ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

JULY 1967

AN OJIBWAY PUBLICATION

Repairing Solid-State Auto Radios

Servicing Integrated Circuits

Troubleshooting Color Video Amplifiers

we looked into your future, then created the "little corporal," a most remarkable CRT tester.

B & K has done it again . . . put you a "jump ahead" by looking into your future . . . your problems, *your* needs. This is the "Little Corporal," the CRT Rejuvenator and Checker, designed to provide maximum obsolescence protection by providing continuously variable voltages for all CRT elements. You can make the most accurate possible tests, even on future CRT types, because the heater voltage is metered and is continuously variable from 0 to 13 volts with any tube heater current. And, using the required adaptors, you can test and correct all tube, transistor or integrated circuit black and white and color picture TV tube troubles (including GE 11" color and imported color tubes) in a few minutes . . . in the home or on the bench . . . without removing tubes from the TV set.

You can give new life to weak or inoperative picture tubes—prove to your customers their need for new tubes.

The "Little Corporal," another product of B & K electronic innovation, carries the B & K Professional Servicing Equipment emblem, your assurance . . . your customers' assurance . . . that you use the finest equipment made.

Model #465, Net: $89.95.

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Where Electronic Innovation Is A Way of Life

. . . for more details circle 104 on postcard

ELECTRONIC TECHNICIAN

TEKFAX

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

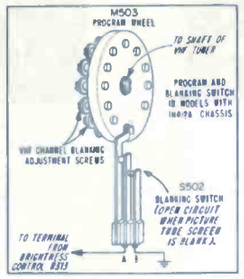
GROUP 179

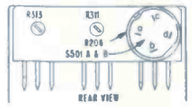
SCHEMATIC NO.		SCHEMATIC NO.	
ADMIRAL	1093	PHILCO-FORD	1096
TV Chassis H3-1A, H4-1A, 1H4-2A		TV Chassis 17J28	
CORONADO	1094	SILVERTONE	1098
Color TV Model TV21-9643A		TV Model 7151, 7152, 7154, 7155, 7156, 7157, 7158	
OLYMPIC	1095	TRUETONE	1097
TV Chassis 9P56, 57, 58		Color TV Model 2DC3555	

1093
ADMIRAL
TV Chassis H3-1A, H4-1A, 1H4-2A

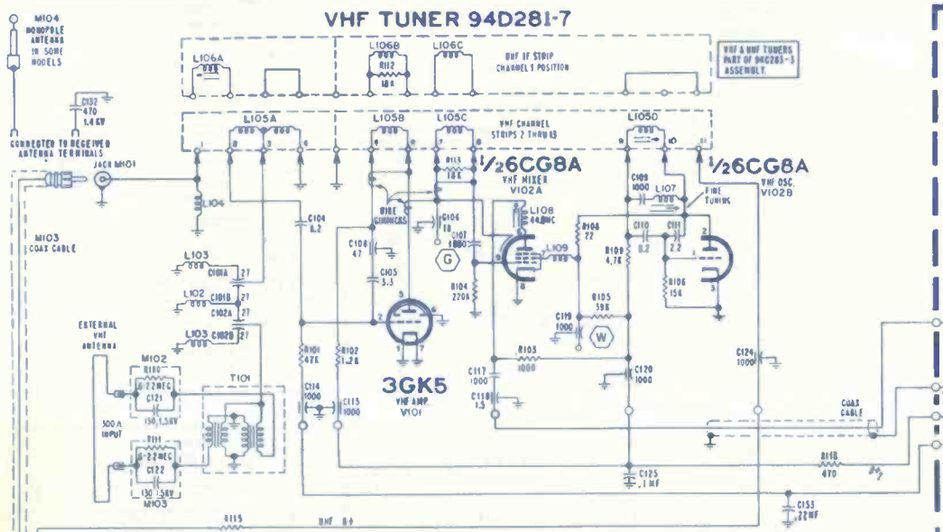
JULY • 1967

SCHEMATIC NOTES:
- CHASSIS GROUND.
- PART NOT MOUNTED ON PRECISION WIRED SYSTEM.
- VOLTAGE BLUE PART WITH SETTING OF CONTROLS. RESISTOR VALUES 1/2 WATT 10%, CAPACITOR VALUES IN MICROFARADS, UNLESS OTHERWISE INDICATED. DC VOLTAGES MEASURED AT 120V AC LINE, NO SIGNAL, MAX. CONTRAST & BRIGHTNESS, & MID. VOLUME WITH VTVM.

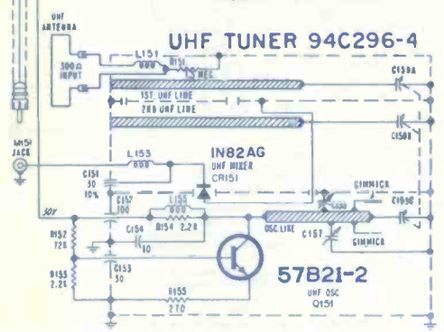




VHF TUNER 94D281-7



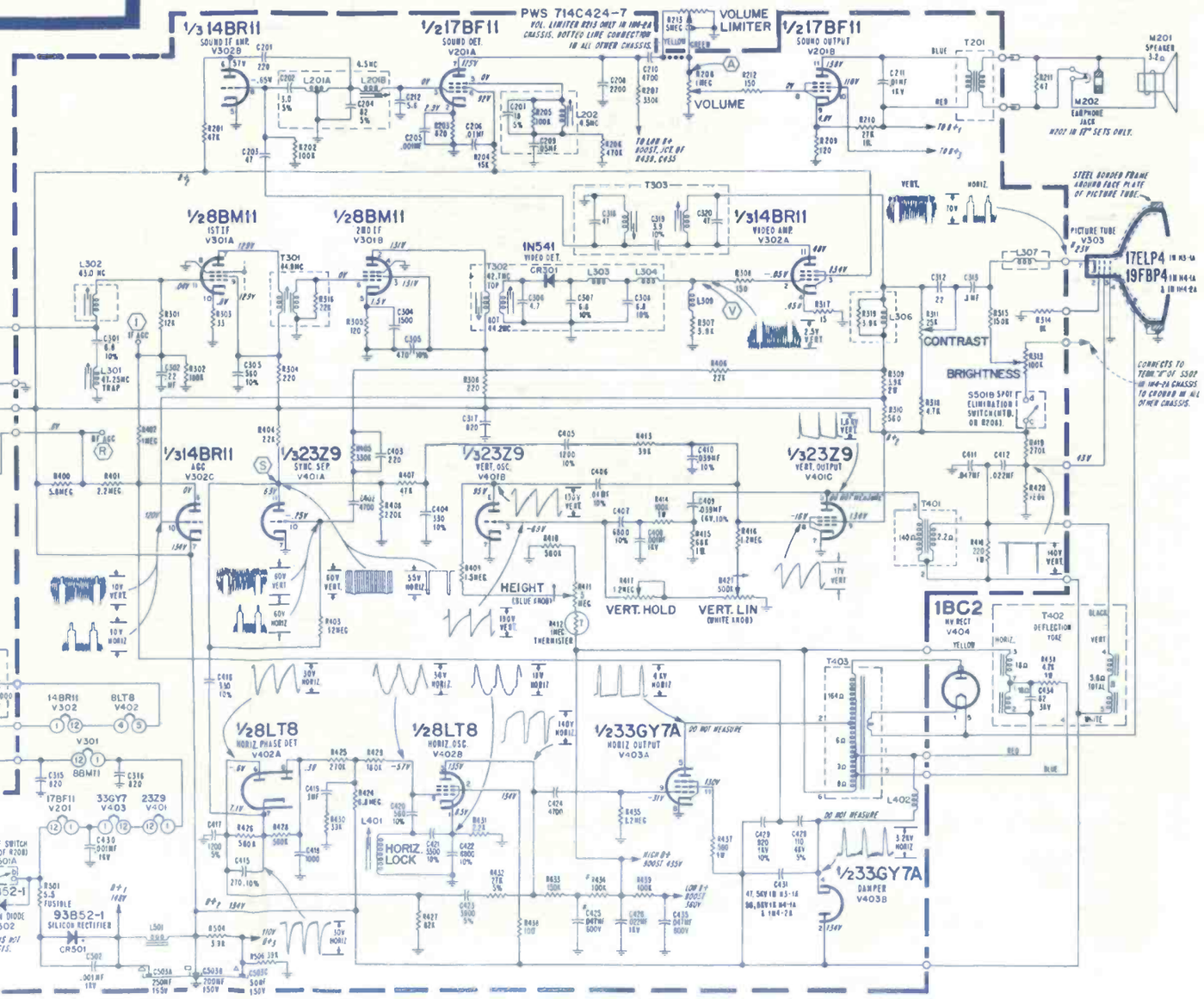
UHF TUNER 94C296-4



RUN CHANGES

(13) Start of production.

(14), (15) No service significance.



1094
CORONADO
Color TV Model
TV21-9643A

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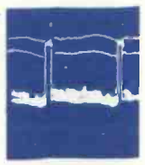
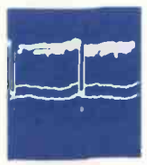
ELECTRONIC TECHNICIAN **TEKFAX**

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


WF-1
2.5VP-P
60~


WF-2
90VP-P
60~

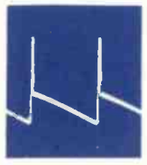

WF-3
8VP-P
15,750~


WF-4
750VP-P
15,750~


WF-5
110VP-P
60~


WF-6
34VP-P
15,750~


WF-9
165VP-P
60~


WF-10
750VP-P
60~


WF-11
19VP-P
60~

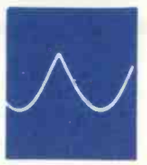

WF-12
280VP-P
15,750~


WF-13
24VP-P
60~


WF-14
0.08VP-P
60~


WF-15
150VP-P
60~


WF-16
240VP
15,750~


WF-17
2VP-P
15,750~


WF-18
72VP-P
60~

SYMBOL	DESCRIPTION	CORONADO PART NO.
T101	1st video IF	T-S1810
T102	47.25MHz trap	T-S1519
T103	2nd video IF	T-S1038
T104	3rd video IF	T-S1040
T105	video det	T-S1039
T106	4.5MHz trap	T-S2706
T107	2nd snd IF	T-S2016
T108	audio output	T-V108
T109	bond pass	T-S3002
T110	burst phase	T-S3001
T111	3.58MHz osc	T-S3004
T112	vert output	T-W32
T113	H.V. flyback	T-F86A
T114	power	T-P42AA
T115	Rt. horiz blueline	T-A38
T116	top-bottom pin	T-A39
L101	heater choke	T-L106
L102	heater choke	T-L106
L103	12µh peaking	T-L50D
L104	100µh peaking	T-L2501
L105	12µh peaking	T-L50
L107	200µh peaking	L-2505
L109	quad	T-S2014
L110	480µh peaking	T-L2006
L113	150µh peaking	T-L2516
L114	180µh peaking	T-L65
L115	chroma take off	T-S3003
L116	reactance	T-S3005
L117	4.7µh peaking	T-L1002
L119	1500µh filter	T-L7010
L120	horiz osc	T-A41
L123	12µh peaking	T-L67
L125	efficiency	T-A90
L126	Rt. R/G vert lines	T-A36
L127	RT. R/G horiz lines	T-A37
L128	filter choke	T-B25
L130	delay line	T-S308
L135	bottom pin	T-A20
L136	convergence correcting blue	T-A40
L137	70µh peaking	T-L2514
L138	degaussing	T-L7068
L139	lin	T-A95
L140	deflecton yoke	T-D70
L141	convergence yoke	T-D68
D1	vdea det	T-E1014
D3	H.F. burst amp	T-E1029
D4ab	AFC	T-E1061A
D5	power rectifier silicon	T-E1050
SE1	convergence diode selenium	T-E1011
	degaussing coil voltage regulator diodes (4 used)	T-E1078
VR101	snd reject 500Ω	T-G0046
VR102	vol cont and off/on switch 500K	T-G6425
VR104	brightness 250K	T-G1848
VR105	contrast 500Ω	T-G1808
VR106	blue drive 5K	T-G1012
VR108	AGC 5K	T-G1012
VR109	vert hold 1M	T-G1820
VR110	vert lin 1M	T-G1002
VR111	vert height 100K	T-G1010
VR112	vert center 15Ω	T-G1832
VR113	focus 500K	T-G1802
VR114	H.V. adjust 500K	T-G0025
VR115	horiz center 15Ω	T-G1832
VR116	color killer 1M	T-G1002
VR117	hue 1K	T-G1853
VR118	color 500Ω	T-G1855
VR119	kine bias 500K	T-G1802
VR121	green screen 1M	T-G1002
VR124	left R/G horiz lines	T-G2006B
VR126	top R/G vert lines	T-G2030
VR131	bottom blue horiz lines	T-G2031
VR132	horiz hold 1M	T-G1820
VR133	vert peaking 5K	T-G0006
VR134	DPC balance 50K	T-G0501
VR135	sub brite 1M	T-G0012
R3	5K 3w	RW-54
R46	800Ω 20w	
R72	12K 3w	
R901	thermistor (part of L140)	T-E1059
C24	500pf 5kv ceramic	500L5K
C27	500pf plastic film	CC-152
C30	50µf elect (part of C33-C34)	T-C8164V
C33	30µf elect (part of C30-C34)	T-C8164V
C34	60µf elect (part of C30-C33)	T-C8164V
C51	500pf 1kv ceramic	CC-630S
C59	50pf 5kv ceramic	CC-130
C64	60-50-30µf elect	T-C8164SNR
C317	100µf 100v elect	CC-102
C327	400pf plastic film	CC-115
C336	.001 1kv ceramic	
C404	.5µf met paper	CC-17
C428	.1µf met paper	40AM1
	circuit breaker 1.75A	T-E2709

CORONADO
Color TV Model TV21-9643A

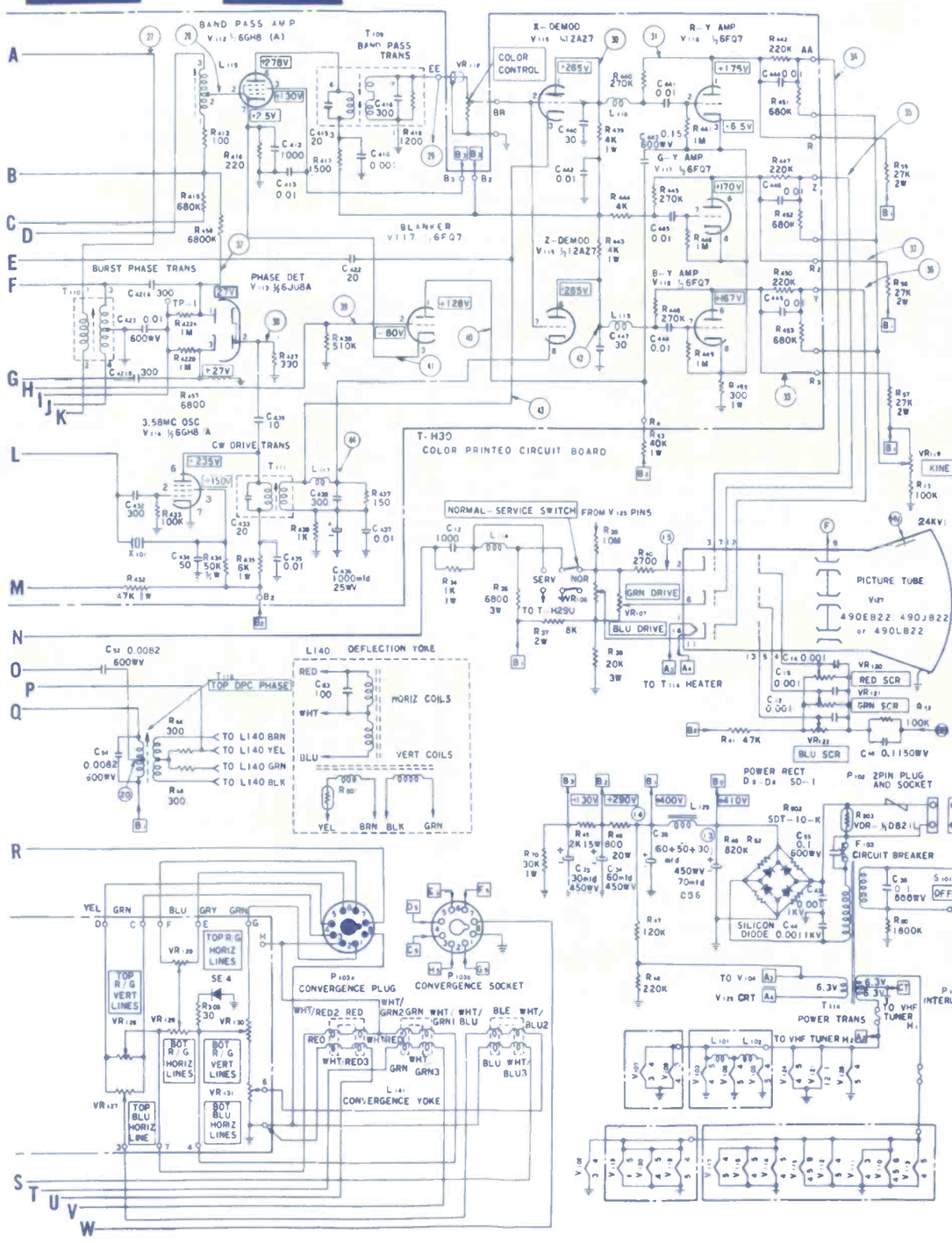

WF-7
72VP-P
60~


WF-8
160VP-P
60~


WF-19
230VP-P
60~


WF-20
140VP-P
60~

ANTENNA INPUT IMPEDANCE	300 ohms balanced
CONVERGENCE	Magnetic
FOCUS	Electrostatic
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	Approx. 170 sq. in. on a 490EB22 Kinescope
POWER INPUT RATING	350 watts total, 120 volts, AC, 60 cycle
SWEEP DEFLECTION	Magnetic
TELEVISION R-F FREQUENCY RANGE	
Any of 70 UHF channels	470 mc. to 890 mc.
Any of 12 VHF channels	54 mc. to 88 mc., 174 mc. to 216 mc.



CHECK OF VHF R-F OSCILLATOR ADJUSTMENTS (FIELD)

Tune in all available stations to see that receiver R-F oscillator is adjusted to the proper frequency on all channels.

Remove the channel selector knob by loosening the set screw.

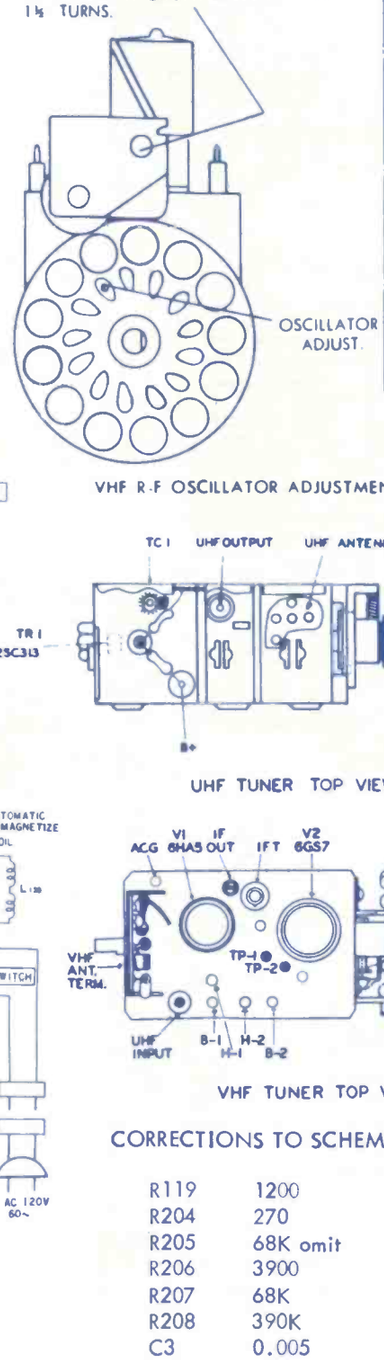
There are thirteen gears around the disc on the tuner face, one for each channel from 2 through 13. The one in the "U" position is not used. Center fine tuning for each channel as shown in Figure 5.

Rotate the channel selector to a channel received in your area.

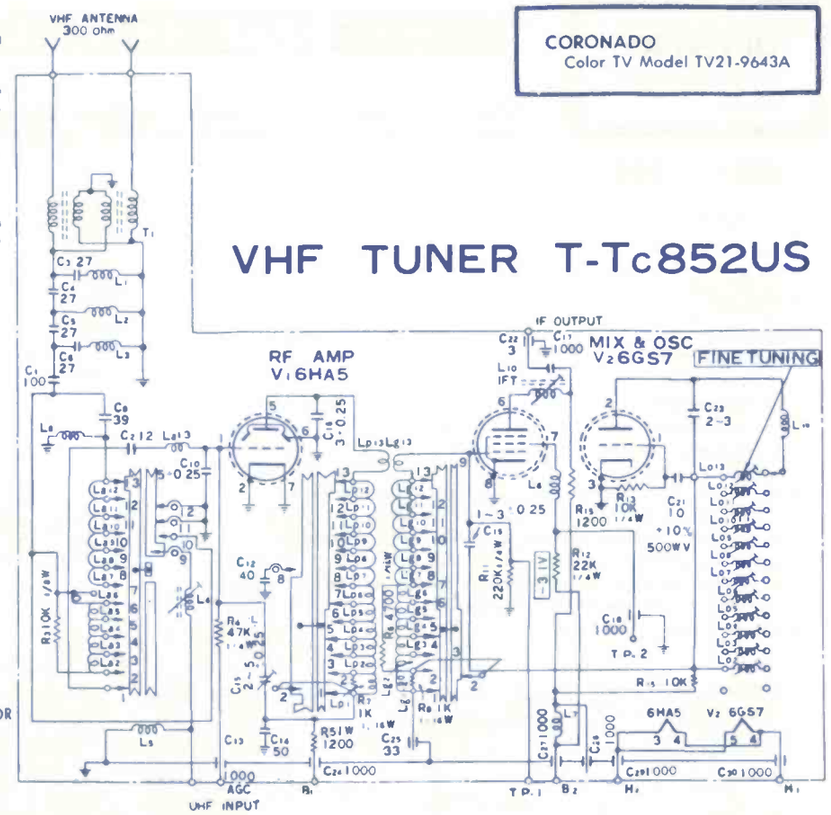
Then adjust the channel oscillator slug for the best picture and sound. Repeat the steps for all other channels.

NOTE: This is a critical adjustment and should be performed by a qualified service technician.

After the oscillator slugs are properly set, the "One Set" fine tuning gears may be readjusted at any time to maintain identical tuning for all channels as the channel selector is rotated.



VHF R-F OSCILLATOR ADJUSTMENT



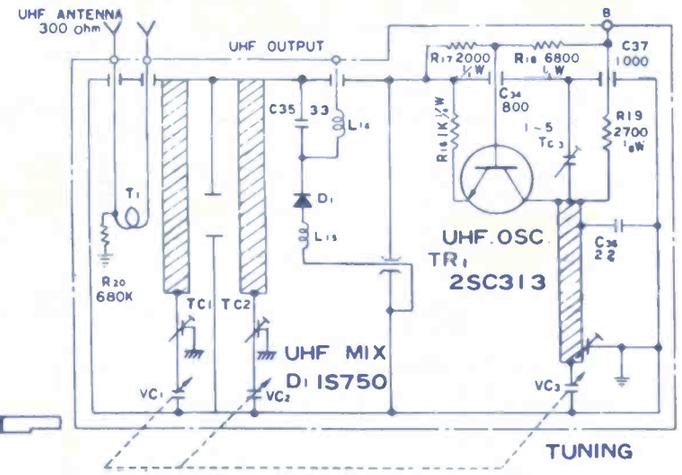
UHF TUNER TOP VIEW

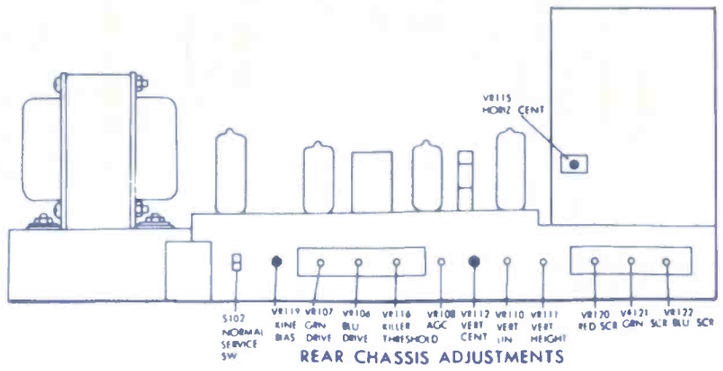
VHF TUNER TOP VIEW

CORRECTIONS TO SCHEMATIC

R119	1200
R204	270
R205	68K omit
R206	3900
R207	68K
R208	390K
C3	0.005

UHF TUNER T-T1026US





REAR CHASSIS ADJUSTMENTS

1095

OLYMPIC
TV Chassis 9P56, 57, 58

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

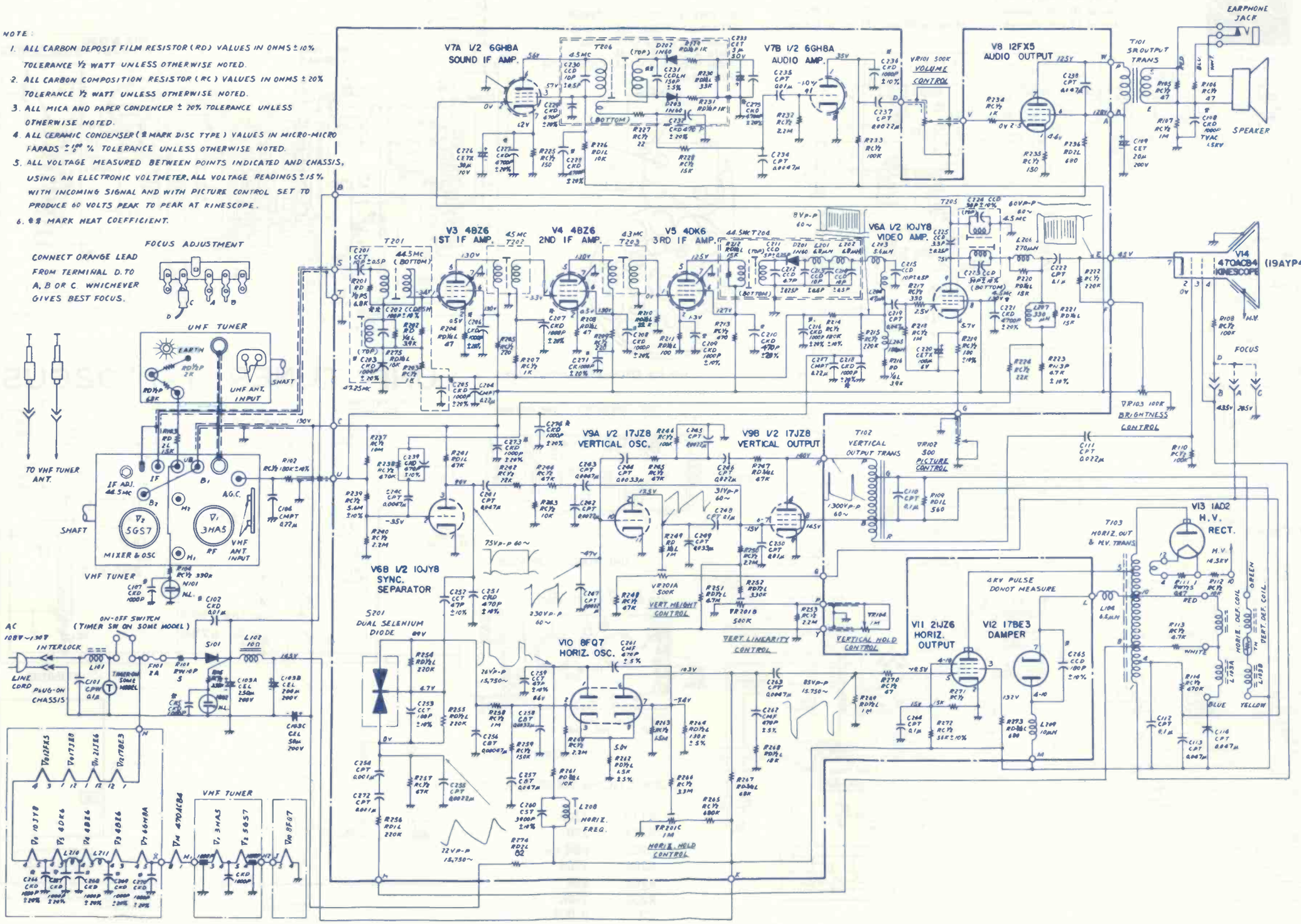
SYMBOL	DESCRIPTION	OLYMPIC PART NO.
VR101	500K variable (volume) 9P58	PTJ60485
VR101	500K variable (volume) (power on-off) 9P56 and 9P57	PTJ33392
VR102	500K variable (picture)	PTJ33393
VR103	100K variable (brightness) 9P57 and 9P58	PTJ60483
VR104	1M variable (vert hold) 9P57 and 9P58	PTJ60486
VR104	1M variable (vert hold) 9P56	PTJ33395
VR201A	500K variable (vert height)	PTJ60111
VR201B	500K variable (vert lin)	PTJ60111
VR201C	1M variable (horiz hold)	PTJ60111
R101	5Ω ±10% 10w	REJ33209
R236	680Ω ±10% 2w	REJ60480
R274	82Ω ±10% 2w	REJ60482
C103	250µf +200µf +50µf 200v	COJ33413
C108	1000pf +100% −0	
C109	20µf 200v	COJ33414
C220	100µf 6v	COJ60319
C234	0.0047µf ±20% 30µf 10v	COJ31391
T101	speaker output	TRJ33387
T102	vert output	TRJ60103
T103	voltage high	TRJ60105
T201	I-F-T A input	TRJ60314
T202	I-F-T D 1st	TRJ60320
T203	I-F-T B 2nd	TRJ60315
T204	I-F-T C 3rd	TRJ60316
T205	snd I-F-T	TRJ33022
T206	ratio det	TRJ33241
L101	coil choke	CLJ60479
L102	choke filter	CLJ33385
L103	yoke deflection	CLJ60106
L104	coil choke 6.5µh	CLJ60478
L201	coil choke 6.8µh	CLJ60471
L203	coil inductor 5.6µh	CLJ60472
L204	coil inductor 47µh	CLJ60473
L205	coil inductor 180µh	CLJ60474
L206	coil inductor 270µh	CLJ60475
L207	coil inductor 330µh	CLJ60476
L208	coil horiz freq	CLJ33390
L209	coil choke 10µh	CLJ60477
L210	coil choke	CLJ60484
F101	fuse 2 amp	FUJ31376
	tuner VHF (9P56, 9P57 and 9P58)	CUJ60107
	tuner UHF (9P56)	CUJ60142
	tuner UHF (9P57 and 9P58)	

NOTE:

1. ALL CARBON DEPOSIT FILM RESISTOR (RD) VALUES IN OHMS ±10% TOLERANCE ½ WATT UNLESS OTHERWISE NOTED.
2. ALL CARBON COMPOSITION RESISTOR (RC) VALUES IN OHMS ±20% TOLERANCE ½ WATT UNLESS OTHERWISE NOTED.
3. ALL MICA AND PAPER CONDENCER ± 20% TOLERANCE UNLESS OTHERWISE NOTED.
4. ALL CERAMIC CONDENSER (▲ MARK DISC TYPE) VALUES IN MICRO-MICRO FARADS ±10% TOLERANCE UNLESS OTHERWISE NOTED.
5. ALL VOLTAGE MEASURED BETWEEN POINTS INDICATED AND CHASSIS, USING AN ELECTRONIC VOLTMETER. ALL VOLTAGE READINGS ±15% WITH INCOMING SIGNAL AND WITH PICTURE CONTROL SET TO PRODUCE 60 VOLTS PEAK TO PEAK AT KINESCOPE.
6. ▲ MARK HEAT COEFFICIENT.

FOCUS ADJUSTMENT

CONNECT ORANGE LEAD FROM TERMINAL D. TO A, B OR C WHICHEVER GIVES BEST FOCUS.



