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ELECTRONIC TECHNICIAN/DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

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WHY REPAIR TV TUNERS?

CASTLE REPLACEMENTS

start at

Select by part number below. Write, phone or wire order.

No mailing . . . no waiting . . . no nonsense!

895



UNIVERSAL REPLACEMENTS

Prefer to do it yourself?

These Castle replacement tuners are all equipped with memory fine tuning and UHF position with plug input for UHF tuner. They come complete with hardware and component kit to adapt for use in thousands of popular TV receivers.

*Supplied with max. length selector shaft (measured from tuner front apron to tip) . . . you cut to suit.



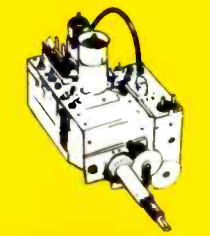
EXACT REPLACEMENTS

Purchase outright . . . no exchange needed, \$15.95 ea.

Castle replacements made to fit exactly in place of original tuner. Available in the following popular numbers.

ADmiral	EMERSON	340042-1	LOPTT399Y			470V030H01	175-424	175-721	175-1133	MISC. INCLUDING
		340052-1	LOPTT399YA	76-13955-1	KRK133BC	470V049H01	175-426	175-722	175-1134	PRIVATE
94E210-1	471351	340053-1	OPTT399YA	76-13955-2	KRK133D	470V149H01	175-431	175-731	175-1135	TAB2
94E210-3	471512	340066-1	OPTT402	76-13955-5	KRK133U	470V151H01	175-454	175-732	175-1136	TA124
94E227-2	471515	340067-1	LOPTT402			470V158D03	175-601	175-733	175-1137	TA129
94E228-1	471678	340069-1	CPTT403			470V161D03	175-602	175-734	175-1138	TA131
94E229-4	471682	340078-1	OPTT404			470V188D01	175-604	175-735	175-1139	TA133
94E229-8	471700	340078-2	OPTT404A			470V188D02	175-621	175-736	175-1140	TA136
94D257-1		340095-2	CPTT405			470V190D01	175-622	175-737	175-1141	TA137
94D257-7			OPTT414A			470V191D01	175-641	175-738	175-1142	TA147
94D257-49						470V191D02	175-642	175-741	175-1144	TA150
94E260-8H						470V191D03	175-643	175-741	175-1145	TA157
94E260-11							175-644	175-742	175-1146	25A1241-002B
94E261-1B	ET86X188						175-645	175-743	175-1147	25A1241-004B
94E261-1C	ET86X208						175-646	175-744	175-1148	25A1241-005B
94E261-1D	ET86X212						175-647	175-745	175-1150	25A1241-006B
94D261-4	ET86X213	OPTT123C					175-660	175-746	175-1151	25A1245-005D
94C273-2	ET86X214	OPTT123D					175-661	175-747	175-1152	25A1245-006D
94C273-3	ET86X215	TT133A					175-662	175-748	175-1153	25A1245-009
94C273-4	ET86X221	TT133A					175-663	175-750	175-1154	25A1245-011
94C273-7	ET86X224	PR9021					175-667	175-752	175-1156	25A1246-003
94C273-8	ET86X227	PR9044					175-668	175-753	175-1157	25A1246-004
94C273-9	ET86X230	PR9045					175-669	175-754	175-1160	25A1246-005A
94C273-10	ET86X231	PR9050					175-671	175-755	175-1161	25A1246-005A
94C273-13	ET86X232	PR9058					175-680	175-756	175-1162	25A1249-001A
94C273-15	ET86X236	CPTT332A					175-681	175-757	175-1163	25A1249-001E
94C281-1K	ET86X242	PR0352-1					175-682	175-758	175-1164	25A1253-001E
94C281-1D	ET86X244	PR0364					175-683	175-759	175-1165	25A1253-001B
94C281-1E	ET86X255	PR0376					175-684	175-760	175-1166	25A1253-001D
94C281-1J	ET86X256	PR0376					175-685	175-761	175-1167	25A1256-001C
94C281-1L	ET86X265	PR0376					175-686	175-762	175-1168	25A1256-001A
94C281-4J	ET86X277	PR0404					175-687	175-763	175-1169	25A1258-001C
94C281-5	ET86X281	PR9045					175-688	175-764	175-1170	25A1263-001E
94C281-12		PR9058					175-689	175-769	175-1171	25A1264-001B
94C281-16		PR9058					175-690	175-770	175-1172	25A1264-001B
94C281-1		PR9058					175-691	175-771	175-1173	25A1264-001B
		PR9058					175-692	175-772	175-1174	25A1264-001B
		PR9058					175-693	175-773	175-1175	25A1264-001B
		PR9058					175-694	175-774	175-1176	25A1268-001E
		PR9058					175-695	175-775	175-1177	25A1270-001
		PR9058					175-696	175-776	175-1178	006-014700
		PR9058					175-697	175-777	175-1179	006-015000
		PR9058					175-698	175-778	175-1180	006-015700
		PR9058					175-699	175-779	175-1181	006-016500
		PR9058					175-700	175-780	175-1182	006-017300
		PR9058					175-701	175-781	175-1183	006-017700
		PR9058					175-702	175-782	175-1184	006-018600
		PR9058					175-703	175-783	175-1185	006-020100
		PR9058					175-704	175-784	175-1186	006-020900
		PR9058					175-705	175-785	175-1187	006-021000

*Supplied with new channel indicator skirt knob, original illuminated dial is not used.



OVERHAUL SERVICE — All makes and models.

- VHF or UHF tuner (1960 or later) \$9.95
- TRANSISTOR tuner \$9.95
- COLOR tuner \$9.95

Overhaul includes parts, except tubes and transistors.

Dismantle tandem UHF and VHF tuners and send in defective unit only.

Remove all accessories . . . or dismantling charge may apply. Your tuner will be expertly overhauled, aligned to original standards and warranted for 90 days.



CUSTOM EXCHANGE REPLACEMENTS

When our inspection reveals that original tuner is unfit for overhaul, we offer an exact replacement

If exact replacement is not available in our stock we custom rebuild the original at the exchange price.

(Replacements are new or rebuilt.)



PROFESSIONAL "CONTACT OVERHAUL" KIT

Do your own minor tuner overhauling by using this professional kit of chemicals.

Dealer Net \$5.50



CASTLE TV TUNER SERVICE, INC.

MAIN PLANT: 5713 N. Western Ave., Chicago, Ill. 60645 • Ph. 312-561-6354

EAST: 130-03 89th Rd., Richmond Hill, N.Y. 11418 • Ph. 212-846-5300

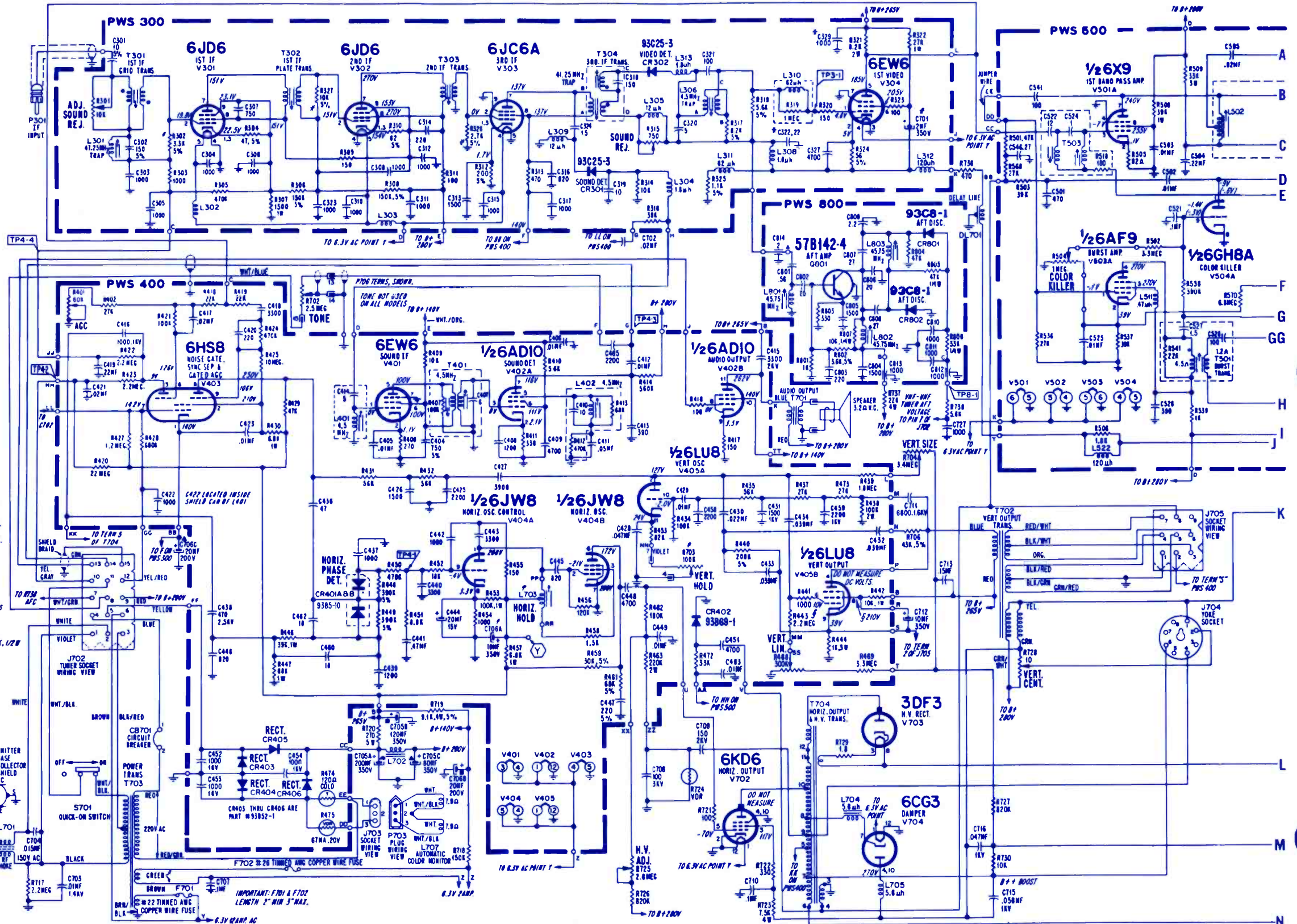
. . . for more details circle 105 on Reader Service Card

SYMBOL	DESCRIPTION	DUMONT PART NO.
R258-1M	volume control	970430
R301-10K	adj sound reject control	75A101-8
R315-750Ω	sound reject control	75A101-3
R401-60K	AGC control	75A101-9
R468-300K	vert lin control	970435
R474-120Ω	thermistor	61A50-3
R475-67MA	20V, VDR	61A51-1
R504-1M	color killer control	970436
R523-700K	blue background control	75A95-9
R615-150Ω	top blue horizontal control	75A64-7
R701-500Ω	color control	75A127-6
R703-100K	vert hold control	75A134-6
R704-3.4M	vert size control	75A96-20
R707-1,100Ω	tint control	75A127-7
R708-250K	bright control	75A134-5
R709-250Ω	contrast control	75A134-4

R710-3.4M	master bright control	970449
R712-1M	master screen control	75A136-1
R714-3,900Ω	special 1/4W, 10%	970450
R724-VDR		61A46-13
R725-2.8M	high voltage adjustment	970452
R728-10Ω	vert centering control	76A64-17
R731A-200M	focus rectifier module	970454
R731B-40M	focus rectifier module	970454
R732-15M	focus control	970455
R745-3.8Ω	thermistor	61A27-1
C705A-200μf	350V electrolytic	970475
C705B-120μf	350V electrolytic	970475
C706A-80μf	350V electrolytic	970475
C706B-10μf	350V electrolytic	970476
C708-20μf	200V electrolytic	970476
C708C-20μf	200V electrolytic	970476
C706D-50μf	50V electrolytic	970476

L401-sound takeoff coil	72A287-4
L402-quad coil	72A136-3
L502-bandpass coil	72A269-4
L702-filter choke	74A46-12
L703-horiz oscillator coil	94A268-4
T401-sound IF xformer	72A314-2
T501-burst xformer	72A284-4
T503-bandpass input coil	72A302-1
T701-audio output xformer	970485
T702-vert output xformer	79A106-5
T703-power xformer	80A104-4
T704-horiz output xformer	79A146-2
M701-deflection yoke	94A377-6
Q801-transistor, AFT	57A142-4
CB701-circuit breaker	84A17-11
DL701-delay line	72A217-3
deflection yoke	94A377-6

RUN CHANGES
Start of production.



SYMBOL DESCRIPTION GENERAL ELECTRIC PART NO.

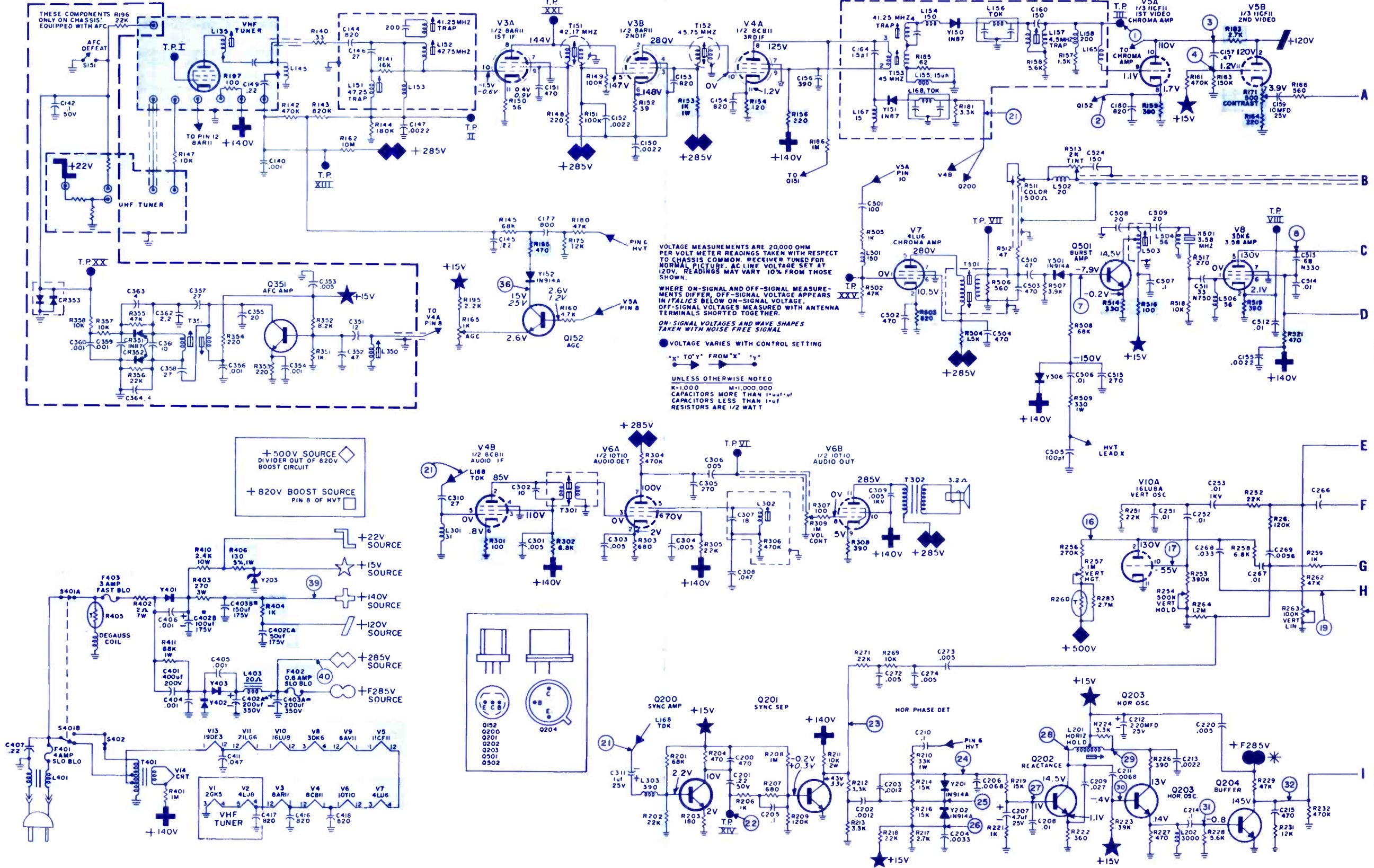
C219-240µf, ±10%, 5kv, N2200	EP22X25
C402A-200µf, +100%-10%, 350v electrolytic	EP31X23
C402B-100µf, +100%-10%, 175v electrolytic	EP31X23

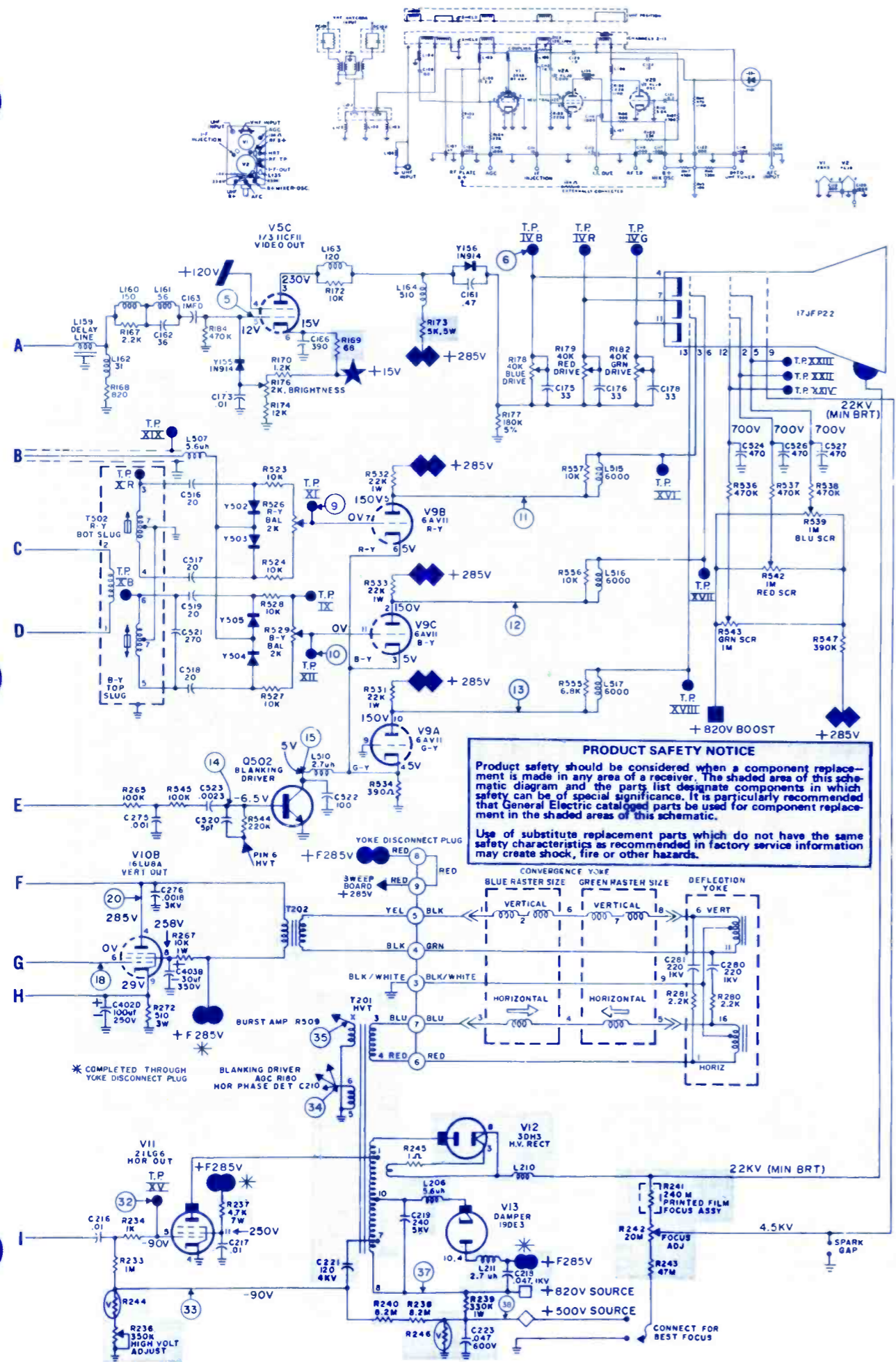
C402C-50µf, +100%-10%, 175v electrolytic	EP31X23
C402D-100µf, +100%-10%, 250v electrolytic	EP31X23
C403A-200µf, +100%-10%, 350v electrolytic	EP31X23
C403B-150µf, +100%-10%, 175v electrolytic	EP31X22
C403C-30µf, +100%-10%, 350v electrolytic	EP31X22
L152-coil, 1F xformer	EP36X42

L157-coil, 4.5MHz trap w/core	EP61X3
L159-coil, delay line	EP36X50
L201-coil, horiz oscillator	EP36X55
L302-coil, quad	EP36X52
L401-line choke, 3.2-4.1MHz	EP36X57
T201-xformer, horiz output	EP77X8
T202-xformer, vert output	EP64X10
T301-xformer, audio interstage	EP36X34
T302-xformer, audio output	EP64X8
T401-xformer, filament	EP64X11
T501-coils, chroma bandpass	EP36X2
T502-xformer, chroma demodulator	EP36X65
R241-focus, voltage drooping	EP14X30
R243-47M, ±10%, 1.5w, 4kv carbon film	EP14X1
R244-varistor, 1ma, ±15%/850v	EP13X2
R246-varistor, 1ma, ±15%/575v	EP13X3
R260-thermistor, 500K, ±10%/25°C	EP14X20

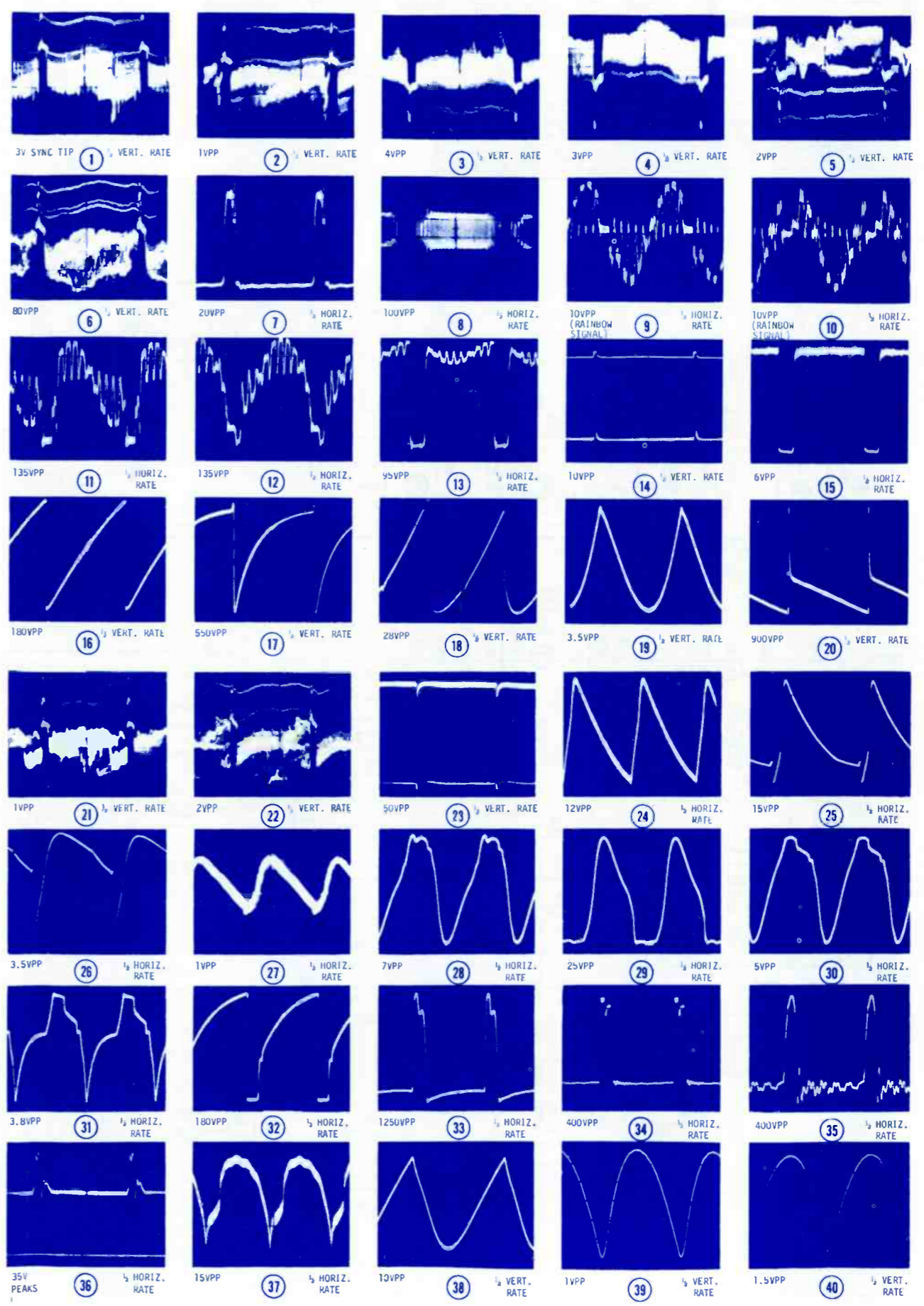
R405-thermistor, PCTR, 20n cold, 5K hot	EP39X4
Q151-transistor, NPN, silicon, AFC amp	EU5X1
Q152-transistor, NPN, silicon, AGC keyer	EU15X7
Q200-transistor, NPN, silicon, sync amp	EP15X3
Q201-transistor, horiz AFC	EP15X7
Q202-transistor, horiz react	EP15X9
Q203-transistor, horiz oscillator	EP15X9
Q204-transistor, horiz driver	EP15X10
O501-transistor, NPN, silicon, burst amp	EP15X5
O502-transistor, NPN, silicon, blanking drive	EP15X9
R165-control, AGC, 1K	EP49X44
R171-control, triple contrast, 500K, 20%	EP49X59
R176-control, triple brite, 2K, 20%	EP49X58
R178-control, triple, blue drive	EP49X59
R179-control, triple, red drive	EP49X58
R182-control, triple, green drive	EP49X58

R236-control, HV adjust, 350K	EP49X46
R242-control, 20M, focus adjust	EP49X51
R254-control, triple, vert hold, 500K, 30%	EP49X59
R257-control, dual, vert height, 1M	EP49X45
R263-control, vert lin, 100K, dual	EP49X45
R309-control, volume, 1M	EP49X53
R511-control, color, 500n	EP49X54
R513-control, tint, 2K	EP49X55
R526-control, dual, red balance, 2K	EP49X594
R529-control, dual, blue balance, 2K	EP49X594
R539-control, triple, blue screen, 1M	EP49X43
R542-control, triple, red screen, 1M	EP49X43
R543-control, triple, green screen, 1M	EP49X43
fuse, 4a slow-blow	EP10X7
fuse, 0.6a slow-blow	EP10X5
fuse, 3a fast-blow	EP10X4
yoke, deflection	EP76X3





PRODUCT SAFETY NOTICE
 Product safety should be considered when a component replacement is made in any area of a receiver. The shaded area of this schematic diagram and the parts list designate components in which safety can be of special significance. It is particularly recommended that General Electric cataloged parts be used for component replacement in the shaded areas of this schematic.
 Use of substitute replacement parts which do not have the same safety characteristics as recommended in factory service information may create shock, fire or other hazards.



SYMBOL	DESCRIPTION	PHILCO-FORD PART NO.
C204A	200 μf/200v electrolytic	30-2616-11
C204B	150 μf/350v electrolytic	30-2616-11
C204C	20 μf/200v electrolytic	30-2616-11
C204D	50 μf/200v electrolytic	30-2616-11
C207A	500 μf/50v +20v electrolytic	30-2616-10
C207B	500 μf/50v +20v electrolytic	30-2616-10
C207C	100 μf/50v +20v electrolytic	30-2616-10
CB200	power, ac	42-2136-6
IC91	3.58MHz oscillator	46-5002-4
L41	horiz hold	32-4891-2
L91	sound interstage	32-4936-2

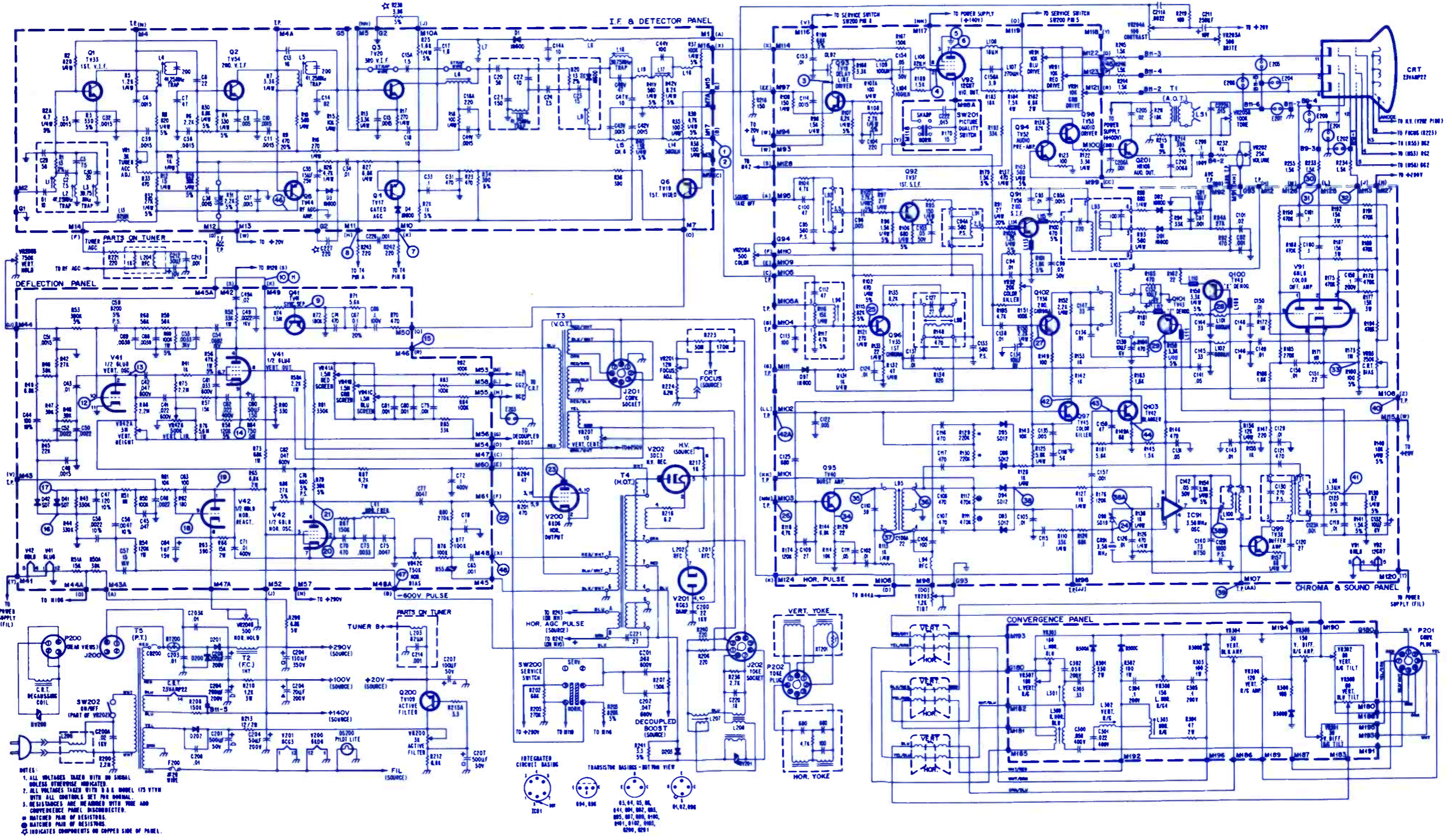
L93	sound ratio detector	32-4928-1
L94	tint control	32-4942-1
L96	chroma t o	32-4878-3
L99	chroma bandpass	32-4929-1
RT200	degaussing thermistor	33-1376-6
RT201	vert damping	32-3029-2
RV55	horiz bias	33-1379-2
T1	audio output xformer	32-10119-3
T2	filter choke	32-10095-3
T3	vert output xformer	32-10080-4
T4	horiz output xformer	32-10130-1
T5	power xformer	32-10131-1

VR42	A-vert height, B-lin, C-bias	33-5627-3
VR92	color killer	33-5628-6
VR93	CRT bias	33-5628-12
VR201	12M, focus adjustment	33-5631-24
VR202	25K, volume	33-5634-17
VR203	1.2K, tint	33-5623-20
VR204A	500n, horiz hold	33-5636-16
VR204B	100n, contrast	33-5636-16
VR205A	100K, tone	33-5644-3
VR205B	500n, bright	33-5644-3
	tuner, VHF TT 1800	76-140996-V
	yoke assembly	76-14236-1

TUBE RESISTANCES

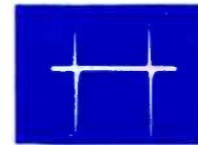
TUBE	FUNCTION	1	2	3	4	5	6	7	8	9	10	11	12
V41	VERT. OUT/OSC.	F	*3.75M	17K	—	*2.5M	*2.5M	20K	1.8K	*800K	0	F	
V42	HORIZ. OSC/REACT.	10K	*1.8M	12K	F	F	50K	0	50K	0			
V43	COLOR DIFF. AMP.	20K	30K	30K	F	F	1.1M	150	*1.1M	800K			
V44	VIDEO OUTPUT	700	25K	700	F	F	22K	22K	1.8K	100K			
V45	HORIZ. OUTPUT	0	—	18K	—	*800K	—	*800K	—	20K	0		
V46	DA-1	0	—	18K	—	*800K	—	*800K	—	20K	0		

*R01000
 METER BAK 120
 SCALE = R0100
 R010000

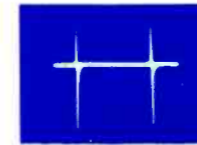


OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver AGC control adjusted for an approximate peak-to-peak output of two volts at the video detector, using an air signal. Do not reset AGC control when using color bar generator. All monochrome voltages taken with average air signal and all chroma voltages taken with a color bar generator connected to the antenna input terminals. The chroma peak-to-peak voltages were taken with the chroma control set for 0.3V peak-to-peak at center tap of chroma control or M110 and the tint control set for proper color bars (approximately mid-range), all other controls set for normal viewing. The frequencies shown are those of the waveforms...not the sweep rate of the oscilloscope. All voltages taken with a wide band scope having a 5MHz bandwidth similar to B&K Model 1450. Line voltage 120V.



