrace time are coupled from the horizontal oscillator to the regulator tube grid. A proper 2kv P-P pulse at the regulator tube plate is shown in Fig. 5.

The regulator tube is "gated on" during retrace time only. With the regulator tube conducting only during the retrace interval, it oper-

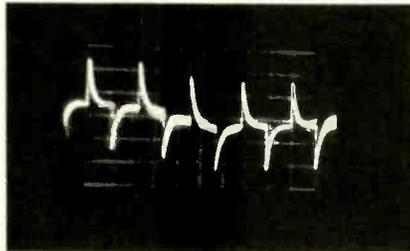


Fig. 3 — Proper 40v P-P pulse which appears at the 6HS5 regulator tube grid.

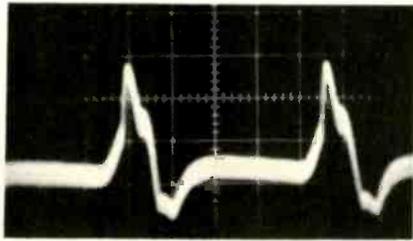


Fig. 4 — Proper 2v P-P waveform at cathode of the 6HS5 regulator.

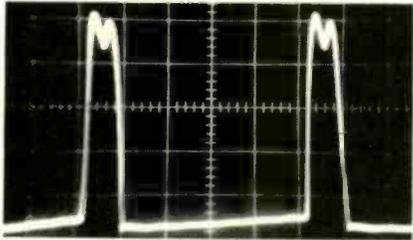


Fig. 5 — A 2kv P-P pulse at the plate terminal of the 6HS5 voltage regulator.

ates at higher efficiency, extends tube life, has virtually no effect on raster width and the X-ray emission hazard is not a problem at this state. Just one more case of "imagineering" in the electronics field.

Now for some problems that may be encountered in this type circuit.

Possible Problems

One chassis was observed to have sluggish HV regulation, and voltage checks in the regulator and horizontal sweep section

checked normal. The scope was connected and the pulse regulator circuit waveshapes were checked. At terminal 2 of the 6HS5 (control grid of V21 Fig. 1), the horizontal pulse was missing (see Fig. 3 for the correct waveform). A few more checks revealed that C117, a 68pf capacitor from the cathode of V18B, had opened. Result — no control pulse and little HV regulation. *Always* scope test points for either correct or incorrect waveforms.

In some Zenith color TV chassis that use the 6HS5 regulator tube, you may have noted that the pulse regulator plates will run red hot and the raster will pull in on the left side, then the picture goes blurred and may black out. This usually occurs when the line voltage is 125vac or higher. If you have this problem, replace the 6HS5 tube and remove the jumper wire from between the 6HS5 socket terminals 3 and 4 (V21) and ground terminal 3 to the chassis. Then connect all other leads (taken off terminal 3) to pin 4 (cathode of V21) and check HV for proper setting. Now this same condition could be caused by an inadequate drive pulse, a gassy 3AT2 (in some models), improper screen voltage, shorted yoke or sweep transformer and other excessive loads on the sweep circuits. You should make this modification first, however.

'Eyeball Buster'

Remember back when you would come across a B/W TV having a keystone picture. Then, as now, technicians in the "know" would immediately remark "shorted yoke windings or bad capacitor across the deflection coils." We now have the same trouble with color but we see the keystone

tion was set up by variations or changes in some component tolerance.

The cure we found for this problem was to install ferrite sleeves over all leads connected to pin-cushion correction circuits of V11A. Apparently this dampened the oscillations.

White Streaks that 'Sing'

This trouble has been observed on both Zenith B/W and color TV sets, plus other brands. One type of symptom you may observe is shown in Fig. 9. At times, when you first switch the set on, these streaks will appear and then the screen goes black. Many times this symptom will be accompanied by a loud high pitched squeal emitted from the horizontal sweep system.

As you may have already guessed, the problem is an open filter capacitor in the B+ supply. The filter that caused this trouble in a Zenith 25NC38 chassis (See Fig. 10) is C27D and is in the 250v B+ line that supplies voltage for the horizontal oscillator and sweep circuits.

Bridge a new capacitor across the 250v line or use a scope to check for too much ac ripple.

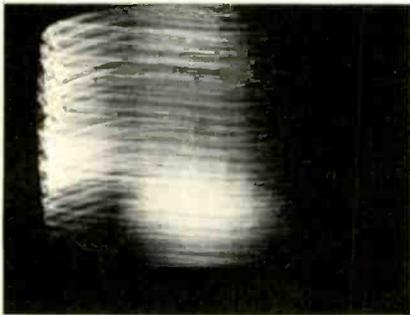


Fig. 9 — Streaks on screen caused by defective electrolytic filter.

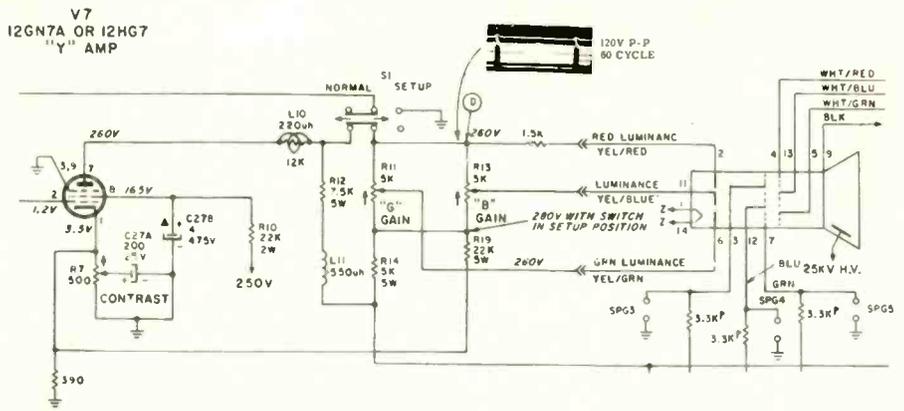


Fig. 7 — Section of Zenith 25NC37 schematic showing capacitor C27A and CRT control circuitry.

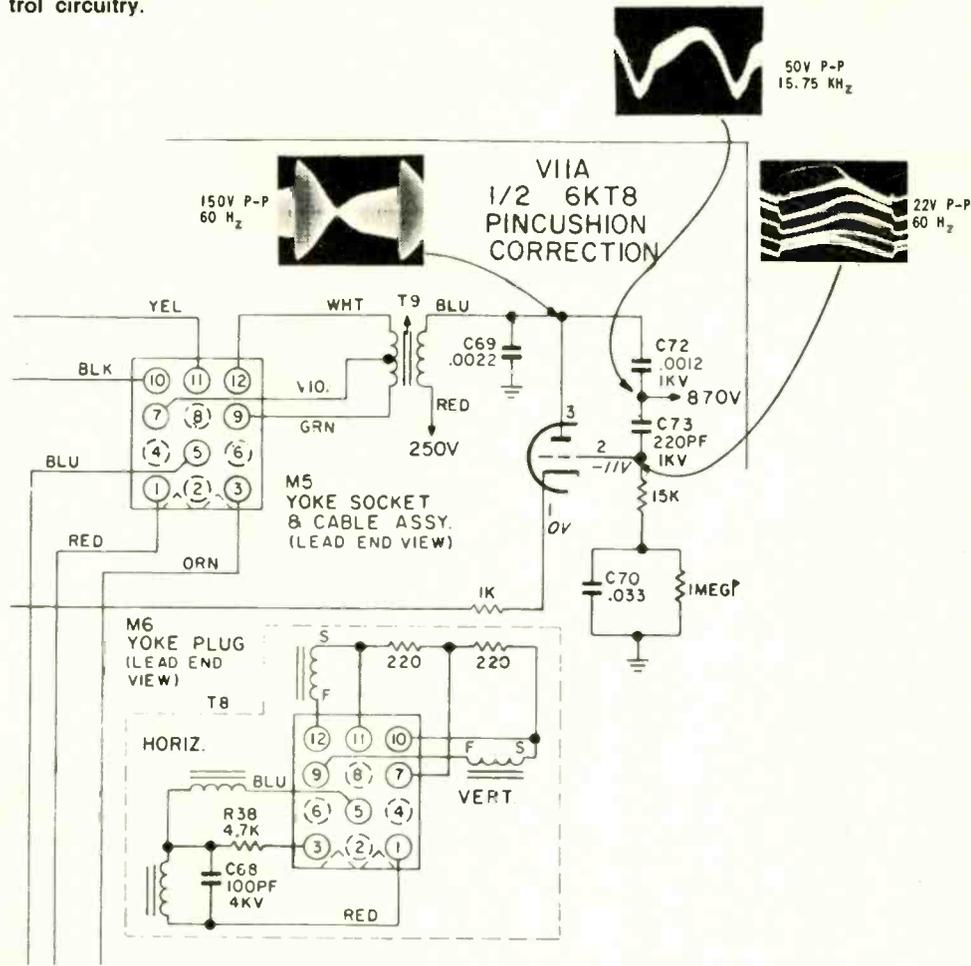


Fig. 8 — Pin-cushion correction circuit of Zenith 20Y1C48 chassis.

