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the magazine of electronic servicing

Time to Move?



Color TV Service Training

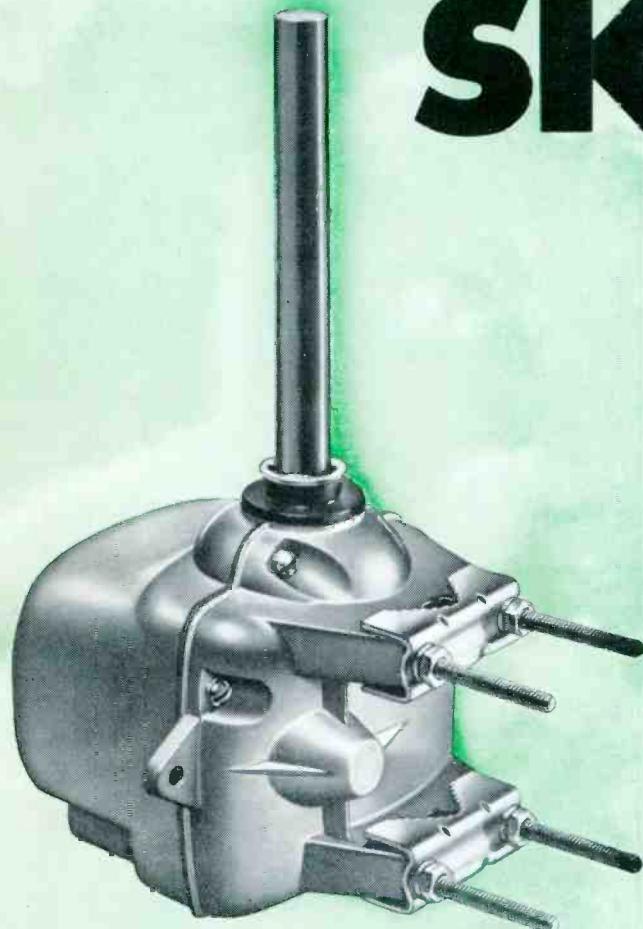
Video Speed Servicing



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- Annual Index
- The Troubleshooter
- Color Countermeasures
- Notes on Test Equipment
- Tube Substitution Supplement

Help stamp out green sky



CDE's Skyline series rotor helps give the truest urban/suburban color TV reception!

Green sky, purple people and brown water...help your customers avoid these with CDE's Skyline series rotor. It's the most rugged lightweight on the market...the first rotor system designed specifically for metro-suburban area.

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Circle 1 on literature card



CDE CORNELL-DUBILIER

ANNUAL INDEX

The following code of symbols is used to identify regular department locations in the subject page listings: CCM, Color Countermeasures; Sym, Symfact®; TE, Notes on Test Equipment; TS The Troubleshooter; and VSS, Video Speed Servicing.

AGC

- Color receiver, circuitry in Sep 51
- Filter capacitor, shorted causes video overload, Admiral Chassis G-1263-1 VSS Feb 6
- Forward keyed transistor system, analysis of Oct 4
- Keyed systems Dec 30
 - hybrid designs Dec 33
 - noise-cancelling effects Dec 31
 - servicing procedures Dec 31
 - transistor circuits Dec 33
- Overload picture on strong signal, Motorola Chassis TS-912 VSS Jul 14
- Transistor TV, employed in Jun 62

ANTENNAS

- Installing for color Apr 60
- Lead-in Feb 24
- Selling Apr 58

AUDIO SYSTEMS

- Equipment for servicing Mar 20
 - AC VTVM Mar 20
 - books concerning Mar 22
 - distortion analyzers Mar 21
 - phase checker Mar 22
 - signal generator Mar 20
 - wattmeter Mar 22
- High-quality systems, servicing Aug 32
 - components Aug 32
 - distortion measurement Aug 38
 - frequency response Aug 58
 - sensitivity measurement Aug 38
 - separation measurement Aug 58
 - system analysis Aug 33
 - tuner bandpass measurement Aug 38
 - turntable tests Aug 60
- Intercom and music distortion systems, installing Dec 24

AUTO RADIOS

- High end of band inoperative when receiver installed in car, Pontiac Model 983873 TS Jun 56

BOOK REVIEWS

- Audio Amplifier Design Dec 62
- Communications Electronics Circuits Jan 37
- Directory of Electronic Circuits Jun 54
- Electricity One through Electricity Seven May 60
- Electron Tubes Feb 18
- FET Circuits Dec 36
- How to Build Speaker Enclosures Mar 77
- Power Supplies for Electronic Equip-

- ment Jul 53
- Single Sideband: Theory and Practice Oct 41
- Transistor Basics: A short course Aug 72
- Understanding UHF Equipment Sep 42

BUSINESS

- Advertising, measuring the results of Aug 44
 - attitude advertising, testing Aug 49
 - immediate response ads, tests for Aug 47
 - information concerning Aug 51
 - planning Aug 45
 - repeat Aug 49
 - results expected Aug 45
 - using several media Aug 50
- Credit procedures, proper handling of Oct 52
- Depreciation reserves for equipment, computing Jan 26
- Electronic service shop, operating a typical Sep 37

- Legal services Feb 30
 - antitrust problems Feb 52
 - credit problems Feb 54
 - disposing of business Feb 54
 - inventory and other financing Feb 48
 - laws affecting employees Feb 50
 - litigation Feb 54
 - organization of business Feb 30
 - sources of information Feb 56

CAPACITORS

- Electrolytics in TV May 27
 - defects and testing May 27
 - filter defects May 32
 - picture symptoms May 32
 - primary filter circuits, in May 28
 - scoping May 32
 - secondary circuit applications May 29

CITIZENS BAND

- Shop, visit to Apr 38

COLOR COUNTERMEASURES

- Buzz in audio, Philco Chassis 16QT85 Feb 58
- Color missing or intermittent, RCA Chassis CTC12, 15 Nov 66
- Color sync critical, Magnavox Chassis T-918 Sep 64
- Color sync poor, Sylvania Chassis D01 and D02 Oct 62
- Color weak, indicator light goes out when color control turned up (Motorola Chassis TS-914) Jan 68

- Contrast missing, raster and color signals remain on screen (RCA CTC11 chassis) Mar 62

Oct 61

Diathermy interference on high channels, Zenith Chassis 26KC20 Jan 68

Extension cables for Zenith convergence panels, constructing Apr 71

Ghosts, evenly spaced, multiple Oct 62

Green screen on color, b-w normal (Zenith Chassis 24NC312 and 25NC38) Oct 61

Height lost, RCA Chassis CTC24 Nov 66

Horizontal and vertical sync intermittent, RCA Chassis CTC22 Dec 53

Horizontal bars of color on b-w and color programs, RCA Chassis CTC16, 17 Nov 67

Horizontal overscan of blue raster, Zenith Chassis 23XC36, 38 Apr 71

Hue changes when color level control is rotated, Zenith Chassis 23XC36, 38 Apr 71

Hue control action reversed, Zenith Chassis Oct 62

Ringing lines, diagonal (Philco Chassis 16M91) Feb 58

Screen temperature shifts to predominate hue after warmup, RCA Chassis CTC22 Dec 54

Tinted screen, varies with hue control setting (Magnavox Chassis T-918) Sep 64

Vertical jitter, RCA Chassis CTC24 Nov 66

Vertical retrace lines, Zenith Chassis 23XC38 Feb 58

Width insufficient

- General Electric CB chassis Jan 68
- RCA Chassis CTC15 Dec 53

COLOR GENERATORS

- B & K Model 1242 TE Jun 50
- Hickock Model GC660 TE May 47
- Mercury Model 1900 TE Mar 38
- RCA Model WR-64B Sym Feb 37
 - normal operation Sym Feb 37
 - troubles Sym Feb 38
- Unijunction transistor employed in multivibrator circuit TE May 46

COLOR TV

- Bar of color creeps up screen, RCA Chassis CTC15 May 23
- Blobs of color, sync unstable (Sylvania DO5 Chassis) May 55
- Blooming, Emerson Chassis 120699 VSS Feb 8
- Blue and yellow fringing on

- horizontal edges of b-w picture Sym Mar 48
 Blue and yellow fringing on horizontal edges of b-w picture information Sym Mar 46
 Brightness missing, Emerson Chassis 120699 VSS Feb 8
 Brightness reduced
 —Emerson Chassis 120699 VSS Feb 8
 —Motorola Chassis TS-908 VSS May 10
 —screen control operation reversed, Motorola Chassis TS-908 VSS May 9
 Buzz in audio, Philco Chassis 16QT85 CCM Feb 48
 Chroma circuitry, new for 68 Nov 8
 Chroma oscillator, operation of Sym Apr 51
 Color in b-w program, off-channel snow is confetti Sym Jun 32
 Color intermittent, b-w normal
 —Admiral Chassis G1263-1 VSS Feb 5
 —Olympic Chassis CTC-15/U VSS May 12
 Color killer, operation of Sym Jun 31
 Color level control must be advanced when switching from strong to weak station Sym Jun 34
 Color missing
 —generator produces 10 green bars Sym Apr 52
 —misadjusting color killer produces out-of-sync color Sym Apr 53
 —Motorola Chassis TS-912 VSS Jul 13
 —or intermittent, RCA Chassis CTC12, 15 CCM Nov 66
 —or weak, Motorola Chassis TS-912 VSS Jul 13
 —poor vertical sync, Admiral Chassis 25D6 TS Jul 52
 Color missing, b-w normal
 —Admiral Chassis G1263-1 VSS Feb 6
 —indicator light on at all times, Motorola Chassis TS-908 VSS May 10
 —Magnavox Chassis C/U45-01-00 VSS Mar 5
 —Magnavox Chassis C/U45-01-00 VSS Mar 6
 —Olympic Chassis CTC-15/U VSS May 11
 —Zenith Chassis, 24MC32, 42 VSS Mar 7
 Sym Apr 52
 Sym Jun 32
 Color signal, developing the Aug 23
 Color sync
 —critical, Magnavox Chassis T-918 CCM Sep 64
 —intermittent, Magnavox Chassis C/U45-01-00 VSS Mar 6
 —intermittent, Zenith Chassis 24MC32, 42 VSS Mar 7
 —lost during commercials, Curtis Mathes Chassis CMC15 TS Aug 54
 —poor, Sylvania Chassis D01, D02 CCM Oct 62
 —troubles Jan 22
 —unstable, Truetone Model 2DC/663A VSS Jul 16
 Color temperature changes, Sylvania D03 chassis Apr 47
 Color weak
- indicator light goes out when color control turned up, Motorola, Chassis TS-914 CCM Jan 68
 —on weak stations, sync unstable Sym Apr 54
 —or missing, hue control has no effect Sym Jun 33
 Colors incorrect due to phase error Sep 32
 —symptoms Sep 32
 —troubleshooting Sep 33
 Contrast lost, raster and color remain (RCA Chassis CTC11) CCM Oct 61
 Contrast missing, RCA Chassis CTC11 CCM Mar 62
 Convergence assembly Sym Mar 45
 CRT troubles Apr 20
 Diathermy interference, Zenith Chassis 26KC20 CCM Jan 68
 Extension cables for Zenith convergence panels, constructing CCM Apr 71
 Fine tuning control does not function correctly, Motorola Chassis TS-912 VSS Jul 14
 Focus poor, brightness low, width reduced (Motorola Chassis TS-908) VSS May 10
 Generator signal produces color but phase changes until sync or color is lost Sym Apr 54
 Ghosts, evenly spaced, multiple CCM Oct 62
 Green flashes on screen, intermittent, (RCA Chassis CTC 12) Apr 22
 Green screen on color, b-w normal (Zenith Chassis 24NC312) CCM Oct 61
 Green tint on b-w program, disappears after set warms up (Zenith Chassis) Apr 22
 Height lost, RCA Chassis CTC24 CCM Nov 66
 Horizontal and vertical sync intermittent, RCA Chassis CTC22 CCM Dec 53
 Horizontal bars of color on b-w and color programs, RCA Chassis CTC16, 17 CCM Nov 67
 Horizontal bars of wrong color drift through color picture, b-w normal Sym Apr 53
 Horizontal sync
 —drifts, Admiral Chassis G1263-1 VSS Feb 5
 —poor or intermittent raster, Motorola Chassis TS-912 VSS Jul 13
 —weak, RCA Chassis CTC25X TS Nov 59
 Horizontal tear and drift, Truetone Model 2DC1663A VSS Jul 16
 Horizontal tearing, vertical roll, Channel 3 beat (RCA Chassis CTC11D) TS Feb 66
 Hue changes with rotation of color level control, Zenith Chassis 23XC36, 38 CCM Apr 71
 Hue control action reversed, Zenith Chassis CCM Oct 62
 Hues unstable, Olympic Chassis CTC-15/U VSS May 12
 Killer control inoperative
 —color weak Sym Jun 34
 Left side of raster purple, Motorola Chassis TS-908 VSS May 9
- Overloaded picture
 —Olympic Chassis CTC-15/U VSS May 11
 —on strong signal, Motorola Chassis TS-912 VSS Jul 14
 Overscan of blue raster, Zenith Chassis 23XC36, 38 CCM Apr 71
 Picture missing
 —both color and b-w, Zenith Chassis 24MC32, 42 VSS Mar 8
 —Truetone Model 2DC1663A VSS Jul 15
 Raster black, retrace lines, creeping bar of color (RCA Chassis CTC15) May 23
 Red and green vertical lines not converged on left of screen Sym Mar 74
 Red color component missing in b-w and color, Admiral Chassis G1263-1 VSS Feb 5
 Red excessive in color and b-w picture, Truetone Model 2DC1663A VSS Jul 15
 Red vertical fringing on b-w picture information Sym Mar 46
 Ringing lines, Philco Chassis 16M91 CCM Feb 58
 Ringing on left side of raster, Motorola Chassis TS-912 VSS Jul 14
 Screen temperature shifts to predominate hue after warmup, RCA Chassis CTC22 CCM Dec 54
 Shadows superimposed on picture, increased contrast (RCA Chassis CTC11D) TS Jan 57
 Sheet-beam demodulator, operation of Jul 28
 68 circuitry Dec 12
 —chroma circuitry Nov 8
 —CRT control circuits Dec 12
 —Iuminance circuits Dec 16
 —models and CRT sizes Nov 6
 —sound circuits Dec 23
 —sweep and high voltage Dec 20
 —tuning and indicator circuits Dec 44
 Smear and out of focus picture, Olympic Chassis CTC-15/U VSS May 12
 Solid-state receivers, introduction to Motorola Chassis TS-915 and TS-919 Aug 40
 Sound and picture missing, Emerson Chassis 120699 VSS Feb 7
 Sweep alignment of color IF amplifiers Nov 41
 —double-tuned, two IF system Nov 52
 —input and detector pads Nov 44
 —stagger-tuned system Nov 50
 Tearing and overload of pictures, brightness reduced (Motorola Chassis TS-908) VSS May 9
 Tint control inoperative, b-w picture normal (Truetone Model 2DC1663A) VSS Jul 16
 Tinted rasters, defects causing Jul 44
 Tinted screen, varies with hue control setting (Magnavox Chassis T-918) CCM Sep 64
 Tuner AFC defects, symptoms associated with Sym May 42
 Vertical and horizontal hold poor, Magnavox Chassis C/U45-01-00 VSS Mar 6
 Vertical and horizontal sync missing, Emerson Chassis 120699 VSS Feb 7

Vertical defects	Nov 33	measurement of	Sep 13
—case histories	Nov 34		
—height insufficient	Nov 33		
—horizontal white line	Nov 33		
—intermittent troubles	Nov 34		
—rolling	Nov 34		
Vertical drift, Magnavox Chassis C/U45-01-00	VSS Mar 5		
Vertical jitter —Admiral Chassis G1263-1	VSS Feb 6		
—RCA Chassis CTC24 CCM Nov 66			
Vertical red and green edging over entire screen during b-w program	Sym Mar 47		
Vertical red lines displaced to right on sides, left in middle	Sym Mar 48		
Vertical retrace lines, Zenith Chassis 23XC38	CCM Feb 58		
Vertical roll, intermittent, (Olympic Chassis CTC-15/U)	VSS May 11		
Vertical sweep insufficient, bottom compressed (Zenith Chassis 24MC32, 42)	VSS Mar 8		
Vertical sweep missing, Magnavox Chassis C/U45-01-00	VSS Mar 5		
Vertical sync poor —foldover and retrace lines at top, Emerson Chassis 120699	VSS Feb 7		
—Zenith Chassis 24MC32, 42	VSS Mar 8		
Video amplifier defects, effects on color	May 23		
Width reduced —after set operates for extended period, Truetone Model 2DC1663A	VSS Jul 15		
—General Electric CB chassis	CCM Jan 68		
—RCA Chassis CTC15	CCM Dec 53		
COLOR TV SERVICE TRAINING			
AGC and sync	Sep 51		
Bandpass, receiver	Sep 46		
Chroma circuits	Nov 20		
—ACC	Nov 31		
—bandpass amplifier	Nov 24		
—chroma demodulation	Nov 24		
—color difference amplifiers	Nov 28		
—color killer	Nov 31		
—reference oscillator	Nov 28		
Developing the color signal	Aug 23		
—chrominance signal	Aug 24		
—composite color signal	Aug 25		
—luminance signal	Aug 23		
—video spectrum	Aug 27		
Horizontal AFC and oscillator	Oct 20		
Horizontal output and high-voltage circuits	Oct 22		
Horizontal phase detector	Oct 19		
Luminance circuits	Sep 51		
Power supply	Sep 54		
Sound IF and audio	Sep 49		
Tuners	Sep 46		
Vertical deflection circuitry	Oct 17		
Video IF amplifiers and detector	Sep 47		
CRT TESTERS			
B & K Model 465	TE Jul 49		
Hickok Model CR 35	TE Sep 58		
SENCORE Model CR 13	TE Dec 40		
SENCORE Model CR 143	TE Aug 52		
DIODES			
Forward and reverse resistances,			
		Sync coupling, analysis of	Jul 40
		Tear and drift, Truetone Model 2DC1663A	VSS Jul 16
		Tearout caused by defective filter	Jan 18
		Twist, post-video (Trav-ler Chassis 740-78)	TS Aug 54
		Unstable	Sep 16
		Weak, RCA Chassis CTC25X	TS Nov 59
		HUM	
		Until raster appears, Zenith Chassis 15L22	TS May 58
		IF SECTION OF TV	
		Troubleshooting with oscilloscope	Apr 4
		—ground circuit difficulties	Apr 6
		—hum in IF signal	Apr 5
		—low contrast versus stage gain	Apr 5
		—picture pulling or loss of sync	Apr 5
		—poor picture quality	Apr 4
		INDUSTRIAL ELECTRONICS	
		Basic circuits	Jan 45
		—anti-chatter relay	Jan 45
		—dual primary transformer	Jan 45
		—load positioning control	Jan 48
		—manual/automatic control circuits	Jan 45
		—modulated-light photorelay	Jan 46
		—self-latching relay	Jan 50
		—shockover capacitor	Jan 46
		—thermocouple break protection	Jan 49
		—voltage regulation	Jan 46
		Circuit descriptions and functions	Apr 28
		—bin-level control	Apr 32
		—chopper amplifier	Apr 36
		—conductivity meter	Apr 32
		—differential transformer	Apr 28
		—energy-storage welding	Apr 30
		—flame-failure safeguard	Apr 33
		—infrared pyrometer	Apr 36
		—nixie readout	Apr 32
		—phase-controlled rectifier	Apr 28
		—photomultiplier	Apr 56
		—saturable reactor	Apr 30
		—ultrasonic sensor	Apr 33
		INTERFERENCE	
		Diathermy on higher channels, Zenith Chassis 26KC20	CCM Jan 68
		TVI traps, setting	TS Jun 56
		INTERMITTENT TROUBLES	
		Collapsed raster, Admiral Chassis G13	Nov 35
		Color intermittent, b-w normal —Admiral Chassis G1263-1	VSS Feb 5
		—Olympic Chassis CTC-15/U	VSS May 12
		Color, RCA Chassis CTC12, 15	CCM Nov 66
		Color sync —Magnavox Chassis C/U45- 01-00	VSS Mar 6
		—Zenith Chassis 24MC32, 42	VSS Mar 7
		Green flashes on screen, RCA Chassis CTC12	Apr 22
		Height, Admiral Chassis D11	Nov 37
		Horizontal and vertical sync, RCA Chassis CTC22	CCM Dec 53
		Horizontal quiver, Westinghouse Chassis V-2233-4	Jan 17

Raster intermittent or poor horizontal sync, Motorola Chassis	VSS Jul 13
TS-912	
Reduced raster, RCA Chassis	
CTC19	Nov 34
Vertical roll	
—caused by video signal distortion	Jan 20
—Crosley Model 487	Jan 19
—Olympic Chassis	
CTC 15/U	VSS May 11
—Philco Chassis 17MT80	Nov 37
Vertical sweep, Admiral Chassis	
21B1	TS May 58
Vertical sync, RCA Chassis	
KCS68	Jan 18
Volume weak on right channel, RCA Model VGP82	Jun 47

MISCELLANEOUS

Adapting extension cable to fit octal plug	May 39
Electronic cables	Feb 19
—characteristics	Feb 19
—handling techniques	Feb 21
—high fidelity	Feb 23
—installation techniques	Feb 22
—television lead-in	Feb 24
Organ servicing, getting started in	May 25
Symbol standardization	Jan 1

NOTES ON TEST EQUIPMENT

Amphenol Model 870 FET Voltmeter	Oct 28
B & K Model 465 CRT Tester	Jul 49
B & K Model 1242 Color Generator	Jun 50
Hickock Model CR 35 CRT Tester	Sep 58
Hickock Model GC 660 Color Generator	May 47
Hickock Model 860 Injecto-Tracer	Aug 52
Lectrotech Model TT-250 Transistor Analyzer	Nov 39
Mercury Model 1900 Color Generator	Mar 38
Precision Model E-200-C RF Generator	Feb 34
Seco Model HC8 In-Circuit Current Checker	Nov 40
Seco Model 107-C Tube Tester	Jul 50
Semitron Model 1000 Transistor Tester and Set Analyzer	Mar 39
SENCore Model CR13 CRT Tester/Rejuvenator	Dec 40
SENCore Model CR 143 CRT Tester	Aug 52
SENCore Model MP-140 Tube Tester	Apr 44
Triplet Model 600 FET Meter	Dec 44
Unijunction transistor multivibrator used in color generators	May 46

OSCILLOSCOPES

Advantages and limitations of IF section, using to signal trace in	Jun 28 Apr 4
Probes used with	Mar 28
—applications	Mar 59
—capacitance divider	Mar 56
—combination isolating and direct	Mar 30
—demodulator probe	Mar 44
—direct probe	Mar 28
—low-capacitance probes	Mar 42

TV tuner, using to troubleshoot Video amplifier, using to signal trace in	Apr 1 Apr 7
PICTURE SYMPTOMS	
Barkhausen line	Sep 16
Blobs of color on screen, sync unstable (Sylvania Chassis DO5)	May 55
Blue and yellow fringing on horizontal edges of b-w picture information	Sym Mar 46 Sym Mar 48
Brightness missing, Emerson Chassis 120699	VSS Feb 8
Brightness reduced	
—Emerson Chassis 120699	VSS Feb 8
—Motorola Chassis	
TS-908	VSS May 10
—screen control operation reversed, Motorola Chassis	
TS-908	VSS May 9
Color bar creeps up screen, no color on rest of screen (RCA Chassis CTC15)	May 23
Color in b-w program, off-channel snow is confetti	Sym Jun 32
Color intermittent, b-w normal	
—Admiral Chassis	
G1263-1	VSS Feb 5
—Olympic Chassis	
CTC-15/U	VSS May 12
Color missing	
—misadjusting color killer produces out of sync color	Sym Apr 53
—Motorola Chassis	
TS-912	VSS Jul 13
—on station signal, generator produces 10 green bars	Sym Apr 52
—or intermittent, RCA Chassis	
CTC12, 15	CCM Nov 66
—or weak, Motorola Chassis	
TS-912	VSS Jul 13
—poor vertical sync, Admiral Chassis	
25D6	TS Jul 52
Color missing, b-w normal	
—Admiral Chassis	
G1263-1	VSS Feb 6
—indicator light on at all times, Motorola Chassis	
TS-908	VSS May 10
—Magnavox Chassis	
C/U45-01-00	VSS Mar 5
—Magnavox Chassis	
C/U45-01-00	VSS Mar 6
—Olympic Chassis	
CTC-15/U	VSS May 11
—Zenith Chassis	
24MC32, 42	VSS Mar 7 Sym Apr 52 Sym Jun 32
Color overloads when switching from weak to strong station	SYM Jun 34
Color sync	
—critical, Magnavox Chassis	
T-918	CCM Sep 64
—intermittent, Magnavox Chassis	
C/U45-01-00	VSS Mar 6
—intermittent, Zenith Chassis	
24MC32, 42	VSS Mar 7
—lost during commercials, Curtis Mathes Chassis	
CMC15	TS Aug 54
—poor, Sylvania Chassis D01 and D02	CCM Oct 62
—unstable, Truetone Model	
2DC1663A	VSS Jul 16
Color temperature shifts, Sylvania D03 chassis	Apr 47
Color weak, killer control inoperative	Sym Jun 34
Color weak, Motorola Chassis	
TS914	CCM Jan 68
Color weak on weak stations, sync unstable	Sym Apr 54
Color weak or missing, hue control has no effect	Sym Jun 33
Colors incorrect, b-w normal	Sep 32
Contrast lost	
—raster and color remain, RCA Chassis CTC11	CCM Oct 61
—RCA Chassis CTC11	CCM Mar 62
Contrast low	Apr 5
Definition poor, caused by defect in video amplifier	Apr 8
Electrolytic capacitor failures, caused by	May 30
Focus lost when antenna disconnected or brightness control adjusted from 3/4 to maximum, Admiral Chassis	
1G1155-1	TS Aug 55
Focus poor, brightness low, width reduced (Motorola Chassis TS-908)	VSS May 10
Ghosts, evenly spaced, multiple	CCM Oct 62
Green flashes on screen, intermittent, (RCA Chassis CTC12)	Apr 22
Green screen on color, b-w normal (Zenith Chassis 24NC31,Z)	CCM Oct 61
Green tint on b-w program disappears after set warms up (Zenith Chassis)	Apr 22
Horizontal bars of color on b-w and color programs, RCA Chassis, CTC16, 17	CCM Nov 67
Horizontal bars of wrong color drift through color picture, b-w normal	Sym Apr 53
Hue changes with rotation of color level control, Zenith Chassis	
23XC36, 38	CCM Apr 71
Hue control action reversed, Zenith Chassis	CCM Oct 62
Hue unstable, Olympic Chassis	
CTC-15/U	VSS May 12
Hum bar	Apr 5
Left side of raster purple, Motorola Chassis	
TS-908	VSS May 9
Muddy and filled up, caused by defect in video amplifier	Apr 7
Overload on strong signal, Motorola Chassis	
TS-912	VSS Jul 14
Overloaded picture, Olympic Chassis	
CTC-15/U	VSS May 11
Picture and sound missing, Emerson Chassis	
120699	VSS Feb 7
Picture missing	
—both b-w and color, Zenith Chassis	
24MC32, 42	VSS Mar 8
—Truetone Model	
2DC1663A	VSS Jul 15
Poor picture quality	Apr 4
Ringing and circuit ghosts caused by defects in video amplifier	Apr 8
Red and green vertical lines not converged on left of screen	Sym Mar 47
Red color component missing in	

