ELECTRONIC TECHNICIAN

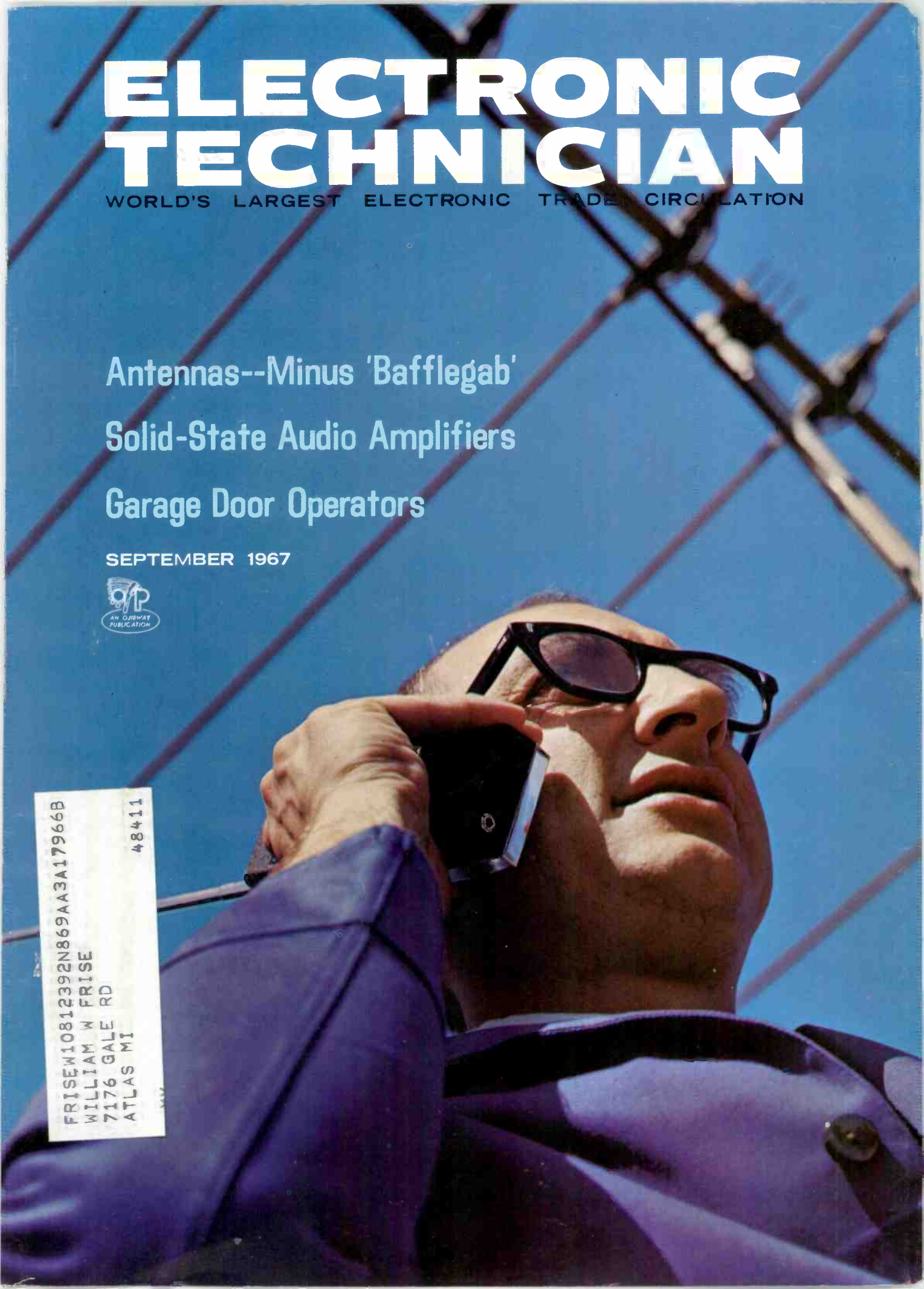
WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

Antennas--Minus 'Bafflegab'

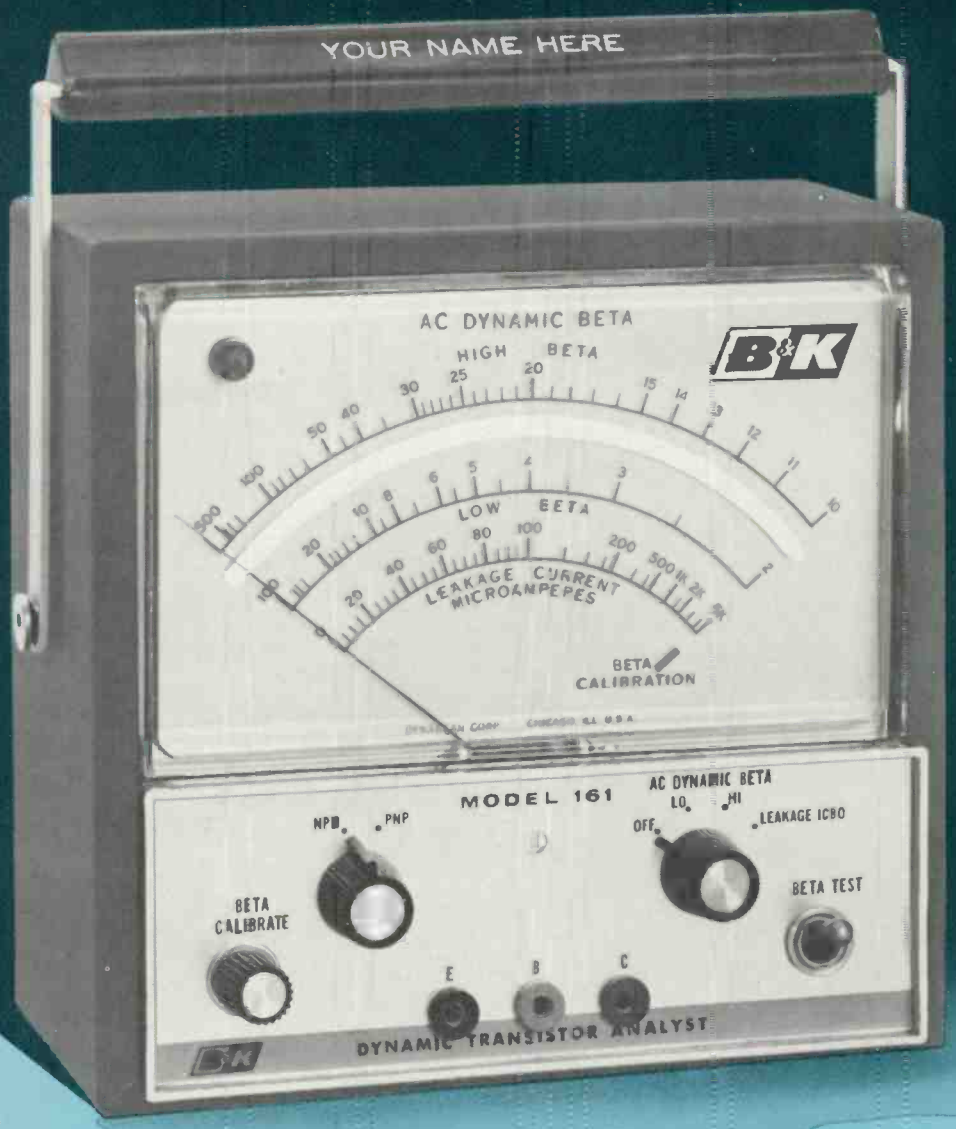
Solid-State Audio Amplifiers

Garage Door Operators

SEPTEMBER 1967



New B&K Dynamic Transistor Analyst



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

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

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

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

B&K Division of Dynascan Corporation
1801 W. Belle Plaine • Chicago, Illinois 60613

B&K

Where Electronic Innovation Is A Way Of Life

. . . for more details circle 101 on postcard

ELECTRONIC TECHNICIAN

TEKFAX

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

GROUP 181

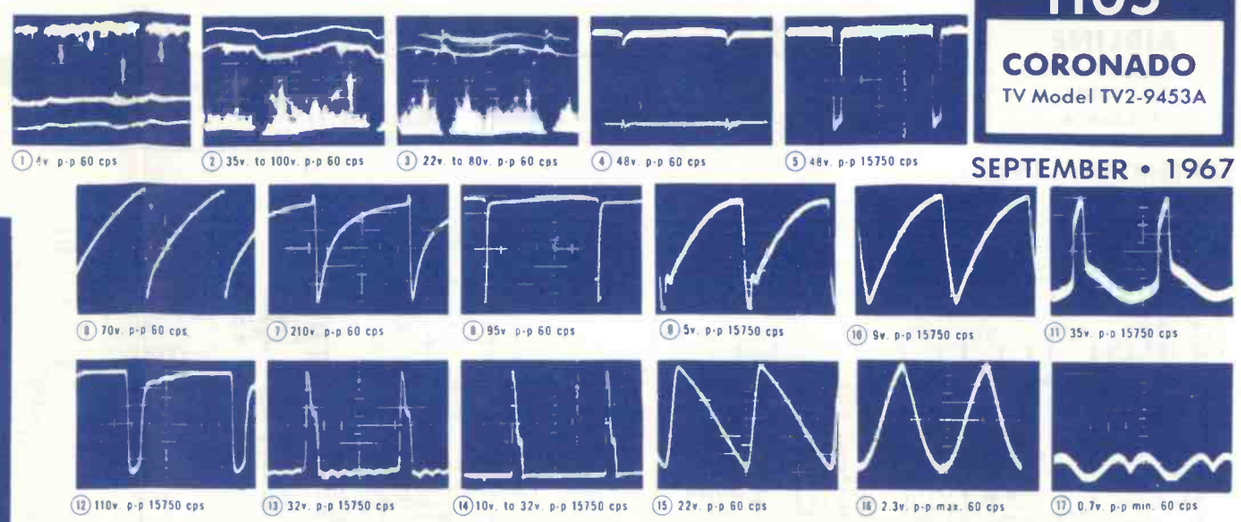
1105

CORONADO

TV Model TV2-9453A

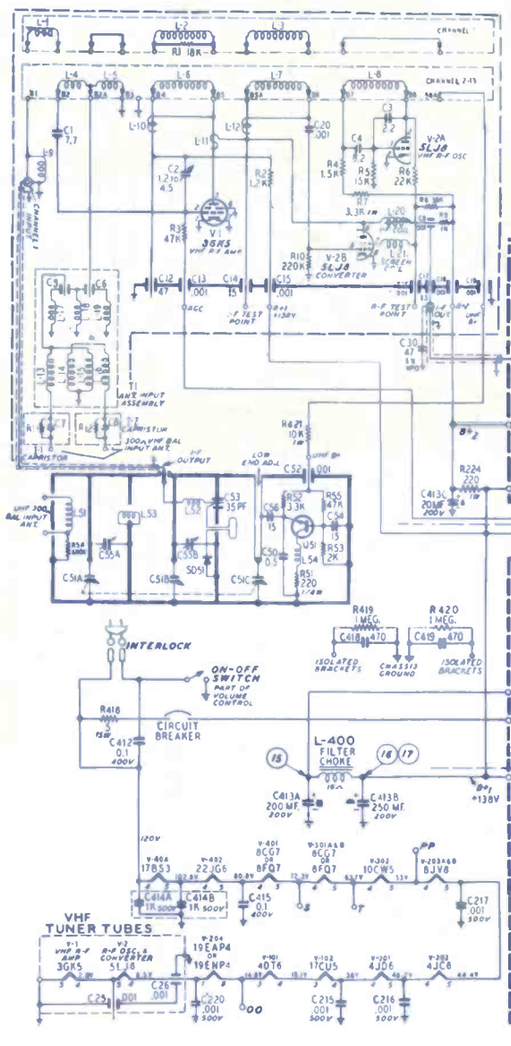
SEPTEMBER • 1967

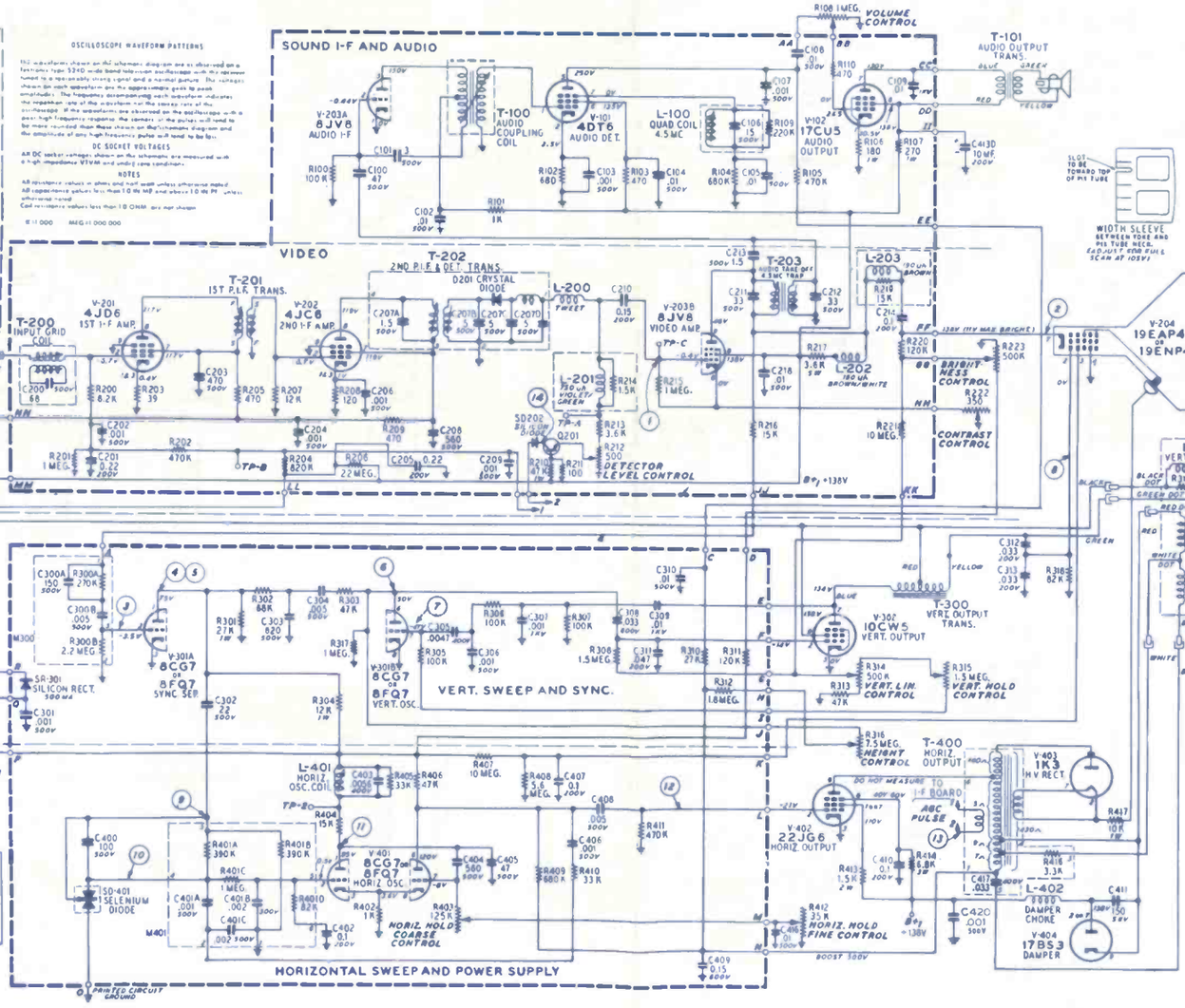
	SCHEMATIC NO.		SCHEMATIC NO.
AIRLINE Color TV Model GEN-8077A,GEN-8447A	1106	RCA VICTOR Color Chassis CTC22 Series	1109
CORONADO TV Model TV2-9453A	1105	SYLVANIA TV Chassis B06-1,-2,-3,-4,-5	1108
MOTOROLA TV Chassis TS-458	1107	TRUETONE TV Model 2DC1803	1110

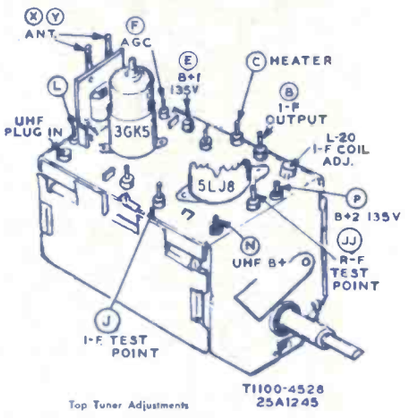


CENTERING OF 19" RECEIVERS

These Receivers using the 114° picture tubes are more subject to pin cushion and linearity problems when not properly centered than are the 90° type sets. Should you experience any difficulty with either of these problems, a careful check of centering should be made. Exact centering and adjustment of the height and linearity controls will result in an improved picture in nearly all cases.







Top Tuner Adjustments

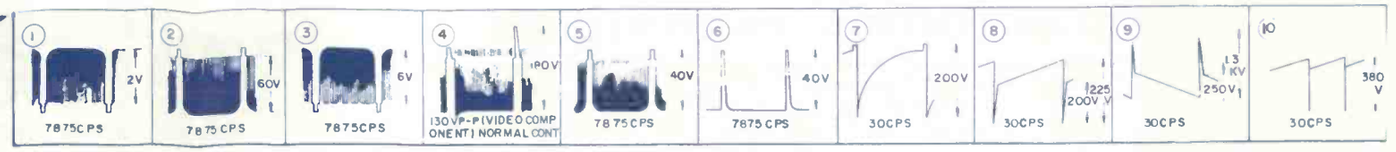
SYMBOL	DESCRIPTION	CORONADO PART NO.
C108	1.0M on-off vol control	36X0453-002
R212	det level control 500Ω	40X0592-001
R222	350Ω contrast control	40X0585-027
R223	500K brightness control	40X0585-010
R314	500K vert lin control	40X0585-004
R315	1.5M vert hold control	40X0585-008
R316	7.5M height control	40X0585-002
R412	35K horiz hold control (fine)	40X0585-044
C109	.01µf 1kv ceramic	80X0099-061
C404	560pf 500v poly	46X0528-005
C411	150pf 5kv ceramic	80X0098-009
C413A	200µf	
C413B	250µf	
C413C	20µf	200v dry elect 45X0519-001
C413D	10µf	
C414A		
C414B	1K pf 500v dual ceramic	80X0003-001
R217	3.6K 5.0 pyrex	43X0331-001
R413	1.5K 2.0 pyrex	43X0450-013
R414	6.8K 3.0 pyrex	43X0378-001
R418	5.0Ω 15WW	43X0317-001
L100	quad coil	9A2595-001
L200	choke tweet filter	9A2432-001
L201	peaking coil — 750µh	36A0094-002
L202	peaking coil 190µh	36A0094-001
L203	peaking coil 190µh	36A0094-010
L400	filter choke	52X0102-006
L401	horiz osc coil	9A2515-001
L402	damper choke	9A2380-001
T100	snd IF coil	9A2597-001
T101	audio output xformer	51X0235-001
T200	IF input coil	9A2642-001
T201	1st PIF xformer	9A2622-001
T202	2nd PIF xformer	9A2650-001
T300	vert output xformer	51X0229-003
T400	horiz output xformer	53X0433-001
	tuner VHF	25A1245-007
	tuner UHF	25A1260-001
	deflection yoke assy	9A2604-001
	capristor (M-403)	76X0018-001
	capristor (M-300)	76X0068-001
	capristor (M-401)	76X0069-001
	transistor (Q201)	86X0006-001
	circuit breaker	2A0568-001

1106
AIRLINE
Color TV Model
GEN-8077A,-
GEN-8447A

SEPTEMBER • 1967

ELECTRONIC TECHNICIAN **TEKFAX**

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

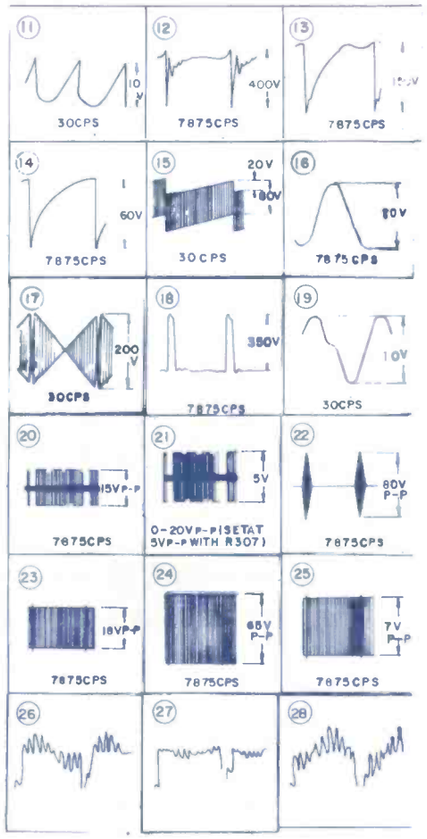


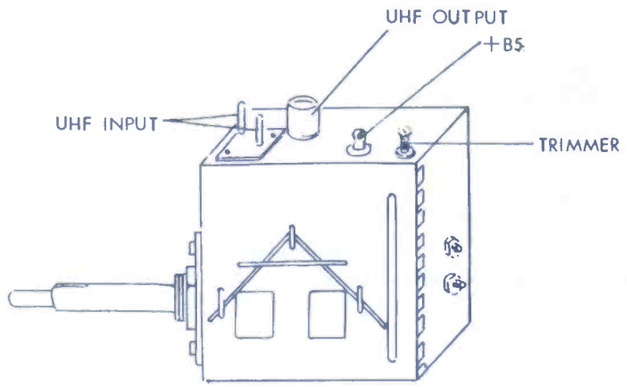
PT5-5U2W(63-8447)
NT5-5U2W(63-8077)

UT5-1U2

PURITY ADJUSTMENT TERMINAL

BIAS-UNIT



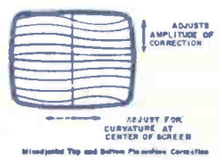


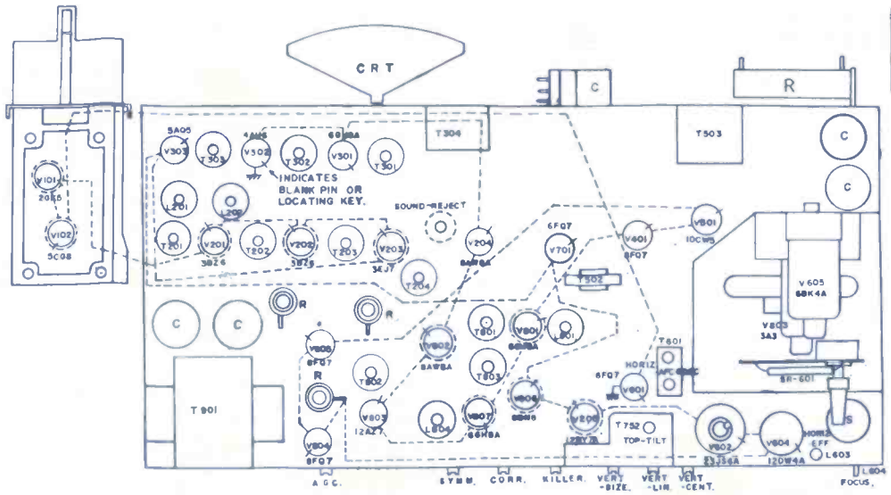
UHF TUNER (UT5-1U2)

ELECTRICAL SPECIFICATIONS

ANTENNA INPUT IMPEDANCE...300 ohms balanced
CONVERGENCE.....Magnetic
FOCUS ..... Electrostatic
AUDIO POWER OUTPUT RATING ... 1.0 Watts max.
INTERMEDIATE FREQUENCIES
Picture I-F Carrier Frequency.....45.75 mc.
Sound I-F Carrier Frequency.....41.25 mc.
Color Sub-Carrier Frequency ... 42.17 mc. (Nominal)
PICTURE SIZE.....Approximately 168 SQ. IN.
POWER INPUT ..... 120 volts AC, 60 cycle
POWER RATING.....340 watts total
SPEAKER SIZE AND TYPE ..... See Parts List
SWEEP DEFLECTION.....Magnetic
TELEVISION R-F FREQUENCY RANGE
All 12 VHF channels.....54 mc. to 88 mc., 174 mc. to 216 mc.
All 70 UHF channels..... 470 mc. to 890 mc.

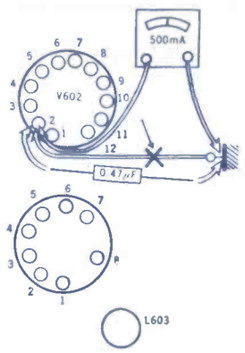
SYMBOL	DESCRIPTION	AIRLINE PART NO.
C405	.001µf 1000v 10% tubular (mica)	TV 3176
C507	10µf 250v elect (non polarized)	TV 32125
C602	50pf 2kv 10% discap	TV 33242
C610	700pf 500v 10% tubular (mica)	TV 3196
C617	50pf 5000v 10% discap	TV 33243
C618	130pf 5000v 10% discap	TV 33229
C624,C625	500pf 3000v 10% discap	TV 33244
C627	50pf 5kv 10% ceragap (discap)	TV 33243
C757	.004µf 500v 10% tubular (Mica)	TV 3191
C901	1µf 10% special	TV 33101
C904 A,B	100µf/100µf@450v elect	TV 32124
C905 A,B		
C906 A,B	60µf/60µf@450v elect	TV 32116
C918 A,B,C,D	20µf/20µf/20µf/20µf@450v elect	TV 32114
R213	6K 3w 10% carbon	TV 2301
R315,R316,R317	12K 3w 10% carbon	TV 2338
R414	6K 3w 10% carbon	TV 2301
R513	3K 20w 10% WW	TV 2349
R607	70K 3/4w 10% carbon	CC 5368
R625	60M 5kv special	TV 2381
R722	6.8K 3w 10% special	TV 2353
R726	5.6K 4w 10% special	TV 2355
R727	33K 4w 10% special	TV 2356
R801	6K 3w 10% carbon	TV 2301
R901	6Ω 30w 10% WW	TV 2382
R903	600Ω 30w 10% WW	TV 2383
R904 A,B	20Ω/28Ω 30w 10% WW	TV 2384
R216	750Ω pot snd reject (8V-045)	TV 25135
R258	250K pot brightness (8V-348)	TV 2543
R263	500Ω pot contrast (8V-306)	TV 2541
R310, SW-901	500K pot volume w/on-off switch (8V-075UL)	TV 25167
R404	500K pot AGC (8V-266)	TV 25144
R502	1M pot vert hold (8V-172)	TV 2540
R504	5M pot vert size (8V-269)	TV 25146
R507	100K pot vert lin (8V-265)	TV 25143
R512	50Ω pot ver centering	TV 25168
R610	1M pot horiz hold (8V-172)	TV 2540
R623	100Ω pot horiz centering	TV 25169
R629	500K pot HV adjust	TV 25170
R702	150Ω pot convergence B-2 (8V-034)	TV 25134
R705	60Ω pot convergence RG-3 (8V-032)	TV 25132
R706	60Ω pot convergence RG-4 (8V-032)	TV 25132
R708	120Ω pot convergence RG-A1 (8V-033)	TV 25133
R709	30Ω pot convergence B-A (8V-031)	TV 25131
R711	60Ω pot convergence RG-T1 (8V-032)	TV 25132
R724	5K pot G Drive (8V-057)	TV 25138
R731	500K pot CRT bias (8V-059)	TV 25140
R733	1M pot G screen (8V-058)	TV 25139
R752	100K pot correct amp (8B-265)	TV 25143
R756	10K pot symmetry amp (8V-004)	TV 25124
R806	500Ω pot color	TV 25171
R838	1.5K pot tint (8V-055)	TV 25137
R840	1M pot color killer (8V-197)	TV 25147
L201	coil 47.25MHz trap (2TIF-419)	TV 62279
L202	coil 41.25MHz trap (2TIF-420)	TV 62280
L203	coil peaking (TL-250)	TV 61303
L205	coil 4.5MHz trap (2TIF-481)	TV 62281
L207	coil peaking (TL-280)	TV 61280
L206	coil peaking (TL-252)	TV 61304
L209	coil peaking (TL-279)	TV 61279
L210	coil peaking (TL-281)	TV 61281
L211	coil delay line (TL-962)	TV 61305
L213	coil peaking (TL-282)	TV 61282
L601	coil snivet (TL-601)	TV 61175
L603	coil horiz efficiency (2TL-904)	TV 61344
L604	coil focus (2TL-908)	TV 61348
L701	coil convergence control assy RG-2 (TL-71)	TV 61297
L702	coil convergence control assy RG-1 (TL-70)	TV 61298
L721	coil peaking (TL-286)	TV 61286
L722	coil peaking (TL-285)	TV 61285
L751	coil bottom tilt pincushion control (TL-49)	TV 61293
L801	coil chroma take-off (2TL-913)	TV 61347
L802	coil peaking (TL-258)	TV 61284
L803	coil peaking (TL-258)	TV 61284
L804	coil reactance (2TL-912)	TV 61352
L805	coil phase (TL-75)	TV 61353
L806	coil peaking (TL-230)	TV 6188
L901	coil automatic degaussing (TL-915)	TV 61351
L902	coil filter choke (9T-177)	TV 11162
L903,L904	coil RF choke (TL-603)	TV 6191
T201	xformer 1st pix IF (2TIF-416)	TV 62276
T202	xformer 2nd pix IF (2TIF-417)	TV 62277
T203	xformer 3rd pix IF (2TIF-418)	TV 62278
T204	xformer video det assy	TV 61302
T301	xformer 1st snd IF (TIF-494)	TV 62282
T303	xformer snd demodulator (TIF-535)	TV 62291
T304	xformer audio output (7T-167)	TV 1185
T501	xformer vert oscillator (9T-160)	TV 11147
T502	xformer vert conver reactor (9T-162)	TV 11149
T503	xformer vert output (8T-182)	TV 11145
T601	xformer horiz. osc (2TL-905)	TV 61354
T602	xformer horiz output (8FT-620)	TV 11163
T701	xformer convergence control assy B-1 (TL-72)	TV 61298
T702	convergence assy (TL-82) w/leads	TV 61299
T752	xformer top tilt pincushion control (TL-84)	TV 61301
T801	xformer chroma 1st bond pass (TL-59)	TV 61294
T802	xformer chroma 2nd bond pass (2TL-906)	TV 61355
T803	xformer burst phase (TL-14)	TV 61288
T804	xformer 3.58MHz osc (2TL-912)	TV 61352
T901	xformer power (5T-184)	TV 11164
M401	capristor (PRC-302)	TV 3452
M901,M902	filter (2TL-914)	TV 61307
F901	fuse 4.0 amp 125v pigtail (slo-blo)	315004
	tuner VHF GEN-8077A (NT5-5U2W)	TV 35128
	tuner VHF GEN-8447A (PT5-5U2W)	TV 35129
	tuner UHF (UT5-1U2)	TV 35130
	yoke deflection (assy)	TV 61306





CHASSIS LAYOUT

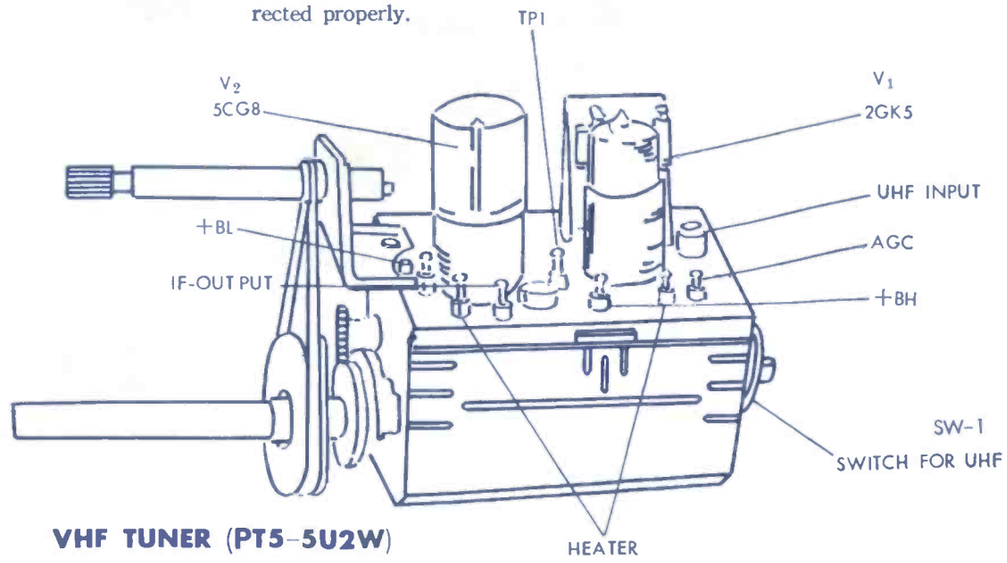
AIRLINE
Color TV Model GEN-8077A, GEN-8447A



TOP AND BOTTOM PIN-CUSHION ADJUSTMENT

The top and bottom pin-cushion adjustment is pre-set at the factory and normally needs no further adjustment. If necessary, adjustment may be made by adjusting for straight horizontal lines at the top and bottom of the raster. "Horizontal Efficiency Coil adjustment" should be performed prior to making pin-cushion adjustments.

1. The receiver should be allowed to run at least 5 minutes with cross-hatch or horizontal line pattern on the screen.
2. Turn CORR-AMP. (R752) and SYMM. (R756) fully to the right.
3. Turn TOP-TILT (T752) screw to make the upper picture symmetric to the center line of picture.
4. After turning the SYMM. (R756) fully to the left, turn BOTTOM-TILT (L751) screw to make the lower picture symmetric to the center line of picture.
5. After turning the SYMM (R756) to make the horizontal line at the picture center straight, minimize CORR-AMP (R752) so that the picture may be corrected properly.



VHF TUNER (PT5-5U2W)

Horizontal Efficiency Coil Adjustment

1. Open the lead at Pin 2 (cathode) of V602 (23JS6A).
2. Insert a milliammeter (500 MA range) between Pin 2 of V602 and ground. (Positive lead to pin 2)
3. Bypass the meter with a 0.47µF capacitor, as shown.
4. Turn the receiver on and allow to run about 3 minutes.
5. Adjust Horizontal Efficiency Coil (L603) for minimum reading (approximately 180 MA) on the meter.

AGC ADJUSTMENT

Turn the AGC control clockwise until the picture begins to bend or otherwise distort, and then retard the control slightly below the point where the distortion is eliminated. Change channels and observe the AGC performance on a strong, local broadcast. Retard the AGC control again if the picture does not immediately reappear when changing channels.

TUBE AND TRANSISTOR COMPLEMENT

V1	2GK5	VHF Amplifier
V2A & B	5CG8	VHF Oscillator & Mixer
Q51	GMO-380	UHF Oscillator
D51	1S-750	UHF Mixer
V201	3BZ6	1st Picture IF Amplifier
V202	3BZ6	2nd Picture IF Amplifier
V203	3EJ7	3rd Picture IF Amplifier
V204A & B	8AW8A	1st Video Amplifier & Sync. Separator
V205	12BY7A	2nd Video Amplifier
V801A & B	6GH8A	1st Bandpass Amplifier & Killer
V802A & B	8AW8A	2nd Bandpass Amplifier & Burst Amplifier
V803A & B	12AZ7	X & Z Demodulators
V804A & B	8FQ7	R-Y Amplifier & B-Y Amplifier
V805A & B	8FQ7	G-Y Amplifier & Blanker
V806A & B	6BN8	Phase Detector & Killer Detector
V807A & B	6GH8A	3.58 mc Oscillator & Reactance Control
V401A & B	8FQ7	Sync. Limiter & Vertical Oscillator
V501	10CW5	Vertical Output
V601A & B	6FQ7	Horizontal Oscillator & AFC Control
V602	23JS6A	Horizontal Output
V603	3A3	High Voltage Rectifier
SR601	HS-7/1	Focus Rectifier
V604	12DW4A	Damper
V605	6BK4A	Shunt Regulator
V701A & B	6FQ7	Dynamic Pincushion Corrector & Keyed AGC
V301A & B	6GH8A	1st Sound IF Amplifier & Audio Amplifier
V302	4AU6	2nd Sound IF Amplifier
V303	5AQ5	Audio Output
V901	490EB22	Picture Tube
	490JB22	Picture Tube
	490LB22	Picture Tube

Refer to Parts List for Replacement Instructions.

