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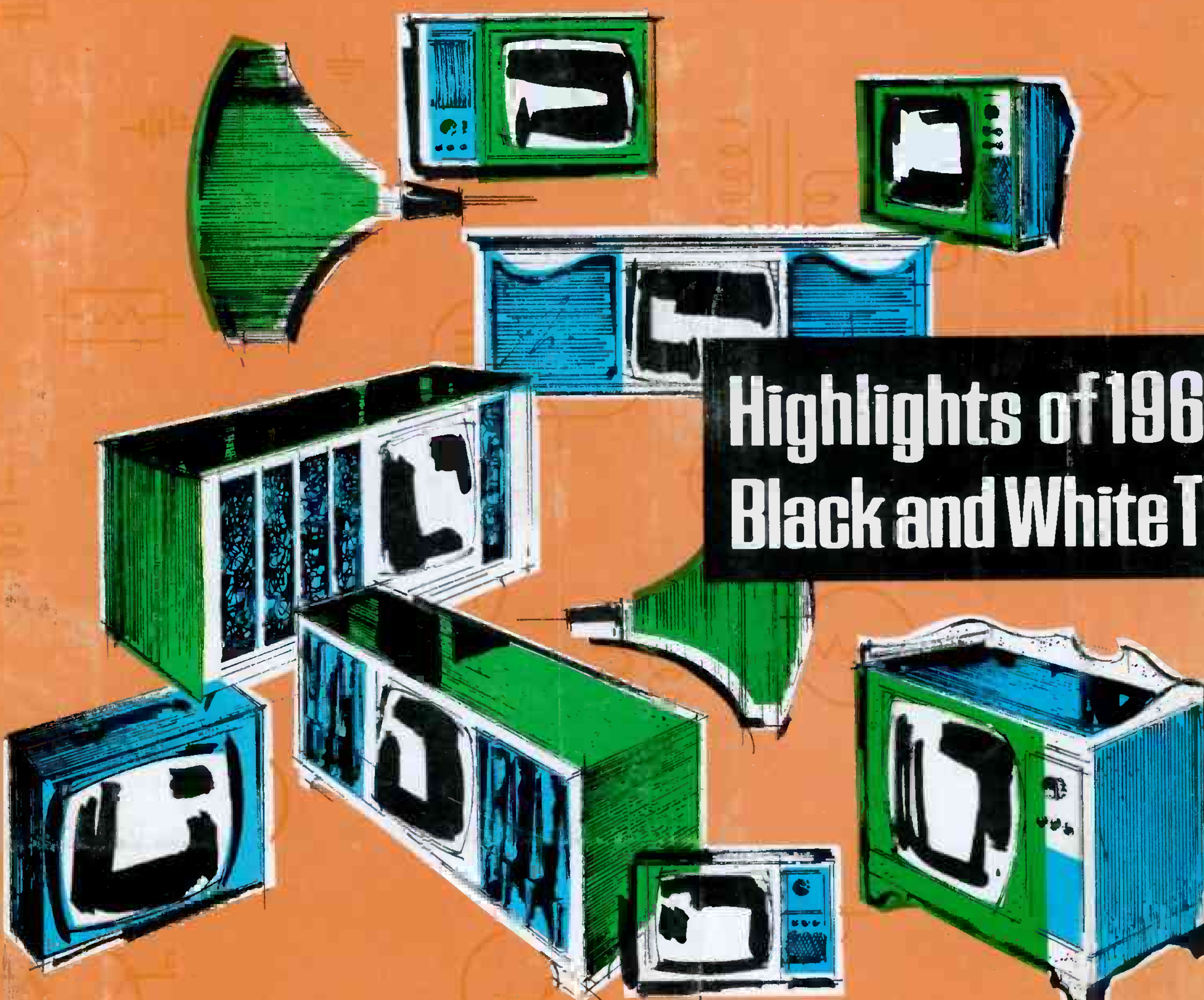
OCTOBER 1967 75¢

PF Reporter

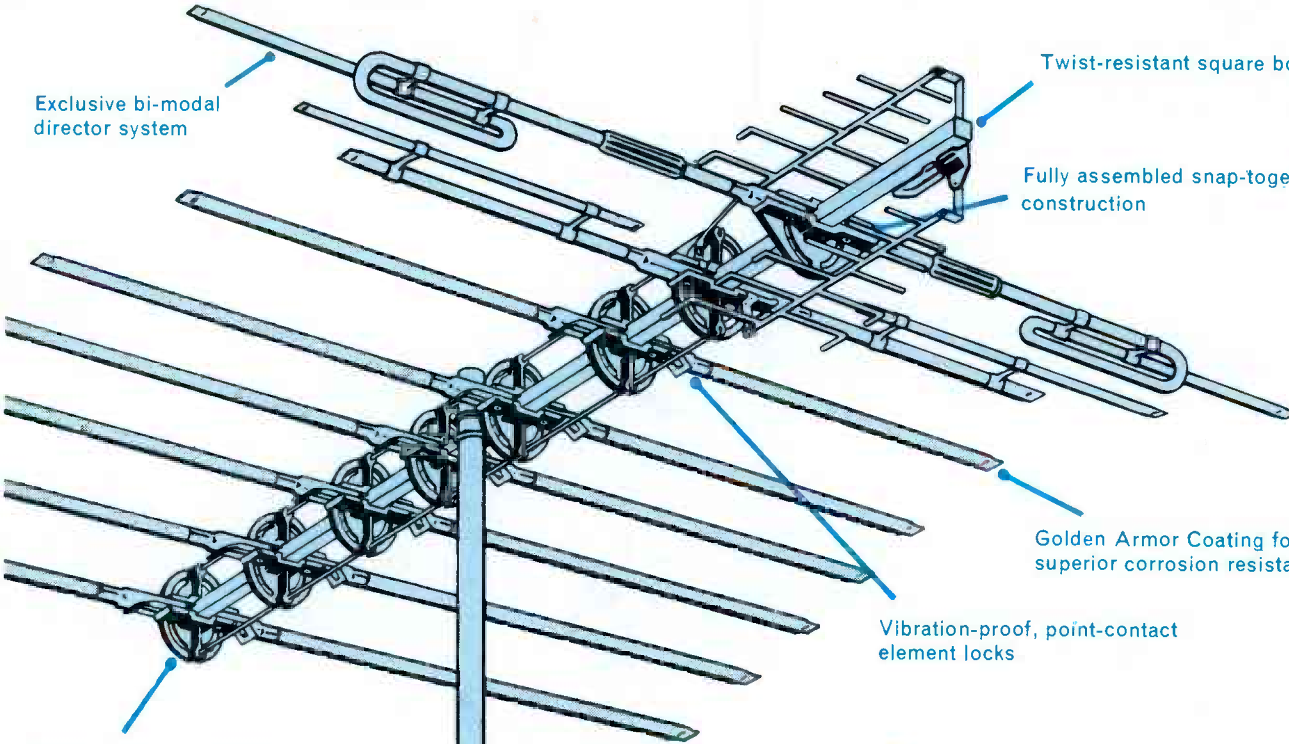
PHOTOFACT

the magazine of electronic servicing



Highlights of 1968 Black and White TV

- Color TV Service Training
- Highlights of '68 TV Lines
- Repairing the Deluxe AM-FM Chassis
- Notes on Test Equipment
- The Troubleshooter



82-channel signal grabber

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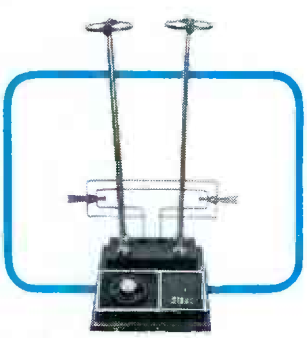
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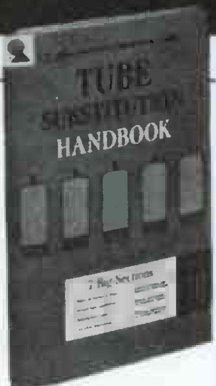
Tube Substitution Supplement

This Supplement has been designed to provide you with the latest up-to-date information on new tubes. The format allows maximum use during a house call or at the bench.



REMOVE THIS SUPPLEMENT FROM

PF Reporter®

and put it in the back of your

TUBE SUBSTITUTION HANDBOOK

direct substitutes

Included are the older tubes that will substitute directly for the new tubes. This information supplements the sections in the Tube Substitution Handbook for American Receiving Tubes and Picture Tubes.

basing diagrams

The basing diagram for each new tube will help you in the servicing of new receivers when service literature is not available.

typical characteristics

The typical, or average, characteristics of each new tube can be of great help when troubleshooting new circuits.

easy reference

The direct substitution list will be cumulative each month. Thus, only the latest edition need be carried in the Tube Substitution Handbook.

Direct Substitutions

To Replace	Use	To Replace	Use
1BK2	1AX2 1S2A	4JH6	4BZ6
1BL2	*	5GH8A	5EA8 5GH8 5U8
2CN3A	*	6BY11	*
2EG4	*	6BW11	*
3BL2	3AT2 3BN2	6CL3	6CJ3 6CK3 6DW4A 6DW4B
3BM2	3BN2	6CM3	*
3BN2	3AT2 3BL2	6EJ4	*
3BS2	3BS2A	6JC6A	6HM6 6HT6 6JC6 6JD6
3BS2A	3BS2	6KT6	*
3CN3A	3CN3	6KV6	*
3JC6A	3HM6 3HT6 3JC6 3JD6	6KY6	*
4JC6A	4HM6 4HT6 4JC6 4JD6		

PF REPORTER October, 1967, Vol. 17, No. 10. PF REPORTER is published monthly by Howard W. Sams & Co., Inc., 4300 W. 62nd, Indianapolis, Indiana 46206. Second-class postage paid at Indianapolis, Indiana. 1, 2 & 3 year subscription prices; U.S.A., its possessions and Canada: $5.00, $8.00, $10.00. Other countries: $6.00, $10.00, $13.00. Current single issues 75¢ each; back issues $1.00 each.

To Replace	Use
6LB6	*
6LC6	*
6LH6	*
6LJ6	*
6ME8	*
6MF8	*
6MK8	*
7KY6	*
7KZ6	*
8GU7	*
9GH8A	9EA8
9KX6	*
9LA6	*
12CL3	12CK3 12DW4A
12FQ7	*
17CL3	17CK3 17DW4A
17KV6	*
22KM6	*
25CM3	*
29KQ6	*
30KD6	*
34CM3	*

To Replace	Use
11SP22	*
11TP4	*
12BQP4	12BKP4
12BUP4A	12BUP4
12CBP4	*
12CEP4	*
12CNP4	12CFP4
12CQP4	*
12CSP4	*
12CTP4	*
15KP22	*
15LP22	*
16CHP4A	16CHP4
16CSP22	*
17EQP4	*
19GBP4	19CZP4 19DAP4
19GJP4	19DQP4 19DWP4 19FCP4
19GJP4A	19DWP4 19FCP4 19FJP4 19GJP4
19GVP22	*
19GWP22	*
19HAP4	*
21FBP22A	*
21FYP4	*
21GCP4	*
21GJP4	*

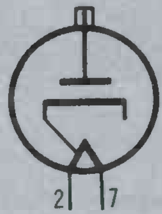
To Replace	To Replace	Use	Use
22JP22	*	23HUP4A	23HUP4
22KP22	*	23HWP4	*
		23HWP4A	23HWP4
23FLP4	*		
23GHP4	*	25TP4	*
23HBP4	*	25WP22	*
23HRP4	*	25XP22	*
23HUP4	23HUP4A	25YP22	*

*No replacement at present time. See future editions of Tube Substitution Handbook

General Specifications

2CN3A

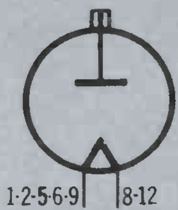
High-Voltage Rectifier
Fil.—1.8V @ 0.9A
PIV—38KV @ 2.2ma



8MN

3BM2

High-Voltage Rectifier
Fil.—3.0V @ 0.3A
PIV—30KV @ 1.7ma

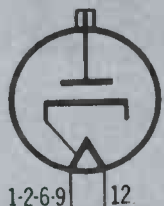


12HK

Suggested direct replacement: 3BN2

3BS2

High-Voltage Rectifier
Fil.—3.15V @ 0.48A
PIV—38KV @ 2.2ma



12EW

Suggested direct replacement: 3BS2A

3BS2A

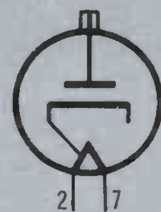
High-Voltage Rectifier
Fil.—3.15V @ 0.48A
PIV—38KV @ 2.2ma

12EW

Suggested direct replacement: 3BS2

3CN3A

High-Voltage Rectifier
Fil.—3.15V @ 0.48A
PIV—38KV @ 2.2ma



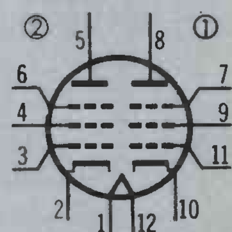
8MN

Suggested direct replacement: 3CN3

6BW11

#1—Video Amplifier
#2—General Purpose
Fil.—6.3V @ 0.8A

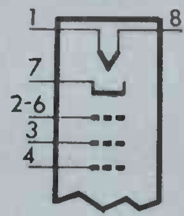
		#1	#2
E_P	=	125	125V
E_{SG}	=	125	125V
R_K	=	56	56Ω
I_P	=	22	11ma
I_{SG}	=	4.8	3.8ma
G_m	=	8500	13,000 μmhos



12HD

12BUP4A

Protection—tension band
Deflection—110°
Filament—6.3V @ 0.45A (11 sec)
Grid 2—50V

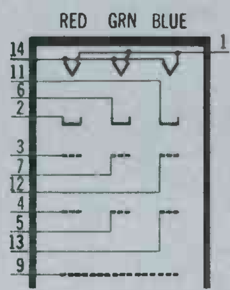


8HR

Suggested direct replacement: 12BUP4

15KP22

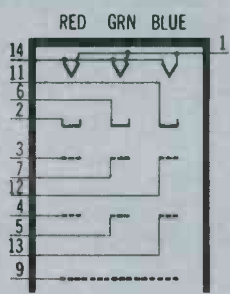
Protection—None
Deflection—90°
Filament—6.3V @ 0.9A



14BH

15LP22

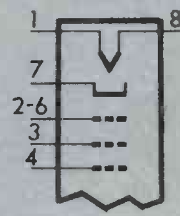
Protection—Bonded
Deflection—90°
Filament—6.3V @ 0.9A



14BH

19GJP4

Protection—tension band
Deflection—114°
Filament—6.3V @ 0.45A (11 sec)
Grid 2—400V

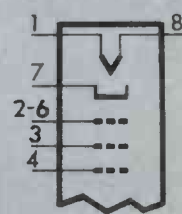


8HR

Suggested direct replacements: 19DQP4, 19DWP4, 19FCP4

19HAP4

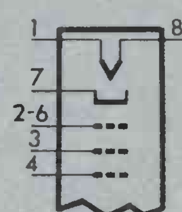
Protection—tension band
Deflection—114°
Filament—6.3V @ .315A
Grid 2—50V



8HR

23GHP4

Protection—tension band
Deflection—94°
Filament—6.3V @ 0.45A (11 sec)
Grid 2—200V



8HR

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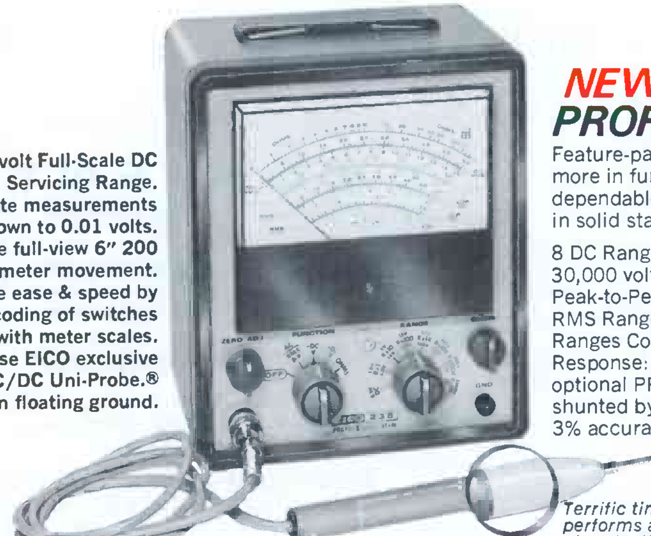
- Signal isolation floating ground.



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Wired $44.95
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All other foreign countries: 1 year—$6.00, 2 years—$10.00, 3 years—$13.00. Single copy 75¢; back copies $1.

Indexed in Lectrodex. Printed by the Waldemar Press Div. of Howard W. Sams & Co., Inc.

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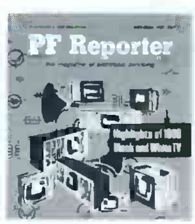
VOLUME 17, NO. 10 OCTOBER, 1967

CONTENTS

ABOUT THE COVER

This month's cover illustrates abstractly the many new monochrome TV receivers in the '68 lines. The symbols in the background point out that many of the new models are either hybrid or completely solid-state. For more information on the new sets see the article starting on page 4.



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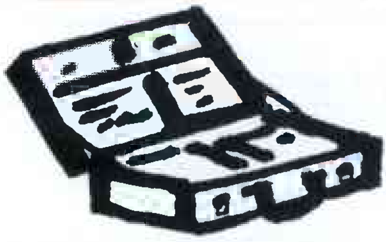

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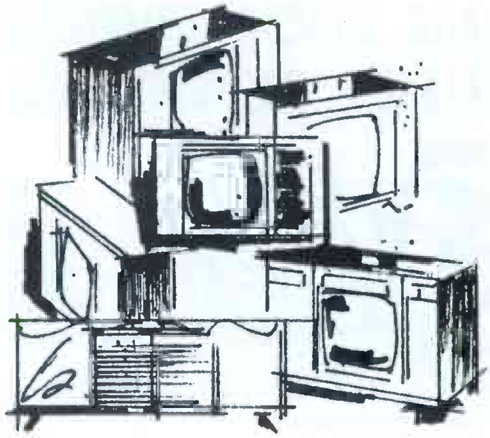
HIGHLIGHTS OF 1968 TV LINES



A preview of the black-and-white models offered for the coming year, including an analysis of new features and circuitry.

by J.W. Phipps

ADMIRAL

A wide variety of screen sizes and a new hybrid chassis are featured in this manufacturer's black-and-white lineup for '68. Although the majority of models are new, nearly all use carryover chassis.

Leading the lineup are two new 22″ table models employing the previously introduced 3G5 chassis. Also offered is a 22″ holdover table model using the 7G7 chassis. Eight consoles are included in the new line; four are new models using the 3G5 chassis, while the other four are carryovers that use chassis 7G7.

The portable grouping offers screen sizes ranging from 9″ to 20″. Two Playmate 9″ models are available; one is a new deluxe version and the other is last year's introduction. Both use the recent MG2-1 chassis. The Playmate series has also been extended to the 12″ models with the addition of four new portables using the familiar H1-1A and 1H1-1A chassis. All four come with a sun shield (Fig. 1) that snaps on the front of the cabinet to provide improved contrast outdoors, or in brightly illuminated rooms.

Fig. 1. Sun shield used on Admiral's Playmate portable series.

Three new 14″ models are also included in the extensive portable grouping. Each uses Chassis 1H2-1A. Two of the three 16″ models are equipped with the new "Sun Shield." All use the H3-1A chassis and come equipped with "roll-about" stands.

Roll-about stands also come with all 18″ and 20″ portable models. Eight 18″ models are available; five use the H4-1A chassis and the other three use a version of the new hybrid H5 chassis. The three 20″ portables also use a version of this new chassis. One 20″ set, the Jubilee (Model P2037C), is shown in Fig. 2.

The new H5 hybrid chassis uses five tubes (plus picture tube) and thirteen transistors. The tubes include the following: a double pentode 24BF11 used in the sound detector and sound output stages, a triode-pentode 24JZ8 employed in the vertical oscillator and vertical output circuits, and a twin diode-pentode 11LT8 serving the horizontal AFC and horizontal oscillator. Rounding out the tube complement are a diode-pentode 53HK7 functioning in the horizontal output and damper circuits and a 1AY2 high voltage rectifier. A 19HAP4 or 21GTP4 picture tube is used with the H5 chassis.

Three transistor video IF stages are included in the H5 design, along with two transistorized stages of video amplification. Sound is taken off the collector of the 1st video amplifier and fed to a PNP transistor sound IF circuit, which in turn feeds a conventional tube-type quadrature detector.

A forward, keyed AGC system (Fig. 3) is employed in the H5 chassis. The term "forward" describes the biasing effect the AGC voltage has on the transistors to which it is fed. With the exception of voltage polarities and values, Q1 operates like a tube-type keyed AGC stage. A negative-going video signal from the emitter circuit of the 1st video amplifier is applied to the base of Q1, while a horizontal pulse is fed through C1 to the collector. The simultaneous application of both signals (during horizontal retrace) causes Q1 to conduct, charging C1. The charge on C1 is added to an existing 3.3-volt charge on C2, producing approximately 8 volts of

Fig. 2. Admiral's 20″ Jubilee model.

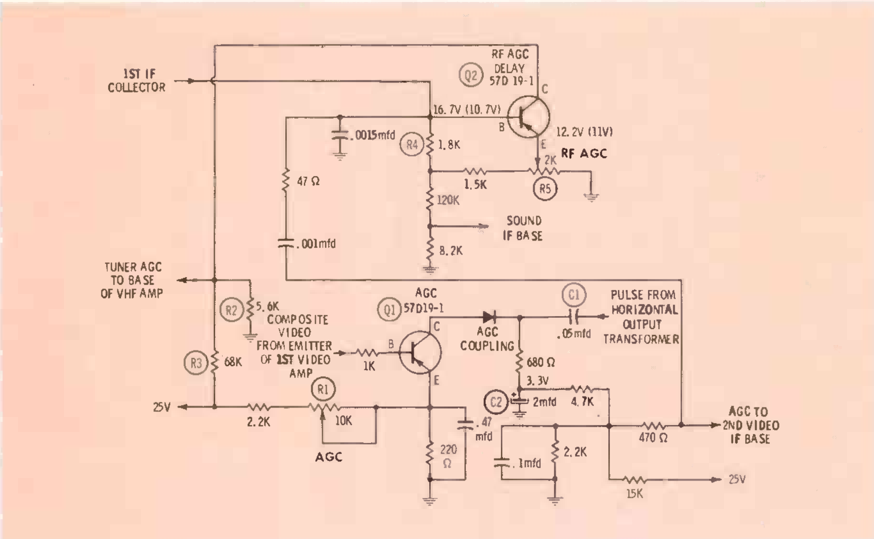


Fig. 3. Forward AGC system employed in Admiral's new H5 hybrid chassis.

positive AGC voltage. (The actual amount of AGC voltage produced is dependent on the level of the video signal applied to the base of Q1 and the setting of R1, the overall AGC control.)

The positive AGC voltage is then applied as forward bias to the base of Q4, the 2nd video IF (Fig. 4). Current through Q4 increases and, in turn, develops a larger voltage drop across R6. Since R6 is in series with Q4, the increased voltage drop across it detracts from the emitter-to-collector voltage of the transistor, thus decreasing the gain of the stage.

The 1st video IF also feels the effects of the forward AGC voltage. An increase in the voltage drop of R6 produces a more positive voltage at its ungrounded end. This increased positive voltage is applied to the base of Q3, increasing the forward bias on this stage and producing a reduction in gain in the same manner as was described for the 2nd video IF.

To prevent reduced gain in the tuner during the reception of relatively weak signals, the AGC applied to the VHF amplifier is delayed by Q2 (Fig. 3). With low-level IF signals, Q2 is biased to cutoff. R5, the RF AGC control, determines the level of signal required to bring Q2 into conduction. When a high-level signal is received, the added voltage drop across R4 forward biases Q2 into conduction, which raises the voltage at the high side of R2 and adds to the forward bias applied to the VHF amplifier transistor. Increased forward bias reduces the gain of this stage exactly the way it does for the 1st and 2nd video IF amplifiers.

Other features of the H5 chassis include "Instant Play" and spot elimination circuits. Both are shown in Fig. 5. With the on-off switch in

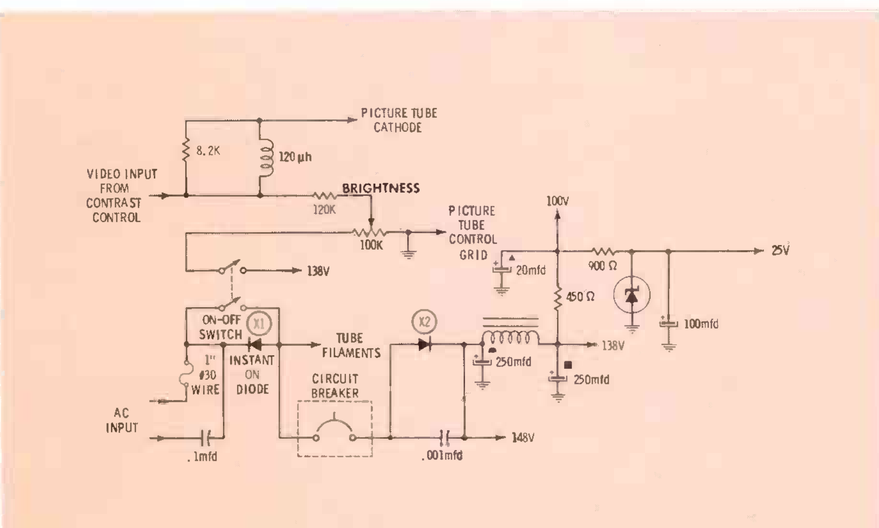


Fig. 5. Low-voltage power supply used in H5 chassis.