ELECTRONIC TECHNICIAN **TEKFAX**

1096

PHILCO-FORD

TV Chassis 17J28

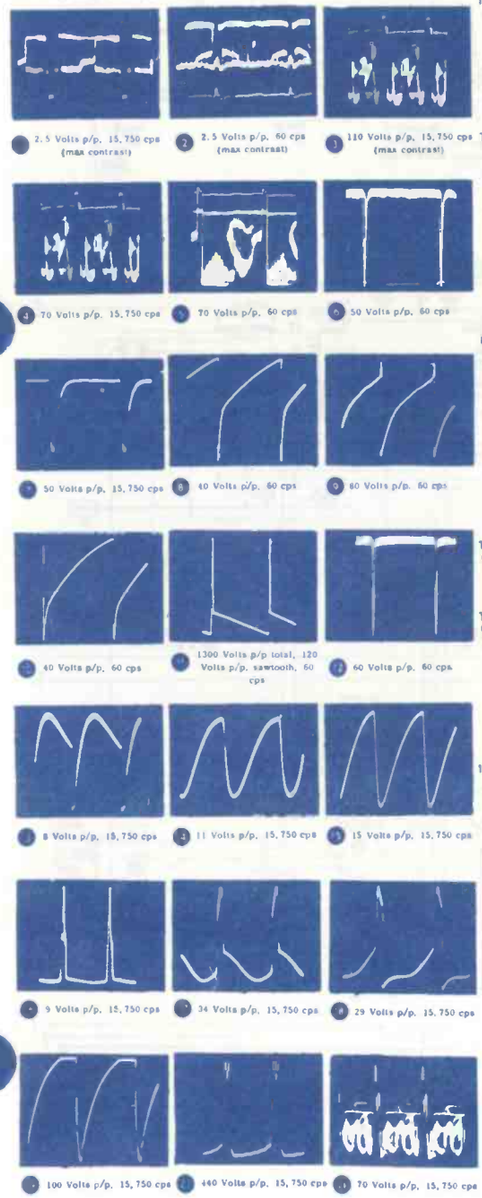
JULY • 1967

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

SYMBOL	DESCRIPTION	PHILCO PART NO.
C48	160/240/5@200v elec	30-2601-33
D1	phase comp	34-8037-1
D2	2nd det	34-8022-6
D3	rect silicon	34-8054-7
L1	180 plate series	32-4762-7
L2	330 plate shunt	32-4762-20
L3	choke 60MHz RF choke damper	32-4112-62
L4	interstage snd IF	32-4745-13
L5	choke 60MHz damper cath	32-4112-62
L6	220mh noise inv cath	32-4762-25
L7	quad snd det	32-4876-1
L8	xformer 4.5MHz trap & snd take off	32-4688-14
L9	ch 6 beat video det	32-4645-7
L10	tuner coupling	32-4652-96
L11	1st IF plate	32-4686-34
L12	horiz stabilizer	32-4753-3
L13	47.25MHz trap	32-4652-78
L14	41.25MHz trap	32-4652-80
L15	1st grid pole	32-4652-79
L16	47.25MHz trap	32-4652-78
L17	40MHz trap 2nd det	32-4837-1
L18	video det	32-4652-79
L19	2nd IF plate	32-4652-78
N1	retrace supp	30-6024-9
N2	SIF cathode	30-6031-16
N3	vert int	30-6030-12
N4	horiz osc	30-6057-1
N5	phase comp	30-6035-2
N6	isolation CRT	30-6058-2
N7	isolation vol control	30-6058-2
R63	1.5Ω 7w fil & B+	33-1363-134
A.O.T.	audio output	32-10013-4
H.O.T.	horiz output	32-10008-7
V.O.T.	vert output	32-10012-6
F.C.	B+ filter choke	32-10010-5
VR1	2M V lin-500K V size 60K horiz hold	33-5595-8
VR2	1M noise adjust	33-5613-1
VR3	3K width	33-5620-1
VR4	100K bright 1M vol on-off sw	33-5618-24
VR5	15K contrast	33-5619-29
VR6	150K vert hold	33-5619-3
	tuner UHF TT152	76-13827-1
	tuner VHF TT162C	76-13945-4
	yoke & cable assy	76-12942-4

OSCILLOSCOPE WAVEFORMS

These waveforms were taken with the receiver adjusted for an approximate output of 2.5V p/p at the video detector. Voltage readings taken with raster just filling screen and all controls set for normal picture viewing except for photos 1, 2 and 3 where contrast was at maximum. The voltages given are approximate peak-to-peak values. The frequencies shown are those of the waveforms...not the sweep rate of the oscilloscope. All readings taken with Model PS127 Sencore Oscilloscope.



1. 2.5 Volts p/p, 15,750 cps (max contrast)
2. 2.5 Volts p/p, 60 cps (max contrast)
3. 110 Volts p/p, 15,750 cps (max contrast)
4. 70 Volts p/p, 15,750 cps
5. 70 Volts p/p, 60 cps
6. 50 Volts p/p, 60 cps
7. 50 Volts p/p, 15,750 cps
8. 40 Volts p/p, 60 cps
9. 80 Volts p/p, 60 cps
10. 40 Volts p/p, 60 cps
11. 1300 Volts p/p total, 120 Volts p/p, sawtooth, 60 cps
12. 60 Volts p/p, 60 cps
13. 8 Volts p/p, 15,750 cps
14. 11 Volts p/p, 15,750 cps
15. 15 Volts p/p, 15,750 cps
16. 9 Volts p/p, 15,750 cps
17. 34 Volts p/p, 15,750 cps
18. 29 Volts p/p, 15,750 cps
19. 100 Volts p/p, 15,750 cps
20. 440 Volts p/p, 15,750 cps
21. 70 Volts p/p, 15,750 cps

1097

TRUETONE

Color TV Model
2DC3555

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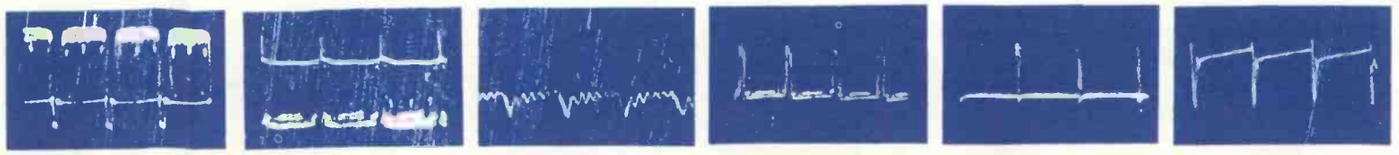
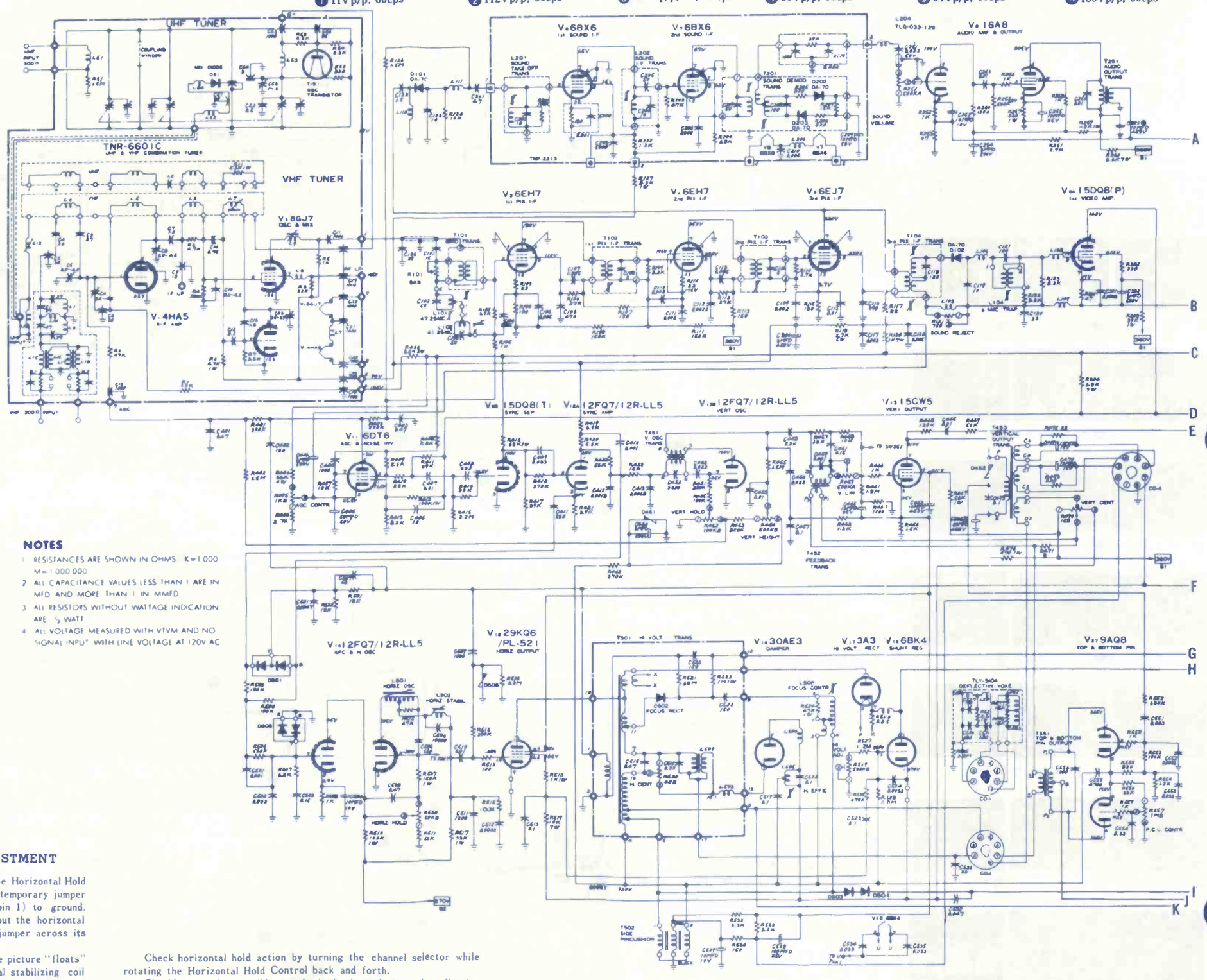


1 11Vp/p, 60cps 2 112Vp/p, 60cps 3 320Vp/p, 15,750cps 4 30Vp/p, 60cps 5 64Vp/p, 60cps 6 180Vp/p, 60cps

SYMBOL	DESCRIPTION	TRUETONE PART NO
R121	control snd rejection	EVD-NOAA00BJ2
R251	control off-on-vol	EVA-A06L26A55
R311	control brightness	EVV-M0AL40B55
R317	control contrast	EVA-B0AL40E52
R355	control blue drive	EVT-F1AS10B53
R360	control blue screen	EVT-G8AS10B26
R405	control AGC	EVD-N0AA00B13
R452	control vert hold	EVV-M0AL40B15
R454	control vert height	EVD-N0AS10B55
R459	control vert fine	EVD-N0AS10A55
R470	control vert centering	EVW-56AB01BC1
R520	control horiz centering	EVW-57AB01B41
R529	control high vol adj	EVT-G8AS10B55
R538	control horiz hold	EVV-M0AL40B54
R557	control top & bottom pin	EVD-N0AA00B16
R601	control killer threshold	EVD-N0AS10B16
R607	control tint	EVV-M0AL25B13
R617	control color	EVV-M0AL25B52
R623	control chroma output	EVJ K0AA00032
R701	control left horiz red & green	EVW-M1AB01B22
R707	control horiz left blue	EVW-M1AB01BC2
R716	control vert red & green master amplitude	EVW-M1AB01B61
R118	metal oxide, 2.7K ±10% 7w	ERG-5P5K272
R120	metal oxide, 1K ±10% 7w	ERG-7P5K102
R260	metal oxide, 3.3K ±10% 7w	ERG-7P5K332
R364	WW, 3.3K ±10% 6w	ERM-6PK332
R801	WW, 560Ω 30w	ERM-30H561
C530	oil tubular, 0.047μf ±20% 1kv	ECN-D10473M
C536	ceramic, 33pf ±10% 6kv	ECC-D60330K
C551	oil tubular, 0.003μf ±10% 1kv	ECN-D10302K
C555	oil tubular 4, 700pf ±10% 1kv	ECN-D10472K
C637	polystyrene, 200pf ±10% 2kv	ECQ-S20201K
C804	elect, 40μf 450v	ECE-P450VD40A
C805	elect, 80μf +40μf 450v	ECE-P450VBX1A
C806	elect, 50μf +10μf +3μf 450v	ECE-P450VB63A
CR201	180Ω 5,000pf	EXA-2PK72
CR202	39K, 1,000pf	EXA-3HK71
L101	coil, 47.25MHz trap	TL1-53052
L102	coil, 41.25MHz trap	TL1-53053
L103	coil, peaking 12μh	TLQ-120-106
L104	coil, 4.5MHz trap	TLS-51003
L105	coil, peaking 12μh	TLQ-120-139
L108	coil, peaking 70μh	TLQ-700-999
L109	coil, peaking 3.3μh	TLQ-033-126
L111	reactor, filter choke 12μf	TLQ-120-106
L201	trans, sound take-off	TLS-1510
L202	trans, sound IF	TLS-1408
L203	coil, heater choke	TLP-408
L204	coil, RF choke 3.3μh	TLQ-033-126
L501	trans. horiz. osc	TLH-312
L502	coil, horiz. stabilizing	TLH-203-1
L504	coil, reactor 12μh	TLQ-120-106
L505	coil, horiz. efficiency	TLH-5602
L508	coil, focus	TLH-5902
L601	trans, chroma take-off	TLK-1005
L603	coil, peaking 620μh	TLQ-621-999
L607	coil, peaking 90μh	TLQ-900-999
L608	coil, 3.58MHz phase control	TLK-4102
L701	coil, horiz. right red and green	TLC-1105
L703	coil, horiz. right blue	TLC-1202-1
L803	coil, heater choke	TLP-463-2
L804	coil, heater choke	TLP-451-2
L806	coil, heater choke	TLP-451-2
L809	coil, filter choke	TLK-5102
T101	trans, 1st pix. IF grid trans.	TL1-51251
T102	trans. 1st pix. IF	TL1-51252
T103	trans, 2nd pix. IF	TL1-51253
T104	trans, 3rd pix. IF	TL1-52251
T201	trans, Sound demodulator	TLS-3310
T251	trans, audio output	ETA-48E27M
T451	trans, vert. osc	TLV-101
T452	trans, vert. feed back	TLV-5405
T453	trans, vert. output	TLV-5204
T501	trans, high voltage	TLF-5002-1
T502	trans, side pincushion	TLH-5702
T551	trans, top and bottom pin output	TLV-5504
T601	trans, 1st band-pass	TLK-3103
T602	trans, 2nd band-pass	TLK-3204
T603	trans, burst phase	TLK-2003
T604	trans. 3.58MHz osc	TLK-4005
T801	trans. power	TLP-5213
	deflection yoke assy	TLY-5304
D451	varistor, voltage clamp	ERV-08RC3471K
D452	varistor, voltage clamp	ERV-08RC3421K
D501	rectifier, horiz. AFC	TVS-TC0.09m 21/3
D502	rectifier, focus	TVS-HS 7/1
D506	varistor, voltage clamp	ERV-08RC3331S
D805	varistor, ADG	ERV-10DC1120M
D806	thermistor, ADG	TRT-D20JY101M
CB	circuit breaker	TSF-3150-9
TD-301	line, delay line	TLK-801 (883)



NOTES

1. RESISTANCES ARE SHOWN IN OHMS. K=1,000 M=1,000,000
2. ALL CAPACITANCE VALUES LESS THAN 1 ARE IN MFD AND MORE THAN 1 IN MMFD
3. ALL RESISTORS WITHOUT WATTAGE INDICATION ARE ½ WATT
4. ALL VOLTAGE MEASURED WITH VTVM AND NO SIGNAL INPUT WITH LINE VOLTAGE AT 120V AC

HORIZONTAL OSCILLATOR ADJUSTMENT

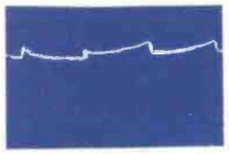
Tune in a station in a normal fashion. Set the Horizontal Hold Control (R538) to the center of its range. Place a temporary jumper from the Sync. Separator tube grid (V9B 15DQ8 pin 1) to ground. Picture will lose vertical and horizontal sync. Short out the horizontal stabilizing coil (L502) by placing another temporary jumper across its terminals.

Adjust horizontal oscillator coil (L501) so that the picture "floats" horizontally. Remove the jumper across the horizontal stabilizing coil (L502). Adjust L502 so that the picture "floats" horizontally. Remove the jumper from the Sync. Separator grid to ground.

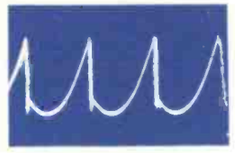
Check horizontal hold action by turning the channel selector while rotating the Horizontal Hold Control back and forth.

Should it not be possible to obtain horizontal sync. by adjusting the Horizontal Hold Control (R538).

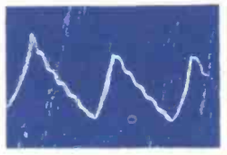
TRUETONE
Color TV Model 2DC3555



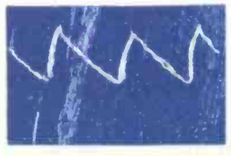
⑦ 140Vp/p. 60cps



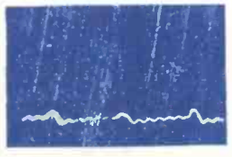
⑧ 6Vp/p. 60cps



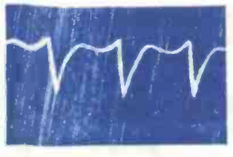
⑨ 17Vp/p. 15,750cps



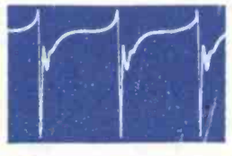
⑩ 21Vp/p. 15,750cps



⑪ 17Vp/p. 15,750cps

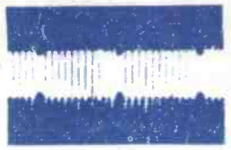


⑫ 140Vp/p. 15,750cps

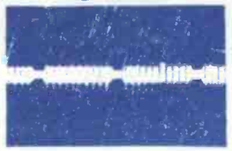


⑬ 490Vp/p. 15,750cps

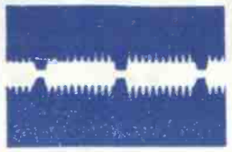
⑭ 140Vp/p. 15,750cps



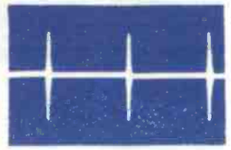
⑮ 9Vp/p. 15,750cps



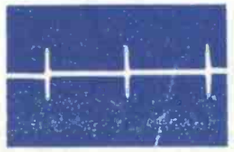
⑯ 2Vp/p. 15,750cps



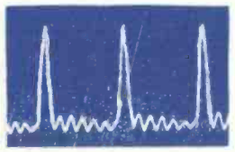
⑰ 4Vp/p. 15,750cps



⑱ 330Vp/p. 15,750cps

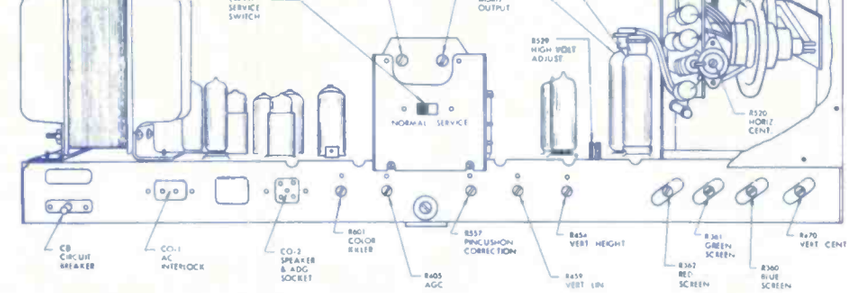


⑲ 100Vp/p. 15,750cps

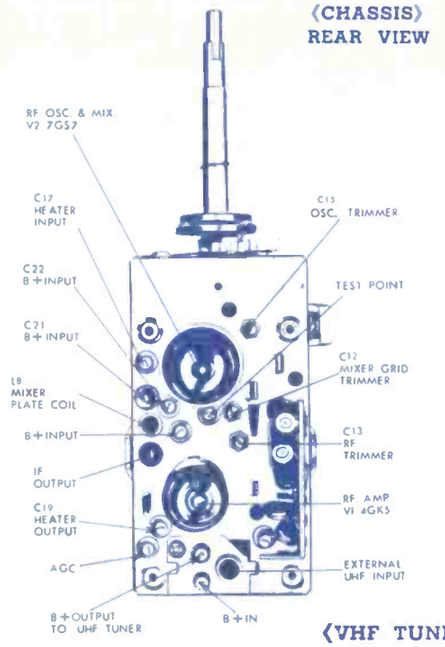


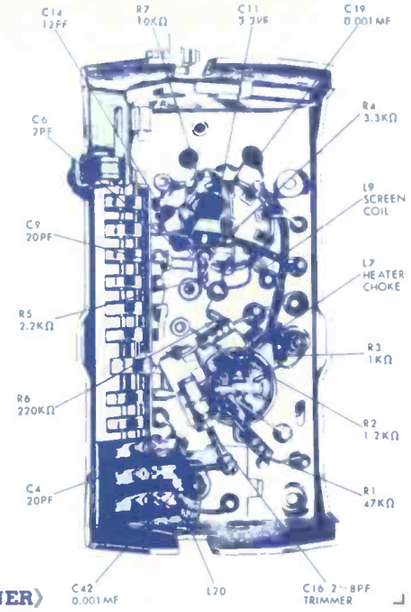
⑳ 200Vp/p. 15,750cps

㉑ 100Vp/p. 3.58mc.



〈CHASSIS〉
REAR VIEW





〈VHF TUNER〉

1098
SILVERTONE
TV MODEL 7151, 7152, 7154, 7155, 7156, 7157, 7158

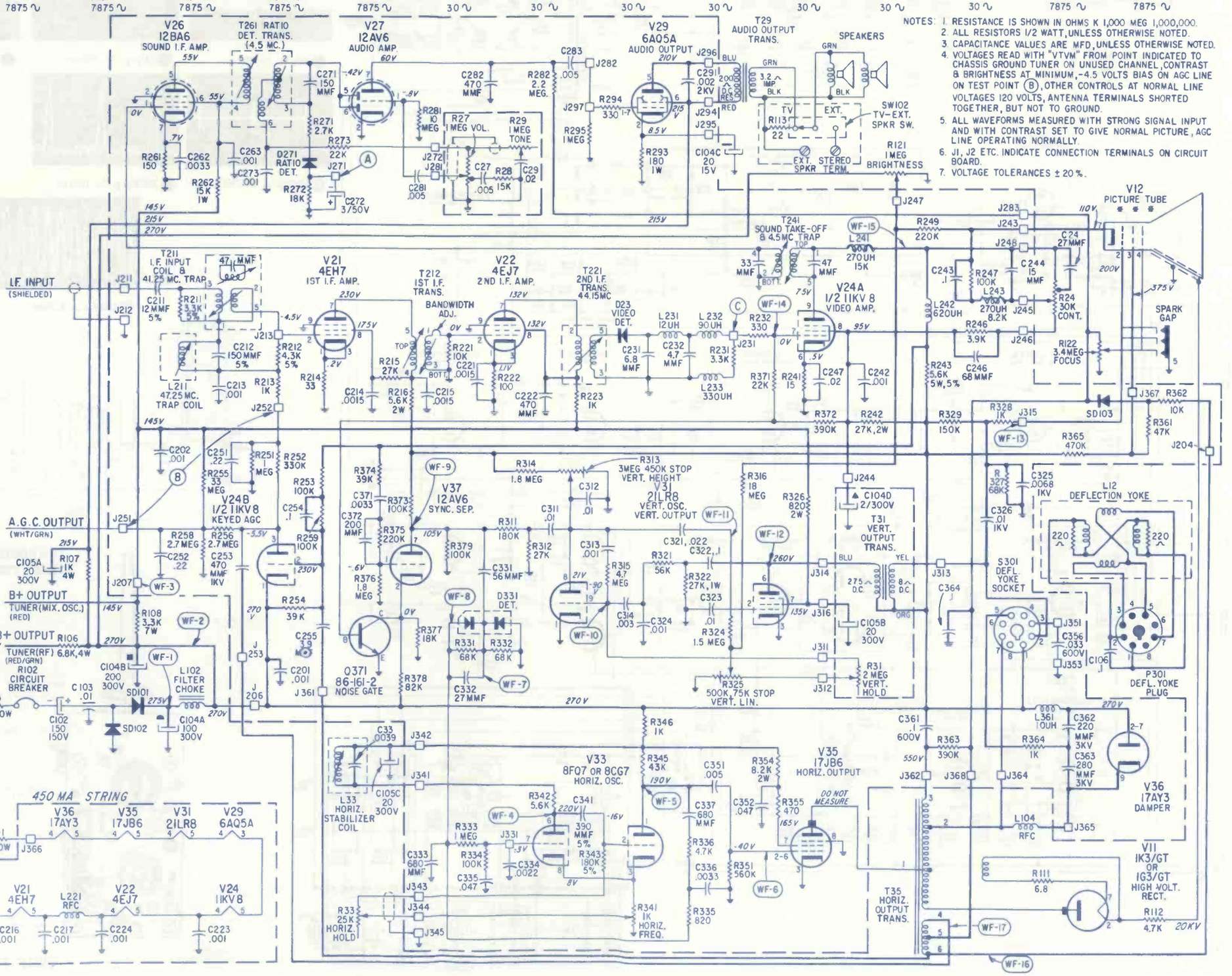
ELECTRONIC TECHNICIAN **TEKFAX**
JULY • 1967

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

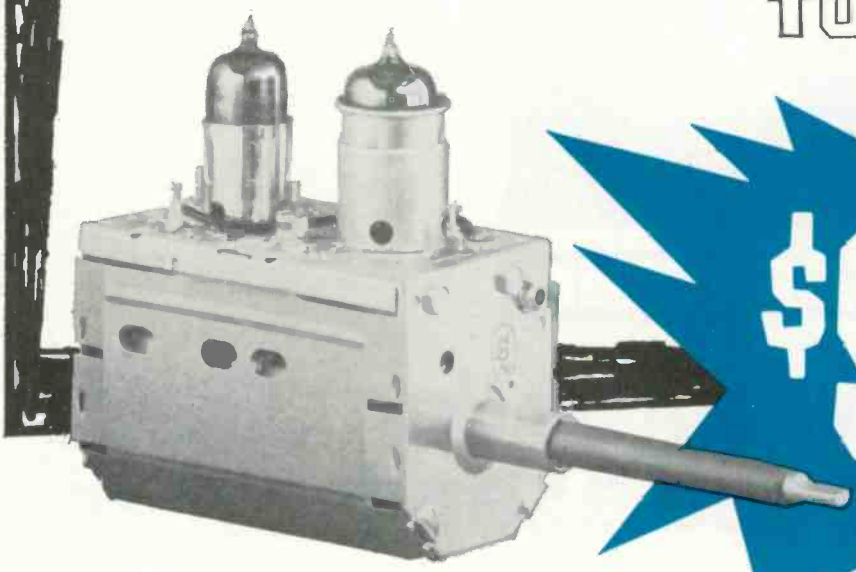
WF-1	WF-2	WF-3	WF-4	WF-5	WF-6	WF-7	WF-8	WF-9	WF-10	WF-11	WF-12	WF-13	WF-14	WF-15	WF-16	WF-17
38V P-P 30 ∿	2.3V P-P 30 ∿	1V P-P 30 ∿	55V P-P 7875 ∿	140V P-P 7875 ∿	140V P-P 7875 ∿	7V P-P 7875 ∿	15V P-P 7875 ∿	42V P-P 30 ∿	260V P-P 30 ∿	28V P-P 30 ∿	1200V P-P 30 ∿	85V P-P 30 ∿	1.5V P-P 30 ∿	100V P-P 30 ∿	650V P-P 7875 ∿	650V P-P 7875 ∿

SYMBOL DESCRIPTION	SILVERTONE PART NO.
R24 — 30K (contrast)	24-753
R27 — 1M (vol push pull on-off)	24-873
R29 — 1M (tone)	24-947
R31 — 2M (vert hold)	24-794
R33 — 25K (horiz hold)	24-751
R121 — 1M (brightness control)	24-754
R122 — 3.4M (focus)	24-491
R313 — 3M (vert Height control)	24-817
R325 — 500K (vert lin)	24-816
R341 — 1K (horiz freq control)	24-570
C104A,B,C,D — elect 100µf 300v(A); 200µf 300v(B); 20µf 15v(C); 2µf 300v(D)	18-156-5
C105A,B,C — elect 20µf 300v (A,B,C)	18-96-3
C211 — disc 12pf 5% NPO	12-120281-2
C212,C271 — disc 150pf 5% NPO	20-619-0
C246 — disc 68pf 10% GP	12-680764-2
C253 — disc 470pf 1kv Z5U	12-471804-3
C291 — disc .002µf 2kv	20-623-0
C325 — disc .0068µf +80% −20% 1kv	12-682874-6
C326 — disc .01µf GMV 3kv	12-103894-8
C341 — polyfilm 390pf 5%	20-277-1
C362 — disc 220pf 3kv	12-221566-8
C363 — disc 280pf 3kv	12-281516-8
R101 — 32.5Ω 10w	61-272-0
R102 — circuit breaker (1.5 amps)	43-12-2
R103 — 565Ω 5% 15w WW	61-297-0
R104 — 1.2K 5% 10w	63-12295
R105 — 4.5Ω 10w	61-191-0
R106 — 6.8K fused oxide 4w	68-68241
R107 — 1K fused oxide 4w	68-10241
R108 — 3.3K 7w	63-33271
R111 — 6.8Ω 5%	63-68905
R211 — 3.3K 5%	64-33205
R212 — 4.3K 5%	64-43205
R243 — 5.6K 5% 5w	68-56255
R343 — 180K 5%	64-18405
T29 — xformer audio output	80-255-1
T31 — xformer vert output	80-31-2
T35 — high voltage xformer & base w/high voltage leads & R11	84-17923
T101 — choke line radiation	10-289-1
T211 — coil input IF 41.25MHz trap	10-62-3
T212 — first video IF xformer	10-58-3
T221 — second video IF xformer	10-59-3
T241 — coil 4.5MHz trap	10-209-1
T261 — ratio det xformer	10-260-1
L12 — deflection yoke & Plug	80-51-4
L33 — horiz stabilizer coil	10-75-5
L102 — choke filter	80-44-6
L104 — coil choke	10-242-1
L211 — coil 47.25MHz trap	10-86-3
L221 — coil filament choke	10-240-1
L231 — coil peaking (12µh)	10-65-1
L232 — coil peaking (90µh)	10-256-1
L233 — coil peaking (330µh)	10-253-1
L241 — coil peaking (150µh)	10-255-1
L242 — coil peaking (620µh)	10-236-1
L243 — coil peaking (270µh) (wound on 8.2K resistor)	10-170-1
L361 — coil horiz suppression	10-124-1
D23,D271 — diode video and ratio det	86-10-1
Q371 — transistor (noise gate)	86-161-2
circuit board (complete with all components except tubes)	35-13325
circuit board only	25-152-0

NOTES:
1. RESISTANCE IS SHOWN IN OHMS K 1,000 MEG 1,000,000.
2. ALL RESISTORS 1/2 WATT, UNLESS OTHERWISE NOTED.
3. CAPACITANCE VALUES ARE MFD, UNLESS OTHERWISE NOTED.
4. VOLTAGES READ WITH "VTVM" FROM POINT INDICATED TO CHASSIS GROUND TUNER ON UNUSED CHANNEL, CONTRAST & BRIGHTNESS AT MINIMUM, -4.5 VOLTS BIAS ON AGC LINE ON TEST POINT (B), OTHER CONTROLS AT NORMAL LINE VOLTAGES 120 VOLTS, ANTENNA TERMINALS SHORTED TOGETHER, BUT NOT TO GROUND.
5. ALL WAVEFORMS MEASURED WITH STRONG SIGNAL INPUT AND WITH CONTRAST SET TO GIVE NORMAL PICTURE, AGC LINE OPERATING NORMALLY.
6. J1, J2 ETC. INDICATE CONNECTION TERMINALS ON CIRCUIT BOARD.
7. VOLTAGE TOLERANCES ± 20%.