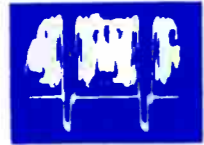
36 12 VOLTS P/P,
15,750 HZ
PIN 5 L95



37 12 VOLTS P/P,
15,750 HZ
PIN 4 L95



1 2 VOLTS P/P,
60 HZ (MAX.
CONTRAST)
M17



2 2 VOLTS P/P,
15,750 HZ
(MAX.
CONTRAST)
M17



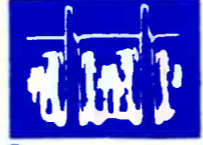
3 4.2 VOLTS P/P,
15,750 HZ
Q93 COLL.



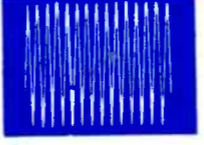
4 3.8 VOLTS P/P,
15,750 HZ
PIN 2 V92



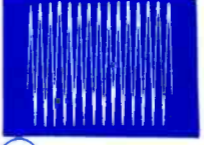
5 80V. P/P. (cont.
at point of start
of sync compression)
15,750
HZ Pin 7 V92



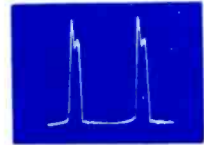
6 65V. P/P. (MIN.
CON.) 15,750 HZ
PIN 7 V92



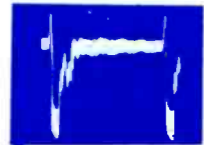
38 6 VOLTS P/P,
3.58 MHz
D93, D94



38A 0.8 VOLTS P/P,
3.58 MHz
PIN 3 IC91



7 40 VOLTS P/P,
15,750 HZ
M10



8 13 VOLTS P/P,
15,750 HZ
M11



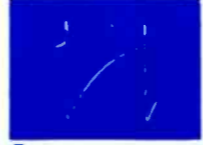
9 6.6 VOLTS P/P,
15,750 HZ
BASE OF Q41



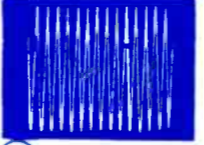
10 50 VOLTS P/P,
15,750 HZ
M49



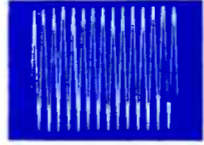
11 50 VOLTS P/P,
60 HZ
M49



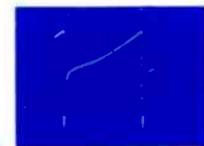
12 85 VOLTS P/P,
60 HZ
PIN 10 V41



38B 16 VOLTS P/P,
3.58 MHz
PIN 7 IC91



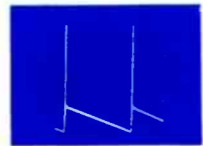
39 1.6 VOLTS P/P,
3.58 MHz
M107



13 110 VOLTS P/P,
60 HZ
PIN 2,6,7 V41



14 10 VOLTS P/P,
60 HZ
PIN 9 V41



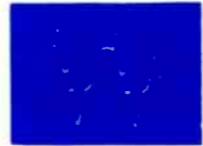
15 1KV VOLTS P/P,
60 HZ (SPIKE)
200 VOLTS P/P,
60 HZ (SAWTOOTH)
M46, OR PIN 4 V41



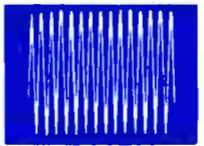
16 12 VOLTS P/P,
15,750 HZ
D41, D42



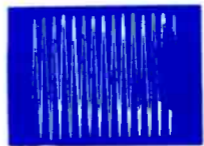
17 16 VOLTS P/P,
15,750 HZ
D41 TOP END



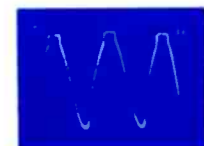
18 8 VOLTS P/P,
15,750 HZ
PIN 9 V42



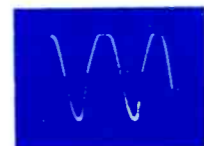
40 1.0 VOLTS P/P,
3.58 MHz
PIN 4 L97 OR
M108



41 1.0 VOLTS P/P,
3.58 MHz
L98-R139



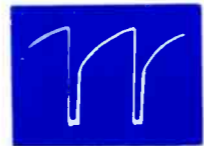
19 45 VOLTS P/P,
15,750 HZ
PIN 1 V42



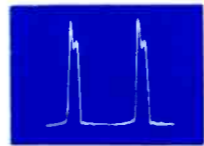
20 150 VOLTS P/P,
15,750 HZ
PIN 2 V42



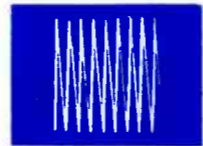
21 200 VOLTS P/P,
15,750 HZ
PIN 6 V42



22 200 VOLTS P/P,
15,750 HZ
M61



23 15,750 HZ LOOSE
COUPLED
V200 PLATE



24 4.0 VOLTS P/P,
3.58 MHz
CR91, D98, R124



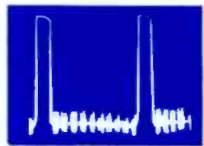
42 55 VOLTS P/P,
60 HZ
Q97 COLL.



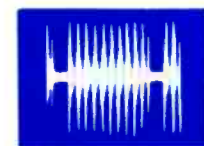
42A 0.85 VOLTS P/P,
60 HZ
M102



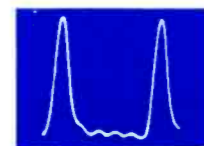
43 12 VOLTS P/P,
16,750 HZ
Q103 BASE



44 3.5 VOLTS P/P,
17,500 HZ
Q103 EMIT.



25 0.1 VOLTS P/P,
± .05 15,750 HZ
Q96 BASE



26 5.5 VOLTS P/P,
15,750 HZ
M103



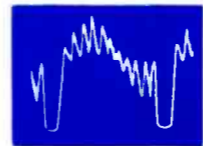
27 .3 VOLTS P/P,
15,750 HZ
Q102 BASE
R150, R151



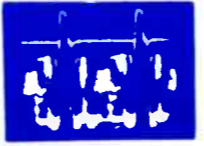
28 7 VOLTS P/P,
15,750 HZ
Q100 COLL.



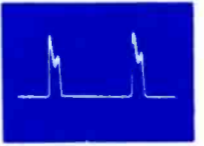
29 8.5 VOLTS P/P,
15,750 HZ
Q101 COLL.



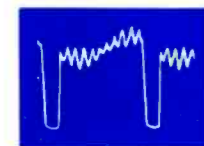
30 45 VOLTS P/P,
(CHROMA)
70V P/P. (SYNC)
15,750 HZ
M126



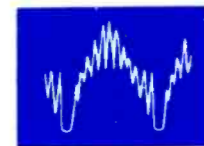
45 90 VOLTS P/P,
15,750 HZ. CONT
SET JUST BELOW
POINT OF SYNC
COMPRESSION
M123



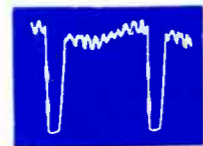
46 30 VOLTS P/P,
15,750 HZ
Q5 COLL.



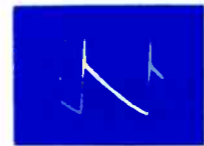
31 17 VOLTS P/P,
(CHROMA)
70V. P/P. (SYNC)
M125



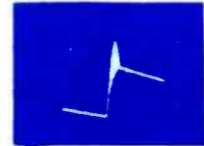
32 50 VOLTS P/P,
(CHROMA)
70V. P/P. (SYNC)
M113



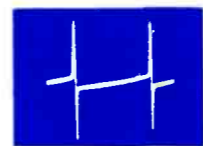
33 2 VOLTS P/P,
(CHROMA)
25V. P/P. (SYNC)
R160, R173
PIN 7 V91



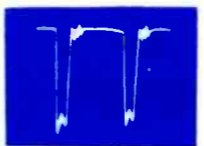
34 0.7 VOLTS P/P,
15,750 HZ
Q95 EMIT.



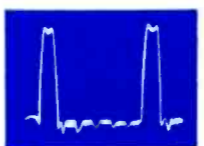
34A EXPLODED
VIEW OF
BURST OF
VIEW 34



35 70 VOLTS P/P,
15,750 HZ
Q95 COLL.



47 660 VOLTS P/P,
15,750 HZ
M48A



48 420 VOLTS P/P,
15,750 HZ
M48

LINE VOLTAGE - 120 VAC
AIR SIGNAL - FOR MONOCHROME SIGNALS
COLOR BAR GEN. - B&K 1245 - FOR COLOR SIGNALS
ACTIVE FILTER AT 20 VDC

PHILCO-FORD
Color TV Chassis
20QT74

B & K METER 175
A.G.C. FULL CLOCKWISE
ACTIVE FILTER +20 VDC @ M13
LINE VOLTAGE 120 VAC

TRANSISTOR VOLTAGES NO SIGNAL

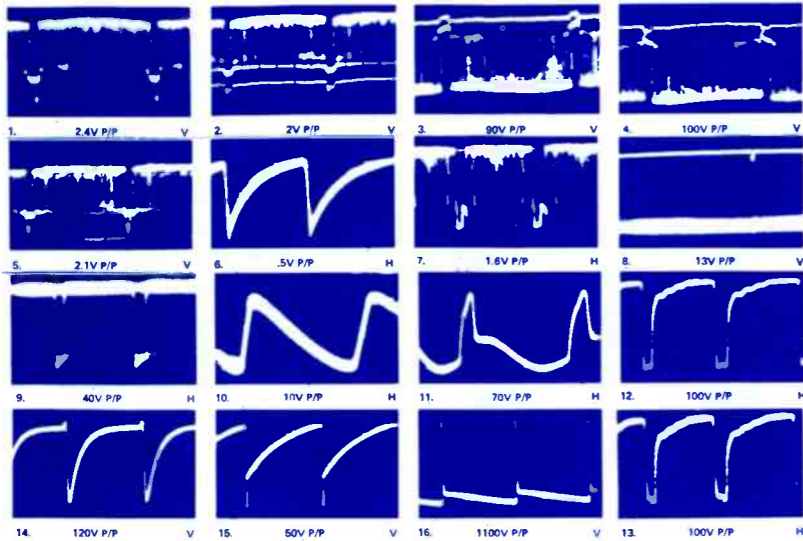
TRANSISTOR	FUNCTION	E	B	C
Q1	1ST V.I.F.	1.7	2.6	14.6
Q2	2ND V.I.F.	2.7	3.3	12.8
Q3	3RD V.I.F.	3.1	3.75	14.5
Q4	GATED AGC	17	16.75	21
Q5	RF AGC	8	13.2	1.2
Q6	1ST VIDEO	1.5	1.2	12.6
Q41	SYNC SEP	0	-1.3	42
Q91	2ND S.I.F.	11	11.6	14
Q92	1ST S.I.F.	6	6.8	10.4
Q93	DELAY DRIVER	3.6	4.2	14.6
Q94	AUD PRE AMP	0	.58	2.4
Q95	BURST AMP	4.8	0	39
Q96	1ST CHROMA	.2	.92	17.5
Q97	COLOR KILLER	0	-.1	20
Q98	AUD DRIVER	1.8	2.4	20
Q99	BUFF AMP	.86	1.5	17.5
Q100	X DEMOD	1.6	1.40	12.6
Q101	Z DEMOD	1.4	1.44	12.6
Q102	2ND CHROMA	.52	0	20
Q103	BLANKER	.52	-1.34	6.6
Q201	AUD. OUTPUT	.64	1.18	108
Q200	ACTIVE FILTER	19.7	20.5	28

TRANS.	FUNCTION	E TO GND	B TO GND	C TO GND	C TO E (- -)	C TO B (- -)	B TO E (- -)
Q1	1ST V.I.F.	330	1150	1100	2300 (1250)	2300 (1500)	1500 (1300)
Q2	2ND V.I.F.	330	2100	1050	1400 (6.5k)	1400 (1785)	1.8k (5.6k)
Q3	3RD V.I.F.	270	1700	875	950 (2k)	3.1k (1.6k)	1.8k (1.3k)
Q4	GATED AGC	1100	1175	35k	35k (2k)	3.9k (1.4k)	1.4k (1.9k)
Q5	RF AGC	350	500	1530	1875 (2.5k)	1.7k (3.6k)	1650 (1450)
Q6	1ST VIDEO	250	1k	1050	1.3k (1.3k)	4.5k (1.3k)	1.2k (1k)
Q41	SYNC SEP	0	1475	25k	25k (22k)	190k (1350)	1450 (1700)
Q91	2ND S.I.F.	1.8k	450	1350	3.1k (3.2k)	1.5k (1.3k)	2.4k (2.4k)
Q92	1ST S.I.F.	880	1k	600	1375 (1375)	1575 (1275)	1550 (1.8k)
Q93	DELAY & DRIVER	300	1475	1030	1350 (1350)	3k (1.4k)	14.5 (2.3k)
Q94	AUD PRE AMP	100	1725	2800	3k (1.8k)	50k (1.5k)	1550 (42k)
Q95	BURST AMP	10k	4.5k	13k	5k (16k)	20k (1450)	1.5k (1.8k)
Q96	1ST CHROMA	65	1.3k	1050	1125 (1100)	4.6k (1725)	1625 (3.4k)
Q97	COLOR KILLER	2.3k	3.2k	1380	6k (4.4k)	220k (1.4k)	1.5k (20k)
Q98	AUD DRIVER	6k	2.8k	780	3.7k (7k)	1.9k (1.9k)	1550 (30k)
Q99	BUFF AMP	75	1175	450	550 (550)	1.4k (1350)	1125 (125)
Q100	X DEMOD	470	1.2k	1450	4k (1.8k)	5k (1.3k)	1550 (1550)
Q101	Z DEMOD	480	1.2k	3.8k	4k (20)	4.8k (1.3k)	1375 (1350)
Q102	2ND CHROMA	182	2k	1350	1500 (1550)	10k (1725)	1750 (8.2k)
Q103	BLANK	82	1800	2750	2.8k (20)	8k (1650)	1.7k (5.5k)
Q201	AUD OUTPUT	18	1.3k	28k	28k (3.4k)	40k (1.1k)	108k (10k)
Q200	ACTIVE FILTER	245	1380	3.4k	3k (1450)	3.3k (1080)	1100 (3.4k)

*R10000
R1100

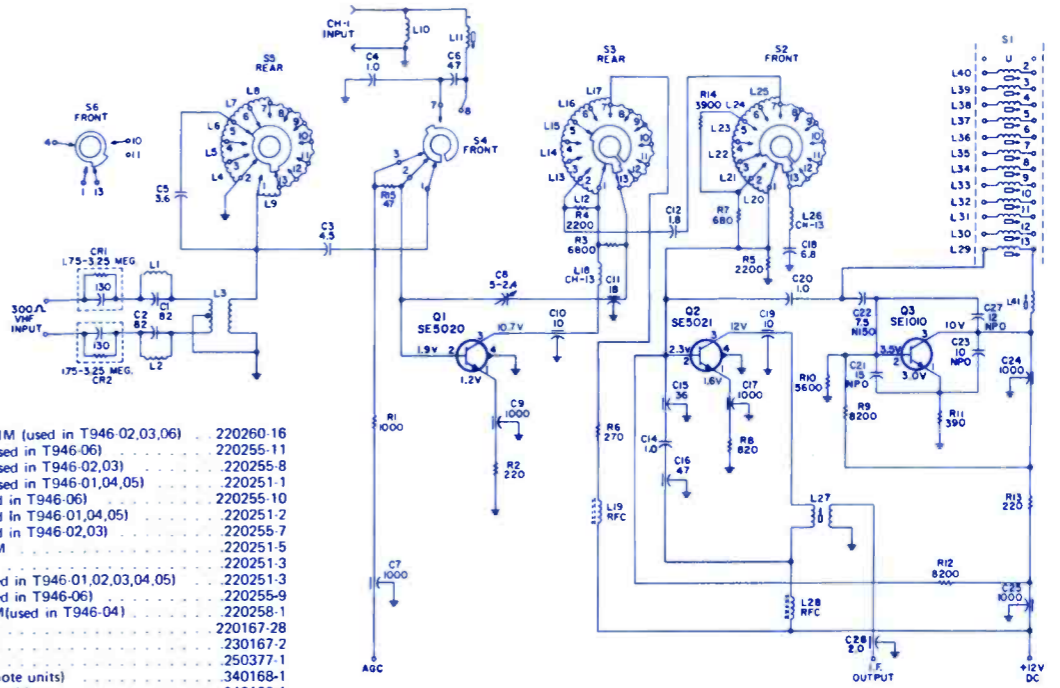
TRANSISTOR RESISTANCES

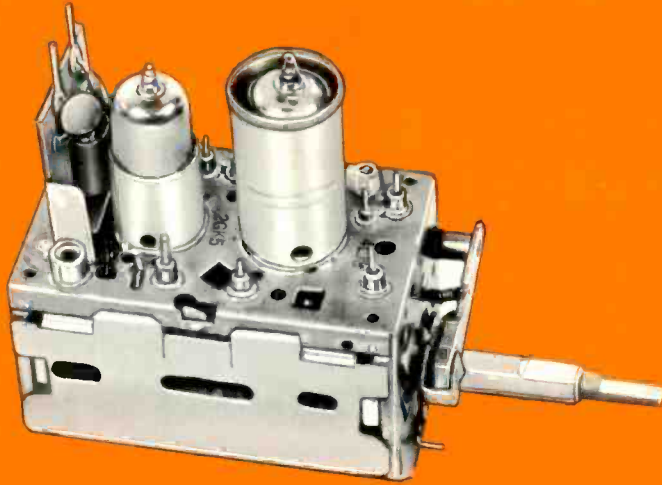
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SYMBOL	DESCRIPTION	MAGNAVOX PART NO.
L1	sound take-off coil	361344-1
L2	sound interstage xformer	361369-1
L3	quadrature coil	360847-2
L6	41.25MHz trap coil	361381-1
L16	4.5MHz trap coil	360851-1
L21	filter choke	320367-1
T1	audio output xformer	320368-1
T2	vert output xformer	320369-1
T3	horiz output xformer	361373-1
	deflection yoke	361377-1
C1	silver mica, 200pf, 20%, 500v	250366-537
C77	200µf, 200v, 400/40µf, 175v electrolytic	270099-12
R62	thermistor	230130-2
R92	4.7, 10%, fusible	240098-1
R9	volume, w/switch, 1M (used in T946-01,04,05)	220247-7008

R9	volume, w/switch, 1M (used in T946-02,03,06)	220260-16
R31	contrast, 600Ω (used in T946-06)	220255-11
R31	contrast, 600Ω (used in T946-02,03)	220255-8
R31	contrast, 600Ω (used in T946-01,04,05)	220251-1
R38	bright, 200K (used in T946-06)	220255-10
R38	bright, 200K (used in T946-01,04,05)	220251-2
R38	bright, 200K (used in T946-02,03)	220255-7
R60	vert linearity, 3.5M	220251-5
R68	height 2M	220251-3
R73	vert hold, 1M (used in T946-01,02,03,04,05)	220251-3
R73	vert hold, 1M (used in T946-06)	220255-9
R86	volume limiter, 2M (used in T946-04)	220258-1
R87	width, 50	220167-28
VDR1	varistor	230167-2
PC1	packaged circuit	250377-1
	VHF tuner (non-remote units)	340168-1
	UHF tuner (remote unit)	340189-1
	circuit breaker	180723-7003





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This month's cover shows RCA's new 4BG69 Permacolor Antenna, one of the largest consumer color-TV antennas ever made. It is designed to produce exceptionally sharp pictures in fringe areas where small antennas are ineffective. The photo was supplied through the courtesy of RCA Parts and Accessories, Deptford, N.J.

-
- 3 TEKFAQ: Up-to-date schematics for easier servicing.
 - 23 EDITORIAL: A Return to Better Times.
 - 24 LETTERS: Pertinent comments concerning past issues.
 - 26 READERS' AID: What you need or have for sale.
 - 29 PUBLISHER'S MEMO: NEW Show Report from Sunny Bal Harbour, Florida.
 - 30 NEW SHOW: The "what and where" for many of the displays at this very important exhibit.
-

FEATURES

- 39 **TEKLAB REPORT**
Interesting circuits encountered when examining General Electric's N-2 Color-TV Chassis.
 - 43 **MASTERING THE TV ANTENNA SYSTEM MARKET—PART II**
Obtaining the desired TV-antenna signals and modifying them for use in a distribution system—by Lon Cantor.
 - 46 **COLOR TV RECEPTION—PART II**
Comparing the characteristics of circuits that are used commonly in both color- and B/W-TV sets—by William Spero.
 - 50 **THE MICROWAVE OVEN—A NEW FIELD IN SERVICING**
Some principles which will be of value to you when expanding your business to include another important field of consumer electronics—by Lew Christy.
 - 55 **TEST INSTRUMENT REPORT**
A review of specifications for B & K's new Model 179 solid-state FET-VOM.
 - 56 **GUEST AUTHOR: HOW A MANUFACTURER CAN HELP OR HINDER THE DISTRIBUTOR/SERVICE DEALER**
William Carlson, Director of Federal Pacific Electric's Marketing Communications Dept., offers some suggestions concerning how manufacturers can make your job easier.
-
- 58 COLORFAQ: Tips for easier color-TV set repair.
 - 62 TECHNICAL DIGEST: Hints and shortcuts for more effective servicing.
 - 73 BOOK REVIEWS: Our appraisal of recent publications.
 - 76 ADVERTISERS' INDEX: Manufacturers concerned about you.
 - 77 READER SERVICE: A source of additional information.
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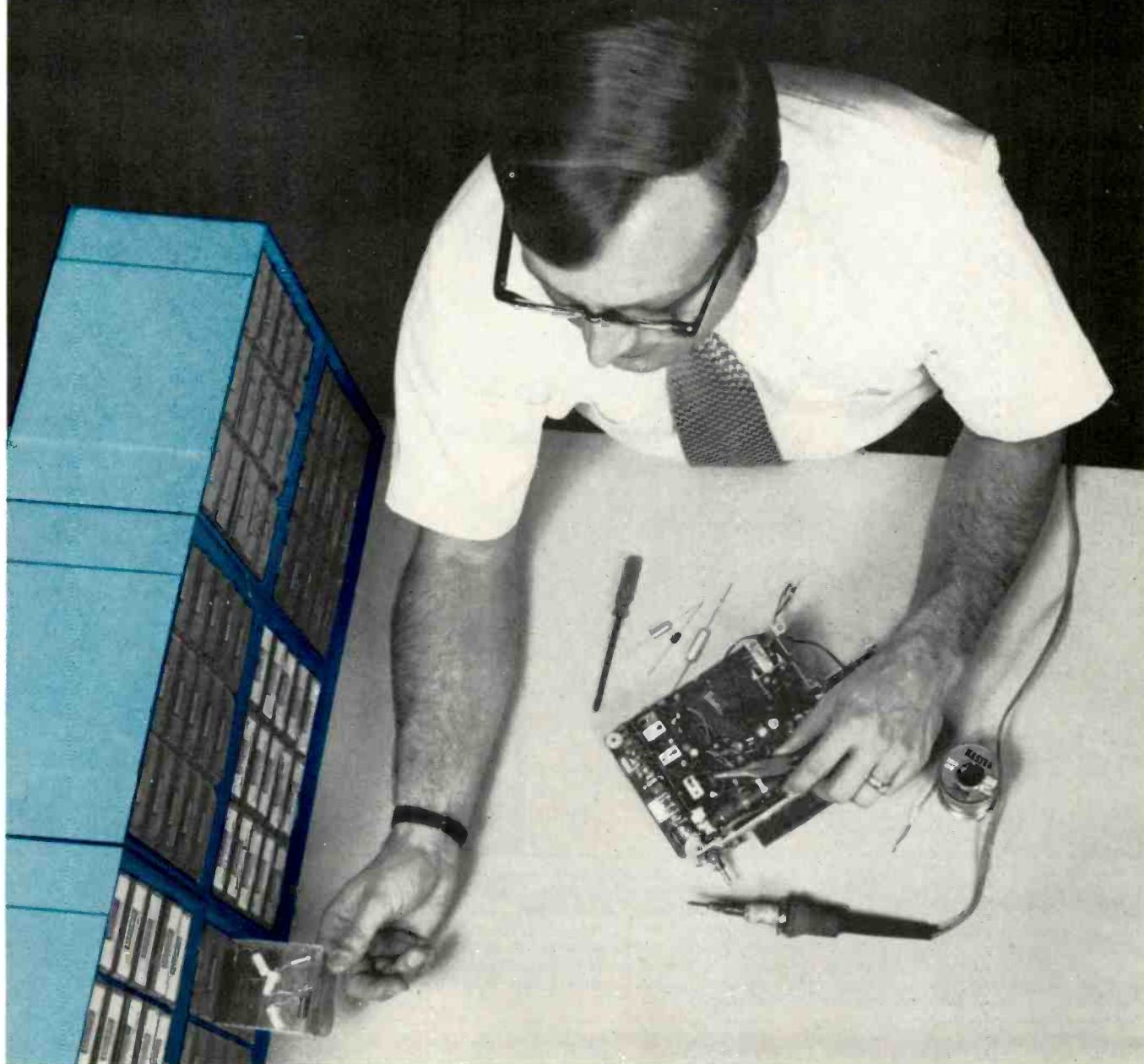
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For a copy of the PS booklet which covers all of our products, and the name of your field representative, write RCA Sales Corporation, Dept. 634, 600 N. Sherman Drive, Indianapolis, Indiana 46201.

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A Return to Better Times

During the past year we have printed a number of feature articles and Editor's Memos concerned with the bad economic trends that we were either about to experience or beginning to feel. Our publication emphasized the fact that when fewer new consumer products are purchased, there is a greater demand for servicing the old ones—any decrease in sales revenue being compensated for by an increase in revenue from repairs.

As you know, there were several factors that contributed to this temporary economic situation. Not only were interest rates rising (up to 8½ percent for GI and FHA home loans, and even higher for many other types of loans), corresponding cutbacks in federal spending were costing the jobs of many men and women involved in government contract work. Resulting public pessimism produced a marked decline in the stock market and renewed interest in the security and high earnings that could be had in savings accounts—as opposed to the desire for purchasing that new hi-fi set, color-TV set, etc., as planned.

Although government spending has not again reached its previous extravagant levels, most manufacturers that were forced to readjust to fewer government contracts have now completed the task of tightening their belts and are not laying off any more personnel. Having readjusted to this “peace time” market, some companies have found that there really is more business than anticipated, with some personnel being reemployed. Many employees not rehired have now had time to either secure better paying jobs, or at least adequately paying jobs for the time being. Even some of those still unemployed are getting tired of going without and are using a small portion of their unemployment checks to purchase that new phonograph or TV set.

Today's American consumer is just too accustomed to what at one time would have been considered luxuries. He may be frightened into “pinching pennies” for six to nine months, but then the strain becomes just too much—he feels that he simply must have that new FM radio, tape recorder or whatever—budgets can be considered some other day.

Good or bad, this is a reality, a new way of life in this country. A phobia for “keeping up with the Jones'.” Maybe it has reached a point of being a sickness that government is unable to cure in a democracy such as ours. Or, maybe it is something entirely different—an example of the complete faith that the people in our country have in both our government and the free enterprise system. A healthy byproduct of the dynamic “American Incentive” for turning misfortune into good fortune.

Although we complain of a little more government “red tape” than we were faced with a decade or so ago, we can still be proud of the fact that we experience more economic freedom than can be had in any other country in the world. Although this extreme freedom might seem risky and even foolhardy to those accustomed to the government control prevalent in foreign countries, time has proven them wrong. Our freedom has permitted **great** economic flexibility. We are free to rapidly self-adjust as economic conditions change—not being hampered by the muddled machinery of some bureaucracy of mutually acclaimed experts.

Open those shutters and breathe in that fresh air! Listen as the merry tune of those ringing cash registers grows louder. The recession is ending! Now is the time to get out there and **sell!**

Within the next few weeks, our electronic industry will be holding its NEW Show in Bal Harbour, Fla. In this issue, Scotty Wallace's Publisher's Memo introduces a preview to that show—where the industry will be displaying the many new products that will assist you in refilling your cash boxes.

Phillip Dahlen

LETTERS

Reader comments concerning past feature articles, Editor's Memos, previous reader responses or other subjects of interest to the industry.

Who Made That Probe?

Judging by the number of inquiries both you and we are receiving, it might be useful if we could let your readers know clearly that the three-

tip probe that is so useful in troubleshooting transistor sets, as described in your November, 1970, issue of *ELECTRONIC TECHNICIAN/DEALER*, is the B & K probe FP-1.