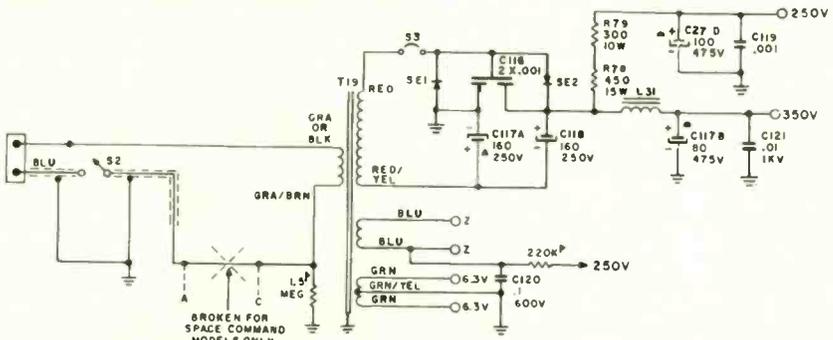


Fig. 10 — Power supply schematic of Zenith 25NC38 showing C27D.

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

COLOR TV

703

Series has latest features

Three color television console additions to the Custom Color series are introduced. Model CF611W, finished



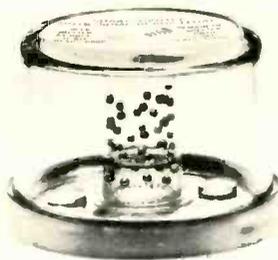
in walnut, is styled with an overhang top and tapered legs. It features a 29.5sq in. viewable screen (23in. measured diagonally). Included in the set are automatic fine tuning, variable tone control, preset volume control, illuminated channel indicators, memory fine tuning and a color level monitor. List price is \$529.95. Sylvania.

X-RAY DETECTOR

704

Detector measures soft TV radiation

Introduced is a small, lightweight radiation detector to indicate the presence of harmful radiation. It is designed for monitoring the weak but



potentially dangerous X-rays sometimes given off by color television sets. It is easy to operate and needs no batteries. Simply pick up the detector and shake for a few seconds until the red beads float in the plastic chimney. The electrostatically charged beads let you see at a glance if a dangerous X-ray condition exists. If X-rays are present, the beads will fall to the bottom of the cage. The intensity of the radiation can be determined by the length of time it takes the beads to reach the bottom, according to a scale furnished with the detector. The radiation de-

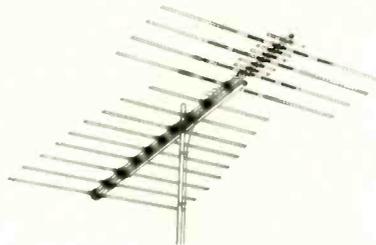
tor can also be used for nuclear fallout detection. Simple instructions are provided to tell you how to determine the strength of the radiation. Retail price is \$12. Circle Square.

TV ANTENNAS

705

Reception includes TV channels and FM band

A series of television antennas reportedly provides improved color and monochrome reception on all TV channels and the FM band. An optional extra "Power Zoom" UHF element can be used to increase gain of about 35 percent on difficult channels. The design, together with the



construction of the antennas, provides for their ability to withstand winds and icing conditions. The five antenna models in the series, available for direct 300Ω installation and instantly convertible to 75Ω operation by snap-on transformers, are for areas classified from "local" to "deep fringe" in signal strength. The antennas are compact, lightweight and factory pre-assembled. VUfinder Plus antennas are priced from \$21.95 to \$64.95. Jerrold.

RADIO

706

Eleven band receiver operates on ac or batteries

Introduced is the Royal 7000 transoceanic portable radio reportedly unequalled by any receiver of its kind. Its 11 bands provide listeners with the power to tune in the world. Operating on standard flashlight batteries, 115v or 230vac power, the receiver provides VHF/FM pretuned weather band; long wave weather/navigation; marine and weather, ship-to-ship and amateur reception on shortwave I and II; five international shortwave bands; FM and AM broadcast bands. With an exclusive beat



frequency oscillator, the radio provides reception of single side band, code, Consol and Consolan navigational bearing transmissions. Weight with batteries is 15 lb, 13 oz. Zenith.

MICROPHONE

707

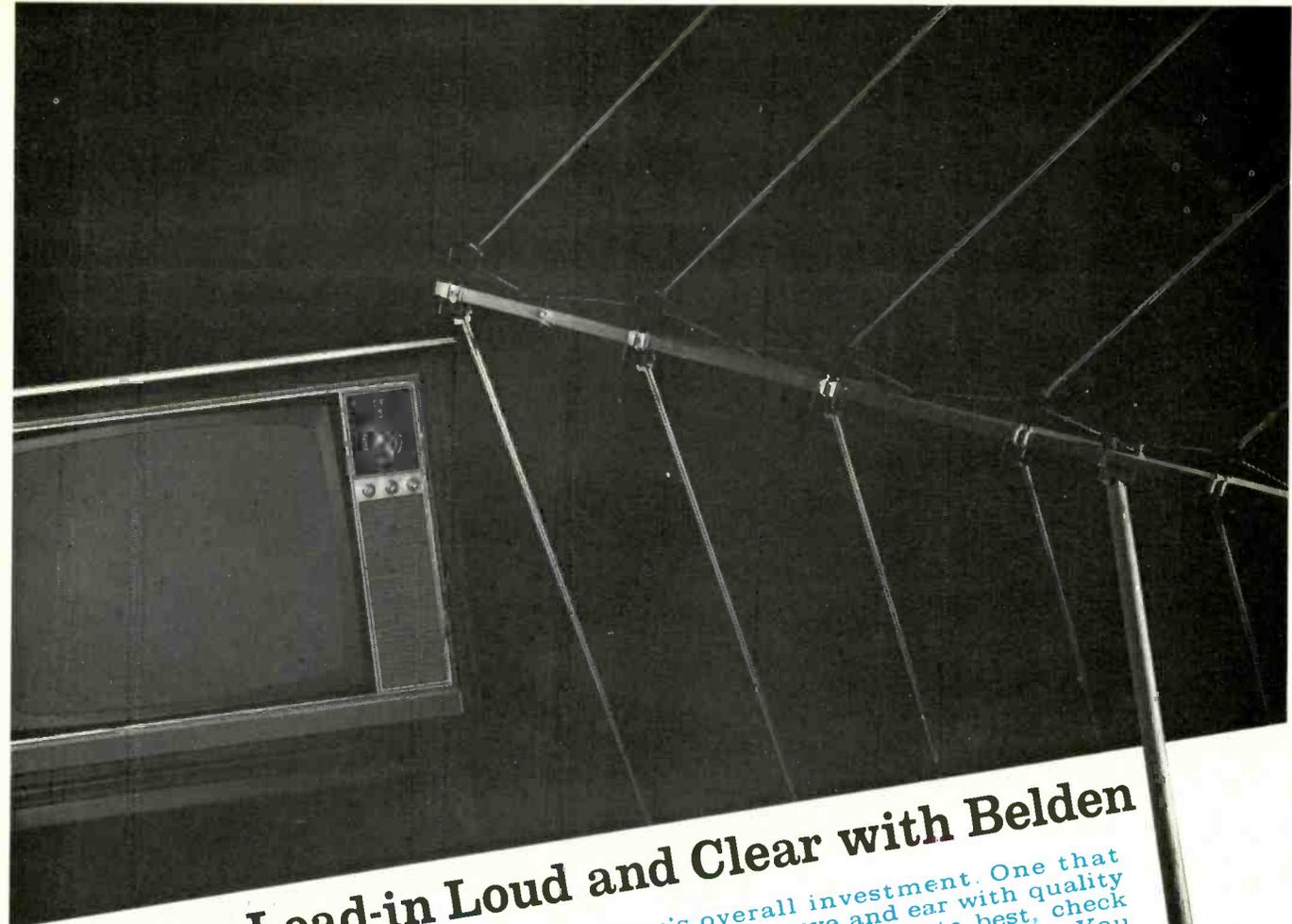
Miniature microphone weighs less than 3oz.