1107

MOTOROLA

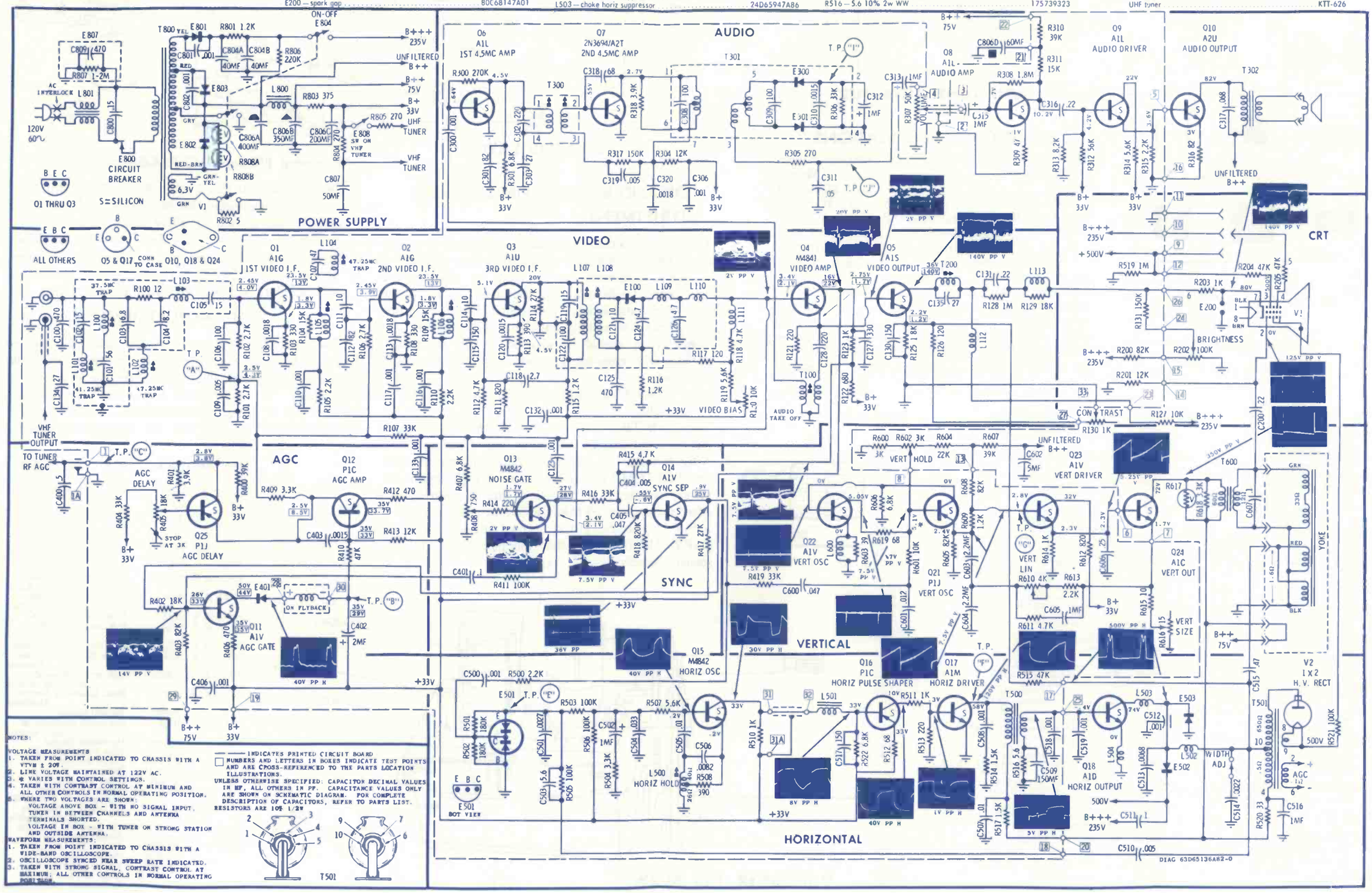
TV Chassis TS-458

SEPTEMBER • 1967

ELECTRONIC TECHNICIAN **TEKFAX**

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

SYMBOL	DESCRIPTION	MOTOROLA PART NO.
C514	.0022µf 10% 1000v	8G10246A06
C804	40µf/300v 40µf/300v	23C65891A06
C805	40µf/300v 40µf/300v	23C65891A06
C806	400µf/125v 60µf/40v 350µf/100v 200µf/40v	23C65807A29
C807	50µf/50v elect (use 23C60119A06)	23C65808A12
E200	spark gap	80C68147A01
E401	diode crystal (AGC gate)	48C67120A02
E800	circuit breaker	80C66390A18
L100	37.5MHz trap incls core	24D67754A20
L101	41.25MHz trap incls core	24D67754A21
	41.25MHz trap incls core (A-01 and later)	24D67754A23
L102	47.25MHz trap incls core	24D67754A22
L103	1st IF base incls core	24D67754A23
L105	1st IF & 47.25MHz trap incl core	24V68607A31
L106	2nd IF interstage	24D67754A27
L107	3rd IF primary incls core	24D67754A23
L108	3rd IF secondary incls core	24D67754A25
L110	choke IF resonant 8.8µh	24C66772A11
L112	compensating 900µh	24D68002A38
L113	compensating 200µh/18K	24D68002A42
L500	horiz osc incls core	24D68130A03
L501	horiz pulse shaping 6600µh/10K (8-00 & earlier only)	24D68002A35
L502	choke horiz suppressor	24D65947A85
L503	choke horiz suppressor	24D65947A86
L600	compensating 1000µh/39	24D68002A40
L700	yoke defl 114° (P/N 24D68523A01 & 24D68554A01)	24G10250A04
L800	choke filter	25D67554A11
L801	choke line	24V68611A85
	choke IF resonant 8.8µh (balun choke)	24C66772A11
T100	4.5MHz trap & A.T.O. incls core	24D68822A02
T300	4.5MHz interstage	24D68822A01
T301	ratio det incls E300, E301, C308, C309, C310, R306	24V66550A80
T302	audio output	25D67552A16
T500	horiz driver	25D67440A03
T501	horiz output xformer complete pri-sec winding can be purchased separately	24D68804A03
T600	vert output	25D65840A22
T800	power	25D6814A01
R127	10K 10% 7w WW	17S135542
R516	1.0 10% 2w WW (use 17K561979)	17S132815
R516	5.6 10% 2w WW	17S139323
R520	33Ω 10% 5w WW	17S132786
R617	varistor (vert)	6C66263A08
R700	thermistor (on yoke)	6C65884A07
R802	5 10% 5w WW	17S745634
R803	375 10% 10w WW	17S135771
R806A	varistor (power supply)	6C66263A08
R806B	varistor (power supply)	6C66263A08
R120	1st video bias 10K	18D66401A19
R130	contrast 1K	18D67502A07
R202	brightness 100K	18D67637A49
R307	on off & volume 50K	18D68418A01
R405	RF AGC delay 18K	18D66401A20
R408	vert lin 4K noise gate 750Ω	18D67678A03
R602	vert hold 3K	18D67637A50
R610	vert lin 4K noise gate 750Ω	18D67678A03
R616	vert size 1.5Ω WW	18D68447A01
	VHF tuner	SCPTT-394
	UHF tuner	KTT-622
	UHF tuner	KTT-626

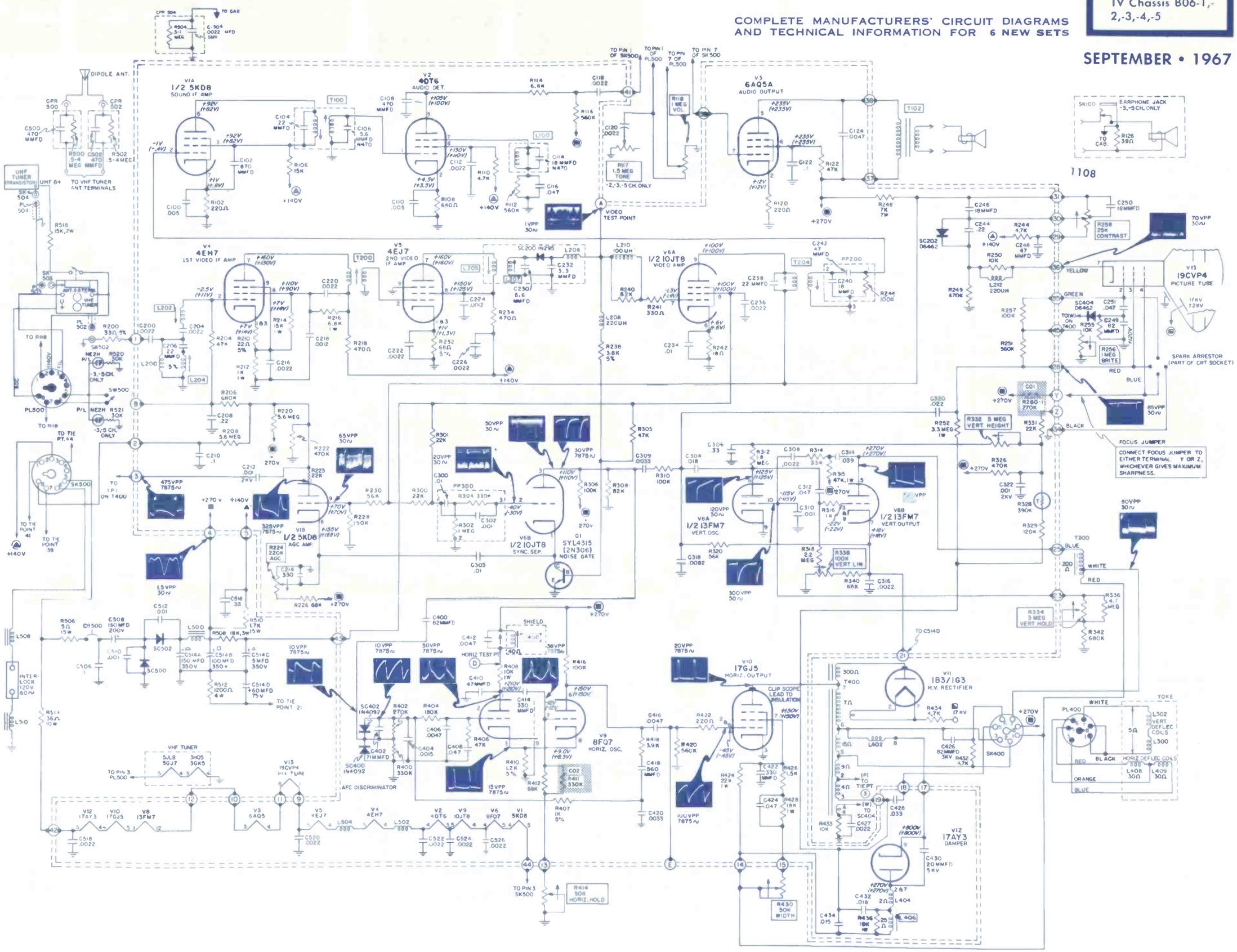


ELECTRONIC TECHNICIAN TEKFAX

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

1108
SYLVANIA
TV Chassis B06-1,-2,-3,-4,-5

SEPTEMBER • 1967



1109

RCA VICTOR
Color Chassis
CTC22 Series

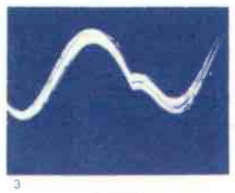
ELECTRONIC TECHNICIAN TEKFAX

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

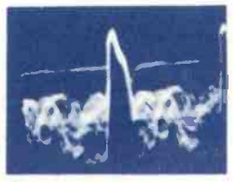
SEPTEMBER • 1967

1 PW200 TP1 4V P-P (VERT.) 2ND DETECTOR

2 PW200 TP1 4V P-P (HORIZ.) 2ND DETECTOR



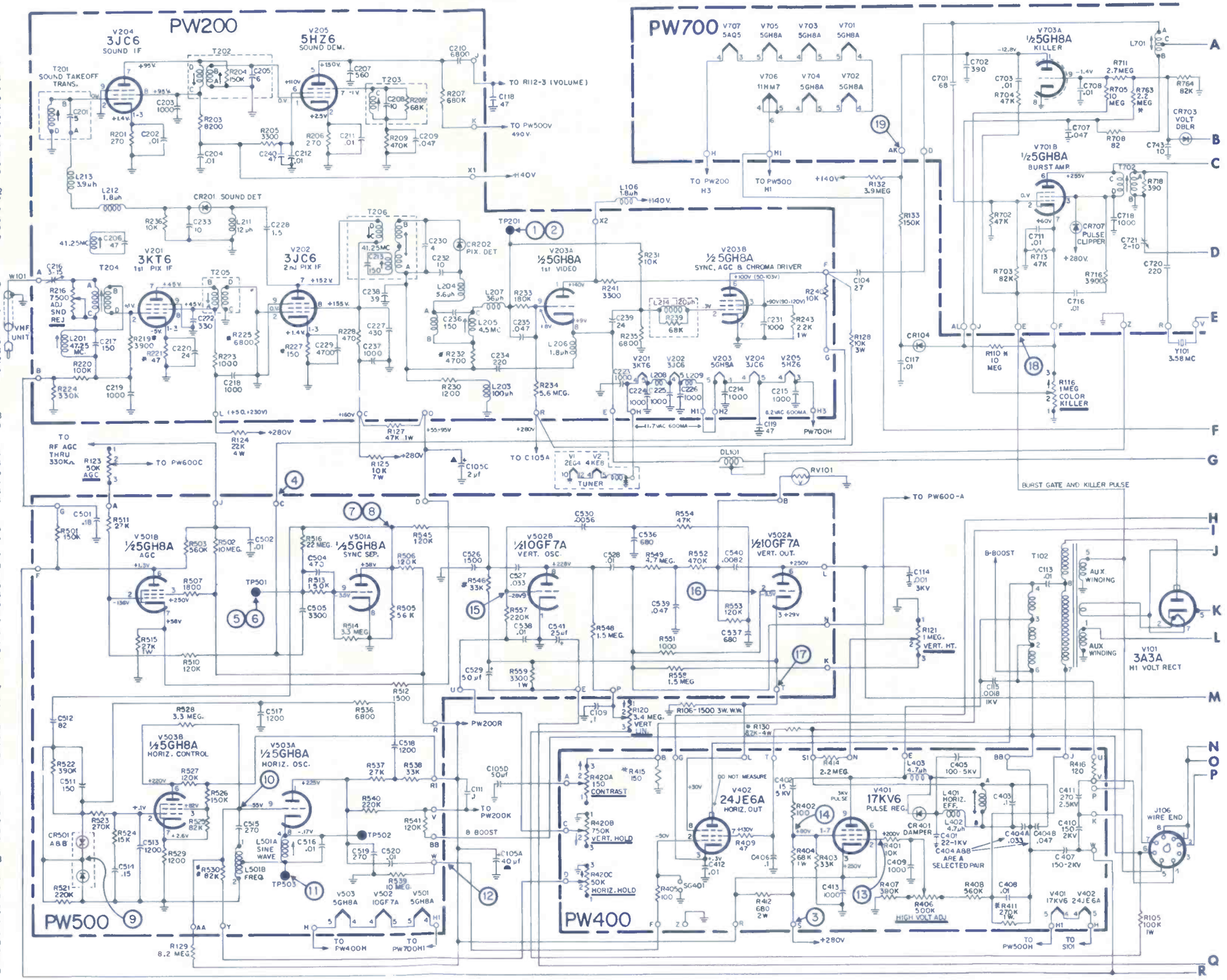
3 PW400S 2.5V P-P VERT. RATE B PLUS RIPPLE



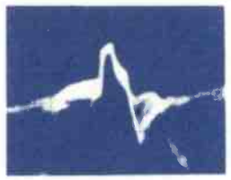
4 PW500C 50V P-P HORIZ. RATE SYNC AGC OUTPUT

5 TP501 50V P-P (VERT.) SYNC SEPARATOR GRID

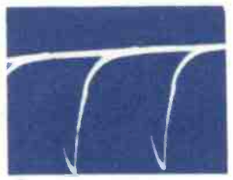
SYMBOL	DESCRIPTION	RCA PART NO.
R112	control — volume with switch S101	120773
R113	control — brightness	120775
R114	control — color	120776
R115	control — tint	120774
R116	control — color killer	120805
R120	control — vert lin	120807
R121	control — vert height	120805
R123	control — AGC	120804
R216	control — adj snd rej 7.5K	120808
R406	hi-voltage adj	120806
R420A	control — contrast, vert hold horiz hold	120809
R601A	control — red drive green drive video peak	120811
R602A	control — red, green, blue screen	120812
R801	control — left blue	114627
R804	control — right blue horiz lines 100Ω 1w	120949
R811	control — top red/green vert lines	116635
R814	control — bottom red/green vert lines	105059
C105	4 section elect	120789
	A — 40μf 350v	
	B — 2μf 175v	
	C — 100μf 300v	
	D — 50μf 50v	
C106	2 section elect	120790
	A — 150μf 350v	
	B — 100μf 350v	
C107	2 section elect	120787
	A — 50μf 250v	
	B — 250μf 175v	
C110	0.0033μf ±10% 1.6kv paper	119585
C115	0.0018μf ±10% 1kv paper	121448
C216	3 — 15pf trimmer	116502
C217	150pf ±5% 500v mica	269865
C222	330pf ±10% 500v mica	79191
C227	430pf ±5% 500v mica	
C228	1.5pf ±0.25pf 500v ceramic NPO	
C519	270pf ±5% 500v mica	
C540	0.0028μf ±20% 1kv paper	109818
C712	0.82pf ±5% 500v headed lead	116500
C714	10pf ±5% 500v ceramic NPO	
C721	2 — 10pf trimmer	116501
CB101	breaker-circuit	120784
CR101	silicon	113998
CR104	silicon (killer delay)	119596
CR202	1N60	112524
CR401	damper	120818
CR501	AFC	109474
	A — AFC	
	B — AFC	
DL101	line delay	120786
F101	fuse 7 amp 250v	120785
L105A/B	AC line filter	
L201	47.25MHz trap	121447
L203	100μh	117380
L204	5.6μh	109171
L205	4.5MHz trap	121446
L206	1.8μh	109248
L207	36μh	116056
L211	12μh RF choke	120831
L213	3.9μh	116507
L214	120μh (used with R239)	120795
L401	horiz efficiency	120794
L403	4.7μh RF choke	120839
L501	horiz sine wave	109947
	A — horiz sine wave	
	B — horiz sine wave	
L701	chroma take-off	120797
L702	osc strength	120798
L707	620μh	109257
L709	27μh	116511
L710	330μh	118710
L803	120μh	118245
PW800	convergence-complete convergence assy	120052
R108	2Ω 7w WW	115350
R118	6.8K 4w	107541
R125	10K 7w	
R412	680Ω 2w WW	
R530	82K ±2%	120810
RT102	thermistor-120Ω cold	107191
RV101	varistor 870v at 1.0ma	112876
SG401	capacitor spark gap	120819
T102	horiz output	120820
T103	audio output	120822
T104	vert output	120821
T105	filament 6.3 vac. 8A	120823
T201	sound take-off	120824
T202	4.5MHz driver	120828
T203	snd quad	120825
T204	IF input and 41.25MHz trap	116560
T205	pix IF	120826
T206	pix IF output and 41.25MHz trap	120827
T701	band-pass	120817
T703	3.58MHz osc	120815
Y101	crystal 3.58MHz	105330
R102	resistor 220Ω ±10% ½w (part of yoke)	502122
RT101	thermistor 1.3Ω cold	120891
	yoke deflection	120890



RCA VICTOR
Color Chassis CTC22 Series



6
TP501
60V P-P (HORIZ.)
SYNC SEPARATOR GRID

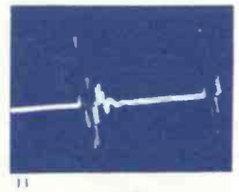


7
JUNCTION R516 & R545
70V P-P (HORIZ.)
SYNC SEPARATOR PLATE

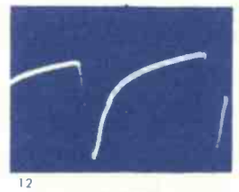
8
JUNCTION R516 & R545
80V P-P (VERT.)
SYNC SEPARATOR PLATE

9
COMMON CATHODE
13V P-P (HORIZ.)
HORIZ. PHASE DETECTOR

10
V503-9 (C515)
300V P-P (HORIZ.)
HORIZ. OSCILLATOR GRID



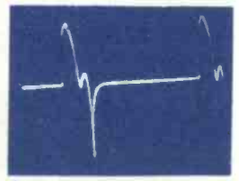
11
TP503
300V P-P (HORIZ.)
HORIZ. OSCILLATOR COIL



12
PW500W
300V P-P (HORIZ.)
HORIZONTAL DRIVE

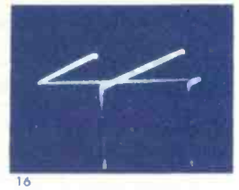
ALL RESISTANCE VALUES ARE IN OHMS. K = 1000.
ALL RESISTORS ARE 1/2 WATT EXCEPT AS INDICATED.
ALL CAPACITANCE VALUES LESS THAN ONE ARE IN µf, 1.0 AND ABOVE ARE IN pf EXCEPT AS INDICATED.
ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION.
* INDICATES 5% TOLERANCE FOR RESISTORS.
** INDICATES 2% TOLERANCE.

13
V504-2
50V P-P (HORIZ.)
PULSE REGULATOR CONTROL GRID

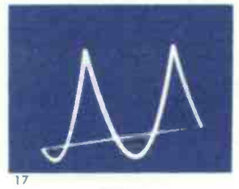


14
V401 PIN 1 AND 7
750V P-P (HORIZ.)
PULSE REGULATOR SCREEN GRID

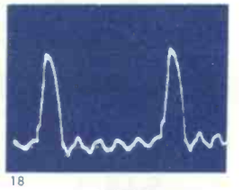
15
V502-9 (R557)
100V P-P (VERT.)
VERT. OSCILLATOR GRID



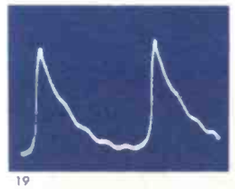
16
V502-2 (R551)
300V P-P (VERT.)
VERT. OUTPUT GRID



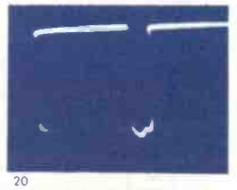
17
PW500T
11V P-P (VERT.)
VERT. OUTPUT CATHODE



18
PW700-E
280V P-P (HORIZ.)
KILLER AND BURST GATE PULSE

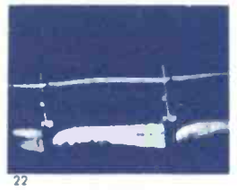


19
V703-1 KILLER PLATE
70V P-P HORIZ. RATE
HORIZONTAL PULSE



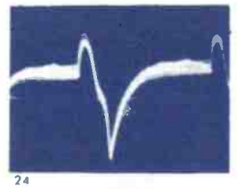
20
PW700 P2 (BLANKER PLATE)
150V P-P HORIZ.
PLATE BLANKER PULSE

21
PW700-AC
100V P-P (HORIZ.)
LUMINANCE VIDEO FROM
DELAY LINE



22
PW700-AC
170V P-P (VERT.)
LUMINANCE VIDEO OUTPUT

23
PW700-AB
700V P-P VERT. PLATE
VERT. BLANKING PULSE



24
PW700-Y
12V P-P (HORIZ.)
INPUT FROM
BRIGHTNESS CONTROL

1110

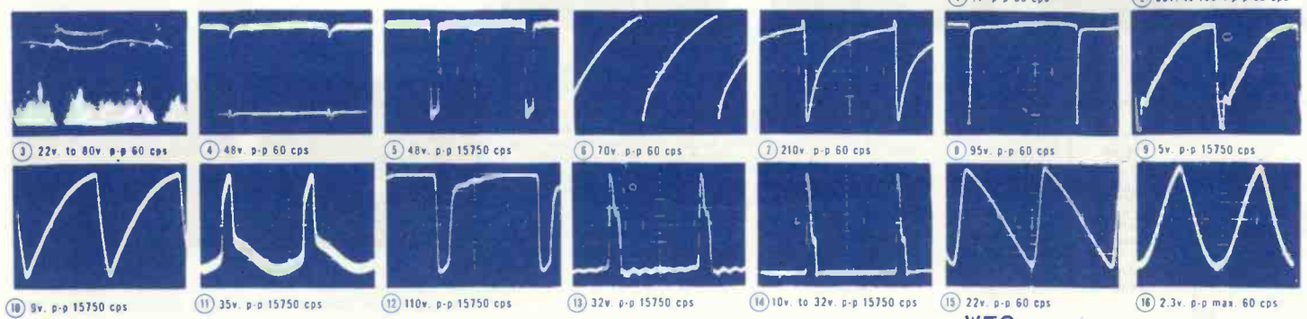
TRUETONE

TV Model 2DC1803

ELECTRONIC TECHNICIAN **TEKFAX**

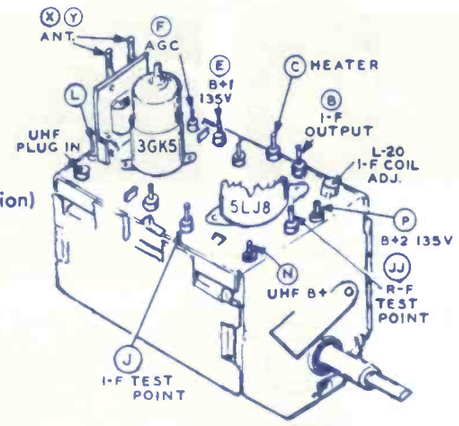
SEPTEMBER • 1967

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



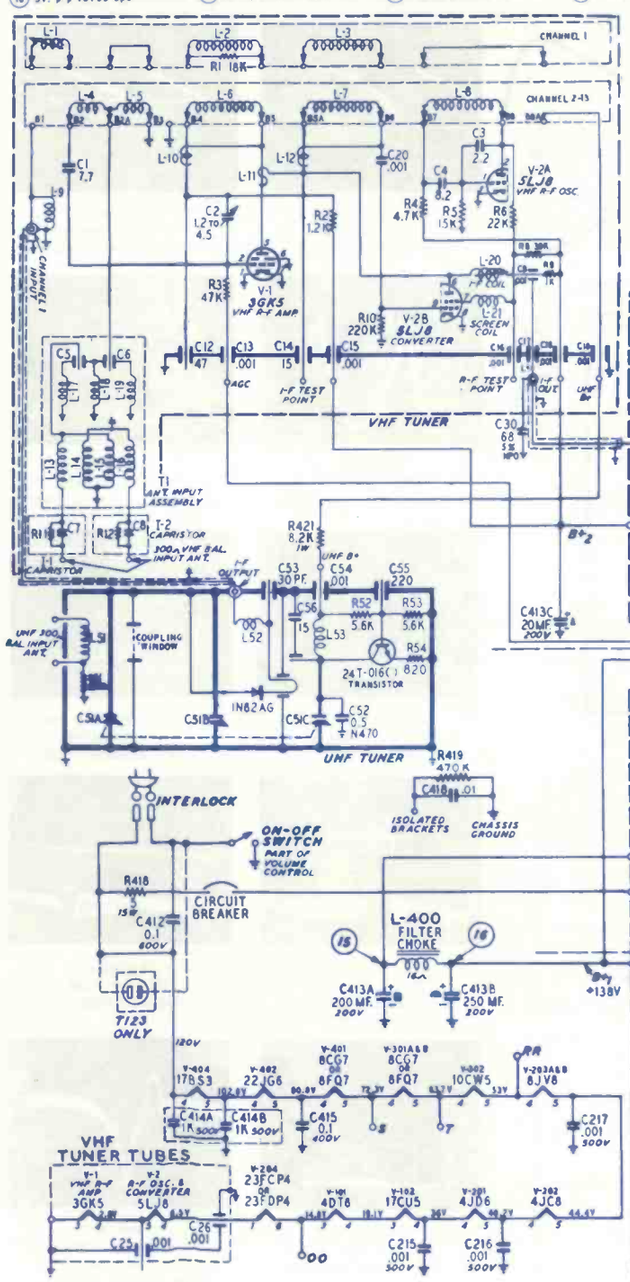
ELECTRICAL SPECIFICATIONS

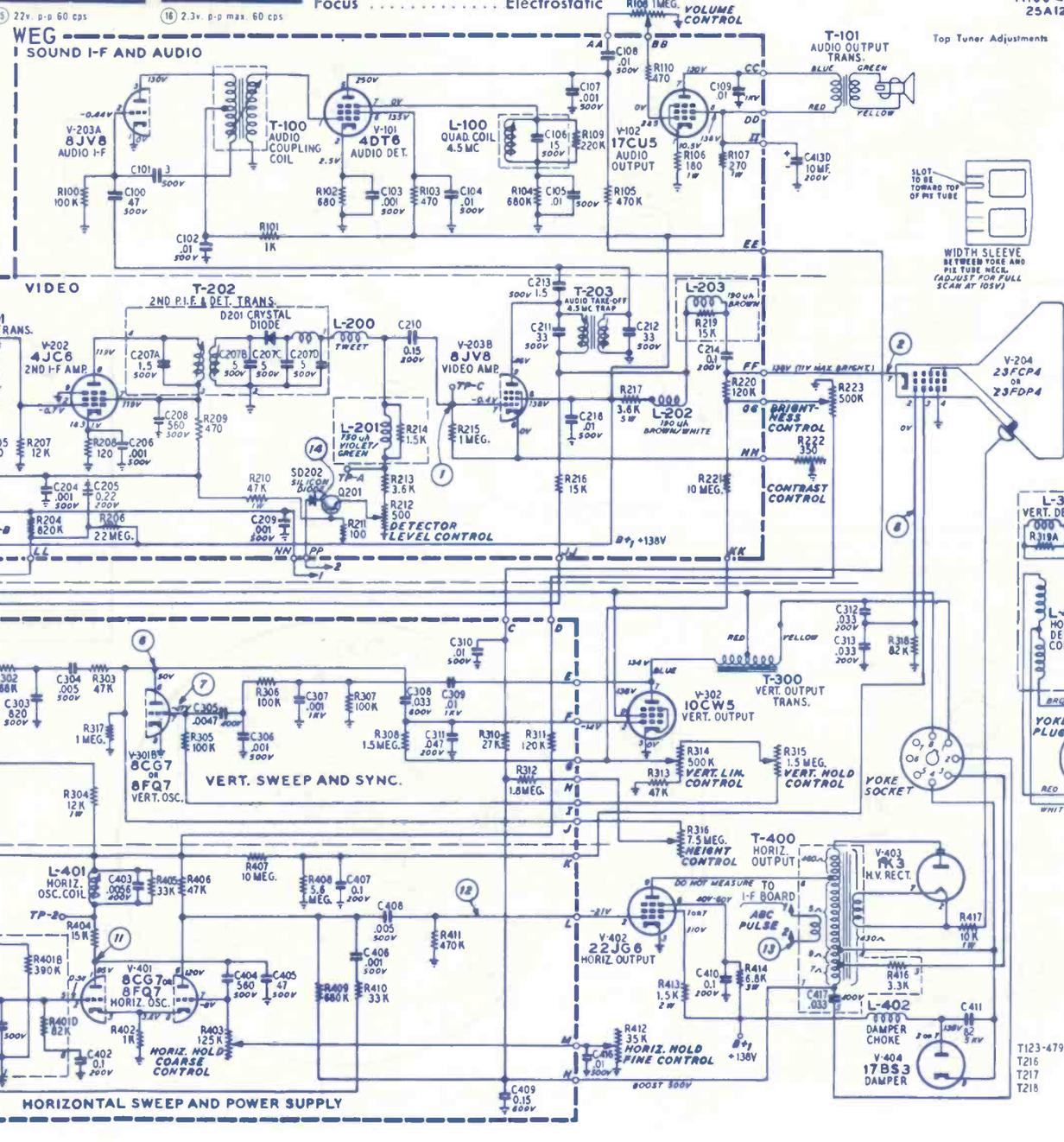
Power Supply	120 Volts AC 60 cycles only
Power Consumption	115 Watts
Power Output	1.0 Watt 0.7 Watts (10% Distortion)
Tuning Range	Channels 2 thru 83
Intermediate Freq.	Picture—45.75 MC Sound—41.25 MC
Antenna Input Imp.	300 Ohms Balanced
Intercarrier Sound System	4.5 MC
Focus	Electrostatic



T1100-4528
25A1245

Top Tuner Adjustments





T123-4794A
T216
T217
T218

For $1100, you can buy these seven pieces of stereo testing equipment.

Together they do what Amphenol's new Stereo Commander does alone...for $329.95.

Now you can have a profitable stereo repair business without a huge investment.

The Stereo Commander Model 880 lets you test and adjust stereo and monaural FM tuners, Multiplex adaptors and amplifiers.

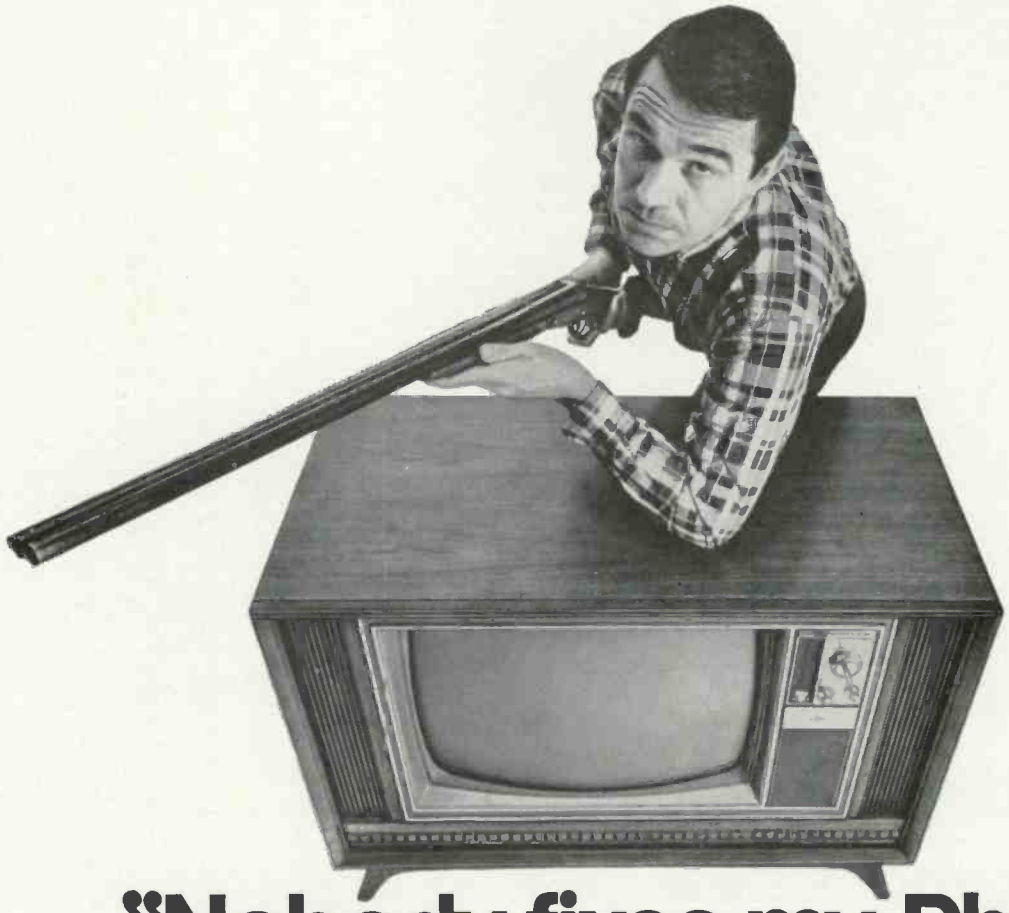
The Stereo Commander is easy to use. It operates on 117 volts AC. All the connecting leads necessary are provided. And, to top it all off, the operating manual included with each unit is really a short course in stereo servicing.

See your local Amphenol distributor. Find out why you don't need seven separate pieces of stereo test equipment to go into business for yourself . . . or write us direct for more facts about the Stereo Commander Model 880. Amphenol Corporation, 2875 South 25th Avenue, Broadview, Illinois 60153.

AMPHENOL

TM

. . . for more details circle 104 on postcard



"Nobody fixes my Philco but a Philco technician!"

That color TV cost him $500 and he wants a real specialist to fix it! Why don't you become the specialist? Give Philco Qualified Service and get the business.

Qualified PHILCO SERVICE CENTER

Your service technicians can get all the training they need right there in your area. Local training meetings are held all over the country. Then, after the course, our Tech Data Service keeps them tuned in to what's new. And you get the fastest parts delivery in the industry. Philco Parts Distributors stock almost every part you'll ever need. Any part they don't have will be on its way to you by air within 24 hours through our Lifeline Emergency Service.

Get new customers — more business. Your shop can appear in our Yellow Pages listings, and you become your area headquarters for Philco Service. There's plenty of attractive identification material wherever your firm name is used.

Philco owners are sold on the idea of specialist service. Shouldn't you be? Your local Philco-Ford Distributor will give you all the details. Call him now and ask for the Service Manager.

Philco-Ford Corporation
Philadelphia, Pa. 19134

PHILCO Ford

FAMOUS FOR QUALITY THE WORLD OVER

. . . for more details circle 137 on postcard

ELECTRONIC TECHNICIAN

WORLDS LARGEST ELECTRONIC TRADE CIRCULATION

SEPTEMBER 1967 • VOL. 86, NO. 3

37 STEREO HI FI AND TODAY'S TECHNICIAN
A new look at the stereo Hi Fi industry and what it means to service-dealers and technicians today

40 SOLID-STATE AUDIO AMPLIFIERS
First article of an in-depth series covers the fundamentals of solid-state audio amplifiers and lays the ground-work for detailed trouble-shooting and repair techniques

43 A TECHNICIAN LOOKS AT MOTOROLA'S TS915 CHASSIS
The first article of a two-article series will zero in on important details of this unusual solid-state color chassis

48 SERVICING GARAGE DOOR OPERATORS
Tells you how to build a profitable business servicing GDOs

53 SEMICONDUCTORS FROM A TO Z
The fourteenth article in this continuing series covers additional characteristics of the RCA IC201 integrated circuit

58 ANTENNAS—SANS BAFFLEGAB AND BUSHWA
Part one of a two-article series takes the pain out of selecting the proper antenna for a given job

22 LETTERS TO THE EDITOR
24 EDITOR'S MEMO
28 TECHNICAL DIGEST
62 COLORFAX
70 NEW PRODUCTS
80 NEWS OF THE INDUSTRY
85 BOOK REVIEWS
90 CATALOGS & BULLETINS
92 ADVERTISERS' INDEX
93 READER SERVICE CARD

COVER

Years ago when we oriented antennas we used a long power cord and a pair of powered-phones to communicate from the roof to the set in the living room below. Now we use 100mw transistorized two-way radiophones.

TEKFAX • 16 PAGES OF THE LATEST SCHEMATICS • **Group 181**

AIRLINE: Color TV Model GEN8077A, GEN8447A
CORONADO: TV Model TV29453A
MOTOROLA: TV Chassis TS458
RCA VICTOR: Color Chassis CTC22 Series
SYLVANIA: TV Chassis BO6-1, -2, -3, -4, -5
TRUETONE: TV Model 2DC1803

OJIBWAY PRESS, INC.

ELECTRONIC TECHNICIAN is published monthly by Ojibway Press, Inc. Subscription Rates: One year $5.00, Two years $8.00, three years $10.00 in United States and Canada. Other Countries: One Year $9.00, two years $14.00, three years $18.00. Single Copies, 60¢. Second Class postage paid at Waseca, Minnesota and at additional mailing offices.

POSTMASTER: Send form 3579 to ELECTRONIC TECHNICIAN, Ojibway Building, Duluth, Minnesota 55802.

LETTERS TO THE EDITOR

Tube Source and Specs

If anyone is interested, 35A3, 35A5 and 35D5 tubes are available from States Labs, Inc., 215 Park Ave. S., New York 10003. The telephone number is 212-677-8400. Check to make sure that 35A3 is not really 35A5. They are sometimes confused.

JOHN C. BRIGGS
Rochester, N.Y.

. . . According to Mil-HDBK321, dated Nov. 2, 1959, the 35A3 tube is a miniature receiving halfwave rectifier (Italian) and 35D5 is a miniature beam power pentode.

W. E. TAYLOR
Cherry Hill, N.J.

'MG' Goes Poetic

Mind if I wax poetic for once?
Tools I have of many kinds,
Ancient, used and new ones;
Some are plain but most are colored—
Red and Green and Blue ones.

In former years a tool was gray
Or black or even duller;
But now I look around and see—
My bench in living color!

M. G. GOLDBERG
St. Paul, Minn.

He's Satisfied

I have been a more-than-satisfied reader of ET for years. In fact, I consider it the only TV-radio magazine worth reading. Does anyone have an idea how I can apply up-to-date information to my Hickok 550X tube tester which the manufacturer advises is obsolete and roll-charts are no longer furnished for it?

L. M. JENNE
Tampa, Fla.

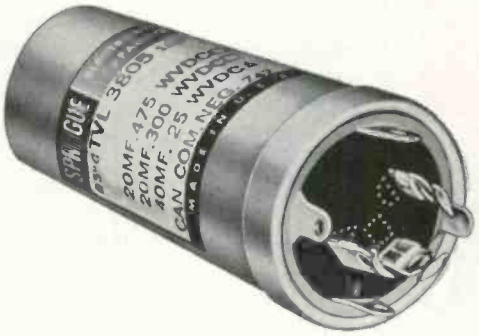
Needs Needle Microscope

Who manufacturers a phono needle microscope that you can carry around in your pocket? I have never found a satisfactory type.

M. LINN
Brooklyn, N.Y.

• *Frankly, we don't know. Perhaps some manufacturer will read this letter and let us know. We used one years ago, about the size of a fountain pen, which worked satisfactorily.—Ed.*

LET'S FACE IT . . . TWIST-PRONG CAPACITORS JUST DON'T HAVE THE "FITS-ALL" ABILITY OF STRETCH SOCKS



. . . THERE'S NO NEED TO STRETCH ANYTHING WITH A SPRAGUE TWIST-LOK®

they come in 2,365 ratings and sizes so you can make EXACT replacements

Some people claim that you can use multi-rating twist-prong capacitors to make replacements "as exact as they need be." Putting it another way, some other people say that you can take "a certain amount of leeway in the matching of ratings and sizes."

BUT — there is nothing exactly like an exact replacement, particularly when working with the exacting requirements of Color TV circuitry.

Yes, you can replace one twist-prong capacitor with another that has a higher voltage rating and everything's OK. That is, everything except the cost. You have to pay for the extra voltage.

True, too: Circuit tolerances may allow you to make successful replacements without matching original capacitance values exactly. However, if you pick a replacement that's at the high end of the circuit's tolerance, its own manufacturing tolerance may throw it out of the ball park. For example, you pull out a 100 μF @ 350 V unit and figure that the 150 μF capacitor on your shelf is a close enough replacement. But the standard industry tolerance on this part is +50%, —10%. Therefore, it may actually have a capacitance of 225 μF — more than double the value your circuit calls for. And probably will get you called back.

We repeat: There is nothing exactly like an exact replacement.