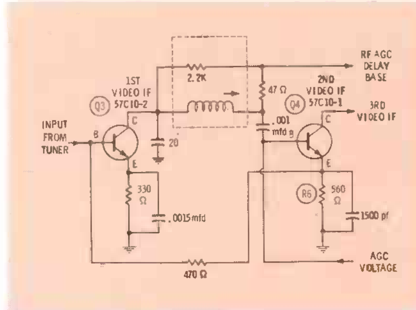


Fig. 4. Positive AGC voltage applied to base forward biases Q4.

the off position (as shown in Fig. 5), X1 provides all tube filaments with half-wave current instead of the normal full-wave current. No B+ is developed in the off position because X1 and X2 are back-to-back. The spot elimination circuit is ganged to the on-off switch and in the off position, removes B+ from the brightness control, causing the picture tube to draw increased current, thereby quickly discharging the aquadag coating and eliminating the spot on the screen.

Also shown in Fig. 5 is the half-wave low-voltage power supply. Four values of B+ are provided. The 25-volt source is regulated by a Zener diode and used in the transistor circuits.

ANDREA

An 18" and a 22" table model make up Andrea's b-w line for the coming year. Both models use the same transformer powered chassis that was introduced in last year's models. The 18" Courier model is shown in Fig. 6.

The big news this year from Andrea concerns the new 5-year consumer guarantee offered on all of their television chassis. The 5-year guarantee covers all parts except the picture and receiving tubes, which are covered by a separate 1-year guarantee.

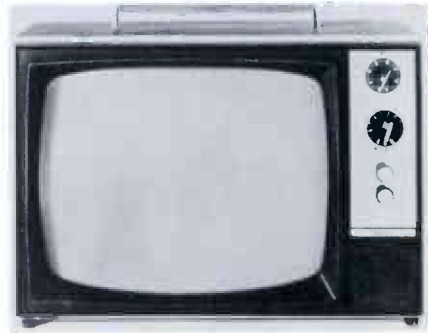


Fig. 6. Andrea's 18" Courier model.

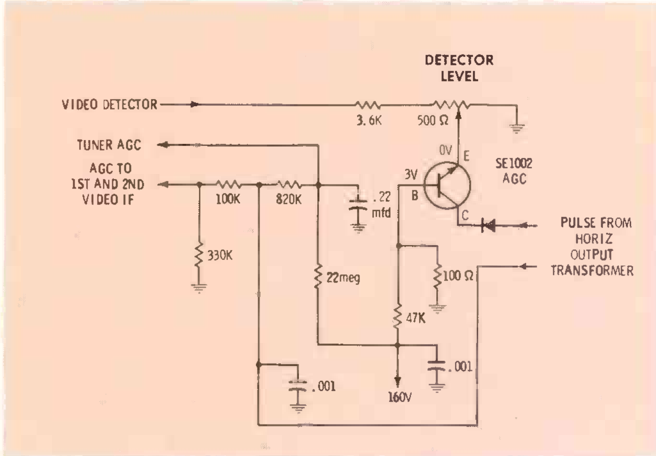


Fig. 7. Solid-state AGC circuit employed in Catalina chassis.

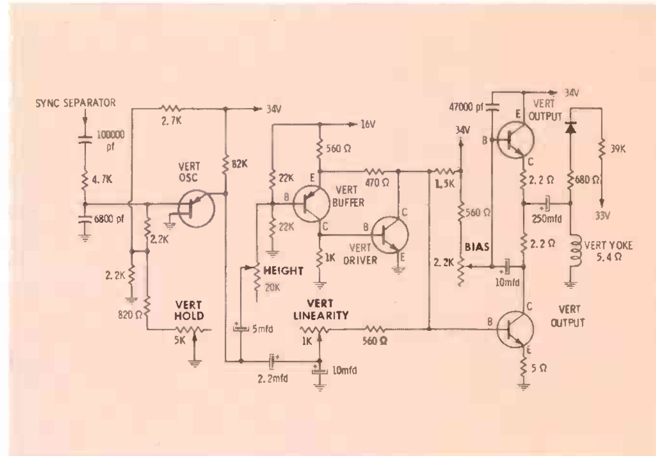


Fig. 8. Vertical system found in Electrohome's new chassis.

CATALINA

Three new models are offered in Catalina's '68 line. Two are 22″ consoles and one is a 20″ portable model. The transformer-powered tube-type chassis used in the two consoles has a transistorized keyed AGC circuit (shown in Fig 7). The transformerless, series-filament chassis utilized in the 20″ portable uses a similar transistorized AGC stage. In addition, the portable chassis is equipped with "instant on."

CORONADO

Five portables and three console models are available from Coronado for '68. Smallest of the portables is a 12″ model using a tube-type imported chassis. Next in line are three 18″ portables, all employing transformerless, tube-type chassis equipped with transistorized AGC. Two of the 18″ models also feature "instant on" circuits. The "Arcadia" 18″ portable is equipped with a "sleep switch" timer that turns the set off after up to three hours of operation. The largest screen size offered in the portable group is 20″, available in the Sierra model.

Two 22″ consoles and one 22″ combination model complete the line. All three use a tube-type transformer-powered chassis featuring the transistorized AGC circuit mentioned above. The combination model is equipped with an AM-FM radio and four speed stereo phono.

ELECTROHOME

Offered for 1968 are fourteen b-w models using two solid-state chassis and one tube-type chassis. CRT sizes include 22″, 20″, 19″, 18″, and one 10″.

The consoles and one table model included in the new line are 22″ receivers using the transformer-powered tube-type M4 chassis. The 18″ portables also use the M4 chassis.

One 19″ portable uses the new solid-state M5 chassis. All circuitry in this chassis is transistorized except for the high-voltage stage, which uses a 1K3 vacuum tube rectifier. The vertical sweep system employed in this chassis is unique. As shown in Fig. 8, a unijunction transistor is employed in the oscillator circuit and a push-pull arrangement serves the transformerless output function. The horizontal sweep system is designed with an AFC amplifier, Hartley-type sine-wave oscillator, and a buffer stage that is transformer-coupled to the common-emitter horizontal output stage. The transformer-type power supply feeding this chassis consists of two rectifier circuits; one is a full-wave circuit followed by a regulator system which has 16- and 34-volt outputs. The other rectifier circuit is a half-wave arrangement producing a single 14.5-volt output. The 6.3-volt AC filament of the picture tube is supplied by a separate winding on the power transformer secondary.

The basic circuitry of the solid-state chassis used in the 10″ AC/DC portable is electrically similar to the M5 chassis. Major differences, other than the CRT (an 11NP4), include the high-voltage stage (which uses a 1BG2 tube) and the absence of a unijunction transistor in the vertical oscillator system.

EMERSON

Six chassis designs power Emerson's 18-model line for '68. The smallest screen size offered is 11″, available in two personal portables using carryover chassis. One 11″ model is an AC/DC solid-state receiver and the other is an AC-only design.

A carryover transformerless chassis is employed in the three 15″ portable models, as well as in four of the six 18″ receivers included in the new line. The remaining two 18″ models use a more recent chassis (120856, 857) equipped with a half-wave low-voltage supply powered by an autotransformer. Other electrical differences in the two chassis include the addition of a 3rd video IF amplifier and width control. The width control is a potentiometer in the screen circuit of the horizontal output stage. One other major change involves the movement of the 1st video IF circuit from the main printed circuit board to a separate board. All but one of

Fig. 9. Emerson's new Model 19P76.

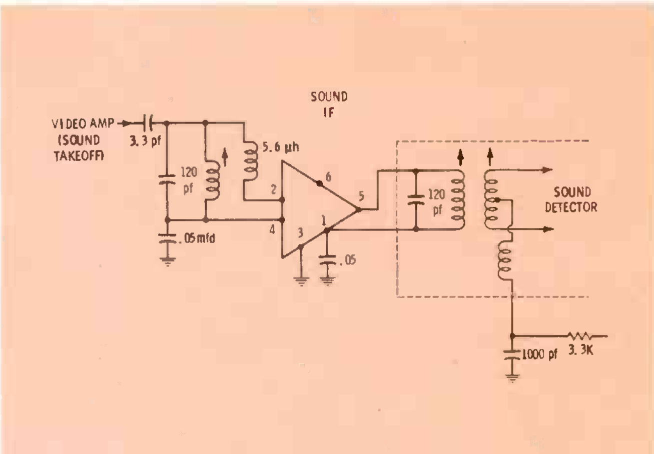


Fig. 10. Packard Bell's 88-21 chassis uses integrated circuit.

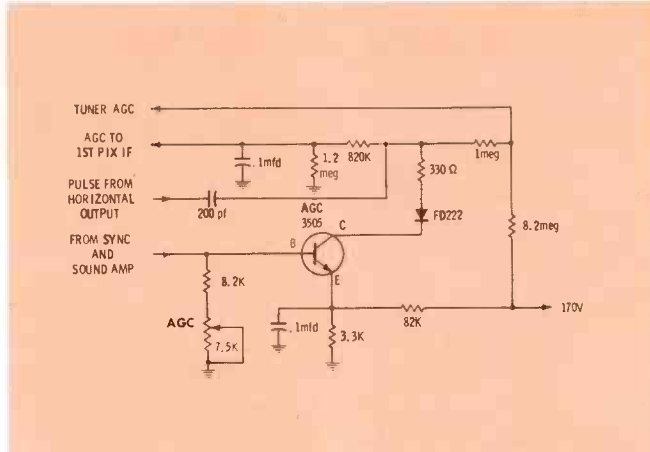


Fig. 12. Transistor AGC circuit used in RCA's KCS158.

the 18″ receivers are equipped with a "quick-on" circuit, two have clock timers that provide automatic cut-off of the set after a selected period of operation, and two use Emerson's new VHF tuner featuring "Perm-Lok" fine tuning.

A 19″ screen is available on two portable models. The 19P76 is shown in Fig. 9. Both use 20ADP4 picture tubes and chassis that are identical to the 120856, except for slight modifications of the CRT circuits. Both 19″ models are equipped with the "quick-on" and clock-timer circuits, as well as the new "Perm-Lok" tuner.

Completing Emerson's '68 line are five 22″ models. The chassis used in all five models are also identical to the 120856 chassis, except of course, for the CRT (a 23HWP4). Features common to all 22″ models are "quick-on" and "Perm-Lok" fine tuning.

PACKARD BELL

Fourteen models with screen sizes ranging from 8″ to 22″ are available in this manufacturer's new b-w line. Heading up the small-screen portable sets are two 8″ AC/DC models sharing the same solid-state chassis. Included in the chassis design are three stages of video IF, two video amplifier stages, a noise canceller circuit, and tripler-type high-voltage supply feeding the 9XP4 picture tube. A full-wave bridge rectifier is used for AC operation, together with an active power filter circuit which also serves during DC operation.

Fig. 11. Panasonic's 8″ Model TR-238B.

Tube-type chassis are used in the two 12″ and two 15″ AC-only models. Both chassis designs employ series filaments and a transformerless half-wave low-voltage supply. The only major difference in the chassis are the CRT's; the 12″ models use a 12CUP4, while the 15″ models use a 16CVP4.

Two new models and one carry-over are offered in the 18″ portable grouping. Both new models use the transformer-powered tube-type 88-21 chassis. An integrated circuit, shown in Fig. 10, is featured in the sound IF stage of this chassis.

An 18″ table model and two 22″ consoles complete this manufacturer's '68 line. All three models use the 88-21 chassis.

PANASONIC

Three new models are included in Panasonic's '68 offerings. Model TR-205, the "Starstream", is a 5″ solid-state AC/DC portable equipped with a new "dark-tint" screen. Three video IF stages and two video amplifier stages are used along with a noise canceller circuit, sync separator, and sync amplifier. Also used are three stages of audio amplification fed by a ratio sound detector and a single-stage sound IF. The deflection circuits use drivers between the oscillator and output stages. A bridge-type rectifier supplies power for AC operation. For DC (battery) operation, the input is fed directly to an active power filter circuit.

Models TR-238B (Valley View) and TR-228D (Georgetown) use the same basic circuitry as the TR-205 described previously. The major electrical difference in the three designs involves the CRT sizes and the accessory circuits. Both the TR-238B (shown in Fig. 11) and TR-228D employ 9XP4 picture tubes and are therefore categorized as 8″ portables. The TR-238B also employs a charging circuit for its "built-in" cartridge-type battery. An added feature of the TR-228D is an automatic timer which allows up to two hours of operation before automatically turning the set off. One other difference involves the high-voltage circuits; the 5″ TR-205 uses a voltage tripler arrangement consisting of three semiconductor diodes, whereas the two 8″ chassis use a 1X2B tube-type high-voltage rectifier circuit. Both the TR-238B and TR-228D are equipped with "dark-tint" screens.

Other solid-state models featured in Panasonic's new line are: An 8″ AC/DC portable using a chassis similar to TR-205; one 8″ AC/DC portable and one 8″ AC/DC table model equipped with AM/FM radios; one 8″ AC/DC table model with clock and timer; and one 9″ AC/DC portable.

Tube-type and hybrid AC portables round out this manufacturer's line. Included are three 12″ and one 15″ all-tube receiver. The two hybrids offered have 18″ screens.

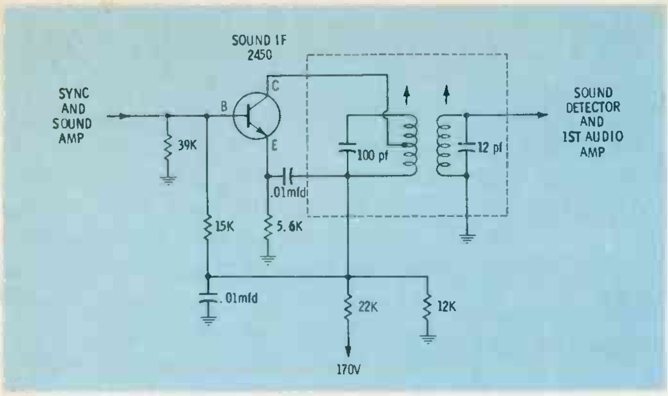


Fig. 13. Sound IF stage of Chassis KCS158 is solid-state.

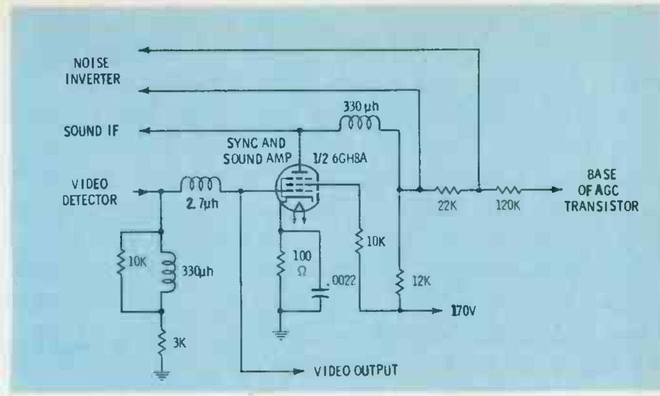


Fig. 14. Sync and sound amplifier employed in KCS158 and KCS159 chassis.

PHILCO

A variety of tube, hybrid, and all-transistor chassis are utilized in Philco's 37-model b-w "R" line for the coming year. A total of 13 chassis are used, including 7 carryovers and 6 recent designs. Screen sizes range from 8″ to 22″.

Offered in the 8″ size is one transistorized AC/DC portable with a built-in battery charger. Three 12″ models are included in the new line; all use the tube-type 17C21 carryover chassis. Three 16″ portables also use carryover tube-type chassis (17H22 and 16H22).

Seven tube-type and three compact hybrid models comprise the 18″ size group. Carryover 17J27 and 17J25 chassis are used in six of the tube-type 18″ receivers. One hybrid 18″ uses the previously introduced 17JT41 chassis, while the other two 18″ hybrid receivers employ a newer version of the same chassis (18JT41). One 18″ model features Philco's "Midnite Mask" black glass screen.

Two 19″ compact models are available. One employs the new 18J32 chassis equipped with a 20RP4 picture tube. A remote control unit utilizing an integrated circuit is used with the chassis powering the other 19″ receiver. This chassis is also equipped with the 20RP4 picture tube.

Chassis 18LT43, a transformer-powered hybrid chassis similar to last year's 17LT43, is used in two 20″ compact models. A 21FYP4 picture tube is used in both models.

Three 22″ table models and eight 22″ consoles employ Chassis 18N35, which is nearly identical to the previously introduced 17N35 chassis except for a different VHF tuner and minor circuit changes. Completing the "R" line are five 22″ consoles powered by Chassis 18NT45, a newer version of the hybrid 17NT45 introduced last year. The UHF and VHF tuners employed with this chassis are solid state.

RCA

The 23 black-and-white models offered for 1968 by this manufacturer are designed around twelve chassis. Eight are continuing chassis employed in the 1967 line, two are recently introduced chassis, and the remaining two are new chassis.

Continuing chassis are the KCS-152, a tube-type vertical chassis used in one 15″ model; KCS155, an autotransformer-powered vertical tube-type chassis employed in an 18″ model; KCS156, a transformer-powered horizontal chassis used in another 18″ model; and KCS161, a transformerless, vertically mounted chassis serving in one 20″ receiver. Other continuing chassis are the transformer-powered KCS163, a horizontally mounted chassis used in one 18″ set; KCS159, a horizontally mounted transformer-type chassis employed in three 22″ consoles and one 22″ table model; and KCS160, an autotransformer-powered, vertical chassis utilized in two 18″ and one 19″ model. Rounding out the continuing chassis list is the KCS-164, a chassis similar to KCS160. Two 18″ and one 20″ receiver use this chassis.

The four small-screen portables offered in RCA's '68 b-w line use the two recently introduced chassis. A completely solid-state chassis, the KCS157, functions in two personal 8″ models, aptly named "Minikin Jr."

The other recently introduced chassis, KCS165, is a compact tube-type employed in two 11″ receivers. The design of this series-filament chassis includes two stages of video IF, a single video output stage, and a transformerless, half-wave, low-voltage supply. Two twelve-pin duodecar-type tubes are included in the complement of eleven tubes and four solid-state diodes. One is a 33GY7 diode-beam power pentode serving the horizontal output and damper stages. The other twelve-pin type is a 17BF11 double pentode used in the quadrature sound detector and audio output circuits. A 12CNP4 or 310AUB4 bonded-faceplate picture tube is used in this chassis.

The new KCS158 chassis (used in two 19″ models) is electrically similar to the KCS159 mentioned previously, while the actual physical layout closely resembles KCS164. Similarities to the KCS159 include a transistor AGC circuit (Fig. 12) and a transistor sound IF stage (Fig. 13). In addition, both the KCS158 and KCS159 employ a separate sync and sound amplifier, shown in Fig. 14.

One major difference between the KCS158 and KCS159 involves the low-voltage power supply. The continuing KCS159 uses a conventional power transformer in a full-wave

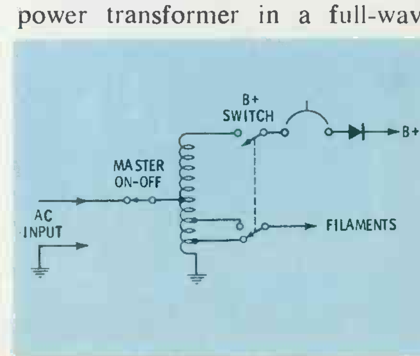


Fig. 15. KCS158 "Instant-Pic" circuit.

configuration, along with parallel filaments. The low-voltage supply of the KCS158 employs an autotransformer, half-wave rectifier, and series filaments. Also, the KCS158 is equipped with an "Instant Pic" circuit, shown in Fig. 15. Two on-off switches are provided. One is labeled "Master on-off", and in the off position, completely removes power from the autotransformer. The other on-off switch serves two functions: In the off position it disables the B+ circuit and provides half of the normal voltage to the filaments, thereby keeping them warm and ready for instant use. In the on position it re-establishes the B+ circuit and switches the filaments to a tap that supplies full voltage to them. Either a 19DQP4 or 20TP4 picture tube is used with the KCS-158 chassis.

The other new chassis found in RCA's '68 line is the KCS168, used in two 15″ receivers. One of these models, equipped with a clip-on dark filter, is shown in Fig. 16. The physical and electrical characteristics of this chassis are similar to those of the KCS165 described previously. However, the KCS168 uses a 16CHP4, whereas the KCS165 is equipped with a much smaller 12CNP4. This difference in CRT size necessitates slight differences in the deflection stages and CRT blanking and supply circuits. A twelve-pin 38HE7 diode-pentode is used in the horizontal output and damper circuits of the KCS168 in place of the twelve-pin 33GY7 diode-pentode employed in the same circuits of the KCS165. The only other tube difference is found in the AGC and video output stages; the KCS168 uses an 8JV8 triode-pentode in these stages, while the KCS165 uses an 11KV8. Other differences involve the vertical yoke windings; those employed in the KCS168 are supplied from a tap on the primary of the vertical output transformer, whereas the yoke windings of the KCS165 received their supply from the secondary of the same transformer.

Fig. 16. RCA's Model AJ-058 is equipped with a clip-on dark filter.

SYLVANIA

Eight chassis are found in this manufacturer's '68 models. Three (A02, A06, A07) are solid-state carryover designs used in one 12″ personal portable and two 18″ "roll-about" portables. Other 18″ roll-about portable models use either chassis B05 or B06 (tube-type carryovers).

Two new 19″ models (the MY71K is shown in Fig. 17) use the recently introduced B09 chassis. This is a transformerless, series-filament chassis employing a full-wave voltage doubler in the power supply. Two transistors (in addition to the one in the UHF tuner) are included in the main chassis complement of the B09. Both are used in a two-stage noise suppression circuit consisting of a noise gate circuit in series with the cathode of the sync separator and a noise amplifier connected between the output of the video detector and the base of the noise gate. DC picture restoration and horizontal blanking are also included in this chassis, as well as all other chassis in Sylvania's new line. The CRT used in the B09 is a 110° 20ZP4.

Six models are offered in the 22″ size group; two are table models and four are consoles. Powering these 22″ receivers is Chassis B04, a tube-type carryover. One other chassis, the B07, is included in Sylvania's new line; however, no information concerning this new chassis is available at the present time.

WESTINGHOUSE

A total of 32 models comprise Westinghouse's '68 b-w line. Leading off the new line is the "Jet Set" grouping which offers eight models equipped with a no-glare black-tinted glass over the screen. One of the two 12″ receivers included in this group is a combination TV/phonograph/clock-radio. Called the "Mini-Combo", the unit measures 15″ high by 19″ wide by 11″ deep. The tube-type TV chassis (V2490-9) used in this model is a carryover and like all of this manufacturer's tube-type b-w chassis, is equipped with an instant-on circuit.

Other models and screen sizes available in the "Jet Set" grouping include three 18″, two 20″, and one 8″ receiver. Chassis V2483, a solid-state design introduced last year, is used in one 18″ and one 20″ model. The only tube employed in this chassis, other than the CRT, is a 1K3 high-voltage rectifier.

The 8″ "Jet Set" receiver is an AC/DC model equipped with the V2652 all-transistor chassis. A voltage tripler circuit provides 9.5 kv of high voltage to the 9XP4 picture tube used in this chassis. Also employed in this chassis is an active power filter circuit, shown in Fig. 18. The remaining 18″ and 20″ "Jet Set" models use carryover Chassis V2487. This is a transformerless tube-type chassis.

Thirteen additional portable receivers (not included in the Jet Set grouping) are also available. Four of these are 12″ models utilizing the V2490 chassis. Eight portable models use the carryover V2486 chassis; six have 18″ CRT's and two offer 20″ screens. One 18″ portable uses the all-transistor V-2483 chassis.

The table and console models included in Westinghouse's '68 b-w line all use 22″ screens. One roll-about table model is offered, along with two receivers that can be used as either table or consolette models. The console grouping consists of eight models; five use Chassis V2487.

ZENITH

Two new chassis designs are in-

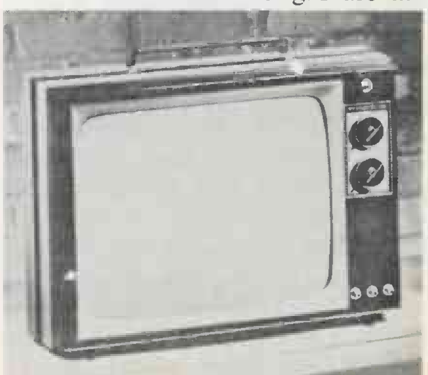


Fig. 17. Sylvania's new Model MY71K.

cluded in the make-up of this manufacturer's '68 b-w line. One is completely solid-state except for the 3BM2 used in the high-voltage stage The other is a hybrid.

The solid-state chassis, 1Y21B55, is employed in two 19" models equipped with Zenith's new "squared corner" 20UP4 rimbond CRT. A total of 25 transistors and 17 diodes are used in this chassis, including the 3 NPN silicon types contained in the new rotary bandswitch VHF tuner. The continuous type UHF tuner is essentially the same design employed in Zenith's tube-type b-w chassis.

The physical construction of this chassis (Fig. 19) is unique. Most of the deflection, power, AGC, and sync circuitry is contained on the horizontally mounted main chassis. However, the remaining circuitry is located on two separate subchassis which are vertically mounted on the main chassis. One subchassis contains the video IF amplifiers, detector, and video driver. The other subchassis includes the sound IF, limiter, and ratio detector circuitry. Both subchassis are enclosed in shielded metal cases to minimize radiation and provide isolation.

