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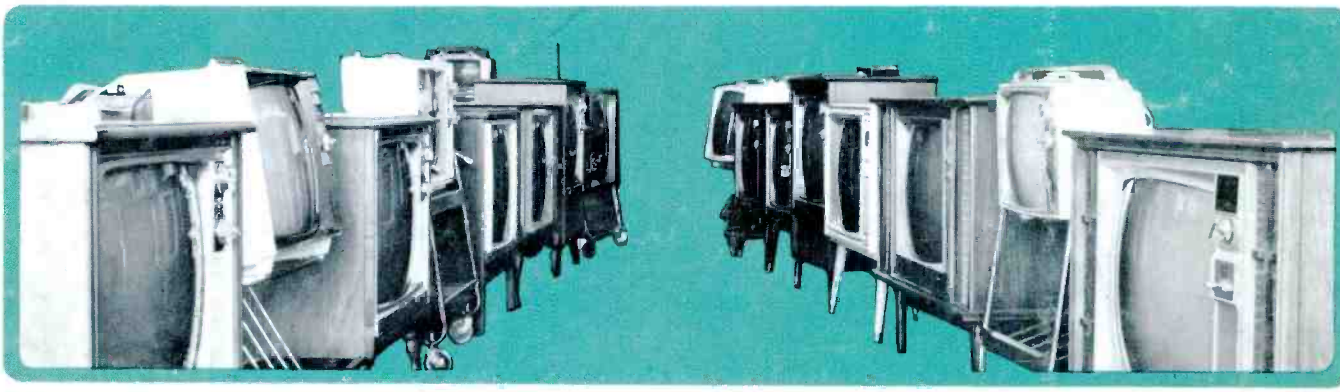
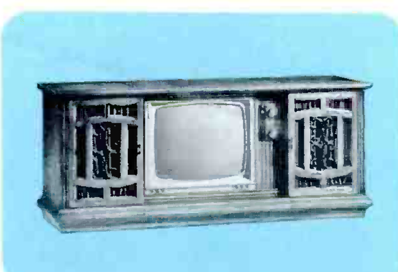
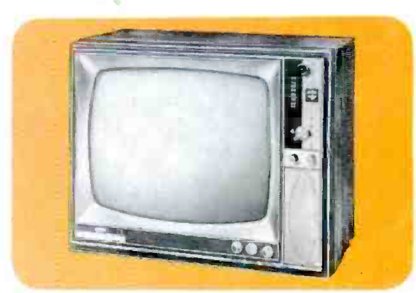
the magazine of electronic servicing

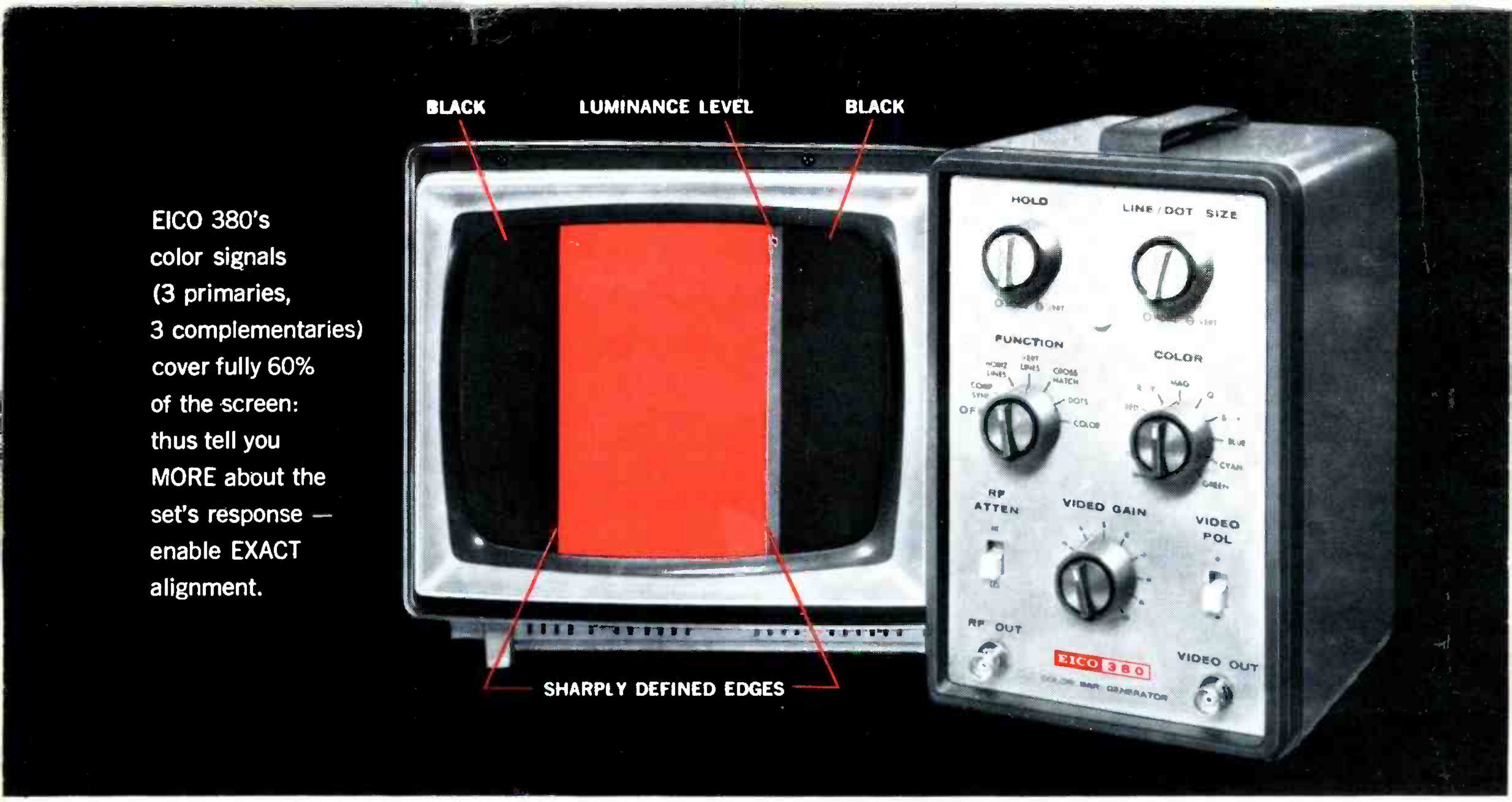


highlights of 1967 TV Receivers





- Recommended Equipment for Square-Wave Testing
- Gated-Beam FM Communications Detectors
- Wild Sync
- How to Sell TV Antennas
- More About TV AGC



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Highlights of 1967 TV Lines

by J. W. Phipps

ADMIRAL

The 1967 line of black-and-white receivers offered by Admiral comprises 21 portables (with 13", 15", 19", and 21" screen sizes), two 23" table models, and ten 23" console models. All models, with the exception of the 13" and 15" portables, use carryover chassis introduced in '65 and '66. Continued chassis include G346-3, used in three 19" portable models; G5, used in five 19" portables; 7G7, used in one 19" portable, one 21" portable, two 23" table models, and six 23" consoles; 8G7, used in a 19" portable equipped with a remote unit; 9G5, used in four 21" portables; and 3G5, used in four 23" consoles. An "Instant Play" circuit, which provides immediate sound and picture when the set is turned on, is available in one of the 19" portables, one of the 21" portables, the two 23" table models, and in five versions of the 23" console line.

Completely new chassis are used in the 13" and 15" portables. Chassis H1-1A, used in the *Playmate* three-model 13" series, and Chassis H2-1A, used in the *Vagabond* two-model 15" series (shown here), and the *Executive* 15" model, are basically alike in all respects, except of course, picture tubes. Both CRT types, the 13CP4 used in the H1-1A and the 15JP4 used in the H2-1A, are square-cornered and flat-faced, with a steel bonded frame around the faceplate.

Compactrons are used liberally in the new chassis. A 23Z9 double-triode/pentode compactron serves the triple functions of sync separator (triode section), vertical oscillator (triode section), and vertical output (pentode section). Another double-triode/pentode compactron, a 14BR11, performs the functions of sound IF amplifier (triode section), video amplifier (pentode section), and AGC (triode section. Additional compactrons include a 17BF11 double pentode, used in the sound detector and sound output stages, and a 33GY7A diode/pentode employed in the horizontal output and damper stages. The horizontal phase detector uses the twin diode section of an 8LT8 twin-diode/pentode, while the pentode section of the same tube serves the horizontal oscillator stage. Completing the tube complement of the main chassis are an 8BM11 double-pentode compactron, used in the 1st and 2nd picture IF's, and the 1BC2 high-voltage rectifier.

The transformerless low-voltage power supply uses a single silicon diode with a 5.5-ohm fusible resistor providing surge and overload protection. A series filament string and polarized line cord are used in the chassis.

CHANNEL MASTER

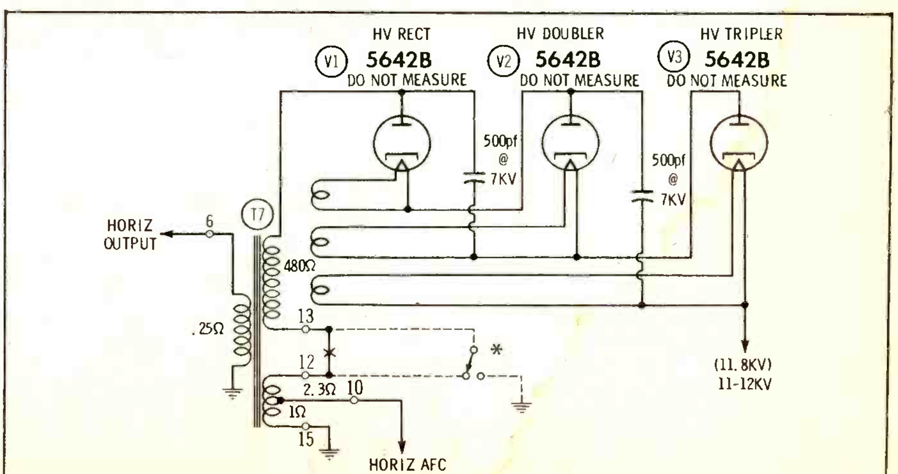
Two new chassis are featured in Channel Master's line for the coming year. In addition, Model 6573, a tube-type 12" portable introduced last year, will continue to be offered.

The first of the new models is an 11" transistorized portable receiver, Model 6571. Two printed-circuit boards, mounted on the vertical chassis, contain most of the video, sound, and sweep circuitry. The only tubes employed in the set are three 5642B diodes, used in the high-voltage tripler arrangement shown here. The transformer-powered low-voltage supply, capable of operation from either an AC or DC source, employs a bridge type rectifier and electronic filter. A battery charging circuit is provided for use with an accessory, rechargeable, battery pack. Line overload protection is provided by a 5-amp fuse in the transformer primary, with B+ protection afforded by a .5-amp fuse in the rectifier output circuit.

A solid-state complement of 28 transistors and 21 diodes is used in the receiver circuitry, which includes three stages of video IF, two video amplifier stages, two stages of sound IF, and two stages of audio amplification. Blocking oscillators are used in the vertical and horizontal sweep circuits. Solid-state diodes are used profusely throughout the set, serving such functions as a pulse gate between the AGC keyer collector and the horizontal-output transformer, as oscillator protection in both the vertical and horizontal circuits, as a boost rectifier, and as a wave-shaping diode in the horizontal-output circuit.

Two separate AGC circuits are employed in this receiver. Both circuits are shown here. One is a keyed system employing an amplifier and keyer stage, with an input reference level from the video amplifier. This keyed circuit is used to control the video IF gain. The second AGC circuit is a delayed system that samples the output of the 1st video IF and uses this reference level to control the VHF tuner gain.

The other new set is a transformerless 16" tube-type portable, Model 6574. Included in the tube complement are four compactrons: a double pentode 17BF11 used in the sound detector and sound output stages; a triode/beam pentode 17JZ8 used in the vertical oscillator and output stages; a 17BE3 diode used in the damper; and finally, a double-diode/double-



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CHASSIS NO.	CRT TYPES	DEG DFL	PWR XFM	B+ RECT	IF AMP	DC CPL	AGC	NL	HOR AFC	WIDTH CTRL	FOCUS	SOUND DET	PROTECTED CIRCUITS LINE	B+	FIL
ADMIRAL															
G3	19FBP4, 19FSP4	114°		one sil	2		P-N		CC		jumper	quad	FR 5.5		
G5, 3G5, 9G5	19EGP4, 19ENP4	114°		one sil	3		P-N		CC		jumper	quad	ckt brkr		
	21FUP4, 23FRP4	110°													
7G7	19EGP4	114°	✓	FWR	3		MC	M	CC	coil	jumper	quad	ckt brkr		
	21FUP4, 23FRP4	110°													
8G7	19EGP4	114°	✓	FWR	3		MC	M	CC	coil	jumper	quad	ckt brkr		
H1-1A, H2-1A	13CP4, 15JP4	NA		one sil	2		TN		D		NA	quad	FR 5.5		
CHANNEL MASTER															
6571	11QP4	90°	✓	*	3		AC	D	S	coil	pot	ratio	fuse 5 amp	fuse .5 amp	
6574	400TB4	110°		one sil	2		TC		D	NA	jumper	quad	fuse 2 amp		
DUMONT															
120854, 855	23HWP4	110°	✓	one sil	3		TN		CC	pot or jumper		quad	fuse 1.2 amp		
EMERSON															
9P50	A23-10WE	90°	✓	*	3		AC		S		pot	ratio	fuse .4 amp	fuse 2 amp	
12P50	310JB4	90°		one sil	3		TN		CC	jumper	jumper	ratio	fuse 2.3 amp		
12P51	310MB4	90°	✓	*	4		AC		S		pot	ratio	fuse 1 amp		
120840, 41A, 42, 48G	16CMP4	114°		one sil	2		TC		CC			quad	fuse 1.2 amp		
	19FJP4	114°													
120852A, 53A, 55A	23HWP4	110°	✓	one sil	3		TC		CC	pot or jumper		quad	use 1.2 amp		
GENERAL ELECTRIC															
AC	23FVP4-A	114°	✓	FW dbl	3		TC		D	coil		quad	fuse 2 amp		link
DC	19ECP4	114°		one sil	2		TN		D	coil		quad	fuse 1.5 amp		
	21GBP4	114°													
ETV	23ESP4	110°	✓	FW dbl	3	✓	TC		D	coil	jumper	quad	fuse 2 amp		link
SC	12CDP4, 12BMP4	104°		one sil	2		TN		D			quad	fuse 1.5 amp		
	16CQP4, 16CFP4	104°													
TC	12BZP4, 16CNP4	NA	✓	*	3		BC		CC			ratio	fuse 1 amp		
VC	11RP4	104°		one sil	2		TN		D			quad	fuse 1.5 amp		
MAGNAVOX															
T908	23MP4, 24AHP4,	114°	✓	*	3	✓	*		S		pot	ratio	ckt brkr		
	272P4	110°													
T910	19FLP4	114°		one sil	3		MN		S		pot	quad	ckt brkr		
T915	19FLP4, 19DWP4	110°	✓	*	3	✓	*		S		pot	ratio	ckt brkr		
MOTOROLA															
TS 461	12BKP4	110°		one sil	2		TN		CC	capacitor	jumper	quad	FR 5		
TS 594	21FVP4, 21FZP4	114°	✓	FW dbl	3	✓	BC	N	CC	coil	jumper	ratio	ckt brkr		
	23FSP4, 23GXP4	110°													
	23GSP4, 23HLP4	110°													
PHILCO															
1214, 16	12BXP4	110°		one sil	2		TN		CC	jumper	jumper	quad	fuse 1.5 amp		
17JT41	19DUP4	114°	✓	*	3		*	*	CC	pot	jumper	quad	ckt brkr		#26 link
17J27, 27A	19DUP4	114°		one sil	2		*	T	CC	pot	jumper	quad	ckt brkr		
17LT43	21FYP4	114°	✓	*	3		*	*	CC	pot	jumper	quad	ckt brkr		#26 link
17NT45	23GWP4	110°	✓	*	3		*	*	CC	pot	jumper	quad	ckt brkr		#26 link
17N35	23GWP4	110°		one sil	2		*	T	CC	pot	jumper	quad	ckt brkr		

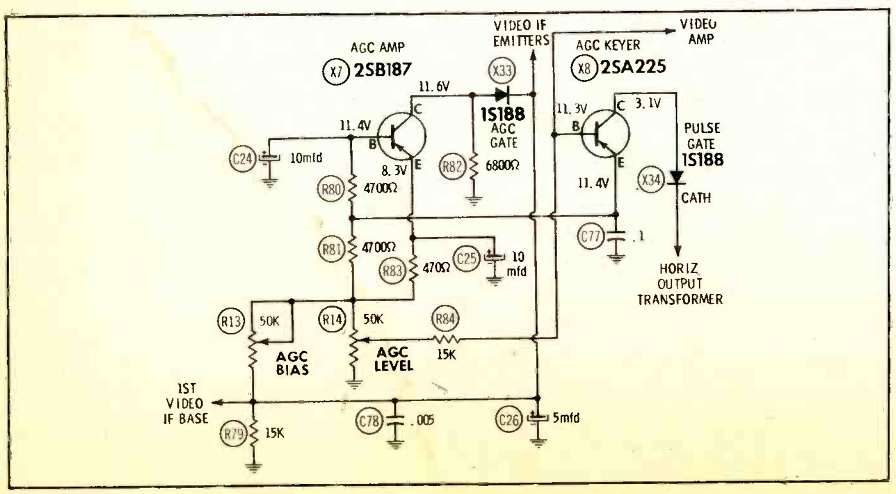
triode 8B10 used in the keyed AGC circuit, sync separator, and horizontal phase detector stage.

DUMONT

Two new 19" portables, the "Saturn" and "Apollo," are featured in Dumont's 1967 b-w line. The two chassis, which are similar except for a three-hour clock timer included in the Apollo, employ three stages of video IF amplification, a "quick-on" picture and sound feature, a picture optimizer to customize reception, and illuminated channel indicators. One other 19" portable, a model continued from last year, is also offered.

Rounding out Dumont's new line are the 23" models—three consoles and a table model.

Featured on both the consoles and the table model is an illuminated, dual slide-rule control panel for both UHF and VHF tuning.



The basic chassis used in the 23" models is an autotransformer-powered type with series connected filaments. A 1.2-amp Chemfuse protects the low-voltage power supply, which uses a single silicon diode as a half-wave rectifier. The 1st video IF (housed on a separate circuit board) utilizes a 4EH7 pentode, as does the 2nd video IF. Other tubes include a 4EJ7 pentode in the 3rd video IF, an 8AW8A triode/pentode shared by the video amplifier and vertical oscillator, a 6LX8 triode/pentode serving the keyed AGC circuit and horizontal oscillator stage, and a 6LN8 triode/pentode used in the sync separator and sound IF stages. A 4DT6 pentode is used in the audio detector, while a 17CU5 (or 17C5) is used in the audio output circuit. The horizontal-output and damper circuits share a diode/pentode 38HE7 compactron. Rounding out the tube complement are the 1K3 high-voltage rectifier and the pentode 10CW5 vertical oscillator. A 23HWP4 picture tube is used.

EMERSON

This company's line of black-and-white

CHASSIS NO.	CRT TYPES	DEG DFL	PWR XFM	B+ RECT	IF AMP	DC CPL	AGC	NL	HOR AFC	WIDTH CTRL	FOCUS	SOUND DET	PROTECTED CIRCUITS LINE	B+	FIL
RCA															
KCS 153X	12BNP4	110°	✓	bridge	3	✓	CC	N	S	coil		*		ckt brkr	
KSC 156	19FEP4A	114°	✓	FWR	2	✓	TN		CC	pot		quad	#34 link	ckt brkr	#28 link
KCS 159	19DQP4	114°	✓	FWR	2	✓	CC	T	CC	pot	jumper	quad	#34 link	ckt brkr	#28 link
KCS 160, C	19FEP4A, B	114°		one sil	2	✓	TN		CC	pot		quad	#34 link	ckt brkr	
KCS 161	21FVP4	114°		FW dbl	2	✓	MC		CC	coil		quad	#34 link	ckt brkr	
KCS 162	21FVP4	114°		FW dbl	2	✓	MC		CC	coil		quad	FR 5 amp #34 link	ckt brkr	
KCS 163	19FEP4A	114°	✓	FWR	2	✓	TN		CC	pot	jumper	quad	FR 5 amp #34 link	ckt brkr	#28 link
KCS 164	19FEP4A	114°	✓	one sil	2	✓	TN		CC	pot		quad	#34 link	ckt brkr	
SYMPHONIC															
110, 111	11QP4	NA	✓	bridge	3		BC		S	coil	ratio		fuse .5 amp	use 1.5 amp	
120, 121	12AYP4	NA		one sil	2		TC		D		jumper	quad	fuse 2 amp		
TRUETONE															
2DC1605	23GJP4	110°		one sil	2		TN		CC		jumper	quad	ckt brkr		
2DC1613, 15, 17	23FMP4, 23GBP4	110°	✓	FWR	2		AC		CC		jumper	quad		ckt brkr	link
2DC3609	230DB4	NA	✓	bridge	3		CC		CC		jumper	ratio	fuse .5 amp	fuse 2 amp	
2DC3612	12AYP4	NA		one sil	2		TC		D		jumper	quad	fuse 2 amp		
2DC3616	16AUP4	114°		FW dbl	3		PC		S	coil	pot	ratio			
2DC3731	19ENP4	114°		one sil	2		TN		CC		jumper	quad	ckt brkr		
WESTINGHOUSE															
V-2483-1	19CMP4A	114°	✓	*	3		AC	N	CC			ratio	fuse 1.25 amp		
V-2487	19CMP4, 19FEP4	114°		HW dbl	2		PC	T	CC	pot		quad	fuse 2 amp		
	23HRP4, 23HSP4	110°													
V-2490	12BLP4	110°		one sil	2		*		CC	jumper		quad	fuse 1.75 amp		
ZENITH															
13X15, Z	12BEP4, 12CBP4	110°		one sil	3		MC		CC	sleeve	jumper	quad	fuse 1.8 amp		
14M21	16BXP4	114°		FW dbl	3		MC	M	CC	pot	jumper	quad	fuse 1.7 amp		
14N22	23FNP4	92°	✓	FW dbl	3		MC	M	CC	sleeve	pot	quad	fuse 2 amp		#24 link
14N26	21FXP4	114°	✓	FW dbl	3		MC	M	CC	pot	pot	quad	fuse NA		#24 link
14N27	19CXP4, 19DBP4	114°	✓	FW dbl	3		MC	M	CC	pot	jumper	quad	ckt brkr		#24 link
14N28	19GAP4	114°	✓	FW dbl	3		MC	M	CC	pot	pot	quad	fuse 2 amp		#26 link
14N29	19GAP4	114°		FW dbl	3		MC	M	CC	pot	jumper	quad	fuse 2 amp		
14N33	19GAP4	114°		FW dbl	3		MC	M	CC	pot	jumper	quad	fuse 2 amp		
14X21, Z	16BXP4	114°		FW dbl	3		MC	M	CC	pot	jumper	quad	fuse 1.7 amp		

ABBREVIATIONS AND SYMBOLS — In any column, **CHECK MARK** indicates chassis has feature; **ASTERISK** means "see text," **NA** means data not available at press time. For individulal columns — **B+ RECT:** one sil, one silicon rectifier; HW dbl, half-wave silicon doubler; FWR, full-wave rectifier using two silicon diodes. **IF AMP:** Figure indicates number of stages. **DC CPL** means set has DC path or DC restoration in video drive circuit of CRT. **AGC:** First letter — A, transistorized keyer; B, transistor circuit (separate IF and tuner circuits); C, transistor gate circuit; M, multipurpose tube ('HS8, 'BU8, or similar); P, pentode keyer; T, triode keyer; S, simple (no tube). Second letter — C, has potentiometer; N, no AGC adjustment. NL (noise limiter): D, solid-state diode in transistor circuit; M, part of multipurpose tube ('HS8, 'BU8, etc.); N, transistor noise circuit; T, triode noise inverter. **HORIZ AFC:** CC, common-cathode dual selenium diode; CT, common-cathode dual diode plus triode section of tube (controlling sinewave or Synchroguide oscillator); S, two selenium diodes in series; D, dual diode sections of tube; T, triode used. **SOUND DET:** quad, quadrature circuit; ratio, ratio detector circuit. **FOCUS:** jumper, set has wire from **CRT** to select voltage; pot, has focus potentiometer. **PROTECTED CIRCUITS:** figure following fuse is rating in amps; FR indicates fusible resistor and is followed by ating in ohms; link means short wire, of gauge indicated.

television for the coming year ranges from a 9" transistorized AC-DC personal portable to a 23" console group featuring three compact consoles, three deluxe 38" wide consoles, and one table model Other sets are available in 12", 16", and 19" sizes.

A total of 26 transistors and 13 solid-state diodes are used in the new 9" portable. In addition, a four-unit selenium assembly, connected as a bridge circuit, is used in the AC power supply. The only tubes used in the set, with the exception of the CRT, are three 5642 diodes, series connected in the high-voltage supply. The picture tube is an aluminized 90° A23-10WE. Three video IF and two video amplifier stages are used, along with two stages of sound IF and two stages of audio amplification. Both the UHF and VHF tuner are transistorized. As stated previously, the set is an AC-DC type and may be operated from an ordinary AC source or from the 12-volt system of a car or boat using a special accessory power-cable assembly. The special accessory cable contains a built-in voltage regulator to prevent surge damage. Another optional item with this portable is a 12-volt rechargeable battery and battery charger kit.

The 12" portable model is also fully transistorized and can be operated from either AC or DC. The video IF section consists of four stagger-tuned stages, with the first two stages AGC controlled. Video amplification is accomplished by a two-stage section using one PNP germanium and one NPN silicon transistor. The video-output amplifier operates from a collector supply voltage of +80 volts. This voltage is obtained by rectifying a pulse at the primary of the high-voltage transformer. The sound IF, amplified and limited by two stages, is detected by a symmetrical ratio detector, which in turn feeds an audio driver and class "B" audio-output stage. Blocking oscillators are used in both the vertical and hori-sweep circuits. In the power supply, a bridge-type, full-wave rectifier and regulator circuit provides B+ voltage with the aid of a power transformer.

The Model 12P50 tube-type 12" portable is retained from last year. Operating on AC only, the circuitry is of conventional design, using three video IF's, a single video amplifier, and one sound IF. The transformerless power supply uses one solid-state diode in a half-wave configuration. Series connected heaters are employed in the set, along with a 310JB4 picture tube.

The 16" models and three of the 19" receivers use transformerless, series chassis which are electrically similar in most respects, except CRT sizes. One compactron, a 38HE7 diode/pentode, is used in the horizontal-output and damper stages. The remaining tubes and circuitry are relatively conventional. The 16" models use a 16CMP4 CRT, while the 19" models use a 19FJP4. The two top performance 19" sets use a transformer-powered chassis with Emerson's "Quick-On" feature and a three-stage video IF. In addition, one of the models is equipped with a three-hour sleep switch timer.

GENERAL ELECTRIC

Compactrons are used extensively in General Electric's black-and-white offerings for '67. Six basic chassis are used in a model line which varies from an 11" TV/clock-radio combination to thirteen 23" consoles. Also included is an all-transistor chassis used in three 12" and two 16" portables.

The AC chassis, used in the 23" consoles and two 23" table models, is a transformer-powered horizontal type employing two printed-circuit boards. This chassis is a good example of the wide use of compactrons, found throughout General Electric's '67 line. A double-pentode 6AR11 is shared by the first two stages of the three stage picture IF; the video amplifier, audio amplifier, and sync clipper are served by a double-triode/pentode 6AF11; a double-pentode 6T10 is used in the audio detector and audio-output stage; and a twin-triode 6FY7 performs in the vertical-oscillator and vertical-output circuits. Other compactrons include a 6GE5 beam pentode in the horizontal-output stage, a 1AD2 diode in the high-voltage rectifier, a 6AX3 diode in the damper circuit, and a double-diode/pentode 6LT8 in the horizontal phase detector and oscillator. The only conventional tube used in the main chassis is a triode/pentode 6JN8, used in the 3rd picture IF and AGC keyer stages.

The DC, SC, and VC chassis are all electrically similar, varying only in the tube complement and CRT types. As in the AC chassis, compactrons are found in most stages. A half-wave rectifier, series connected filaments, and two-stage picture IF are common to the three chassis. B+ overload protection is provided by a 1.5-amp fuse. The DC chassis is used in fourteen 19" and two 21" table models, while the SC chassis is employed in five 12" and three 16" table models. The VC chassis is used in the 11" TV/clock-radio combination.

The transistorized TC chassis, used in five portable models, employs a three-stage picture IF, two stages of video amplification, two audio IF stages, a two-stage audio amplifier, and a push-pull audio-output stage. The AGC system is a two-stage circuit with individual controls for both tuner and IF AGC voltage. A grounded-emitter buffer stage provides isolation between the horizontal-oscillator and horizontal-output circuits.

Three power input circuit variations are used with the TC chassis, depending upon the model. However, all three variations use a full-wave rectifier configuration for AC operation, as well as a regulator circuit consisting of three transistors and one Zener diode. Model TR810CTN, a 12" set, is designed for AC operation only. Twelve-inch models TR812CVY and TR814CEB are capable of either AC or DC operation, with the latter model equipped with a built-in battery charger. Both 16" models are designed for AC-DC operation. The AC-DC models can be operated from either a battery or a 12-volt (negative ground) automobile system. Chassis ETV is offered in a "C" line 23" table model with a tone control and speaker jac.

MAGNAVOX

Concentrating on large-screen b-w television, Magnavox will continue to offer 24" and 27" screen sizes along with 19" and 23" models. Three chassis are used in this manufacturer's '67 line. Last year's transistorized T908 chassis is utilized in five 23" consoles, seven 23" table models, two 24" table models, seven 24" consoles, and three 27" consoles.

Nine tube-type 19" portables use Chassis T910, which is similar to the T914 chassis introduced previously. The T910 chassis is a series filament type with the majority of circuitry contained on one printed-circuit board. A bonded faceplate CRT, type 19FLP4 or 19FTP4, is used.

The video IF circuitry consists of two 4BZ6 pentodes in the 1st and 2nd IF amplifiers and a 4CB6 pentode in the 3rd IF. The 1st and 2nd IF stages are AGC controlled by a keyed AGC circuit. A 1N60 germanium diode is used as the video detector and is mounted in the 3rd video IF shield can. The single stage of video amplification employs the pentode section of a 10GN8 triode/pentode. The triode section of the same tube is used as the sync separator.

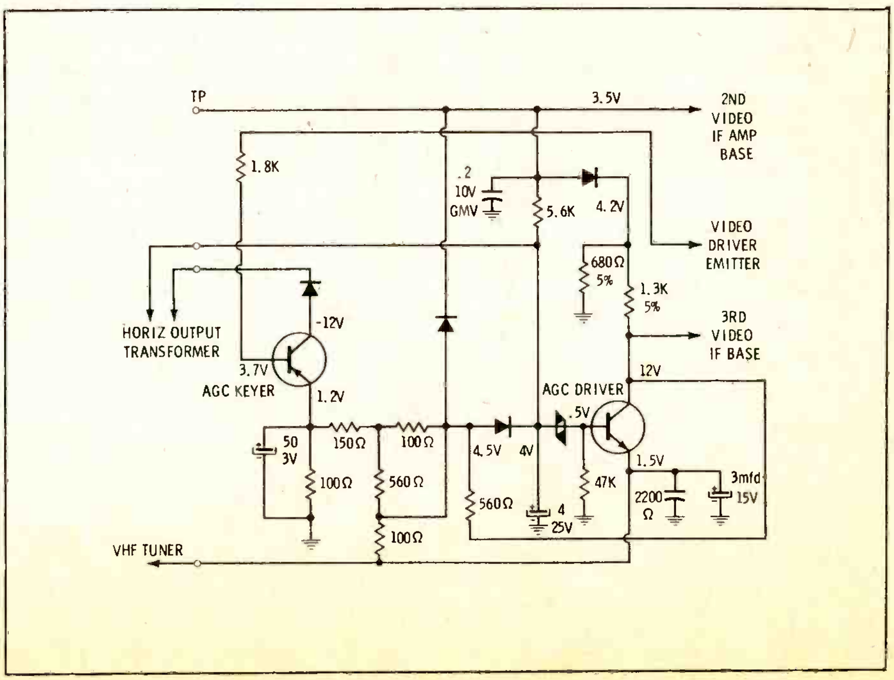
A 13V10 double pentode serves the quadrature sound detector and output stage, while a 4AU6A pentode performs in the sound IF circuit. The sweep circuits are relatively conventional and employ a double-triode 8FQ7 in the common-cathode horizontal oscillator, an 18GB5 pentode in the horizontal-output stage, and a triode/pentode 15KY8 in the vertical multivibrator-output stage. A dual selenium diode is used in the horizontal AFC.

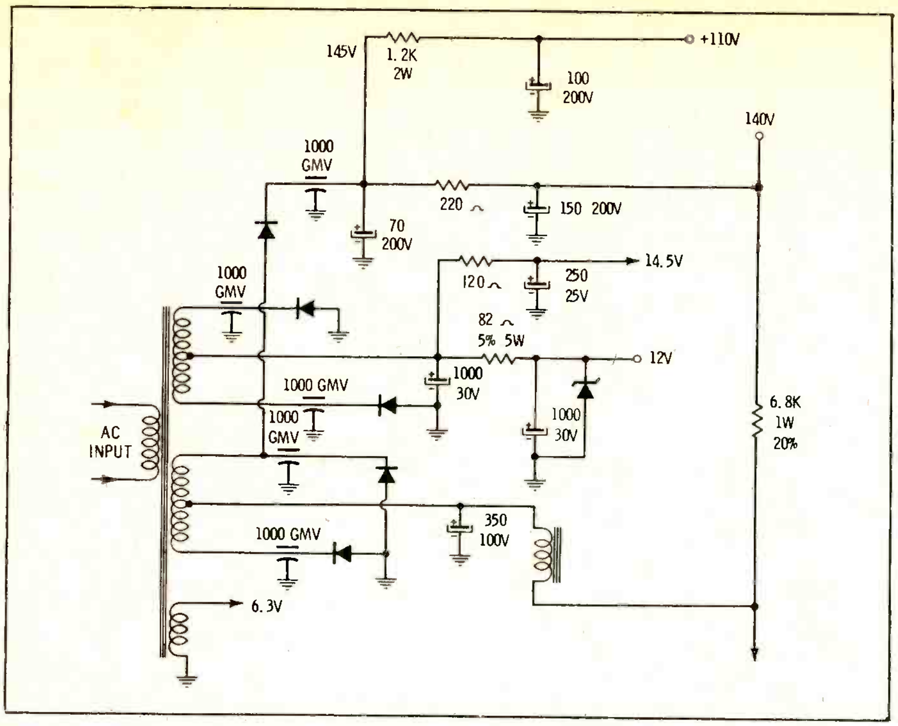
A 1G3GT diode is employed in the high-voltage supply and a 17AY3 serves the damper. The low-voltage supply is a transformerless half-wave rectifier and uses a single silicon diode, with overload protection from a 4.7-ohm fusible resistor.