And . . . we make Twist-Lok Capacitors in 2,365 ratings and sizes so you can make exact replacements.

You can get a copy of Sprague's comprehensive Electrolytic Capacitor Replacement Manual K-109 from your Sprague Distributor or by writing to Sprague Products Company, 65 Marshall Street, North Adams, Massachusetts 01247.

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

SPRAGUE®
THE MARK OF RELIABILITY

EDITOR'S MEMO

'Cabbage-Odor' in the Winds

We get a lot of letters from ET readers. We try to print at least one page of these letters every month. But we get ten times as many as we can print. In fact, we can't personally answer every one of them. Even if the editors spent all their time answering letters—we still couldn't do it—but we try.

Out of all these letters we frequently get a few—these are always typed on attractive business stationery—which start our brain-neurons vibrating in high C. These letters invariably raise one question. We'll quote from a typical letter.

"Can you tell me why the home-entertainment equipment manufacturers spend so much money advertising to the general public on TV, radio, in newspapers and multimillion circulation newsstand magazines?

"All this effort is ostensibly designed to brain-wash people into buying a certain brand of product. Don't the electronic equipment manufacturers know that they are not selling breakfast food? Nor the latest topping for strawberries? Nor miniskirts? Nor men's shorts? Et cetera?

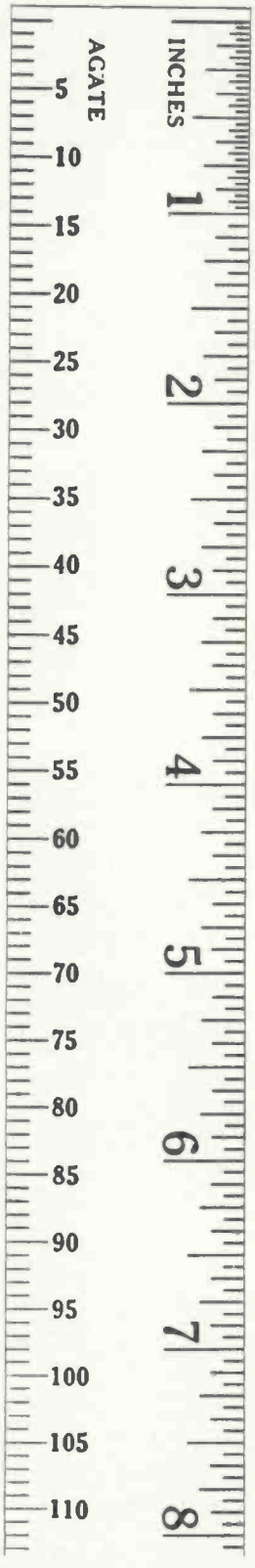
"In our town (100,000 population) the service-dealers and our technicians recommend the equipment which our customers buy—and they buy what we recommend."

Frankly, we've never been able to answer the questions raised in these "cabbage-green" letters. We can only suggest to the reader that he ask the manufacturer.

But there must be an answer tucked away somewhere in the mass of data maintained in market research files and sometimes used by manufacturers to direct their advertising campaigns. We've studied some of the data but it doesn't make much sense to us. We can understand the age-old urge to ride-herd on the affluent, purse-powered masses. But nothing is more fickle than public whims. You think you have it going in one direction and then—pow!—it stampedes in the opposite direction—no matter what you use for brain-wash.

So, we know a "cabbage-odored" smell when we smell it. And we know who's really selling and servicing the bulk of the color and B/W TVs, radios, phonos and tape recorders across this land.

NOW...a full-sized VOM in a palm sized "package"



160 Volt-Ohm-Milliammeter
Complete with alligator clip leads and operator's manual.
.....$50.00

Carrying Case—
Cat. No. 2225.....$ 9.50
Accessory Leads—
Probe Tip Lead—
Cat. No. 2055.....$ 2.75

Simpson 160 Handi-VOM®

Simpson Handi-VOM gives you the ranges, the time-saving conveniences and the sensitivity of a full-sized volt-ohm-milliammeter—yet it's only 3-5/16" wide, weighs a mere 12 ounces. Recessed range-selector switch never gets in the way . . . polarity-reversing switch saves fuss and fumble. Self-shielded taut band movement assures high repeatability and freedom from external magnetic fields. Diode overload protection prevents burn-out—permits safe operation by inexperienced employees and students. The demand is BIG, so get your order in to your electronic distributor, TODAY!

RANGES

ACCURACY: ±3% FS DC, ±4% FS AC
DC VOLTS: 0-0.25, 1.0, 2.5, 10, 50, 250, 500, 1000 @ 20,000 Ω/v
AC VOLTS: 0-2.5, 10, 50, 250, 500, 1000 @ 5000 Ω/v
DC MICROAMPERES: 0-50
DC MILLIAMPERES: 0-1, 10, 100, 500
DB: −20 to +10, −8 to +22, +6 to +36, +20 to +50
"O" REFERENCE: 1 MW into 600Ω
RESISTANCE: Rx1, Rx10, Rx 100, Rx1 K , Rx10K (30 Ω center)

AGM DIVISION

Simpson
INSTRUMENTS THAT STAY ACCURATE

SIMPSON ELECTRIC COMPANY

5200 W. Kinzie Street, Chicago, Illinois 60644 • Phone: (312) 379-1121
Export Dept: 400 W. Madison Street, Chicago, Illinois 60606, Cable, Simelco
IN CANADA: Bach-Simpson Ltd., London, Ontario
IN INDIA: Ruttonsha-Simpson Private Ltd., International House, Bombay-Agra Road, Vikhroli, Bombay

Representatives in Principal Cities ...See Telephone Yellow Pages

WORLD'S LARGEST MANUFACTURER OF ELECTRONIC TEST EQUIPMENT

... for more details circle 145 on postcard


SYLVANIA
SYLVANIA
RADIO
TV
SERVICE
BRIGHT
GUY

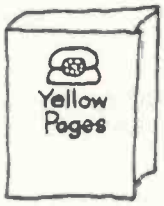
Are you eligible for the Bright Guy Awards?

It's easy to get them—and to get all the business they'll bring you. New customers. More sales. More money.

The Bright Guy Awards is the big program Sylvania's running this year to boost your sales.

Your Sylvania distributor can put your name and address in TV Guide in your own area. These Sylvania ads will call you "the brightest serviceman in town"—and tell people in your town why they should call you.

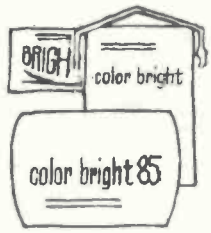
You'll get into the Yellow Pages, too, under the heading "TV Service and Repairs."



Once again this year you'll be eligible for over one hundred valuable, interesting SMB-Bright Guy gifts, just for buying the Sylvania TV replacement parts you normally buy anyway.

And you'll get window displays proclaiming you "the brightest"—the TV serviceman everyone's reading about.

You're eligible for the Bright Guy Awards just by buying Sylvania's famous *color bright 85*® color picture tube. And our other picture tubes, and our receiving tubes. So see your Sylvania distributor.



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

SYLVANIA

SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS GT&E

TECHNICAL DIGEST

ADMIRAL

TV Chassis H5/1H5—New Hybrid Chassis

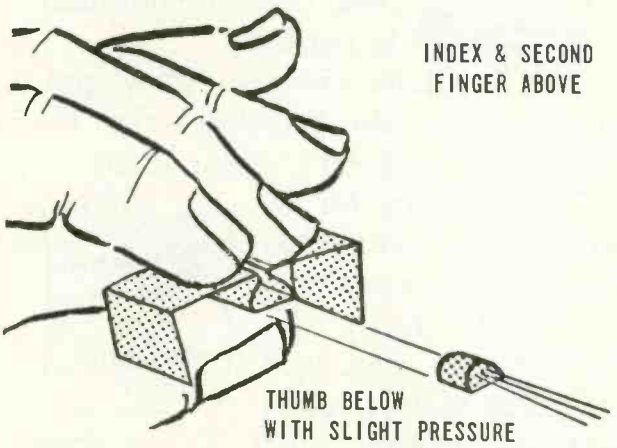
The H5 and 1H5 chassis employ both tubes and transistors. Nine transistors and five tubes (plus CRT) are used. Tubes are used in the audio output, vertical output and horizontal sections; the rest of the circuitry, including both VHF and UHF tuners, use semiconductors.

Four new receiving tubes and two new CRTs are used in the following chassis: 11LT8, 24BF11, 24JZ8, 53HK7, 19HAP4 and 21GTP4.

Portable Phono Chassis 2E2/2E2A—New Transistor Heat Sink

Portable phono models with the 2E2 and 2E2A chassis use a new type of output transistor which requires a unique heat sink. This transistor has a black plastic case instead of the metal case generally used on output transistors.

The heat sink, 15A3453-1, requires special handling because it can be easily broken (see drawing). To maintain



a balanced output, the heat sink must be unbroken and must be mounted so the base of the transistor is flush with the bottom edge of the heat sink. If it is slid too far down, it can short out the transistor leads.

CANADIAN GENERAL ELECTRIC

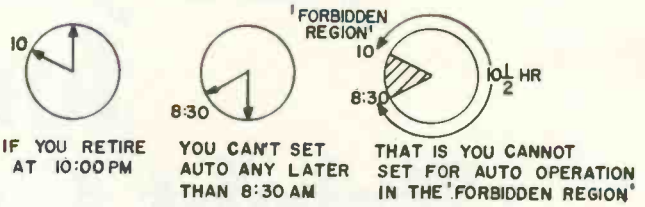
Clock Radio—Timer Operation Automatic Mode

From time to time, reports have been received about improper timer operation of clock radios. The cause of most of these complaints was traced to a lack of understanding of the limitations of the timing cycle.

In all clocks, there is a "forbidden" region for automatic operation. This is the period of time the automatic cycle will override the normal operation of the radio.

The timer on the clock may be set for automatic operation, for a maximum of 10½ hr in advance of the desired wake-up time. For example, if you retire at 10:00p.m., the alarm hand must be set to awake you no later than approximately 8:30a.m. The sketches shown may better illustrate this point.

If the alarm hand is set during this forbidden region

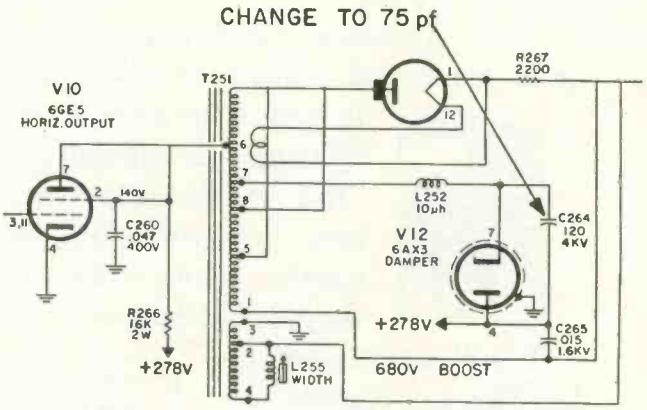


and the timer is switched to one of the automatic modes, the following will be observed depending on the model:

1. For full feature clock radios, for example, 35R62 or 35R63, the radio will begin playing immediately after warm-up.
2. On radios without full features, for example, 35R31, the timer will not stay in the AUTO position, it will "pop" out of this position.

TV Chassis M664—Reducing Width

The plate to cathode capacitor, C264, on the damper tube, V12, has been changed to reduce scan width. Change



C264 on your schematic from 120pf to 75pf 4kv.

The part is a standard value and will not be stocked.

MOTOROLA

TV Chassis TS460 Video Amplifier and Output Circuits—Circuit Description

A two-stage video amplifier is used in the TS460. The first stage is used to provide a relatively high impedance load to the 2nd detector and a low impedance to the video output. Since audio, sync and AGC information are taken from the output of the video amplifier, the video output can be designed to take advantage of this to obtain a 25 percent increase in video output over what could be obtained if sync, sound and AGC information had to be retained.

Forward bias for the video amplifier, Q7, (shown in schematic) is provided by a voltage divider consisting of R114, R115, R116, R117 and R603C. The video bias control, R603C, is adjustable and is used to vary the bias

continued on page 30

Getting a hernia and not getting paid for it?

Let Arcolytic® capacitors lift the load off your mind. Or anywhere else it happens to be.

These aluminum electrolytics are built to last: wound with computer-grade 99.99% pure aluminum foil so they'll keep operating in your customers' sets even at continuous temperatures of 85°C.

You'll find they take the worry right out of premature failure, lost customer confidence and costly call-backs.

There's no premium cost, either. Arcolytics are priced along with other home entertainment capacitors.

Ask your Authorized Arco Distributor for Arcolytic electrolytic capacitors in single-section tubular, multiple-section tubular, or twist-mount designs. It may be the best break you get this year.

Arco Electronics

A DIVISION OF LORAL CORPORATION
Community Drive, Great Neck, N.Y./
Arlington, Texas/Elk Grove Village,
Illinois/Pasadena, Menlo Park,
California. Write for our free catalog.

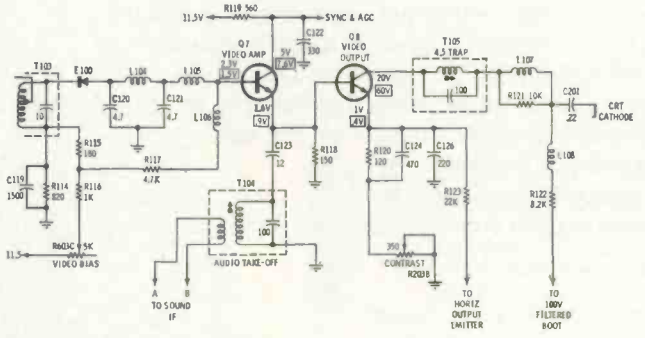
. . . for more details circle 106 on postcard

TECHNICAL DIGEST

continued from page 28

of the video amplifier, Q7. Since the video output, Q8, base circuit is connected back to the emitter of the video amplifier, any change in bias setting of R603C will also change the conduction of Q8. Bias for Q8 is derived by the current flowing through the emitter resistor R118 of the video amplifier, Q7.

When the IF is amplifying, noise or signal is applied to the 2nd detector diode. The diode conducts on the negative peaks or negative portions of the signal and



electrons flow through L104, L105, L106, R117, R115 and T103. The electron flow in R117 causes a voltage drop, because of signal or noise which is in opposition to the bias voltage, thus reducing the forward bias on this stage. Because of this, the receiver should be tuned to a low noise vacant channel, preferably channel 13, or set between channels, when adjusting the bias control, R603C.

To adjust the bias control:

1. Set receiver to vacant channel, preferably channel 13 (or set between channels).
2. Set contrast control to maximum.
3. Adjust video bias control counter-clockwise (CCW) until snow disappears.
4. Rotate control clockwise (CW) until snow appears normal, plus about ⅛ turn.
5. Check receiver on all channels to determine if they are snow free.

At this setting, the collector voltage of the video output, Q8, should be approximately 10-12v (with the IF disabled by shorting the emitter-to-base of the 3rd IF amplifier, Q6, and with the tuner set on a vacant channel).

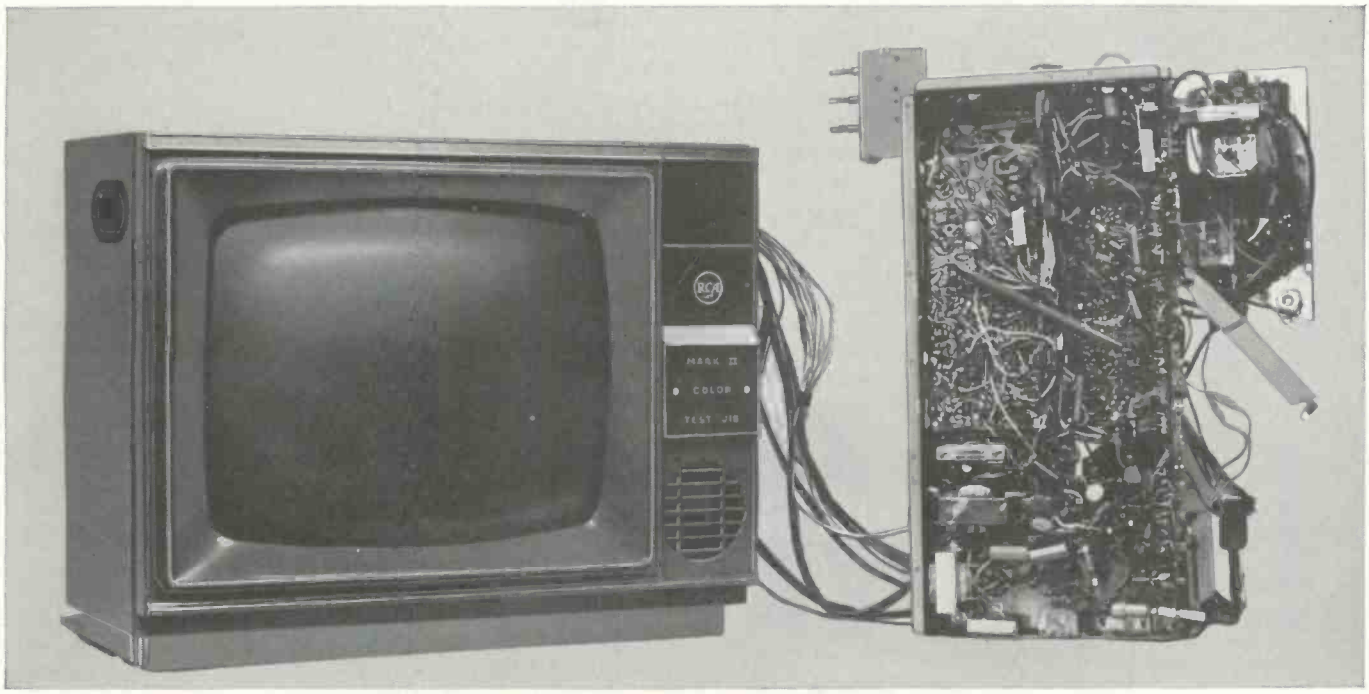
The video amplifier, Q7, operates as an emitter-follower for video and audio information and as a common-emitter for sync and AGC information. The 2nd detector output controls the base/emitter voltage of Q18 and in turn determines emitter/collector current. T104, in the emitter circuit of the video amplifier, Q7, is a sound take-off transformer, tuned to 4.5MHz. Composite video appearing across the emitter resistor, R118, is directly coupled to the base of the video output, Q8. Video is also taken from the collector of Q7 and fed to the AGC gate and sync separator.

The emitter resistance of Q8 is near 250Ω. The contrast control, R203B, introduces degeneration in the emitter circuit when set toward minimum contrast (maximum resistance). C124 and C126 provides some bypassing of the higher frequencies to improve high frequency response.

The collector load of Q8 consists of L107, L108 and

continued on page 32

RCA announces 2 new color-TV test jigs



New RCA MARK II

■ **IDEAL** for servicing all the RCA 90° rectangular receiver chassis (18″ diagonal and larger) and RCA 70° round (21″) receiver chassis made within last 10 years.

■ **COMPACT** in size, weight and price. 30% smaller and less than half the weight of former models.

■ **PACKED WITH NEW FEATURES.**

. . . Automatic degaussing assembly.

. . . Large padded hand holds double as side entry paths for servicing cables.

. . . Preassembled Kine neck components are ready to slip on and clamp in place.

. . . Rugged welded-steel cabinet, in rich hammeroid cobalt grey to match test equipment. Picture tube not included.

New RCA MARK III

■ **PORTABLE,** for in-the-home chassis check, without removing chassis from cabinet.

■ **A SALES TOOL.** Lets you compare customer's picture tube with test jig picture tube performance.

■ **VERSATILE.** Use the Mark III with all RCA 90° rectangular receiver chassis (18″ diagonal and larger), and all RCA 70° round receiver chassis (21″) made within last 10 years.

■ **INCLUDES** all Kine neck components—preassembled. Ready to slip on and clamp in place. Durable polyethylene cabinet. Picture tube not included.

Put an RCA Mark II in your shop and an RCA Mark III in your truck. The combination will help you speed up job completions . . . and sales. See both of these outstanding color-TV test jigs at your RCA Distributor today.

RCA PARTS AND ACCESSORIES, Deptford, N.J.

The Most Trusted Name in Electronics

See the Perry Como Holiday Special in color on NBC-TV. Thursday, November 30. 7:30-8:30 P.M. EST.

TECHNICAL DIGEST

continued from page 30

R122. The video information is ac-coupled from the Q8 collector circuit, to the CRT cathode by C201. T105 is a sound trap tuned to 4.5MHz and is adjusted for minimum 4.5MHz interference on the CRT. L107 and L108 provide high frequency peaking. Collector voltage is supplied by the boot strap circuit of the horizontal output stage.

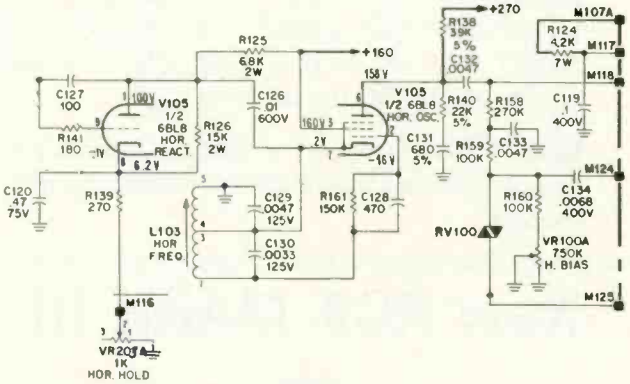
Horizontal retrace blanking is provided by introducing a positive horizontal pulse from the emitter circuit of the horizontal output, Q23, through R123 to the emitter of the video output. This positive pulse turns off the video output, Q8. The collector voltage of Q8 will then rise—biasing off the CRT during the horizontal retrace interval.

PHILCO

Color TV 'Q' Line—Improving Vertical Linearity Performance

On the deflection sound panel, capacitor C133 was changed from a 0.0047μf 500v part #30-1294-13 to a 0.0015μf 500v part #30-1294-30. The capacitor is located in the plate circuit of the horizontal oscillator tube.

Also, capacitor C134 was changed from a 0.0068μf 20 percent part #30-4705-111 to a 0.001μf 20 percent part #30-4705-201. This capacitor is located between lug



M124 and resistor R160 in the horizontal oscillator circuit. This panel will be identified by a red slash.

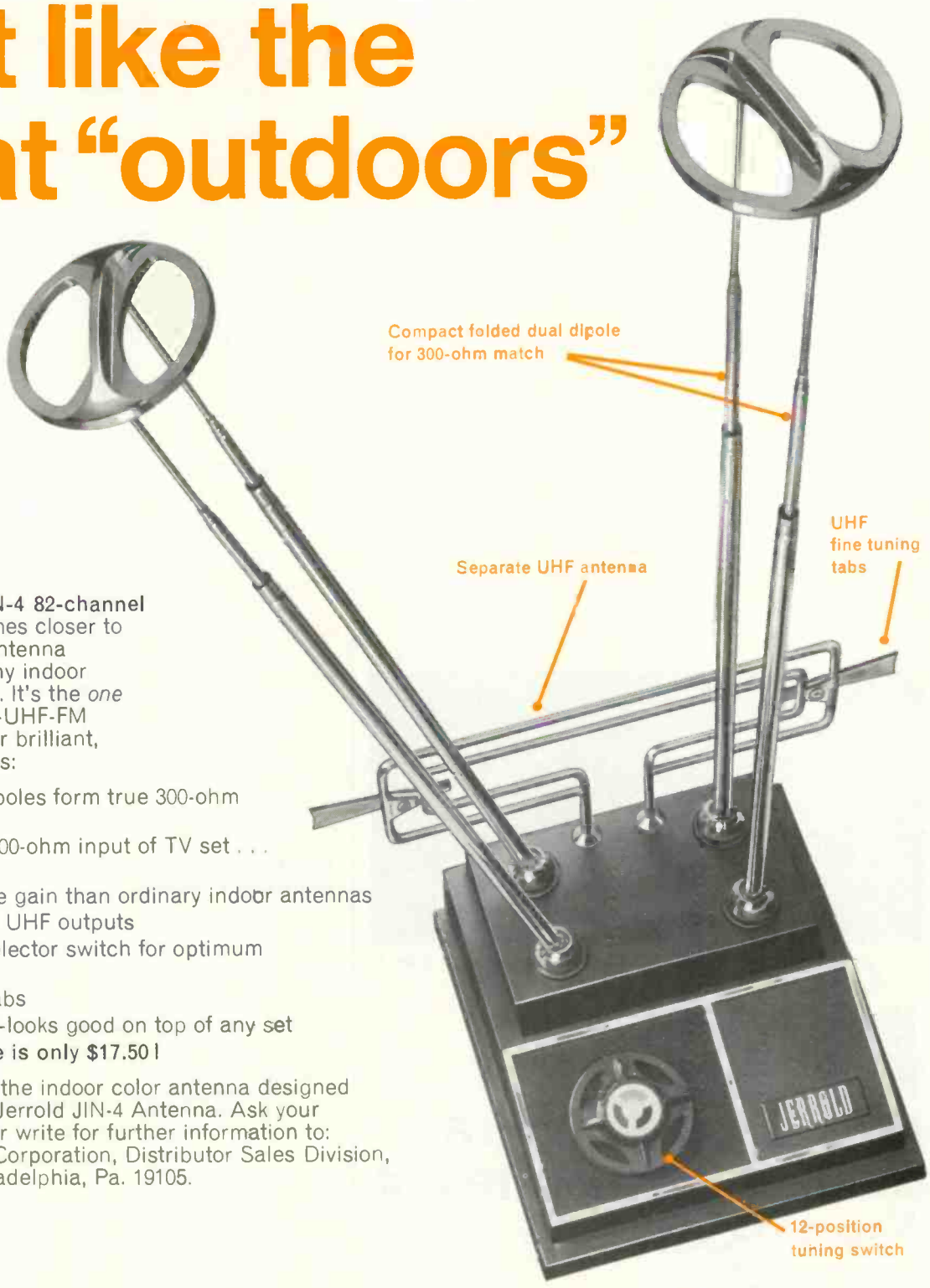
The above changes will help eliminate the low frequency oscillation in the horizontal output circuit.

In the event capacitor C120 (0.47μf 75v) in the cathode circuit of the horizontal reactance tube, V105, requires replacement, add a 1K ½w resistor between the center arm of the horizontal hold control, VR203A, and ground. This change will insure improved protection against intermittents which could cause voltage stress on C120.

A touch up of L103 (horizontal frequency coil) may be necessary after adding the resistor to center the horizontal hold range.

IF YOU CHANGE YOUR ADDRESS
NOTIFY: ELECTRONIC TECHNICIAN
Ojibway Building
Duluth, Minnesota 55802
Please include the address label from a recent issue and allow six weeks for the change.

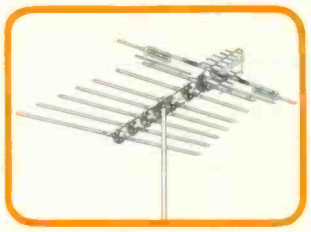
Built like the great "outdoors"



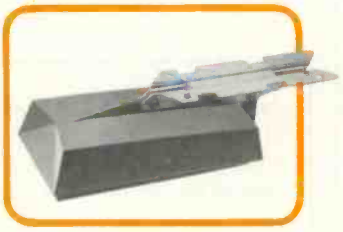
The new Jerrold JIN-4 82-channel Indoor Antenna comes closer to delivering outdoor antenna performance than any indoor antenna made today. It's the *one* 300-ohm indoor VHF-UHF-FM antenna designed for brilliant, life-like color pictures:

- Twin telescoping poles form true 300-ohm folded dipole
- True match with 300-ohm input of TV set . . . ends color smears
- Delivers 2 dB more gain than ordinary indoor antennas
- Separate VHF and UHF outputs
- Twelve-position selector switch for optimum tuning
- UHF fine tuning tabs
- Attractive styling—looks good on top of any set
- **And the List Price is only $17.50!**

Get more details on the indoor color antenna designed to be the best. The Jerrold JIN-4 Antenna. Ask your Jerrold Distributor or write for further information to: Jerrold Electronics Corporation, Distributor Sales Division, 401 Walnut St., Philadelphia, Pa. 19105.



Outdoor antennas



Distribution equipment

JERROLD

Focusing on one thing... better reception

. . . for more details circle 125 on postcard

ERRATUM

Many readers may have noted that the second color imprint for Fig. 7, 8 and 9 in the July 1967 "Semiconductors From A to Z article" was not properly aligned. Those figures should have appeared as they are now shown here.

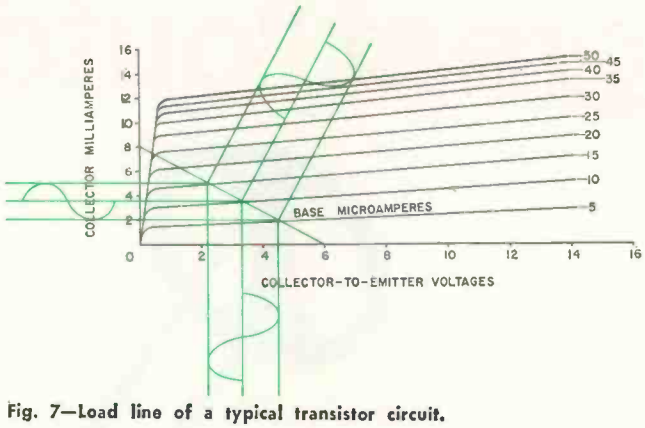


Fig. 7—Load line of a typical transistor circuit.

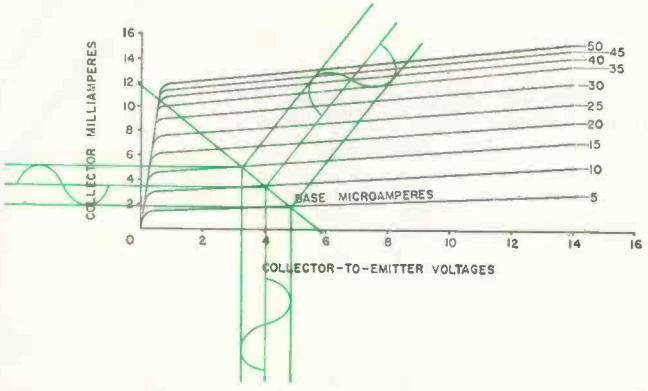


Fig. 8—The transistor's collector-to-emitter voltage increases as the load resistance decreases.

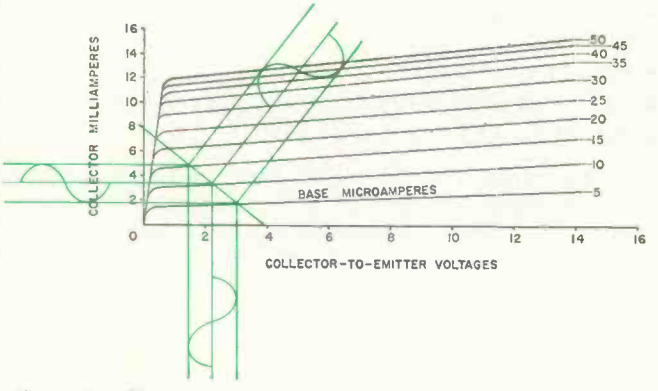


Fig. 9—A reduction in the amount of voltage supplied to a transistor circuit appears almost entirely as a reduction in its collector-to-emitter voltage.

Take advantage of the handy mail-order card in this magazine. If you would like information about the products listed on this card, return it to us and we will see to it that you receive the literature that you desire.

ELECTRONIC TECHNICIAN
Ojibway Building **Duluth, Minn. 55802**

Using silicon rectifiers in horizontal AFC circuits

FIG. 1. 6AL5 AFC CIRCUITS

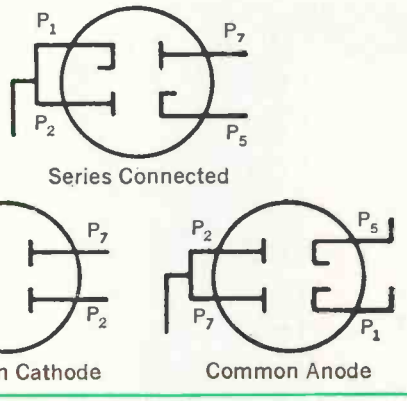


FIG. 2. SELENIUM RECTIFIER AFC CIRCUITS

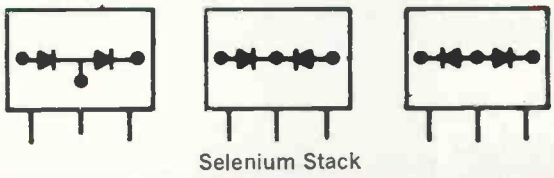
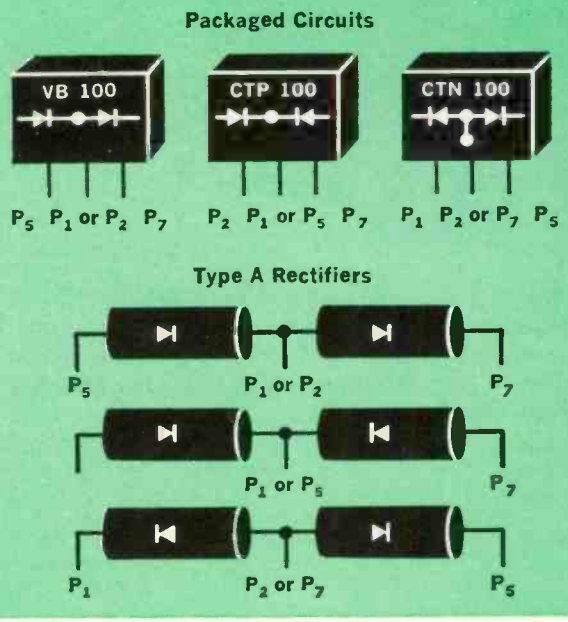


FIG. 3. MALLORY SILICON RECTIFIER REPLACEMENTS



Many of the older TV sets you'll run into have a 6AL5 dual rectifier tube in the horizontal automatic frequency control circuit. Its function is to insure a stable horizontal frequency, by comparing the input signal from the sync separator with a feedback signal from the horizontal output. Three different circuits were used for this job, as shown in Figure 1.

In some later sets, selenium rectifiers took over the 6AL5 job for AFC. These were connected as shown in Figure 2.

When you run into one of these AFC circuits that needs fixing, you can do your customer a favor by switching to Mallory silicon rectifiers. You'll give him a repair job that will shape up this part of the set for all time, at no extra cost. You won't have to chase around finding a selenium stack with exactly the rating you need. And you're sure you won't ever have a call-back on the job.

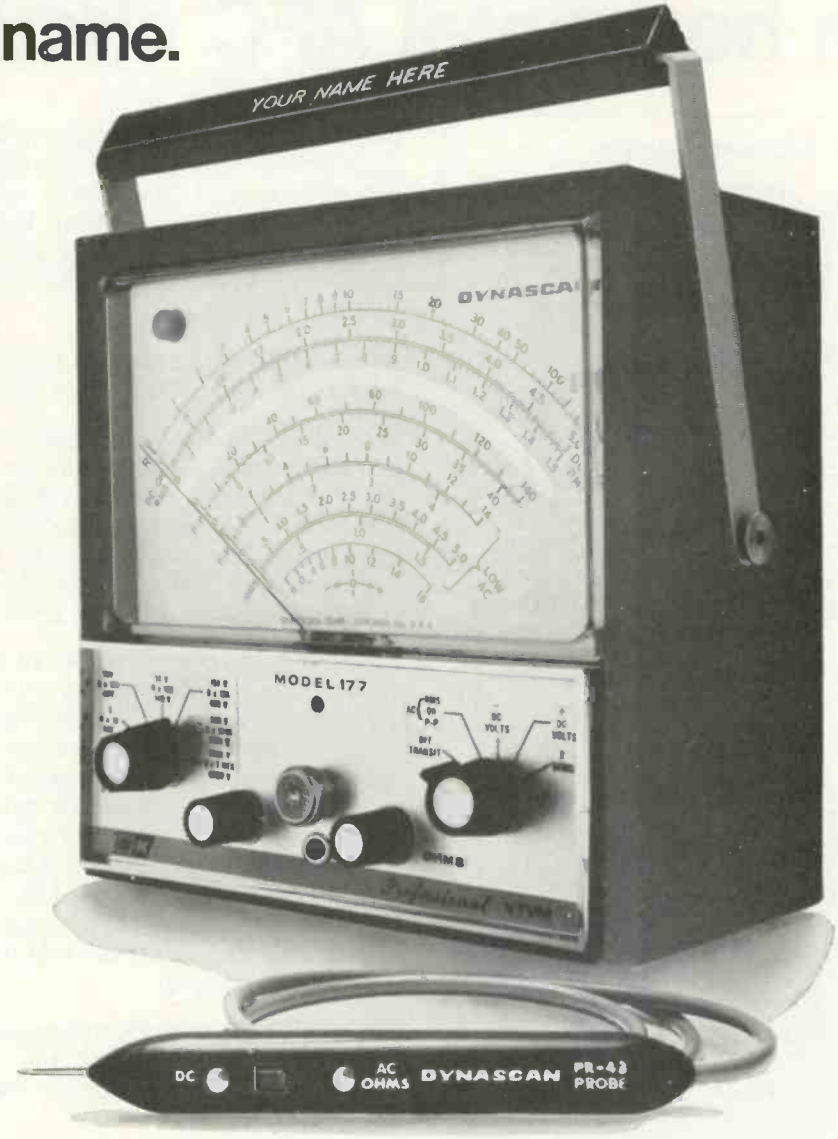
You can go either of two ways with Mallory silicon replacements. Simplest is to use a Mallory packaged rectifier circuit—a pair of factory-connected rectifiers in a single compact plastic case. Cost is slightly less than two separate rectifiers, and installed reliability is better because you have fewer solder connections to make. The VB doubler is ideal for the series-connected AFC circuit; just get a Mallory VB100 and hook it to the tube socket. For the common cathode AFC circuit, use a Mallory CTP100 (full wave, center tap positive). And for the common anode circuit, use a Mallory CTN100 (full wave center tap negative).

Or if you prefer to work with separate rectifiers, get yourself a pair of Mallory Type A's. The A100 will work fine. Either way, just make your connections as shown in Figure 3.

For this service, 100 volt ratings are ample to give you full protection against transient "spikes" and assure long life. For other applications in TV sets, stereo, radios and industrial equipment, take a look at the complete line of Mallory power rectifiers, zener diodes and other semiconductors stocked by your Mallory Distributor. He's a good guy to know for everything you need for service, prototype building or experimental work. Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Indianapolis, Indiana 46206.

There's a heckuva lot of VTVM units around.

Only the 177 "Professional" has battery eliminator, mirrored scale, half volt scale for transistor circuits and–your name.



If you're one of the skeptics who think one VTVM is pretty much like another, the B&K 177 "Professional" will change your mind. This one stands out from the crowd.

A gigantic 7" mirrored scale reads faster, more accurately. An extra-sensitive 0.5 VDC range will check transistor circuits.

A zener diode regulated power supply insures reliable ohmmeter performance. No batteries required. A single probe ends cable fumbling. Transit switch position protects the meter on the road. The vinyl covered steel case is good-looking and tough. Its appearance symbolizes your professional status and, above all, it has B&K quality.