The IF subchassis is electrically connected to the main chassis by six plug-in leads. Three stages of video IF amplification are contained on this subchassis. Each is a common emitter configuration employing NPN transistors. The first stage is AGC controlled using forward bias; the gain of the stage is decreased by increasing the collector current which, in turn, reduces the

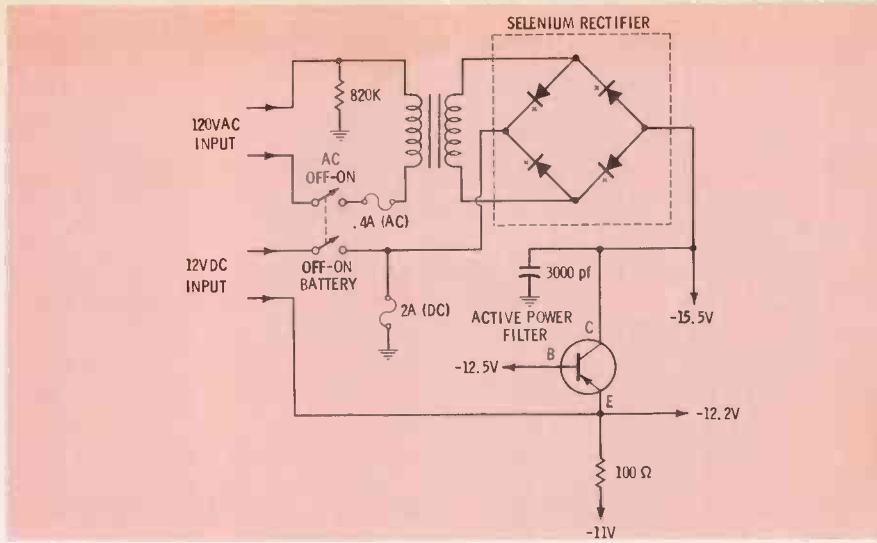


Fig. 18. Power supply employed in Westinghouse's solid-state chassis.

collector to emitter voltage. The video detector is of conventional design, producing an output of approximately 2½ volts p-p. This output is fed to the NPN video driver (Fig. 20), which is essentially a modified emitter-follower circuit designed to match the relatively high impedance of the detector to the low impedance input (base) of the video output stage.

The noise gate driver is triggered by noise peaks and cuts off the noise gate circuit shown in the block diagram of Fig. 21. The noise gate, in turn, prevents conduction of the sync limiter and AGC gate transistors when noise peaks are present.

A forward gated (keyed) AGC system is employed in this chassis. As shown in Fig. 21, the circuit consists of a gate stage, an output stage, and a tuner delay circuit. The gate stage operates similar to a tube-type keying stage. The output stage is an emitter-follower configuration used to match the high impedance of the AGC gate transistor collector circuit to the low impedance of the IF and tuner AGC lines.

Fig. 22 shows the actual circuitry of the AGC system. Q2 conducts only when a negative pulse from the horizontal output transformer appears on the collector and a negative sync pulse from the video driver is fed to the base. Both pulses must occur simultaneously. With an increase in signal level, the sync pulse fed to the base of Q2 drives the base more negative (forward bias), increasing the collector current. This increase in collector current is felt as a more positive voltage at the base of Q1 and, in turn, increases the forward bias of Q1, causing it to conduct more and raising its emitter voltage. The IF clamp diode, X2, conducts less and the IF AGC voltage increases. When Q1 emitter voltage reaches approximately 2.5 volts, the tuner clamp diode, X1,

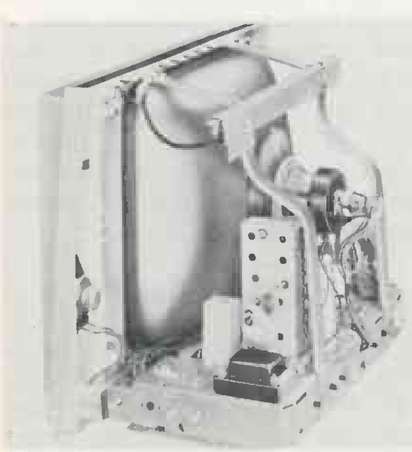


Fig. 19. Zenith's new solid-state chassis has unique construction.

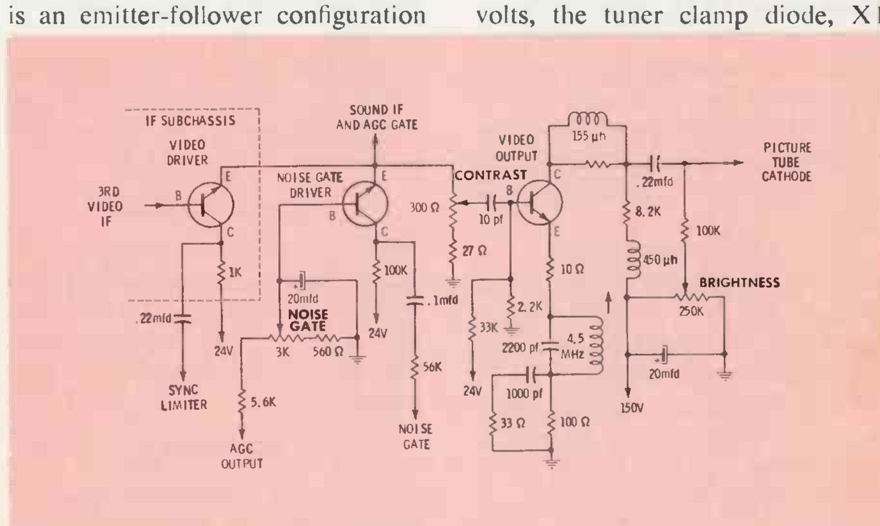


Fig. 20. Video amplifier circuitry of Zenith's solid-state 1Y21B55 chassis.

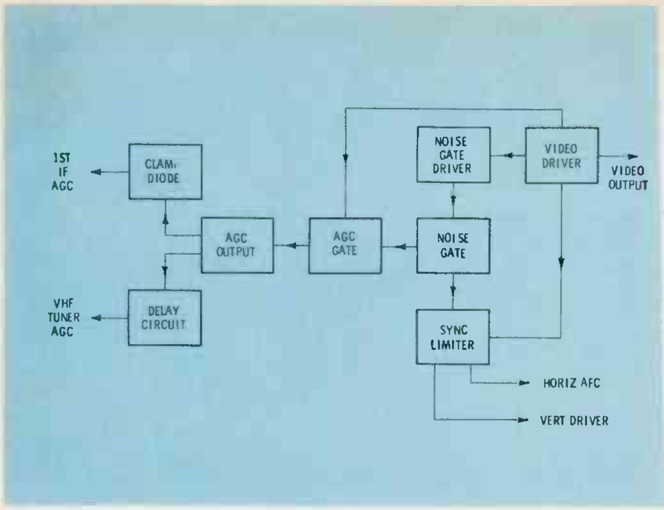


Fig. 21. Partial block diagram of Zenith Chassis 1Y21B55.

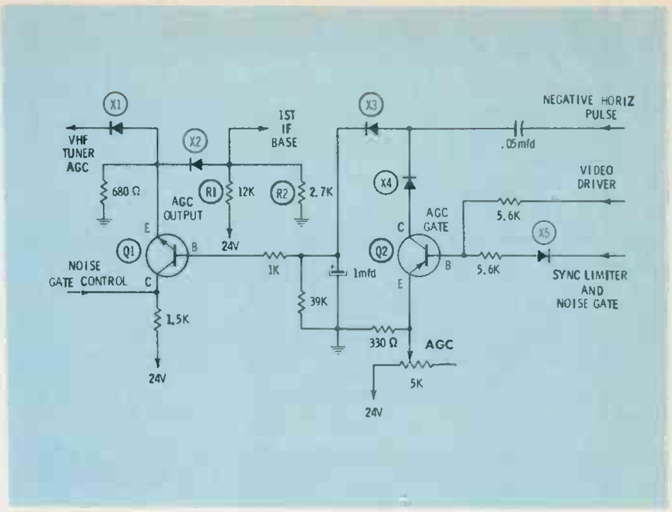


Fig. 22. Forward AGC system employed in Zenith's 1Y1B55 solid-state chassis.

begins to conduct and the tuner AGC voltage increases. The IF clamp diode, X2, stops conducting altogether when Q1 emitter voltage reaches 2.8 volts and the IF AGC voltage is stabilized at about 3.3 volts. Any further increase in video signal level produces a reduction in the gain of the VHF tuner via conduction of X1, the tuner clamp diode. A factory adjusted potentiometer in the collector circuit of the 1st IF amplifier sets the AGC gain reduction of the IF and, therefore, the delay point of the tuner AGC. The AGC control in the emitter circuit of the AGC gate stage adjusts the overall AGC action.

Chassis 8Y4B36, Zenith's new hybrid design, employs a three-stage transistorized IF section similar to the one used in the previously discussed solid-state chassis. However, because the video detector load resistor (2.2K ohm) presents about the same output impedance as found in tube-type receivers, the video driver circuit is not included in the 8Y4B36 design. Instead, the output of the detector is fed directly to a single tube-type video output stage.

The AGC system used in this chassis is also similar to the system designed into the 1Y21B55 chassis, except that the double pentode half of a triode-double pentode 6BA11 performs the keying (gating) function. An NPN transistor serves the AGC output stage which provides forward AGC control to the 1st video IF.

The remaining circuitry of Chassis 8Y4B36 uses tubes and is similar in most respects to last year's 14N26 chassis. A full-wave voltage doubler provides B+, including a positive 24 volts to the transistor circuits. The 24 volts is developed across a 4.4K-ohm dropping resistor and is regulated by a Zener diode. Chassis 8Y4B36 is employed in three 20″ portable models.

Eight other chassis are found in Zenith's '68 line. Chassis 14N33, used in one 18″ portable, and Chassis 14N22, used in five 22″ consoles and three 22″ table models, are carryover chassis from last year. Chassis 13X16 and 13Y16, used in two 12″ portables, are similar to last year's 13X15 chassis. Two 16″ portable models employ Chassis 14Y21, used in last year's models. Rounding out the '68 chassis lineup are: Chassis 14Y33, used in two 19″ portables and comparable to the 14N33 chassis; and Chassis 14-Y26 and 14X26, both similar to last year's 14N26. Chassis 14Y26 is found in two 19″ portables, as well as serving in one 20″ portable. Other versions of the same 20″ portable use Chassis 14X26.

OTHER BRANDS

Specific details concerning the chassis used in the following manufacturers' new lines were not available at press time. Therefore, only general model information is presented.

MOTOROLA

Heading this manufacturer's new line is a group of receivers that features all solid-state circuitry, except for the high-voltage rectifier tube. Portables offered in this group include two 9″ AC/DC models utilizing a transformer-powered chassis, and one 12″ AC-only model, also equipped with a transformer-powered chassis. Rounding out the all solid-state receiver group are three table models (one 20″ and two 22″) and seven 22″ consoles. Solid-state VHF and UHF tuners are used with all of the above models. In addition, all table and console models are equipped with tinted screens.

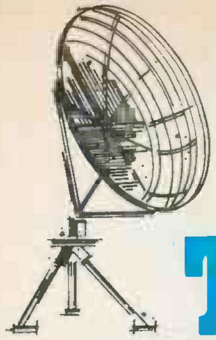
Tube-type receivers offered by this manufacturer include two 12″ and two 15″ portables. Also found in Motorola's '68 b-w line are three 18″ and two 20″ portable models using hybrid chassis. Eleven transistors are employed in the signal processing section of this hybrid chassis.

SONY

Small-screen solid-state AC/DC portables are the featured items in this manufacturer's '68 b-w line. Offered are two 4″, one 5″, one 7″, and one 8″ model. In addition, two 12″ AC-only models are also included in the '68 line; one is a portable and the other is a table model. Both are solid-state designs.

SYMPHONIC

Highlighting the Symphonic '68 line is an exceptionally small 3″ AC/DC solid-state personal portable that weighs just 5½ lbs. including C-cell batteries. Also offered by this manufacturer are an 8″ and a 12″ tube-type portable. ▲



THE ELECTRONIC SCANNER

news of the servicing industry

Hugo Gernsback Dies

Hugo Gernsback, pioneer in electronic invention, author, publisher, and called the father of modern science fiction, died on Saturday, August 19, in New York City. He was 83 years old.

At his death Mr. Gernsback held 80 scientific patents. He was editor in chief of RADIO-ELECTRONICS, editor in chief and publisher of the magazine Sexology, and chairman of the board of Gernsback Publications, Inc.

During his long publishing career, he put out more than 50 magazines, including the first radio magazine, MODERN ELECTRONICS in 1908, and the first science fiction publication, AMAZING STORIES in 1927. Mr. Gernsback is widely credited with having written the first true science fiction story, and with coining the term itself. In his honor, science fiction writing awards are called "Hugos."

He is perhaps best-known as a "Prophet of Science," as Life called him in a 1963 article. His first science fiction story, published in 1911, accurately predicted radar, microfilm, stainless steel and numerous other now commonplace things, even including night baseball. His window into the future has been producing amazingly accurate predictions ever since. M.I.T. scientists, in announcing the first Venus probe, opened with the statement that it was first "proposed by Gernsback in 1927."

Mr. Gernsback sponsored New York's first television broadcast in 1928, and was honored by the radio industry in 1953 in recognition of his "first 50 years of inspiring leadership in radio-electronic art."

His awards and associations include: Marconi Memorial Wireless Pioneer Medal, Veteran Wireless Operators, 1950; Gold Medal of Luxembourg, Grand Order of Oaken Crown; Silver Jubilee Trophy, Belgian Society Helios, 1953. Member American Physics Society, A.A.A.S.; founder Wireless Association of America.

Academy Avionics is a subsidiary of Ag Aviation Academy and is a resident, full-time aviation electronics school. VA approval means any of the courses may be pursued under the various G. I. Bill provisions.

Courses included in the certification are Basic Electronics, a 6-month course; Avionics (aviation electronics), 12 months; Advanced Avionics, 960 hours or approximately 6 months; and FCC License Course.

TV Next?

Philco-Ford announced price increases of 1 to 3%, effective September 22, on all of its appliance lines except air conditioners. The company said the move was taken "most reluctantly, but was forced upon us by the continuing increases in the costs of materials, labor and freight."

Products affected include refrigerators, freezers, ranges, dishwashers, automatic washers, dryers, combination washer-dryers and wringer washers.

The company pointed out that the industry price base for these products is substantially less now than it was in 1952, compared with an increase of more than 20% in all items on the Consumer Price Index. Average 1966 refrigerator prices, for example, were less than 55% of what they were in 1952.

$5 Reward

In an effort to locate the few remaining sets which may have radiation levels above acceptable levels, **General Electric** is offering $5 reward for turning in the obsolete HV regulator tubes from those sets. The tubes in question are: 6EA4, 6EF4, and certain 6LC6's. Contact your nearest GE distributor for details.

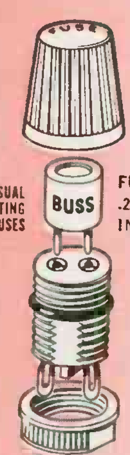
Microelectronic VR

An integrated microelectronic voltage regulator developed by **Delco Radio Division** will be introduced in some models of the 1968 Pontiacs. The miniaturized voltage regulator is so small that it can be included as a part of the Delcotron generator produced by Delco-Remy Division. In the past voltage regulators have been separate units about 3 × 3 × 4 inches in size.

The new Delco Radio unit has no moving parts. It is about the size of a man's wristwatch. Benefits derived from the new regulator include increased reliability because there are no moving parts, elimination of external wiring, and because electronic sensors are unaffected by moisture, aging, or vibration.

Courses Approved

Full Veterans Administration approval has been awarded **Academy Avionics** for electronics courses offered at Reno/Stead Airport, Reno, Nevada, the school has announced.



Circle 6 on literature card

Mergers, Expansions, Etc.

Admiral announced that it has licensed Canadian General Electric Company and a European company to manufacture color picture tubes of Admiral design for television receivers, and to use Admiral-developed engineering and production equipment.

Vincent Barreca, president, said that the contracts also include provisions for technical assistance, and added that other discussions are being conducted with potential licensees in other parts of the world.

A new research and development center that will permit expansion of technical services to customers has been announced by **Belden.**

Robert W. Hawkinson, president of the Chicago-based manufacturer of wire, cable and cords, announced that Belden has purchased a 22,000-sq. ft. building near Geneva, Ill. "All research and development activities now being conducted at both our Chicago and Richmond, Ind., plants will be centralized in this modern new location," he said.

Globe-Union, manufacturer of electoronic components, batteries and other packaged power units, has completed occupancy of its new Administrative and Research Park in Glendale, Wisconsin.

The new 33-acre park houses executive offices for the firm, extensive research and engineering facilities plus headquarters for Globe-Union's two divisions, Globe Battery and Centralab Electronics. Also located at the Glendale facility are Globe-Union's financial and data processing operations, a 30-thousand volume technical library, sales and purchasing organizations plus corporate and divisional administrative offices.

Perma-Power, a fast-growing Chicago-based electronics manufacturer, has occupied a second major facility on the city's Northwest side. The new facility, a modern two story brick structure, is directly adjacent to the company's main plant and provides Perma-Power with an additional 20,000 square feet of space. With the additional space, Perma-Power now occupies almost six times as much space as it did four years ago.

Texas Instruments and **Sprague** have entered into a non-exclusive, cross licensing agreement under their patents in the semiconductor field. Under this agreement, each is licensed to use the other's patents in the design and fabrication of semiconductor devices, including both integrated circuits and transistors. The rights exchanged are worldwide, except for Japan, and include TI's Kilby patents as well as Sprague's Lehovec patent.

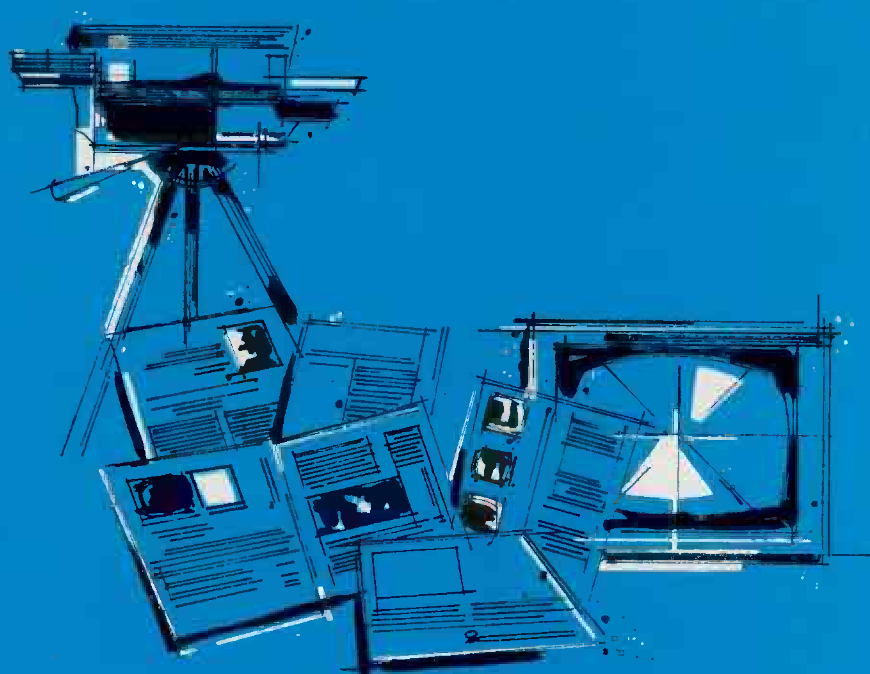
The agreement further calls for dismissal without prejudice of TI's appeal from an adverse Patent Office decision and Sprague's counterclaim for infringement. The financial terms of the agreement were not disclosed. ▲

Circle 6 on literature card

COLOR TV

PART 3

service training



MASTERING CIRCUITS

VERTICAL DEFLECTION

HORIZONTAL DEFLECTION

HIGH VOLTAGE

In lesson 2 of this series, the tuner, video IF amplifier, sound IF amplifier and output, luminance (or video) amplifier, and the sync and AGC circuits were discussed. All of these circuits are similar to circuits having the same functions in a black-and-white set.

The tuner and IF circuits are modified only slightly to increase the response near the upper edge of the video passband. Additional traps are required to prevent interaction between the 4.5-MHz sound carrier and the 3.58-MHz chroma information. The additional traps make it necessary to move the sound takeoff point "forward" and use a separate sound IF detector. Otherwise, the sound system is conventional. The AGC and sync circuits are nearly identical to the ones found in monochrome receivers.

The luminance channel performs the same functions as the monochrome video amplifier and also it has some additional features. It provides for video delay, performs the retrace blanking, incorporates the brightness control, and, of course, it drives three CRT cathodes instead of one. The luminance channel is direct coupled and this can lead to service problems for the unwary technician.

Vertical Deflection Circuit

The circuit most frequently used to generate the vertical deflection current is a modified free-running multivibrator. The modifications are incorporated to change the usual square-wave output into a waveform which produces a sawtooth current through the deflection coil or yoke. Since the impedance of the yoke is inductive, current lags the voltage; and so the multivibrator output waveform rises very steeply, decays steeply to about one-half its maximum, and then decays at an almost linear rate.

The circuit shown in Fig. 1 is from the Zenith 24MC32 chassis. This circuit is typical of many receivers although several sets examined used the old, familiar twin-triode configuration. We also noted that some circuits have the hold

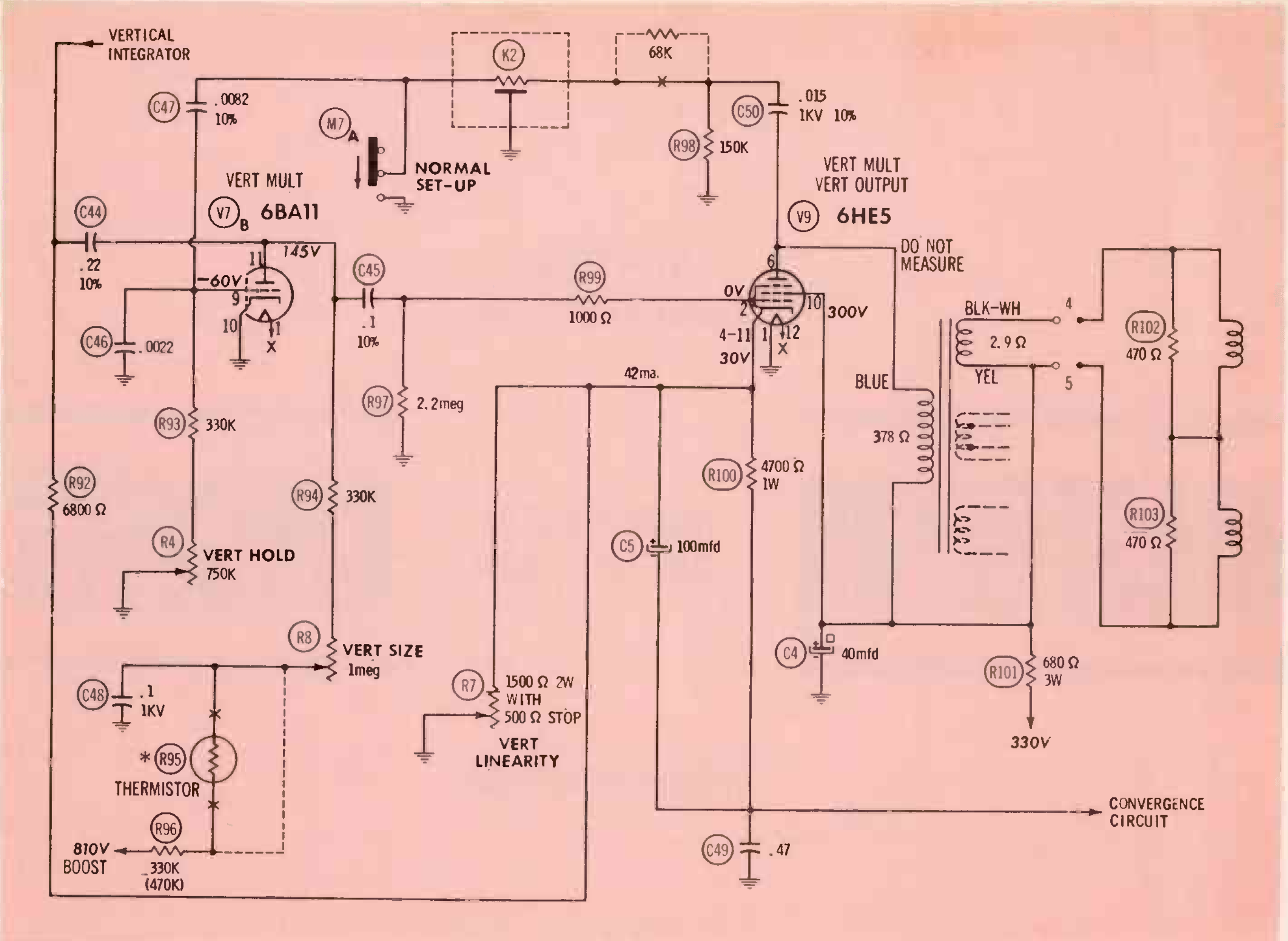


Fig. 1. Vertical multivibrator of the Zenith 24MC32 chassis.

control in the cathode circuit instead of the grid circuit of the normally cutoff tube.

Consider the circuit at a time when the vertical sweep is approaching the bottom of the CRT. The grid of V9 is swinging in a positive direction as current flows upward through R97 to charge the right side of C45. The current through V9 and the deflection coils is increasing at a linear rate. V7 is cut off by the negative charge at the top of C46 although this voltage is approaching the level where the tube can go into conduction.

Shortly before V7 would go into conduction spontaneously, the negative, integrated vertical sync pulse is applied to the grid of V9. The following things all happen in a very few microseconds:

1. The current through V9 is diminished.

2. The field around the deflection coils begins to collapse, causing a positive spike to begin forming at the plate of V9.

3. This positive pulse is coupled to the grid of V7 causing it to conduct.

4. The plate of V7 swings in a negative direction and this negative spike is coupled to the grid of V9.

5. V9 is cut off and the plate rises to a peak of several hundred volts as a result of the total collapse of the field around the deflection coils.

6. The collapsing field drives the electron beam to the top of the CRT, ready to begin another downward scan.

7. The positive spike is coupled from the plate of V9 to the grid of V7. This drives V7 into saturation, the grid draws heavy current, and a negative charge collects at the top of C46. When the spike from the plate of V9 is ended, C46 begins discharging through R93 and R4 and this cuts off V7.