These are available at all B & K distributors.

We hope that your readers will find these as useful as the author did when he unsolicitedly wrote that fine article.

Leaving out the manufacturer's name removed the element of commercialism, but on the other hand it denied many of your readers an easy

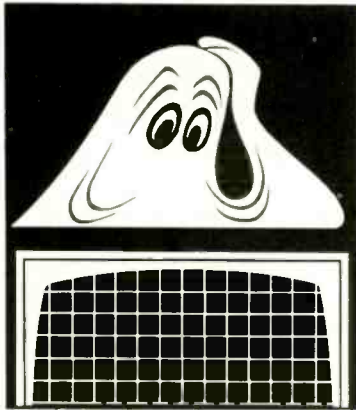
way to follow up on its purchase if they so desired.

Hopefully, this letter will clear this matter up.

Keep up the good work!

HAROLD J. SCHULMAN
EXECUTIVE VICE-PRESIDENT
DYNASCAN CORP.

As Harold indicated, we did receive quite a number of letters—that were forwarded to B & K—asking who manufactured the probe described in the article, "Test Probe Leaves One Hand Free in Three-Handed Job." Ed.



Two new B&K digitals that don't stand a chance of a ghost.

Ghosts, blurs, wiggles, jitters . . . whatever you call them, you won't get them with our two new digital color generators. You can converge, install or trouble-shoot color TV's quickly and accurately. Because these two units employ totally new concepts that take the trouble out of trouble-shooting.

Integrated circuit flip-flops perform all binary counting functions. Just no way they can jump a count. Result: Crisp, clean, stable test patterns.

And all IC's (nine of them) and transistors are silicon devices, which means they can withstand severe weather changes with no effect on performance.

The 1243 is a basic 6 pattern color generator. The deluxe 1246 has nine patterns, three more than the 1243, and

also features a 4½ MHz sound carrier, crystal controlled RF for channels 3 and 4, gun killers, and comes with its own instant-use case.

All the accuracy and reliability of a computer in these compact units, and they're guaranteed to be maintenance free, making your job a lot easier.

So don't get a CBG that may come back to haunt you. Get one of B&K's new digital generators: They don't have a chance of a ghost.

B&K Products of
DYNASCAN CORPORATION
1801 W. Belle Plaine
Chicago, Illinois 60613
The new standard of stability

(Ask your distributor or write us for complete catalog)

1. B&K Model 1246 Color Generator \$149.95

2. B&K Model 1243 Color Generator \$99.95



... for more details circle 102 on Reader Service Card

Diversification Pays Off

In response to Joseph Humphries' letter in the March issue of *ELECTRONIC TECHNICIAN/DEALER*, I would like to say that in the field of electronics there never was a time when any one person could service everything. Progress has proceeded so rapidly in this line that there is still no one that can cover it alone.

In Mr. Humphries' letter, he does not give the radio-TV serviceman a technical rating. With the radios, stereo components and color-TV sets out today, I believe his rating is equal to that of any other technicians—electronic or mechanical.

As for sticking to what you know, anyone that has lived through the depression knows that it is good to have your hand in more than one trade. You answered the letter well, though I worked the problem out in a different manner. During the summer months, when radio-TV servicing slows down, I sharpen lawnmowers and saws on homemade machines. I must be doing the job well since the same customers return with more work.

I suppose that when Mr. Humphries breaks a shaft off some tool, he sends it to the manufacturer for repairs. I take it to my cellar and either weld it together or turn out a new piece in my small South Bend lathe.

PETER LEGON

Although some electronic technicians may consider it beneath their professional dignity to branch out into other fields, in certain market areas it is an economic necessity. Pride will not pay your bills. What is most important is that you have enough self-respect to do the best job you can—whether it is in repairing defective electronic equipment or sharpening lawnmowers. Ed.

MOVING?

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

SERVICE

Technicians know that Color TV repair demands more time and effort. That's why Sprague strives to simplify Color TV capacitor selection.

COLOR

TV capacitors by Sprague come in the exact ratings required to meet the exacting requirements of Color TV.

TV

service becomes more demanding as Color TV keeps expanding. That's why exact capacitor ratings are important. They help you to restore original set performance.

EASIER

selection of replacement capacitors for Color TV is assured when you look to the broad Sprague line. You'll get the capacitor you need—when you need it—every time.

Just off the press! See your Sprague Distributor for a free copy of our new 44-page K-110 Twist-Lok[®] and Print-Lok[®] Capacitor Replacement Manual, or write to: Sprague Products Company, 65 Marshall St., North Adams, Mass. 01247

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THE BROAD-LINE PRODUCER OF ELECTRONIC PARTS

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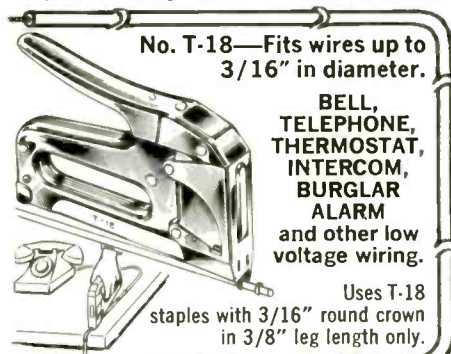
MAY 1971, ELECTRONIC TECHNICIAN/DEALER | 25

ARROW AUTOMATIC STAPLE GUNS

CUT WIRE & CABLE INSTALLATION COSTS

... without cutting into insulation!

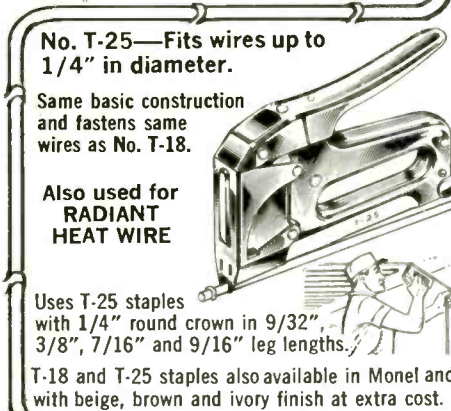
SAFE! Grooved Guide positions wire for proper staple envelopment! Grooved Driving Blade stops staple at right depth of penetration to prevent cutting into wire or cable insulation!



No. T-18—Fits wires up to 3/16" in diameter.

BELL,
TELEPHONE,
THERMOSTAT,
INTERCOM,
BURGLAR
ALARM
and other low
voltage wiring.

Uses T-18
staples with 3/16" round crown
in 3/8" leg length only.



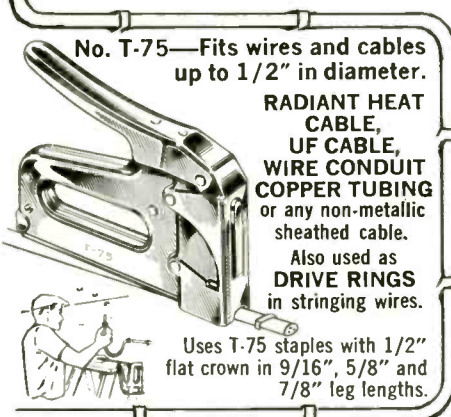
No. T-25—Fits wires up to 1/4" in diameter.

Same basic construction
and fastens same
wires as No. T-18.

Also used for
RADIANT
HEAT WIRE

Uses T-25 staples
with 1/4" round crown in 9/32",
3/8", 7/16" and 9/16" leg lengths.

T-18 and T-25 staples also available in Monel and with beige, brown and ivory finish at extra cost.



No. T-75—Fits wires and cables
up to 1/2" in diameter.

RADIANT HEAT
CABLE,
UF CABLE,
WIRE CONDUIT
COPPER TUBING
or any non-metallic
sheathed cable.

Also used as
DRIVE RINGS
in stringing wires.

Uses T-75 staples with 1/2"
flat crown in 9/16", 5/8" and
7/8" leg lengths.

Arrow Automatic Staple Guns save 70% in time and effort on every type of wire or cable fastening job. Arrow staples are specially designed with divergent-pointed legs for easier driving and rosin-coated for greater holding power! All-steel construction and high-carbon hardened steel working parts are your assurance of maximum long-life service and trouble-free performance.

Ask your Electrical Supply Dealer
or write for further details.



... for more details circle 101 on Reader Service Card

READERS' AID

Space contributed to help serve the personal needs of you, our readers.

Needs Manual

I have recently come into possession of an Oscilloscope, Model 300, made by Precise Development Corp. I need a schematic, operator's manual or any information I can find about it. I will gladly pay for a schematic or copy and return material if requested.

WILLIAM PERRY

Electronicus
3533 S.E. 6th St.
Renton, Wash. 98055

Because of the numerous requests that have come across our desks, we are asking help in locating a source of information for any or all instruments that were manufactured by Precise Development Corp. If anyone can supply us with this information we will be more than happy to pass this information along to you, the readers. Ed.

I have a Precise Oscilloscope, Model No. 300, Serial No. B-3509. I am in need of an operating manual and schematics for this scope. If anyone has this information, please contact me.

RONNIE DAY

1326 Broadway
Cincinnati, Ohio 45210

I am willing to pay for a manual covering the operation and recalibration of the Universal Power Bridge, Model 650 B, S/N 1077, manufactured by the Polytechnic Research & Development Co., which is no longer in business.

HOWARD ADAMS

630 N.E. 50th St.
Oklahoma City, Okla. 73105

I am in need of an operator's manual for a Dumont 5-in Oscilloscope, Model 303-A.

ALAN C. JACQUES

201 Timber Lane
LaGrange Park, Ill. 60525

I have a 3-in. general-purpose bench scope I am trying to put into service. It was bought from an Army Surplus Depot and bears no manufacturer's name that I can find. It is a Model OS-34/USM-32 and the chassis plate reads: NO BSR 52688, 1508 CDU. Can anyone possibly give a hand in

locating a manual or at least a schematic for this unit?

THOMAS M. KING

P.O. Box 24
Wellington, Ohio 44090

Needs Address

Can someone supply me with the name and address of a company that makes the Phoneking telephone answering and recording device?

R. C. DIEHL

3723 Woodruff Avenue
Oakland, Calif. 94602

Needs Old Tubes

Where can I buy old vacuum tubes? The tubes I need are 1232, 6A8G, 6K7G and 6V6G.

HENRY T. MULLINS

Mullins Radio & TV
3400 East Kearney
Springfield, Mo. 65863

I collect old battery radios as a hobby and need some early type tubes for them. I am looking for the following: 01A, 00A, 71A, 199, 120, WD11, WD12. If anyone has any of these, either new or used, please contact me.

I would also like a good case and knobs for a Pilot TV-37 TV set.

ALVIN HECKARD

RD 1, Box 88
Lewistown, Pa. 17044

For Sale

I am quitting the TV business and wish to dispose of 250 tubes, plus test gear and parts at best offer.

JACK MANDIK

1333 Ridge Ave.
Evanston, Ill. 60201

Needs Schematic

I need a schematic and any other information available on a "Candle" portable TV set, Model MT-510. Or I would appreciate the address where I can obtain this information.

WILLIAM B. CLARK

7319 Farwest Drive
San Antonio, Texas 78233

Needs Chart

Can anyone supply me with an address where I can obtain a roll chart for a Model 111 GM & EM tube tester manufactured by Precise Development Corp.?

GENE L. KELLER

2255 Colonial Pkwy N.E.
Massillon, Ohio 44646



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the new**

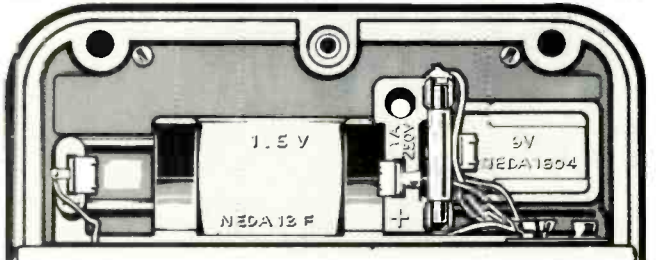
Simpson
260[®]
SERIES 6
VOM

THE NEW SERIES 6 HAS ALL THESE NEW FEATURES PLUS ALL THE ADVANCEMENTS IN THE SERIES 5:

- External access battery and fuse compartment.
- Clip-type fuse holder.
- 0-1 volt DC range.
- 0-500 volt AC and DC ranges.
- Available 5000 volt adapter-type DC safety probe.
- Multi-purpose, screw-on test leads with combination probe and alligator clips.
- Only 2 batteries . . . one 9-volt NEDA 1604 and one 1½-volt "D" cell.
- Rugged taut band movement.
- Varistor overload protection.

260-6 \$65.00
260-6M (Mirror scale) \$67.00

EXTERNAL BATTERY AND FUSE COMPARTMENT



260-6RT (Roll-top protective case) \$71.00
260-6MRT (Mirror scale and roll-top case) \$73.00
260-6P (Overload protected) \$97.00
260-6PRT (Overload protected and roll-top case) \$103.00
Safety Probe: 5000 volt DC adapter type #00506 \$4.50

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—OR WRITE TODAY FOR BULLETIN T-810.**



SIMPSON ELECTRIC COMPANY

5200 W. Kinzie St., Chicago, Ill. 60644, Phone: (312) 379-1121

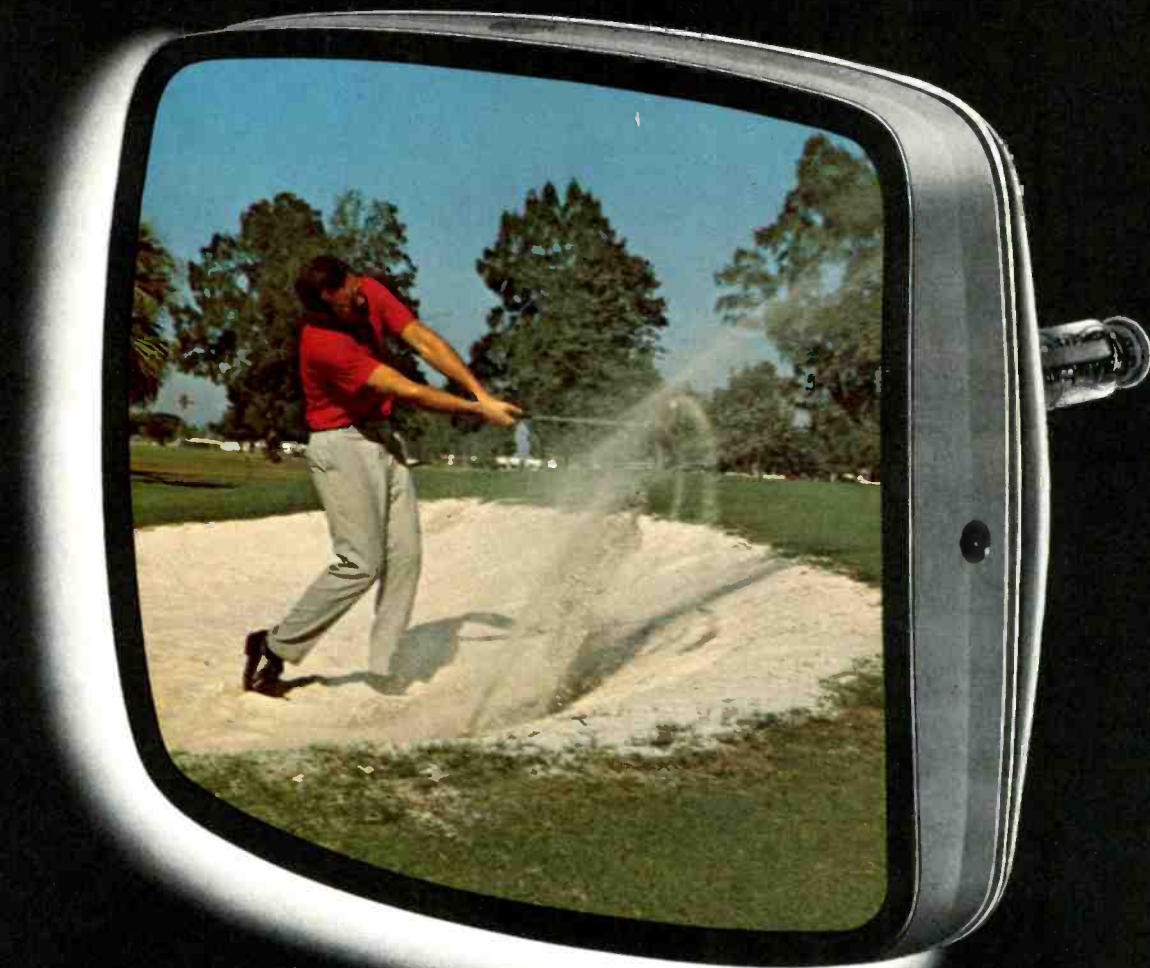
Export Dept: 5200 W. Kinzie St., Chicago, Ill. 60644, Phone: (312) 379-1121, Cable SIMELCO

IN CANADA: Bach-Simpson Ltd., London, Ontario

IN INDIA: Ruttonsha-Simpson Private, Ltd., International House, Bombay-Agra Road, Vikhroli, Bombay

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It takes time to replace a color picture tube...

GE ULTRACOLOR[®]

works to cut back
the need of
replacing the
replacement

sustained brightness and color purity are assured through use of advanced getter material. Gases generated by the tube's operation are removed, providing longer life and sustained color purity.

reliability and quality assurance are built in. Only the highest quality replacement components are used... and they're still expected to prove themselves. First during the manufacturing process, through continuing in-line inspections, and extensive life testing of the finished product, afterwards.

GE ULTRACOLOR[®] picture tubes provide the service and dependability that guarantee customer satisfaction. *(Made by professionals, for professionals.)*

TUBE PRODUCTS DEPARTMENT • GENERAL ELECTRIC COMPANY
OWENSBORO, KENTUCKY 42301

GENERAL  ELECTRIC



This photo, representing our trip to sunny Florida, was made from a color slide taken recently by Dick Pavak of Tech Spray while watching the planes take off at Chicago's O'Hare Airport.

NEW Show Report From Sunny Bal Harbour, Florida

PUBLISHER'S MEMO

Most of our readers are aware of the fact that each spring our industry holds its annual manufacturers, distributors and reps convention, known as National Electronics Week (NEW). This show gives manufacturers the opportunity to introduce their latest equipment and parts to those in attendance—who upon return will be passing this vital information along to you.

This year the show will be held in Bal Harbour, Fla., and pre-registration indicates that the attendance will surpass that of previous shows. Therefore, the electronic servicing industry can expect an exceptionally good sales outlook for the remainder of 1971. As I have reported so many times in the past, it is unfortunate that you, our readers, are unable

to attend functions such as the NEW Show, since you are the key people responsible for the growth of our industry.

So that we can give you advanced coverage of what will be presented for the first time, we are eliminating our regular product coverage in this month's issue. We wish to apologize for any of the manufacturers who will be in attendance but were unable to release material to us in time to be included in this section. They will be covered in future months in our regular New Products section.

Each company in this NEW Show listing is "keyed" to the Reader Service Card provided in this May issue. And you can be assured that your request for further information will receive priority answers from them.

PROFILE OF OUR NEW PUBLISHER

Alfred A. Menegus has been named publisher of Electronic Technician/Dealer. Coming to ET/D as District Manager in February, 1969, Al has a long list of outstanding achievements in serving ET/D advertisers and prospects throughout the east. With over 22 years experience in the electronics industry at senior marketing and advertising levels of companies, Al brings an expertise to ET/D which should be favorably reflected in the future.

meet the metrics

Xcelite's where the Metrics are!

A great variety of tools and sets to help you turn most any Metric fastener or adjusting screw you're likely to encounter... hex socket set screws and cap screws, hex nuts, hex head cap screws, and whatever.

All tools precision made for exact fit. Bright nickel chrome nutdriver shafts and protective black oxide finished hex socket screwdriver blades. Plastic (UL) handles shaped for perfect grip and balance.

FIXED HANDLE NUTDRIVERS



NUTDRIVER SHANKS & HEX SOCKET SCREWDRIVER BLADES for use interchangeably in Series 99 plain and ratchet type handles.



COMPACT SETS

No. 99-PS-41-MM
(7 Metric hex socket blades, extension and handle)



No. 99-PS-51-MM
(10 Metric nutdriver shanks, extension and handle)



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... for more details circle 139 on Reader Service Card

NEW SHOW

Advance Systems Div. 700

This new division of Advance Ross Corp. has been formed to manufacture and market a complete line of MATV active and passive products.

Amperex Electronic Corp. 701

Exhibiting in booth No. D-109 and D-111, they will provide product coverage for their full line of industrial tubes, a line of blank cassettes and eight-track tapes, head cleaners and chargers. They will also tell of their new vidicon replacement program.

Arrow Fastener Co. 702

Company spokesmen indicate that their Arrow T-75 Staple Gun Tacker (for wiring public-address systems, laying antenna coaxial cable, etc.) is now available with a new chemical coated staple. These "Grip-Tite" staples are said to drive deeper and provide many times the gripping power of plain staples without this special chemical coating.

Belden Corp. 703

This manufacturer will be displaying its communication cable, neoprene control cable, special data and instrumentation cable, camera cable, hook-up wire and their line of retractile cords at booth No. B-112 and B-114.

Blonder-Tongue Laboratories, Inc. 704

In booth No. K-100, this company will display their new single channel amplifier, UHF mast-mounted preamplifier, MATV amplifier and solid-state broadband amplifiers.

Bogen Div., Lear Siegler, Inc. 705

At their conference suite—Lanai Suite L-237—several new sound products will be displayed similar to the recently announced "C" series economy-priced, solid-state public-address amplifiers.

BSR McDonald Div., BSR Ltd. 706

They will display automatic turntables, component stereo systems and

eight-track record/playback decks in booth No. D-113 and D-115. This will include the "Professional" Series, Models 610, 510 and MP60; the "Promotional" Series, Models 310 and 5500; and the "Minichanger" Series, Models 210/X and 1000/X.

Burgess Battery/Gould Inc. 707

Occupying booth No. D-122, they will exhibit a complete line of dry batteries, mercury, alkaline and sealed nickel-cadmium batteries.

Castle 708

Introduced will be an expanded range of exact replacement and universal replacement TV tuners and an improved version of the contact overhaul kit.

Chemtronics, Inc. 709

Located in booth No. A-129, the caddy-size aerosol spray tuner cleaners, lubricants and polishers with their special spray heads will be featured.

Cinch Manufacturing Co. 710

They plan to introduce two new types of connectors. One will be a complete line of printed-circuit edge connectors with 0.100 in. centers. In addition to these new connectors, they plan to display a new line of D-sub-miniature connectors with 0.025 in. square terminations for wire wrapping.

Columbia Electronic Cables 711

This company will be exhibiting in booth No. K-101 and K-103. Besides displaying a complete line of skin and blister pack material, they indicate that they will exhibit a new 92-page catalog.

Cornell-Dubilier Electronics 712

Exhibiting in booth No. A-107 and A-109, this manufacturer will introduce a new antenna rotor. Also, many new electrolytic capacitor assortments and kits will be featured.

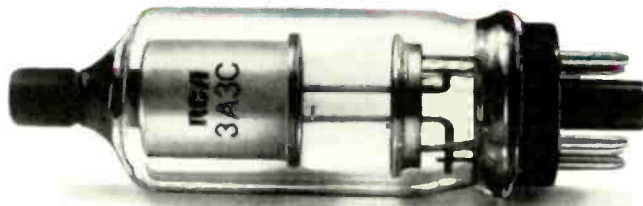
Dynascan Corp. 713

This manufacturer will display new CB transceivers, monitors, oscilloscopes and tube testers at booth No. B-113 and B-115.

continued on page 32

Stops arc-backs and cuts call-backs...

RCA-3A3C HIGH VOLTAGE RECTIFIER



It's the tube that saves you time, trouble and dissatisfied customers . . . because it minimizes arcing in rectifier circuits of TV receivers and other high voltage applications.

RCA makes this tube with special equipment that pre-coats the cathode and pressure welds the coating . . . producing such a smooth, uniform surface that arcing is significantly reduced.

The RCA-3A3C takes 38,000V peak inverse plate voltage and supplies 100 mA peak plate current.

For high voltage applications, put the RCA-3A3C high on your tube inventory list. This high-volume replacement type is available from your RCA tube distributor along with all the other types you need for your service business.

RCA | Electronic Components | Harrison, N.J. 07029.

RCA

The RCA portable color bar generator



Performs like the big ones Costs only \$75*

- Provides color bar, dot, cross hatch, and blank raster patterns
- All solid state circuitry including ICs
- Pattern signals, RF output frequency and color subcarrier all crystal-controlled
- Battery operated, AC adapter available
- Lightweight — less than 20 oz., only 6½" wide x 4" deep x 3" high

For all the technical specs get in touch with your RCA Distributor. RCA | Electronic Components | Harrison, N.J. 07029.

* Optional User Price

RCA

... for more details circle 128 on Reader Service Card

NEW SHOW...

continued from page 30

714

EICO Electronic Instrument Co.

It has been reported that they will display all of the new products featured in their updated 1971 Anniversary Catalog. This includes such new items as their 718 "Space Ranger" four-band FET solid-state communications receiver; the Cortina 2 3780 all silicon solid-state AM-FM receiver shown on last month's cover; and a transistor-diode curve tracer; plus a FET meter that is even too new to even be listed in that catalog.

GC Electronics

715

They report that a totally new and revitalized Audiotex Electronic Accessory line will be exhibited. It is said to feature an extremely wide range of connectors, cables and adapters, as well as stereo hi-fi convenience, maintenance, expansion and replacement items.

General Electric Co.

716

Occupying booth No. C-111 and C-113, receiving tubes, cathode ray tubes, semiconductors, power tubes, rechargeable batteries, silicon products, panel instruments, capacitors and variable transformers will be displayed.

International Rectifier

717

In addition to displaying their line of products in booth No. E-103, E-105, E-107 and E-109, this company will be holding its national sales meeting at the Americana Hotel in conjunction with the show.

Jerrold Electronics

718

In booth No. E-108 and E-110 this company will be displaying their line of antennas. Also included will be MATV and CCTV systems plus reception aids.

JFD Electronics Corp.

719

At their booth, this company will unveil a new solid-state TV antenna which uses a copper-etched printed-circuit board for receiving signals that are amplified at the antenna.

continued on page 64

Grab the **HOT LINE**

in color TV lead-in sales!

BELDEN 

They're "market-engineered" to dominate color reception lead-in sales. Metro-Color™ for congested viewing areas. Maxi-Color™ for the suburban viewing market. Real sales grabbers. Created to bring home a better color picture . . . more profit for you. Colorful eye-stopping packages. Long warranties. Flexible, small size for easy installation. Competitive pricing. And a "Hot Line" display, too! That's the program. Grab it while it's hot. See your Belden DISTRIBUTOR today.

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Belden Corporation,
P. O. Box 5070-A,
Chicago, Illinois
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 Sharper picture quality - Delivers more signal
 Clearer sound - Easy installation - For VHF, UHF and FM
 100% shield coverage - No stand-offs needed
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White ics—radio and TV servicing, audio and hi-fi, industrial electronics, communications, engineering—you will find that Electronics Book Club will help you.

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Bonus Books: If you continue in the Club after fulfilling your Trial Membership, you will receive a Bonus Dividend Certificate with each additional Club Selection you purchase. For the small charge of only \$1.99, plus three (3) Certificates, you may select a book of your choice from a special list of quality books periodically sent to Members.

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Fill In Other Side and Mail Today!

Typical Savings Offered Club Members on Recent Selections

Jack Darr's Service Clinic No. 2	List Price \$7.95; Club Price \$3.95
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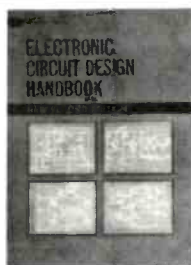
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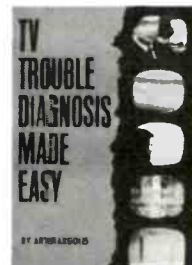


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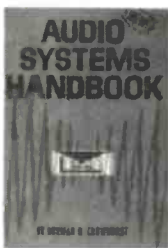


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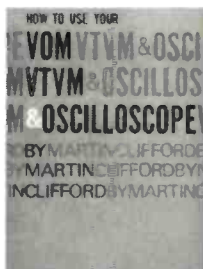
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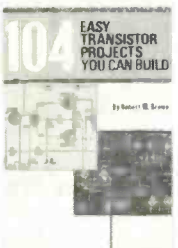


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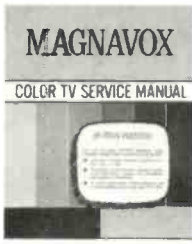
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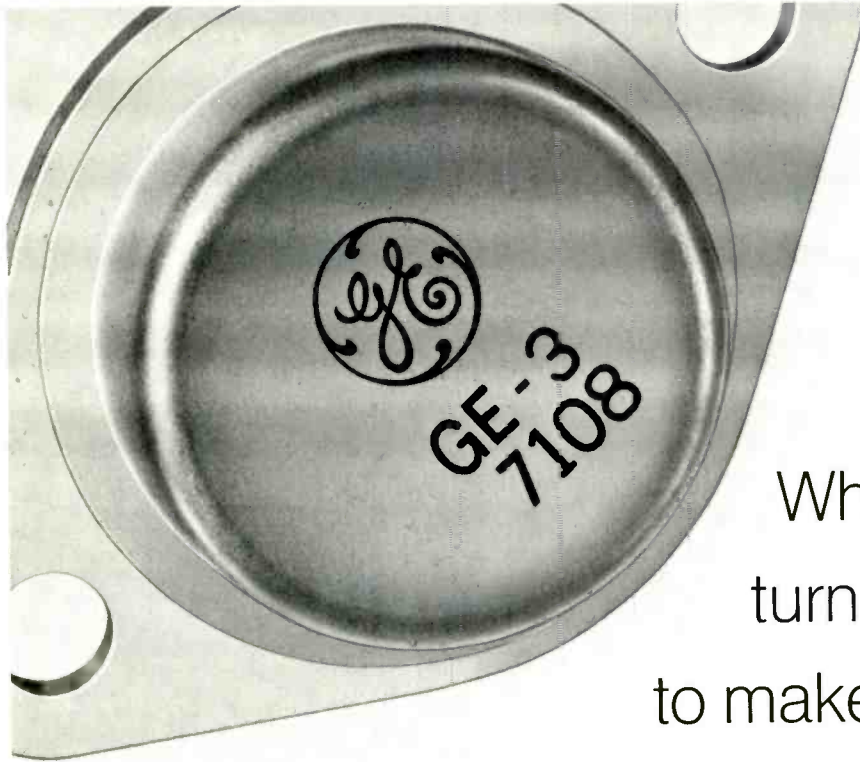
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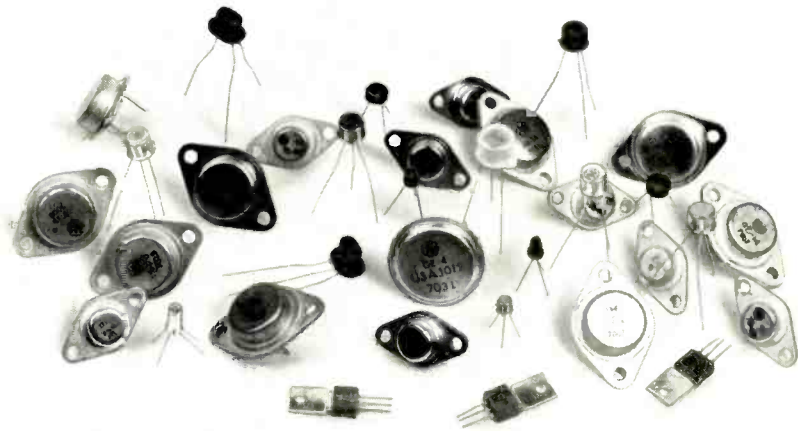
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TEKLAB REPORT

A high degree of serviceability is built into the mechanical and circuit design of this portable TV set to make your job easier.