Any way you look at it, the 177 "Professional" is really different and it's all *yours*—the handle is personalized with your name. Cost? Just **$79.95.**

B&K Division of Dynascan Corporation
1801 W. Belle Plaine • Chicago, Illinois 60613

B&K

Where Electronic Innovation Is A Way Of Life

. . . for more details circle 109 on postcard

ELECTRONIC TECHNICIAN

SEPTEMBER 1967

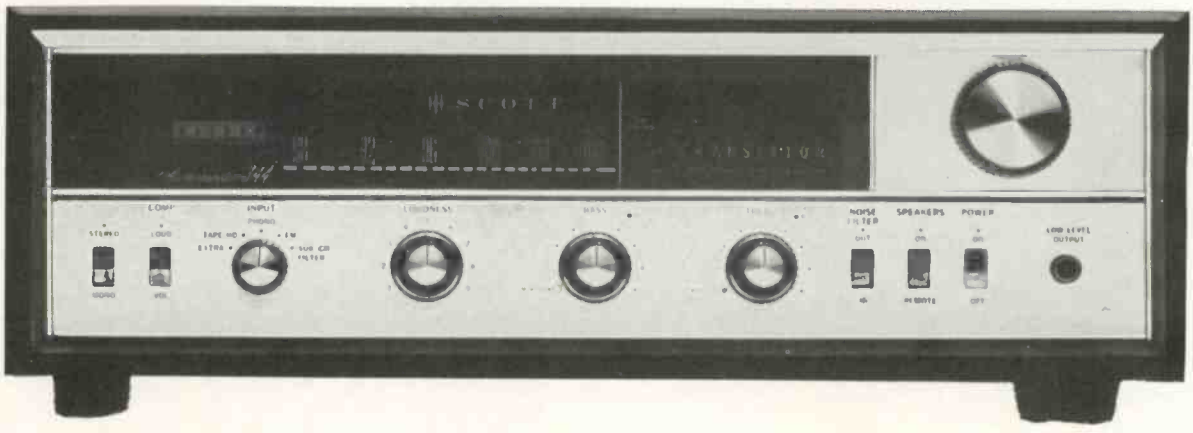
Stereo Hi Fi and Today's Technician

Keep up or fall by the wayside

■ What began as a novelty and a long-haired hippie-audiophile-craze (we still remember the stereo recording of a train that appeared to enter one door of the living room and make its exit out another door on the opposite side) has now grown into a multimillion dollar home-entertainment business.

In those days almost anything and everything having two speakers was sold to the public as stereo "Hi Fi" (much of it was neither stereo, nor Hi, nor Fi). But, as the public learned and became more discriminating, the equipment improved and after that no one except perhaps the "teen-group" showed any interest in the counterfeit, so-called Hi Fi junk being made and sold by quick-buck, fly-by-night manufacturers. And the general public demand for more sophisticated equipment continued unabated.

FM/multiplex broadcasting followed. The FCC established reasonably tight technological standards for both transmitting and receiving



Above: H. H. Scott solid-state integrated FM and FM/MUX receiver, preamp and amplifier. Opposite: Harman-Kardon solid-state integrated FM and FM/MUX receiver, preamp and amplifier.

TODAY'S TECHNICIAN . . .

equipment. A heavy demand for stereo/mux adapters arose. Then came "the works"—all in one package—to compete with the "component part" Hi Fi concept.

In the meantime, "revolutionary" type speakers and enclosures were developed and lightweight record player tone-arms that "floated on air," so to speak, became the rage. Two-track, four-track, eight-track stereo tape recorders followed close behind. Then tape players for autos and for the home. On top of all this came the surging wave of solid-state technology—pounding against the crumbling sea-walls of conventional electron tube concepts—exotic transistor designs and microminiature integrated circuits that made Dick Tracy's wrist radio look like a steam locomotive in comparison.

Some Prospered

Quite a few service-dealers got on the bandwagon, kept up with the trends through their trade magazines, trained apprentice technicians for Hi Fi troubleshooting and repair and slowly built their stereo Hi Fi sales and service departments, along with TV sales and service, into profitable organizations.

Successful operators used every means at their disposal to promote Hi Fi equipment—both mono and stereo—including promotional material provided free by various Hi Fi equipment manufacturers. They left much of this material—booklets on tape recorders, AM/FM/Stereo tuner and amplifier components, tape players, FM antennas, etc., in homes while making TV service calls. A supply of this material was also made available on store counters. These service-dealers also kept up on new product developments by using the "Tell-Me-More" reader service cards which can always be found in the back section of ELECTRONIC TECHNICIAN every month.

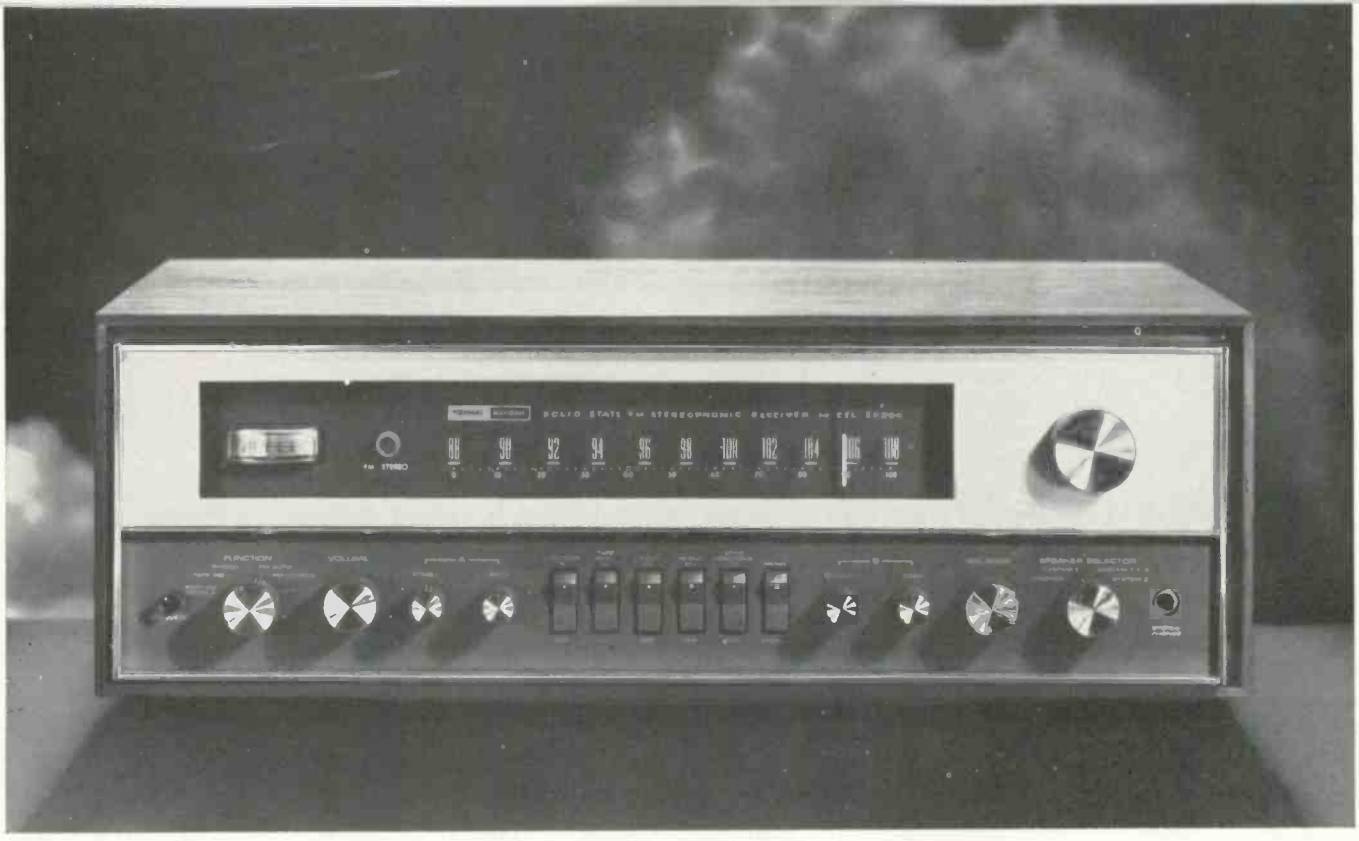
Some Missed the Boat

But a significant number of service-dealers got confused and became lost among the fast-shifting sands. And a lot of their technicians failed to keep up with solid-state technology and found themselves unable to cope intelligently with the troubleshooting and servicing problems involved with the new equipment.

But who can blame these well-meaning few who fell by the wayside? After all, who was really interested in locomotives—steam, Diesel or electric—that passed noisily through living rooms? What's this business about "monaural" (literally meaning 'one-eared') and monophonic (literally meaning single-channel audio)? And what's the real difference between derived-channel stereo reproduction versus two-channel recording and reproduction? What about all the equipment (much of it highly advertised at the time) that also passed in one door and out the other—to be heard from no more? The manufacturer's representatives and distributors who sold this equipment have long-since departed for greener fields. Even mail sent to their last-known addresses last week was returned today marked "Moved. Left No Address."

"At a seminar," one service-dealer says, "I asked 'What is stereo?' and the reply I got was a sub-professional doubletalk song-and-dance which reminded me of the spiel of a 'horse-liniment' salesman I heard at the county-fair carnival when I was a kid."

But people are human. And because people are human, they seldom find the median path through any particular situation in life. They swing—like clock pendulums—through a central point: yanked and pulled back and forth by various in-



fluences loitering along the way on both sides of the road. Only a few have the guts to follow the well-beaten path—straight ahead—being guided only by their hard-won ideas and dreams and dogged determination to succeed.

Where Are We Now?

The nature of Hi Fi equipment is such that it does not really matter much at what point a service-dealer begins to do business with it. He can begin, in point of time, at any spot on the continuously up-swinging linear line. But, essentially, the graph of Hi Fi growth is more exponential than linear. The business grew more this year than it did last year—and it will grow more next year than it did this year.

We are confronted with rising sales in all types of home-entertainment equipment in addition to TV and regular radios: Hi Fi mono and stereo components, stereo packages, tape recorders, tape players and portable phonos. In all but a very few locations dominated by widely advertised discount houses, the business is there for the taking. But it won't come to you. You have to spend a little time and a little money promoting it. And when you do promote and sell it, don't talk technical jargon. Forget that you know anything about crossover networks, derived center channels, db, equalization, feedback, harmonic distortion, gain and a score of other terms. Sell entertainment—good music reproduction. And don't try to sell stereo by claiming that it is something new that replaced "Hi Fi." Stereo *is* Hi-Fi—at its best.

It will not be long until transoceanic stereophonic broadcasting via satellite will be a reality. And this will provide added impetus to Hi Fi equipment sales.

FM/multiplex broadcasting continues to expand and so does the demand for better reception in this area. In almost all cases, this means better antenna equipment and more accurate servicing and equipment alignment.

If you are a technician working for a service-dealer who sells or plans to sell Hi Fi stereo equipment, then you'd better start studying. Bone up on amplifier basics—especially solid-state amplifier theory, integrated circuit theory and troubleshooting techniques (see the articles "Semiconductors from A to Z" and "Solid-State Audio Amplifiers" running in ELECTRONIC TECHNICIAN).

Another article, "Rapid-Fire Location of Stereo Amplifier Faults" which appeared in the May 1966 issue of ET, is must-reading if you want to keep up with modern techniques being developed to troubleshoot and align stereo equipment quickly and accurately.

Specialized test instruments are also required for troubleshooting, aligning and repairing stereo Hi Fi equipment. (See the article, "Using Audio Test and Alignment Instruments which began in the March 1967 issue of ET.) Besides a good scope, you'll need a good square-wave generator, test records and test tapes, "wow" and "flutter" meter and perhaps a distortion analyzer. These and other specialized instruments will prove to be very helpful in getting the job done accurately, faster, more efficiently and meet the demands of a more discriminatic public.

Merchandising and sales techniques are changing fast. And so are servicing techniques. Selling has become more sophisticated and service more technical. If you can face up to these two realities existing in our industry today, you can project yourself way ahead of where you now stand.

Part One of a Series

Solid-State Audio Amplifers

Learn how they work and repair them faster

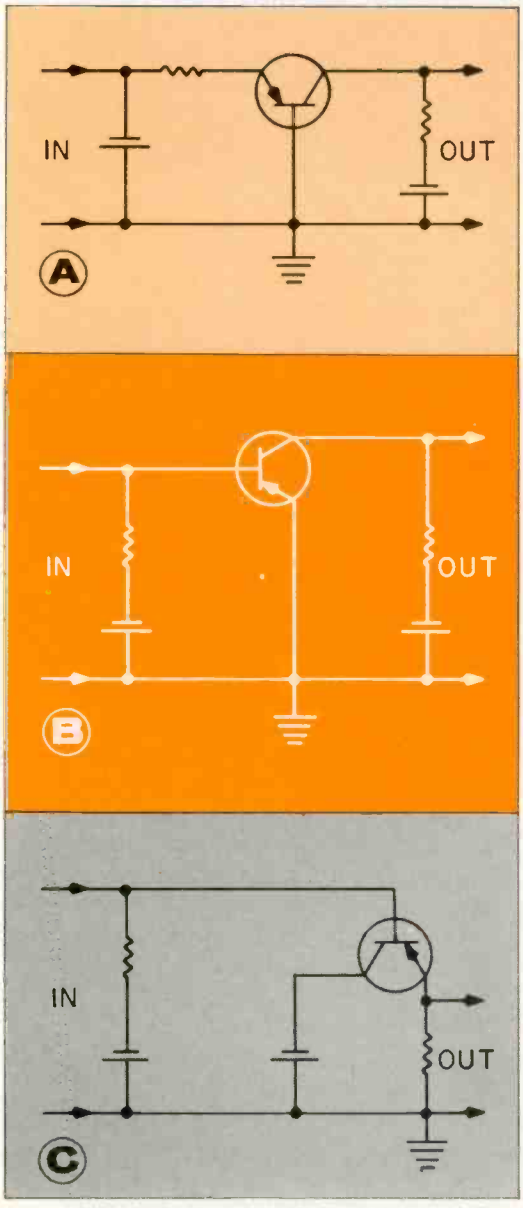


Fig. 1 (A)—Grounded-base. (B)—Grounded-emitter. (C)—Grounded-collector. All using PNP transistors.

■ As we have already learned, three basic transistorized circuits are used in electronic equipment. As shown in Fig. 1, they are the grounded (common) base, grounded (common) emitter and grounded (common) collector circuits. The grounder-emitter circuit is probably the most widely used, followed by the grounded-collector circuit (frequently called an emitter-follower).

We will discuss each of the aforementioned circuits, including the grounded-base configuration, in somewhat greater detail later—especially those circuits and combinations used in audio amplifiers. This does not mean, however, that the solid-state amplifier theory will be explored from the designer's viewpoint. This article is addressed to professional home-entertainment equipment service technicians.

It is naturally assumed here that readers have had adequate training in solid-state basics. If you require additional information in this area, refer to the lengthy article series, "Semiconductors from A to Z," which has been running in ELECTRONIC TECHNICIAN for more than a year. This article also covers integrated and microelectronic circuits presently used in audio amplifier circuits.

Audio Amplifier Types and Coupling Methods

It is the practice in discussing solid-state amplifiers to refer to "small-signal" and "large-signal" amplifiers. Small signal amplifiers, of course, are those stages that precede the final, large-signal, or power output amplifier. Small-signal amplifiers are normally "cascaded" in stages to build up the signal in steps to a sufficient amplitude to drive the output amplifier which in turn drives a speaker or speakers. As a rule-of-thumb, we can say that small signal amplifiers have from a few mw output up to about 1w and all outputs beyond 1w can be considered large-signal amplifiers.

We already know, too, that amplifiers are generally classified according to their operating modes: Class A, AB or B. We will not detail the fine differences which exist between the AB_1 and AB_2 amplifier operating modes. Nor will we discuss the class C amplifier which is not used in audio circuits.

Let's remind ourselves that a class A amplifier is biased to operate on the most linear portion of the dynamic transfer characteristic curve (the input-output curve shown in Fig. 2). The base bias and alternating input signal are adjusted so collector current flows continuously

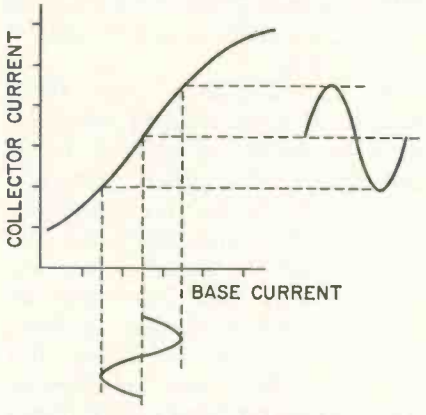


Fig. 2—Class A amplifier dynamic transfer characteristic curve.

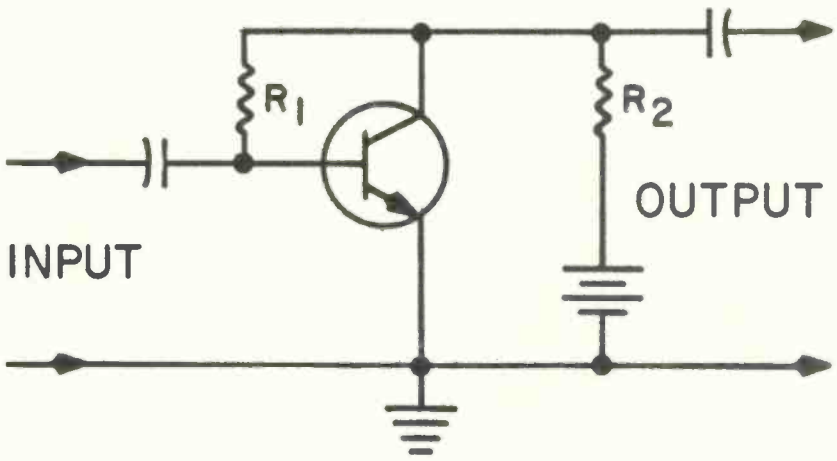


Fig. 3—Grounded emitter, single-ended, low-level class A amplifier using an NPN transistor.

during the complete cycle of the signal—and even when no signal is present. This type amplifier provides a faithful reproduction of the input signal and is usually employed in a single-ended circuit although it may be used in push-pull to minimize distortion. This assumes, of course, that the bias is maintained stable under all conditions. A simplified schematic of a low-level, single-ended class A amplifier is shown in Fig. 3. Simple class A amplifier circuits are frequently used in low-level audio stages in preamplifiers and drivers.

In the simplified circuit shown in Fig. 3, note that R1 determines the base bias and the output signal is developed across the load resistor R2. This is a grounded-emitter circuit. We will discuss component functions in these circuits in forthcoming articles—especially from the trouble-diagnosing viewpoint.

The class B amplifier is biased to approximately collector-current cutoff to allow a small amount of collector current to flow for approximately one-half of each cycle when an alternating signal is applied. On the other half cycle, the transistor conducts, producing a half cycle at the output. This type amplifier is operated push-pull to reduce distortion in the output signal.

When two transistors are connected in class B push-pull, one transistor amplifies half the signal and the other transistor amplifies the other half. These half-signals are then combined in the output circuit in an amplified state. A simplified schematic of a class B push-pull audio amplifier is shown in Fig. 4.

The class AB amplifier is operated between the A and B amplifier modes—a combination of both. The base bias and the ac input signal are set so collector current flows for somewhat more than half but less than the entire cycle. That is, collector current is cut off for a portion

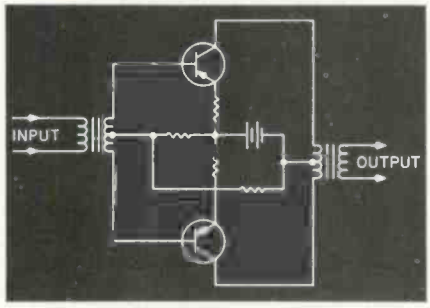


Fig. 4—Simplified schematic of a class B push-pull audio amplifier.

of a half cycle, but not for an entire half cycle. This amplifier is also operated in push-pull to minimize distortion.

It should be noted at this point that audio power amplifiers are generally designed to operate class A single-ended or class A, class AB or class B push-pull. Other specific types of circuits are used, however. These include single-ended class B circuits which employ two similar-type transistors and the complementary/symmetry circuits which use two different type transistors. The circuits offer certain advantages of class B push-pull operation in addition to direct input coupling and speaker voice-coil coupling—eliminating either or both transformers. Since this latter group of circuits is becoming common in some audio equipment today, it will be helpful from the troubleshooting viewpoint to understand how they function.

A single-ended class B circuit, employing two PNP transistors and input driver transformer, is shown in Fig. 5. The secondary windings of the driver transformer are bifilar-wound (both wires of the two coils are wound together). These windings are phased so a negative signal flows from base to emitter (PNP) of one transistor simultaneously with a positive signal which flows from base to emitter of the other transistor.

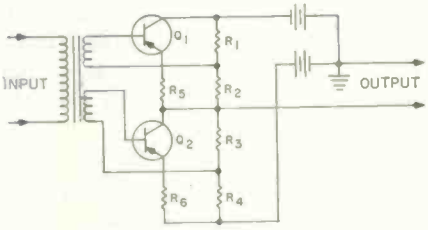


Fig. 5—Simplified schematic of a single-ended class B amplifier using two PNP transistors.

Thus, when a negative signal is applied to the base of transistor Q1, it draws current. This curernt is forced to flow through the load because of the positive signal on the base of transistor Q2 which cuts it off. When the signal polarity reverses, transistor Q1 is cut off, while Q2 conducts current. The dividers R1/R2 and R3/R4, provide a dc bias to keep the transistors slightly above cutoff under nonsignal conditions which reduces or minimizes crossover distortion. The emitter resistors R5 and R6 help compensate for minor differences between transistors and the effects of variations caused by temperature changes. The output of this circuit arrangement is connected directly to the speaker voice coil. Because little or no dc current appears across the load (voice coil) another arrangement is used to eliminate both coupling and output transformers.

Recall that electron flow in a PNP transistor is from base to emitter (opposite the point of the arrow on the emitter symbol). Electron-current flow in the NPN transistor is from emitter to base (also opposite the point of the arrow on the emitter symbol). By using a PNP and NPN transistor (see Fig. 6) in a

Solid-State Amplifiers . . .

complementary/symmetry circuit, the dc electron-current path in the output circuit is completed through the collector-emitter circuits. Note that direct coupling is used at the input and the output with this arrangement.

Three methods are generally used to couple solid-state audio amplifier stages together: transformer, resistance/capacitance (RC) and direct coupling. Impedance coupling is a modified form of RC coupling where inductances replace the load resistors but the system is rarely used in home-entertainment audio equipment. The simplified circuit of a transformer coupled single-ended grounded-emitter class A power amplifier is shown in Fig. 7. Note that a PNP transistor is used. If an NPN type is employed, of course, the polarity is reversed.

A simplified capacitively coupled small-signal class A amplifier using an NPN transistor was previously shown in Fig. 3.

A two-stage grounded-emitter, RC coupled amplifier circuit using NPN transistors, is shown in Fig. 8.

The next article in this series will review practical audio amplifier circuits and prepare the groundwork for a forthcoming article on modern troubleshooting and repair techniques. ■

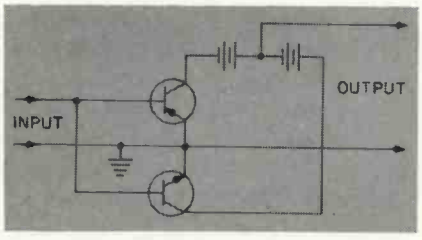


Fig. 6—Basic complementary/symmetry circuit using an NPN and a PNP transistor.

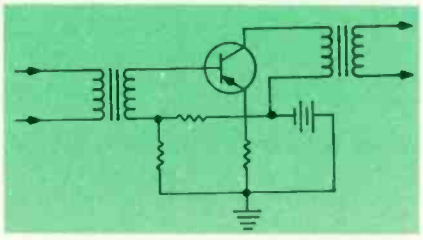


Fig. 7—Simplified circuit of a transformer coupled single-ended grounded-emitter class A power amplifier.

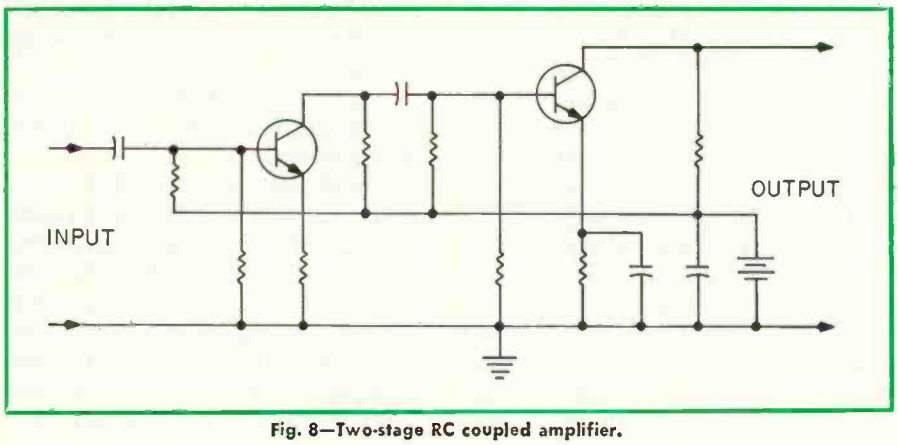


Fig. 8—Two-stage RC coupled amplifier.

TEKLAB REPORT

A Technician Looks at Motorola's TS915 Chassis

Get in on the technical ground-floor of a color set that may start a solid-state 'peacock' parade

■ We were anxious to unpack the first solid-state color TV we've had in ET's TEKLAB and take a look at the chassis and circuit layout.

Looking at the front we first noticed the throttle-type tuning levers for HUE, INTENSITY, CONTRAST, BRIGHTNESS and VOLUME.

Each solid-state chassis has a new "Visi Trak" tuning device in which a warning light flashes when the color picture is not tuned perfectly; it goes off automatically when fine tuning is properly adjusted and on model TS915 an electronic device locks-in the picture.

We also noticed UHF push-button channel selectors similar to those used on auto radios.

"Drexel" cabinetry in lower price areas has been expanded.

The chassis was easily pulled forward by removing two screws. The wires to the power supply and convergence have easily removable cable connectors. The chassis slides forward on guide-rails and convergence adjustments can be easily made from the front.

Two chassis are currently being made and the TS919 is electrically identical to the TS915—even to interchangeable panels. Only the mechanical layout differs.

Each chassis has 62 transistors, 28 diodes and 1 integrated circuit in the audio panel.

The power supply for both the TS915 and TS919 is removable as a unit. A transformer powered full-wave bridge power supply is said to assure excellent regulation to prevent picture bounce, changes in raster size and fluctuations in contrast and brightness. Some of the important features of the new sets are:

Since the development of transistors in 1948, we all have known that semiconductors would eventually replace electron tubes in a majority of circuit applications. This is exactly what Motorola has now done. The company has introduced a line of solid-state, all-transistorized color-TV receivers. The new models employ transistors in place of conventional electron tubes—except for the HV rectifier and CRT.

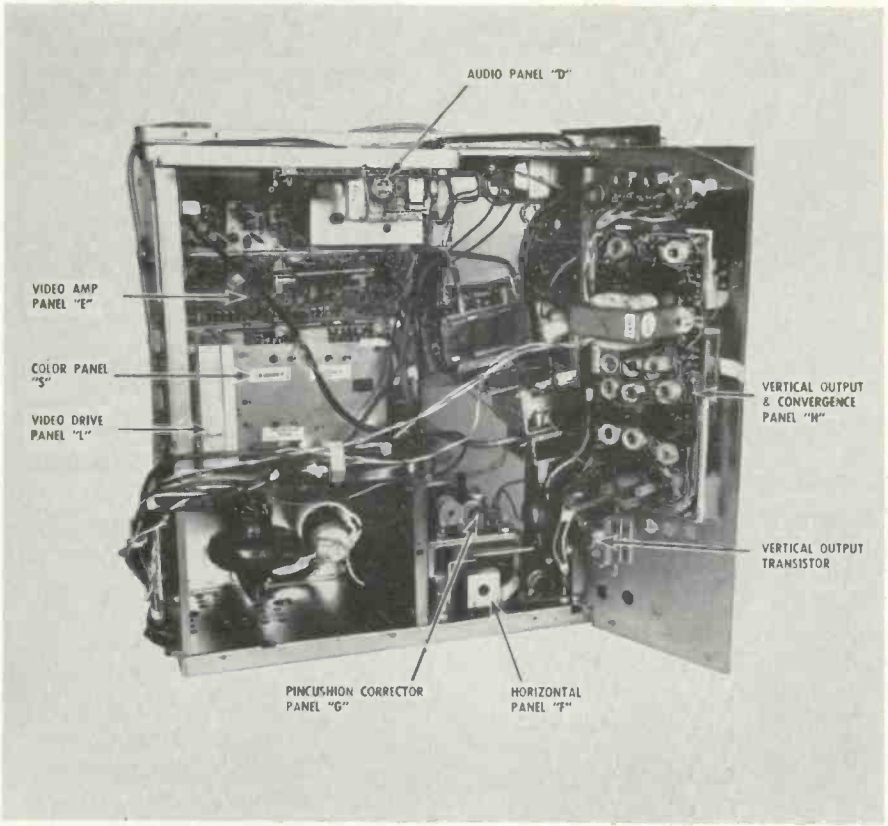
Ten plug-in etched circuit panels make the transistion from tube-type to solid-state technology easier for service technicians—breaking the major components down to ten, rather than hundreds of individual parts.

The TS915, in its service position, is shown in Fig. 1. After two screws are removed, the chassis slides forward on guide-rails for easy access and adjustment.

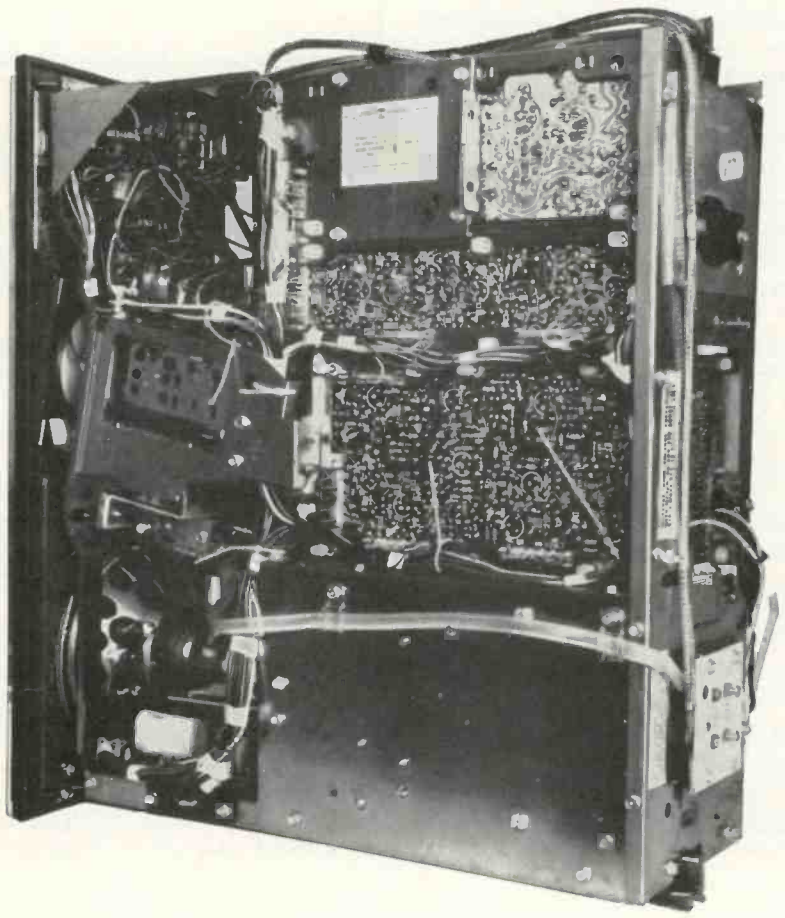
The "sound" panel shown in Fig. 2 is being inserted into position on the TS915 chassis. This plugability feature is common to both the TS-915 and TS919 chassis.

Circuit panels (see Fig. 3) have test points and identifying numbers for all components. All components are mounted on one side of the board with legend.

An integrated circuit (IC), shown in Fig. 4, replaces 12 transistors, 12 diodes and 16 resistors in one



(Above)—Left side of the chassis, as viewed from the front, shows the vertical output and convergence panel in its "swing-out" position.
(Below)—Right side of the chassis showing tuner, speaker and various removable printed circuit panels.



tiny capsule. It performs as a 4.5MHz amplifier, 4.5MHz limiter, FM detector and audio preamplifier.

An automatic brightness limiter circuit maintains correct relationship between contrast and brightness. This feature prevents excessive CRT beam current.

Hue is adjustable independently without altering the color signal, shifting the color oscillator or manipulating color sync.

Quick-acting solid-state switches provide horizontal and vertical retrace blanking, color killer action and fine tuning indication.

It is said that direct demodulation of the composite color signal provides true color video voltage including brightness information.

Tuner

The tuner is a three-stage subassembly employing an RF amplifier, mixer and local oscillator. Delayed forward AGC bias is used to vary the RF gain.

The RF amplifier, shown in Fig. 5, is similar to the one used in the conventional B/W receivers. Using an NPN silicon transistor, the base receives a fixed forward bias from the 35vdc source and is lower than the base by about the usual —7vdc. The RF amplifier operates at maximum sensitivity for all but the very strongest signals. At this threshold an increase in forward bias is supplied by the AGC circuitry to achieve an effective reduction in gain—eliminating signal overload and cross modulation.

FM signal rejection is achieved by an adjustable bridged T trap. A fixed-tuned trap suppresses pickup near video IF frequencies.

The oscillator employs an NPN silicon transistor which operates at a frequency higher than the selected channel by 45.75MHz for the picture and 41.25MHz for the sound carrier.

The mixer receives signals from both the oscillator and RF amplifier. This NPN silicon transistor converts the two signals to the single IF in the typical superheterodyne process.

Video IF Amplifier

The complete video IF amplifier is shown in Fig. 6. Three NPN sili-

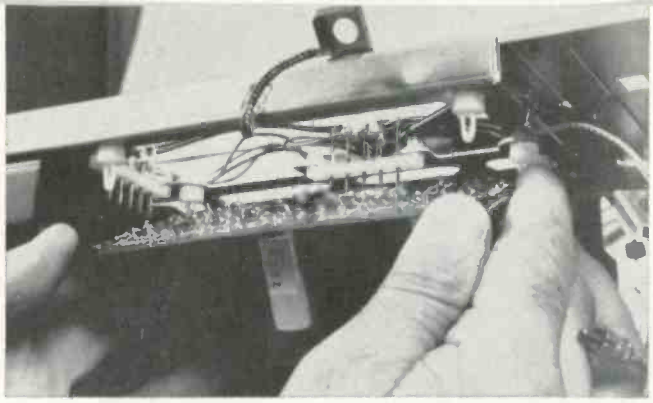


Fig. 2—Plugability feature on all panels is common to both the TS915 and TS919 chassis.

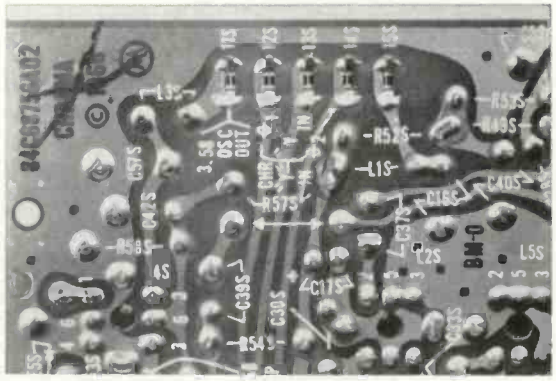


Fig. 3—Wiring, test points and legend which identifies all components for conventional servicing.

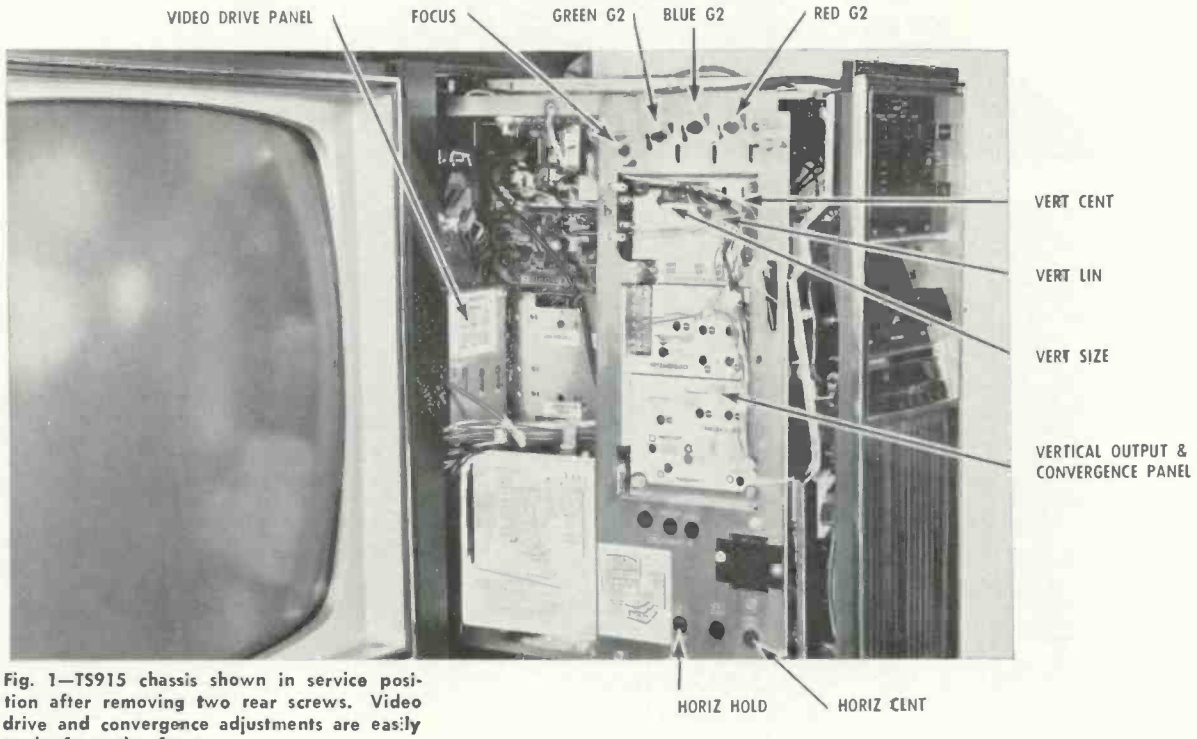


Fig. 1—TS915 chassis shown in service position after removing two rear screws. Video drive and convergence adjustments are easily made from the front.

con transistors are chosen for high gain, optimum frequency response and stability. Available NPN units simplify the problem of dc bias and neutralization.

The tuner output is low-side coupled to the video IF amplifier input. The mixer collector coil and the IF amplifier input coil make up an over-coupled transformer tuned to the 44MHz IF center frequency. The input to the 2nd stage is a broadly tuned transformer damped by a resistor across the primary. Here again the resonant frequency is about 44MHz. Likewise, the input to the 3rd stage features a relatively high Q circuit damped only by the output resistance of the 2nd stage. The output of the 3rd stage drives the video detector through an overcoupled 3rd IF transformer.

A bridged T trap at the input tunes to 47.25MHz, the lower adjacent sound carrier, and also sharpens the high frequency skirt. Low-end skirt selectivity is obtained by three traps. One is tuned to the upper adjacent video carrier, 39.75-MHz. This parallel resonant trap appears in the IF input circuit. Another trap, located in the 1st IF amplifier collector circuit, is parallel-tuned to 35.25MHz which is the upper adjacent sound carrier. Finally, sound carrier trapping is accomplished in the secondary of the 3rd IF transformer. A 41.25MHz parallel-tuned trap in the secondary provides some residual circulating current at this frequency. A take-off winding close to the primary circulates a 41.25MHz current through a coil and a series-resonant 41.25MHz phasing circuit. When the phase coil is properly adjusted, the circulating currents create opposing fields at the trap to reject the sound carrier effectively.

Feedback capacitance from collector-to-base is neutralized by a bridge arrangement. Fixed neutralizing capacitors can be used because of inherent stability and uniformity of the transistors chosen.