8. As soon as V7 returns to cutoff, its plate swings positive. This positive-going pulse partially discharges C45 and allows V9 to resume conduction.

When V9 begins conduction, the trace begins its downward deflection. The grid voltage of V9 gradually becomes more positive as current flows upward through R97 to charge C45. This increases the current through V9 and the deflection coils to produce the vertical sweep.

There are three controls in the vertical circuit: hold, size, and linearity. The hold control determines the time required for C46 to discharge to the point where V7 can conduct. If this discharge time is too short, (free-running frequency too high) a new vertical scan will have started before the arrival of the next sync pulse and the picture will roll down. If the free-running frequency is slightly lower than the scan rate, the vertical multivibrator synchronizes normally.

The size control determines the plate saturation voltage of V7. The difference between saturation voltage and B+ is the amplitude of the signal which is coupled to the grid of V9 and this ultimately determines the amplitude or size of the sweep.

The voltage at the grid of V9 is

not completely linear since it is a portion of the exponential charging curve of a capacitor; however, V9 is not linear either (gain is different at various bias levels). By proper adjustment of the linearity control, a level of bias is obtained that causes these two inherent nonlinearities to be equal and opposite.

The network consisting of C47, K2, R98, and C50 shapes the feedback pulse to the grid of V7. The shape of this pulse determines the conduction time of V7 and this determines the retrace time. M7 disables the multivibrator for color setup purposes. R102 and R103 are loading resistors across the deflection coils. They prevent the coils from oscillating at the end of the retrace interval. The resistance of R95 decreases with temperature rise to compensate for the increase in resistance of R96, R8, and R4 as the temperature rises.

Some sets use a vertical centering circuit to control a small DC current which flows through the vertical deflection coils. This current either aids or opposes the vertical deflection current to shift the entire raster up or down.

Horizontal Phase Detector

The horizontal oscillator and its synchronizing circuits used in color sets are no different than those used in b-w receivers. The schematic shown in Fig. 2 is the horizontal phase detector circuit used in the Philco 16QT85 chassis. The two inputs to the phase detector are compared to determine their relative timing and a correcting voltage (error signal) is developed to correct the oscillator frequency.

Negative sync pulses from the sync separator are applied to the junction of the cathodes of the phase detector diodes and both diodes conduct. This places a negatie charge on the tops of C75 and C52. Between sync pulses, these capacitors discharge as follows: C75 discharges downward through R113 causing the anode of X20 to be negative with respect to ground. C52 discharges downward through R112 causing the bottom of R112 to be positive with respect to its top. Since the voltage at the bottom of R112 cannot be negative with respect to the top of R113 and the voltage drops across R112 and R113 are nearly equal, the voltage measured from the top of R112 (or C52) to ground is nearly zero.

At about the same time that the sync pulse is applied to the junction of the diode cathodes, a negative pulse from the horizontal output transformer is supplied to the junction of C76 and C77. This drives electrons away from the top of C76 and down through R112 and R111. During the interval between pulses, the current flows back up through R111 and R112 producing a positive-going sawtooth at the top.

Now consider the interaction of the two separate actions which result from the sync pulse and the feedback pulse. Referring to Fig. 3A, we see the phase relation of the two voltages when the oscillator is operating at the correct frequency. The sync pulse arrives shortly after the start of the negative-going feedback pulse. Since X19 can conduct only until its anode becomes negative with respect to its cathode, only a portion of the electrons that could be supplied by the sync pulse actually get to the top of C52. During the long interval between sync

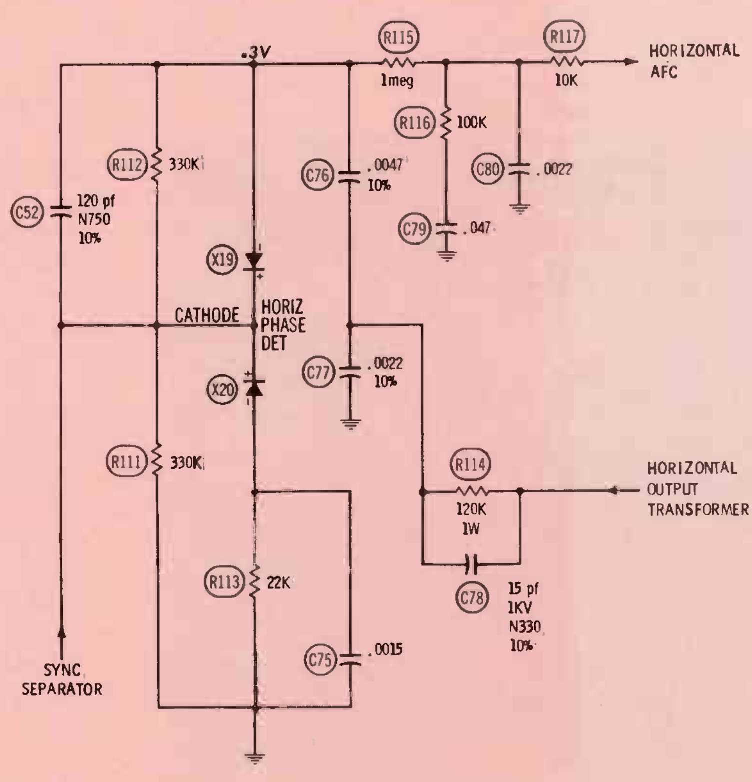
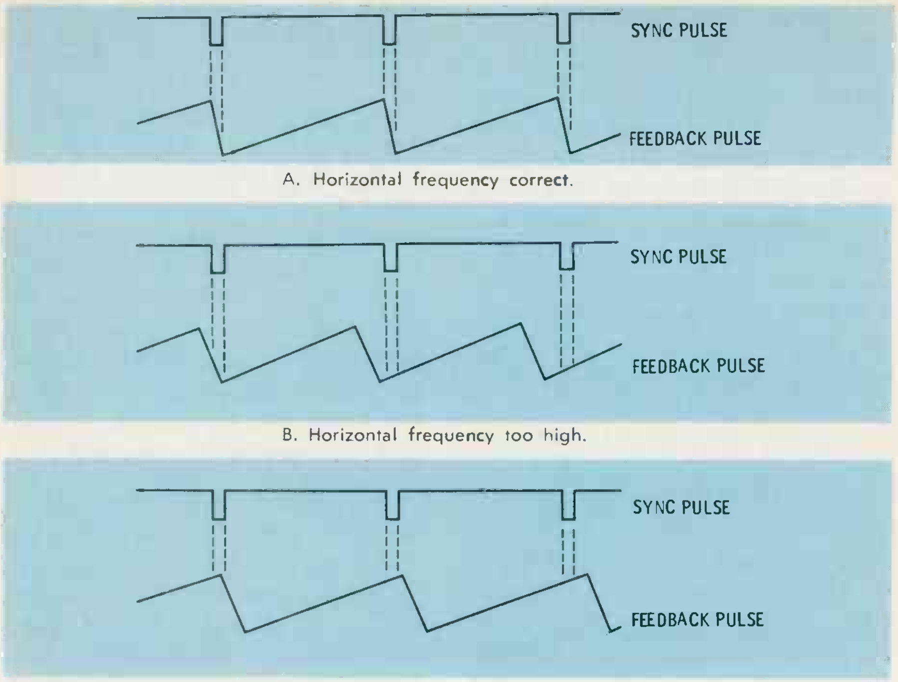


Fig. 2. Horizontal phase detector of the Philco 16QT85 chassis.



A. Horizontal frequency correct.

B. Horizontal frequency too high.

C. Horizontal frequency too low.

Fig. 3. Horizontal sync and feedback pulses.

pulses, some of the electrons required to recharge the top of C76 are supplied from C52 and the remainder flow upwards through R111 and R112. Since the total-current through R111 and R112 has been diminished by the action of the feedback pulse, the average-voltage at the top of C76 is less positive than it would be in the absence of the sync pulse.

Fig. 3B illustrates the action of the phase detector if the oscillator frequency is too high. The feedback pulse is shifted to the left from its normal position and the anode of X19 is driven farther negative before the sync pulse arrives. As a result, fewer (or none) of the electrons supplied by the sync pulse are actually deposited on the top of C52. During the interpulse interval, all of the electrons must flow upwards through R111 and R112 and the voltage at the top of C76 is more positive.

Inspection of Fig. 3C shows that if the feedback pulse arrives too late (frequency low), a greater portion of the sync pulse electrons reach C52 and the average voltage at the top of C76 is less positive than before.

Referring once again to Fig. 2, R115, R116, R117, C79 and C80 form the anti-hunt network. This is essentially an integrating circuit which smooths the voltage at the top of C76 into an almost constant level. If the integrations are too great (time constants too long), horizontal pulling will result because the AFC tube will not correct the frequency quickly enough. On the other hand, too little integration will cause horizontal jitter because the AFC tube will tend to overcorrect the frequency (hunt).

From this discussion of the phase detector circuit, we learn that an increase in oscillator frequency results in a positive-going error signal at the grid of V7. While this is true of this specific circuit, some circuits are designed so that the exact opposite is true. That is, increased frequency produces a negative-going error signal in some receivers even though the circuit configuration is quite similar.

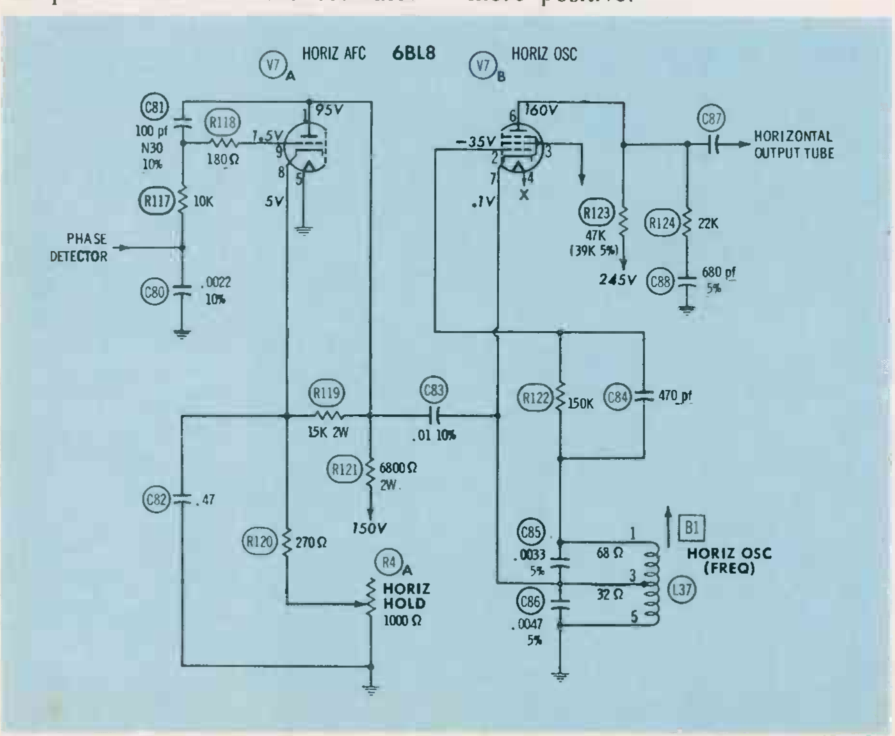


Fig. 4. Horizontal oscillator and AFC of the Philco 16QT85 chassis.

Horizontal AFC and Oscillator

Referring to Fig. 4 which is the schematic of the AFC and oscillator circuits of the same Philco 16QT85 chassis, the error signal is applied to pin 9 of V7. However, before attempting to understand the operation of the AFC tube, the operation of the oscillator must be thoroughly understood.

The oscillator is basically a Hartley type although the tank circuit capacity, as well as the inductance, is tapped. The waveshape of the oscillator output is modified by R-124 and C88 before it is applied to the output tube. V7B is grid-leak biased by R122 and C84.

The frequency-determining circuits of the oscillator are L37, C85, C86, and the AFC tube. Insofar as an AC signal is concerned, the AFC tube is shunted across C86, and so the current through V7A is part of the total current of the tank circuit.

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Here are oscilloscope photographs from the outputs of two typical competitive color generators, one transistorized and one tube type, and the B&K Model 1245. The detailed analysis with each photograph shows a few of the reasons why you'll save time and effort with B&K.

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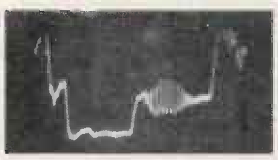
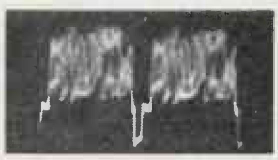
STANDARD STATION SIGNAL

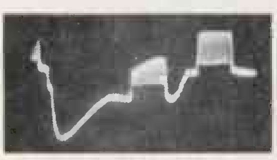


One horizontal sync pulse with its color burst.

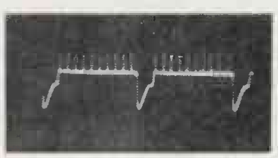


Two lines showing horizontal sync pulse with black and white tv signal,

TRANSISTORIZED B&K MODEL 1245

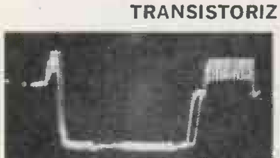


Good duplication of station signal including back porch. If the set won't sync, the set is defective.

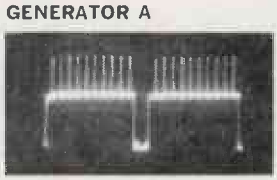


Well defined back porch on horizontal sync pulse permits accurately setting color killer and almost eliminates need to adjust brightness and contrast.

TRANSISTORIZED GENERATOR A



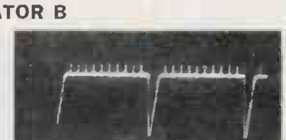
No back porch causes unstable color sync. Burst amplitude compression may permit sync on wrong color bar.



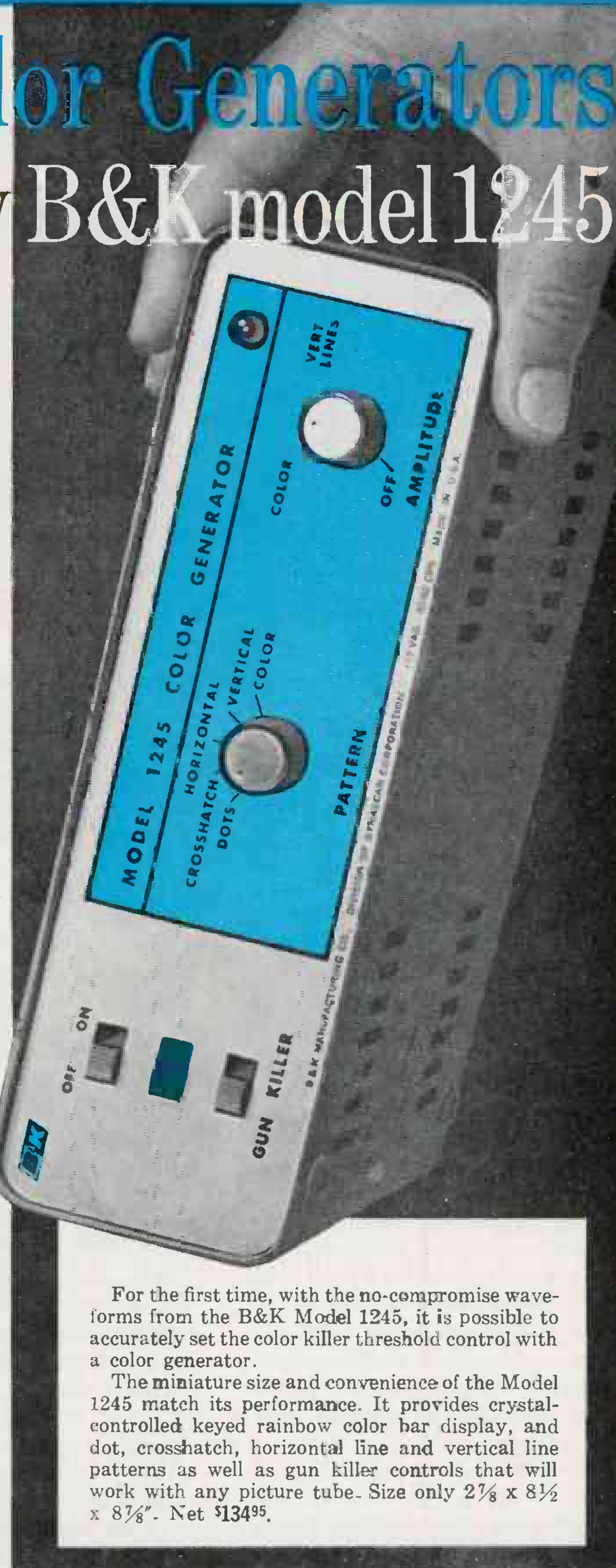
Square wave horizontal sync pulse with no back porch and poor dc coupling forces adjustments of brightness, contrast & fine tuning to obtain usable pattern.

GENERATOR B

No back porch; color information on top of sync-pulse makes sync difficult on some sets.



Complete absence of any back porch necessitates readjustment of brightness, contrast and fine tuning to obtain a usable pattern.



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B&K

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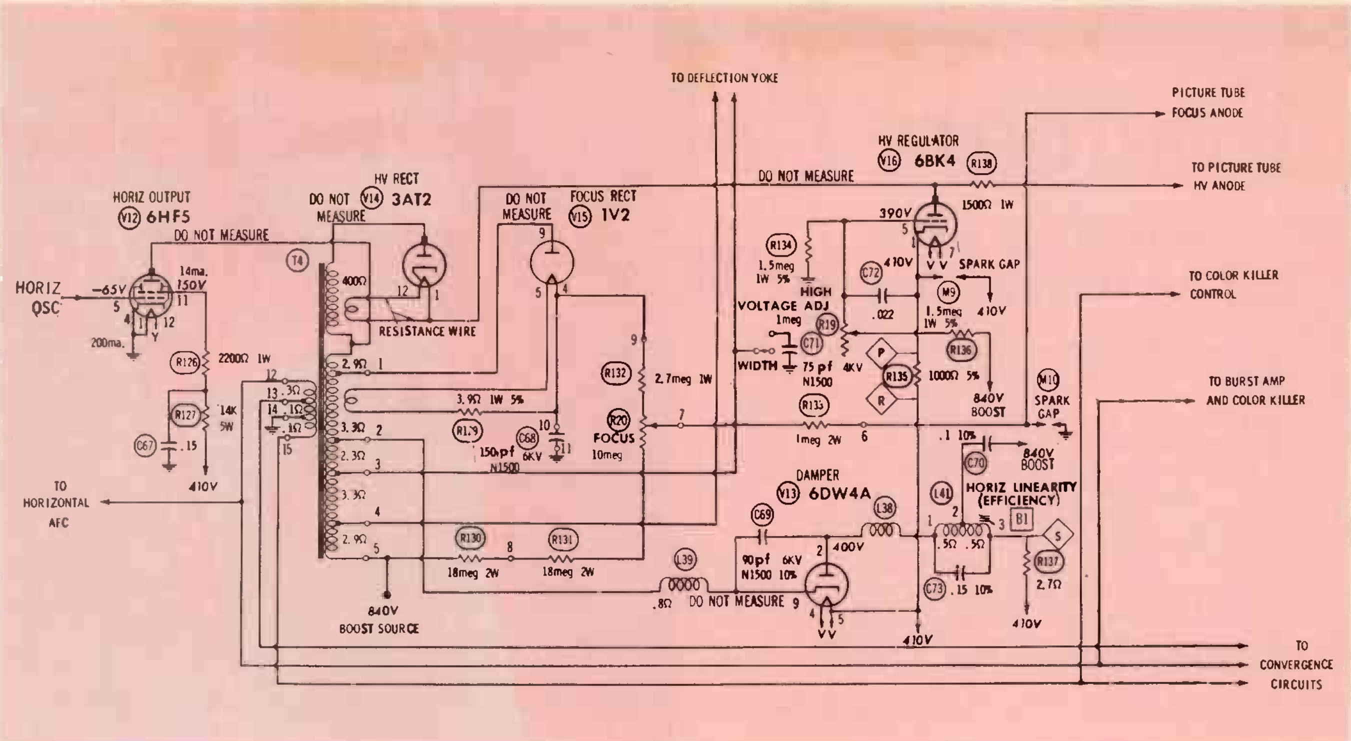

Fig. 5. Horizontal output and high-voltage circuit of the Zenith 25LC30 chassis.

V7A has two inputs, the error signal from the phase detector and also the 15,750-Hz signal present at the cathode of V7B. This second signal is shifted in phase by the combination of C81, R117, and C80 so that the voltage at the grid of V7A is leading the voltage at the cathode of V7B. This leading voltage causes a leading current to flow through V7A and through the tank circuit. From basic electronic theory, we recall that a leading current is a capacitive current, and so the current of V7A appears as an additional capacitive current in the tank. Thus, as the error signal goes positive, the capacitive current increases and the resonant frequency decreases to reduce the error.

R4 and R120 set the bias of V7A and determine the free-running frequency of the oscillator. The error signal at the grid of V7A causes the capacitive current to vary above or below this level to maintain horizontal sync.

It was pointed out earlier that the *direction* of the error signal generated by the phase detector can be either positive or negative for a given frequency error. It is also possible to change the AFC circuit from the one shown in Fig. 4 so that a positive error signal at the grid will increase the frequency rather than decrease it. One way of doing this is to interchange the values of C80 and C81. Now, the feedback would lag and the current through V7A would appear inductive rather than capacitive.

There are numerous other circuits which are used to generate the horizontal time base. Space limitations do not allow an exhaustive analysis of each of them in this course. For most service problems, the technician will be able to solve the difficulties if he will simply take time to identify the frequency-determining components and determine the *direction* of the error signal from the phase detector.

Horizontal Output and High-Voltage Circuits

Regardless of the oscillator and AFC circuits used, the designs of the horizontal-output sections used by various manufacturers are similar. In many respects, the circuits are the same as ones used in monochrome receivers, but the whole horizontal deflection system has been "beefed up" for several reasons:

1. The ultor (high-voltage anode) voltage (about 25 kv) is higher than it usually is in b-w receivers, and the CRT beam current is increased three-fold.

2. The shunt regulator draws additional current from the ultor supply.

3. The boosted B+ has a higher potential and the load is greater.

4. The focus rectifier and bleeder, the convergence circuits, and the pincushion circuits extract power from the horizontal output circuit.

The schematic of the horizontal output and high-voltage circuit used in the Zenith 25LC30 chassis is shown in Fig. 5. The yoke is driven in the conventional manner by taps on the primary of the high-voltage transformer. A secondary winding is used to obtain the voltages necessary for convergence, horizontal AFC, and keying of the AGC, color killer, and burst amplifier.

The anode supply for the focus rectifier is obtained from a tap on the primary of the high-voltage transformer. The output of V15 is divided by the bleeder consisting of R130, R131, R132, and R20; and the focus voltage is controlled by the setting of R20. C68 is a filter for the focus supply and R133 is an arc protector.