A miniature, lightweight dynamic cardioid microphone is announced. The microphone, Model 2850, weighs less than 3oz. It may be used in the hand, on a stand or, using the cord



CONRAC CORPORATION

and clip supplies, as a lavalier. Its directional cardioid pickup pattern effectively cancels sound arriving from the rear and provides peak-free response to sounds arriving from the front. The microphone is 6in. long, has a head diameter of 1 13/16in. and has a housing molded of Cyclocac. It has a 70-12,000Hz frequency response range, high-low impedance combination (works with any amplifier), and an on-off shorting switch. At high im-



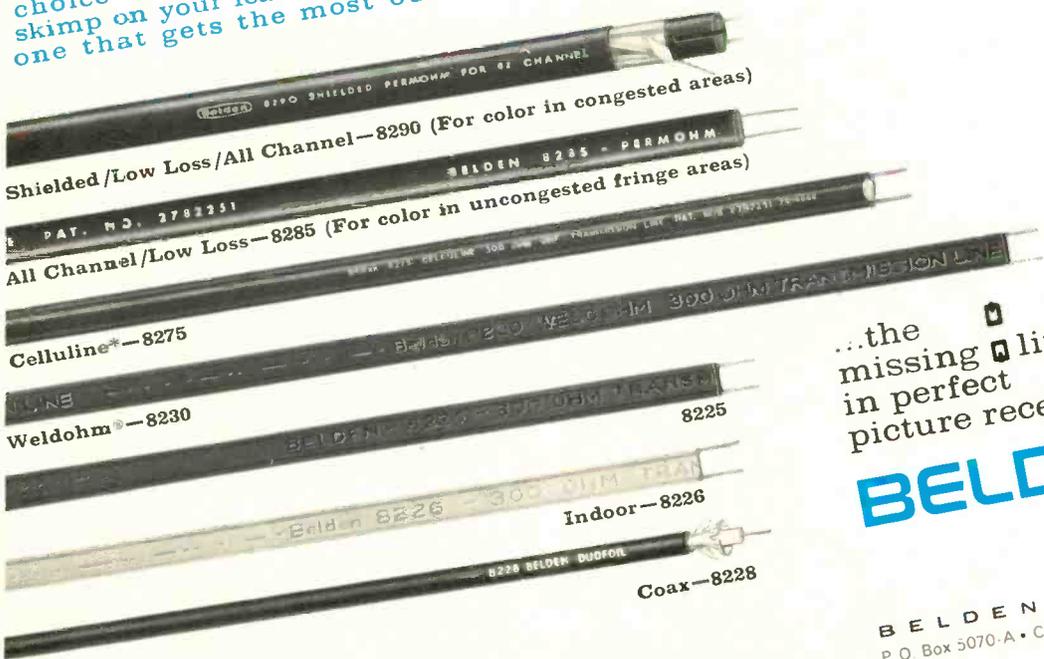
Step up...Lead-in Loud and Clear with Belden

TV lead-in. Belden makes all kinds. Indoor, outdoor, for color and black and white reception. All have one thing in common: for price and performance you won't find better lead-in anywhere. They provide a picture-perfect link between antenna and set. Since no two installations are alike, Belden gives the right choice for every situation. But don't skimp on your lead-in. Step up... choose one that gets the most out of the cus-

tomers overall investment. One that will delight the eye and ear with quality reception. For the absolute best, check out 8285 and 8290: the Color Twins. You won't find anything comparable for all-channel black and white as well as living color. Your Belden Distributor has all the facts. Talk to him today. Belden Corporation, P.O. Box 5070-A, Chicago, Illinois 60680.

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don't forget to ask them what else needs fixing?



...the missing link in perfect picture reception



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ET/D DEALER SHOWCASE

pedance the output level is -60db; at 150 Ω (low) impedance, output is -62db. The microphone is supplied with a 12ft. cable. List price \$40. Conrac.

RADIO INTERCOM 708

Can employ eight indoor stations

Introduced is the FM-16W radio/intercom. Flick the "talk/listen" switch at any station to "listen" and AM/FM radio music or intercom



calls can be received. Calls automatically override music—eliminating shouting—and are completely private; no "eavesdropping" from other stations is permitted. The system can employ as many as eight indoor stations in addition to the master and door stations. Calls to anyone in the home can be accomplished from any station. Security is provided with the resident able to answer the door from any station in the home. Emerson Electric.

RADIO RECEIVER 709

83 shortwave bands in four tunable ranges

An advanced version of the SX-122 receiver with dual conversion of all radio bands providing AM, CW, SSB and shortwave reception in the frequency range of 540kHz to 34MHz is introduced. Frequency coverage of



the receiver for standard broadcast is 540-1600kHz; three shortwave bands—1750kHz to 4.9MHz to 12.6MHz, 12.5MHz to 34MHz. Bandspread is calibrated for 80, 40, 20, 15, 10 meters and Citizens Band. Other features of the receiver include: RF stage; variable selectivity (.5-2.5 and 5.0kHz); antenna trimmer to compen-

sate for loading effects of different types of antennas; separate RF gain control; a switch controlled automatic noise limiter for reducing interference; "S" meter; dual illuminated circular dials; dual detection system, diode AM detection and a product detector for SSB and CW; provision for adding optional 100kHz (HA19) crystal calibrator and front panel switch; pre-marked BFO for sideband selection; voltage regulated oscillator circuitry; rear chassis mounted fuse holder; balanced and unbalanced antenna inputs; voltage regulated transformer operated power supply; provision for remote receive/transmit control; and standard 1/4 in. jack for headphone operation. The front panel controls, mounted on a two-tone grey and brushed aluminum panel, include main tuning, bandspread, RF GAIN, BAND SELECTOR, calibrate on-off, ANTENNA trimmer, S-meter, SELECTIVITY, ANL on/off, AUDIO GAIN, BFO (LSB-CW-USB), FUNCTION switch and phone jack. Power requirements are 105-125/220v, 50/60Hz, 85w. Size is 8 x 18 3/4 x 19 13/16 in. HWD. Weight is 28 3/4 lb. Net price is \$350. Hallicrafters.

COAXIAL CABLE 710

Packaged in paperboard folders and blister packs

A new line of 10 coaxial cable/connector assemblies is packaged in a combination of paperboard folders and blister packs. Line introduction



includes pretested RF cable assemblies most used by communications equipment personnel, CB-ers, amateur radio buffs and general electronics experimenters. The assemblies can be selected directly from display fixtures in showrooms. The assemblies include: (1) tarnish-free PL-259 (Amphenol 83-1SP) connectors on both ends of RG-58/U type polyfoam cable in 3, 12, 20, 50, 75 and 100ft lengths; (2) a 20ft length of RG-58/U type polyfoam cable with PL-259 connector on one end, spade lugs on the other; (3) Astroplated PL-259 connectors on both ends of RG-8/U type polyfoam in 50, 75 and 100ft lengths. Amphenol.

MICROPHONE 711

Unidirectional dynamic rejects background noise

A unidirectional dynamic cardioid microphone is introduced. This new ball-type cardioid microphone, Model



No. 11/125, has dual impedance, ON/OFF switch and is supplied with 25ft of cable and holder. The unidirectional pickup characteristics are said to eliminate the problem of microphone placement. It effectively rejects background noise and squeal caused by feedback. A built-in three-stage wind and pop filter permits "on the mouth" use without blasting for a clear reproduction during outdoor use. The transducer is also shock-mounted to minimize mechanical vibrations caused by microphone handling. American Geloso.

RECORDING TAPE 712

Smooth oxide surface assures increased output, reduced distortion

A professional-quality magnetic recording tape is introduced. "Brand 7" stands at the top of the line, with a smoother oxide surface said to result in increased output, reduced distortion and better frequency response. Each reel has green leader tape at the be-



ginning and red at the end. With pre-spliced aluminum-foil sensing and cueing strips, the tape is ready for use with automatic stop and reverse-control recorders and other electronic sensing devices. The new tape is packaged in color-coded library boxes with a broad "7" across the face. It is available in 3/4, 5 and 7 in. reels of 1 and 1.5mil acetate and .5 and 1mil polyester. There are tensitized, double play and triple play varieties, listing from \$2.35 for a 5 in. reel of 1.5mil acetate (600ft. playing 30min. at 3 3/4 ips) to \$13 for a 7 in. reel of triple-play polyester (3600ft. playing 180 min. at 3 3/4 ips). Robins.