Forward AGC is applied from the AGC amplifier to the 2nd IF amplifier's base. An increase in signal strength brings about an increase in positive forward bias to push the stage into beta-compression, reducing gain. Forward AGC for the 1st stage is applied from the emitter of the 2nd.

The video detector diode is typical, having the single function of

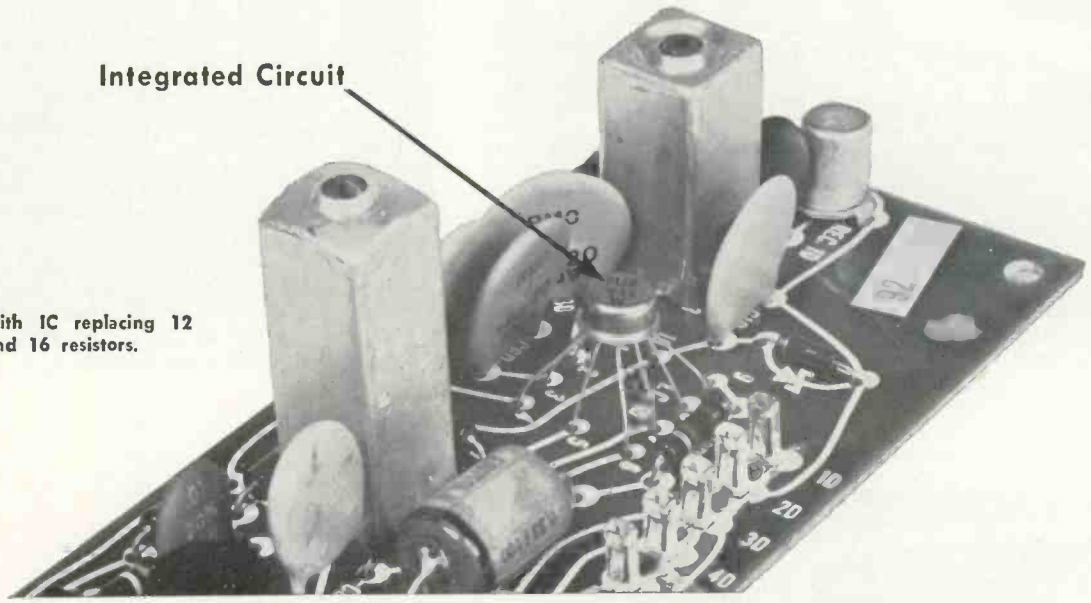


Fig. 4—Audio panel with IC replacing 12 transistors, 12 diodes and 16 resistors.

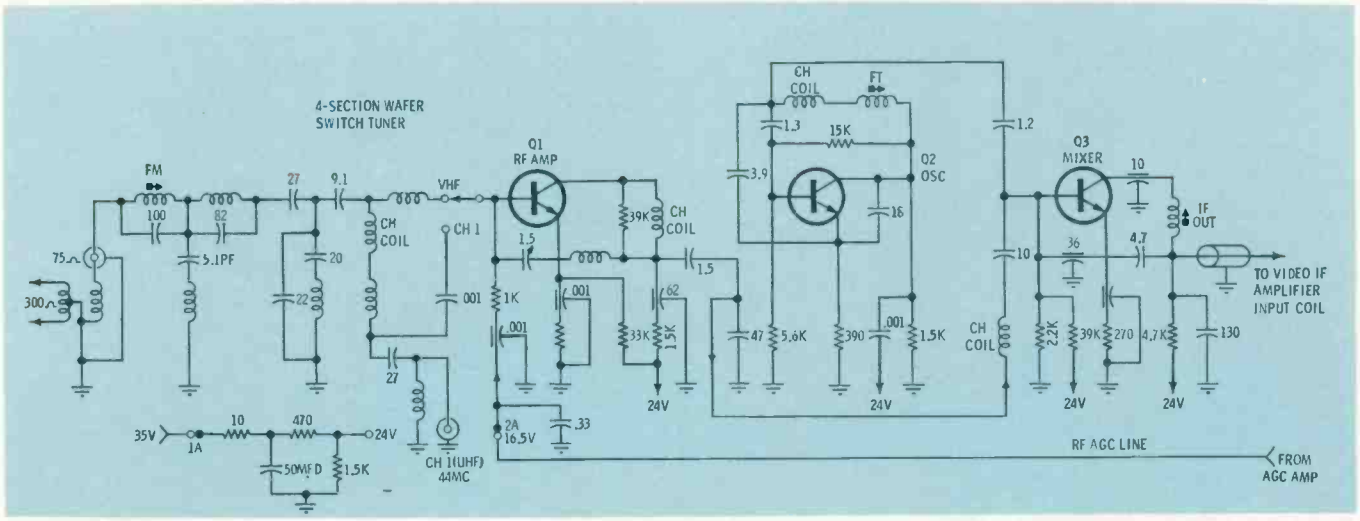


Fig. 5—Schematic of tuner employing three conventional NPN transistors with no special circuitry. Only one increment of the total tuning is shown for simplification.

extracting the composite video components from the picture IF carrier. Any 4.5MHz beat between picture and sound carriers at the video detector is rejected by a trap.

Video Output Section

This section of the set appeared very interesting to our TEKLAB technicians. The brightness signal is passed through each of three demodulators without effect. Proceeding on to the CRT by way of three separate and parallel video channels (see Fig. 7), the brightness signal produces a typical monochrome picture when no color is received. When color programing is received, the brightness signal combines with the demodulated color signals at the demodulator to produce red, blue and green video voltages. Each of these video channels drives a related CRT cathode eliminating matrixing color-difference and brightness voltages at the various CRT grids and cathodes.

The 3.58MHz reference carrier is prevented from reaching the CRT by a bridged T trap located in each video channel.

Direct coupling, combined with series peaking, is said to provide excellent frequency-phase and amplitude fidelity. A video peaking control permits variable response.

An NPN emitter-follower sends the composite video signal in two directions: Brightness information is coupled to an NPN common-emitter 1st video amplifier. Color information is coupled to an NPN common-emitter 1st color IF amplifier.

The emitter-follower accomplishes the signal transfer without loading the video detector. The 2.2k delay-line is matched to the 2nd video amplifier which, in turn, supplies the demodulator, driver and output stages with brightness signals. The contrast control is between the 2nd video amp and demods.

Red, blue and green color video signals are directly developed in the demodulators.

Each video output transistor is arranged in a common-emitter circuit. The collector source is 255vdc to provide a 150v P-P signal.

A forthcoming article will cover other circuits in this first-of-a-kind color receiver—and we will detail servicing techniques.

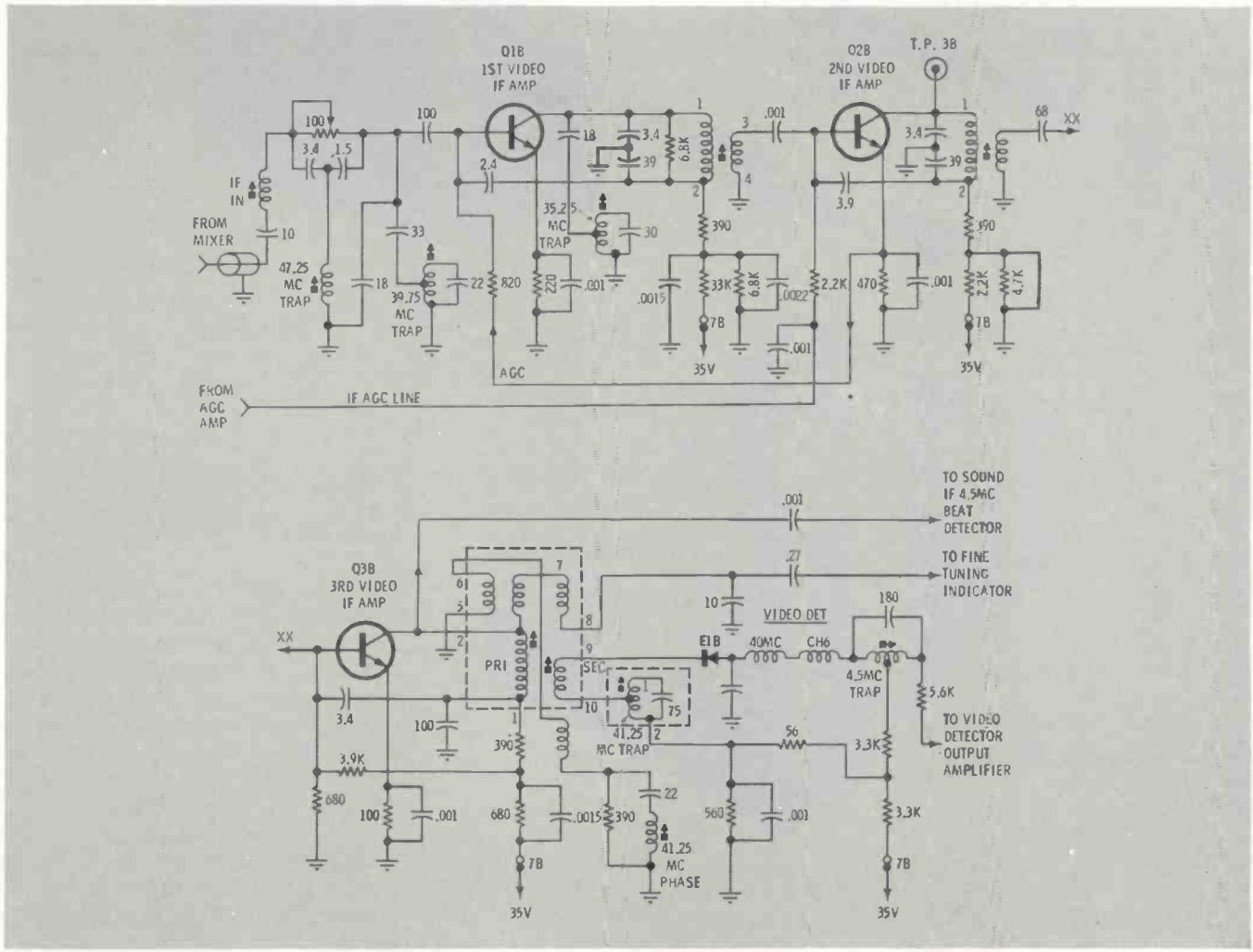
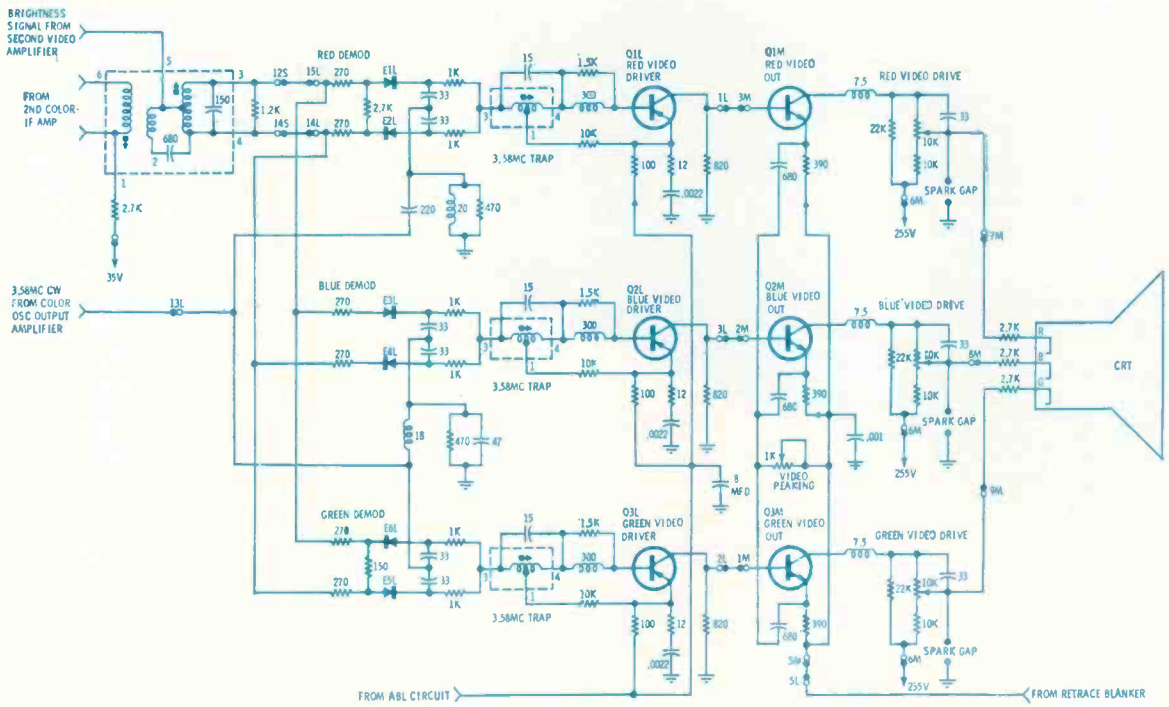


Fig. 6—Complete schematic of video IF showing forward AGC applied directly to 2nd stage.

Fig. 7—Complete schematic of video output section showing the direct coupled circuitry. Brightness and color signals combine at the 2nd IF transformer.



Complete Perma-Power GDO showing track, receiving unit and transistorized transmitter.

Servicing

Increase your annual 'take'

Service-dealers can increase their profits considerably by selling, installing and maintaining garage door operators. If you want to expand your business, add to it or fill-in during "slack" periods, the garage door operator can do it for you. And it will prove to be a profitable business if handled correctly.

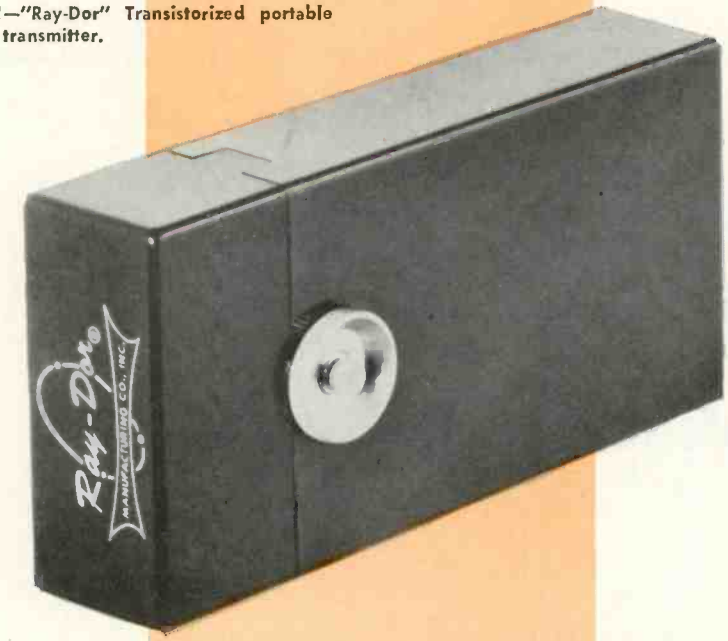
The population-explosion is constantly accelerating. More new homes are being built. In many cities the "GDO" business is waiting for those who can handle it.

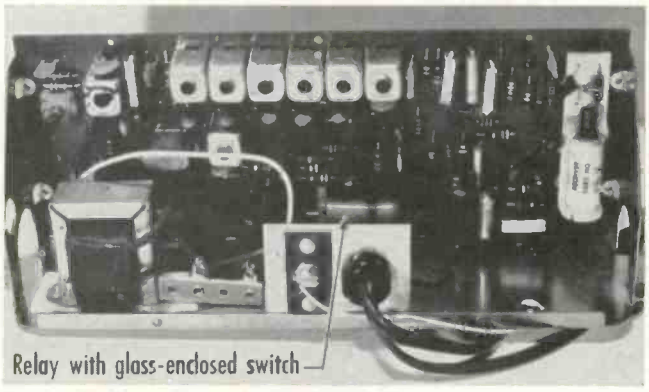
Garage-Door Operator Types

Basically, there are two types of GDOs: One uses a "wired-in" transmitter and the other a hand-held portable transmitter. Both types allow a garage door to be opened and closed from a distance within the car. With the wired-in type, a dash button switches the transmitter on, sending an RF signal to the receiver located in the garage. The transmitter is generally located under the car hood. The older tube-type transmitters are switched on with the ignition key. When the dash button is pressed, the vibrator in the transmitter goes into action—supplying power to the transmitter unit.

Greater distance of operation, more security against theft and damage are the main advantages of the wired-in transmitted type. Complete portability and no installation problems are the main advantages of the portable transmitter. The two types are equally reliable. The self-con-

Fig. 1—"Ray-Dor" Transistorized portable GDO transmitter.





Receiver having a glass-enclosed relay switch.

Garage Door Operators

with this excellent profit builder

tained battery in the portable transmitter unit will last its normal shelf life. When operation is desired from several automobiles, a separate transmitter may be easily installed in each car.

Most wired-in transmitters are housed in a small metal box that mounts on the fire-wall or inside front fender. Some transmitters use the auto radio antenna for convenient installation. The operating distance of the wired-in transmitter ranges from 100 to 200 ft. The hand-held types have a range from 30 to 60 ft.

Most GDO transmitting units made today are transistorized. This includes both wired-in and portable hand-held transmitter units. The small, transistorized portable-type transmitters (see Fig. 1) can be stored in a glove compartment, under the seat, in a pocket or clipped onto the sun visor. It is conveniently operated from the sun visor or by holding it near the windshield. The most satisfactory operating position is obtained by trial since transmitters will work differently from each car type. A hybrid schematic is shown in Fig. 2.

The operating frequencies of GDO transmitters and receivers may be from 5kHz up to 465MHz. Some systems use the CB frequencies from 26.97 to 27.255MHz. Another type uses the 465MHz VHF band. This band has the advantage of being free from man-made noise, including radiation from neon signs, auto ignition, lightning, etc.

Transmitters

Some older-type transmitters used a twin-triode tube as an oscillator. A 6 or 12v vibrator came on when the dash button was pressed and stepped up the voltage to operate the transmitter. One-half of the triode was used as the oscillator and the other half as a tone oscillator. Most of these units were not crystal controlled as transmitters are today.

In the crystal-controlled transmitter, one-half of the double triode is used as the crystal oscillator. Frequency adjustment is not necessary with this type unit because a plug-in tone-channel coil is used. The tone-channel coil prevents a next-door neighbor's GDO from being actuated. A typical tube-type transmitter is shown in Fig. 3.

As previously explained, transistors are now widely used in both transmitters and receivers. These units draw less power, provide

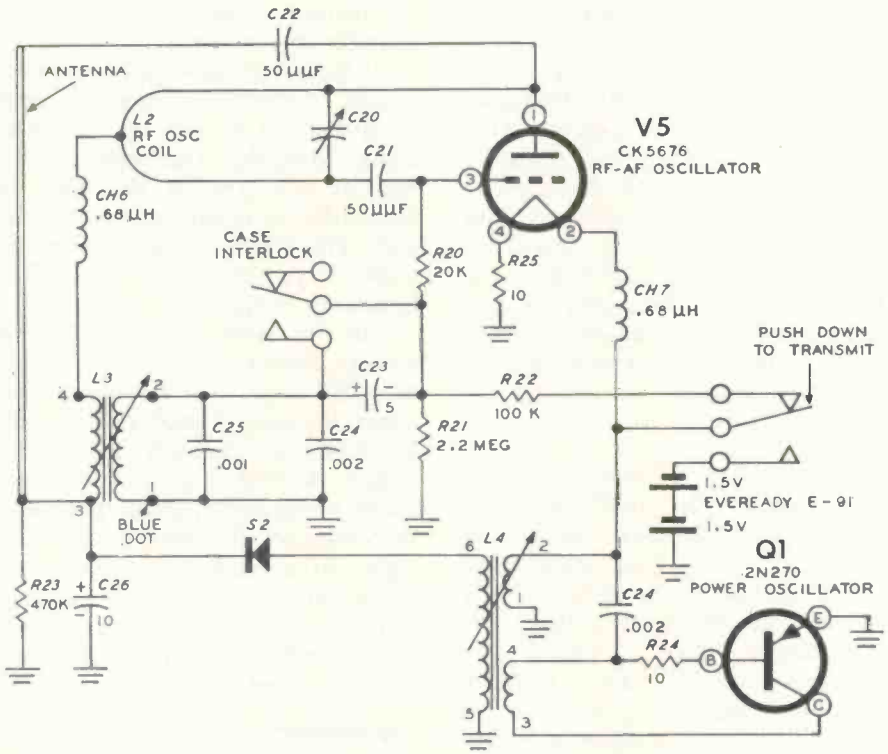
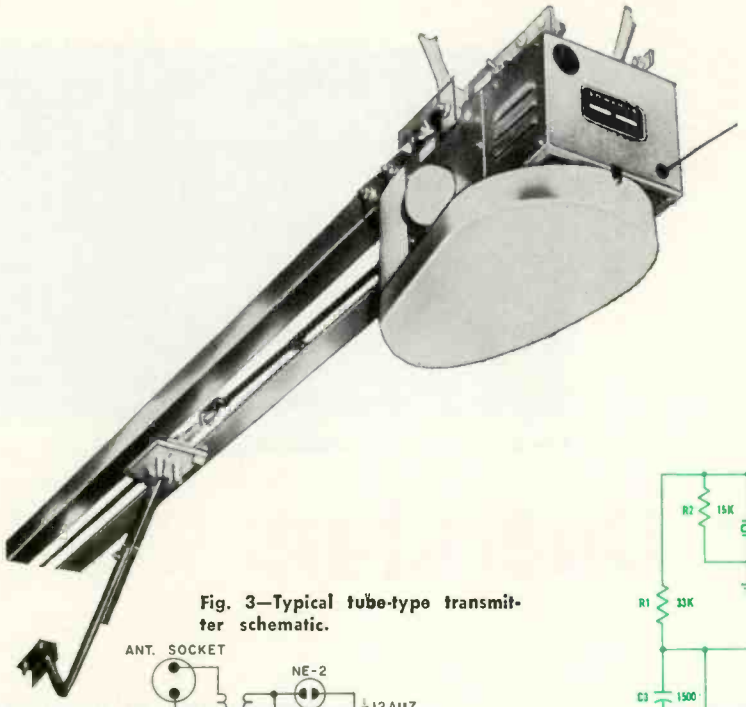


Fig. 2—Schematic of hybrid transmitter using small tube and transistor. Courtesy Heathkit.



Edward model R80 GDO.

Fig. 3—Typical tube-type transmitter schematic.

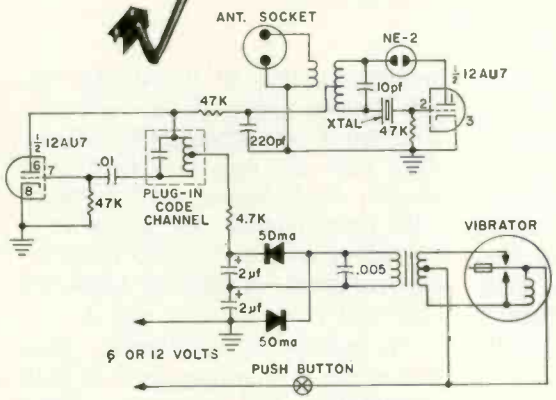
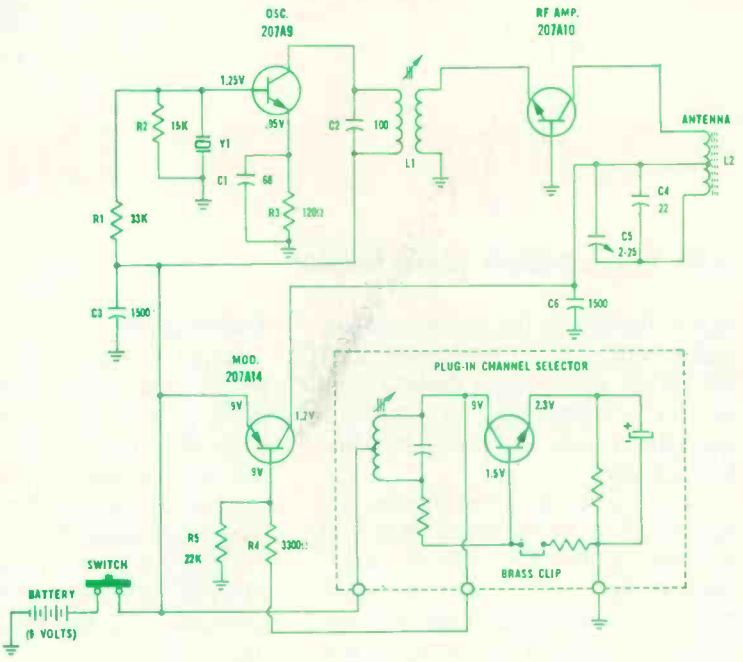


Fig. 4—Transistorized portable GDO transmitter schematic.



longer service life and less trouble. And the small portable, hand-held transmitter can be operated from the car or outside of it.

The schematic of a transistorized, battery-operated portable transmitter is shown in Fig. 4. The oscillator is crystal-controlled and transformer-coupled to the RF amplifier. A built-in antenna coil serves as the antenna and for loading. One transistor is used as modulator, having a plug-in channel code selector frequency coil. The audio-type transistor is inside the plug-in coil. A 9v battery supplies voltage.

Receivers

The receiver is usually mounted up close to the overhead door operating mechanism inside the garage. The low-level transmitted signal, picked up by the receiver's antenna, is amplified through several stages before it triggers the sensitive relay. The relay switches on the 117vac supply to the overhead door motor—raising or lowering the garage door.

These receivers are tuned to the exact frequency of the companion transmitter. Again, a receiver may be tube-type or transistorized.

A typical transistorized receiver has an 8ft piece of wire which must be strung out to pick up the small signal from the transmitter. Don't cut off any part of the wire. It should be insulated from metal objects. This transistorized receiver operates in the 26.97 and 27.27MHz frequency range.

The transmitted signal, picked up by the antenna, feeds into an RF amplifier stage. A crystal-controlled converter stage is used, followed by IF amplifier, detector and audio stages. A level detector is tied directly to the limiter stage. The pulse detector and dc amplifier feed the signal to a relay driver—actuating the small relay's solenoid winding. An ac power supply is transformer-coupled with two small silicon diode rectifiers in an RC filtering network.

Transmitter Troubles

The first check to make if a GDO fails, is to determine if the transmitter is actually transmitting RF power. A neon lamp is located in the RF transmitter output circuit of some models and it will light when the transmitter button is pressed. You can also hold a small neon lamp near the transmitter tank coil and see the action—if the transmitter is working. But in hand-held transmitters, a meter is better.

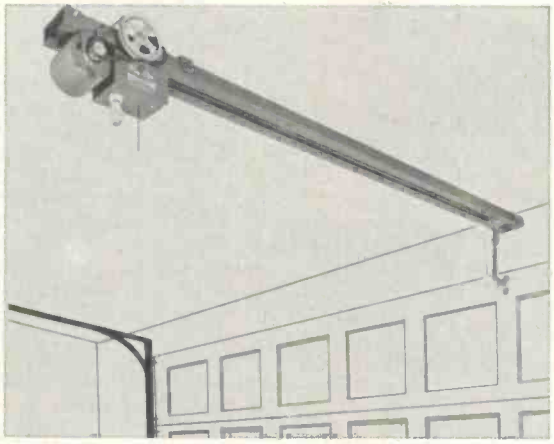
If you do not have an RF radiation tester, coil up 10 or 12 turns of hookup wire and solder a 1N34 diode to one end of the coil. Now connect the diode and other coil end to a 100 or 250μa meter. (see Fig. 5). You can also use the smallest voltmeter scale in a sensitive VOM.

Hold the wire loop near the transmitter tank coil. Press the transmitter button and see if the meter indicates RF energy. If the indication is weak or the meter needle does not move, then the transmitter is not functioning properly. On VHF transmitter checks, use only 2 or 3 turns of number 12 rubber-covered wire for the pickup loop.

A Stanley-Berr model BA6 GDO mounted in garage.

Perma-Power GDO installation in garage.

Alliance GDO transmitter and receiver.



"Ray-Dor" model CA7-2 GDO.

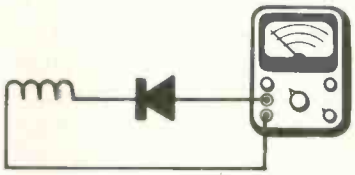


Fig. 5—Schematic of transmitter radiation tester.

Now check to see if the transmitter is receiving correct supply voltage. Check the small battery in the hand-held models on a regular battery tester. If a battery tester is not handy, check the battery under load while the transmitter button is pressed down. Replace the battery if it checks 1v lower than its rating.

In the permanently installed auto models, check the battery voltage at the transmitter supply terminals. Check for an open fuse. If the potential is down from 2 to 5v, check the car ignition switch and wire contacts going to the transmitter. Be sure the transmitter switch is on. Dirty contacts can easily drop the "A" voltage to a point where the transmitter will not work properly.

Substitute a new tube in the tube-type transmitter units. Check for a defective tube socket in case the tube does not light. Feel the tube for warmness, as it is rather difficult to see the tube heater glow inside the small metal box. You should hear the vibrator hum, if it's working properly. If not, replace it.

If the tube transmitter still doesn't function, check for B+ power supply voltage. Then check for voltage on the oscillator and modulator tube. Look for broken wires or contacts. Auto- and rough-road vibration can cause leads on capacitors, coils and resistors to break off or become loose.

When working with transistorized transmitters, check the battery and switch. Check voltages on the various transistors. Remember, these voltages are very small and a VTVM or sensitive VOM should be used. Check for broken contacts or perforated wiring on the etched board.

Check transistors on an in-circuit transistor tester. It should be noted that, in some circuits where a coil or diode may be bridged across a transistor, the collector lead should be disconnected from the circuit. Otherwise an in-circuit tester may give an erroneous reading. All defective transistors should be replaced with exact or equivalent-type transistors.

Receiver Troubleshooting

Most GDO receivers are like regular radio receivers except a relay is added in place of a speaker. Check all tubes in tube-type receivers. If in doubt, substitute known-good tubes.

Some receivers have test points. Connect a VOM to the test point and chassis. With the transmitter button depressed, the meter reading should increase.

See if the receiver's antenna is unplugged, is loose or lying on the garage floor. On VHF units, the antenna is only a short metal rod.

If the relay does not click or a decent meter reading is not obtained when the transmitter button is pressed, the trouble is in the receiver. Of course, this assumes that the transmitter is radiating a proper RF signal. In case the relay clicks on and the door does not rise or move, check the duty-relay contacts. Also check motor, motor starting circuits and door lifting assembly.

Check for possible power supply

trouble in the transistorized receiver. See if a dc voltage appears on the electrolytic capacitor filter network. If not, check the resistance of the selenium or silicon diodes.

When checking a silicon diode, remove one lead from the circuit. The ohmmeter should read from 5 to 15Ω one way. Reverse the ohmmeter leads for a high resistance reading. If you get a low resistance reading both ways, discard the defective diode. When silicon diodes are defective, they will either check short or open. Sometimes they will "knock" themselves out, so to speak, without a heavy load being applied. Check the power supply electrolytic for leakage or short. Open or dried-out filter capacitors will cause oscillation and erratic receiver operation.

At this stage of the game, do not attempt to adjust any alignment screws in the RF or oscillator coils. They do not change by themselves and should not be touched except when necessary and while following the regular alignment procedure. If the aforementioned receiver/transmitter checks do not get the GDO units operating, bring both units to the shop for a bench check.

Most GDO receivers can be aligned with a signal generator and VTVM. The signal generator can also be used to signal-trace the receiver. Loosely couple the signal generator output to the antenna wire or place a test probe from the signal generator near the receiving antenna. Use a signal tracer with RF probe and check from stage to stage.

Another method to check a transistorized receiver quickly is to check each transistor. In most cases the transistors are soldered to the etched board. Again, if the in-circuit transistor tester is handy, use it. All transistors can be checked for quality and leakage, except directly driven stages. Remove the collector lead to check these. Recheck any transistors that appear defective after removing them from the PC board.

After the receiver has been repaired, use the ohmmeter as relay indicator to check transmitter operation with the receiver. Bring the transmitter within a few feet of the receiver and watch the meter hand move. Check the transmitter at 20 and 50ft to see if both units are tracking together.

CHART I

Trouble	Transmitter	Receiver
Short Range Operation	1. Check tubes or transistors. 2. Check battery. 3. Check RF output with radiation meter.	1. Check tubes or transistors. 2. Check antenna location and input plug. Change for best pickup.
Erratic or Intermittent Operation	1. Check battery connections. 2. Check all components in PC board. 3. Check "A" leads in car installed units. 4. Check for intermittent tubes or transistors.	1. Check antenna connections. 2. Check tubes or transistors. 3. Check supply voltage. 4. Check relay contacts.
Door Does Not Operate From Automobile	1. See if transmitter operating—use RF meter. 2. If two automobiles are equipped, try other auto transmitter. 3. Usual check on transmitter. 4. Check tubes or transistor. 5. Check power input leads.	1. Meter test point check 2. Check tubes or transistors. 3. Check with signal generator and signal tracer. 4. Check receiving antenna.
Door Operates By Itself	1. Intermittent short circuit in wall button or defective wiring. 2. Check neighborhood installation on same radio code. 3. Check defective radio transmitter. 4. Try moving receiving antenna.	
Motor Continues To Run Unless Power Turned Off	1. Check for defective relay or sticking relay contacts. 2. Check for defective relay controller. 3. Clean up relay points.	
Door Does Not Operate From Wall Button	1. Check for electrical power. 2. See if motor circuit breaker is open. 3. Dirty relay contacts—clean. 4. Check for defective power relay transformer. 5. Defective motor. 6. Check wires and defective wall button.	
Motor Fails To Reverse	1. Check defective reversing switch. 2. Check for defective motor.	

Relay Trouble

The sensitive relay consists of a solenoid coil, iron armature and contact points. Solenoid windings seldom go bad. Most relay trouble is caused by defective contact points. Relay contacts can be cleaned with contact spray. Burned contacts should be cleaned with crocus cloth or filed and burnished. Some relay contacts are enclosed in a glass tube for protection.

Most of these relays do not have to be adjusted unless the contacts are burned and have been filed down. Check to see if the contact points have a good pressure contact. With a pair of small, long-nose pliers, the lower reed can be pushed up or down to make proper contact. Keep reeds and contacts parallel for maximum contact. See chart I for troubleshooting symptoms and suggested solutions to problems.

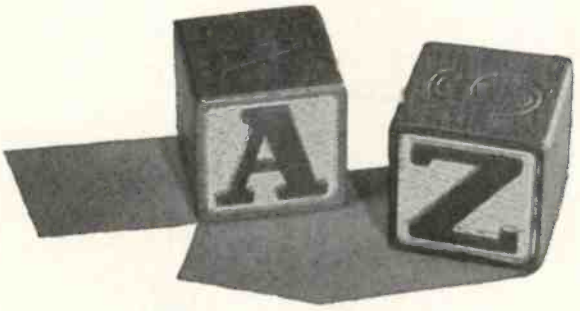
A Few Case Histories

We got a call on one unit where the complaint was "intermittent reception." Batteries and push-button contacts were checked in the transmitter. The radiation meter indicated the transmitter was operating. The receiver was taken apart and all tubes were checked. A 2D21 relay was substituted. Also, a quick voltage check was made. The intermittent trouble turned out to be a 22pf capacitor that had a poorly soldered joint to the antenna terminal.

Another GDO, an old one, would only raise the door but not let it down. We located a defective 3P3T toggle limit-switch with one side open. This made the motor go in one direction and would not reverse the field, or direction, of the motor. Replacement of the limit switch restored the unit to proper operating condition.

In another GDO, garage door operation was intermittent. Sometimes

continued on page 89



Semiconductors from A to Z

Today's new receivers can be more effectively serviced if you understand integrated circuits

The fourteenth article in a continuing series

■ The July and August articles in this series explained how IF signals (Fig. 1), induced across the secondary winding of the input transformer (T201), are amplified by eight transistors (Q1 through Q8) in the integrated circuit (IC201) before they are applied to the primary winding of the discriminator transformer (T203). We have seen that the first portion of the integrated circuit, where the IF signal has been amplified, contains two voltage regulating circuits (that use transistors Q9 and Q10) and a negative feedback circuit (that uses resistor R15). As the frequency of the IF signals shift above and below 4.5MHz, in response to the audio signal it contains, the amplitude of the voltages applied to diodes D4 and D3 also shifts—increasing

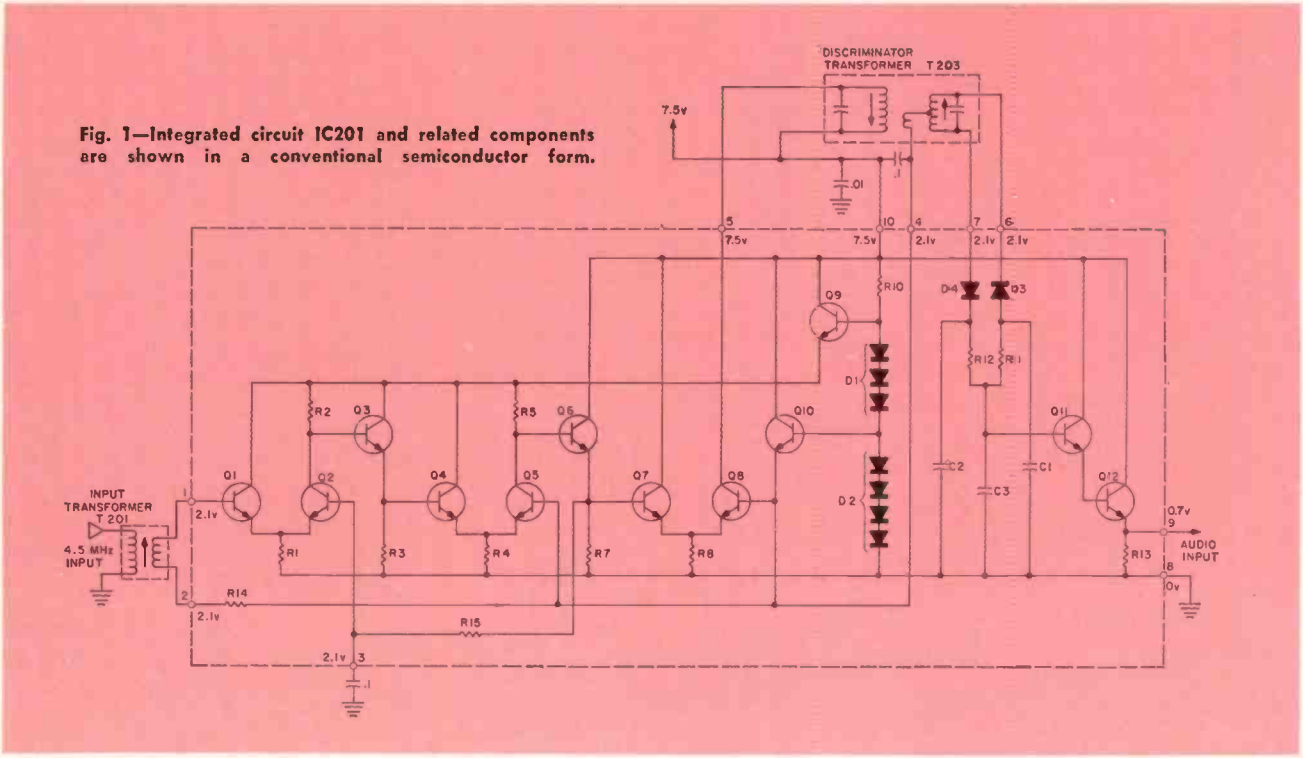


Fig. 1—Integrated circuit IC201 and related components are shown in a conventional semiconductor form.