The ultor voltage is developed in the usual manner but, unlike b-w supplies, it is regulated by a shunt regulator. Regulation is accomplished by the special regulator tube (V16). R19 is used to set the bias on V16 so that it is near cutoff when an all-white picture is being displayed. As portions of the picture

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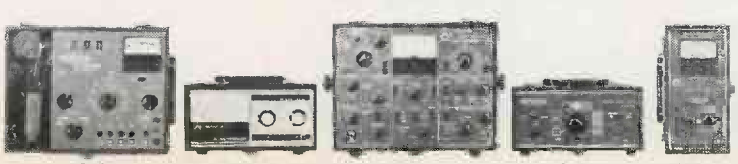
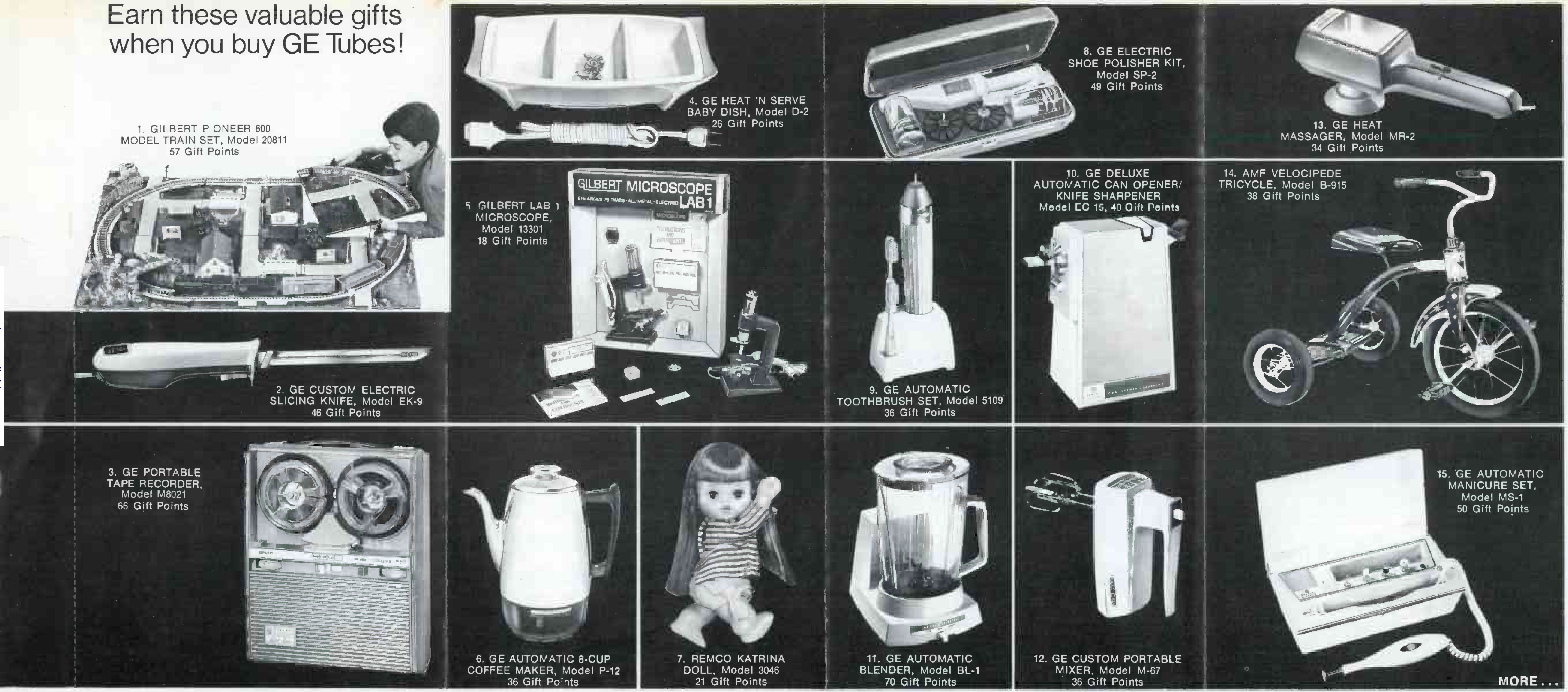


CRT Milivolt Stereo Color Signal

AMPHENOL ™

Circle 8 on literature card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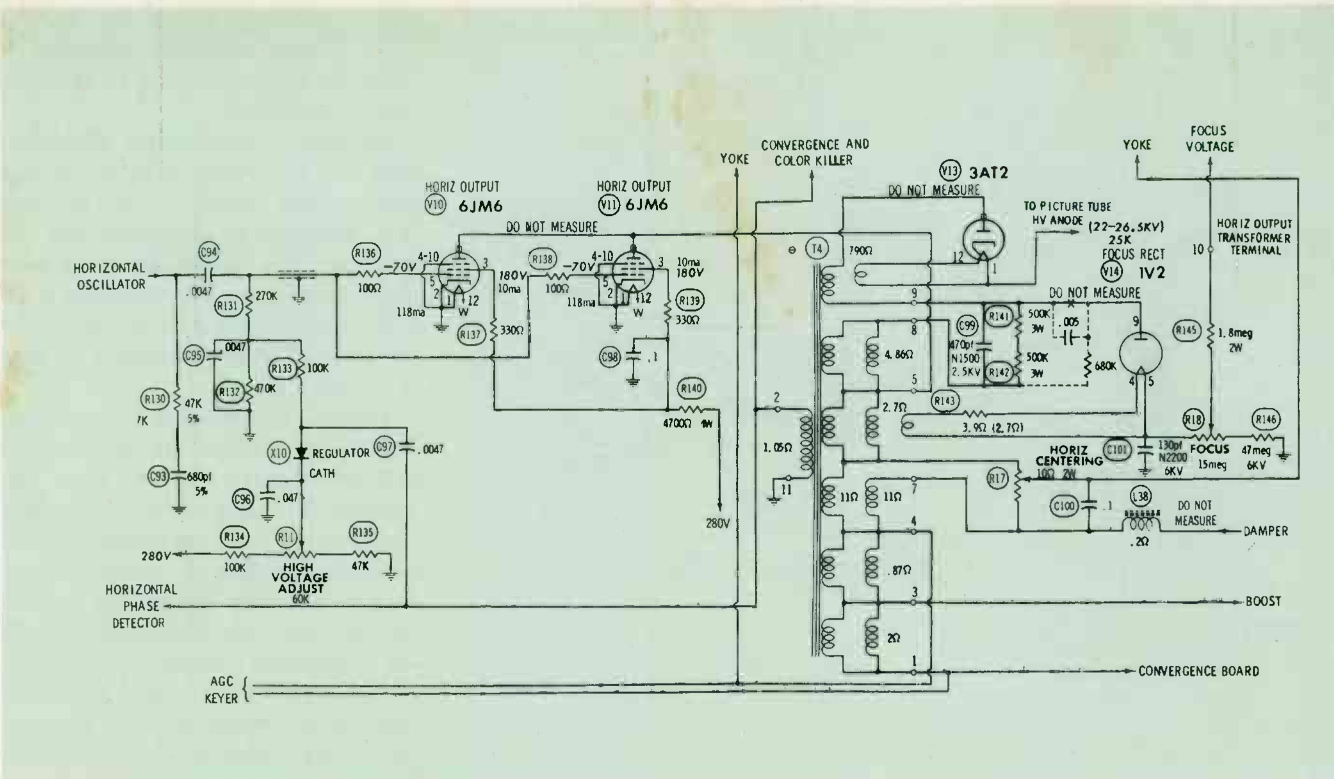

Fig. 6. Horizontal output and high-voltage circuit of the Admiral 1G1155-1 chassis.

are made black or gray, the CRT beam currents decrease and the ultor supply voltage tends to rise. The boosted B+ also rises and this positive-going voltage is used to decrease the bias on V16. Thus, V16 conducts more, the load on the ultor supply remains constant, and the ultor voltage is stabilized.

Some manufacturers use the average potential of the CRT cathodes as a control voltage for the ultor regulator. A black picture is produced by a positive-going voltage at the CRT cathodes, and this voltage (in lieu of the boosted B+) is used to increase the conduction of the regulator tube.

A rather unique approach to the problem of high-voltage regulation is illustrated in Fig. 6. This is a schematic of the horizontal output and high-voltage section of the Admiral 1G1155-1 chassis. Notice that no shunt regulator is used.

A feedback pulse from the secondary winding (terminals 1 and 2) of T4 is rectified by X10 and the resulting voltage is added to the bias supply for the horizontal output tubes. This total bias determines the amount of drive to the high-voltage transformer and, finally, the potential of the ultor supply.

As the CRT beam currents increase and load the supply, the am-

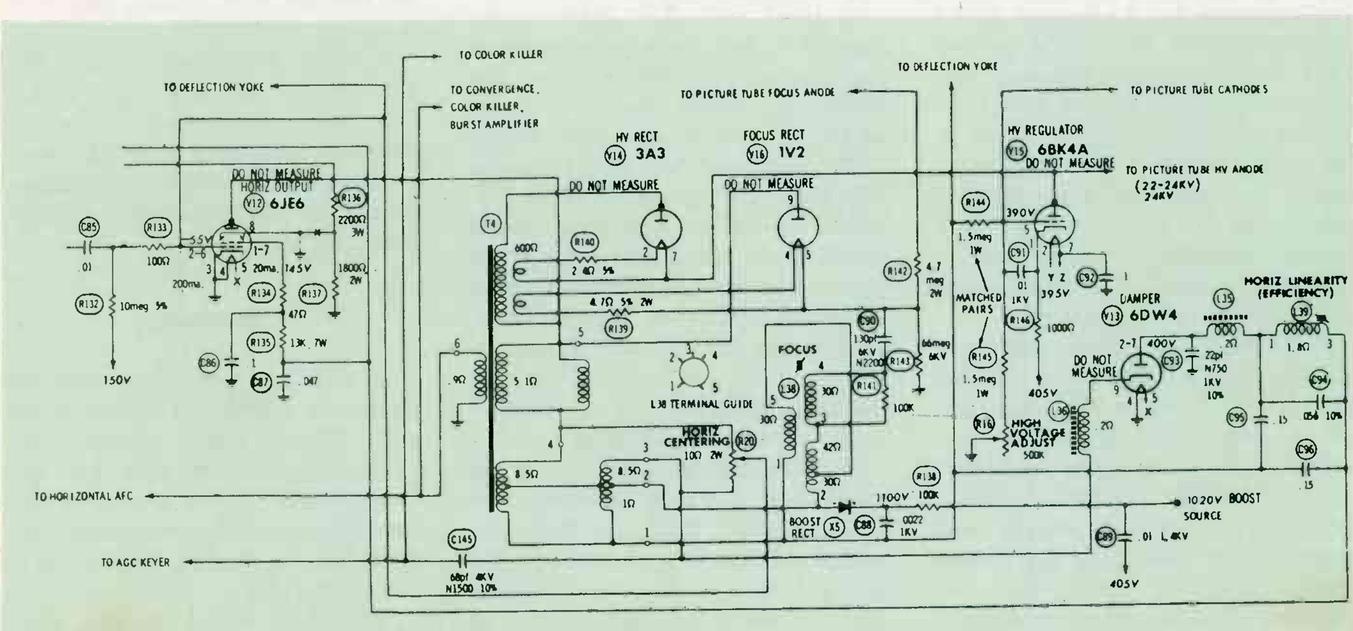

Fig. 7. Horizontal output and high-voltage circuit of the RCA CTC16 chassis.

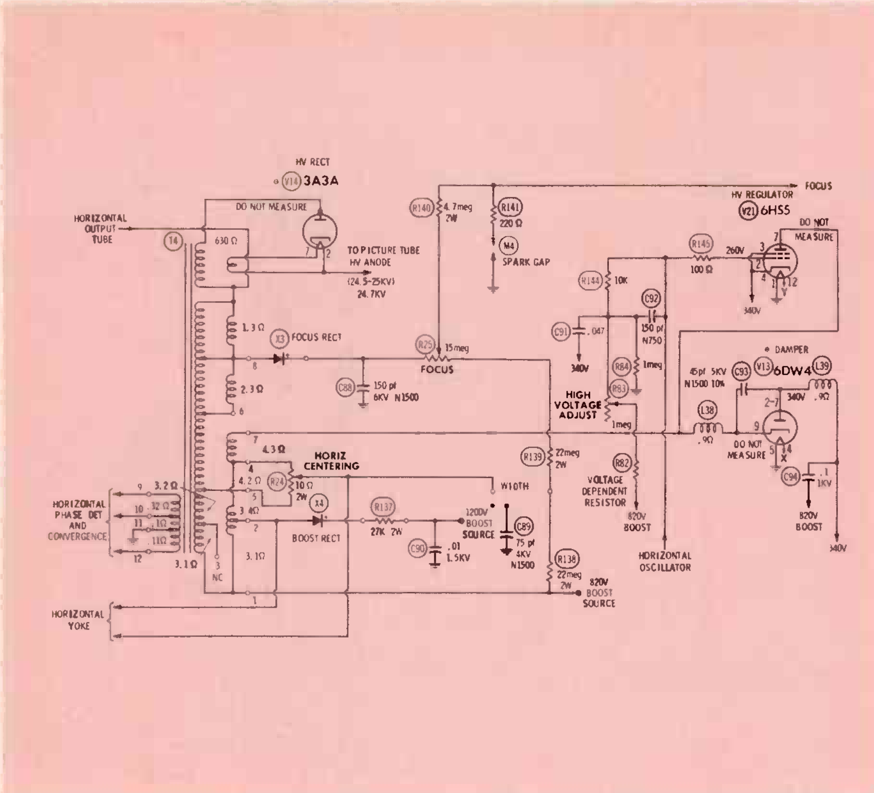

Fig. 8. Horizontal output circuit in Zenith 23XC38 chassis.

plitude of the feedback pulse is decreased and this results in a lesser bias voltage at the grids of V10 and V11. This causes V10 and V11 to conduct more heavily to increase the ultor voltage.

While this system is adequate, it does allow some variations in the high voltage. In order to maintain good focus over a range of ultor voltages, the focus voltage is made to "track" the ultor voltage. This is accomplished by R141 and R142 along with their filter, C99. As the CRT beam currents increase, the voltage across R141 and R142 increases and this voltage is added to the output of the focus rectifier to adjust the focus automatically for changes in CRT current. A slight change in width as the brightness control is rotated is normal in receivers using this circuit.

The horizontal output and high-voltage circuits of the RCA CTC16 chassis are shown in Fig. 7. In this circuit, the focus rectifier is connected to the plate of the horizontal output tube and develops 4 to 4.5 kv. The ultor voltage supply and regulator are similar to the Zenith chassis discussed earlier, but the regulator control voltage is derived from the CRT cathodes.

The horizontal-centering problem is solved by driving the yoke with two identical windings of the high-voltage transformer. A 10-ohm potentiometer used as a centering control is connected between terminals 3 and 4, and a small DC potential exists across it. One end of the yoke is connected to the center arm of the control. Depending on the setting of the control, a small DC current can be caused to flow in the yoke to change the centering.

A third method of high voltage regulation has been developed in the Zenith 23XC38 chassis. The horizontal output circuit is shown in Fig. 8. This circuit uses a type 6HS5 regulator (V21) whose cathode and plate are connected to B+ and a tap of the horizontal-output transformer, respectively. Since the tube is operating at potentials which are much lower than those encountered in the conventional shunt regulator circuit, there is no need for radiation shielding or a double-ended envelope for the tube.

The control signal for V21 is derived from a divider network consisting of R82, R83, and R84 connected between a portion of the boosted B+ supply and ground. R83 is used to set the bias level of V21 and this ultimately adjusts the ultor supply voltage. A second voltage is also applied to the grid of V21. This is a positive pulse taken from the cathode circuit of the horizontal oscillator.

Assume a white raster which results in maximum loading of the ultor power supply. The boosted B+ potential is minimum and the bias on V21 is maximum. Under these conditions, the conduction of V21 is minimum and the regulator has little effect on the output voltage of the ultor supply.

Under black-raster conditions, there is no load on the ultor supply and this voltage tends to rise. The boosted B+ also tends to rise and the bias of V21 is reduced. The horizontal-oscillator pulse causes V21 to conduct during the retrace interval and this conduction loads the horizontal output transformer. Stated another way, V21 clips the positive excursion of the "ringing" or flyback pulse of the horizontal-output transformer and this tends to reduce the ultor supply voltage. The amount of clipping (or loading) is determined by the boosted B+ potential which, in turn, is determined by the load on the ultor supply. As the raster changes from black to white, the conduction of V21 becomes progressively less and so the ultor supply voltage is stabilized.

The regulator tube is pulsed on only during horizontal retrace for two reasons:

1. Since V21 is cut off during the forward scan, it does not affect the width of the raster.

2. Since V21 conducts only during retrace, the duty cycle is low and only a minimum amount of power is extracted from the horizontal-output circuit. This also minimizes the plate-dissipation requirements for V21.

Summary

In this lesson, we have analyzed the power supply and deflection circuits. The principal difference between these circuits and their b-w counterparts is that greater power-handling capability and greater stability are required in the circuits of color receivers.

The next lesson in this series (Part 4) will begin the discussion of the chroma circuits. ▲

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AC Volts:	0-3-10-50-250-1,000-5,000 at 5,000 ohms/volt.
Decibels:	−20 to +11, +21, +35, +49, +61, +75; "0" DB at 1 MW on 600 ohm line.
DC Microamperes:	0-100 at 250 Mv.
DC Milliamperes:	0-10-100-1,000 at 250 Mv.
DC Amperes:	0-10 at 250 Mv.
Ohms:	0-1,000-10,000 (4.4-44 at center scale).
Megohms:	0-1-100 (4,400-440,000 at center scale).

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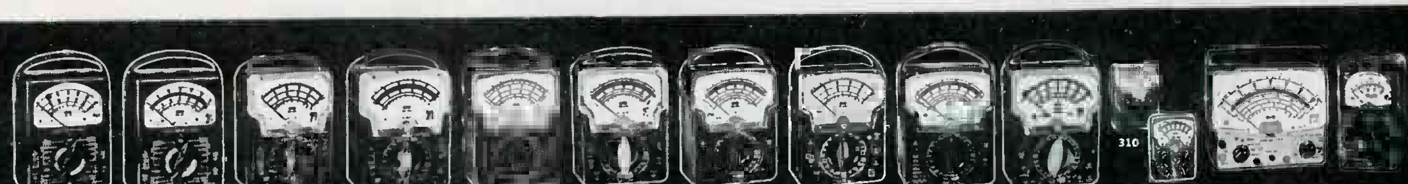

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NOTES ON TEST EQUIPMENT

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

By T. T. Jones

FET VM

The new "Millivolt Commander" just released by Amphenol is about as close to the state of the art as you can get. It combines the feature of many different instruments into one package.

It functions as a VOM (sorry, no current scales) because it's completely portable — no line cord. It's a good substitute for a VTVM because it boasts 10.6-megohm input resistance on DC ranges and 10-megohm impedance on AC. It also has high-sensitivity ohms scales — 10 ohms to 10 megohms center scale. It even masquerades as an AC VTVM because it has the very sensitive AC ranges usually found only in AC VTVM's. And to top it off, the accuracy is ± 2% DC and ± 3% on AC ranges.

FET meters are popping up like spring tulips all over the industry. Nearly every test equipment manufacturer is either producing or developing one. Amphenol's Model 870 happens to be the first we've had an opportunity to analyze, but if others follow the pattern of desirable features per dollar, then the VTVM may be on the way out.

The basic metering circuit is shown in Fig. 2. Q1 is the FET. Just think of it as a conventional triode tube. It's purpose is impedance matching from the high-Z input to the low-Z second stage. It also provides amplification.

CR-1 is an overload protection diode. It's not a conventional zener, but acts as one in this circuit. Its purpose is to keep the applied voltage within the FET's gate ratings. Remember that even a momentary overload can puncture the gate insulation and irrepairably damage a FET.

Q2 is the second stage of amplification. This stage is a conventional PNP common emitter configuration and needs no explanation. Most of

Fig. 1. New meter features field-effect transistor.

Amphenol Model 870 Specifications

DC Voltmeter

Ranges:
0-.1 1-1000V in a 1-3 sequence. + DVC or − DCV.

Input resistance:
10.6 megohms all ranges.

AC rejection:
40 dB greater than full-scale affects reading less than 1%.

Accuracy:
± 2% of full scale.

AC Voltmeter

Ranges:

Input impedance:
0-. 01-300V in a 1-3 sequence. −40 to +50 dB in 10 dB steps.
.01 to 1V scales; 10 megohms shunted by 31 pf. All other scales; 10 megohms shunted by 20 pf.

Accuracy:
± 3% of full scale.

Ohmmeter

Ranges:
0-500Ω—500MΩ with 10 center.

Voltage:
1.5V open circuit.

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± 3° arc.

Size (HWD):
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Weight (with batteries)
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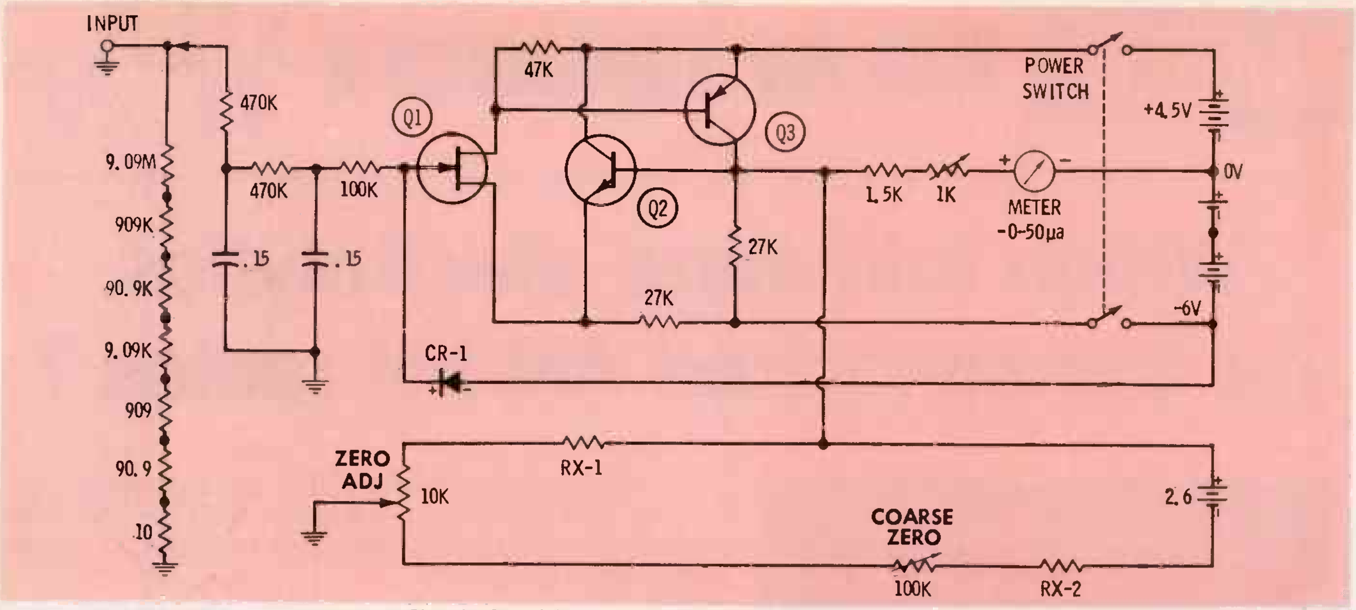

Fig. 2. Simplified schematic of the DC voltmeter.

the output is applied to the meter, but a portion of Q2's output is fed to Q3, the stabilizer. Similar stabilizing stages can be found in most high-quality VTVM's. It senses changes in the overall gain of the amplifier and compensates for these changes. Thermal drift, power supply voltage changes, and aging of components may cause a slight drift in overall gain. Q3 acts on this through an inverse feedback arrangement and corrects the errors.

When measuring AC voltages, an additional two-stage amplifier is switched in between Q2 and the meter. There are also some frequency compensating components switched in at the input.

The Model 870 is housed in a black leatherette-covered wood case which matches the other instruments in the Amphenol line. There's a large pocket in the cover for lead storage. To help conserve batteries, the instrument is automatically switched off when the cover is closed. ▲

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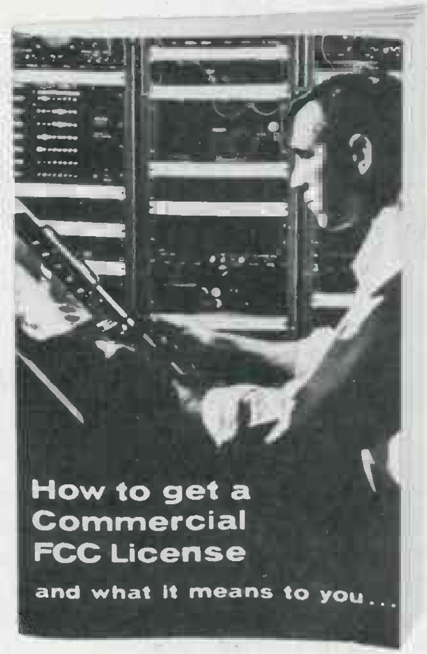

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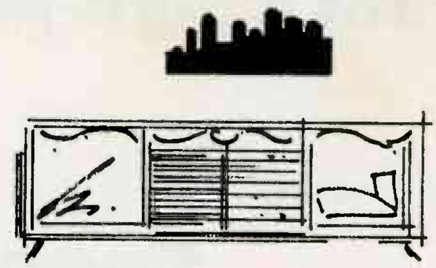
repairing the deluxe AM-FM CHASSIS



by David Held

Sophisticated circuitry doesn't necessarily require the most elaborate test equipment. The case histories and troubleshooting techniques discussed in the following paragraphs help clarify this point.

The size, shape, and audio power rating of high-quality AM-FM solid-state chassis is as varied as cabinet sizes and design. Shown in Fig. 1 is a block diagram of a typical solid-state AM-FM chassis. The most common model is the AM-FM stereo combination. The larger consoles provide 60 to 250 watts of audio power and employ up to 44 transistors and 31 diodes, These large console units also employ up to eight speakers covering the 20 to 20,000-Hertz audio frequency range.

The circuitry of the solid-state AM-FM chassis is basically similar to the vacuum tube chassis, except for more stages. This is especially true in the audio amplifier section.

One significant difference between the tube and transistor chassis is the low-voltage power supply. The tube chassis may have voltage requirements ranging up to 450 volts; however, the solid-state chassis seldom needs more than 70 volts maximum—typically, much less.

Most high-quality AM-FM receivers have an FM-RF amplifier stage followed by a converter or separate oscillator-mixer stage. In the AM section, we find an AM-RF stage and converter circuit. Three or more transistor IF stages are used for both AM and FM functions.

Table I

Transistor Replacement

STAGE AND TYPE	RCA	General Electric	Delco
AM Convertor or RF, PNP	SK 3005	GE-1	DS-25
FM-RF AMP, PNP	SK 3006	GE-9	DS-41
FM-IF AMP or FM-Convertor, NPN	SK 3018	GE-11	....
AF Output or Driver, PNP	SK 3004	GE-2	DS-26
NPN	SK 3020	GE-10	DS-46
Audio Output	SK 3009	GE-3	DS-52
Audio Output Hi Fidelity AMP (Matched Pair)	SK 3014		

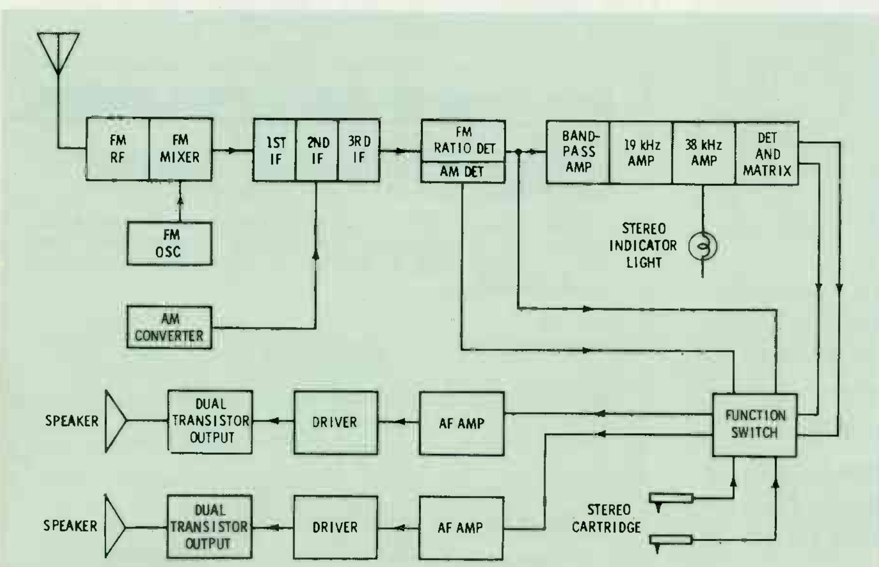


Fig. 1. Block diagram of a typical deluxe AM-FM Chassis.