TRANSISTORS, A SELF-INSTRUCTIONAL PROGRAMED MANUAL, by *Federal Electric Corp.*, published by *Prentice-Hall, Inc.*, \$13.95, cloth bound.

This book is different from most of the self-teaching courses we have seen in recent months. The book is sectioned into seven "parts," each covering a major subject. Each part contains specific "sets" which deal with a major idea. The sets are then divided into "frames" which are considered the working parts of the course. The reader can work each "frame" in a particular "set" at his own speed. A set is planned to be the recommended minimum work requirement. Each frame is actually a statement or question with blanks which must be filled in with the correct answer or key word. The answers are given next to and just below each frame, placed so the student can cover the page with a piece of cardboard and slide it down to reveal the frame only. He fills in the blanks with his answer and can check the given answer against his own.

KNOW YOUR VOM-VTVM, by *Joseph A. Risse*, published by *Howard W. Sams & Co., Inc.*, 160 pages, 5½ x 8½ softbound, \$3.50.

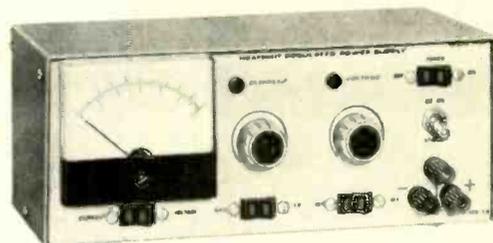
For the technician, engineer, hobbyist or student, this book describes the basics of ac-dc circuits and the circuits used in these test instruments. The first five chapters also explain how the VOM functions to make various measurements followed by a chapter on VOM maintenance. The next three chapters do the same job on the VTVM describing how it works, various probes and also includes a chapter on maintenance. The last chapter gets into the solid-state electronic VOM with information on several makes. At the end of each chapter are a series of questions which the reader can use to help reinforce his learning. The answers are provided at the back of the book. The book is relatively basic and would probably be of more use to an electronic student than to an experienced technician or engineer.

WORKING WITH SEMICONDUCTORS, by *Al Saunders*, published by *TAB Books, Inc.*, 224 pages, 185 illustrations. \$7.95 hardbound, \$4.95 paperbound.

This book contains 15 chapters which are devoted to semiconductor theory and application. However, the first four chapters dealing with theory are done in a manner that tends to eliminate the boring repetition of complicated physical structures. It still gets into the makeup of semiconductors and explains their operating characteristics, biasing and the other little goodies we should all know about. But the diagrams and method of presentation provide a welcome, light reading approach to the subject matter. The rest of the 11 chapters probe into the actual circuit application of various semiconductors including the FET, Unijunction and zener devices. The last chapter is devoted entirely to special circuits used in power supplies, amplifiers, sensors, photo-flash and others. The author makes good use of practical, illustrative diagrams throughout the text and they are drawn in a way that makes any written circuit explanation almost unnecessary. The book is easy to read and anyone wanting a better understanding of semiconductors and their operation will find it a worthwhile reference.

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HIGH-INTENSITY LAMP 713

Eliminates heavy transformer and hum

A high-intensity lamp without a transformer, hum and dead-weight is introduced. A lamp comes in brilliant colors, with fingertip mobility, a wide cool-aid shade that dissipates heat and



reportedly provides two and one-half times the light area of present lamp styles. The white concentrated light is provided by a standard 40S11 bulb without heat and glare. The bulb is guaranteed to last 500 hours with 200w illumination. The Model No. 800 "T-Bar" with a 24in. extension shown is available with a weighted base for desk or table-top, with C-clamp, with wall or permanent mounting. Model No. 900 "All-Angle Mobile" extends 24in. and is available with all four mountings. Springs provide complete mobility in all directions, and swivels and bases are die-cast. Colors available in all lamps are red, black, brush silver, gold and blue satin. Bases are heavy chrome and black vinyl finish. Swing-O-Lite.

TUNER LUBRICANT 714

Employs a built-in cleansing agent

A tuner spray with a cleansing lubricant is developed. "Tun-O-Foam" is a lubricant in which the carbon has been replaced by a synthetic element. The tuner spray reportedly maintains lubricity from -40°F to $+290^{\circ}\text{F}$ and it is claimed that it won't cake or dry out. It is not a liquid, but a thick foam that clings to tuner contacts. Along with lubrication, it provides a cleaning and polishing action. Said to be effective on

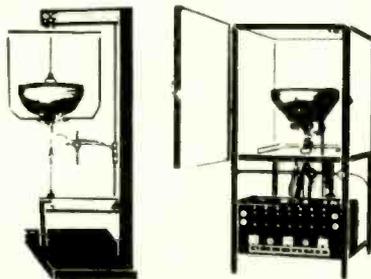


silver and gold plated contacts, it is non-abrasive and will not wear away thin precious metal platings. Chemtronics.

PICTURE TUBE REBUILDER 715

Low priced unit for B/W or color

Announced is a new low priced "Color Champion," Model 1500. It is identical to the company's present



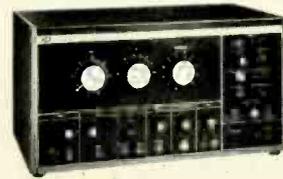
line of picture tube rebuilders with the exception that this unit uses smaller pumps. The unit comes complete with all supplies and priced at \$2775.00. Lakeside Industries.

TELEVISION ANALYST 716

Checks UHF and transistorized TV

Model 1077 television analyst, designed for troubleshooting all types of television receivers, is announced. This diagnostic instrument reportedly offers all the features of the previous instrument plus the ability to check UHF and transistorized TV, as well as VHF and tube-type receivers, both

color and B/W. The instrument uses the flying spot scanner system and signal-substitution techniques. Reportedly TV signals can be injected at any time, at any point and the unit will track down the source of intermittent or general TV troubles, using the generated test pattern. Features include: RF outputs at VHF and all



UHF channels; an IF of 20-48MHz with 1kHz cycle audio; outputs for video, sync, chroma, and audio; low impedance outputs for analyzing transistorized circuits, as well as tube-type; calibrated bias supply; horizontal and vertical driving signals; outputs for analyzing the TV sweep section, transformers and yokes; checks B/boost and high voltage; has high level keying pulse for testing AGC and color circuitry and provides keyed rainbow color signals for analyzing color circuitry. An illustrated 108-page instruction manual comes with the unit. Net price is \$379.95. B&K.

VHF BROAD BAND AMPLIFIER 717

60db or one volt per channel on nine channels

A VHF broad band amplifier Model M-110, which reportedly will deliver 60db or better than one volt per channel on nine channels, plus full FM coverage, is available. Using the Amperex double frame grid 8233 tube



in engineered circuits, this high output has been achieved with a low inter-modulation figure. All tube current is held constant by dc bias stabilization. With better than one volt per channel on both low and high bands, the amplifier will handle long cable runs and risers making it ideal for large apartment buildings, hotels

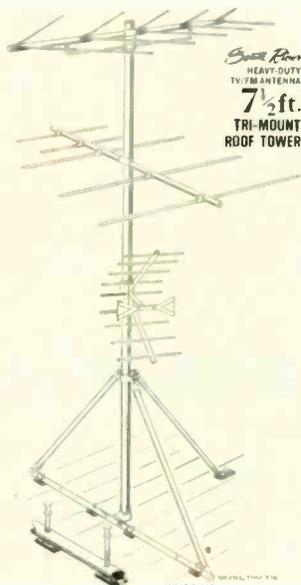
and hospitals. Monitor points at -20db are also provided at the amplifier input and output. List price of the M-110 is \$315. Finney.

ROOF TOWER

718

Base opens like an umbrella

A $7\frac{1}{2}$ ft tri-mount roof tower for installation of multiple antennas on a single mast is announced. The mast, integrated into a special triangular



base assembly, reportedly permits two or three antennas to be mounted quickly and securely on this unit. The mast is made of high carbon, 16 gauge x $1\frac{1}{4}$ in. o.d., hot-dip, galvanized, rustproof steel. The one-piece base assembly opens like an umbrella and is secured in position with a single wing nut. The base assembly is secured to the roof with special double head annular ring nails. Retail price is \$10.58. South River.