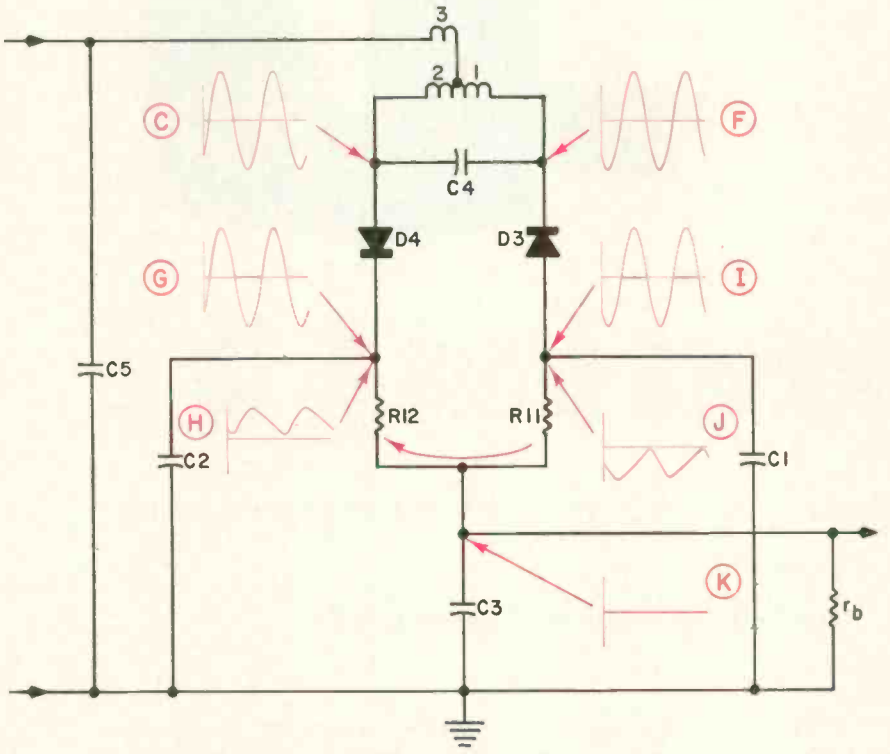
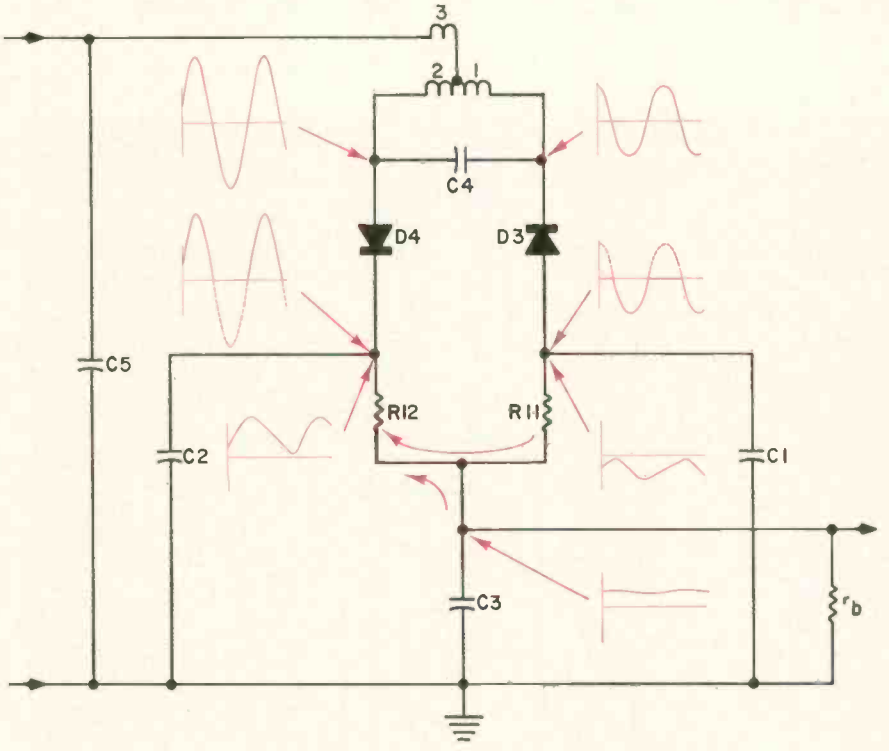


Fig. 2—The voltages present in an unbiased discriminator circuit at 4.5MHz.

Fig. 3—Voltages present in an unbiased discriminator circuit at a frequency below 4.5MHz.



across one diode while decreasing across the other, and vice versa. The resulting voltage drops across resistors R12 and R11 are altered by capacitors in the discriminator circuit (Fig. 2).

Capacitor Time Constants

As you may know, capacitor C2 in Fig. 2 has the function of partly shorting to ground the ac portion of the voltage drops developed across resistor R12. As diode D4 conducts current during positive half cycles, electrons flow from resistor R12 producing a positive voltage drop across it. Electrons also flow from the side of the capacitor connected to the resistor (R12) and diode (D4)—making that side of the capacitor also positive with respect to its other side. Since some of the current flows from the capacitor, the resistor supplies only a portion of the current flowing through the diode. The resistor, therefore, does not develop as great a positive voltage drop as would have occurred without the capacitor. For this reason, the positive pulse shown in curve H (Fig. 2) is not as large as the corresponding one shown in curve G. (Curve G represents the voltages developed across resistor R12 when the capacitor is not connected in the discriminator circuit; while curve H represents the voltages developed across the resistor when capacitor C2 is in the circuit.)

The side of the capacitor that has lost the electrons will remain positive until electrons are returned to replace those that have left it.

The number of electrons that a capacitor may loose or gain is expressed in terms of coulombs (Q). One coulomb is equal to 6,250,000,000,000,000,000 electrons ($1Q = 6.25 \times 10^{18}$ electrons). The flow of these electrons can be expressed in terms of current. One ampere is equal to 6.25×10^{18} electrons per second or one coulomb per second. If 25×10^{18} electrons flow through a wire in one second, four coulombs are flowing through the wire in one second, and the wire is conducting four amp of current

$$\left(I = \frac{Q}{T} = \frac{4 \text{ coulomb}}{1 \text{ sec}} = 4 \text{ amp}\right).$$

If a capacitor could have a value of one Farad, it could gain or loose 6.25×10^{18} electrons or one coulomb for every volt applied across it.

When one side of a $10\mu f$ capacitor has a 10v positive potential, the capacitor will be able to lose 1×10^{-4} coulombs or 6.25×10^{14} electrons ($Q = C \times V = 10 \times 10^{-6}f \times 10v = 100 \times 10^{-6}$ $Q = 10^{-4}Q$ or 10^{-4} coulombs). When only 0.01ma of current is allowed to return to the capacitor, the electrons are permitted to return at a rate of only 0.1×10^{-4} coulombs per sec. or only 6.25×10^{13} electrons each second ($0.01 \times 10^{-3}a = 0.1 \times 10^{-4}$ a $= 0.1 \times 10^{-4}$ coulombs per second). At that rate, it will require 10sec for the electrons to return the 6.25×10^{14} electrons that had been lost before the voltage across the capacitor can return to normal.

A capacitor that has a value of $0.1\mu f$ and a 2v positive potential will loose 2×10^{-7} coulombs of electrons ($Q = 0.1 \times 10^{-6}f \times 2v = 0.2 \times 10^{-6}$ coulombs or 2×10^{-7} coulombs). When 5ma is allowed to return to the capacitor, the voltage across the capacitor returns to normal in 4msec

$$\left(T = \frac{2 \times 10^{-7} \text{ coulombs}}{5\text{ma}} = \frac{2 \times 10^{-7} \text{ coulombs}}{5 \times 10^{-3}a} = \frac{2 \times 10^{-7} \text{ coulombs}}{5 \times 10^{-3} \text{ coulombs/sec}} = 0.4 \times 10^{-4} \text{ sec} = 4\text{msec}\right).$$

When a diode is used to conduct 10ma from a capacitor for 1 sec then a resistor will require 10sec to return the same number of electrons at a rate of 1ma ($10\text{ma} \times 1\text{sec} = 10 \times 10^{-3}$ coulombs/sec $\times$ 1sec $= 10 \times 10^{-3}$ coulombs, $1\text{ma} \times 10\text{sec} = 1 \times 10^{-3}$ coulombs/sec $\times$ 10sec $= 10 \times 10^{-3}$ coulombs). When, during positive pulses, a diode is able to remove more electrons from a capacitor than a resistor has time to return with a smaller current, the voltage remaining across the capacitor maintains a voltage drop across the resistor.

Part of the current flowing through the diode (D4) during positive half cycles (Fig. 2) comes from the capacitor (C2) as well as the resistor (R12). The positive voltage drop across the resistor is, therefore, less than the drop developed when all the current comes from the resistor. During the half cycle that the diode is not conducting current, the resistor (R12) does not allow a sufficient current to flow through it to the capacitor (C2) for the capacitor to loose the entire positive voltage drop developed across it. Curve G shows the voltage drops developed across the resistor (R12) when the capacitor (C2) is not in the circuit, while curve H shows the voltage drops developed across the resistor when the capacitor is in the circuit.

Part of the current flowing through diode D3 during negative half cycles (Fig. 2) goes into the capacitor (C1) as well as the resistor (R11). This reduces the negative voltage drop developed across the resistor (R11). During the positive half cycles that the diode (D3) is not conducting current, the resistor (R11) impedes the outward flow of electrons that had entered the capacitor (C1) and prevents the capacitor from losing a portion of the negative voltage developed across it.

Curve I shows the voltage drops developed across the resistor (R11) when the capacitor (C1) is not in the circuit, while curve J shows the voltage drops developed across the resistor when the capacitor is in the circuit.

The capacitors (C2 and C1) have reduced the maximum and minimum voltage drops developed across the resistors (R12 and R11) and have had the effect of shorting to ground some of the IF signal that would have otherwise been developed across the resistors.

Voltages induced across the secondary windings of the discriminator transformer at 4.5MHz (Fig. 2) result in a positive voltage drop across resistor R12 and a negative voltage drop across resistor R11. The major portion of the IF signal, that would otherwise appear across these resistors, is shorted to ground by capacitors C2 and C1, and the remaining voltages across the two resistors are nearly equal—though of opposite polarity. The positive voltage drop across resistor R12 cancels the negative voltage drop across resistor R11—current flows from resistor R11 to resistor R12, and no current resulting from the IF signal remains to flow through the effective base resistance (r_b) of the transistor in the next portion of the circuit. At 4.5MHz, the IF signal does not produce a voltage drop across the effective base resistor (r_b) or the capacitor (C3) connected in parallel with it.

Voltages induced across the secondary windings of the discriminator transformer at a frequency below 4.5MHz (Fig. 3) result in a positive voltage drop across resistor R12 that is larger than the negative voltage drop across resistor R11. As a result of the smaller voltage drop across resistor R11, less current flows through that resistor than flows through resistor R12. The remaining current through resistor R12 flows from the effective base resistor (r_b). The IF signal below 4.5MHz results in a positive voltage drop across the effective base resistor (r_b) and the capacitor (C3) connected in series with it.

Voltages induced across the secondary windings of the discriminator transformer at a frequency above 4.5MHz (Fig. 4) result in a positive voltage drop across resistor R12 that is smaller than the negative voltage drop across resistor R11. As a result of the larger voltage drop across resistor R11, more current flows through that resistor than flows through resistor R12. The extra current from resistor R12 flows through the effective base resistor (r_b). The IF signal above 4.5MHz results in a negative voltage drop across the effective base resistor (r_b) and the capacitor (C3) connected in series with it.

As the IF signal fluctuates above and below 4.5MHz, the resulting voltage drop across the effective base resistor (r_b) and capacitor C3 fluctuates between positive and negative. The value of capacitor C3 is larger than the value of capacitors C1 and C2, and it (C3) gains and loses more electrons than the other capacitors, when subject to the same voltage change. Not enough current flows through resistor r_b for the capacitor to gain or lose electrons faster than the audio rate of voltage fluctuations. Only voltage fluctua-

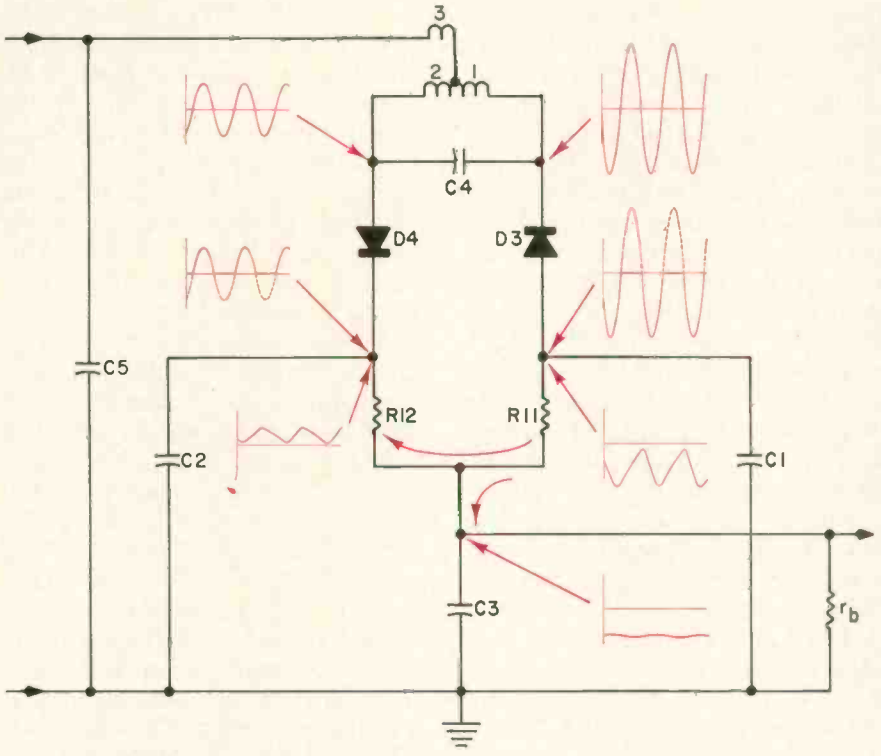
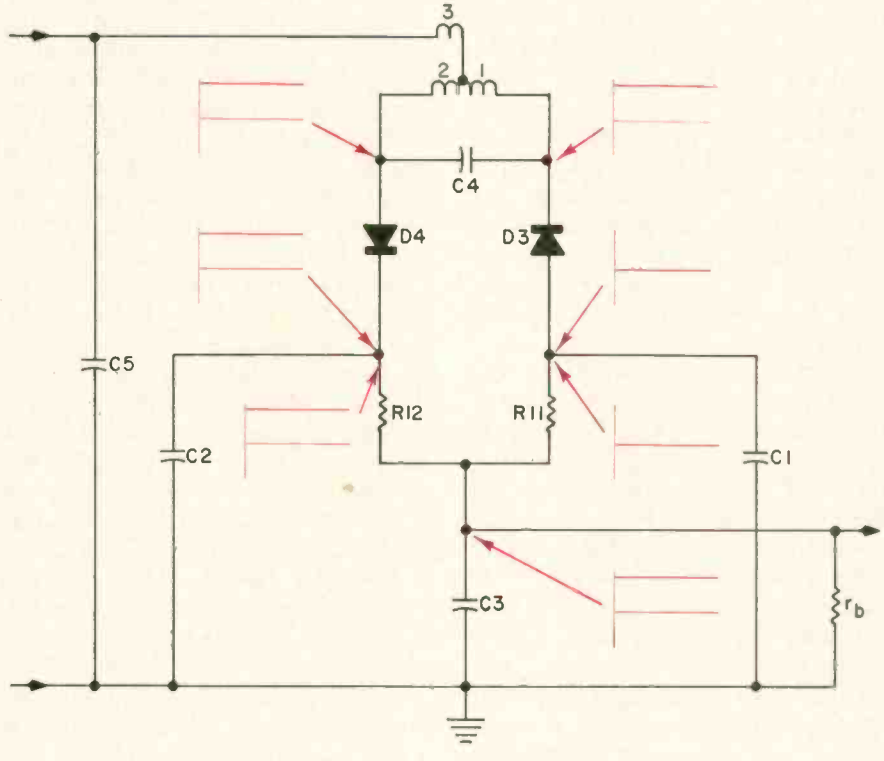


Fig. 4—The voltages present in an unbiased discriminator circuit at a frequency above 4.5MHz.

Fig. 5—Voltages present in a biased discrimnator circuit without an IF signal.



tions of the audio frequency and below occur across capacitor C3 and the effective base resistor (r_b) connected in parallel with it.

The diodes (D3 and D4) function in the manner described with Fig. 2, 3 and 4 only when they are not connected to a dc bias supply. We see, however, (Fig. 1) that voltage-regulating transistor Q10 supplies a 2.1v positive potential to the anode of diode D4 and the cathode of diode D3. Unless another voltage source is also used to develop a voltage drop across the effective base resistor (r_b), the voltage drops that occur in the discriminator circuit, when there is no IF signal, will resemble those shown in Fig. 5.

Since diodes D3 and D4 will conduct curent only from their cathodes to their anodes, and electrical currents flow only from negative to positive, only diode D4 can conduct current. A current flowing through diode D4 will develop a positive voltage drop across resistor R12, while no voltage drop will occur across resistor R11; since diode D3 is not conducting current. All of the current flowing through resistor R12 will, therefore, have to flow through the effective base resistor (r_b), which will also develop a positive voltage drop.

When a 4.5MHz signal is induced in the secondary of the transformer, in a circuit containing the potentials shown in Fig. 5, the resulting signals resemble those shown in Fig. 6. The voltages applied to the anode of diode D4 are positive for more than 75 percent of the time, and the diode conducts current as long as its anode is more positive than its cathode. The voltages applied to the cathode of diode D3 are also positive for more than 75 percent of the time, and this diode conducts current only during the short intervals that its cathode is more negative than its anode. The voltage drop across resistor R12 is, therefore, considerably larger than the voltage drop across resistor R11.

If weaker IF signals were applied to both diodes, no voltage drop would occur across resistor R11, and the entire IF signal would pass from the anode to the cathode of diode D4 where the signal would be shorted to ground by capacitor C2.

The Cascade Amplifier

Transistors Q11 and Q12 (Fig. 7) form a cascade amplifier (the signals amplified by the first transistor are then amplified by the second transistor) in integrated circuit, IC201.

The emitter current of transistor Q12 passes through resistor R13. The voltages shown in Fig. 1 indicate that when no signal is applied to the integrated circuit (and the base of transistor Q11) there is a 0.7v potential drop across resistor R13. The emitter of transistor Q13 is, therefore, normally at that potential above ground.

The base of transistor Q12 is connected directly to the emitter of transistor Q11. From Fig. 8 on page 104 of the October 1966 article in this series we see that there is a definite relationship between the emitter-to-base voltage (V_{EB}) and the base current (I_B) of transistor Q12—which in this case is also the emitter current (I_E) of transistor Q11. The emitter of transistor Q11 is, therefore, more positive than the emitter of transistor Q12, which is more positive than ground.

The base of transistor Q11 is at least as positive as its emitter and only a fraction of a volt of dc potential is present across diodes D3 and D4 (Fig. 2, 3 and 4). The manufacturer indicates that normally 4 to 6 P-P volts of 4.5MHz IF signal is induced in the secondary winding of the discriminator transformer (Fig. 2). The slight dc bias across the diodes (D4 and D3) is, therefore, nearly insignificant when compared to the signal voltages.

The effective base resistor (r_b) described with Fig. 2, 3 and 4 is the effective resistance between the base of transistor Q11 (Fig. 7) and ground. As the IF signal fluctuates above and below 4.5MHz, the voltage developed across capacitor C3 and applied to the base of transistor Q11 (Fig. 8) increases and decreases, providing the audio signal that is transmitted by the sound intermediate frequency.

As the base of transistor Q11 becomes more positive, there is a reduction in the transistor's collector-to-emitter voltage and the transistor (Q11) conducts more current. The emitter current conducted by transistor Q11 is also the base current of transistor Q12. As the emitter of transistor Q11 becomes more positive, because of the reduced voltage drop across the transistor, the base of transistor Q12 also becomes more positive and its emitter current also increases. This results in an increased voltage drop across its emitter resistor (R13).

The audio signal developed in the discriminator circuit and applied to the base of transistor Q11 is amplified by transistors Q11 and Q12 and appears across resistor R13—the output of the integrated circuit. From there, the audio signal passes through a volume control and to additional stages of audio amplification outside the integrated circuit before the audio is applied to the speaker.

The capacitance of diodes tend to vary with the voltage applied across them. The next article in this series will describe how some diodes are now being used in place of a mechanical variable capacitor to tune AM radios as well as FM radios and TV sets.

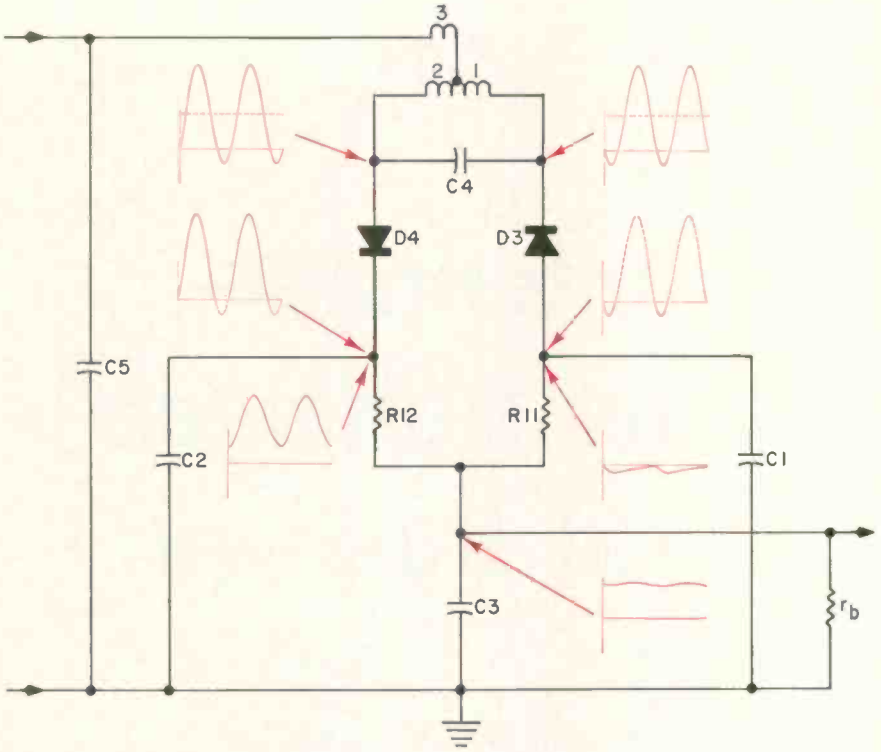


Fig. 6—The voltages present in a biased discriminator circuit at 4.5MHz.

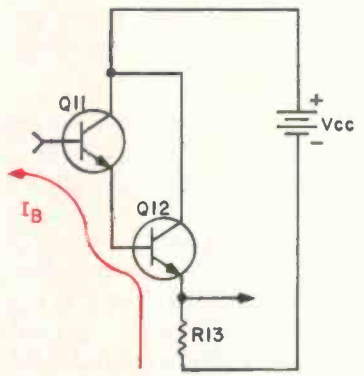


Fig. 7—Base currents in the integrated circuit's cascade audio amplifier.

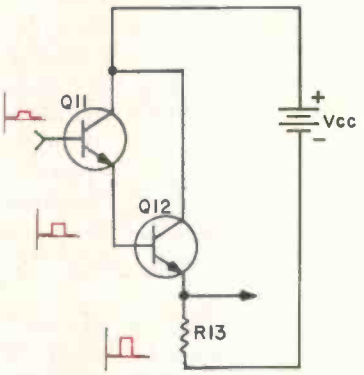
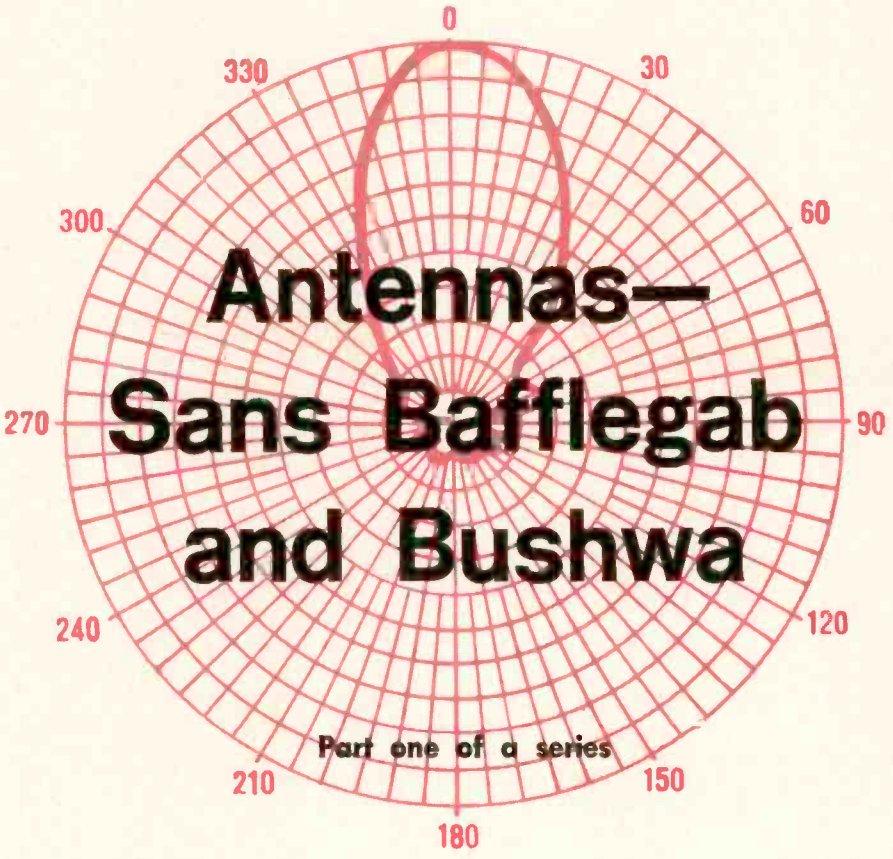


Fig. 8—Signals in the integrated circuit's cascade audio amplifier.



Antennas—Sans Bafflegab and Bushwa

Part one of a series

Understand the antenna business and increase your profits $5000 or more a year

■ Maybe you're a small operator: a two-man partnership with one good technician, an apprentice and an office girl. Last year you sold $130,000 worth of B/W and color-TV sets, radios, tape-players, phonos; some Hi Fi and CB equipment—including your services. After all operating expenses (including paying each partner $11,000) the operation ended up with $4500 net profit. You and your partner agreed to plow some of this back into the business for new "props" and test instruments. You used some more of it to increase working capital so you could handle more stock.

You paid an accountant $600 during the year just to "keep tabs" on the operation and his opinion was that you were going "great guns."

But the consensus of opinion among many successful service-dealers is: *You may have missed the boat!* There may be something radically wrong with your operation. Maybe you're lost in the bafflegab, bushwa and linguistic fog that surrounds the antenna business.

We've received a number of letters from readers during recent times which indicate that considerable confusion exists about what is important in the antenna business. This made us wonder. Perhaps *we* have failed to see things in the proper perspective—failed to keep some of you properly informed.

When senators and congressmen want to know how they stand with their constituents on any subject (and especially just before an upcoming election), they usually go out into the "bush" and ask questions. So we sharpened the "brush-hook" and departed on a safari through the back-woods.

Out in the Bush

The first service-dealer buttonholed had some not-too-subtle opinions about the antenna business. "Much of the information manufacturers furnish about their products is 'bushwa,' " he said, quietly.

The next dealer frankly indicated (not too quietly) that the antenna "bafflegab" was so thick you couldn't cut it with a meat axe.

And the third operator, a prosperous looking service-dealer, parried our first question by asking a question himself.

"Did you finish college?" he wanted to know.

When we admitted that some of us didn't, he asked us not to worry about that.

"What you may have learned," he continued, "would not help you through the linguistic fog that shrouds hard-core technical information about TV and FM antennas."

As he warmed to the subject he continued asking questions—and answering them, too.

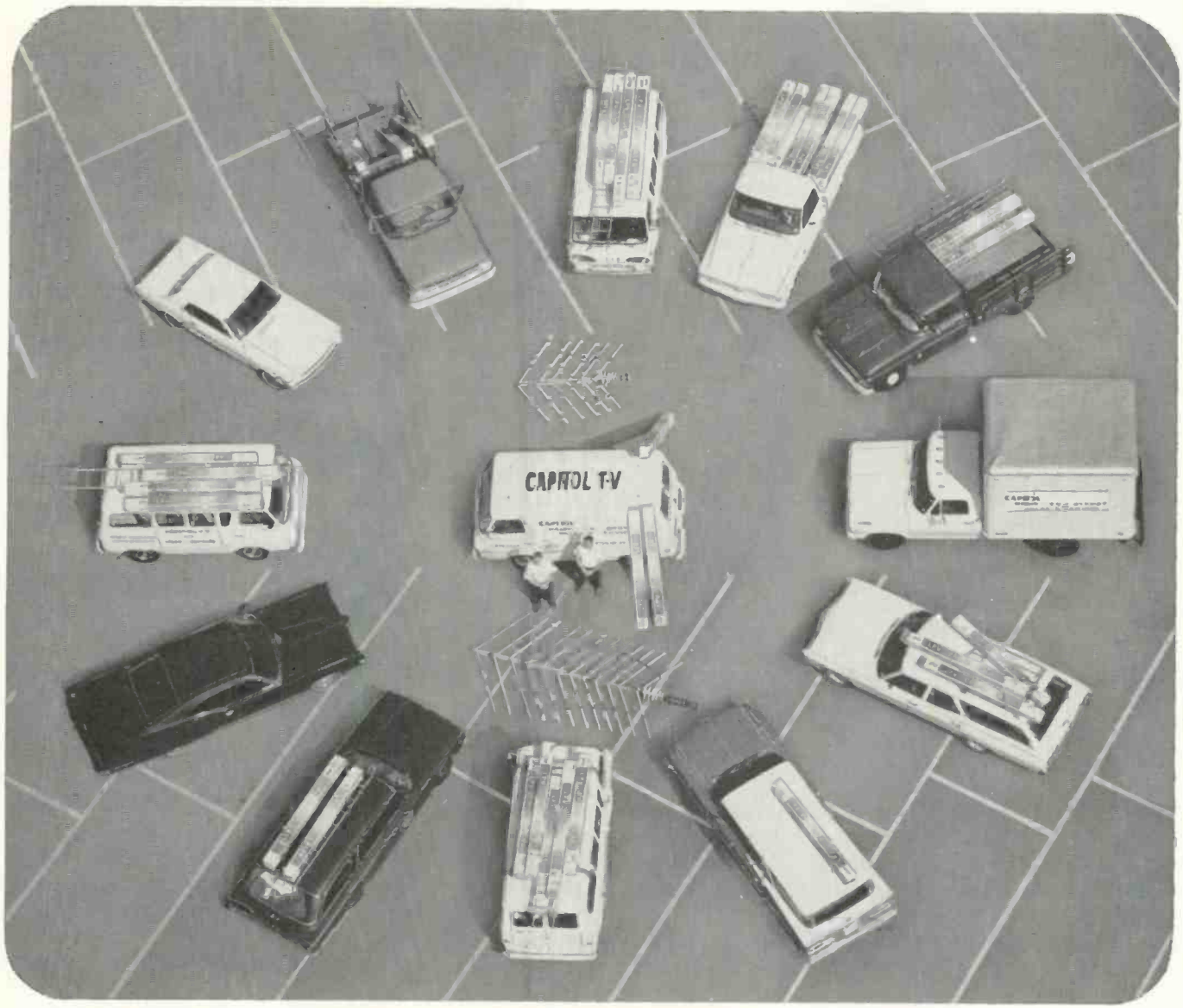
"Did you ever go through Jasik's 'Antenna Engineering Handbook,' " he asked.

We admitted being vaguely familiar with the book.

"Well," he said, "it wouldn't help technicians much even if they memorized everything in it. It's good only for the design engineers to learn how to re-design antennas that circumvent the ideas contained in previously re-designed antennas —to re-design still other antennas which are sufficiently 'new' and 'different' from previously re-designed antennas to avoid patent infringements. And, in some cases, they don't quite make it," he concluded.

We kept kicking around-about in the tall corn and finally discovered that most service-dealers (and especially those who have been reading ET for a number of years), had somewhat different views.

We've been asked by some, in effect, to "tell the truth about antennas." This is no easy job. But we'll do our best to rephrase the "bafflegab," leave out the "bushwa" and serve up the dish in a form calculated to be more palatable to that particular group of service-dealers who are obviously selling a lot of B/W, color and FM/multiplex equipment but who seem to be missing the boat in the antenna business.



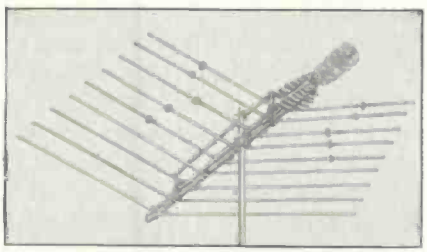
"When you guarantee finer color pictures...

...like we do, you *better* deliver!" says George Comer and Bob Garrison, of Capitol TV Sales and Service, Atlanta, Georgia.

"We install antennas for many dealers, retailers, chains and department stores here in the Atlanta area. They look to us to give their customers the fine color reception their customers were guaranteed when they bought their sets. We make sure we deliver the best possible color pictures by installing JFD Color Lasers.

"Before using Color Lasers, we installed VHF LPV Log Periodics. Frankly, we didn't think a combination 82-channel antenna would work so well across the VHF, UHF and FM bands. But the Color Laser is proving it to us where it counts — in happy customers and protected profits."

George Comer and Bob Garrison know from experience—like other professionals



— that JFD Color Lasers come through with the superb reception people expect from a professional service company.

Only Color Lasers offer:

☐ **BRILLIANT COLOR** — flat (frequency independent) response across each channel, free from suck-outs or roll-off. Keeps colors vivid and alive.

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

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

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

The Best Antenna for Color TV is The Color Laser by

JFD®

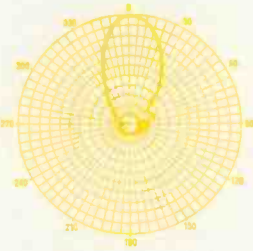
Now at your JFD distributor!

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

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

LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,958,081; 2,985,879; 3,011,168; 3,108,280; 3,150,376; 3,210,767, RE. 25,740 AND ADDITIONAL PATENTS PENDING IN U.S.A. AND CANADA. PRODUCED BY JFD ELECTRONICS CO. UNDER EXCLUSIVE LICENSE FROM THE UNIVERSITY OF ILLINOIS FOUNDATION. LICENSED UNDER ONE OR MORE OF U.S. PATENTS 2,955,287 AND 3,015,821 AND ADDITIONAL PATENTS PENDING

. . . for more details circle 126 on postcard



ANTENNAS . . .

Through the Fog

It may be true, in a sense, that all present-day antennas are an outgrowth of previously established basic principles. But we do know, whatever the cause or the means used, that the efficiency of TV and FM antennas has steadily improved during the past two decades. This has come about through constant research and development. Old fundamentals have been expanded and refined. For example, although the basic fundamentals used to design the first log-periodic antennas may have been in the books for years, it was not until a few years ago that Dr. Paul E. Mayes, University of Illinois Antenna Laboratories, took one of the infinite varieties of log-periodic structures possible and made a good TV and FM antenna out of it. The same thing has happened to the basic principles involved in many other antenna concepts—including the well-known yagi-type antenna.

Admittedly, some ill-designed promotional "bafflegab' issued by some manufacturers (much of which is oriented toward the general public who only use antennas recommended by their service-dealers and technicians) has had the effect of obscuring the facts which service-dealers and technicians are most interested in; it seems that all this is beside the point. You don't have to be led to the "bubbling springs" in the first place, and even if you allow yourself to be "carried away," you don't have to drink the stuff!

As one knowledgeable dealer put it, "Sure, because of competitive factors, antenna manufacturers are constantly inventing impressive-sounding 'buzzwords,' coining and registering new trade-marks. But I don't care about that. I'm in a serious business, like any other serious business. Antenna installations are a very important part of our operation—especially in this day of up-swinging color and FM/multiplex equipment sales."

No, the antenna is no "orphan" in the home-entertainment sales and service business—and it will grow as color TV and FM/multiplex expand. The antenna happens to be the heart of a good color TV or FM/multiplex receiver installation. Antennas are, and always have been, big business for many successful service-dealers. And the dealer who does not know this and has not taken the necessary steps to handle this business properly is only greasing the skids for himself at the exit-door of the home-entertainment equipment business.

"But what's all *this* 'gobbledygook' about the antenna business?" you may ask. Let's hear what the owner of a quarter-million-a-year-gross, medium-sized, six-man operation has to say about it.

The Professional Approach

"It's no 'big-deal,' " he says. "It has always been the consensus of opinion among successful service-dealers, those tens of thousands of medium-sized sales and service organizations who perhaps sell and service more TVs, radios and Hi Fi equipment than any other group in the country, that two main considerations are involved in the professional approach to antennas: 1) the technical factors and 2) the merchandising factors. Both areas of consideration are equally important and must be given equally adequate attention."

We wanted to know what both the technical and merchandising factors consisted of. But we didn't get it in one big, refined lump. It came in little pieces—dribs and drabs. We've put it together to make a reasonably clear picture of what alert, successful service-dealers consider the "professional approach" to the antenna business.

Another service-dealer claims that 20 percent of his $180,000 gross sales comes from antenna installations. He claims the technical considerations are relatively simple.

"We long ago provided our operation with a technical file on every TV and FM antenna made. And we keep it updated with manufacturers' performance data covering the latest models. We are not concerned with design data as such—but with performance and capability data. It doesn't require much record keeping and one three-ring binder contains the data. The binder contains quickly available data concerning maximum db gain. We have curves of each antenna plotted across the VHF and UHF bands (or VHF/UHF on all-channel antennas) and the FM band. We have front-to-back ratios and a record of polar patterns on each antenna manufactured by each company."

Another dealer, who agreed substantially with this approach, claimed that he insisted that his service-manager and all technicians who worked on antennas keep abreast of manufacturers' technical data.

"Besides that," the man continued, "our service-manager and technicians who work on antenna installations are thoroughly familiar with the terrain in our area of operation and can, within a few minutes, specify the type of antenna required at any given location in this area which will give optimum results. Our aim is to give the customer the best possible reception available and recommend to the customer whatever antenna is necessary to obtain top-quality reception. You'd be surprised how much word-of-mouth advertising this generates," he concluded.

If service-dealers, service-managers and technicians are not thoroughly familiar with antenna performance data and conditions in their operating area, it is the consensus of opinion that they are imposing an unnecessarily dangerous handicap on the future welfare of the business.

continued on page 88

Stockroom on wheels!

Your stockroom is as big as a catalog and as near as a Greyhound bus, when you specify Greyhound Package Express

Greyhound Package Express puts a warehouse at your fingertips. Gives you easy access to more different kinds of items than your shelf space could possibly accommodate. No matter what your customer wants—if it's in a catalog, you can get it for him fast by GPX. Your profits are boosted by a wider choice of merchandise...while your capital investment is kept to a minimum. GPX shipments travel on regular Greyhound buses, running on fast, frequent passenger schedules. Very often, you get what your customers need in a matter of hours. Specify GPX for round-the-clock service. 7 days a week, 24 hours a day. Weekends and holidays, too! Choice of C.O.D., Collect, Prepaid, or GPX Charge Account. For complete information about service, rates and routes, call Greyhound, or write: Greyhound Package Express, Dept. 53-I, 10 South Riverside Plaza, Chicago, Illinois 60606.