b-w and color, Admiral Chassis G1263-1	VSS Feb 5
Red excessive in color and b-w picture, Truetone Model 2DC1663A	VSS Jul 15
Red vertical fringing on b-w picture information	Sym Mar 46
Ringing caused by IF regeneration	Apr 4
Screen temperature shifts to predominate hue after warmup, RCA Chassis CTC22	CCM Dec 54
Shadows filter across screen, increased contrast (RCA Chassis CTC11D)	TS Jan 57
Single 2" bar of color, rest of screen black (RCA Chassis CTC 15)	May 23
Smeared and out of focus, Olympic Chassis CTC-15/U	VSS May 12
Sweep alignment, indicating need for	June 5
Tearing and overload, brightness reduced (Motorola Chassis TS-908)	VSS May 9
Tinted screen, varies with hue control setting (Magnavox Chassis T-918)	CCM Sep 64
Trap off frequency in video IF, effect of	Jun 10
Tuner AFC defects, associated with	Sym May 42
Twist and bends caused by electrolytic filter defects	May 30
Twist, post video (Trav-ler Chassis 740-78)	TS Aug 54
Vertical red and green edging over entire screen during b-w program	Sym Mar 47
Vertical red lines displaced to right on sides, left in middle	Sym Mar 48
Video and audio disappear, Philco Chassis 14N50	TS Dec 55
Video missing, sound poor (General Electric Chassis AY)	TS May 57
Video overload on strong signals, Admiral Chassis G1263-1	VSS Feb 6
Weak reception on all channels, heavy snow, distorted sound (Motorola Chassis TS-408A)	TS Apr 63
PICTURE TUBES	
Arcing at anode connection, Olympic Model 6P25	TS Apr 65
Defects, pinpointing	Apr 20
Filament burned open, Motorola Chassis 534D-13	TS May 59
Green tint on b-w program disappears after set warms up (Zenith Chassis)	Apr 22
Heater to cathode short causes loss of contrast, RCA Chassis CTC11	CCM Mar 62
Impurities, permanent	Apr 22
Intermittent green flashes on screen caused by bad CRT, RCA CTC12 chassis	Apr 22
Spot elimination circuit employed in Admiral H5 chassis	Oct 6
Substitution, RCA Chassis 72A	TS Apr 63
POWER SUPPLIES	
Color receivers, used in	Sep 54
Electrolytic capacitor applications	May 28
Twists and bends, defects causing	May 31
PREVIEWS OF NEW SETS	
Admiral Model LKS6511M, Chassis 1H1298-2	Mar 1
Airline Model GHJ7537B, Chassis 913-179466	May 5
Emerson Model 23T02, Chassis 120844A	Mar 2
General Electric Model M980CWD, Chassis KC	May 6
Magnavox Model 30U505K, Chassis V918-01-BB	Feb 1
Motorola Model CTC606CN, Chassis 20TS-918A-00	Feb 2
Motorola Model XP201CU, Chassis 9TS-460A-09	Jul 9
Packard Bell Model CSW-606, Chassis 98C15	Mar 3
Philco-Ford Model 85506SEA, Chassis 17MT80B	Mar 4
Pilot Model C309	May 7
RCA Model AJ-00E, Chassis KCS157A	Jul 10
RCA Model GH784H, Chassis CTC21C	Feb 3
Sears Model 7160, Chassis 562.10220	Jul 11
Sylvania Model 19TC14-1, Chassis D05-1	May 8
Zenith Model X4541W, Chassis 20X1C36	Jul 12
Zenith Model 25X6547M, Chassis 23XC36	Feb 4
RADIO	
Sound reduced on lower frequencies, General Electric Model C403G	TS Feb 66
RASTER (FAULTS)	
Barkhausen lines	Sep 16
Black raster, retrace lines, small creeping bar of color (RCA Chassis CTC15)	May 23
Blooming	
—causes of in solid-state circuits	Sep 15
—Emerson Chassis 120699	VSS Feb 8
Boost, high voltage, and raster missing (Zenith Chassis 14M20)	TS Oct 48
Brightness reduced	
—Motorola Chassis TS-908	VSS May 10
—screen control operation reversed, Motorola Chassis TS-908	VSS May 9
—tearing and overload, Motorola Chassis TS-908	VSS May 9
Collapsed raster, Admiral Chassis G13	Nov 35
Delayed height, Motorola Chassis WKTS-584	TS Jan 59
Foldover, vertical (Sylvania Chassis D03)	Nov 36
Height insufficient, Motorola Chassis TS-586/Y	TS Dec 57
Height intermittent, Admiral Chassis D11	Nov 37
Height reduced, RCA Chassis CTC16XL	Nov 34
Horizontal foldover, causes of in solid-state circuits	Sep 15
Horizontal nonlinearity, causes of in solid-state circuits	Sep 16
RESISTORS	
Thermistors	Jul 30
—deflection circuits, in	Jul 31
—filament strings, in	Jul 30
—servicing	Jul 32
—typical resistance	Jul 30
Varistors	Jul 32
—deflection circuits, in	Jul 34
—servicing	Jul 34
—voltage/resistance, typical	Jul 34
SIGNAL GENERATORS, RF	
Precision Model E-200-C	TE Feb 34

RCA Model WR-50B	Jan 39
SOUND SECTION OF TV	
Alignment, symptoms indicating need for	Jun 6
Buzz, Philco Chassis 16QT85	CCM Feb 58
Color receivers, used in	Sep 49
Distortion, heavy snow on screen (Motorola Chassis TS-408A)	TS Apr 63
Electrolytic capacitor applications	May 29
Grid leakage in output tube, de Forest Model DKW	TS Sep 68
Hum until raster appears, Zenith Chassis 15L22	TS May 58
Integrated circuit, sound system employing	Oct 8
STEREO FM	
Audio weak on stereo and monaural, no separation on stereo	Sym Jan 43
Audio weak on stereo and monaural, separation poor, but indicator lights	Sym Jan 44
Audio weak on stereo and monaural, stereo indicator illuminated	Sym Jan 43
Distortion and weak, garbled volume in left channel (Elec- trohome Model TR30M)	Oct 37
Distortion in right channel, Magnavox Chassis R204-10	Oct 36
FM and AM reception missing, phono normal (RCA Chassis RC1223A)	Oct 33
FM reception noisy, AM and phono normal (RCA Chassis RC-1227B)	Oct 34
FM reception poor, rushing sound in speaker (Admiral 20C4A chassis)	Jun 47
High-quality systems, servicing	Aug 32
—components	Aug 32
—distortion measurement	Aug 38
—frequency response	Aug 58
—sensitivity measurement	Aug 38
—separation measurement	Aug 58
—system analysis	Aug 33
—tuner bandpass measurement	Aug 38
—turntable tests	Aug 60
Hissing sound on FM, AM normal (Truetone Model 4DC-5665A)	Oct 32
Left channel intermittent on radio and phono positions, General Electric Chassis	Jun 44
Motorboating in left channel, RCA Chassis	Jun 47
Noise during stereo reception, separation poor	Sym Jan 44
No stereo reception, Silvertone Chassis 528.63310	Oct 34
Separation missing on stereo FM	Sym Jan 42
Separation poor on strong signal, missing on weak	Sym Jan 42
Troubleshooting procedures	
—audio stages	Oct 36
—circuit analysis	Oct 32
—multiplex stages, in	Oct 34
—noise generators, with	Jun 40
—signal generators, with	Jun 40
—signal injection	Oct 33
—transistor checking	Jun 41
—VTVM or VOM tests	Oct 33
Volume intermittently weak on right channel, RCA Model VGP82	Jun 47
Volume low on right channel, RCA Model VFP 32E	Jun 44
Warm up slow, Silvertone Chassis 528.63430	Jun 48
SYMFAC	
Chroma oscillator	Apr 51
Color Generator, RCA Model WR-64B	Feb 37
Color killer	Jun 31
Convergence Assembly	Mar 45
Multiplex amplifier and doubler	Jan 41
Tuner AFC, RCA Chassis CTC21C	May 41
SYNC (Also see horizontal and vertical)	
Analysis of	Jul 35
—horizontal sync coupling	Jul 40
—servicing procedures	Jul 42
—sync separator	Jul 35
—vertical sync coupling	Jul 35
Color receiver, circuitry in	Sep 51
Horizontal and vertical intermittent, RCA Chassis CTC22	CCM Dec 53
Horizontal tearing, vertical roll, Channel 3 beat (RCA Chassis CTC11D)	TS Feb 66
Intermittent and time-lapse troubles	Jan 17
Solid-state circuitry	Aug 7
—horizontal AFC and oscillator	Aug 11
—vertical sweep	Aug 7
Vertical and horizontal hold poor	VSS Mar 6
Vertical and horizontal sync missing, Emerson Chassis 120699	VSS Feb 7
TELEVISION	
AGC, keyed	Dec 30
Color models for 68	Nov 6
Electrolytic capacitors used in	May 27
Lead-in	Feb 24
—coaxial type	Feb 26
—installation tips	Feb 60
—losses	Feb 24
—shielded twin-lead	Feb 60
1968 TV lines, models and features of	Oct 4
Station test signal	TS Feb 66
Sweep alignment	Jun 5
—difficulties and precautions	Jun 8
—misaligned traps, effects of	Jun 9
—peak alignment	Jun 11
—response curves, interpreting	Jun 6
—RF-IF response, checking	Jun 10
—step-sweep IF alignment	Jun 11
—symptoms indicating need for	June 5
—traps, aligning	Jun 10
Transistor, servicing	Jun 36
TEST EQUIPMENT	
CRT Testers	
—B & K Model 465	TE Jul 49
—Hickok Model CR 35	TE Sep 58
—SENCORE Model CR 13	TE Dec 40
—SENCORE Model CR 143	TE Aug 52
Color generators	
—B & K Model 1242	TE Jun 50
—Hickok Model GC 660	TE May 47
—Mercury Model 1900	TE Mar 38
—RCA Model WR-64B	Sym Feb 37
Electronic Organs, for repairing	May 52
FET Voltmeters	
—Amphenol Model 870	TE Oct 28
—Triplet Model 600	TE Dec 41
In-circuit current checker, Seco Model HC8	TE Nov 40
Meters (VTVM and VOM)	
—application of	Jun 25
—frequency response	Jun 26
—input capacitance	Jun 26
—waveform errors	Jun 28
Ohms and AC functions defective, Olson TE-168 VOM	TS Mar 60
Oscilloscopes, advantages and limitations of	Jun 28
RF signal generators	
—Precision Model E-200-C	TE Feb 34
—RCA Model WR-50B	Jan 39
Scope or meter, deciding which	Jun 25
Signal tracer, Hickok Model 860 Injector-Tracer	TE Aug 52
Transistor analyzer, Lectrotech Model TT-250	TE Nov 39
Transistor Tester and Set analyzer, Semitron Model 1000	TE Mar 39
Tube testers	
—Mercury Model 2000	Jan 38
—Seco Model 107-C	TE Jul 50
—SENCORE Model MP-140	TE Apr 44
THEORY	
Color signal, development of	Aug 23
Field effect transistors	Sep 34
Ohm's law for AC	Jan 28
Organs	May 26
RC Circuits	Oct 38
Sheet-beam demodulator	Jul 28
Symbol standardization	Jan 1
Sync, horizontal and vertical	Jul 35
TRANSISTORS	
Beta and leakage readings in AM-FM chassis	Oct 33
DC voltage distribution	Dec 4
—bias circuits	Dec 56
—collector junction leakage	Dec 4
—common base circuits	Dec 6
—common collector circuits	Dec 56
—cutoff test	Dec 5
—open and shorted collector junctions	Dec 5
—voltage indications, comparative	Dec 6
FET used in voltmeter	TE Oct 28
Field effect transistors, introduction	
to	Sep 34
—basic theory	Sep 34
—features of	Sep 34
—precautions	Sep 44
—test procedures	Sep 36
Replacement table for AM-FM chassis	Oct 32
Testing	
—beta	Mar 25
—characteristics	Jun 41
—in-circuit	Jun 37
—leakage	Mar 25
—symptom association	Jun 43
Testers, typical	Mar 26
Unijunction transistor employed in vertical oscillator	Oct 7
Unijunction transistor multivibrator used in color generators	TE May 46
Lectrotech Model TT-250	TE Nov 39
TRANSISTOR TESTERS	
Operation of	Mar 24
—beta tests	Mar 25
—leakage tests	Mar 25

—typical instruments	Mar 26
Semitron Model 1000	TE Mar 39
Solid-state stereo, using to check transistors in	Jun 41
TRANSISTOR TV	
Deflection circuits	
—horizontal AFC and oscillator	Aug 11
—horizontal output and high voltage	Sep 9
—horizontal troubles	Aug 12
—vertical sweep	Aug 7
—vertical troubles	Aug 9
Motorola all-transistor Chassis	
TS-915 and TS-919, introduction to	Aug 40
Troubleshooting techniques	Jun 36
—AGC circuits	Jun 62
—basics	Jun 36
—horizontal circuits	Jun 39
—in-circuit testing	Jun 37
—precautions	Jun 64
—special circuits	Jun 38
—vertical circuits	Jun 62
TROUBLESHOOTER, THE	
Arcing at CRT anode connection, Olympic Model 6P25	Apr 65
Arcing from "S" winding of flyback to iron core	Mar 60
CRT filament burnout, repeated (Motorola Chassis 534D-13)	May 59
CRT substitution, RCA Chassis 72A	Apr 63
Color coding of oscillator and IF transformer adjustments in AM/FM radios	Apr 65
Color missing, poor vertical sync (Admiral Chassis 25D6)	Jul 52
Color sync lost during commercials, Curtis Mathes Chassis CMC15	Aug 54
Delayed height, Motorola Chassis WKTS-584	TS Jan 59
Focus lost when antenna disconnected or brightness control adjusted from $\frac{3}{4}$ to maximum, Admiral Chassis 1G1155-1	Aug 55
Grid leakage in audio output tube, de Forest Model DKW	Sep 68
Heavy snow on screen, distorted sound (Motorola Chassis TS-408A)	Apr 63
Height insufficient, Motorola Chassis TS-586/Y	Dec 57
High end of band inoperative when receiver installed in car, Pontiac Model 983873	Jun 56
Horizontal output transformer overheating, Zenith Chassis 16E25	Jun 56
Horizontal output tube overheats, Admiral Chassis 1601	Feb 66
Horizontal sync weak, RCA Chassis CTC25X	Nov 59
Horizontal tearing, vertical roll, Channel 3 beat (RCA Chassis CTC11D)	Feb 66
Hot cabinet, Zenith Model Z1511-BUZ	Nov 59
Hum until raster appears, Zenith Chassis 15L22	May 58
Ohms and AC functions defective, Olson TE-168 VOM	Mar 60
Raster, boost, and high voltage missing (Zenith Chassis	
14M20)	Oct 48
Raster missing, sound normal (General Electric Chassis MW)	Feb 65
Shadows and increased contrast, RCA Chassis CTC11D	TS Jan 57
Sound reduced on lower frequencies, General Electric Model C403G radio	Feb 66
Station test signal	Feb 66
TVI traps, setting	Jun 56
Twist, post video (Trav-ler Chassis 740-78)	Aug 54
Vertical roll after one hour of operation, Zenith Chassis 14L20	Oct 47
Vertical sweep intermittent, Admiral Chassis 21B1	May 58
Vertical sync poor, Zenith Chassis 14M21/X	Oct 45
Vertical sync weak	
—Sears Model 9146B	Nov 60
—Zenith Chassis 14N33	Nov 60
Video and audio disappear, Philco Chassis 14N50	Dec 55
Video and sound disappear when contrast control is turned down, Admiral Chassis 20B6CB	Sep 68
Video missing, sound poor (General Electric Chassis AY)	May 57
Wavy pattern when tuning near sound side, Setchell Carlson receivers	Oct 47
TUBES	
Heater to cathode shorts, effects on raster and color	May 24
Sheet-beam chroma demodulator	Jul 28
Stock Guide for TV	Apr 24
Substitution of 6GM6 for 6AU6 cures trouble	TS Jul 52
TUBE TESTERS	
Mercury Model 2000	Jan 38
Seco Model 107-C	TE Jul 50
SENCORE Model MP-140	TE Apr 44
TUNERS, TV	
Automatic frequency control, operation of	Sym May 41
Balun coil, rewinding	Jan 24
Color receivers, used in	Sep 46
Fine tuning control does not function correctly, Motorola Chassis TS-912	VSS Jul 14
Troubleshooting with oscilloscope	Apr 1
VERTICAL SWEEP	
Collapsed raster, intermittent (Admiral Chassis G13)	Nov 35
Color TV, circuits employed in	Oct 17
Delayed height, Motorola Chassis WKTS-584	TS Jan 59
Foldover, Sylvania Chassis D03	Nov 36
Intermittent	
—Admiral Chassis D11	Nov 37
—Admiral Chassis 21B1	TS May 58
Jitter, Admiral Chassis G1263-1	VSS Feb 6
Missing	
—Magnavox Chassis C/U45-01-00	VSS Mar 5
—RCA Chassis CTC24	CCM Nov 66
Reduced	
—bottom compressed, Zenith Chassis 24MC32, 42	VSS Mar 8
—intermittent, RCA Chassis CTC19	Nov 34
—Motorola Chassis TS-586/Y	TS Dec 57
—Motorola Chassis TS-912	Nov 36
—RCA Chassis CTC16XL	Nov 34
Retrace lines, Zenith Chassis 23XC38	CCM Feb 58
Solid-state circuitry	Aug 7
—common troubles	Aug 9
—output stage	Aug 8
—sawtooth generation	Aug 7
—two-stage system	Aug 8
Top reduced, RCA Chassis CTC20A	Nov 38
Transistor TV, employed in	Jun 62
Unijunction transistor employed in oscillator, Electrohome M5 Chassis	Oct 7
Vertical pulse contaminating horizontal sweep, RCA Chassis KCS151	Mar 75
VERTICAL SYNC	
Drift, Magnavox Chassis C/U45-01-00	VSS Mar 5
Instability resulting from difference in b-w and color vertical frequency	Jan 21
Intermittent with jitter, RCA Chassis KCS68	Jan 18
Jitter	
—RCA Chassis CTC15	Nov 37
—RCA Chassis CTC24	CCM Nov 66
Poor	
—color missing, Admiral Chassis 25D6	TS Jul 52
—foldover and retrace lines at top, Emerson Chassis 120699	VSS Feb 7
—Zenith Chassis 14M21/X	TS Oct 45
—Zenith Chassis 24MC32, 42	VSS Mar 8
Roll	
—after one hour of operation, Zenith chassis 14L20	TS Oct 47
—caused by defective VDR, Admiral Chassis 25H6	Nov 38
—intermittent, caused by video signal distortion	Jan 20
—intermittent, Crosley Model 487	Jan 19
—intermittent, Olympic Chassis CTC-15/U	VSS May 11
—intermittent, Philco Chassis 17MT80	Nov 37
—RCA Chassis CTC20	Nov 38
—slow, Sylvania Chassis D02	Nov 35
Servicing procedures	Jul 42
Sync coupling, analysis of	Jul 35
Weak	
—Sears Model 9156B	TS Nov 60
—Zenith Chassis 14N33	TS Nov 60
VIDEO	
Amplifier defects, effects on color	May 23
Amplifier, signal tracing in	Apr 7
Color missing, b-w pix normal (Magnavox Chassis C/U45-01-00)	VSS Mar 5
Color receiver, circuitry used in	Sep 47
Contrast low	Apr 5
Definition poor	Apr 8
Delay line causes loss of brightness, Emerson	

Chassis 120699	VSS Feb 8
Disappears along with audio, Philco Chassis 14N50	TS Dec 55
Hum in IF signal	Apr 5
IF amplifiers, sweep alignment of	Jun 5
Overload	
—Olympic Chassis CTC-15/U	VSS May 11
—on strong signals, Admiral Chassis G1263-1	VSS Feb 6
Picture and sound missing, Emerson Chassis 120699	VSS Feb 7
Picture missing	
—both b-w and color, Zenith Chassis 24MC32, 42	VSS Mar 8
—sound poor, General Electric AY chassis	TS May 57
—Truetone Model 2DC1663A	VSS Jul 15
Picture pulling or loss of sync	Apr 5
Poor picture quality	Apr 4
Ringing and circuit ghosts	Apr 8
Smeared and out of focus picture, Olympic Chassis CTC-15/U	VSS May 12
Twist, post video (Trav-ler Chassis 740-78)	TS Aug 54
Video and sound disappear when contrast control is turned down, Admiral Chassis 20B6CB	TS Sep 68
White compression	Apr 7

VIDEO SPEED SERVICING

Admiral Chassis G1263-1	Feb 5
Emerson Chassis 120699	Feb 7
Olympic Chassis CTC-15/U	May 11
Magnavox Chassis C/U45-01-00	Mar 5
Motorola Chassis TS-908/A,B,YA,YB	May 9
Motorola Chassis TS-912	Jul 13
Truetone Model 2DC1663A, 65A, 67A	Jul 15
Zenith Chassis 24MC32, Z and 24MC42, Z	Mar 7

VOM's

Application of	Jun 25
FET type, Amphenol Model 870	TE Oct 28
Frequency response	Jun 26
Input capacitance	Jun 26
Ohms and AC functions defective, Olson TE-168 VOM	TS Mar 60
Transistorized, Triplett Model 600	TE Dec 41
Waveform errors associated with	Jun 28

VTVM's

Application of	Jun 25
FET type, Amphenol Model 870	TE Oct 28
Frequency response	Jun 26
Input capacitance	Jun 26
Waveform errors associated with	Jun 28

WAVEFORMS

Bandpass amplifier response	Nov 21
Bandwidth of video IF, method used to measure	Apr 4
Chroma oscillator, in	Sym Apr 51
Color burst at phase detector	Jan 53
Color generator, in	Sym Feb 37
Color killer, in	Sym Jun 31

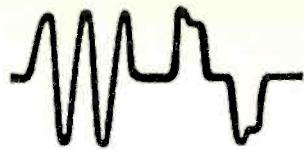
Color signal, expanded	Jun 60
Composite video showing sync defects	Jan 20 Jan 21
Convergence assembly, in	Sym Mar 45
Demodulator, chroma	Nov 28
Difference amplifier grids, at	Sep 33
Doubled-tuned color IF system, responses in	Nov 51
Hash on defective filter capacitors	Jan 21
Horizontal keying pulse at burst amplifier grid	Jan 53
Horizontal linearity poor, effects on waveform	Jun 28
Horizontal-output system, in	Sep 10
Horizontal sync and feedback pulses	Oct. 20
Horizontal sync pulse	Jan 18
Hum in video IF signal	Apr 5
IF and chroma response, overall	Nov 24
IF bandpass curve, in color receiver	Sep 47
Keyed-rainbow chroma signal	Nov 26
Low-voltage supply circuits, in	May 28
Musical notes, typical	May 26
Response curve of video IF peaked, associated with poor picture quality	Apr 4
Response curves, video IF in color receiver	Sep 48
Ringing test, scope patterns obtained in	Sep 14
Rise time, measurement of	Jun 59
Secondary electrolytic applications, associated with	May 29
Sine and square waves, hybrid	Apr 7
Square wave with differentiation, ringing, and overshoot	Apr 8
Square wave with overshoot	Apr 8
Square wave with nonsymmetrical overshoot	Apr 8
Stagger-tuned color IF system, responses in	Nov 41
Sync circuits, in	Jul 37
Sync pulses compressed in video IF signal	Apr 5
Sync separator, at grid and plate of	Jan 19
Transient responses of lab- and service-type scopes	Jun 59
Tuner AFC, in (RCA Chassis CTC21C)	Sym May 41
Tuner signal observed when input is from AM signal generator	Apr 3
Tuner signal observed when input is from pattern generator	Apr 3
Vectorgram display of color receiver	Jun 59
Vertical sync defects	Jan 21
Vertical sync feedback pulse	Jan 17
Vertical sync pulse in sync separator	Jan 19
Vestigial sideband transmission, compensating for	Jun 7
Video amplifier responses, square and sweep	Apr 8
Video IF response —curves, typical	Jun 8
—effect of misaligned trap	Jun 9
—effects of misalignment	Jun 6
—effects of oscillation in video IF strip	Jun 9
—frequency increase graphs	Jun 8
—hash in	Jun 9
Video IF section, signal	
observed in	Apr 4
Video IF signal, undistorted	Apr 5
Video signals, normal and abnormal	Apr 7
White compression in video signal	Apr 7

YOKES

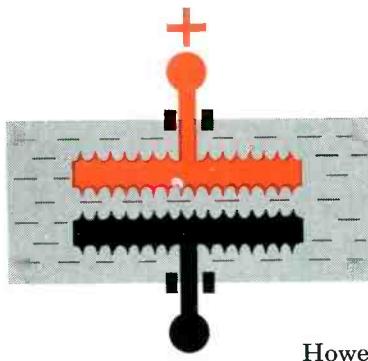
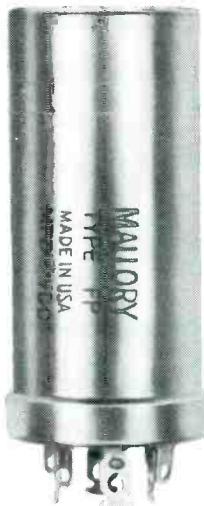
Ringing	Sep 16
---------	--------

INDEX OF TITLES

Annual TV Tube Stock Guide	Apr 24
Antennas Can Add Profits	Apr 58
Audio Equipment	Mar 20
DC Voltage Distribution in Transistor Circuity	Dec 4
Depreciation Reserves for Equipment	Jan 26
Electronic Cables	Feb 19
Electrolytic Capacitors in TV Receivers	May 27
Electronic Service Shop	Sep 37
Getting Started in Electronic Organ Servicing	May 25
Great Blobs of Color	May 22
Highlights of 1968 B-W TV	Oct 4
Industrial Electronics Notebook —Part 2	Apr 28
Installing Intercom and Music Distribution Systems	Dec 24
Intermittent and Time Lapse Sync Troubles	Jan 17
Introduction to FET's	Sep 34
Keyed AGC—A Review	Dec 30
Know Your 68 Color Circuits Part 1	Nov 6
Know Your 68 Color Circuits Part 2	Dec 12
Legal Services for Small Retail And Service Firms	Feb 30
Many Hued Rasters —Part I	Jul 44
Many Hued Rasters—Part II	Sep 32
Measuring the Results of Advertising	Aug 44
Meet A CB Specialist	Apr 38
Ohm's Law for AC	Jan 28
Picture Tube or Chassis— Which?	Apr 20
Protect Your Business From These Credit Abuses	Oct 52
RC Circuits	Oct 38
Removing the Barber Pole	Jan 22
Repairing the Deluxe AM-FM Chassis	Oct 32
Scope or Meter—Which?	Jun 25
Scope Probes	Mar 28
Servicing High-Quality Audio	Aug 32
Sheet-Beam Demodulators	Jul 28
Solid-State Color is Here	Aug 40
Solid-State Deflection Circuits —Part 1	Aug 7
Solid-State Deflection Circuits —Part 2	Sep 9
Solid-State Stereo Revisited	Jun 40
Source Guide to Imported Sets	Feb 28
Sweep Alignment for TV	Jun 5
Sweeping Color IF Amplifiers	Nov 41
Sync from Video to Oscillators	Jul 35
Symbol Standardization	Jan 1
The Case of the Bifilar Balun	Jan 24
Thermistors and Varistors in TV	Jul 30
Transistor Testers	Mar 24
Transistor TV Techniques	Jun 36
Troubleshooting RF, IF, and Video With the Oscilloscope	Apr 1
Twelve Vertical Color Problems	Nov 33

MALLORY**Tips for Technicians**

Why some filter capacitors develop hum... and some don't



Aluminum electrolytic capacitors are widely used as filters in DC Power Supplies. This is because of their large capacitance in relatively small size. All in all, they do an efficient job of reducing ripple (hum) to acceptable levels.

However, all electrolytic capacitors are not alike. This is often why some types seem to allow hum to rise to objectionable levels more quickly than do others. In order to understand why, we must investigate actual construction methods.

As you know, electrolytics are basically made by depositing a film of aluminum oxide on aluminum foil to form the positive anode. The oxide is the dielectric. A semi-liquid electrolyte surrounds the anode and is actually the negative cathode. In order to connect this semi-liquid cathode to a terminal, a second piece of aluminum foil is used. This is often called the cathode, but it is not. It is actually only the *cathodic connection*. (The preceding describes a "polarized" electrolytic capacitor.)

When high ripple currents are applied to polarized electrolytics, a thin oxide film forms on the so-called "cathode". It begins to assume the characteristics of a second anode. This in turn, has the same effect as placing two capacitors in series. Consequently, overall capacitance is reduced. Inevitably hum increases.

This action is especially noticeable in electrolytics which use plain foil as the "cathode". This is simply because the oxide builds up over a relatively small area.