Four other 19" portable models use the transistorized T915 chassis. Employing a total of 22 transistors (18 on the main chassis, three in the VHF tuner, and one in the UHF tuner) plus 22 diodes and one dual diode (used in the horizontal AFC), this chassis is all solid state except for the 1K3 high-voltage rectifier and 19FLP4 or 19DWP4 CRT.

Three stages of video IF are provided, along with a driver and an output stage. A single IF stage, a ratio detector, an audio driver, and an output stage make up the sound circuits. Blocking oscillators, drivers, and output stages are used in both the horizontal and vertical circuits.

The AGC circuit used in Chassis T915 and T908 is shown here. It consists of two stages, a keyer and a driver. With an extremely weak input signal the keyer remains cut off, and the only AGC developed is the charge across capacitor C236 (obtained from the 12-volt regulated supply). This bias voltage is applied to the 2nd IF stage and biases it so that maximum gain is provided in this stage. With a further increase in the input signal level, the keyer stage conducts, and the charge on C236 increases because of the collector current in the keyer transistor. This increased charge, in turn, increases the forward bias on the 2nd IF transistor, which also increases its collector current. Because the transistors used in the stages under discussion are designed to work with forward AGC, an increase in forward bias results in a reduction in gain. In addition, an increase in the collector current of the 2nd IF transistor is reflected back to the 1st IF transistor in the form of increased forward bias, and a reduction in gain of the 1st IF results. As the incoming signal increases to a signal of average strength, the increase across C236 is applied to the VDR (voltage dependent resistor), decreasing its resistance and causing the driver transistor to conduct. A positive voltage is developed across R101 and is applied to the RF amplifier in the VHF tuner, adding to the fixed bias on this stage and reducing its gain. When the IF AGC voltage reaches approximately 5 volts, diode D204 becomes forward biased and prevents the IF AGC voltage





from increasing further. On extremely strong input signals when the RF AGC voltage reaches approximately 7 volts, diode D205 becomes forward biased, allowing a portion of the RF AGC voltage to be added to the IF AGC voltage which increases the forward bias on the 2nd IF transistor and reduces its gain still further.

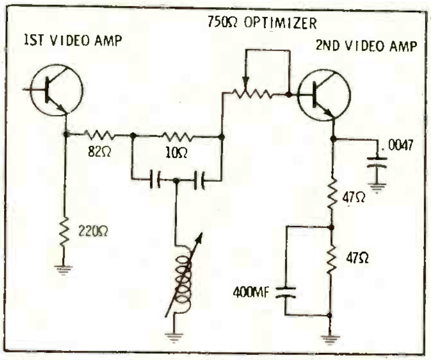
A unique feature of the T908 and T915 chassis is the power supply circuit. As shown here, there are five separate voltage sources: 110 volts used to power the audio-output stage, 140 volts used to power the video-amplifier stage, 14.5 volts used to power the horizontal driver, 68 volts used in the sweep output stages, and a regulated 12 volts used in the remaining circuits. Also available is a 6.3-VAC source which is used only for the picture tube filaments and any dial indicator lamps that may be used (depending upon model).

MOTOROLA

Two new chassis, TS-461 and TS-594, are included in Motorola's '67 b-w line, which consists of 20 models using 12 versions of five basic chassis. Fifteen are new models and five are models that were introduced last December. Model types and sizes in the new line include two 12" portables, two 16" portables, three 19" portables, three 21" table models, two 23" table models, and eight 23" consoles. Two of the 19" portables are new; the other five portables are carryover models. The table and console models are all new.

The most notable feature of this manufacturer's '67 chassis is the increased use of transistors in the low-level signal stages. In addition, all chassis feature four-circuit VHF tuners with frame grid RF amplifiers, transistorized UHF tuners, silicon diode in the B+ supplies, and horizontal and vertical retrace blanking. All picture tubes utilize built-in implosion protection, therefore do not require the use of a safety glass. With one exception (TS-596), all chassis have a considerable portion of the circuitry mounted on etched boards.

The two 12" "Cadet" portables use either the retained TS-454 chassis or the new TS-461, which is electrically the same as the TS-454. The main difference between the two horizontally mounted chassis is in the mechanical construction. The tuners and control bracket of the TS-461 are supported by a vertical side member on the chassis instead of being mounted to the cabinet as in the TS-454. This difference in construction allows the TS-461 chassis to be removed as a unit for servicing.



The new TS-594, introduced in a total of 13 receivers, is a transformer-powered hybrid chassis utilizing transistors in the low-level signal circuits and tubes in the output stages, as well as in the VHF tuner. Models using this chassis include three 21" table models, two 23" table models, and eight 23" consoles. Although the tube circuits are electrically similar to last year's TS-589, the TS-594 is more compact—a feature made possible by the saving in space realized from the use of transistorized circuits. The transistorized stages are contained on an etched circuit board mounted in the center of the horizontal chassis and include the three-stage video IF's, the 1st video amplifier, the video output, the audio IF, audio driver, the AGC gate and amplifier circuits, and the noise gate and sync separator circuits. A total of 11 transistors are used. The diode complement consists of 10 diodes and two silicon power rectifiers on the main chassis, plus one diode in the UHF tuner. Six tubes are employed on the main chassis (plus 2 in the VHF tuner), including three compactrons: a 6JN6 beam pentode, used in the horizontal-output stage; a 6AL3 diode in the damper circuit; and a 3AT2, used in the high-voltage rectifier. Other tube types are: a triode/pentode 6BL8 shared by the vertical and horizontal oscillators, a beam pentode 6GK6 in the vertical-output stage, and a 6GK6 pentode in the audio-output circuit.

An added feature of the TS-594 chassis is an "optimizer" control (shown here), which reduces the effects of high-frequency noise on the picture. The control, located at the rear of the chassis, decreases the video amplifier high-frequency peaking for noisy signals and increases the peaking for noise-free signals. If a strong noise-free signal is being received, the "optimizer" should be set in the "sharp" position to obtain maximum picture detail.

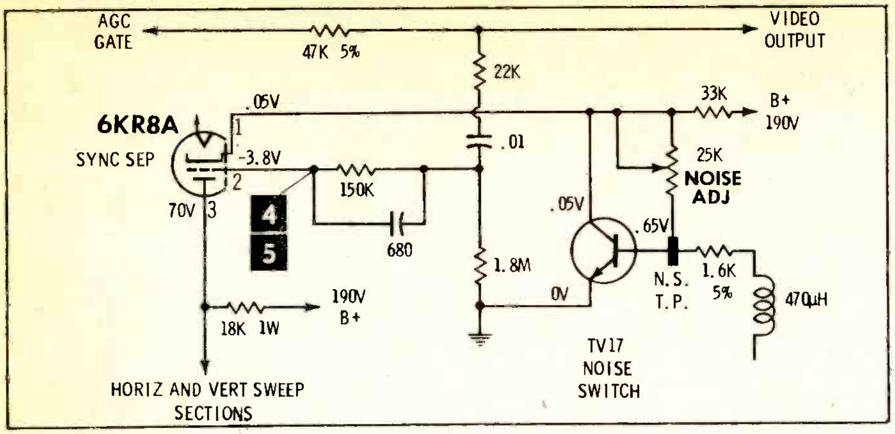
The remaining two chassis used this year are carryovers. Chassis TS-596 is used in one 19" portable model retained from last year. Two 16" and two 19" portables (new models) use the TS-597 chassis, which was introduced in December of last year.

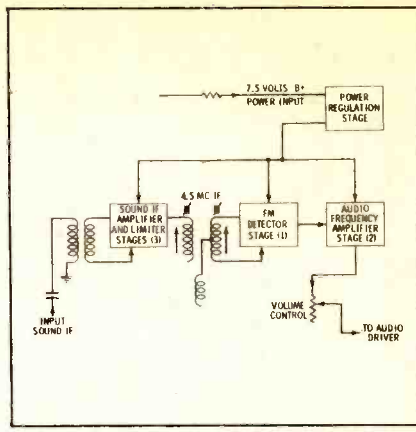
PHILCO

A new hybrid chassis (using both transistors and tubes) is introduced in Philco's 19" Sportster, 21" Premier, and 23" Custom series. Also newly introduced is a tube-type chassis (17C21A) used in the 12" Caddy models. The remaining models, with 9", 17", 19" and 23" CRT's use either carryover chassis or those introduced in December of last year. In all, ten chassis designations and ten model series are included in the '67 line.

This year's "O" line hybrid chassis is similar in many respects to last year's "P" line hybrid (the 16JT26). Solid-state VHF and UHF tuners are still used, as are a transistorized three-stage IF and two-stage AGC. The 3rd IF transistor, a TV16 in the 16JT26, has been replaced by a TV20 in the new chassis. Another addition to the 1966 hybrid is a solid-state noise switch, shown here. Basically, the noise switch is an "on-off" device in the cathode of the sync separator. Normally, the noise switch is conducting and allows regular sync separation. When a noise pulse appears, the noise switch is driven into cutoff and thus opens the cathode circuit of the sync separator. This prevents the transfer of the noise pulse into the sync circuits.

All versions of this year's hybrid chassis (Chassis 17JT41, 17LT43, and 17NT-45) utilize a power transformer and full-wave rectifier to develop 190 volts of tube B+ (as compared to 150 volts in 1965). The transistor B+ supply has been increased from 12 volts to 15 volts and is developed by a half-wave rectifier fed by a secondary winding on the power trans-





former, rather than by a winding on the horizontal-output transformer, as was the case in the 16JT26 chassis. The AGC circuit in this chassis is basically the same as that used in the 16JT26. Two transistors are used, one as the AGC gate and the other as the AGC amplifier.

Chassis 17J27 and 17J27A (identical except for different VHF tuners) are respresentative of the all-tube chassis Philco is offering this year. The transformerless chassis uses a single circuit board and series connected filaments. B+ is supplied by a single silicon half-wave rectifier and protected by a reset type circuit breaker mounted on the volume control. Two circuit modules are used, one containing the IF input traps and the other, the video detector circuit. Another notable feature of the chassis is the use of compactrons. A 17JZ8 triode/beam pentode is used in the vertical oscillator and vertical-output stage, and a beam pentode 21GY5 is employed in the horizontal-output stage. The remaining compactron, a 17BE3 diode, serves the damper circuit. Also employed in this chassis (and this year's 17N35) are a gated triode AGC circuit and triode noise inverter, both similar to the comparable circuits used in last year's "P" line.

RCA

A total of 12 chassis make up RCA's '67 black-and-white line. Included are five continuing chassis and seven "recently introduced" units. The continuing chassis are the 19" KCS144 and KCS145 portables, the 16" KCS152 portable, and the 23" KCS136M used in three console models.

Also continued, but changed, is the transistorized 12" KCS153 chassis. Redesignated KCS153X, this portable receiver now employs an integrated circuit (a television first) in the sound section. An equivalent circuit diagram of the integrated circuit (IC) is shown here, along with another illustration that indicates the receiver stages contained within the chip. The IC actually performs the functions of 26 conventional components. Other changes in the basic KCS153 include a video bias adjustment, which sets the operating level of the video amplifiers. Also, a new RF amplifier transistor, type 3504, is used in the KRK126B VHF tuner.

Five 19" portables and two 21" portables are contained in the "recently introduced" chassis line. Two new horizontally mounted, transformer-powered chassis with two IF stages are used in two of the 19" models. The chassis, KCS156 and KCS163, use one circuit board which contains most of the circuitry. KCS163, shown here in the 19" Damosel model, also uses a new *Nuvistor*, four-circuit VHF tuner (KRK133D).

Chassis KCS159, another horizontally mounted, transformer- powered chassis, features a solid-state AGC stage, a solid-state sound IF circuit, and a separate "sync and sound amplifier."

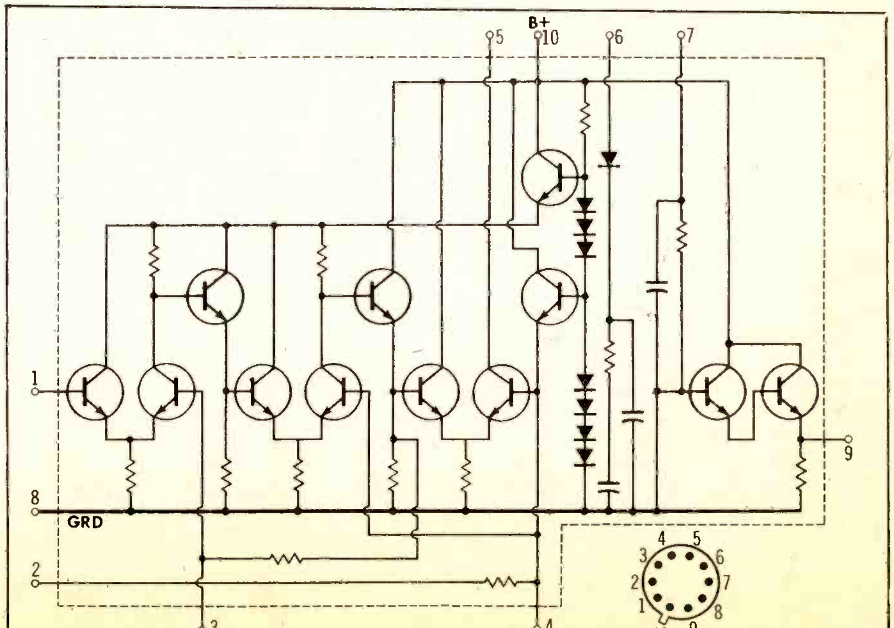
Completing the 19" portable group are Chassis KCS160 and KCS164. Both chassis are vertically mounted, have a two-stage IF, and employ an autotransformer-equipped B+ supply and series connected filaments. Featured in both chassis are vertical and horizontal blanking, fixed AGC, and a spot elimination circuit which places a high positive potential on the cathode of the 19EFP4A picture tube when the set is turned off. The basic difference in the two chassis is the type of VHF tuner employed. The KCS164 uses the KRK133C *Nuvistor* four-circuit tuner, while the KCS160 employs a KRK-127 frame-grid, three-circuit tuner. Also, a new frame-grid 4EH7 pentode is used in the 1st video IF stage of the KCS164 to provide better matching for the tuner. A miniature, transistorized UHF tuner (KRK122) is used in both chassis.

The two 21" chassis, KCS161 and KCS162, are also similar except for the VHF tuner. Both chassis are vertically mounted and utilize two circuit boards. Other features are a two-stage video IF circuit and a transformerless voltage doubler B+ supply.

SYLVANIA

Four transistorized 12" personal portables head up Sylvania's 16-model black-and-white line for '67. Two of the 12" sets (chassis AO4) are designed for AC operation only, while the other two are capable of AC or DC operation. One model, the GT12, is a carryover from last year. All use transformer-powered chassis with gated AGC. DC picture restoration, horizontal blanking, transistorized VHF and UHF tuners, and pre-set fine tuning. Like all sets in this manufacturer's b-w line, overload protection is provided by a reset type circuit breaker. The two "AC-only" models are identical, except that Model 12P16 is equipped with an earphone jack. Lighted channel selectors, earphone jack, and minor cabinet features are the only differences in the two AC-DC models.

Three tube-type and one solid-state model (Chassis AO6) are offered in the 19" portable group. A transistorized noise-suppression circuit is featured in two of the tube types (Models 19P38 and 19P39). The third tube-type chassis features illuminated VHF-UHF channel



windows and preset fine tuning. All three tube types employ silicon voltage doublers, DC restoration, horizontal blanking, gated AGC, tube-type (frame grid) VHF tuners, and transistorized UHF tuners. The transistorized 19" portable includes most of the features of the tube types, except that the chassis is transformer powered. In addition, both the VHF and UHF tuners are transistorized.

The 19" table model group consists of three models including two tube-type chassis and one solid-state compact set (Chassis AO7). Features of these receivers are much the same as those found in the conventional tube and transistorized 19" portables. Added to the transistor table model are a preset volume control, variable tone control, and power transformer.

Two table models and three consoles are presented in the 23" category. Transformer-powered tube-type chassis with transistorized noise-suppression circuits are used in all five models.

SYMPHONIC

A new solid-state 3" personal portable, weighing only 5½ lbs with batteries, highlights Symphonic's '67 presentations. The "Mini 3," as the 3" model is aptly named, operates on a self-contained "C" cell battery or on a rechargeable battery pack, car or boat battery, or on ordinary AC. One noteworthy feature of the unit is its ability to play and recharge the battery pack simultaneously when operating on AC. More specific circuit details on this particular model were not available at press time.

Other models include an 11" transistorized portable, a 12", and a 19" tube-type portable. The solid-state 11" set uses a transformer-powered bridge circuit and a three-transistor voltage regulator to provide 12 volts when operating on AC. During DC operation, only the voltage regulator is used. A 1.5-amp fuse is used for battery pack protection and a .5-amp fuse provides AC line protection. B+ protection is provided by a 1.5-amp fuse. Two circuit boards contain most of the main chassis circuitry, which includes three video stages, two sound IF stages, two stages of sound amplification, and two stages of video amplification. The high-voltage power supply is designed around three 5642B diodes.

The 12" tube-type chassis is an "AC only" chassis with series connected filaments and a transformerless half-wave low-voltage power supply. A 2-amp fuse assures line overload protection. Four compactrons are used in this set. One, a double-diode/double-triode 8B10, is used in the AGC, sync separator, and horizontal phase detector circuits. A double-pentode 17BF11 serves the sound detector and sound-output stages. The horizontal-output and damper stages use a diode/pentode 33GY7, and the combination vertical-oscillator / vertical-output circuit employe a triode/beam pentode 17JZ8.

TRUETONE

Picture sizes varying from 9" to 23" are offered in Truetone's new line. Included in the portable group are a 9" transistorized model, one 12", one 16", and three 19" models. The console group is available in only the 23" size.

The transistorized 9" portable, which operates from either AC or DC, employs 24 transistors and 14 diodes. A built-in charger circuit is provided for use with a rechargeable 12-volt battery pack (offered as an accessory), which permits up to four hours of operation. A recharge time of ten hours is required once the battery has provided the maximum four hours of operation. A three-stage picture IF, using PNP transistors, and two stages of video amplification (also using PNP transistors) serve the cathode of the 230DB4 picture tube.

The low-voltage supply utilizes a bridge-type rectifier and power transformer for AC operation. Overload protection is provided by a .5-amp fuse during AC operation and by a 2-amp fuse when the battery is used. The only tube circuit (except the CRT) employed in the receiver is the high-voltage supply which uses three 1D-K29 diodes in a voltage-tripler configuration.

Two stages of IF amplification, a ratio detector, a driver stage, and a push-pull output stage make up the sound section. In addition, a two-way earphone jack is provided for either earphone only or earphone/speaker operation.

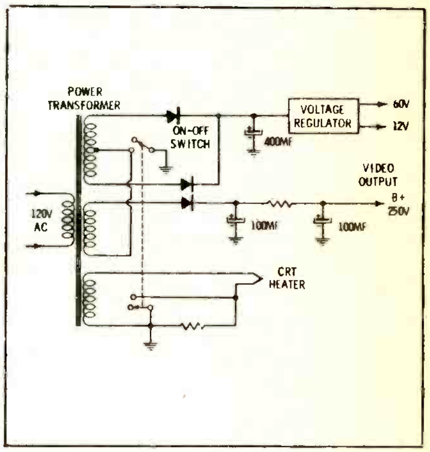
Two chassis types are used with the 23" console models. Three of the consoles use a transformer-powered chassis equipped with Truetone's "Insta-Vu" and a tinted, aluminized, bonded 23FMP4 or 23GBP4 picture tube. A two-stage picture IF, a single stage of video amplification, and one sound IF amplifier are used in the chassis. The remaining 23" console uses a transformerless chassis with series connected filaments and a 23GJP4 picture tube

The tube-type portable models use chassis that are similar in most respects except for the tube complement and CRT type. Basically the chassis are transformerless types employing series connected filaments, two-picture IF stages, and single-stage video and sound IF amplifiers. The half-wave low-voltage power supply uses a single silicon rectifier. Compactrons are used in the 12" and 19" chassis. Those used in the 12" set include a double-diode/double-triode 8B10, shared by the AGC, synce separator, and horizontal AFC stages; a diode/pentode 33GY7 serving the horizontal-output and damper circuits; a triode/beam pentode 17JZ8 in the combination vertical oscillator–output circuit; and a double-pentode 17BF11 in the sound detector and audio output stages. The 19" chassis uses a 17BE3 diode in the damper circuit and a 21GY5 in the horizontal-output stage.

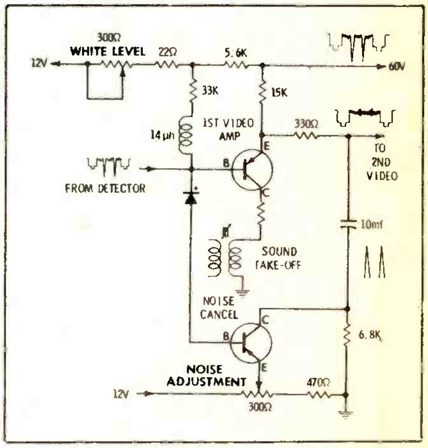
WESTINGHOUSE

From all indications, this manufacturer has few changes for '67 and will continue using the same chassis that carried last year's models, with two exceptions: Chassis V2486, previously used in 19" models, is to be dropped, while a new transistorized version, Chassis V-2483-1, will be used in some 19" models for the coming year. Those chassis retained are V-2487, used in both 23" and 19" sets, and V-2490, used in the 12" models.

The transistorized V-2483-1 uses 23 transistors in the main chassis and four in the tuners. The only tube used (besides the CRT) is a 1K3 high-voltage rectifier. The low-voltage power supply, illustrated here, consists of two separate rectifier circuits. A full-wave rectifier supplies 75 volts to the regulator circuit, which in turn provides two regular outputs: a regulated 60 volts for the audio output,



vertical output, horizontal driver, and horizontal output stages; and a regulated 12 volts for the remainder of the circuitry —with the exception of the video output.



A conventional half-wave rectifier is employed to provide the 250 volts needed by the video-output stage.

Two other noteworthy features are found in the V-2483-1 chassis. They are a "white level control" and a noise cancellation circuit (both illustrated here). The "white level" control, in the base circuit of the 1st video amplifier, functions as follows: The "white level" of the composite video signal is the "grassy" area between the bases of the blanking pedestal (as pointed out in the partial schematic) and represents the maximum conduction level of the CRT. Since the 1st and 2nd video amplifiers are emitter followers, the composite video signal is passed from the video detector, through the video amplifiers, to the base of the video-output transistor without phase inversion. The "white level" adjustment controls the base voltage of the 1st video amplifier, and because there is no phase inversion between the 1st video amplifier and video-output stage, it effectively controls the maximum conduction level of the CRT. This control is preset at the factory to provide maximum conduction desired in the video-output transistor and should not require adjustment unless one of the three video amplifiers changes characteristics or is replaced.

The noise cancellation circuit shunts the 1st video amplifier stage. In the illustration, two noise pulses are shown riding along in the video information at the detector output. The noise canceller removes these pulses by inverting them and coupling them back to the video signal where they mix with, and cancel, the original noise pulses. The noise-adjust control is adjusted to a point just before the picture bends.

ZENITH

Nine model groups using nine horizontally mounted chassis are presented in Zenith's black-and-white line for '67. CRT sizes range from 12" to 23". Chassis 13X15, with either a 12EP4 or 12CBP4 CRT (not interchangeable), is used in the two 12" personal portable models. Features of this chassis include the use of the following compactrons: a diode/pentode 38HE7 in the horizontal and damper circuits, a triode/pentode 17JZ8 shared by the vertical oscillator and output stage, and a 17AB10 used in the sound-detector and sound-output circuits. Other tubes employed are: three 4BZ6 pentodes in the three-stage IF, a 4HS8 twin pentode in the AGC and sync stages, and a triode/pentode 10JT8 shared by the sound limiter (triode section) and video amplifier. A 1.8-amp pigtail fuse protects the low-voltage supply, which uses a single silicon diode.

The two 16" lightweight portable models use either a 14X21 or 14M21 chassis. The basic difference in the two chassis is the tube complement. Both chassis use a full-wave voltage doubler (two silicon diodes) protected by a 1.7-amp fuse, and like the previously mentioned 13X15 chassis, have series connected filaments and a three-stage picture IF.

Chassis 14N33, 14N29, 14N28, and 14N27 are used in nine "Slim Line" and "Skyline" 19" portables. Chassis 14N33 and 14N29 are identical in every respect except for the addition of a filter choke in the ground return side of the AC input of Chassis 14N29. Series connected filaments and a full-wave voltage doubler B+ supply are used in the chassis, with overload protection provided by a 2-amp fuse. Compactrons are used in the sound detector and sound output (double-pentode 13Z10), AGC/sync clipper and vertical output (triode/twin pentode 8BA11), horizontal output (17JN6 beam pentode), high-voltage rectifier (2AS2 diode), and damper 22BW3 diode). Chassis 14N28 and 14N27 are similar to 14N33 and 14N29 with the exception of the tube complement and low-voltage power supply. Both chassis are transformer powered with full-wave voltage doublers and parallel filaments. In addition, Chassis 14N27 uses either a 19CXP4 or 19DBP4 CRT (not interchangeable) as compared to the three other chassis which use 19GAP4 picture tubes. Two of the "Skyline" series 19" receivers, Models X1943 and X1946, are equipped with Zenith's Space Command "300" remote control unit.

The four 21" "Award Series" portables use Chassis 14N26, which is identical to the 14N28 chassis described previously, with the exception of the 21FXP4 CRT. Model X2145 of the series is equipped with the Space Command "300" transistorized remote unit.

Chassis 14N22 (similar to 14N26, 14N27, and 14N28, with the exception of the tube complement and CRT) is used in the 23" model line which includes three table models and six consoles. One table Model, X2343, is remote controlled through the use of a transistorized Space Command "400" remote unit. Tube types used in the 14N22 chassis include compactrons in the high-voltage rectifier (2AS2 diode) and combination vertical oscillator-vertical output circuit (double-triode 6FM7). Other tube types are two 6BZ6 pentodes, used in the 1st and 2nd IF; a 6EJ7 pentode, used in the 3rd IF; a 6JT8 triode/pentode, used in the video amplifier and sound limiter stages; a 6Z10 twin pentode, used in the detector and output stages of the sound system; and a 6HS8 twin pentode performing in the sync clipper and AGC circuits. Rounding out the tube types are a triode/pentode 6GH8A or 6KD8, used in the horizontal control and oscillator stages; a 6JN6 pentode serving in the horizontal-output circuit; and finally, a 6AY3 in the damper. Overload protection is provided the full-wave B+ supply by a 2-amp Belfuse in the primary side of the power transformer. The parallel filaments are protected by a 1½" loop of #24 copper wire.

OTHER U.S. BRANDS

Editor's Note: Complete information from these companies had not been received by press time. The information presented below is all that we were able to obtain.

Andrea is marketing two 23" sets, one a table model and the other a custom model for "built-in" installations. Also included in this manufacturer's new line are a 19" portable and an all-transistor 9" portable (AC-DC).

Electrohome is offering 16 b-w models for the coming year. Nine portables and seven consoles make up the line. The portable group will include an undetermined number of 19" models and one 11" fully-transistorized, battery-operated portable. Four-stage transistorized, video IF circuits; power transformers; and hand-wired circuits are additional features of this company's '67 line.

Olympics b-w line for '67 will include fifteen new models. Heading the list of new sets will be four new 23" combinations equipped with Olympic's "Rapid On" feature and stereo phonographs, with a choice of either AM, AM/FM, or AM/FM/FMS radios. Three of the models are also equipped with an "all-at-once" feature which enables the TV, radio, and phonograph to be played simultaneously in different rooms. Other new models include seven 23" consoles, three 19" portables, and a 21" table model. A full-feature clock with timer and sleep-switch is available on one of the portable models.

Packard Bell's '67 line includes a 9" AC-DC solid-state portable with optional battery pack. Larger screen b-w sets in the line are three 19" portables, two 19" table models, a 23" table model, and four 23" consoles. Hand-wired chassis are still used in the tube models, along with other features that include keyed AGC, three stages of video IF, and "set-n-forget" volume and VHF fine tuning controls.

Sparton of Canada has included a 23" portable in their new line. Other models include four transformer-powered 23" consoles, a transformerless 23" table model, and three 12" and five 19" portables. Two of the 19" portables are transformer-powered and one is equipped with an AM radio. The 12" model series comprises one basic model with a dual sound system and one with an AM radio. All 23" and 19" chassis have keyed AGC, B+ overload protection provided by a circuit breaker, quadrature detectors, and a three-stage video IF.

FROM JAPAN

Delmonico's '67 line includes five 23" combination models, one 23" consolette, one 19" lightweight portable, one 12" portable, one 9" transistorized portable, and a 4½" all-transistor, battery-operated model. The combination models are available in different variations featuring separate audio systems, self-contained stereo phono or multiplex, in addition to AM/FM-FM multiplex radio units. Chassis design includes three-stage picture IF, handwired construction, and in some combo models, a push-pull audio output circuit. The alltransistor, 4½" battery-operated portable shown here weighs 8½ lbs. including batteries and charger circuit. Twenty-nine transistors, 24 diodes, and a solid-state high-voltage multiplier module are contained in this set. Input power is obtained from either a rechargeable battery pack or from an auto, boat, or other external 12-volt source (using an optional adapter cord).

Panasonic is continuing to offer 9" and 12" transistor portable models with transformer-powered chassis. A deluxe version of the basic 9" set is also available.

Sony presents five transistorized, small-screen, personal portables for the coming year. All are AC-DC, capable of operation from either self-contained batteries or rechargeable battery pack, 12-volt auto/boat systems, or from household AC. Screen sizes are 8", 7", 5" and 4". ▲

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PF Reporter™

PHOTOFACT

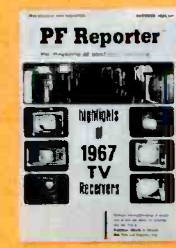
the magazine of electronic servicing

VOLUME 16, NO. 10 OCTOBER, 1966

CONTENTS

About the Cover

Change for the sake of change alone accomplishes little in electronics. In the television industry, change means improvement and involves not only completely new designs, but also refinements to existing circuits. Our cover this month illustrates a few of the new models offered for the coming year. The 8-page book section beginning on Page 1 of this issue gives a detailed account of what is new in black and white for 1967.



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Circle 3 on literature card

Letters to the Editor

Dear Editor:

My brother and his family have an exchange student from Chile living with them. She would like to take a 16" Zenith portable television (Model 1605) home with her. Can you inform me of the necessary changes I will have to make for it to operate satisfactorily in Chile?

B. PITTS

Weidman, Michigan

Television transmission in Chile is on the 525-line system and on the same channels frequencies as in the United States. The receiver in question does not have to be modified in this respect. However, the power lines are at 230V, 60 Hertz, and additional filtering may be required. A step-down transformer will be required, but this can be external to the receiver.—Ed.

Dear Editor:

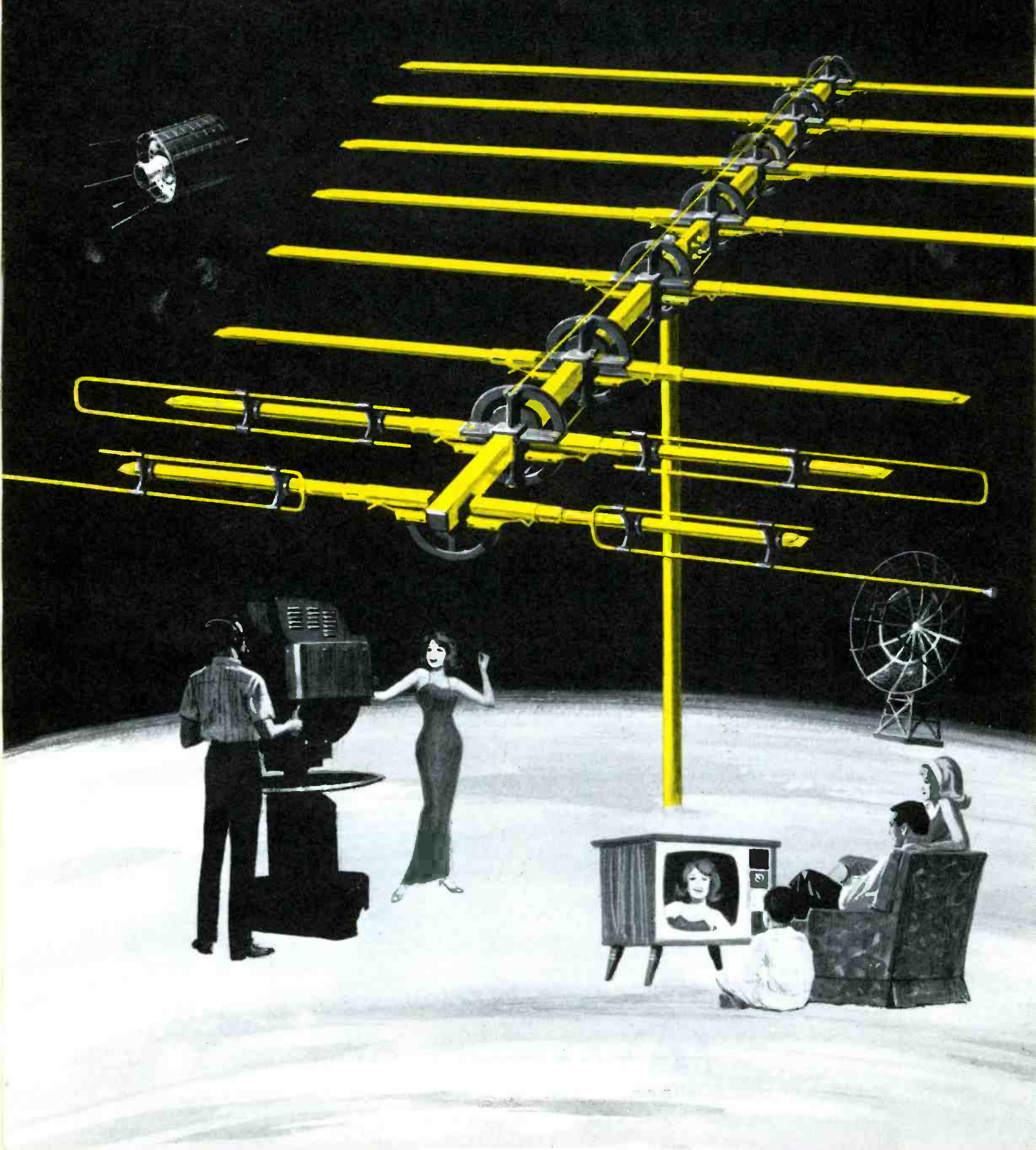
This is in reference to your article in the May issue, page 20, titled "Keyed AGC." In Fig. 1A you show a semiconductor diode with its anode connected to point A (labeled Rectified Positive Voltage). In Fig. 1C you show the same configuration with a vacuum tube and now call point A Rectified Negative Voltage. Something has to be wrong.