It's there in hours and costs you less

For Example	Buses Daily	Running Time	20 lbs.	30 lbs.	40 lbs.*
LOS ANGELES SAN FRANCISCO	22	9 hrs. 15 min.	2.10	2.45	2.80
DALLAS SAN ANTONIO	10	7 hrs. 0 min.	2.10	2.40	2.70
CINCINNATI LOUISVILLE	13	2 hrs. 30 min.	1.85	2.10	2.40
CLEVELAND COLUMBUS	10	2 hrs. 55 min.	2.00	2.30	2.65

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

GPX
GREYHOUND PACKAGE EXPRESS

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

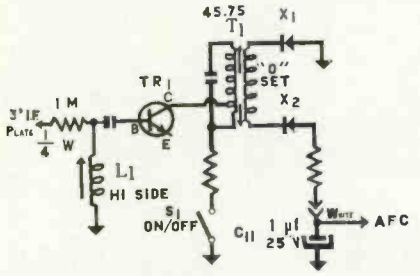
. . . for more details circle 121 on postcard

COLORFAX

Zenith's AFC Circuit

The AFC (automatic fine tuning control) permits the receiver to lock on the proper color tuning when the fine tuning perma-set control is reasonably close to frequency.

Circuitry is basically an FM discriminator network of two diodes, center-tuned to 45.75MHz, at the output of a transistor. Since 45.75MHz is on the slope of the IF response curve, a correction has to be introduced in the form of L1, which is tuned above 45.75, reacting with the IF curve to create a flat area between 45 and 46MHz.



Automatic Fine-Tuning Control

The discriminator transformer is tuned so the primary (top) is on 45.75MHz. The secondary is then adjusted so that, on an air signal, with the perma-set tuning adjusted for the best picture, there is no shift in tuning frequency as the AFC switch on the front panel is switched from "off" to "on."

When making frequency adjustments of L1 and primary of T1, the AFC output white lead is disconnected to improve sensitivity. It is then reconnected while making the final "Zero Shift" adjustment of the T1 secondary.

This unit is a plug-in type, with a mounting screw to secure firm ground contact. It may be removed from the set for servicing without upsetting receiver operation, other than deleting the AFC function.

The discriminator response curve for the AFC unit is rather typical, with one exception. Note that the low frequency side of the response curve dips back below zero to the negative side in the vicinity of 42.75-MHz.

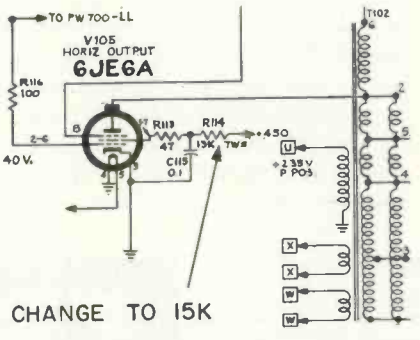
This was designed for a very good reason—there are two carriers involved in the transmitted television signal: the picture carrier at 41.75-MHz and the sound carrier at 41.25-MHz. Now with a normal discriminator response curve we would observe that as 45.75 shifted upward in frequency. it would move into the negative portion of the response curve. However, the 41.25 carrier would then be riding up the far left portion of the positive skirt so the two voltages would tend to counteract and cancel.

With the negative dip designed into the response curve at 42.75MHz, however, we find that the carriers work together: when the frequency shifts upward and the 45.75MHz picture carrier shifts into the negative voltage area, the 41.25MHz sound carrier also dips toward the 42.75-MHz minimum and develops a negative voltage, to aid in the AFC error voltage.

On the other hand, as frequency shifts downward, and 45.75MHz moves into the positive voltage area, the 41.25MHz signal drifts out to the left into an area of no correction voltage so it has no effect and can be disregarded.

New Damper Tube in RCA Victor Color Chassis

Effective with November 1966 production, all 25in. color chassis CTC21, 24, 25 and 25X were equipped with a new type damper tube, 6CL3. The tube biasing is identical to the Novar



6DW4. However, the tubes are not interchangeable without circuit modification.

The 6CL3 is said to be more efficient than the 6DW4, requiring an increase in the screen grid load of the horizontal output tube. It will be necessary to change R114 from 13K to 15K if the new damper is used. Horizontal efficiency coil and HV adjustments must be performed after the conversion.

If you encounter a chassis where repeat failures occur — a change from the 6DW4 to the 6CL3 may help.

Brighter Picture Adjustments on Olympic Color Model CT910

1. Adjust RED, BLUE, GREEN drive controls to maximum.
2. Set service switch to SERVICE position.
3. Adjust RED, BLUE, GREEN screen controls to produce visible medium bright line.
4. Return service switch to NORMAL and adjust AGC for normal bright picture with contrast and brightness set near maximum.
5. Adjust HV to achieve approximately 23.5kv at zero beam.
6. Check and reset drive controls for proper black and white reproduction at all brightness levels.
7. Adjust focus at bright picture level.
8. Adjust color killer to permit wider range on fine tuning before losing color.

All Transistorized Color TV Introduced by Motorola

Motorola introduces a line of solid-state, all transistorized color TV receivers.

These receivers will employ integrated circuits and other features pertaining to tuning, color fidelity and serviceability, according to Arthur L. Reese, executive vice president and general manager, consumer products division.

Video Buzz or Hum In Admiral Color TV Audio

When encountering the conditions mentioned, try replacing the sound IF tube (6BN11 or 6EW6). If this makes no improvement, put the original tube back and try touching up the sound alignment as outlined below:

1. Disconnect outside antenna, short antenna terminals together if necessary, to reduce signal to low level. Properly adjust fine tuning to avoid weakening audio.
2. Disregard any distortion at this point.
3. Check schematic diagram and locate the plate slug of the sound IF

continued on page 64

Join "THE TROUBLESHOOTERS"

who get paid top salaries for keeping today's electronic world running

Suddenly the whole world is going electronic! And behind the microwave towers, push-button phones, computers, mobile radio, television equipment, guided missiles, etc., stand THE TROUBLESHOOTERS —the men urgently needed to inspect, install, and service these modern miracles. They enjoy their work, and get well paid for it. Here's how you can join their privileged ranks—without having to quit your job or go to college to get the necessary training.

JUST THINK how much in demand you would be if you could prevent a TV station from going off the air by repairing a transmitter... keep a whole assembly line moving by fixing automated production controls... prevent a bank, an airline, or your government from making serious mistakes by servicing a computer.

Today, whole industries depend on electronics. When breakdowns or emergencies occur, someone has got to move in, take over, and keep things running. That calls for one of a new breed of technicians—The Troubleshooters.

Because they prevent expensive mistakes or delays, they get top pay—and a title to match. At Xerox and Philco, they're called Technical Representatives. At IBM they're Customer Engineers. In radio or TV, they're the Broadcast Engineers.

What do you need to break into the ranks of The Troubleshooters? You might think you need a college degree, but you don't. What you need is know-how—the kind a good TV service technician has—only lots more.

Think With Your Head, Not Your Hands

As one of The Troubleshooters, you'll have to be ready to tackle a wide variety of electronic problems. You may not be able to dismantle what you're working on—you must be able to take it apart "in your head." You'll have to know enough electronics to understand the engineering specs, read the wiring diagrams, and calculate how the circuits should test at any given point.

Learning all this can be much simpler than you think. In fact, you can master it without setting foot in a classroom . . . and without giving up your job!

For over 30 years, the Cleveland Institute of Electronics has specialized in teaching electronics at home. We've developed special techniques that make learning easy, even if you've had trouble studying before. Our AUTO-PROGRAMMED™ lessons build your knowledge as easily and solidly as you'd build a brick wall—one brick at a time. And our instruction is personal. Your teacher not only grades your work, he analyzes it to make sure you are thinking correctly. And he returns it the same day received, while everything is fresh in your mind.

Always Up-To-Date

To keep up with the latest developments, our courses are constantly being revised. This year CIE students are getting new lessons in Laser Theory and Application, Microminiaturization, Single Sideband Techniques, Pulse Theory and Application, and Boolean Algebra.

In addition, there is complete material on the latest troubleshooting techniques including Tandem System, Localizing through Bracketing, Equal Likelihood and Half-Split Division, and In-circuit Transistor Checking. There are special lessons on servicing two-way mobile radio equipment, a lucrative field in which many of our students have set up their own businesses.

Your FCC License—or Your Money Back!

Two-way mobile work and many other types of troubleshooting call for a Government FCC License, and our training is designed to get it for you. But even if your work doesn't require a license, it's a good idea to get one. Your FCC License will be accepted anywhere as proof of good electronics training.

And no wonder. The licensing exam is so tough that two out of three non-CIE men who take it fail. But our training is so effective that 9 out of 10 CIE graduates pass. That's why we can offer this famous warranty with confidence: If you complete a license preparation course, you get your FCC License—or your money back.

Mail Coupon for 2 Free Books

Want to know more? Send for our 40-page catalog describing our courses and the latest opportunities in electronics. We'll also send a special book on how to get a Government FCC License. Both are free—just mail coupon below.

ENROLL UNDER NEW G.I. BILL

All CIE courses are available under the new G.I. Bill. If you served on active duty since January 31, 1955, or are in service now, check box in coupon for G.I. Bill information.

CIE Cleveland Institute of Electronics
1776 E. 17th St., Dept. ET-31, Cleveland, Ohio 44114

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

Please send me without cost or obligation:

1. Your 40-page book "How To Succeed In Electronics" describing the job opportunities in electronics today, and how your courses can prepare me for them.
2. Your book on "How To Get A Commercial FCC License."

Name_____ (Please Print)

Address_____

City_____

State_____ Zip_____

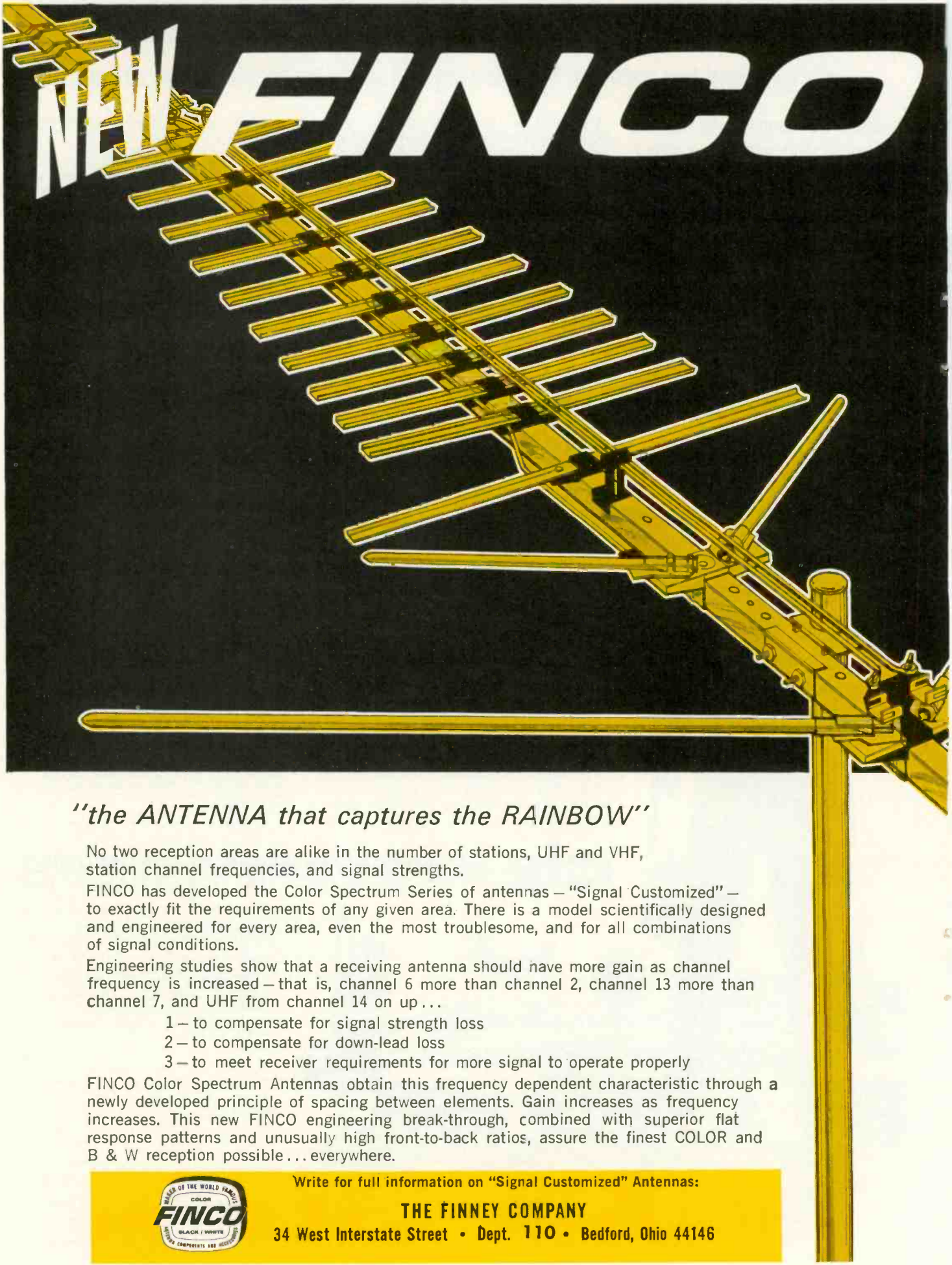
Occupation_____ Age_____

☐ **Check here for G.I. Bill Information**

Accredited Member National Home Study Council

ET-31

. . . for more details circle 115 on postcard



"the ANTENNA that captures the RAINBOW"

No two reception areas are alike in the number of stations, UHF and VHF, station channel frequencies, and signal strengths.

FINCO has developed the Color Spectrum Series of antennas – "Signal Customized" – to exactly fit the requirements of any given area. There is a model scientifically designed and engineered for every area, even the most troublesome, and for all combinations of signal conditions.

Engineering studies show that a receiving antenna should have more gain as channel frequency is increased – that is, channel 6 more than channel 2, channel 13 more than channel 7, and UHF from channel 14 on up...

1 – to compensate for signal strength loss
2 – to compensate for down-lead loss
3 – to meet receiver requirements for more signal to operate properly

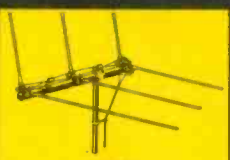
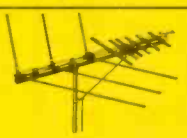
FINCO Color Spectrum Antennas obtain this frequency dependent characteristic through a newly developed principle of spacing between elements. Gain increases as frequency increases. This new FINCO engineering break-through, combined with superior flat response patterns and unusually high front-to-back ratios, assure the finest COLOR and B & W reception possible... everywhere.

Write for full information on "Signal Customized" Antennas:

THE FINNEY COMPANY
34 West Interstate Street • Dept. 110 • Bedford, Ohio 44146

COLOR SPECTRUM ANTENNAS are "signal customized" for better reception.

Check this chart for the FINCO "SIGNAL CUSTOMIZED" Antenna best suited for your area

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

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

. . . for more details circle 119 on postcard

COLORFAX

continued from page 62

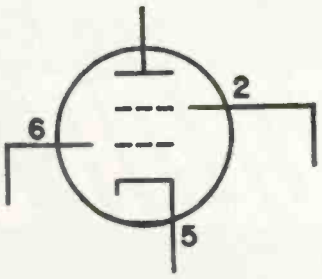
(usually the lower slug in the sound transformer).
4. Adjust until noise is minimum and audio signal stands out.
5. Center the slug in this area.
6. Reconnect antenna and tune properly to strong local station. Make sure you avoid AGC overload.
7. Turn up treble control — set volume high in a quiet surrounding.
8. Adjust quadrature coil to a point where highs are received with maximum clarity.

If hum still persists — replace 6AD10 (or 6HZ6).

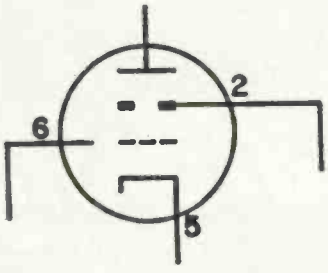
Canadian M678 Color Chassis 6EF4 Regulator Tube Explanation

The 6EF4 regulator tube has been shown in the M678 schematic with this base diagram. A technician would assume that this is a tetrode, but this is incorrect.

Tube element 2 is not a grid, but rather a high voltage shield. The shield



BASE DIAGRAM AS SHOWN IN SCHEMATIC



CORRECT BASE DIAGRAM

is used to minimize the effects of a momentary arc within the tube. The correct base diagram is shown here.

When the brightness control is set for minimum, it is normal for the plate of this tube to exhibit a dull red color at maximum dissipation. In addition, the 6EF4 may exhibit a bluish glow on the upper half of the bulb wall inner surface. This glow is the result of fluorescence and it should not be mistaken for gas.

Burst Amplifier Tube Change In Magnavox Color TV

Color TV chassis T911, T918, T919 and T920 are now using a 6KE8 tube in the burst amplifier (V706) instead of the 6GH8. These tubes are directly interchangeable with no circuit changes required. The 6KE8 provides an increase in burst amplitude at the output of the burst amp stage and is recommeded as a replacement for the 6GH8 (V706) in cases of critical color sync.

New Features in General Electric's 1968 Color TV Line

G-E's new line of large screen color TV receivers includes 23 models. One feature employed in the line is a new high definition CRT with no need for the etched faceplate. This tube is used in all 23in. models. A wireless remote control is used on selected sets and power tuning models.

Insta-View is included in 14 models. The picture appears almost immediately after the set is switched on.

All sets employ automatic fine tun-

continued on page 68

Are you up-to-date on solid state?

(Let Motorola help you)

Motorola has one of the largest programs in the industry to help independent servicemen keep pace with solid state technology.

No other manufacturer is better qualified to help you than Motorola—the TV industry's largest producer of solid state devices.

Every day, you see more and more home entertainment products with advanced solid state circuitry. This means great opportunities for service organizations that stay abreast . . . and problems for those that don't.

That's why Motorola has developed a complete program designed to help you and your technicians stay on top of solid state. Many Motorola Distributors conduct regular training meetings. Often, the Motorola Regional Service Managers take part in the meetings to provide detailed information about design and service features.

In some cases, your Motorola Distributor can enroll your servicemen in Motorola's "Professional Technician Program." These "P.T.P." training sessions are conducted right in your place of business, with your technicians working on a man-to-man, face-to-face basis with one of our factory technicians.

Each member of our large (and greatly expanded) staff of technical representatives has had extensive, practical experience. They know your business—from your side of the counter. It's their job to teach you all that's new in solid state.

Stay up-to-date on fast-changing solid state technology—contact the service manager from your Motorola Distributor. He's the man who can help you with almost any type of training activity.

MOTOROLA®

. . . for more details circle 131 on postcard

COLORFAX

continued from page 64

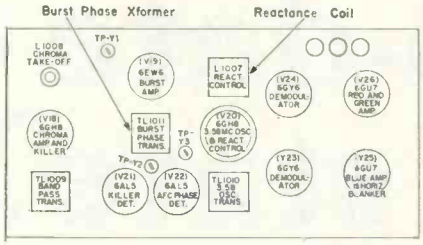
ing (AFT). After fine tuning control has been set for best reception on each VHF channel, the set automatically returns to the same optimum setting when it is switched on or when channels are changed.

"Meter-Guide" tuning will be featured in most 1968 models taking the guesswork out of fine tuning.

Large screen color sets have both 72 and 300 Ω antenna inputs.

Intermittent Color in Setchell Carlson TV

Symptoms: Color goes off when the micro tuning is set for best picture. Color goes on and off as the horizontal hold is adjusted within the horizontal lock-in range. No color on some stations or programs. No color when TV receiver is first switched on or after it has been on for some time.

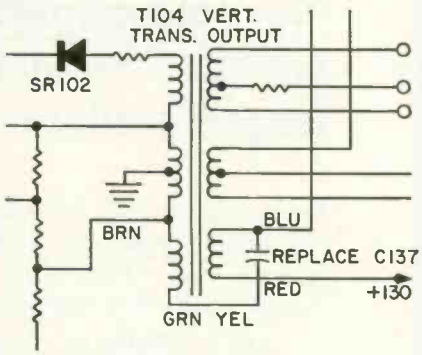


Correction: Adjust Color Killer Control. (1) Set the channel selector to a vacant UHF channel. (2) Set the color control at maximum clockwise position. (3) Advance the color killer control until color appears in the snow and then retard the color killer control approximately 10deg past the point where color disappears in the snow. **Adjust 3.5MHz Oscillator Frequency.** (1) Connect a color bar generator to the receiver. (2) Set the color control for normal color level. (3) Remove the burst amplifier tube (6EW6-CY unit). (4) Adjust the reactance coil for color oscillator zero beat (minimum movement of the color bars). The reactance coil is located in front of the 6EW6 bust ampifier and to the left of the 6GH8 3.58MHz oscillator. (5) Replace the burst amplifier tube.

Check the TINT control range. The tint control range can be centered by a slight adjustment of the burst phase transformer. The burst phase transformer is located between the 6EW6 burst amplifier and the 6AL5s.

Critical Vertical Hold on RCA Victor CTC17, 17X Chassis

Reports indicate that leakage of C137, a 0.0033μf capacitor, may cause critical vertical hold.



It is recommended that when a replacement is necessary, an RCA stock #120347 capacitor or one with exact specifications, be used. This capacitor is a ceramic 0.0033μf ±10% and rated at 3kv.

Marketing axiom number 1:

SELL WHERE YOU BUY.

Chances are you or somebody in your company uses the Yellow Pages regularly to buy supplies or services you need to do business. A study of just manufacturing firms alone proved 9 out of 10 buyers do. That's why the Yellow Pages is such a good place to reach business prospects with *your own* advertising. Sell where you buy. It's good business.

NEW PRODUCTS

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

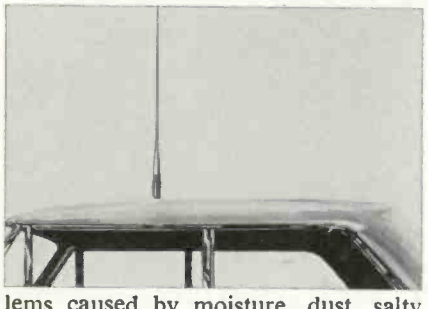
Color CRT Tester **700**

A color CRT tester features three separate G2 screen grid controls and an automatic color tracking system for

comparing individual guns. The instrument reportedly also contains all the standard color and B/W CRT tests including shorts, emission and life test. Specifications indicate that rejuvenation and shorts removal are accomplished with an automatic rejuvenation circuit. The instrument measures 10 by 8 by 3½in. and weighs 11 lb. Price $99.50. Sencore.

CB Antenna **701**

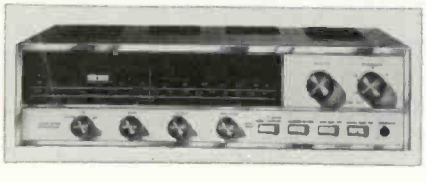
Announced is a 36in., mobile, rooftop, CB antenna reportedly enclosed in fiber glass to protect it from prob-



lems caused by moisture, dust, salty air and extreme cold. C/P Corp.

AM/FM Receiver **702**

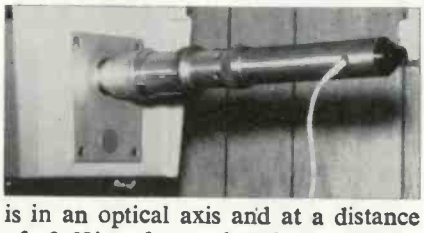
An all-silicon semiconductor receiver is announced which reportedly has a 1.8μ FM sensitivity and –95db of cross-modulation rejection and AM



sensitivity is rated at 2.0μv with a 7.5kHz bandwidth. The receiver will reportedly deliver 140w into a 4Ω load at 0.6% harmonic distortion. Specifications indicate that the receiver has a power bandwidth from 12Hz to 35kHz. Chassis size is 16½ x 14 x 4½in. Price $409.50. Sherwood.

TV Camera Gage **703**

Announced is an optical device designed to fit onto a TV camera, in place of the lens, and project built-in test patterns onto the photo sensitive surface of a vidicon tube. The image on the monitor can reportedly show an exact replica of the original pattern if the surface of the vidicon tube



is in an optical axis and at a distance of 0.69in. from the front of the camera's "C" mount. Specifications indicate that the gage contains a 110v, 60Hz power-pack rated at ±1% stability for constant light output. Zolomatics.

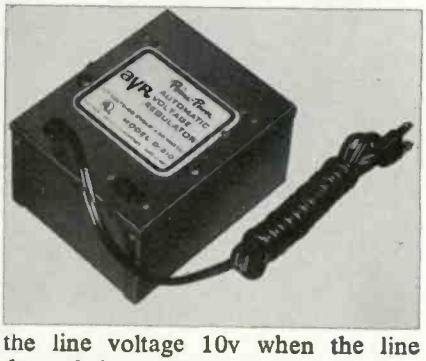
Radio/Phono **704**

A combined phonograph and AM/FM tuner is announced that reportedly features a magnetic pickup in the phonograph section and an automatic electronic stereo switch in the FM

portion. Specifications indicate that the unit also includes a stereo-headphone receptacle on the front panel, a tuning meter for best AM and FM reception and the facility to handle a tape recorder for record and playback. Price $329.50. Harman-Kardon.

Voltage Regulator **705**

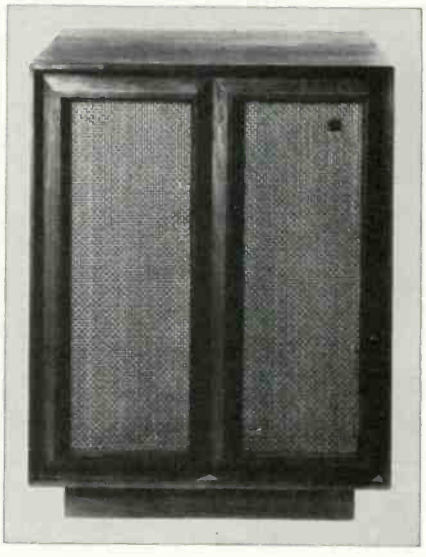
A voltage regulator is announced that will reportedly enable color TV sets to be used more efficiently in areas where line voltage regulation is poor. The unit is designed to boost



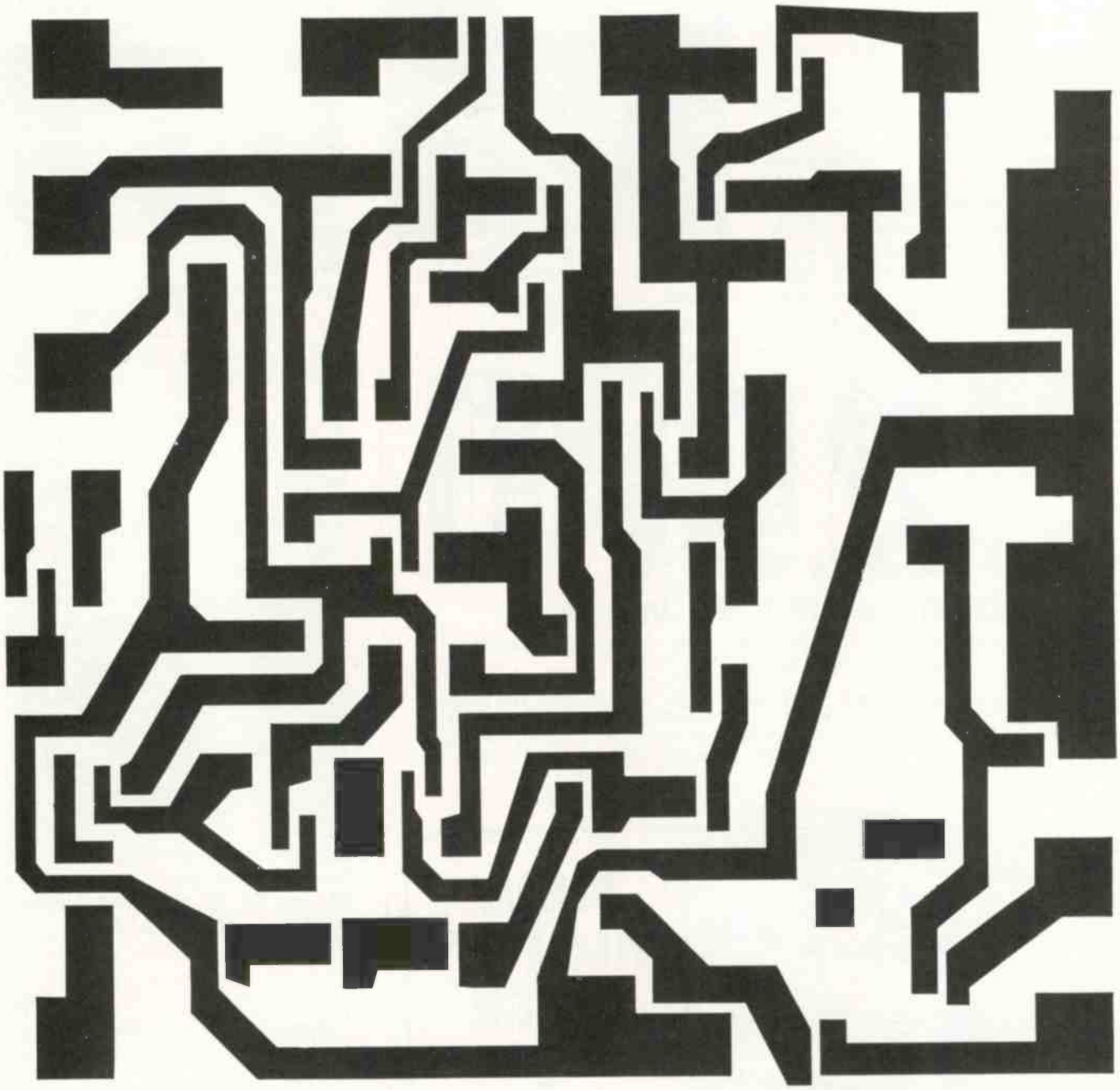
the line voltage 10v when the line drops below 110v and cut out when the voltage is normal. The manufacturer indicates that the regulator contains no tubes or moving parts to wear out and can handle 400w loads. Perma-Power Co.

Speaker System **706**

A woofer, midrange and tweeter speaker system is designed with a crossover network that reportedly limits the load impedance range for more efficient performance with solid-state components. Specifications indicate that it comes in a hand-rubbed walnut enclosure that measures 27 by 21 by 16in. and features snap-out grille frames that permit the change of grille fabric to match room decor. Price $274.95. H. H. Scott.



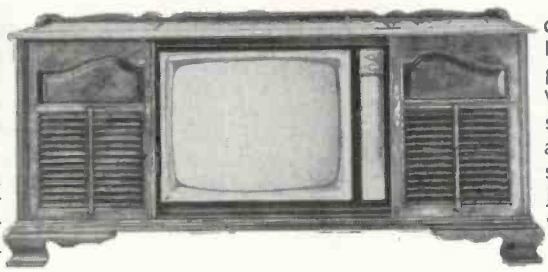
Start here:



and come out dollars ahead.

(It's an integrated circuit—and RCA Victor uses it now.)

Blown up to several thousand times its actual size, an RCA integrated circuit looks like no more than a maze. In actuality, it's no less than amazing. Just one of these silicon chips may incorporate 40 or 50 electrically interconnected components. Patterns that make up the mosaic are as narrow as two human hairs. Far more amazing than that, though, is their dollar-making potential. Integrated circuits are designed to be the most reliable kind of circuitry ever made for a consumer product. Reliability is what prompted RCA Victor to use integrated circuits in the sound system of some of our newest color and black-and-white TV sets. When you start with an integrated circuit, there's just no telling where it can take you.



RCA The Most Trusted Name in Electronics

NEW PRODUCTS

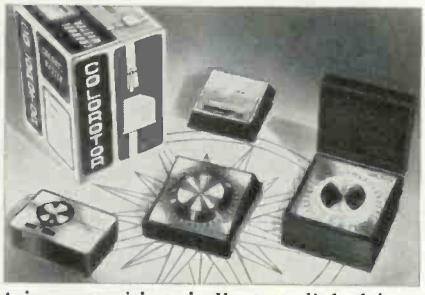
Cartridge Tape Recorder 707

A solid-state portable tape recorder is designed to operate with tape cartridges. It features pushbutton operation and a capstan drive. A record-level meter is designed to indicate the correct audio recording level, and a special interlock prevents unintentional erasure of recorded tape. External connections include jacks for earphone, microphone, external-

power and footpedal switch. The recorder measures 1⅞ x 4⅞ x 2¾-in. and weighs 3½ lb without batteries. Price $69.95. G-E.

Antenna Rotator 708

Announced is a line of antenna rotators that includes two models for automatic use. They reportedly con-



tain a position indicator dial driven by a motor that is synchronized with the exterior drive unit motor to provide an accurate indication of the antenna's direction. Channel Master.

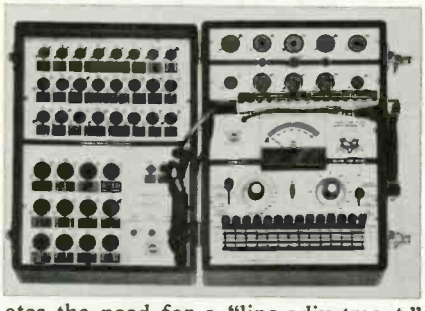
Transistor Analyzer 709

Announced is a solid-state transistor analyzer designed to provide fast in-circuit "go-no-go" checks. With transistors out-of-circuit, the instrument can reportedly indicate dc gain

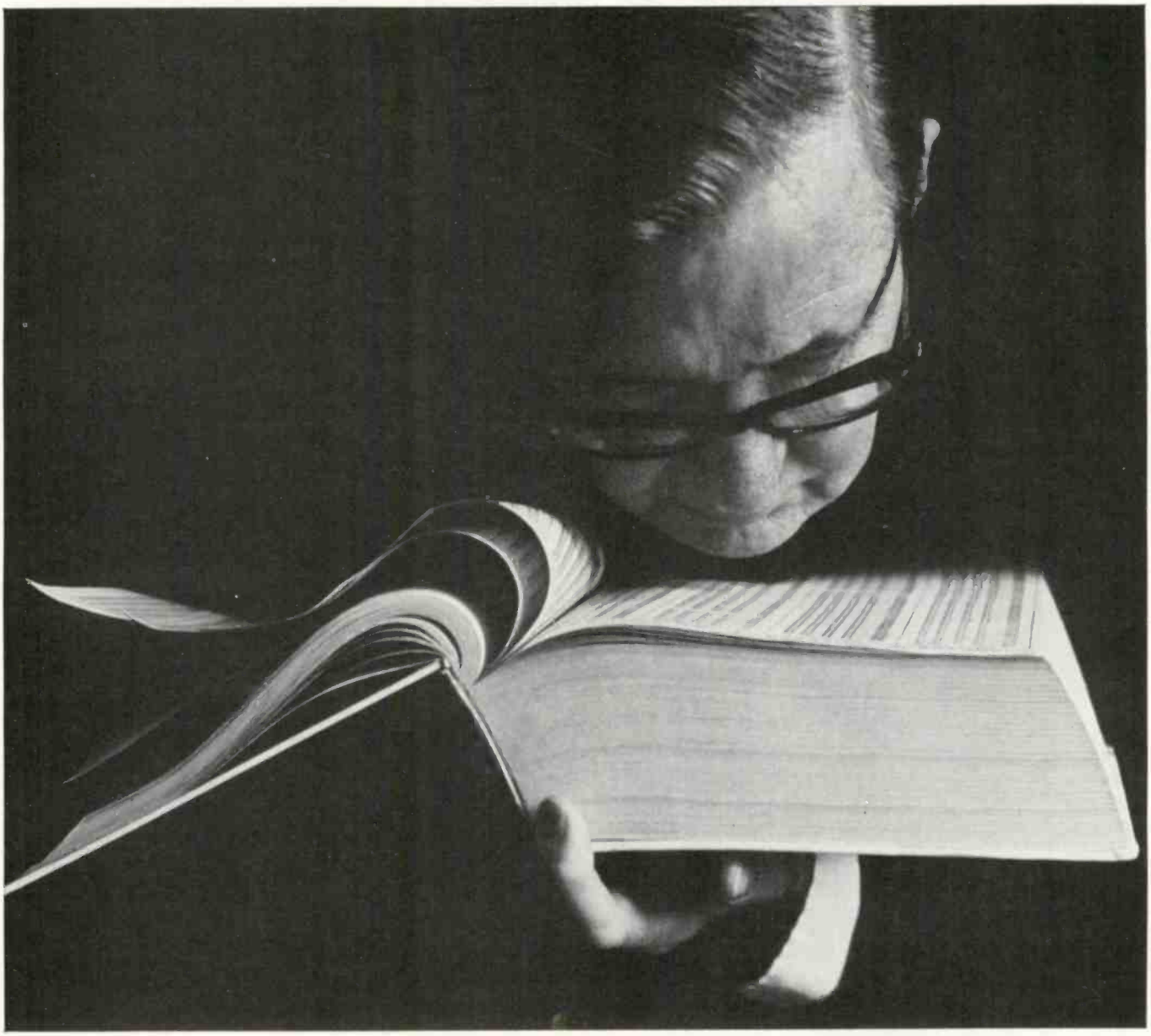
I_{CEO} and I_{CBO}. Specifications indicate that the instrument is mounted in a 8¾ by 7⅜ by 4¼in. vinyl-covered case for 115vac operation. Price $69.50. Seco.

Tube Tester 710

Announced is a tube tester that contains an "eye" tube to indicate momentary shorts that may be missed by normal meter "lag." A constant voltage transformer reportedly elimin-



ates the need for a "line-adjustment." A bank of fourteen 5-position switches is used for cathode emission tests. Specifications indicate that the instrument is housed in a 13 by 9 by 7in. vinyl covered carrying case. Net price $198.50. Seco.



Listen!

Service dealers...stop playing the numbers game

If you're in the service business you're selling time. And tracking down loudspeaker numbers can be a real waste of it.

Get out of the speaker numbers game and turn wasted time into profit by remembering this: Jensen has every replacement speaker in the book. You tell the Jensen distributor the type of speaker you need and he'll take one right off the shelf. That's fast.

Another nice thing about Jensen speakers is that they make the set sound better than new.

So when it comes to loudspeakers, the only number you need to remember is the telephone number of your Jensen distributor. You name it—radio, television, automotive, intercom, electronic musical instrument or hi-fi—he's got a loudspeaker for everything.

Call him now. If you don't have the name of your Jensen distributor we'll send it to you.

Write to us: Jensen Manufacturing Division, The Muter Company, 6601 South Laramie Avenue, Chicago, Illinois 60638.

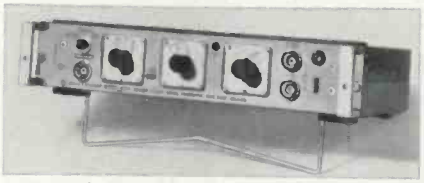
jensen

. . . for more details circle 124 on postcard

NEW PRODUCTS

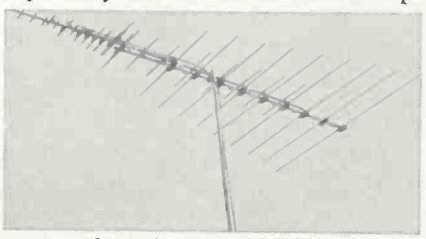
Stereo Signal Generator 711

A solid-state, FM-stereo signal generator designed to cover an 87 to 108MHz frequency range is announced. Specifications indicate that it also provides a 10.7MHz IF output variable over ±500kHz, plus an attenuator for 0.3μv to 0.3v RF output and 1μv to 1v IF output. The instrument is available in a cabinet or for a 19-in. rack. Price $995. Rohde & Schwarz.



UHF/VHF/FM Antennas 712

Announced is a TV antenna, with single lead-in, designed to receive all 82 channels plus FM. The antenna reportedly has a built-in lead-in support and strain relief for durable installations. The manufacturer indicates that a free band-splitter is provided for use at the TV set. Kay-Townes.