AC MILLIVOLTMETER

719

Reads down to $100\mu\text{v}$

Announced is the Model LMV-87A ac millivoltmeter, a solid-state instrument that will read down to



$100\mu\text{v}$. The meter is designed to measure ac voltages from the low millivolt up to 300v over a wide frequency range. The unit is useful in areas where hum and noise measurements are being made. The high input impedance permits connection to sensitive circuits with minimum loading effects. In addition, it can be used as a wideband pre-amplifier. Specifications: Voltage range— 1mv to 300v full scale in 12 ranges. Decibel range— -80 to $+52\text{db}$ for $0\text{db}+1\text{mv}$ into 600Ω ; -80 to $+50\text{db}$ for 0db at 1v . Accuracy— ± 3 percent full scale. Bandwidth— $\pm 1\text{db}$: 10Hz to 1MHz . Input impedance— 10M : 45pf ,

1mv to 300mv ranges; 22pf , 1v to 300v ranges at connector. Amplifier output— 500mv P-P at full scale. Power Supply— 115v $50/60\text{Hz}$; 1.5va . Size and Weight— $8 \times 6 \times \frac{3}{4}$ in. 5.5 lb approx. Price \$129. Leader.

TV TUBE BRIGHTENER

720

For miniature base tubes in portables

A new television tube brightener for miniature base (7G4) tubes used on portable TV sets is announced. The unit has been designated the Model C-414. It can be used to brighten fad-

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ET/D NEW PRODUCTS

ed pictures on series wired television sets with 4.5 and 6.3v picture tubes. Applicable tube numbers include 114P4, 12BFP4, 12BMP4, 12CDP4,

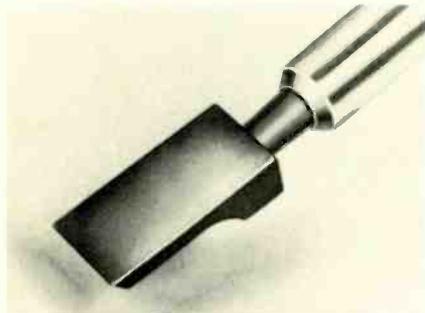


12CFP4, 12CMP4, 12CNP4, 16CFP4, 16CQP4 and others. The new brightener can be used on ac-operated sets but not on battery-operated sets employing a 12v tube. List price is \$3.35. Perma-Power.

SOLDERING TOOL 721

Makes flat pack removal easy

Introduced is a low cost accessory tip for the removal and resoldering of flat packs from printed circuit boards. The tip assembly, ESK-50, fits the standard Model W-TCP soldering



tool. Conversion from standard soldering capability to the flat pack assembly is said to take less than a minute. The basic tool is a thermo-magnetically temperature controlled device and reduces the danger of component damage. The tip spans all seven leads at once and is non-wettable, thereby reducing bridging of circuit lands. Weller.

WIRING TOOL 722

Four-in-one tool

An electrical wiring hand tool is introduced. Called the "Plike," the combination four-in-one tool has serrated needlenose plier jaws for grip-

ping, pulling and bending wire; a crimper orifice for crimping solderless terminals; cutting jaws for wire; and six stripping holes for removing

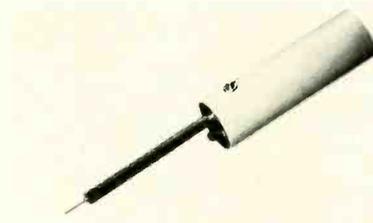


insulation from stranded and solid wire sizes AWG #12 through 22. The tool is provided with an insulated, comfortable hand grip. It is 6½ in. long and lists for \$2.98. Hunter.

SIGNAL INJECTOR KIT 723

Solid-state unit in low-priced kit form

A new solid-state signal injector is available in a low-priced, easily-assembled kit form. The model KG-644,



completely portable and self-contained, includes an insulated test probe and a battery condition light. A cylinder-type handle houses the circuit. It is useful for anyone who works on radios, audio amplifiers, TV and other electronics devices. The unit, complete with batteries, is priced at \$4.95. Allied.

HI FI TAPE 724

Output variance claimed not more than $\pm 2db$

A line of sensibly priced high fidelity cassette recording tapes is introduced. Non-jamming and easy-loading, the Duratape cassette has a



full-frequency range when a constant input voltage is applied. The cassettes can be made erasure-proof and each cassette comes protected in a pre-formed polyethylene plastic case. The tape is available by part numbers which indicate the recording times—C-30, C-60, C-90 and C-120. Also available is a cassette head cleaner, part CHC, for cleaning all cassette recording heads. The product is being introduced with a bonus offer of one dozen alkaline C batteries free with each gross of tape cassettes. Mallory.

CONVERTER 725

Unit contains built-in squelch for noiseless monitoring

A converter designed at the request of policemen, firemen, pilots, reporters, ambulance service, wreckers and others desiring VHF reception on their standard broadcast radios is introduced. The unit can be ordered

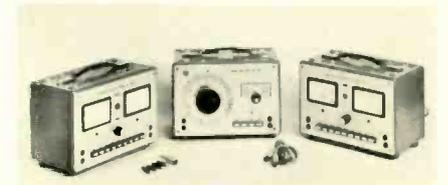


with one or two crystals which are accessible from the front and can be interchanged within the 3 percent frequency range. The converter can be installed in 6 or 12v vehicles in minutes and comes complete with squelch, coax cable, swinging mount, mounting screws and instructions. It is 4½ by 2 by 3 in. and comes in light grey. The price is \$39.95 with one crystal and \$44.95 with two crystals. Herbert Salch.

FLUTTER METERS 726

Separate instruments indicate drift

Three solid-state units are introduced: two flutter meters and a precision wave analyzer determining the



frequency of the offending flutter. Both flutter meters feature separate instruments for indications of drift, which is the deviation from correct speed, and flutter content in $\pm\%$. The instruments have self-contained 3150-Hz oscillators which permit recording of the test signal as well as calibration

of the metering section. Weighted and unweighted measurements can be made and both meters feature a unique input circuit which allows use of any input level above 30mv without the necessity for level adjustment. A relay in the ME-102B unit prevents erroneous readings from insufficient input signal levels. The ME-102B also provides switching between 3000Hz and 3150Hz to accommodate both international and U.S. frequency standards. Flutter between 1Hz and 315Hz is metered. The companion ME-301 wave analyzer provides precision continuous tuning between 1Hz and 330Hz to facilitate diagnosis of the source of flutter. Filter steepness of more than 40db/octave, a self-contained amplifier for loss-free operation and provision for self-calibration are features of the unit. Price is: ME-104 \$365, ME-102B \$460, ME-301 \$780. Gotham.

VOLTAGE ADJUSTER 727

Increases 117v line voltage to 140v

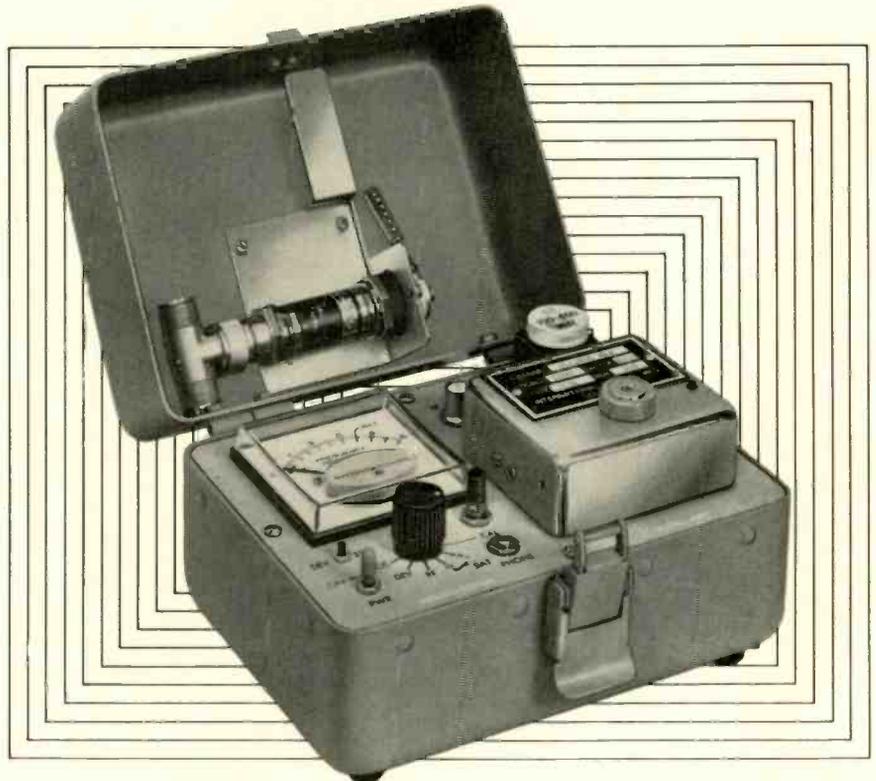
A new device for the improvement of color television performance is announced. The Saturn Model 50-172



is claimed to give lifelike color and improve clarity and brightness by correcting low or changing ac line voltages. The voltage adjuster is installed on the color television set with an easy to read edge view meter and six-position switch to allow the viewer fingertip control of the ac line voltage. Suggested retail price is \$26.95. Terado.