Complete TUNER REPAIR for only



$9.50

Sarkes Tarzian, Inc., largest manufacturer of TV and FM tuners, offers unexcelled tuner overhaul and factory-supervised repair service. Completely-equipped and conveniently-located Service Centers offer fast, dependable and factory-supervised repair service on all makes and models. Centers are staffed by well-trained technicians, assisted by engineering personnel.

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Always send TV make, chassis and Model number with faulty tuner. Check with your local distributor for Sarkes Tarzian replacement tuners, parts or repair service. Or, use the address nearest you for fast, factory-supervised repair service.

TSC

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Tel: 201-792-3730

SOUTH-EAST — 938 Gordon St., S. W.
Atlanta, Georgia
Tel: 404-758-2232

WEST—
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Tuner Service Division
10654 Magnolia Blvd.,
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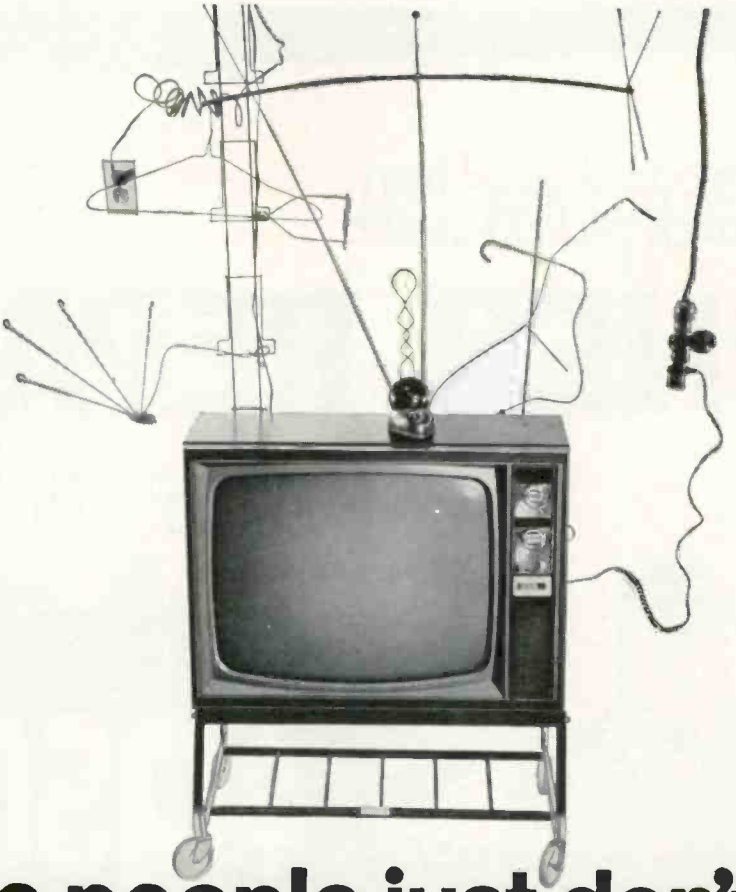
Tel: 213-769-2720



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ELECTRONIC TECHNICIAN

WORLDS LARGEST ELECTRONIC TRADE CIRCULATION

JULY 1967 • VOL. 86, NO. 1

COVER
Solid-State electronic circuits are being made smaller and smaller. See page 61 for details about this month's cover.

TEKFAX • 16 PAGES OF THE LATEST SCHEMATICS • **Group 179**

ADMIRAL: TV Chassis H3-1A, H4-1A, 1H4-2A
CORONADO: Color TV Model TV21-9643A
OLYMPIC: TV Chassis 9P56, 57, 58
PHILCO-FORD: TV Chassis 17J28
SILVERTONE: TV Model 7151, 7152, 7154, 7155, 7156, 7157, 7158
TRUETONE: Color TV Model 2DC3555

OJIBWAY PRESS, INC.

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LETTERS TO THE EDITOR

He Thinks It's About Time, Too

Your editorial, "It's About Time," in the October 1966 issue of ELECTRONIC TECHNICIAN, was excellent. The industry needs someone to go to bat for the home-entertainment service technician.

If you could get service-dealers and manufacturers to agree with your thinking, we might get somewhere. In the same issue there's an article "Marching in the 'Peacock' Parade," which tells about a service-dealer operation that does not make a profit on its service department, primarily because of warranty work. The cost is billed to the sales department.

Manufacturers could be a big help if they spent more money educating the public and dealers to the facts of life — including the lack of trained electronics technicians. A good share of the shortage is the fault of both. Locally, two good independent service technicians quit the business recently.

Hooray for you. I hope you have started something. More surveys and pricing examples by locality would be helpful.

I have enjoyed your magazine for years. I think it is the best in the business. It has helped me keep up with the technology of this ever-changing business.

RALPH B. OLSON
Elmira, N.Y.

CRT Tester/Rejuvenator

I need a schematic for an Anchor CRT tester/rejuvenator Model #T400. Answer via ET editor.

N. R. ROBINSON
Little Rock, Ark.

More on Technician Shortage

The reason there are few good TV-radio technicians available is because the pay generally offered in this area of the electronics industry is too low. For example, in Los Angeles technicians are being offered $140 for a 6-day week. In Portland, Ore., technicians are being offered $3.31 an hour. In Detroit they are offering a little more. I'm making $4 an hour here (15 years' bench experience). I think the shop-owners who can't manage their business so they can pay technicians at least $4 an hour are putting themselves slowly out of business.

JACK DENTON
Chicago, Ill.

WHY risk your reputation with "just-as-good" capacitors?

When you pay little or no attention to quality in tubular replacement capacitors, you leave yourself wide open for criticism of your work . . . you risk your reputation . . . you stand to lose customers. It just doesn't pay to take a chance on capacitors with unknown or debatable performance records when it's so easy to get guaranteed *dependable* tubulars from your Sprague distributor!

There's no "maybe" with these 2 great SPRAGUE DIFILM® TUBULARS!

The ultimate in tubular capacitor construction. Dual dielectric . . . polyester film and special capacitor tissue . . . combines the best features of both. Impregnated with HCX®, an exclusive Sprague synthetic hydrocarbon material which fills every void in the paper, every pinhole in the plastic film *before it solidifies*, resulting in a rock-hard capacitor section . . . there's no oil to leak, no wax to drip. Designed for 105°C (220°F) operation *without voltage derating*.

DIFILM® BLACK BEAUTY®
Molded Tubular Capacitors

The world's most humidity-resistant molded capacitors. Tough, protective outer case of non-flammable molded phenolic . . . cannot be damaged in handling or installation. Black Beauty Capacitors will withstand the hottest temperatures to be found in any TV or radio set, even in the most humid climates.

DIFILM® ORANGE DROP®
Dipped Tubular Capacitors

A "must" for applications where only radial-lead capacitors will fit . . . the perfect replacement for dipped capacitors now used in many leading TV sets. Double-dipped in rugged epoxy resin for positive protection against extreme heat and humidity. No other dipped tubular capacitor can match Sprague Orange Drops!

For complete listings, get your copy of Catalog C-617 from your Sprague distributor, or write to Sprague Products Company, 65 Marshall Street, North Adams, Massachusetts 01247

SPRAGUE®
THE MARK OF RELIABILITY

WORLD'S LARGEST MANUFACTURER OF CAPACITORS

65-610BR1

. . . for more details circle 128 on postcard

LETTERS TO THE EDITOR

Ferris Microvoltmeter

Can any reader help me locate an instruction manual for a Ferris model 18D, #367, microvoltmeter. I have been a subscriber to ET since 1954 and like it very much. Answer via ET editor.

AUBREY DOUCETTE
Holt, Mich.

German Radio

Can any reader tell me where I can obtain service information on a Loewe Opta Mallorca Stereo type 4822w German radio? Answer via ET editor.

W. R. CULLEN
Little Rock, Ark.

Needs Precision Roll Chart

I wonder if any reader can help me with an old roll chart for a Precision Model 660 if they have an extra to spare? I have none. Data for this tester comes in book form to supplement with the roll chart. Answer via ET.

M. JEFFREY
New York, N.Y.

Supreme Tube Tester

I need a tube listing later than the one I have (1948/4965-248) for a Supreme tube tester. The chart was used on models 504A, 504B, 589, 589A, 599 and 599A.

LEO SMITH
RD1 Box 375b
Sandy, Utah 84070

Dobro Guitar Amplifier

Need information on Model B, 20w guitar amplifier made by National Dobro Corp. I have been reading ET for over 10 years and find it the best TV-radio magazine of its kind. Answer via ET editor.

KENNETH SASAKI
Honolulu, Hawaii

A Stale Orchid

In reading and utilizing ELECTRONIC TECHNICIAN since even before its present title, I feel as rewarded as someone who recently purchased a very lucrative stock which did exceptionally well.

On pages 42 and 43 of the June 1966 issue is a seemingly familiar article concerning Homer Davidson and the quite successful organization he operates. Needless to say, I refer specifically to the last paragraph of the article.

Recently in Chicago, it was found that several service-dealers were "gyps," etc. People like Mr. Davidson have a distinct advantage over the Chicago folk, according to your article. I feel confident that he would classify as one of the more sensible, qualified and above all, most ethical type businessmen. What we need now is more of this type to upgrade our industry.

We here at Central TV & Radio and I'm certain the state of Ohio (TSA-OHIO) voice our opinion in favor of your article about Mr. Davidson. It is greatly appreciated by all our members and we thank you kindly.

BILL FRANK, Owner
Central TV & Radio
Columbiana, Ohio

Wants To Relocate

I have enjoyed ELECTRONIC TECHNICIAN for several years and the articles are great. Keep up the good work.

After reading the letter from Mr. Delzio in the April issue it occurred to me that you might assist me. I plan to relocate in Burlington, Mass. this summer.

I would like to offer my services to one of the better service organizations in the Boston area. I have been servicing home entertainment equipment for the past eight years—mostly color TV.

I attended National Electronics Inst. in Denver. I also have certificates from Delco Radio, Philco Quality Service and RCA. I am thirty years old and will furnish work and character references.

I will be available after June 1st.

LEON ELDRIDGE
3040 NW 65th
Oklahoma City, Okla. 73116

More on the 19A3 Tube

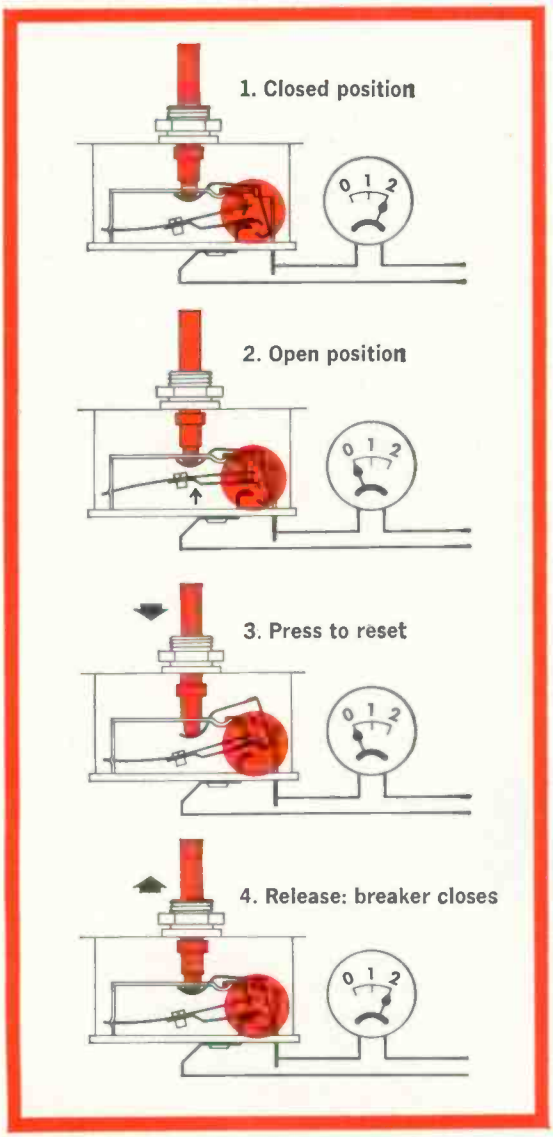
In certain Japanese made AM/FM table radios the 19A3 tube is frequently used as a rectifier.

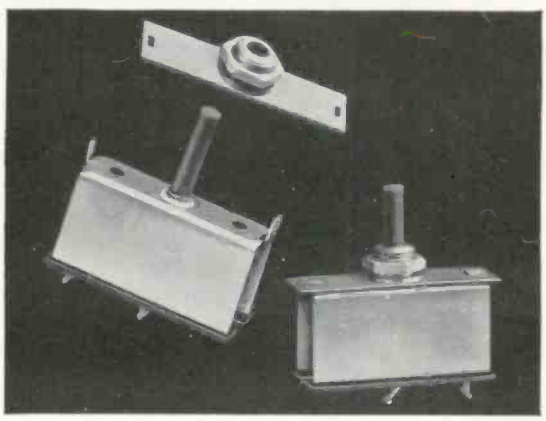
No American made equivalent is available in many areas. Experience has shown, however, that a 35W4 will, in nearly all instances, operate satisfactorily in the circuit.

Please pass this information on to service technicians.

ROBERT E. GERSON
Electronics Div.
Japan Light Machinery
Information Center
437 5th Ave.
New York, N. Y. 10016

Tips on replacing circuit breakers





That little red "breaker reset" button that sticks out of the back of nearly every television chassis can be a time-saver or a trouble-maker, depending on what's wrong inside the set, and who's pushing the button. As you well know, when a transient fault has popped the breaker, you can get the set back in business just by pressing the reset. But if there has been a short-circuit failure and some uninformed tinkerer presses the button and *keeps* it pressed, there's a good chance that more power keeps flowing into the fault. Result: a minor trouble becomes a calamity.

This is why Underwriters' Laboratories require that breakers should be "cheat-proof"—that is, they should not allow current to pass when the reset button is held depressed. Some of the replacement breakers you'll find on the market *aren't* cheat-proof. We have one that *is*. It has features that you'll find valuable any time you need to install a new breaker, or when you're working on a breadboard circuit that needs over-current protection.

Take a look at how this breaker works, and you'll see what we mean.

At top (Picture 1) is the way the breaker mechanism looks when it's in the "on" position.

Along comes an overload (Picture 2). The bi-metal strip heats, snaps into the "break" position, opening the current carrying contacts.

Now you press the button to reset (Picture 3). As long as you hold the button down, the contacts at the right remain open. Release the button and the contacts go back to closed (Picture 4). If the overload is still there, the breaker will open again. You can't keep it closed on a short circuit!

No wonder this particular breaker is used as original equipment on the majority of all television sets. They're made for Mallory by Mel-Rain Corp. to the same specifications as for original equipment, and they're available from a Mallory distributor near you. Off-the-shelf ratings go all the way from 0.5 to 7 amperes break current, and include all the values you'll need for service replacement or for industrial equipment maintenance. And as an extra convenience, you can get them with either a twist-tab or bushing mount. For your copy of our new 24-page cross-reference guide to circuit breaker replacement in all popular TV sets, see your Mallory distributor, or write to Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., P. O. Box 1558, Indianapolis, Indiana 46206.

. . . for more details circle 116 on postcard

EDITOR'S MEMO

Today Well Lived

There's a very old Chinese saw which says: "Today well lived makes every yesterday a dream of happiness and every tomorrow a vision of hope —look well, therefore, to this day."

Viewed from another angle, it means that you will never regret what you did yesterday nor worry about what tomorrow will bring if you keep up with today's events and grasp today's opportunities.

We are reminded that many service-dealers and technicians are not taking advantage of the business and educational opportunities that present themselves today.

Take FM radio, for example. In the past five or six years the number of FM broadcast stations in the United States have increased about 70 percent —from 889 stations in 1961 to 1521 at the end of 1966. And the number of stations that broadcast programs on FM/stereo have increased 900 percent —from 50 to nearly 450. Sales of FM radios have increased 500 percent. Approximately 10 million sets capable of receiving FM were sold in 1966. But this is only the beginning.

FM radio is a natural. You don't need to sell it. It sells itself when properly demonstrated. Audio output is almost completely free of static—even during a local thunder storm.

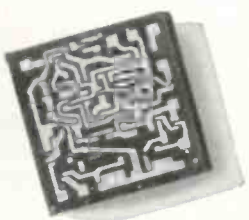
Solid-state technology has made the equipment more compact. Programing has increased in both quantity and quality.

The FCC's ruling which prevents stations in larger cities from duplicating more than 50 percent of their programing on commonly owned AM/FM facilities has brought about a greater diversity of programs available to listeners. The big price tags that once hung on FM/stereo equipment have become smaller. There is now a wider selection of FM/stereo equipment available to the listener today at prices which were unheard of only a few years ago.

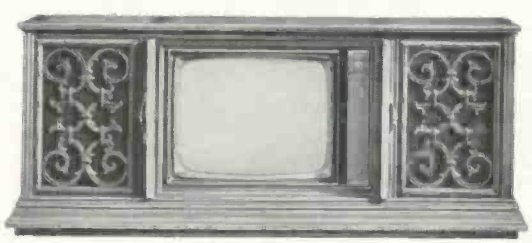
And there's some talk about using space satellites to beam FM/stereo signals throughout the country. If and when this takes place—and it will eventually—the public interest in FM/stereo will surge upward to higher levels.

Yes, indeed: how you function *now* will determine the character of your "yesterdays" and your "tomorrows." Look well, therefore to this day.

The hottest thing in electronics hardly gets hot at all



(RCA's solid integrated circuit, that is)



With the tiny chip there are few heat problems and low power consumption. And because integrated circuits run cooler, parts can be placed closer together to enhance design convenience. One day you may see stereo cabinets with more real storage space, and color TV sets the size of a transistor radio. At RCA Victor we've taken a step into tomorrow by using integrated circuits now in new color and black and white TV and in stereo phonographs. They're not only the most advanced products of their kind, they are more reliable than ever before.

RCA The Most Trusted Name in Electronics

Tmk(s)®

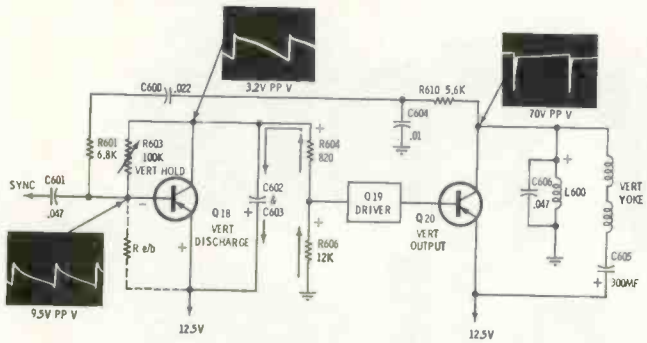
TECHNICAL DIGEST

MOTOROLA

TV Chassis TS460 — Vertical Sweep Circuit Description

The purpose of the vertical sweep section is to supply the proper voltage and current to the vertical deflection coils, causing the CRT beam to trace from top to bottom in synchronization with the TV studio camera.

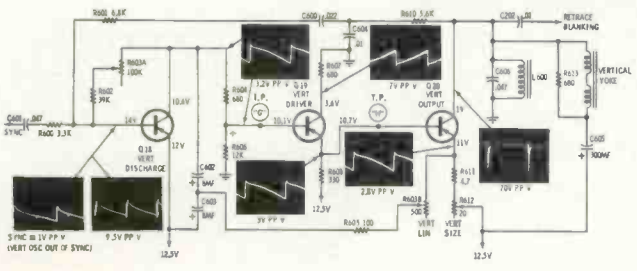
A simplified diagram of the vertical sweep section is shown here. The oscillator is a multivibrator, similar to that used in tube-type receivers, which provides feedback from the output to the discharge stage, maintaining oscillation. Capacitors C602 and C603 make up the sawtooth-forming network. (These capacitors are directly across the



discharge transistor, Q18.) At the beginning of trace, these capacitors are completely discharged. The collector and base of Q18 are at the same potential as its emitter, therefore, Q18 will not conduct. As the capacitors charge, the forward bias on the driver and output stages increases causing the beam to be deflected from top to bottom.

During this time, the voltage across the vertical discharge transistor, Q18, is also increasing. This voltage is divided by the vertical hold control, R603, and the emitter-to-base resistance of Q18, and it is used to forward bias this stage.

When Q18 begins to conduct, its collector voltage becomes more positive, reducing the forward bias on the driver and output stage. (The driver is an emitter-follower and can be considered a direct connection as far as the oscillator action is concerned.) The magnetic field that has been built around the vertical deflection coils, L600, now begins to collapse, causing retrace, inducing a voltage across the deflection coils and L600 which causes the collector of the output stage to go negative. This negative pulse is coupled by R610, C600 and R601 back to the base of the discharge transistor, Q18, driving it into



saturation, discharging the sawtooth forming capacitors quickly. When the magnetic field around the yoke has collapsed, no more negative voltage is induced across the deflection yoke and the collector voltage of Q20 now goes back toward zero. This positive-going voltage now cuts off Q18 and the sawtooth capacitors begin to charge, repeating the sequence of events.

Negative going sync pulses are applied through C601 to the base of Q18 which turns Q18 on to begin trace. This synchronizes the receiver with the transmitted signal.

A complete schematic of the vertical sweep section is shown.

The vertical discharge transistor, Q18, receives forward bias from its collector and R604. Q19 provides an impedance match between the high impedance of Q18 collector circuit and the low impedance base circuit of the output transistor, Q20. The vertical size control, R612, determines the amount of bias and degeneration in the emitter circuit of the output stage. A sawtooth is taken from the emitter circuit of Q20, shaped into a parabolic waveform by C603 and fed back into the base of the driver, Q19. The amplitude and shape of the parabola is controlled by the vertical linearity control, R603B. As in the horizontal output stage, a germanium device is used for the vertical output circuit. C604, in the feedback circuit, filters out the horizontal pulses picked up by the vertical yoke, to prevent vertical jitter.

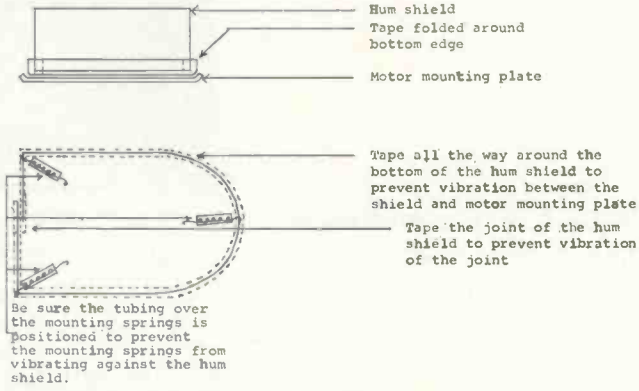
C605, in series with the vertical deflection coils, blocks dc current through the coils to prevent decentering of the raster.

R613 and C606 prevent the negative pulse, induced during retrace, from exceeding the breakdown voltage of Q20. C606 presents a relatively low reactance to this short-time duration pulse. R613 lowers the "Q" of the yoke to help limit this pulse.

GENERAL ELECTRIC

Tape Recorder TP1150/TD20-1 Tape Deck—Intermittent 'Mechanical Buzz'

"Mechanical Buzz" caused by vibration of the motor hum shield against the motor mounting plate can be



eliminated by installing electrical tape as shown in the illustration.

Zenith is honored to be the only TV manufacturer to win NATESA's "Friends of Service" award five times!

Zenith supports the aims and objectives of the National Alliance of Television and Electronics Service Association. So we are especially proud to receive the NATESA "Friends of Service" award for the *fifth straight year.*

Zenith is the only TV set manufacturer to be so honored five times by NATESA.

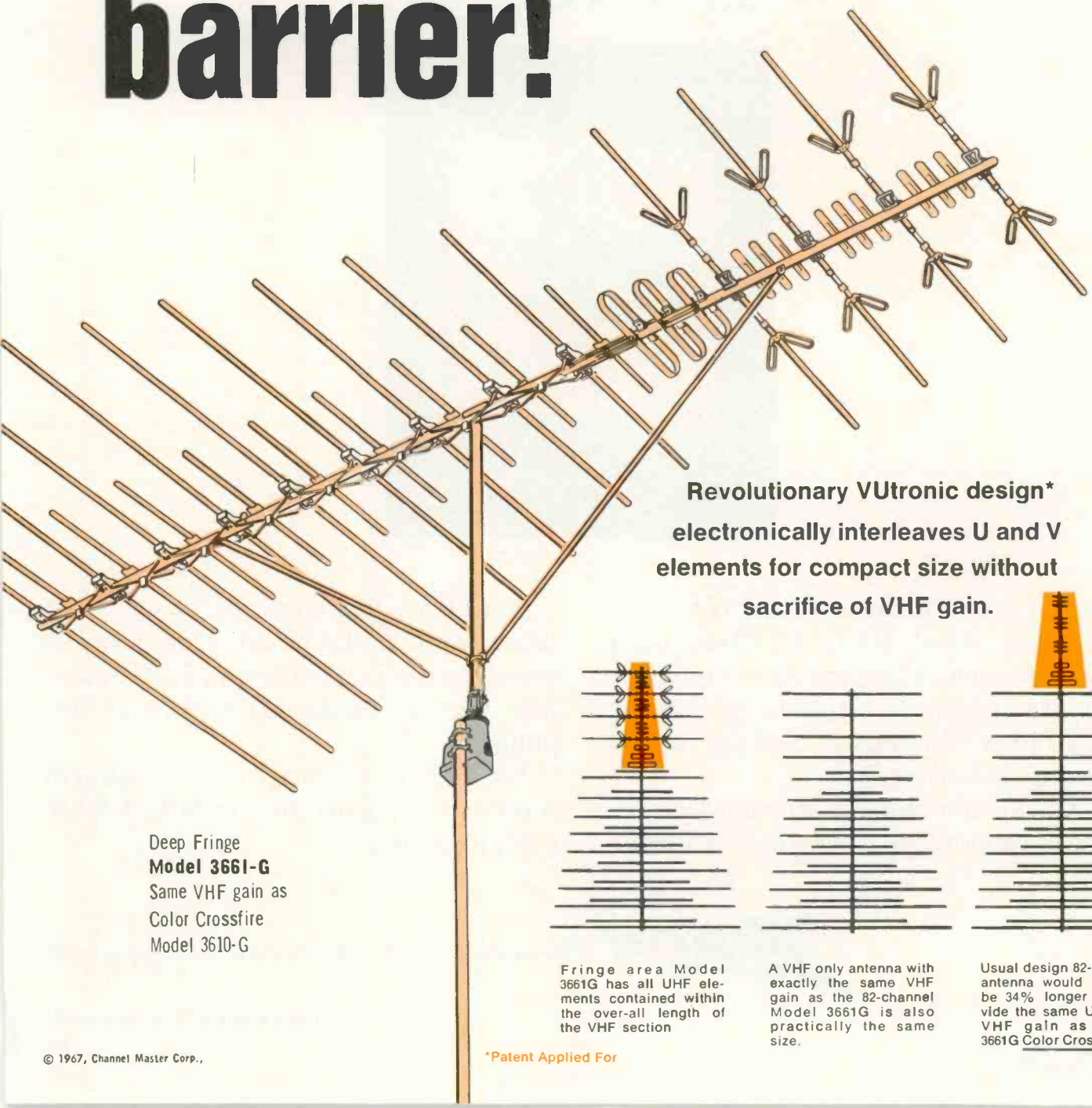
NATESA members for many years have played a vital role in providing expert electronics service and in training new men for dedicated service to the public.

We at Zenith pledge our continued support and cooperation in NATESA's great program.

ZENITH® *The quality goes in before the name goes on*

. . . for more details circle 131 on postcard

Channel Master smashes the 82 Channel size barrier!



Deep Fringe
Model 3661-G
Same VHF gain as
Color Crossfire
Model 3610-G

Revolutionary VUtronic design* electronically interleaves U and V elements for compact size without sacrifice of VHF gain.

Fringe area Model 3661G has all UHF elements contained within the over-all length of the VHF section

A VHF only antenna with exactly the same VHF gain as the 82-channel Model 3661G is also practically the same size.

Usual design 82-channel antenna would have to be 34% longer to provide the same UHF and VHF gain as Model 3661G Color Crossfire 82.

*Patent Applied For

New Color Crossfire 82

UHF/VHF Antennas plus FM/FM Stereo

Totally new concepts in UHF/VHF design are joined with Channel Master's proven Crossfire principle to produce the first 82-channel antennas that meet UHF reception needs yet also provide unsurpassed VHF gain...and with no appreciable increase in over-all size.

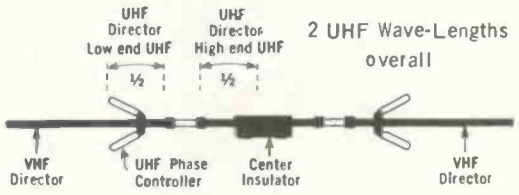
Here is another example of a major development from Channel Master Laboratories where, as always, leadership begins with research.

Until now, antenna manufacturers have created combination UHF/VHF antennas by coupling a UHF section to the front of a VHF antenna. To avoid costly, unwieldy, and unsightly construction, this has always meant sacrificing VHF gain. Now Channel Master fills the 82-channel gain gap with Color Crossfire 82 antennas designed for metropolitan to fringe areas where maximum VHF gain is as important as UHF reception power.

In addition to the famous Channel Master Crossfire VHF Proportional Energy Absorption Principle, these new antennas employ unique series-fed folded UHF dipoles with carefully engineered dimensions so that they literally "disappear" and operate as a perfect 300 ohm line at VHF frequencies...no "lossy" couplers required as is the case with the usual parallel-fed UHF elements.

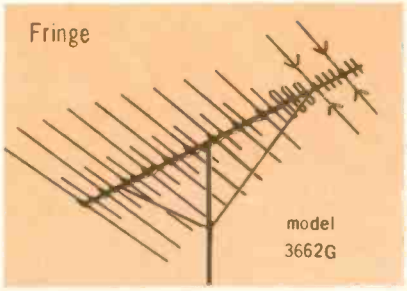
And, of course, every Color Crossfire 82 antenna features Channel Master's famous E.P.C. golden coating and rugged preassembled construction.

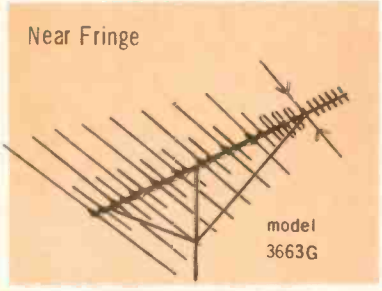
HERE'S THE SECRET

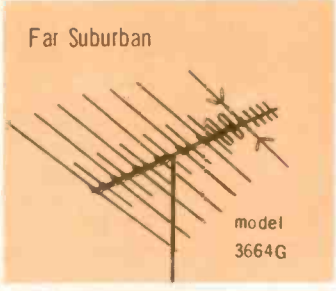


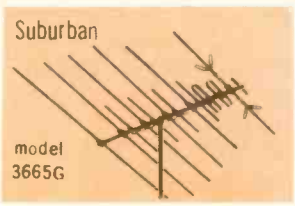
VUtronic design employs unique dual-function co-linear directors (on all but three metropolitan models) serving both UHF and VHF sections. This permits space-saving inclusion of the UHF elements **into** the physical structure of the full-power VHF array. The exclusive UHF phase controller "whiskers" boost UHF gain by making each full-wave director the equivalent of two full wave lengths.

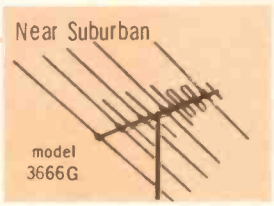
Now the first and only complete line of full VHF Power 82-channel antennas.

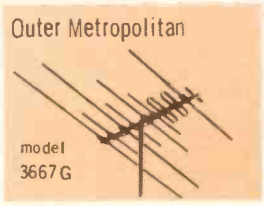


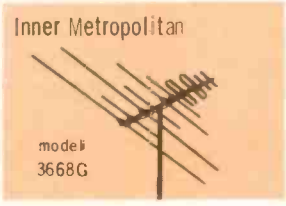












More Channel Master Crossfire Series Antennas have been sold and are being sold...than any other antenna in the history of television.

CHANNEL MASTER
Ellenville, N.Y.