Mallory avoids this problem by etching the "cathode" on electrolytics. As a result, oxide build-up is spread over a vastly increased area. Therefore, ripple currents are maintained at very low levels for very long time periods.

Of course etched "cathodes" cost a lot more to make. But you get them from Malloy at *no extra cost*.

Meanwhile, see your local Franchised Mallory Distributor for capacitors, resistors, controls, switches, semiconductors, and batteries. Or write Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Indianapolis, Indiana 46206.

DON'T FORGET TO ASK 'EM "What else needs fixing?"

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PHOTOFACt

the magazine of electronic servicing

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CONTENTS

Tube Substitution Supplement

Annual Index

Color TV Service Training

Part 5—Continuing analysis of the chroma circuits; including the burst amplifier, reference oscillator, color killer, and ACC circuits.

Notes on Test Equipment T. T. Jones

Lab report on Pomona Model 2900 High Voltage Probe and Seco Model 260 Transistor Analyzer.

The Electronic Scanner

Letters to the Editor

Time to Move Your Business? Ernest W. Fair

A check list for determining the time to relocate.

PHOTOFACt BULLETIN

The Troubleshooter

Video Speed Servicing

Color Countermeasures

Product Report

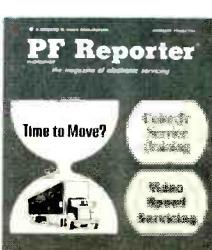
Book Review

Free Catalog and Literature Service

Monthly Index on Free Literature Card

ABOUT THE COVER

As any shop owner, manager, or service technician will agree, there are many facets to a successful service business. Some factors are business, or management, oriented; while others deal strictly with servicing problems. In any event, it must be conceded that both areas require attention if a business and those connected with it are to prosper. Our cover this month illustrates that the content of PF REPORTER follows this premise of double coverage—with, of course, greater emphasis placed on servicing.





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



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

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

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

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

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

True, too: Circuit tolerances may allow you to make successful replacements without matching original ca-

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PART
5

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CHROMA CIRCUITS

Part 4 of this series included a detailed block-diagram analysis of the chroma circuits which are most often encountered in present-day color receivers. Following this discussion, a description of specific circuits currently in use was initiated. While space limitations make it impossible to analyze all of the circuits in use, representative circuits from popular sets will be discussed in detail. Part 5 continues the analysis of the burst amplifier, reference oscillator, color killer, and ACC circuits.

RCA Closed-Loop ACC

In part 4 of this series, the final paragraphs were devoted to a discussion of the ACC (Automatic Chroma Control) used in RCA chassis CTC21, 28, and 30. This circuit is an *open loop* system. That is, the output of the ACC circuit is not used to control the gain of the amplifier which feeds it. By contrast, the ACC circuit used in the RCA CTC31 chassis is a *closed loop* system. The loop is from the grid of the first chroma amplifier, through the burst amplifier, through the ACC amplifier, and back to the grid of the first chroma amplifier. Fig. 1 is a simplified schematic of this circuit.

The color burst as well as the chrominance information are amplified by the first chroma bandpass amplifier. The plate load is the primary of the double-tuned transformer and one of the outputs from the secondary is fed to the burst amplifier. The burst amplifier amplifies the color burst and injects it into the reference oscillator circuit to control its phase.

First, consider the circuit with no burst signal present. The oscillator operates at its natural frequency and

develops approximately 3.5 volts of negative bias at its grid. This voltage is applied to the emitter of the ACC amplifier and a positive potential of about 35 volts is present at the collector. Because of the voltage drop across R739, the DC potential at the grid of the first chroma bandpass amplifier is about +5 volts. (This bias voltage may vary considerably from set to set.)

During color operation, the color burst from the first chroma bandpass amplifier is fed through the burst amplifier, which is gated on during horizontal retrace, to the grid of the oscillator. This signal increases the drive and causes the bias to increase to about -8 volts. This 5-volt change in voltage at the grid of the reference oscillator is amplified by the ACC amplifier transistor and causes a 31-volt swing at its collector. The normal collector voltage is about 4 volts when a nominal 80-volt burst signal is applied to the oscillator grid. The bias voltage at the grid of the first chroma amplifier is approximately -5 volts under these conditions. If the amplified color burst signal increases in am-

Burst Amplifier
Reference Oscillator
Difference Amplifier
Demodulators
Color Killer

plitude, the grid of the reference oscillator becomes more negative and the emitter current increases. This, in turn, causes the collector current to increase and the collector potential to swing in a negative direction. Finally, this negative-going voltage is used to increase the bias of the first chroma amplifier and reduce its gain.

Conversely, if the amplified color burst decreases in amplitude for any reason, the emitter and collector voltages of the ACC amplifier become less negative, decreasing the bias on the first chroma amplifier and increasing its gain. Thus, the burst amplitude at the grid of the oscillator is maintained at a constant 80 volts. This is the optimum level to properly phase the reference oscillator. Since the first chroma bandpass amplifier also amplifies the chrominance signal, it, too, is maintained at its optimum level. This, of course, is the more important function of the ACC circuit.

The principal advantage of the closed-loop ACC circuit is its ability to maintain a more nearly constant level of chrominance signal. The

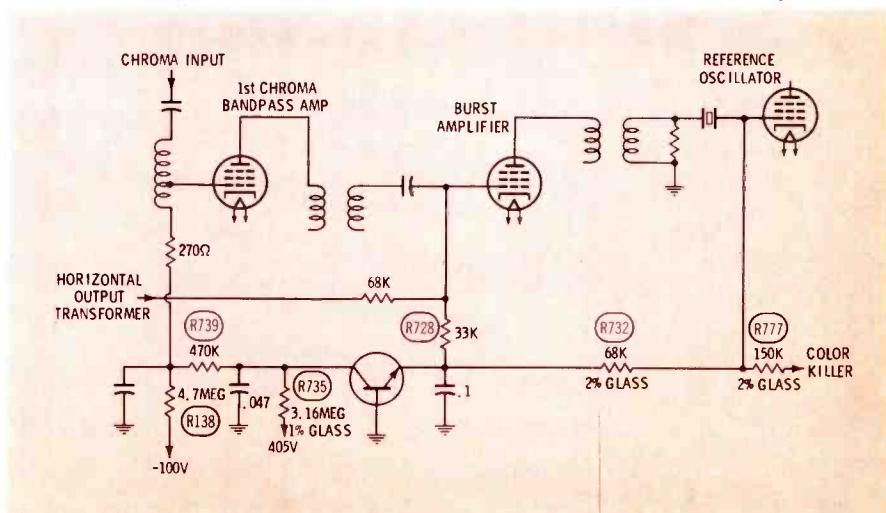


Fig. 1. Simplified ACC circuit of the RCA CTC31 chassis.

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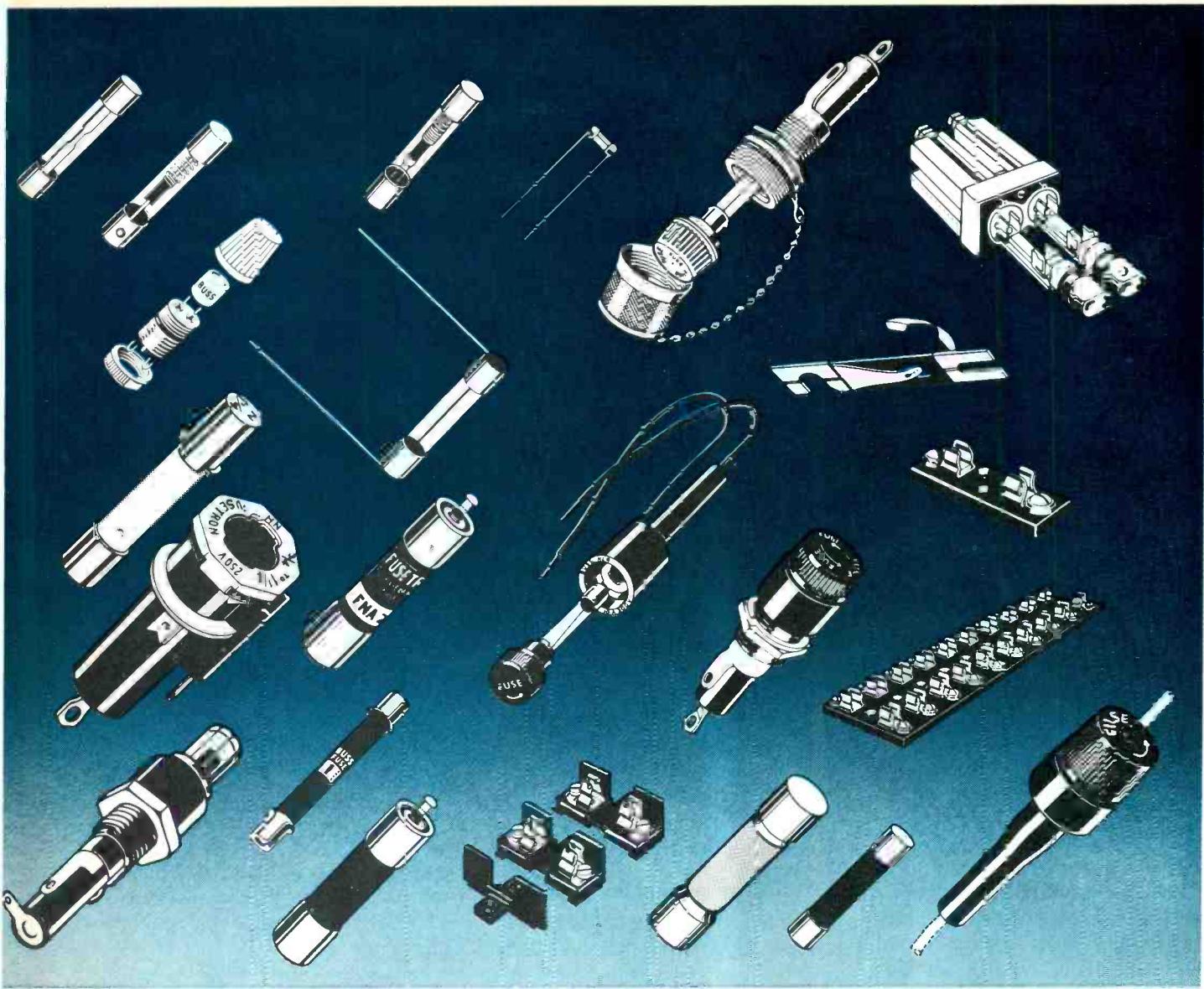


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curves shown in Fig. 2 demonstrate the characteristics of the two types of control, open-loop and closed-loop. Bear in mind that these curves illustrate the characteristics of the two basic systems and do not apply to any specific circuits.

Notice that R732, R777, and R735 are quite critical as to value, drift characteristics, and temperature coefficient. For this reason, glass resistors having close tolerance and low temperature coefficients are used.

RCA Color Killer

Incorporation of closed-loop ACC made it necessary to revise several other circuits in the RCA chroma system. Since the color burst is amplified by the first chroma amplifier, color-killer bias had to be fed to a different stage; the demodulators were chosen. The use of transistors in the ACC and color killer is also a significant departure from earlier RCA designs.

A simplified schematic of the color-killer circuit used in the RCA CTC31 chassis is shown in Fig. 3. The base voltage of the killer transistor is established by the setting of the killer control and the potential at the grid of the reference oscillator. Under no-color conditions, the base potential is about .5 volt positive with respect to the emitter and the transistor is cut off. Since the transistor is cut off, the collector voltage is determined by the voltage divider, R737 and R749, connected between the blanker grid and ground. Since the blanker grid is about -100

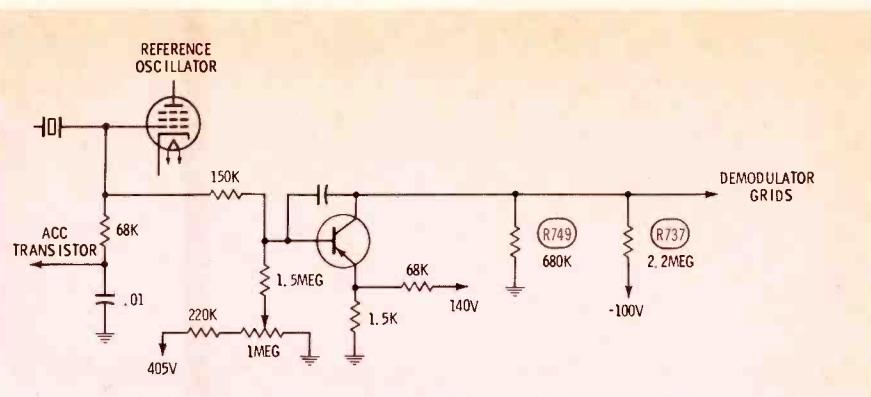


Fig. 3. Simplified color-killer circuit of the RCA CTC31 chassis.

volts, the collector voltage is about -25 volts. This voltage is also present on the screen grids of the demodulators and keeps these tubes below cutoff.

When a color burst is applied to the reference oscillator, the grid swings negative and the killer transistor is driven into saturation. This clamps the collector voltage to the emitter potential, raising the screen voltage of the demodulators to about 2 volts, well above cutoff. Notice that the color-killer transistor operates either at saturation or cutoff. Thus, variations in color-burst amplitude have no effect on the bias supplied to the demodulators.

RCA Reference Oscillator

The RCA CTC31 chassis uses an injection type reference oscillator which is similar to the one used in the CTC18, CTC20 and CTC24 chassis. Fig. 4 is a simplified sche-

matic of the oscillator used in the CTC31. Basically, the oscillator is of the tuned-plate, tuned-grid, electron-coupled type. The frequency is determined by the crystal in conjunction with the small trimmer capacitor shunted across it.

As with any TPTG oscillator, the oscillator plate tank (L704) is tuned slightly above the oscillator frequency. In this circuit, it is adjusted so that the self-bias developed at the oscillator grid is -3.5 volts with no burst signal applied. In earlier models using the injection oscillator, the counterpart of L704 was not adjustable. In the absence of a color burst, the oscillator runs at the reference frequency, but with a random phase. When the burst is injected through T702, this signal pulls the oscillator into phase with it. The oscillator is stable enough to remain properly phased until the arrival of the next burst.

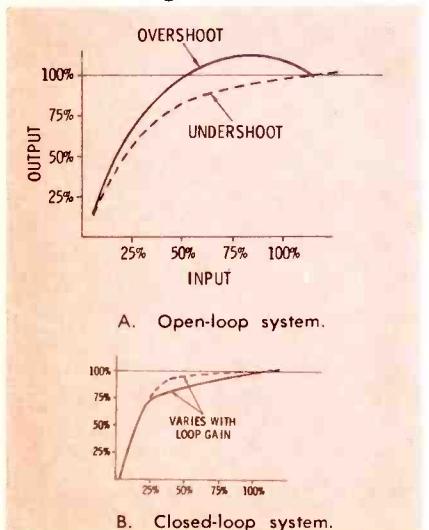


Fig. 2. Characteristics of open-loop and closed-loop control systems.

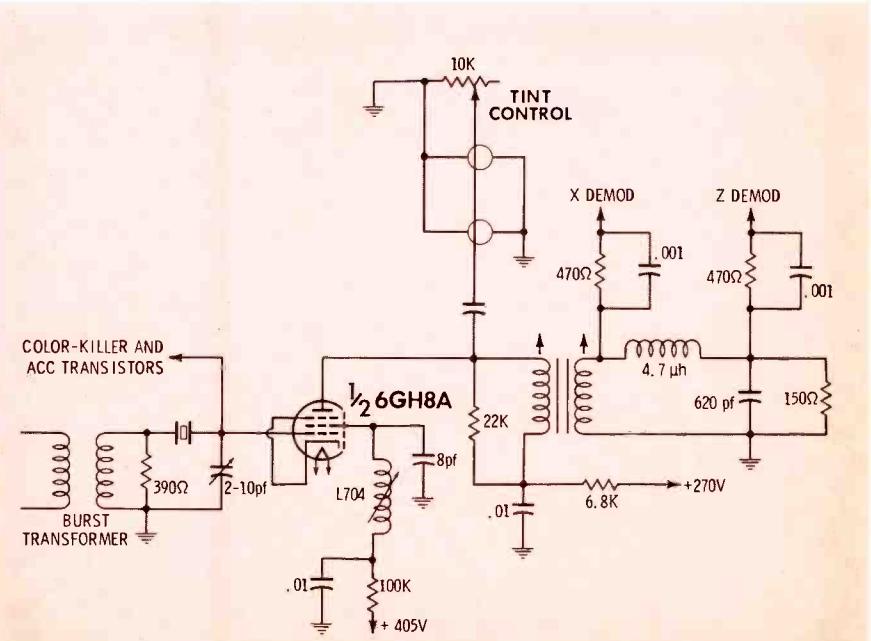


Fig. 4. Simplified reference oscillator circuit of the RCA CTC31 chassis.



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January, 1968/PF REPORTER 17

Admiral Burst Amplifiers and Reference Oscillators

Fig. 5 shows the burst amplifier and reference oscillator circuit of the Admiral 1G1155 and other chassis. The more recent chassis, 3H10, 4H10, 5H10, and 4H12, use essentially the same burst amp and oscillator circuitry except for the tube type. The chroma signal from the plate of the first chroma bandpass amplifier and a positive enabling pulse from the horizontal output transformer are both fed to the burst-amplifier grid. The enabling pulse, having an amplitude of 50 volts, brings the tube out of cutoff and the color burst is amplified to a peak-to-peak amplitude of about 170 volts. The large value of cathode resistance, 39K ohms, prevents saturation. During the time that V5 is conducting, the drop across R166

charges C120. Between pulses, current flows upwards through R166 to discharge C120, maintaining an average cathode bias of about +45 volts. This prevents the chrominance signal from appearing in the plate circuit of the burst amplifier.

The reference oscillator is an injection type, electron-coupled oscillator and its operation is similar to that of the RCA circuit discussed above. The self-bias under free-running conditions (no color) is -3 volt. When a burst signal is injected, this bias swings negative and the negative excursion is used to operate the color killer and the ACC circuit. The output of the reference oscillator is coupled through the plate transformer, L35, to the phase shifting circuits, L36, C129, and L37, which establish the correct phase of the reference sig-

nal for R-Y and B-Y demodulation. C128 and R6, the tint control, are used to shift the phase of the reference signal without disturbing the phase displacement between the R-Y and B-Y axes.

Admiral ACC and ASC Circuits

As shown in Fig. 5, the ACC circuit used in the chassis series 1G1155-1, 2G1156-2, 2G1157-1, 3G1155-2, and 3G1155-3 has two variations. In the solid-line drawing, the ACC control voltage is taken from the grid of the reference oscillator and, after filtering, is used as bias voltage for the first chroma amplifier. Since the oscillator grid swings more negative as the color burst increases in amplitude, the chroma-amplifier gain is reduced as the level of the composite chrominance signal (chroma and color

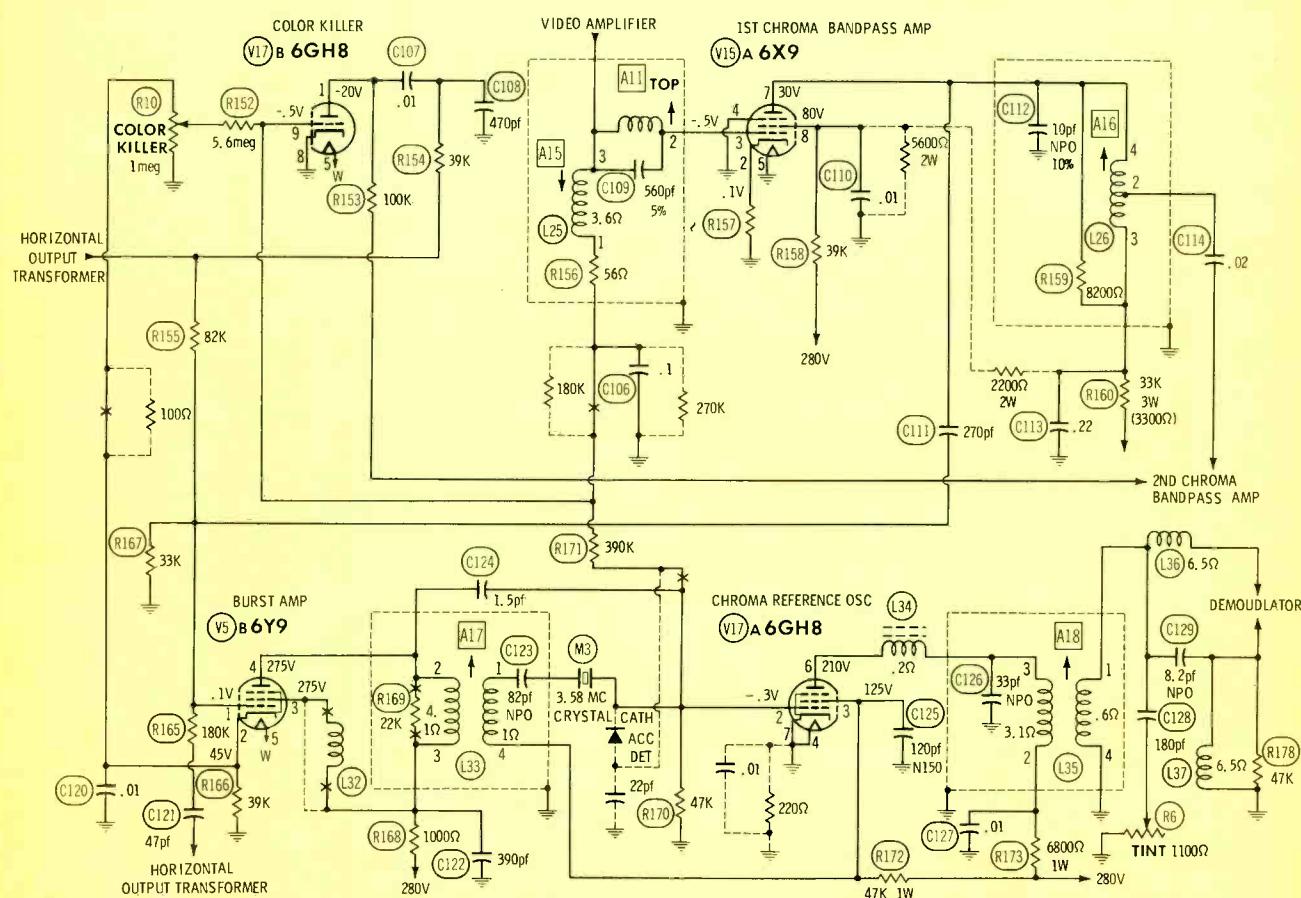


Fig. 5. Reference-signal circuits of the Admiral 1G1155 chassis.

burst) increases. The operation of the dashed-line circuit is much the same, although a diode detector has been added. Since this addition increases the amount of the control voltage, a divider network, 180K ohms and 270K ohms, is also added to the circuit.

The ASC (Automatic Saturation Control) circuit used in the 3H10NC57-1 chassis is shown in Fig. 6. This circuit, as well as the one described above, is a closed-loop system. A portion of the output from the first chroma amplifier is rectified by X11 and the negative voltage which is produced is used, after filtering, to control the gain of the first chroma amplifier. Thus, as the chrominance level increases, the bias increases to reduce the amplifier gain and vice versa. If this were the only control voltage, the dynamic range of saturation would be seriously limited (the degree of color saturation of the picture would remain constant regardless of the degree of saturation of the scene being televised). To prevent this, a second voltage is combined with the bias derived from X11. The negative voltage at the grid of the reference oscillator, which is proportional to the color-burst amplitude, is also fed to the grid of

the first chroma amplifier. Thus, sufficient bias is always available to maintain the desired dynamic range of saturation.

Admiral Color Killer

The color-killer circuit shown in Fig. 6 is typical of many of the circuits used in late-model Admirals. The positive cathode bias of the burst amplifier is divided across the threshold control, R9, and negative voltage is obtained from the grid of the reference oscillator. In the absence of a color burst, this negative voltage is slight and the color-killer tube will conduct if plate voltage is supplied. The source of plate voltage is the positive pulse from the horizontal-output transformer which is fed to the left side of C128. Current flows through V15A, charging the right side of C128 to a negative potential. Between pulses, C128 partially discharges through R170 and the negative voltage which is developed holds the second chroma amplifier below cutoff. When a color burst is received, the negative voltage at the grid of the reference oscillator increases and cuts off the color-killer tube. This allows C128 to completely discharge and the cutoff bias is removed from the second chroma amplifier.

Notice that the setting of R9 affects the bias of the first chroma amplifier and, if R9 is misadjusted, the operation of the ASC circuit will be impaired. To properly set R9, adjust all front-panel controls for proper operation and set the color control at mid-range. Turn to an unused channel, set the color-killer control fully clockwise, and then adjust it until the color in the snow almost disappears.

Zenith Burst Amplifier and Reference Oscillator Circuit

The chroma-reference circuits of Zenith's 20X1C36 and 20X1C38 are shown in Fig. 7. In many respects, they are similar to the circuits of the RCA CTC25 chassis discussed under the heading "Circuit Analysis of Reference Oscillator Circuits" in Part 4. The composite chrominance signal from the plate of the first chroma amplifier and a positive enabling pulse from the horizontal-output transformer are fed to the grid of the burst amplifier. Since the color burst is coincident with the enabling pulse, the burst is separated from the remainder of the chrominance signal and amplified. The positive cathode bias of about 45 volts is developed by conduction through R176 while the

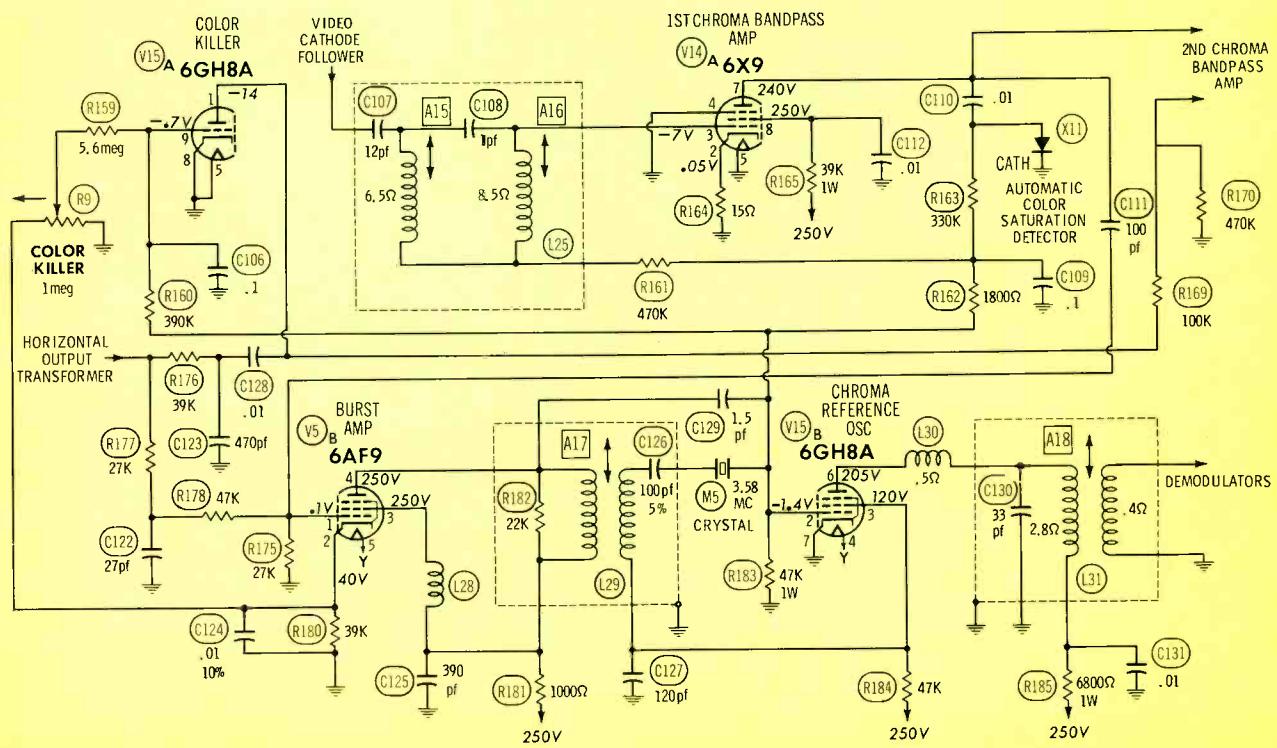


Fig. 6. Reference-signal circuits of the Admiral 3H10NC57-1 chassis.

tube is gated on, and this voltage is sustained between pulses by the charge stored in C127.