If my basic theory serves me well, Figures 1A and 1B are mislabeled, Fig. 1A should say negative voltage and Fig. 1B should say positive voltage.

JAMES DUFF

Brooklyn, New York

You are correct. Figs. 1A and 1B are reversed and we apologize for the error.—Ed.



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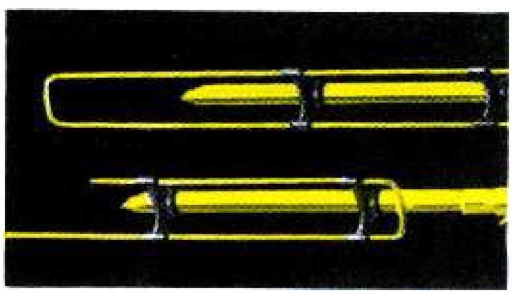

The BI MODAL parasitic elements combine two high band directors into a single director covering all low-band channels, plus the entire FM band. These directors are resonated to overcome the natural tendency for fall-off in gain at 108 MHz and 216 MHz. Thus, the Paralog-Plus is exceptionally flat across the entire VHF television and FM bands.

The Paralog-Plus driven elements work in two modes simultaneously: (1) ½ wavelength for low-band channels, and (2) 3/2 wavelength for high-band channels. Thus, each element in the Paralog-Plus serves double duty.

In the Paralog-Plus, more of the elements work to bring in any given channel. The result is an "ungimmicked" antenna that is unusually compact. An antenna that returns to the basic periodic principle and gives it new direction. Test the Paralog-Plus against any antennas comparable in size and price. You'll be surprised at the difference.

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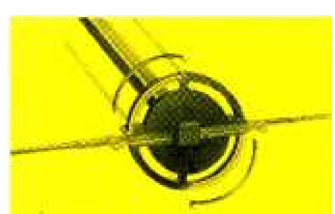
CYCOLAC INSULATORS



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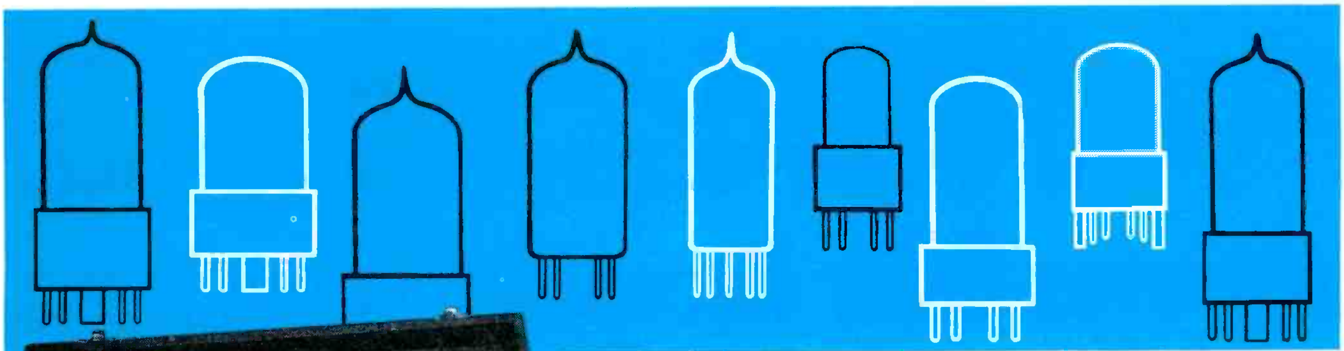

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The Electronic Scanner

news of the servicing industry

SALUTE TO SARNOFF

Three national organizations — the EIA, the IEEE, and the NAB — co-sponsored the "Salute to David Sarnoff." It was held in the Grand ballroom of the Waldorf-Astoria Hotel, in New York, on September 30, the exact day sixty years ago when General Sarnoff started working for a telegraph company.

In a joint statement announcing plans for the dinner, the presidents of the sponsoring organizations said that the event was being held to commemorate General Sarnoff's "outstanding contributions to the progress and welfare of his industry, his country, and his fellow men. No man has placed his stamp of genius more firmly upon an era than General Sarnoff." This is the first time, it was pointed out, that these three associations have ever united in such a tribute.

General Sarnoff, who earlier this year celebrated his 75th birthday, came to this country in 1900 at the age of nine. He sold newspapers and worked as a delivery and messenger boy. On September 30, 1906, he joined the Marconi Wireless Telegraph Company of America as an office boy and began his career in wireless. When the Radio Corporation of America was formed, in 1919, he became its Commercial Manager.

General Sarnoff was elected President of RCA in 1930, at the age of 39. In 1947, he was elected Chairman of the Board and Chief Executive Officer. In 1966, he relinquished the post of Chief Executive Officer, continuing to serve actively as Chairman of the Board.

A memorandum he wrote to his superior officer at Marconi in 1916 has become famous in the annals of American industry. In it, he proposed a plan for broadcasting programs into the home by using a "radio music box." This proposal led directly to the development of the radio and radio broadcasting as it is known today.

General Sarnoff likewise was the moving force behind the development of both black-and-white and all-electronic, compatible color television. In 1944, the Television Broadcasters Association conferred upon him the title "Father of American Television."

In addition to his scientific and industrial activities, General Sarnoff has achieved wide recognition for his efforts in military communications, especially during World War II. He served as Special Consultant on Communications at SHAEF Headquarters in Europe, and was elevated to the rank of Brigadier General on December 6, 1944.

MERGERS

From **Dynascan Corporation** comes good news for the servicemen who have been unable to obtain replacement parts for test instruments made by **Precision Apparatus.** Dynascan has acquired the inventory of Precision, Paco, and Precision-Paco divisions of Precision Apparatus. The address is:

Precision Apparatus Division
Dynascan Corporation
1801 W. Belle Plaine Ave.
Chicago, Illinois 60613

Oak Electro/Netics Corp. acquired the business and circuit TV, master antenna TV, educational TV and community antenna equipment.

Corning Glass Works has announced it will build a plant at State College, Pa., to manufacture glass for color television tubes.

Increased capacity is needed because of the rapid growth of television industry requirements, and Corning will continue to make television bulbs at its other television plants at Albion, Mich., Bluffton, Ind., and Corning, N. Y.

It was also announced that Corning Glass Works of Canada Ltd. will construct a plant at Bracebridge, Ont., which initially will manufacture glass for television tubes for the Canadian market.

POTPOURI

Admiral Corporation has received a contract from several NATO countries for a quantity of new low light-level television cameras developed by the company's government electronics division.

The new system will aid the detection of airborne targets when they are surrounded by waves, mountains, rugged terrain and other radar reflective material known to the military as "clutter".

The Admiral low light TV camea, incorporating the same type of pick-up tube used by television networks in studio cameras, can be utilized as a reinforced kind of detection system because it can track low-flying aircraft. It is capable of operating under all daytime and nighttime conditions.

The compilation of the first six months of returns to the 1966 continuous year-long survey by the **National Fed-**

assets of Phillips-Advance Control Co., the relay division of Phillips-Eckardt Electronic Corporation, for $1.8 million in cash.

Phillips-Advance, and its subsidiary, Phillips Control Corp. of Puerto Rico, which was also acquired by O/E/N in the transaction, produce a broad line of relays for the electronics and communications industries.

The formation of a new company, **RCA Colour Tubes Limited,** to manufacture RCA color television picture tubes in England for the British and export markets, was announced jointly by the Radio Corporation of America and Radio Rentals Limited.

The company's initial product line will include 25-inch and 19-inch rectangular color television picture tubes similar to those now manufactured in quantity by RCA in the United States.

It was emphasized that the output of RCA Colour Tubes Limited is intended primarily for the British market, although it is expected that some of the tubes will be exported. It was also pointed out that the tubes will operate equally well with the color television system to be used in the United Kingdom and any system that has been proposed for use in Europe or elsewhere.

EXPANSIONS

Blonder-Tongue Laboratories, Inc., has launched production in a new 36,000-square-foot plant, its sixth in Newark, N.J.

The new manufacturing facility is being devoted to the production of selected items from the company's various lines—distributor products, laboratory instruments, closed-

Interconnected on a printed ceramic substrate on which resistors have been screened.

The new IF amplifier has an overall gain of 55 db with a maximum output level swing of 1 volt rms. The unit operates from +10 volts and −4 volts with a total current drain of 6mA.

The **Zenith Radio Corporation** filed additional technical data on its subscription TV system in response to a request issued by the Federal Communications Commission. The document filed gives full details on its Phonevision system and describes a new decoder engineered for color as well as black-and-white subscription telecasts.

The new Phonevision decoder contains a TV tuner that can accommodate any VHF or UHF channel, and is quickly installed by shifting the subscriber's antenna connection from receiver to decoder and then attaching the decoder output wires to the TV set's antenna terminals.

When the subscriber wishes to watch a program, he turns his decoder to the proper program code as shown in a special program guide, then inserts a ticket in the decoder. This connects the decoder to the TV receiver and also drives a series of pins through the ticket in a pattern dictated by the program's code number. The sound and picture are then unscrambled for the duration of the program.

Shortly before the end of the current month or validity period, the subscriber is sent his next ticket and a self-addressed envelope for returning the used ticket to the subscription TV company. The ticket is processed through a computer, which provides a bill to be mailed to the subscriber.

• *Please turn to page 89*

eration of Independent Business shows that since last year 37% of the firms have expanded, with an average investment per expanding firm of $22,764. However, new job creation by the independent firms appears to be slightly lower than the previous year.

In another national survey by NFIB, 35% of the independent businessmen report difficulties with collections, up from 31% at the end of the first half of the year. In some states though, business has apparently been tightening upon credit and been more active in collecting overdue accounts. Many states show substantial reductions in firms with collection problems.

Further computerized checking indicates that the big rise in collection problems started in June, coinciding with the time that the new income tax withholding schedules went into effect.

One of the newest integrated circuit developments from the **Sprague Electric Research and Development Center** was revealed for the first time at the opening of the WESCON show.

A complete 455 kHz amplifier on a ceramic plate only 1" wide by 1½" long was achieved by using a combination of thick-film, thin-film, and diffused microcircuit technology in combination with discrete capacitive elements. No transformers or external components are required.

The 455 kHz intermediate frequency amplifier consists of two tuned IF stages and an AGC circuit. It has a Q of 55, and the center frequency of 455 kHz has a stability of ±0.5%. The active electronics and frequency-determining components are provided by monolithic microcircuits.

Recommended Equipment for SQUARE WAVE TESTING

by Robert G. Middleton

Equipment recommendations for square-wave testing depend upon the job that you wish to accomplish. For example, the equipment needed to make square-wave tests of integrating circuits is much less elaborate (and much less expensive) than the equipment needed to make some of the key tests that concern the technician, and note the square-Again, the equipment required for the same test of video amplifiers. tests of video amplifiers is much less elaborate (and far less costly) than the equipment needed for tests of snap-recovery diodes. Within each category of test requirements, there is an area of personal choice. For example, we can make square-wave tests of integrating circuits with a calibrated or uncalibrated scope. But if we use an uncalibrated scope, we must follow up our square-wave test with a signal-generator check of the time-base speed in the scope. This takes more time than if we use a scope that is calibrated.

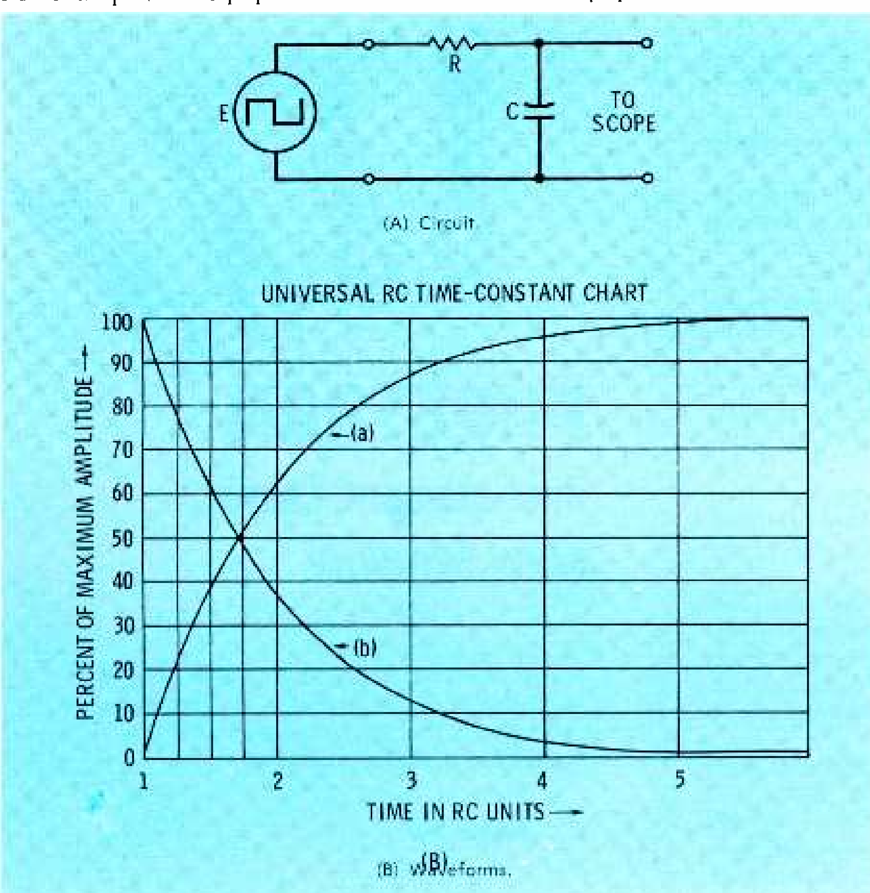


Fig. 1. Simple integrator.

In general, we use square-wave tests to make streamlined analyses of components, circuits, stages, amplifiers, receivers, and systems. Therefore, if we employ square-wave equipment that requires an excessive number of auxiliary procedures and measurements, we are defeating the primary intent of the test method. It is good practice to utilize square-wave equipment that is fully adapted to the job. By the same token, it is wasteful to use unnecessarily elaborate and expensive equipment to make simple and undemanding tests. Accordingly, we will summarize wave equipment that is fully adapted to each category of test.

Integrator Circuits

Among the various circuits and units encountered in routine troubleshooting work, integrators make minimum demands upon square-wave equipment. This fact results from the very limited frequency response of conventional integrators. In turn, the rise of the output waveform from an integrator is quite slow. This response places only a limited demand on the rise time of the square-wave generator. It also places only a limited demand on the rise time of the scope. Since we evaluate an integrator unit on the basis of rise time, it is very helpful to employ a scope that has a calibrated time base.

Fig. 1A shows the simplest form of integrating circuit. We are chiefly interested in the output voltage waveform (a) in Fig. 1B. Waveform (b) is the circuit current—the voltage waveform across the resistor.* This integrator was used in some early TV receivers, but has been supplanted by more complex circuits. Nevertheless, it serves as an instructive introductory example. The time constant of the integrator is approximately 0.5 millisecond, which means that it can be tested satisfactorily with a square-wave generator and scope that have comparatively slow rise times. We must not suppose, however, that there are no other requirements.

An integrator operates in a TV receiver at a 60-Hz repetition rate, so our basic test is a 60-Hz square-wave test. The square-wave generator should supply a flat-topped 60-Hz square wave, and the scope should reproduce a flat-topped 60-Hz square wave. Most instruments meet this requirement, but there are exceptions. Therefore, it is advisable to check the generator and scope, as depicted in Fig. 2. Although a small amount of tilt, such as 5% or 10%, can be tolerated in practical work, a large degree of tilt in a 60-Hz square wave is unsatisfactory; the output waveform shown in Fig. 1B will be distorted objectionably.

Derivation of the universal time-constant chart is explained in the Oct., 1965 issue of PF REPORTER.

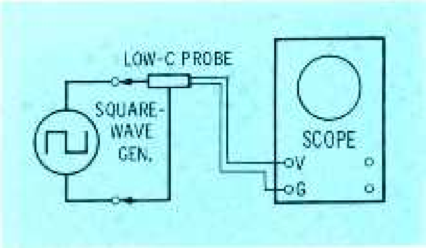
Note that the tilt distortion seen in Fig. 2B can be caused by the square-wave generator, by the scope, or by a combination of tilt in both instruments. A DC scope is best, because it will introduce no tilt even at very low square-wave frequencies. An AC scope is satisfactory for integrator tests if it does not impose more than a small percentage of tilt in a 60-Hz square wave. Some square-wave generators have DC-coupled output circuits, and these generators will introduce no tilt, even at very low square-wave frequencies. A generator with an AC-coupled output circuit is adequate if it does not produce more than a small percentage of tilt in a 60-Hz square wave.

Time-Base Calibration

Service-type scopes that have good 60-Hz square-wave response nevertheless have uncalibrated time bases. This means that you cannot evaluate a waveform from the universal time-constant chart in Fig. 1B until the sweep speed has been checked. If you have an accurate audio signal generator, it is quite practical to check the sweep speed, although this does entail an additional step in the test. Most modern scopes are provided wtih a graticule that is ruled with lines spaced at uniform intervals. The horizontal intervals are used when we calibrate the sweep speed.

Beginners may suppose that the time base is calibrated in a service-type scope, because the sweep-range control is marked in frequency steps. However, from the standpoint of measuring rise time, the scope is uncalibrated. First, the various frequency steps serve only as a rough guide—the indicated values are not held to a tight tolerance. Secondly, the sweep-vernier control is completely uncalibrated, so we have only a rough idea of the sweep speed if we rely on the control indication.

Therefore, we must make a sweep-speed calibration as illustrated in Fig. 3. The audio generator is set to a frequency f at which the displayed sine wave occupies a chosen horizontal interval, such as from zero to T_2 in Fig. 3. Then, the sweep speed is given by $1/f$. For example suppose that the audio generator is set to a frequency of 1 kHz. Then, the time from zero to T_2 in Fig. 3B is equal to 1 millisecond. The time from zero to T_1 is equal to 0.5 millisecond. As long as we do not change the sweep-control settings on the scope, we know that each horizontal interval on the graticule represents 0.5 millisecond.



(A) Equipment set-up.

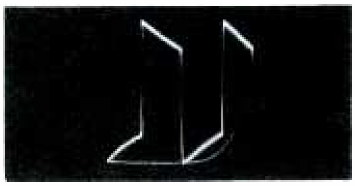
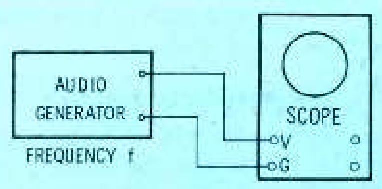
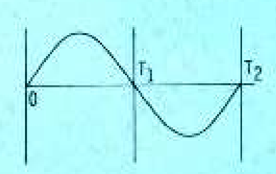

(B) 60Hz square-wave with excessive tilt.

Fig. 2. Checking equipment for tilt.

Note that it is not necessary to use triggered sweep in order to have a calibrated time base. We can use a scope with free-running sweep. However, after a scope with free-running sweep has been calibrated for sweep speed, we cannot touch any of the horizontal controls; this includes the sync control. Any variation of controls in the horizontal-sweep will upset the time-base calibration. Therefore, we can save a considerable time by using a scope



(A) Equipment set-up.



(B) 0 to T_2 equals $1/f$.

Fig. 3. Calibrating the time base.

Fig. 4. Moderately-priced lab scope.

with triggered sweep and a calibrated time base—with this type of scope, any of the horizontal-sweep controls can be reset at any time, and we merely read the sweep speed directly from the settings of the time-base controls.

Note Fig. 4. This is a utility-type lab scope with triggered sweep and calibrated time base. Since the sweep is triggered, the sweep speed is not affected by the setting of the sync-amplitude control. Calibration of the time base is held to a tight tolerance, so that the sweep speed is indicated accurately at any setting. Therefore, we dispense with the calibration procedure shown in Fig. 3 when using a lab-type scope. Since the vertical amplifier of the scope is flat to 5 MHz, color waveforms can be evaluated in detail. Unless we use triggered sweep, waveform detail cannot be expanded—Fig. 5 shows how a portion of a color-bar signal can be expanded with a wide-band triggered-sweep scope.

Intermediate Scopes

In between the service-type scopes and the utility-type lab scopes, we find the scope that provides triggered sweeps with an uncalibrated time base. An intermediate scope permits expansion of waveform detail. However, rise times cannot be measured unless the scope is calibrated in a separate procedure. Note that it is not difficult to provide a simple version of triggered sweep in a service-type scope. This modification was discussed in the March 1966 issue of PF REPORTER. The principle of the modification is to provide an adjustable cutoff bias for the sweep oscillator. Horizontal deflection is initiated by the arrival of the leading edge of an input signal.

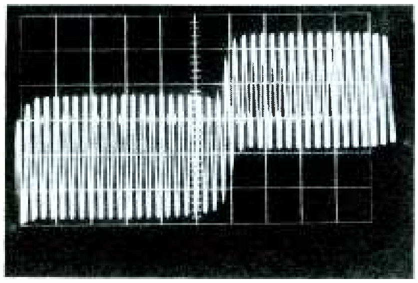


Fig. 5. Expansion of color-bar signal shows 3.58 MHz sine wave.

The intermediate scope provides a choice of free-running, triggered, or magnified sweep. When set to the free-running mode, the sawtooth oscillator operates as in a conventional service-type scope. In the triggered mode of operation, a potentiometer provides an adjustable cutoff bias on the horizontal sweep oscillator. Consequently, there is no horizontal beam deflection until the leading edge of an input signal arrives. The beam then makes one horizontal excursion; another excursion cannot occur until the next leading edge arrives to bring the sweep oscillator out of cutoff. The sweep speed is unaffected by the setting of the sync-amplitude control; nevertheless, the exact sweep speed is unknown in this type of scope unless a calibration is made as illustrated in Fig. 4.

Sweep magnification employs free-running sweep, and is useful for expansion of waveform detail in the same general way as with triggered sweep. As before, the sweep speed is unknown unless separate calibration is made. Sweep magnification is accomplished by greatly overdriving the horizontal-amplifier tubes so that only a portion of the incoming waveform is displayed horizontally. The desired portion to be expanded is chosen by adjusting the grid-cathode bias for the horizontal amplifier.

Sweep Triggering

Now let us consider a further requirement in the square-wave testing of RC circuits. If we connect the scope across R in Fig. 1, the circuit is being operated as a differentiating circuit, and the waveform has a very fast rise, as shown in Fig. 1B. In some applications, we may be concerned merely with the decay interval of the differentiated square wave—in such case, we do not make a rise-time measurement. On the other hand, there are numerous applications in which we are chiefly concerned with the rise time of the differentiated square wave. This measurement requires a square-wave generator that supplies a fast-rise square wave and a scope that can display the fast rise.

In order for the scope to display the rise of the differentiated square wave, horizontal deflection must start at the beginning of the leading edge, as depicted in Fig. 6. This entails the basic problem of triggering the sweep slightly before the waveform starts to rise. Any sweep oscillator requires a small amount of time to respond to a trigger voltage. Therefore, if a sweep system were used such as in the intermediate scopes, more or less of the leading edge in Fig. 6 would be "lost" and could not be displayed on the scope screen, and a rise-time measurement becomes impossible to make.

This problem is overcome in scopes such as illustrated in Fig. 4, by means of a delay line which is connected in series with the vertical amplifier. The delay line "holds" the input signal for a short period of time, while the trigger pulse gets the horizontal sweep system started. Horizontal deflection will have started by the time the signal arrives at the vertical deflecting plates of the

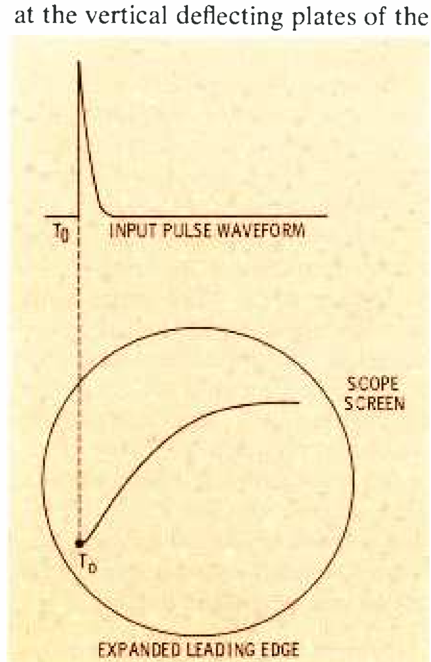


Fig. 6. Sweep must start at the beginning of the pulse.

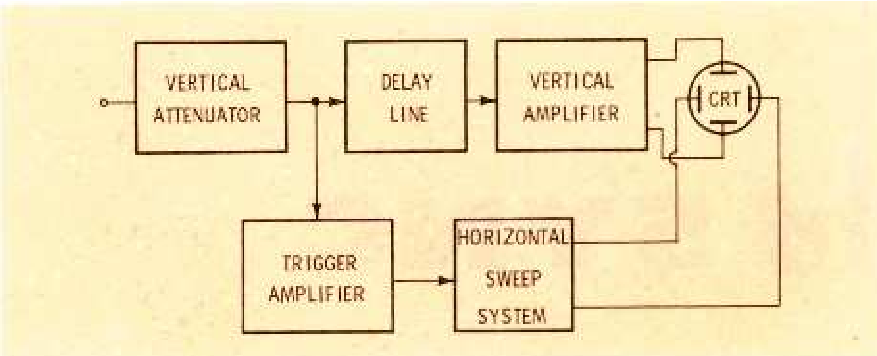


Fig. 7. Delay line permits early triggering of sweep.

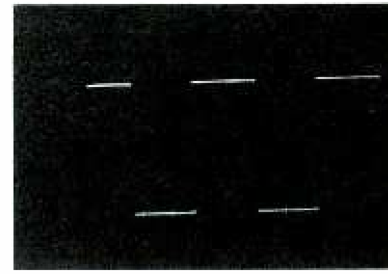


Fig. 9. Leading edge is invisible.

CRT, and all of the leading edge in the waveform is displayed. Fig. 7 shows the plan of a triggered-sweep scope with a delay line.

Delay lines for triggered-sweep scopes are elaborate, compared with those used in color-TV receivers. The delay is comparatively short, but many sections are used in a scope delay line to avoid distortion of the waveform. A typical scope delay line employs 40 LC sections, connected in cascade (see Fig. 8). This is a low-pass filter configuration, with a cutoff frequency higher than that of the vertical amplifier. Because many sections are used, the response is very uniform and there is no observable phase shift. Scope delay lines typically have an elapsed time of 0.25 microsecond from input to output. This short delay suffices for the horizontal sweep system to start operating before the signal arrives at the vertical deflection plates of the CRT.

Hold-Off or Lockout Circuit

When the leading edge of a waveform is greatly expanded, as shown in Fig. 6, the sweep oscillator completes its operating cycle before the applied waveform has decayed to zero. Thus, the expanded leading edge represents a complete sweep cycle which is followed by the decay interval of the pulse. The decay voltage can also trigger the sweep oscillator and will produce a confusing overlapped pattern unless the decay interval is locked out. This is the function of the hold-off or lockout circuit which is provided in most triggered-sweep scopes. Lockout is automatic, and functions as follows:

When the leading edge of the incoming signal produces an output voltage from the trigger amplifier, the lockout circuit is simultaneously energized. It feeds back a cutoff bias to the trigger amplifier so that no signal can pass for a certain interval. The trigger pulse has been applied to the horizontal sweep system, but the trigger amplifier is immediately disabled so that another trigger pulse cannot be produced until the lockout bias has decayed to zero. Thus, false triggering and overlapping patterns are avoided, no matter what type of waveform may be fed into the vertical amplifier.

CRT Unblanking

The more elaborate triggered-sweep scopes also have a CRT unblanking circuit. This is necessary to avoid screen burns. Observe Fig. 9. The leading edge of the square wave rises so fast that it is invisible. If we should advance the intensity control sufficiently to make the leading edge visible, the flat tops would become excessively bright (because the beam is moving slowly), and the CRT screen would be burned. When the leading edge of a fast-rise waveform is expanded, as in Fig. 6, the pattern is invisible until we advance the intensity control sufficiently.

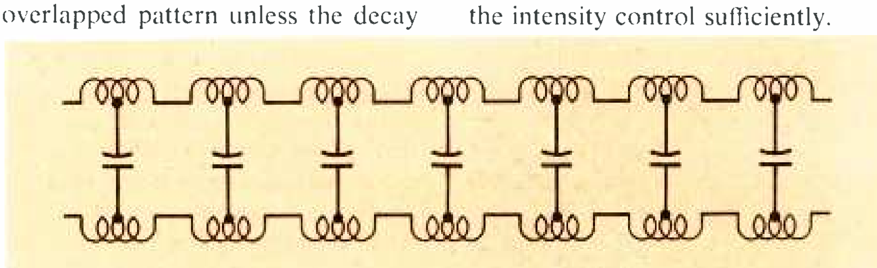


Fig. 8. Basic delay-line circuit.

This requirement involves the problem of the beam "spot" in between successive sweeps. The spot remains motionless at the left-hand side of the screen after the leading edge is completed, and until the next trigger pulse is produced. Therefore, display of the resting spot cannot be permitted—it would immediately burn a hole in the screen. The CRT unblanking circuit prevents any screen display until the horizontal sweep system starts to operate; the CRT beam is then unblanked for the duration of the forward sweep. As soon as the forward sweep is completed, the CRT beam is again blanked. Thus, in the absence of an input signal, the screen of a triggered-sweep scope remains completely dark.

Conclusion

In this article, we have observed some introductory facts concerning recommended equipment for square-wave testing. Integrator circuits make minimum demands on square-wave generators and scopes. This is shown by the universal RC time-constant chart which depicts the slow rise. Nevertheless, although a narrow-band scope is adequate, it is helpful to employ calibrated sweeps.

By way of comparison, differentiating circuits make maximum demands on square-wave generators and scopes, if we are concerned with the rise time of the output waveform. This requirement can be met only by fast-rise square-wave generators, and triggered-sweep scopes with lockout and beam-unblanking functions. All such scopes have calibrated time bases. If a narrow-band scope is used in this type of test, the output waveform will be highly distorted. Its rise will indicate the rise time of the scope—not of the circuit. ▲

Wild SYNC

by Stan Prentiss

Do you believe that horizontal and vertical sync problems must continue to plague the novice and amuse the pros? Or do you suppose there's a straightforward way to solve any sync difficulty just by ogling the schematic and testing once or twice with an oscilloscope probe? The following case discussion should help you answer these questions.

Circuit Operation

The circuit of Fig. 1 is a vertical multivibrator and vertical-output tube combined, with RC coupling from the output back to the input for positive feedback. The vertical sync pulses, previously separated, are amplified by the sync amplifier, integrated by R85 and C81, and coupled to the grid of the vertical multivibrator through C82, R90, and C83. A DC control bias is generated through R5 (the vertical-hold control) and R4 (the vertical linearity control) whose No. 1 terminal approaches ground through R97.

Normally, with no signal applied, the DC voltage measured at the grid of V14B is −46 volts. The tube is then completely cut off. In the absence of trigger pulses, conduction is accomplished by the large positive AC spikes (from the vertical-output tube) that constitute both the vertical sweep and multivibrator free-running trigger. Since AC cannot be measured on a DC meter, there is no way to detect their presence without an oscilloscope unless the raster can be viewed. The positive transitions are rapid and must overcome the negative bias and allow the tube to conduct and produce positive drive pulses for the output.

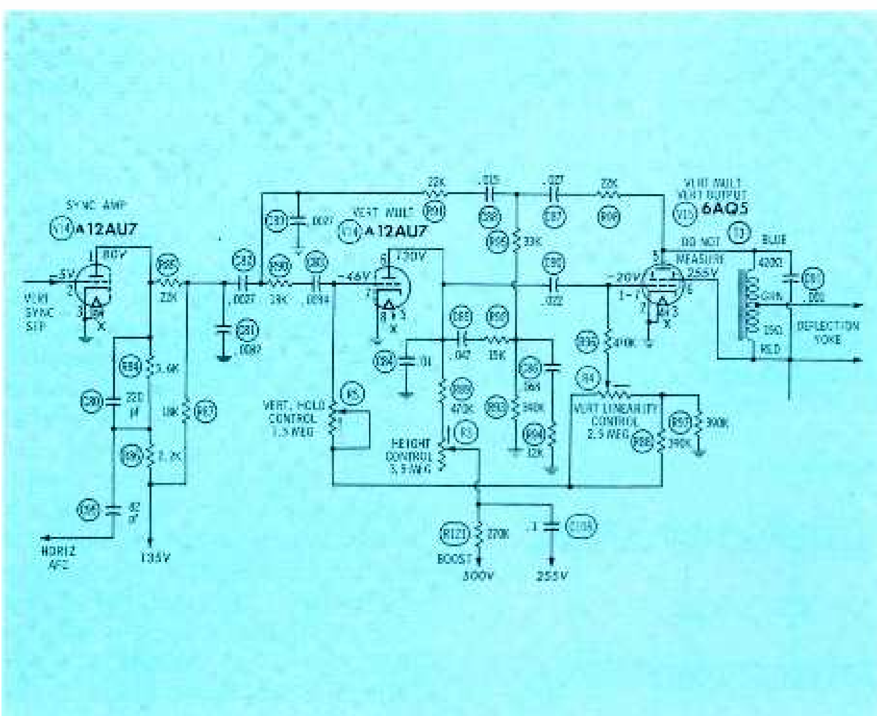


Fig. 1. Vertical section of RCA Chassis KCS84F.