General Electric's N-2 Color TV Chassis

by Joseph Zauhar

■ The small-screen portable color-TV set is still in popular demand and taking quite a percentage of current TV-set sales. Many of these TV sets are bought as second sets, the consumer wanting a lightweight portable small enough to be carried around. Each year, as the new TV sets are placed on the market, the electronic technician looks for a higher degree of serviceability without drastically increasing his parts inventory to service the new sets.

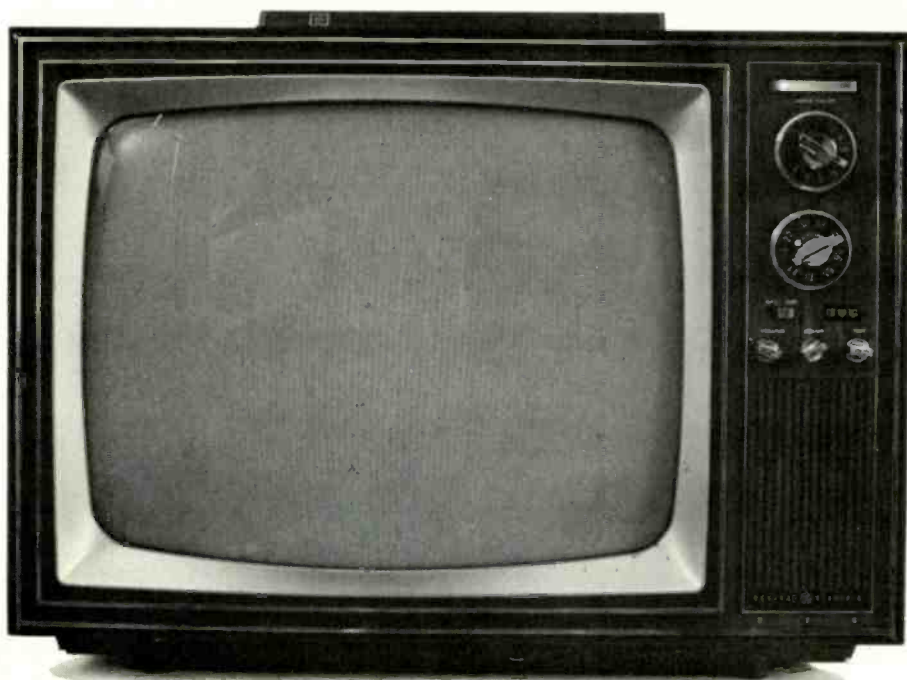
After examining the General

Electric Model WM257NWD-2, with its N-2 color chassis, we feel that it supplies both of these requirements quite adequately. The TV set weighs 47 lb and features Insta-Color[®], a built-in antenna and automatic degaussing, plus a number of other important features—along with a high degree of serviceability.

After we removed the back cover of the chassis, some aspects of the TV set reminded us initially of the first Porta-Color* set reviewed a few years ago. The first thing that caught our eye was the accessibility to components. And by removing the cover, a unique flap attached to the cabinet back is also removed to provide access to the bottom components (Fig. 1).

The TV set's front panel can also be removed simply by unsoldering the antenna leads from the antenna board, removing a ground strap and then removing four screws that secure the front panel to the bottom of the chassis (Fig. 2).

The tuner is placed in a convenient position so that it can be cleaned or serviced by merely un-snapping the cover—no disassembly is necessary. The main fuses are mounted in clips on top of the high-voltage compartment (Fig. 3), thus offering greater accessibility. A specially designed high-voltage compartment (Fig. 4) simplifies the re-



General Electric's Model WM257NWD-2 color-TV set employing the N-2 chassis.

*Trademark General Electric Co.

placement of the HV transformer and the HV rectifier tube. Efficiency coil adjustments are eliminated and the high voltage is adjusted by a one-screwdriver adjustment. Convergence is simplified by employing an "in-line" picture tube—as used in previous Porta-Color Chassis.

The N-2 hybrid chassis is similar to the N-1 (both are 16-in. portable color-TV sets) and contains 13 tubes and 9 transistors. When viewed from the bottom of the chassis, the identification of test points and circuit components is clearly "road-mapped" to facilitate troubleshooting and component replacement.

Since many of these circuits are similar to the earlier chassis, we will review only the new circuits found in this chassis. The circuits that we review can be found in this month's TEKFAX Schematic No. 1357.

DC Restoration Circuit

A dc restoration circuit clamps either the positive or negative peak voltage of a wave form to the desired voltage level. For video signals, this wave form is clamped at the blanking level, which effectively restores the black level established at the transmitter. In this chassis a simple diode/capacitor clamp circuit (containing diode Y155) is employed to accomplish the dc restoration. (As in other TV sets, we are working with a composite video signal, a signal which results from combining a blanked picture signal with the sync signal. The video signal should communicate a dc characteristic to the CRT relative to the transmitted sync pulse.)

A circuit that is capable of holding the black level of the composite video signal constant at the CRT will replace the dc component lost in the first capacitive coupling between the receiver's video detector and the CRT. The circuit shown in Fig. 5 is an example of how this dc level can be lost. There, the signal source is the transistor, C represents any coupling capacitor, and R is the load to which the signal is delivered.

The positive going pulse at the collector has a 0v base line. After it passes through the coupling capacitor, the 0v base line is shifted to near the middle of the wave form

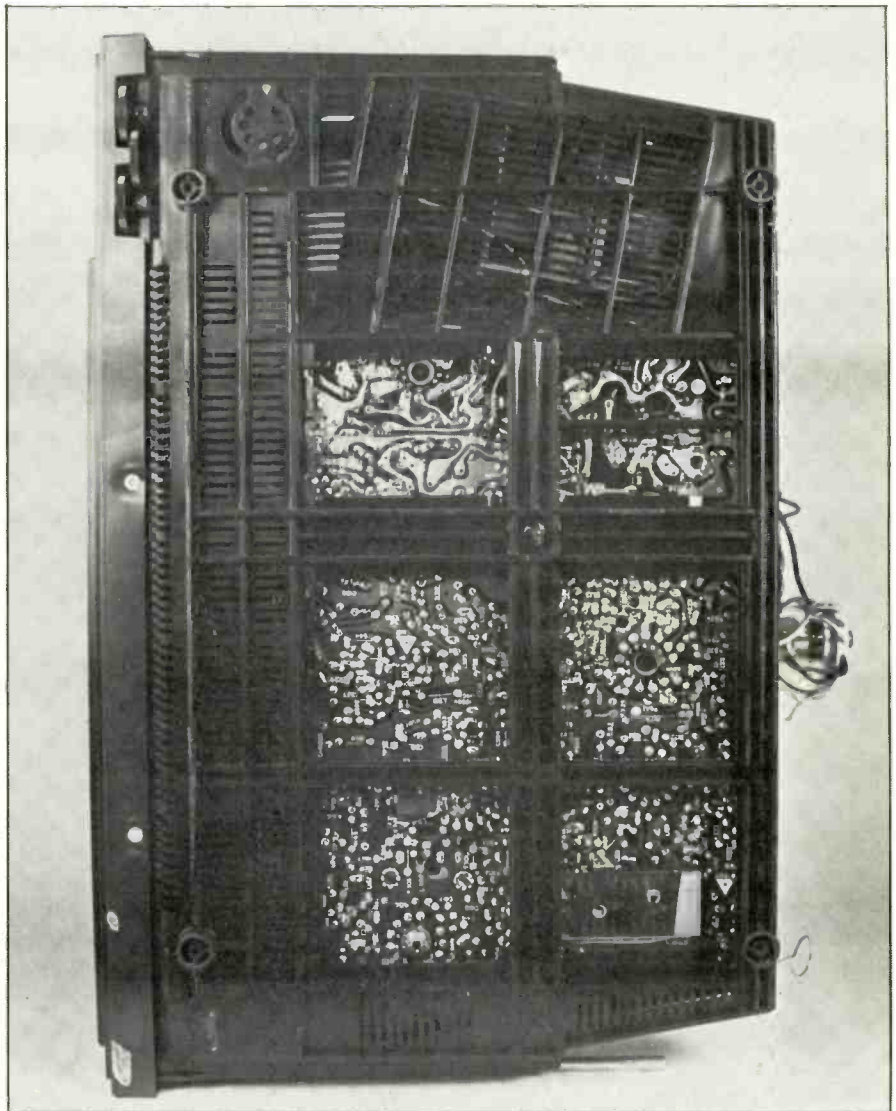
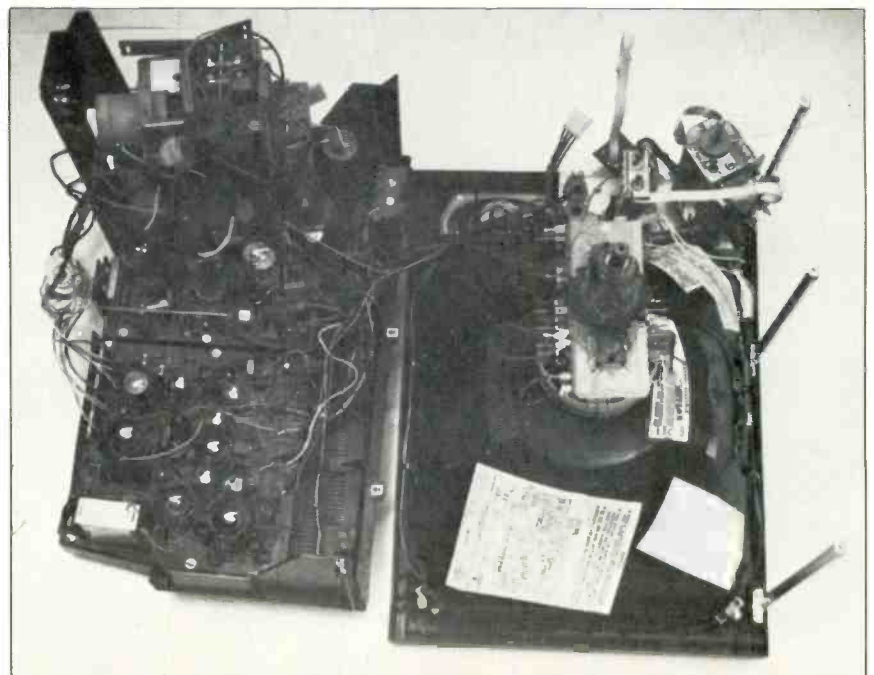


Fig. 1—After the back cover is removed, most of the components are accessible without further disassembly of the chassis. The test points and components are clearly "road mapped" for identification.

Fig. 2—The cabinet front separates from the bottom of the cabinet for difficult jobs that require moving the picture tube.



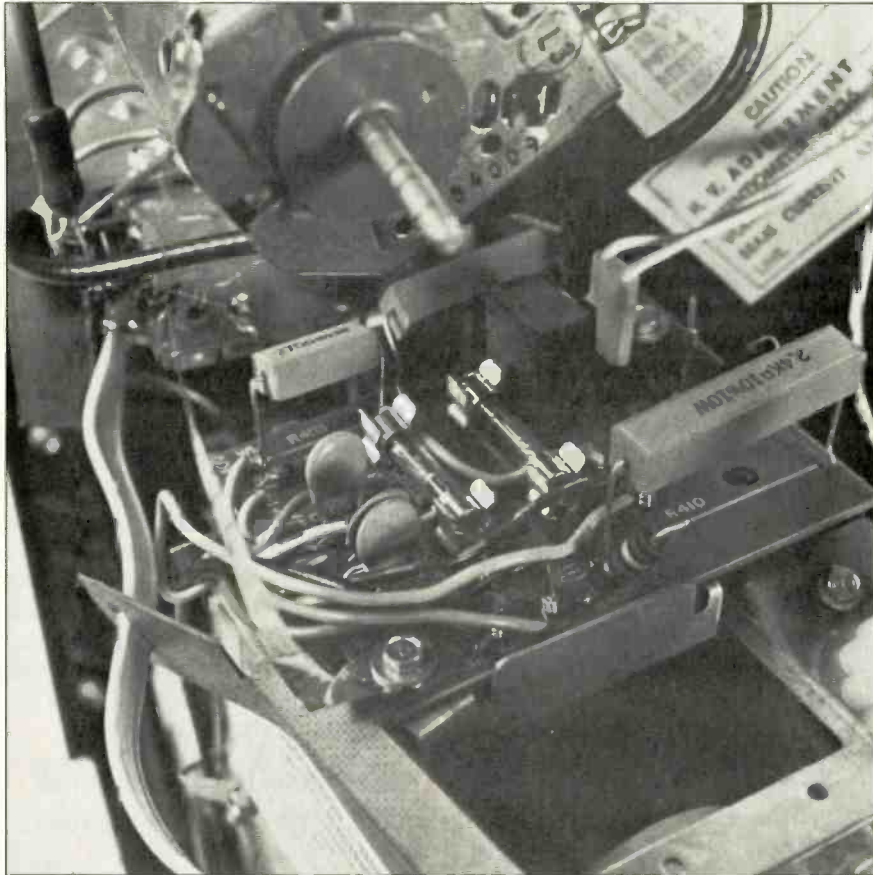
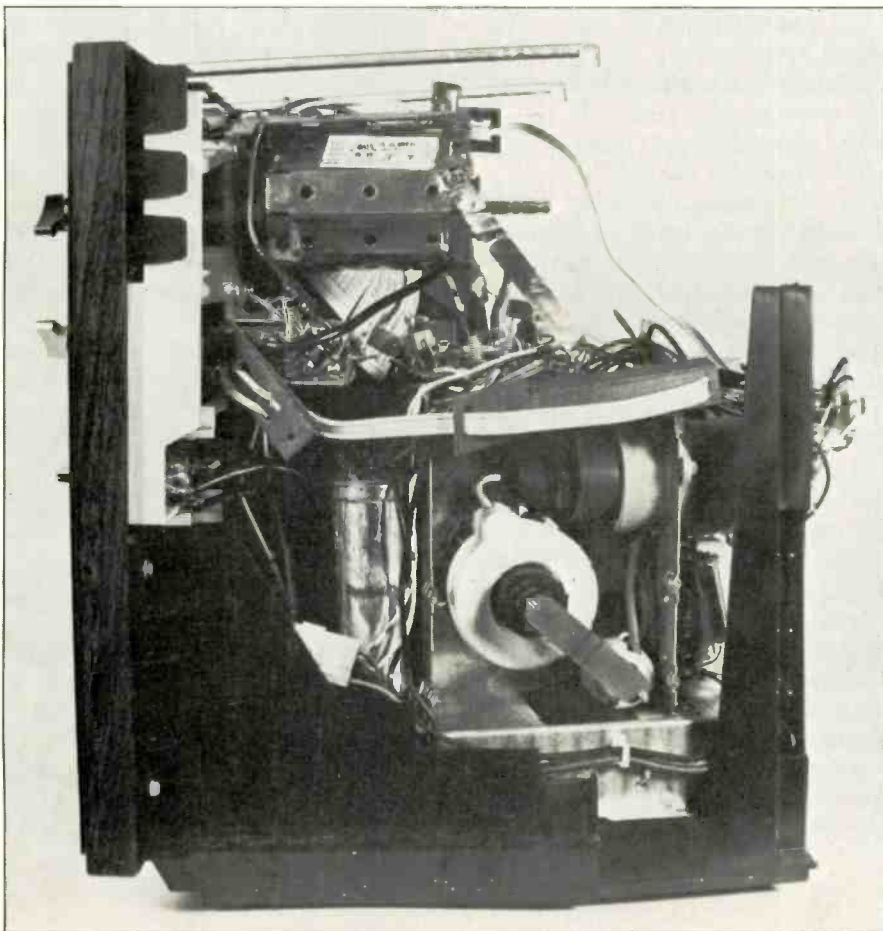


Fig. 3—The main fuses and power resistors are placed on the top of the high-voltage cage for easy access.

Fig. 4—Side view of the chassis with the hinged door and side panel removed from the high-voltage cage for easier servicing.



and the wave shape itself has now taken on a negative characteristic.

If the original positive peak represents the black level, then after the signal passes through the capacitor the positive excursion away from 0v will no longer be sufficient to produce black. If the peak-to-peak amplitude is constantly varying, a problem of maintaining black becomes compounded, and the black reference point is lost.

Fig. 6 shows what occurs when a clamping diode has been added to the basic capacitive-coupled circuit. If the signal attempts to go negative with respect to the chassis, it is clamped to the 0v level by the diode. In the circuit shown in Fig. 7, the clamping diode is reversed and the

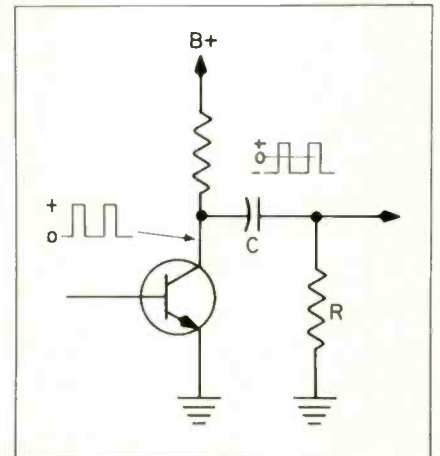


Fig. 5—The dc level can be lost with capacitor coupling.

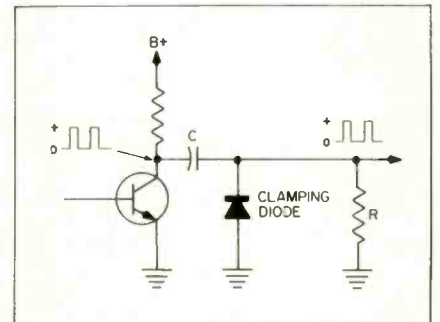
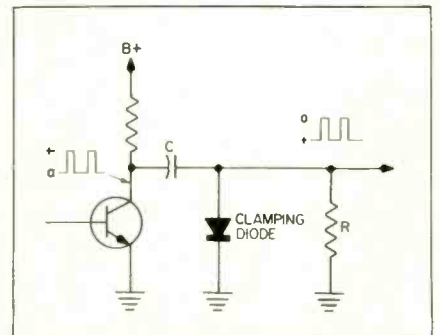


Fig. 6—A basic clamp circuit using a ground-anode clamping diode.

Fig. 7—A basic clamp circuit using a ground-cathode clamping diode.



clamping action occurs on the positive peaks.

A clamp circuit having off-set bias is shown in Fig. 8. There the signal is obtained from the cathode of the clamping diode and the clamping action occurs on the negative portion of the applied signal—the battery offsetting the clamping level by its voltage and polarity.

The brightness control permits setting the clamped video black level

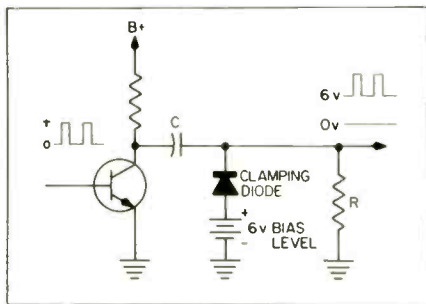


Fig. 8—A clamp circuit with a bias voltage applied to the clamp level.

so that the black in the signal is the black viewed on the CRT screen. The video information is now referenced to the clamped black level.

Brightness Limit Control

The automatic brightness limit control protects the CRT from customer misadjustments and circuit malfunctions which are related to video amplifiers. This circuit limits the CRT cathode current to I_{ma} .

When there is no beam current through the CRT, this tube is not the cause of any voltage drop across resistor R177. However, since diode Y156 is forward biased, the plate voltage of the video output tube (V5C) is impressed across this resistor. We now have dc coupling from the plate of V5C to the CRT. (If we measure the voltage on either side of Y156, we will find approximately 230v when the brightness and contrast controls are at their minimum settings.)

The cathode of the CRT must become less positive to turn it ON and produce a picture. If we turn the brightness and contrast controls, the plate voltage of V5C becomes less positive, the CRT cathode also becomes less positive and a raster appears. (Under these conditions, approximately 200v appears at either side of Y156.)

As the V5C plate voltage becomes even less, the CRT cathode current increases to I_{ma} , developing an 180v drop in voltage across the 180K resistor (R177). A further reduction in V5C plate voltage will not effect the CRT cathode voltage, since diode Y156 then becomes reverse biased and ceases to conduct current. Although the dc coupling between the video amplifier and CRT is lost, the ac coupling continues through coupling capacitor C161.

Chroma System

We noticed a major change in the manner in which the tint control functions. In the past, the control of the tint has been accomplished by varying the phase of the 3.58MHz subcarrier, while now it is achieved by changing the phase of the chroma signal.

In this circuit, the chroma amplifier signal is applied to a 500Ω potentiometer (R511) which controls the amplitude of the chrominance signal applied to the tint control (R513). This signal then passes through the variable phase shift that affects the tint.

Vertical-Output Stage

An understanding of the vertical-output stage is very important and most technicians realize how critical this stage is in a color-TV set. At times constant height and linearity adjustments are required.

In this chassis, advanced design concepts are employed to automatically correct for the aging characteristics and maintain satisfactory deflection throughout the life of the tube. The vertical circuit is oscillatory, but more commonly known as a ramp (sawtooth) generator system.

This output stage is a conventional pentode power amplifier, Class A operating and receiving its bias from an R-C cathode network. The output signal is applied through a transformer, which matches the impedance of the output tube (V10B) to the impedance of the yoke. The control grid receives three signals: a degenerate feedback signal coupled from the plate through a low-pass filter consisting of resistor R261, capacitor C269 and other compo-

nents in the grid system; the generator ramp voltage coupled from the vertical oscillator tube (V10A); and the vertical-sync pulse from the sync separator.

The feedback loop includes linearity control and automatic correction for tube aging. By degenerative, we mean that the out-of-phase signal tends to oppose the original signal present at the grid. This signal must be substantially attenuated or else the feedback signal would significantly attenuate the drive signal to the amplifier. Also, the feedback signal is changed by the low-pass nature of the feedback loop. The automatic correction feature results as the feedback signal diminishes—the ramp generator signal then receives less opposition and the amplifier is driven harder. As a result of this circuit function, constant raster size is maintained throughout the life of the vertical output tube.

High-Voltage Hold-Down Circuit

High-voltage regulation is achieved by the hold-down circuit, which is somewhat similar to a shunt-type regulator. The hold-down circuit establishes the operating point of the horizontal-output stage and alters this operating point according to variations in the amplitude of the horizontal flyback pulse.

The operation of this circuit is very simple. The flyback pulse is capacity coupled (through capacitor C221) to a voltage-dependent resistor (R224), which is connected to ground through a potentiometer (R236). In this application, the VDR functions somewhat like a diode.

Current flow through the VDR is started by the high-voltage positive pulse, which charges capacitor C221. The discharge and charge cycles are the same, but since the voltage across the capacitor is less than that of the flyback pulse, the VDR offers more resistance—resulting in a voltage drop across the VDR and potentiometer. This voltage is used as the horizontal-output stage bias voltage. The charging current into the capacitor is regulated by potentiometer R236, permitting the adjustment of the bias voltage.

continued on page 71

Mastering the TV Antenna System Market--Part II

by Lon Cantor

During this decade industry experts anticipate a boom in the construction of Master Antenna TV systems. Will you be there to collect a share of the profits?

■ Last month's article provided some background information indicating why an MATV boom is now anticipated. It offered some helpful hints concerning effective techniques for selling MATV systems and general pointers concerning MATV system design. The article then went into considerable detail to describe various MATV distribution systems and techniques for calculating signal losses in such systems. But MATV distribution systems must obtain high-quality TV signals from somewhere—and that is what this month's article is about.

Head Ends

The first step in designing a head end is to make an on-site survey. Use a battery-powered field-strength meter, a UHF dipole antenna and a VHF dipole antenna. Take this equipment to the roof and measure each sound and picture carrier. Then, fill out a form such as the one shown in Fig. 2.

When making the signal survey, be sure you know the direction from which each channel is being telecast. Do not guess. Use a compass and an aerial map or a station coverage map to pinpoint each channel. "Walk the roof" as much as possible to find the best spot for each antenna. Also, if one or more channels are weak, try changing the elevation of the dipole antennas for maximum signal pick-up.

Once the on-site survey is completed, you can proceed to select antennas. MATV antennas are a lot like antennas for home TV set use. In fact, some installers actually use home antennas for small systems. However, special, ruggedized MATV

antennas such as that shown in Fig. 1 are preferred. Basically, the differences between home antennas and MATV antennas are as follows:

- Because a single antenna or group of antennas serve a large number of TV sets, you can afford to spend more on the antennas.

- You cannot use a rotor in an MATV system. Therefore, you have to point antennas in each direction from which you want to receive TV or FM stations. Single-channel antennas are practical in many MATV systems.

- MATV systems are generally sold with service policies. Since antennas are exposed to the elements, they are vulnerable. Therefore, it generally pays to use the best of mounting gear, lead-in wire and accessories, plus ruggedized antennas.

Types of Amplifiers

Two basic types of amplifiers are used in MATV head ends—broadband and single channel. Broadband amplifiers are preferable for most systems, since they cost less and are

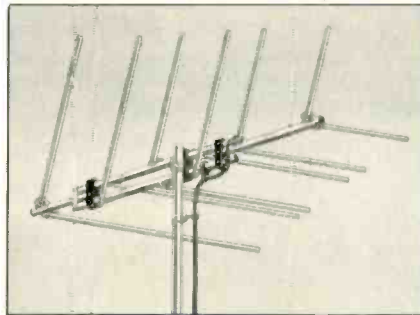


Fig. 1—Ruggedized MATV antennas are generally preferred for larger installations.

JOB SITE _____			
Street Address _____		City _____ State _____	
OWNER _____			
Name _____		Address _____	
TYPE OF BUILDING _____			
(hospital, school, hotel, motel, etc.)			
NUMBER OF FLOORS _____		NUMBER OF ROOMS _____	
CHANNELS TO BE RECEIVED			
CHANNEL NUMBER	LOCATION (City)	PICTURE CARRIER SIGNAL (in microvolts)	SOUND CARRIER SIGNAL (in microvolts)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
SURVEY PREPARED BY _____			
Signature _____			

Fig. 2—Recommended TV signal survey form.

easier to install and service. In very large systems, single-channel amplifiers have been used because they provide more output per channel. However, recently developed broadband amplifiers can provide almost as much output per channel as single-channel amplifiers. In spite of this development, single-channel amplifiers are still preferable where there are problems—such as widely fluctuating signal strength.

With mixing filters, it is possible to use single-channel antennas with broadband amplifiers (Fig. 3) or broadband antennas with single-channel amplifiers (Fig. 4).

Whichever type of head end you use, an important consideration is signal balancing. All signals should come out of the head end at about the same level—except that it is often desirable to run UHF channels with about 6dB more signal strength than the VHF channels to overcome increased system signal losses in the UHF band.

There are several ways that you can adjust signals to their proper level:

- Use mast mounted preamplifiers for weak channels.
- Use equalizing mixing filters or fixed attenuators to attenuate strong channels.
- Adjust amplifier gain for the desired output per channel. [Even broadband amplifiers permit separate adjustment of low-band VHF (channels 2 through 6), high-band VHF (channels 7 through 13) and UHF (channels 14 through 83) signals.] When using single-channel amplifiers, you can adjust the gain of each channel individually.

Choosing Head End Amplifiers

Head end amplifiers have one very important job—they provide enough signal output to overcome the distribution system losses. Therefore, before you can choose an amplifier, you must calculate total distribution system losses—as described in last month's article.

There are two important characteristics of head end amplifiers—gain and output capability. Let us look at a typical situation to cover this more fully. Suppose you have a total distribution system loss of 41dB. Suppose also that Channel

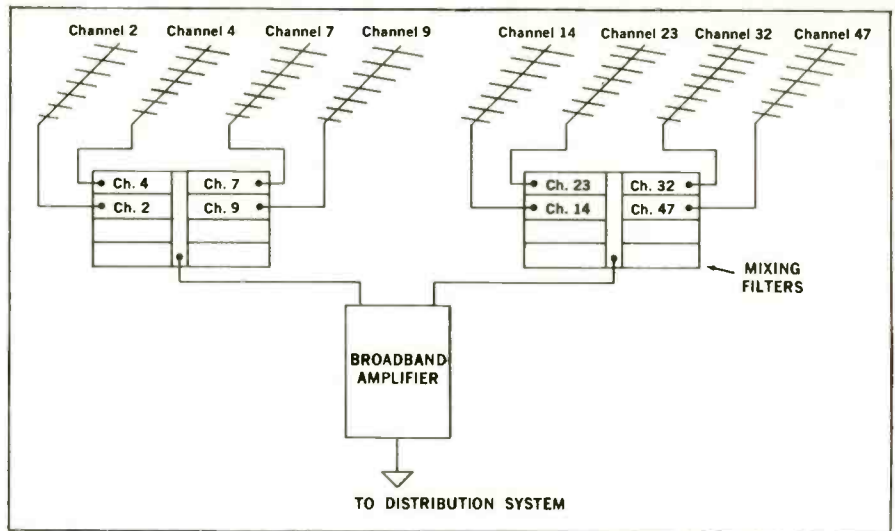


Fig. 3—The output of several single-channel antennas can be combined with mixing filters and applied to a single broadband amplifier.

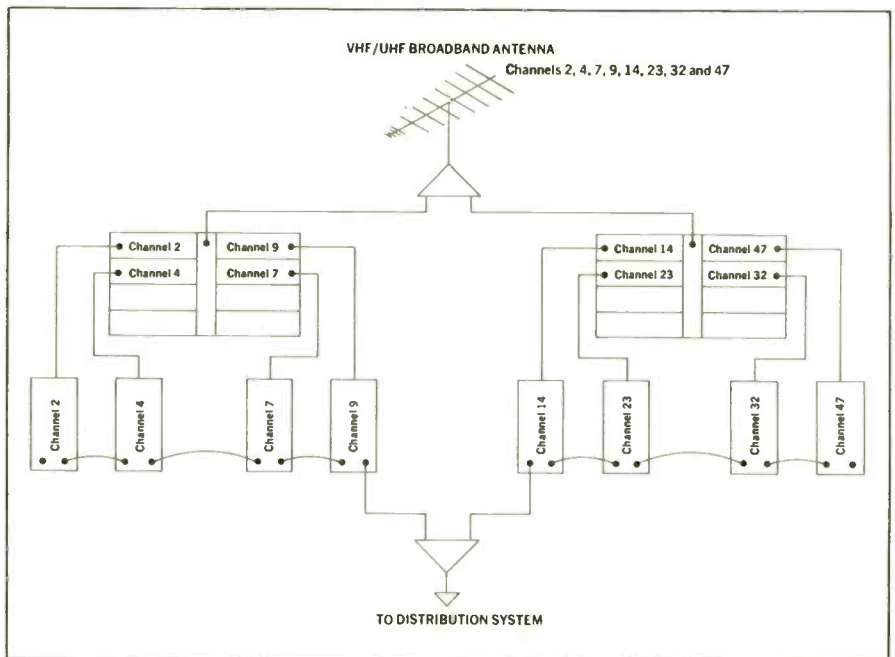


Fig. 4—With the use of mixing filters, the output of a single broadband antenna can be applied to several single-channel amplifiers.

47, the highest channel in the system, was received with -3dBm signal strength during your on-site survey. The UHF antenna you chose provides a gain of 14dB, which gives you $+11\text{dBm}$ input to the amplifier. This indicates that you need an amplifier that provides 30dB gain (11dBm input, added to 30dB gain = 41dBm output).