For more information on these
NEW PRODUCTS
See page 83
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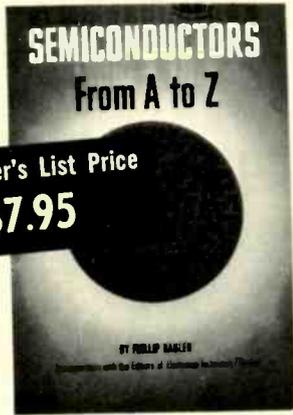


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SEMICONDUCTORS FROM A TO Z contains all you need to know about the entire range of transistors and semiconductors used today. Written in language anyone can understand, this book explains how various semiconductor devices work and how they are used,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

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

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

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

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RCA Facility Training TV Repairmen Under "Four Cities" Program

Eighty formerly jobless men attend regular classes and laboratory sessions in the RCA training center in Newark, N.J. The facility is preparing the men for careers as TV service technicians.

The center is part of the "Four Cities" program, which is operated by the RCA Service Co. under a \$2.5 million contract with the Dept. of Labor to train 400 of the nation's jobless as television repairmen. RCA is contributing more than \$1 million above the government's cost to the program.

Newark is one of four cities where training centers have been established by RCA for an 18-month program that includes courses in basic education and social development in addition to intensive vocational instruction. Graduates of the program will eventually be placed with RCA service branches or other companies.

The other three participating cities are Camden, N.J., also with 80 trainees, and Chicago and Los Angeles with 120 each.

The Newark trainees range in age from 18 to 50, with an average age of 24. A total of 82 percent of the students are black, 15 percent are Spanish-American and 3 percent are white. Approximately 28 percent have served in the armed forces.

Recruitment and initial screening of prospective trainees were conducted by the federally funded Total

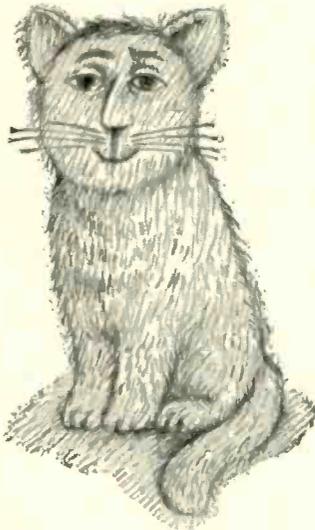
Employment and Manpower (TEAM) in Newark and by the New Jersey State Employment Service. Applicants were tested and their eligibility determined according to the U.S. Labor Dept. standards prior to their referral to the RCA project.

Dudley V. Simms, manager of the Newark center, said that the trainees become RCA employees upon acceptance into the program and earn \$2 per hour for the duration of their respective training periods. Simms noted that the maximum training period for an enrollee is 18 months.

EIA Announces Record January Consumer Electronics Sales

Based on EIA marketing services department preliminary sales to dealers figures, the Consumer Products Div. has announced that television, radio and phonograph categories all recorded substantial increases over January 1968.

Color television sales of 514,862 sets were the largest January on record, increasing 26.9 percent over January 1968. Monochrome sales, up 5.7 percent over January 1968, reached 399,298 sets. Total television sales of 914,160 sets represented a 16.7 percent increase over January 1968. Portable and table phonograph sales also showed exceptional growth, registering a 42.5 percent increase over January 1968, with 315,947 units sold, an all-time January high. Console sales at 121,134 units registered a 9.8 percent increase to bring January total phonograph sales to another all-time high of 437,081 units, or 31.6 percent increase over 1968. Automobile radio sales also showed a significant January increase; 24.2 percent over January 1967. Home radio sales of 691,444 sets represented a 3.0 percent increase over January 1968. Total radio sales of 1,633,253 sets in January was 14.2 percent over 1968.



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Owners of Color Sets Relate Experiences

Subscribers to Consumer Reports who own color television were asked to comment on their sets in the consumer magazine's most recent annual questionnaire.

Responses totaled 90,000. Among the conclusions:

- A color set is more likely to break down than any other major household appliance.
- Owners are also likely to spend more on repairs for the average color set than for any other appliance.
- Despite the costs, owners are satisfied, on the whole with the quality of service available for color TV sets.

Engineer Awarded Patent for TV High Voltage Regulation

An improved method of regulating the high voltage produced by line deflection circuitry in cathode ray tube television monitors and receivers has been patented by Joel E. Jones, an engineer of Conrac Corp. Jones, technical director of the Conrac Div. of Conrac Corp., assigned the patent to the parent company.

According to the patent award, the invention deals with television systems in which the line deflection of a cathode ray beam is produced electromagnetically and the high voltage for accelerating the electron beam is developed from the flyback voltage pulse produced by the line

deflection circuitry in television monitors and receivers.

The invention solves the problem of ultra high voltage from the flyback pulse. In his patent application, he noted that "the load upon the high voltage power supply varies with the intensity of the cathode ray beam" and, that when a scene changes from near black to near white or when the brightness control is advanced, "the increased load on the system tends to lower the ultor voltage." The result of the changing of electron beam velocity alters picture size and impairs video reception.

Instead of stabilizing the voltage by conventional dissipative methods, he suggests regulation by automatically varying the amount of energy stored magnetically during the trace time of the cathode ray beam which is made available for high voltage generation during retrace time.

The patent suggests the use of a saturable reactor with its active winding connected effectively in parallel with the primary winding of the high voltage transformer. The control winding of the reactor is supplied with a control current which increases with the high voltage lead. The amount of energy stored magnetically in the reactance then increases with the load current.

"At least part of the additional stored energy is discharged into the transformer during retrace time," Jones said, "producing a higher induced voltage in the transformer and thereby stabilizing the high voltage input."

CBS Technique To Televisive Color Coverage of Moon Landing

The system which beamed the world's first successful color television broadcast 28 years ago from New York

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City will be used by Apollo astronauts to relay man's first color telecast from the moon's surface to a global television audience.

The tiny field sequential camera will transmit color images of the lunar environment to earth more than 238,000 miles away. It uses a spinning 3.5 in. disk with the primary colors of red, green and blue, which rotate rapidly in a sequential motion to produce images in their original hues. The field sequential system was first developed by Dr. Peter C. Goldmark, president of CBS Laboratories, a division of Columbia Broadcasting System, Inc.

Announcement of the plan to televise the lunar mission in color was made by the National Aeronautics and Space Administration in Houston. Officials at the NASA Manned Spacecraft Center said that color television coverage with a field sequential system is expected during the Apollo flights this year. The color coverage from a manned spacecraft marks a space first, they added.

Ordinary color television systems require intensive light sources to relay distinguishable color images for home viewing.

The field sequential technique planned for the moon telecast requires approximately one-third as many components as a standard color television camera, Dr. Goldmark said. The camera can be used with only one television broadcast tube and there is no problem of color registration. Color information is transmitted as the color filters on the spinning disk pass in front of the tube in sequence.

A complete image is sent first in red, then in blue, then in green. The human eye's persistence of vision provides the complete color picture, Dr. Goldmark explained.

As the information is beamed, ground stations on earth equipped with electronic devices will pick up the signal in its sequential form. A magnetic disk with scanning converter will process the signals into a form suitable for standard television transmission techniques for telecast by all major networks to home receivers.

There is a better than 50-50 chance that the descent of two Apollo 10 astronauts toward the moon will be seen on home television in live color, NASA officials said.

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COLOR BAR ...

continued from page 50

prevents any manufacturer from using them in a color generator at this time. This particular manufacturer admitted, however, that with the rapid changes in the state-of-the-art, IC circuits may soon become practical.

Another manufacturer said that IC circuits are not magic and would create more problems than they would solve. He added that these devices will only be used when they can compete with discrete components in performance and price. The remainder of the responding companies said IC circuits will be more popular in the near future and will act to improve stability, size and reliability--but not necessarily the cost of the instrument.