Scope to the Rescue

In this instance, both free-running and sync triggers were present, but there was not a full raster. The weak cathode ray tube vaguely showed that the bottom portion of the picture was cut off and the top elongated. An oscilloscope, with low capacitance probe, showed the incoming trigger pulse "sitting" at 100 volts DC, at an amplitude of 70 volts peak-to-peak (Fig. 2). The vertcial multivibrator output, however, was only 85 volts DC at 100 volts peak-to-peak (Fig. 3), indicating that the tube was operating at almost 100 volts DC less than normal with a resultant shortening of the multivibrator waveform. Rotating the 3.5-megohm height control filled the picture at the bottom, but left the top stretched out of proportion. A quick check of the boost voltage supply showed a full 500 volts on the bottom side of R121, the 270K dropping resistor. So I knew there was enough plate voltage available for the multivibrator if I could just get it there.

The waveform of the multivibrator did, however, indicate one other prime aspect. Note that some of the vertical output pulse widths (Fig. 3) are shorter or longer than others. A check on the vertical circuit side of R85 revealed that the vertical oscillator was out of sync (Fig. 4). Adjusting the vertical-hold control

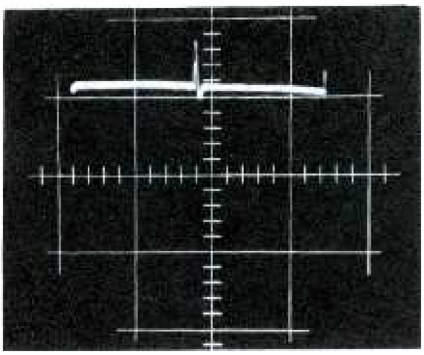


Fig. 2. Scoped vertical sync trigger.

knob would not align a symmetrical number of positive pulses with the same number of negative pulses. Even adjusting the linearity control produced no more than a shift in frequency. Thus the weak CRT had failed to show a multiple increase in the vertical frequency, which varied with the setting of the vertical-hold control. The negative pulses, of course, are the actual vertical oscillator frequency spikes from the feedback network, while the positive spikes are the incoming sync pulses as amplified and integrated. The two sets of pulses must coincide to produce vertical sync lock.

My Problem

This, indeed, was a problem. Several years ago, I had replaced most of the paper capacitors in this circuit with Mylar and paper units to prevent leakage and changes in filter, divider, and sawtooth forming capacitors C84, C85, and C86. I also replaced C90 to prevent any positive DC leakage to the grid of the vertical-output tube. Such leakage would cause the grid to be driven positive, producing insufficient peak plate current, which in turn would result in a white foldover at the bottom of the raster.

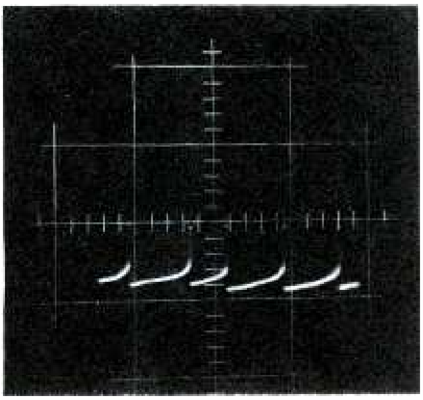


Fig. 3. Abnormal vertical-output pulse.

A quick check of R92, R89, R93, and R94 showed no changes in value. Replacing capacitor C83 had no effect. Therefore, my trouble had to be either in the triggering pulses or in the potentiometer controls. As far as I could tell, all pertinent drive pulses were well shaped and of sufficient amplitude. This left only the potentiometers as the possible source of trouble. Disconnecting all leads from the 2.5-megohm vertical linearity control, I found it had increased in value to more than 3 megohms. Doing the same to the vertical-hold control, I found, to my amazement, that this control had *decreased* in value from 1.5 megohms to 90K.

The Cause

Normally these controls change little with the small amounts of current generated by excitation bias. The only explanation I can offer is that at one time the vertical multivibrator tube must have shorted, causing a partial change in the characteristics of both R5 and R4, but in opposite directions. There would be, of course, almost twice the current through R5 as through R4 because of the different resistances. Usually, a quick increase in current will cause a carbon resistor to decrease in value, while a slow excess current will increase the value of the carbon toward an open. That's why discolored banding on any composition resistor should always be investigated. By the same reasoning, any sign of leakage of electrolyte from a filter capacitor demands a quick check with a capacitance checker to be sure the filter does not have an unusually large power factor, or is not partially or completely open.

The Cure

Both potentiometers were replaced, and the vertical multivibrator-output waveform returned to normal, as shown in Fig. 5 (inverted and "hanging" at almost 200 volts, with an amplitude of nearly 200 volts p-p). The sync functioned normally (waveform repetitions equal), and sufficient AC was developed to drive the vertical-output amplifier adequately.

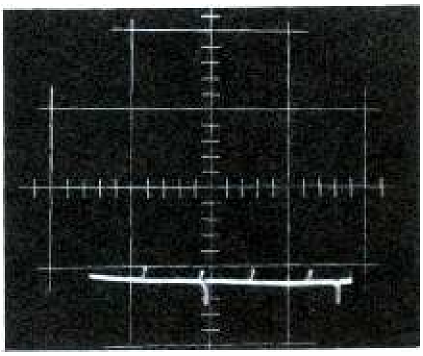


Fig. 4. Vertical oscillator out of sync.

Conclusion

The input time constants of C83 and R5 govern the timing of the vertical multivibrator, which consists of both the oscillator and output tubes—one conducting during trace time and the other conducting during retrace time. An increase in RC value will lower the oscillator frequency and make the picture roll up. A decrease in the value of RC (the trouble in the previous discussion) causes the picture to roll down. In the case just mentioned, the bottom of the picture was superimposed on the top and the scanning lines were spread too far apart.

How useful was the oscilloscope? Would a DC meter have told the whole story? Hardly! In this case, the use of a DC oscilloscope gave both DC levels and AC amplitudes at the same time, cutting the troubleshooting time in half by allowing both waveforms to be viewed simultaneously. There is also another good point to remember: Always troubleshoot television receivers with a signal applied. I have never seen a piece of signal-sensitive, electronic equipment that would operate by quiescent voltages alone. ▲

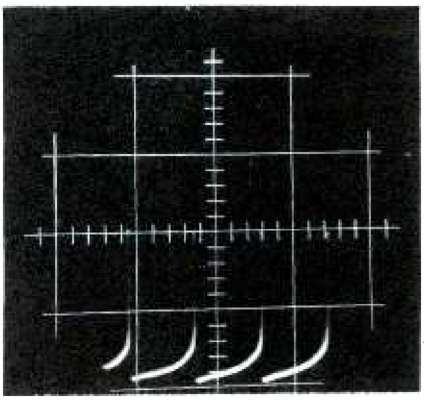


Fig. 5. Normal vertical-output pulses.

more about TV AGC

INCLUDING TRANSISTOR TYPES

by Allen F Kinckiner

Previous Shop Talk articles about Keyed AGC made little mention of AGC sensitivity control circuits, even though such circuits were included in the article's schematics. The more common types of AGC sensitivity control circuits are presented in Figs. 1A and 1B. In virtually every receiver having an AGC control, the circuit will be a variation of one of these. Moreover, even through Figs. 1A and 1B differ considerably, the control functions are identical; they set the static bias level of the AGC tube. The dynamic bias, which varies with the strength of the received signal, produces AGC voltage in proportion to the strength of the signal. In Fig. 1A, the Magnavox T-904 circuit, AGC sensitivity is controlled by varying cathode voltage of the AGC tube. In Fig. 1B, the Admiral D-61 circuit, the AGC tube's cathode voltage is fixed and its sensitivity is controlled by varying the G-1 voltage.

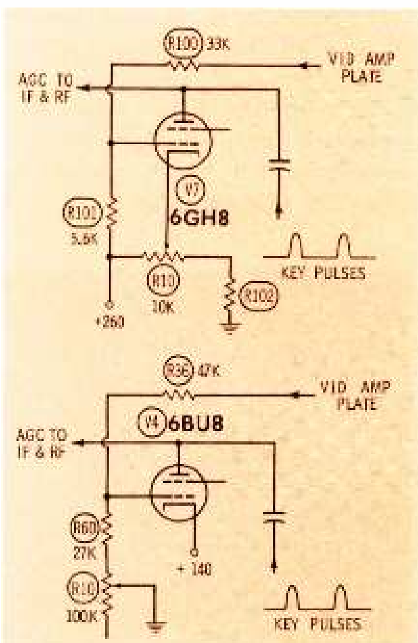


Fig. 1. Sensitivity of keyed AGC stage is controlled by either of these circuits in many designs.

An entirely different approach to obtain correct AGC voltages is used in some Westinghouse receivers (Fig. 2). Here, instead of varying the AGC tube's sensitivity, the amplitude of the keying pulse is varied. This keying pulse, taken from the junction of capacity voltage divider C-60 and C-61, is supplied from a tap on the horizontal output transformer. With C-60 at minimum capacity, high keying pulse amplitudes are applied to the keyer's plate, and high levels of AGC voltage will be obtained. With C-60 at maximum capacity lesser values of AGC voltage will be obtained. Knowledge of this circuit led to correcting a "tough dog" AGC trouble encountered in a receiver that did not have any type of AGC control circuit.

The receiver involved was a 'dealers stock' Philco 16J27 chassis with the circuit shown in Fig. 3. When the receiver was turned on it played faultlessly for as long as it remained tuned to the same channel. However, if channels were changed after initial warm-up, a picture similar to Fig. 4 resulted. The same condition could be induced by momentarily grounding the control grid of the first video IF tube.

Substituting a complete set of new tubes only proved that tubes were not the trouble. Varying the noise inverter control had no effect, and led to the suspicion that the noise inverter stage was causing sync lockout. This might also account for the AGC malfunctioning and the negative picture condition. Therefore every component and voltage in the V-3b circuit (Fig. 3), was checked and double checked. The only abnormality found was that the grid of V-3b remained at minus 7 volts regardless of the setting of R-7. By shunting R-49 with a 3.9 meg resistor the grid voltage could be varied from minus 7 to minus 9.5

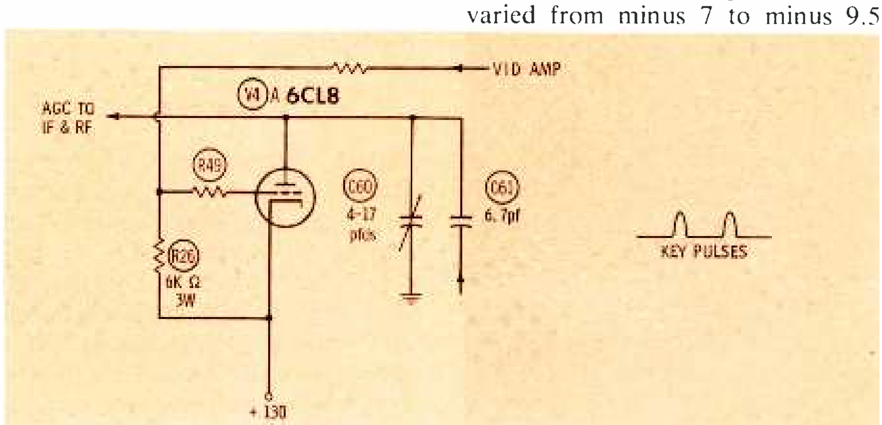


Fig. 2. Westinghouse controls levels of AGC voltage developed by varying amplitude of keying pulses via variable capacitor C-60.

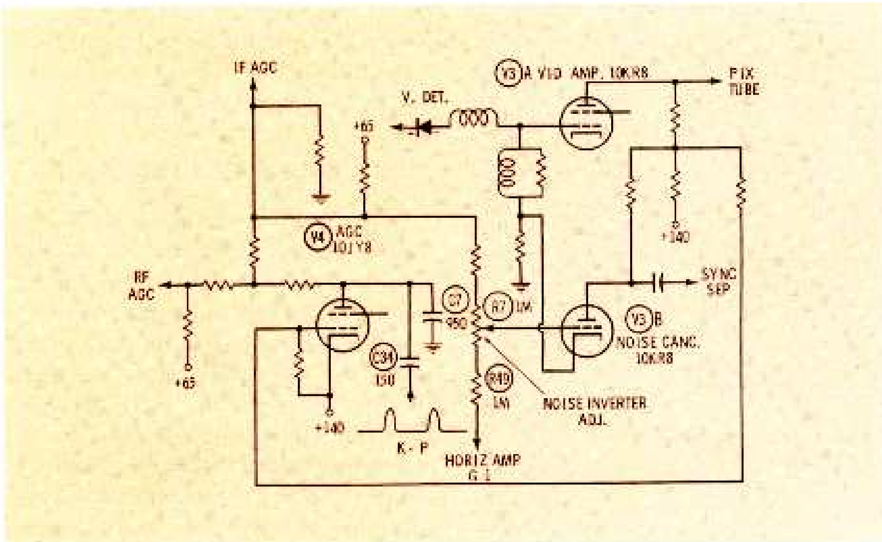


Fig. 3. Decreasing capacity of C-7 to 820 pf cured trouble in Philco.

Fig. 4. Trouble in Philco appeared only in changing channels or when signal was interrupted.

volts. At the higher value the trouble was far less severe; the negative picture did not occur, although syncing took about twenty seconds each time channels were changed or the signal was interrupted.

Earlier tests had shown that a high minus voltage, suggesting IF oscillation, existed on G-1 of the first video IF during the negative picture, out of sync condition. Now every component in the AGC circuit was critically checked and found to be right up to par. The large capacity of C-7 from plate to ground of the AGC tube did not seem correct. When an 820 pf. unit was substituted for C-7 the trouble was cured entirely.

Now when channels were changed pix overload never occured and sync lock-in was immediate. Since C-7 is one element of a capacity voltage divider, decreasing its value slightly increased the keying pulse amplitude and produced better AGC action.

Transistorized Keyed AGC

There are a few similarities but also many differences between Keyed AGC in transistor TV receivers and Keyed AGC in tube receivers. One similarity does stand out; in either type, control of the AGC stage is obtained from voltage shift in a video amplifier load. When the voltage shift is obtained from a transistor collecter load, operation is quite like plate load voltage shift in tube receivers. However, in transistor receivers it is also possible to use the signal induced voltage shift in the emitter load of a video amplifier. A comparative circuit in tube sets would be the use of voltage shift in a video amplifier cathode resistor.

The variety of designs in transistor receivers is great because of the greater flexibility of transistors. While tube gain can be decreased only by decreasing tube current, gain in transistors can be decreased by decreasing current(reverse biasing), or by increasing current (forward biasing). With tube designs the keying pulse is invariably positive and developed AGC voltage is negative; with transistors the keying pulse can be of either polarity and developed AGC can be of either polarity depending on whether the controlled transistors are PNP or NPN units. In tube sets one stage is usually enough for good AGC operation; in transistor receivers it is not uncommon to use an AGC amplifier stage. In transistor receivers, both plain or Zener diodes are often employed, whereas diodes are rarely used in tube sets except occasionally to clamp the delayed AGC to the tuner. AGC circuits in tube sets usually supply many times the amount of AGC needed for transistor sets. Overall, a great variety of circuit designs are found in transistorized AGC, whereas tube circuits generally conform to a few basic designs.

Zenith Chassis IM30T20 (Fig. 5)

Conduction of the AGC transistor, X-8, is controlled by voltage applied to its base through R-52. This voltage varies in step with signals from the video section. Specifically, the DC levels attained at X-6's collector at horizontal sync pulse times furnish dynamic bias of the AGC keyer. Correct magnitudes of AGC voltage are developed from the pulses applied to X-8's collector circuit. These keying pulses have approximately 25 volts positive polarity, and are fed through R-122 and C-61 to diode X-39. Negative DC AGC voltage proportionate to signal levels at the video detector develops at the junction of X-39 and C-61. R-90 and R-10, also in the base circuit of X-8, set the static bias level.

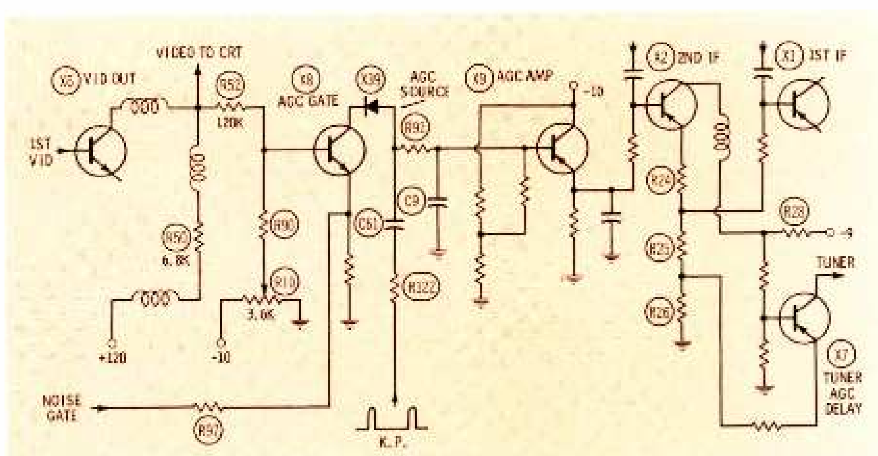


Fig. 5. Late transistorized TV by Zenith uses this keyed AGC circuit with some interesting features.

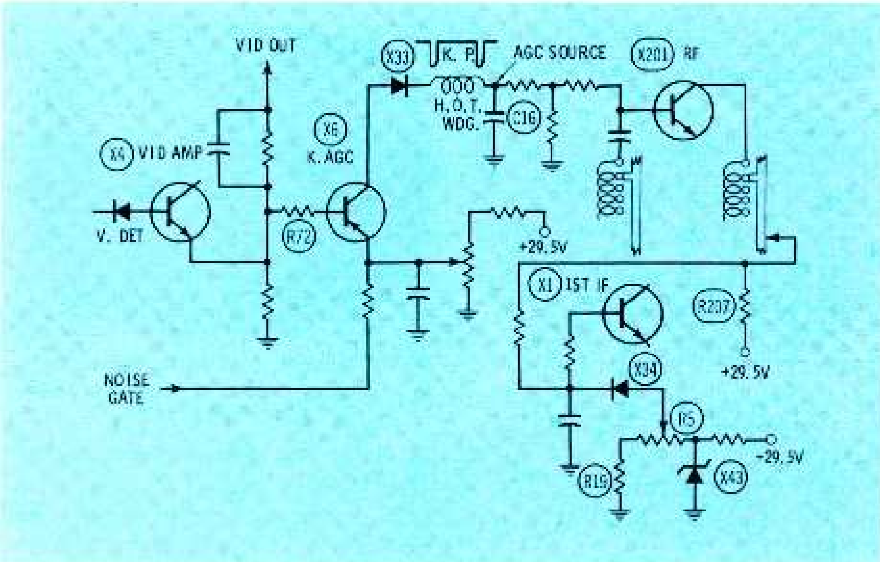


Fig. 6. RCA transistorized TV uses simpler keyed AGC circuit.

The noise gate also has a small amount of control over X-8's conduction. Positive bias is applied during large noise bursts through R-97 to the emitter of X-8.

AGC developed at the junction of C-61, R-92 and X-39 is filtered by R-92 and C-9 and fed to the base of X-9. The AGC time constants are not very different from those of tube circuits and are capable of minimizing fading signal effects while providing quick acting AGC. The voltage applied to X-9 receives additional filtering and power amplification and is then fed to the return of the base resistor of X-2, the second IF stage. Up to this point this AGC circuit has some similarities to tube circuits; here we come to a major difference.

Since the AGC has a negative DC polarity and is applied to the base of a PNP transistor, it constitutes forward biasing and increases current of X-2. Inasmuch as it is the function of increasing AGC to reduce gain, it might be wondered how increasing X-2's current can reduce its gain. Here's how forward biasing does it: The increased current produces a greater voltage drop across resistors R-24, R-25, R-26 in the emitter circuit, and also across R-28 in the collector circuit. Therefore the operating voltage of X-2, from emitter to collector, is reduced and gain will be reduced also. But that's not the whole story—higher voltage is also present at the junction of R-24 and R-25 and is fed to the base of X-1 which it controls by forward bias in similar fashion. In addition, the greater voltage difference between the top of R-28 and the junction of R-25 and R-26 produces delayed AGC from X-7 to control the tuner (forward biasing also). It is interesting to note that not only is this AGC via forward biasing different than AGC in tube receivers, it is directly opposed to gain control in transistor radios, where gain is reduced by reducing forward bias.

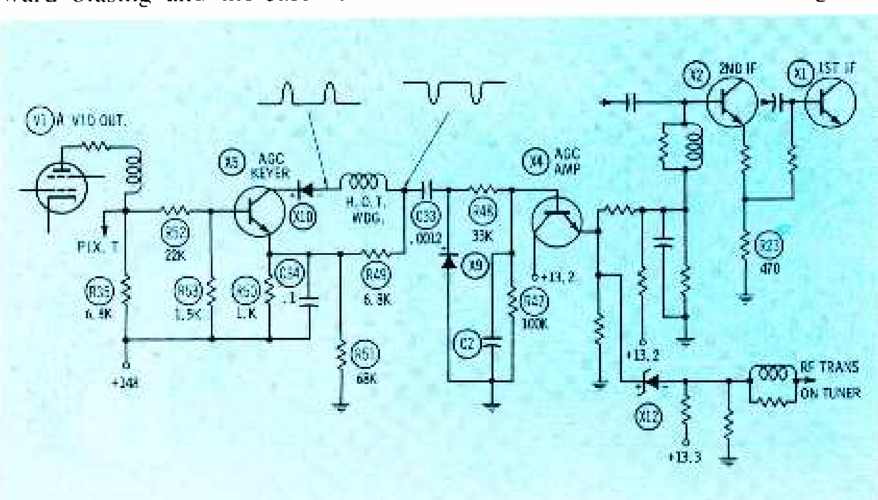


Fig. 7. Philco 16JT26 intermixes tubes and transistors but keyed AGC circuits uses transistors. Shop Talk Editor thinks three circuits are typical of future designs.

RCA Chassis KCS-153 (Fig. 6)

While AGC in the RCA KCS-153 shares some similarities with the Zenith just discussed, it also has its differences. Horizontal sync tip DC levels at the emitter of the first video amplifier, X-4 in Fig. 6, are applied through R-72 to the base of X-6, thus furnishing dynamic bias. From a winding on the horizontal output transformer a 25-volt negative keying pulse is applied to X-6's collector through X-33. When the two signals at base and collector arrive simultaneously, a positive AGC voltage is developed which charges C-16. After being filtered, the AGC voltage is applied to the base of X-201, the RF transistor. Since X-201 is an NPN transistor and AGC is positive voltage, gain of X-201 is controlled by forward bias, and the greater the forward bias the lower the gain.

Voltage drop across R-207 in the collector circuit of X-201 is amplified by increased forward bias and this amplified DC is used to reduce bias and gain of X-1, the first video IF transistor. R-5 and R-19 form a voltage divider across a positive voltage regulated by Zener diode X-43. Voltage at the arm of R-5 is fed to the base of the first IF transistor through X-34. Under reasonably low signal conditions this voltage is the only bias on X-1, but when strong signals are received the amplified AGC from X-201 provides gain reduction in X-1. Thus the IF stage receives delayed AGC—delayed not in time but until the amplified AGC from X-201 attains a certain level.

This RCA AGC system has three really interesting features: (1) It employs both reduction and increasing of forward bias to control gain in separate stages. (2) It uses one transistor; X-201, to double as an RF amplifier and also as an AGC amplifier. (3) It applies delayed AGC to an IF stage.

Philco Chassis 16JT26 (Fig. 7)

In addition to the all-transistor receivers, which usually drive a 14 inch or smaller picture tube, some

Please turn to page 77

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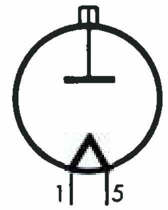
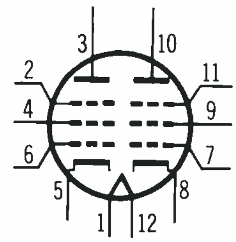
RECEIVING TUBES

1BH2
High-Voltage Rectifier
Fil.—1.25 @ 0.2A
PIV.—18KV @ 0.5ma



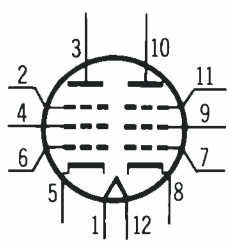
9RG

12BV11
Color Demodulators
Fil.—12.6V @ 0.45A (11 sec)



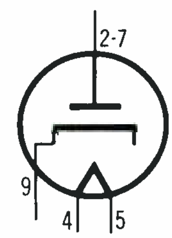
12HB

6BV11
Color Demodulators
Fil.—6.3V @ 0.9A



12HB

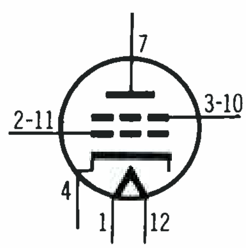
12DW4A
Damper
Fil.—12.6V @ 0.6A (11 sec)
PIV.—5.5KV @ 250ma



9HP

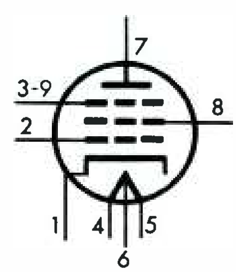
NOVAR

6HS5
High-Voltage Regulator
Fil.—6.3V @ 1.5A



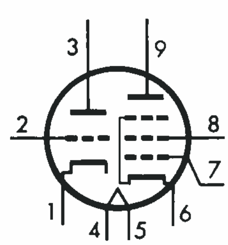
12GY

12HL7
Video Amplifier
Fil.—6.3/12.6V @ 0.6/0.3A



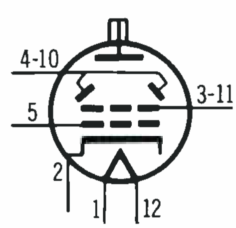
9BF

6KR8A
Pentode—Video Amplifier
Triode—General Purpose
Fil.—6.3V @ 0.775A



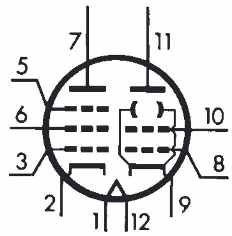
9DX

12JS6
Horizontal Output
Fil.—12.6V @ 1.125A



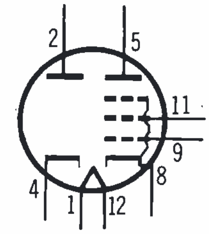
12FY

17BF11A
Pentode 1—Power Output
Pentode 2—FM Detector
Fil.—16.8V @ 0.45A (11 sec)
Shorter bulb than original



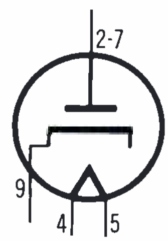
12EZ

33GY7A
Pentode—Horizontal Output
Diode—Damper
Fil.—33.6V @ 0.45A (11 sec)
Less snivets than original



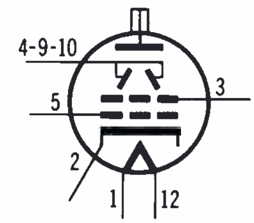
12FN

17DW4A
Damper
Fil.—16.8V @ 0.45A (11 sec)



9HP
NOVAR

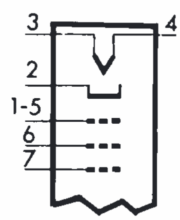
40KD6
Horizontal Output
Fil.—40.0V @ .45A



12GJ

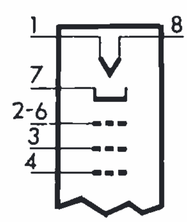
CATHODE-RAY TUBES

9UP4
Protection—none
Deflection—90°
Filament—126V @ .075A
Grid 2—100V
Neck Diam.—0.796″



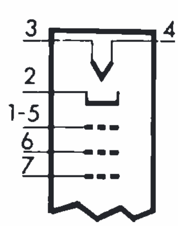
7GR

16CQP4
Protection—none
Deflection—104°
Filament—6.3V @ 0.45A (11 sec)
Grid 2—140V
Neck Diam.—0.788″



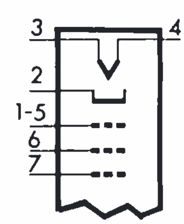
7GR

12CDP4
Protection—none
Deflection—104°
Filament—6.3V @ .45A (11 sec)
Grid 2—140V
Neck Diam.—0.788″



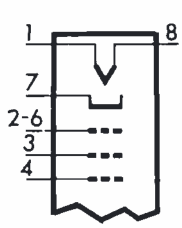
7GR

16CVP4
Protection—none
Deflection—114°
Filament—4.2V @ .45A (11 sec)
Grid 2—50V



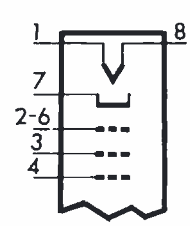
8HR

12CTP4
Protection—tension band
Deflection—110°
Filament—6.3V @ .45A (11 sec)
Grid 2—100V
Neck Diam.—.788″



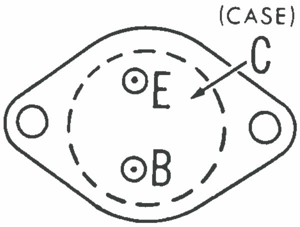
7GR

23JBP4
Protection—tension band
Deflection—110°
Filament—6.3V @ 0.6A (11 sec)
Grid 2—400V

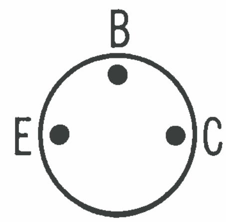


8HR

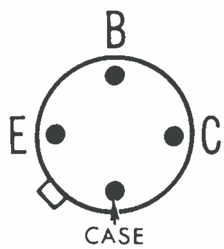
AD149
Vertical Output
PNP—Germanium



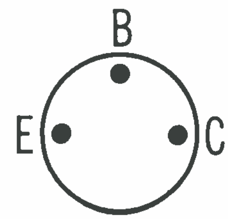
2N3566
Voltage Regulator
NPN—Germanium



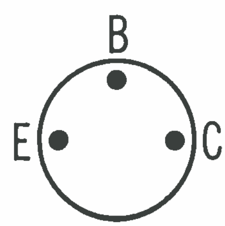
AF179
Video IF Amplifier
PNP—Germanium



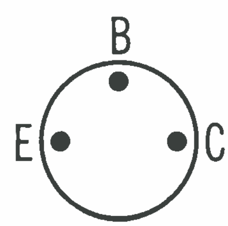
2N3567
Horizontal Amplifier
NPN—Germanium



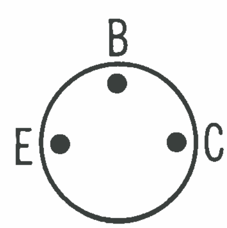
2N3568
Horizontal Amplifier
NPN—Germanium



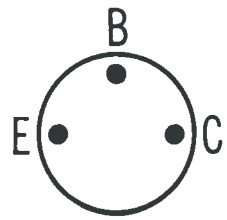
2N3569
Horizontal Oscillator
NPN—Germanium



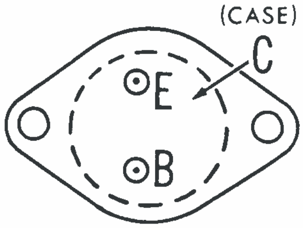
2N3638
Vertical Oscillator
PNP—Germanium



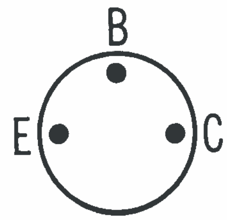
2N3640
Audio IF Amplifier
PNP—Germanium



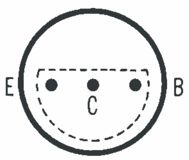
2N3731
Horizontal Output
PNP—Germanium



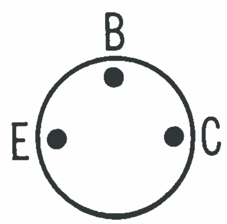
2N3663
Video IF Amplifier
NPN—Silicon



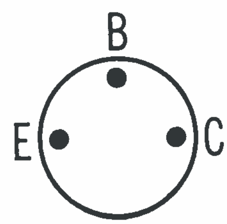
2N3855
Audio IF Amplifier
NPN—Germanium



2N3691
Audio IF Amplifier
NPN—Germanium



2N3885
Audio IF Amplifier
NPN—Germanium



how to SELL TV Antennas!

by Lon Canter

1965 was a banner year for color television. More than 2.5 million sets were sold. And because color TV is more difficult to receive properly than black-and-white, 1965 was also a banner year for TV antenna sales. The demand was so great that every major antenna manufacturer in the country was heavily back-ordered last fall.

1966 promises to be even better. Industry experts predict sales of more than 5.5 million color sets. This, in fact, will be the first year that color set sales exceed those of black-and-white receivers. Therefore, sales will soar for those technicians who know how to merchandise color antennas properly.

Merchandising is not some mysterious black art. It's just as logical an undertaking as determining why a resistor has burned out. Merchandising principles are well known and widely used in many fields. More important, these principles have been applied to antenna sales by a number of installers across the country. Thus, the techniques discussed in this article are tried and tested. They are a synthesis of the most effective methods used by the most successful TV antenna installers. In short, these techniques can double or triple your antenna business.