Now let us look at another example. We are still working with the same signal (-3dBm at Channel 47) and the same antenna (14dB gain), but our distribution system loss is 60dB. It is, therefore, easy

to calculate that we need an amplifier with 49dB gain (11dBm input, added to 49dB gain = 60dBm output).

Unfortunately, however, we could choose an amplifier (or combination amplifier and pre-amplifier) with 49dB gain and the system still might not work. This is because we have not yet considered output capability. Drive any amplifier too hard and you get distortion. Acceptable distortion in an MATV amplifier is less than 0.5 percent. Therefore, manufacturers generally specify output capability in terms of how

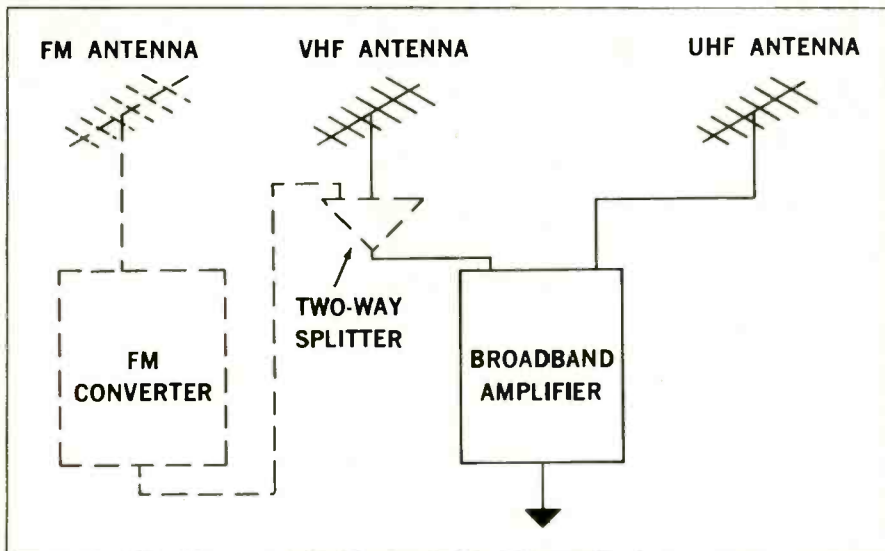


Fig. 5—FM or audio converters can be added to any MATV system.

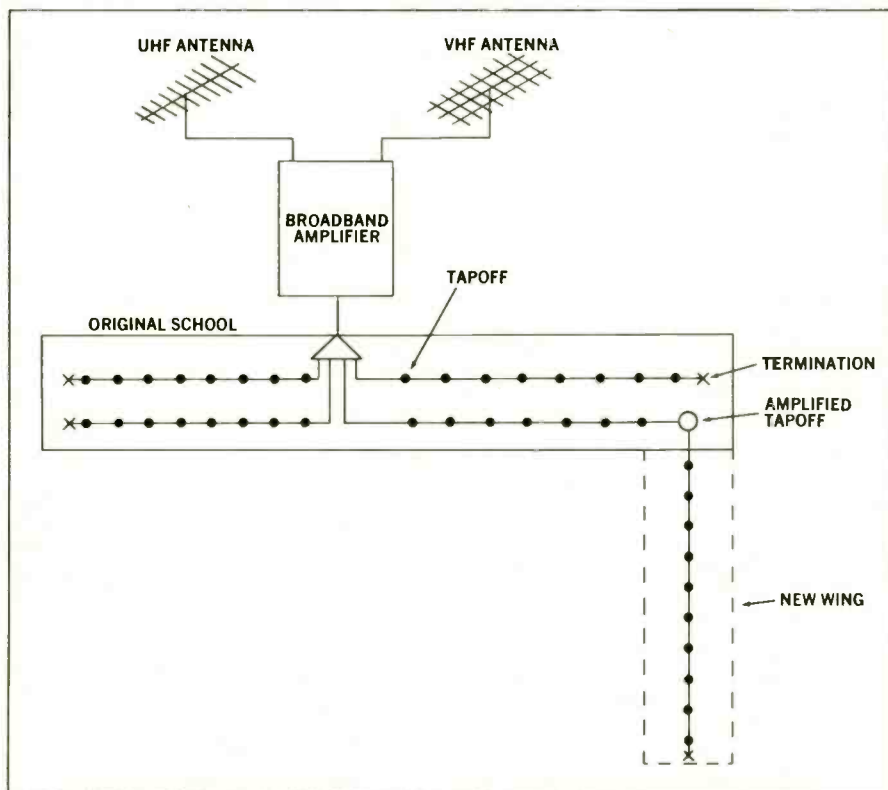


Fig. 6—By using an amplified tapoff, the MATV system can grow with the school.

much signal the unit can deliver with less than -46dB of cross-modulation, which is equal to 0.5 percent distortion. An amplifier can provide 50dB gain, but if its output capability is only 50dBm per channel, it cannot possibly serve a distribution system having a 60dB loss.

Therefore, you must choose your amplifier or amplifiers on the basis of both their gain and output capability.

Amplified Accessories

Unfortunately there is a limit to how much signal you can get out of an amplifier. Today's single-channel amplifiers can deliver up to 70dBm , while the best broadband models can provide 60dBm output per channel. What happens if distribution system losses exceed the capabilities of the amplifier?

The answer is to use cable-powered amplified accessories. In last

month's article, Fig. 6 showed a typical system using "line stretchers" to extend long trunklines. These amplifiers are compact and require no ac power. They operate on 17v ac, fed to them from the head end amplifier on the same coaxial cable that carries the signal.

A variation of this is the amplified tapoff, which looks like an ordinary tapoff but also serves the function of a line stretcher. Other amplified accessories include amplified splitters and bridges.

Fig. 6 is a layout diagram for a school that has added a new wing. By substituting an amplified tapoff for the tap originally installed at the end of the trunkline, the installer has been able to expand the system to include the new wing at minimal cost.

Background Music and Paging

Your sales can be increased by upgrading new and existing MATV systems to include background music or paging. These additions are quite inexpensive—it is not necessary to have an FM receiver or even an additional amplifier in each room. The TV set does the job. Fig. 5 shows how an FM converter or an audio converter can be added to the head end of any MATV system. The audio converter works from a microphone, phonograph, tape recorder or any other audio source. The FM converter works in conjunction with a built-in FM tuner. Both units convert their inputs to TV channel frequencies, usually on a channel adjacent to one occupied by a TV station. The audio or FM is used to modulate the sound carrier of the unused frequency. When a TV set connected to any tapoff in the system is tuned to that channel, it displays a blank screen and reproduces the sound.

Adding CCTV

Schools often use CCTV to originate their own instructional TV programs. Apartments, hotels and motels use CCTV to watch doors, elevators, swimming pools, etc. It is easy to add CCTV to any well designed MATV system. All you need is a modulator capable of accepting video and audio inputs and produc-

continued on page 74

Color Television Reception

Part II--The Color-TV Receiver

by William Spero

Basically, all color-TV receivers are similar and most of those in production today are of the hybrid variety—a mixture of tubes and semiconductors

■ A color-TV receiver has a few additional circuits that the normal B/W-TV receiver is lacking. This can be more clearly seen with the block diagram in Fig. 1. (To illustrate, a Sylvania D-12 "Gibraltar" chassis has been chosen, which contains 9 tubes, 23 transistors, 28 diodes and 1 integrated circuit. The VHF and UHF tuners also use solid-state components.) The labeled portion of this diagram corresponds to that required for a conventional B/W-TV set. It consists of the tuner section, vertical- and horizontal-sweep circuitry, the IF and audio sections, video output and picture tube. The power supplies are straightforward and almost identical for both color- and B/W-TV sets.

RF signals for all the channels are received by the antenna, which couples this energy into the VHF or UHF tuner. For this article we will cover the signals received when the TV set is tuned to Channel 4.

Fig. 2 shows a graph representing the relative strength of the RF signals present in that channel. The channel boundaries are from 66 to 72MHz. The picture carrier (video) is at 67.25MHz. The sound carrier is at 71.75MHz. Since the sound is frequency modulated and has a ± 25 kHz bandwidth, we have a 225kHz upper guard band (i.e., 72MHz — 71.75MHz = 250kHz, 250kHz — 25kHz = 225kHz). It can also be shown that there is a lower guard band of 475kHz on the lower side of the FM sideband.

Notice that the upper picture sideband is 4MHz away from the pic-

ture carrier. In TV, vestigial sideband transmission is used, which means that the entire upper video sideband is transmitted along with only part of the lower video sideband. In the video transmitter, 2.75MHz of the lower sideband is suppressed. This, of course, reduces the total spectrum space required for each channel and allows more VHF TV channels to exist in any one geographical area. This can be done since only one sideband is needed to transmit all of the video

information. While it would be desirable to eliminate the entire lower sideband, we cannot do this due to the difficulty of building suitable filters that would prevent undesirable phase shift distortion.

When the RF signal for Channel 4 is beat against the Channel 4 oscillator, in the mixer stage of the tuner, an intermediate frequency is obtained. The resultant is a 6MHz band of frequencies between 41 and 47MHz. (For Channel 4 the receiver oscillator is at 113MHz, the

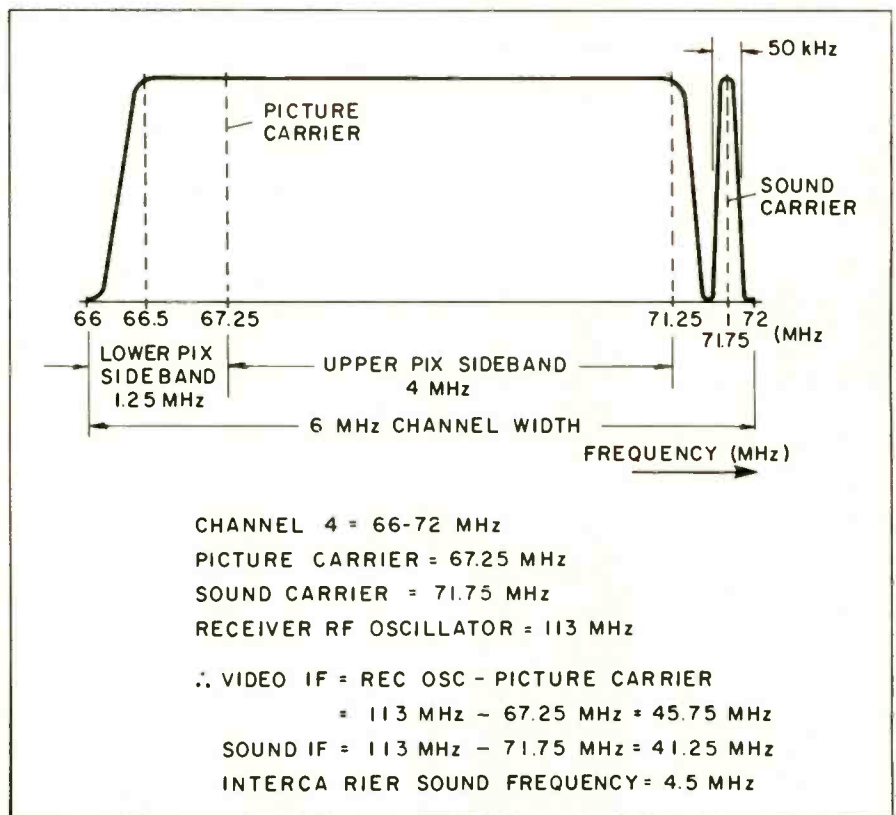


Fig. 2—Graph representing the RF signals that make up Channel 4.

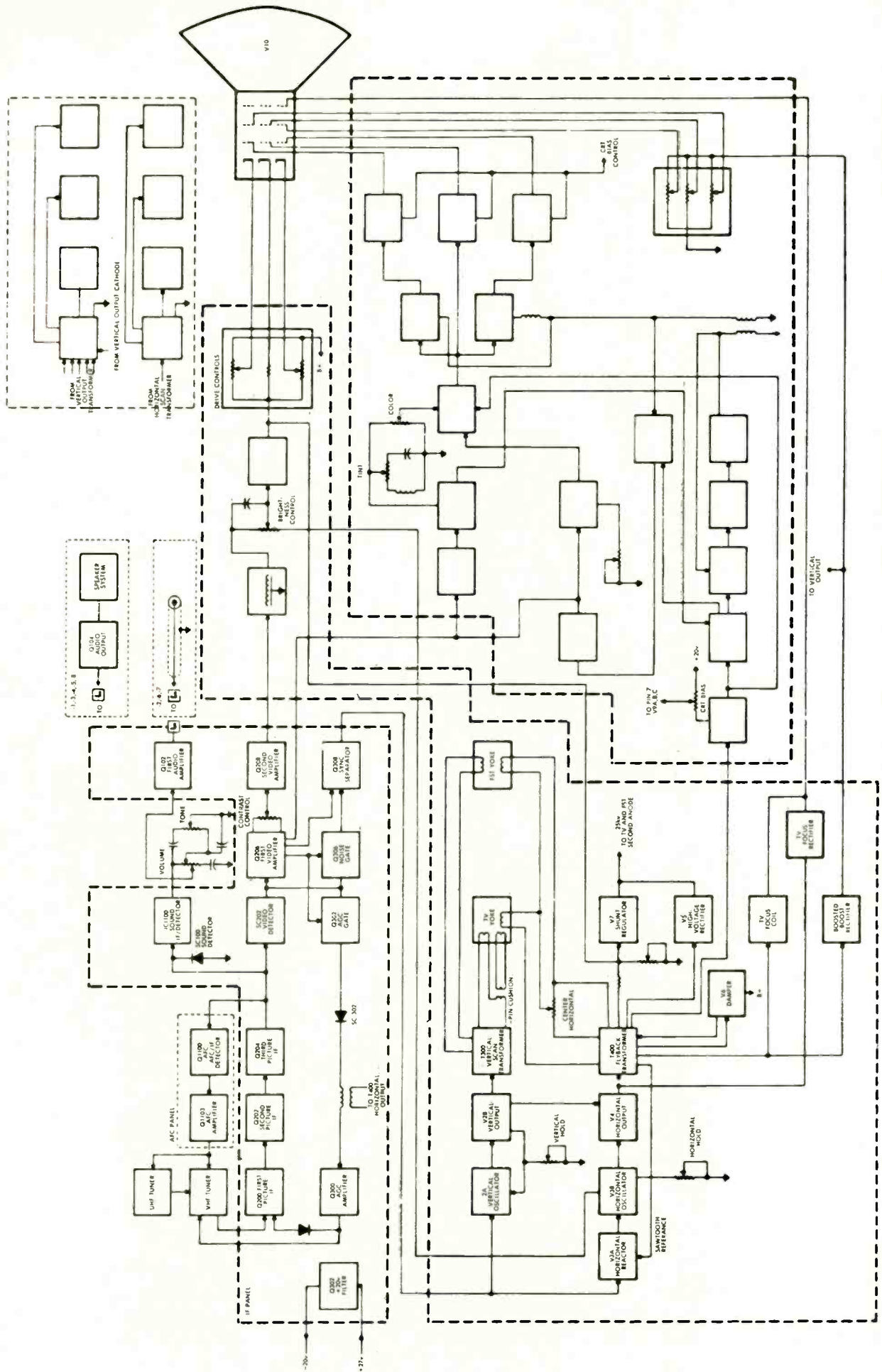


Fig. 1—Block diagram of Sylvania's D-12 "Gibraltar" chassis. The labeled portion contains those circuits generally found in a B/W-TV set.

resulting video intermediate frequency is 45.75MHz and the sound intermediate frequency is 41.25MHz.) We therefore have a frequency distribution as shown in the lower part of Fig. 3. These curves are idealized and not the actual response observed when sweeping an IF circuit in a receiver. Notice that in the mixing process there is a frequency inversion.

Fig. 4 shows the actual response curve that you will most likely observe when the front end of the receiver is swept (a scope being connected at the collector of the first picture IF transistor). This band of frequencies (41 to 47MHz) is coupled to the first picture IF stage for further processing; and the first, second and third IF stages are stagger tuned to maintain the necessary bandwidth. The center frequency is 44MHz.

It is in the IF stages that the video IF and trap alignment is controlled. Fig. 5 shows the resulting overall response from the tuner mixer to the video output stage—obtained by injecting a sweep signal into the base of the mixer transistor (a scope being connected to the emitter of the first video amplifier transistor after the 4.5MHz trap). By adjusting the IF coils and traps, the IF response is shaped like that shown.

Proper IF alignment is much more important for color-TV reception than it is for B/W-TV reception. Fig. 6 shows the color carrier and sidebands in their proper frequency perspective. The color information consists of a burst frequency (nine cycles of a 3.58MHz signal) positioned at the "back porch" of the horizontal blanking pulse. The sidebands are located $\pm 0.5\text{MHz}$ away from the 3.58MHz carrier. The total chroma information, therefore, is contained in a 1MHz bandwidth. If we subtract the three discrete frequencies (i.e., 3.08MHz lower sideband, 4.08MHz upper sideband and 3.58MHz sub-carrier) from the 45.75MHz video carrier, we obtain the intermediate frequencies corresponding to these chroma frequencies, or 42.67MHz, 41.67MHz and 42.17MHz. The position of these frequencies on the

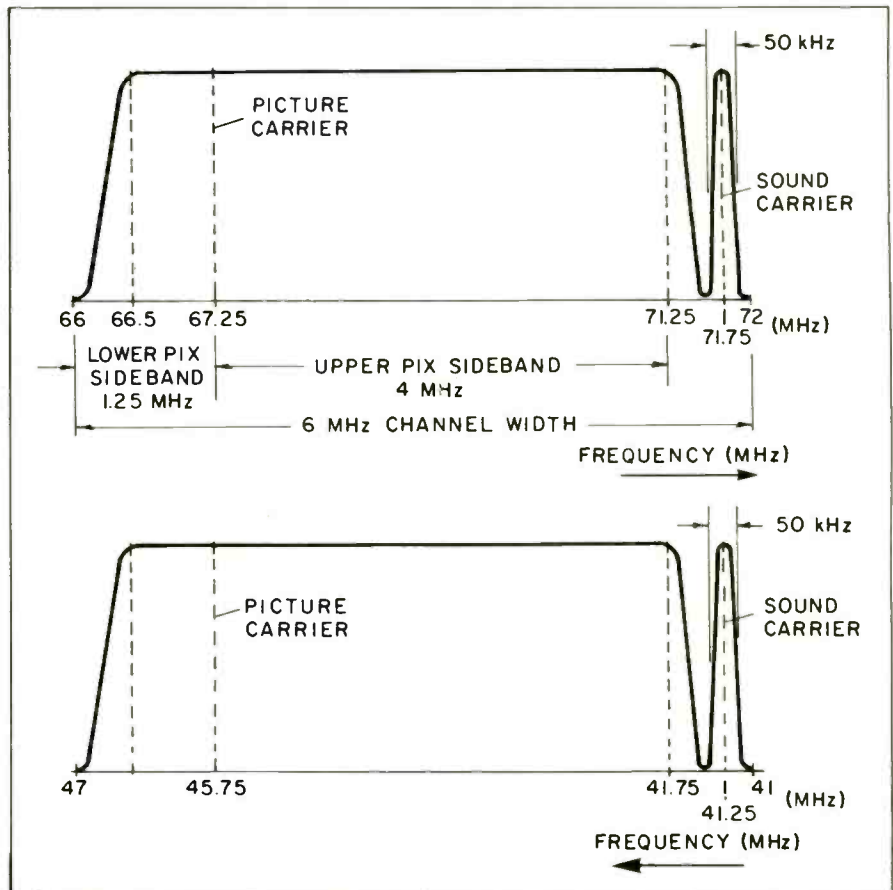


Fig. 3—When a 113MHz TV-set oscillator signal is beat against the RF signals present in Channel 4, these intermediate frequency signals result.

IF response curve is very important for color reception.

From the curve in Fig. 6 it is obvious that a poor high-frequency response at 3.58MHz (the upper picture sideband attenuated) would reduce the amplitude of the color sidebands. Since all of our color information is transmitted in the 1MHz band about the 3.58MHz subcarrier—a portion of this information would be lost. This could greatly reduce the response of the TV set to color information. One would like an IF bandwidth as close to 4MHz wide as possible. This is probably the most severe requirement of a color-TV receiver.

At this point, one might ask, "If the foregoing statement is true—then why not place the 45.75MHz video carrier and the 42.17MHz color subcarrier at the 100 percent point on the IF curve rather than at the 50 percent point as shown in Fig. 5? In answering that question, let us refer back to Fig. 2. It was previously mentioned that the pres-

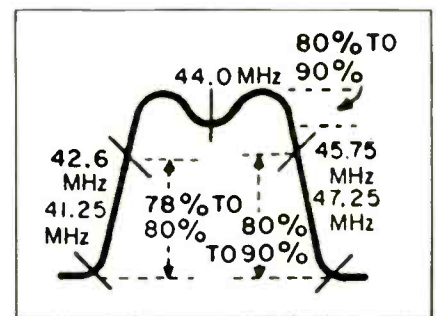


Fig. 4—The response curve that will most likely be observed when the front-end circuits of the color-TV set are swept.

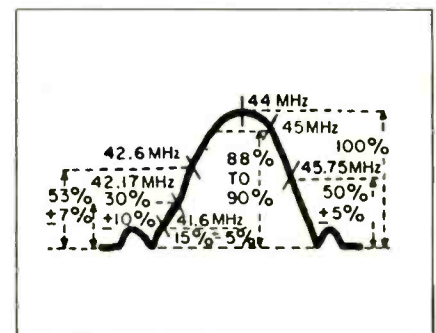


Fig. 5—The overall frequency response of a color-TV set from the tuner mixer to the video output stage.

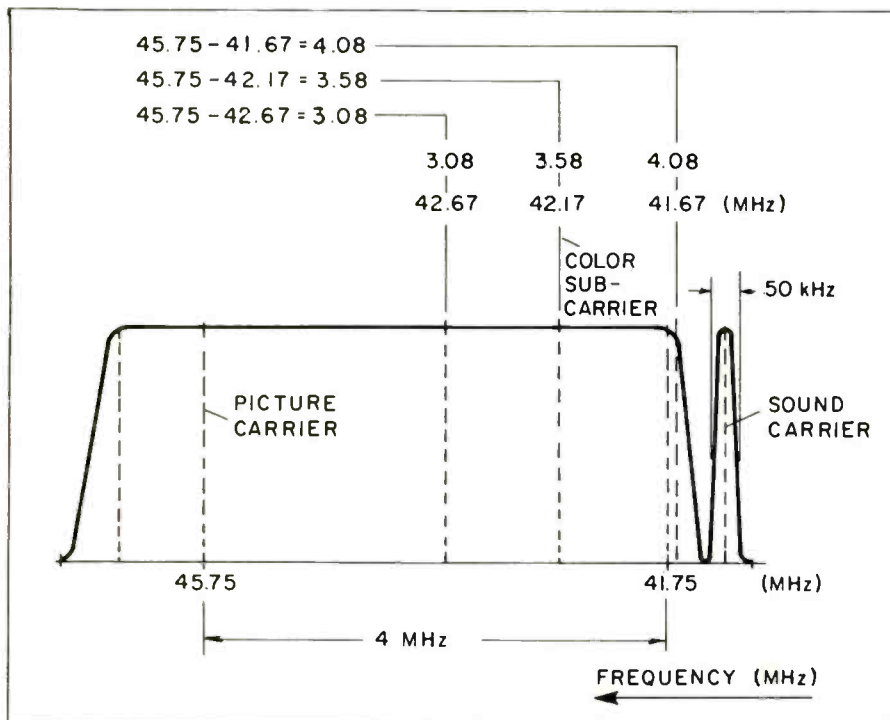


Fig. 6—The color carrier and sidebands in their proper frequency perspective.

ent state of the art utilizes vestigial sideband transmission. That is, the entire upper sideband is transmitted, but only a part of the lower video sideband. In other words, 1.25MHz of the lower sideband and the first 1.25MHz of the upper sideband consists of a group of frequencies with greater energy transmitted than the frequencies from 1.25MHz (in the upper sideband) to 4.0MHz. Remember, a 2.75MHz group of frequencies in the lower sideband is suppressed.

By placing the video carrier at 50 percent of the IF curve (Fig. 5), those frequencies with greater energy transmitted (above 45.75MHz) come out lower than the 50 percent mark on the IF curve. Those frequencies with less energy transmitted (below 45.75MHz) come out higher than the 50 percent mark on the IF response curve. The net result is a nearly flat response to these frequencies in the IF section of the color-TV set.

Video Detector and Amplifier Section

The output of the third picture IF stage (Fig. 1) is coupled through an IF transformer to the video detector diode, SC202. The 41.25MHz sound carrier is trapped out before

the video detector. A 4.5MHz trap after the video detector attenuates any sound IF still present at the input of the first video amplifier, Q206.

The composite video signal at the collector of transistor Q206 is coupled via the contrast control to the second video amplifier, Q208. Transistor Q208 amplifies the monochrome signal and ac couples it to the grid of the video output tube, V1 (the box shown to the right of the brightness control—Fig. 1).

A positive pulse (about 1300v p-p) from the vertical output stage is coupled to the plate of tube V1 (video output) to produce blanking during the vertical retrace intervals. The video output from the plate of this tube (V1) is dc coupled to the cathodes of the three-gun cathode ray tube.

Sound Section

The sound section (Fig. 1) employs a sound-detector diode (SC100), integrated-circuit IF/discriminator/sound, first audio amplifier (Q102) and audio output amplifier (Q104).

The picture IF stages employ an intercarrier (combined sound and IF) system through the third stage.

The output of this stage is coupled to the separate sound detector diode, SC100, for 4.5MHz sound IF detection. This avoids interference in the video detector and amplifiers.

The 4.5MHz sound IF is filtered through a low-pass filter to remove all 40MHz IF frequencies. It is then coupled to the input of the integrated-circuit network (IC100). This network provides amplification of the 4.5MHz IF frequency, FM limiting, FM detection and one stage of audio signal amplification. The resulting audio signal is then coupled to the input of transistor Q102. This amplified audio signal is applied to the audio output transistor (Q104) and then to the speaker system.

Sweep Circuitry

The sweep circuitry used in this color-TV set is the same as that incorporated in a conventional B/W-TV receiver. The high-voltage section is also the same as in a B/W-TV set except for perhaps the regulator circuit and high-voltage protection circuitry, which is needed because of the 24kv required for the CRT second anode. The protection circuitry consists of interconnected bias networks.

When there is high-voltage regulator failure or circuit misadjustment, the following conditions generally occur:

- Horizontal-output drive is reduced.
- CRT conduction is decreased by negative biasing the final video amplifier.
- There is over-voltage protection for the flyback, CRT and high-voltage components.

The high-voltage regulator is required to prevent changes in CRT brightness.

Another circuit not found in a conventional B/W-TV set is the 20v filter (Q302). Not shown in this month's article, this is a unique transistorized filter circuit which reduces the ripple voltage in the 20v B+ line that feeds the sync separator, IF amplifier, video amplifier, AGC and sound circuits. All of these circuits, by the way, utilize transistors. ■

A New Field in Servicing

by Lew Christy

Many simple electronic gadgets and household products are being put on the market annually. An exception to this is the all-electronic microwave oven, which is by no means a simple gadget. This is an instrument which must be handled and serviced with utmost care and above all, safety.

■ In this article we will cover the installation of a microwave oven, the theory of its operation, check-out procedures in case of failure and safety precautions for the servicing technician and the consumer. Basically, most all household-type microwave ovens are the same. The unit presented in this article is a Model R-5500, manufactured by Sharp Electronics Corp.

INSTALLATION

All microwave ovens are equipped with a grounded three-prong plug. Be sure to use a properly grounded adapter, if necessary, but *do not* defeat the purpose of the plug. The proper load carrying capacity of the oven itself is at least 15a. Do not overload the circuit by using other appliances on this same outlet.

For proper ventilation, place the oven at least 6 in. away from the nearest wall. It should not be installed in areas where heat and steam are generated—such as from gas heaters and ranges.

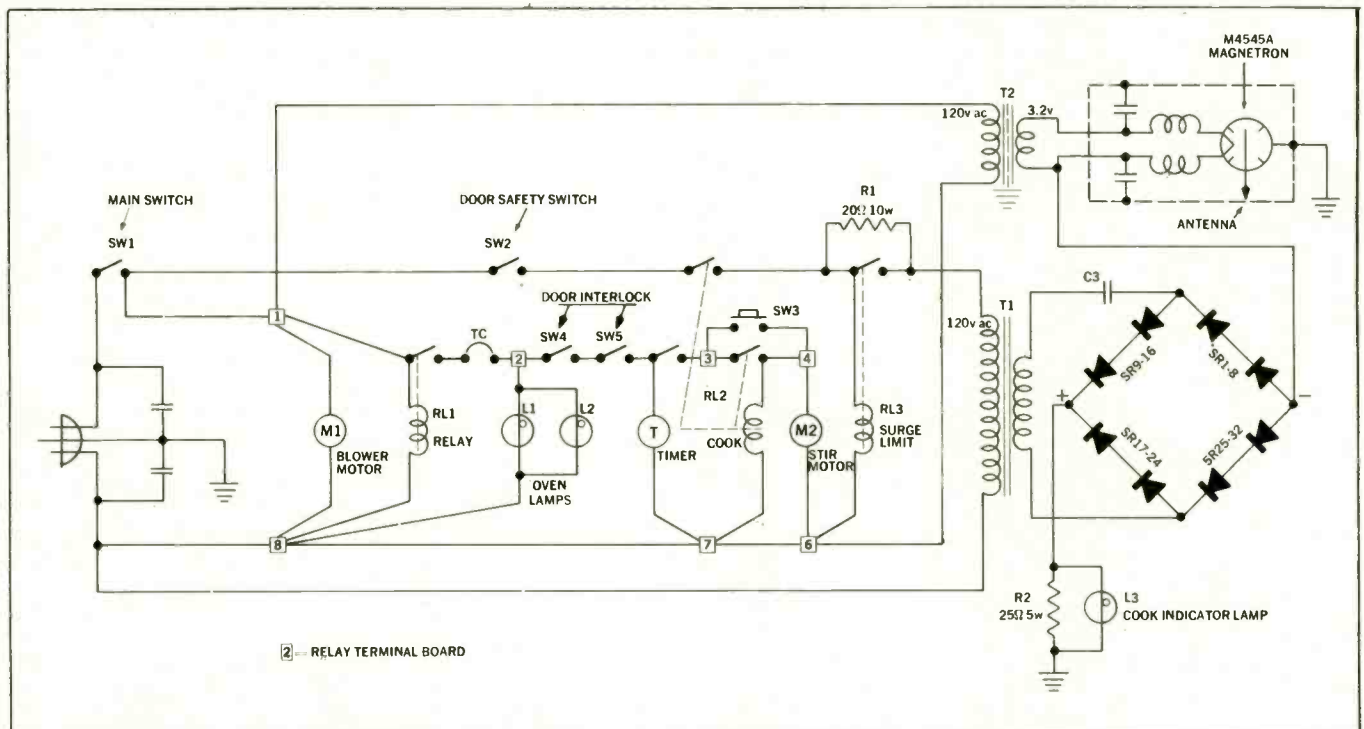
Post-Installation Checkout

After the oven has been properly installed, depress the main switch to its ON position (the blower motor should start). After about 8 sec, the oven lamps will automatically light. Place a glass of water inside the oven, close the door and depress the COOK switch. The water should boil in about 3 min. This being the case, the oven is now ready for household use.

Precautionary Measures

Never operate a microwave oven when it is empty. It is always advisable to place a glass of water inside the oven when cooking small amounts of food, since such a procedure will prolong the life of the magnetron tube.