Troubleshooting

If I had to choose only three test instruments for troubleshooting AM-FM solid-state chassis they would be the noise signal generator, in-circuit transistor checker, and VTVM. With these test instruments, a service technician can uncover the cause of most troubles in AM-FM chassis. Of course, nearly all up to date service shops have a scope, capacitor analyzer, and signal and audio generator to round out the test equipment required for solid-state servicing.

Circuit Analysis

We had a Truetone Model 4DC-5665A come into the shop with only a hissing sound on FM. The local FM station could just barely be heard. Of course, the stereo indicator light would not come on. The AM stations and phonograph played perfectly.

Looking at the schematic diagram, we attempted to isolate the circuit. Since the AM section worked perfectly, the trouble must be located between the first IF stage and the FM antenna. Another clue was a weak local FM station received at 93MHz.

This last clue told us that the FM oscillator and mixer stages were performing—although weak—so the trouble must be in the FM-RF stage. We clipped the in-circuit transistor tester to the three transistor terminals, as shown in Fig. 2. The absence of a beta or leakage reading indicated an open transistor. Once this defective RF transistor was replaced, the receiver returned to normal operation.

In many solid-state receivers, the circuitry is so compact that individual stages are difficult to get at. Be extra careful when unsoldering and pulling small transistors out of such tight places—unnoticed damage to surrounding components and circuitry can add hours to a simple thirty minute repair job. Also, check the replacement transistor before it is installed, and be sure it is installed in the exact spot as the original. Table 1 provides a list of common replacement transistors for solid-state AM-FM chassis.

Signal Injection

An RCA Chassis RC1223A had no AM or FM reception. The phonograph played normally. Using the output of a signal noise generator, and starting at the AM audio function switch, we progressed from the crystal detector to the IF stages. We reasoned that the trouble had to be in the IF stages since both AM and FM reception were dead. The schematic revealed that the AM converter was fed to the 1st FM-AM IF amplifier stage.

Applying the output of the noise signal generator to the base and collector of the 3rd and 2nd IF stages (in that order) localized the trouble to the base of the 2nd AM-FM IF amplifier. The signal was heard at the collector but not at the base. No signal was heard by injecting the signal at the emitter.

The in-circuit transistor checker indicated that the 2nd IF amplifier transistor was shorted. It is possible to have high microamp leakage in an in-circuit transistor tester, but usually a dead short or 2K- to 5K-ohm leakage will show up as a defective transistor. For an accurate leakage test, the suspected transistor should be removed from the circuit board. Many times a diode or directly driven transistor tied in the collector circuit will show up as a shorted transistor.

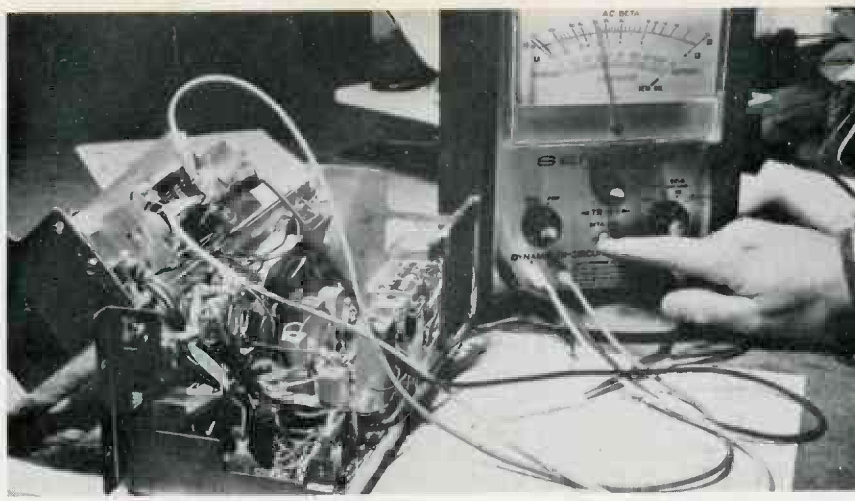


Fig. 2. Checking beta and leakage with an in-circuit transistor tester

In-circuit transistor beta and leakage tests may produce readings that differ slightly from one chassis to another; however, the readings shown in Table 2 are typical and, therefore, can be used for comparison purposes.

In another solid-state AM-FM chassis, the high end of the AM band was completely dead. Below about 1000 kHz the radio operated normally. The FM band and phono were also normal.

If this trouble symptom was displayed by a tube-type chassis, the oscillator tube would be suspected and replaced. Why should the solid-state chassis be treated any differently—after all, the circuitry is basically the same.

The oscillator transistor was removed and checked on the high-beta scale. The beta reading was 50, with no sign of leakage. A couple of new transistors designed for the oscillator stage were selected and their beta readings checked. The RCA SK-3008 had a beta of 70, the SK3005 checked in at 80, and the SK3007 produced a beta reading of 100.

According to the PHOTOFACT for this particular chassis, the oscillator required an RCA SK3005 transistor. Sure enough, the AM radio played perfectly across the entire AM band when the new oscillator transistor was installed. The defective transistor was checked in an older type transistor tester and produced a reading in the green scale.

The most common failure in solid-state circuitry is a shorted, weak, open, or noisy transistor. It is easy to locate a defective transistor stage by using a noise signal generator and proceeding from base to collector of each transistor until the defective stage is located. Then, an in-circuit transistor checker will show if the transistor is at fault. In the event the transistor checks good, voltage and resistance checks can be made to isolate the defect.

VTVM or VOM Tests

Solid-state servicing requires an accurate VTVM and a good ohmmeter to check the low resistances and voltages found in transistor circuits. Transistor emitter and base voltages range from .1 to 6 volts. Collector voltages vary from zero to

Table 2

Typical Transistor Readings In AM-FM Solid-State Chassis

STAGE	BETA READING	LEAKAGE (MICROAMPS)
RF Hi-scale	35	1K
OSC Hi-scale	25	2K
IF	45	225
AF	35-45	0 to 20
Power Hi-fidelity	30-500	5K

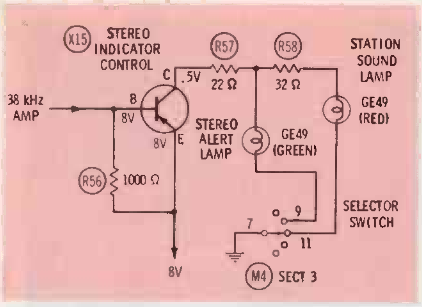


Fig. 3. Stereo and sound indicator circuit of Silvertone Chassis 528.63310.

60 volts. (The higher voltage is found in output stages.)

Along with low emitter and base voltages, transistor circuits also have low values of resistance. The emitter resistances of the RF and converter stages range from 330 to 4700 ohms. Emitter resistors in the IF stages vary from 330 to 1000 ohms, while the emitter resistance in the audio output stage may be as low as .39 ohms. With these low values of voltage and resistance, a VTVM or 20,000 ohms-per-volt meter should be used.

Multiplex Stages

The ratio detector circuit employed in most deluxe AM-FM chassis uses two crystal diodes. Only one diode is used in the detector stage of the AM band. The FM stereo signal is fed to the multiplex and doubler stages. A stereo indicator lamp is found in the matrix output stage.

The stereo FM indicator bulb will light only if a stereo multiplex signal is being received. The stereo indicator circuit of a tube-type FM receiver uses a neon bulb as the stereo indicator. Nearly all transistorized chassis use a pilot light in the collector leg of a separate stereo indicator amplifier stage.

As a preliminary check of the multiplex section of the receiver, tune in a local FM stereo station and observe the stereo indicator light; it should come on. If not, remove and replace the pilot light. Also, check the pilot light socket and wiring associated with the stereo indicator circuit.

We had an unusual case of "no stereo reception" come in from a local TV shop. The receiver was a Silvertone 528.63310 chassis and we were told there was no FM stereo reception. The technician had checked the pilot light and made a few simple voltage checks. He also informed us that he had tried to make the stereo indicator light come on by adjusting the 19-KHz doubler and 38-KHz amplifier transformer slugs. Of course, he didn't have an FM stereo multiplex signal generator to correctly align the stages.

After we spent an hour aligning the multiplex section, the stereo indicator still failed to light. However, the station sound lamp was operating. (This chassis has, in addition to the stereo indicator, a station sound lamp that can be switched into the stereo indicator transistor circuit, as shown in Fig. 3.) In a few minutes the stereo indicator was repaired by resoldering a poor connection on pin 9 of the switch section.

Multiplex and IF transformers seldom change alignment by themselves. It is possible to have shunting capacitors change value and throw them off frequency, but such cases are very rare. Never try to align a multiplex circuit until all tests have proven conclusively that alignment is the problem, and then follow the manufacturer's alignment procedure using proper equipment.

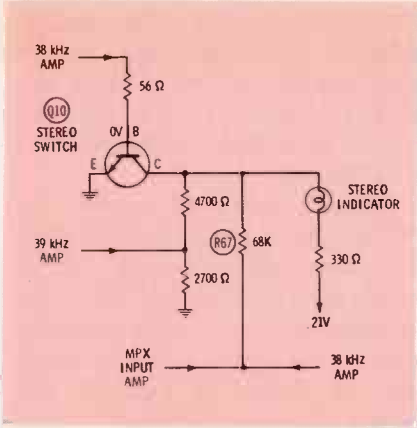


Fig. 4. Stereo indicator circuit employed in RCA tuner Chassis 1227B.

Another trouble involved a solid-state RCA RC-1227B tuner chassis that was noisy during FM reception. The popping and cracking noise was evident across the entire FM band. Reception on a local FM station was quite good, except for the noise. The AM and phonograph sections were quiet and played perfectly. This trouble was definitely a noisy transistor in the FM front end.

The IF transistors were checked, but nothing showed up. We unplugged all front end transistors and checked each individually. Often, a noisy transistor cannot be detected on a transistor checker, so we substituted all three transistors. Still no results. The local FM stereo station was tuned in once again and we noticed the stereo indicator light was out. We had not noticed this condition before, so we checked the indicator bulb. When the bulb checked good, we probed around in the indicator circuit (Fig. 4) and stumbled across the trouble: One of the stereo indicator light plugs had been pulled off and opened the circuit at the top of R67. Replacing the small plug brought life to the stereo indicator light and knocked out all popping and cracking.

While repairing the stereo indicator section of an RCA RC-1223A chassis (Fig. 5), a few voltage checks were made. We found that when a local FM stereo broadcast station was tuned in, the collector voltage of Q11 returned to zero. Of course, the stereo indicator light was on with the station tuned in properly.

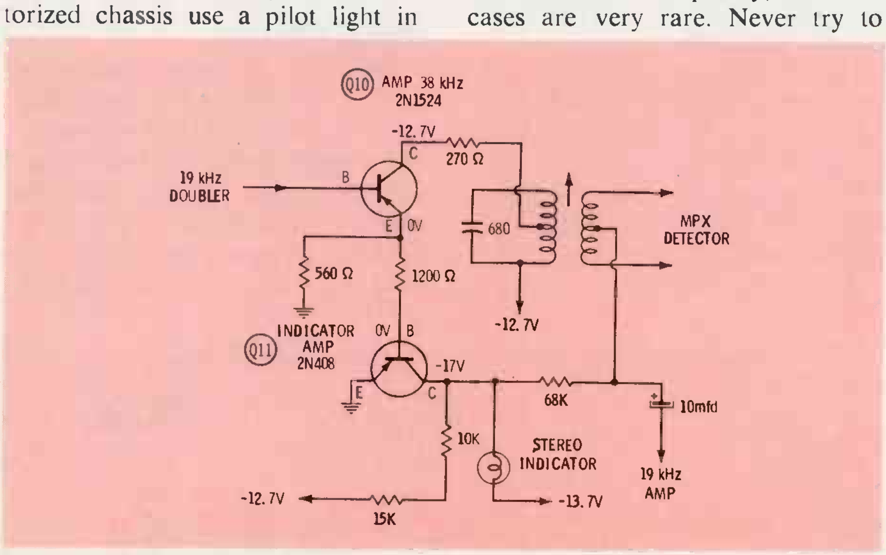


Fig. 5. RCA Chassis 1223A uses stereo indicator circuit shown here.

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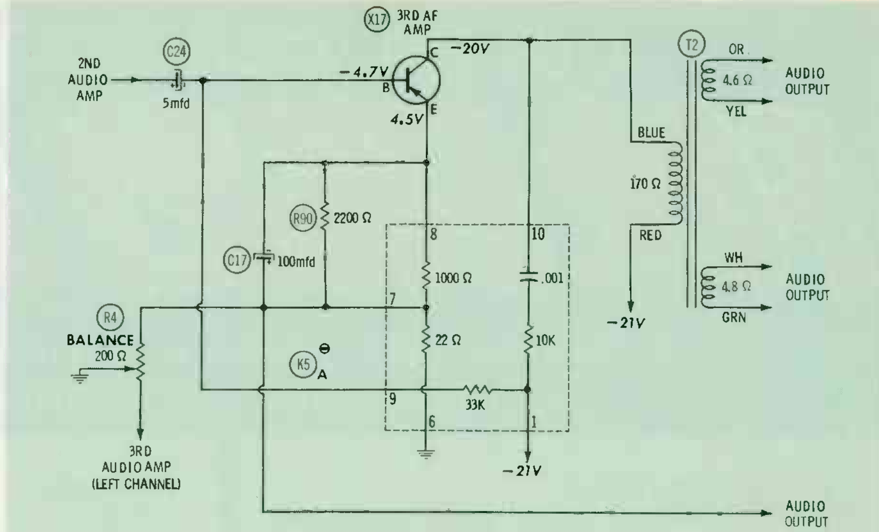


Fig. 6. Leaky coupling capacitor caused distortion in right channel of Magnavox Chassis R204-10.

With the receiver tuned slightly off station, the light went out and Q11 collector voltage returned to the value of the supply voltage. In this particular case, the collector voltage was −12.7 volts.

If the indicator light is not open, the voltage on the collector terminal of Q11 is zero; if the stereo indicator light is open, the voltage will increase to −12.7 volts. The base voltage of Q11 is zero when a stereo station is not being received. On a local stereo station, the base voltage of the indicator transistor will increase to −1 volt.

Checking the Audio Stages

The noise signal generator can also be used to find a defective audio stage. From the base terminal of the final audio output stage proceed back toward the phono input jack. A reduction or complete loss of audio signal will be encountered at the defective stage. Use the VTVM or VOM to find the defective component.

With a small audio signal loss, or in case of extreme distortion, a scope and audio signal generator should be used. When the volume of one channel is extremely low and will not balance up properly, the noise signal generator will help locate the trouble. But when there is only a small loss of signal, the scope will quickly pinpoint the defective stage. For cases involving extreme distortion, a square-wave audio generator and scope will quickly locate the stage causing the distortion.

A Magnavox Chassis R204-10 had extreme distortion in the right channel. The crystal cartridge was checked by switching the phono input leads. For a sure check, the square-wave audio signal generator was attached to the phono input stage. The volume control was turned wide open, while the output of the square-wave generator was kept as low as possible at 2000 Hz.

The scope probe was applied to the collector and base of each transistor and the scope readings compared with those in the normal left channel. Using this method, the distortion was quickly localized to the input of the 3rd AF amplifier. A 5-mfd electrolytic coupling capacitor, C24 in Fig. 6, was found to be leaky. Electrolytic capacitors, burned resistors, and leaky audio output transistors are the most common causes of distortion in AM-FM solid-state chassis. A good circuit capacitor tester will quickly locate a bad capacitor.

Intermittent audio stages can be caused by a cracked crystal cartridge or defective audio coupling capacitors. Many times a poor solder connection on a PC board will cause an intermittent condition. Twisting or pushing up and down on the PC board will usually uncover this source of intermittent trouble.

We had another case of extreme distortion with low, garbled volume in the left channel of an Electrohome Model TR30M. This trouble had to be in the final output stages. Using the PHOTOFACT schematic, we located the two final power output transistors and removed them from the chassis. One of the transistors had a dead short. A new RCA SK3009 power transistor was installed in its place.

We still had low volume with some distortion. Checking the circuit closer, we discovered that R93 and R89 (Fig. 7) were burned and had changed value. It is adviseable to check for burned resistors in final output transistor circuits when a leaky or shorted transistor is found.

Conclusion

Repairing the solid-state deluxe AM-FM chassis is no more difficult than servicing tube-type chassis if proper test equipment is used. A good schematic is a must item. For extreme distortion or intermittent conditions, use the scope and capacitor analyzer. Use an in-circuit transistor checker to quickly check the transistor in the suspected section. If the transistor is not defective, check voltages and resistances with a VTVM or 20,000 ohms-per-volt (or better) VOM. ▲

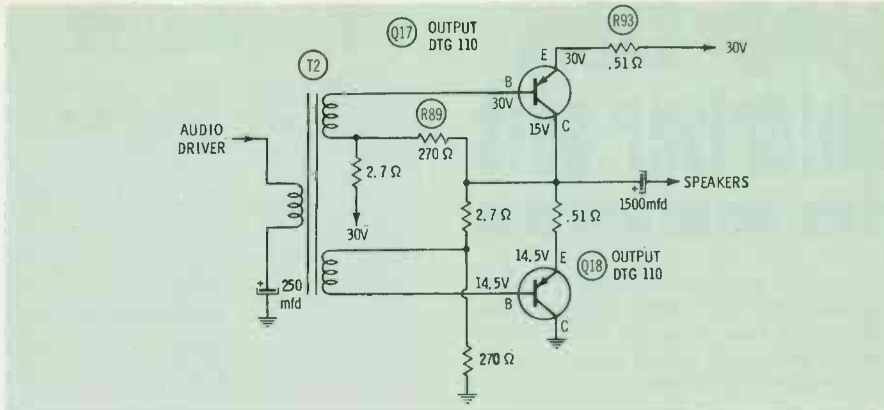


Fig. 7. Shorted transistor and burned resistors caused extreme distortion and low volume.

RC CIRCUITS

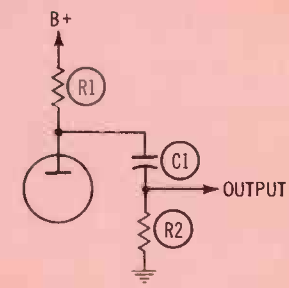
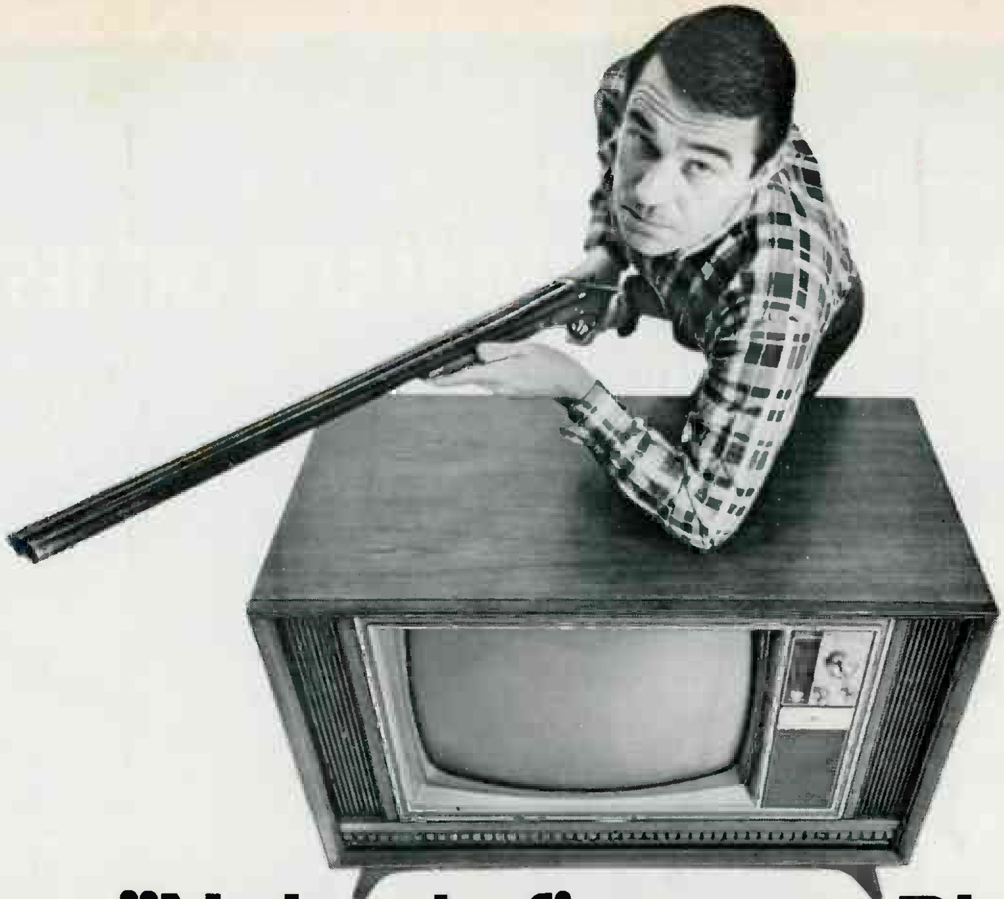


Fig. 1 shows a typical RC coupling circuit that might be used between almost any two audio or video amplifiers. In most cases, this circuit is designed to couple the signal with a minimum of distortion, although it may be designed to change the shape of the signal waveform in some applications. The effect of the circuit on the waveform is determined by the values of R2 and C1 so long as the impedance of these two components is great with respect to R1.

Let's assume that R1 is 20K ohms so that it is small with respect to R2 and will not affect the circuit. If C1 is .01mfd and R2 is 1 megohm, the RC time constant of the coupling circuit is .01 second. RC time = R (in ohms) X C (in farads) = time (in seconds). Assume the input to be a square wave whose width is more than 5RC. The voltage at the junction of R2 and C1 will be 37% of the applied voltage at the end of 1RC time.

At the end of 2RC time, the output will have dropped to 37% of its value at the end of 1RC time, or about 14% of the applied voltage. The output will continue to decay at this exponential rate, and it may be considered to have reached 0 at the end of 5RC time. In our example, the output would be 0 at the end of .05 second.

To couple without distortion, the RC time constant should be at least 10 times the duration of the widest pulse that has to be passed by the circuit. Thus, in our circuit, the maximum pulse width which can be coupled has a width of .001 second. At the end of 1/10 RC time, the output will have fallen to about 90.7% of the input level. ▲



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BOOK REVIEW

Single Sideband: Theory and Practice: Harry D. Hooten, W6-TYH; Editors and Engineers, Ltd., New Augusta, Ind. 1967; 352 pages, 8¾" × 5¾", hard cover; $6.95.

This text treats the subject of single sideband in a manner that will be easily understood by both the technician and engineer. Basic principles and circuitry are emphasized, while mathematics is used only when needed to clarify or expand a point. Wherever possible, specific commercial equipment of current design is used to explain theory and illustrate circuit applications.

The origin of single sideband is the first item discussed (Chapter 1) and is followed by an analysis of the single-sideband signal (Chapter 2). Chapters 3 through 6 examine the techniques and circuits involved in the actual development of the single-sideband signal. These include carrier generation, speech amplifiers and associated filters, carrier suppression, and sideband selection. After being examined on an individual basis, the circuits and techniques are combined in Chapter 7 to form the single-sideband generator. Both the filter and phase-shift type generators are discussed. The process of converting the low-frequency signal to the desired transmission frequency is found in Chapter 8.

The features and characteristics of specific low-power transmitters are analyzed in Chapter 9. The function and design considerations of linear RF power amplifiers are the subjects of Chapter 10. Specific models of receivers and transceivers are presented in Chapters 11 and 12. The final Chapter is concerned with tests and measurements. ▲

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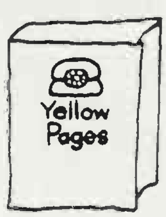

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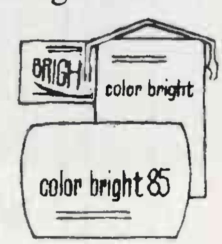

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THE TROUBLE-SHOOTER

Poor Vertical Sync

We have a Zenith chassis 14M21/X (PHOTOFACT Folder 764-4) with poor vertical sync. I have measured the voltages at V5, the sync separator, AGC, and noise canceller tube. The table below shows the results and also the correct voltages taken from the PHOTOFACT Folder.

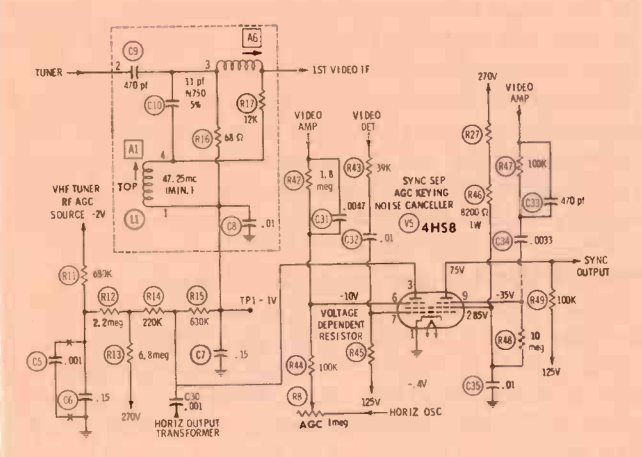
Pin No.	Measured	Correct
2	85	103
3	10	13
6	-10	-17
7	-.4	-.9
8	75	54
9	-35	-3

The resistance readings are normal except that the resistance from pin 3 to the B+ source is only 1.4 megohms. R13 was disconnected and it measures 6.8 megohms. With it disconnected, pin 3 to B+ reads 1.7 megohms.