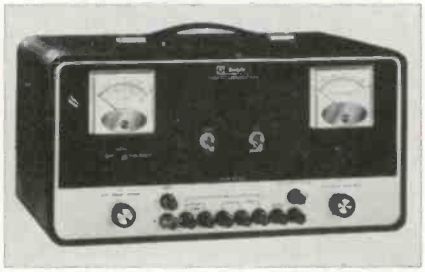
Recording Depthsounder 713

A depthsounder is announced that is designed to read and record depths in three phases from 0 to 80ft, 80 to 160ft and 160 to 240ft with automatic switching between phases according to the prevailing water depth. Specifications indicate that the recorder traces a permanent record of the precise depth and contour of the bottom on calibrated paper for later reference in navigation or shipping. Price $249. Raytheon.

NEW PRODUCTS

Power Supply 714

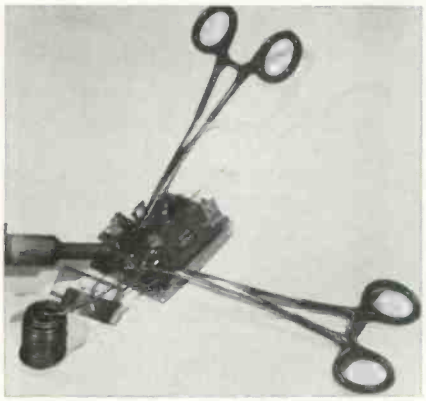
A B+ filament and dc bias supply is announced that is designed to fill the need for multiple voltages required. Specifications indicate that it delivers 0 to 4000v of regulated dc power at



up to 200ma continuously, 0 to 100vdc at 1ma regulated for line variation, 6.3vac at 6a and 12.6vac at 3a for filament supply voltage. Two front panel meters continuously monitor voltage and current. The output impedance is reportedly less than 10Ω, and the supply is 7¾ by 14¾ by 9¾ in. Kit price $94.50; assembled price $140. Allied.

Seizer/Pliers 715

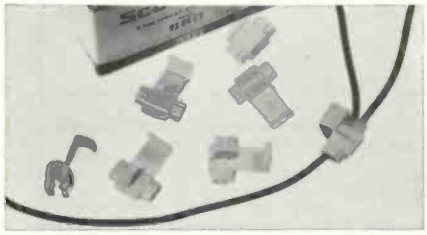
A seizer/plier is announced for holding and retrieving small components of many shapes. It feaures a medical



locking device for clamping, permitting use of the instrument as a heat sink and to hold fine wires securely for soldering. Price $3.89. Allis.

Electrical Connectors 716

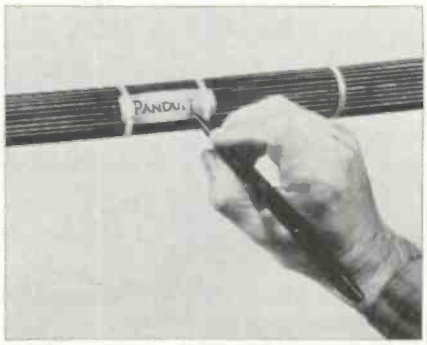
A low-voltage electrical connector designed for control systems, audio



installations and other electrical applications of 30v or less is announced. Specifications indicate that tape splices, inline splices and pigtail splices can be made with one connector without stripping, twisting or soldering. Connections are reportedly made on 14- to 18-gage wire by driving the "U-type" element down over the conductors with pliers. 3M.

Marker Plates 717

Announced is a line of identification marker plates for identifying wire bundles up to 4in. Specifications indicate that the markers are made of

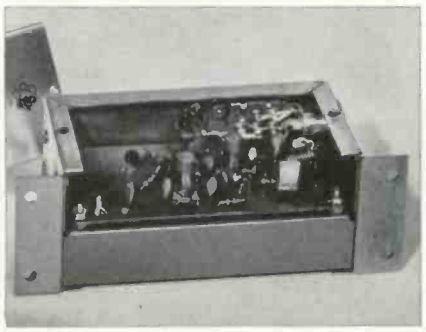


nylon and are ¾ in. wide in 1½, 3¾, 2, 2½ and 3½ in. lengths. They can reportedly be hot-stamped or marked with a nylon marking pen. Panduit.

NEW PRODUCTS

UHF Converter **718**

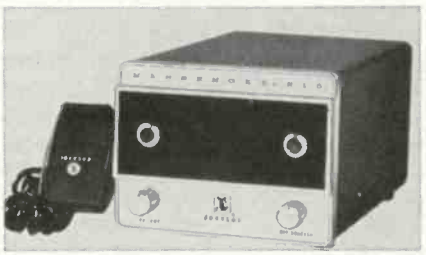
A seven-transistor, five-diode converter designed for converting any specific FM frequency between 30 and 175MHz to the AM broadcast band is announced. Specifications indicate that the converter is connected to the automobile radio and 12v power



source by plug-in cables supplied with it. It reportedly incorporates its own squelch system to eliminate noise. Price $44.95. SSB Electronics.

Business-Band Transceiver **719**

A 15-w, business-only transceiver is announced that features a built-in, two-way power supply for interchangeable base station and mobile use. It is reportedly furnished with ac



and dc power cords, a push-to-talk microphone and crystals for operation on an assigned frequency. An accessory is also available for increasing the transmitting power to 85w. Price $219.50. E. F. Johnson.

CB Transceiver **720**

An all solid-state transceiver is announced that is designed for 5-channel CB communications. Specifications indicate that it weighs only 3 lb, measures 7¾ by 2¼ by 6in., has 0.5μv to open squelch, adjacent channel 50db down and cross modulation

80db down. It reportedly comes complete with channel 9 crystals for use in the Highway Emergency Locating Plan. Price $99.90. Pearce-Simpson.

Miniature Torch **721**

Announced is a torch designed to weld metal smaller than 0.002in. wire and up to 16 gage steel. Specifications indicate that it uses oxygen and a fuel gas to produce a 6300°F flame, and that it operates at pressures of 2 to

4psi, using gas at a rate of 0.023 to 2.54cfh. Tescom.

NEWS OF THE INDUSTRY

RCA Opens New Computer Service Training Center

RCA Service Co. has announced the opening of a new computer service training center to help meet accelerating demands for technical personnel in electronic data processing. Situated at Cherry Hill, N.J., the training facilities include 13 classrooms, 5 computer systems and various other instructional equipment.

H. W. Johnson, division vice president of the Electronic Data Processing Service, said the 19,000-sq-ft center can accommodate 140 students a week at present, and will be able to handle some 200 students a week by 1968. Courses involving installation, maintenance and service of computer equipment will be offered at the center.

Rechargeable D-Size Cell Sold with Lifetime Guarantee

Waldom Electronics has introduced a 1.5v rechargeable "D" cell, which contains a reversible top section for plugging into an ac wall outlet.

Although the cells have a list price of $4.45 each or $8.45 per pair, they are guaranteed to last a lifetime. The guarantee indicates that should the cells fail to operate for any reason they can be replaced for a $1 postage and handling charge.

FM Radio Sales Climb Above Color-TV Level

The Electronics Industries Assn. (EIA) reports that during May 1967 dealers purchased 264,657 FM radios and 263,181 color-TV sets. This resulted in a 55.4 percent jump in FM radio sales over the previous May, while there was only a 5.3 percent increase in color-TV set sales.

The year-to-date increase in FM radio distributor sales was up only 1.7 percent over 1966, while the year-to-date increase in color-TV sets was 13.7 percent. These figures may indicate increased interest in Hi Fi music reception and a saturation of color-TV sales at current prices.

Illinois House Rejects Bill To License Technicians

A bill to license and regulate radio and TV technicians in Illinois, House Bill No. 1400, was rejected by the Appropriations Committee of the House. This is the seventh attempt since 1953 to obtain such legislation, which has met defeat. The Associated Radio and Television group opposed the measure.

Philco-Ford Moves Sales and Distribution Div. Offices

The headquarters of the Newark Dist. of Philco-Ford Co.'s Sales and Distribution Div. is moving from Elizabeth, N.J., to 753 Boulevard, Kenilworth, N.J.

William Oppenheim, Newark district manager, said the new headquarters will be in a 12,000-ft building of colonial design. Space will be provided for a sales office, a showroom for displaying the company's lines of consumer electronics and appliances, and for a parts and service facility.

FCC May Approve Limited Pay TV

A Federal Communications Commission committee has recommended that subscription TV be authorized by the FCC on a permanent, but limited, basis. Three members of the seven-man commission felt that pay TV could beneficially supplement conventional TV programing. Written comments from interested parties should be presented by Sept. 15.

Proposed conditions governing the use of pay TV would limit these stations to towns already served by four commercial TV stations. The subscription stations would be required to supply at least 28 hours of nonsubscription programs weekly after their first three years of operation. Sports events that had been regularly televised in the community during the past two years could not be carried by a pay TV station. A limited number of feature films more than 10 years old could be telecast each year, while non-reserved seat feature films less than two years old would be barred. At least 10 percent of broadcast time would have to carry programing other than sporting events and feature films to assure the broadcast of cultural and educational programs.

Justice Department Delays Merger of ABC and ITT

The Justice Dept. issued a one-sentence statement July 20 indicating that it would inform the Federal Appeals Court of its plans to appeal the 4-to-3 Federal Communications Commission decision approving the American Broadcasting Co. and International Telephone & Telegraph Corp. merger. The appeals court has granted a temporary delay until after some decision is reached.

The 10-page notice of appeal indicated that the FCC had not made a proper analysis of the competitive effects resulting from the proposed merger, and that the merger would be to the detriment of public interest without corresponding benefits. The Justice Dept. claimed that the FCC relied too heavily on promises about future conduct.

G-E TV Sets Said To Endanger Public Health

Owners of large screen G-E color-TV sets are being urged by the Public Health Service to disconnect their sets and notify local G-E dealers. The Surgeon General advises that tests indicate that tubes in a large percentage of the sets being recalled emit X-rays at energy levels potentially harmful to human health.

Since May, G-E has been attempting to locate all of the color TV sets in question. One of their warnings was published in the July news section of ELECTRONIC TECHNICIAN. At last report, however, there were still approximately 9000 G-E large-screen color-TV sets that had not yet been located for modification.

Strom Communications Acquires Stromberg-Carlson Products Line

Strom Communications Corp., of Chester, Pa., has acquired the distributed products line from Stromberg-Carlson Co. of Rochester, N.Y., the two companies announced. Strom Communications Corp. will continue to market the line through its sound product distributors.

The distributed products line acquired by Strom Communications are all designed for business, institutional and educational markets. They include public address systems, school sound systems, personnel registry systems, nurses call systems, and loudspeaking and telephone intercommunications systems. These products are sold through a completely separate distributor organization unlike Stromberg-Carlson telecommunication and data products.

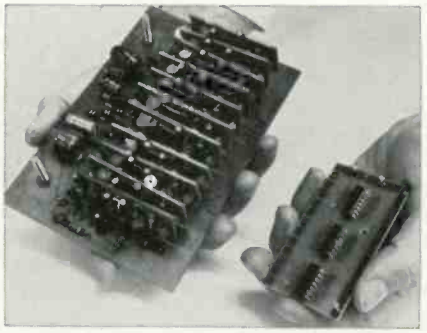
NEWS OF THE INDUSTRY

Motorola Develops MOS ICs For Electronic Organs

Two MOS integrated circuits, designed specifically for application in electronic organs, are introduced by Motorola's semiconductor products division. They have been exhibited in a model combo organ built by Motorola to demonstrate the new MOS IC capability.

The MOS IC frequency divider contains four toggle flip-flops, two cascaded internally and two separate. The toggle frequency is reportedly from dc to 500kHz. The MOS IC dual keyer gate with sustained control inputs is designed to provide high isolation and low intermodulation.

Thomas J. Conners, Motorola's marketing manager, reports that the use of MOS ICs eliminates 80 percent of detailed piece-part assembly, compared to designing the same equipment with bipolar devices and diodes. "Also," he said, "the IC approach reduces by 60 percent the individual



piece parts that must be produced, approved and assembled in present conventional approaches."

Although the divider and keyer have been developed for the electronic organ industry, Mr. Connors noted that these functions are common to other consumer areas such as automotive, appliance and control products.

Benjamin Electronic Sound Acquired by Instrument Systems

Benjamin Electronic Sound Corp. of Farmingdale, L.I., N.Y., is acquired by Instrument Systems Corp., a public company of Huntington, L.I., N.Y. The transaction was for an undisclosed amount of stock.

Benjamin, a manufacturer and distributor of Hi Fi equipment, is the exclusive U.S. distributor of Miracord record playing products and manufactures a line of radio phonographs and battery chargers for portable TV sets.

Edward J. Garrett, president of I. S. C. said Benjamin's management, headed by Joseph N. Benjamin, would remain and the company would operate as a subsidiary.

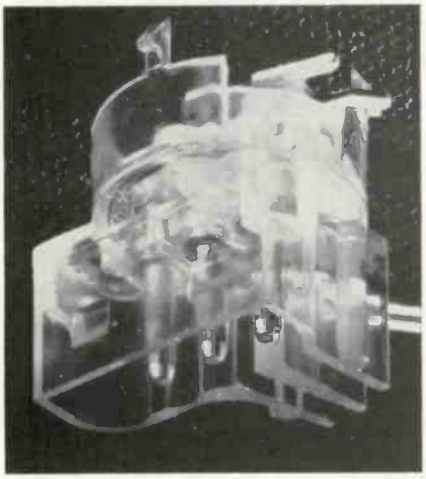
Techpress Appoints Sales Representative

Techpress, Inc., an electronics book publisher in Brownsburg, Ind., announces the appointment of Mike Berman of Mike Berman Sales in Skokie, Ill., as Techpress representative in the northern Illinois, eastern Wisconsin area.

NEWS OF THE INDUSTRY

Polycarbonate Switch Housing Reduces Record Changer Cost

Cost savings resulted when a one-piece polycarbonate switch housing was designed to replace six metal and



fiber parts, eliminate ten mechanical and soldered connections and reduce assembly time. The new injection-molded component is an ON-OFF switch for record changers manufactured by V-M Corp. Quick assembly and disassembly of the unit in a record changer chassis is facilitated by three integral snap-in "ears" at the base of the housing. The possibility of electrical shock to the user is reportedly eliminated because the polycarbonate housing insulates the current-carrying switch components from the record changer.

JFD Produces TV Antenna For Dealer Displays

JFD Electronics Co. is producing a point-of-sale model TV antenna display designed to make it apparent at a glance that the line is for sale at the showroom.

The display is a gold anodized aluminum reproduction-in-miniature of a JFD color-TV antenna with dipoles, trapezoid driver and disc-on-rod director. But instead of pulling in 82-channel color-TV pictures, this model is designed to pull in impulse antenna sales.

NEA Recognizes Certified Electronic Technicians

The National Electronic Assn's. (NEA) national group of dealers and technicians has passed a resolution giving technicians, previously certified by the Washington State Electronics Council (WSEC) as Certified Electronics Specialist," equal status to those technicians who are now recognized in 13 other states as NEA Certified Electronic Technicians. Washington State presently has 63 technicians who have qualified under their state program — now in effect for two years.

The WSEC recently adopted the NEA Certification Program's technical and theory test as their official test. Previously no written test was required by WSEC, as their certification program has been based on work experience, employer's reference, technical training and an elaborate point system for qualifications — similar to the system used by the Washington, D. C.-based "Certified Engineering Technician" program.

First Quarter Figures Indicate Domestic and Foreign Market

The Electronic Industries Assn.'s (EIA) marketing services department indicates that the total U.S. market for radios of all types during the first three months of 1967 amounted to 8,675,849 units. Of this total, 4,680,-183 were imported. U.S. brand imports, included in the latter figure, attained 778,466 sets or nearly 9 percent of the total market.

The total U.S. TV receiver market (including both B/W and color TV sets) during the first quarter reached 3,032,966 units. Imported TV sets numbered 369,304 units or 12 percent of the total TV market, while U.S. brand imports were 157,994 sets or 43 percent of the imports.

The U.S. market for phonographs absorbed 1,549,466 units during the first 1967 quarter. The phonograph import total of 413,772 units contained 89,264 U.S. brand imported players or 22 percent of all units coming from abroad.

Perma-Power Appoints Smith in New England

Perma-Power Co., a Chicago-based manufacturer of electronic products, announces the appointment of the Robert Smith Co. as sales representatives in the New England states. According to Norman Ackerman, Perma-Power's vice president of marketing, the Smith organization will handle sales of TV tube brighteners, solid-state garage door operators and packaged public address systems in Massachusetts, Connecticut, Rhode Island, Vermont, New Hampshire and Maine.

The two-man Smith organization is headquartered at 59 Verndale St., Brookline, Mass., and has a branch office in West Hartford, Conn.

BOOK REVIEWS

PROBLEMS IN ELECTRONICS WITH SOLUTIONS. *By F. A. Benson. Published by Chapman and Hall Ltd., distributed in the U.S. by Barnes & Noble, Inc., 320 pages, soft cover. $4.24. Hard cover. $8.*

Problems, supplementing those a technician would encounter when taking advanced courses in electronics, are given along with answers in the first portion of this book, while the second portion contains, in brief form, the methods for obtaining these answers. The 349 problems cover a broad range of electronic applications including electronic computing circuits, voltage and current stabilization, UHF effects, filters and antennas. An eight-page index makes this book a handy reference for engineers working on unfamiliar applications. Although the British terminology may seem a little strange at times to U.S. readers, this book should be of value to those technicians who already are familiar with the more complex forms of mathematics applied to advanced electronics.

ELECTRICITY ONE-SEVEN. *By Harry Mileaf. Published by Hayden, 976 pages, hard cover $12.76, seven individual paperbound volumes, $16.95.*

The material covered in this book begins with a simple explanation of pulsed dc currents for communications, and this principle is developed into a description of the complex waveforms used in radar and color-TV sets. Many two-color illustrations are used to make the explanations as simple as possible. Explained are such principles as the nonlinear mixing of signals, and the bandwidth and selectivity of RF amplifiers. This book will help both the beginning and advanced technician broaden his understanding of electronics.

TRANSISTOR SPECIFICATIONS & SUBSTITUTION HANDBOOK, 1967 EDITION.
Written and published by Techpress, Inc., 188 pages, soft cover. $2.95.

This handbook lists transistors three ways: according to type (78 pages), according to collector current ratings (17 pages) and according to collector-to-base or collector-to-emitter voltages (19 pages). Over 6000 transistors are included in these listings. This may be a conservative estimate. Only the first listing contains all transistor characteristics, and it should be referred to as a final check before selecting substitutions according to the other two listings. A fourth listing (42 pages) contains suggested substitutions for many of the transistors. When spot checking the listing according to type, we did note a few errors in the book. Transistors of type 2N923, 2N924, 2N925, 2N926, 2N927 and 2N928 were listed as NPN transistors. After checking with the manufacturer we were advised "these devices are registered as PNP devices with the JEDEC Council and are supplied by National Semiconductor Corp."

ELEMENTARY NONLINEAR ELECTRONIC CIRCUITS. *By George E. Anner. Published by Prentice-Hall, Inc., 288 pages, hard cover. $9.00.*

The nonlinear resistive and reactive behavior of electron tube and semiconductor circuits are described in detail with the aid of series expansions, calculus, characteristic curves, vectors and equivalent circuits. This book may be of value to advanced undergraduate electronic engineering students or experienced electronic technicians who have a good background in calculus.

BOOK REVIEWS

ZENER DIODE HANDBOOK. *Written and published by Motorola Semiconductor Products Inc., 192 pages, soft cover. $2.*

Basic semiconductor theory, the structure of a semiconductor diode and zener diode avalanche breakdown theories introduce the described functions of this semiconductor component. Although the chapter on production techniques tends to be a manufacturer's commercial, it does present important information to readers interested in quality control. Characteristic curves, equations and diagrams are used to describe zener diode characteristics and their applications in various types of circuits. The book also contains a very good description of transistor voltage regulation circuits that use zener diodes. The remaining 52 pages contain a selection guide and cross reference for voltage regulating semiconductor components. This book should be of value to technicians dealing with regulated power supplies and special circuits in radios, TV sets and other electronic equipment.

CATV OPERATOR'S HANDBOOK. *Edited by Verne M. Ray. Published by TAB Books. 160 pages, soft cover. $7.95.*

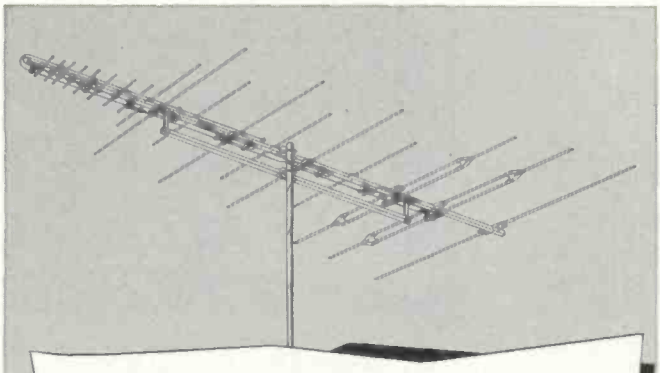
This book is rather similar to the book CATV SYSTEM MANAGEMENT & OPERATION also published by TAB Books and reviewed in the October 1967, issue of ELECTRONIC TECHNICIAN. It describes many of the factors that must be considered when designing a CATV system. Also included are accounts of effective promotional activities used by CATV systems as they sign up their initial subscribers, the use of automated equipment to reduce costs and the addition of an information channel or FM channel. This book would be of interest to anyone who is either thinking of going into the CATV business or who may be planning to update a system already in use.

TRANSISTOR BASICS: A SHORT COURSE. *By George C. Stanley, Jr. Published by Hayden Book Co., 112 pages, soft cover. $2.75.*

Simplified diagrams, characteristic curves and equations are used to explain the function of transistors and diodes. The author does not assume that the reader has had any previous experience with semiconductors, and the equations involve only simple algebra. After carefully reading this book, most readers would probably be able to design at least a simple transistor circuit. As an aid, 25 of the more common transistor symbols, 3 pages of rule-of-thumb formulas and 3 pages of exact equations are listed in the book. The volume also includes a chapter that gives hints for transistor circuit troubleshooting. This book should be of interest to any technician who has had very little theoretical contact with semiconductor technology.

INTERPRETING FCC BROADCAST RULES & REGULATIONS. *Edited by Verne Ray. Published by Tab Books, 160 pages, soft cover. $5.95.*

This handbook quotes and interprets FCC regulations concerning programing (88 pages), diversification of ownership (22 pages), defense against encroachment (18 pages), notice of filing (7 pages), public records (6 pages), advertising (9 pages), billing (7 pages), fines (4 pages) and operator requirements (2 pages). It also clarifies these regulations by making reference to some of the case decisions made by the FCC. This book may be of interest to managers of commercial broadcasting stations.



3-Way Combination

FREE SPACE STANDING WAVE MAGNETIC ANTENNA

ZEROS IN YOUR SIGNAL—

Discriminates Between Desired Signal and Unwanted Noise!

Here is an antenna with the unique ability to discriminate between the desired signal and unwanted noise! A complete absence of minor lobes and an extremely high front to back ratio are characteristics of these antennas. This is made possible by the development of the Free Space Standing Wave Magnetic Drive Antenna system (F.S.M.). The outstanding electrical qualities, combined with the simplified mechanical construction of this system yields a total performance package unparalleled in today's market. 4 models, 60-inch to 180-inch boom, all modestly priced.

UNEXCELLED!

UHF — VHF — FM — COLOR

INVESTIGATE NOW!

S&A Electronics Inc.

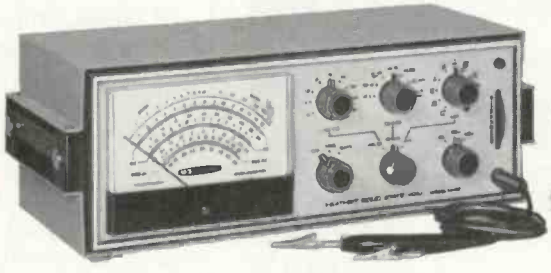
Manufacturers of the TARGET ANTENNA

204 West Florence Street
Toledo, Ohio 43605

. . . for more details circle 138 on postcard

If You're Still Using A V.T.V.M. It's Time To Change ...Go Solid-State!

Ⓐ Kit IM-16 $44.95



Ⓑ Kit IM-25 $80.00

Wired IMW-25 $115.00

These New Heathkit® Solid-State Meters Feature State-Of-The-Art Performance At Prices You Can Afford

- Modern, stable, long-life solid-state circuitry
- New low-voltage ranges to accurately analyze modern transistor circuits
- Full capability to go "out on the job" . . . instant selection of internal battery power or 120/240 v. 50-60 Hz AC operation
- Exceptional accuracy . . . 3% on DC volts, plus a large, easy-to-read 6" meter face
- High impedance F.E.T. input for minimum circuit loading

Ⓐ New! Deluxe Solid-State Volt-Ohm Meter

Features 8 DC and 8 AC voltage ranges from 0.5 v to 1500 v full scale; 7 ohmmeter ranges (10 ohms center scale) x1, x10, x100, x1k, x10k, x100k, & x1 megohm; 11 megohm input on DC ranges; 1 megohm on AC ranges; internal battery or 120/240 v 50-60 Hz AC power for portable or "in shop" use; large readable-across-the-bench 6" meter; separate switches for individual functions; single test probe for all measurements; modern, stable solid-state circuit-board construction.

Kit IM-16, 10 lbs. **$44.95**

Ⓑ New! Deluxe Solid-State Volt-Ohm-Milliammeter

All silicon transistors plus FET's. Features 9 AC and 9 DC voltage ranges from 150 mV to 1500 volts full scale; 7 ohmmeter ranges (10 ohms center scale) x1, x10, x100, x1k, x10k, x100k, & x1 megohm; 11 current ranges from 15 uA to 1.5 Amperes full scale; 11 megohm input on DC voltage ranges; 10 megohm input on AC voltage ranges; internal battery power or 120/240 v 50-60 Hz AC power for maximum versatility; easily readable 6" meter face; ±3% accuracy on DC volts; ±4% on DC current; ±5% accuracy on AC voltage and current; separate range switches "human engineered" for efficiency in actual use; modern circuit board construction; all solid-state components; easy to assemble.

Kit IM-25, 10 lbs. **$80.00**
Wired IMW-25, 10 lbs. **$115.00**

HEATHKIT

HEATH COMPANY, Dept. 24-9
Benton Harbor, Mich. 49022
In Canada, Daystrom Ltd.

☐ Please send my FREE 1968 Heathkit Catalog.

☐ Enclosed is $_____, plus postage.

Please send model(s)_____

Name_____

Address_____

City_____ State_____ Zip_____

Prices & Specifications subject to change without notice. TE-165

. . . for more details circle 122 on postcard

GARAGE DOOR . . .

continued from page 52

the door would close and again the button would have to be pushed repeatedly before the door would move. The door worked perfectly on manual pushbutton operation. We could hear the relay click, but no operation. The relay and switch contacts were checked. Sometimes an ohmmeter check showed from 5 to 100Ω between the two contact points. The trouble was corrected by cleaning and burnishing the relay contact points.

A dead transmitter in another GDO was checked for possible defect. The battery checked low and was replaced—but the door still wouldn't operate. When the components on the PC board were checked, we found a connection from the crystal to the base terminal of the oscillator transistor was broken. This was repaired by using a piece of regular hookup wire and the unit worked fine.

Be sure to check for cracked or broken boards on hand-held transmitters since they are frequently dropped from the car.

We were called to look at another GDO unit which had the "chills"—the customer said. "It's teeth began to chatter and smoke poured out of the motor," he said. So he switched it off and called us. We found a relay burned to a crisp. After installing a new one, we checked for a possible cause of the difficulty and found the glass reed contacts in the receiver relay were frozen together. These contacts are enclosed in a glass tube and the switch contacts are soldered into the PC board. This made the motor relay stay on all the time and, of course, something had to give.

Despite some of the difficulties you bump into occasionally most of the GDO problems are easy to solve and after you service a few, the job becomes a snap.■

ANTENNAS . . .

continued from page 60

Some of the information received from service-dealers fits in with our

own experiences. And it may be helpful to digress briefly at this point and recall that editors of ELECTRONIC TECHNICIAN did some extensive local and fringe-area research (following 18 combined years of practical experience) with TV and FM antennas a few years ago. Reception of TV VHF channels 2, 4, 5, 9, 11 and 13 were involved. We received full cooperation from every leading antenna manufacturer in the country. They all supplied complete performance data on their antennas and offered many helpful suggestions.

In these checks we employed single channel yagis, stacked yagis, single broad-banded yagis, stacked broad-banded yagis, log periodic, colinear (and other) variations; plus preamplifiers, rotators and field-strength meters. Although we did not learn anything basically new about antennas, we did confirm many general theories that we had held about antennas over the years. Besides this, we learned a lot about the terrain in which we did the research and we came up with some significant and helpful information which was given to ELECTRONIC TECHNICIAN readers in a series of articles published in 1963.

We also learned, for example, that all antennas of that period had various advantages and disadvantages—especially considering particular needs and requirements for a given location. Generally, we learned that one antenna worked about as well as another—when each had similar capability specifications—no matter what the brand name was. But a few antennas, having similar capability specifications, did give better results than others in certain specific locations.

From the mechanical viewpoint, some antennas were more ruggedly constructed than others. Some were capable of being more easily and rapidly set up and installed than others.

A forthcoming article will further explore the professional approach to antennas—including the merchandising factors. You may be surprised to learn that many of the approaches to "selling" antennas are closely associated with your duty, as a serious professional, to the customers whom you expect to support and remain loyal to your business.■

CATALOGS AND BULLETINS

Electrolytic Capacitors 400

A 32-page cross reference has been compiled to include all electrolytic capacitors used in color-TV chassis made by 32 set manufacturers. The listing has been designed to help technicians service all current color chassis with a direct reference to rated capacity/voltages for single, dual, triple and quadruple section units. Cornell-Dubilier.

Aerosols 401

A bulletin contains both illustrations and descriptions of aerosols used for cleaning printed circuits, cleaning electrical contacts, flushing away contaminants, cooling circuits, repelling water, providing dry lubrication, neutralizing static electricity, protecting against fungus, applying insulating coatings and aiding in cutting. Sprayon Products.

VR Transformers 402

A six-page bulletin describes the theory of voltage regulation with ferroresonant transformers, lists the effects of undervoltage and overvoltage on electrical performance and contains illustrations to show transformer characteristics. Illustrations of various transformer models and a table of their specifications are also included. Acme.

Mobile Carts 403

A 12-page catalog contains pictorial illustrations and descriptive data covering 14 mobile carts. Suggested arrangements of test instruments are shown. Cambridge Electronics.

Reed Relays 404

More than 160 reed relays, including ultraminiature, microminiature, miniature, standard and mercury-wetted reed relays, are listed in a 10-page catalog. Also listed are detailed electrical, mechanical and environmental specifications, dimensional drawings, photographs and applications. Wheelock.

RF-Power Meter 405

A four-page catalog lists coaxial load resistors, absorption wattmeters and directional wattmeters. Also described are related custom-built accessories like coaxial filters. Bird.

Indicator Lights 406

A line of sub-miniature, insulated, two-terminal indicator lights for incandescent or neon lamps is described in a 12-page catalog. Included are diagrams, photographs and specification tables. Dialight.

Power Transistors 407

An engineering data sheet contains detailed descriptions for a series of four high-voltage silicon NPN power transistors. Some are designed to handle collector-to-emitter potentials safely up to 500v. Test circuits and characteristic curves are included. Bendix.

TV Monitor 408

A bulletin contains photographs and technical specifications that describe a B/W TV monitor with 172sq-in. screen. Setchell Carlson.

Soldering Guns 409

A four-color, four-page illustrated catalog describes a line of single-post type soldering guns having heat ranges from 25w to 450w. Wen.

Crystals 410

A 12-page catalog detailing frequency control crystals includes engineering data, crystal holder descriptions and military specifications. Texas.

MOVING?

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

Electronic Components 411

A 64-page catalog includes wire antennas, audio cable, tubing, insulators, connectors, jacks, lugs, nuts, switches, test leads, transistor heat sinks, tuning dials and related hardware. One page contains tables that compare centigrade and fahrenheit temperature scales, inch and metric equivalents, copper wire stranded construction and theoretical values for standard annealed copper wire. Birnbach.

Fiber Glass Antenna 412

A data sheet describes a 36-in. fiber glass roof-top CB mobile antenna. Included are specifications and a diagram of its design. C/P Corp.

Electrolytic Capacitors 413

A complete family of molded case electrolytic capacitors is described in a 12-page catalog. Included are photographs, electrolytic capacitor definitions, plus tables and graphs showing capacitor characteristics. P. R. Mallory.

Microphones 414

An eight-page catalog lists an assortment of dynamic cardioid and ceramic microphones. The inside front cover contains a pictorial index listing of all microphones in the catalog. Sonotone.

ADVERTISERS INDEX

Allied Radio Corp. 88
American Telephone & Telegraph Co. 69
Amphenol Distributor Prod. 19
Antenna Specialists Co. 74
Arco Electronics 29
Argos Products Corp. 85
Arrow Fastener Co., Inc. 92
B&K Div., Dynascan Corp. 2nd Cover, 36, 89
Bell P/A Products Co. 88
Borden Chemical, Krylon Div. 86
Castle TV Tuner Service 89
Channellock, Inc. 68
Cleveland Institute of Electronics 63, 81
Columbia Wire Products Co. 82
Cornell-Dubilier ..... 3rd Cover
Enterprise Development Corp. 89
Finney Co. 64-65
GC Electronics Co. 24
Greyhound Lines, Inc. 61
Heath Co. 87
Hickok Electrical Instruments Co. 92
Jensen Mfg. Div., The Muter Co. 73
Jerrold Electronics Corp. 33
JFD Electronics Co. 59
Kay-Townes Antenna Co. 82
Lechtrotech, Inc. 80
Mallory Distributor Products 35
Mosley Electronics, Inc. 79
Motorola, Inc. 67
Multicore Sales Corp. 92
National Electronics Enterprises 78
National Radio Institute 30
Oxford Transducer Corp. 90
Pearce-Simpson, Inc. 34
Perma-Power Co. 83
Philco-Ford 20
Radio Corporation of America
RCA Electronic Components & Devices ..... 4th Cover
RCA Institutes, Inc. 78
RCA Parts & Accessories 31
RCA Sales Corp. 71
S&A Electronics, Inc. 87
Seco Electronics Corp. 90
Sencore, Inc. 32, 66, 72, 77, 84
Simpson Electric Co. 25
Sonotone Corp. 89
Sprague Products Co. 23
Sylvania Electric Products, Inc. 26-27
Vaco Products Co. 84
Winegard Co. 22
Workman Electronic Products, Inc. 91
Xcelite, Inc. 74
Zenith Sales Corp. 91

NO REWARD THE EXACT KID

*Be on the lookout for the Wide Ranger. He represents CDE's wide-range electrolytic program in the TV serviceman's never ending fight for easier, faster, more profitable service calls.

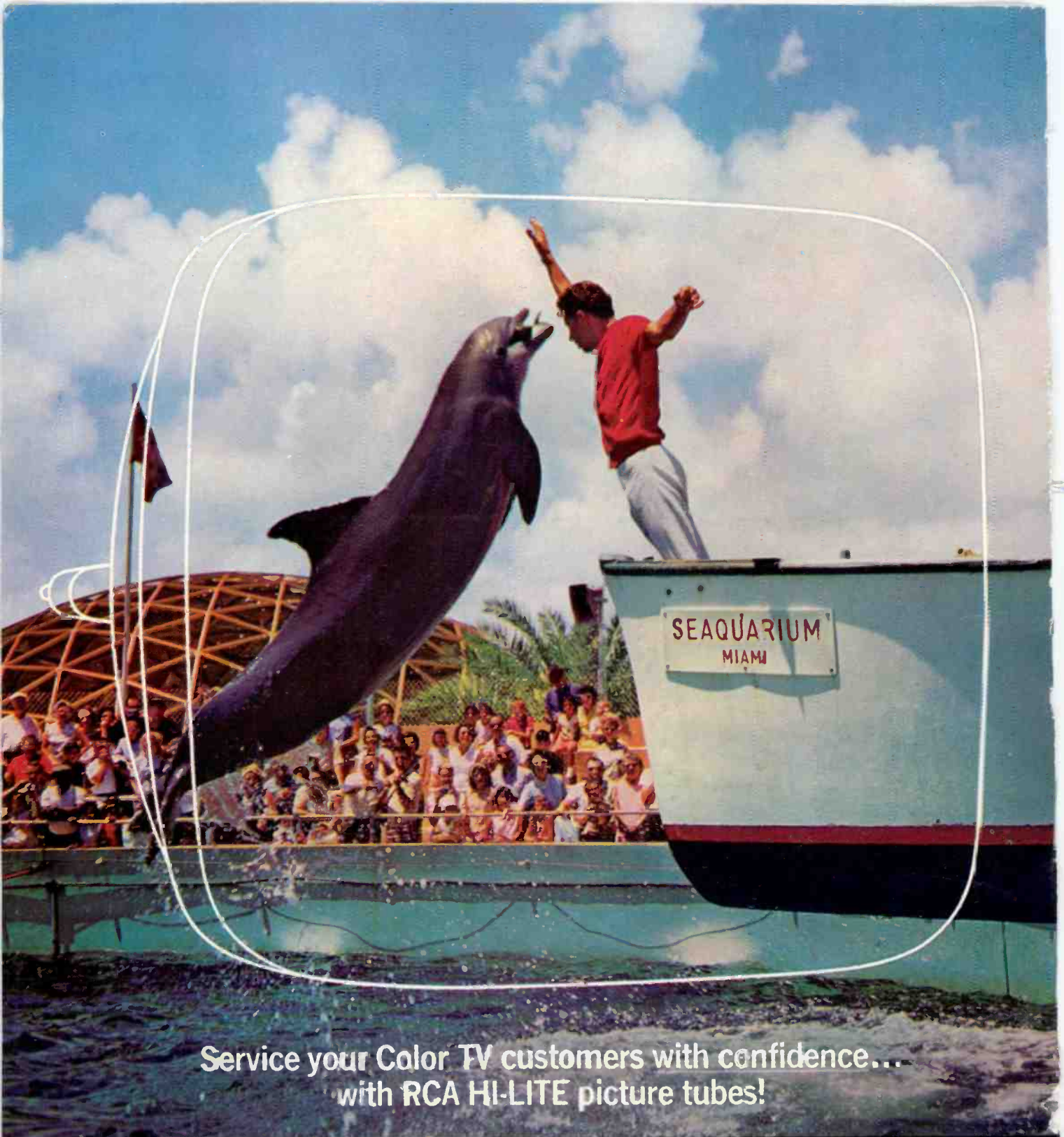
It doesn't pay you to go looking for the Exact Kid—any Exact Kid.

The Wide Ranger's 200-plus replacement electrolytics do the job of the Exact Kid's thousands. So your distributor always has the wide range electrolytic you need, in stock.

That's why everybody calls the CDE WIDE RANGER* a Good Guy.

CDE CORNELL-DUBILIER

. . . for more details circle 102 on postcard



Service your Color TV customers with confidence... with RCA HI-LITE picture tubes!

Customer satisfaction . . . and consequently your service reputation . . . can very often depend on the quality of the replacement parts you use. When it comes to replacement picture tubes, you can depend on an RCA HI-LITE for picture brightness and color fidelity at its finest. Install them and you literally "up-date" your customer's set with the same quality... the same tubes . . . that go into today's original equipment sets.

Enjoy the confidence of offering the finest. Rely on RCA picture tubes to protect your service reputation. They are designed to protect the biggest reputation in the Color TV industry

RCA Electronic Components and Devices, Harrison, N.J.

RCA **The Most Trusted Name in Electronics**