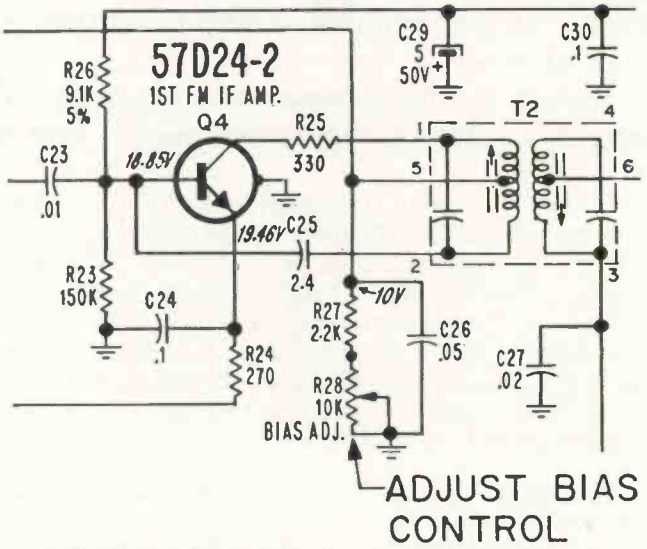
. . . for more details circle 108 on postcard

TECHNICAL DIGEST

ADMIRAL

Stereo Chassis 17A4—Low FM Sensitivity

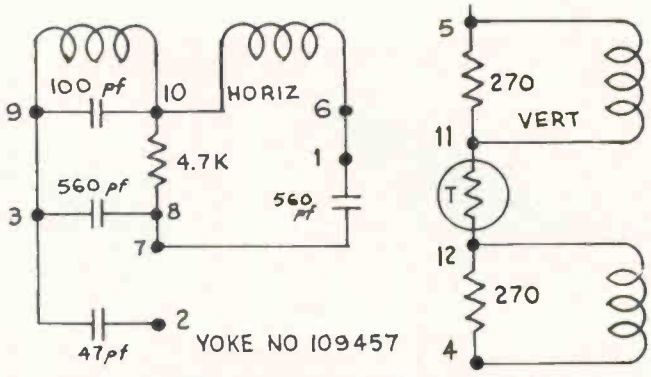
Incorrect adjustment of the RF BIAS control, R28, (shown in schematic) may cause low FM sensitivity. The control can be adjusted with a pocket screwdriver without removing the chassis from the cabinet. If this does not correct the condition, you may have a bad FM IF transistor. Tune in a local FM station and adjust the RF BIAS control to kill the FM RF amplifier. If the output is cut off completely instead of just being reduced or if the tuning meter acts peculiarly as you tune near cutoff, replace transistor Q4.



RCA VICTOR

Color Chassis CTC10, -11 — Yoke Substitution

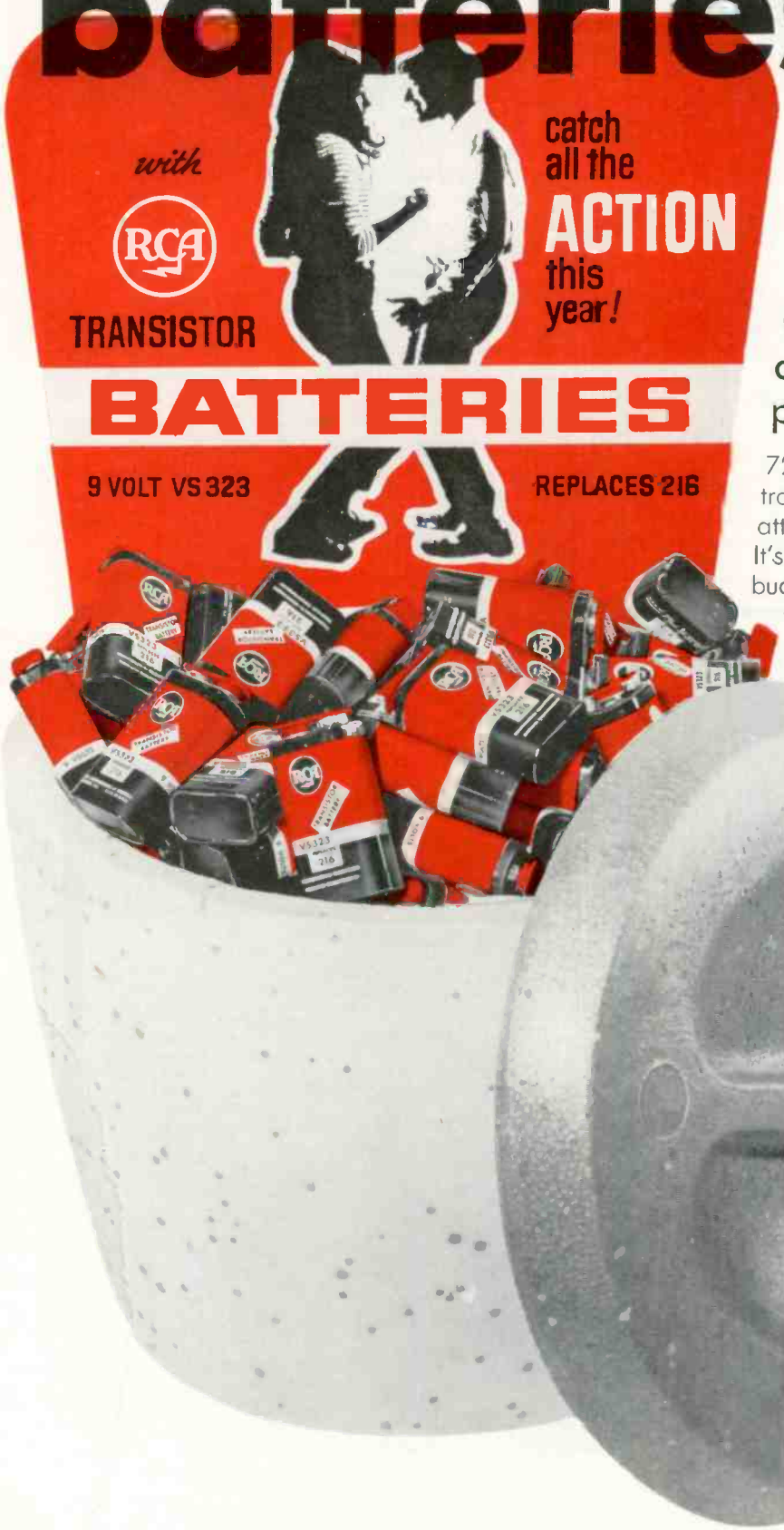
When RCA yoke stock #109457 is used on the CTC10 and 11 chassis, the following changes should be made as shown in the schematic. Also, a check should be made against the schematic.



Add two soldering lugs to the holes marked 7 and 8.
Move components from lug 2 to lug 8.
Add jumper wire from lug 7 to lug 8.
Add a 47pf ±5% 3kv (106306) from lug 2 to 3.
Change the two resistors on lugs 5 and 11, 4 and 12 to 270Ω (502127).

Order RCA's 9-volt summer special

"A bucket of batteries"



Catch all the battery action during the peak summer months

72 of the popular RCA VS323 9-volt transistor batteries are prepacked in this attractive, reusable ice-bucket merchandiser. It's a sure-fire summer seller. Offer the bucket as a gift to the customer who buys the last battery . . . or use it at home for picnics or parties. All batteries have a plastic terminal protector to prevent shorting.

See your RCA battery distributor and ask about his summer special "Bucket of Batteries" promotion offer!

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

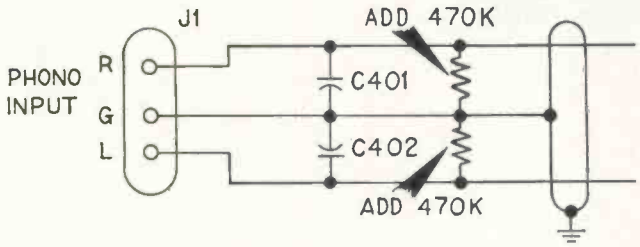
RCA® The Most Trusted Name in Electronics

TECHNICAL DIGEST

RCA VICTOR

Radio/Victrola Model VGT66 — Loud 'Pop' in Speakers

If a loud pop is heard in the speakers when the pickup touches the record and adjusting the muting switch will not correct the trouble, it may be caused by the following:



The charge and discharge cycles of C401 and C402 may not follow the muting switch, causing a pop in the speakers. To correct this condition, add a 470K ½w resistor across each channel of the phono injut as illustrated.

The phono input jack is located on the rear apron of the RC1218 tuner chassis.

AM Tracking Alignment Tool

When checking alignment tracking of broadcast receivers a simple and inexpensive tool can be made from a piece of ferrite rod and a shorted loop of copper wire. The device consists of a 6in. length of ½ or ⅝in. ferrite rod (old discarded ferrite antenna) and a 2in. diameter coil of #6 copper wire with the ends soldered. The coil is attached to the end of the ferrite rod to form a wand. The wire loop can be attached to the ferrite rod with adhesive or plastic electrical tape.

In practice the device is quite simple to use in checking tracking. The ferrite rod with the shorted loop of the tuning wand is held near the ferrite or loop antenna of the receiver, while tuning the receiver to 600kHz, 1MHz, 1.4MHz and while listening to the noise level.

If there is any noticeable increase in the noise level, it is an indication that tracking is off and could be improved by realignment of the RF section of the receiver. Tests indicate that the average discernible noise level change heard by the human ear is approximately 3db, under quiet surroundings.

When the coil end of the wand is placed against the receiver ferrite antenna and a noise increase is noted, it would indicate the circuit inductance is too high. The circuit would require adjustment.

When the rod-end of the wand is placed against the receiver antenna and the noise increases, the circuit has insufficient inductance and requires readjustment.

When required, alignment of the RF section, including antenna, RF and oscillator tracking, can best be done by rocking the tuning capacitor above and below 600kHz with an excursion of 40kHz for maximum output. The best tracking at 1MHz requires trimming of the split plates of the tuning gang rotor. The high side 1.4MHz adjustment can be easily attained by trimming padders for maximum output. This method requires an audio modulated RF signal generator and speaker or meter indicator. *Diagram courtesy of RCA Victor.*

OLYMPIC

TV Models 5T100, 6C125, 6C126 — Parasitic Oscillation

To prevent the possibility of parasitic oscillations (inability to lock picture horizontally), particularly on channels 2, 3, 4, the front bottom control panel should only be grounded to the CRT grounding strap. If the control panel is grounded to the speaker and tuner mounting bracket, remove the ground between the control panel and speaker.

On units with monopole antennas, using the NCP or NDP chassis, lift the ground lead running from antenna to top of the HV cage, insert a 560Ω ½w resistor between terminal of cage and ground lead.

GENERAL ELECTRIC

Phono Models V631, V632, V633—Securing Cartridge Mount

If the cartridge mount is loose when playing a record, the output from the speaker may have an intermittent "Raspy or Garbled" sound.

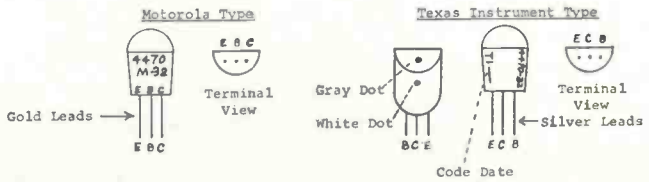
In some units it has been found that the screws securing the cartridge mount are too long and it is possible to "bottom" the screws without securing the mount.

The problem can be solved by installing shorter screws or by filing the screw ends off until they secure the cartridge mount properly.

GENERAL ELECTRIC

Identification of EA1451/EA15X59 Transistors

Two different vendors are currently supplying EA1451/EA15X59 transistors used both in the manufacture of amplifiers and in New Concord and Utica replacement parts stock. These transistors are electrically identical but differ in terminal arrangement and therefore must be connected into the terminal board differently. The necessary information to identify both units completely and the terminal diagram of each is illustrated here.



Since the Texas Instrument type unit was not in use at the time of printing the amplifier service manuals, its base diagram does not appear on the schematic page of the appropriate manuals.

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JULY 1967

TROUBLESHOOTING COLOR VIDEO AMPLIFIERS WITH A DUAL-TRACE SCOPE

The 'old pro' tells how to use a high performance lab-type scope and squarewave generator to check, troubleshoot and peak video amplifiers for top picture quality

■ As every experienced technician knows, a video signal is composed of a combination of transient voltages, and a good TV picture depends on the transient response of the video amplifier. Squarewaves can prove highly successful in making frequency-response and over-all performance checks of color video amplifiers. Clues to circuit defects that cause poor picture reproduction can be uncovered.

Sometimes marginal defects are caused by cumulative drift of component values. Capacitance, inductance and resistance can be very critical in obtaining peak-picture quality from video-amplifier circuits. Peaking coils develop shorts or leakage between layers, thus changing their inductance. Resistors tend to increase in value as the TV set ages and capacitors (common trouble-makers) develop various degrees of leakage. Tolerances are cumulative and as picture quality deteriorates, it is very difficult to determine which components are defective.

Considering the competitive factors involved in today's service atmosphere, it has become necessary to employ the best test instruments available for solving various types of troubleshooting problems. And the ability to use these techniques comes only with experience and study.

All checks described here are performed with a dual-trace, triggered, wide-band type scope and a squarewave generator.

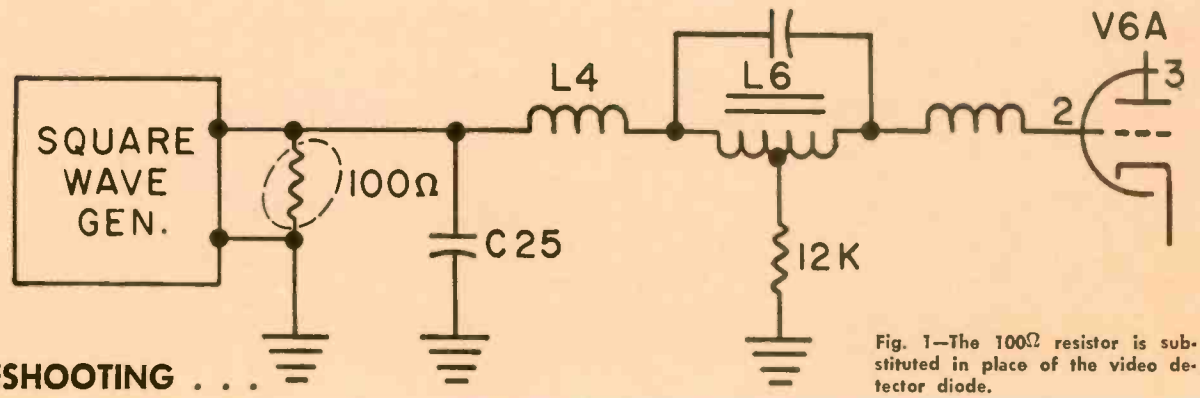


Fig. 1—The 100Ω resistor is substituted in place of the video detector diode.

TROUBLESHOOTING . . .

Triggered-sweep scopes have direct-reading vertical gain controls in terms of P-P voltages—permitting you to make quick voltage and gain measurements. Until you have used one of these scopes, you cannot realize what an asset it can be for fast, accurate and more profitable troubleshooting. The scope used by the "old pro" was purchased second-hand at a reasonable price.

General Considerations

The video-amplifier circuits in color TV receivers are more elaborate than those in B/W sets. A delay line, for example, slows the color video signal for approximately 1μs without distortion.

To obtain an undistorted squarewave display, interference from blanking pulses and stray fields must be eliminated. This is done by removing both the horizontal and vertical output tubes from the set. Signal overload from all sources should also be eliminated.

To check the video amplifier, a signal from the squarewave generator is injected at the input. The video detector is removed from the circuit and a 100Ω resistor is substituted, as shown in Fig. 1. A low-capacity probe is then employed to trace the squarewave to the CRT cathode.

Tune the squarewave generator to 100kHz. This frequency will provide the most information while viewing the scope screen for proper video signal response. The normal 100kHz squarewave response of a color video section is illustrated in Fig. 2. Note that "preshoot" and "overshoot" are indicated. This is essentially a symmetrical waveform because the video section has a linear phase response. A five-times (5X) expanded squarewave trace showing details is illustrated in Fig. 3.

If the squarewave response is unsymmetrical, a defective peaking-coil or choke is indicated. A waveform with the squarewave generator set at 50kHz is shown in Fig. 4. These same checks can be used for B/W sets but the squarewave response will have overshoot and ringing present—but no preshoot and the waveform will be unsymmetrical.

Squarewave checks can also be made to determine the response and gain of the R-Y, B-Y and G-Y color amplifiers. It is very easy to measure the gain with a dual-trace scope. The amplitudes can be compared, for example, by connecting the scope's "A" amplifier to the "Y" amplifier control grid and the "B" amplifier to the plate of this same tube. Then we can determine stage gain, if any.

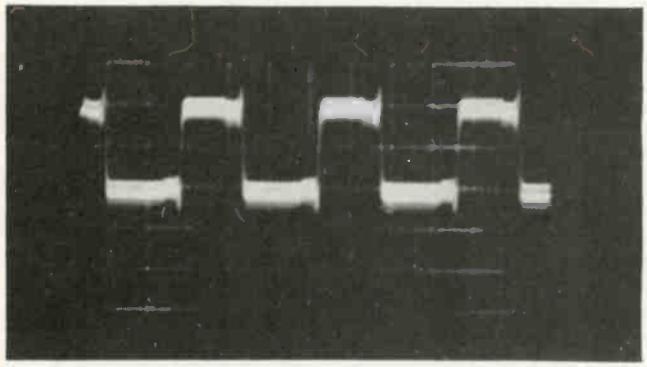


Fig. 2—Normal 100kHz squarewave taken from the output of a color TV video amplifier. Note both preshoot and overshoot.

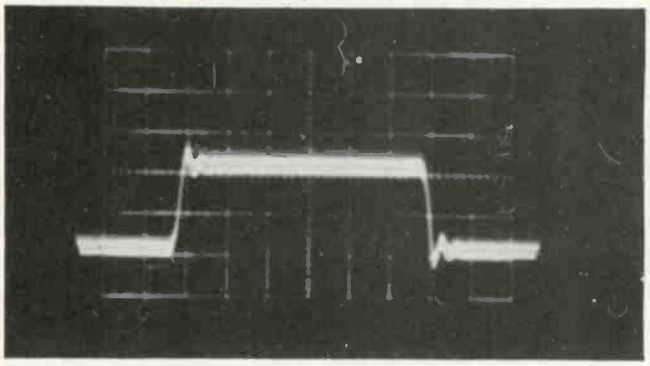


Fig. 3—Same squarewave as shown in Fig. 2 but expanded five times.

Actual Troubleshooting Cases

A Zenith color chassis, 23XC38, had a half-black and half-white picture with retrace lines as shown in Fig. 5. A very faint picture appeared in the background. The squarewave signal was injected and each of the three video stages were checked. It was quickly determined that L10, a 250μh choke was open (see Fig. 6.). This choke feeds the blanking pulses to the control grid, element 2, of the 12HL7 "Y" amplifier (V7). A new L10 choke was installed and a sharp picture appeared.

Phantom Color 'Spoof'

An intermittent video picture problem came up in

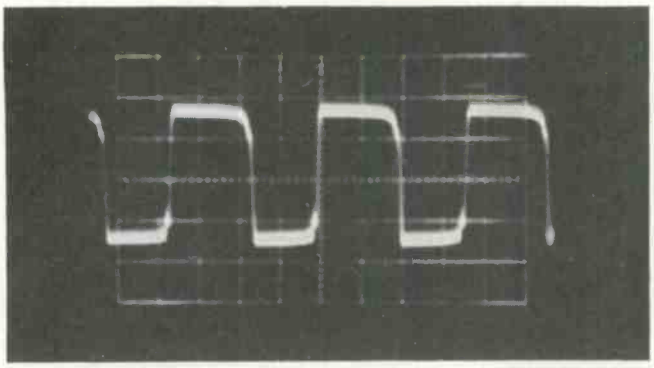


Fig. 4—A normal 50kHz squarewave that has passed through a properly operating color TV.

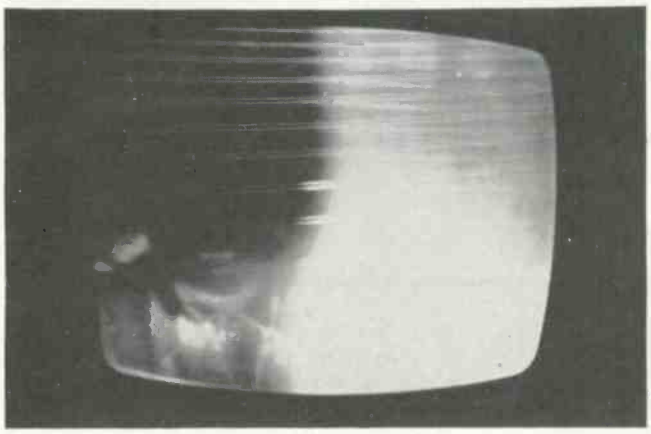


Fig. 5—Defective picture caused by open choke.

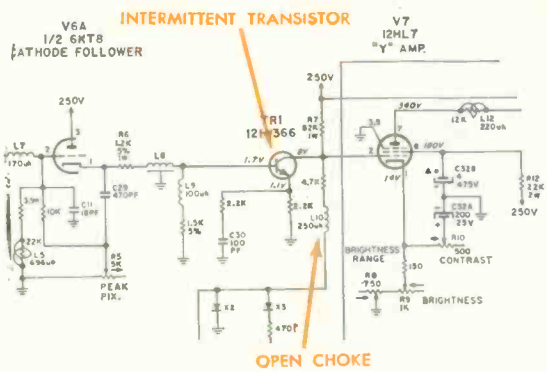


Fig. 6—Schematic of a portion of the video section of a Zenith 23XC36 chassis.

the same type of chassis. B/W information on a color telecast would disappear and the color information only would appear. This condition would exist for about five minutes and then disappear. The set would then work fine for about an hour and even sometimes for a full day.

In this case we used the station video signal and the dual-trace scope was connected to various test points in the video section. The set was then switched on to "cook" and the bench technician, while working on another set, glanced over at the scope occasionally. After swaping the scope probes around several times, the trouble was narrowed down to transistor TR1 (see Fig. 6). The transistor would open for a few seconds and the waveforms appeared as shown in Fig. 7. Note the bottom trace shows only the blanking pulse present (no video) at terminal 2 of V7. The top trace was taken at the base of transistor TR1. This problem could

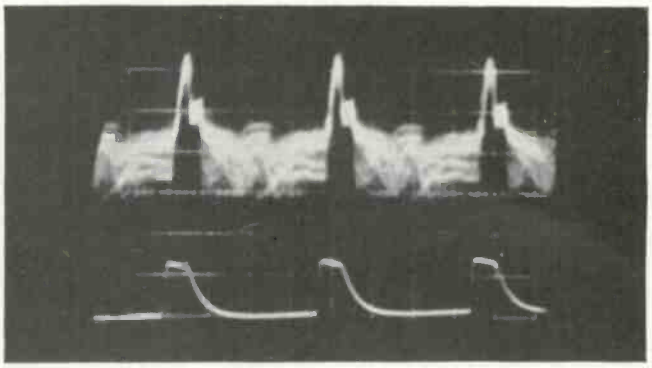


Fig. 7—(Top) Normal video signal at the base of transistor TR1. (Bottom)—Blanking pulse only is shown with video missing at tube terminal 2 of V7. This problem was caused by an intermittent transistor.

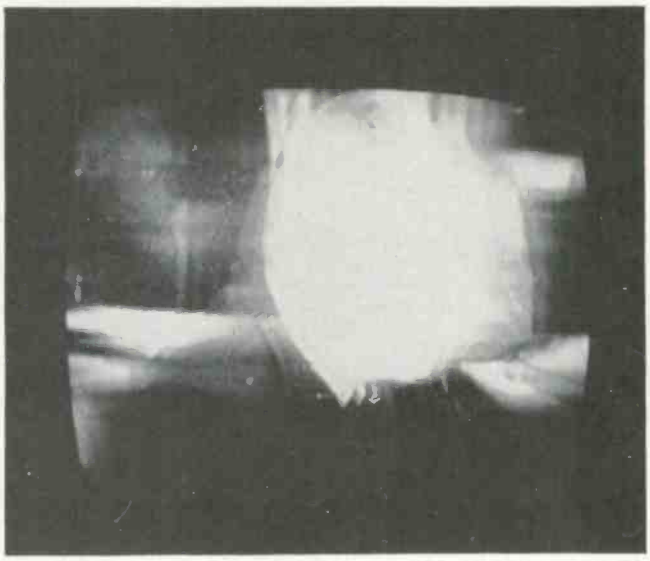


Fig. 8—The shorted diode, CR103, in an RCA CTC19A caused this double reflected image on the screen.

have been a tough nut, but the dual-trace scope cracked it quickly. This same technique can be used to spot intermittently open coupling capacitors.

Reflected Images

An RCA CTC-19A color TV chassis had what appeared to be double reflected images (Fig. 8). The tuner and IF stages checked out OK so the scope and squarewave generator were warmed for a look at the video amplifier stages. The trouble was quickly narrowed to a shorted diode, CR103, shown in Fig. 9 at the delay line, DL101, output. Apparently a reflected signal was set up within the delay line as the current flowed in both directions because of the shorted diode. The blanking pulses are fed into this diode via R167 and these pulses caused the condition. We have noted the same problem on some older model color sets caused by component aging. If a diode is inserted at the output and in series with the delay line, this will sometimes solve the problem.

Someone slipped a Zenith 20X1C36 color chassis on the service bench when our back was turned. The picture that greeted us when the set was switched on, is shown in Fig. 10. Without thinking, we ran outside to check our antenna but found that it was "ghost-free."

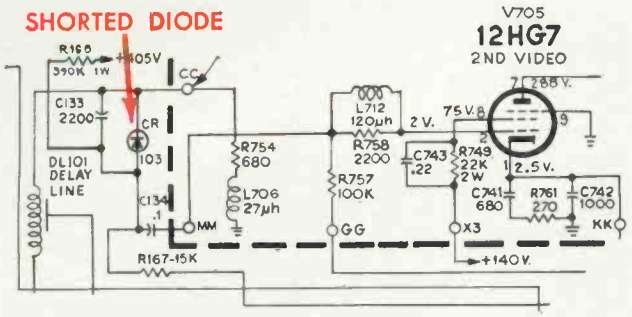


Fig. 9—Section of the CTC19A where shorted diode is located.

Fig 10—Triple image caused by an open choke,L9, in a zenith 23xC36 chassis.

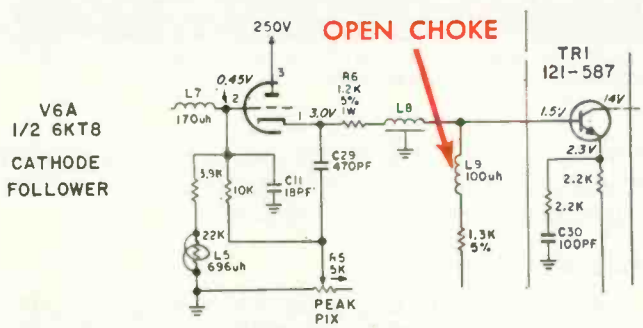


Fig. 11—Schematic of a portion of the video section showing where open choke, L9, is located in a Zenith 23XC36 chassis.

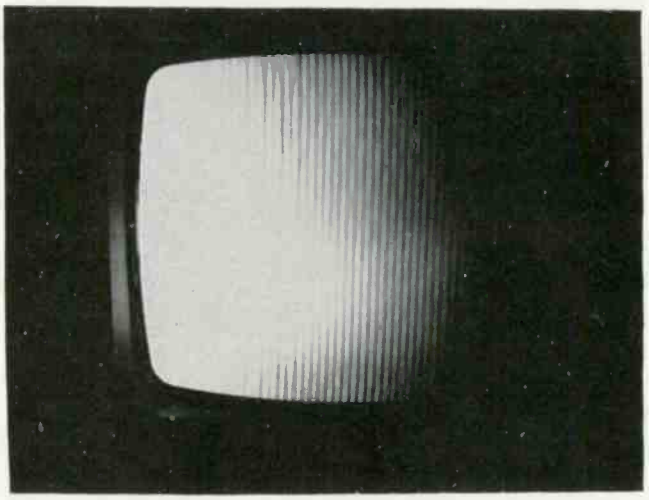


Fig. 12—'Rare-bird' photo made from screen of Zenith 20X1C38 which was caused by a poor solder joint in the horizontal sweep section.

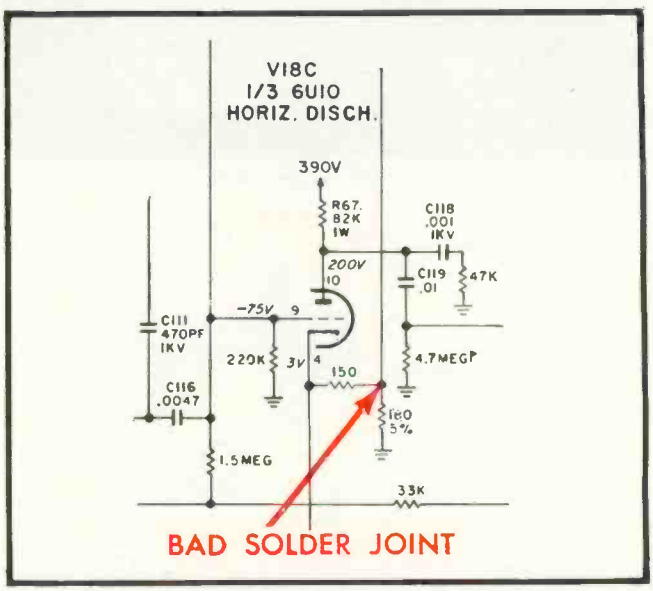


Fig. 13—Simplified schematic of the horizontal discharge section of a Zenith 20X1C38 chassis where a poor solder joint was located.

A few preliminary checks were made and all symptoms pointed toward the video section. The scope was still warm so the probes were jumped quickly across all three stages. Ringing of the squarewave appeared at the base of transistor TR1 and a few ohmmeter checks quickly located an open L9 choke. (See the schematic in Fig. 11.) Here the return of the delay line is through a 180Ω resistor to ground. With this coil open, the delay line was actually having a ringing or reflected effect on the video signal—thus causing a triple ghost in the picture. A defective delay-line has been known to cause this same type of picture ghost.

Damped Vertical Stripes

A new 20X1C38 Zenith was unpacked and fired up for checking before making delivery. What appeared on the screen is shown in Fig. 12. We were afraid to even guess at the cause. The dual-trace scope was used to track down this "video trouble" which turned up as a cold solder joint in the horizontal oscillator stage. The ground end of the 150Ω resistor connected to terminal 4, cathode, of the horizontal discharge tube, V18C, had the poor joint (see Fig. 13).

We've told you what caused this odd condition, but you'll have to decide how the picture was completely eliminated — because we obtained a good picture after the ground-end of this resistor was well soldered.

The beauty of using a dual-trace scope is that the two waveforms, from the input and output of a video stage, for example, can be superimposed for an exact analysis and comparison. ■

Repairing Solid-State Auto Radios

You can make money in this business today if you go at it properly

■ Many service-dealers still think of solid-state auto radio repair as a "dirty job" and not worth the effort. But it is a profitable business today if you have or obtain, the necessary tools and specialized know-how.

Most auto owners have "acclimated" themselves to the higher costs now prevailing for solid-state auto radio repairs and, although it may be a little more difficult to locate and replace defective transistors, not every Tom, Dick and Harry can locate defective transistors like they can bad tubes. Hence, if you know your business, you can increase your profits by doing solid-state auto radio repairs.

You'll need the following equipment, test instruments and material to do this type of repair work:

1. Universal bench power supply
2. Signal tracer
3. Noise or regular signal generator
4. Transistor tester
5. Auto radio schematics and service data.

You will also need a few convenient tools, most of which are found in the average TV-radio shop.

Checking Speaker and Antenna

Depending on the complaint, always check the antenna and speaker before pulling the radio out of the auto. Check both for continuity with a VOM set on a low resistance range.

The impedances of transistorized auto radio speakers run from about 8 to 40Ω. Although the speaker cannot be checked for reproduction quality while mounted in the auto, a continuity check can be made to determine if the voice coil is open. Many situations arise with inexperienced technicians where the car radio is pulled and when connected on the bench it operates perfectly—the trouble being in the car.

The antenna can be checked for an open lead-in or high resistance leakage from center wire to the outside shielded cable. An open auto lead-in will pick up only strong local radio stations. If water or heavy moisture accumulates inside the antenna or lead-in, the results will be similar. Sometimes the ohmmeter will not show leakage caused by moisture or water but the antenna, if suspected, should be removed and checked.

If the antenna checks open, the lead-in will usually be broken at the plug that goes into the radio or at the bottom of the antenna mounting assembly. If the lead-in is open, it is better to install a completely new antenna.