I would appreciate any comments you can make concerning these voltage and resistance readings. Also, I would like to know if the voltage and resistance readings shown on the PHOTOFACT Folder are actual readings made by your technicians.

C. H. ALEXANDER

Ebensburg, Pa.



You are correct in assuming that the resistance readings shown in the PHOTOFACT *Folder are taken by our staff. Incidentally, the voltage, waveform, and alignment data are also derived from actual measurements and adjustments made by our technicians using accurately cali-*

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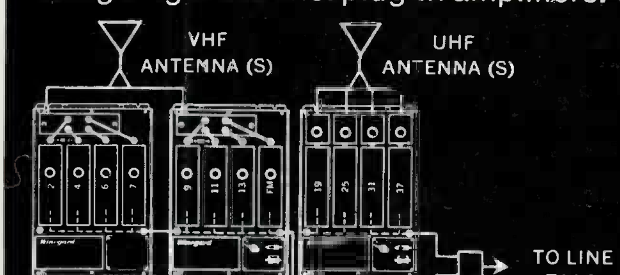

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brated equipment.

There are several bleeders from B+ to ground and the total DC resistance is about 34K ohms. Thus, if either C7 or C8 were leaking, the resistance from pin 3 of V5 to B+ could drop to the value you measured. If C5 or C6 were leaking, the resistance would be somewhat higher unless, of course, R12 had changed value. C9 or C30 leaking also could cause a low-resistance path to B+.

The increase in voltage at pin 2 of V5 is probably caused by a decrease in value of either R46 or R27. After you have corrected this problem, you will probably find the voltage at pin 9 to be normal.

The increase in negative voltage at pin 7 indicates that R45 has increased in value. When you have corrected the two other faults, you may find that the set has good vertical sync. Even so, don't risk a call-back; change R45 if the voltage is abnormal.

Tuning Trouble

I have had the same problem with several Setchell-Carlson receivers which were manufactured about 10 years ago. When I adjust the fine tuning control, just as I tune from the "sound side" to where a clear picture should appear, a wavy pattern appears. This pattern changes as I adjust the fine tuning.

Originally, I thought this might be a fault in one make of tuner, but now I have had the same problem with two different makes of tuner. I sent one tuner to a repair service and it worked properly when it was returned. If you know a solution to this problem, I would appreciate your help.

LEONARD W. BAUMAN

Woodruff, Wis.

Since your problem is of a general nature, here are some suggestions which are also of a general nature.

1. *Be sure the output of your sweep generator is properly terminated and also matched to the receiver input.*

2. *Keep the leads of this matching network as short as possible. The unshielded leads should be no more than 1 inch long.*

3. *Make sure the detector probe and cable is well shielded and keep the unshielded leads as short as possible.*

4. *Make sure the output of your sweep generator is flat. If it has a "notch" in its output, you may be peaking the tuner response during alignment to compensate for it.*

5. *Be certain that bias on the tubes is the same during alignment as it is in normal operation. Use a well-regulated, filtered bias supply.*

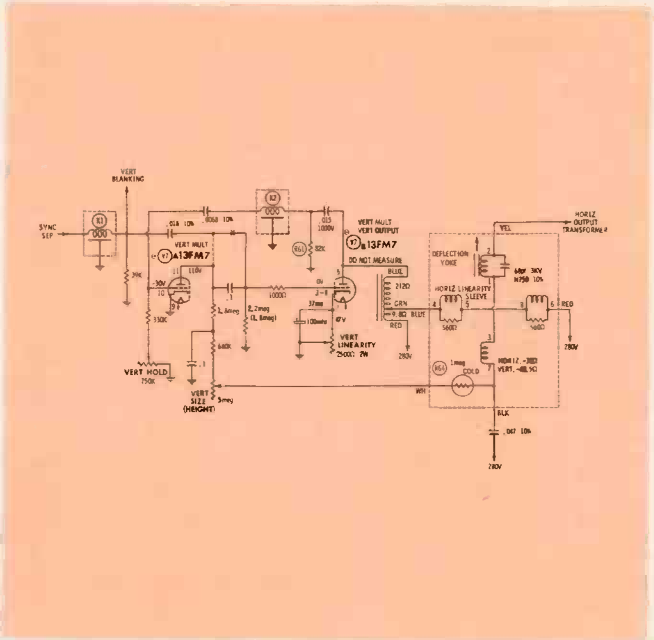
6. *Be careful of lead dress and lead positions both during alignment and after the set is put back in the cabinet. If lead position changes the response curve during alignment, find out why and correct the trouble.*

7. *Keep the shields in place to prevent a change in the response curve when you replace them.*

Vertical Roll

A Zenith Chassis 14L20 (PHOTOFACT Folder 711-4) displays a vertical roll after about one hour of operation. I have recently replaced the yoke with a Triad Y-83-1. All scope patterns seem normal. The trouble has not been cured by changing every resistor and capacitor in the vertical oscillator and output stages. The vertical blanking bar rolls within 2" of the bottom edge and stays there until the vertical hold is adjusted. It will lock back in sync for about 15 minutes and then the same symptom occurs again. The picture cannot be centered without a black area at the bottom of the screen. The vertical hold does not seem to have much variation. Could the new yoke be defective and if so, would it cause the trouble I have described.

EUGENE N. SPETTER
Rossville, Kans.



The Triad Y-83-1 yoke is a correct replacement and, from the symptoms you describe, it is probably OK. I assume that you followed the installation notes in the PHOTOFACT *Folder.*

With no waveform or voltage data to go on, it is very difficult to guess which component is causing the trouble. I would guess that one of these three components, R64, K1, or K2, is the culprit; but this is only a guess. Observe the pertinent waveforms with your scope to determine the general area of the trouble, and then isolate the faulty component with the VTVM.

Compounded "No Raster" Problem

I have a Zenith 14M20 chassis (PHOTOFACT Folder 741-4) that has no raster, boost, or high voltage. Ordinarily I don't have much trouble solving "no raster" symptoms; however, the horizontal oscillator used in this chassis depends on the boost source for plate voltage. Since the set doesn't have boost or high voltage, I do not know where to start troubleshooting or what procedure to use.

Gary, Ind.

NORMAN WISE

The "no high voltage" symptom you are experiencing can be difficult to solve. Since boost voltage is used to supply the horizontal oscillator plate, troubleshooting the horizontal and high-voltage sections of this chassis can quickly involve the technician in a confusing cycle of trying to determine what caused what.

The best approach to this problem is to divide the horizontal and high-voltage section at the grid of the horizontal output tube. Using a television analyist, substitute oscillator

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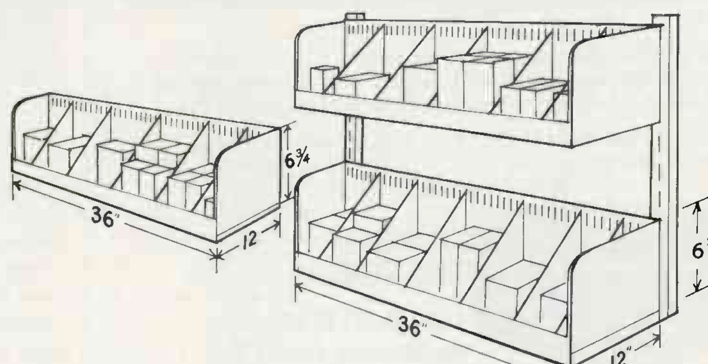

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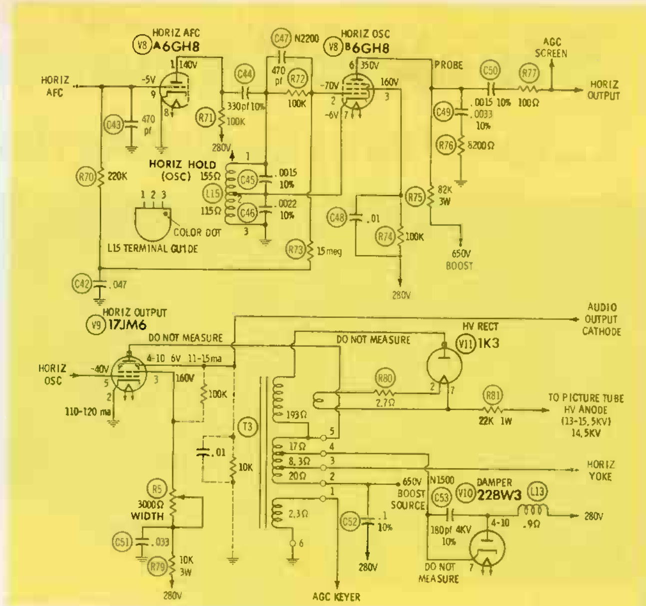


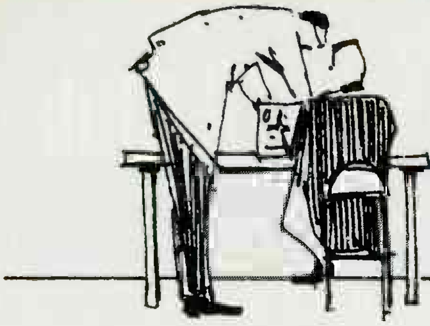
from another set, or some other source, inject a drive signal at the horizontal output grid. If high voltage, boost, and raster return, you can be fairly certain the trouble is in the horizontal AFC or horizontal oscillator. However, if high voltage, boost, and raster do not return, the trouble is probably in the horizontal output, high-voltage, or damper circuits.

If the foregoing procedure indicated trouble in the stages preceeding the horizontal output grid, you can localize the trouble even further by grounding the grid of the horizontal AFC stage. High voltage, boost, and raster should return if the defect is in the AFC circuit. Once the trouble is localized to the AFC or horizontal oscillator circuit, voltage and resistance checks will isolate the actual defect.

If injecting a drive signal at the horizontal output grid did not restore high voltage, boost and raster, the trouble, as noted before, must be located in the horizontal output, high-voltage, or damper circuits. Although there are a number of sequences that can be followed in troubleshooting these circuits, probably the quickest is to first check the most logical suspects. Begin with the boost capacitor (C52). There are a couple of effective methods you can apply here, such as substitution or removing the damper tube (jumper across damper filament because of the series filament string), which should restore high voltage and a narrow rippled raster if C52 is shorted. If C52 is not defective, disconnect the yoke leads while monitoring the boost voltage. If boost is restored or greatly increased with the yoke disconnected, a defect in the yoke has been causing an excessive load on the system. Next, measure the screen grid voltage on the horizontal output tube. An open or increase of R79 could disable this stage.

Another possible cause of no high voltage is a defective CRT. Remove the high-voltage lead to the CRT anode and see if high voltage and raster are restored.

At this point you have eliminated nearly all suspects (it is assumed all tubes and B+ were checked as preliminary procedure) except the flyback itself. A flyback checker can be used to check this component; however, it cannot be considered an absolute indication of a good or bad flyback unless all other circuits have been previously tested or have been disconnected before the flyback is tested. Also, some flyback defects will show up only while the flyback is connected in the circuit and operating. It is generally conceded that the best check of a flyback is substitution after all other possible circuit defects have been eliminated. Of course, the foregoing is true only if there are no visible signs that the flyback is defective, (melted wax, etc.). ▲



Protect your business from these credit abuses

by Ernest W. Fair

Proper handling can reduce the risks involved in extending credit. The following article outlines the correct procedures to follow, both before and after an account is opened.

Well over half of today's business is transacted on a credit basis. That percentage grows every year, and soon may be near universal. As credit expands, so do the hazards involved. The very life of any electronic service business may well depend on how adequately it is protected against abuse of this credit.

In past years, improper and haphazard operation of credit has accounted for as high as 65% of small business failures. While some losses can be attributed to lax procedures in granting credit, this problem has been decreasing during the past five years due to better education on procedure and greater availability of checking agencies. During the past year several surveys have revealed this decline but also pointed up an alarming increase in losses through abuse of credit.

We've carefully studied several such reports, as well as surveys on the subject. In paragraphs to follow is a list of the top ranking credit abuses which were responsible for fully 90% of these losses. With each is shown recognized and proven steps to avoid damage to the business. Following these steps should be a "must" procedure to assure a profitable year of business.

Changes in credit status. Yesterday's well-rated customer can, through all sorts of circumstances, become a dangerous risk tomorrow. Failure to watch over the continuing credit status of major customers is always a hazardous procedure.

Preventive: Periodically survey account status of all customers. Watch carefully any account which has become slower and slower in making payments over any past three-month period.

"Softness" in collection procedure. One is always tempted to grant the good credit account some extra concessions. Too often this leads to a major loss.

Preventive: Strict adherence to conventional credit terms at all times is a must. Extension of such terms in cases of genuine emergency are justified only on a short-term basis.

Mistakes or errors in bookkeeping. Failure to charge the proper account, and errors in transcription of invoice or sales slips to account ledgers are the two most common mistakes in this area.

Preventive: A well developed system for handling the paper work for all charges and a constant check of employees to see that this is being followed does the job. Avoid "hurry and rush" in handling these steps.

Laxity in follow-up on delinquent accounts. There should be no exceptions regardless of how good the customer involved may be. Carelessness in handling delinquent accounts invariably leads to greater delinquency.

Preventive: Establish a definite procedure to follow and use it on every account without exception. Never wait more than 30 days to put it into use.

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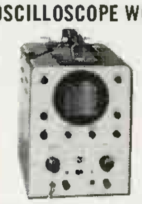

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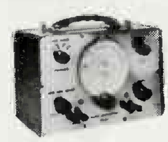

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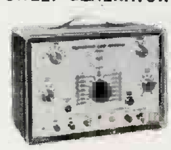

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TOWARD PURCHASE OF
WV-77E VOLTOHMYST®

Mr. Distributor: Refer to RCA Fall Festival Announcement. Void where prohibited, taxed or restricted. Cash value 1/20¢. Offer expires October 31, 1967.

$14.00

TOWARD PURCHASE OF
WO-91B 5" OSCILLOSCOPE

Mr. Distributor: Refer to RCA Fall Festival Announcement. Void where prohibited, taxed or restricted. Cash value 1/20¢. Offer expires October 31, 1967.

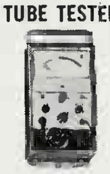
$20.00

TOWARD PURCHASE OF
WR-99A MARKER-GENERATOR

Mr. Distributor: Refer to RCA Fall Festival Announcement. Void where prohibited, taxed or restricted. Cash value 1/20¢. Offer expires October 31, 1967.

$10.00

TOWARD PURCHASE OF
WT-115A COLOR PICTURE TUBE TESTER



Mr. Distributor: Refer to RCA Fall Festival Announcement. Void where prohibited, taxed or restricted. Cash value 1/20¢. Offer expires October 31, 1967.

ALSO SAVE ON RCA KITS!

$5.00

TOWARD PURCHASE OF
WO-33A(K) 3" SCOPE KIT

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$2.50

TOWARD PURCHASE OF
WV-38A(K) V.O.M.

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$4.50

TOWARD PURCHASE OF
WR-50B(K) RF SIGNAL GENERATOR KIT

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$2.50

TOWARD PURCHASE OF
WV-77E(K) VOLTOHMYST

Mr. Distributor: Refer to RCA Fall Festival Announcement. Void where prohibited, taxed or restricted. Cash value 1/20¢. Offer expires October 31, 1967.

TUNE IN ON THE PERRY COMO HOLIDAY SPECIAL IN COLOR ON NBC-TV. THURSDAY, NOVEMBER 30, 7:30 - 8:30 P.M., E.S.T.

Chronically slow accounts. Many a good credit customer has been permitted to down-grade into an undesirable one because of failure to insist on payment according to agreed terms.

Preventives: (a) Reduce the amount of credit allowed. (b) Keep in a separate file for closer attention. (c) Institute a 1% per-month service charge for failure to pay on the due date.

Carelessness in handling credit cards. More use of bank-type credit cards is a certainty for the future. Carelessness in handling the charge slips means sure loss.

Preventive: Make certain every item of basic data needed is clearly reproduced on the slip (particularly the account number of the customer).

Charges by unauthorized individuals. Members of the family or associates of an individual who charge to his account without permission are involved in this abuse.

Preventive: Make a matter of record names of those who can use the account and take time to check with the account in each instance before going ahead.

Too many returns for credit. Every such action does away with profit on the given sale and increases the chance for error in handling the transaction. Frequently credits are made for larger amounts than the original charges.

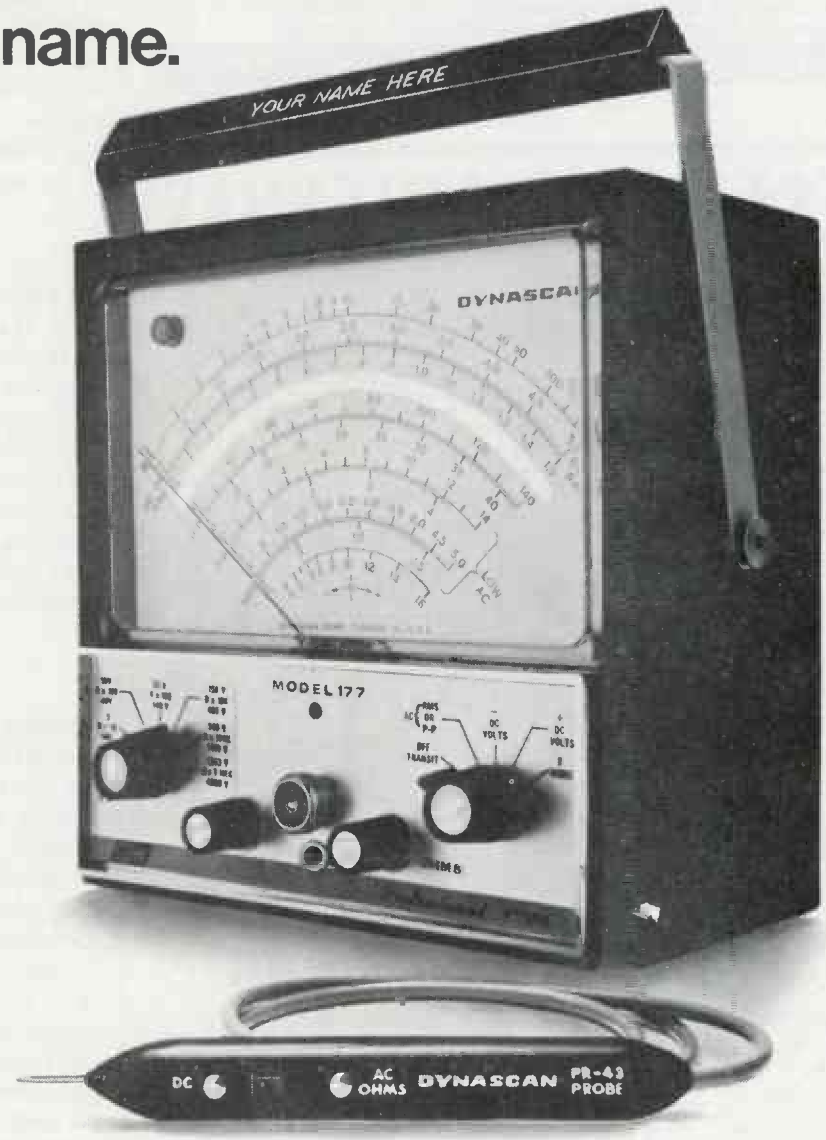
Preventive: Require original charge slip to accompany each such return. Exert more sales pressure to convince the customer to retain the item he purchased.

Partial payments on accounts month after month. This too often leads to a dangerously large balance the customer cannot pay and will then jeopardize his previously good credit rating.

Preventives: (a) An account charge of 1% per-month on the unpaid balance each time. (b) Reduce the limit of credit allowance as the practice continues. (c) Personal contact with the customer after the

There's a heckuva lot of VTVM units around.

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



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

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

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

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

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

B&K
Where Electronic Innovation Is A Way Of Life

Circle 34 on literature card

second or third such partial payment to help solve the problem before it grows larger.

Granting requests for larger than authorized amounts of credit. This is usually done for a good customer of long standing as a special favor.

Preventive: Without exception, granting the request should be delayed long enough to check on the reasons behind it, the ability of the customer to pay the larger sum, and any changes in financial capabilities of the account.

Checking only one credit reference. Many substantial losses were noted during the last year where only one reference was required on credit applications or only the first was checked if more were listed.

Preventive: Check **all** references and require at least three from every applicant. Questionable credit risks often make an excellent record with one account for just such a reason.

Urging customers to use credit. The drive for additional business can never be discouraged in any concern but when such business is obtained on a basis of credit where not justified, it usually costs much more than the profit made thereby.

Preventives: (a) Discourage use of high pressure methods which result in customer over-use of credit beyond ability to pay. (b) Hold fast to all credit rules in periods where special business promotion activities are underway. (c) Set up separate credit facilities for use at such times.

Too liberal concession to accounts during emergencies. This has generally been the granting of 90- to 120-day payment-free periods or extra credit allowances to customers on such occasions. This invariably results in laxity of responsibility by the customer in the future.

Preventives: (a) Set up special arrangements to cover partial payment of account during these periods (b) Arrange for financing at a

This part speaks for the whole radio.

This box speaks well of you.

To the listener, the speaker is the most important part of the radio. Reason enough that it be of the highest quality and reliability. And when it says Delco on the box you can be certain you've got it: genuine OEM quality.

Delco Radio Parts are designed by engineers who specialize in automotive radios. Delco Radio speakers, for example, provide greater efficiency and sensitivity per ounce of magnet than any other speakers built. And since nearly half the cars on the road have Delco Radios as original equipment, you are assured of a vast pre-sold market.

Doesn't it make sense to stock the best for your customers?

They know Delco's reputation. So, the next time you reorder, remember your United Delco Supplier. He handles the most widely advertised, merchandised and recognized name in the parts business.

Why not let Delco Radio speakers say something nice about you?

Delco Radio, Division of General Motors, Kokomo, Indiana.

GM
MARK OF EXCELLENCE

United Delco

Circle 37 on literature card

bank or elsewhere to handle money needs created by the emergency. (c) Pay close attention to the account immediately at the end of the period in order to put it back into line as speedily as possible.

Assuming the good "cash customer" is automatically an excellent credit risk. This has been one of the leading reasons for credit losses among small business concerns everywhere for a number of years.

Preventive: A positive policy of complete investigation on **every** credit application.

Accepting recommendation of present customer for another. This is sometimes a good method of building new credit accounts but where all checking of such an applicant is waived it has often proven an unsound practice.

Preventive: Handle every such new account with the regular routine used for all credit applicants. Where offending the old customer cannot be risked, an immediate grant of small credit pending regular checking will usually handle the problem.

Failure to pursue collection steps for fear of losing a good customer. Almost every business failure during the last year revealed the presence of such procedure. An uncollectable account is certainly anything but that of a **good** customer.

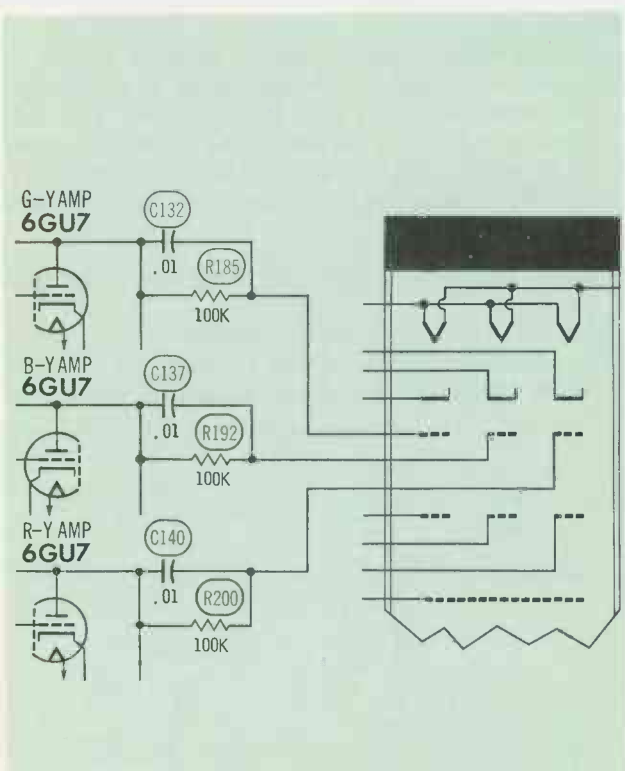
Preventives: (a) Follow through on a standard policy of handling credits and collections with no variance for any but emergency considerations (b) Realize that the good customer whose account has become hazardous has lost his good status and handle it accordingly.

Finally, the **lack of proper credit and credit control records**, has always been a contributing factor where credit abuses have eaten heavily into the profits of the business. The system which fails to immediately point up existence of shaky credit conditions is an inadequate one. Without workable credit records and systems, all other safeguards the business may use will prove inadequate. ▲

COLOR COUNTERMEASURES

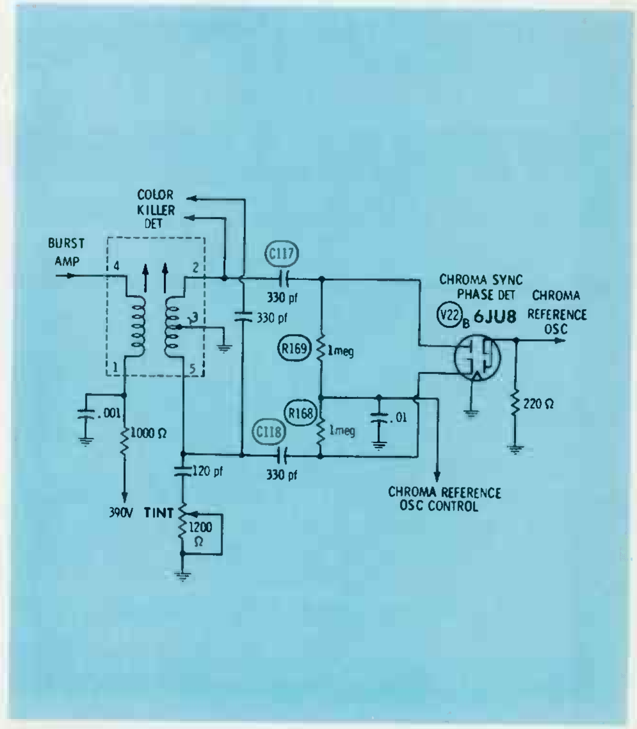
SYMPTOMS AND TIPS FROM ACTUAL SHOP EXPERIENCE

Chassis: RCA CTC11
Symptom: Complete loss of contrast. Raster and color signals remain on screen.
Tip: Check for Heater-Cathode short in V24 (CRT).
Analysis: Heater of CRT is connected to B+. A heater-cathode short will place this B+ source on the cathode. The power supply filter will then filter out the luminance information normally present on the cathodes of the CRT. In addition, the +180 volts applied to the cathode will clamp the normal bias and in effect make the grids of the CRT positive with respect to cathode, allowing raster to remain on screen.