Tell 'Em What You Got

Communication is the first step in selling anything. You have to offer your products for sale. In fact, for mass merchandising, you have to offer your products for sale to many people. Further, you have to offer the products to the right people, at the right time, and in the right way.

There are two moments in a person's life when he is susceptible to buying a new outdoor antenna:

(1) When he buys a new TV set.

(2) When his old antenna gets wornout or damaged.

If you could have a salesman ready to contact all of the people in your area at these two moments in their lives, you'd enjoy fantastic sales.

Unfortunately, that ideal is unattainable. But you can try.

Your first step should be to contact all TV appliance stores in your area. Offer to install antennas for them on a contract basis.

Here's what you do for the appliance dealer:

(1) You train his TV salesmen in how to sell antennas. You show them which antenna to sell for which area (a marked-up map of the area is helpful), and indicate a price for each installation.

(2) You install the antenna for him, supplying all parts and labor.

(3) You stand behind the installation, handling any callback problems.

Here's what he does for you:

(1) He sells the antenna installation.

(2) He collects from the customer.

(3) He pays you for the installation, deducting his profit.

In selling TV appliance dealers, point out that what they make on the antenna sale is pure profit. They carry no inventory, have no turnover problems, and no headaches. Experience has shown that, in most areas, from 40% to 60% of their customers will buy antenna installations. Moreover, a good antenna keeps the color set sold and prevents callbacks.

Here's how the average sale works:

Charge to customer	$59.95
Appliance dealer cost	45.00
Appliance dealer profit	$14.95 or 25%
Your Costs	
Antenna	$12.00
Mast, cable, hardware, etc.	8.00
Labor	10.00
Total	$30.00
Your profit	$15.00 or 33%

As you can see, this sale is very profitable, both for you and the appliance dealer. Generally, the appliance dealer gives his floor salesman a 5% commission on the sale (in the case of the $59.95 antenna the salesman gets $3.00). Encourage this. It gives the salesman a good reason to try hard for the antenna sale. Make the salesmen's commission part of your original proposal to the appliance dealer. He pays the commission out of his 25% profit.

Use manufacturers' sales aids and literature in the appliance dealer's store. TV-set knob danglers (see

Get this $65 RCA color TV course FREE

when you buy this

WR-64B RCA Color Bar/Dot/Crosshatch Generator

or this

WR-69A RCA TV-FM Sweep Generator

or this

WR-99A RCA Marker Generator

or this

WO-91B RCA 5" Scope

That's right! RCA Institutes famous Home Study Color TV Servicing Course FREE, when you buy ANY ONE of the instruments shown here. Buy all four...get four courses. Enroll all your technicians while you equip your shop with the instruments you'll need for color TV servicing anyway.

Here's how it works: Simply buy one, or all, of the four instruments shown, the WR-64B, WR-69A, WR-99A, or WO-91B—ALL essential color TV test instruments—from your Authorized RCA Test Equipment Distributor between now and November 15, 1966. Fill out your warranty registration card and attach the white identification label on the carton. Send them to RCA, Test Equipment Headquarters, Bldg. 17-2, Harrison, New Jersey. We will send you the enrollment form and a binder containing the first two lessons. When you complete the lessons and forward them to RCA Institutes for grading, the next lessons will be supplied to you directly from RCA Institutes, all without charge to you.

But do it now. This offer is good only for equipment purchased between September 1, and November 15, 1966. To allow for postal delay, we will honor cards received up until December 1, 1966. Here's your chance to equip your shop for color servicing while we train your people for FREE!

Electronic Components and Devices, Harrison, N.J.

RCA

The Most Trusted Name in Electronics

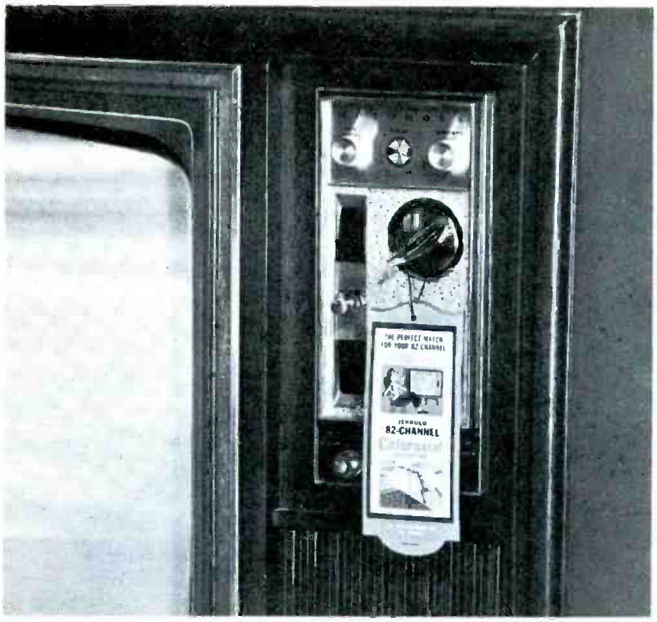


Fig. 1. TV-set knob dangler.

Fig. 2. Store display is lighted and animated.

Fig. 1) will serve to remind the customers that they can get an antenna with the TV set. Simple in-store displays (Fig. 2) invite antenna inquiries. Marked-up literature (Fig. 3) can be used by the set salesman to recommend the right antenna and show the customer what he is getting for his money.

Of course, you'll need an excellent knowledge of reception conditions throughout your area to recommend the right antenna for each job, and you'll have to negotiate suitable packages for each appliance dealer.

Once the customer has been sold a new set, what about the TV owner with the beat-up antenna? How do we reach him? The answer is his TV repairman. Many of the most competent technicians hate to climb roofs. They actually discourage antenna business. Call on all of the TV repair shops in your area and offer to contract antenna installations. Offer them the same terms as you offered the appliance dealer. Point out that you do all the work, have all the headaches, and yet they make 25%. Show them how easy it is to sell an antenna installation after they've repaired the set and reception is still far from perfect. Help them to step their customers up from an older antenna to a quality color antenna. They'll make a lot more money and you will, too.

Fig. 3. Sales brochures should always be available.

Direct Selling

Thus far we have discussed ways of increasing your business through other people. This is important. If you follow this program, you will add many men to your sales force.

However, we should not neglect direct sales. One important reason is that you make more money on your own direct sales—the 25% commission becomes yours.

Your first step in this direction is identification. You and all of your men should wear uniforms, with the name of your company and the antenna you carry marked prominently on them. Your trucks should be well painted and conspicuously marked. If you have a store front, window signs should be used, such as the American Institute for Better Television Reception sign shown in Fig. 4. And if you have any walk-in

• *Please turn to page 72*

Fig. 4. Window sign identifies you.

install ALLIANCE Tenna-Rotor®...now

Profit now with world-famous Tenna-Rotors®.

You'll sell more than ever before.

And they're twice as easy to sell!

In-store demonstrations sell on sight! Hook up a Tenna-Rotor . . . Every color set needs one . . . Then, watch their faces light up when you turn the dial and they see a beautiful color picture. Switch to black & white or FM Stereo. Same result: Tenna-Rotor pulls 'em in sharp, clear, bright and strong! **Use the color-TV delivery lag** to sweeten up **profits** with Tenna-Rotor sales, antenna and lead-in wiring jobs. Then, you'll be all set for fast, easy deliveries and installations.

Install the world famous Alliance Tenna-Rotor® *"TV's Better Color Getter"*

The ALLIANCE Manufacturing Company, Inc.
(Subsidiary of Consolidated Electronics Industries Corp.) **ALLIANCE, OHIO**
Maker of GENIE® Garage Door Openers

Circle 15 on literature card

BOOK REVIEW

Basic Microwaves; Bernard Berkowitz; Hayden Book Company, Inc., New York, 1966; 167 pages, 6″ × 9″; clothbound $5.95; paperbound $3.95.

This book is intended for the reader who desires to undertake a broad study of microwave technology, either as an end in itself or as a background for more detailed study later. The text begins with a chapter on the behavior of waves in free space. The subject is introduced in terms of physical concepts, and then the mathematical relationships are introduced and related to the physical principles.

Succeeding chapters introduce theory with increasingly specific application to microwaves. The second chapter describes the interaction of waves with objects. Topics include reflection, index of refraction, Snell's law, Fresnel equations, VSWR, and rectangular wave guides. Chapter three is concerned with antenna theory. The discussion includes horns, lenses, paraboloid reflectors, antenna patterns and gain, and other subjects. Chapter four describes several types of antennas. Chapter five is concerned with transmission lines. Considerable theory is included, and the use of the Smith chart in solving transmission-line problems is explained. The last chapter describes a number of microwave components, such as the directional coupler, magic tee, attenuators, detectors, etc.

The book has been written without the use of calculus, but the reader will need at least some familiarity with algebra, trigonometry, and geometry. Some prior knowledge of fundamental electrical and magnetic principles is also necessary. The text is liberally supplemented with line drawings and a number of photographs. A summary concludes each chapter, and a list of review questions (answers are not given) follows each chapter but the last.

While this text is designed as an introduction to microwaves, there is considerable information contained within its covers. The reader will not gain much from a superficial reading of the book; but if he is willing to expend a moderate amount of effort, he should acquire a basic understanding of microwave theory. ▲

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You get Sylvania Means Business (SMB)-Mister Right dealer certificates from your participating distributor. One certificate for every $12.50 worth of Sylvania receiving tubes you buy. And one for every picture tube—SILVER SCREEN 85®, *color bright 85*(TM) or COLOR SCREEN 85.

The more certificates you earn, the more gifts you can choose from. Check the selection with your Sylvania distributor. He'll give you an order form for prizes, too.

So start stocking up now—for prizes and for *profits.* Sylvania Means Business.

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

SYLVANIA

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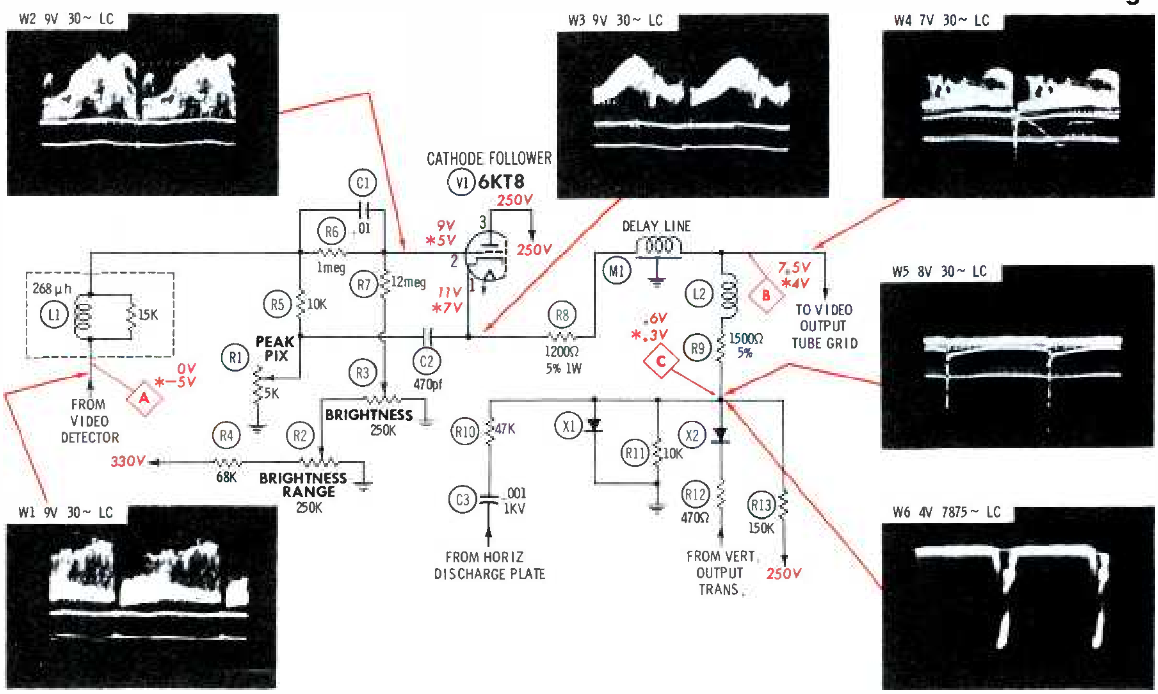
GENERAL TELEPHONE & ELECTRONICS GT&E

Circle 18 on literature card

Luminance Cathode Follower

Video Stages



DC VOLTAGES taken with VTVM, on inactive channel; antenna terminals shorted. *Indicates voltage taken with signal present — see "Operating Variations."

WAVEFORMS taken with wideband scope; TV controls set to produce normal picture and sound. LC (low-cap), D (direct) probes are used where indicated.

Normal Operation

Excellent frequency response, low distortion, and low impedance output make cathode follower good impedance matching device between high-impedance output of video detector and low impedance of delay line. Delay line is necessary to delay luminance signal approximately one microsecond so it will arrive at CRT at same time as chroma signal. Chroma signal is "slowed down" by narrow bandpass characteristics in color circuitry. Circuit above is from Zenith chassis 25NC38; other manufacturers use similar circuitry. Video-detector output is coupled through peaking coil L1 and RC network (C1-R6) to grid of V1. Coil and RC network accent highs in signal. Peak Pix control (R1), with R5 and C2, form adjustable peaking circuitry. Grid bias of tube is controlled by voltage divider network, consisting of R2 (brightness range), R3 (brightness), R4, and R7. Varying bias changes operating level of tube and controls amplitude of signal at cathode. Signal across cathode load resistor R8 is delayed by M1 and coupled directly to grid of video-output tube, point B. Both horizontal and vertical blanking information are also supplied to this point. Horizontal and vertical pulses from sweep circuits are fed to point C. Diodes X1 and X2 assure only negative pulses reach this point. Functions realized from this stage include impedance matching, a method of varying brightness level by controlling video amplitude, blanking pulse insertion, and automatic control of bias on video output stage according to amount of video signal.

Operating Variations

A DC voltage changes in direct proportion to amplitude of detected signal—from 0 volts at no signal, about −3 volts on fringe station signal, to maximum of approximately −8 volts on strong signal. Brightness control has no effect.

B Voltage varies approximately ±2 volts (normal 4 volts) with changes in brightness level. Voltage measures about −1 volt with signal and 1 volt without at minimum brightness; at maximum, 6 volts with signal, 9.5 volts without.

Pins 1, 2 Brightness control and brightness range determine voltage at pin 2 (grid) which controls cathode potential. Grid runs from 0 volts at minimum brightness to 14 volts at maximum; −4 to 10 volts with signal. Cathode is similar: 3 volts to 17 volts without signal; −.5 volts to 10 volts with. Voltages vary approximately ±2 volts with brightness.

WAVEFORMS W1 and W2 are output of video detector and amplitude is fairly stable due to AGC action. Picture is acceptable with about 5 volts p-p (maximum near 10 volts p-p). W3 and W4 composition and amplitude are dependent on brightness setting. Blanking pulse is constant but video information changes from zero (blanking pulse only) at minimum brightness, to 70% at normal, and 100% (video same amplitude as blanking pulse) at maximum brightness.

Symptom 1

Insufficient Brightness

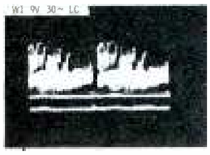
Sound and Other Picture Qualities Normal

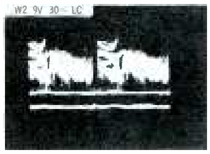
R7 Increased Value

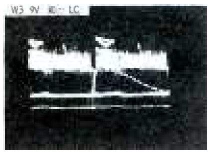
(Grid current limiting resistor—12 megohms)

Symptom Analysis

B-w picture and sound normal except for insufficient brightness—even with controls at maximum. Raster is full width, doesn't bloom, and focus is normal. Color picture is low in brightness, but chroma information is normal. Symptoms indicate loss of luminance signal.



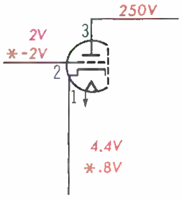




Waveform Analysis

Normal waveform at A (W1) and at grid of V1 (W2), both in amplitude and content, indicates receiver front-end circuits are operating normally. Waveform at cathode of V1 (W3) looks normal at first glance, but closer observation shows that overall amplitude is near normal 9 volts p-p, but video information is only about half this amplitude. Rest of waveform amplitude is blanking pulse fed back from point B. Normally, W2 and W3 are similar in amplitude and content.

Voltage and Component Analysis



Voltage readings taken with brightness controls at maximum. Normal grid voltage is about 14 volts with controls at maximum. Cathode voltage is wrong since it depends upon grid bias. Increased R7 (approximately 25 megohms, normally 12 megohms) reduces bias and changes operation of tube. Cathode waveform is clipped and low in video information. Since the waveform amplitude is near blanking, loss of brightness results. Wrong cathode voltage causes incorrect bias at video-output. R2, R3, or R4 could cause similar symptoms.

Best Bet: Careful scope work; then VTM.

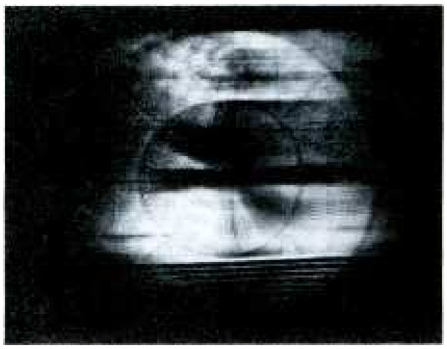
Symptom 2

Pix Smeared and Streaked

Pix Also Lacks Detail

C1 or R6

(RC Decoupling and Peaking Network)

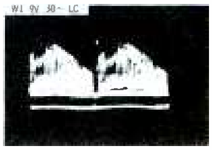


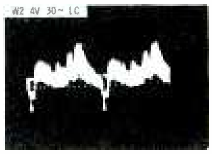
Symptom Analysis

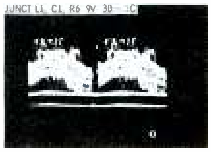
B-w picture smeared and streaked—lacks detail. Brightness, contrast, and fine tuning operate but do not improve picture. Color program shows same trouble in luminance, but chroma seems normal and color and hue controls operate normally.

Waveform Analysis

Waveform at A (W1) normal as would be expected since color signal appears normal—color information from this point fed to bandpass amplifiers. Next checkpoint—pin 2 of V1 (grid)—shows definite trouble. Amplitude is about half of W1 and video content greatly reduced. Trouble definitely isolated to input circuitry, and waveform check at junction of L1, C1, and R6 further pinpoints defective component since waveform is within expected tolerances.







NO VOLTAGE CLUES

Voltage and Component Analysis

Voltages are well within normal tolerances, with and without signal. Grid and cathode voltages measure slightly below normal with signal applied, but these readings change with content of video signal and are acceptable. Waveform analysis isolates defective component to C1 or R6. These components form RC network for decoupling and also accent high-frequency portion of video signal. C1 offers little impedance to high frequencies when operating normally; but, with capacitor open, signal is coupled through R6 only.

Best Bet: Scope will locate.

Vertical Retrace Lines

Symptom 3

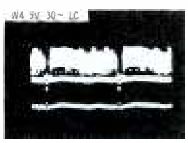
Very Pronounced Off Channel

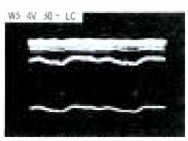
X2 Open

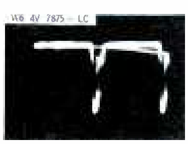
(Blocking and Waveshaping diode)

Symptom Analysis

Vertical retrace lines all through picture during both color and b-w. More predominant in scenes with high brightness and low contrast. Lines can be eliminated by reducing brightness and increasing contrast controls, but picture too dark.







Waveform Analysis

Waveform at point B sufficient in amplitude and content to produce normal picture (5 volts p-p versus 7 volts p-p normal), but vertical blanking spike is missing. Waveform W5 shows what appears to be horizontal pulses of proper amplitude; however, vertical pulses (normally twice horizontal in amplitude) are missing. W6 proves horizontal blanking signal is normal. One more waveform check at junction of X2 and R12 would isolate trouble.

Voltage and Component Analysis

NO VOLTAGE CLUES

Most color TV manufacturers use both horizontal and vertical blanking to eleminate retrace lines. Source and insertion of the blanking pulses vary greatly between manufacturers. This chassis uses horizontal pulses from plate of horizontal discharge tube and vertical sawtooth from convergence winding of vertical-output transformer. X1, X2, and associated circuitry shape waveforms and prevent any positive going information from being introduced into video signal. Loss of blanking is more noticeable on weak CRT.

Best Bet: Scope will locate.

Weak Picture

Insufficient Brightness

Symptom 4

M1 Internal Leakage

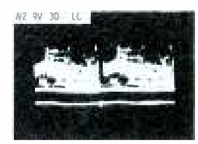
(Delay Line)

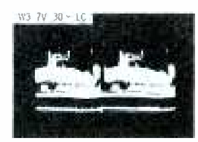
Symptom Analysis

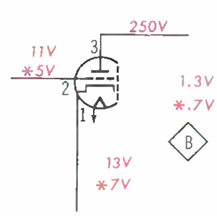
Symptoms similar to situation 1—width and focus normal—except video appears weak. Contrast control doesn't change picture much. Chroma information displayed normally, but lacks luminance signal. Screen, with no signal applied, is darker than normal.

Waveform Analysis

Symptom indicates loss of luminance signal. W2 shows near normal waveform. W3 is slightly below normal (7 volts p-p—normal 9 volts p-p) but sufficient in amplitude and content to produce picture. Circuit tracing to point A isolates trouble since W4 is greatly reduced (2 volts p-p, normal 7 volts). Most of signal is blanking information, with almost no video information. The normal amplitude loss is only about 2 volts between cathode of V1 and point B.







Voltage and Component Analysis

Voltage at point B with signal only .7 volts (normally 4 volts). Grid and cathode of V1 show readings within tolerances. (Grid and cathode might be even higher since brightness control may be advanced to brighten picture). Point B is also grid of video-output tube, so a short here, in addition to almost eliminating W4, upsets bias of next stage. Result is loss of necessary video signal at CRT cathodes needed to bias CRT into conduction. In this case, delay line M1 has internal leakage of about 200 ohms to ground.

Best Bet: Scope to isolate; VTVM to pinpoint.

Varying Picture Quality

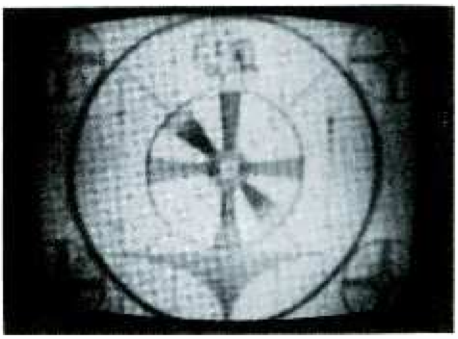
Symptom 5

Weak, Blurry Picture

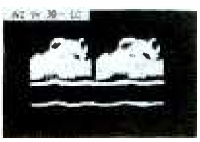
L2 Defective

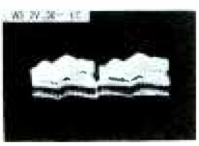
(High-Frequency Filter Coil)

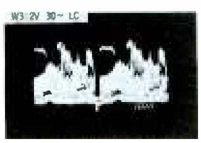
Symptom Analysis



At times screen is dark at any brightness control setting. Other times, screen may be dark at maximum brightness, with almost normal picture at lower settings. Most of time, picture shows excessive brightness, impossible to focus, and retrace lines evident.



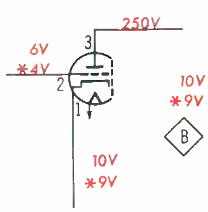




Waveform Analysis

Brightness control action (or lack of action) indicates video-circuit problems. Input waveform (W2) shows normal amplitude and content (9 volts p-p). W3 indicates trouble in V1 since amplitude is very low (2 volts p-p versus 9 volts p-p normal) and video portion of waveform seems to be riding near blanking level. With brightness control at maximum (dark screen), W3 shows much of video information above blanking level. Conclusion: output circuit (cathode) at fault.

Voltage and Component Analysis



Voltage readings at cathode and grid of V1 are incorrect, unstable, and inconclusive. Voltage at cathode and point B indicates no voltage drop across R8 and M1. L2, R9, and R11 form DC path to B− for V1 cathode and video-output grid. Defective component in this circuit upsets cathode follower and video output. Since cathode is "floating", V1 doesn't conduct properly, if at all. Little or no signal is fed to video-output grid, which results in cutoff of stage. CRT cathodes lose bias and high-voltage circuits can be damaged.

Best Bet: Scope; then VTVM.

Insufficient Contrast

Symptom 6

Fine Detail Missing

L1 Open

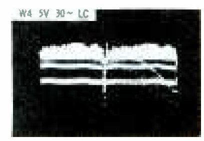
(Part of Peaking Unit)

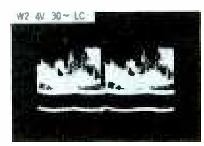
Symptom Analysis

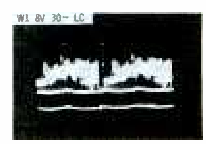
Blacks not black enough, even at maximum contrast setting. AGC adjustment doesn't help. Appears to be video-output problem. Brightness must be reduced in order to balance b-w portions of picture (contrast). Fine detail missing and some smearing evident.

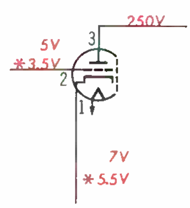
Waveform Analysis

Symptoms indicate video output problems. W4 is good starting point. W4 p-p amplitude is a little low (5 volts, normally 7 volts), but most is blanking pulse with less than half video information. This indicates trouble is before video output. W2 greatly reduced with only 4 volts p-p (normally 9 volts). Near normal waveform at point A isolates trouble to cathode-follower input circuit. Check at junction of L1 and C1-R6 would pinpoint defective component.





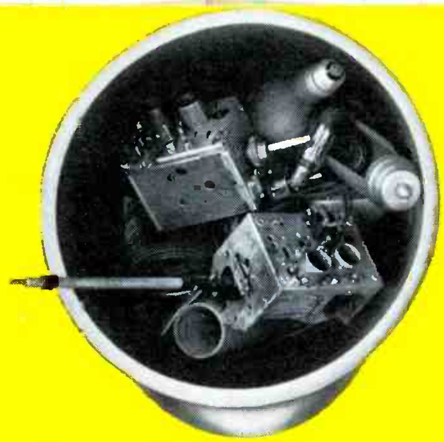




Voltage and Component Analysis

Voltage measurements at grid and cathode of V1 and point B, although lower than normal, offer no real clue since they are controlled by brightness control and it is set lower than normal in an effort to compensate for reduced contrast. Normally, L1 accents high-frequency portions of signal, but with coil section open signal loses amplitude and high-frequency information across resistor. Since coil and resistor are manufactured as one unit, an open common lead would cause complete loss of luminance signal.

Best Bet: Scope is adequate.



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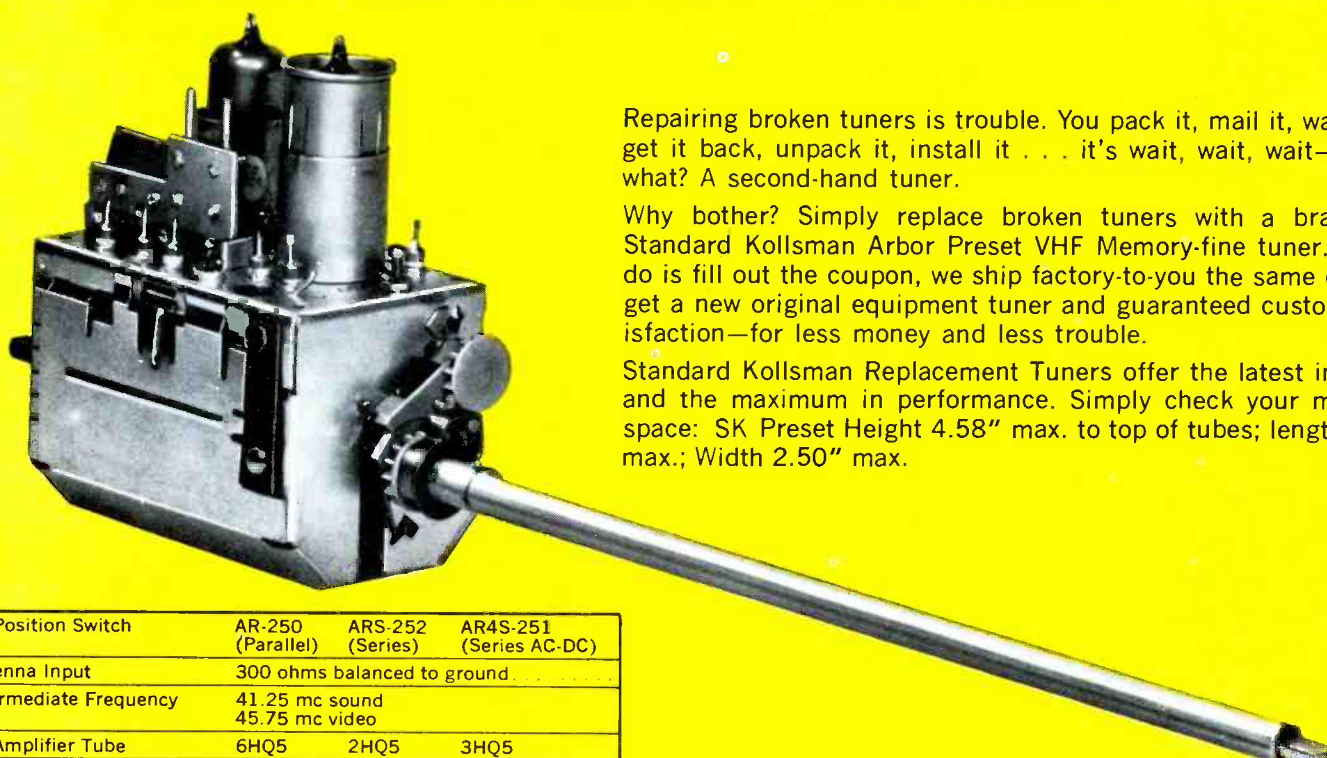

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Antenna Input	300 ohms balanced to ground		
Intermediate Frequency	41.25 mc sound 45.75 mc video		
RF Amplifier Tube	6HQ5	2HQ5	3HQ5
Oscillator-Mixer Tube	6GX7	4GX7	5GX7
Heater	6.3 volts	600 ma	450 ma
B Plus	125-145 volts dc		

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Notes on Test Equipment

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

by T. T. Jones

Lab 'Scope

The instrument pictured in Fig. 1 is designed to fill a gap in the line of oscilloscopes available in today's market. Heretofore, scopes have been confined to two general types; the service type, and the laboratory type.

The service types have been available in many forms. Narrow band, wide band, calibrated vertical, and even a few with triggered sweep. They usually cost in the range of $50 to $250.

The lab scopes have features which greatly increase the range of their applications. Foremost is the calibrated time base. With this feature, it is possible to measure frequency of a wave, or time of a pulse. Other desirable features are wide bandwidth, fast rise time, stable triggering, and delayed vertical sweep. Many other features are desirable for specialized applications. All of these features cost money, and for this reason, lab scopes have previously cost from $500 up into the thousands of dollars.

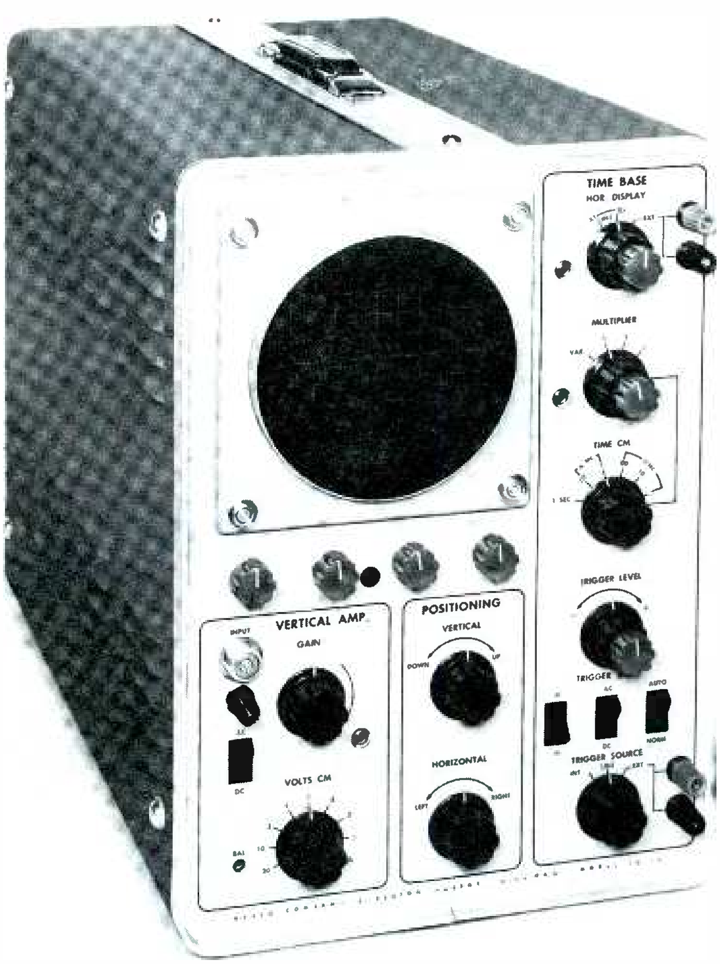

Fig. 1. New laboratory oscilloscope.

HEATHKIT MODEL IO-14 SPECIFICATIONS

Vertical:

Sensitivity:
0.05 v/cm

Frequency response:
DC to 5 MHz —1 db
DC to 8 MHz —3 db

Input impedance:
1 megohm shunted by 15 pf.

Attenuator:
9-position compensated, calibrated in 1, 2, 5 sequence. Continuously variable uncalibrated control between steps. Accuracy ± 3%.

Maximum input:
600 volts P-P. 120 volts P-P provides full-scale deflection on highest scale.

Horizontal:

Time base:
Triggered 18 steps in 1, 2, 5 sequence from 0.5 sec/cm to 1 microsecond/cm. Continuously variable uncalibrated control on each step. Accuracy ± 3%.