The output of the burst amplifier is fed to the chroma-sync phase detector and to the ACC and color-killer detector. The hue control, R3, in conjunction with C131 allows the viewer to vary the phase of the amplified color burst.

The chroma-sync phase detector compares the relative phases of the reference oscillator signal from L30 and the color burst from the burst amplifier. Any phase error is converted to a voltage error which is used to change the conductance of the chroma reference-oscillator control tube. The operation of this type of circuit was explained in Part 3 of this series.

The reference oscillator is typical of the type of oscillator used in conjunction with an AFC tube. Since the system of chroma demodulation used by Zenith requires four reference signals in quadrature, a special output transformer is used instead of the usual RLC phase-splitter network.

Zenith Color-Killer and ACC Circuits

The color-killer and ACC circuit of the Zenith 20X1C36 chassis is also shown in Fig. 7. The color-killer and ACC detector is a conventional phase detector, but, since the phase relationship of two inputs is constant, the amplitude of the

output becomes a function of the amplitude of the color burst. When no burst is present, the output is - .7 volt, but, during normal color reception, this potential increases to approximately - 6 volts. If the amplitude of the color burst decreases from its normal value for any reason, the detector output also decreases.

The output of the detector is filtered by C64 and used as bias for the grid of the first chroma amplifier, V4B. Under no-color conditions, V4B is near saturation and the screen potential is about 75 volts. This voltage is at one end of a series network consisting of R165, R17, and R164. The opposite end of R164 is connected to the grid of the horizontal discharge tube which is 65-volts negative. When R17 is properly adjusted, the voltage at its junction with R164 is about - 28 volts. This voltage is used to bias the second chroma amplifier below cutoff. C118 is a bias filter which integrates the horizontal pulses from the horizontal discharge tube.

During color reception, the grid bias of V4B increases to - 6 volts and the screen and plate voltages rise to 225 volts. This would cause the voltage at the grid of the second chroma amplifier to rise to a positive potential if it were not for the clamper diode connected across C118. The actual bias of the second chroma amplifier is 0 volt.

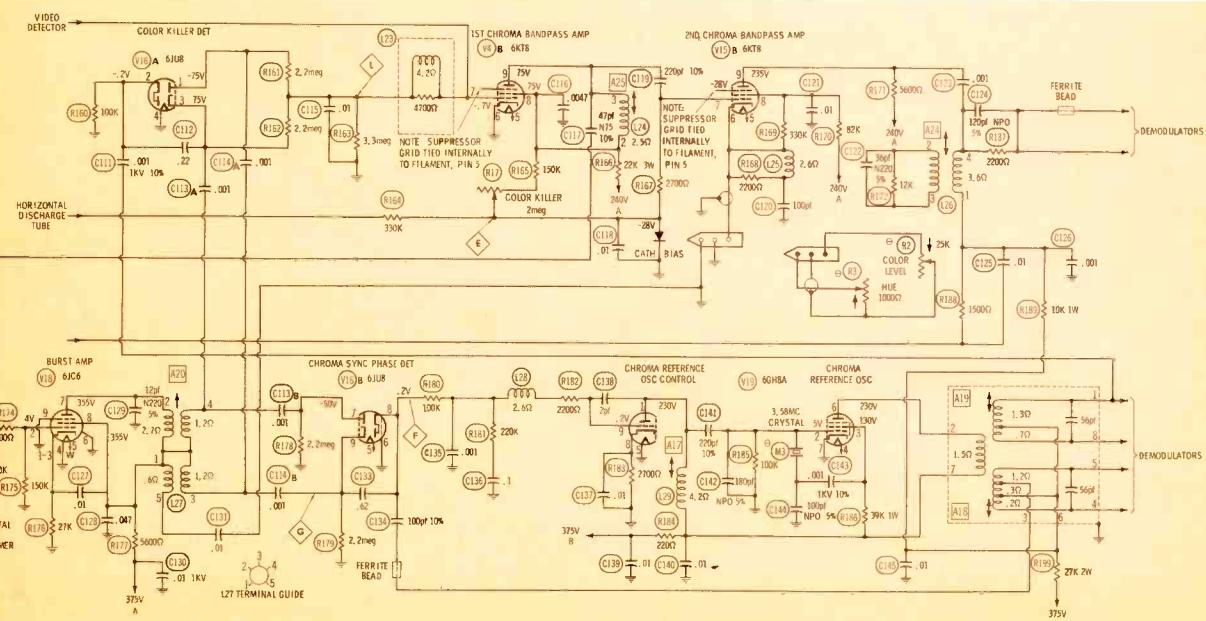
As stated before, the output of the color-killer and ACC detector

is - 6 volts under conditions of normal color reception. If the chrominance level varies from its normal value, the detector output will also change. Thus, a decrease in chroma level reduces the negative bias on V4B, increasing its gain. Conversely, an increase in the chroma level increases the bias on V4B to reduce its gain. Notice that small variations in bias on V4B do not affect the bias of the second chroma amplifier because of the action of the clamper diode. This, too, is a closed-loop system.

General Electric Reference Circuits

Fig. 8 shows the burst gate and subcarrier amplifier circuits of the General Electric HC chassis. The output of the chroma-bandpass amplifier is fed to the cathode of the burst gate tube, V5B, and the 100-volt enabling pulse from the horizontal-output transformer is fed to the grid. This allows the color burst to be separated from the composite chroma signal and amplified. The positive enabling pulse causes the grid of V5B to draw grid current, charging C72 and C73. Between pulses, these capacitors discharge through R87, developing about 85 volts of bias. This bias, of course, holds the tube below cutoff between pulses.

The output from the burst-gate tube is coupled through L20 and excites the 3.58-MHz crystal, caus-



ing it to ring. Because of the high Q of the crystal, this ringing continues throughout the interval between color bursts. Each successive color burst rephases the crystal if there has been any drift. The amplitude of the ringing signal at the grid of V5C is large enough to overdrive the tube, and thus the output remains constant throughout the interval between bursts.

C86, connected between the plate of V5C and ground, shifts the phase of the reference signal to provide tint control. Quadrature reference signals are required, so a transformer having two secondaries is used as the plate load of V5C.

No color-killer circuit, as such, is used in this chassis. Since the demodulators have no output unless there is a reference-signal input, and since the 3.58-MHz crystal "rings out" if there is no color burst, the modulators are, in effect, cut off during b-w operation.

Motorola Reference Circuits

The burst amplifier, chroma sync amplifier, color killer, and demodulator of the Motorola A22TS-918A are depicted in Fig. 9. The chroma cathode follower (not shown) drives both the chroma bandpass amplifier and the burst amplifier. An enabling pulse from the horizontal-output transformer turns on the burst amplifier, V16A, during the horizontal retrace interval, allowing the color burst to be separated from the composite chrominance signal.

The interstage transformer between V16A and V16B is tuned to

the burst frequency. The network consisting of R4, L31, and C149 is a phase-shifting network which allows the phase of the burst to be adjusted for correct hue. V16B further amplifies the color burst and feeds it, via the 3.58-MHz crystal, to the chroma-demodulator tube. Notice that the positive pulse applied to the screen grid of V16B gates this tube on during the horizontal retrace interval only.

The chroma-demodulator tube not only demodulates the chroma signal, but serves as the reference oscillator as well. This combination of both functions in a single tube was not noted in any of the other makes of sets examined. Since this particular portion of the color training series is limited to reference-signal and associated circuits, the method of demodulation will be discussed at a later time. At present, we will consider only the functions of the cathode, control grid, and screen of V15.

Consider V15 as an electron-coupled Hartley oscillator. In the absence of color bursts, oscillations are sustained by virtue of the split-inductance tank typical of a Hartley oscillator. During color reception, the amplified color burst is injected through the crystal to the grid of V15 and rephases the tank circuit to synchronize it with the burst signal. In this respect, the oscillator is similar to the injection-locked oscillator used in a number of other sets.

Since the oscillator is an integral part of the demodulator circuit, there is no way to split the oscillator

phase prior to demodulation. As we shall see later, chroma demodulation may be achieved so long as the phase of either the reference signal or the chroma signal is split. Motorola's decision to split the phase of the latter instead of the former is unique but equally acceptable.

The color-killer circuit is similar to the ones used in many of the sets discussed in the preceding pages. In the absence of color, a pulse from the horizontal-output transformer causes V5B to conduct, charging C131 and producing cutoff bias for the chroma amplifier. During color reception, the cathode current of V15 increases (because of the increased oscillator activity) and this drives the cathode of V5B positive into cutoff. Since C131 cannot charge when V5B is cut off, the bias is removed from the chroma-bandpass amplifier.

Summary

From an examination of the circuits described in this issue and the latter portion of Part 4 of this series, we observe that there is a great degree of similarity among the several burst amplifiers. The main variation is in the method whereby the composite chroma signal and gating pulse from the horizontal-output transformer are injected into the circuit. The most common circuit configuration combines these two signals at the grid of the burst amplifier, but it is not unusual to have the chroma signal fed to the cathode and the positive enabling pulse fed to the grid.

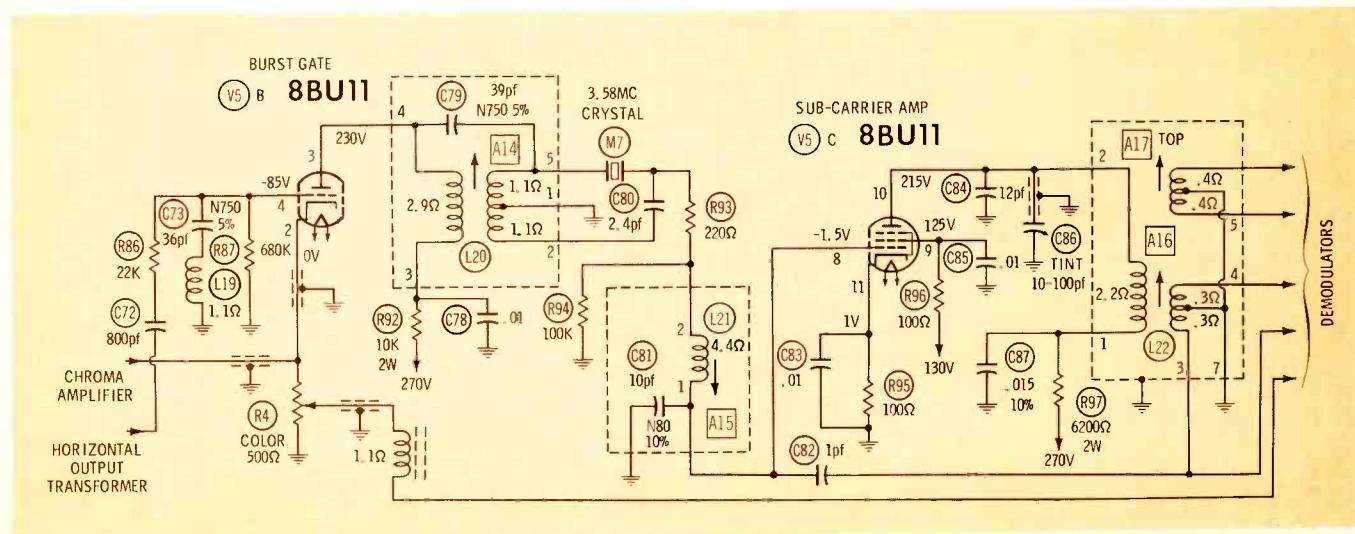


Fig. 8. Burst gate and subcarrier amplifier circuits of the General Electric HC chassis.

Two other variations are technically feasible but are not widely used, if they are used at all. A negative enabling pulse could be fed to the cathode of the burst amplifier while the chroma signal is fed to the grid, or both signals could be fed to the cathode. Notice that when a signal is fed to the cathode, the impedance of the source must be relatively low and a significant load is placed on the source. This is typical of any grounded-grid amplifier configuration.

Three basic methods of phasing the reference signal are in vogue. The system wherein the phase of the output from the oscillator is compared with the phase of the color burst is quite popular. The two signals are compared in a phase detector whose output controls an AFC tube. This circuit is similar to many horizontal-oscillator circuits which employ an AFC circuit. A second popular reference-oscillator circuit,

using injection locking, is also used extensively in horizontal-oscillator circuits. In this type of circuit, the color burst is injected directly into the tank circuit of the oscillator and the phase of the oscillator is controlled by "brute force." A third system uses no reference oscillator at all. Here, the color burst is amplified and fed to a final amplifier which resembles an oscillator but has insufficient feedback to sustain oscillation. The stage simply "rings" throughout the interval between color bursts to provide a continuous reference signal.

Reference oscillators take several forms, but all of them are crystal-controlled or crystal-stabilized. A pentode tube in an electron-coupled configuration is most popular. Nearly any oscillator configuration is possible, but the Hartley and the tuned-plate, tuned-grid types are popular.

Most color-killer circuits are simi-

lar in design, although the means of sensing the color burst varies from one make of set to another. Usually, if the reference oscillator is controlled by an AFC tube, an additional phase detector is used to operate the color killer. If an injection-locked reference oscillator is used, the oscillator-grid bias is normally used to control the color killer. In either event, the color-killer tube is cut off during color reception. The threshold control is set at the point where colored snow in an unused channel just disappears. In sets having an ACC circuit, the setting of the color-killer threshold may be critical. Follow the procedure recommended by the manufacturer or the one contained in the appropriate PHOTOFAC^T folder for the chassis being repaired.

Part 6 of this series will cover the operation of various chroma amplifiers, demodulators, and color-difference amplifiers. ▲

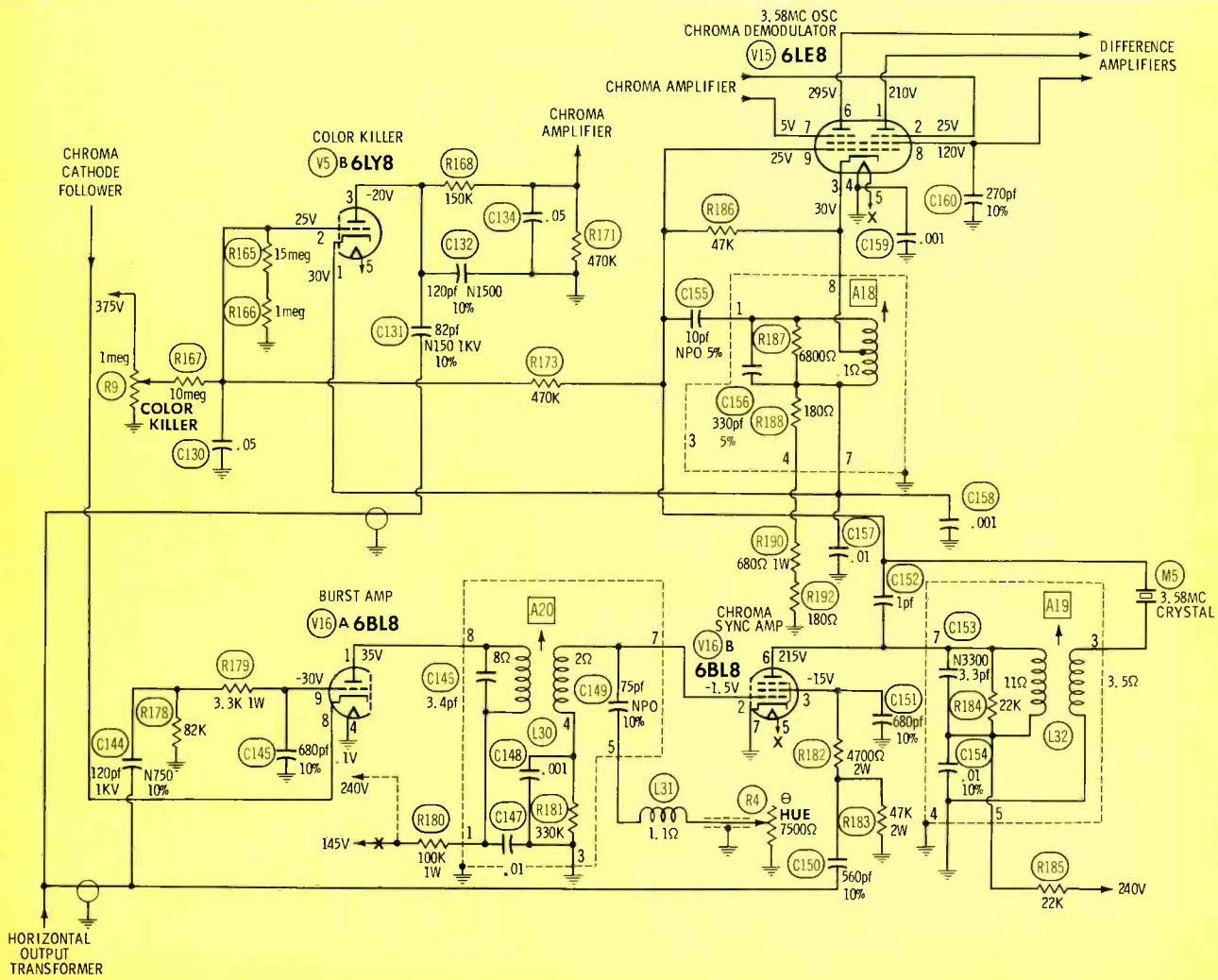


Fig. 9. Reference-signal circuits of the Motorola A22TS-918A chassis.

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January, 1968/PF REPORTER 23

NOTES ON TEST EQUIPMENT

*analysis of test instruments
...operation...applications*

by T. T. Jones



Fig. 1. HV probe has built-in meter.

High Voltage Probe

With the recent rash of publicity about X-rays, we're all aware now that the anode voltage in a color set should be accurately measured each time the set is serviced. This requirement does present a problem, since many servicemen do not like to carry more than a caddy on a house call.

Pomona has an answer to the problem in their Model 2900 High Voltage Test Probe (Fig. 1.) This instrument fits in the caddy, is self-contained, accurate, easy to use, and best of all, it's only \$19.95. Since a good accessory HV probe costs between \$10 and \$20, and you still have to buy the meter, the Model 2900 seems especially attractive.

The instrument is so simple to use its hardly worth mentioning. You just connect the ground lead, touch the probe to the ulti cap, and read the meter. There's no range switch to fumble with, no interpreting or mental arithmetic, and no guess work. The instruction sheet packed with the instrument gives a complete list of safety precautions to be observed while working with high voltage. Perhaps it does not sufficiently stress the fact that the ground lead must be connected before touching the probe to the ulti. Otherwise, you're liable to get a little jolt.

The heart of the tester is the meter in the handle, which is a 50 microamp movement. It's calibrated in 1 kilovolt increments, but the divisions are wide enough so you can interpolate $\frac{1}{4}$ kilovolt steps. The tester is shipped with a shorting wire across the meter, and it was necessary to disassemble the handle to remove the short before the first use. This gave us a chance to check the construction of the tester. It's constructed of high-impact plastic and appears as though it will stand years of banging around, but we recommend the styrofoam shipping box be used to store the instrument in the caddy.

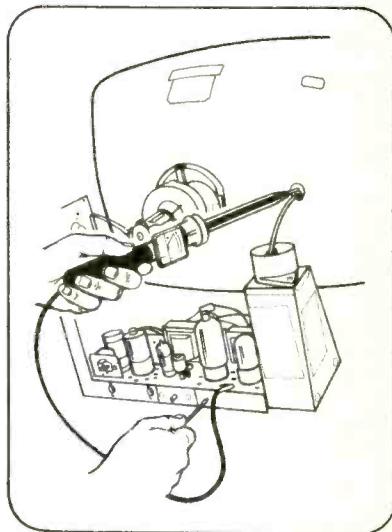


Fig. 2. The Model 2900 in use.

Pomona Model 2900 Specifications

Range:
0-30 KV DC

Input impedance:
600 Megohms.

Accuracy:
 $\pm 3\%$ fullscale.

Power requirements:
None.

Size (LWD):
14 $\frac{3}{4}$ " x 1 $\frac{3}{4}$ " x 1 $\frac{1}{2}$ ".

Weight:
8 ounces.

Price:
\$19.95.

For further information circle 70
on literature card.



Fig. 3. New transistor tester has no Beta Cal control.

Transistor Analyzer

The new Seco Model 260 transistor analyzer is the one of the simplest we have used. By simple we mean easy to use, though the circuit is also quite simple.

The in circuit testing procedure consists of: turn on the instrument, switch it to "Dynamic," connect the E, B, and C leads, and read the meter. If the needle moves upscale, the transistor is OK. If the needle doesn't move, reverse the PNP-NPN switch. If it still doesn't move, the transistor should be removed from the circuit for further tests.

The circuit for the dynamic check is shown in Fig. 4. Qx is the transistor under test. The circuit is a regenerative oscillator, operating at about 7kHz. If the transistor is capable of amplification, it will also oscillate, and there will be considerable voltage developed in the tank circuit C1-L1. A portion of this voltage is tapped off through R2, C2, R3, and C3, rectified by the diodes, and read on the meter. The actual voltage doesn't matter, since the presence of any voltage at all indicates the transistor is oscillating and is OK.

• Please turn to page 29

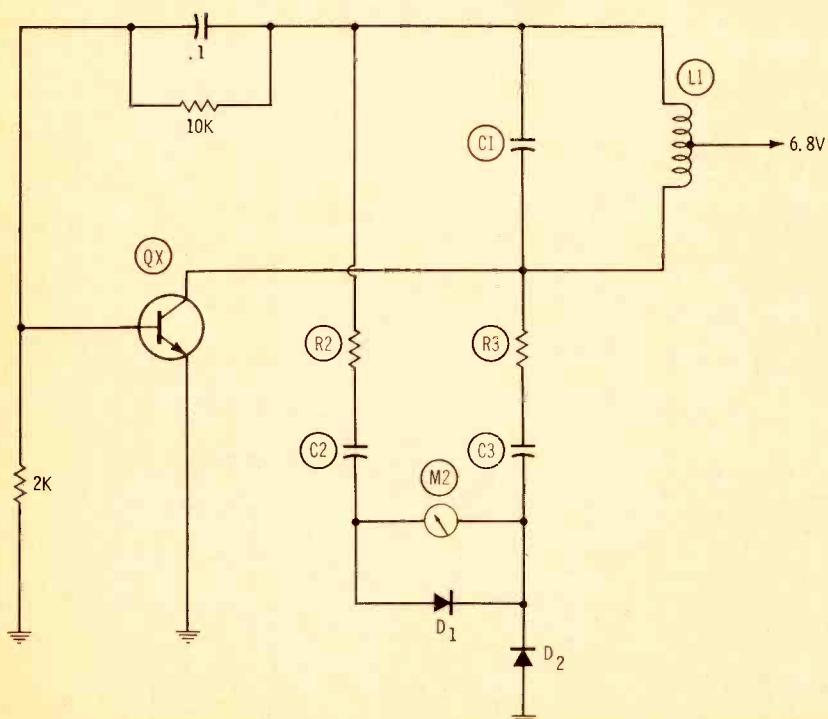


Fig. 4. Dynamic test measures oscillating ability.

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ADVANCED COLOR TV



- **Build your own custom color set in 5 training stages**
 - **50 designed-for-learning color circuit experiments**
 - **Programmed with 18 “bite-size” lesson texts**

A comprehensive training plan for the man who already has a knowledge of monochrome circuits and wants to quickly add Color TV servicing to his skills. **DEFINITELY NOT FOR BEGINNERS.** It picks up where most other courses leave off — giving you "hands on" experience as you build the only custom Color TV set engineered for training. You gain a professional understanding of all color circuits through logical demonstrations never before presented. The end product is your own quality receiver.

TRAIN WITH THE LEADER

This NRI course — like all NRI training — is an outgrowth of more than 50 years experience training men for Electronics. NRI has simplified, organized and dramatized home-study training to make it easy, practical, entertaining. You train with your hands as well as your head, acquiring the equivalent of months of on-the-job experience. Demand for Color TV Service Technicians is great and growing. Cash in on the color boom. Train with NRI — oldest and largest school of its kind. Mail coupon. No obligation. No salesman will call. NATIONAL RADIO INSTITUTE, Color Div., Wash., D.C. 20016.

MAIL FOR FREE CATALOG



NATIONAL RADIO INSTITUTE
Color TV Division
Washington, D.C. 20016

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Send me complete information on NRI new Advanced Color TV Training. (No salesman will call)

Name _____ Age _____

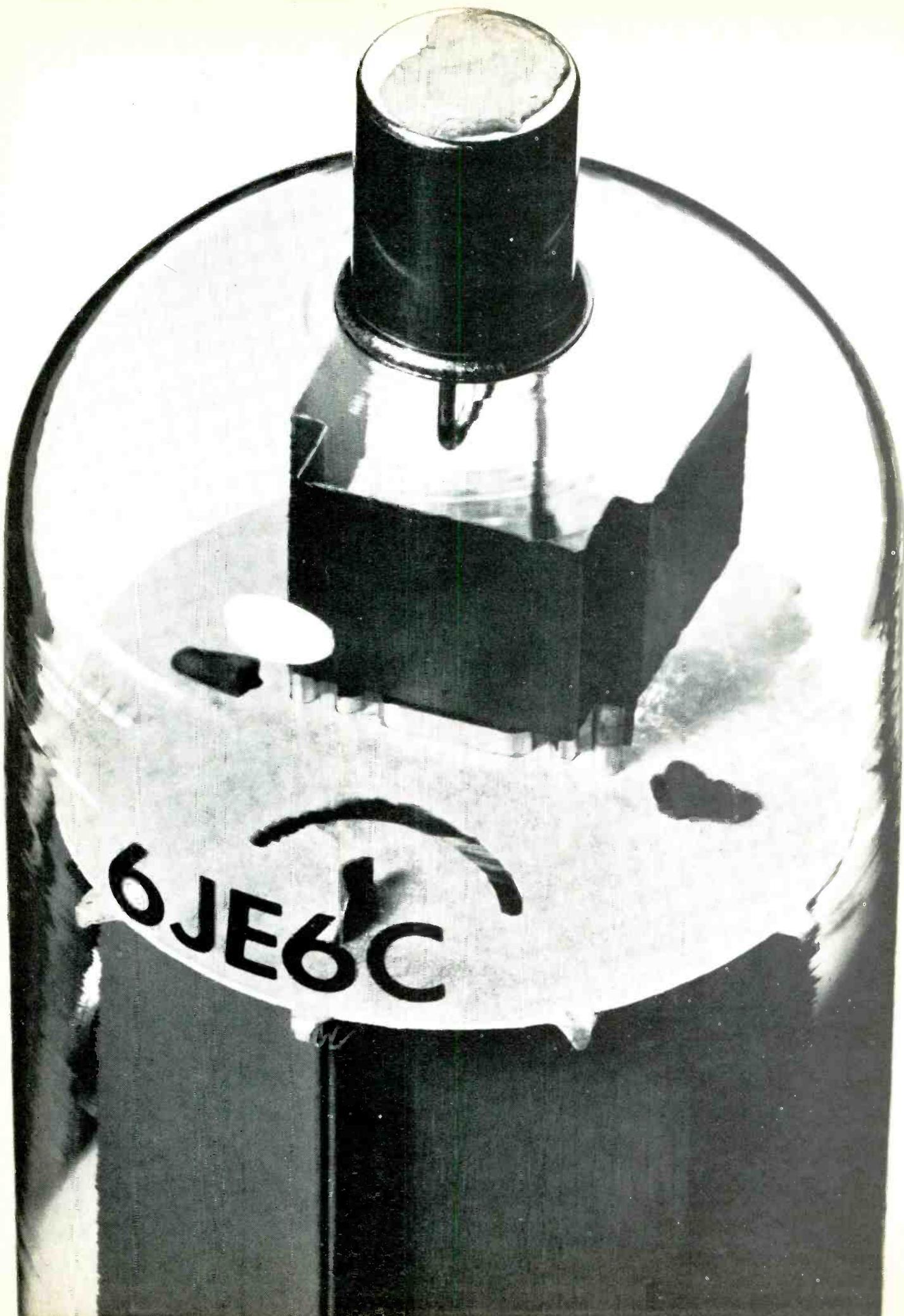
Address _____

City _____ State _____ Zip _____



Circle 7 on literature card

January, 1968 / PF REPORTER 25



The cool new "C." It has more life.