Be sure that the oven is cleaned frequently with a mild soap (oil stains are apt to cause a loss of power). Never slam the oven door or place any objects on the door. Damage to the sealer plate around the door will cause leakage of micro-



Schematic of Sharp Microwave Oven, Model R-5500.

waves—a hazardous situation.

Always wait a few minutes before turning OFF the main switch once the cooking is finished, so that the blower will have time to cool down the magnetron. Clean the air filter at least once a month, and never place objects on the exterior of the oven body.

THEORY OF OPERATION

With the aid of the schematic diagram shown in this article, we can

follow the step-by-step procedure that takes place while the microwave oven is in operation.

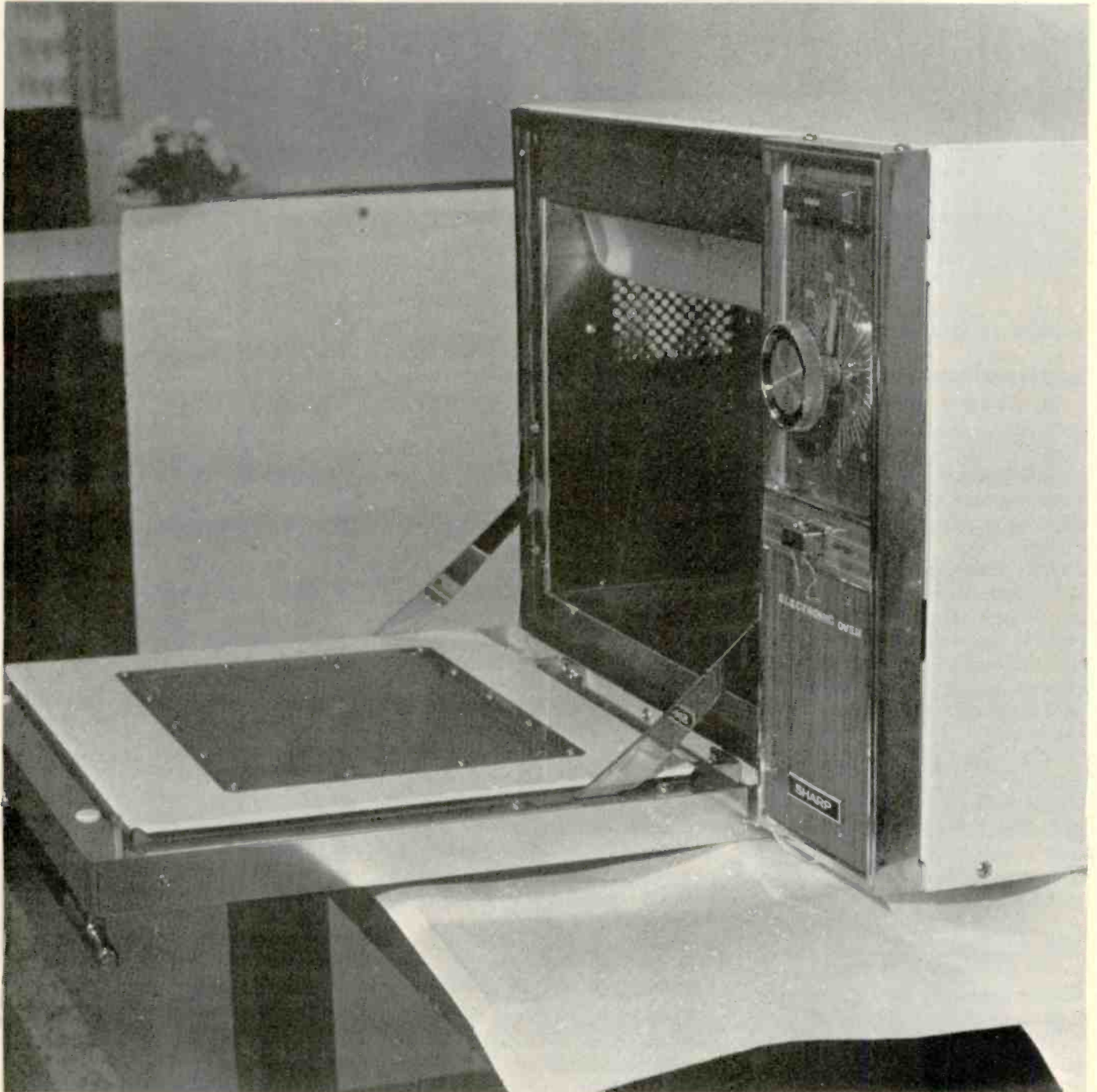
Stand-by Condition

When the main ON-OFF switch (SW1) is pressed to the ON position, the power is applied to the following components and circuits:

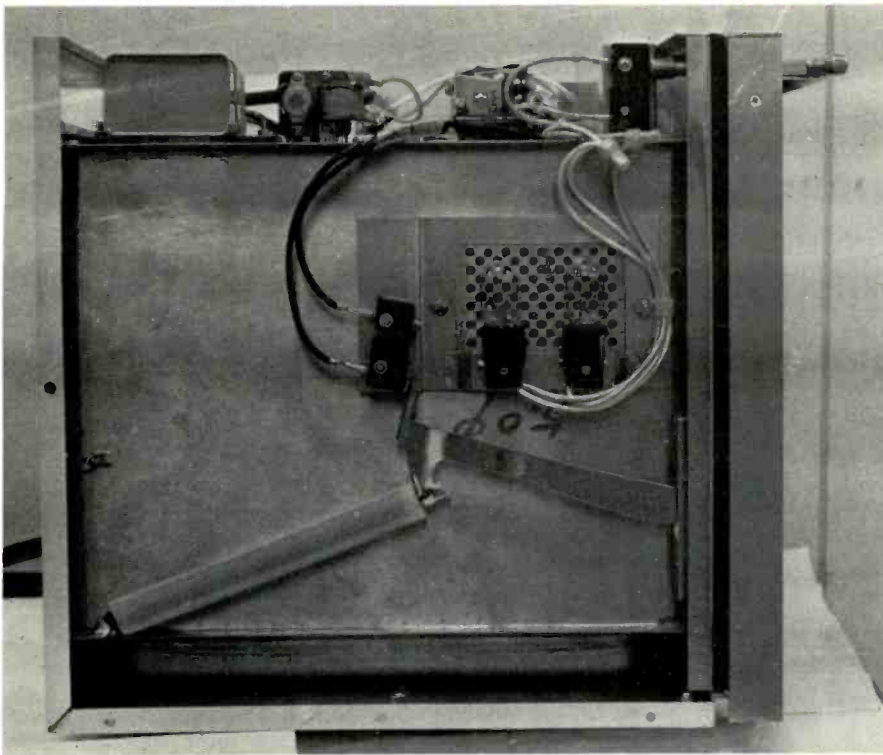
- AC line voltage is applied to the blower motor (M1), thus circulating the flow of air around the magnetron.

- Simultaneously, power is supplied to the input of the heater transformer (T2), which delivers a secondary voltage of 3.2v to the filaments of the magnetron.

- As power is also delivered to the coil of the delay relay (RL1), the contacts will close after an 8 sec pause, and voltage is applied to the oven lamps (L1, L2) through the thermo-cutout (TC), thus lighting the lamps. The oven is now in stand-by condition.



Door of oven showing sealer (white outer square) and sealer frame (dark center square) used to keep the microwaves within the oven.
Courtesy of Sharp Electronics Corp.



Left side of oven—note oven lamps (L1 and L2) and door safety switch (SW2). Door interlock switch (SW4) is located at top right. Courtesy of Sharp Electronics Corp.



Illustration of how a child can easily push a safety pin through oven grille while the oven is in operation, exposing herself to serious danger.

Cooking Operation

Place food in the oven, close the door and set the timer to the necessary position. Through the door interlock switches (SW4, SW5) and timer contacts, power is applied to the contact points of the cook relay (RL2). When the cook switch (SW3) is depressed, the cook relay is self-maintained and the following components are placed in operation:

- The line voltage is damped by the 20Ω resistor (R1) at the input of high-voltage transformer T1.
- The stirrer motor (M2) begins operation.
- The surge-limiting relay (RL3) operates, and its contact points are closed. Resistor R1 is short circuited and normal voltage is supplied to transformer T1. The rectified high voltage from the secondary windings of T1 is supplied to the magnetron, which begins to emit microwaves to heat the food. The stirrer rotates slowly and displaces the microwaves being transmitted through the built-in antenna of the magnetron.

The magnetron anode current flows through a 25Ω 5w resistor (R2). The resulting voltage drop lights the cook indicator lamp (L3).

Completion of Cook Cycle

When the timer has completed its cycle and returns to the "O" position, the timer contacts will open and thus release the cook relay (RL2). The stirrer motor (M2) stops, and the surge-limiting relay (RL3) is released, the voltage supplied to transformer T1 is cut off, high voltage ceases and the magnetron stops emitting microwaves. At the same time, the cook indicator lamp (L3) goes off and cooking ceases.

When the timer returns to the "O" position, the timer motor will continue to run and the signal bell will continue to ring, indicating that the cook cycle is completed. This bell will continue to ring until the timer is manually turned past "O" to the OFF position. Also, opening the door will cut off the power to the timer motor and stop the bell, until the door is closed again.

Opening Door While Cooking

The door interlock and door safety switches (SW2, SW4, SW5) are automatically turned OFF as the oven door is opened. The supply voltage to transformer T1 is also cut OFF,

discontinuing the operation of the magnetron. The cook relay (RL2) is simultaneously released, also cutting power to the stirrer motor (M2).

To continue the cooking, close the door and reset the cook switch to complete the preset timing cycle.

Thermo-Cutout Period (overload protection)

If the temperature of the magnetron becomes higher than the normal operating temperature while cooking, the following actions will proceed to take place:

- The thermo-cutout device (TC) opens up and the oven lamps (L1, L2) will turn OFF.
- During the same instant, the cook relay (RL2) is released, the stirrer motor stops and the timer ceases to function.

COMMON CAUSES OF FAILURE

The following checklist is helpful for electronic technicians that are not yet experienced in servicing microwave ovens.

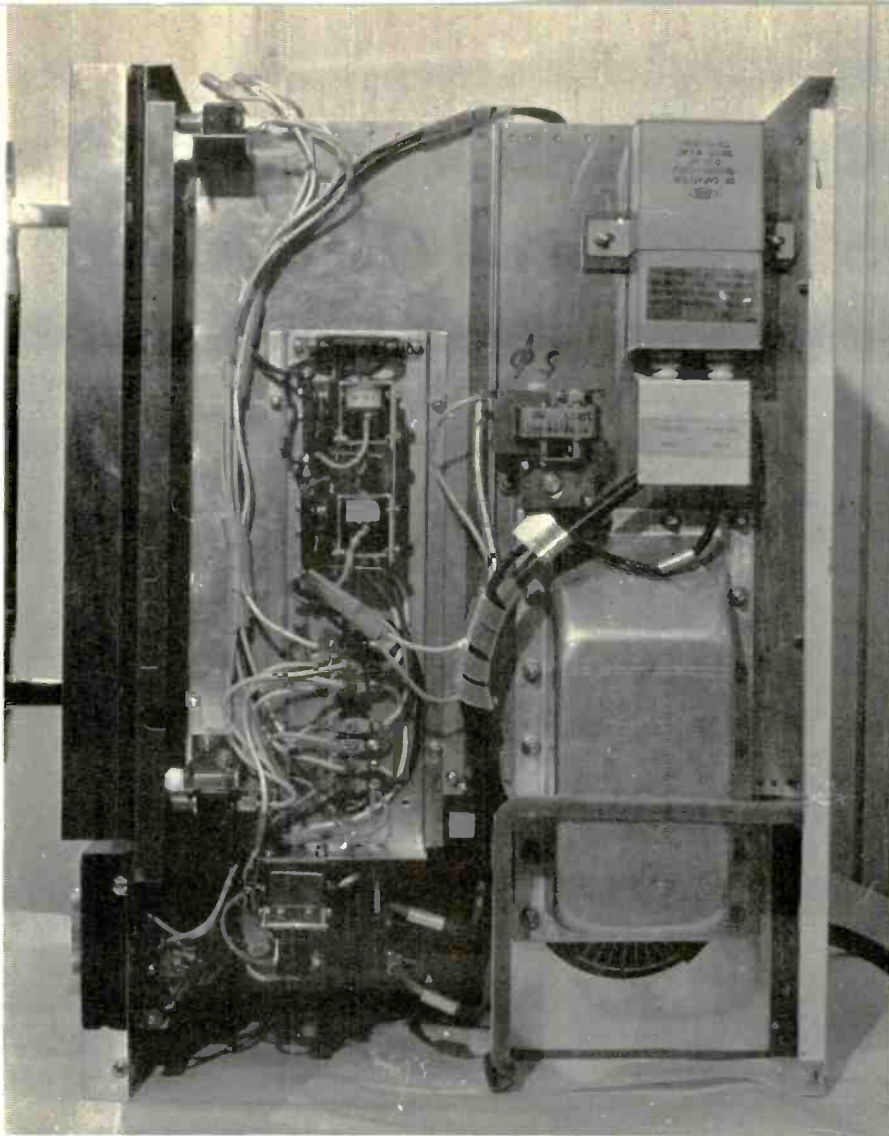
Oven is "dead" when main switch is depressed:

- Defective switch (SW1).

Oven does not operate when cook switch is depressed, blower is operating, but oven lamps are not lit:

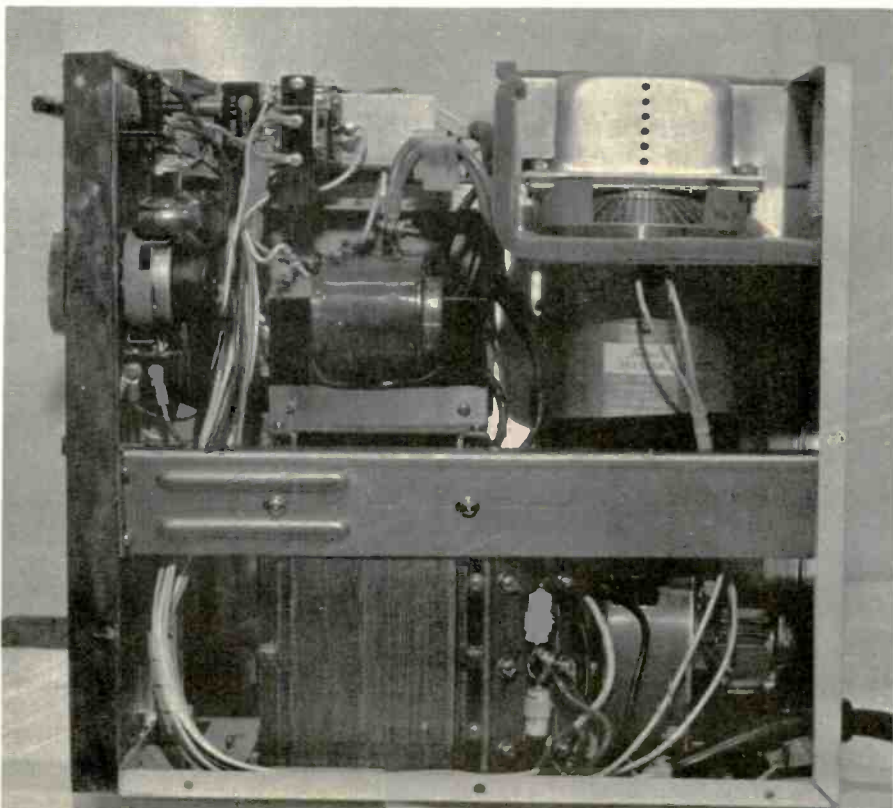
- Open relay coil (RL1).
- Thermo-cutout is open. If it opens below 220°F, it is defective. If it opens at a higher temperature, the magnetron cooling system (M1) is not working properly.

Blower and oven lamps work nor-



Top view of oven—magnetron is located at lower right corner, covered by wave guide. Stirrer motor (M2) is located near center, between wave guide and high-voltage capacitor (C3). Courtesy of Sharp Electronics Corp.

Right side of oven—blower motor (M1) is shown at lower right hand corner, to its left is the high-voltage transformer (T1). The heater transformer (T2) rests on top of the other transformer. Courtesy of Sharp Electronics Corp.



mally, but oven does not work when cook switch is depressed (stirrer does not work either):

- Defective switches SW3, SW4 or SW5.

Blower, oven lamps and stirrer function normally, but oven does not work when cook switch is depressed:

- Open relay coil (RL2).

Both stirrer and timer function normally, the cook relay works, but the oven will not heat (cook indicator lamp not lit):

- Defective door switch (SW2).
- Defective contact points on relay (RL2).
- Open relay coil (RL3).
- Open transformer (T1) secondary winding.
- Defective diode bank (SR1-8, SR9-16, SR17-24, SR25-32).
- Poor contact at high-voltage capacitor (C3).
- Open transformer (T2) secondary winding or magnetron filament.
- Anode resistor (R2) and lamp (L3) open.

Cook indicator lamp (L3) lights, but oven does not heat:

- Shorted magnetron.
- Transformer (T2) secondary shorted to ground (in this case, the anode current is considerably higher than normal).

Cook indicator lamp very dim, heating is very weak:

- One of the diodes (SR1 through SR32) is defective (in this case the anode current is less than normal).
- Defective magnetron.

When main switch is depressed, the oven works normally, but when the cook switch is depressed, it blows the line fuse or opens the circuit breaker at the electrical junction box:

- Input to capacitor (C3) grounded.
- Shorted transformer (T1) secondary windings.

While cooking, oven lamps suddenly go off and cooking stops:

- Defective blower motor (M1).
- When the magnetron is over heated because of this motor's failure, the thermo-cutout will open.

Cooks food unevenly:

- Defective stirrer motor (M2). It may be stopping or slowing down intermittently, causing erratic displacement of the microwaves emitted.

Cooking does not stop when door is opened (DANGER!!):

☑ Door interlock switches (SW4, SW5) and door safety switch (SW2) are defective.

☑ Both cook relay (RL2) and surge-limit relay (RL3) contacts are fused together at the same time, and the door safety switch is defective.

Conditions such as those just noted are highly improbable, as all three switches have to be defective at the same time, or both relays and the safety switch must be defective in order to produce this extremely dangerous condition. But, such happenings are not impossible!!

USE CAUTION

Never cook frozen foods in a microwave oven. Why? In cooking a frozen turkey (for example), the center will become cooked first and build up internal pressures, possibly causing it to explode!

Never place a metal container in the oven as it will cause an arcing condition that can eventually damage the magnetron.

Some microwave ovens are equipped with a glass door and others are built with a perforated metal panel in the door. The small perforated holes are of a specific size so that the microwaves cannot penetrate through these openings. However, should a child stick a straight pin or other metal object through the small holes, this pin or object will act as a receiving antenna! The microwaves will then travel through this object to the outside of the oven door and may harm anyone within its range!!

This is one of the reasons why an oven of this type should be inaccessible to children. A child can place a pin through the door without the mother's knowledge, until she turns on the oven. Or, should a child curiously stick a pin through these holes while the oven is in operation, this child could receive very serious or even fatal burns. As a preventive measure, especially with children in the family, this oven door should always be safety checked before the oven is put into operation.

If you should sell microwave ovens, this precaution should be mentioned to the purchaser, since most consumer instruction books

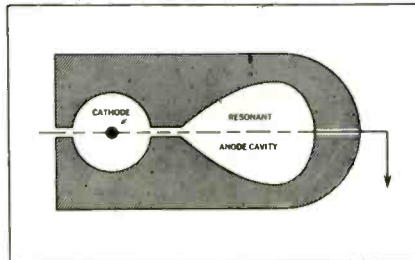
supplied with such products do not even mention this hazard!

THE MAGNETRON

The M4545A/B-type magnetron used in many household microwave ovens is fundamentally a diode with cylindrical electrodes placed in a uniform magnetic field with the lines of magnetic force parallel to the axis of the elements. It consists of a cathode and resonant anode cavity. Consequently, a magnetron tube of this type does not require tuned tank circuits, as would be found in a high-power UHF transmitter.



M4545A Magnetron Tube (note cooling fins).
Courtesy of Sharp Electronics Corp.



Exploded View of Magnetron

Split-anode magnetrons are constructed with a cavity resonator built into the tube structure. The assembly is a solid block of copper, which assists in heat dissipation. At extremely high frequencies, its operation is improved by subdividing the anode structure into 4 to 16 or more segments—the resonant cavities for each anode being coupled to the common cathode region by slots of critical dimensions.

mitter. Operating at $2450\text{MHz} \pm 50\text{MHz}$, this frequency is determined primarily by the tube dimensions and by the electric and magnetic field intensities.

The intensity of the magnetic field is electronically adjusted so that, under static conditions, electrons leaving the cathode move in curved paths, which just fail to reach the anode. All electrons are therefore (in theory) deflected back to the cathode, and there is no anode current.

To best define the magnetron, it is, in reality, a vacuum tube rectifier in which the flow of ions from the heated cathode to the anode is controlled by a magnetic field that is externally applied. The ions run perpendicular to the electric field by which they are propelled, producing very short radio waves as they graze the resonant cavity.

It is not possible to check the magnetron tube for emission or defects unless your shop is equipped with special testing instruments. However, this is not feasible for many shops due to the high cost of these instruments. The most reliable method of determining whether you have a defective magnetron is by checking for proper bias and filament voltages. If these voltages range within the manufacturer's specifications and the oven tends to cook too slowly or not cook at all, then the magnetron is defective. These are the two "dead giveaways" in determining whether a magnetron should be replaced or not.

If replacement should be necessary, four hex nuts must be removed from the mounting plate that is located at the top

inside of the magnetron oven. The tube is then gently lifted from the top of the oven (after the body enclosure has been removed). The tube is fitted in a vertical position, near top center of oven with anode facing downward. The overall length of the magnetron is about 6 in. ■

Magnetron Characteristics

Type	M4545A
Operating frequency	2450MHz ($\pm 50\text{MHz}$)
Magnetic field	Permanent magnet
Cooling method	Forced air cooling
Maximum Ratings	
Heater voltage	3.2v ac
Anode voltage	4.5kv
Anode Current	340ma
Warm-up Time	5 to 8 sec
Heater current	15a
Power output	725w

TEST INSTRUMENT REPORT

B & K Model 179 Solid-State FET - VOM

by Phillip Dahlen

A handy instrument for both the shop and the field

■ For many electronic technicians there is time available for servicing consumer electronic products (where there is money to be made), but little time to keep their own test instruments in good operating condition. Probably one of the worst offenses falls in the area of test instrument battery replacement.

One small FET-VOM, which is light and compact enough for easy use in the field, helps overcome the possible embarrassment of a "dead" meter by offering the option of powering it either from internal batteries or the nearest wall outlet.

The instrument's long list of manufacturer specifications include those given at the right:



B & K
Model 179
Solid-State
FET-VOM. For
more details
circle 900 on
Reader Service
Card.

Power Switch

ON/OFF/BATTERY TEST

Function Switch

Positive DC Volts, Negative DC Volts, AC Volts, DC Current, AC Current and Resistance.

Range Switch

DC Voltage:

0 to 0.3/1.0/3.0/10/30/100/300/1000v

With a 10M input resistance, $\pm 3\%$ full-scale accuracy, and 1kv dc maximum overvoltage at the 0.3v scale.

DC Current:

0 to 30 μ a/300 μ a/1.0ma/3.0ma/10ma/30ma/100ma/300ma

With a 300mv terminal voltage drop, and $\pm 3\%$ full-scale accuracy.

AC Voltage:

0 to 0.3/1.0/3.0/10/30/100/300/1000v rms

0 to 0.84/2.8/8.4/28/84/280/840/2800v p-p

-25.5dBm to +62dBm (0dBm = 1mw across 600 Ω)

With a 10M input resistance; an input capacitance of approximately 50pf at the 0.3v range, approximately 35pf at other ranges

and approximately 80pf in the test cord; $\pm 4\%$ full-scale

accuracy at 60Hz; and a response of ± 0.5 dB from 25Hz to 1MHz

at the 0.3v ac range, ± 1 dB from 20Hz to 3MHz on the other ranges;

and 600v ac (rms for sine waves) maximum overvoltage on the 0.3v ac scale.

AC Current:

0 to 30 μ a/300 μ a/1.0ma/3.0ma/10ma/30ma/100ma/300ma (rms)

With a 300mv ac terminal voltage drop, and 4% full-scale accuracy at 60Hz.

Resistance:

R \times 1/ \times 100/ \times 1K/ \times 10K/ \times 100K/ \times 1M

With 10 Ω center value on the R \times 1 scale and $\pm 3\%$ of scale length accuracy.

Meter Sensitivity

80 μ a dc

Operating Temperature Range

+ 32° to + 104°F

Dimensions

5 in. W by 7 $\frac{5}{8}$ in. H by 4 $\frac{3}{8}$ in. D (excluding handle)

Weight

3 lb, 8 oz

Accessories

Shielded test lead

Instruction manual

How a Manufacturer Can Help or Hinder the Distribution/Service Dealer

by William Carlson

Nothing happens, we used to say, until a sale is made. Perhaps the most vital part of our business economy is the hunt for sales. We are structured to search and sell almost like an army. Each manufacturer—at home base—supplies the product, the advertising, the promotions, the competitive pricing, the descriptive material and the services to a variety of fire bases—called distributors—which maintain reasonable control over their areas. The distributor has established his base with his service, the quality of his product lines, the honesty of his pricing, and the selection of his products. And beyond the fire base, there are squads of electronic service dealers . . . the real hunters . . . whose personal technical expertise actually makes the final sale. Like an army . . . and often just as loused up.

■ We at Cornell-Dubilier Electronics can be honestly critical of the shortcomings of manufacturers. We have been one for a long time (some 60 years). In general, the manufacturer has failed to simplify his product line for the “after market,” communicates to his distributor spasmodically and inconsistently, is light-handed with delivery promises, unconcerned with the financial burden he may place on his distributors by loading them with slow movers, and, in general, makes the big mistake of considering the sale to his distributor his final act . . . the end of the sale.

I cannot think of any manufacturer who is guilty of the above on all counts. Maybe some of you can. But we are all, from time to time, in part responsible for these offenses. It is an imperfect world.

If nothing happens until a sale is made, nothing happens until we start talking. Communications is vi-



William Carlson just recently became director of the Marketing Communications Dept., which is responsible for all advertising, sales promotion, publicity, cataloging, public relations and internal communications for all divisions of Federal Pacific Electric. These are: Cornell-Dubilier Electronics Div., Low Voltage Distribution Systems Div., Power Equipment Systems Div., Environmental Conditioning Systems Div. and Circuit Protective Systems Div. For the past seven years Mr. Carlson was manager of Advertising and Sales Promotion for Cornell-Dubilier Electronics. Prior to that, he was for three years advertising manager for General Instrument, and for 10 years with the Semi-conductor Div. of Raytheon.

tal to the chain reaction that keeps us all in bread. There is a difference between communications and direction. All the written policies in the world will not correct the misunderstandings in the world. Communications is a dialog. The helpful company communicates. When simplifying a product line, you do not do the job by studying plant profit and loss. You do it by finding out what is actually in demand and what selection will make the service dealer's job easier and the distributor's inventory investment less. This is done by asking . . . by sharing the problem . . . and talking.

When producing literature, it is important to make it material that will be useful to the distributor, for his customers, and for the dealer's customers. When introducing a new product, or redesigning one, the manufacturer must ask . . . is the size right? Will the color help you sell it? What can be done to help you sell it?

Pricing, New Products, Promotions, Advertising, Sales Training, Publicity, Technical Bulletins, Promotional Literature, Cross-Reference Material — all these standard facilities, which are the responsibility of a manufacturer to supply—will not, alone, do the job. An example:

The logical replacement of an electronic device is based on the actual characteristics of the replaced part, with its natural tolerances, and not on an arbitrary part number stamped on the component, and referred to as “exact.” Thousands of part numbers exist for hundreds of applications. To be a profit-oriented replacement service, the distributor/dealer finds a way to avoid impossible stocking requirements and unnecessary delivery delays—carefully selecting the functionally appropriate replacement. Manufacturers, in general, have been remiss in ignoring this reality, and have found it convenient to offer a large variety of part numbers that are off-shoots from the many engineering drawings of consumer product manufacturers. It is logical for the mass producer to specify precisely when ordering hundreds of thousands of a specific device . . .

continued on page 75



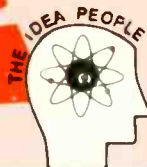
SM152 .. Only Complete Sweep and Marker Generator

Here is why:

- Sweeps all VHF channels
- Sweeps all UHF channels
- Sweeps Chroma Bandpass through IF amplifiers or direct.
- Sweeps FM, IF and complete band of RF
- Covers 20 MHz older sets . . . also includes new imports.
- Eight crystal controlled markers for accurate IF and chroma marking with the push of a button.
- VHF channel markers on both video and sound carriers on four VHF channels.
- Base line zero reference as shown on all manufacturers alignment instructions.

IN STOCK AT YOUR LOCAL PARTS DISTRIBUTOR ONLY \$450.00

USERS SAY YES TO SENCORE

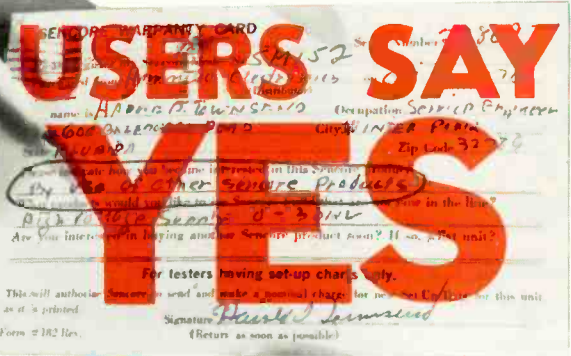


YOU, too, will say YES if you will just try the SM152

SENCORE

3200 SENCORE DRIVE, SIOUX FALLS, SOUTH DAKOTA 57107

... for more details circle 130 on Reader Service Card



TO THE SM152

Yes, yes, yes . . . they all say yes after using the marvelous SM152 sweep and marker generator.

See how the typical user says yes on his warranty card after he has had a chance to use the SM152.

Arthur F. Powers
Arts TV Service
Covington, Ky.

Can't be beat

Roger Hatcher
Electrical Engineer
Columbus, Georgia

Well built equipment

Walker Electronics
Radio TV Repair
Windsor, Colorado

Our shop is now almost all Sencore equipment

Robert Gibson
TV and Radio Repair
Lubbock, Texas

Because Sencore is the best always

David Zeinert
TV Repair
Wittenber, Wisc.

All my equipment is Sencore

NEW AND ONLY FROM EICO—THE INDUSTRY'S LOWEST-PRICED PROFESSIONAL FET-TVM.

- ADVANCED SOLID STATE DESIGN
- BATTERY-POWERED

New Model 239
\$39.95
KIT
\$59.95 Wired



Use the new 239 on your bench or in the field. Checks semiconductor and vacuum tube circuits. 11 Megohm DC input impedance. Reads AC rms and DC voltages in seven 10db steps from 1 to 1000 volts on large 4½" meter. Measures and reads peak-to-peak AC to 2800 volts. Check resistance from 0.2Ω to 1000 MΩ on seven ranges. Includes exclusive time-saving Uniprobe.

2 NEW DE-LUXE FET-TVM's

Includes all purpose DC/AC ohms Uniprobe.



EICO 240 Solid-State FET-TVM. \$59.95 kit, \$79.95 wired. AC or battery operated. 7 ranges each + and - DC volts, peak-to-peak AC volts, ohms. 10 turn zero adjust pot. 4-1/2" 200 μA meter. response to 2 MHz (to 250 MHz with optional r-f probe).