Magnifier:
× 5, accuracy is ±5% when magnifier is on.

Trigger:

Capability:
+ or − slope, AC or DC coupling, variable slope control. "Auto" position provides triggering at about 50 Hz. Internal, external, or line input.

Requirements:
Internal; ½ to 6 cm display.
External; 0.5 volts to 120 volts P-P.

General:
CRT: 5ADP2 or 5ADP31. Interchangeable with any 5AD or 5AB series tube. Magnetic shield. Power supply: fully regulated over range of 105—125 VAC or 210—250 VAC line voltage.
Has Z-axis input, access for direct coupling to vertical plates.

Power Requirements:
115 or 230 VAC, 50/60 Hz, 285 watts.

Size (HWD):
15″ × 10½″ × 22″ overall

Weight:
40 pounds

Price:
$299 kit, $399 wired.

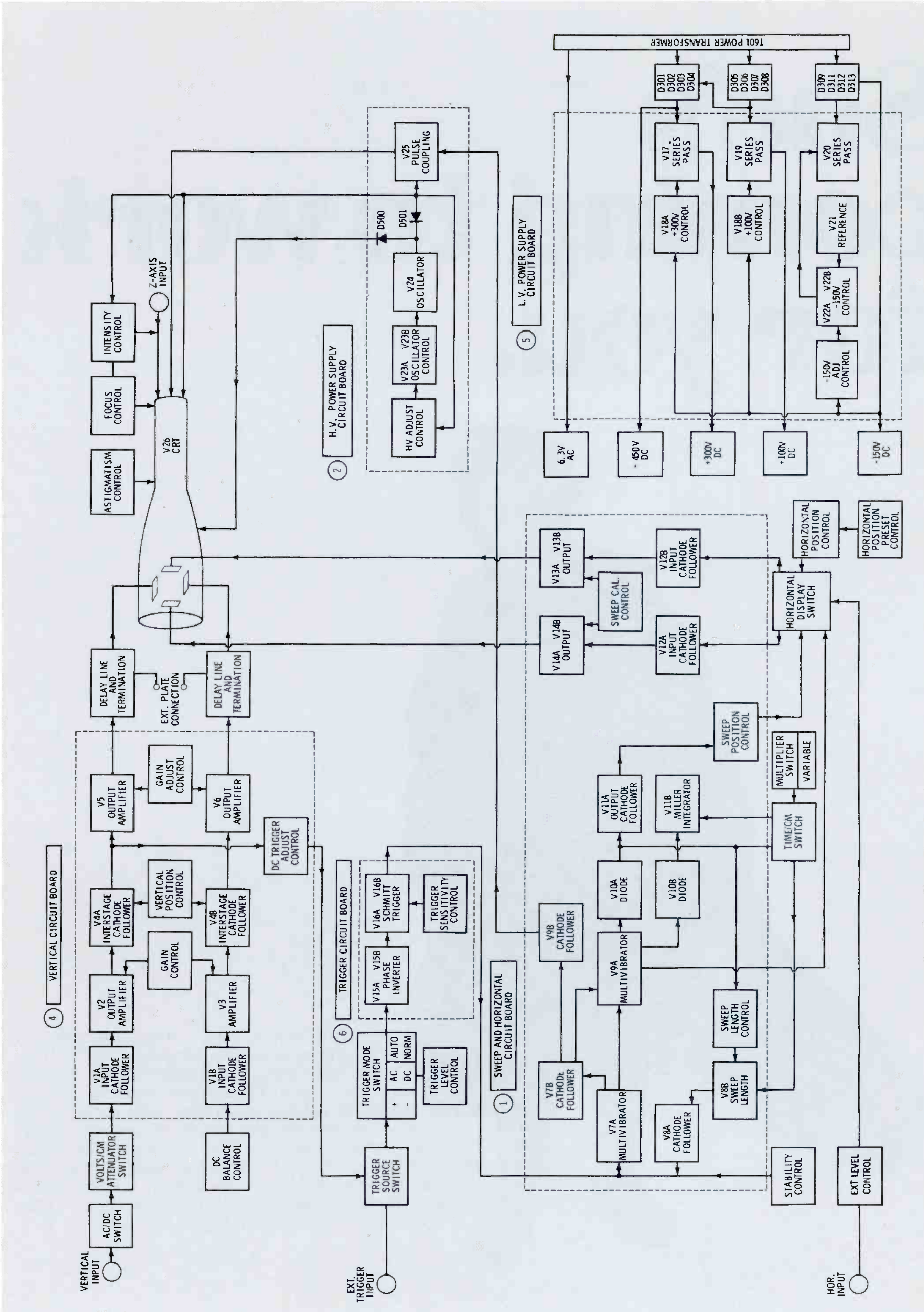

Fig. 2. Block diagram shows many stages

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MODEL #65-2 $39^{95} list

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Finco's famous 2-tube, 4-set VHF-TV OR FM Distribution Amplifier is now available for 75 OHM CO-AX or 300 OHM operation.

Price? You can't beat it! Rugged quality? Finco's got it! Performance? Finco challenges 'em all!

Equip either model with Finco low-loss splitters (#3001 or #3003) and you can drive up to 16 sets in a master antenna system!

FINCO MODEL #65-1 $29.95 list

Outstanding Features:

• 350,000 microvolts maximum input with +8dB to each output • Maximum signal output of .85 volts in each of 4 outputs • Low noise 6HA5 premium tubes • One 300 ohm input — 4 300 ohm outputs • Silicone diode rectifier for dependability • Flat response — ±1/4 db per 6 mc channel • Ventilated perforated steel cabinet 6⁵⁄₁₆ x 3⁷⁄₁₆ x 3⁹⁄₁₆" • Metal enclosed to eliminate shock hazard — easy access for servicing • Easy mounting and connecting • All fittings & brackets supplied • UL listed AC cord — 117 volts, 60 cycles • 100% test for all electrical characteristics

FINCO MODEL #65-2 $39.95 list

Outstanding Features:

• 400,000 microvolts maximum input with +6dB to each output • 200,000 microvolt input — 1 volt output per band • Low noise 6HA5 premium tubes • One 75 ohm input — 4 75 ohm outputs • Most compatible "F" type input and output fixtures • Ultra-flat frequency response and complete RF isolation • Ventilated perforated steel cabinet 6⁵⁄₁₆ x 3⁷⁄₁₆ x 3⁹⁄₁₆" • Metal enclosed to eliminate shock hazard — easy access for servicing • Easy mounting and connecting • All fittings & brackets supplied • UL listed AC cord — 117 volts, 60 cycles • 100% test for all electrical characteristics

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Circle 23 on literature card

Heathkit has filled the price gap with the IO-14. However, they didn't fill the feature gap. Instead, they have built a full-fledged laboratory oscilloscope. With all the above-mentioned features, and more, the IO-14 is available for under $300 in kit form, or $399 fully wired and tested.

A look at the block diagram (Fig. 2) will show that this is a quite complex instrument. There are 26 tubes, many of which are dual purpose. There are also 14 diodes, all used as rectifiers. The low-voltage power supply alone has 7 tubes and 12 diodes. This is necessary to maintain exact values of voltage, and hence calibration, under all reasonable line-voltage fluctuations.

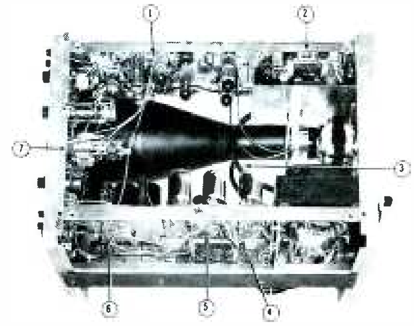

Fig. 3. Left side view.

Fig. 3. shows the IO-14 from the left side, with the side panel removed. Several features of interest are numbered. Number 1 is the sweep and horizontal circuit board. This board, like all others in the IO-14 is made of fiberglass, rather than phenolic, and is virtually impossible to crack.

Arrow 2 points to the high-voltage power supply. The output here is +2500 volts to the anode and −1750 volts to the cathode. The voltages are closely regulated, and the supply is well shielded.

The delay lines are indicated by arrow 3. An explanation of their functions can be found in the article "Recommended Equipment for Square-Wave Testing" in this issue.

Number 4 is the vertical circuit board. The vertical circuits can be roughly compared to a stereo amplifier, but the frequency response in this case is flat within 1 db from DC to 5 MHz and 3 db out to 8 MHz. The output tubes are the familiar 12GN7 video pentodes.

Arrow 5 indicates the low-voltage power supply. The "B" voltages produced here are −150, +100, and +300, all fully regulated. These voltages supply all circuits in the instrument except the HV supply. The +450 unregulated output furnishes power to the HV supply, which has its own regulation.

Indicated by arrow 6 is the trigger circuit board. These circuits include a two-stage phase inverter which operates as either a conventional amplifier or a grounded-grid amplifier, depending on the position of the mode switches.

Number 7 indicates the time/cm switch, interesting because of the close tolerance parts. The capacitors as well as the resistors on this control are 1% tolerance.

Building the kit cannot be called an easy task by any means. Simple, yes. The instruction book is clearly written and profusely illustrated, and there's no reason to get in any trouble during assembly. It was a one-man job too, as there was no operation that required "three hands". But it is a time-consuming job. Our assembler had built many kits before, and this one took 25 hours to assemble, in seven sittings. It took an additional six hours to checkout and calibrate the unit. Part of this time was due to wrong wiring in the power supply. Equipment required for calibration is a VOM, a square-wave generator, and a sine-wave generator, both of which should produce 1 kHz and 100 kHz signals. Remember that the scope will only be as accurate as the equipment used to calibrate it.

The IO-14 has many other features of interest. Among these are the "pin-ball" lights, which go on when the vertical and horizontal sweep circuits are switched to an uncalibrated position. There is also a light to indicate when the sweep magnifier is on. The front panel has been designed to give "eye-appeal", with red and black easy-to-read lettering. The CRT graticule has been black-opaqued outside the scale, and there is a green filter behind it. The graticule is illuminated and has the same dimension mounting holes as those of the Tektronix 540 series. Thus, there are many accessory items such as bezels, cameras, etc. readily available for the IO-14. ▲

For further information circle 78 on literature card

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Severe picture disturbance due to ignition noise.	Ignition noise minimized—but not eliminated.	Eliminates automobile ignition noise.

New 8290 Shielded Permohm TV Lead-in combines the strong signal strength of twin-lead with the clean signal protection of shielded cable. Because it is a balanced line for 300 Ohm TV antennas and receivers, *costly matching transformers and connectors are eliminated.*

8290 is specifically designed for superior color reception on all 82 channels. The twin-lead is encapsulated in low-loss cellular polyethylene insulation, Beldfoil** shielded against all outside disturbances, and protected with a weatherproof jacket. A drain wire is provided for grounding the shield. The need for stand-offs, twisting or routing of lead-in is eliminated. 8290 can be taped directly to a mast or tower, routed through metal pipe, buried underground, or even installed in rain filled gutters to reduce installation time and cost.

Ask your distributor about 8290 Shielded Permohm TV Lead-in cable, today! Or, write P. O. Box 5070-A for complete information.

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8-9-5

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Circle 24 on literature card

Electronics Industrial Giant

by Ralph M. Scott

Not since the 19th Century Industrial Revolution has there been so great an impact upon the social, economic, and political world as has been made by the incredibly rapid rise of the electronics industry. True, the "atomic age," the "space age," the "nuclear age" have far-reaching international implications. They have seriously affected the military and economic status of most nations. They have created awesome relationships among major world powers.

But the skyrocketing electronics industry has infiltrated the lives of **individuals.** And its products today affect every other industry. Thinking persons recognize the international significance of atomic energy and of space exploration — especially the cost. Nevertheless, electronics has already had unalterable effects on the daily and personal lives of millions of people—on the job, in the home, in the school. Yes, even in the church.

There is no doubt that by virtue of the products created by the electronics industry, this new industry will have a greater influence on the individual American than even the rise of the steel and automotive industries at the turn of the Twentieth Century.

Consider the electronics products now in existence: data computers of every type, television, phonographs, tape recorders, high fidelity components, electronic organs—to name a few. These devices affect industry, business, the home, the church, and the school. In turn, what could conceivably have more effect upon the individual than these institutions?

Especially at present, when national economy, inflation, and spending are front page and editorial news daily, it is significant to examine the impact of electronics on the national economy.

According to the **Electronics Yearbook 1965,** total electronics factory sales (consumer, industrial, and government products) increased from \$12.173 billion in 1961 to \$16.135 billion in 1964, a 32.6% rise. Figures yet to be published will show even a more startling increase for 1965. At the same time, between 1961 and 1964 replacement-component sales increased from \$580 million to \$620 million. Therefore, it follows that work done by service repair technicians increased proportionately.

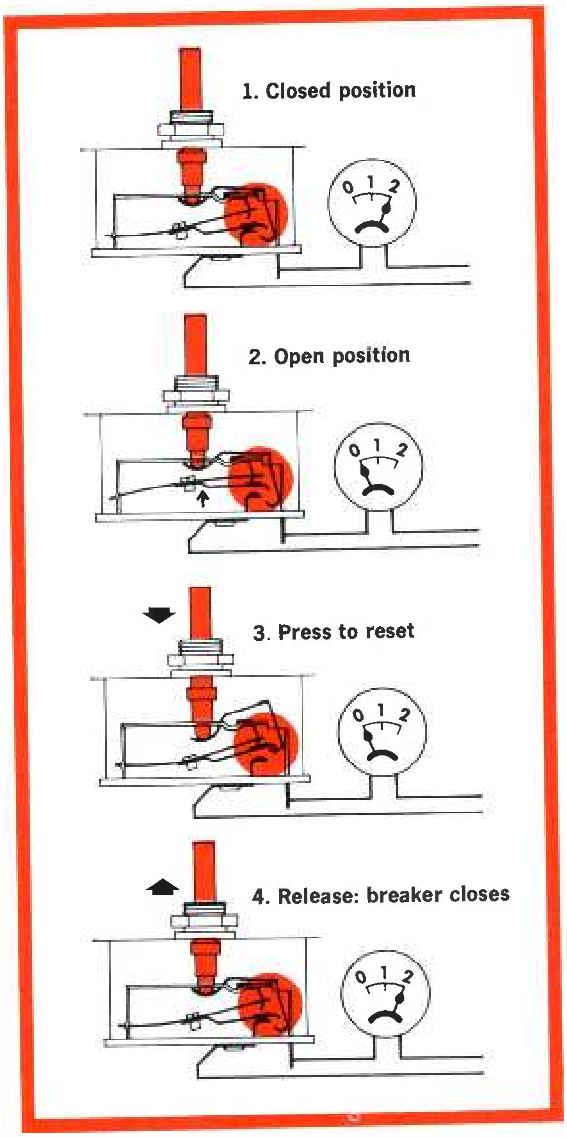
Statistics from the 1965 Yearbook reveal especially the effect of electronics on American homes. Excluding the phenomenal rise in TV sales, in the area of phonographs, high fidelity components, tape recorders, electronic organs, and many other home devices such as intercoms and door controls, factory sales rose from \$587 million in 1961 to \$863 million in 1964. This is a 47% increase. No other industry can claim such a tremendous sales explosion.

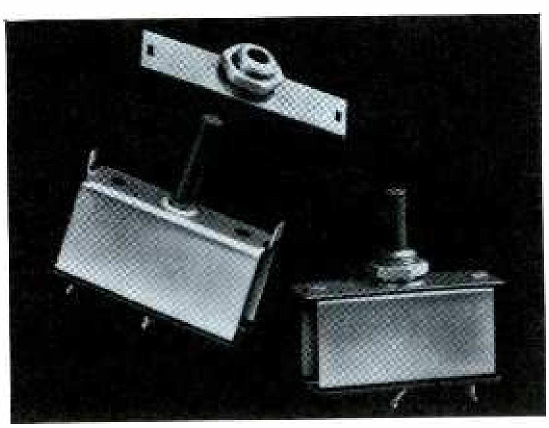
Considering TV sales, the cumulative nine-months distributor sales in 1965 totaled 7,412,808 units, an increase of 19.4% over sales from January to September, 1964. Black-and-white sets showed a 4.19% increase in 1965 over 1964. But color TV showed an incredible 121.65% increase in sales during the same period.

That the various electronics corporations recognize the continuing rapid expansion in products sales is illustrated by these facts: Philco will spend \$20 million to build a color television tube manufacturing plant in Pennsylvania to produce 500,000 additional tubes annually. This corporation also is expanding its Micro-

MALLORY Tips for Technicians

Tips on replacing circuit breakers





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

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

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

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

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

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

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

50th ANNIVERSARY

Circle 26 on literature card

electronics Operation to triple production and create 450 new jobs. RCA Victor Co., Ltd., has announced it will spend $25 million to establish a color television picture tube manufacturing facility. This is the largest single expansion in the history of the Canadian electronics industry. At the same time, RCA will build a $25 million color picture tube manufacturing plant in Scranton, Pa. Zenith Corporation will spend $17 million in a manufacturing expansion program that will increase production of picture tubes 50% by the end of 1966. Zenith expects its annual output of picture tubes to reach 2,000,000 in 1967. Other companies are expanding their facilities in the same way.

Thirty million television sets are now in operation in the United States. The expansion in manufacture by electronics corporations indicates perhaps twice this number of sets within a brief period of time.

While by far the largest percentage of television programs viewed are entertainment, there have been recent giant steps taken in establishment of educational TV in grade and high schools, colleges, and universities. For example, in the Detroit Public School System, in January 1966, two microwave channels began ETV broadcasts simultaneously with an existing UHF educational channel. Similar operations are either planned or are in effect in many other school systems. Colleges nationwide are utilizing television daily in all manner of instruction. Grants in the hundreds of thousands of dollars are made monthly by the Department of Health, Education, and Welfare to establish or improve educational TV. President Johnson has approved the formation of a commission on educational television financed by the Carnegie Corporation of New York to study educational TV. The influence of TV on American education is already incredible. New methods of instruction, accelerated and advanced instruction, and vast new areas of knowledge are becoming available daily to millions of students of all ages, including adults.

Television has brought religious programs of all faiths weekly—even daily—into homes whose members may never have been inside a church. Programs of worship and religious education are broadcast from stations nationwide.

Finally, the electronics industry, TV in particular, has been responsible for the greatest increase in dissemination of world news since Gutenberg's invention of printing. Daily news reports and news evaluation programs bring up-to-the-minute news to millions of viewers. Telstar and Early Bird bring European news events live to homes from Florida to Washington State, from San Diego to Bangor, Maine, to rich and poor alike. Americans are taking an unbelievable interest in sports events of which they knew little or nothing a few years ago.

True, much criticism is justly directed toward many television programs. And data computers have been proven to be far from infallible.

Yet the first horseless carriage is a far cry from super-powered automobiles speeding along super highways. Only about 65 years separate the two. Just 63 years ago, the Wright brothers flew 120 feet at less than 20 miles an hour. That is less footage than the wingspan of supersonic jets. How long has the electronics industry been in existence?—What the future holds for Americans as a result of electronics is beyond imagination.

But there is a sobering, very realistic factor to be considered by every member of the industry—from the largest manufacturer to the single independent TV repair and service technician. That factor is the major role electronics plays in the national economy.

Electronics Yearbook 1965 noted that between 1961 and 1964 sales of electronic organs increased from $51 million to $105 million — and added that the **decline in organ prices** probably accounted for their popularity. And this came during a period when the cost of living was steadily rising (as it still is).

Because of the vast influence that electronics now exerts — and will exert — on American lives, the industry must assume a major portion of leadership in stabilizing the national economy, under our system of private enterprise. Inflation, in 1966, is perhaps a worse threat to our well being than the crisis in Viet Nam. It therefore behooves all ele-

Please turn to page 90

Circle 29 on literature card

ARE YOUR SHELVES *BOOSTER PROOF?*

by James Scott #30171

1965 was a good year for the electronics business. It was also a good year for me. As a professional shoplifter, or booster, I managed to walk off with nearly enough amplifiers, radios, and similar items to open my own shop. And there is an excellent chance that at least a part of that loot came from your shelves.

I wasn't the only one getting an easy dollar at your expense. According to the law books, shoplifting is known as larceny or simple theft, and next to disorderly conduct it results in more convictions than any other offense. Authorities estimate that we steal about $200 million worth of goods from retailers every year, or in other words, 2% of gross sales.

A professional shoplifter isn't too particular where his share of the 2% comes from so long as what he steals meets two requirements: (1) it has to be reasonably portable, and (2) it has to be something he can sell for a good price. Quite obviously, transistorized tape recorders, radios, amplifiers, TV sets, and even the whole range of bulkier electonic items (many thoughtfully supplied with handles) make ideal loot.

Most of my own work, for instance, was done in transceivers. I had a ready market for all I could steal, and the handy compactness of these items gave me about the highest value-to-bulk ratio possible. This is a very important factor, since no booster with any "smarts" about him is going to clout (or steal, as a layman would say) a twenty-pound bale of linen if he can get the same price for a one-pound radio.

From a man who knows—a man now serving two to four years in the penitentiary as the price for knowledge—here is sound advice on a problem that must be faced by any service shop handling retail equipment.

Discounting kleptomaniacs—who make colorful newspaper copy, but who are as rarely encountered in service and sales shops as the barracuda—shoplifters fit into one of two categories: There are the professionals, like me, who go at it strictly for a living; and there are amateurs. This second group is by far the more numerous; and even though its members lack the precision and finesse of professionals, they still manage to account for sixty percent of your losses. For sheer volume, they make men of my stripe look like the rankest of amateurs. They include everything from juvenile delinquents to respectable matrons, and their reasons for stealing range from kicks to miserliness. These people take your merchandise simply because they want it, and because it is small and not under glass. Professionals take it because it is easy to convert into cash.

Shoplifters present a double threat to any business. By walking off with merchandise they take a direct slice out of profits—and indirectly they take even more by preying on customers. One of the biggest hazards of shoplifting is getting caught, in or out of a store, with merchandise that has no sales slip. Many professionals get around this by concentrating on items that have already been bought and paid for by legitimate customers. They wait until a customer puts down a purchase while looking for another item, then they scoop up the neatly wrapped bundle and casually stroll away.

This seemingly casual boldness is characteristic of professionals. I've known many who worked so openly that they would walk into a shop, wave a greeting at the first employee they met, then pick up something perfectly ridiculous—say a console TV—and shove it out the door. And

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Compare these features and you'll decide in less than 8 minutes that you need a new Sencore Lo-Boy.

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NO. 1 MANUFACTURER OF ELECTRONIC MAINTENANCE EQUIPMENT

426 SOUTH WESTGATE DRIVE, ADDISON, ILLINOIS 60101

Circle 30 on literature card

they get away with it because people don't associate such openness with larceny. At least not quickly enough. Rather than set up a screech for the law, they stop to wonder whether the manager might not have authorized removal of the merchandise, or another employee transacted its sale.

Most people, in fact, just don't believe they are going to be robbed. One old boosting partner of mine used to take advantage of this in a big way. We called him "steamboat" because he actually used a small steamer trunk to conceal his stolen merchandise. Steamboat used to manhandle that trunk into a shop, wiping sweat from his brow and singing a tale of woe about his mother-in-law who had just blown into town; and here he is, stuck with her stinking luggage when he's got all this shopping to do. Steamboat really puts on an act. As he stood there gasping for breath like a carp on a river bank, he carefully picked out the items he was going to steal—an expensive speaker, perhaps, complete with enclosure; or a couple of amplifier kits. Whatever items he picked out, as soon as the salesman's attention strayed elsewhere, he would spring that trunk on them like a bear trap.

Usually he purchased a phono cartridge or an an album rack. Then, as often as not, he would con the manager into helping him carry the trunk out to the curb where he could catch a cab. And that is probably the cruelest cut of all, making a businessman accessory to the theft of his own merchandise.

But, to one degree or another, you are almost always an accessory to the theft of your merchandise, because such losses are generally invited by carelessness, indifference, or lack of awareness.

There is no sure way of eliminating theft. So long as hi-fi components and other easily portable items are displayed on open counters and shelves, merchandise is going to turn up missing. Such thefts, however, **can** be greatly reduced if you take precautions and if you know what to watch for.

Probably the most basic protection against theft is to keep all open displays in neat order and to keep all stacks filled. Whenever pos-

the instrument with endless uses... the all new improved completely solid state SENCORE FS134 FIELD STRENGTH METER

HERE ARE JUST A FEW OF THE MANY USES...

A. INSTALLING AND CHECKING OUT DISTRIBUTION SYSTEMS

Qualify for this multimillion dollar business in hotel, motel, and hospital installations.

B. INSTALLING UHF, VHF, AND FM ANTENNAS

Cut down installation time and pay for the FS134 in a short time on critical UHF as well as VHF and FM antennas.

C. COLOR INSURANCE

Be sure the signal is adequate on each channel for proper color TV operation.

D. CHECK TRANSMISSION LINES

For the first time read actual db loss in either 75 or 300 ohm transmission lines.

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For actual db gain; see which is best for each location, both VHF and UHF. Also excellent for orienting "dishpans" for translator use at the high end of UHF band.

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For correct frequency and output all the way up to a tenth of a volt RMS. What a time saver when you want to know if your generator is putting out.

PLUS: LOCALIZE NOISE AND INTERFERENCE

Find noise source fast; pick quiet locations for antenna installations or orient antenna away from noise when possible.

These are only a few uses of this UHF-FM-VHF accurately microvolt calabrated field strength meter. You can start paying for the FS134 tomorrow in the time saved today — if you see your Sencore distributor now. Why not pick up the phone and ask him to show you the new FS134?

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NEW STAR ON COLOR TV

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1. *You need an excellent antenna for good color TV reception.*
2. *Jerrold Coloraxial antennas are best because they use shielded coaxial cable—like TV studios use.*
3. *Your antenna should be installed by a professional—the Jerrold Coloraxial Reception Specialist.*

Yes, the Jerrold Coloraxial Reception Specialist plays a starring role in these commercials. He is a man of stature, the recognized antenna expert in his selling area. And this massive TV ad campaign creates tremendous consumer demand for his services.

Think you have the experience and know-how to qualify as a Jerrold Coloraxial Reception Specialist? Want to increase your antenna sales substantially this fall? Contact your local Jerrold representative or write:

JERROLD

Distributor Sales Division
4th and Walnut Streets
Philadelphia, Pa. 19105

Circle 33 on literature card

sible, boosters avoid taking anything that will leave a conspicuous empty spot. Well kept and well laid out displays are not only good business, they present a problem to thieves.

A frequent tip-off to the shoplifter is his clothing. Most are partial to large, loose-fitting jackets or topcoats that will conceal the items they have taken without showing a telltale bulge. Professionals often go a step further by wearing coats furnished with deep, roomy pockets on the inside. The openings are pinned to the belt so that when the coat is held away from the body the pockets will gape open like gunny sacks. It take no more than a flick of the wrist, and half a display counter can vanish into one of these coats.

Female boosters usually carry a "stall," some sort of prop to aid them in their thefts. This can be anything from a large purse or shopping bag to a baby carriage. They like to lay coats and packages on the counters, also, to serve as a cover for their thefts. Salespeople should watch customers who lay **anything** on top of merchandise.

It's also a wise idea to keep an eye on anyone who spends too much time in the minute inspection of merchandise. Such behavior is characteristic of the amateur shoplifter who is trying to get up his nerve or waiting for the "right moment."

And watch for signs of nervousness. A booster may look cool and relaxed on the outside, but inside he's running up and down the walls. Anyone who risks his freedom by stealing ought to be nervous.

Apprehending a booster is apt to be a rather touchy business, and whenever possible this should be left to the police. A large percent of boosters are drug addicts trying to steal enough to support a $50-a-day habit, and it is definitely not wise to latch on to one of these. For that matter, I always carried at least a pen knife, and most other boosters have some little thing about them that may help them avoid apprehension. As a friend of mine once put it, "What do you want I should do if some big jerk comes after me with a soldering iron in his hand? I'd sooner go boostin' without my pants than without my switchblade."

Simple awareness and vigilance will afford effective protection against professionals. But you shouldn't let the matter rest there. Make it your busines to know the laws governing shoplifting. If local courts tend to be lenient with boosters, get together with other businessmen in the area and make it known that you want the laws to be strictly enforced. The fact that the penalty for this crime is generally low is exactly why most professionals practice it. And a tendency on the part of the courts to hand out token punishment or merely reprimand the offender accounts for the fact that many amateurs will continue to steal.

Boosters are a clannish bunch and word gets around fast when the heat is on in a certain store or business district, or when violators are being nabbed and handed stiff sentences. If that happens, we just pack up and head for easier pickings.

There are plenty of soft-touch businesses around where a booster can count on a good score. See to it that you are not among them—and your merchandise will wind up with legitimate customers only. ▲

GATED BEAM FM Communications Detectors

by Leo G. Sands

Several of the tube-type FM mobile receivers employ a gated-beam discriminator in place of the conventional Foster-Seeley discriminator. The typical mobile radio technician looks upon the conventional discriminator as an old friend and often distrusts new types. More than 15 years ago, the Bradley FM detector used in Philco mobile equipment evoked controversy. Servcie technicians didn't like it because an FM signal generator and a scope were required to adjust it properly. But the manufacturerer liked it because it worked better.

There is another relatively new FM detector which an Air Force technical manual says is better. It is the gated-beam detector, which is also used in many TV sets as the sound-channel detector. It can be adjusted with no instruments; only a tuning wrench is required. It is considered to be a better FM detector because of its high audio recovery for narrow FM deviation and because it also acts as an IF limiter and as an AF amplifier.

The schematic symbol of a gated beam tube (3BN6, 6BN6, 12BN6, etc.) is the same as for a conventional pentode. However, the characteristics of the gated beam are different.

AND Gate

Shown in Fig. 1 is an AND gate. With S1 and S2 in the positions shown, grid 1 (control grid) and grid 3 (quadrature grid) both have a negative voltage applied to them. No plate current flows through R_L since the tube is cut off, and plate voltage is equal to the plate supply voltage.

The tube will conduct only when S1 and S2 are set so that both grid 1 *and* grid 3 are positive, at which time maximum plate current flows. The tube becomes saturated and plate voltage drops to a low value.

If either S1 or S2 is thrown to apply a negative voltage to either grid 1 or grid 2, plate current is again cut off. When a conventional pentode is used, only the control grid will have a significant effect on plate current. The suppressor grid voltage has but little effect on plate current.

Frequency Sensor

Now examine Fig. 2. If the AC input signal is at the same frequency to which L and C are resonant, and the signals at grid 1 and grid 3 are in phase, maximum plate current flows when the input signal is positive, and minimum plate current flows during the negative half cycles. If the frequency of the AC input signal changes, or the phase relationship of the signals at the two grids changes, one grid may be increasing plate current while the other is reducing it. Or, one may start increasing plate current earlier or later during the signal cycle.

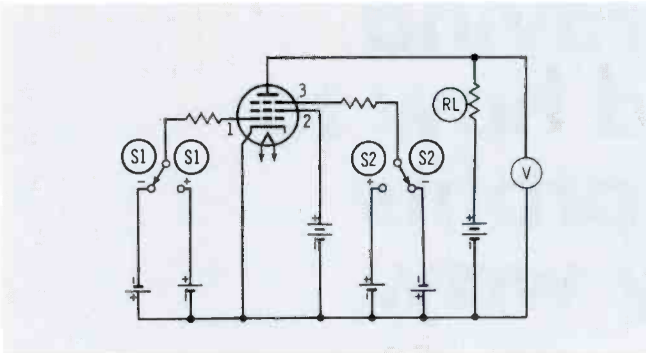

Fig. 1. AND gate using gated-beam tube.

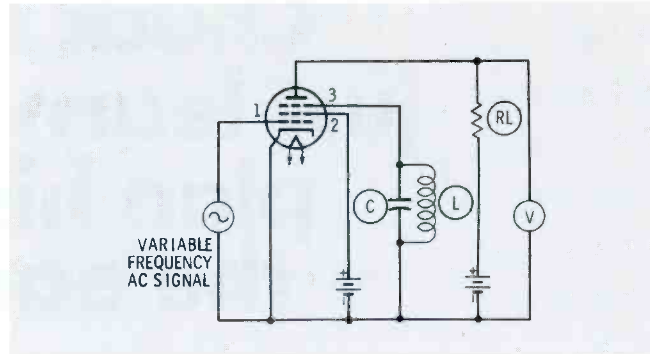

Fig. 2. Gated-beam frequency sensor.

Since the tube is saturated by small positive voltages occuring simultaneously at both grids, or cut off by a small negative voltage at either grid, plate current flows in the form of a train of pulses of varying width. The average plate curent, therefore, depends upon the width and recurrence rate of the pulses.

FM Discriminator/Limiter

The circuit of a gated-beam FM

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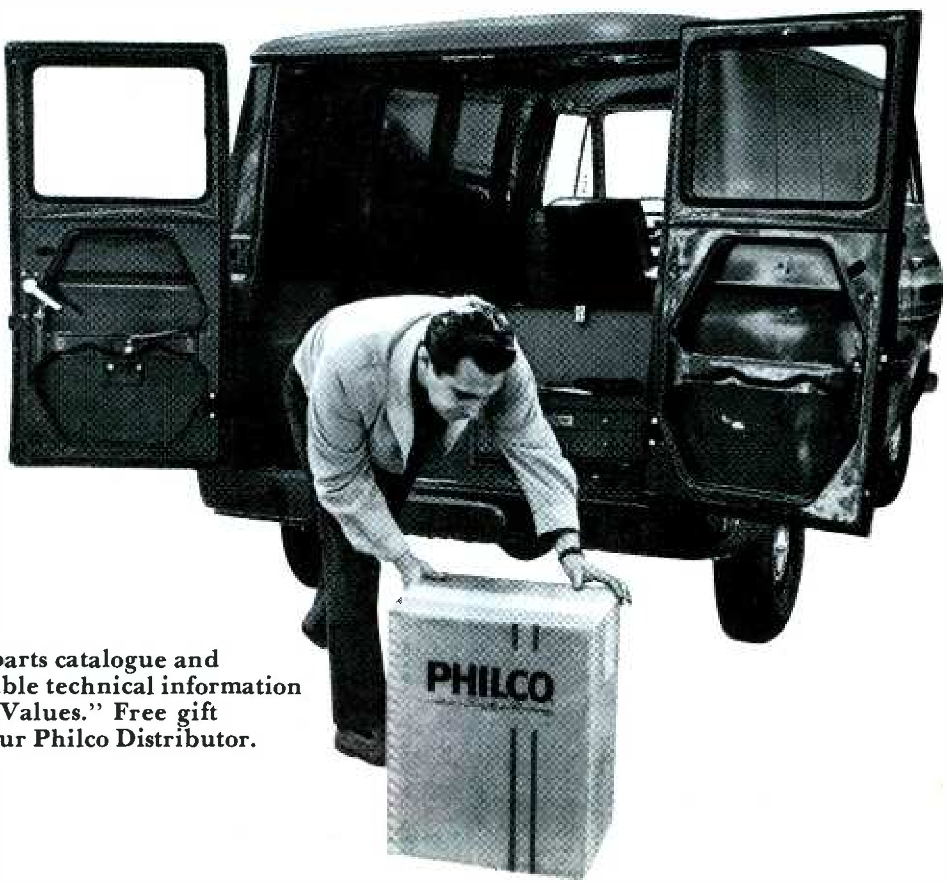

New...just off the press. Philco's parts catalogue and reference guide. It includes valuable technical information plus Philco's '66/'67 "Parade of Values." Free gift offers. Get your copy now from your Philco Distributor.