Speaker troubles will show up usually as open voice coils, cone vibration or "mushy" distortion. Under various kinds of weather conditions the speaker cone may warp and drag on the center pole piece. Sometimes only the cone will vibrate loose and can be re-glued again. Low- or high-note vibrations can be caused by split or torn speaker cones. Check intermittent speakers by pressing gently on the cone while the speaker is operating.

Troubleshooting

Several methods can be used to locate solid-state auto radio troubles quickly. Defects can be located by signal tracing, through sight or smell and by rapid transistor checking methods. Generally, most skilled

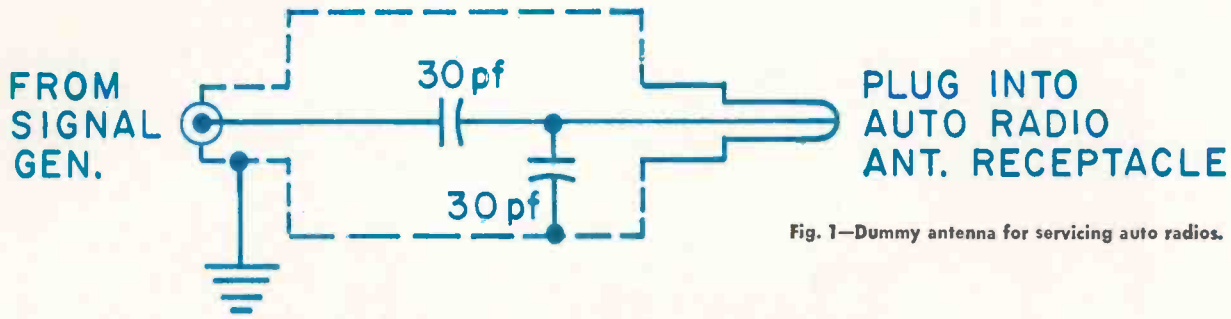
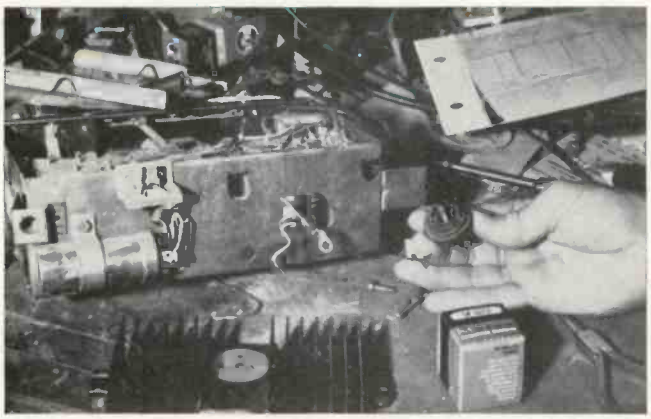
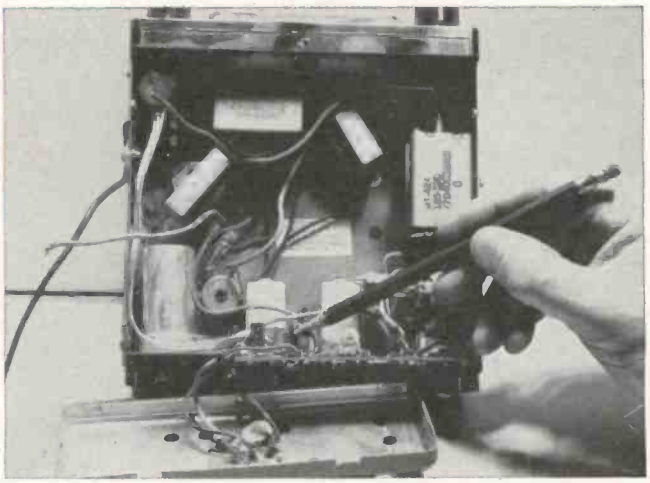


Fig. 1—Dummy antenna for servicing auto radios.



When replacing a power transistor make sure it is mounted exactly as the original component. Watch for small mica insulators on some transistors and do not forget to put silicone grease on the metal collector terminals for heat dissipation.



Pencil points to a defective auto radio transistor.

technicians use a combination of these methods.

When checking transistorized radios, whether in the auto or on the service bench, trouble-symptoms indicated by the speaker are very important. If a clicking or humming sound appears in the speaker, for example, it can be assumed that the output stage is operating. Weak audio from the speaker may be caused by a shorted or weak power output transistor. No audio usually indicates a shorted output transistor having an open bias resistor.

To begin troubleshooting, go directly to the volume control. Inject a signal here with a noise generator or 400Hz modulated signal from a regular signal generator and check out the audio stages. With the volume control wide open, a loud signal should be heard. If so, all the audio stages are functioning. Now proceed toward the detector, IF and converter stages.

If you do not get a loud signal from the speaker with a signal injected at the volume control, then proceed toward the speaker, from base to collector of each audio transistor, until the signal is heard. At this point you have located the defective stage. It can be found one stage back toward the front end of the receiver.

The IF stages can be checked by injecting a generator signal to the base of the converter transistor. The signal generator frequency must be set at the proper IF. To check the RF stages, connect the signal generator through a dummy antenna load as shown in Fig. 1.

Do not forget your sense of sight, touch and smell. Expert technicians locate many troubles by detecting charred or overheating resistors through one or more of these three senses. If a transistor becomes hot after the set has been on for a few minutes, it is probably shorted. But this is a relative matter which becomes significant only through experience. Most power output transistors, for example, will get rather warm after operating for several hours. Always check the variable bias resistor and adjust it for correct current in the output stage as specified on the manufacturers' schematic.

Checking Transistors

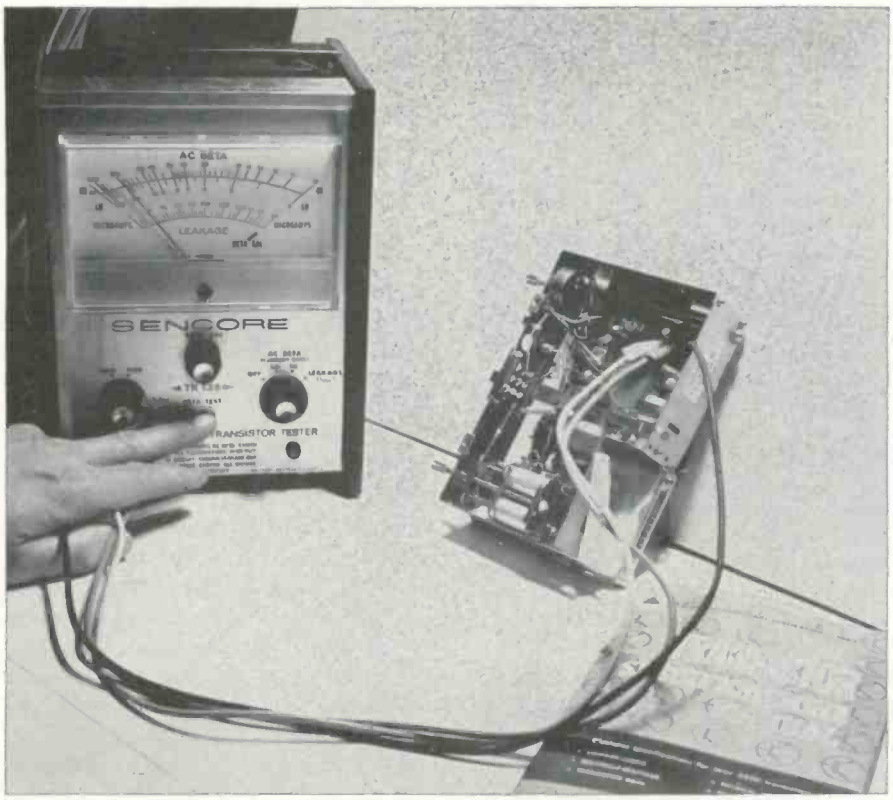
Suspected transistors should always be checked with an in-circuit transistor tester. This tester will check both NPN and PNP types for beta quality and element leakage while the transistors are soldered to the circuit board. Not only can the quality of the transistor be checked, but a short or high leakage can be quickly detected.

When checking for beta or leakage, it is important to remember one thing: Many AF stages in solid-state auto radios are directly driven. In this case, remove the transistor from the PC board before checking. It *is* possible, under these circumstances, to get an erroneous reading when a diode or a directly coupled transistor is used in a circuit.

Several sources for transistor replacements are available. Major source include: 1) G-E, 2) Motorola (HEP line), 3) RCA (SK top of line series), 4) Semitronics and 5) Workman (miracle five).

Intermittent Trouble

Dead solid-state auto radios are



An in-circuit beta transistor tester is used to check auto radio transistors.

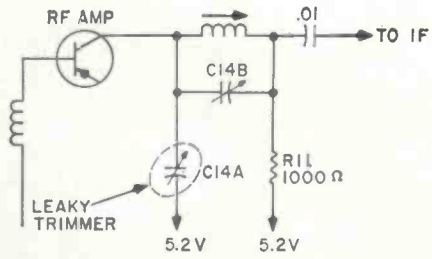


Fig. 2—Dashed circle encloses leaky trimmer section in a Volkswagon auto radio which caused noisy reception.

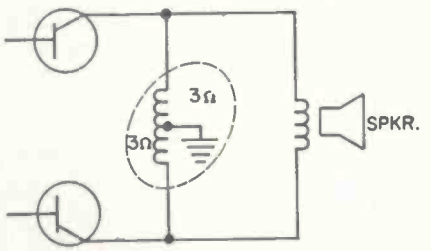


Fig. 3—Burned transformer in CTA62 Motorola auto radio.

very easy to repair. Weak or intermittent radios are difficult at times. All intermittent equipment should be handled with care. Intermittent troubles are frequently caused by broken or poor etched board connections. IF transformers and high-ohm voice coil speakers generally come next.

It is also possible to have an intermittent transistor. Isolate the intermittent stage first and unsolder the transistor from the PC board, connect the tester to the transistor and tap it lightly while observing if the beta reading changes on the tester's meter scale.

Noisy Volkswagen. A Bendix model 6BVT Volkswagen, solid-state radio came into the shop with noisy reception. The noise was traced to the first RF assembly. C14A (Fig. 2) proved to be leaking. When it was checked with an ohmmeter, however, no leakage resistance could be measured. The top end of the capacitor was unsoldered and a VTVM reading showed 0.45v leakage. After replacing C14A and B trimmer assembly, the radio was quiet.

'Cold' Chevrolet Radio. After operating for the first half hour, this Delco radio had very weak audio output. The volume would then slowly increase but it still never reached peak output. The radio was left to cool overnight and the next morning a few voltage checks were made. An incorrect bias voltage appeared on the output transistor.

Very little voltage existed on one side of the bias fuse resistor. The input potential was 12.6v. The value of the bias resistor was 10K and should have been 0.47Ω. This same bias resistor was placed back in the circuit and after warming up it measured 10Ω! Both the bias resistor and the DS501 output transistor were replaced. Although the radio operated perfectly with the old transistor, we saw no good reason to take a chance on a possible intermittently shorting component.

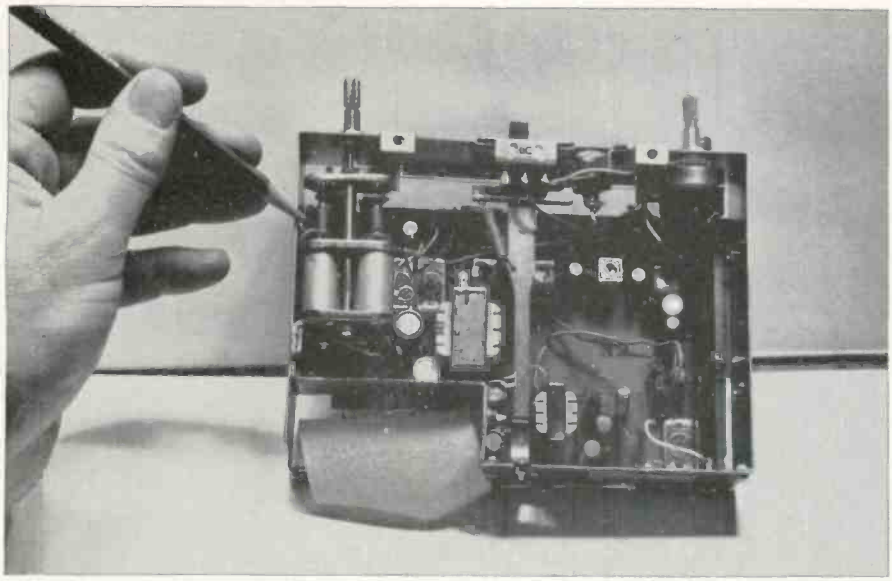
Weak 'Olds.' A Delco 7279515 model had very weak audio output. All stations tuned in up and down the dial but they were difficult to hear. We reasoned that the RF and IF stages were good, so we went directly to volume control.

The noise generator was connected to the volume control and the signal at the output was very weak. Tracing the signal to the output revealed a defective power transistor. It's collector-to-emitter resistance was 0.5Ω. A transistor tester showed that the component had a definite leakage of 3ma.

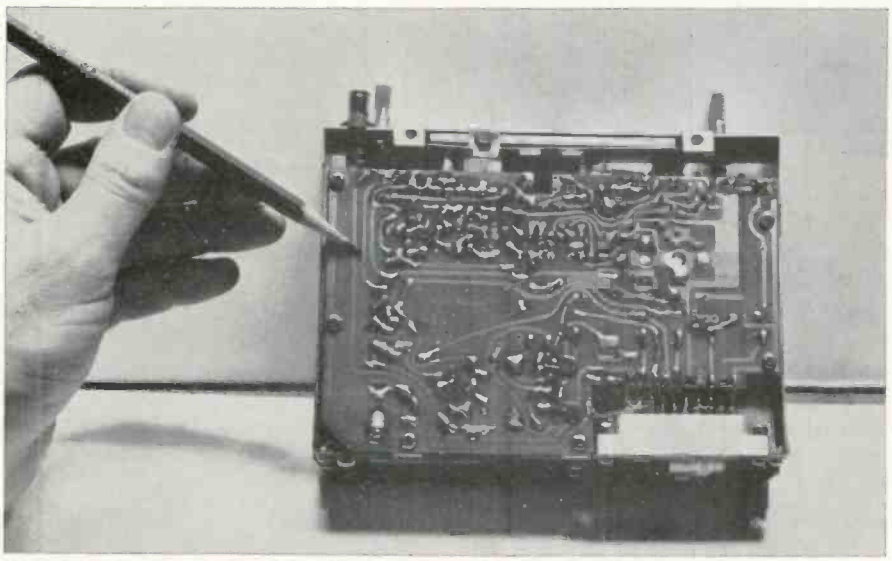
'Mid-day' Ford. The owner of a 5TMF Ford solid-state auto radio turned in a very unusual complaint. "The radio," he said, "could be switched on when I took the car to work and would begin operating about mid-morning or around lunch time. On cool summer days the radio would not begin operating until much later."

Sure thing, when we placed his radio on the bench, it was "dead." Our records show that dead auto radios are the easiest to repair, but what component in it would warm up and be OK after three or more hours under summer weather conditions?

A few important voltage checks were made but no clues showed up. Then each transistor was checked in-circuit and the 1st IF transistor



Poor selectivity and poor sensitivity can result from a cracked or broken RF tuning rod. Defects can often be seen.



Many intermittents are caused by defective etched boards. Boards warp and sag. Cracks are caused by heavy components — filter capacitors and transformers.

Chart I

1. Be sure the power on solid-state auto radios is switched off before doing in-circuit checking or repairs. The voltage may be low enough to eliminate shock hazards, but you may generate sparks and transients that cause damage to transistors.
2. When using an ohmmeter in transistor circuits be sure the voltage in series with the meter isn't too great to damage transistors.
3. When servicing solid-state auto radios, set the volume control to mid-range — otherwise the audio input transistors, when checked in-circuit, may appear to be shorted.
4. In FM auto radios it is possible to find transistors that will not oscillate at their designed frequencies. The beta of the new transistor should match that of the original transistor. Check this in a transistor specification manual.
5. When replacing power output transistors be sure and use silicone grease on the new one.

checked very weak. Most RF and IF transistors will show a high beta reading and should be checked on the high-beta meter scale of the tester. A new 2SA72 IF transistor was placed in the circuit. After four days of alternately "cooking" and "cooling," the set operated perfectly and was re-installed in the car.

Burned Output Transformer. A dead Motorola model CTA62 came into the shop. It had a "smelly" output transformer. You could see that the small transformer was practically burned to a crisp.

After checking with the local parts distributor and then with the Motorola distributor, it was determined that a replacement could not be obtained for about three weeks.

This kind of job always seems to come up when a customer plans to go on a trip the very next day. This customer planned to leave for a West-Coast vacation within 12 hours. Now we really had a problem.

We checked the radio's schematic and service date and learned that the output transformer was a simple center-tapped affair, wound with number 26 enameled wire. The total resistance was 6Ω (see Fig. 3).

What won't technicians do sometimes to keep a customer happy! The old winding was removed from the shell and steel laminations. We scramble-wound number 26 enameled wire over the coil form until it measured 3Ω on the VTVM. The coil form was twisted into a loop and another 3Ω of wire was wound on the coil form. Although the scramble-wound coil was slightly larger than the original, the assembly did go back together again. A flexible piece of wire was soldered to the center and taped up. Spaghetti insulation was slipped over each end of the coil leads and they were soldered directly to the output transistors.

Since the old transformer was badly burned, both output transistors were replaced. The radio operated like a charm. The customer, to this day, doesn't know that the old output transformer was "rebuilt," but he was happy to have a radio on his journey westward.

Some hints on repairing transistor auto radios are listed in Chart I. ■

AGC circuits are not as difficult as some "experts" have led us to believe.

UNDERSTANDING MODERN AGC CIRCUITS

Use your 'noodle' — diagnose — isolate — repair

Part Four of a Continuing Series

The third article of this series ended with a brief introduction to AGC trouble symptoms and troubleshooting techniques.

It was made clear that troubleshooting AGC circuits was not as difficult as some "experts" have led us to believe. It was admitted, however, that *apparent* AGC trouble symptoms could be caused by a defect in any one of a number of other curcuits, but it was also made clear that an external bias supply could, in most cases, be used to determine if the fault was in the AGC system or elsewhere. This technique may have to be varied somewhat in certain types of AGC systems, especially solid-state circuits, but it will not be necessary to alter the procedure radically.

The Over-all Viewpoint

Before we can begin to troubleshoot modern, keyed AGC circuits quickly and effectively, we must first establish and constantly maintain a special mental viewpoint based on the general nature of these circuits.

What is the "nature" of a keyed AGC circuit? The AGC circuit is part of a closed loop system that covers a considerable area and its efficiency depends on the proper operation of a number of other circuits —RF, IF, video detector, video amplifier and certain areas of the horizontal sweep circuit. Thus, the nature of keyed AGC circuits is characterized by interdependence.

The efficient operation of a keyed AGC circuit depends on the proper operation of the video detector and video amplifier circuits. And these two circuits cannot operate properly unless the IF section is up to par. But an efficient IF section depends on a properly operating AGC system! This may appear to be an enigma or a paradox or worse. But it is neither.

A keyed AGC circuit, for example, is somewhat comparable to a horizontal oscillator/discharge circuit that takes its B+ from a "boost" voltage source. The oscillator/discharge and boost circuits are *interdependent*. A component failure in either circuit can disable both circuits. And it is difficult to determine which is the *cause* and which is the *effect*.

The nature of these circuits, then, requires that we "see" the total area clearly and recognize that a symptom revealed by the CRT screen can be caused by a defective component in other circuits apart from the AGC circuit. We must be careful to avoid jumping to conclusions and "suspecting" any particular circuit. We must proceed in a logical, orderly manner to isolate the problem to a particular circuit. And once we have arrived at this stage, we then pin-point the defective component in that circuit by using the most effective test instruments available on the bench. If we do not proceed in this manner, however, we are almost certain to end up with a self inflicted, time-consuming "tough dog" on our hands. And, of course, as every skilled technician knows through experience, "tough dogs" belong only to the unskilled and the so-called experts who become too "cocky" at times.

With this over-all view firmly established in our minds, let's explore some common and not-too-common symptoms that point to possible trouble in keyed AGC circuits.

Symptoms and Troubleshooting Logic

In a generalized sense, most AGC trouble symptoms are caused by either too much or too little AGC voltage. And the records will probably indicate that most troubles are caused by *too little* or *no* AGC voltage. Additionally, both conditions have clearly defined symptoms which can be categorized.

Too much AGC voltage, for example, can cause a weak picture, a "snowy" picture or no picture and the sound can also be poor or completely absent. Too little or no AGC voltage can cause overloading (very dark picture elements), horizontal tearing, a negative picture, excessive audo buzz or even a complete picture loss. In this case a very strong signal can cut the tubes off and leave a "snow free" raster. Both the vertical and horizontal sync can also be adversely affected through compression.

The records will probably also

A magnifying glass with circular fluorescent bulb helps when checking or replacing an IC.

Working with ICs

Don't let these microminiature marvels scare you

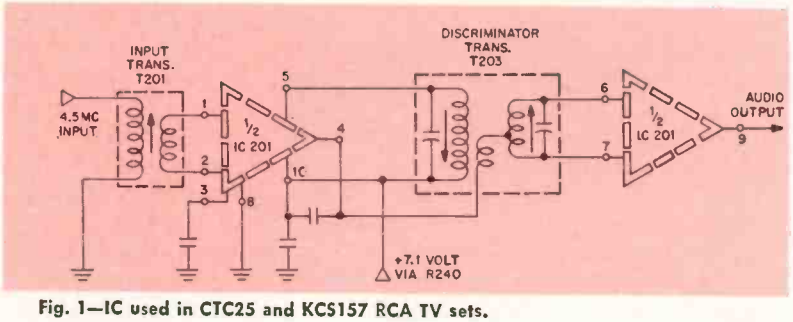


Fig. 1—IC used in CTC25 and KCS157 RCA TV sets.

■ Every alert service-dealer and technician knows by now that we live in the space-age. And the space-age is synonymous with integrated circuitry (IC).

A number of home-entertainment equipment manufacturers have already produced B/W and color TV receivers, radios and portable phonographs having ICs.

Two types of ICs are currently being manufactured — linear and digital. We are primarily concerned only with linear types. Linear-type ICs are designed to be used in audio, mixer, RF, video, phase detector and limiter circuits. More specifically, linear IC-types will be used in radio, Hi Fi stereo, other audio amplifiers and the audio sections of TV receivers.

One group of ICs consists of several layers of silicon material on a chip about the size of the end of a pencil. Transistors, capacitors and resistors form the internal IC. Most of the transistors in ICs are directly coupled—and transistors are frequently used in place of coupling capacitors. It is said that ICs were designed primarily for reliability and longer life.

TV Applications

The RCA IC201 is used in the CTC25 color chassis and in the 38-sq-in. B/W portable receivers—the transistorized KCS157 portables which use the 9WP4 CRT.

This small microelectronic package contains about a dozen resistors and two dozen transistors and diodes. It performs IF amplification, audio detection and low-level audio amplification. Conventional transistors are used for the external audio driver and push pull audio output. A schematic of the IC201 circuitry is shown in Fig. 1.

A 4.5MHz IF signal is taken from the emitter of the 1st video amplifier and applied to a selective tuned circuit, T201 — the IF input transformer. This signal is then processed by a series of transistor amplifier/limiters contained in the IC. At this point the discriminator transformer is inserted — the output of this transformer being fed back into the IC where detection takes place and the signal is amplified by a series of low-level audio amplifiers which deliver approximately 100 to 200mv of audio at the IC output.

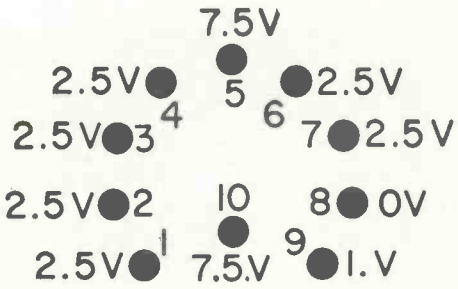


Fig. 2—Bottom view of IC201 showing terminal numbers and voltage measured under no-signal conditions.

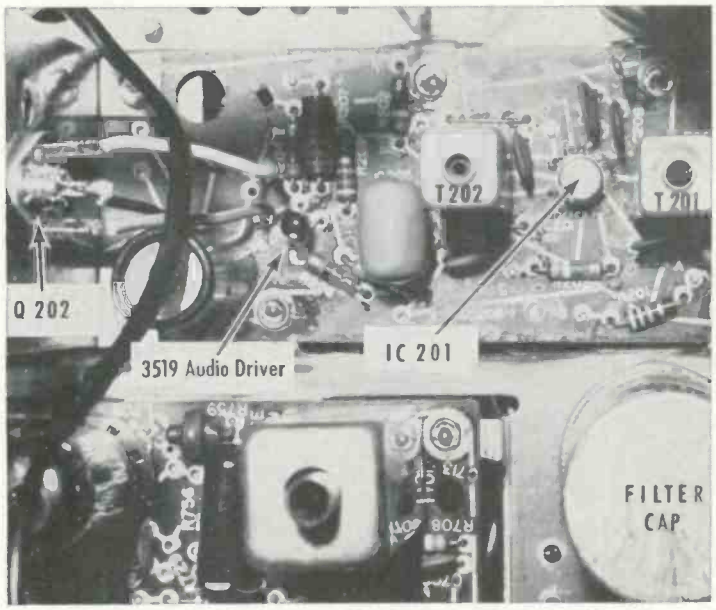


Fig. 3—Top view of the RCA IC201. The small IC package is placed between the two sound IF transformers.

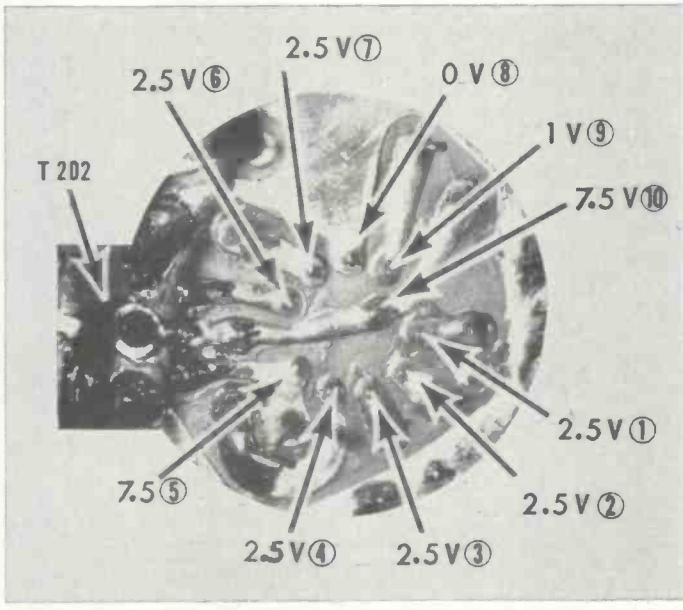


Fig. 4—Soldered-in bottom view of the IC201 showing voltage measurements under no-signal conditions.

Troubleshooting

Our approach to troubleshooting ICs is, of course, in no way different from that used in conventional circuitry. All we have to remember is to think of the entire IC as one component. If it breaks down—the entire IC will be replaced. The important point is, however, to know the circuit and what jobs it performs. This means knowing IC trouble-symptoms, too.

First, make certain the trouble is in the IC and not in external connecting components. In the RCA CTC25 chassis, for example, check the audio signal from the IC201 output (terminal 9) through the two following audio stages up to the speaker. If the audio section is working properly, a loud rushing sound will be heard when the volume control is fully clockwise. If there's only a hum, instead of a loud rushing noise, the trouble is probably in the IC or forward of it.

Inject a signal from a noise generator or a modulated 1kHz signal from a regular signal generator at terminal 9 of the IC. Turn the volume control all the way up. If the audio section is functioning properly, a loud 1kHz tone will come from the speaker.

If the audio stages are OK, then check the IC. Now remove the 3rd video IF tube (6JS6). When the tube is removed and the volume is turned full up, a fairly loud hum can be heard in the speaker.

Apply the signal or noise generator probe tip to terminals 1 and 7. A loud hissing tone will be heard if the IC is functioning properly. If you get a weak signal or no signal through the IC, it is probably defective. Another sure method is to apply a modulated 4.5MHz signal to terminal 1 and chassis ground. Leave the volume control full on and turn up the signal generator output so that the signal is heard in the speaker. If no signal is heard, proceed to terminal 5 and check for signal amplification at this point. In this case, if a modulated tone is heard in the speaker, we know the discriminator coil is working.

Voltage and Current Checks

To determine definitely if an IC is defective, a quick voltage

measurement can be made. Look at Fig. 2 for approximate voltages on various terminals of the IC201. The potential at terminals 5 and 10 is 7.5v. In the event one of these voltages is very low, we have a leaky IC or insufficient supply voltage. All meansurements are made with a VTVM under no-signal conditions. When making resistance checks on an IC, it is best to use a VTVM or a 20,000 ohm/v VOM to prevent possible damage to the IC.

Voltage checks can be made from the top of the chassis directly at the IC leads. This IC is soldered directly to the PC board. You will find that all ICs are generally "wedged" between components, and voltage measurements are sometimes difficult from the top of the PC board. The IC201 is mounted on the PW200 board as shown in Fig. 3. The bottom view of the PC connections to the IC201 in the color chassis is shown in Fig. 4. Note that terminal 10 is off center. It is easy to mistake this terminal for the common ground connection, as the etched wiring is tied to the mounting legs of T202. Actually, the etched wiring goes on through the transformer terminals to the driver emitter transistor components.

To determine if the IC has a short or is drawing too much current, insert a milliammeter in series with terminal 10. Since voltage is supplied by the etched wiring, take the point of a sharp knife blade and cut out a section of the etched wiring. This is a simple job and can be done by digging the blade under the etched wiring. Attach your VOM probes (with the VOM set on the 50ma scale) and then switch the receiver on. The correct current reading should be 10 to 12ma. If considerably higher, replace the IC component. Resolder a piece of bare tinned wire over the cut-out section before installing a new IC.

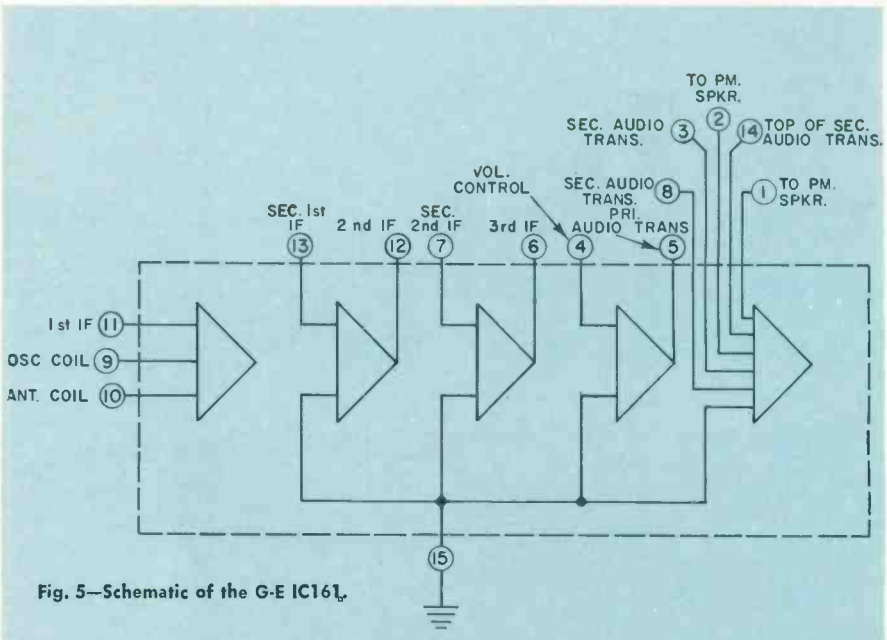


Fig. 5—Schematic of the G-E IC161.