EICO 242 Solid-State FET-TVOM. \$69.95 kit, \$94.50 wired. As 240 plus 7 ranges each AC/DC milliammeter, 1 ma to 1A: very low voltage ohmmeter. 10 turn ohms and zero adjust pots. Large 6-1/2", 200 μA meter.

Write for '71 catalog of 200 EICO Top Buys in test equipment, stereo, color organs, science project kits, environmental lighting.



EICO, 283 Malta St., Brooklyn, N.Y. 11207. (212) 949-1100.

COLORFAX

The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

MAGNAVOX

Remote Receiver Model 704058—Station Skipping

Adjustment of the horizontal hold, remote sensitivity and high voltage are all important to proper operation of the remote receiver and in some cases misadjustment can result in channel skipping. In such cases the following checks are suggested:

- Check the horizontal hold to insure that the horizontal sync locks-in on all stations. Note: If the horizontal oscillator is running off frequency due to a change in value of resistor R533, this can cause channel skipping. Check resistor R533 (174K, 5%, ½w) and if necessary replace it with a Magnavox part No. 230190-1745.
- Check the setting of the search sensitivity control and if the control is set too low this can cause skipping.
- Check the high voltage and adjust the High-Voltage control as necessary to provide 24.5kv as outlined in the service manual.

During the normal operation of a TV set having a 704058 remote control receiver, the collector of transistor Q1, the coincidence gate transistor located on the AFT board of the TV chassis, and the base circuit of transistor Q20, the sync gate driver transistor located on the remote receiver chassis, receive their operating voltages from a ±60v pulse supplied from the horizontal output transformer. When the tuner is off-channel, transistor Q1 will be cut off because sync pulses are not present to bias it into conduction. During this time the voltage at the base of transistor Q20 is sufficient to cause it to saturate. When a station is tuned in, the sync pulses provide the saturation bias for transistor Q1. When transistor Q1 saturates, the forward bias voltage to transistor Q20 is reduced to below cut-off.

If the high voltage adjustment is set to increase the high voltage appreciably above its normal value, the loading on the horizontal output circuit will be reduced and the amplitude of the pulse voltages in the horizontal output circuit will increase. This increase in pulse voltage can be sufficient to keep the forward bias of transistor Q20 from being reduced to cut-off value, resulting in the remote receiver search circuit not recognizing that a station has been located.

If you encounter a problem of "station skipping" and all other conditions, including the adjustment of the AGC, Horizontal Hold and Remote Sensitivity controls seem normal, check the value of the high voltage and readjust as necessary.

Chassis T936—High Voltage Adjustment

The high voltage adjustment on this chassis is located directly behind the vertical height control and is adjustable by inserting a screwdriver through the hollow shaft of the height control. Although these two adjustments are concentric, the controls are not physically connected and there is a narrow space between them. In compliance with current safety standards that the high voltage adjustment be made inaccessible to the customer, a fishpaper barrier has been installed in the space between the two controls in current production. Therefore, to adjust high voltage in instruments using this chassis, the back must be removed, and

continued on page 61

... for more details circle 109 on Reader Service Card



Larry Steckler
Editor
Radio-Electronics



Wayne C. Leckey (Top)
Home and Shop Editor
Popular Mechanics



Jim Hall
Designer of the
Chaparral 2J, world's
most advanced racing car

Match wits with the experts and win a \$1000 shopping spree.

Three top pros challenge you to come up with an imaginative use for General Electric Silicone Seal or Silicone Lubricant. Something they may not have thought of.

Using the seal, electronics expert Larry Steckler repaired a speaker cone, and sealed an antenna lead-in feedthrough and outdoor antenna terminals. With the lube, he sprayed telescoping auto and TV antennas, a record changer mechanism and slide, and an antenna rotator.

With the sealant, home-and-shop expert Wayne C. Leckey dabbed rubber "feet" onto a trinket chest, sealed a rain gutter and caulked a bathtub. With the lube, he sprayed a fishing reel, some stuck drawers and all of his tools.

On his Chaparral 2J, Jim Hall used Silicone Seal to make formed-in-place gaskets, to seal all electrical connections, and as an adhesive to hold components to the body. Then he spray-lubed the throttle linkage, suspension ball joints, wheel lugs and battery terminals.

Now here's what you can do: send in another use for either product, different from those mentioned above, and enter our sweepstakes. (To win, all you must do is fill in your name and address and the name and address of the store where you saw GE Silicone Seal and GE Silicone Lubricant on display.)

Grand Prize: \$1000 worth of anything from your favorite store carrying GE Silicone Seal and GE Silicone Lubricant. Next 100 prizes: \$25 worth each. Next 1000 prizes: one-year subscriptions (or renewals) to the magazines from which you clip your official entry blank.

GE Silicone Seal: The most reliable adhesive/sealant/insulator/moisture-proofer/instant rubber. Guaranteed for 10 years. Ignores temperatures from -60°F . to 500°F . Won't harden, soften, crack or shrink. Ever. Dab it on, overnight it becomes a strong, flexible, permanent rubber. In white, black, clear and metallic. In 3-oz. tubes and 12-oz. cartridges.

GE Silicone Lubricant: The slipperiest stuff in a can. Longest wearing, strongest moisture resister, best corrosion fighter. Age, water and temperature (-70°F to 400°F) can't hurt it. First lube of its kind that can be painted over. Really works on just about everything, even aluminum. (Not recommended for TV tuners.) In 6-oz. aerosol cans.

OFFICIAL RULES—NO PURCHASE REQUIRED

- (1) On Official Entry Blank or plain piece of 3"x5" paper, print your name, address, zip code and the name and address of your favorite store carrying GE Silicone Seal and GE Silicone Lubricant. Include suggestions for new or different uses for either product, and name of magazine in which you saw this ad.
- (2) Enter often, but mail entries separately to: MATCH WITS, P.O. Box 250, Murray Hill Station, New York, N.Y. 10016. Entries must be postmarked by July 5, 1971 and received by July 12, 1971.
- (3) Winners selected in random drawings by an independent judging organization. Decisions final. All prizes awarded. Only one to a family.
- (4) BONUS PRIZE: If you win the Grand Prize and your entry includes a new or different use, you receive a Bonus Prize of \$100.
- (5) Any resident of the U.S. is eligible except employees and their families of General Electric Company Silicone Products Dept. and its agencies. Void where prohibited. Subject to all federal, state and local laws and regulations.

OFFICIAL ENTRY BLANK

MATCH WITS

P.O. Box 250, Murray Hill Station
New York, N.Y. 10016

Here's what I did with (check one) GE Silicone Seal
or GE Silicone Lubricant:

(attach extra sheet of paper for additional uses)

Name _____

Address _____

City _____

State _____

Zip _____

Name and address of my favorite store carrying GE
Silicone Seal and GE Silicone Lubricant _____



GENERAL  **ELECTRIC**

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Now you can get the little woman something she really needs.

You don't have to spend a cent to get soothing gifts from GTE Sylvania.

Just keep on buying Sylvania receiving tubes. And before you know it you'll pile up enough Certificates to get anything your heart desires.

Take your pick from hundreds of good things: TV and stereo sets, sport coats and jockey shorts, cameras and projectors, golf clubs and fishing gear, rifles and sporting goods, tools and watches.

There's also a lot of stuff like dresses, hand-

bags, hair dryers, teakettles, necklaces and earrings.

Things the little woman can really use. Even if you can't.

Get your copy of the "Profits for Independents" book from your participating GTE Sylvania Distributor. It describes the awards. Remember—GTE Sylvania supplies you: we don't compete with you.

GTE SYLVANIA

continued from page 58

the fishpaper tilted to one side before a screwdriver can be inserted into the high voltage control. You are reminded that this adjustment should be made only while monitoring the anode voltage at the CRT.

GENERAL ELECTRIC

Color TV Chassis C-1—Focus Tracking Network—Arc and Raster Bloom

In the C-1 chassis receivers, arcing in the Focus-Tracking Network Spark Gap on capacitor 7C278 can be caused by problems in any of the following: video amplifier, CRT, HV rectifier, focus and focus tracking (see this month's TEKFA X Schematic No. 1353).

Since the focus-tracking network is in series with the high-voltage rectifier and the focus rectifier, any unusually large current through these circuits will cause a large voltage drop across the focus-tracking resistors and cause the spark gap to arc continuously. This lowers the CRT second anode voltage so that the raster blooms.

Use the following steps, in the sequence given, to determine which circuit is causing the arcing. If the arcing does not stop by applying the first step, replace the CRT socket, etc., so that the set is in operating condition before proceeding to the next step. Follow the same procedure with succeeding steps.

- Disconnect the CRT socket. If the arcing stops, the trouble is caused by wrong CRT bias voltages. This can be confirmed by checking the CRT cathode-to-control-grid voltages. The grids are normally -100 to -150 v with respect to the cathodes. If this voltage should change to -50 v or less, heavy current will flow through the focus-tracking resistors 7R283 and 7R284. Since the video amplifier is dc coupled from the video detector to the CRT, incorrect CRT bias voltages could be caused by any of the following: plate-to-cathode short in tube V5a; V5a cathode-to-chassis short; shorted capacitor 4C179; shorted transistor Q304; shorted transistor Q301; open resistor 3R169.
- Remove the HV rectifier tube, V13, and position the plate cap so that there is no danger of an arc from the cap to chassis ground. If the spark gap arcing stops with the rectifier tube out, check the rectifier tube, its filament winding on 7T252 and the CRT.
- Disconnect 7Y256 Focus Rectifier cathode from the focus circuit. If this stops the arcing, check the focus rectifier and the focus circuit components 7C279, 7T263, 7R281 and 7R286.
- Check Focus Tracking resistors 7R283 and 7R284. This can be most easily done by measuring the resistance between the focus rectifier anode and the plate cap of the horizontal output tube, V10. The resistance should be 860K.
- Replace the spark gap capacitor.

MOVING?

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

DEALER INVENTORY PACKAGE OF COLOR TV CONTROLS

ALMOST ALL REQUIREMENTS OF 2-4 WATT WIREWOUND CONTROLS



ASK YOUR DISTRIBUTOR FOR THIS TIME SAVING PACKAGE

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WORKMAN Electronic
P.O. BOX 3828 SARASOTA, FLORIDA 33578 PRODUCTS, INC.

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AUDIO - COLOR
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TRUE TRIGGERED SWEEP OSCILLOSCOPE/VECTORSCOPE

MODEL TO-50

- DC to 10 mhz frequency response
- .02 volt sensitivity
- Calibrated vertical attenuator
- Calibrated time base
- Supplied with combination direct/locap probe
- 5 X magnifier
- Automatic triggering mode
- 5" flat face tube edge-lit graticule



One Year Warranty \$ **339.50**
All American Made



See your distributor or write Dept. ET-5.
LECTROTECH, INC.
4529 N. Kedzie Ave., Chicago, Illinois 60625

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TECHNICAL DIGEST

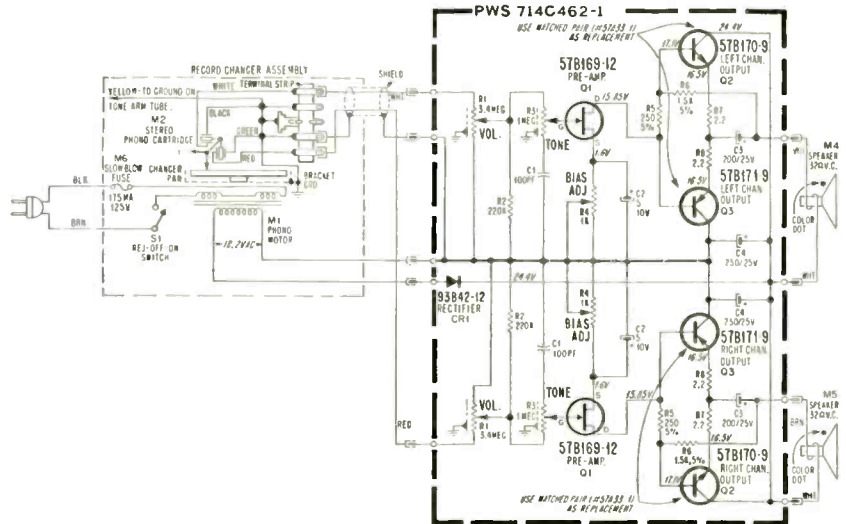
The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

ADMIRAL

Amplifier Chassis 2J2/4J2—Circuit Description

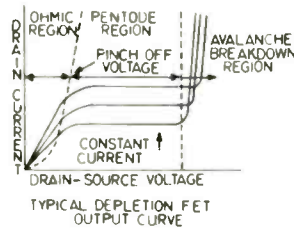
No stabilizing diodes or thermistors are said to be required to protect the complimentary symmetry output transistors incorporated in this phonograph amplifier. It is said to be protected by the characteristic constant-current circuit design of the FET bias-resistor R4, the bias adjustment for the FET source, is correctly set for a 5ma idling current through the FET and resistor R5. The same current, plus a few microamps of base current, flows through resistor R6 and the 32Ω speaker back to B+. Resistors R5 and R6 and the speaker also form the forward biasing divider network for output transistors Q2 and Q3.

The 5ma current from the FET through the biasing network is much greater than the base current of the output transistors and even if the output transistors heat up with a resulting decrease in their base current, there would not be any appreciable change in the output transistor base



bias voltage. The stable base bias voltage prevents thermal problems from occurring. Because of the negative temperature characteristic of the N channel FET, any chassis temperature increase will automatically reduce the forward bias of the output transistors, stabilizing the amplifier by reducing the base and collector currents.

Another advantage of the new circuit design is that the drain current of the FET is essentially constant for all practical variations of line and power-supply voltages. Therefore, little dc filtering is required for the B+ supply. With the correct bias setting, noise and hum components in the power source are not readily noticeable in the speaker output.



Besides regulating the applied current, the FET matches the circuit's impedance with the high impedance of the phonograph's low-capacity cartridge.

Why pay an answering service when you can own your own?

Dictaphone has a machine to make sure you never lose another cent through a missed phone call or a garbled message. In fact, we have a whole line of them.

They're called Ansafones. You can buy one outright or possibly lease it for about what you're paying your answering service now. And it works for you 24 hrs. a day, 7 days a week.

For a free brochure describing how much an Ansafone can help you, mail this coupon now.

Dictaphone

Box A24, 120 Old Post Road, Rye, New York 10580

Please send me full details of the Ansafone line.

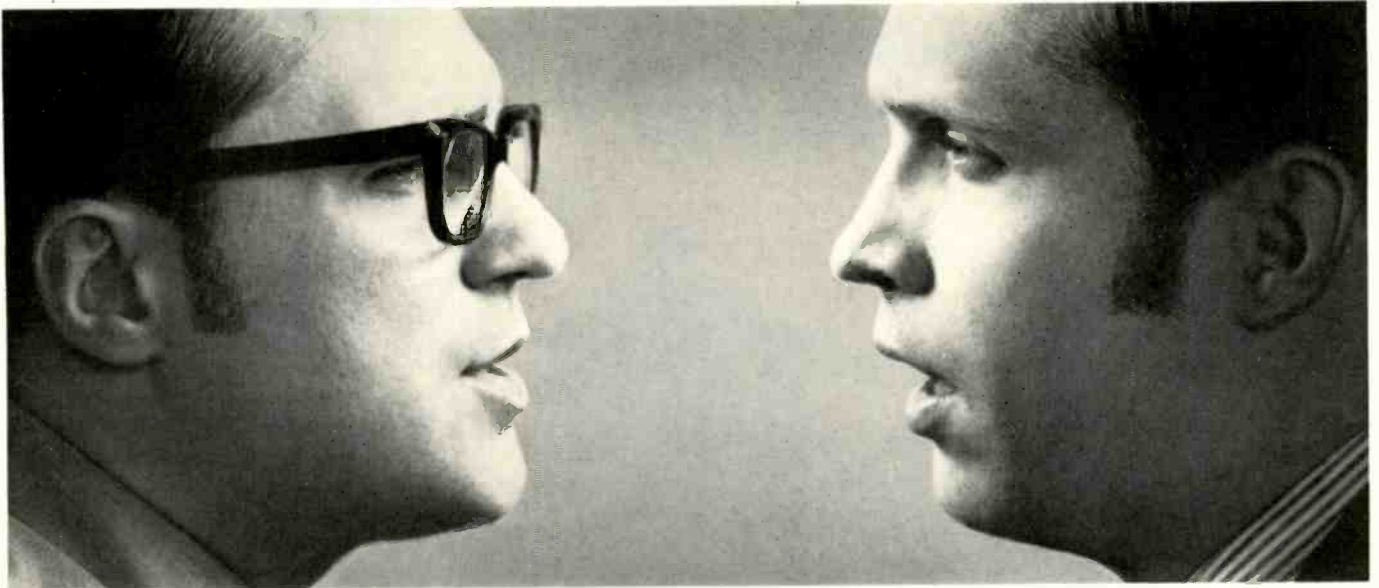
Name _____
 Company _____ Phone _____
 Address _____
 City _____ State _____ Zip Code _____

Ansafone and Dictaphone are registered trademarks of Dictaphone Corp.
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Comments from our readers are always welcome.

Address your letters to:

Phillip Dahlen, Editor
 Electronic Technician/Dealer
 1 East First Street
 Duluth, Minnesota 55802



Why do you always use RCA SK Replacement Devices?

Because SK's are specifically designed and engineered for replacement use in home-entertainment equipment. RCA doesn't make SK types unless they're needed in the field and serve the professional.

Will I need a large inventory?

Not at all. Only 67 types cover a broad range of replacements in TV, hi-fi, and other entertainment equipment. It's the shortest line of product with the broadest range of replacement applications. That's just one of the reasons I like it.

What's another reason?

Quality — it's assured! SK's are tested with the finest dynamic testing equipment, operated by the same personnel who test other RCA power, signal, and IC devices. They're even tested again at the factory warehouse before shipment.

Are you saying RCA is the only source for reliable solid-state replacements?

No. But SK's are top quality, and the SK Replacement Guide is a truly reliable source for cross-reference information. RCA only cross references types where there is engineering assurance that the SK will do the job as well as, or better than, the original.

Seriously, is the SK Replacement Guide that great?

Better! It includes technical information on the line, plus a "Quick Selection Chart" which is unique in the industry. Now I can choose the proper SK replacement for almost every type made.

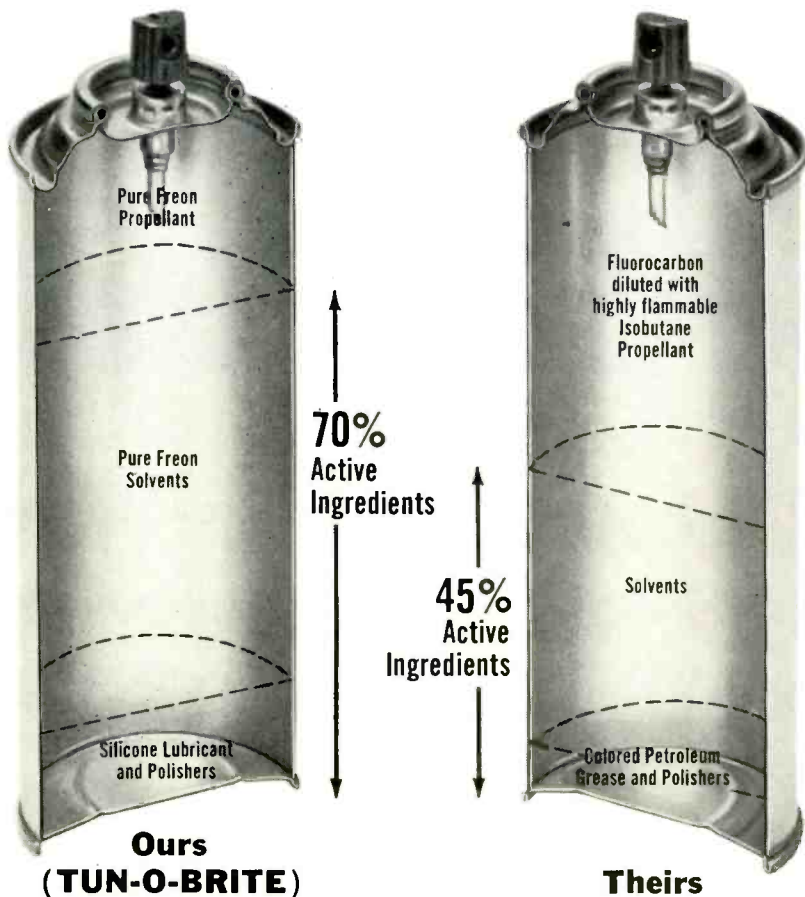
I'm sold! How can I go wrong with RCA SK's?

You can't. No one can!

RCA

RCA | Electronic Components | Harrison, N.J. 07029

The inside story of Tuner Sprays



**Ours
(TUN-O-BRITE)**

Theirs

Ever wonder, with all the brands and conflicting claims, is there a difference?

All tuner sprays contain active ingredients. To clean. Lubricate. Polish. Quantity and kind of ingredients are what make the difference.

What's so different about TUN-O-BRITE? Chemtronics uses only special blends of Freon*. The very best cleaning solvent, and at the same time, one of the most efficient propellants for aerosols. Non-flammable too. A little goes a long way. And TUN-O-BRITE contains more of it.

No wonder servicemen find they **double the number** of tuners they clean with TUN-O-BRITE.

What about the lubricant? Chemtronics uses only non-evaporating silicones. Stable. Also non-flammable. Last longer.

For polishing ingredients, Chemtronics formulated a microscopic, hollow-core particle. Like a bubble it disintegrates after the initial wiping action of the tuner. Polishes without wearing away precious metal plating.

Prove it to yourself. Spray TUN-O-BRITE on a paper and rub it. Feel the initial grittiness? Now rub again. Abrasiveness disappears. This safe polishing action is unique with TUN-O-BRITE.

There's no mystery to a good tuner spray. How do you tell if quality ingredients or low-grade substitutes are being used?

Read the label. Does it say "non-flammable"? It should. Are there directions for a clogged nozzle? If a lubricant will dry and cake in the nozzle, think what it will do on your contacts. Try the "abrasion test."

Or, to be sure buy TUN-O-BRITE.

CHEMTRONICS INC.

1260 Ralph Avenue, Brooklyn, New York 11236

*Trade name of E. I. DuPont

See us at NEW SHOW—Booth A-129

... for more details circle 106 on Reader Service Card

NEW SHOW...

continued from page 32

Kay-Townes Antenna Co. 720

A complete line of MATV equipment will be exhibited, including distribution amplifiers, antenna-mounted booster, high-gain tandem amplifier boosters, wall tap-offs, drop taps, splitters, couplers, FM traps and other related equipment.

Leader Instruments 721

Exhibiting at booth No. D-114 and D-116, this manufacturer will display its new Model LSW-330 Sweep/Marker Generator for circuit alignment of chroma, sound and video IF's. It is said to also feature a 10.7MHz sweep for use with FM receiver IF circuits, plus two TV RF channels (4 and 10). In addition to this new generator, the company will be displaying its new line of scopes.

Lectrotech, Inc. 722

They will be displaying a new sweep marker generator, Model SMG-39. This instrument is designed to provide intensity markers (using the scope Z axis to modify the brightness of the characteristic curve at spots corresponding to the marker frequency)—horizontal or vertical pulse-type markers also being available from the instrument when wanted.

Mallory Distributor Products Co. 723

In booth No. C-101 and C-103 will be this company's line of new products such as the cassette recorders, recording tapes, professional and standard cassette tapes, intrusion alarms and accessories, and aluminum electrolytic capacitors—type TCG.

Midland Communications Co. 724

An automatic high/low police-band scanner and a new model CB 23 channel unit containing a two-channel scanner represent a few examples of the company's full line of consumer goods that will be displayed in booths B-119 through B-125 and C-118 through C-124 at the show.

Oxford Speaker Co. 725

Having confirmed space in one of the conference suites, they plan on having on display a representative group of speakers, paging horns, automotive kits and related accessories.

continued on page 66

Only the best-selling van gives you all these better ideas

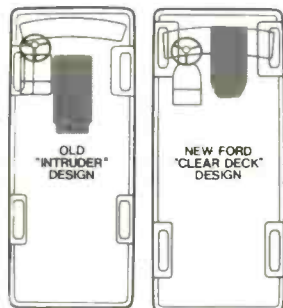


Easy, out-front servicing.

Simply raise the convenient outside hood and your routine service points are

right at hand: radiator, oil level, battery, windshield

washer reservoir, voltage regulator, wiper motor, brake master cylinder. Better ideas make servicing fast, easy.



Engine clear forward.

The engine is moved forward in Ford's clear-deck van—all the way out of the cargo area. Clear floor space behind driver's seat measures over 8½ ft. in Econoline Van . . . over 10 ft. in the Supervan.



Strong, smooth-riding Twin-I-Beam. The independent front suspension that has revolutionized truck riding qualities. Two forged steel I-beam axles give it strength . . . big coil springs give it a smoother ride.



Sales leader for 10 straight years.

Biggest payload of all. Husky construction and high capacity axles allow you to carry a heavier load than any other van. Maximum payload of 4320 lbs. is largest in industry.

Shorter outside, easier to park.

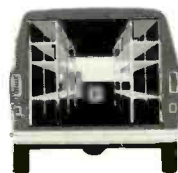
Overall length of Econoline Vans is significantly shorter than other makes. This means easier parking and better maneuverability in city delivery operations



—time saved on every trip.

Wider at top for built-ins.

Body sides are more vertical, wider apart at top than other vans. So built-in units fit better and leave more aisle. Modular units, designed to fit and work together allow you to custom design almost any interior you need. Job packages, such as insulated florist's van, are also available.



Driver's "walk-thru" to rear.

Econoline's forward engine position clears the deck for the driver, too. He can easily step from his seat into the rear load area and exit through side or rear doors.

See your Ford Dealer and see all the better ideas in America's best-selling van—Ford Econoline.



A better idea for safety: Buckle up.

Model	Max. Payload	Max. GVW
E-300	4320 lbs.	8300 lbs.
E-200	1800 lbs.	5400 lbs.
E-100	1120 lbs.	4500 lbs.

FORD ECONOLINE VANS



For more details circle 113 on Reader Service Card

NEW SHOW...

continued from page 64

PACE Inc.

726

In announcing the Sodr-X-Traction System, the manufacturer indicated that it is a portable, self-contained, bench-top unit designed to remove all previously known solder joint configura-

tions as well as those found in the latest designs of micro-electronic equipment.

RCA Electronic Components 727

In booth No. F-115, F-117 and F-119, this manufacturer will be displaying color picture tubes, entertainment receiving tubes, test equipment and semi-conductors.

RCA Parts and Accessories 728

The Permacolor outdoor TV antennas, indoor TV antennas, rotators, antenna systems accessories and exact replacement parts will be displayed in booth No. F-109, F-111 and F-113. Also included will be TV service aids and car tape stereos.

RMS Electronics, Inc. 729

Several models of stereo headphones will be on display at booth No. B-106 and B-108. Also displayed will be a complete section of TV antenna equipment and accessories in peg-hang blister packs.

Rohn Manufacturing Co. 730

Not introducing any specific new product, they will display many items from their line of TV towers, accessories and hardware at booth No. B-107, B-109, C-106 and C-108.

Sencore, Inc. 731

This manufacturer will be displaying the latest in test equipment in booth No. A-110 and A-112. The CG159 Color Generator and the FE160 Field Effect Meter will be among the seven new products introduced.

Simpson Electric Co. 732

This company will be exhibiting at Booth B-110. Among products to be featured will be a new Digital Multimeter Model 460; the new Series 6 of the 260 line; and a new 3 1/2-in. Edgewise Model 3623.

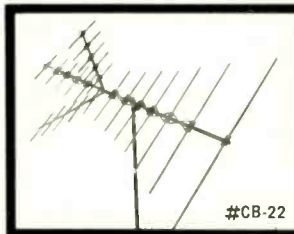
Sonar Radio Corp. 733

Occupying booth No. L-108 the VHF-FM marine transceiver, Model 2308, will be shown. Also included in the display are the VHF-FM marine radio telephone, Model FM-1803, the Model 3601 FM transceiver, Model PS2923 ac power supply and the Model 2101 business radio.

South River Metal Products Co. 734

Occupying two exhibit booths, No. C-110 and C-112, they plan on introducing: New designs in TV/FM antenna mountings and accessories appropriate for areas using telescoping masts and tower installations; new designs in eave mounts and roof mounts; and a complete line of antenna mounting kits, which contain all mountings

DEPENDABLE ANTENNAS AND ACCESSORIES FOR PROFITABLE INSTALLATIONS...



#CB-22

RMS COLOR-BOOSTER UHF/VHF SINGLE DOWN-LEAD ANTENNAS...

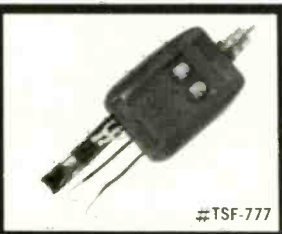
#CB-22: 22 elements, #CB-28: 28 elements, #CB-34: 34 elements. Adds mileage to UHF/VHF TV reception. Features Reynolds Aluminum Colorweld weather-proof Gold finish.



#CR-880

RMS MODEL CR-880 SOLID-STATE UHF CONVERTER...

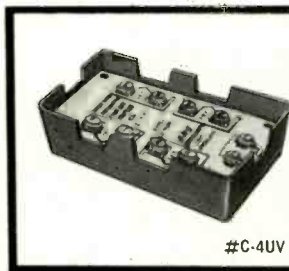
Powerful amplifier and Local/Distant Switch provides 30 db gain! Brings in clearest Color and Black and White UHF reception even in areas where other Converters fail to!



#TSF-777

RMS HAS THE MOST COMPLETE LINE OF UHF/VHF/FM SPLITTERS AND MATCHING TRANSFORMERS

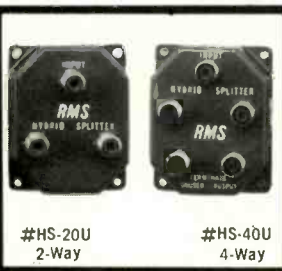
For all multi-set home installations, master antennas, and closed circuit TV systems. All configurations for every requirement.



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RMS UHF/VHF/FM HIGH GAIN 4-SET COUPLER

Couple 4 TV and/or FM Sets to a single antenna with low signal loss—minimum interference between sets. Or couple 2 antennas, (VHF, UHF or FM), to a single down-lead.



#HS-20U
2-Way

#HS-40U
4-Way

UHF/VHF 2-WAY AND 4-WAY HYBRID SPLITTERS

For multi-set home and master antenna installations. Unbeatable specifications. Also top performing UHF/VHF Tap-Offs.



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DEPENDABLE ALL-PLASTIC COLOR-TUBE BRIGHTENERS

Reusable. Simple installation. Plugs in between color tube and color tube socket. #CTB-70 for 70° button base tubes. #CTB-90 for 90° button base picture tubes.

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Consumer Electronics Show—Booth 113—McCormick Place, Chicago, Ill.

... for more details circle 129 on Reader Service Card



and accessories necessary for a TV/FM antenna installation—except for the antenna.

735

Sylvania Electric Products Inc.

Not introducing any specific new product at the show this year, they will concentrate on their broad product lines of TV picture tubes, receiving tubes and ECG replacement semiconductors. These will be displayed in booths B-101 and B-103.

Tech Spray

736

This company will be displaying its product line—chemical tools for the technician—in booth No. G-104.