When the horizontal deflection tube in a color TV set goes dead, chances are you've been replacing it with our 6JE6-A.

(You learn by hard experience what's best. Who needs callbacks?)

But this doesn't mean that what's best can't be made even better. At least it doesn't to Sylvania electronic engineers.

That's the reason for our third-generation 6JE6-C. (We skipped "B" altogether.)

The "C" is the new workhorse of color television. We've given the plate wings.

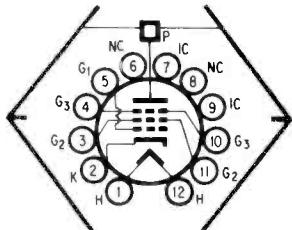
It's been so designed that it acts as a superior heat sink. It holds more heat. Radiates it out from a larger surface. Dissipates it more quickly.

The new tube runs cooler and has longer life.

And it still costs the same as the "A".

It should mean fewer replacement calls.

Try the "C" and see.



Big plate fins
absorb heat
and radiate it
out of the tube.

SYLVANIA
A SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS

Circle 8 on literature card

January, 1968 / PF REPORTER 27

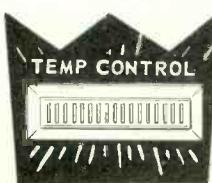
ONLY ONE COLOR GENERATOR IS WINTER PROTECTED



Sencore's Color King puts an end to cold weather instability.

Transistors just don't perform properly on those cold, cold winter days. So, when you bring in an ordinary solid state color bar generator from a freezing car or van, you wait and wait for stable patterns. Even then you can't be sure.

Only Sencore's new Color King is truly winter protected. Only the Color King has a built-in heating element surrounding the critical timing circuits. The instant you plug in the generator, this heating element warms up these circuits; also driving out excessive humidity. When optimum oper-



ating temperature is reached, a thermostat automatically turns off both the heating element and the Temp Control indicator light. Now you know the circuits are rock stable.

Protect yourself this winter. Go for the hot one. The CG141 Color King. The color generator that works when its hot and works when its COLD.

That's why the **Sencore Color King** stays sold.

Only \$149.95 User Net



SENCORE

NO. 1 MANUFACTURER OF ELECTRONIC MAINTENANCE EQUIPMENT
426 SOUTH WESTGATE DRIVE, ADDISON, ILLINOIS 60101

Circle 9 on literature card

NOTES

(Continued from page 25)

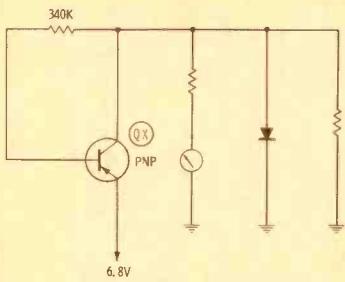


Fig. 5. Schematic of Beta test.

The Model 260 also includes a very simple Beta test. The transistor is inserted in the socket and DC Beta is immediately indicated. The Beta Cal control usually found in transistor testers has been eliminated by the circuit shown in Fig. 5. The 340k resistor is quite large compared to the internal resistance of the transistor, so it effectively regulates the Base current to 20 microamps. With this current fixed, then the meter can be calibrated in Beta, the ratio of base current to collector current. For NPN transistors the meter and voltage connections are transposed.

The Model 260 also measures I_{CBO} and I_{CEO} out of circuit. The power supply is a full-wave bridge, zener regulated. The case is leatherette-covered wood, and all leads are furnished.



SECO Model 260 Specifications

Tests performed:

Quality on a relative scale.
Beta; 0-200, 0-1000. Base current 20 μ A signal, 1 mA power.
VCE 6.8v.

I_{CBO} ; 0-2 mA, 0-100 mA power
(VCE 6.8v).

I_{CEO} ; 0-200 μ A signal and power
(VCB 6.8v).

Size (HWD):
4 $\frac{1}{4}$ " X 7 $\frac{3}{8}$ " X 8 $\frac{3}{4}$ ".

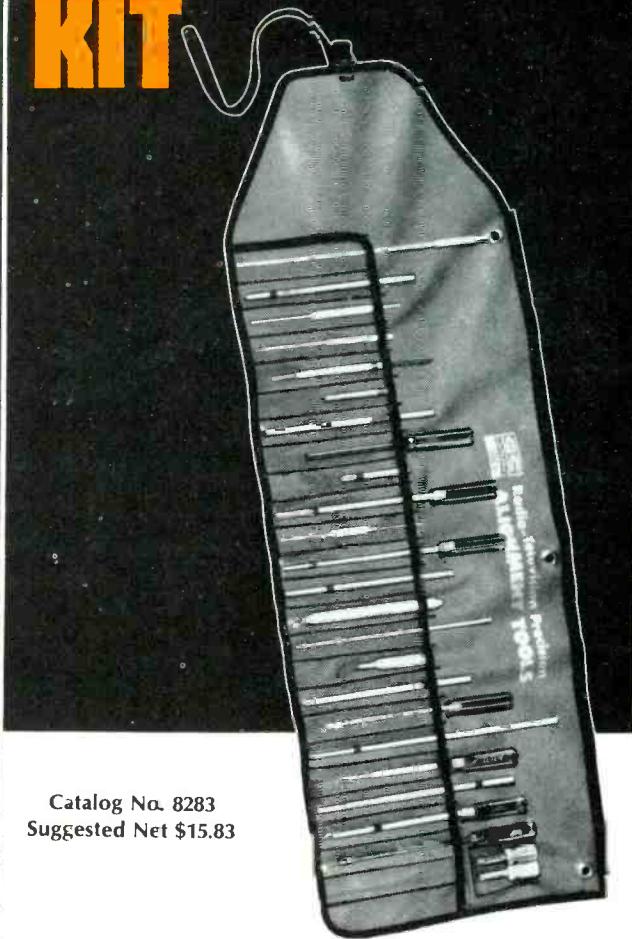
Weight:
4 $\frac{1}{4}$ pounds.

Power requirements:
115 VAC 60 Hz.

Price:
\$69.50.

For further information circle 71
on literature card.

MASTER DELUXE TV TOOL KIT



Catalog No. 8283
Suggested Net \$15.83

An exceptional value, one kit containing over 25 selected tools to provide electronic technicians with alignment and adjustment tools to service all radio and TV sets, mobile communication, marine and amateur gear. All GC tools are designed to make service jobs easier and faster... all are precision manufactured from specially formulated materials that meet or exceed all government, military, or industrial specifications... all are backed by GC's reputation for quality assuring maximum service life.

Always insist on **GC**...
you'll get more for your money, everytime!



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A DIVISION OF HYDROMETALS, INC.

MAIN PLANT: ROCKFORD, ILL. U.S.A.



Giant FREE Catalog...

Only GC gives you everything in electronics... has for almost 40 years. Match every part and service need from over 10,000 quality items. Write for your copy today!

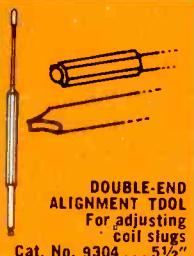
Circle 10 on literature card



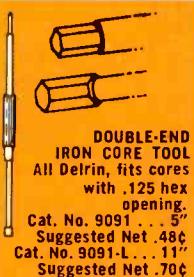
has
everything
in
**ALIGNMENT
TOOLS**



ZENITH-ADMIRAL
DELRIN DOUBLE-END
HEX WRENCH
Cat. No. 8606 ... 5"
Suggested Net .48¢
Cat. No. 8606-L ... 11"
Suggested Net .63¢



DOUBLE-END
ALIGNMENT TOOL
For adjusting
coil slugs
Cat. No. 9304 ... 5 $\frac{1}{2}$ "
Suggested Net .48¢

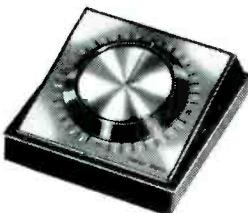


DOUBLE-END
IRON CORE TOOL
All Delrin, fits cores
with .125 hex
opening.
Cat. No. 9091 ... 5"
Suggested Net .48¢
Cat. No. 9091-L ... 11"
Suggested Net .70¢





Meet the number one swinger!



More antennas swing with Channel Master's Automatic Colorotor than any other automatic rotator in the country. That just goes to show that dealers and customers know a winner when they see one.

And everybody has been seeing a lot more rotator sales since color came into the picture. Color set owners usually want the best and research has proved that ghosting can be substantially reduced by a rotator even when all stations are in one direction!

Channel Master's Automatic Colorotor is the ultimate in convenience and performance! Aims the antenna within **one degree** of precise transmitter location—impossible to knock out of alignment by reversing direction. Built-in thrust bearing provides friction-free rotations under heavy loads. Resynchronizes smoothly and automatically merely by rotating the antenna.

Ask about Channel Master's unique dealer profit protection policy and instant replacement warranty!

CHANNEL MASTER
Color-Engineered Antennas and Accessories

Circle 11 on literature card



THE ELECTRONIC SCANNER

news of the servicing industry

Electronic Sales Up

Despite some slow-downs earlier in the year, the electronics industry in 1967 will show a 10% gain in total factory sales over 1966, according to Robert W. Galvin, president of the **Electronic Industries Association**.

Preliminary estimates of the EIA Marketing Service Department, Mr. Galvin said, indicate that total factory sales in 1967 will reach about \$23 billion for a new record. Continued growth in 1968, he added, will bring an additional rise of more than 5% and combined industry sales of \$24 billion.

Color television set sales rebounded from summer doldrums and 1967 factory sales are expected to total 5.5 million or more compared with 5 million in 1966, the EIA president said. In 1968 the industry believes color receiver sales will exceed 6 million. Rising sales of FM radios and magnetic tape equipment also are helping to push total consumer product sales close to \$5 billion.

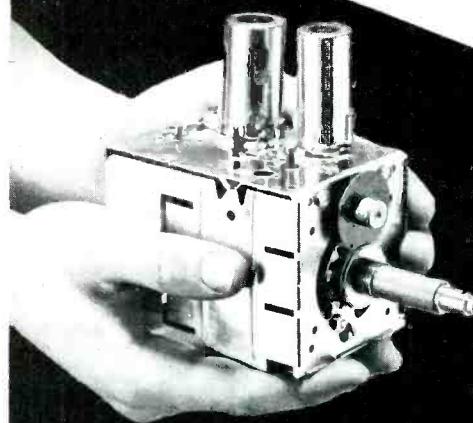
Component sales for the year are estimated at \$5.75 billion, Mr. Galvin said, compared with \$5.64 in 1966, but the increase has been chiefly in newer product areas such as color TV tubes and integrated circuits.

Both imports and exports of electronic products by the United States rose in 1967, Mr. Galvin noted, but exports rose at a faster rate. During the first eight months exports were up 29% and imports 18%.

CB Industry Moves

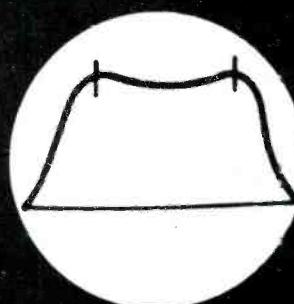
Television, radio and magazine messages carrying the story of citizens two-way radio to the consumer market-

COMPLETE TUNER OVERHAUL



ALL MAKES —
ONE PRICE

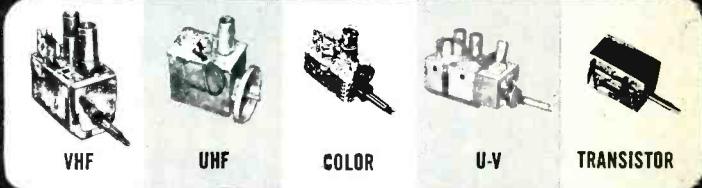
995



3.58

COLOR TUNERS

GUARANTEED COLOR
ALIGNMENT — NO
ADDITIONAL CHARGE



Simply send us the defective tuner complete; include tubes, shield cover and any damaged parts with model number and complaint. Your tuner will be expertly overhauled and returned promptly, performance restored, aligned to original standards and warranted for 90 days.

UV combination tuner must be single chassis type; dismantle tandem UHF and VHF tuners and send in the defective unit only.

Exact Replacements are available for tuners unfit for overhaul. As low as \$12.95 exchange. (Replacements are new or rebuilt.)

And remember—for over a decade Castle has been the leader in this specialized field . . . your assurance of the best in TV tuner overhauling.

Pioneers of TV



Tuner Overhauling

CASTLE
TV TUNER SERVICE, INC.

MAIN PLANT: 5701 N. Western Ave., Chicago 45, Illinois

EAST: 41-90 Vernon Blvd., Long Island City 1, N.Y.

place will spearhead the CB industry's 1968 advertising and publicity program, enthusiastically approved by the Citizens Radio Section of the Electronics Industries Association at its recent quarterly meeting in Los Angeles.

The newly-formed CB manufacturers' group will launch early in the year a market development program to greatly expand public awareness of the value of CB radio through consumer-oriented literature, highway signs, feature articles and store

displays as well as public-service messages in mass media.

Wins Service Award

Melvin C. McKenzie, the owner of a radio and TV store in Bay City, Michigan, has just received the third Community Radio Watch Distinguished Service Award to be given in the State of Michigan.

The award—a plaque and two hundred dollars in U.S. Government Savings Bonds—was presented to McKenzie for his quick radio noti-

fication which helped keep a fire from doing considerable damage to downtown Bay City, Michigan.

Mr. McKenzie radioed a report to his wife, who was working his base station, immediately notifying her of the fire and the location. His wife then telephoned the report to the Bay City Fire Department.

Earlier this year, a Detroit area fuel truck driver, Fred R. Howe, received the first Community Radio Watch Distinguished Service Award for notifying the authorities of a woman who had been thrown through her vehicle's windshield as the result of an accident. And later Charlie Jones, a driver for the Detroit Department of Street Railways, received the fifth Distinguished Service Award for saving apartment dwellers from being caught in a conflagration which occurred in the small hours of the morning.

THE BEST PERFORMING UHF CONVERTER TODAY!



RMS SOLID-STATE ALL TRANSISTOR UHF CONVERTER HAS BUILT-IN AMPLIFIER... INCREASES GAIN AN ADDITIONAL 10 db!

Updates any VHF TV set to receive any of the 83 UHF/VHF Channels. Low noise, drift-free UHF performance. Amplifier increases gain an additional 10 db to bring in reception where all other converters fail! Simple hook-up for profitable installation. Easy operation. Attractive Charcoal Gray cabinet.

Model CR-550A with Amplifier

Model CR-500 without amplifier

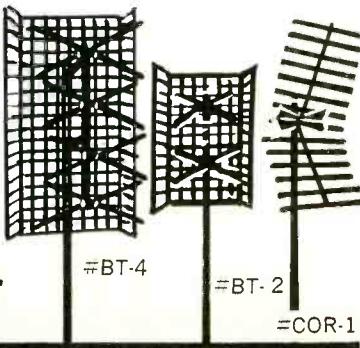
List price \$49.95

List price \$39.95

UHF ANTENNAS

Make your next installation profitable with these dependable RMS Antennas. Write for FREE Informative Catalog! . . . Dept. PFC.

RMS ELECTRONICS, INC.
50 Antin Place, Bronx, N.Y., 10462



Circle 13 on literature card

Mergers & Expansions

Belden announced that a new plant will be constructed during 1968 at Jena, La., to produce insulated copper wire and cable. Approximately 200 employees will initially staff the new facility upon its completion late next year.

Belden's President Robert W. Hawkinson said a 43-acre site was selected at Jena in central Louisiana, for the Chicago-based company's fifth manufacturing plant. The facility will offer more than 150,000 sq. ft. of space including about 8,000 sq. ft. for offices. It will be designed to permit further expansion to meet future increases in production capacity, Hawkinson said.

Production of color television picture tubes has been started in Monterrey, Mexico by Sylvamex Electronica S.A., a subsidiary of **General Telephone & Electronics International**. Bernard T. O'Dea, President of Sylvamex, said the operation was begun to meet the anticipated growth of color TV in Mexico. 26,000 square feet has been added to Sylvamex's 60,000-square-foot plant to provide space for production of 10-inch and 25-inch color picture tubes for Mexican TV set manufacturers.

IRC's Board of Directors approved in principle an agreement of merger with TRW Inc. A preliminary arrangement to combine the firms was announced on October 3rd.

The IRC Board also agreed to reconvene to consider action on the definitive merger agreement, which will be submitted to IRC's stockholders for approval at a special meeting in January. The agreement is also subject to approval by TRW's Board of Directors.

The addition of two new facilities to the training network of **Sams Technical Institute** has been announced by Howard W. Sams, Chairman of the Board, Howard W. Sams & Co., Inc.

A new 15,000 square foot building recently completed in Fort Wayne's Interstate Industrial Park will provide facilities for 400 student enrollments this fall in the northern Indiana area. Initial classes are underway there with additional classes planned for September.

The addition of Bramwell Business College in Evansville adds a complete range of business courses to the STI curriculum. It is the second Evansville STI facility serving southern Indiana. Established in 1919, Bramwell is a resident school offering day and evening programs in seven business subject areas.

The new training facilities in Fort Wayne and Evansville, together with the Indianapolis Center, will bring Indiana STI student enrollment in full-time resident courses to 2,225 by this fall. An additional center in Dayton has 300 students enrolled. Centers are planned for other key cities in the nation, Mr. Sams announced.

General Instrument and **Jerrold** announced that their respective Boards of Directors have approved the acquisition of Jerrold by General Instrument on the basis previously announced. The formal merger documents, pursuant to which General Instrument will issue seven-tenths of a share of its Common Stock for each outstanding share of Common Stock of Jerrold, have been signed.

As previously announced, the merger is subject to approvals of stockholders and receipt of a favorable ruling of the Internal Revenue Service.

Oak Electro/Netics formally dedicated a new television tuner assembly plant near Seoul, Korea in ceremonies attended by officials of the U.S. and Korean governments.

O/E/N Korea is expected to have an annual production rate of 2 million tuners by 1969. It is the third Far Eastern production facility established in the past five years by O/E/N. The other Far Eastern operations are an 84,000 square foot tuner assembly plant in Hong Kong and a Japanese facility in Hachioji that produces components assemblies for Japanese companies.

NARDA Convention

Houston will host the "1978" NARDA Convention next month. The association decided that now is the time for dealers to start planning how to cope with the problems and deal with customers of tomorrow—hence the ten-year theme.

You may register for the convention, to be held in Houston, Texas, February 8th through 10th, by writing to: NARDA, 827 Merchandise Mart, Chicago, Ill., 60654.

it Pays to go with the Guy that brought You!



Let's face it! Oxford pioneered this speaker business—to coin a phrase—this "sound" business of speakers you're in. The fact that we were first in the making, and still first in selling, ought to tell you something. We've got the name—the quality—the value that sells.

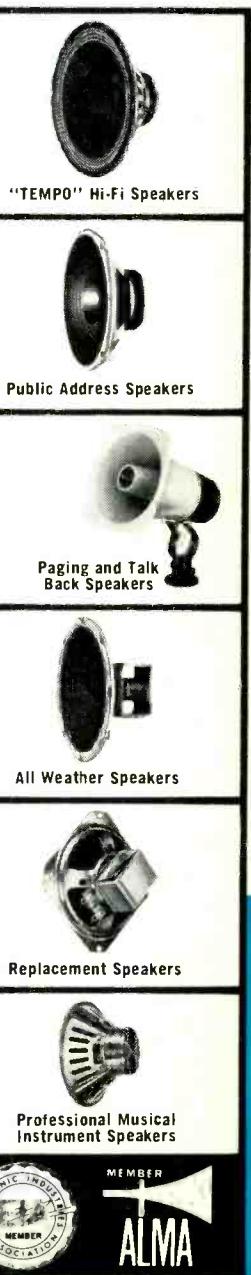
Take Oxford's new "TEMPO" High-Fidelity speaker line. No one can touch it. Their exclusive "Floating Suspension Surround" extends the low frequency spectrum without "hangover", provides clean, transient response with smooth mid-range and brilliant high frequency response. You don't need to talk this one up... the unsurpassed brilliance and clarity of sound sells itself.

For replacement or new installations, it pays to go with "the guy that brought you", That way, you know you're home safe.

OXFORD TRANSDUCER COMPANY

A Division of
Oxford Electric Corporation

3911 S. Michigan Ave.
Chicago, Ill. 60653



Circle 14 on literature card

January, 1968 / PF REPORTER 33

If none of these things attracts you to
the Parts and Service location at our Open House,
there's always the free doughnuts.

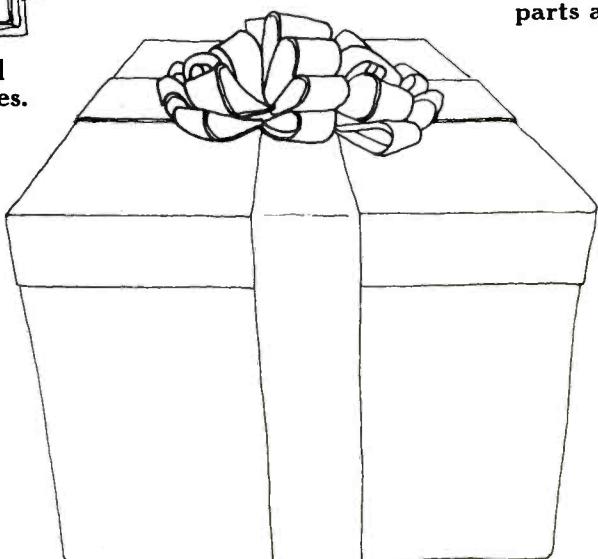
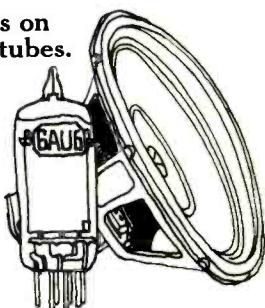


1. Free manuals and trouble-shooting guides.



2. Training on new products.

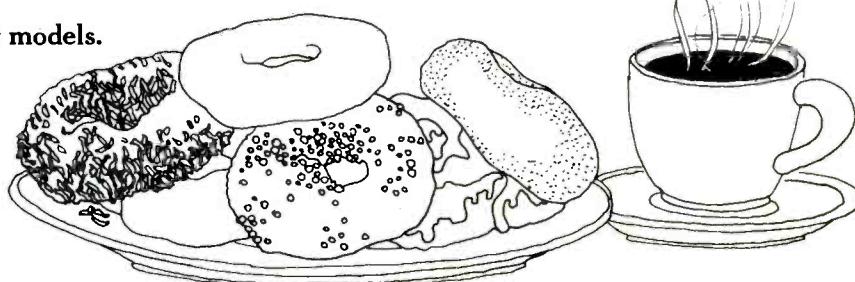
4. Specials on parts and tubes.



3. Free gifts and door prizes.



5. Preview of new models.



If you're feeling a little hungry during January or February, drop into
our Open House at your Philco-Ford Distributor's or Parts and Service location.



FAMOUS FOR QUALITY THE WORLD OVER
Philco-Ford Corporation, Philadelphia, Pa. 19134

FAST

COMPLETE OVERHAUL ON ALL MAKES OF TV TUNERS

Maximum Time In Shop 24 Hrs.

(WE SHIP C.O.D.)

\$9.50

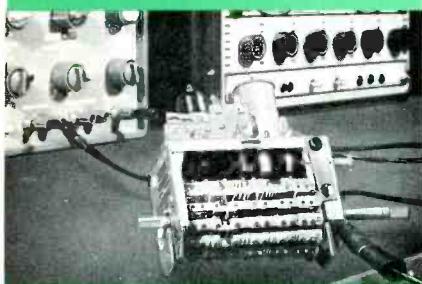
Black &
White
or Color

VHF or
UHF



UV Combo's \$15.00

Price includes all labor and parts except Tubes, Diodes & Transistors. If combo tuner needs only one unit repaired, disassemble and ship only defective unit. Otherwise there will be a charge for a combo tuner. Ship tuners to us complete with Tubes, Tube Shields, Tuner Cover and all parts (including) any broken parts. State chassis, model number and complaint.



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

GEM CITY TUNER REPAIR SERVICE

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

Circle 15 on literature card

LETTERS TO the EDITOR

Dear Editor:

I read Mr. Benzing's letter in the November PF REPORTER with much understanding. We service many Motorola color receivers and the same symptoms had us bugged for a while. While he found the defective component, the defect was of a different nature.

The inner conductor in early production was a tinned wire. During the tinning process some kinks occurred and these kinks caused the conductor to break after repeated heating and cooling cycles. When the set is then cold, the two parts come together and make contact. When the set is in use, the cable warms and expands, thus pulling the inner conductor apart. The capacity between the two parts passes some signal, with the best signal being those on the low band and, of course, the strong stations. Another problem we ran into was that the vertical sync was affected without a loss of picture, again usually on the low band only.

I hope this solution will help a lot of men save their hair.

R. ANDERSON

Palmer, Mich.

Dear Editor:

I have a foreign television set which the owner would like to have converted for American reception. This set is not listed in the PHOTOFACt Index and was last used in Sweden. Before we get too involved, do you think this conversion is practical? What about parts availability on future breakdowns?

H. HANSON

Ashland, Wis.

As a first step, I would advise you to read "Foreign TV Systems" in the July 1964 PF REPORTER. General information is contained in this article. To be specific, Sweden uses the CCIR 625-line system. This would require retuning of the horizontal and vertical scanning oscillators. The vertical circuit would require component changes. Channels E-2 through E-11 and channel E-43 are in use in Sweden with 5.5-MHz picture-sound separation and 7-MHz channel separation. These correspond closely to our channels 2, 3, 7 through 13, and 43. The tuner oscillator coils must be retuned and the RF coils retuned to attain 7-MHz bandpass.

The decision to proceed with the conversion must be made by you and the owner.—Ed.

impedance mismatch problems?

When most voice coil impedances were either 3.2 ohms or 8 ohms, speaker replacement was relatively simple. Then came transistor sets, and equipment without output transformers, and now voice coil impedances range all over the map.

It's important to remember that a mismatched impedance in a speaker replacement will almost surely create problems... from a loss of volume to a blown transistor.

Quam...
and only Quam...
helps you avoid
these problems
these three ways.

1. WIDE CHOICE—As Photofacts/Counterfacts participants, we know in advance what voice coil impedance the new equipment will require, so we generally have the right speaker in our comprehensive line *when you need it*.

2. VERSATILE SPEAKERS—Quam multi-tap speakers offer a choice of impedances in a single unit. Available in all the sizes you need for automotive replacement, Quam multi-taps handle 10, 20, or 40 ohm applications.

3. SPECIAL SERVICE—Just in case you run across an oddball, we offer this convenient exclusive: *any Quam speaker can be supplied with any voice coil impedance*, only \$1.00 extra, list price.



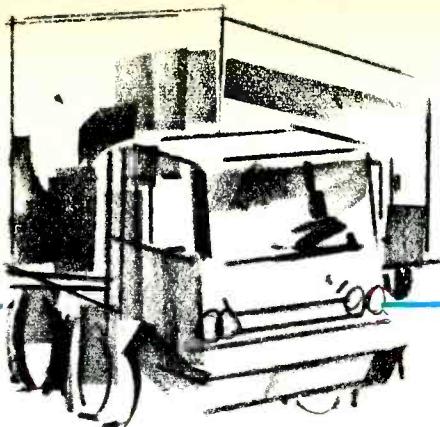
QUAM
THE QUALITY LINE
FOR EVERY SPEAKER NEED

QUAM-NICHOLS COMPANY

234 East Marquette Road • Chicago, Illinois 60637

Circle 16 on literature card

January, 1968 / PF REPORTER 35



TIME TO MOVE?