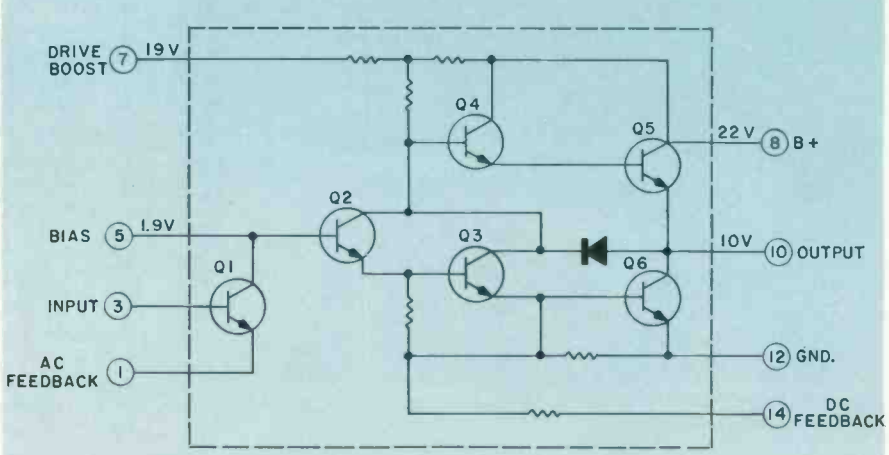


Fig. 6—Schematic of IC used in G-E portable phono.

Resistance measurements are not too valuable when checking out an IC. Voltage, current and signal checks are more positive and much faster. You should always check for poor solder joints and especially grounding points from the etched board to TV chassis. An in-circuit transistor tester can't be used to check out an IC circuit.

Various IC Types

G-E has produced an IC radio which operates from a 3.75v nickel-cadium battery. No external transistors are used in this small radio. The only external components are coils, transformers, speaker, capacitors and some resistors. A schematic of the flat, 14-lead IC (ICI61) is shown in Fig. 5.

By injecting a noise or tone-modulated signal at the various terminal connections, the signal can be traced to the speaker. Again, voltage and current measurements are important in locating the defective components. Minimum current drain is 8ma.

This same manufacturer is also using an IC amplifier in a portable phonograph. The small audio chip produces an audio power of lw and is said to have a maximum distortion of 5 percent. A schematic of this IC is shown in Fig. 6.

When troubleshooting this amplifier, connect a lkHz tone from an audio signal generator to the ungrounded side of the phono crystal cartridge. Proceed toward terminal 3 until the defective component is uncovered. A low signal can be heard in the speaker when the audio generator signal is connected to terminal 10. The B+ supply

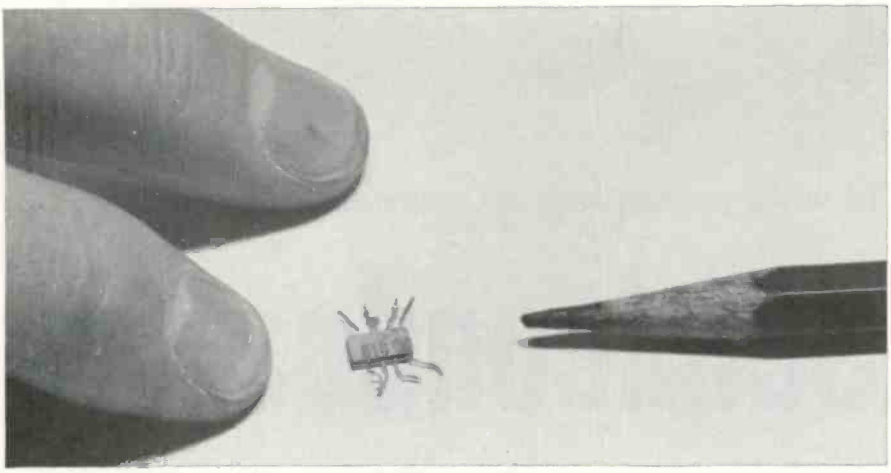


Fig.7—The Westinghouse WC183 compared to a pencil point.

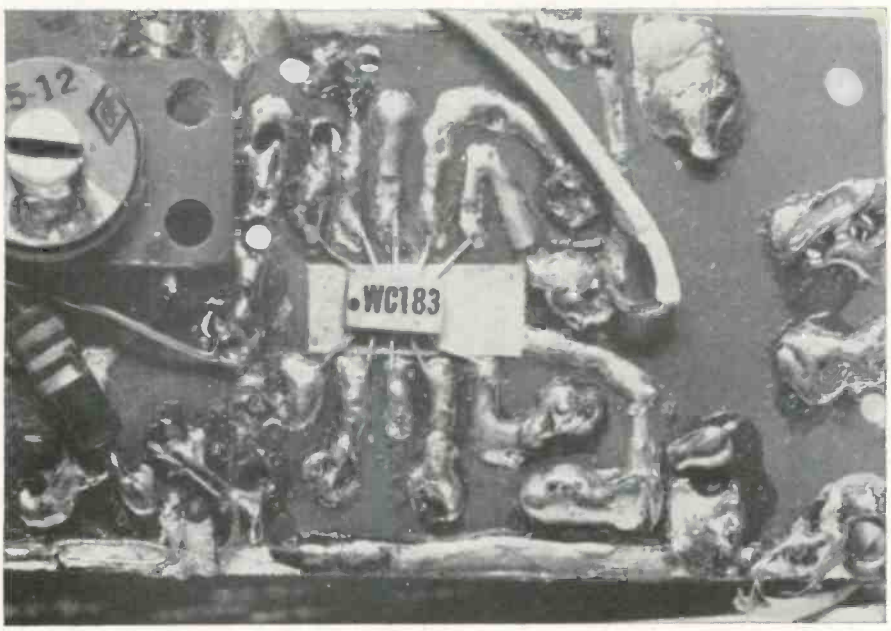


Fig. 8—The WC183 shown wired into an etched board.

Chart I
IC Dos and Don'ts

1. Do be careful not to apply too much heat with the soldering iron and use long-nose pliers as a heat sink.
2. Do be careful when making voltage checks on the terminal connections of an IC to avoid shorting two terminals.
3. Do use a small pencil soldering iron and magnifying light when working on an IC.
4. Don't unsolder or change any lead of an IC while the equipment ac switch is in the ON position.
5. Don't remove an IC until all other external components have been checked.
6. Don't forget to check all soldered terminals of an IC to determine if they are good or bad.
7. Don't forget to check all IC terminal voltages after soldering in a new unit.

of this unit is taken from a secondary winding on the phono motor field. Fullwave bridge rectification is used with a 25v filter network.

Voltage measurements on terminals 5, 7, 8 and 10 will quickly determine if the IC is defective. A milliammeter from the bridge rectifier to terminal 8 should read from 8 to 40ma.

An audio circuit by Westinghouse, WC183, is shown in Fig. 7. This unit is shown wired into a circuit in Fig. 8.

The flat 10-terminal unit is said to produce 100mw and have a reasonably flat frequency range from 50Hz to 20kHz.

A Case History

An RCA CTC25A chassis had no audio. Only a hum came from the speaker when the volume control was rotated up and down. From past experience we felt certain that the final output stages were working properly. But a signal from a noise generator was applied to the base of the driver transistor, 3519, to make sure. We got a loud signal from the speaker with the volume control wide open. The two final audio stages were good.

A voltage check was now made on terminal 10 of the IC. Instead of 7.5v, the VTVM measured only 0.5v. A milliammeter inserted in series with terminal 10 and the supply voltage read 52ma. We suspected the IC had a high internal leakage.

The IC unit was removed and a new one soldered in and voltage checks were made. All voltages were normal and the audio section worked normal also.

Replacing an IC201 requires skill and patience. When removing one, use a soldering iron with a solder suction bulb to take up the solder from the 10 connections. A good magnifying light comes in handy when working with IC circuits.

Although ICs are relatively new, skilled technicians can troubleshoot and repair these circuits with proper test instruments and tools.

A few "dos" and "don'ts" for servicing IC circuits appear in Chart I. ■

The Twelfth Article in a Continuing Series

Fig. 1—The integrated circuit currently used in many TV sets is so small it can be placed on the end of a pencil.

TV service is easier when you understand integrated circuits

Semiconductors

■ A line of TV sets currently on the market uses an integrated circuit, IC201, in the sound IF and audio circuits. The silicon chip upon which this circuit is grown measures less than 0.05in. and, when in its case, the IC201 is not much larger than the end of a pencil (Fig. 1).

The manufacturer's schematic of the integrated circuit is shown in Fig. 2, while a schematic of how the integrated circuit is incorporated in a TV set is shown in Fig. 3.

These two schematics are combined and converted to a more conventional form in Fig. 4. The general layout of the integrated circuit's sub components in this diagram is nearly the same as that shown in Fig. 2. The only modification, for the sake of simplicity, is in the change in layout of the sub components connected to terminals 6 and 7.

The dc voltages indicated at the terminals of the integrated circuit (Fig. 4) are within ±15 percent of the VTVM voltages that can be read when the TV set is functioning properly. If the voltage at terminal 10 is not within the indicated range, the fault probably lies in the B+ supply. An improper bias voltage at terminal 1 might be caused by an open secondary winding of the input transformer (T201), while an abnormal reading at terminal 5, 6 or 7 may be caused by a defective discriminator transformer (T203).

When checking a TV set that

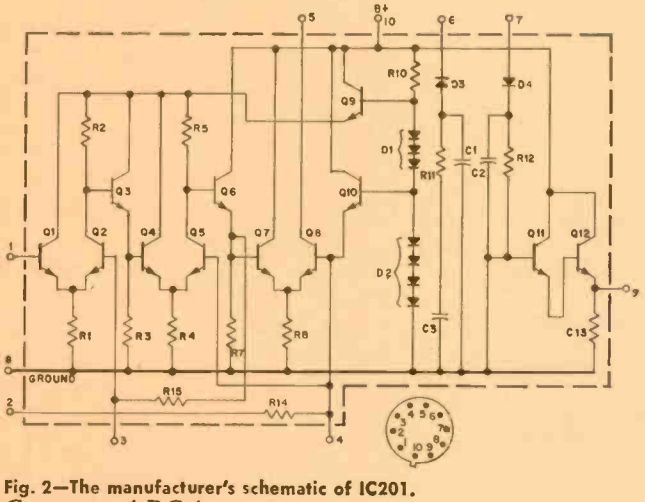


Fig. 2—The manufacturer's schematic of IC201. *Courtesy of RCA.*

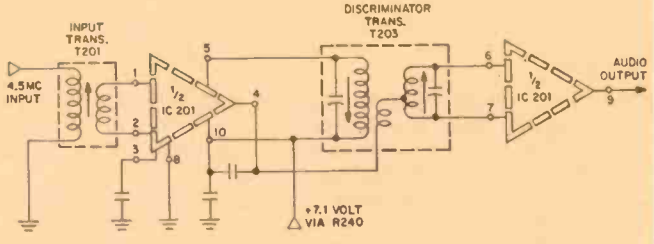
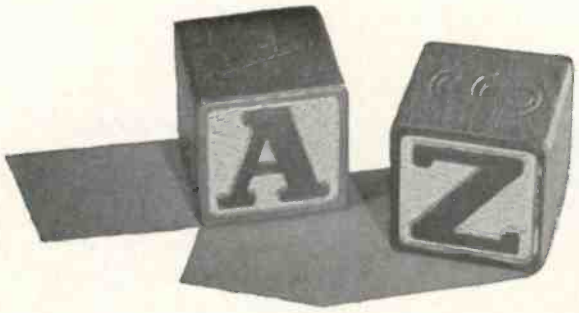


Fig. 3—The manufacturer's schematic of how IC201 is incorporated in a TV receiver's sound IF and audio circuits. Courtesy of RCA.



from A to Z

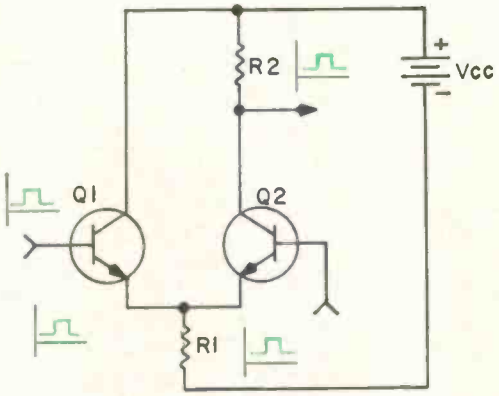


Fig. 5—The first two transistors are shown apart from the total integrated circuit to simplify functional descriptions.

has no audio, the integrated circuit is the component that should be least suspected. To service a TV set containing an integrated circuit, however, technicians should understand how the circuit functions.

Differential Amplifiers

The bases of the two transistors (Q1 and Q2), in the first two stages (Fig. 5) of the integrated circuit, have been forward biased to produce emitter currents in both transistors. This bias circuitry is not shown since it will be described later. (A similar unbalanced differential amplifier circuit was described and shown in Fig. 9 of the April 1967 article.)

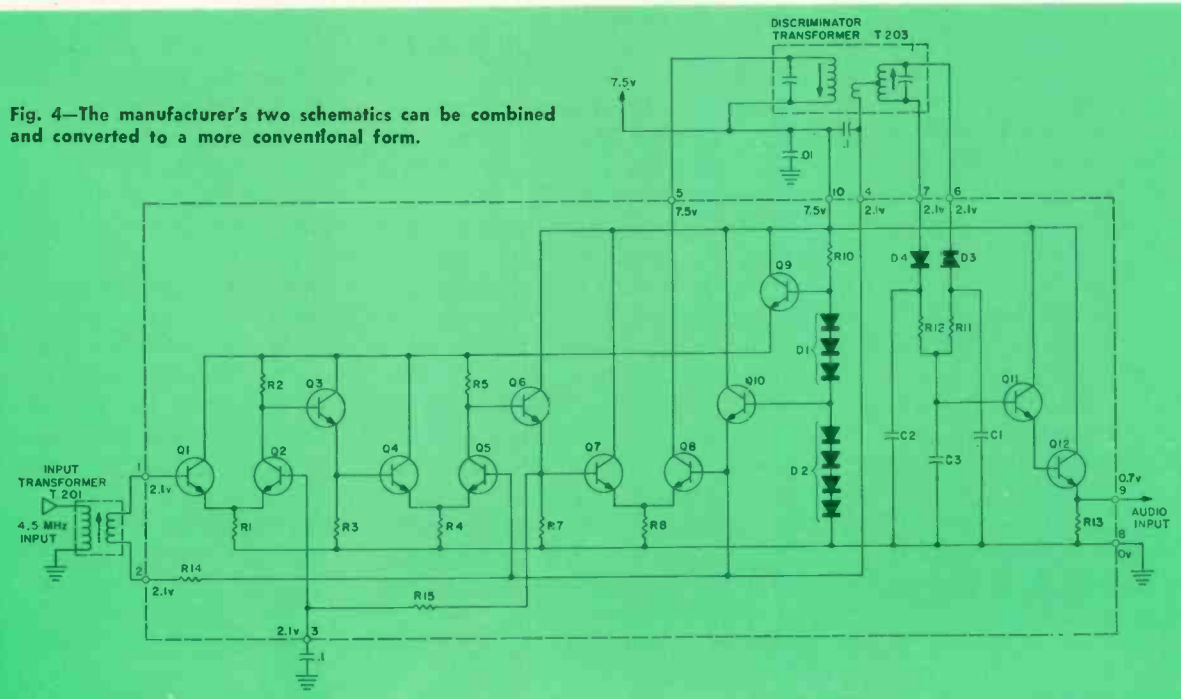
A positive signal applied to the base of transistor Q1 (Fig. 5) will cause it to conduct more collector-to-emitter current. This will result in a greater voltage drop across the common emitter resistor (R1). The emitters of both transistors will, therefore, become more positive with respect to ground.

The base of transistor Q2 is biased at a relatively constant potential above ground. As the transistor's emitter becomes more positive with respect to ground, its base becomes less positive with respect to the emitter. The effective reduction in the second transistor's base bias reduces its collector-to-emitter current. This, in turn, reduces the voltage drop across resistor R2, and the collector of transistor Q2 becomes more positive.

The April 1967 article also explained that in a differential amplifier circuit, such as this, the collector-to-emitter signal current in the second transistor (Q2) must be smaller than the collector-to-emitter signal current in the first transistor (Q1). The circuit still experiences a gain, however, since the entire collector-to-emitter signal current in the first transistor (Q1) alters the voltage drop only across resistor R1 while the collector-to-emitter signal current in transistor Q2 alters the voltage drop across both resistor R1 and resistor R2. A voltage gain, rather than a current gain, is experienced in the circuit.

The first two amplifier stages (Fig. 5) are shown as a part of the

Fig. 4—The manufacturer's two schematics can be combined and converted to a more conventional form.



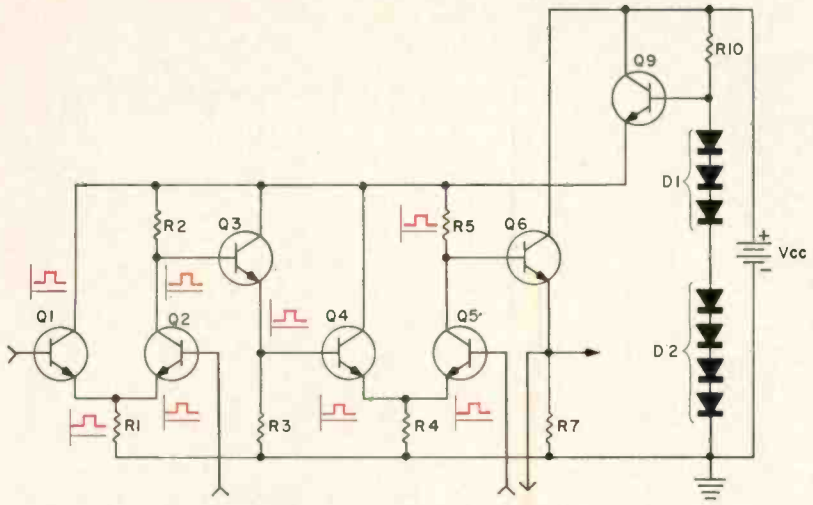


Fig. 6—The first six amplifier stages in the integrated circuit.

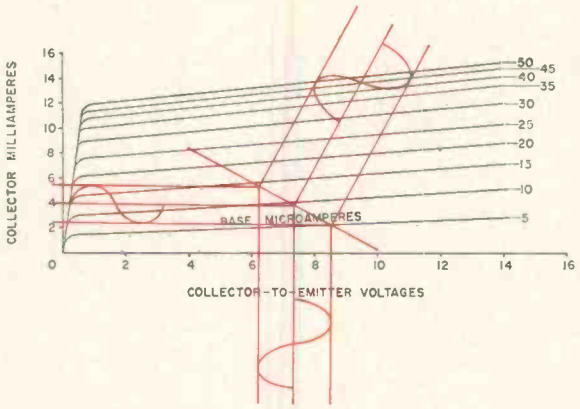


Fig. 7—Load line of a typical transistor circuit.

circuit in Fig. 6. A positive signal applied to the base of transistor Q1 results in a voltage-amplified, positive signal across resistor R2, increasing the base forward bias of transistor Q3.

As the emitter current of transistor Q3 increases, a greater voltage drop is developed across resistor R3, and the signal is amplified further.

The positive signal across resistor R3 is applied to the base of transistor Q4. Transistors Q4 and Q5 then function in the same manner as the transistors shown in Fig. 5. A positive signal applied to the base of transistor Q1, therefore, results in an amplified positive signal across resistor R5.

When the collector-to-emitter current in transistors Q2 and Q5 decreases, a corresponding increase occurs in the collector-to-emitter current through transistors Q1, Q3 and Q4. Conversely, this current through transistors Q2 and Q5 increases when it decreases through the other transistors.

As previously indicated, the collector-to-emitter signal current through transistor Q1 is greater than that through transistor Q2. This situation is also true for transistors Q4 and Q5.

When a positive signal is applied to the base of transistor Q1, its increase in collector-to-emitter current is greater than the corresponding decrease in current through transistor Q2. At the same time, there is an increased current flow through transistor Q3. The increase in current flow through transistor Q4 is also greater than the decrease in current though transistor Q5. The transistors that experience the greatest collector current when the base of transistor Q1 is positive, experience the least current when this signal is negative.

As a positive or negative signal is applied to the base of transistor Q1, the total amount of collector current conducted by transistors Q1 through Q5 increases or decreases as though these transistors were but a single component.

As indicated in the April 1967 article, IC resistors cost more to produce than transistors since they require a larger area on the chip. The cost of producing resistors R1 through R4 can be reduced if their values can be kept to a minimum.

Voltage-Regulating Transistor

Transistor load line characteristics were discussed in the October 1966 article in this series. It was indicated that the voltage supplied to a transistor circuit is equal to the voltage drop across the load resistor plus the transistor's collector-to-emitter voltage. The load line of a typical transistor is shown here in Fig. 7. By reducing the load resistance from 750Ω to 500Ω, the cost of manufacturing it in an integrated circuit is also reduced. This change (Fig. 8), however, has increased the transistor's collector-to-emitter voltage drop across the load resistor. The transistor is now consuming more power ($P = I_C V_{CE}$), and producing more destructive heat, to provide nearly the same amount of amplification as before.

A reduction in the amount of voltage supplied to the transistor circuit (Fig. 9) reduces only slightly the voltage across the load resistor and appears almost entirely as a reduction in collector-to-emitter voltage. The signal voltage remains virtually the same while the transistor's power consumption has been reduced.

The economy resulting from a lower supply voltage and load resistance can be applied to the amplifier stages shown in Fig. 6. A lower supply voltage is not applicable to later amplifier stages since the signal voltage is then greater.

A resistor (R6) connected in series (Fig. 10) with the collectors of transistors Q1 through Q5 cannot reduce the voltage applied to that portion of the circuit. The value of that resistor is now a portion of the total load resistance, with the voltage supplied remaining the same. As indicated pre-

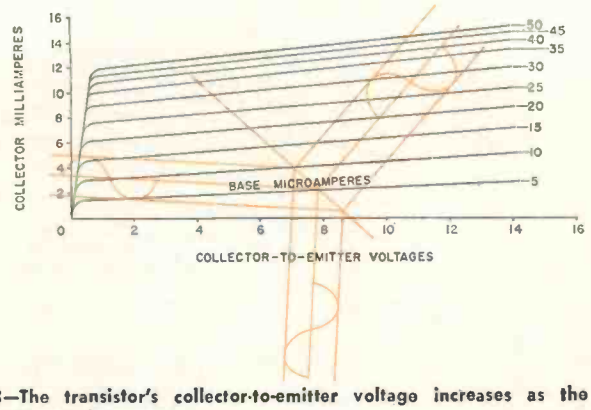


Fig. 8—The transistor's collector-to-emitter voltage increases as the load resistance decreases.

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.

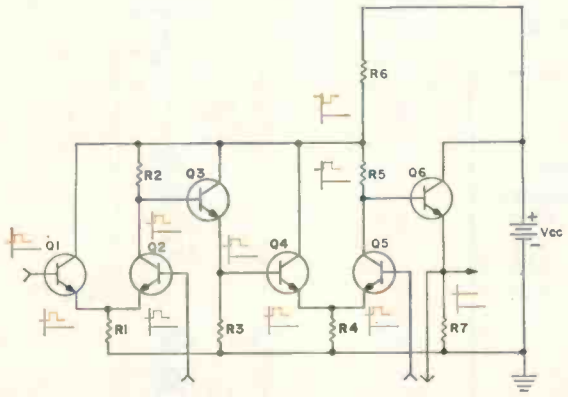
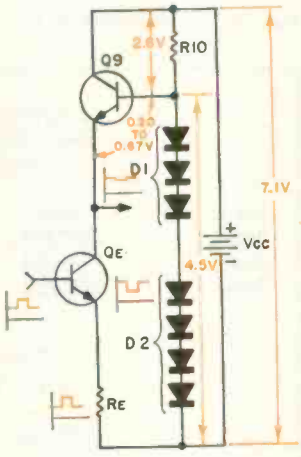


Fig. 10—A resistor connected in series with the first five amplifier stages will increase their total load resistance rather than reduce the supply voltage.

Fig. 11—The diodes are used as part of a voltage divider and compensate for temperature changes in the integrated circuit. Transistor Q_E and resistor R_E represent the effective equivalent of transistors Q1 through Q5 and their related load resistors.



viously, when a signal is applied to the base of transistor Q1, the total amount of collector current conducted by transistors Q1 through Q5 increases or decreases as though these transistors were but a single transistor.

A positive pulse applied to the base of transistor Q1 would result in an increased voltage drop across resistor R6. As previously indicated too, the positive pulse applied to transistor Q1 also results in a reduced voltage drop across resistor R5. Depending on the values of resistors R5 and R6, the increase in voltage across one resistor may equal the decrease across the other, and the signal to be applied to the base of transistor Q6 could be neutralized.

Transistor Q9 can be used (Fig. 4) to reduce the voltage applied to transistors Q1 through Q5. Since resistor R10 and diodes D1 and D2 are also required for biasing the base of transistor Q10, the cost of using transistor Q9 to provide a lower supply voltage is less than the cost of providing transistors Q1 through Q5 with larger load resistors. Transistor Q9 not only reduces the cost of the integrated circuit but, as we will see, increases the stability of the circuit.

The base of the voltage-regulating transistor (Q9) is biased in the same manner as the current limiting transistor (Q3) in the CA3005 balanced differential amplifier circuit. This circuit is shown in Fig. 6 in the May 1967 article. The two groups of diodes (D1 and D2) in the IC201 circuit are used to regulate the base current of transistor Q9 in the same manner as the two diodes (D1 and D2) in the CA3004 circuit. These diodes cost less to "grow" than resistors and compensate for the changes in the characteristics of transistor Q9 with changes in temperature.

The varying relationship between the base bias current and the base-to-emitter voltage of a typical transistor was shown in Fig. 8 on page 104 of the October 1966 article.

As indicated in the present article, however, the diodes shown in Fig. 11 compensate for this varying relationship and we can assume that the 25°C curve will apply for all temperatures. From this curve we can see as the base-to-emitter voltage increases from 0.2 to 0.67v, the base current increases from 0 to 50μa.

A drop of about 4.5v is developed across diodes D1 and D2. Since 7.1v is supplied the circuit, a 2.6v drop in potential must occur across resistor R10 [$V_{CC} - V_{(D1 + D2)} = V_{R10}$].

The collector-to-emitter voltage (V_{CE}) of transistor Q9 is the sum of its collector-to-base voltage (V_{CB}) and its emitter-to-base voltage (V_{EB}). ($V_{CE} = V_{CB} + V_{EB}$.) The voltage drop across resistor R10 determines the col-

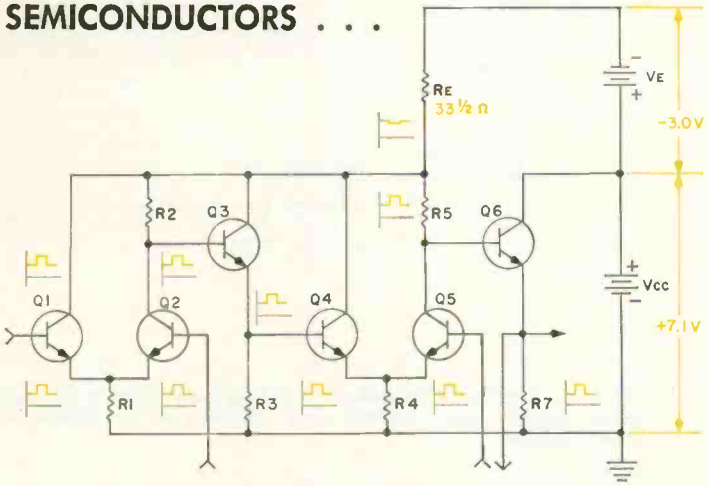


Fig. 14—The equivalent to a voltage-regulating transistor is substituted for transistor Q9.

Factory Sales of Integrated Circuits During First Two Months of 1966 and 1967

	First Two Months 1966			First Two Months 1967		
Circuit Type	Units	Dollars	Average Value	Units	Dollars	Average Value
Digital	2,847,000	14,914,000	5.24	6,297,000	22,059,000	3.50
Analog	179,000	3,615,000	20.20	857,000	7,782,000	9.08
Total	3,025,000	18,529,000	6.13	7,154,000	29,841,000	4.17

Percent of Increase or Decrease First Two Months 1966 and 1967

Circuit Type	Units	Dollars	Average Value
Digital	121.2	47.9	33.2
Analog	378.8	115.3	55.0
Total	136.5	61.1	32.0

lector-to-base voltage of transistor Q9 (V_{CE} = 2.6v). This collector-to-base voltage is shown on the characteristic curve (Fig. 12) of a typical transistor as a dot-dashed line representing part of the total collector-to-emitter voltage.

As previously indicated, when the emitter-to-base voltage of a typical transistor increases from 0.2 to 0.67v, the base current increases from 0 to 50μa. (The description of Fig. 6 in the September 1966 article of this series explained the composition of the base current. In good transistors this current is virtually the current from the emitter to the base.) This data, obtained from Fig. 8 of the October 1966 article, can be applied to the typical transistor characteristic curve (Fig. 12). There the collector-to-base voltage (V_{CB}) is shown as a dot-dashed line. (This line is used merely as a reference and does not indicate any corresponding base or collector current.) By adding the emitter-to-base voltage (V_{EB}), to the collector-to-base voltage (V_{CB}), we can show the total collector-to-emitter voltage (V_{CE}). This total voltage is plotted against corresponding base currents.

Transistor Q_E and resistor R_E represent (Fig. 11) the effective equivalent of transistors Q1 through Q5 and their related resistors. Just as the total current conducted by these amplifier stages increases as a positive pulse is applied to the base of transistor Q1, the current conducted by transistor Q_E increases as a positive signal is applied to its base. We have substituted a single transistor and resistor for these stages of amplification merely to simplify the explanation of the function of transistor Q9 in the circuit.

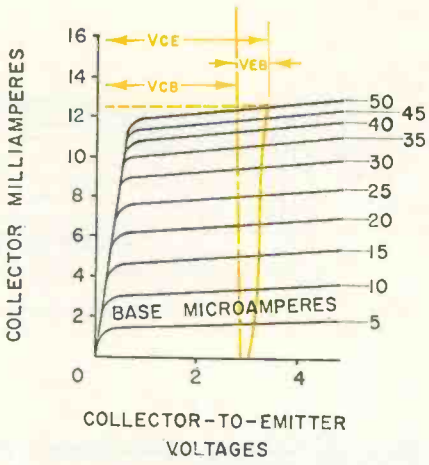


Fig. 12—Collector-to-base and emitter-to-base voltages are shown on a transistor's characteristic curve.

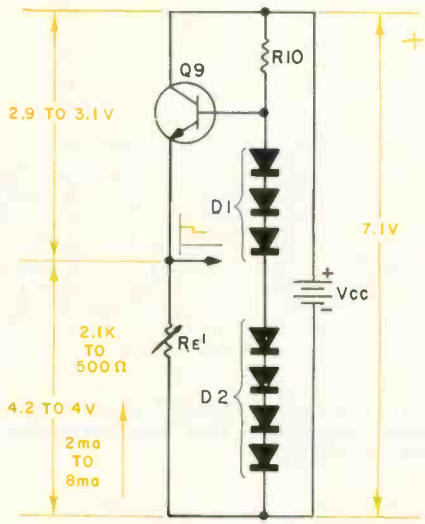


Fig. 13—A variable resistor demonstrates the function of a voltage-regulating transistor.

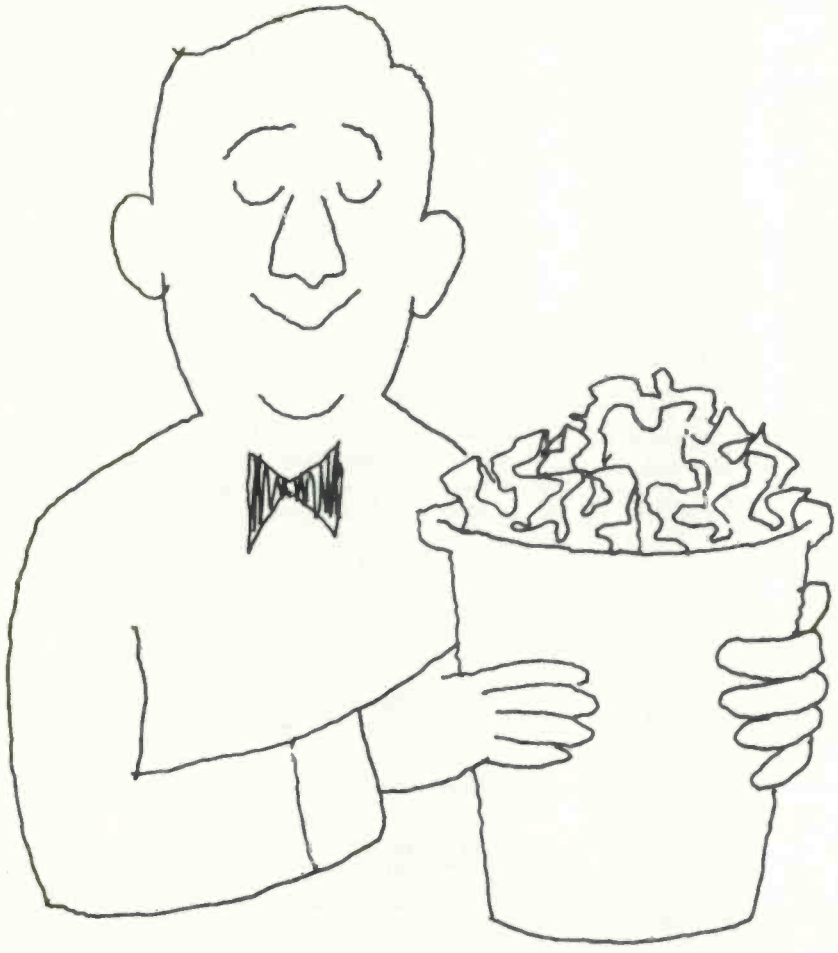
As a positive signal is applied to the base of transistor Q_E, there is a reduction in its collector-to-emitter voltage, and the transistor (Q_E) conducts more current. This results in a greater voltage drop across the emitter resistor (R_E) and a greater voltage drop between the emitter and base of transistor Q9.