Circle 37 on literature card

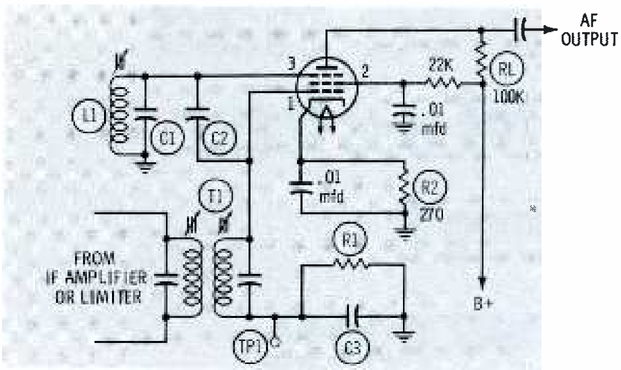

Fig. 3. FM discriminator/limiter.

illustrated in Fig. 3. The input signal is from an IF amplifier or limiter and is fed through IF transformer T1 to grid 1. The resonant circuit (L1C1) is connected to grid 3 and is tuned to the FM signal carrier frequency (as converted to IF within the receiver).

As the input signal deviates in frequency (FM), the resonant quadrature grid circuit tends to stay on the carrier frequency. The phase relationship of the signals at grid 1 and grid 3 varies, and causes plate current pulses to be produced whose average value varies in accordance with the amount (audio level) and rate (audio frequency) of input signal deviation.

Hence, the audio signal is recovered across load resistor R_L.

When the IF signal is at a relatively low frequency (455 kHz, for example), capacitor C2 is used to feed more signal to grid 3. In TV sets with a 4.5-MHz sound IF, the capacitor is not required.

The circuit also functions as a limiter. When the IF input signal swings negative beyond a certain point, plate current is cut off. And, when it swings sufficiently positive, the tube is driven to saturation. Thus, a further increase in input signal level will have no effect. This is a very fast limiter since it employs no RC circuits to extend its time constant. Don't be fooled by the presence of C3 and R1. They are there only to provide a convenient test point when aligning T1 and the stages ahead of it. Cathode bias is provided by R2 to select the desired portion of the tube's operating curve.

Adjustment of the gated-beam FM discriminator is relatively easy. While receiving an FM signal, simply adjust the core of L1 for maximum audio level as heard in the speaker. For more precise adjustment, apply a tone-modulated FM signal to the antenna terminals, or to one of the mixers at an appropriate frequency and adjust L1 for maximum audio output voltage as indicated by an AC voltmeter connected to the speaker terminals.

Added system efficiency can be realized (although not necessary) by adjusting the local oscillator trimmer for maximum DC voltage at TP1 while listening to the reference signal from a distant transmitter, then adjusting L1 for maximum audio recovery.

Conclusion

The gated-beam discriminator is an effective detection and limiting device, and as previously stated is easy to adjust. Its adaptation to the sound system of television has come about as a result of these qualities. What is needed now is a solid-state version. ▲

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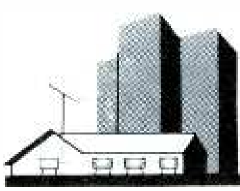
- **Training Program:** Leader in recognizing the tremendous residential MATV market the Color Explosion is creating, Channel Master offers a thorough training course in home and small commercial installation.



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Circle 29 on literature card

The Troubleshooter

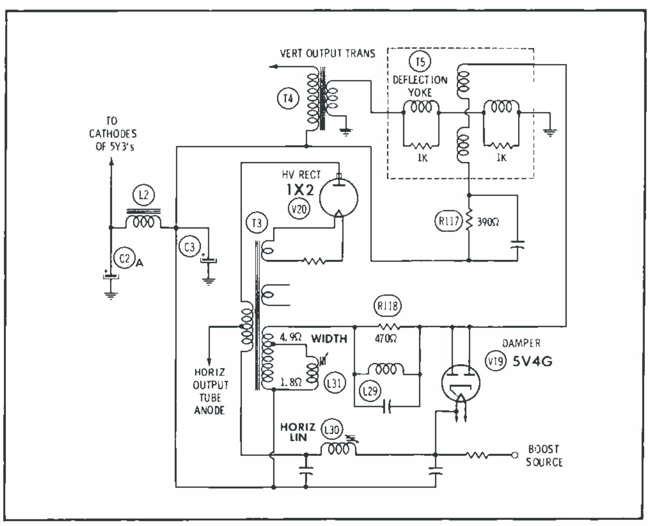
answers your servicing problems

Coil Smokes

I have a Philco 50T1632 (PHOTOFACT Folder 110-10) which has a smoke problem. Coil L29 in the flyback secondary smokes when the set is turned on. By disconnecting the yoke, I have high voltage, and a bright spot in the center of the screen. Connecting the vertical yoke only, I have a bright vertical line. When the horizontal yoke is connected, the trouble begins. Resistance measurements show 10K ohms from the top of C2A to ground, with the yoke unplugged. With the yoke in the circuit I read only 80 ohms to ground. I haven't found the trouble yet.

FRANK SZPIECH

Newark, N.J.



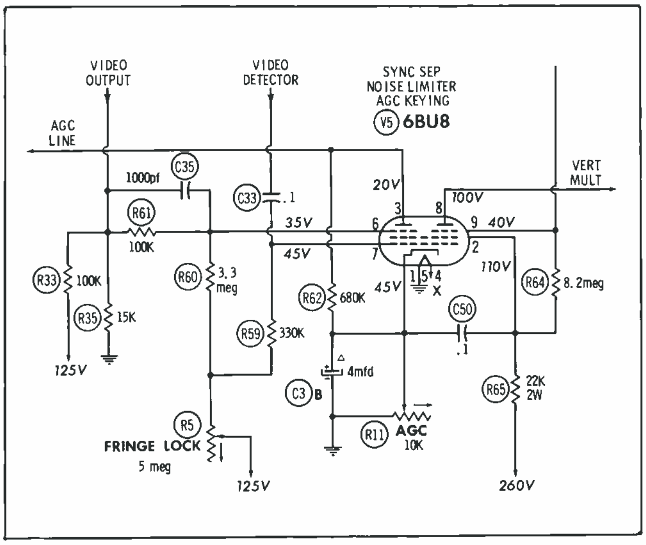
Your troubleshooting procedure is quite sound. The next step to take is resistance measurements of the yoke itself. All indications are a short between vertical and horizontal windings, as the vertical winding presents a ground at each end. There is a possibility of a mechanical short to ground anywhere along the wiring between the yoke and the horizontal output transformer.

Same Cause?

I have recently experienced a problem in a Zenith Chassis 16F28 (PHOTOFACT Folder 524-2) which is identical to the problem in a Zenith Chassis 17D20 described in the June '66 Troubleshooter Column of PF REPORTER. In both instances sound and picture were lost, but the raster remained unaffected. Since the two chassis are similar, it is very probable that the same trouble existed in each. Troubleshooting the 16F28 Chassis revealed that R65 in the screen circuit of V5 had opened, dropping the voltage on pin 2 of the 6BU8 to zero. Replacing this resistor restored video and sound.

JOHN F. DEWILDE, JR.

Carlsbad, California



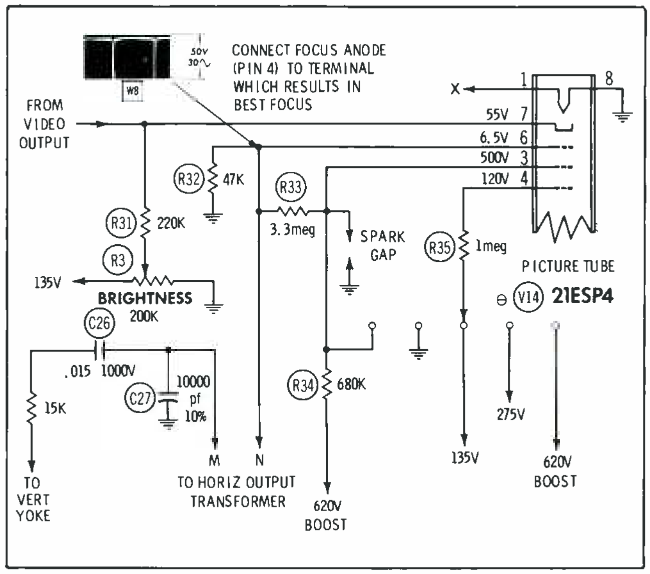
Thanks for sharing your solution with us. Without screen voltage V5 will not conduct, no AGC voltage will be developed, and the 1st video IF stage will become overloaded, causing the loss of both video and sound. However, it should be pointed out that the possible troubles described in the June Troubleshooter Column can result in the same symptoms—which just goes to show that there is always more than one side to every trouble, and in this case we overlooked one.

Bright Retrace Lines

I have a GE "M5-line" (PHOTOFACT 465-1) with good contrast and brightness, but very bright retrace lines. I checked every capacitor in the blanking circuit for leakage. All were OK. Every resistor was good too. I wonder if the picture tube could be bad.

JOHN MELMICK

Bayonne, N. J.



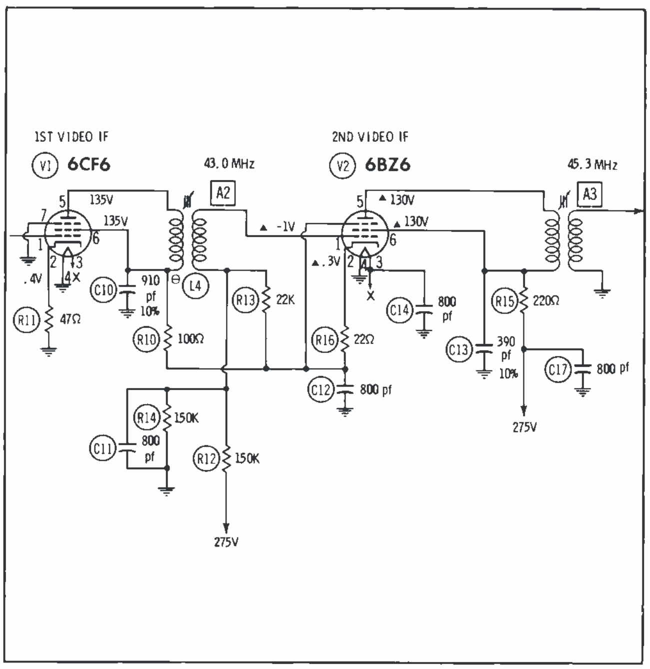
Yes, you could have a bad CRT. Open elements often cause retrace problems. Many CRT testers tie all the *elements together for emission tests, and skip some elements in their shorts-open tests. Make sure your tester has a positive test for each element. Open G2 will cause a considerable loss of brightness, with some retrace, whereas open G1 affects mostly retrace, with little loss of brightness if it opens. But first scope the signal at the CRT socket to make sure the proper signal (W8) is being applied to G1.*

Resistor Pops

A GE M5-line portable TV (PHOTOFACT folder 465-1) was brought to the shop with a no pix, no sound complaint. A visual examination disclosed that R15 was burned to a crisp. L5 was found to be shorted, and was replaced along with C13 and C17. R15 continues to "Pop." Would this indicate a dead short to ground? If so, where?

ANGEL D. MADRID

Fresno, California

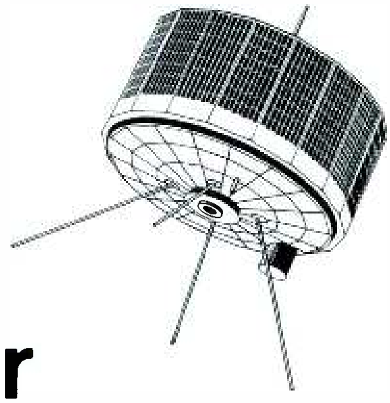


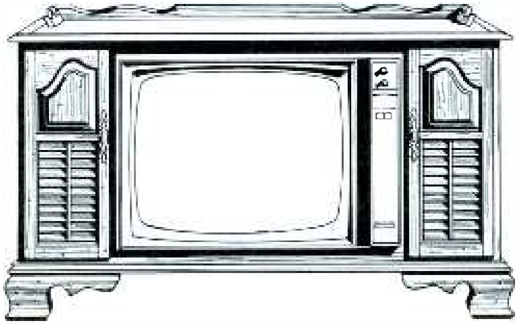
Note that most of the voltage readings around V2 have a small symbol ▲ beside them. This indicates the foot note "▲ measured from pin 7 of V2." The plate of V2 is actually 265 volts above ground, the cathode 135.3 volts, and the grid 134 volts. A heater-to-cathode short in V2 would make the cathode 0 volts, G1 134 volts and the plate 265 volts, and the tube would draw very excessive current. If C12 or C10 shorted the effect would be much the same.

10, 12, 15, 18 . . . ?

My curiosity is aroused. Why the magic number 47? Specifically, resistors such as 470, 47k, etc., and capacitors like .47, .047 etc. Also, can I use a .05 capacitor in place of a .047, since the difference is only 3%.

A. F. GALLAGHER





The value 47, as well as the other values in the series, was chosen by the old RMA (now the EIA). The figure was arrived at by adding 20% to the lowest number in the series, and continuing up the series, usually rounding off to the next highest number. For instance 10 + (10 × 20%) = 12; 12 + (12 × 20%) = 14.4, rounded off to 15, and so on. The system rounded off on the lower number at 39, and 39 + (39 × 20%) = 46.8, rounded off to 47.

A 0.5 capacitor should work in place of a .047 and vice versa. A possible exception is in time-constant networks.

Stray Field Effect

I would like to pass along my experience with an Emerson 11" Model 11PO2 (PHOTOFACT Folder 756-2). The set came into the shop with vertical roll and a reduced raster at both the top and bottom. After failing to accomplish any noticeable change in the symptom by substituting tubes, I decided to check the vertical sync pulse. I cut the foil at the integrator output and found a beautiful vertical sync pulse at this point. Moving the scope probe to the oscillator produced such weird traces that it was impossible to pinpoint any one particular defect. At this point, I decided to check voltages. However, all measurements were within tolerance—another dead end.

Returning to the scope, I encountered a most strange situation: regardless of where I placed the scope probe, the set would sync and the raster would fill out. While substituting components I discovered that with any capacitor tacked to the bottom of the printed board, the sync would return to normal; yet, with the capacitor connected to the top of the board the original troubles persisted.

After wasting many man-hours on what appeared to be a phantom trouble, I happened (by chance) to turn up the volume control. To my amazement, the raster increased in height about an inch. Experimenting further, I discovered that the volume control was functioning much the same as a hold control and at mid range the picture would sync and the raster returned to normal height. At either end of the control range, the old symptoms of reduced height and loss of sync would return.

At last, armed with a clue that provided a basis for solid reasoning, I checked the shielded audio cable and found that it came up around the vertical hold control and was dressed against the vertical wiring. I checked the shielded audio cable, but found no defects. This left a choice of two cures. I could either redress the vertical wiring or replace it with shielded cable. I decided on the shielded cable, which proved an effective cure: the sync locked in and the height returned to normal. I hope my description of this incident will save other technicians some man-hours.

ROBERT RALSTON

Westernport, Maryland

Thanks for sharing this "out of the ordinary" troubleshooting experience with us. It helps to point up, to all of us, the real effects of poor lead dress and shielding.

▲

Sell TV Antennas

(Continued from page 36)

traffic at all, it's easy to create attractive in-store antenna displays.

Door Hangers

One of the most successful techniques for direct selling is a door-hanger campaign (see Fig. 5). Consistent door-hanger programs alone have doubled and tripled sales of some antenna installers.

There are a variety of door hangers available from antenna manufacturers. Generally, they cost you little or nothing. Some are aimed at selling people on the idea of reaching out for distant channels. Some feature addition of UHF reception. Some sell the concept of upgrading the system for all-channel reception. Some are personalized, pointing out that you have just installed an antenna for a neighbor, Mr. John Smith, at 1741 Locust Street. Others are aimed at customers whose outdoor antennas are dilapidated.

Make it a habit to leave door hangers at neighbors' houses after every installation. Get high-school boys to deliver hangers after school. Use door hangers in a direct-mail program.

The key to success is consistency. Don't expect immediate results. People generally have no idea where to go for a professional antenna installation. Often, they will save your door hangers until they need an installation. Antenna installers who have used this program say that they often get calls more than a year

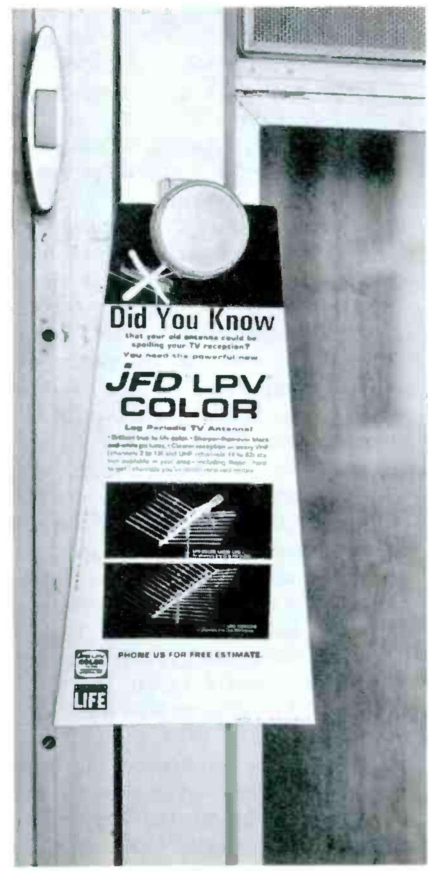


Fig. 5. Doorknob tags find customers.

after the door hanger was placed on the customer's knob.

Advertising

This is the most powerful weapon in your arsenal of ways to "tell 'em what you got." While other programs can reach people by the hundreds, advertising can reach them by the thousands. Work with your distributor and the manufacturer he represents to get as much co-operative financial help as possible. Don't be afraid to add money of your own. Consistent newspaper and/or television advertising can firmly identify you in the public mind as the place to contact for the best in antennas.

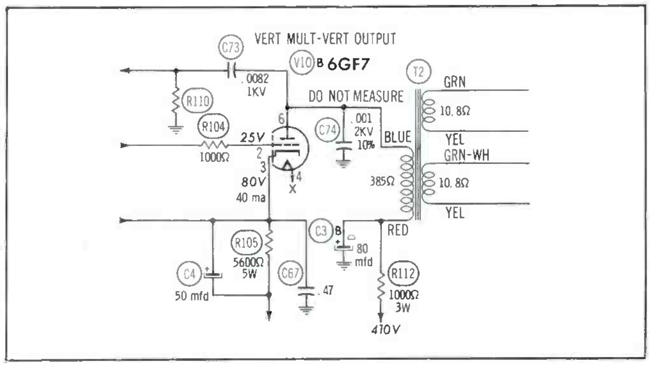
Most antenna installers make too little use of cooperative funds. You can capitalize on this fact in two ways: First, your advertising will not face much competition; second, you may be able to obtain some of your competitor's unused cooperative ad funds for your own use, especially if you're willing to match cooperative dollars with your own. Talk to your distributor and directly to the antenna manufacturer. They are generally eager to get consistent ad exposure of their products in your area. Most manufacturers supply ad mats, and TV and radio commercials, without charge.

Does all of this sound like a lot of work? It is. There is no easy way to increase business. You have to think and act more like a businessman than a technician. But the rewards are tremendous. You can become the biggest, best known antenna installer in your area.

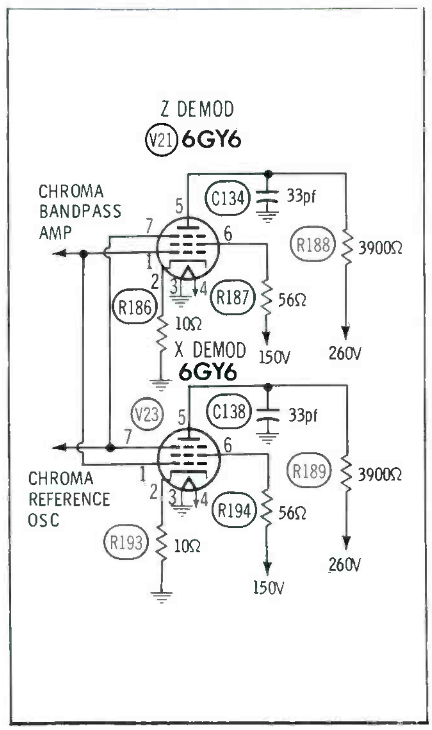
Antenna installations are generally much more profitable (and easier)than television repairs. And with the coming '66 color boom, there was never a better time to make an all-out effort to sell antennas. ▲

Color Countermeasures

Chassis: RCA CTC 16, 17
Symptom: Slight vertical jitter, agitated during reception of fringe stations.
Tip: Check C74 connected from the vertical output tube plate to ground.
For a positive check, a known good capacitor having a 2kv rating should be substituted.



Chassis: RCA CTC 16
Symptoms: Interference on UHF reception, especially when tuned to lower UHF channels.
Tip: Change R187 and R194 to 1200 -ohms. Note: Some CTC 16 chassis are already equipped with 1200 ohm units



Circle 47 on literature card

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Book Review

TV Video and Sound Circuits; Thomas M. Adams; Howard W. Sams & Co., Inc., Indianapolis, Indiana; 1966; 158 pages, 8½ x 5½, soft cover; BEW-2; $3.25.

This book, along with its companion text, **TV Sync and Deflection Circuit Actions** (BEV-2), is designed to provide a complete coverage of the fundamental circuits used in VHF television receivers. Both books are continuations in the Sams *electronic circuit action series,* using unique four-color diagrams to help explain the functions of the circuits discussed.

The method of presentation used in this book clearly identifies each electron current flowing in the circuits, and shows what happens to these currents during each phase of circuit operation. When the actions of all the electron currents in a circuit can be visualized, it is much more probable that a full understanding of that circuit can be achieved.

The first chapter of the book discusses the video signal and the reproduction of images on the picture tube screen. The following two chapters deal with the different types of circuitry employed in the tuner section of a typical TV receiver. Chapters 4 and 5 process the composite video signal from the tuner, through the video IF section, video amplifier, to the CRT circuits. Sound systems, including quadrature, gated beam, and ratio detectors, are the subjects of Chapters 6 and 7. The final chapter is devoted to the more common power-supply circuits found in TV receivers. Circuits discussed include both transformer and transformerless configurations, as well as voltage divider circuits.

Because of the enormous simplification in the teaching-learning process used in this series, this book is neither too advanced for high school or technical institute studies, nor too elementary for college engineering instruction. ▲

TV AGC

(Continued from page 28)

manufacturers are intermixing tubes and transistors in larger screen receivers. The Philco 16JT26 chassis is typical—it uses transistors in all stages preceding the video detector, and a two transistor keyed AGC system. Operation of the keyed AGC in this chassis is quite a bit different than the others discussed.

The AGC keyer transistor (X-5) is controlled by the DC voltage level at the plate of the video amplifier tube. The resulting voltages on X-5 are considerably higher than those on the AGC transistors in Figs. 5 and 6. Under conditions of no signal, the base of X-5 is back-biased so that it does not conduct and no AGC is developed. As signals are detected and applied to V-1A, X-5 conducts in proportion to strength of the signals. While the circuits in Figs. 5 and 6 develop AGC voltage directly from conduction of the AGC keyer and its collector diode, in this circuit the keyer transistor varies amplitude and polarity of the keying pulse so that a separate diode is entirely responsible for AGC voltage. Here's how it works:

Under no signal conditions (X-5 not conducting), impedance to ground from the anode of X-10 is higher than that of the junction of C-33 and R-49. Since the keying pulse winding is applied across these points, pulse amplitude will be greatest at the point having the higher impedance to ground. Bear in mind that the polarity of the pulse at either end of the winding is opposite with respect to ground. Therefore, when the anode of X-10 has a high impedance to ground, a positive polarity keying pulse is present at this anode, with a very small negative pulse present at the junction of C-33 and R-49. When signals are detected and applied to V-1A these conditions reverse—now impedance from X-10's anode to ground is reduced, with the pulse amplitude correspondingly reduced. At the same time, the impedance at the junction of C-33 and R-49 increases, as does the amplitude of the negative pulse at this point. The negative keying pulse here is applied through C-33 to X-9 which rectifies it to positive DC. After being filtered by R-48 and C-2, it is fed to transistor X-4, the AGC amplifier. Resistor R-48 and C-2 form an AGC charge network, and C-2 and R-47 form the AGC discharge network.

Since X-4 employs an emitter follower configuration, the voltage output at the emitter will be about 98% of the input to the base. But the emitter's impedance is only 27% of the input impedance, so X-4 is actually a current amplifier.

AGC from X-4 is fed through separate feedlines to the IF and RF transistors. The IF AGC controls X-2 through forward biasing, and the voltage shift across R-23 in turn applies forward bias to the base of X-1. Operation of forward bias to reduce gain of the controlled transistors is similar to the Zenith circuit. Control of the RF stage is also obtained from the emitter of X-4, but it is fed through a biased Zener diode providing delayed AGC.

Common Factors

All three of these circuits (and virtually every other transistorized Keyed AGC circuit) have points in

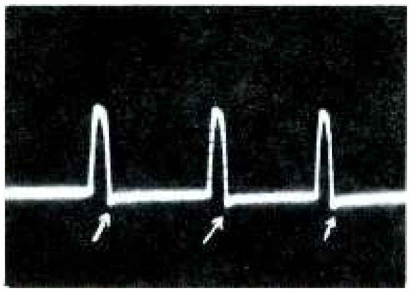


Fig. 8. Most AGC keying pulses have reverse overshoot following pulses.

common. For example, the presence of a diode at the AGC transistor's collector, which serves the same purposes in every case. Being wired to the collector and with same front-to-back conduction factor as the collector, it prevents an incorrect DC polarity from being applied to the collector. Having a higher pulse capability than the collector junction, it also protects the collector junction from the high keying pulses. Since every keying pulse has a reverse polarity overshoot (see Fig. 8), the diode protects the junction from damage by this reverse overshoot.

Control of the AGC transistor is another feature common to all receivers. The dynamic bias is always obtained from signal induced voltage shift across a load resistor in a video amplifier stage. This is one feature that must be understood to successfully troubleshoot and repair AGC.

Other features common to all keyed AGC circuits using transistors are voltage polarity and amplitude. First, DC polarity of the AGC voltage is always opposite to the polarity of the keying pulse applied. Second, AGC voltage always increases in step with signal strength.

Troubleshooting and Servicing

Complaints symptomatic of AGC troubles in transistor AGC circuits are identical to those in tube circuits. A whited-out raster with some life indicates complete lack of AGC, an overloaded picture indicates insufficient, a washed out picture excessive AGC and a dead white-out raster extremely excessive AGC. Transistor keyed AGC circuits are capable of one trouble not found

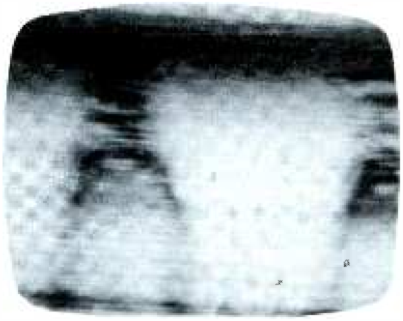


Fig. 9. Thin horizontal line streaking in transistorized AGC circuits is produced by noisy junction in transistor or AGC diode.

with tube circuits— the thin horizontal line streaking shown in Fig. 9, which results from a noisy junction in either the AGC transistor or the diode in series with its collector.

While the use of over-ride bias is helpful in troubleshooting where tube circuits are involved, its application is not as useful with transistor circuits. Voltage analysis is the only efficient and effective means of troubleshooting these circuits. Because of one peculiarity of the circuit schematics available to servicemen, this method is enhanced considerably.

Circle 51 on literature card

The voltages supplied on virtually every schematic apply for a no-signal condition. Therefore, to troubleshoot these circuits, all the technician has to do is to short the antenna connections and read voltages.

Initially, the voltage drop that controls keyed conduction should be read. For example, a smaller drop across R-50 (Fig. 5) than is noted on the schematic indicates either a weak X-5 or X-6, or less likely, decreased resistance of R-50. A greater than indicated drop across R-50 would denote a leaky X-5 or X-6 or a shorted diode (X-37 or X-38). The point is: whenever AGC trouble is suspected the video amplifier stages should be checked first.

After voltages of the video amplifier circuits are found to conform to schematic values, voltage across the keyer transistor's emitter should be checked. If this is found to be correct the VTVM should be connected at the AGC voltage source, and a resistor of the same size as the video load shunted across the video load (example—R-50 in Fig. 5). A slight but definite voltage increase should develop at the AGC source and at all points on the AGC line. The Philco circuit, Fig. 7, offers another quick check. If a 50K resistor is shunted from the anode of X-10 to ground, approximately correct AGC voltages will be found on the AGC line. If these voltage checks are normal, then the video and AGC stages are good. The voltages on the IF and tuner transistors should then be critically examined, with emphasis on the emitter voltages.

If the video amplifier stage voltages conform to schematic values but the keyed AGC transistor develops no voltage or excessive voltage with the load shunting suggested, it very definitely indicates trouble in the keyed AGC circuit. This stage should be re-examined more critically for incorrect emitter and base voltages, which would pinpoint a defective transistor. Finally the scope should be employed to check for presence, amplitude and polarity of the keying pulses. Unlike the clean keying pulses usually seen in tube type AGC, as in Fig. 10A, pulses in transistor keyed AGC are

Circle 53 on literature card

Circle 52 on literature card

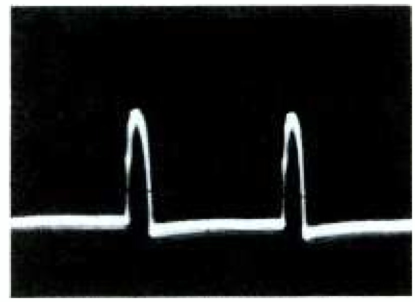


Fig. 10A. Keying pulses in tube circuits are generally clean.

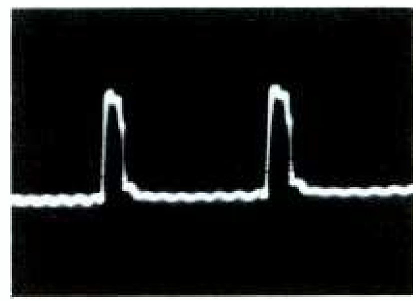


Fig. 10B. The keying pulse in transistor receivers contains noise, ringing, etc.

not as clean and in some instances can be very hash-ridden, Fig. 10B.

The diodes in these circuits also can produce AGC trouble. An open diode series connected to the AGC transistor's collector will result in no AGC. A leaky or shorted diode in this location will invariably destroy the AGC transistor, and in case of a defective AGC transistor, the diode should receive critical checking and be replaced for the slightest leakage. Since the function of the Zener diode is for delayed AGC provisions, should it become defective it will produce disproportionate ratios between the IF and RF AGC voltages.

Conclusion

Not only is it necessary to have a receiver's schematic on hand, the circuit should be carefully studied before any troubleshooting is attempted. Knowledge of how these circuits function to develop AGC, and the use of a VTVM to carefully check circuit voltages, should enable every technician to successfully service these circuits. ▲

Product Report

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

Color Generator

(200)

As part of their "Green Line" of test instruments, **Precise Electronics** has introduced a new color generator, the model 660.

Specially designed for rugged portability, the unit will be convenient for use in the home as well as the shop. Utilizing unijunction transistors, the model 660 has seven output signals—vertical and horizontal lines, crosshatch, dots, keyed rainbow, clear raster, and shading bars. The latter is a special pattern of 4 levels of brightness, useful for gun tracking adjustments. Price is $124.95.

Wirewound Trimmer

(201)

A specially designed wiper block system that effectively isolates electrical elements is one of the features of this new rectangular wirewound trimmer. Other features of the **IRC** unit include a one-piece corrosion resistant shaft and *teflon*-insulated leads extending from a diallyl phthalate case. The new units, rated at 1.0 watt at 70°C, are available with resistance values ranging from 10 ohms to 50K ohms, ±5% tolerance. The units are priced at $3.56 each in lots of 100.

Microphone Mixer

(202)

A new microphone mixer has been designed to meet the modern day multiple-microphone requirements of commercial public address and paging systems, as well as the needs of serious-minded tape recording enthusiasts. The **Shure Brothers** Model M68 has inputs to accommodate up to four dynamic or ribbon microphones. These microphones may be either high or low impedance, as each input is equipped with a switch for impedance selection. Dynamic and ribbon microphones may be mixed without the need for costly external line transformers. In addition to the four microphone inputs, one auxiliary high-level input is provided to accept a tape recorder or AM-FM tuner signal. When used in conjunction with an A68P phono pre-amp accessory, it also accepts a magnetic or ceramic phonograph signal.