▀ Nearly every shop owner, at one time or another, ponders the question of if and when to relocate. The correct answer to both questions requires careful consideration of a number of factors, most of which are included in the following check list. ▀

Ernest W. Fair

Change and movement are marked features of life in the business world today. Each year sees further increase, according to the statistics which study such trends. The change factor is so important today that virtually every multiple-store company has developed its own system for determining the profitable time to move to another location.

Few such firms wait until declining business makes it obvious that a move is required. Instead, they apply their check list each time lease renewal comes up, or any other development makes it wise to do such an analysis.

Survival for the single-outlet electronic service shop owner can be even more important, for his future depends on that one business. It is important to him that he anticipate the need for change of his business location well ahead of its being a necessity for survival.

We've condensed three of the aforementioned systems into the following check-list, and any reader may use it to determine whether or not it is time to move his shop location.

✓ Has the general area of the business operation started to show a decline in buying power of customers therein over at least a six-month period?

If no over-all temporary cause can be isolated, a drop in business is always a prime factor to consider. Residents in another area may possess not only better, but more stable buying power.

✓ Have recent developments resulted in major changes of traffic

flow into, around or through the area surrounding the shop?

If such a development is making it more difficult or inconvenient for customers to do business with your shop, then the situation is certain to be damaging in the long run. Naturally, any new location being considered must pass the favorable traffic flow test.

✓ Has the problem of customer parking at the present location become acute? Is there no method of handling it or no space available to solve it?

If this is a factor in patronage, the failure to find a solution can result in great loss of business. Change of location may be fully justified under such circumstances.

✓ Are virtually all of the other business establishments in the area being allowed to deteriorate in appearance by their owners?

Sometimes a drive to spruce-up can halt an area decline, but such cooperation is rarely obtained. A deteriorating business area not only fails to attract customers, but it actually repels them.

✓ Has the vacancy percentages of other business buildings in the area been steadily rising?

It is of particular importance to note when worthwhile business buildings continue to remain vacant over a long period of time. Invariably this is an indication that general business confidence in the particular area has disappeared, and usually for very good reasons. It's often more apparent to nonresidents than to the firms struggling to stay alive therein.

✓ Will expensive changes or ex-

pansion in the building be necessary immediately in order to build up the business in the future or even to hold your own for the present?

Where additional space in the immediate area is either too expensive or impossible to obtain for other reasons, or remodeling of an extensive nature will be necessary, it is sometimes wiser to seek another business home elsewhere.

✓ Are costs of doing business in the present location continuing to rise beyond safe margins and are they likely to continue doing so in the future, without a compensating rise in volume of business or net profit?

If increased business volume does not absorb such added costs, then a new location may be the most advisable step for the shop.

✓ Are there opportunities in another area which have such a great potential that the cost of making the move would be inconsequential?

In many cases such a situation will make a move very profitable even though one's shop is not in any unfavorable position at the present location. Utmost care must be exercised in checking, where this is the chief consideration behind a projected change of location.

✓ Will the loss of business closely tied to the present location be of any importance, and is it certain that this will be offset by the volume of new business that will be gained in the proposed location?

Gains of this nature can sometimes be an illusion, for overall increases in business cost on another location may more than offset the added volume. The gains should

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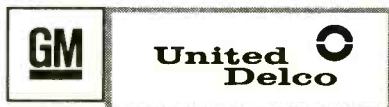
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always be assayed against current losses and future costs.

✓ Will it be possible to obtain a lease in the new location which can be handled under a normal volume of business?

When a new location has many advantages over the present one but a costly and restrictive lease goes along with it, then the actual gain made by the move may be small indeed.

✓ Are the attitudes and approaches of the other business men around the present shop location such as to diminish the possibility of any favorable future for the area?

In business districts where general apathy has set in among the owners of the firms therein, the over-all effect will weigh heavily upon one's own business possibilities no matter how much aggressive effort is put into the shop in its present location.

✓ Are the new business ventures being made in the community all bypassing the general area of the shop's present location even though space therein is available for them?

When this occurs one can be certain that very thorough studies are being made, and the results are proving anything but favorable to one's present location. If this has occurred, you should start doing some close checking on your own.

✓ Has depreciation caught up with fixtures and equipment at the present location to the point where very large sums will need to be spent immediately?

If other indications have pointed to the possible need for a change in business location, this can be a big factor for scrap or salvage of present equipment and installing new equipment in a new location. This will eliminate a costly moving bill, which is always a very important factor.

✓ Is the time at hand when remodeling cannot be put off any longer? Wouldn't it be better to move into a new and modern business home than to bear this expense in a present location?

Even after the renovating has been done, it may be of questionable value and do little to better the present location.

✓ Are changes forthcoming in the type of other business firms in the area which could make it less desirable from the viewpoint of a large segment of present customers?

Usually, one step in such a direction leads to many others and the business area seldom returns to the personality which formerly existed.

✓ Have there been changes in the size of families, steadily mounting average-age figures for most residents, and similar factors covering the present location area?

This generally results in a slow but steady decline of average purchases by customers. Whenever such factors become evident, it is always a good time to seriously consider a change of location.

✓ Finally, during the last two or three years has there been a continuous movement of population from the present area of business to some other in the community? Do all indications point to this as being of permanent nature? If they do, seeking a new location now can not only be a wise step but one necessary to survival of one's business. ▲

PHOTOFACTM BULLETIN

PHOTOFAC BULLETIN lists new PHOTOFAC coverage issued during the last month for new TV chassis. This is another way PF REPORTER brings you the very latest facts you need to keep fully informed between regular issues of PHOTOFAC Index Supplements issued in March, June, and September.

Airline	GEN-11468A (63-11468)	925-1
	GHJ-13668A, GHJ-14098A,	
	GHJ-14148A, GHJ-14158A,	
	GHJ-14548A, GHJ-14558A	928-1
Coronado	TV2-6610A	924-1
Delmonico-		
Nivico	CT-195, CT-197EA, CT-199	928-2
	PCT-198	926-1
Magnavox		
Chassis	T925-01-AA	927-1
Penncrest	4877B-48, 4878B-46, 4886A-49, 4887A-47	924-2
RCA		
Chassis	CTC27A/B	929-1
Chassis	CTC30A/B/C/D/AA/AB/AC/ AD/AE/AF	926-2
Chassis	CTC31A/AA/B/P/R	928-3
Chassis	CTC35A/AA/AB/B	925-2
Chassis	KCS158B/C	924-3
Sears	7100 (Ch. 564.10012)	929-2
	8100 (Chassis 562.10300)	926-3
Zenith	20Y1C38	927-2
Production Change Bulletins		
Admiral		
	Chassis 21A4, 21A4D, 21B4, 21C4, 21F4, 21UA4 21UB4, 21UC4, 21UF4	929-3
Sears	5120, 5121 (Ch. 456/528.61240 thru 249	
Silvertone	456/528.61414/415 456/528.61560 thru 569)	926-4

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This has resulted in a gold mine of new business for licensed service technicians. A typical mobile radio service contract pays an average of about \$100 a month. It's possible for one trained technician to maintain eight to ten such mobile systems. Some men cover as many as fifteen systems, each with perhaps a dozen units.

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trial plants like these, it's the licensed technician who is always considered first for promotion and in-plant training programs. The reason is simple. Passing the Federal Government's FCC exam and getting your License is widely accepted proof that you know the fundamentals of Electronics.

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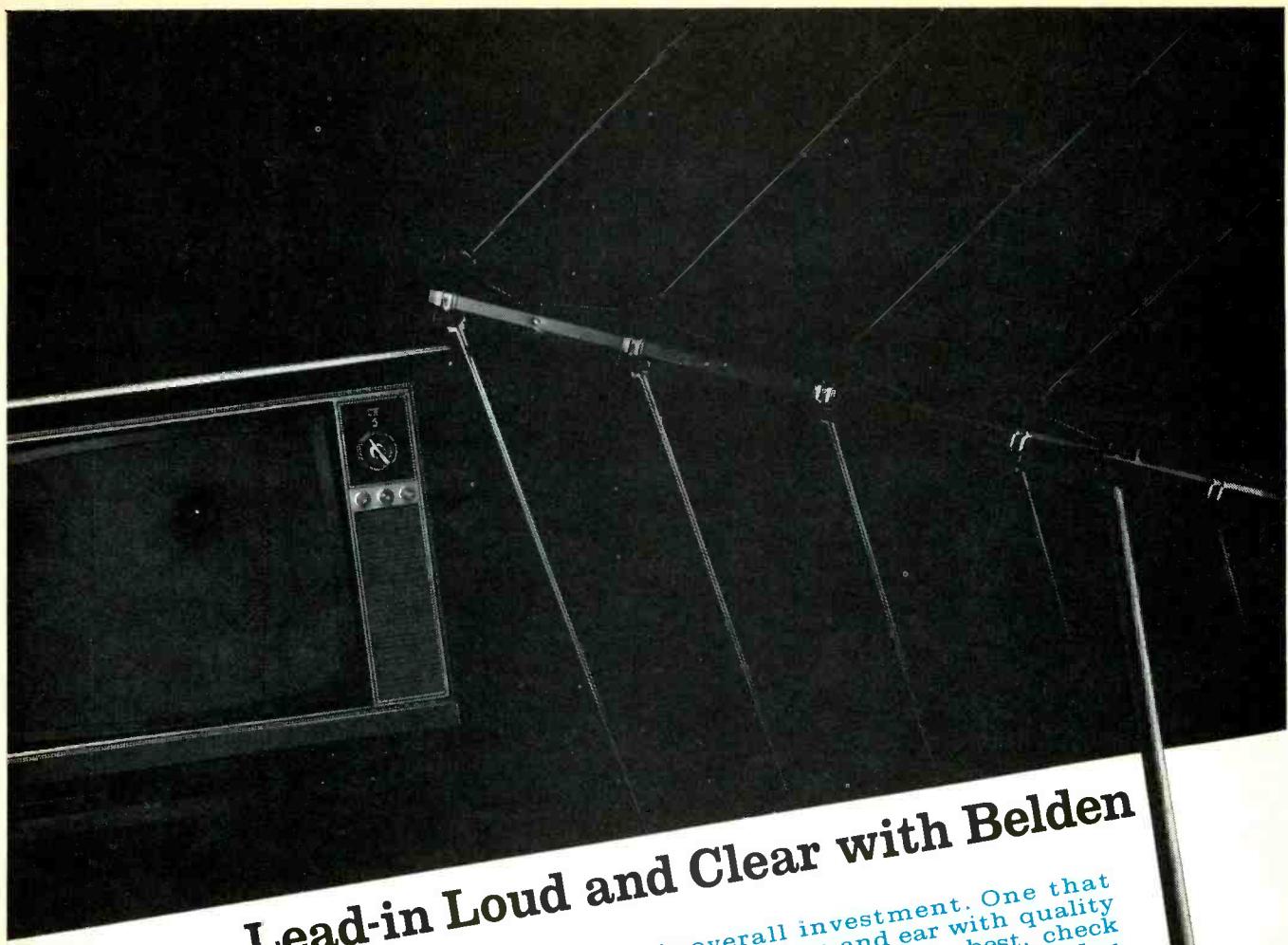
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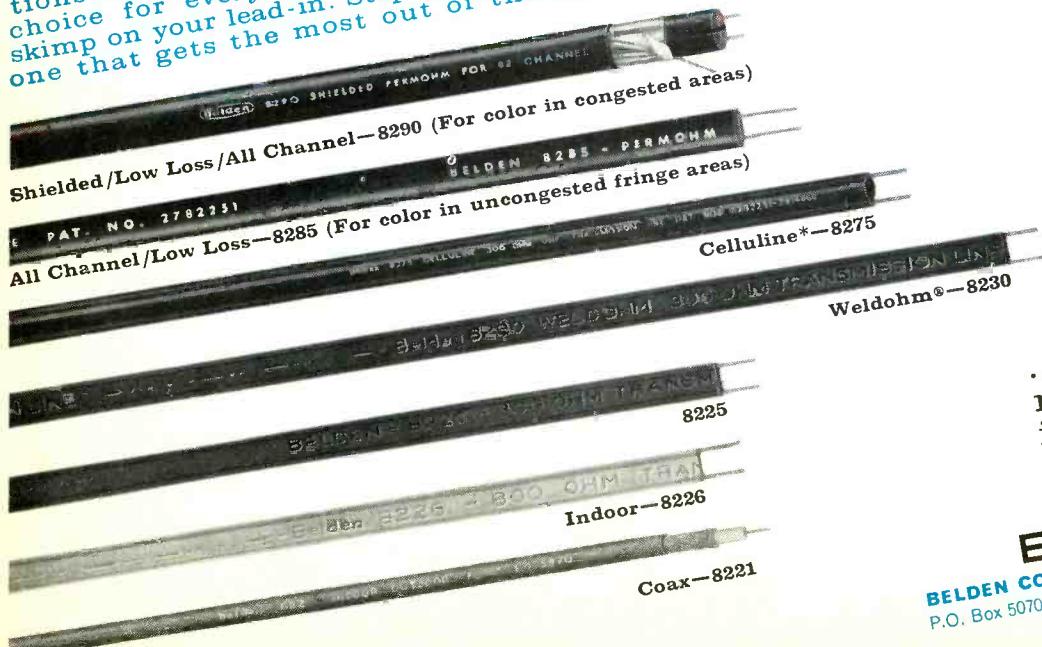
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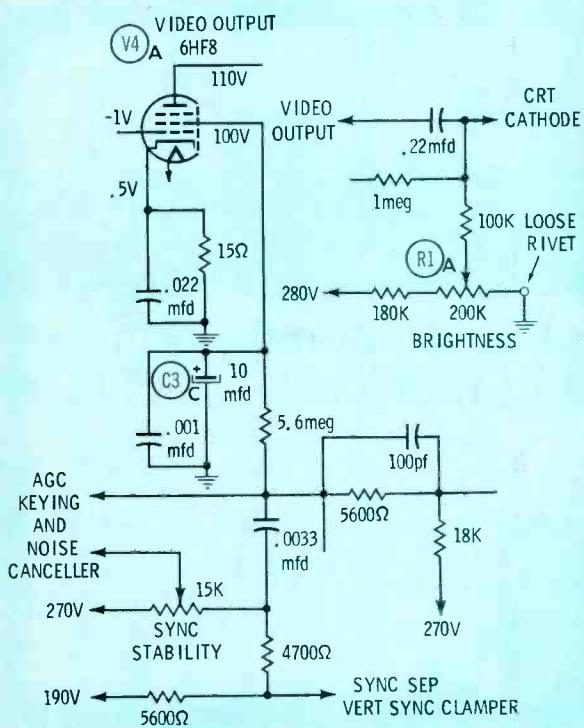
THE TROUBLE-SHOOTER

High Voltage Missing

A Zenith Chassis 14M23 (PHOTOFACt Folder 739-4) has no high voltage. Initial troubleshooting revealed an 850-ohm reading between terminal 7 of the flyback and the plate of the high-voltage rectifier. After replacing the flyback with one of the replacements listed in the PHOTOFACt, the set produces only 15kv (as opposed to the normal high voltage of 19.5 to 20.5kv) and the raster width is reduced. Boost voltage is approximately 450 volts (normally 740 volts). The amplitude of the waveform at the grid of the horizontal output tube is 100 volts p-p (normally 180 volts p-p), while the waveform at the grid of the horizontal oscillator is normal. The voltage at the cathode of low-voltage rectifier X2 measures 255 volts (normally 290 volts). However, when the horizontal output tube is pulled, the voltage at X2 increases to 285 volts.

CHARLES CATTERMOLE

Pleasantville, N.J.



Your description of the trouble symptoms indicates reduced drive to the horizontal output tube, causing it to draw excessive current. However, there are other factors to be weighed before a definite diagnosis can be made. First, is the reduced low voltage a direct result of the increased load caused by excessive current in the horizontal output circuit? To answer this, measure the horizontal output cathode current. If it is more than 160 ma, the excess current could be pulling the high voltage down. If

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the horizontal output cathode current is near normal or below normal (doubtful), the trouble is probably related to a defect within the low-voltage supply, or a defect within another circuit that is pulling the low voltage down. With reduced low voltage, the output of the horizontal oscillator will not be sufficient to drive the horizontal output stage. Or, the original diagnosis of low horizontal output drive may be related to a defect within the plate circuit of the horizontal oscillator—a leaky or partially open C57B could be the culprit.

Before attempting to prove the preceding diagnosis, recheck all connections to the replacement horizontal output transformer, making sure that you have not overlooked a dummy terminal or connected the wrong wire to the wrong terminal, etc. Then, proceed to uncover the reason for the low drive voltage.

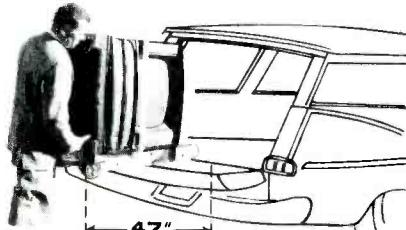
Sync and Brightness Troubles

We have recently experienced a couple of unusual troubles that might be of interest to other service technicians. One involved vertical rolling in an RCA KCS136YA chassis (PHOTOFACt Folder 704-2). The rolling occurred only on Channel 2—Channels 5 and 11 locked in normally. Troubleshooting the sync circuits did not uncover any defects. The trouble was finally traced to a bad electrolytic (C3C) in the screen circuit of the video output stage.

Another unusual defect involved an RCA KCS142 chassis (PHOTOFACt Folder 768-4) that displayed a dark picture. At first, we thought the trouble was caused by low emission in the CRT, but a check of the picture tube revealed no defects. All circuit voltages checked normal. Finally, while probing around, we discovered that the rivet on the ground end of the brightness control was loose.

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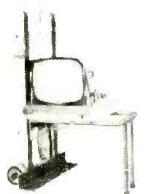
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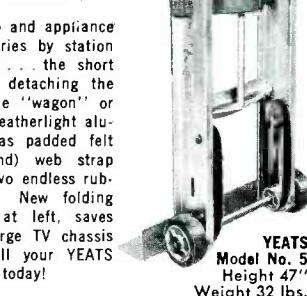
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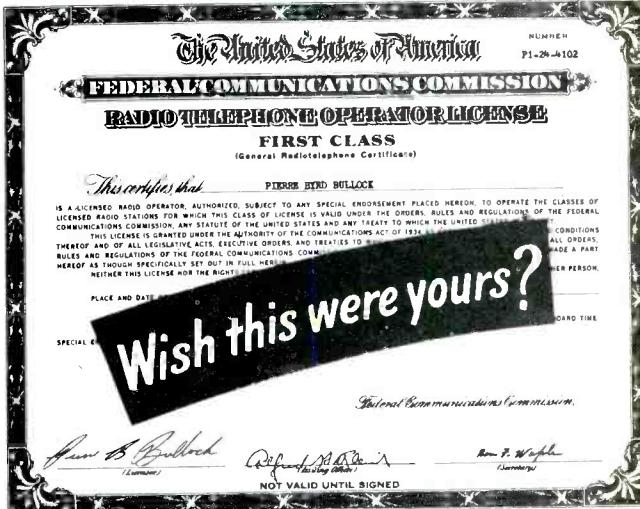
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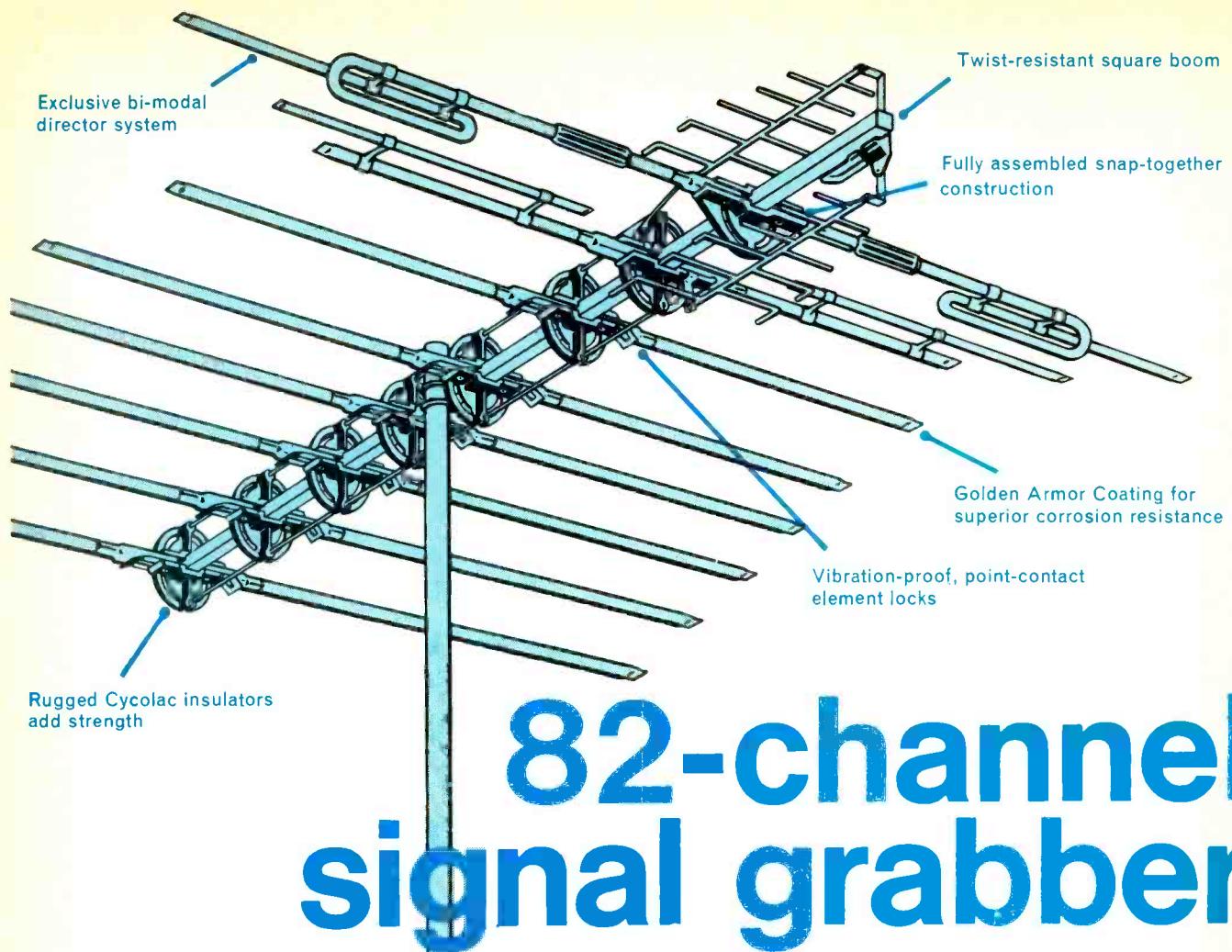
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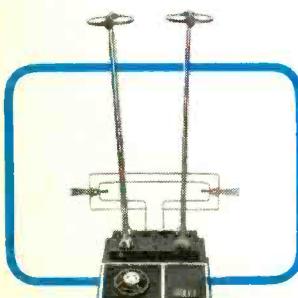
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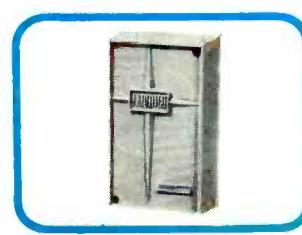
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283 Here are the PHOTOFACt sets with Color TV coverage from the beginning in 1954 through 1967:

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2	32	62	92	122	152	182	212	242	272	302	332	362	392	422	452	482	512	542	572	602	632	662	692	722	752	782	812	842	872	902
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8	38	68	98	128	158	188	218	248	278	308	338	368	398	428	458	488	518	548	578	608	638	668	698	728	758	788	818	848	878	908 Sept.
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11	41	71	101	131	161	191	221	251	281	311	341	371	401	431	461	491	521	551	581	611	641	671	701	731	761	791	821	851	881	911 Sept.
12	42	72	102	132	162	192	222	252	282	312	342	372	402	432	462	492	522	552	582	612	642	672	702	732	762	792	822	852	882	912 Oct.
13	43	73	103	133	163	193	223	253	283	313	343	373	403	433	463	493	523	553	583	613	643	673	703	733	763	793	823	853	883	913 Oct.
14	44	74	104	134	164	194	224	254	284	314	344	374	404	434	464	494	524	554	584	614	644	674	704	734	764	794	824	854	884	914 Oct.
15	45	75	105	135	165	195	225	255	285	315	345	375	405	435	465	495	525	555	585	615	645	675	705	735	765	795	825	855	885	915 Oct.
16	46	76	106	136	166	196	226	256	286	316	346	376	406	436	466	496	526	556	586	616	646	676	706	736	766	796	826	856	886	916 Oct.
17	47	77	107	137	167	197	227	257	287	317	347	377	407	437	467	497	527	557	587	617	647	677	707	737	767	797	827	857	887	917 Oct.
18	48	78	108	138	168	198	228	258	288	318	348	378	408	438	468	498	528	558	588	618	648	678	708	738	768	798	828	858	888	918 Nov.
19	49	79	109	139	169	199	229	259	289	319	349	379	409	439	469	499	529	559	589	619	649	679	709	739	769	799	829	859	889	919 Nov.
20	50	80	110	140	170	200	230	260	290	320	350	380	410	440	470	500	530	560	590	620	650	680	710	740	770	800	830	860	890	920 Nov.
21	51	81	111	141	171	201	231	261	291	321	351	381	411	441	471	501	531	561	591	621	651	681	711	741	771	801	831	861	891	921 Nov.
22	52	82	112	142	172	202	232	262	292	322	352	382	412	442	472	502	532	562	592	622	652	682	712	742	772	802	832	862	892	922 Nov.
23	53	83	113	143	173	203	233	263	293	323	353	383	413	443	473	503	533	563	593	623	653	683	713	743	773	803	833	863	893	923 Nov.
24	54	84	114	144	174	204	234	264	294	324	354	384	414	444	474	504	534	564	594	624	654	684	714	744	774	804	834	864	894	924 Dec.
25	55	85	115	145	175	205	235	265	295	325	355	385	415	445	475	505	535	565	595	625	655	685	715	745	775	805	835	865	895	925 Dec.
26	56	86	116	146	176	206	236	266	296	326	356	386	416	446	476	506	536	566	596	626	656	686	716	746	776	806	836	866	896	926 Dec.
27	57	87	117	147	177	207	237	267	297	327	357	387	417	447	477	507	537	567	597	627	657	687	717	747	777	807	837	867	897	927 Dec.
28	58	88	118	148	178	208	238	268	298	328	358	388	418	448	478	508	538	568	598	628	658	688	718	748	778	808	838	868	898	928 Dec.
29	59	89	119	149	179	209	239	269	299	329	359	389	419	449	479	509	539	569	599	629	659	689	719	749	779	809	839	869	899	929 Dec.
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Circle 17 on literature card

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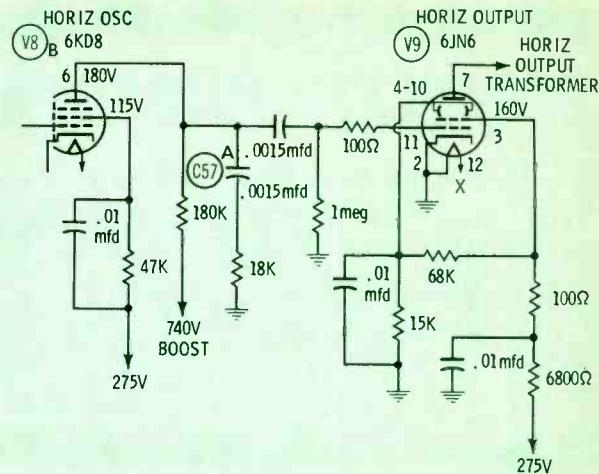
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Circle 25 on literature card

Resoldering the rivet completed the ground path and the CRT returned to normal brightness.

C. E. COMBS

Atlanta, Ga.



Obviously, in your location, the signal from Channel 2 is not as strong as that from Channels 5 and 11. With C3C leaking, the amplitude of the sync pulses was further reduced, so that a combination of the two factors resulted in insufficient input to the sync separator and clapper. The loose rivet on the ground end of the brightness control opened the circuit, placing the full 280 volts on the CRT cathode—producing the obvious result.