Telematic

737

At booth No. G-105 and G-106 in addition to their complete line of service aids and replacement parts, the Econo Jig, Model EJ-190, will be demonstrated using a current production color chassis. Also featured will be the CR-400 and CR-450 isolation brighteners and the complete line of color test jig adaptors for color-TV sets.

Triplett Corp.

738

Located in booths A-111 and A-113, the instrument to be introduced will include a 3½-digit VOM for portable or panel mounted use—Model 8035. Also introduced will be the Model 6028 digital VOM and a Model 990 Industrial Maintenance Analyzer.

Utah Electronics

739

The first public showing of their all-new display pack program covers replacement type automotive, public-address and hi-fi speakers. The second major presentation will be a whole new series of bookshelf speaker systems, including models in all the popular sizes and price ranges—called the "Musique Series." These, plus other speaker systems, will be displayed in booth No. C-121 and C-123.

Vaco Products Co.

740

Featured at booth No. C-100 and C-102 will be the new Torque Commander line of miniature, mobile tool sets, with or without the Torque Commander handle. Also included will be other kits from this line as well as dealer displays.

continued on page 70

INTERNATIONAL

frequency meter



- Tests Predetermined Frequencies 25 to 1000 MHz
- Extended Range Covers 950 MHz Band
- Pin Diode Attenuator for Full Range Coverage as Signal Generator
- Measures FM Deviation

FM-2400CH



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The **FM-2400CH** provides an accurate frequency standard for testing and adjustment of mobile transmitters and receivers at predetermined frequencies.

The FM-2400CH with its extended range covers 25 to 1000 MHz. The frequencies can be those of the radio frequency channels of operation and/or the intermediate frequencies of the receiver between 5 MHz and 40 MHz.

Frequency Stability: $\pm .0005\%$ from $+50^\circ$ to $+104^\circ\text{F}$.

Frequency stability with built-in thermometer and temperature corrected charts: $\pm .00025\%$ from $+25^\circ$ to $+125^\circ$ (.000125% special 450 MHz crystals available).

Self-contained in small portable case. Complete solid state circuitry. Rechargeable batteries.

FM-2400CH	
(meter only).....	\$595.00
RF crystals (with temperature correction)	24.00 ea.
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IF crystals.....	catalog price


INTERNATIONAL
CRYSTAL MFG. CO., INC.
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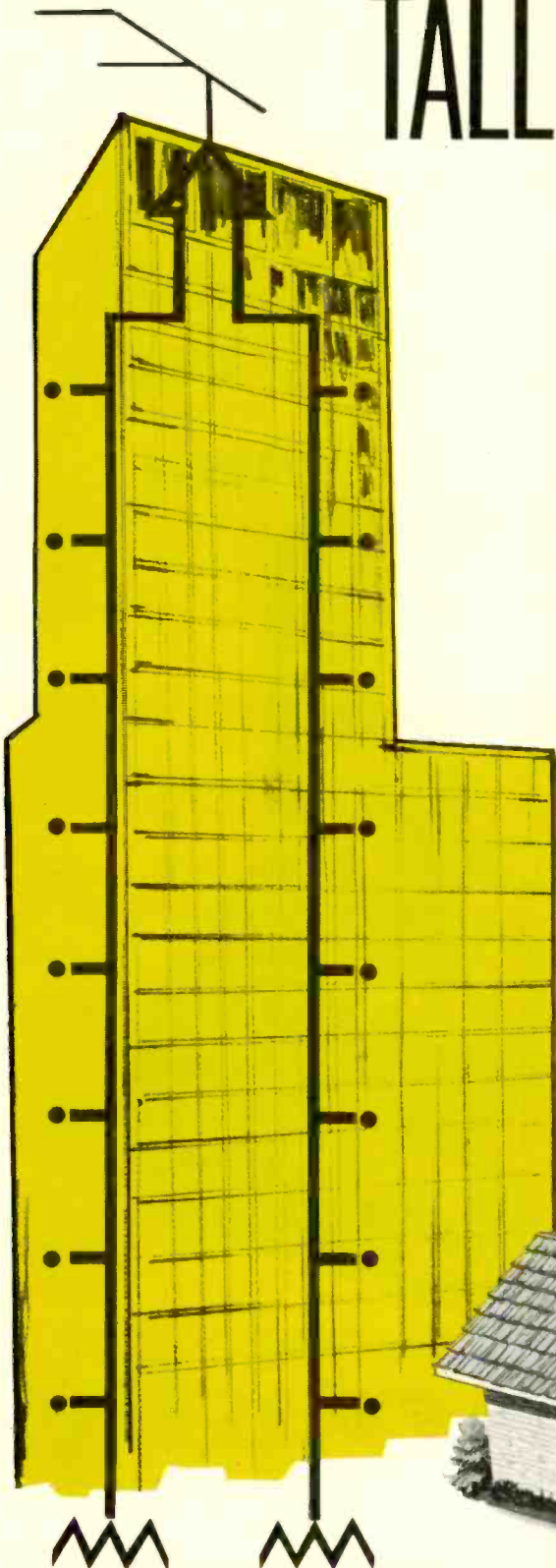
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No matter what you build or where, it pays to build-in Finco MATV. Finco is performance-proved in thousands of installations to deliver the best reception possible ... color, UHF, VHF, and FM/Stereo. Maintenance-free and easily expandable, too.

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If you need more accuracy and resolution than a 2½-digit V-O-M, but don't want to pay the price of 3½-digits ...

Buy Triplet's new 6028



Model
6028
\$275

1. 2¾ DIGITS— Provides high accuracy with resolution to 500 Microvolts.
2. 10 OHMS TO 10 MEGOHMS — 7 Ohms ranges with zero adjust to null lead resistance.
3. LOW CIRCUIT LOADING — Greater measurement accuracy with 10 megohm input resistance for all AC and DC voltage ranges.

Its exclusive 2¾ digit readout lets you read to the nearest "0" or "5" one decimal place beyond the capability of 2½ digit instruments. And at accuracies of $\pm 0.35\%$ of reading $\pm 1/2$ digit on DC voltage ($\pm 0.50\%$ of reading $\pm 1/2$ digit, DC current), AC voltage $\pm 0.50\%$ (current 1.0%) of reading $\pm 1/2$ digit, and resistance to $\pm 0.5\%$ of reading $\pm 1/2$ digit. It also offers (among its 27 ranges) a 10

Ohm range and a front-panel zero adjust to zero out the test-lead resistance. Add to those advantages 100% overrange capability, positive out-of-range and reverse polarity indication, and the familiar single range-switch feature of Triplet's famous analog V-O-M'S . . . so that no retraining is necessary to switch to digital accuracy and readability . . . and you have just a few of the many reasons for

buying Triplet's new Model 6028 Digital V-O-M.

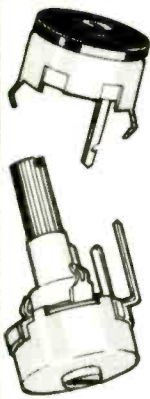
Designed for R&D, production, quality control, maintenance and classroom use, the Model 6028 is priced at \$275. See it at your local Triplet distributor or, for more information or for a free demonstration of all of its great features, call him or your Triplet representative. Triplet Corporation, Bluffton, Ohio 45817.

TRIPLET
BLUFFTON, OHIO 45817

The world's most complete line of V-O-M's
choose the one that's just right for you

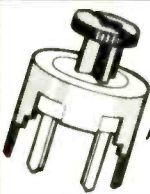
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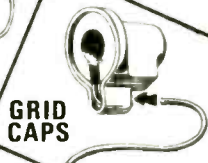
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NEW SHOW ...

continued from page 67

Vikoa, Inc. 741

Occupying booth No. M-100, they will feature a complete line of MATV amplifiers for the UHF and VHF bands. A complete line of wire and cable products will be displayed along with distributor products and associated hardware.

Weller Electric Corp. 742

Exhibiting in booth No. A-102, one of the featured items will be the new vacuum desoldering/resoldering tool, Model DS40. Also introduced at the show will be a new automatic glue gun kit.

Wen Products, Inc. 743

At booth No. A-100 this company will show their Pro-Power line, reportedly featuring insulated, unitized construction.

Workman Electronic Products, Inc. 744

This company will display their line of color TV replacement parts, electronic chemicals, circuit breakers and their new line of color TV controls at booth No. D-107 and E-106. Also included will be imported consumer items for Hi-Fi and stereos.

Xcelite Inc. 745

This manufacturer will be exhibiting in booth No. D-112. They say that, "Xcelite will introduce some tools that will have all the uniqueness, acceptance, and built-in quality that has been the trademark of Xcelite through the years."

Zenith Radio Corp. 746

They plan on exhibiting their line of replacement parts and accessories—including their Chromacolor picture tubes, receiving tubes, blank cassette tapes, antennas, wire, rotors, batteries and exact replacement parts.

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A compact—complete—
circuit analyzer

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INFORMATION

A precision engineered professional quality electronic test instrument. Ideal for field or bench servicing of all types of Communications gear.

CHECKS: sync, sweep, video, audio circuits, high voltage supplies (DC, RF or Pulse), low voltage supplies, coils, capacitors, resistors, tubes, transistors, diodes, transformers, speakers, etc. Will locate trouble to a particular stage, determine defective component and can actually be clamped in circuit to restore circuit operation temporarily in 80% of component or tube defects. Ideal for locating and confirming intermittents.

SPECIFICATIONS:

RF & AF Signal Tracer, RF & AF Signal Injector, AC & DC Voltage Indicator 0/60/550/20,000 DC Polarity Indicator 60/550/20,000 volts, Lo ohms 0-5, Hi ohms 0-500k-20 meg-ohms, Tests Condensers, .00025-12 mfd., Tests Resistors 2 ohms-20 megohms, 2 Capacitance Sub ranges .01-1 & 4-40 mfd., 3 Resistance Sub ranges 50-500 ohms, 5k-25k, 100k-1 meg.

30 DAY MONEY-BACK GUARANTEE

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W A I H X Z

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For best results, clean tuner first with Injectorall #3-24 Spray Cleaner Degreaser; then use Injectorall #699-8 BLUE LUBE



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TEKLAB ...

continued from page 42

When bright scenes are present on the TV screen, the high-voltage current demands increase and the amplitude of the flyback pulse is reduced because of additional flyback-transformer loading. This reduced flyback-pulse amplitude causes capacitor C221 to charge to a lower voltage, making the horizontal-output-tube grid voltage less negative. When this happens, more current flows through the horizontal output tube and tends to bring the high-voltage pulse back to its original amplitude.

Conclusion

After examining the chassis, we concluded that it has a great amount of serviceability within the scope of a marketable piece of merchandise. We also found it to produce a good, stable color picture.

The convergence procedure was simplified by employing the "in-line" gun system (Fig. 9), as in the past. However, it required familiarizing ourselves with a system which is

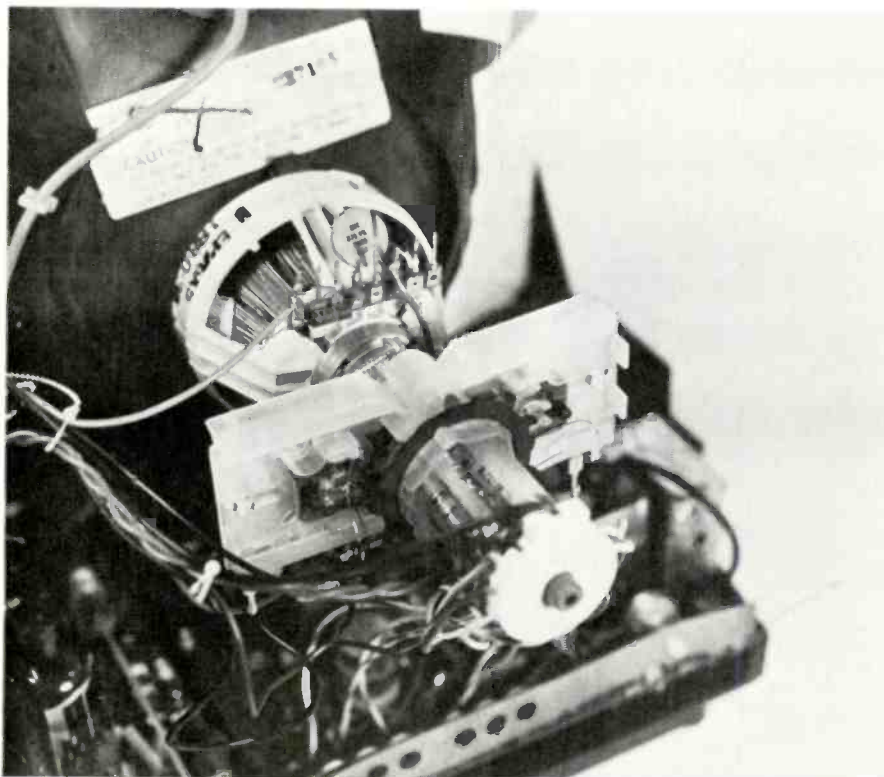
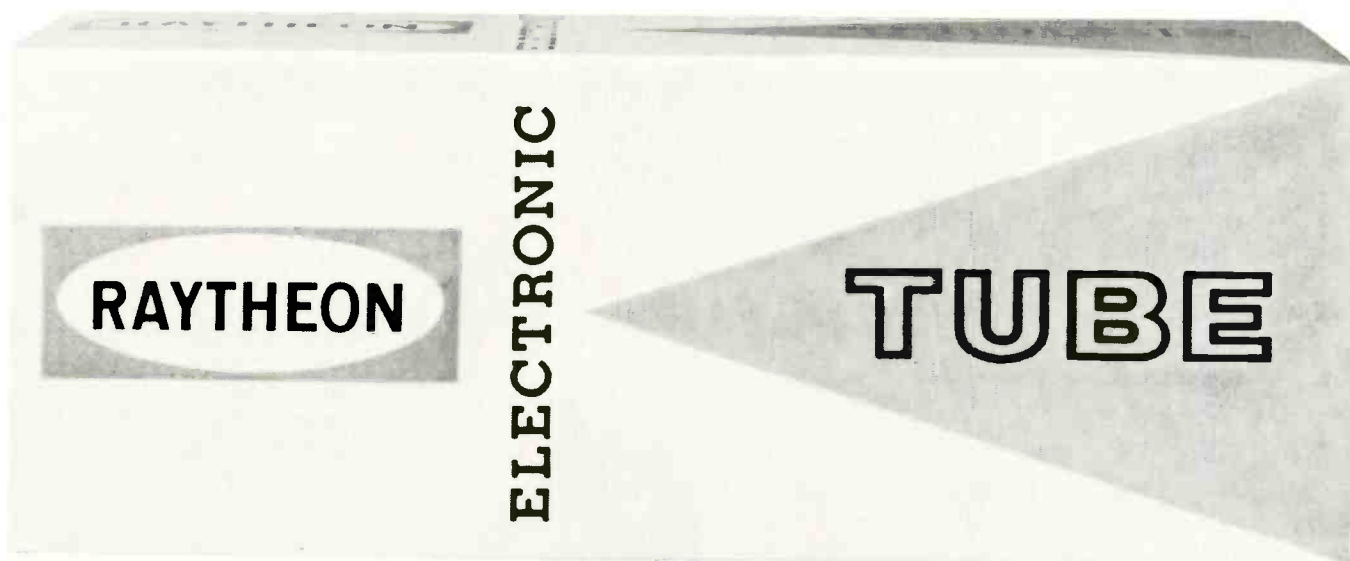


Fig. 9—The picture tube "in-line" gun system is employed to simplify convergence.

quite different from the conventional ones currently on the market.

Before servicing this chassis, it is important to remember that it is a

line connected receiver, and safety precautions should be used by employing a power-line isolation transformer. ■



your silent partner

You and our tubes make a great team. Great because it's a close sales partnership. So close that you, the independent serviceman, are our only outlet.

We don't compete with service trucks. Or captive business. That's helped you make us the largest independent tube supplier in the business.

Together we've come a long way.

You've found it's good business to do business with us.

And because your business is good, ours is.

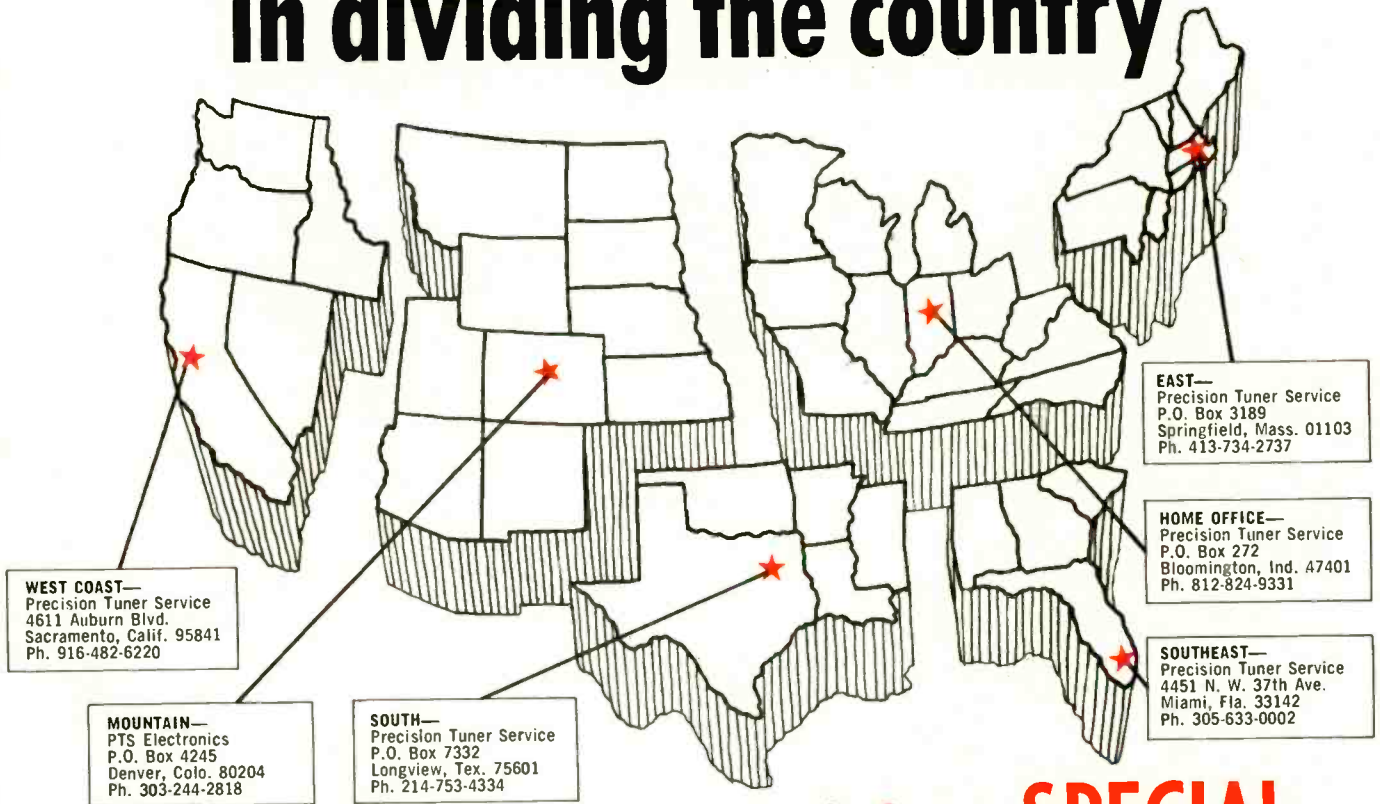
Let's keep it growing together.

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PTS

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Has finally succeeded in dividing the country



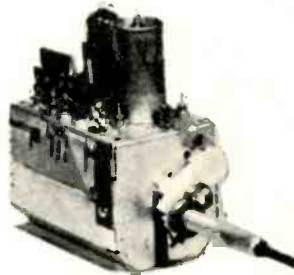
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NEW, NEW, NEW! To be of better service to you, we now make all tuner parts and antenna coils available to you. PTS also has the largest stock of original replacement tuners.

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BOOK REVIEWS

TV TROUBLE DIAGNOSIS MADE EASY by Art Margolis. Published by Tab Books, 256 pages, hardbound \$7.95, paperbound \$4.95.

This book should prove quite helpful for the beginning electronic technician who has had some background in electronics but who has not yet done much servicing. The first chapter of this book contains photographs (in black and white) of virtually every defective color-TV set picture that will be encountered. Along with these pictures, the text tells the reader what portion of the book will explain the symptom shown.

Additional chapters in the book cover such topics as a block diagram analysis of a typical TV receiver, "eyeball" tests, dc voltage testing of tube circuits and solid-state circuits, antenna systems, tuner repair, localizing IF amplifier problems, servicing the video detector and contrast control, troubleshooting AGC and noise gate controls, sync problems before the separator, sync output amplifiers, troubleshooting the ratio detector, sound bar problems, color IF troubleshooting, color killer circuit defects, X and Z demodulators, aligning the color sync, vertical sweep systems, troubleshooting convergence circuits, problems in various portions of the high-voltage system, defective zener diodes in power supplies, the principles of color-TV picture tube operation, and color picture alignment.

The author does not deal with specific TV set circuits. This information would be of little help when dealing with another TV set. Instead, the author describes in detail the principles related to the function of the various tube and transistor circuits normally encountered in a color TV set and how a malfunction of these circuits will produce certain undesirable results.

MONOCHROME RCA TV SERVICE MANUAL by Carl H. Babcock. Published by Tab Books, 176 pages plus a 36-page foldout section, hardbound \$7.95, paperbound \$4.95.

The publisher of this book has printed, or is about to print, a series of manuals covering nearly every brand of TV set that a technician might encounter when servicing. Several of

continued on page 75

New Benchmarks in solid-state test gear



New Heathkit® solid-state 5", 5 MHz scope...\$119.95 (\$179.95 assembled)*

An excellent general purpose bench scope... combining the virtues of top performance, maximum convenience and low cost. All solid-state design is your assurance of long-term reliability under sometimes rough shop conditions. Wide 5 MHz bandwidth, 30 mV/cm sensitivity and 80 nanosecond rise time add up to truly unusual value at this low price. Switch-selected AC or DC coupling adds extra convenience and versatility. Frequency-compensated 3-position attenuator accommodates varying input levels. A separate switch position grounds the input to provide a zero reference line. One megohm FET input minimizes circuit loading. The recurrent, automatic sync type sweep generator provides continuous sweep from 10 Hz to 500 kHz. Front panel external horizontal and sync inputs. One volt P-P output included. The 5" flat-face 5DEP1 CRT gives a brilliant, highly visible trace, even in high light levels. 6x10 cm ruled graticule makes amplitude easy to determine. All supplies are zener-regulated to give the IO-102 excellent display stability. 120/240 VAC wiring options. Put the new Heathkit IO-102 to work for you now. Kit IO-102, 29 lbs. Assembled IO-102, 29 lbs.



Heathkit® solid-state 15 MHz frequency counter \$199.95*

The service instrument you need most but couldn't afford until now. The new Heathkit IB-101 delivers accurate, instant frequency measurement from 1 Hz to over 15 MHz. Computer-type integrated circuitry eliminates blinking readout and provides a rock-stable divider chain that never needs adjustment. Overrange indicator and Hz/kHz switch delivers error-free measurement down to the last Hz... you can do an 8-digit measurement in seconds. The exclusive MOSFET input provides proper triggering over an extremely wide range of input levels without adjustment. Input Z is 1 megohm/20 pF to minimize loading. Goes from kit to counter in about 5 hours, and only an AM radio is required for alignment. Rugged aluminum case with combination handle/tilt stand. BNC cable included. Kit IB-101, 7 lbs.

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MATV ...

continued from page 45

ing a TV-channel output. The modulator can be added to the head end in the same way as a background music converter (Fig. 5).

Sometimes it is desirable to originate CCTV programs away from the head end. Schools, for example, often want the capability of originating in any classroom. This is not difficult if the system uses back-matched taps. The best way to handle this is to use a sub-channel modulator in the classroom and then convert this signal up to an unused TV channel at the head end.

Choosing Cable

Coaxial cable, a very important but often neglected system component, is used to link the entire MATV system together. Two basic cable types are used for MATV work—RG-59 types (about 1/4 in. diameter) and RG-11 types (about 1/2 in. diameter). RG-11 provides lower signal loss but is more expensive and harder to handle. There-

fore, RG-59 type is preferred for all but the largest MATV systems or where coaxial cable must be run outdoors.

Some coaxial cables use a solid dielectric, while others use foam. Since foam dielectrics cause less signal loss, they are generally preferred.

Coaxial cable jackets should be made of non-contaminating polyvinyl.

Cable installation is difficult and time consuming. Therefore, before you start pulling cable, you should check it thoroughly. The four most important aspects of cable performance are:

- Signal loss—typically 14dB per 100 ft.
- Return loss—which indicate the quality of the cable in terms of discontinuities or mismatches.
- Frequency response—some cables attenuate UHF signals severely.
- Shielding—poorly shielded cable can pick up unwanted signals.

You can check shielding visually, simply by cutting away the cable jacket. The denser and more uniform the copper, the better the cable is shielded. It will pay you to pur-

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3 years of constant research and testing have put us way ahead!

NO NOISE has been an innovative force in the development and production of cleaners and lubricants for 25 years. Our technical people, who made us No. 1, were turned loose to create a new line that would out-perform anything on the market. Three years of experimentation and testing developed these 2 new products. Approved by leading service organizations.

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ELECTRONIC CHEMICAL CORP.

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All you need to handle almost any desoldering and resoldering job!

Kit 300K includes the famous Endeco pencil desoldering iron Model 300, six different size tips (.038 to .090) for any job, tip cleaning tool, and metal stand for iron . . . all in a handy lifetime steel storage box. \$19.90 net. Model 300K-3 with a 3-wire cord \$20.90. Also a similar kit for military users. Kit 100K with large Endeco iron (Model 100A) is \$27.40, and 3-wire Kit 100AD-3 \$28.40.

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chase good quality cable and to test every reel yourself before you install it. Nothing is more profit wasting than making service calls on systems with cable troubles.

The MATV business may sound somewhat complex, but designing and installing systems actually takes a lot less know-how than repairing TV sets. What's more, MATV is a lot more profitable. ■

GUEST AUTHOR...

continued from page 56

the cost savings are very real. But it is not logical for a replacement part—purchased by the component, by the dozen or even hundreds—to be so narrowly specified! The cost *loss* is so very real.

There is no way to "Ivory-Tower" the solution to a problem such as this. It can only be resolved by efficient communications between the manufacturer, distributor and service dealer . . . all links of the chain that turns the wheel. ■

BOOK REVIEWS...

continued from page 73

these manuals have been reviewed in past issues of **ELECTRONIC TECHNICIAN/DEALER** and more will be reviewed as space permits.

This manual is said to cover 33 RCA B/W TV set models from 1964 to the present—Chassis KCS136 to KCS178. When checking through the contents page we found direct reference made to the following models: KCS136, 136M, 142, 143, 144, 144B, 149, 151A, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 168, 169, 171, 173, 174, 175, 176, 177 and 178.

Beginning with a section on tuner repair, the manual continues with such subjects as IF repair, video amplifier servicing, AGC and sync troubleshooting, sound circuit repairs, vertical sweep servicing, horizontal sweep repairs, power supply troubleshooting and service notes for nearly every TV set model previously mentioned.

The book is said to be based on factory-issued data and includes field-change modifications to help solve special problems or update existing early-run chassis. We feel that it should prove helpful to electronic technicians that service these receivers.

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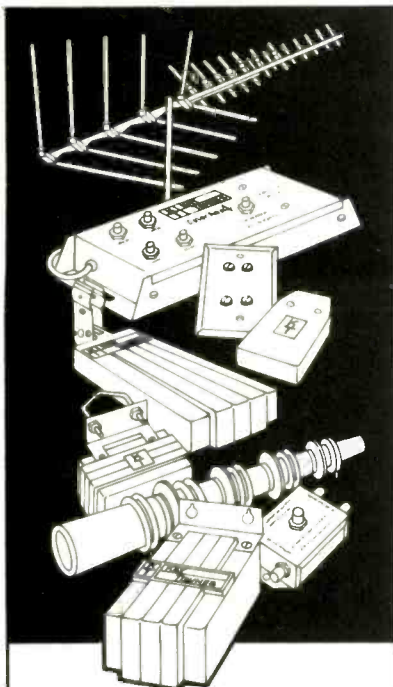
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READERS SERVICE INDEX

ADVERTISER'S INDEX

101	Arrow Fastener Co., Inc.	26
102	B & K Division Dynascan Corp.	24
103	Belden Corp.	33
104	Book Club	34-37
105	Castle TV Tuner Service	2nd Cover
106	Chemtronics Inc.	64
107	Cornell Dubilier Electronics	3rd Cover
108	Dictaphone	62
109	EICO Electronic Instruments Co., Inc.	58
110	Electronic Chemical Corp.	74
111	Enterprise Development Corp.	74
112	Finney Co.	68
113	Ford Marketing Corp.	65
140	Fordham Radio Supply Co., Inc.	76
	General Electric Co.—Tube Div. 28 & 38	
114	General Electric—Silicone Products	59
115	Grantham School of Engineering	76
116	Heath Co.	73
117	Injectorall Electronics Corp.	70
118	International Crystal Mfg. Co.	67
119	Johnson Co., E. F.	74
120	Kay-Townes Antenna Co.	76
121	Lectrotech, Inc.	61
122	Lee Electronic Labs Co.	70
123	Mallory Distributor Products Co.	21
124	Perma Power	75
125	Precision Tuner	72
126	Raytheon Co.	71
	RCA Entertainment Tubes	31
	RCA Picture Tube	4th Cover
127	RCA Sales Corp.	22
	RCA Semiconductor Distributor	63
128	RCA Test Equipment	32
129	RMS Electronics, Inc.	66
130	Sencore, Inc.	57
131	Simpson Electric Co.	27
132	Sprague Products Co.	25
	Sylvania Electric Products	60
133	Telematic Division, UXL Corp.	70
134	Triplet Corp.	69
135	Tuner Service Corp.	19
136	TV Tech Aid	75
137	Workman Electronic Products	70
138	Workman Electronic Products	61
139	Xcelite, Inc.	30

NEW PRODUCTS

700	Advance Systems Div.	30
701	Amperex Electronics	30
702	Arrow Fastener Co.	30
703	Belden Corp.	30
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710	Cinch Manufacturing Co.	30
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712	Cornell-Dubilier Electronics	30
713	Dynascan Corp.	30
714	EICO Electronic Instrument Co.	32
715	GC Electronics	32
716	General Electric Co.	32

717	International Rectifier	32
718	Jerrold Electronics	32
719	JFD Electronics Corp.	32
720	Kay-Townes Antenna Co.	64
721	Leader Instruments	64
722	Lectrotech, Inc.	64
723	Mallory Distributor Products Co.	64
724	Midland Communications Co.	64
725	Oxford Speaker Co.	64
726	PACE Inc.	66
727	RCA Electronic Components	66
728	RCA Parts and Accessories	66
729	RMS Electronics, Inc.	66
730	Rohn Manufacturing Co.	66
731	Sencore, Inc.	66
732	Simpson Electric Co.	66
733	Sonar Radio Corp.	66
734	South River Metal Products Co.	66
735	Sylvania Electric Products Inc.	67
736	Tech Spray	67
737	Telematic	67
738	Triplet Corp.	67
739	Utah Electronics	67
740	Vaco Products Co.	67
741	Vikoa, Inc.	70
742	Weller Electric Corp.	70
743	Wen Products, Inc.	70
744	Workman Electronic Products, Inc.	70
745	Xcelite Inc.	70
746	Zenith Radio Corp.	70

TEST INSTRUMENT

900	B & K's Model 179 Solid-State FET-VOM	55
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