Since transistors Q_E and Q9 are connected in series, the collector current of transistor Q_E is virtually the collector current of transistor Q9.

If we knew that resistor R_E had a value of 375Ω, the collector current of transistor Q_E varied from 2 to 8ma, and Fig. 12 represented the characteristic curves of transistor Q9, we could calculate the range of voltage in this portion of the circuit.

From Fig. 12 we see that the collector-to-emitter voltage of tran-

continued on page 69



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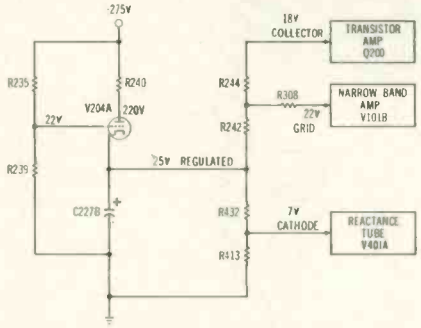
COLORFAX

Voltage Regulator and Diode Protection in Westinghouse V2655 Color Chassis

Triode tube, V204, acts as a series voltage regulator to develop a stable 25v source which is applied to the collector of the video amplifier transistor, Q200, the narrow band amplifier grid, V101B and the horizontal reactance control cathode, V401A. The low voltage regulator is shown in the simplified schematic.

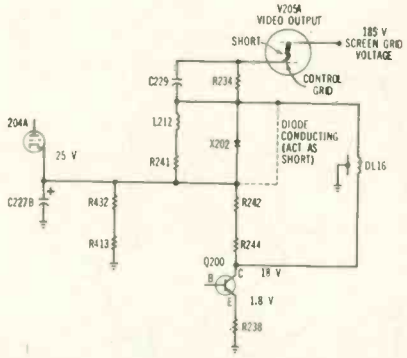
Although the circuit somewhat resembles a cathode-follower arrangement, its action is entirely different since no input or output signal is associated with tube action. Its only purpose is to provide a dc reference voltage that remains at a stable value



despite changes in the amount of current flowing through transistor amplifier Q200. (Q200 is the first video amplifier whose output will vary with changes in signal levels.)

Regulation takes place as follows: The grid potential is fixed at 22v by the voltage divider network R235 and R239 which are connected between ground and the 275v supply. The cathode voltage tends to follow the grid voltages and will be approximately 25v. Also, since the cathode represents a low impedance to ac, its dc output will remain nearly constant at 25v. Any sudden ac changes which try to vary the cathode voltage will be filtered out by electrolytic capacitor, C227B. The current flowing through transistor Q200 and load resistor R244 vary with signal level changes. But these variations do not appear in the cathode circuit of the tube, V204A. The result is a regulated source voltage driving the transistor.

Diode X202 is used as a protective device for transistor Q200. Under normal conditions, the diode is reverse biased and will not conduct. The schematic shown here indicates 25v ap-



plied to its cathode and 18v to its anode. Anode voltage is taken from the collector of transistor Q200 and fed through the delay line, DL16.

If either a momentary or permanent short occurs from the control grid to screen grid of the video output tube, V205A, the 185v screen voltage causes diode X202 to be forward biased by 185v at the cathode side of the diode. The diode conducts, but acts as a short circuit with negligible voltage drop across it. Thus, a potential of approximately 25v is maintained at either end of the diode to prevent HV damage to Q200.

Actually, for dc purposes, the diode X202 is not really necessary, but is essential for ac reasons, particularly for control of the initial surge created when the grid short first occurs in the tube, V205A. If a short occurs, the grid immediately goes from 0 to 185v. The resultant spike charges capacitors C227B and C229 with the voltage divided proportionally between them in relation to their individual capacities. Without the short circuit action of the diode, these capacitor charging currents would produce a voltage spike across R241. The spike would be immediately coupled to the transistor Q200 through the delay line, DL16 and the destruction of the transistor would result. With the diode in the circuit, however, it effectively "short circuits the spike" and protects the transistor.

Magnavox Adapter Plugs and Cables for Color Servicing

All current color TV chassis (T911-

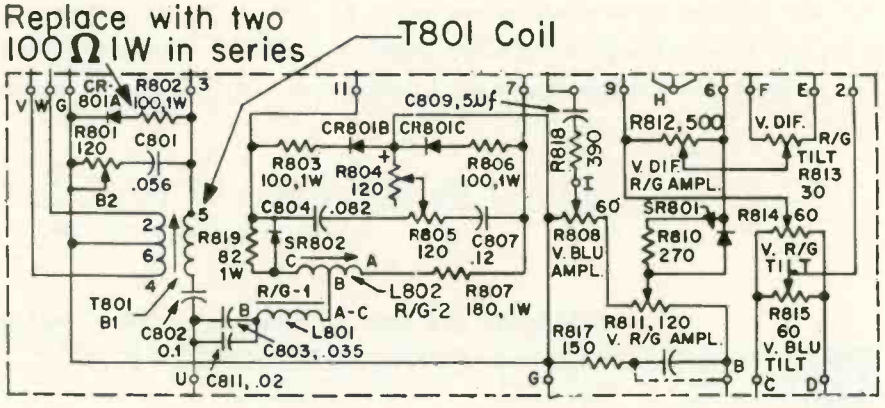
Misconvergence of Olympic CTC-19,-20,-21 Chassis

Severe misconvergence of the blue field or blue convergence out of tolerance by ¼ to ½ in. has been reported.

When this happens, check R802, a 100Ω, 1w resistor located alongside the selenium rectifier on the convergence board. It may have changed value because of excessive current flow before horizontal convergence coil T801 is properly adjusted. (Under normal circumstances, the iron core in T801 should be about ¼ to 5/16in. from top of coil form.)

If the resistor R802 is discolored or burned, it must be replaced by two 100Ω 1w resistors connected in series.

If difficult side convergence is encountered, check for excessive tape (more than one layer) under convergence yoke which was placed there for shipping purposes. It will help improve blue convergence, particularly at the raster sides if excess tape is removed from the CRT neck.



07, T918-09, T919-10, T920-08 and later versions) use a universal power cable. In non-remote models a jumper plug assembly (part #170796-1) is used to terminate this cable. In remote control models this cable plugs into the remote chassis, but if the TV chassis is removed to the shop for service without the remote chassis the jumper plug will be required to operate the TV chassis. Also if the remote receiver should be removed to the shop for repair, this jumper plug can be used to permit normal operation of the TV receiver by the customer. A 170796-1 plug assembly is now included.

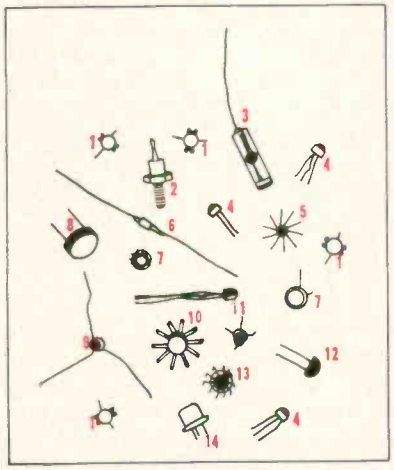
On stereo theatre models this same jumper plug can be used to operate the TV chassis on the service bench. When the TV chassis is removed for service you can keep the radio and phono portions of the unit operating for the customer by using the special ac line cord (part #170786-1) to connect between the remote and outlet.

On non-remote stereo theatre models a relay and cable assembly (part #704038-1) is used between the TV chassis power cable and the radio chassis. If the TV chassis is removed for service on these models the special ac line cord (170786-1) should be plugged into the relay assembly to allow the radio and phono to be operated in the normal manner.

The 704038-1 relay assembly can be a handy service accessory if a remote chassis is removed from a stereo theatre model for service in the shop. By temporarily installing this assembly the customer can have full use of TV, radio and phono while the remote chassis is being repaired.

Our Cover

The semiconductors appearing on our cover this month are shown here in outline and with numbers



to identify each component. Included are the following:

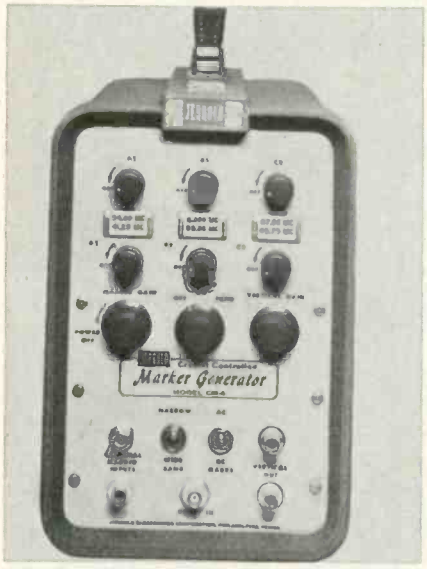
1. Four Bendix B500 plastic encapsulated 25w silicon power transistors.
2. IR 1N1341 silicon diode.
3. RCA 7412 photo resistor.
4. Three Siliconix epoxy-encapsulated field-effect transistors.
5. Texas Instrument's 2N929 0.6w low level, silicon transistor.
6. Sylvania 1N38B germanium diode.
7. Two Fairchild μA702 linear-amplifier integrated circuits.
8. Polaris Electric LRD-C1 photo resistor.
9. Olson TR32 photo transistor.
10. RCA 2N3553 7w silicon RF transistor.
11. Two Crystaionics FF102 Photofet transistors.
12. Fairchild μA703 integrated circuit described last month in the article "Semiconductors from A to Z."
13. RCA R3502 (IC201) integrated circuit described this month in two different articles.
14. G-E 2N167 germanium transistor.

NEW PRODUCTS

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

Marker Generator 700

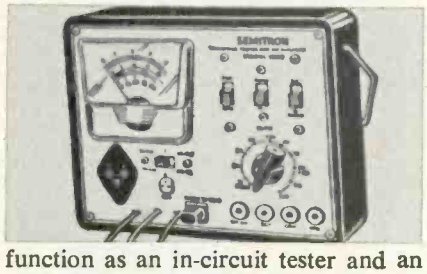
Announced is a marker generator designed to superimpose well-defined, crystal-controlled ac or dc marks on an oscilloscope display of response curves. This instrument can reportedly



be programed to provide any desired fundamental frequency between 2 and 100MHz. The manufacturer indicates that proper choice and proper mixing will provide harmonic and sideband markings across a wide band width. Jerrold.

Transistor Tester 701

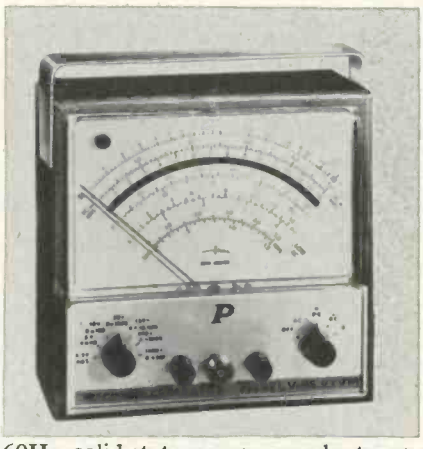
Announced is an instrument designed to be used as a transistor and diode tester, wattmeter, ammeter and signal generator. It will reportedly also



function as an in-circuit tester and an ac and dc beta tester. The manufacturer indicates that the instrument can be used to determine whether a transistor is a PNP or NPN type. Price $34.95. Semitronics.

VTVM 702

A VTVM is announced that reportedly incorporates a 117v 50 to



60Hz solid-state power supply to replace the batteries normally required in a VTVM's ohmmeter section. The manufacturer indicates that the instrument also includes a 7in. meter with mirrored scales to eliminate parallax, a single probe and a transit switch position for meter movement protection. The instrument is also designed to provide electronic protection against burnout. Specifications indicate that the dc scales are ±0 to 0.5v, 1.5v, 5v, 15v, 50v, 500v and 1.5kv while the ac RMS scales are 0 to 1.5v, 5v, 15v, 50v, 150v, 500v and 1.5kv and ac p-p scales are 0 to 4v, 14v, 40v, 140v, 1.4kv and 4.0kv. The instrument reportedly has a frequency response of ±1db from 40Hz to 3MHz across a 600Ω source on the 5v range. The VTVM has a rated accuracy of ±5% full ac scale and ±3% full dc scale. The instrument weighs 4½ lb and is housed in a walnut-grained vinyl-covered steel case. Size 7⅛ by 7¼ by 3⅝in. Price $79.95. Precision.

RF Signal Generator 703

Announced is an RF signal generator designed to cover 100 to 370kHz on Band A, 370 to 1400kHz on Band B, 1.4 to 5.1MHz on Band C 5.1 to 16MHz on Band D and 16 to 54MHz

on Band E. Specifications indicate that over these frequencies the instrument has an accuracy of ±0.5% and is usable to ±0.1% with a built-in 100kHz/1MHz crystal calibrator. A switchable meter reportedly shows RF carrier or modulation levels, while an individually shielded six-switch attenuator is designed for 21 levels to −96db. The manufacturer indicates that the instrument has a floating-type chassis-isolated oscillator and has tunable LC on every band for increased tracking capability. The instrument will reportedly operate on 110 to 130v, 50 to 60Hz. Kit price $95. Allied.

FET Volt/Ohm Meter 704

A field-effect transistor volt/ohm meter is announced that reportedly measures dc voltages from 0.1v full scale to kv full scale in nine increments and ac voltages from 0.01v full scale to 300v full scale in 10 steps.

When used as an ohmmeter, its resistance ranges are reportedly from 10 Ω center scale to 10M center scale. According to the manufacturer, the input resistance of the instrument as a voltmeter is 11M on all dc ranges; and when used as an ac voltmeter its input impedance from 10mv to 1v is 10M shunted by a 31pf capacitor, and from 3v to 300v its impedance is 10M shunted by a 30pf capacitor. Specifications indicate that the instrument has an accuracy within ±2% full scale when measuring dc voltages and within ±3% full scale when measuring ac voltages and resistances. Power reportedly is supplied by two 1.4v mercury cells and eight 1.5v AA zinc/carbon cells capable of lasting their shelf life when used under normal eight-hour-per-day working conditions. Specifications indicate that the instrument uses a single probe for both ac

and dc measurements. Size 9¼ by 6⅜ by 5¾ in. Price $99.95. Amphenol.

CRT Tester 705

A CRT rejuvenator and tester is announced which reportedly incorporates continuously variable voltages for all CRT elements to safeguard against obsolescence of the test instrument. Specifications indicate that

this includes continuously variable metered heater voltage from 0 to 13v, G1 voltage from 0 to 100v and G2 voltage from 25 to 300v. CRT checks reportedly include leakage, shorts, open circuits, emission and useful-life checks of cathode emissive coatings. The manufacturer indicates that the instrument can be used to repair correctable conditions including removal of interelement shorts and leakage, and restoration of emission and brightness. The Tester is completely self-contained. Size 10½ by 11½ by 4½ in. Weight 4 lb. Operates on 117v 60Hz. Price $89.95. B&K.

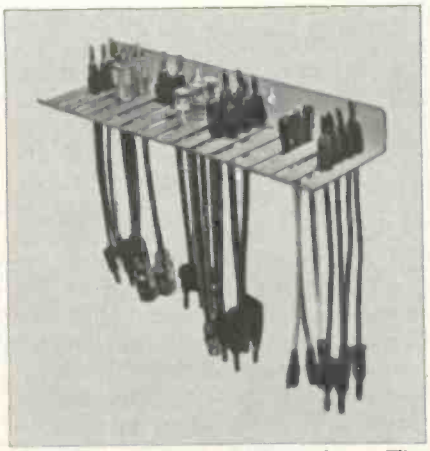
Digital Voltmeter 706

Announced is a digital voltmeter that features automatic range selection and a display storage system. Specifications indicate that the in-

strument contains integrated circuits and an overload indicator is used to prevent erroneous readings. It measures 3¼ x 8¾ x 10in. Price $495. Electrolab.

Test Lead Holder 707

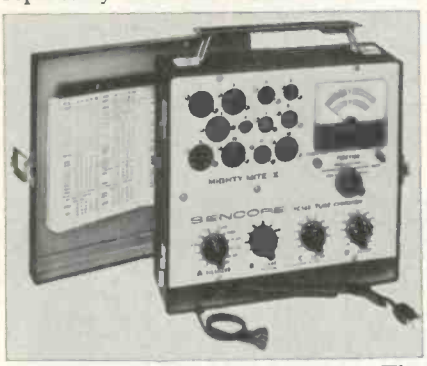
A test lead rack designed to store patch cords and cable assemblies used in electronic testing is announced. The rack is designed to accept cables up to 0.450in. which includes RG213/U, RG214/U and other coaxial cables. Mounting holes are provided for in-



stallation on a vertical surface. The manufacturer indicates that the holder is fabricated from cold rolled steel and has a baked enamel finish. Net Price $2.95. Pomona.

Tube Tester 708

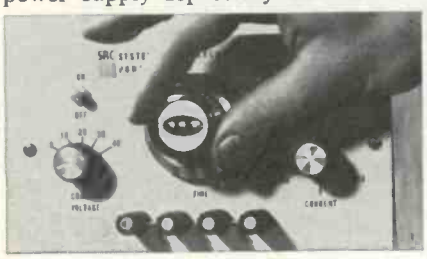
A tube tester is announced that is designed to make full emission, grid-leakage and short tests. Each tube is reportedly checked under full rated



load to find borderline types. The instrument features a horizontal in-line switch arrangement and reportedly has a 0.5μa grid-current sensitivity. Price $74.50. Sencore.

Power Supply 709

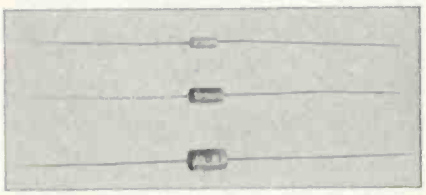
A solid-state power supply containing constant voltage and constant current modes is announced. It features a three decade digital potentiometer that reportedly has a 25mv resolution at 50v maximum output. Specifications indicate 0.01% line and load regulation, 100μv P-P ripple and a time stability of 0.002% during a full day. In the constant current mode, the power supply reportedly has an out-



put current of 1 to 500ma with 25μa ripple and 0.05% regulation at a compliance voltage of 0 to 50v. It is designed for 10G dc isolation and 0.5pf ac isolation from ac input to dc output. The manufacturer indicates that the zener reference and error sensing differential amplifier are housed in an oven that is designed to achieve a high degree of stability for as long as 30 days. Price $275. Moxon.

Tantalum Capacitors 710

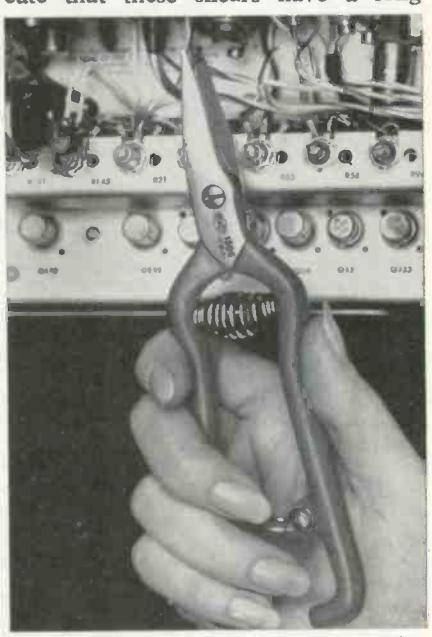
A line of solid tantalum capacitors has reportedly been enlarged to include three different case sizes with a total of 41 ratings ranging from 0.0047μf @ 35wvdc to 68μf @ 2-



wvdc. The manufacturer indicates that the capacitors are of entirely dry construction and, therefore, can not leak electrolyte. According to specifications, the capacitors have an indefinite shelf life and will function properly when operated over a temperature range from −67 to +185°F. Components.

Metal Shears 711

Miniature metal shears are announced for light electronic assembly work and repairs. Specifications indicate that these shears have a long



nose for working in tight spots, plus hot-forged, heat-treated, hollow ground blades for wire snipping and cutting .025-in. thick material. P & C Tool.

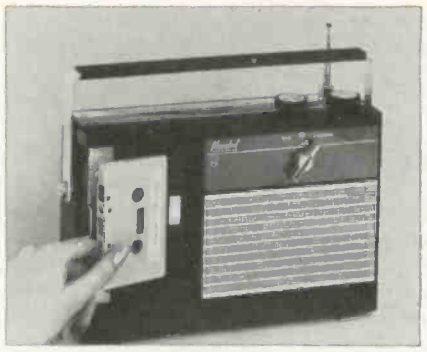
NEW PRODUCTS

CB Transmitter/Converter 712

A solid-state CB radio designed to provide motorists with two-way communications is announced. Specifications indicate that the set is a 12-channel, 5w transmitter/converter which receives in conjunction with a conventional AM car radio and antenna. With this combination unit installed in an automobile, a motorist can reportedly transmit emergency calls up to 10 miles and receive messages over his car radio receiver — tuned to 1505kHz. The manufacturer indicates that the transmitter/converter is no larger than the tuning head of the average push-button car radio, and draws no more current (on standby) than an electric auto clock. Specifications indicate that the Transmitter/converter is designed to operate on any 12v negative ground electrical system. Price $69.95. Pace.

AM/FM Radio/Tape Player 713

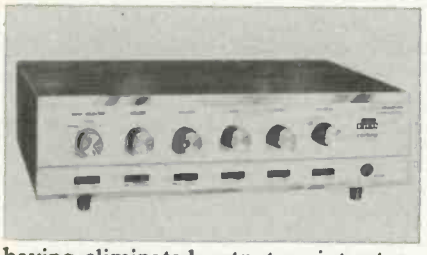
Announced is an AM/FM portable radio with a built-in tape player. It has a removable front panel for insertion of snap-in tape cartridges, each reportedly able to provide up to 90-min playing time. Specifications indicate that the radio/player is powered by five D size cells and weighs 6 lb. According to the manufacturer, it has AFC for FM tuning, a 4in. speaker, ferrous antenna for AM and telescopic antenna for FM. It also



has outlets for earphone listening and for use with a car antenna. The radio/player measures 6⅝ by 10 3/5 by 3in. and comes in a black case with chrome trim. List price $119.95. Norelco.

Stereo Amplifier 714

Announced is a silicon solid-state stereo amplifier with a rated IHF music power output of 70w and 50w with 4 or 8Ω speakers, respectively. The manufacturer indicates that, by



having eliminated output or interstage transformers, the amplifier has a frequency response of 5Hz to 100kHz ±1.5db with less than 0.8 percent harmonic distortion. The power bandwidth is reportedly from 10Hz to 40kHz. Kit price $89.95. Wired price $119.95. EICO.

Dual Power Supply 715

Introduced is a dual power supply designed to provide two independent adjustable sources of 0 to 16v at

500ma. The manufacturer indicates that these sources can be operated in series for 0 to 32v, or opposing for positive and negative voltages. Specifications indicate that the power supply has 25mv maximum regulation, 250μv RMS maximum ripple and 0.3Ω output impedance. Price $59.95. Spar-Electrostatics.

EXTRA POWER
with
FINCO
AMPLIFIERS
For perfect color TV and FM Stero Reception

FINCO MODEL #65-4 Antenna Amplifier $47.95 list VHF-TV Two-transistor Antenna Amplifier for 75 OHM Downlead, and power supply with built-in single or dual 300 ohm outputs. Provides 12 dB gain in the low band and 14 dB gain in the high band.

FINCO MODEL #65-1 Distribution Amplifier $29.95 list 2-tube 4-output VHF-TV or FM Distribution Amplifier for 300 OHM Operation, providing 8 dB gain at each 300 ohm output to feed home or commercial systems.

FINCO MODEL #65-5 Distribution Amplifier $44.95 list VHF-TV 75 OHM Single Outlet Distribution Amplified for deluxe home or commercial use to feed multiple sets through line tap offs or splitters. Delivers 17 dB Low Band and 14 dB High Band.

FINCO MODEL #65-2 Distribution Amplifier $39.95 list 2-tube 4-output VHF-TV or FM Distribution Amplifier for 75 OHM CO-AX Operation, providing 6 dB gain at each 75 ohm output to feed deluxe home or commercial systems.

FINCO MODEL #65-6 Amplifiers $79.95 list. VHF-TV Antenna Mounted two-transistor preamplifier with 75 OHM two-tube Single Output Distribution Post-amplifier up to 30 dB gain for improved reception. Used in home or commercial installations to feed multiple sets.

FINCO MODEL #65-3 Antenna Amplifier $44.95 list New VHF-TV Antenna Amplifier and Power Supply with built in single or dual outputs to improve reception of weak signals in fringe areas. Provides 12 dB gain in the low band and 14 dB gain in the high band.

FINCO MODEL #65-7 FM Signal Amplifier $24.95 list. One-transistor Indoor Behind-the-set FM amplifier with a passive filter input circuit to reject signals outside the FM band which cause interference. Delivers 20 dB Gain.

Sets "COME ALIVE" with Brilliant Sound and Color

A Finco high-gain, low-noise amplifier will bring in the sharpest **COLOR** or B & W TV picture and the finest sound!

All FINCO Products are Engineered For Color!

MAKER OF THE WORLD FAMOUS COLOR FINCO BLACK / WHITE TV AND FM ANTENNAS

Write for Color Brochure #20-411.

THE FINNEY COMPANY

34 W. Interstate Street • Dept. 110 • Bedford, Ohio 44146

NEW PRODUCTS

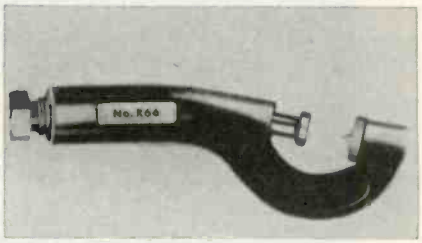
Tape Recorder 716

A four-track, solid-state tape recorder is announced that reportedly produces 3w of peak power on a matched pair of six-in. wing speakers. The swing-out speakers can be removed from their hinges for greater separation. Specifications indicate that the 3¾ and 7½ ips tape-speeds are

controlled by capstan drive, and that the frequency response at 7½ ips is 50Hz to 15kHz with a s/n ratio of 145db. The manufacturer indicates that the cabinet is a walnut grain finish on polystyrene. Price $129.95. G-E.

Bolt Buster 717

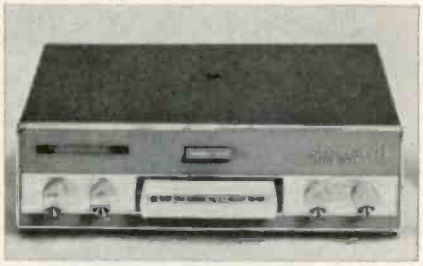
A tool is designed to remove rusted nuts without damaging bolts or studs. The manufacturer indicates that it exerts 25,000 lb of pressure on a chisel



point, splitting the flat of a rusted or frozen nut without need of a hammer. The tool is reportedly made of forged steel with ball thrust bearings for minimum effort in removing bolts. Price $9.95. Roycraft.

Cartridge Tape Player 718

Announced is a new eight-track stereo, solid-state cartridge player with inputs for phonograph, AM/FM tuner, or another tape recorder. The manufacturer indicates that the cartridge



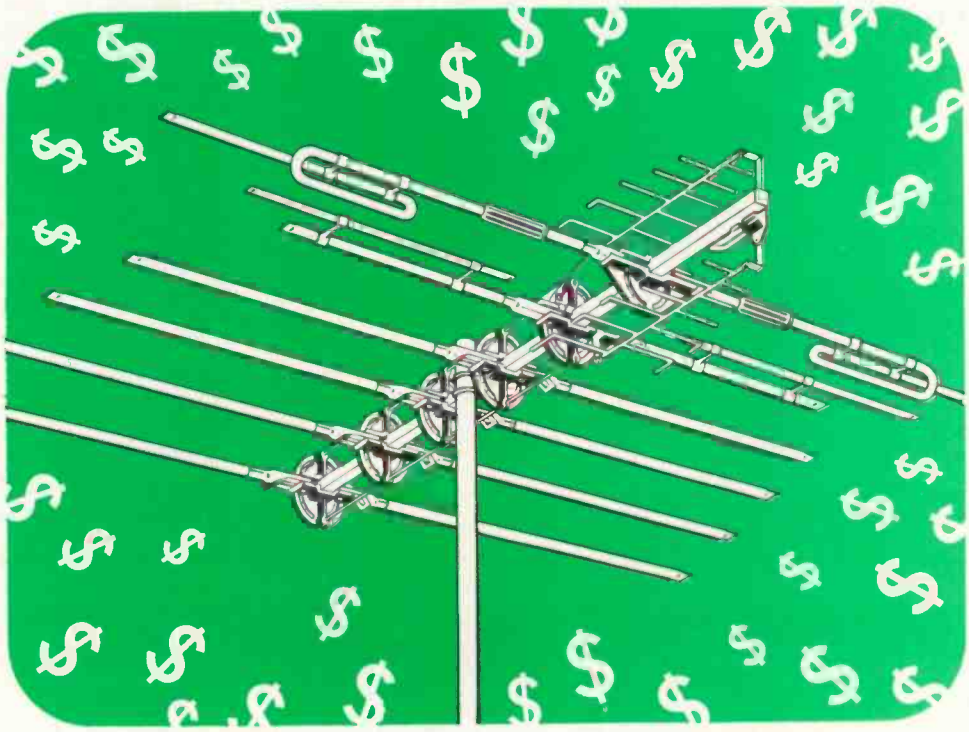
player automatically switches to the next track at the end of the program or it can be changed manually with a simple push button switch. Housed in a walnut cabinet with matching speakers, the player is reportedly fully transistorized. Price $139.95. Tele-Tone.

Tape Recorder 719

A cartridge tape recorder is announced which is designed to operate not only as a cordless portable tape

recorder but as a foot controlled dictating machine. An optional adapter is available for ac recorder operation or for recharging the batteries. 3M.

Pull in more profits with Jerrold VUfinder® Antennas



Now—a line of antennas designed to deliver quality performance without eroding your profit margin. The Jerrold VUfinder 82-channel Antenna line. Perfect for bringing you the best in VHF, UHF color and black and white, plus FM reception:

- Excellent front-to-back ratio eliminates interference
- Unusual flatness assures greater color fidelity
- Sharp directivity eliminates ghosts, picks up strong, clear signals—even in difficult reception areas
- Tough, all-weather construction of vibration-proof, point-contact element locks, rugged Cycolac insulators and twist-resistant boom
- All parts snap into place—anywhere—on the ground or on the roof

In short, all the benefits of the Jerrold Colorpeak line—plus UHF—are available with Jerrold VUfinders.

Compact, rugged, easy to install, Jerrold VUfinders come in five models ranging between $17.95 and $79.95 List.

The VUfinder line is one of a complete spectrum of problem-solving Jerrold reception aids—Pathfinder, Paralog Plus, and Colorpeak antennas . . . Powermate pre-amplifiers, amplified-couplers, and splitters . . . coaxial cable, wall outlets, and wall plates. Get more details. See your Jerrold distributor, or write for our new catalog.