Tips on Zenith Chassis

In the Troubleshooting column in the October '67 issue, Mr. C. H. Alexander described a vertical sync

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problem he encountered in a Zenith chassis. I've experienced the same symptom in Zenith chassis, and the cause of the trouble was an open screen bypass capacitor in the video output stage.

In the same column and issue, another technician (Mr. N. Wise) described the high-voltage problem he was experiencing with another Zenith chassis. I've had many such problems with Zenith chassis and have worked out a system of diagnosis that seems to work quite well. I've divided high-voltage troubles into "squeal" and "no-squeal" symptoms. The presence of squeal with a high-voltage problem can indicate a dead horizontal oscillator, shorted capacitor (180 pf) between the plate and cathode of the damper tube, an open filter section, or perhaps a shorted IK3 high-voltage rectifier.

A "no high voltage" symptom without squeal can be caused by an open dropping resistor in the plate of the horizontal oscillator. After checking this resistor, try drawing an arc from the plate of the high-voltage rectifier. If no arc can be drawn, or if the arc is weak, disconnect the yoke from the horizontal output transformer. If high voltage returns, or increases, replace the yoke with a new one. If the high voltage does not return, or if the arc is still weak, replace the horizontal output transformer. This procedure has worked with approximately 90% of the high-voltage problems I have encountered in Zenith Chassis.

MAX GOODSTEIN

Flushing, N.Y.

Thank you for sharing your tricks-of-the-trade with us. Your technique concerning the "squeal" and "no squeal" categorizing of high-voltage problems in Zenith chassis is unique. Obviously, the Zenith chassis you referred to with regard to the vertical sync problem was not a Zenith 14M-21/X chassis. This particular chassis does not have a screen bypass capacitor in the video output stage — the screen is connected directly to the 125-volt B+ line.

Ion Spot and Halation

I have a Zenith 17B20 (PHOTOFACt Folder 429-2) that displays an ion spot and halation after the set is turned off. The picture has good definition and contrast at low brightness. How can I get rid of the ion spot and halation?

G. KEIL

Freeport, Ill.

The ion spot and halation you are experiencing is a result of the fact that

the high voltage does not decay as rapidly as the sweep voltage when the set is turned off. The high voltage may remain for as long as two or three minutes unless the set is operating at high brightness, which quickly discharges the high-voltage filter capacitor or aquadog coating of the CRT.

Several types of spot-killer circuits have been designed into many chassis to provide quick removal of the ion spot after the set has been turned off. One such circuit uses an extra switch ganged to the on-off switch to decrease

the CRT bias when the set is turned off. The same effect can be realized by merely turning up the brightness control before turning the set off. Other types of spot killers include a switch that removes the B+ from the brightness control when the set is turned off, resulting in increased CRT conduction and quicker current drain. Another type applies a positive voltage to the CRT grid to accomplish the same quick current drain. An automatic spot killer using an NE2 neon bulb has also been used. ▲

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January, 1968 / PF REPORTER 47

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ment, location of IF overloads and color convergence. We are more competitive now that we use the B&K Television Analyst because we spend far less time on the jobs that used to be dogs, with benefits both to the shop and our customers."

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SEE PHOTOFACT Set 796, Folder 3

Mfr: Magnavox

Chassis No: T/U 904

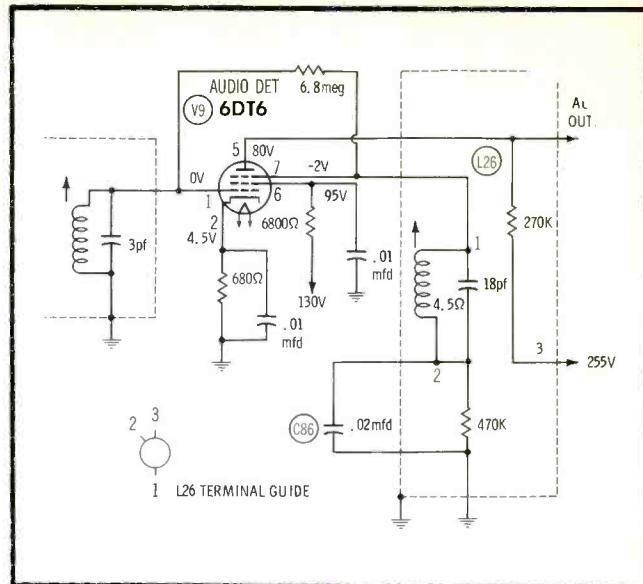
Card No: MA T/U 904-1

Section Affected: Sound.

Symptoms: Buzz in sound.

Cause: Open capacitor in quadrature circuit of audio detector.

What To Do: Replace C86 (.02 mfd).



Mfr: Magnavox

Chassis No: T/U 904

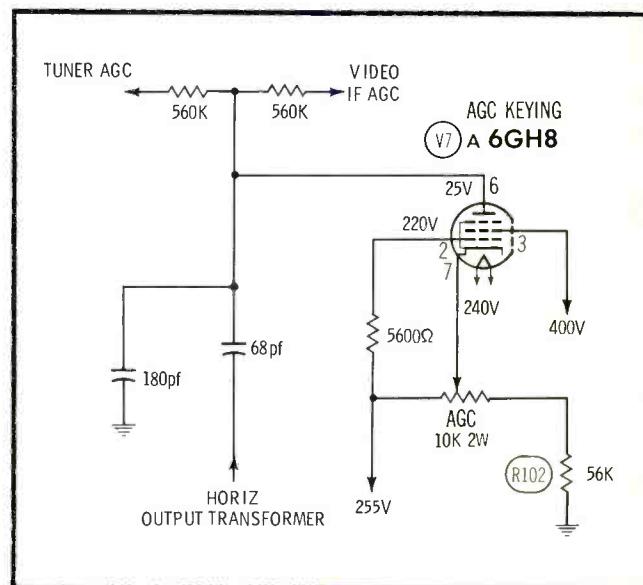
Card No: MA T/U 904-2

Section Affected: Color pix.

Symptoms: Video overload on strong station signal.

Cause: AGC keying circuit cathode resistor overloads and opens.

What To Do: Replace R102 (56K); also V7 (6GH8).



Mfr: Magnavox

Chassis No: T/U 904

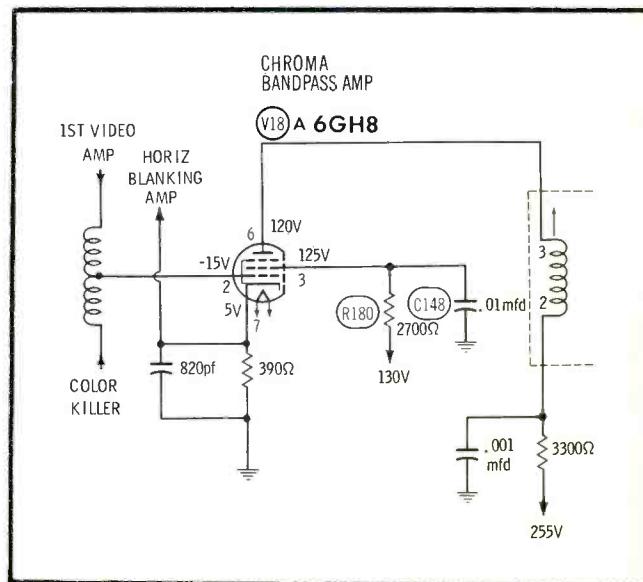
Card No: MA T/U 904-3

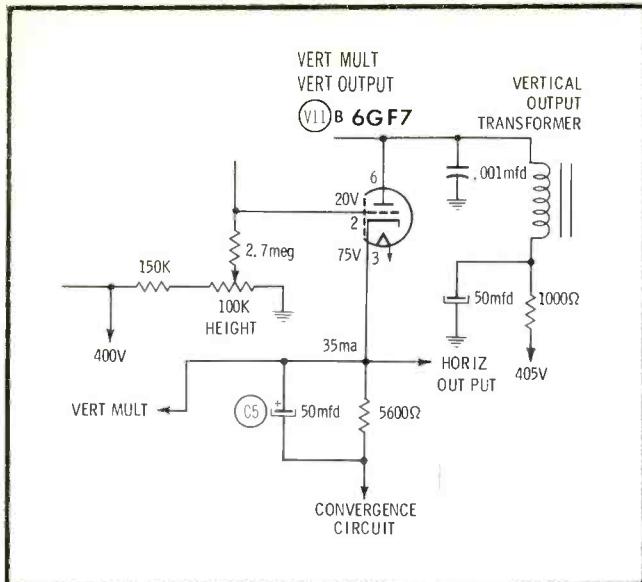
Section Affected: Color Pix.

Symptoms: No color pix; black-and-white normal. Low voltage on screen grid (pin 3) of chroma bandpass amplifier.

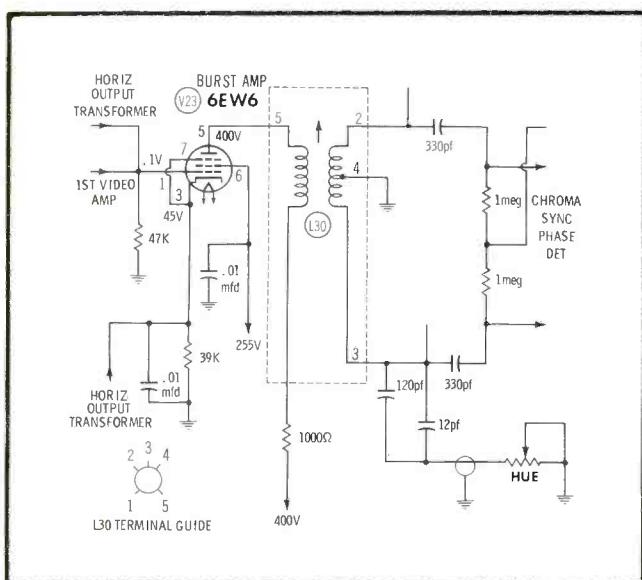
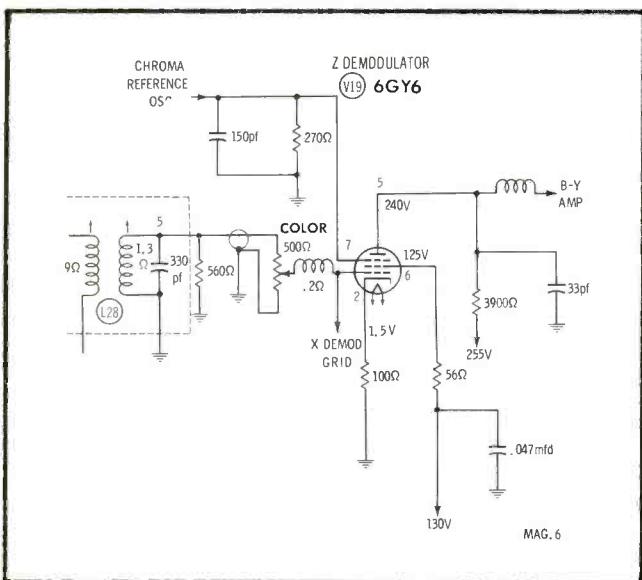
Cause: Leaky screen grid bypass capacitor in chroma bandpass amplifier circuit.

What To Do: Replace C148 (.01 mfd) and R180 (2700 ohms).





SEE PHOTOFACt Set 796, Folder 3

Mfr: Magnavox**Chassis No:** T/U 904**Card No:** MA T/U 904-4**Section Affected:** Raster.**Symptoms:** Vertical jitter.**Cause:** Defective cathode bypass capacitor in vertical output circuit.**What To Do:** Replace C5 (50 mfd).**Mfr:** Magnavox**Chassis No:** T/U 904**Card No:** MA T/U 904-5**Section Affected:** Color sync.**Symptoms:** Color pix floats in and out of sync; black-and-white pix normal.**Cause:** Bad ground connection to burst amplifier transformer.**What To Do:** Resolder ground connection at terminal 4 of L30, burst amplifier transformer.**Mfr:** Magnavox**Chassis No:** T/U 904**Card No:** MA T/U 904-6**Section Affected:** Color pix.**Symptoms:** No color pix; black-and-white pix normal.**Cause:** Defective color control cable.**What To Do:** Replace color control cable.

SEE PHOTOFACt Set 834, Folder 4

Mfr: Zenith

Chassis No: 25NC37

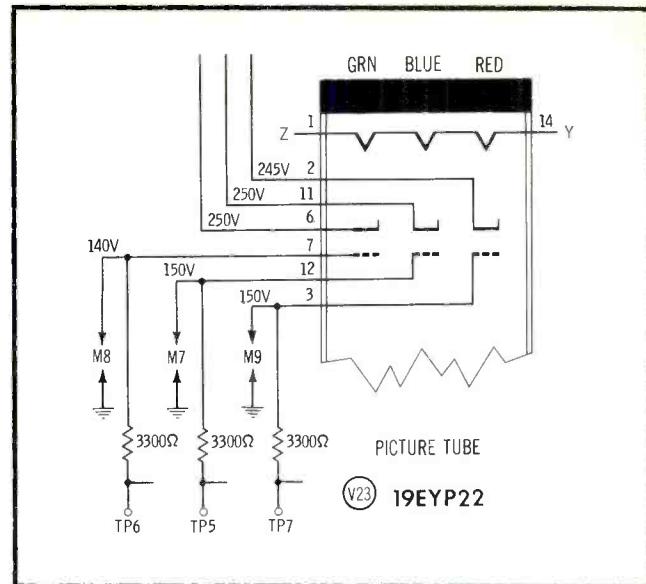
Card No: ZE25NC37-1

Section Affected: Raster; b-w setup.

Symptoms: Red-green and/or blue fields not obtainable.

Cause: Shorted spark gap at one of three screens of CRT.

What To Do: Replace defective spark gap, M7, M8, or M9.



Mfr: Zenith

Chassis No: 25NC37

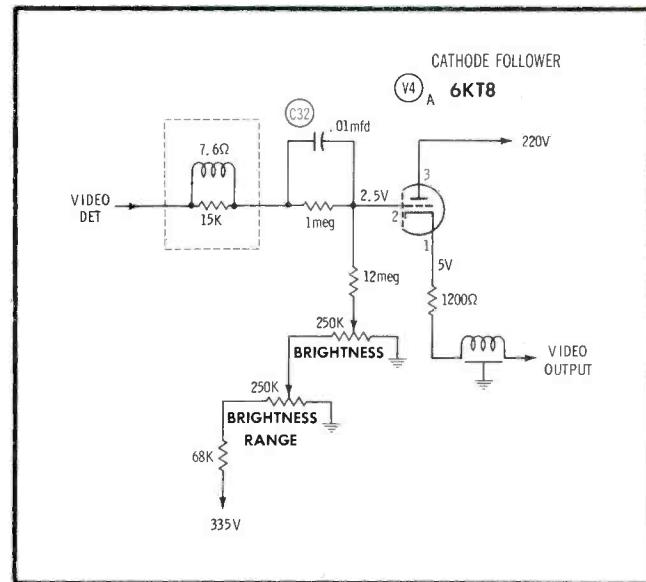
Card No: ZE25NC37-2

Section Affected: Raster.

Symptoms: Very dim raster.

Cause: Shorted coupling capacitor in cathode-follower stage of video amplifier.

What To Do: Replace C32 (.01 mfd).



Mfr: Zenith

Chassis No: 25NC37

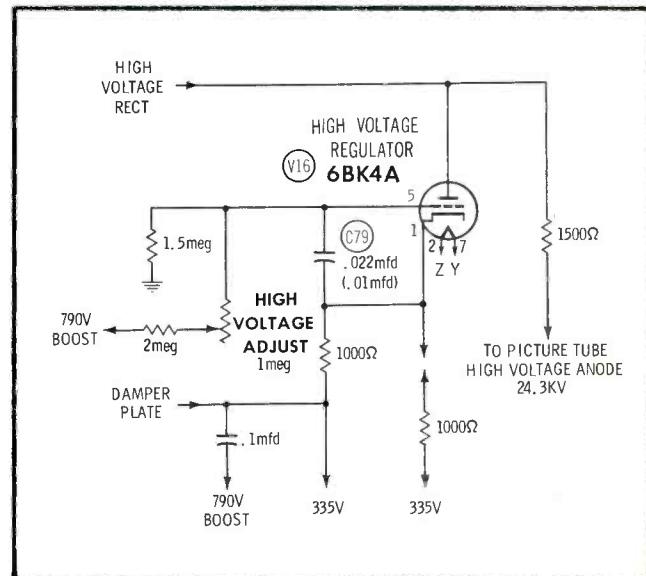
Card No: ZE25NC37-3

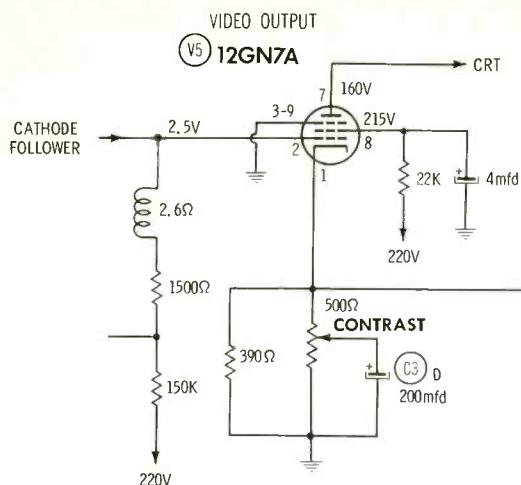
Section Affected: Raster.

Symptoms: No focus.

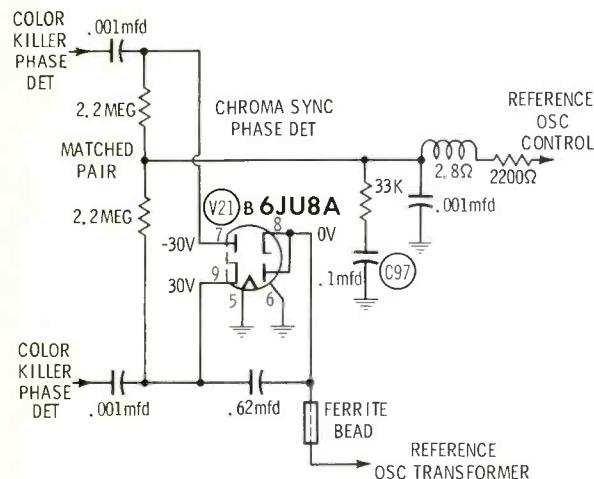
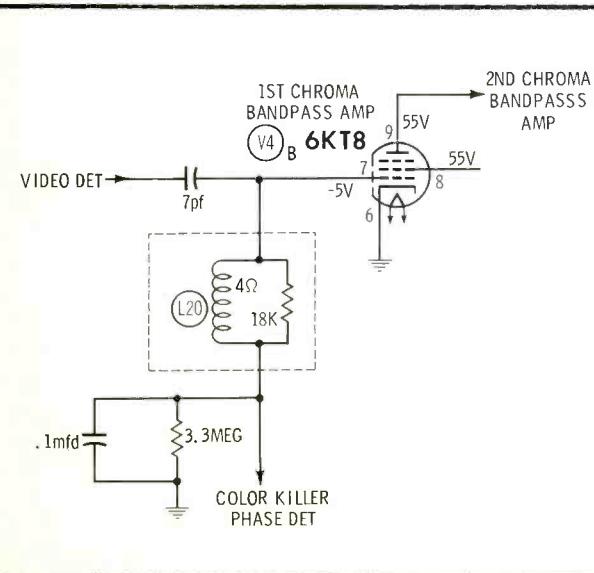
Cause: Shorted grid-cathode capacitor in high-voltage regulator.

What To Do: Replace C79 (.022 or .01 mfd).





SEE PHOTOFACt Set 834, Folder 4

Mfr: Zenith**Chassis No:** 25NC37**Card No:** ZE25NC37-4**Section Affected:** Pix.**Symptoms:** Poor contrast; no control of contrast.**Cause:** Open cathode filter capacitor in video output circuit.**What To Do:** Replace C3D (200 mfd).**Mfr:** Zenith**Chassis No:** 25NC37**Card No:** ZE25NC37-5**Section Affected:** Color sync.**Symptoms:** Color sync lost when channel is changed.**Cause:** Shorted capacitor in chroma sync phase detector output circuit.**What To Do:** Replace C97 (.1 mfd).**Mfr:** Zenith**Chassis No:** 25NC37**Card No:** ZE25NC37-6**Section Affected:** Color.**Symptoms:** Color overshoot; blue shadow occurs on one side of figure; face may be shadowed blue or green.**Cause:** Open peaking coil in grid circuit of 1st chroma bandpass amplifier.**What To Do:** Replace L20, coil resistor combination.

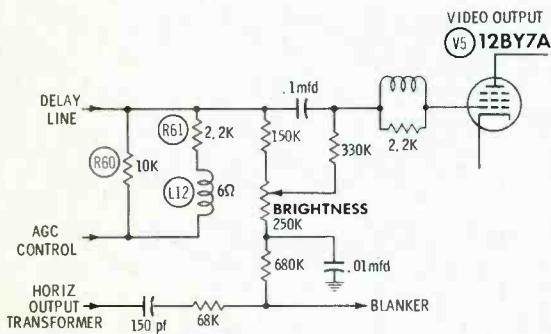
COLOR COUNTERMEASURES

SYMPTOMS AND TIPS FROM ACTUAL SHOP EXPERIENCE

Chassis: RCA CTC12, 15

Symptoms: Dim picture; no control of brightness.

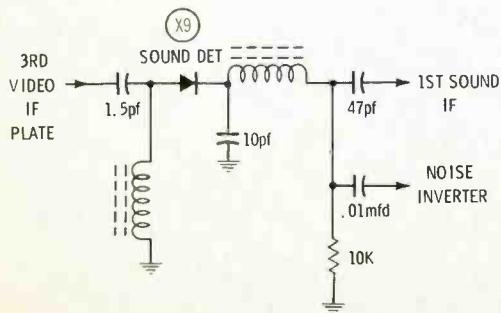
Tip: Rotating brightness control produces no change of brightness on screen. Common cause of trouble is open L12 in grid circuit of video output stage. Positive voltage for the brightness control is obtained from the cathode of the AGC keyer and noise inverter via L12 and R61. With L12 open, the only path for this positive voltage is via the 10K-ohm resistance of R60. This added resistance of approximately 7.8-K ohms reduces the positive voltage to a value lower than normally required for proper brightness control action.



Chassis: Packard Bell 98C7D, 98C8

Symptoms: Video overload when channel changed — clears up in 1 to 4 seconds. In some instances, audio disappears during video overload — depends on strength of station signal.

Tip: Possible cause is defective X9, sound detector diode.



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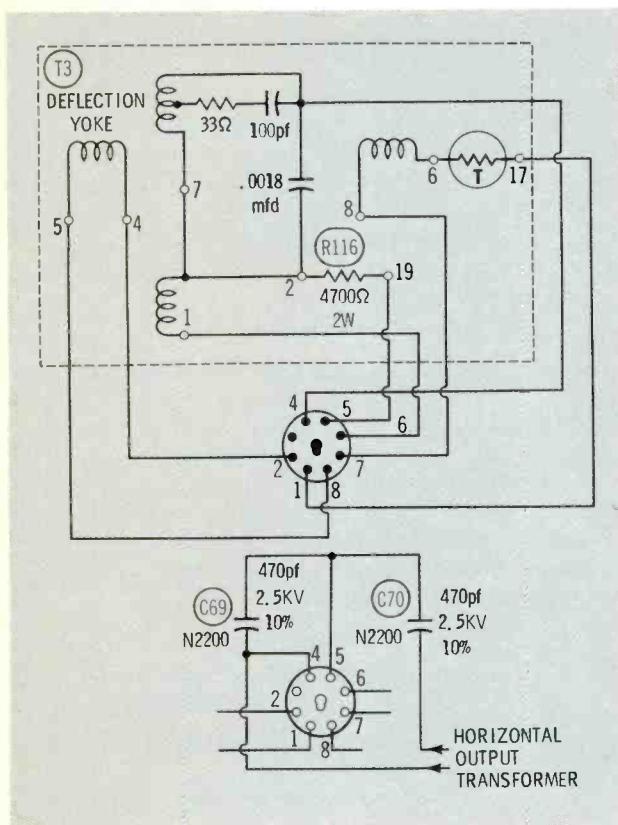
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Circle 30 on literature card

Chassis: RCA CTC24

Symptom: Loss of high voltage; burnt resistor in yoke.

Tip: If R116 is burnt, check C69 and C70 for open or shorted condition. Either defect will unbalance the yoke and cause excessive current to pass through R116.



Chassis: RCA CTC12

Symptoms: No sound, no raster.

Tip: Preliminary check of B+ will uncover open R206 in 255-volt line. Failure of R206 in several chassis has been traced to the following causes:

1. Shorted C136 (decoupling capacitor) in plate circuit of Z chroma demodulator.
2. Shorted C115 (decoupling capacitor) in plate circuit of bandpass amplifier—also burns out R155.

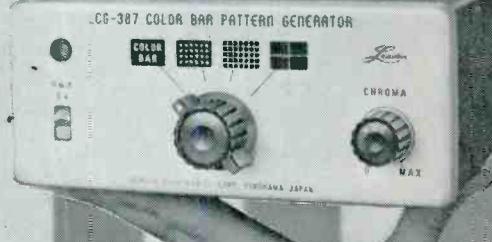


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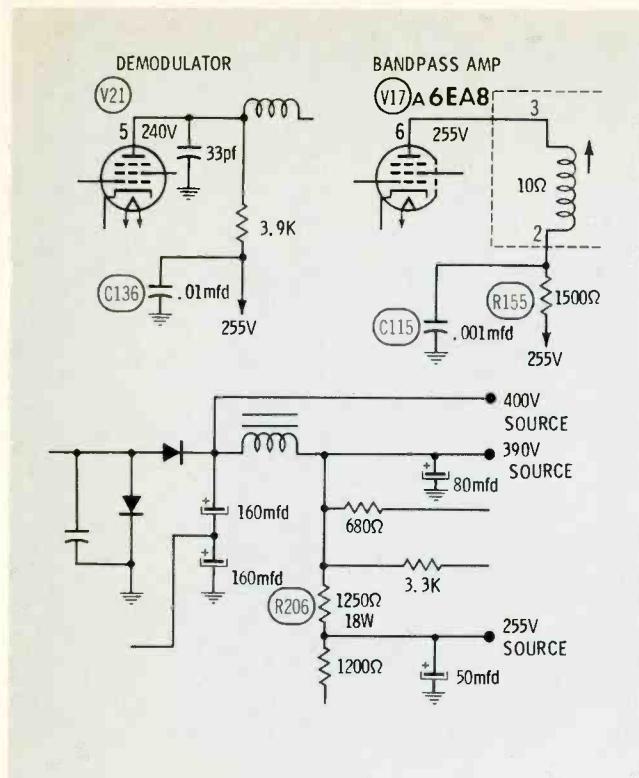
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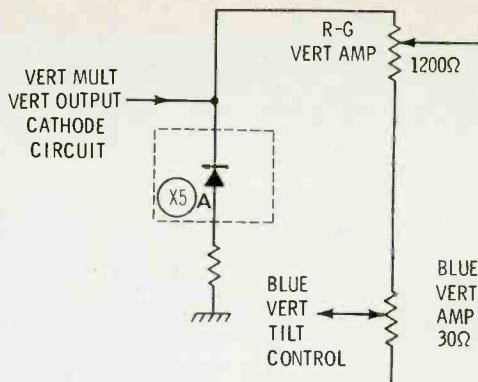
January, 1968/PF REPORTER 55



Chassis: Motorola WTS-907

Symptoms: Bottom of raster shrunk.

Tip: Possible cause of trouble is defective X5 (silicon rectifier) in vertical convergence circuit.



Who Said Trouble Doesn't Pay?