Conclusion:

The questions and answers presented in this article may not solve all the problems of what to buy in a color bar generator, but the replies do indicate that manufacturers are concerned about test instrument reliability and that the technician or service shop gets the most for the money. Many of the manufacturers have different views on what makes a stable, reliable instrument, but all agree that these are of prime importance to the user. After all, these companies are in a competitive field and they can't disagree on too many points or be drastically different from their competition. They all have a common battleground: providing the best instruments possible to make servicing more profitable. As the beginning of this article pointed out, color TV sales are climbing and the number of technicians dropping. To bridge this gap, you have to make more efficient use of service time. The only way you can do that is with test instruments which will aid in quick and accurate isolation of circuit malfunctions.

You may obtain additional information on color generators by writing to any of the companies listed at the end of this article. We express our appreciation to these manufacturers for their cooperation in answering our questions. ■

HYBRID ...

continued from page 54

L-R assembly, the primary one being a defective cathode follower tube or some component in that circuit. It takes very little current drain to destroy a 1/2w resistor. The little 27 μ h choke may or may not be damaged and in some cases it will open while the resistor shows no sign of overheating. The blanking diode is rarely harmed under these conditions because the RC components will block any dc current flow through it.

RETRACE LINES

Once in awhile a blanking diode will fail and cause excessive retrace lines to appear on the CRT screen.

The first time this symptom showed up we suspected a possible picture tube defect, but a thorough CRT check and connecting the chassis to a test jig proved this analysis to be in error.

As we reviewed the symptom, three things appeared to have caused the retrace lines: (1) The CRT screens had been set too high, causing blooming whenever the brightness or contrast controls were increased. (2) The picture was badly smeared and as unusual as it was to visualize, the chroma information on the CRT was not affected. This narrowed the problem to the luminance circuitry, thus eliminating everything preceding chroma take-off. (3) Eventually, this brought us to the blanking diode which we found to be shorted.

It is possible to erroneously increase the screens in the new CRT's to overcome smearing that can cause blooming.

When the blanking diode shorts out we lose the "switch-off" function. Luminance information continues to be received from the delay line. At the same time the video output stage is no longer cut off during retrace time, leaving the beam current active in the CRT. With the normal blanking pulses arriving on schedule and a continued flow to video information being applied to the grid of the "Y" amplifier, we have both smear and excessive retrace lines.

OPEN DIODE

The symptoms here are not quite the same as when the blanking diode shorts out. When the diode opens, we can still have blanking pulses arriving on time, but the video output stage remains in a semi cut-off condition because we have lost the "switching" action. However, there is no luminance information coming out of the delay line because it has been cut off by the open diode. By turning up the contrast control, a smeared image of a luminance picture may appear on the CRT. But brightness will be low and if there is chroma information, the black and white component will not be seen as it is only capacitively "leaking" through the open diode. A signal generator or a black and white program can be used to analyze this symptom.

Caution should be exercised when any of these conditions appear on the CRT. The retrace and smearing symptom can also be induced by setting the CRT screens too high. Technicians who are not familiar with the new types of CRTs should take time to study their characteristics. Older color tubes did not require a red drive control because the phosphors were not overly sensitive and the red gun was usually driven harder than the green and blue, which is not true anymore. If the receiver that you are working on has two red controls on the rear apron, the CRT is the new phosphor type. The setup procedure differs. Use the manufacturer's recommended procedure and save yourself problems. ■

MATV Specifications Guide 400

A 37-page guide for architects and engineers who plan master antenna television (MATV) systems is available. The guide includes recommended minimum specifications for equipment and signal levels at all points of MATV systems. Also included are step-by-step procedures that should be followed in balancing an MATV system and in proving its satisfactory performance. Minimum specifications for each component of a system are listed. Discussed in a special addendum are specifications for long-line, CATV-type equipment that might be needed for an extensive MATV system. The guide also suggests important stipulations to be inserted in contracts for the construction and maintenance of MATV systems. Jerrold.

401

Electronic and Electrical Books

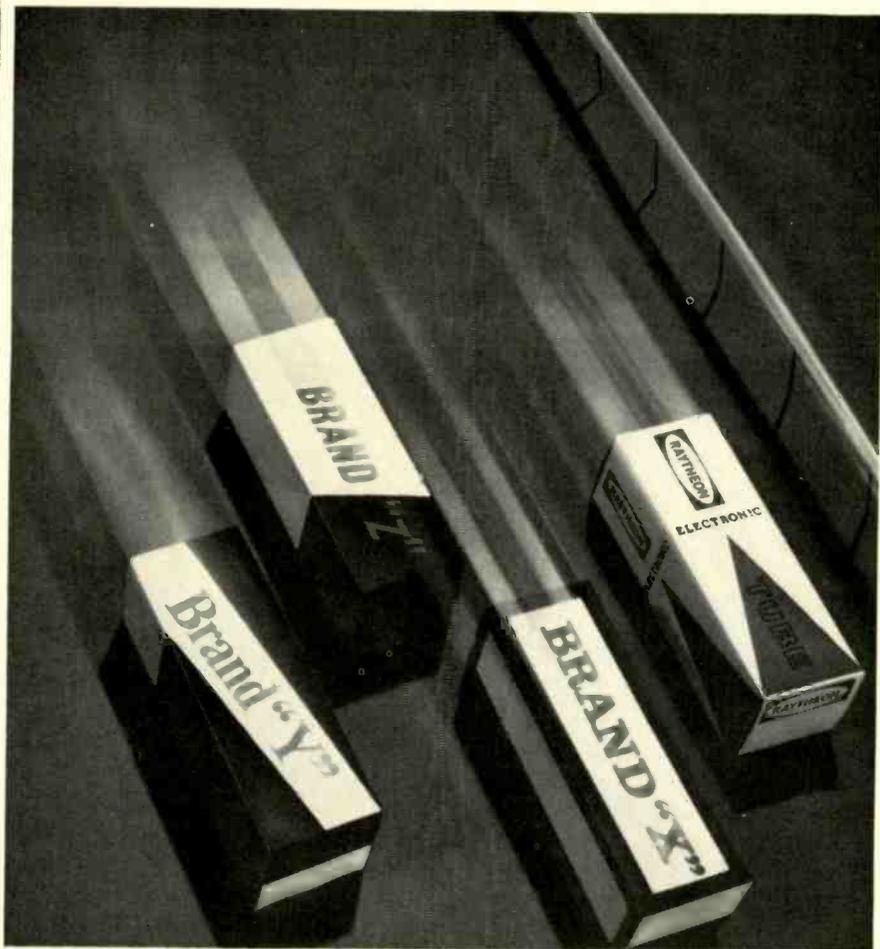
A 16-page catalog describes over 100 current and forthcoming books in the following subject areas: broadcasting; basic technology; CATV; electric motors; electronic engineering; reference; television, radio and electronics servicing; audio and Hi Fi; hobby and experiment; test instruments and transistors. Among the books featured is the recently introduced "Popular Tube Transistor Substitution Guide." Scheduled for publication is "RCA Color TV Service Manual," complete with schematic diagrams and troubleshooting data for 23 models. TAB.

Program Center 402

A new eight-page full-color brochure illustrating a line of home entertainment program centers is available. The new literature provides specifications for each of the 12 home distribution amplifiers designed for city and suburban areas and fringe and weak signal areas. Also illustrated and described are several new kits which expand a four-outlet coaxial cable system or a four-outlet 300Ω system into eight-outlet systems. JFD.

Electronic Importer and Distributor List 403

The Japan Light Machinery, Electronics Div. announces the availability of an importer and distributor list by writing to Information Centre, 437 Fifth Ave., New York, N.Y. This list is free, and contains 26 pages of over 200 names and addresses.



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Raytheon Company, Receiving Tube Operation, Fourth Avenue, Burlington, Massachusetts 01803.

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Cable and Connectors 404

A new 18-page catalog lists thousands of individual connectors, sockets and switches plus a new line of 10 coaxial cable/connector assemblies. The publication also features new sections on the company's popular 131 Series precision and 5116 Series Subminax RF connectors. Also in-

cluded are tube sockets, relay sockets, test jacks, microphone connectors, home and industrial type ac plugs and receptacles plus coaxial connectors and switches. Photographs, line drawings, electrical characteristics and mechanical specifications are provided for each. Amphenol.

Communication Accessories 405

A 26-page brochure, entitled Motorola Radio Communication Accessories—Complete Base and Mobile Equipment, is available. The brochure describes the company's line of ac-

cessory equipment designed to give added flexibility in the expansion of Motorola radio systems. Motorola.