Swing with SPECTRUM 67

JERROLD

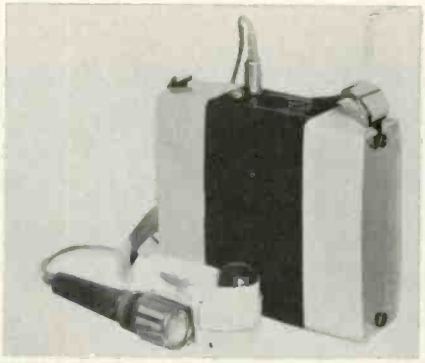
Focusing on one thing... better reception

. . . for more details circle 115 on postcard

NEW PRODUCTS

Portable PA System 720

Announced is a 4w, transistorized, public address system which measures 9 x 8 x 3½in. and operates on eight



flashlight batteries. The 4-lb unit includes a directional cardioid microphone with wind screen. Net price with shoulder strap and batteries included, $99.95. American Geloso.

Two-Way Speaker 721

Announced is a wide-angle paging and talk-back speaker. Specifications indicate it has a frequency response of

250Hz to 13kHz, a power rating of 30w and dispersion angles of 120 deg. by 60 deg., when operated as a speaker. As a microphone, it has a reported sensitivity of −23dbm. Oxford.

Nine-Pin Test Adapter 722

A nine pin novar color test adapter, designed for measuring the cathode current of 6JE6 and 6KM6 horizontal output tubes, is introduced. The unit

provides alligator clip test leads running from the interrupted No. 3 pin of the adapter. When the test adapter is installed between tube and tube socket, a technician can measure cathode current and adjust the circuit to operate within specifications. Net price $3.75. Pomona.

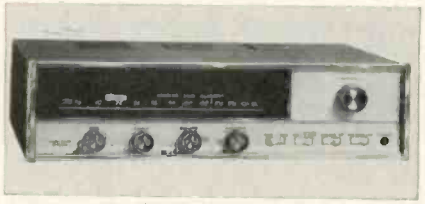
Chisel Sets 723

A 12-piece punch and chisel set is announced, which includes four different sizes of pin punches, a center

punch, a machine drift punch, three cold chisels, a diamond point chisel, cape chisel and round nose cape chisel. Kraeuter.

FM Receiver 724

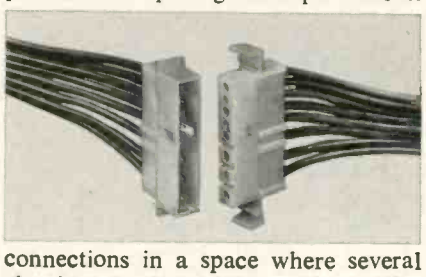
Announced is a silicon, solid-state FM/stereo receiver with a reported IHF sensitivity of 1.8μv. The receiver's amplifier is rated at 80w, music power,



across a 4Ω load. Inputs are provided for a phonograph and auxiliary equipment. The receiver measures 16½ x 12 x 4½in. Sherwood.

High-Capacity Connector 725

A connector is introduced for applications requiring multiple circuit



connections in a space where several circuits require high voltages. The unit features eight circuits in a flat nylon housing. Molex.

continued from page 58

sistor Q9 would vary from 2.9 to 3.1v under these conditions. The voltage drop across resistor R_E would vary from ¾ to 3v ($V = IR$, $2ma \times 375\Omega = 2 \times 10^{-3}a \times 375\Omega = 0.750v$, $8ma \times 375\Omega = 3.00v$). The voltage drop across transistor Q_E would then vary from 3.45 to 1.00v [Since the voltage source equals the sum of the voltage drops in the circuit, $V_{CC} - (V_{Q9} + V_{RE}) = V_{QE}$, $7.1v - (2.9v + 0.75v) = 3.45v$, $7.1v - (3.1v + 3.00v) = 1.00v$].

The 2.9 to 3.1v change in collector-to-emitter voltage across transistor Q9 occurred as the collector current varied from 2 to 8ma. This change would correspond to a 33⅓Ω effective resistance ($R = \frac{\Delta V}{\Delta I} = \frac{3.1v - 2.9v}{8ma - 2ma} = \frac{0.2v}{6ma} = 33\frac{1}{3}\Omega$). If the transistor used as transistor Q9 has a greater beta or steeper base-to-emitter voltage vs base current curve, the effective resistance would be reduced and there would be a smaller fluctuation in voltages as the current varied.

Although we see a relatively large variation in voltages across transistor Q_E and resistor R_E, the voltage drop across transistor Q9 remains nearly unchanged, and as the voltage across transistor Q_E and resistor R_E changes, their total voltage remains nearly the same.

The function of the voltage regulating transistor may be more clearly seen in the circuit shown in Fig. 13. There a variable resistor $R_{E'}$ is substituted for transistor Q_E and resistor R_E in Fig. 11. When the value of the resistor ($R_{E'}$) is 2.1K, 2ma of current flows through the resistor and transistor (Q9). This results in a 2.9v drop in potential across transistor Q9 and a 4.2v drop in potential across the resistor ($2ma \times 2.1K = 2 \times 10^{-3}a \times 2.1 \times 10^{3}\Omega = 4.2v$). When the value of the resistor ($R_{E'}$) is reduced to 500Ω, 8ma of current flows through the resistor and transistor. This results in a 3.1v drop in potential across the transistor and a 4v drop in potential across the resistor ($8ma \times 500\Omega = 4v$). Although the value of the load resistor ($R_{E'}$) has varied from 2.1K to 500Ω, the voltage regulating transistor has permitted the voltage drop across the resistor to vary only from 4.2v to 4v.

If the characteristics of transistor Q9 are the same as those shown in Fig. 12, and its base is biased as shown in those curves, then the circuit shown in Fig. 6 is equivalent to that shown in Fig. 14. Transistor Q9 has the effect of providing a negative voltage source (We have been assuming in this series that voltage sources have no resistive elements.) of 3.0v, which reduces the 7.1v supply potential to 4.1v, with a 33⅓Ω effective resistance.

When using a resistor (R6) to reduce the supply voltage (Fig. 10), an inverted signal is developed across the resistor (R6) that may neutralize the signal across resistor R5, which is to be amplified. The inverted signal developed (Fig. 14) across the effective resistance (R_E) of transistor Q9 is much smaller than the signal developed across resistor R5, and the reduction in the ladder signal is insignificant.

BOOK REVIEWS

PRINCIPLES OF RF POWER AMPLIFIERS. *Written and published by Techpress, Inc., 120 pages, soft cover. $1.95.*

We are living in a time when nearly everyone involved in electronics is interested in semiconductor circuits — even if some tube circuits still perform certain tasks better. Apparently, as a result of the pressure for additional publications in this field, this publisher has again allowed one of its books to show a transistor circuit on the cover when there are no transistor circuits discussed in the book. (*In* ELECTRONIC TECHNICIAN'S *October 1966 review of PRINCIPLES OF ELECTRONIC OSCILLATORS we indicated that a similar misrepresentation was made.*) The book may, however, be of some value to technicians interested in RF power tube amplifiers. These amplifiers are discussed in considerable detail and should be easily understood by anyone having a basic understanding of electronics and simple algebra.

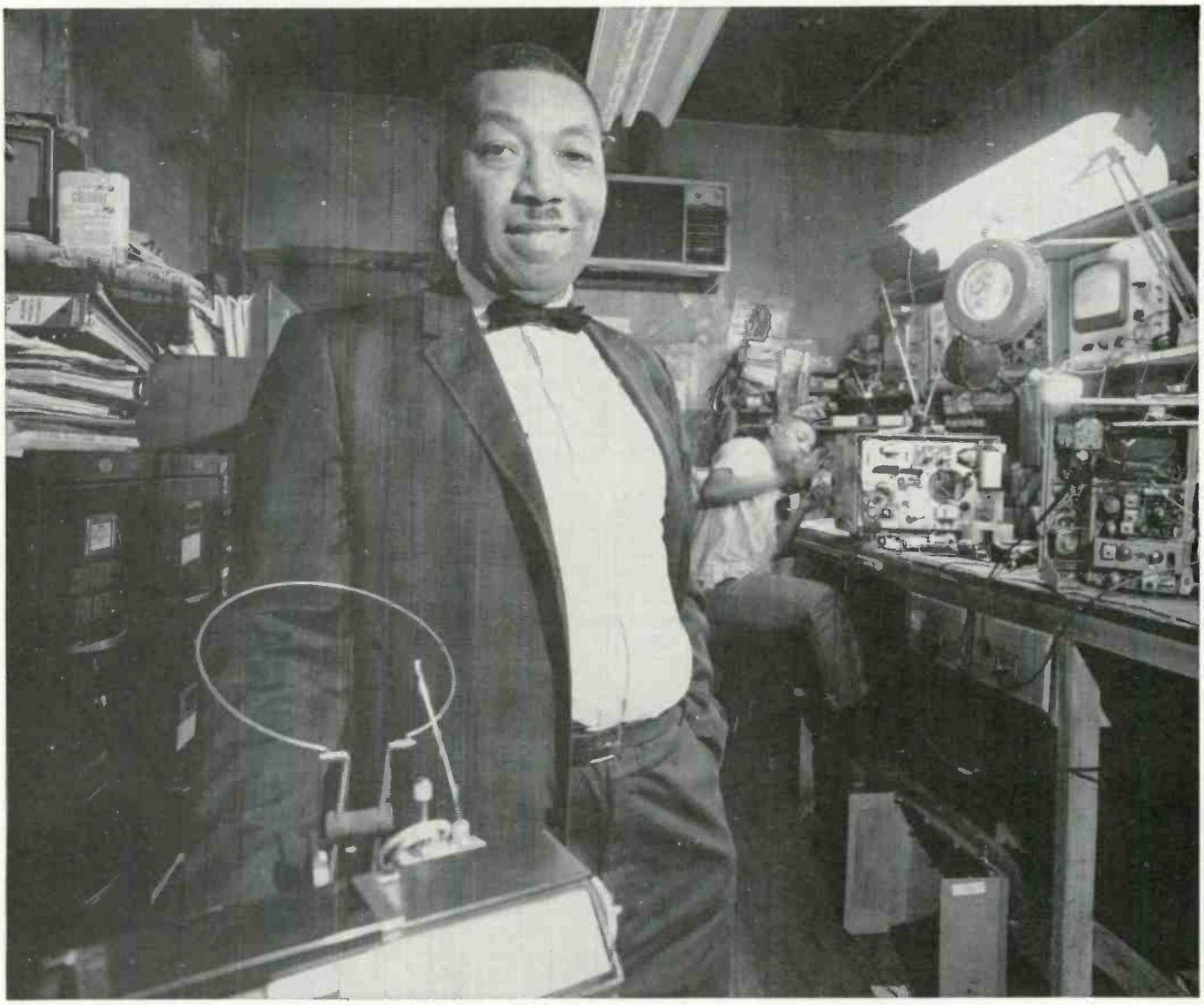
HOW TO MAKE ADVERTISING WORK. *By Burton R. Burkee. Published by McGraw-Hill Book Co., 234 pages, had cover. $6.95.*

Too frequently dealers in their attempt to expand their business fail to make an effective use of advertising. Although the author has not written specifically about using advertising to improve the sale and service of TV sets, the principles covered can be effectively applied to this area of the electronics field. The book does contain an interesting, easily read approach to good advertising that should improve any service-dealer advertising program. The reader may develop many important ideas and questions from having read the book. Advertising can give the service shop a bad reputation by promising better service than it can deliver. The effect can be the same as if the product were all bad. Does your advertising contain a style that will identify you even if your name was omitted? Does it reassure your customers that they have reason to remain loyal? Many American companies have the practice of spending half their corporate net profit on advertising. Check the effectiveness of your advertising by offering something which is absolutely irresistible — such as one slightly used color-TV set for $178 (the promotion may be worth the financial loss on one sale), or make an attention-getting mistake in your advertisement — such as listing a colorless-TV set. In either case the response to the offer or error should indicate how much attention is given your advertisements. Sales can also be helped with "two-stage" advertising designed to promote followup action.

RCA RECEIVING TUBE MANUAL. *Written and published by Electronic Components and Devices Div. of RCA, 608 pages, soft cover. $1.25.*

The major portion of this book (389 pages) contains technical data describing receiving type tubes. In many cases characteristic curves are included with these specifications. Also included is a section (94 pages) describing electron tube theory and related circuits. The last portion of the book contains schematics and descriptions for 30 electron tube circuits — ranging from an ac/dc radio to a CB transceiver and a B/W TV receiver. The book may be helpful to an experienced technician who is repairing a receiver without a schematic. It appears, however, to have been written mainly for either apprentice technicians who need to improve their fundamental knowledge of electron tubes and tube circuits, or the designers of electronic equipment.

Customers wear out the Yellow Pages getting to Jackson's



"I've had nothing but success with the Yellow Pages," says Russell Jackson, owner, Jackson's Radio & Television Service, Philadelphia, Pa. "Our ad there not only identifies us as reliable and established, but also serves as a reference for customers we've served in the past. I've found they turn to the Yellow Pages when they've forgotten our phone number or address. That's more important than anything else. Even after people have been recommended to call us, they still look us up in the Yellow Pages. The phone numbers in our ad ring regularly for service or information."

Advertise for action... Yellow Pages

Today's customers wear out the Yellow Pages instead of themselves. This ad, under TELEVISION SERVICING, leads them to Jackson's. Call your Yellow Pages man to plan your program. Find him in the Yellow Pages under ADVERTISING — DIRECTORY & GUIDE.

NEWS OF THE INDUSTRY

ITT and ABC Reject Merger Position Of FCC and Justice Dept.

International Telephone and Telegraph Corp. and American Broadcasting Co. have charged that the Antitrust Div. of the Dept. of Justice and the Broadcast Bureau of the Federal Communications Commission had "strikingly failed" to develop any creditable evidence against the proposed ITT/ABC merger.

The companies said that the department and the bureau had instead resorted only to "sweeping charges" that wholly ignored the facts and the basic questions of public interest inherent in the merger.

The companies' position was contained in rebuttal filings submitted to the FCC as part of the hearing procedure concerning the proposed merger, which was concluded with oral arguments before the full commission on June 1, 1967.

G-E Recalls TV Sets

General Electric has announced a program to modify some of its large-screen color-TV sets. This program is being carried out on a national basis and should be completed by July 31.

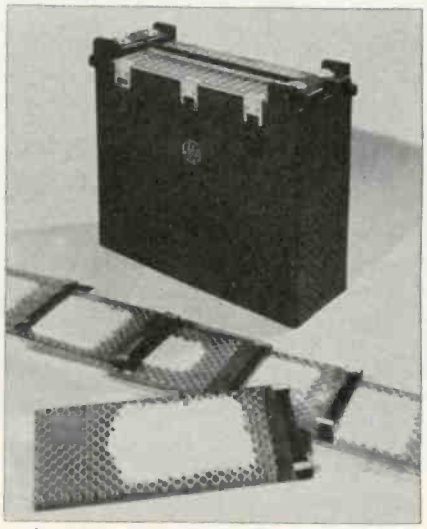
The modification involves the replacement of the regulator tube and adjustment of the power supply. Quality control tests indicate that some of the sets produced between June 1966 and February 1967 emit soft X- radiation in excess of desirable levels. The picture tube is not involved. Although nationally recognized radiological health experts have reportedly confirmed the company's preliminary claim that emissions have not been sufficient to cause harm to viewers, approximately 90,000 of these models are to be checked. G-E's service representatives are contacting customers who purchased these specific models since last June and will make the modification without charge at the customers' convenience. Owner identification is being achieved through the mobilization of the company's entire distributor-dealer organization.

Two Companies Develop New High-Power Cells

A D-size rechargeable sealed silver-zinc cell for industrial and consumer products has been announced by Yardney Electric Corp. The company indicates that the cell under load produces a nominal potential of 1.5v with more than 2½ times the energy density of a D-type nickel-cadium cell. Specifications indicate that the new cell has a 5.3 a/hr capacity at 2a drain, contains 8.0 w/hr of energy and has an energy density of 32 w/hr/lb.

At 125°F these cells will reportedly operate at 100 percent of their capacity while yielding more than 75 percent of their capacity at 32°F. Yardney indicates that the price for a small quantity of these cells ranges from $6.60 to $9.60 each.

A battery has also been developed by General Electric at the request of the U. S. Marine Corps to produce electrical power from thin magnesium sheets and oxygen from the air, using salt water as an electrolyte. In this battery a porous cathode promotes the reaction of oxygen in the air with the water in the electrolyte and the magnesium electrode to produce an electric current. Magnesium hydroxide (milk of magnesia) is formed as a by-product.



Specifications indicate that the new system produces an energy density of 50 w/hr/lb of battery weight or about five times the energy density of the average lead-acid battery.

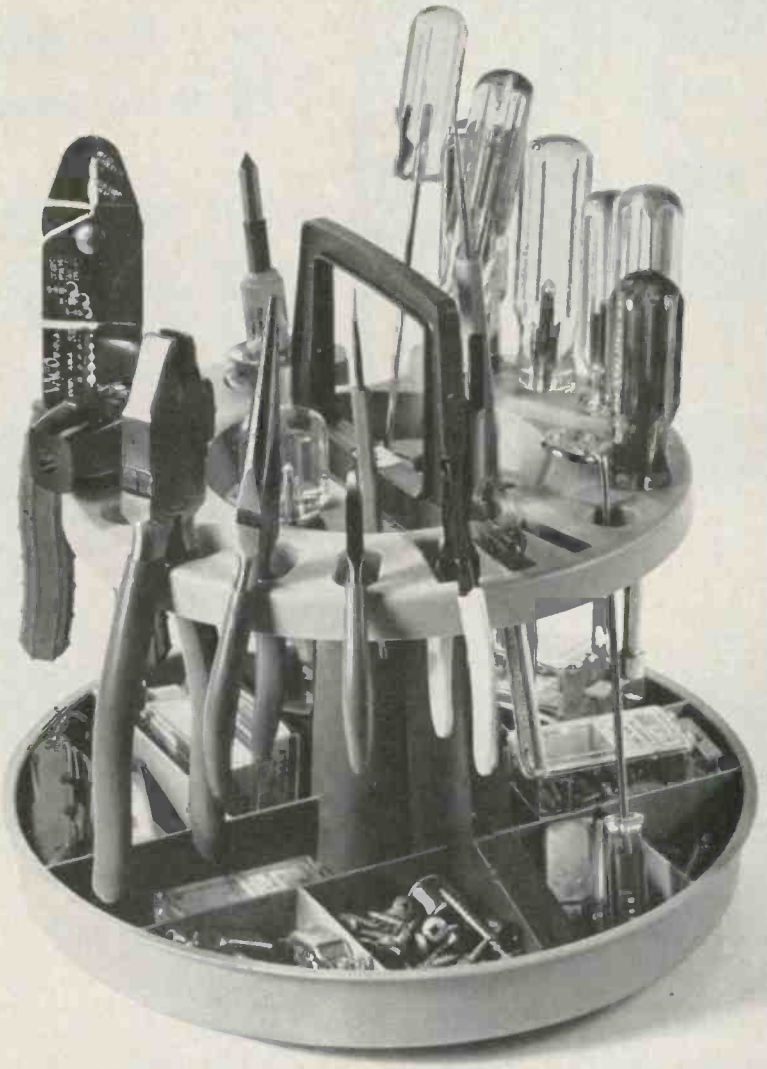
The new power source can reportedly be refueled in about 15 minutes by removing the used magnesium anodes, emptying out the magnesium hydroxide sediment, inserting 23 commercially available magnesium plates, and adding a handful of salt and any available water.

The porus air cathodes are not consumed in the reaction, but eventually deteriorate after repeated use. These cathodes, however, may be replaced one-at-a-time, as necessary. G-E indicates that the batteries have been tested for 30 refills or nearly 400 hours use, without requiring replacement of the air cathodes. They estimate that in actual field use, cell life may be extended to 1000 hours.

This Revolving Tool Caddy

FREE

When you buy RCA SK-Series Transistors and Rectifiers— The Industry's Leading Replacement Line



Tools and Parts not included with caddy

Here's just the tool caddy you've always needed to keep handy around the shop or home work benches. It's Rubbermaid's portable caddy that keeps tools and small parts organized and always at hand. Made of high-impact styrene and designed to revolve on eight ball bearings as a "lazy susan," the caddy is yours free—with the purchase of RCA SK-Series replacement devices from your participating RCA Distributor.

Drop by your RCA Distributor today. He has all details. Act now. Pick up your supply of the RCA SK-Series replacements and take home this brand new tool caddy as well—free—from your participating RCA Distributor.

AVAILABLE THROUGH YOUR PARTICIPATING RCA DISTRIBUTOR

RCA's carton-packed SK-Series "Top-of-the-Line" replacements

include 19 transistors, 2 rectifiers and 2 integrated circuits that can replace more than 9,000 solid-state devices. Cross-referenced in the RCA Solid-State Replacement Guide against both domestic and foreign types, these 23 top performing RCA types can help solve most solid-state replacement problems for experimenters, hobbyists, hams and technicians. Check your RCA Distributor for the SK-Series Replacement line and the replacement guide.

RCA Electronic Components and Devices, Harrison, N.J. 07029

RCA® **The Most Trusted Name in Electronics**

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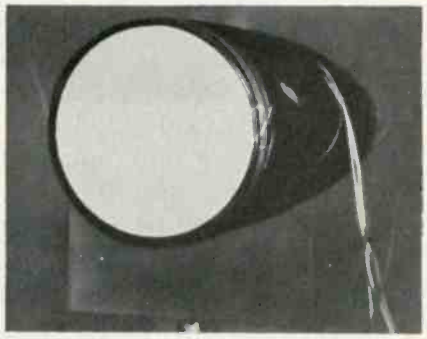
NEWS OF THE INDUSTRY

Sylvania Announces New CRT

Sylvania's Electronic Tube Div. has announced a high-resolution one-gun, two-color information display tube for commercial, industrial and military applications.

The tube uses a red, "rare earth" Europium activated phosphor and a



green phosphor to provide the information displays. The two phosphor layers are separated by a barrier layer. By switching the final anode voltage, the intensity of the electron beam is controlled to excite the first phosphor layers, creating a second color. High-speed voltage switching produces a two-color display that reportedly appears continuous to the observer.

Since the new tube does not have a shadow mask or combination phosphor dot pattern common to entertainment color-TV tubes, greater brightness and finer resolution is possible.

Corning Cuts Price of 'Standard' 12 in. Bulbs

Corning Glass Works has announced a reduction in the price of "standard 12in. TV CRT bulbs to $2.75 each, plus about 22 cents for packing material. At the same time the company increased prices of other 12in. bulbs as part of a campaign to standardize these bulbs. It was said that the new price and standardization are designed to help encourage U.S. manufacturers to produce a small B/W TV set weighing less than 10 lb and priced at $50 to meet future Japanese competition.

EIA First-Quarter Sales Figures

According to figures released by the Electronic Industries Assn. (EIA), color-TV sets, portable and table phonographs again showed sales increases at the distributor level in March.

Color-TV sets sold to dealers totaled 491,078, up 20.2 percent over the March 1966 number. This brought the year-through-March sales figure up to 1,161,461, or 23.3 percent above the 1966 performance for the same period.

Portable and table phonograph sales attained 313,529 units in March, an increase of 28.7 percent. This rise resulted in a first-quarter distributor sales total of 834,805 units, 21.2 percent above the 1966 initial three-month figure.

The figures for other electronic items were not so bright. The 1967 B/W TV distributor sales total at the end of March stood at 1,369,895, or 30.9 percent off from the comparable 1966 total. Console phonograph sales were down 22.1 percent, home radios declined 18.8 percent, FM radios declined 8.3 percent and auto radios sales were down 11.6 percent.

Electronic Assn. Plans Hi Fi Show

The 1967 New England Hi Fi & Stereo Show will be held at the Parker House in Boston, Mass., Nov. 17-19. The weekend event is sponsored by the New England Chapter of the Electronic Representatives Assn.

RCA Enters Roadside Call-Box Market

RCA's first push-button electronic warning system will be installed in the village of Park Forest, Ill., a suburb of Chicago. It is designed to enable motorists or "Good Samaritans" to notify a central dispatcher of a breakdown or accident merely be pressing a button on any one of a series of emergency call boxes located at intervals along a major highway.

This system is identical to those now being installed along the 40-mile Atlantic City Expressway in New Jersey and the 42-mile Maryland portion of the Capital Beltway, 196, around Washington, D.C.

The call boxes are wholly self-contained radio stations incorporating miniature, solid-state transmitters with a range of approximately 25 miles without need of a repeater. They stand on aluminum poles bolted to a concrete base and are powered by batteries that are kept charged by solar cells.

Once a push-button system has been installed on a highway, it can also be used, with minor modification, to accomplish a host of other tasks including the transmission of traffic flow information on a regular basis, the manipulation of electronically activated signals warning of accidents or fog, the detection of ice or the reporting of visibility conditions.

CATALOGS AND BULLETINS

Zener Diodes 400

A data sheet describes a line of zener diodes that reportedly use gold plated, pure nickel leads and are encapsulated in an alkyd-resin case with a tantalum heat sink. A diagram, rating table and characteristic curves are included. Semitronics.

Test Instruments 401

A 12-page catalog describes a line of 23 test instruments. Included are CRT testers, color bar generators, scopes, meters, circuit analyzers, field-strength meters, tube testers, transistor diode testers and power supplies. Sencore.

FET Volt/Ohm Meter 402

A two-page product data bulletin provides detailed mechanical and electrical specifications for a 2½lb transistorized volt/ohm meter. The illustrated bulletin describes how dc voltages, resistance and ac RMS value measurements are made with a single selector switch knob controlling all ranges and functions. Triplett.

Photoelectric Systems 403

A 12-page catalog illustrates a line of miniaturized light sources and photo units. It also describes a line of related amplifier modules. Photomation.

Test Instruments 404

A line of test instruments including tube testers, socket adapters, transistor testers, meters, signal generators, tracers and scopes is described in an 8-page bulletin. Hickok.

Nut and Screwdriver Kits 405

A bulletin describes a 14-piece, multi-purpose roll-up tool kit of nut and screw drivers designed to fit in a hip pocket. Xcelite.

Electronic Equipment 406

A 116-page catalog includes a line of VHF communications receivers, stereo Hi-Fi equipment, CB 2-way radios, tape recorders, ham gear, test instruments, TV receivers, tools and accessories. Lafayette.

Components 407

A 24-page replacement parts catalog is divided into five sections with an index on the front cover. The catalog provides information on composition and wirewound controls, rotary- and lever-action switches, ceramic, polystyrene and miniature electrolytic capacitors and packaged electronic circuits. The catalog also contains specifications, dimensions and application data. Centralab.

Power Supplies 408

A bulletin lists a complete line of power supplies having a range of 1 to 28vdc. It contains complete specifications, mechanical dimensions, pictures and prices. Plug-In Instruments.

Power Outlet Boxes 409

Pre-wired power outlet boxes are described in a 12-page, 2-color booklet. In addition, the booklet describes solid-state motor speed controllers, instrument carts and carriers and a number of replacement parts and accessory items. Waber.

Steel Equipment 410

More than 500 items including benches, cabinets, service carts, shelving, stands and lockers are described in a 48-page catalog. Penco.

Soldering Equipment 411

An eight-page catalog lists an assortment of electric soldering equipment ranging from offset miniature soldering irons to soldering pots and a wattage controller. Electric Soldering Iron.

CATALOGS AND BULLETINS

Electronic Components 412

A 52-page catalog describes a wide assortment of electronic components including batteries, capacitors, resistors, potentiometers, switches, timers, vibrators, rectifiers, diodes and related hardware. Mallory.

Alerting Receivers 413

A four-page bulletin describes three tone-activated receivers for 25 to 54MHz or 148 to 174MHz reception. It describes the various ways these receivers can be tone activated. Plectron.

ADVERTISERS' INDEX

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.

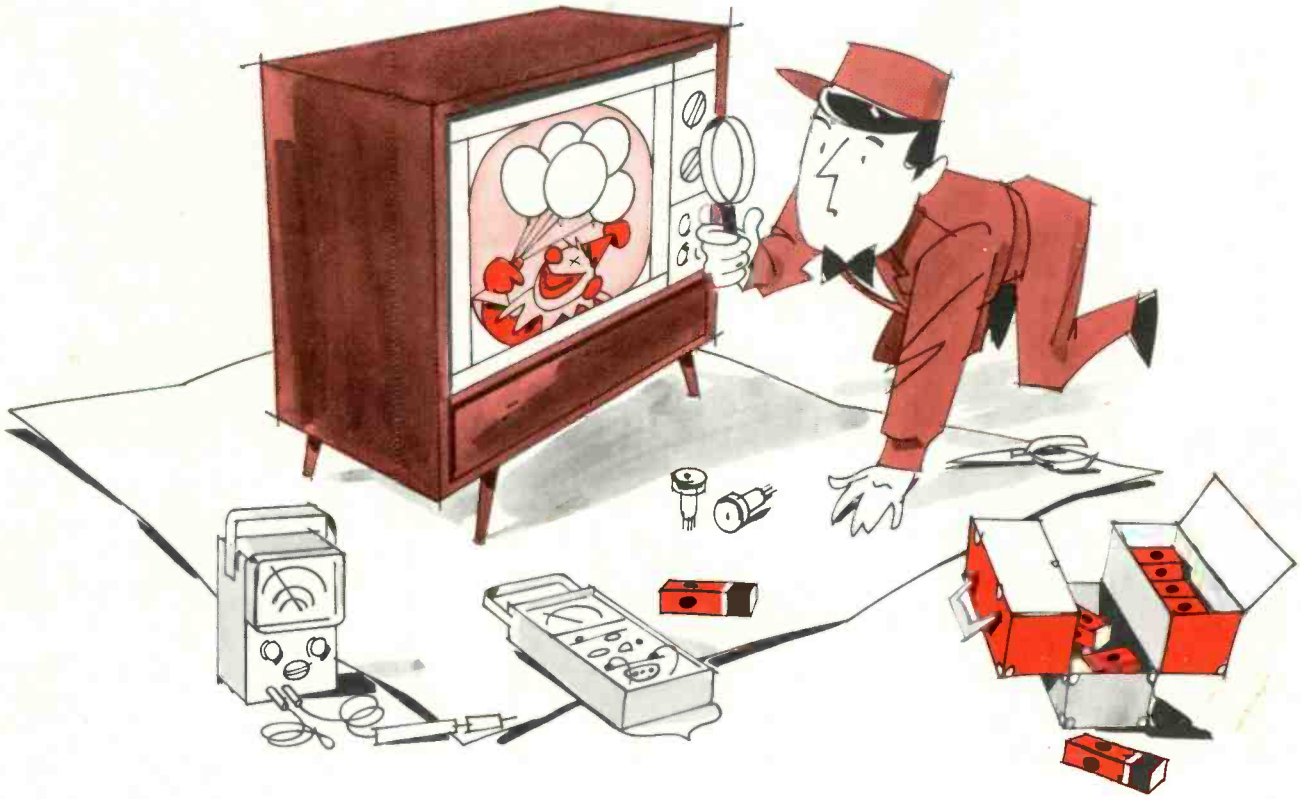
That's why everybody calls the CDE WIDE RANGER* a Good Guy.

CDE CORNELL-DUBILIER

. . . for more details circle 111 on postcard

RCA's COLOR TV FASTCHECK #8

A PRIMARY COLOR MISSING?



If the color picture lacks one of the primary colors, use this procedure to localize the trouble:

Switch the set to an unused channel. If the raster is tinted, follow procedure A. If the raster is normal, follow procedure B.

PROCEDURE A (Color raster)

1. Make sure gray-scale tracking controls are set correctly.
2. Check and/or replace color-amplifier tubes. Remember that:
   white minus blue = yellow
   white minus red = cyan
   white minus green = magenta
3. If tubes are okay, measure tube-pin voltages with a VTVM or VOM. Use a tube-socket test adapter to avoid pulling the chassis.
4. If voltages are correct, use an RCA WT-115A Color Picture Tube Tester to check emission of the picture-tube guns.

PROCEDURE B (Normal raster)

1. Check and/or replace color-demodulator tubes. *Note:* If you suspect a faulty demodulator tube, interchange the demodulators; a faulty tube is indicated by a shift in colors in a color picture or bar pattern.
2. If tubes are okay, measure tube-pin voltages with a VTVM or VOM. Use a tube socket test adapter to avoid pulling the chassis.
3. If any voltage is incorrect, use conventional circuit troubleshooting methods to isolate the defect.

Your RCA tube distributor is your best source for top quality RCA receiving tubes for color TV, black and white TV, radio, and hi-fi. Increase customer confidence. Always replace with RCA receiving tubes.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N.J.

The Most Trusted Name in Electronics