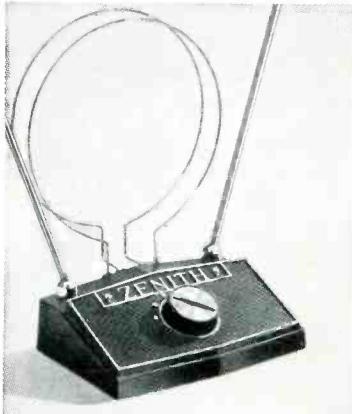
Share your troubleshooting experiences and techniques with the other readers of PF REPORTER—and get paid for doing it. If you've recently run across an out-of-the-ordinary trouble, briefly describe the symptom(s), cause, and cure. Or, if you have an unusual troubleshooting technique that has proved successful, pass it along. Both typed and hand-written material are acceptable. Submit it to:

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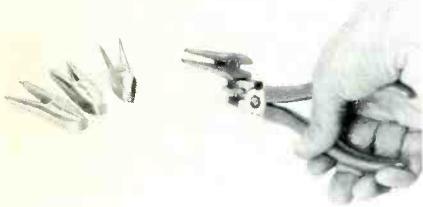
PRODUCT REPORT

for further information on any
of the following items,
circle the associated number on the
Catalog & Literature Card.



Lamp and Magnifier
(60)

The tool shown here is particularly useful for assembling micro components or any other type of work involving the manipulation of small parts or extreme accuracy. Announced by **Swing-O-Lite, Inc.**, the Fluorescent Magnifier-Lamp combines a 5" diameter magnifying glass lens with a 13" focus. The arm has a 45" reach and is counter balanced. A choice of P, C, or W mounts is available, together with a color selection of brown, tan, and grey. Price is \$33.60.

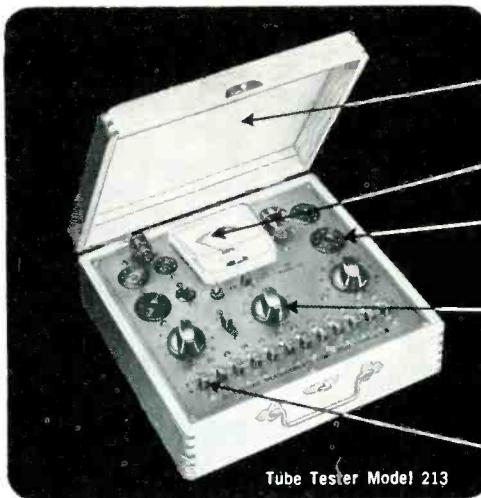


Swivel-Head Plier Set
(61)

A new plier with interchangeable heads that rotate 360° has been announced by **Jensen Tools and Alloys**. Using this tool, the technician can reach into previously inaccessible areas—around corners, into blind spots that cannot even be seen. Eight locking positions are provided at 45° intervals (relative to the plane of the handles). The new Swivel-Head plier thus functions as a standard straight

NO COMPETITORS

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Compact, light-weight portability. Use it on the bench or in the field.

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Three heavy-duty controls for quick set-up of all tests. Check a fistful of tubes in the time it often takes to test one.

12 slide switches for individual selection of tube pins provides versatility in testing, prevents obsolescence.

Full complement of sturdy sockets accepts compactron (12-pin), nuvistor, novar, 10-pin, 9-pin, octal, loctal, and miniature tubes.

Precise programming. Only one socket per tube-base configuration prevents accidental plug-in.

THE MODEL 213 saves you time, energy, money. Checks for shorts, leakage, intermittents, and quality. Tests all tube types including magic eye, regulator, and hi-fi tubes. Checks each section of multi-purpose tubes separately. Gives long, trouble-free life through heavy-duty components, including permanently etched panel. Keeps you up to date with FREE, periodic listings on new tubes as they come out. Your best dollar value in a tube tester. Available in high-impact bakelite case with strap: \$31.40 wired; \$20.90 in kit form. Wood carrying case (illustrated) slightly higher.

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January, 1968/PF REPORTER 57

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58 PF REPORTER/January, 1968

plier and as an angled plier with a choice of eight separate angles to match the work.

Furnished in the set are four interchangeable heads of drop-forged tool steel. Included are a long-nose head with serrations on the gripping surfaces, a shorter duck-bill head with serrations, a duck-bill head without serrations, and a retainer-ring head with pins (.06" diameter) at the extreme ends. The pins also have serrations. Overall length of the plier without head is 6". The complete set (plier handle and four heads) is furnished in a compact vinyl case and is priced below \$15.



Transistor Tester
(62)

This factory-wired and calibrated unit is completely portable and requires no external source. It will test low- and high-power transistors and has sockets for both NPN and PNP transistors to allow convenient transistor matching for complementary symmetry applications.

The **RCA** instrument tests transistors in circuit and out of circuit for DC beta from 1 to 1,000, and out-of-circuit transistors for collector-to-base leakage as low as 2 micromperes, and collector-to-emitter leakage from 20 microamperes to 1 ampere. Low-impedance circuitry assures more reliable in-circuit testing.

Collector currents are adjustable from 20 microamperes to 1 ampere in four ranges, permitting most transistors to be tested at their rated current level. A complete "DC forward current transfer ratio curve" can be plotted from the instrument readings. Three color-coded test leads are provided for in-circuit testing and for out-of-circuit testing of those transistors that will not fit into the panel sockets. Price of Model WT-501A is \$66.75.

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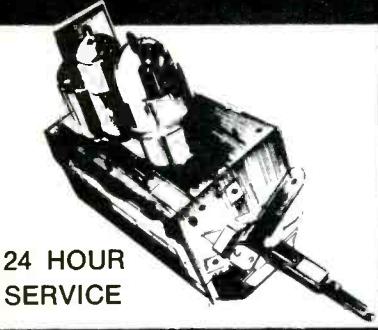
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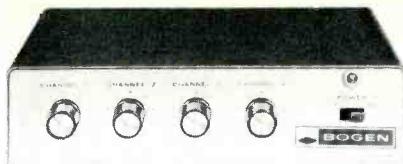
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Mixer-Preamplifier

(63)

A mixer-preamplifier that extends the capability of public address systems or tape recorders has been announced by **Bogen Communications**. Named the Bogen MX6A-T, it is an AC-powered, all-silicon, solid-state unit that can be used singly to add four more microphones or other signals to an existing system. Up to three MX6A-T units can be paralleled to provide 12 individual inputs. The three mixers can be mounted "piggy-back" if desired.

Measuring 9 1/4" x 6" x 2 1/2" and weighing less than five lbs., installation of the new unit requires only plugging into existing equipment for instant operation. The design of the mixer-preamplifier employs all-silicon semiconductors and printed circuits.

The four inputs can handle either high- or low-impedance microphones or electric guitars, each under continuous control through individual volume controls. In addition, two of the four channels will accept tuner or crystal cartridge signals. The output of the MX6A-T is capable of driving any packaged amplifier through its auxiliary input, and it will also drive power amplifiers with 5-volt or better sensitivity. The unit uses standard phone jacks for high-impedance microphones and guitars; screw terminals for low-impedance microphones; RCA-type phono jacks from the output to the auxiliary input of public address amplifiers or tape recorders. Price is \$74.85.



Digital Ohmmeter

(64)

Direct digital display of resistance measurements is provided by a new Digital Ohmmeter, Model DMS-3200/DP-170, announced by the **Hickok Electrical Instrument Company**.

The new instrument provides direct digital readout of resistance measurements from .001 ohm to 1000 meg-ohms in ten ranges with an accuracy capability of $\pm 0.1\%$ full-scale $\pm 0.1\%$ of reading. Of special interest is the low power applied to the resistor under measurement—maximum 1 mw. Four-terminal input with "guard" terminal permits accurate measurement of both extremely low and high resistances.

All-electronic *Nixie*-type display tubes are used for readout, and decimal point indication is automatically displayed. 100% overrange capability is provided, and display time is variable, with provision for holding a reading indefinitely.

The unit features all-solid-state design, utilizes glass-epoxy printed circuit boards, measures 9" x 7" x 13" and weighs 13 lbs. Price is \$560.

High Voltage Test Probe

(65)

The first CRT high-voltage test probe to be offered with a built-in voltmeter has just been introduced by **Pomona Electronics**. The Model 2900 is small enough and light enough to be carried in a tube caddy, and may be used on any color or black-and-white television set.

With the Pomona test probe, high voltage adjustments can be made in

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January, 1968 / PF REPORTER 59

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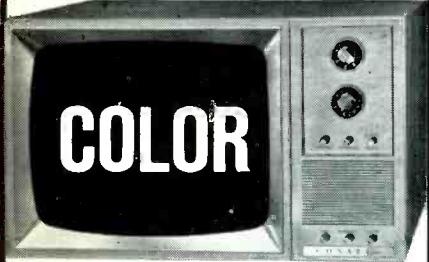
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- Easier to build because it's designed for learning
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Tops for quality, simplicity of design, ease of building, the new CONAR 600 gives you the latest advances in the art of color TV receiver construction. In addition to 21 tubes, this all-channel receiver incorporates a transistor UHF tuner, transistor noise cancellation circuit and 16 solid-state diodes. Separate gun killer switches and a cross hatch generator are built in. All hardware is engineered for accessibility. Attractive bronze-tone steel cabinet with durable wood-grained vinyl covering.

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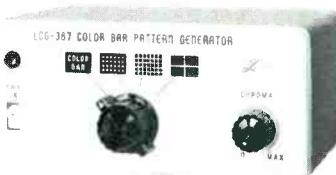


Circle 41 on literature card

60 PF REPORTER/January, 1968



the home without the need for extra equipment. All a technician has to do is ground the instrument, contact the high-voltage anode with the probe tip, and read voltage (up to 30 KV) from the self-contained meter. The probe contains no batteries, and needs no warm-up time. Net Price: \$19.95.



Pattern Generator

(66)

Leader Electronics announces development of a new ultra compact completely solid-state Color Bar Pattern Generator designated the LCG-387. The instrument is designed for convergence and synchronizing adjustments in color and monochrome

TV receivers. It is used extensively in production testing and field servicing, and the only connections are made to the TV receiver antenna input.

Crystal controlled oscillators of 189 KHz and 3.563795 MHz are incorporated in the device for the sync and color burst signals respectively. Flipflop and logic circuitry are incorporated to generate stable and reliable sync and signal pulses. Only transistors of the silicon epitaxial planar type are employed to insure high performance and reliability. Price is \$140.00.



Field Effect Meter

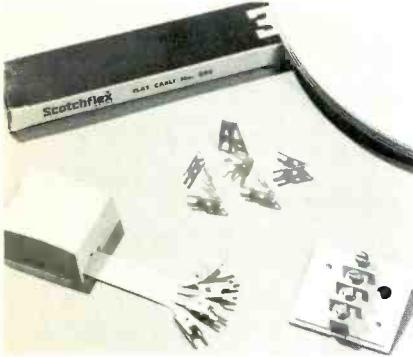
(67)

A new completely portable solid-state field-effect volt-ohm-milliammeter, said to provide all the advantages of a VTVM with none of the disadvantages, has been announced by SEN-CORE.

Designated the FE14, the compact instrument represents a new approach to circuit testing. With 15-megohm input resistance on DC, and 10-megohm input impedance on AC, the FE14 accurately measures voltages with a minimum of circuit loading. Unlike a VOM, which changes loading with

each range, the FE14 is constant on all ranges.

A mirrored scale to prevent parallax error is included as a standard feature. Both meter and internal circuitry are said to be fully protected against AC overload. The FE14 is priced at \$59.95 complete with test leads, less batteries. Optional high-voltage probe 39A19, is \$9.95.



Low Voltage Connector

(68)

A new low-voltage electrical connector designed for use in control systems, sound installations, and other electrical applications of 30 volts or less has been announced by the **3M Company**.

It is called "Scotchllok" brand self-stripping connector No. 560. Preinsulated tap splices, inline splices, and pigtail splices can be made with one connector without stripping, twisting or soldering, according to 3M.

The new connector features a self-stripping "U-type" element encased in white polypropylene. Connections are made by driving the "U-type" element down over the conductors with pliers. The spring compression reserve in the "U-type" element supplies holding power and electrical contact with strong, permanent pressure. A hinged cover attached to the connector's case then is snapped into place for additional protection.

Designed for use on No. 14-18 gauge solid or stranded copper wire, the connector is available in 4-unit blister packs priced at 49¢.



Combiner/Splitters

(69)

A series of accessories called combiner/splitters that provide single-download installation in systems using separate antennas has been announced by **Blonder-Tongue Laboratories, Inc.** The units are designated Models UVF-1 and UVF-c/s for UHF/VHF/FM installation and Model UV-c/s for UHF/VHF.

Model UV-c/s provides separate outputs for an all-channel TV set or converter. This unit mounts indoors either on the back of the set or on the baseboard. Models UVF-1 and UVF-c/s are designed for systems delivering reception on TV channels 2 to 83 and on FM. These weather-proof combiner/splitters can be used indoors or outdoors. Both units can take a single 300-ohm down-lead carrying signals for channels 2 to 83 plus FM and split it into three outputs: one for the FM set and two for the TV set (one for channels 2 to 13; one for channels 14 to 83). The UVF-1 is the deluxe model recommended for all reception areas. It offers high isolation between UHF, VHF, and FM sections. The UVF-c/s is recommended for general applications. Prices for the three units are: Model UVF-1, \$14.95; UVF-c/s, \$6.25; and UV-c/s, \$3.75. ▲

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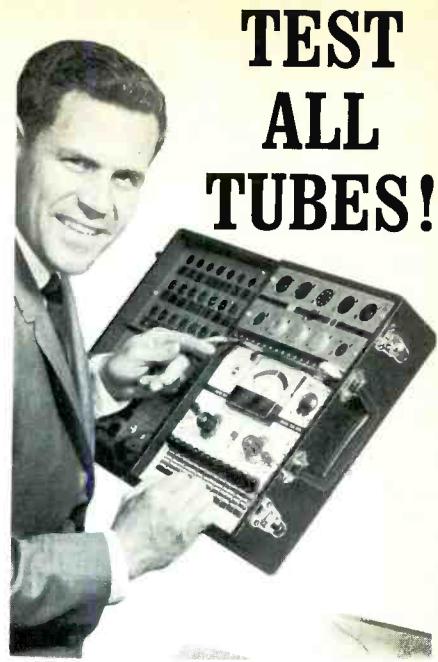
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New Deluxe 107C Tester

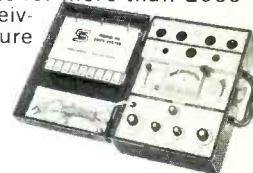
Exclusive "eye" tube spots momentary shorts. Superior accuracy and stability from constant voltage transformer—no line adjust.

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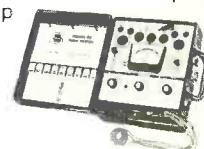
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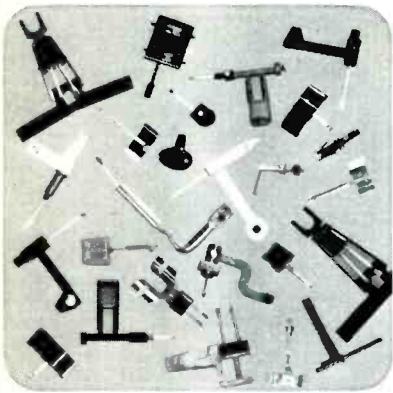
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January, 1968/PF REPORTER 61

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62 PF REPORTER/January, 1968

BOOK REVIEW

Know Your Sweep Generators: Robert G. Middleton; Howard W. Sams and Co., Indianapolis, Indiana, 1967; 176 pages, 8½" x 5½", soft cover; \$3.25.

An understanding of the design and application of sweep generators is essential for those technicians who service TV and FM receivers. Equally as important is the related subject of sweep alignment.

This text covers both subjects in a manner that electronic students, as well as service technicians, will find comprehensive and thorough. Review questions at the end of each chapter help the reader evaluate his understanding and retention of the subject matter. In addition, an appendix located at the back of the book outlines various experiments that involve the use of the sweep generator, thus providing practical application of the knowledge obtained. Included in the outline of each experiment is a list of the materials and equipment needed, a step-by-step description of the procedure, and a reference to the specific portion of the text that relates to that particular experiment.

The text begins with a discussion of the basic principles of sweep alignment, including resonant circuits, frequency response, bandwidth, characteristics of an FM test signal, and response-curve displays. Methods of FM test-signal generation are dealt with in Chapter 2.

Chapters 3 through 6 cover specific types of sweep generator design including beat-frequency, wide-band audio-frequency, wide-band RF, and UHF types. Chapter 7 is devoted to a section-by-section analysis of the trouble symptoms and troubleshooting and servicing procedures associated with sweep generators.

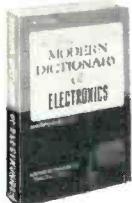
"Constructing Sweep-Generator Kits" is the title of the final chapter. A detailed description of the various aspects of kit building is presented, along with testing and adjusting techniques. ▲

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Control Instrument Mechanisms

by John E. Warren. Explains the mechanical and pneumatic principles governing all pneumatic control instrumentation. Thoroughly analyzes all of the basic components used in control instruments, first individually, and then in the groups in which they are commonly used. Case studies of instruments are presented, each explained by a schematic, a block diagram, and a functional word train. This approach enables anyone to analyze and understand similar complex control equipment. Color is used liberally in illustrations to emphasize force arrows, inputs, outputs, and circuit paths. 160 pages; 8½ x 11"; comb-bound. Order 20596, only \$8.95

101 Questions and Answers About CB Radio Operations

by Leo G. Sands. A handy and practical book answering the most frequently asked questions about CB radio. Each of four special sections deals with one generalized area of CB radio operations, including questions and answers about the four classes of CB radio and their permissible uses, licensing and FCC rules, operating procedures, and advice about the selection of CB equipment. Anyone with an interest in CB will find this an easily understandable and invaluable guide. 96 pages, 5½ x 8½". Order 20604, only \$2.50

Experimental Earth Sciences

by Morris Goran. This fascinating book enables you to learn about the earth and its atmosphere through simple experiments, covering such subjects as the essentials of meteorology (the science of weather and the atmosphere); geology (the study of the earth's crust and interior); oceanography (the science of the seas); and astronomy (the science of the stars). Describes 60 experiments in each of the four areas covered, using readily available materials; includes construction-type experiments for building models. 128 pages; 5½ x 8½". Order 20601, only \$2.50

Practical Problems in Number Systems, Logic and Boolean Algebra

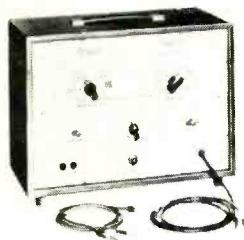
by Edward Bukstein. This workbook is a 62-lesson introduction to digital computer mathematics. Begins with the various number systems (binary, trinary, octal, decimal) converting numbers from one system to another, and some common codes). Then develops the binary and octal arithmetics as a basis for introducing Boolean algebra. The latter, with its relations of AND, OR, and NOT, is elaborated by a variety of tables, diagrams, and maps. Also covers the implementation of Boolean algebra in electronic gating and inverting circuits. The workbook is suitable for either classroom or individual use. No special background in mathematics is required for understanding. 128 pages; 8½ x 11". Order 20609, only \$2.50

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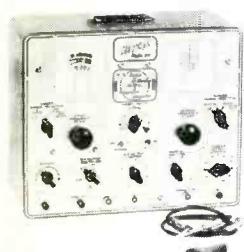
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INDEX TO ADVERTISERS

January, 1968

B & K Mfg. Co., Div. of	
Dynascan Corp.	48
Belden Mfg. Co.	40
Bussmann Mfg.	14, 15
Castle TV Tuner Service, Inc.	31
Channel Master	30
Chemtronics, Inc.	63
Cleveland Institute of Electronics	39
Cornell-Dubilier	Cover 2
Delco Radio Division	37
Electronic Measurements Corp.	57
Electro-Voice, Inc.	62
The Finney Co.	23
G. C. Electronics	29
Gem City Tuner Repair Service	35
Heath Co.	41
Hickok Electrical Instrument Co.	63
Jerrold Electronics Corp.	44
Kay-Townes Antenna Co.	60
Leader Electronics	55
Lectrotech, Inc.	53
Littelfuse, Inc.	Cover 4
Mallory, P. R. & Co., Inc.	9
National Radio Institute	25, 43, 60
Olson Electronics, Inc.	59
Oxford Transducer Co.	33
Philco-Ford	34
Quam-Nichols Co.	35
Quietrole Co.	61
RCA Electronic Components & Devices (Entertainment Tubes)	Cover 3
RCA Institutes, Inc.	54
RCA Sales Corp.	42
RMS Electronics, Inc.	32
Sams, Howard W. & Co., Inc.	45, 62
Sarkes Tarzian, Inc.	17
Seco Electronics Corp.	58, 61
SECORE, Inc.	28, 47
Simon, H. K.	58
Sprague Products Co.	11
South River Metal Products Co., Inc.	57
Superior Tuner Service	59
Swing-O-Lite	46
Sylvania Electric Products, Inc.	26, 27
Texas Crystals	58
Weller Electronics	46
Yeats Appliance Dolly Sales Co.	43
Zenith Sales Corp.	56

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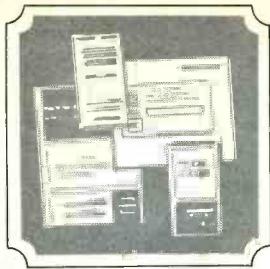
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*CHECK "INDEX TO ADVERTISERS" FOR FURTHER INFORMATION FROM THESE COMPANIES

ANTENNAS

100. *ALLIANCE*—Colorful 4-page brochure describing in detail all the features of Tenna-Rotors.
101. *BLONDER-TONGUE*—Flyer sheet on new "Color Tap" outlet plates and plugs for 300Ω leadin.
102. *DELHI*—Twelve-page catalog introducing a complete new line of home TV towers, ham towers, citizen's band towers, masts, and telescoping masts.
103. *FINNEY*—4-color brochure with description and technical details on new Finco color spectrum frequency dependent antennas for UHF-VHF-FM, VHF-FM, and UHF. Form 20-413.*
104. *JERROLD*—New 4-page full-color catalog describes the new Paralog Plus antennas.*
105. *JFD*—Color Laser and LPV antenna brochures. New 1968 dealer catalog covering complete line of log-periodic outdoor antennas, rotators, and accessories.*
106. *MOSLEY*—Catalogs on CB, Amateur radio, and TV/FM antennas.
107. *WINEGARD*—Fact-finders on "Color-Line 82" coaxial cable pack, "Transcoupler" cut-to-channel Yagi antennas, and "Red-Head 82" solid-state antenna preamplifier.*

AUDIO

108. *ATLAS SOUND*—Specification sheets on new models AP-15, AP-15T, and APT-34T paging speakers.
109. *BELL P/A*—Complete specifications, operating instructions, and schematics on the new "Carillon" series amplifiers.
110. *ELECTRO-VOICE*—Pocket-size guidebooks for EV microphones, Hi-Fi loudspeakers, and systems.
111. *GIBBS*—Literature for use of reverberation units with audio amplifiers.
112. *OXFORD TRANSDUCER*—Bulletin A-109 features speaker installation in automobiles, hospitals, and recreation rooms.
113. *RACON*—Catalog C66ST on horns, drivers, sound columns, and accessories.
115. *UNIVERSITY SOUND*—New 28-page 1968 commercial sound product catalog.

COMMUNICATIONS

116. *AMPHENO*—2-color spec sheets on new Model 650 CB transceivers and Model C-75 hand-held transceiver.*
117. *CUSH CRAFT*—Full line catalog of base station antennas for CB and Business Band radios.

COMPONENTS

118. *MARK PRODUCTS*—Flyer sheets CR659 and AM661 on antennas and accessories for CB and Ham radios.
119. *MOSLEY*—Catalogs on antennas for TV/FM, CB, and Ham use.
120. *SQUIRES SANDERS*—Bulletin on the "Commodore" CB rig.
121. *BELDEN*—Catalog 867, a 56-page catalog of the complete Belden line.*
122. *BUSSMANN*—12-page booklet listing the complete line of BUSS and FUSETRON small dimension fuses by size and type, also indicates proper fuseholder—also shows list prices. Ask for BUSS Bulletin SFUS.*
123. *CENTRALAB*—24-page replacement parts catalog No. 33GL.
124. *CORNELL-DUBILIER*—New 4-page Color-lytic list.
125. *GRAYHILL*—52-page catalog of switches.
126. *MALLORY*—Bulletin 4-82 describes radial and axial lead tantalum capacitors.
127. *MILLER*—Catalog 167, a 156-page general catalog with complete cross-reference guide to the J.W. Miller Line.*
128. *LITTELFUSE*—Pocket-sized TV circuit breaker cross reference gives the following information at a glance. Manufacturer's part number price, color or b/w designation. A second glance gives trip ratings and acquaints you with a line of caddies. Ask for CBCRP.*
129. *QUAM-NICHOLS*—New catalog No. 67 has complete detailed information on the entire Quam line.
130. *SPRAGUE*—C617, a complete catalog of the Sprague Line.*
131. *TEXAS CRYSTALS*—12-page catalog of crystals including engineering data, specifications and prices.
132. *WORKMAN*—46-page catalog #100 on resistors, fuses, circuit breakers, brighteners, adaptors, and test accessories. Cross-reference charts included.*

SERVICE AIDS

133. *CASTLE TUNER*—How to get fast overhaul service on all makes and models of television tuners is described in leaflet. Shipping instructions, labels, and tags are also included.*
134. *GC*—FR-67, the full-line catalog.*
135. *MM BUSINESS FORMS*—Brochures about and samples of two new professional service contract forms designed to earn extra money.

136. *PERMA-POWER*—New 4-page catalog of TV accessories.

SPECIAL EQUIPMENT

137. *ATR*—Literature about DC-AC inverters up to 600 watts load.
138. *WINDSOR ELECTRONICS*—Booklet entitled "The Open Door to TV Profits".

TECHNICAL PUBLICATIONS

139. *CLEVELAND INSTITUTE OF ELECTRONICS*—Free illustrated brochure describing electronics slide rule and four lesson instruction course and grading service.*
140. *RCA INSTITUTES*—New 1968 career book describes home study programs and course in television (monochrome and color), communications, transistors, industrial, and automation electronics.*
141. *SAMS, HOWARD W.*—Literature describing popular and informative publications on radio and TV servicing, communications, audio, hi-fi, and industrial electronics, including special new 1967 catalog of technical books on every phase of electronics.*

TEST EQUIPMENT

142. *B & K*—New 1968 catalog featuring test equipment for color TV, auto radio, and transistor radio servicing, including tube testers designed for testing latest receiving tube types.*
143. *EICO*—New spec sheet describes model 100A4 multimeter with DC sensitivity of 100K ohms per volt.*
144. *HICKOK*—Quick reference catalog No. 67D gives brief descriptions and prices for complete test equipment line.
145. *LECTROTECH*—Two-color catalog sheet on new Model V6-B color bar generator, the latest improved model of the V-6. Gives all specs and is fully illustrated.*
146. *MERCURY*—All-new 16-page test instrument catalog.
147. *SECO*—Operating manual for the HC8 in-circuit current checker for horizontal output tubes.*
148. *SENCORE*—New 12-page catalog on all SENCORE products.*
149. *SIMPSON*—Reprint: "A Guide to the Selection of Multimeters." Explains how to evaluate multimeters before you buy.*
150. *SINGER*—Brochure about the DM-4 deviation monitor scope.
151. *TRIPLETT*—New panel meter catalog D-68 with complete line of measuring instruments.*

TOOLS

152. *ARROW*—Catalog sheet showing 3 staple gun tackers designed for fastening wires and cables up to $\frac{1}{2}$ " diameter.
153. *CHANNELLOCK*—Updated catalog #66 with price schedule.
154. *ENTERPRISE DEVELOPMENT*—Time-saving techniques in brochure from Endeo demonstrate improved desoldering and resoldering methods for speeding and simplifying operations on PC boards.*
155. *SWING-O-LITE*—Catalog sheet on Models BBM-9 and BB45 low-priced bench lamps.*
157. *VACO*—Catalog SD-127 about ratchet box wrenches.
158. *XCELITE*—Bulletin N867 describes hollow-shaft nutdrivers which speed lock-nut/screw adjustments.*

TUBE AND TRANSISTORS

159. *RCA*—PIX-300, a 12-page product guide on RCA picture tubes covering both color and black-and-white. Includes characteristics chart, terminal diagrams, industry replacement, and interchangeability.*

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...so we redesigned the RCA-6BK4A to improve its capability in shunt regulator circuits of high voltage power supplies in color TV receivers. Always the best tube to do the job, the RCA-6BK4B is now even better.

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