Test Accessories 406

A 52-page catalog now contains 375 products—78 of which are new to the line this year. Featured are a series of shielded "Black Boxes" slotted to accept circuit boards, a coaxial adapter, push-on coaxial cables, an ac high voltage probe with built-in voltmeter and a series of standard and miniature unmounted banana plugs and jack hardware. The catalog provides complete engineering information on all items, including product photographs, dimension drawings and schematics. It also illustrates and describes many typical applications with additional information helpful to design and test engineering personnel. Pomona.

Knobs 407

A 20-page catalog lists the complete line of standard, off-the-shelf instrument and control knobs, including 35 new design entries. The catalog, intended for designers and knob specifiers in electronics, appliance and other OEM fields, lists hundreds of knobs, dials and assemblies available from stock tooling for commercial and military applications. Kurz-Kasch.

Switches 408

A 20-page catalog is released featuring an expanded line of miniature electronic switches and keyboard assemblies. The toggle switches are available in five complete lines which include the 5a standard series, 6a series, waterproof series, 15/32 in. bushing series and locking toggle series. SPDT, DPDT, 3PDT and 4PDT configurations are available in each group. Reed actuated keyboard assemblies come in four standard stock models. The catalog describes each product group in detail and lists electrical specifications, dimensions, drawings and prices. Alco.

Cassette and Audio Accessories 409

A 24-page illustrated consumer catalog describes magnetic recording tape and audio accessories. The catalog is available to dealers who can offer copies to customers for mail-order use or simply as a home-audio inventory and check list. The catalog fits into a business envelope for mailing, or may be carried in purse or pocket. Products listed range from cassette and reel-to-reel tape, to devices for editing, mailing and storing as well as items for the care of recorder-reproducers and phonographs. Robins.

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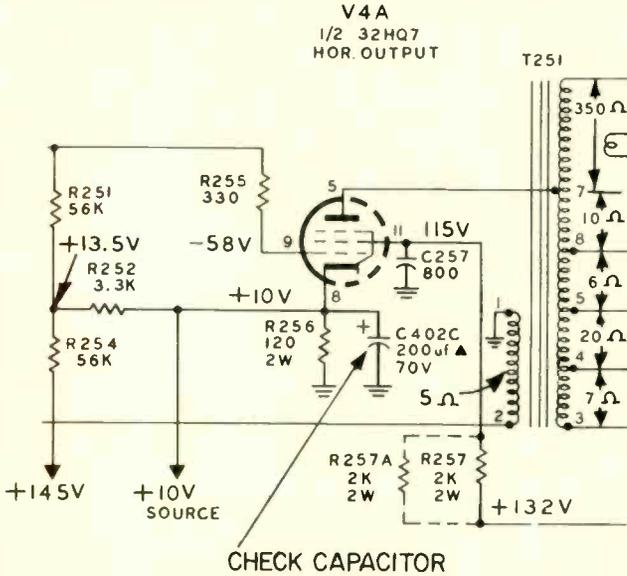
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Continued from page 68

complished by C402C, a 200 μ f 70v electrolytic. In some sets where the ESR goes above 2 Ω , some strange symptoms develop: picture contrast may vary from left to right (left being washed out, right being high contrast). Hori-



zontal tearing, vertical jitter and singing horizontal output transformers may also occur.

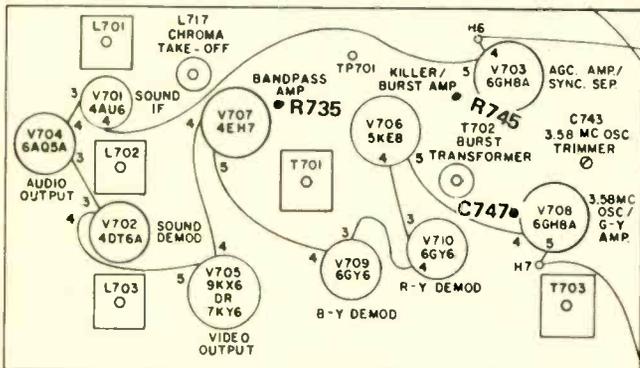
The troubleshooting procedure can be either waveform analysis using an oscilloscope, or bridging of the 10v line with a known good 200 μ f electrolytic. The VHF tuner 10v input terminal is a convenient test point. The oscilloscope pattern of a good electrolytic will show a 0.5v neg spike with a repetition rate of 15.75kHz. A defective unit will show something resembling a distorted 15.75kHz sinewave. As little as 0.3v P-P of this 15.75kHz sinewave component can cause problems in the picture. It is a good practice to bridge the replacement capacitor (ES31X7) into the circuit before removing the original unit to make sure the new unit will function satisfactorily.

Replacement with a new electrolytic capacitor will normally cure the problem.

MAGNAVOX

Color TV Chassis T924—'In Cabinet' AFPC Alignment

AFPC alignment can be accomplished in the T924 chassis without removing the chassis from the cabinet. The accompanying illustration of the chroma board points out the location of three connecting points (available from the top of the chassis), which are electrically equivalent to the alignment points listed in the service manual. They are



as follows: R735-V706B-Pin 2, R745-V706A-Pin 9, C747-T703-Pin 3.

Procedure: (1) Disconnect the chassis from the power source. (2) Connect a long clip lead to each of the three indicated points. Use leads which are sufficiently long to hang over the back of the chassis without shorting. Identify each lead so that its connecting point can readily be determined. (3) Insert tuning tools into T702 and T703, and leave them in place throughout adjustment procedure. (4) Set a long insulated screwdriver in place on C743. (5) Connect the chassis to the power source through an isolation transformer. (6) Complete the AFPC alignment as described in the service manual, using the installed clip leads as test points. (7) Disconnect the chassis from the power source before removing the clip leads and tuning tools.

OLYMPIC

Color TV Chassis CT-911—Sensitivity Improvement

The sensitivity of this model can be improved for fringe operation by performing the following adjustments: (1) Preset contrast control to mid range. (2) Adjust brightness for normal viewing. (3) Adjust AGC control clockwise for best signal-to-noise ratio, while observing for overload on strongest local signal. (4) If luminance tends to overdrive on strong signal, tube V8 can be replaced with an 8JV8 which will effectively reduce contrast level.

Color TV Chassis CTC19/21/31—Intermittent Color

Some of these late production chassis may exhibit intermittent color which is occasionally aggravated by a vibrating or flexing chroma board. Inspecting tube socket V703 may reveal that resistor R746 is shorting against capacitor C724 due to a shift in the position of the spaghetti insulation. Relocate R746 to provide sufficient clearance.

Color TV Chassis CTC20/30—Dark Lines at Left Side of Raster

Ringing bars appearing as three or four dark vertical lines may show up at the left side of the raster in CTC 20/30 color chassis.

The following horizontal output circuit changes will offer relief from this condition.

1. Add a 150pf 3kv capacitor in series with a 1.5K 1/2w resistor between pin #6 of J106 and chassis ground.
2. Add a second identical RC network connected to shunt control RV-102.

SENCORE . . .

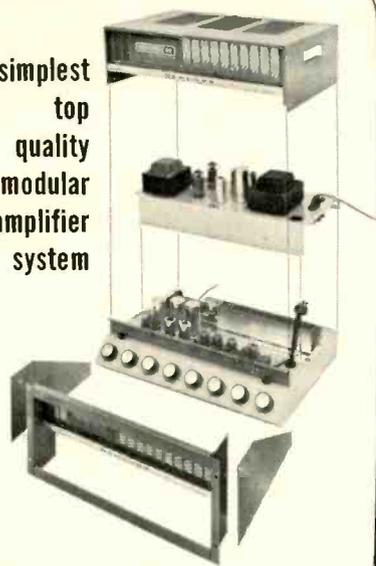
continued from page 56

receiver should be performed with a sweep signal. If the receiver is a monophonic type, the 10.7 crystal signal from the jack may be used.

An external marker signal may be used with the generator to provide a marker point other than the ones found on the front panel. The signal from the marker generator is connected to the SM152 through the external marker jack on the front panel. To use this provision, couple a signal into the external marker jack and depress the external marker button on the right side of the front panel. The external marker frequency will now appear as a regular marker on the response curve.

As the technician becomes more experienced in its use and features, he will likely develop other applications for the instrument. ■

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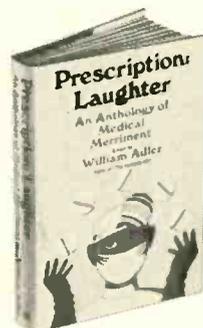
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