The M68 has two outputs. One provides high or low impedance output (selected by a switch) for connection to the microphone input of a P.A. system amplifier or tape recorder. The second is a high-impedance, high-level output designed primarily to feed a power amplifier or tape recorder requiring .5 to 2 volts. Because of the flexibility of outputs, the unit can be used with virtually any type of amplifier.

Each of the four microphone inputs has its own volume control. This allows raising or lowering the level of sound from each microphone to achieve a natural sound balance and to attain maximum potential volume from each microphone in each location, without generating feedback. It also permits cutting microphones in and out at will. An auxiliary input volume control is also provided to control the sound level of a tape recorder, phonograph, or tuner, or to cut it out entirely.

Finally, a master volume control is provided that simultaneously adjusts the volume of the five input sources.

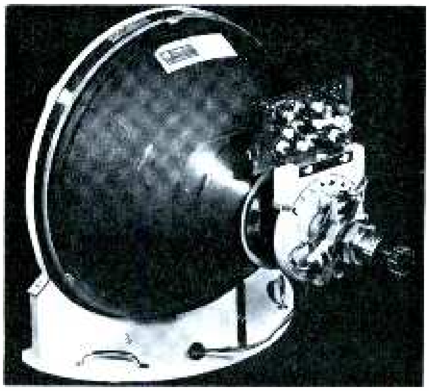
Also available are several optional accessories especially designed to increase the versatility of the microphone mixer. These include: a battery power supply, a locking panel that fastens over the controls to prevent tampering, an output cable adapter kit (which makes it possible to connect the unit to virtually any P.A. system), a phono preamp (which converts the auxiliary input channel to a magnetic or ceramic phonograph input), a stacking kit that allows convenient interconnection and stacking of several mixers, an interconnecting cable for interconnecting several mixers without sacking, and a rack panel kit for mounting the unit. Price of the microphone mixer is $125.00.

Microphone Desk Stand

(203)

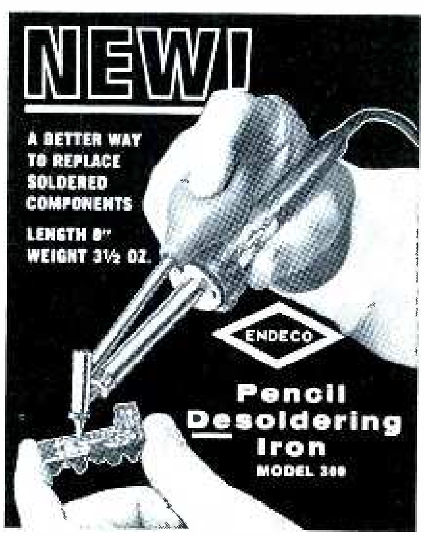
A gold-finished microphone desk

stand, designed for special decor requirements, is announced by **Atlas Sound.** The unit is also intended to complement both black and gold microphones at home, in color TV studios, and in churches. Tube height of the Model DS-6G is 4", and the base diameter measures 10". The design of the unit's base concentrates weight at the outer edge for greater stability, while base pads prevent desk and table-top damage. The model is priced at $5.75.



Color Test Tube Pedestal
(204)

This 21" test tube pedestal is designed to secure a color test tube and convergence panel in position to allow a direct hookup, exactly as in the customer's cabinet. The **Eight Ball Company**



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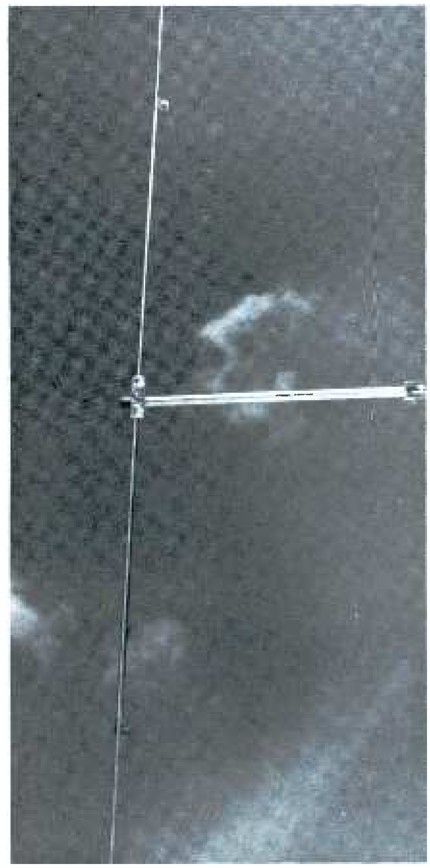
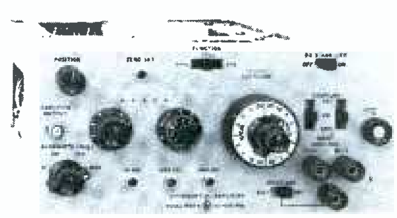
Circle 59 on literature card

unit permits bench service of the chassis in either a horizontal or vertical position and without cables. The setup also provides a full view of the picture in a bench service mirror. Handles mounted on the base of the pedestal provide safe portability with the CRT faceplate resting against the carrier's chest. Weight of the unit, complete with color components, is 45 lbs. Test pedestals designed for 19" test tubes are also available. Price of the unit is $14.50.



Univeral Antenna
(205)

Shown here is a new half-wave, omnidirectional universal antenna designed for a variety of transmit-and-receive uses including citizens band, amateur, business radio, home television, and FM. **Cush Craft's** new "Trik Stik" antenna can be mounted vertically or horizontally. Assembly is accomplished in minutes for permanent installations, temporary stations, or test purposes. The antenna is priced at $6.45.



Scope Amplifier
(206)

This new DC-coupled vertical plug-in oscilloscope amplifier measures microvolt-level AC signals in the presence of large DC levels, with no drift. Both AC and DC voltage measurements may be made with 0.4% accuracy. The **Hewett-Packard** unit has a maximum sensitivity of 50 μv/cm with a new zero-drift feature, and high-resolution calibrated DC offset. The differential amplifier, designated Model 1406A, matches Model 140A oscilloscope main frames, and is even more useful with the recently introduced Model 141A variable-persistence/storage scope.

The calibrated offset feature of the unit converts it to an accurate voltmeter. Readout is to four significant figures, and front-panel lights indicate the decimal point. The amplier supplies up to 10 volts offset on the maximum sensitivity range (50 μv/cm). This increases to 1000 volts on less sensitive ranges. To measure signal amplitudes to a fraction of a percent, just position the waveform top to mid-screen with the offset controls, and take a reading; repeat for the bottom of the waveform. The difference is the amplitude. Small AC signals riding on high DC levels, such as ripple in power supplies, are easily measured. Thoroughout the measurement, the trace won't drift.

The input of the amplifier may be used differentially, without offset. In differential operation, spurious common-mode signals, such as 60 Hz hum, are rejected by 85 dB or more. Dynamic range of the amplifier is such that any part of any signal as much as 50 cm off-screen will be displayed without distortion.

Maximum bandwidth of the amplifier is 400 kHz. Where high-frequency signal components are unwanted, built-in filters reduce bandwidth to 100, 25, or 5 kHz at the touch of a front-panel control. Also built in is an isolating amplifier to drive external equipment, such as an X-Y recorder or magnetic tape recorder. The amplifier's ground connection may be floated either to the measured circuit, or connected to the scope chassis with a convenient front-panel switch. This helps to eliminate groundloops, for clear pictures and high accuracy. The differential amplifier is priced at $850.

Circle 62 on literature card

Transistor Tester/Set Analyzer
(207)

Designed to replace the variety of test instruments usually needed for checking transistors and transistor radios, **Semitronic's** compact Model 1000 is a single instrument designed for finding transistor and transistor circuit troubles. It can be used for checking germanium and silicon transistors, power transistors, RF, IF, and audio transistors (both **pnp** and **npn**), and diodes. All transistor types can be tested, whether low or high power. The tester checks DC current again to 400, and also tests for transistor or diode leakage. A universal test socket simplifies the testing of transistors having different bases. Transistors can be checked in circuit or out of circuit.

In addition, eight test units are comprised in one compact analyzer that supplies a test signal for AF, RF, or IF circuits. It can be used as a circuit signal tracer, or to measure supply voltages on a 20-volt scale, or to measure circuit current drain up to 100 ma. The unit is supplied with three external leads for in-circuit testing and comes complete with a free instruction manual and transistor listing. Price is $34.95.

Color Bar Generator
(208)

This compact solid-state color bar generator, designed with military-type modular construction, provides fully saturated NTSC color signals, including chrominance and luminance signals. Also provided are dot-bar patterns for adjustments of both color and black-and-white sets.

Features found in **Eico's** Model 380 include an individual, switch-selected color display and an adjustable bar width and dot size. Three crystal controlled oscillators are used for color burst, convergence, and RF.

Specifications of the unit are: RF output: 0 to 50,000 μv into 300 ohms (61.25 MHz—crystal controlled for Channel 3). Video output: Both positive and negative polarities, 0 to 10 volts p-p into 4700 ohms. NTSC colors: yellow, I, red, R-Y, magenta, Q, B-Y, blue, cyan, green, and white. Horizontal lines: 13 of variable thickness. Vertical lines: 10 of variable thickness. Cross-hatch: 13 horizontal and 10 vertical lines. Dots: 130 of variable size. The unit measures 8½" x 5¾" x 6¾" and is priced at $169.00.

Portable AC/DC Meter
(209)

A new thermocouple AC-type portable meter, available in two versions (AC ma/Amp or AC voltage measurements with ±1/2% rated accuracy in horizontal position), has been introduced by **Triplett Electrical Instrument Company**. The two versions of Model 835 are designed for electronics development and experimental laboratories, general industrial laboratory testing, plant incoming inspection, production line applications, high school and college laboratory use, and for sophisticated electronics circuitry measurements.

Featuring Triplett's patented Bar-Ring magnet with suspension movement, the units are self-shielded from stray magnetic fields. Wirewound ± .05% accuracy resistors are used throughout the units. The AC milliamp/ammeter version has a range of 0-10-20-50-100-200-500 ma AC/DC at 1.5 volts; and 0-1-2-5 amps AC/DC. The AC voltmeter version has a range of 0-2-5-10-20-50-100-200-500 volts AC/DC at 143 ohms per volt. The new units are designed to replace the 3 or 4 portables previously needed to cover such a broad range of measurements. The portables incorporate a "standby/read" switch which desensitizes the meter in standby. The "read" position is spring loaded for meter safety. The new instrument will withstand up to 300% overload using dual thermocouples operated at reduced levels.

Accuracy of the meter is ±1/2 of 1% of full-scale deflection in the horizontal position at 77°F. The large open-face scale length is 6.84" and features an antiparallax mirror and knife-edge pointer. The portable standard units are encased in a heavy molded black case with a large insulated, movable handle. Dimensions are 7½" x 6¼" x 3⅞".

In addition, an accessory black leather carrying case, Model 859-OP, is available. It is lined with ¼" thick protective sponge rubber, has a built-in self-contained stand, strap handle, and features flaps which open and allow the use of the tester without its removal from the case. The AC ma/Amp version is priced at $250, and the AC voltmeter version is $300. The leather carrying case is priced at $19.50. ▲

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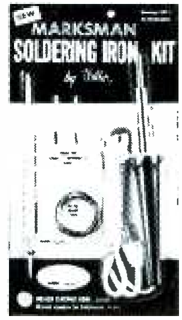
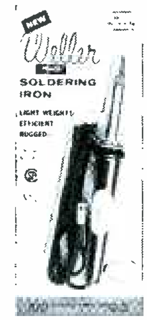
NUTLEY, NEW JERSEY 07110

Circle 67 on literature card

Weller® for every soldering job

Pencil Soldering Irons by Weller





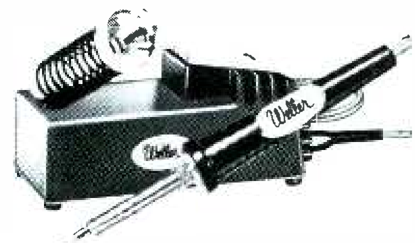
"Marksman" Kit with pencil soldering iron; screwdriver, cone and chisel tips; handy soldering aid and a supply of solder. Model SP-23K. $4.44 list

"Marksman" Iron at popular price. Stainless-steel long-reach barrel. ⅛" replaceable tip. Maximum tip temperature, 750°F. Model SP-23. $2.98 list

Weller Iron is industrial rated, highly efficient. Does work of bigger irons. Only 7⅞" long including the tip. 25 watts. 115 volts. Model WP-S. $5.20 list

Temperature Controlled Soldering Unit

For universal hobby soldering, including heavy-duty metal work. Temperature control is in the tip. Interchangeable tips give a choice of 500°F, 600°F, 700°F and 800°F controlled temperatures. Operates on 24 volts. Complete with 3/16" 700°F tip and 60 watt, 120 volt, 50/60 cycle power unit with soldering pencil stand and tip cleaning sponge attached. Model W-TCP. $26.00 list



Dual Heat Soldering Guns

100/140 Watts. Two trigger positions let you switch instantly to high or low heat to suit the job. Tip heats instantly and spotlight comes on when trigger is pulled. Tip has exceptionally long reach. Model 8200. $6.95 list

145/210 Watts. A professional model with all Weller gun features: instant heat, dual heat, spotlights. Model D-440. $9.95 list

240/325 Watts. Heavy-duty model with all Weller gun features: instant heat, dual heat, spotlights. Model D-550. $10.95 list

Dual Heat Soldering Gun Kit

Includes Weller 100/140 watt dual heat gun, 3 soldering tips, tip-changing wrench, soldering aid, flux brush, supply of solder . . . all in a colorful utility case of break-proof plastic. Model 8200PK. $8.95 list

Heavy-Duty Soldering Gun Kit

Features Weller 240/325 watt dual heat gun; tips for soldering, cutting and smoothing; tip-changing wrench; solder; metal-tone utility case of break-proof plastic. Model D-550PK. $12.95 list

Utility Grade Solder On Hang Cards 5 feet of 40/60 alloy solder in each pack. Acid core, AC-40. Rosin core, RC-40. 39¢ list

Superior Grade Solder In Dispenser Tubes 10 feet of 60/40 alloy rosin-core solder in each tube. Number RC-60. 59¢ list

WELLER ELECTRIC CORPORATION, Easton, Pa.

WORLD LEADER IN SOLDERING TECHNOLOGY

Circle 66 on literature card

Scanner

(*Continued from page 19*)

Money Matters

Record second quarter and first half sales and a sharp increase in earnings were announced today by **Admiral Corporation.** Consolidated sales in the first half increased 45% to $197,095,937, from $135,656,717 in 1965. Profits before taxes in the first six months wre $13,078,685, compared with $4,713,276 a year ago. Net earnings increased 158% and were $6,708,429.

Audio Devices, Inc., manufacturers of precision magnetic tapes, reports substantial increases in sales and earnings for the first half of 1966. Operating net income in the half rose 30% to $509,829, from $392,726 in the same period a year ago. Sales in the first six months were $7,886,901, compared to $5,589,000 in 1965, an increase of 41%.

Belden Manufacturing Company announced that its earnings for the six month period ended June 30, 1966, were $1,749,107 or $1.94 per share compared to $1,402,-474 or $1.57 per share a year ago.

NuTone, Inc., reported a first-quarter sales increase, but said that profits declined from the corresponding period a year ago. Sales in the three-month period ended July 21, 1966, amounted to $14,007,380, compared with $13,924,-143 in the 1965 fiscal first quarter. Net income on common shares in the 1966 period was $653,707, compared with $791,001 in the 1965 quarter. Sales and earnings are adjusted to reflect a pooling of interest with Lightcraft-General, acquired by NuTone in March, 1966.

First six month operations of 1966 for **Oak Electro/Netics Corp.** resulted in the highest sales and earnings in the company's history. Consolidated net sales for the first six months of 1966 totaled $31,380,244, 14% higher than the $27,583,798 reported in the first half of 1965. Earnings in the first half amounted to $1,101,405, or $1.60 per share, compared with $718,278, or $1.07 per share reported in the first six months of 1965, an increase of 53%.

Sales and earnings of the **Radio Corporation of America** set all-time records during the first half of 1966, with sales exceeding $1 billion at mid-year for the first time in the company's history. Profits after taxes for the six months ended June 30 rose 27% to $56 million from the previous half high of $44 million a year earlier. First half sales rose 18% to $1.15 billion from the previous high for the period of $978 million set the year before.

RCA reported that a milestone in the growth of color television was reached during the first half of the year when the company for the first time produced more color TV sets than black-and-white sets, which continued at an extremely high level.

Net sales and income of the **Sprague Electric Co.** reached new highs in the six months ending June 30, 1966. Net sales wer up 40% to $72,367,454 from $51,619,241 in the first half of 1965 while net profit after taxes amounted to $4,336,467, more than double the 1965 figure of $2,136,770.

Texas Instruments Incorporated reported to share-holders that sales and earnings for the first half achieved the highest levels for any comparable period in the company's history. Net sales billed were $285,398,000 for the six months period ended June 30, 1966. This compares with $198,004,000 for the same period of 1965. Profits after taxes were $16,843,000 for the first half of 1966, against $10,541,000 for 1965.

▲

Industrial Giant

(Continued from page 54)

ments of the industry to cooperate with the policy of reduced costs and elimination of wasteful spending. Everyone from manufacturer to service repairman needs to take a long, hard look at the cost to consumer of products and the cost of repair and service.

Between 1783 and 1914, the United States grew from a struggling, disunited nation to the major world power, whose standards of living were higher than any other nation had ever known — the product of individual initiative and private enterprise.

Such a record is unparalled in all history. Similarly, the electronics industry is skyrocketing to the top position of industrial responsibility within the nation. Its responsibility, therefore, is most serious and far-reaching, not only in education, religion, and entertainment, but in assuming leadership at all echelons of the industry, in all phases of our national economy, growth, and lasting prosperity.

The electronics industry — and all others as well — may do well to recall the words of Henry Ford. He said, "I'll make a car the American farmer can buy." The Model T is ample evidence of his success. Note that Mr. Ford did NOT say, "I'll build a car for the suckers and make a million."

Nor did Thomas Edison remark, "I'll invent a gadget and make a pile of dough." The electric light was his contribution to humanity, the result of his consecrated determination to serve human beings.

These men, and countless others, were indeed dedicated to service, to the progress and welfare of mankind. Wealth came as a by-product, a reward — not as their prime objective.

The electronics industry must be dedicated to service in the vital fields of science, industry, education, religion, and entertainment. It, like Mr. Ford, will reap the fruits of its planting. But this new giant, electronics, must be a benevolent leader — not a Frankenstein. ▲

INDEX TO ADVERTISERS

OCTOBER, 1966

FREE Catalog and Literature Service

**Check "Index to Advertisers" for further information from these companies.*

ANTENNAS

85. *ALLIANCE* — Colorful 4-page brochure describing in detail all the features of *Tenna-Rotors.**
86. *ANTENNACRAFT* — Four-color catalog sheet about the new *"Big-Shot-8"* VHF-UHF-FM antenna designed for city and suburban use.
87. *BLONDER-TONGUE* — Compact brochure detailing a line of all-channel products, expressly designed to improve reception in the home and small MATV systems.
88. *FINNEY* — Form 20-353 about the *Finco-Axial* 75-ohm antenna system for UHF-VHF and FM.*
89. *GC ELECTRONICS* — Catalog NR-5033T on hardware and accessories. Form FR-028-C all about all-channel antennas, VHF fringe, and the latest UHF antennas.
90. *JERROLD* — New 82-channel antenna catalog. Includes models for metropolitan to fringe-area reception of UHF, VHF and FM — color and black & white.*
91. *JFD* — New 1966 dealer catalog covering complete line of log-periodic outdoor antennas, indoor antennas, rotators, converters, amplifiers, masting, splitter-couplers/combiners, matching transformers, lightning arrestors, antenna mounts, and hardware.
92. *WINEGARD* — Fact-Finder #233 has specifications and installation and service tips about the RS-230, RS-275 and RD-300 antenna amplifiers.
93. *WRIGHT STEEL & WIRE CO.* — Circular about TV guy wire.
94. *ZENITH* — Information bulletin on antennas, rotors, batteries, tubes, power converters, record changers, picture tubes, wire, and cable.*

AUDIO & HI-FI

95. *ADMIRAL* — Folders describing line of equipment; includes black-and-white TV, color TV, radio, and stereo hi-fi.
96. *ANDREA*—Sales package about Andrea's latest line of quality B&W and Color TV receivers.
97. *ATLAS SOUND* — Catalog 566-67 illustrates and describes many new models of public address loudspeakers, microphone stands, and accessories for commercial sound applications.*
98. *BENJAMIN ELECTRONIC SOUND* — Catalog of all *Miracord* auto-manual turntables.
99. *BRITISH INDUSTRIES*—Product sheets and guides on products from *Garrard, Wharfedale,* and *Ersin.*
100. *CLEVELAND ELECTRONICS* — Catalog sheets about *"Cathedralsonic"* self-contained reverberation kit, and the *"Babe"* solid-state reverb kit.
101. *JENSEN* — Multicolored 24-page catalog No. 165-L featuring speakers and headphones.
102. *NUTONE* — 16-page full-color booklet illustrating built-in stereo music system and intercom radio systems. Includes specifications, installing ideas, and prices.
103. *OAKTRON* — "The Blueprint to Better Sound," an 8-page catalog of loudspeakers and baffles giving detailed specifications and list prices.*
104. *OXFORD TRANSDUCER* — New short form on complete line of Oxford products.
105. *PERMA-POWER*—Catalog sheet about a new 25-watt solid-state megaphone.*
106. *QUAM-NICHOLS* — General Catalog No. 66 listing speakers for public address, sound systems, high fidelity, automotive, and radio-TV replacement.
107. *SETCHELL CARLSON*—Fold-out stereo brochure describes four new models of stereo consoles and lowboys. Color and black-and-white TV's are described in four-color, 18-page booklet. Both catalogs feature 1967 models.
108. *SONOTONE* — 4-color flyer sheet SAH-105 describes new solid-state *Velocitone Mark V* stereo cartridge.
109. *TANDBERG* — Brochures about Models 11, 12, and 64, quality tape recorders.
110. *TURNER MICROPHONE*—New 20-page general catalog.
111. *WATERS CONLEY* — Colorful brochure describes the full line of *Phonola* tape machines and phonographs.

COMMUNICATIONS

112. *ACTION* — Intercom equipment catalogs #701.
113. *AMPHENOL* — 2-color spec-sheets on new Model 650 CB transceiver and Model C-75 hand-held transceiver.*
114. *MOSLEY ELECTRONICS*—Folder about "Talk Power" and new stacked CB beams.
115. *MOTOROLA* — Brochure TIC 2042B describes high-power business-band base stations.*
116. *PEARCE-SIMPSON* — Specification brochure on 1BC 301 business-band two-way radio, *Companion II, Director, Escort II, Guardian 23,* and *Sentry* citizens-band transceivers. Two booklets; "Modern Business Communications" and "How to use and Choose Marine Radiotelephones."

COMPONENTS

117. *BUSSMANN* — 12-page booklet listing the complete line of *Buss* and *Fusetron* small-dimension fuses by size and type. Indicates proper fuseholder—also shows list prices. Bulletin SFUS.*
118. *CENTRALAB* — Catalogs offered on electrolytic capacitors, PEC's, and auto radio shafts and bushings.*
119. *CORNELL-DUBILIER* — 64-page replacement component guide, 112-page Electrolytic capacitor reference, 4-page brochure "The Magnificent 12."
120. *DIALIGHT* — New 8-page catalog about illuminated push-button switches.
121. *EN-POWER* — Spec sheet on rechargeable "D" cell with built-in charger.
122. *J-B-T* — Bulletin JMT-446 describing miniature toggle switches.
123. *LITTELFUSE*—Form CBCRP66H pocket-size cross-reference of circuit breakers for TV.*
124. *MAGNECRAFT*—Catalog 267 lists broad line of relays for all applications.
125. *SPRAGUE* — Catalog C-616 is a complete 52-page guide to capacitors, resistors, filters, PC units, and capacitor testers.*
126. *SWITCHCRAFT* — Bulletin 163 about molded, coiled cords for headsets.

SERVICE AIDS

127. *CASTLE* — 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.*
128. *CLEVELAND INSTITUTE OF ELECTRONICS* — New pocket-sized, plastic "Electronics Data Guide" of formulas and tables, including frequency and wavelength, dB formulas and table, antenna lengths, and color code.*
129. *ELECTRONIC CHEMICAL* — Brochure of aerosol chemicals for controls, tuners, and tape heads.
130. *LAFAYETTE RADIO ELECTRONICS* — 1967 Catalog, No. 670 featuring two-way radios, stereo hi-fi, tape recorders, test equipment, and components.
131. *PENCO* — 48-page catalog about steel equipment including shelving and workbenches.
132. *PRECISION TUNER* — Literature supplying information on complete low-cost repair and alignment service for any TV tuner.
133. *QUALITY TUNER SERVICE* — Introductory letter describing costs and service on all makes of TV tuners. Repair tags and shipping labels included.

SPECIAL EQUIPMENT

134. *DIAMOND ELECTRONICS* — Silicon-transistorized viewfinder cameras.
135. *SQUIRES SANDERS* — CCTV cameras and accessories.
136. *STACO* — Flyer sheet about *adjust-A-Volt* transformers.

TECHNICAL PUBLICATIONS

137. *ALPHA* — Bulletin dealing with the technology of soldering fine copper wire.
138. *HAYDEN* — New 64-page catalog listing books published by the Hayden Book Company, Inc. and John F. Rider Publisher, Inc. for the electronics service technician, student, and hobbyist.
139. *PHILCO* — Information about Tech Data & Business Management Service. Also, free parts catalog.*
140. *RCA INSTITUTES* — New 1966 Career Book, "Your Career in a World of Electronics," describes programs and courses in television, telecommunications, automation and industrial electronics, drafting, and computer programming.*
141. *HOWARD W. SAMS*—Literature describing popular and informative publications on radio and TV servicing, communications, audio, hi-fi, and industrial electronics, including special new 1966 catalog of technical books on every phase of electronics.*

TEST EQUIPMENT

142. *AMPHENOL*—Spec sheets on the *"Commander"* line of color test equipment.*
143. *B & K*—New 1966 catalog featuring test equipment for color TV, auto radio, and transistor radio servicing, including tube testers designed for testing latest receiving tube types.*
144. *EICO*—New 32-page full-line catalog. Describes a complete line of test instruments, CB and ham equipment, hi-fi components, and miscellaneous electronic equipment.*
145. *HICKOK*—Catalog sheet on the DP-140 event counter.*
146. *JACKSON* — Catalog on "Service Engineered" test equipment featuring the new X-100 color generator.*
147. *MERCURY ELECTRONICS* — All-new catalog of time saving test equipment.*
148. *PRECISION APPARATUS* — Illustrated catalog describing signal generators, oscilloscopes and meters.
149. *SECO*—Brochures on new Models 240 SCR analyzer and 260 Transistor analyzer.
150. *SEMITRONICS* — Brochure on a new transistor tester and set analyzer.
151. *SENCORE* — New 4-color catalog about *Econoline* test equipment.*
152. *SIMPSON*—Flyer giving specifications of Model 604 multicorder for measuring and recording volts, amps, milliamps, and microamps.
153. *TRIPLETT* — Catalog #49-T featuring complete line of VOMs, VTVMs, tube testers, transistor analyzers, and all related accessories.

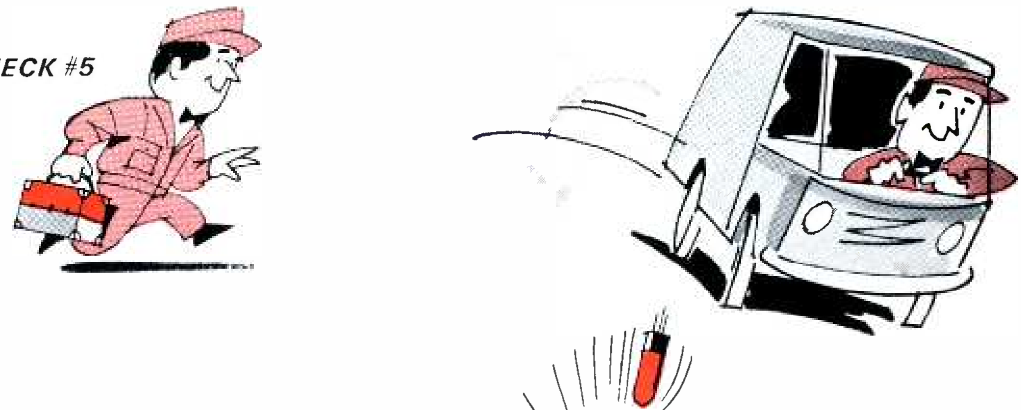
TOOLS

154. *ARROW*—Literature describing 3 staple guns.*
155. *ENTERPRISE DEVELOPMENT*—Time-saving techniques in brochure from *Endeco* demonstrate improved desoldering and resoldering methods for speeding and simplifying operations on PC boards.*
156. *KONIGSLOW* — Catalog sheet about the *"Uni-Swiv"* work holder for changers, chassis, etc.
157. *LUXO*—Flyers on bench lamps and magnifying bench lamps.
158. *VACO* — Catalog No. SD-119 on interchangeable-blade snap driver kits and components. Also two new booklets; "How to Use Screwdrivers," and "Helping Hand for Electrical Wiring."*

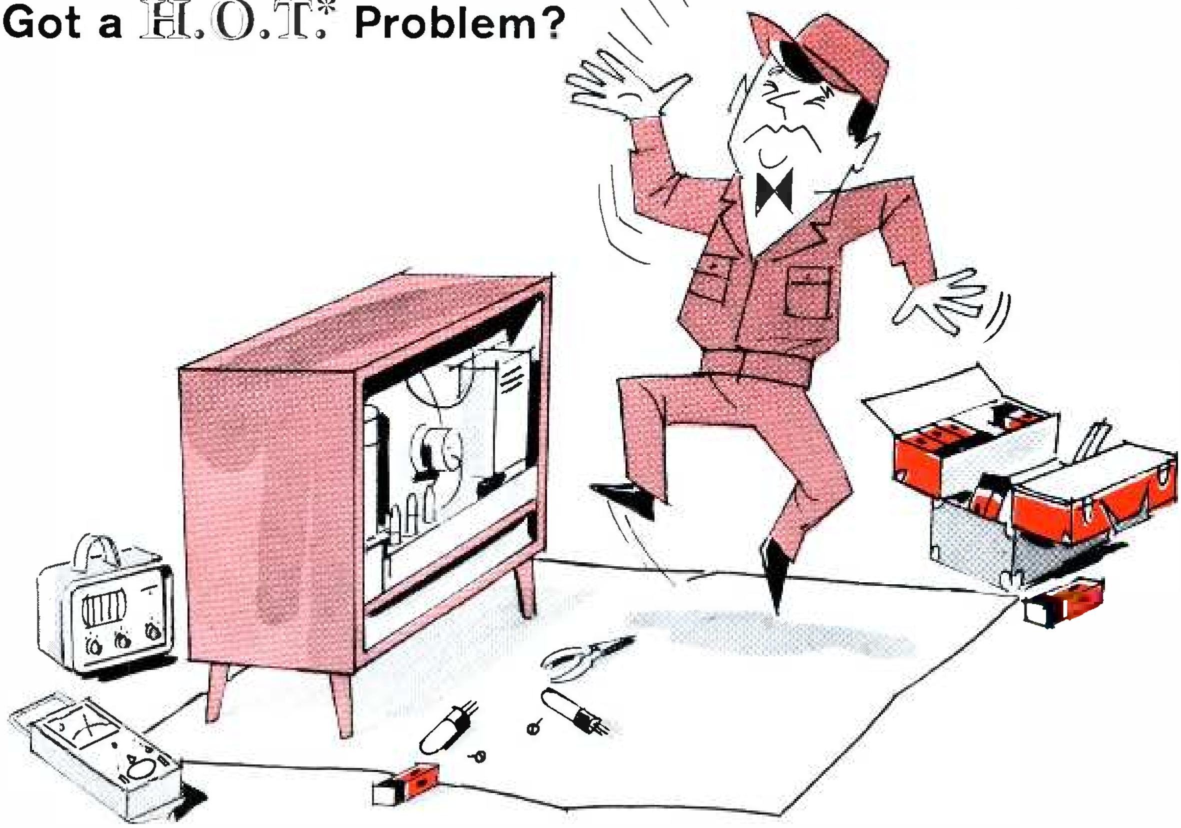
TUBES & TRANSISTORS

159. *INTERNATIONAL ELECTRONICS* — Literature on IEC service range receiving tubes.
160. *INTERNATIONAL RECTIFIER*—Catalog F-66, 34-pages of semiconductors and allied devices.
161. *RADIO CORP. OF AMERICA*—PIX-300 12-page product guide on RCA picture tubes covering both color and black and white. Includes characteristics chart, terminal diagrams, industry replacement, and interchangeability.*
162. WORKMAN — Transistor cross-reference for use with *Miracle Five* transistor line that replaces 2,977 entertainment-type transistors.*

RCA's COLOR TV FASTCHECK #5



Got a H.O.T.* Problem?



Keep it cool...and avoid burnout!

The *Horizontal Output Tube in a color set has to work hard . . . and efficiently. Abnormal circuit conditions can send its plate dissipation far beyond the allowable limit and permanently damage the tube.

The most likely source of damage is failure or removal of grid circuit drive for even 10 to 20 seconds. When servicing horizontal oscillator and deflection circuits, therefore, observe these "don'ts."

1. ***Don't*** pull the horizontal-oscillator tube with power applied to the set.
2. ***Don't*** apply power to a "warm" set if the oscillator tube is cold. Wait a few minutes, or heat the oscillator tube in a tube tester.
3. ***Don't*** risk H.O.T. damage by shorting out overload devices.
4. ***Don't*** disconnect the H.O.T. plate cap to kill high voltage. Use the method recommended by the set manufacturer.
5. ***Don't*** replace an H.O.T. without adjusting the horizontal-efficiency coil for correct cathode current.

Observing these precautions will help you to obtain maximum efficiency and longer life from the horizontal output tube. This is the latest in RCA's continuing series of color TV service hints. You will find your RCA tube distributor your best source for quality RCA receiving tubes for color TV, black and white TV, Radio and hi-fi. To help keep your customers happy, and avoid callbacks, always replace with RCA receiving tubes.

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

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