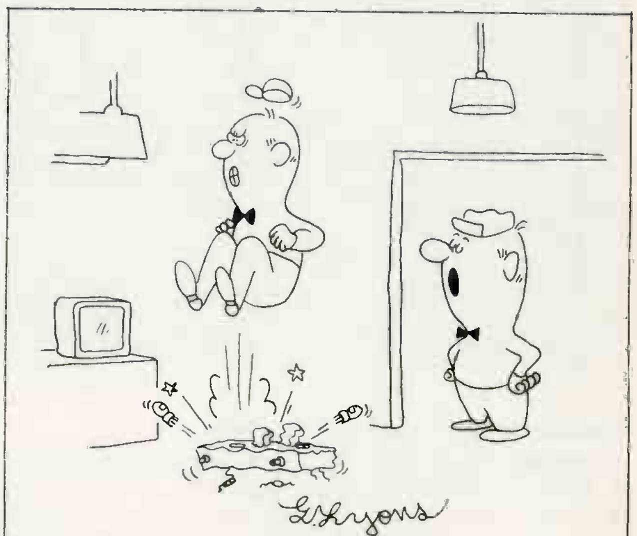
Chassis: Zenith 24NC312 and 25N38.
Symptom: Screen turns light green on color program; normal on black-and-white program.
Tip: Plug that connects hue and color level controls to the chassis is defective. Remove plug and connect wires directly—watch the color code of the wires, as they do not match.

Chassis: Sylvania D01 and D02
Symptom: Poor color sync.
Tip: Check R168 and R169 for changed value. If either is defective, replace both with a matched pair of 2% resistors. Also check C117 and C118 for a leakage or shorted condition.



Chassis: All.
Symptom: Evenly spaced, multiple ghosts in picture.
Tip: May be caused by reflected energy in an improperly terminated delay line. Check for an open terminating network at the output end of the delay line, or an ungrounded shield on the line. An open delay line would result in a complete loss of luminance signal.

Chassis: Zenith, all chassis using socket-type CRT grid leads.
Symptom: Hue control action reversed.
Tip: May be caused by reversal of green and blue grid leads. Disconnect and change position of leads. ▲



"TEMPER, TEMPER, TEMPER!"

PRODUCT REPORT

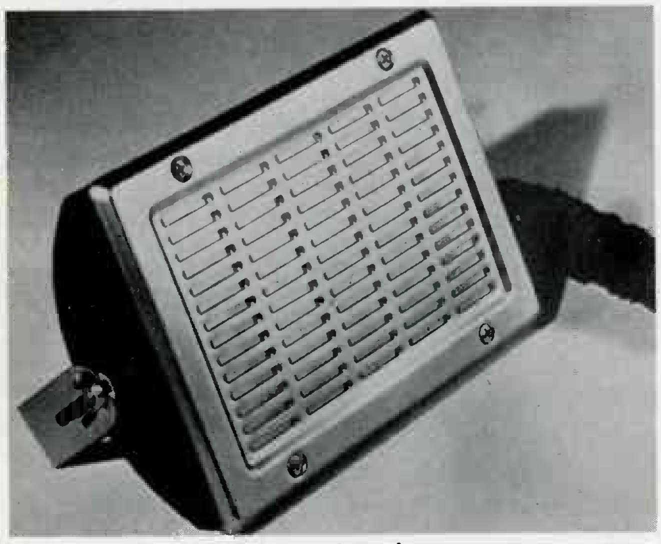
for further information on any of the following items, circle the associated number on the Catalog & Literature Card.

Transistor Analyzer
(57)

Transistors can be checked both in and out of circuit with **Lectrotech's** new Model TT-250 Transistor Analyzer. In-circuit AC gain tests indicate the condition of the transistor as either good or bad, with no numerical interpretation involved. Out-of-circuit tests measure beta or gain on two scales: 0-250 and 0-500. Biasing is automatic and no calibration is required.

The unit measures transistor leakage (I_{cbo}) directly in microamperes. It also measures reverse leakage and forward conduction of diodes and rectifiers to determine front-to-back ratios. Transistor classification—PNP or NPN—can be quickly determined without a set-up book. In addition, electrolytic capacitor leakage current can be checked using 6 volts, with the indication read directly in microamperes.

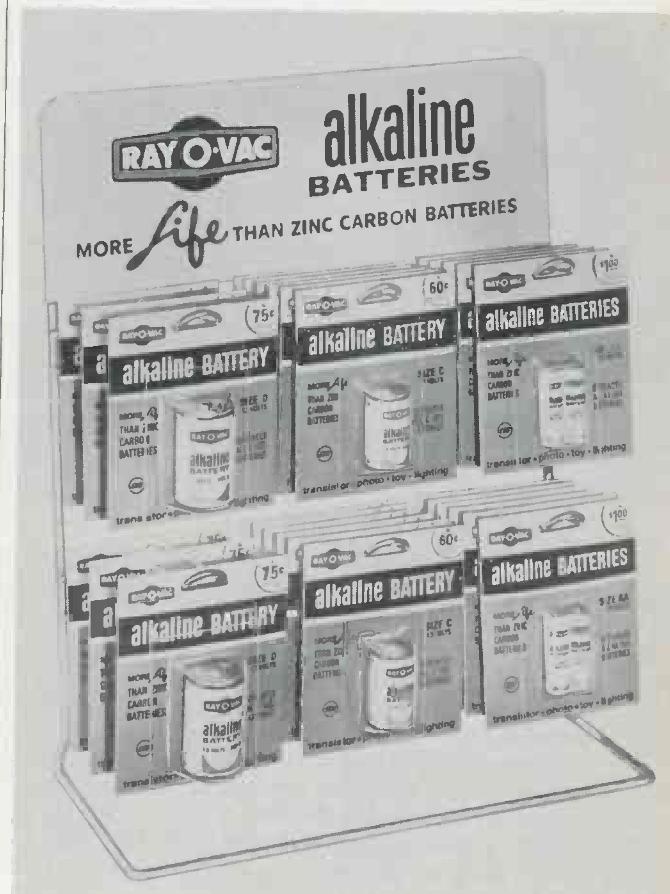
Other features of the analyzer include a 6″ meter and all steel case. The unit measures 10½″ × 7″ × 4″ and weighs 5½ lbs. Price is $87.50.



Stereo Speaker
(58)

A new stereo speaker that can be used anywhere a stereo effect is desired has been announced by **Best Automotive.**

The Model ST46BC speaker comes assembled in an attractive 7¼″ × 5″ × 2⅛″ metal housing with a black finish, complete with chrome grill and chrome mounting bracket. All necessary wire, hardware, and instructions are furnished. A versatile mounting bracket permits ease of installation. Price is $7.25.



Batteries

(59)

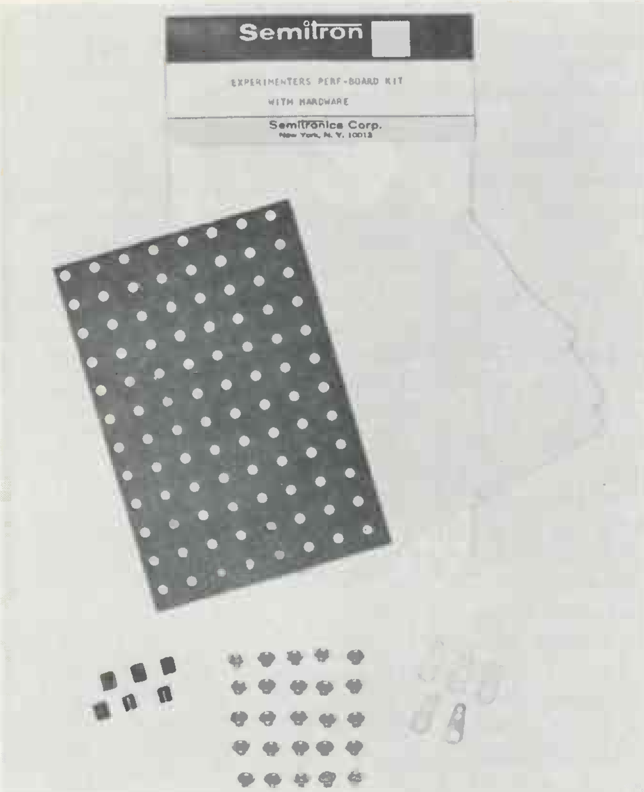
A complete line of manganese alkaline batteries for toys and radios as well as photoflash and portable lighting equipment is announced by **Ray-O-Vac.** Available in open stock or on bubble pack cards, the line consists of five different size batteries: No. 813 Size "D", No. 814 Size "C", No. 815 Size "AA", No. 824 Size "AAA", and No. 810 Size "N". Also available is a battery display (No. MA30) housing the three most popular batteries—815, 814 and 813—on bubble pack cards. The display, which hangs from a pegboard or stands on a counter, is only 13″ wide by 6⅜″ deep by 16⅝″ high and is priced at $23.70.

CRT Test Adapter

(60)

Existing CRT test equipment can be converted to test the picture tubes used in small screen personal portable television sets through the use of a new tube socket test adapter introduced by **Pomona Electronics, Inc.** CRT's such as 9YP4, 11RP4, 12BEP4, 16BXP4, etc., fit the adapter.

The Model 2713 adapter socket accepts tubes using 7GR basing (E7-91 base), and plugs into the standard 12L Duo-Decal socket found on current tube testers. The unit features a clearance hole in the 7GR socket which accepts the CRT evacuation stem and prevents accidental breakage. Price is $1.95.



Experimental Kit
(61)

A new line of experimenters perf-board kits with hardware is designed for experimenters, vocational school students, shop teachers, hobbyists, hams, technicians, and engineers who want a quick setup that can be assembled rapidly and efficiently. The **Semitron** Experimenter's Perf-Board Kit consists of ⅛" tempered board. The spacing of the holes on ½" centers helps prevent component crowding. Solid brass eyelets are supplied, permitting easy soldering and the insertion of a number of component leads through a single eyelet.

Cartesian coordinate graph paper also forms part of the kit, allowing spacing of components after prior planning using the graph. If solderless connections and maximum construction speed are desired, the spring connectors supplied with the kit can be used for making rapid and mechanically secure connections. Using several kits permits modular construction for the design and building of a large number of stages, arranged either horizontally or vertically. The kits are priced at 89c.

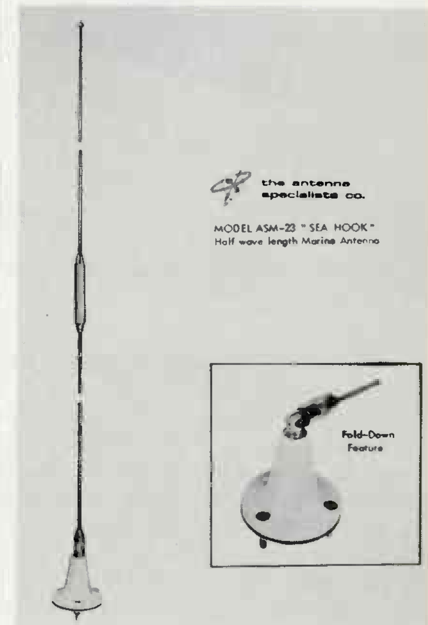
Studio Mixer
(62)

A new battery-operated studio mixer designed specifically for studio, remote, and home hi-fidelity use has been announced by **Switchcraft, Inc.** Called the "Studio MixMASTER" Model 307TR, it is a solid-state stereo-monaural audio frequency mixer/amplifier. The mixer can be used with phonographs, microphones, electronic instruments, and tape recorders. It permits recording sound on sound, fades music and voices, records voice over music, and mixes voice and program sources from several different locations.

Powered by standard "D" batteries, the unit requires no external power. Distortion is 1% maximum (0.5% typical) at 1.5 volts output. Frequency response is 20 Hz to 20,000 Hz with a minimum signal-to-noise ratio of 60 dB referred to 1-mv input.

The mixer accepts from one to four monaural input signals or up to two stereo input signals from any combination or type of program source. It is also equalized for magnetic phono cartridges. Each program input level is controlled individually by a separate gain control or simultaneously with the master gain control. These broadcast-type control knobs are numbered for easy reading and rapid error-free operation. Other controls include an on-off switch, phono equalization, and stereo-mono switches. Standard phone and phono jacks are used for various inputs. Each input will handle a wide range of signals without overloading. The microphone inputs will accommodate both low- and high-impedance microphones without transformers.

Signals are mixed and amplified up to a 2-volt level in each channel, then fed to a single high-impedance output for distribution to recorders, public address, or musical instrument amplifiers. The unit measures 3½" high by 12" wide by 7¼" deep and is finished in satin black enamel with a brushed aluminum escutcheon plate. Protective rubber feet prevent scratches to fine surfaces. Price is $145.00.



Marine CB Antenna
(63)

A new omni-directional marine CB radio antenna with a low angle of radiation for maximum "over-water" range has been announced by **The Antenna Specialists Co.** The new 27-MHz antenna, designated Sea-Hook Model ASM-23, is a full electrical half-wave radiator with an overall length of 97". A feature of special importance to boat owners is the pure-white Cycolac base with a built-in fold-over feature allowing instant "retraction" of the antenna when negotiating bridges.

No ground plate is required since link coupling is employed, thus simplifying installation. All critical parts are solid brass with chrome plating for additional protection. The loading coil is enclosed in white, weatherproof plastic with chrome-plated end caps. The upper and lower whips are fabricated from stainless steel. The impedance of the unit is 50 ohms. VSWR is better than 1.5 to 1.0. The upper radiator can be easily adjusted for fine tuning. The antenna is priced at $29.50.

Seven in One
(64)

The solid-state portable unit shown here incorporates seven instruments for testing audio FM and multiplex. Four signal sources and three measuring instruments are contained in **Amphenol Corporation's** new Model 880 Stereo Commander.

Signal sources provided by the unit include:

(1) An audio generator that supplies either sine or square wave signals used by other sections of the unit.

(2) A multiplex simulator that generates or controls all signals necessary for complete and accurate alignment of an FM multiplex receiver.

(3) RF/sweep oscillator that may be used as an FM source modulated by the signal present at the composite jack (monaural sine wave or square wave) or as a sweep generator with 60-Hz sweep rate for FM tuner alignment.

(4) An oscillator that generates a crystal-controlled 10.7-MHz signal for use as a marker for aligning FM receivers.

Measuring instruments included in the instrument are:

(1) An intermodulation distortion analyzer which measures distortion to 100% using an SMPTE standard signal.

(2) An impedance bridge capable of measuring largely resistive unknowns from 1 ohm to 20,000 ohms. Since the audio generator provides the signal used to drive the bridge, unknown impedance can be checked at any frequency within the generator range. This section may also be used to determine resonant frequencies.

(3) A high-impedance AC voltmeter with a sensitivity of 100 mv full scale. The unit measures from 0.1 volt full scale to 1000 volts full scale in nine increments. The VTVM is also used as an indicator for the impedance bridge and intermodulation analyzer sections.

The Model 880 has a composite output of 5 volts p-p stereo, with 35-dB channel separation up to 10 KHz; 2.5-volts p-p L-R and 3-volts p-p monaural. A sine wave output of 5 volts p-p is available at 19, 38, and 67 KHz. The monaural audio output consists of a 3-volt p-p sine wave and

Circle 48 on literature card

a 10-volt p-p square wave. Both sine and square wave are variable from 35 Hz to 18 KHz in two ranges with less than 1% distortion.

The unit measures 11½" wide by 9¾" high by 6" deep and weighs slightly over 8 lbs. Price is $329.95.

Nutdriver Set
(65)

A selection of hollow shaft nutdrivers in a new plastic case is offered by **Xcelite, Inc.** Identified as No. HS6-18, the set consists of ten color-coded nutdrivers with hex openings from 3/16" through 9/16" and clearance hole depths for long bolts and studs from 4⅜" through 6". The tools are packaged in a molded yellow plastic case. A tight-fitting cover with integral snap lock keeps the nutdrivers clean and dust-free when not in use. It also permits them to be carried on service calls without danger of spilling or becoming lost in the tool box. The nutdrivers are designed with precision fit, case-hardened sockets; polished, plated steel shafts; and shockproof, breakproof, color-coded plastic (UL) handles. Price of the set is $18.50.

Color TV Control Kits
(66)

The two new compact kits pictured here offer the service technician a wide selection of exact replacement controls for color TV sets. Each **Mallory** kit is packaged in a reusable, metal, storage tray and includes a free Lampliter automatic photo electric light control. This device turns lights on at dusk and off at dawn.

The CCK-1 and CCK-2 kits contain a carefully selected assortment of trimmers, convergence controls, and high-voltage controls for virtually every color TV set on the market. Each kit, complete with Lampliter and metal storage tray, is $12.50. ▲

Circle 49 on literature card

MOVING?

Don't lose touch . .

RECEIVE PFR AS USUAL

(INCLUDE OLD AND NEW ADDRESS)

PF REPORTER
CIRCULATION DEPT.
4300 W. 62nd St.,
Indianapolis, Ind. 46206

LETTERS TO the EDITOR

Many readers have responded to Mr. A. DuBusley's request for an effective method of loosening adjustable iron cores that have been frozen in the core.

Dear Editor:

Try a drop or two of penetrating oil directly on the slug. Allow it to soak for a minute or two and then apply a steady pressure with the wrench. Once the slug is loose, remove it from the form and clean out the oil with alcohol and a cotton swab.

E. V. Mappin, Jr.

Lower Burrell, Pa.

Dear Editor:

If the core is the type with hexagonal hole, insert an Allen setscrew wrench through the hole. Hook a soldering gun tip around the offset end of the Allen wrench and turn the gun on and off while applying slight turning force with the gun. Within about two minutes you can feel the slug turn. Do not apply nylon wrench until slug has cooled.

C. Walter

Niagra Falls, N.Y.

Dear Editor:

I have had the problem of frozen cores many times, and I find it much cheaper and quicker to replace the coil. For the few times when a new replacement has been unavailable, I have used a similar coil from a junked set. I don't like to do this but it is sometimes necessary. I always notify the customer that I used an old part and that a new part is on order. The customer usually does not bring the set back when I notify him that the new part has arrived.

B. W. Fowler

Lake View, Texas

▲

PHOTOFACT™ BULLETIN

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

Admiral
Chassis H3-1A, H4-1A, 1H4-2A 909-1

Airline
GEN-8077A, GEN-8447A 907-1

Curtis Mathes
10M070 906-1

Motorola
Chassis 9TS-460A-09, C9TS-460A 911-1
Chassis C/D18TS-594C/D, C22TS-594/CD, D20TS-594C/D 910-1

Olympic
9P56, 9P57, 9P58 906-2
9P59 908-1

Penncrest
4871B-48/72B-46/73B-46/74A-48/75A-46/76A-48/77A-48/78A-46, 4883A-48, 6881C-48, 6882C-49, 6882D-49, 6885A-46 906-3

RCA Victor
AJ005B, AJ009E/Y (Ch. KCS157A) 907-2
Chassis CTC19C/D/U 909-2

Sharp
CN-32T 911-2

Sylvania
Chassis D02-7 thru D02-12 908-2

Symphonic
TCT195 910-2

Truetone
HFP3780A-76 (2DC3780) 910-3

Zenith
Chassis 20X1C36, 20X1C38 908-3

The following TV sets are given schematic coverage in the Extra Contents.

Curtis Mathes
AG3223 (Ch. 12A8, 32) 906

RCA
Chassis CTC27A/B, CTC35A/B 907-9-S

Production Change Bulletins

Airline
WG-4234B, WG-4334B 907-3

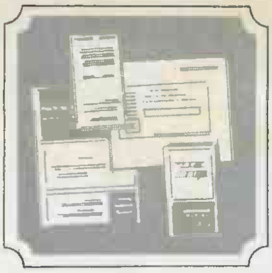
Coronado
TV2-9552B, TV2-9553B, TV2-9554B, TV2-9559B 907-3

Electrohome
A-092, AU-093, A-090, AU-019, A-094, AU-095 909-3

Olympic
Chassis NCP 909-3

INDEX TO ADVERTISERS

October, 1967



$FREE$ CATALOG AND LITERATURE SERVICES

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

ANTENNAS

75. *ALLIANCE* — Colorful 4-page brochure describing in detail all the features of Tenna-Rotors.
76. *BLONDER-TONGUE* — Colorful new flyer describes line of solid-state UHF converters for adding channels 14-83 to VHF TV receivers.
77. *CORNELL-DUBILIER* — New 4-page brochure with instructions for installation of AR10B Skyline Series rotor.*
78. *DELHI*—Twelve-page catalog introducing a complete new line of home TV towers, ham towers, citizen's band towers, masts and telescoping masts.
79. *FINNEY* — 4-color brochure with description and technical details on new Finco color spectrum frequency dependent antennas for UHF-VHF-FM, and UHF. Form 20-413.
80. *JERROLD* — New 4-page full-color catalog describes the new Paralog Plus antennas.*
81. *JFD* — Color Laser and LPV antenna brochures. New 1967 dealer catalog covering complete line of log-periodic outdoor antennas, rotors, and accessories.
82. *MOSLEY* — Information on new Mosley MATV system for up to 8 TV/FM sets. Includes TV antenna, distribution system and outlets.
83. *RMS ELECTRONICS* — Color brochures describing Super Transpower'D and Dynergy VHF, UHF, FM antennas, Mystic and Mark indoor antennas, solid state antenna boosters, amplifier-4-set coupler, UHF converters, antenna replacement rods, splitters and couplers.
84. *SPAULDING* — Brochures about EP series economy-priced towers.
85. *WINEGARD* — New 40-page MATV catalog features Ultra-Plex amplifier system and installation instructions.

AUDIO

86. *ATLAS SOUND* — Catalog 567 illustrates complete line of speakers, horns, microphone stands and booms, transformers, patio speakers, and accessories.
87. *ELECTRO-VOICE*—Catalog 167 on microphones and PA equipment.
88. *OXFORD TRANSDUCER* — Bulletin A-109 features speaker installation in automobiles, hospitals, and recreation rooms.
89. *SHURE* — Catalogs AL310, AL314, and AL318 about microphones for mobile communications, PA, and special purposes.
90. *SWITCHCRAFT*—Bulletin 172 describes Model 307TR, a new battery operated mixer for studio, home, or remote use.
91. *UNIVERSITY SOUND* — PA, Hi-Fi, and microphone catalogs, plus "Technigram" with graph showing what size amplifier to use in a given area.

COMMUNICATIONS

92. *AMPHENOL* — 2-color spec sheets on new Model 650 CB transceivers and Model C-75 hand-held transceiver.
93. *GOLD LINE CONNECTORS* — Catalog 207 about connectors, antennas, and accessories for Ham and CB use.
94. *E. F. JOHNSON* — Catalogs of the complete line. Covers components, CB, business, and industrial radio.
95. *MOTOROLA* — New brochure tells how to reach people on-the-move through use of personal two-way radio.
96. *POLYTRONICS* — Brochures on several CB transceivers and accessories, including TC1 and TC7 selective tone callers.

COMPONENTS

97. *BELDEN* — Catalog 867, a 56-page catalog of the complete Belden line.
98. *BUSSMANN* — Small TV Fuse leaflet designed to fit pocket or tool kit, shows list prices of fuses most commonly used in TV sets. Ask for BUSS Leaflet TVLP.
99. *CENTRALAB*—24-page replacement parts catalog No. 33GL.
100. *CHICAGO MINIATURE LAMP WORKS* — Specifications of miniature lamps and barretters are included in catalog CM-1. Catalog CMT-2 lists specs of subminiature lamps.
101. *GC* — FR-029E wall chart of industrial electronic components.
102. *LITTELFUSE* — Pocket-sized TV circuit breaker cross-reference gives the following information at a glance. Manufacturer's part number, corresponding Littelfuse part number, price, color or b/w designation. A second glance gives trip ratings and acquaints you with a line of caddies. Ask for CBCRP.
103. *MALLORY* — Bulletin 4-82 describes radial and axial lead tantalum capacitors.
104. *MILLER* — 4-page cross-reference guide to color TV sweep, convergence, and linearity coils.
105. *QUAM-NICHOLS* — Complete replacement information on auto radio speakers 1955-1967.
106. *SPRAGUE* — C617, a complete catalog of the Sprague line.
107. *TEXAS CRYSTALS* — 12-page catalog of crystals including engineering data, specifications and prices.

SERVICE AIDS

108. *CASTLE TUNER* — How to get fast overhaul service on all makes and models of television tuners is described in leaflet. Shipping instructions, labels, and tags are also included.
109. *ELECTRONIC CHEMICAL* — Catalog sheets on aerosol sprays for servicemen.
110. *G.C.* — FR-67G flyer on color harnesses. FR-67A complete Audio-tex catalog.
111. *INJECTORALL* — New 1967 catalog of chemicals and alignment tools.
112. *MIDSTATE TUNER* — 24-hour service on any make tuner is described in a colorful brochure.
113. *PERMA-POWER* — Catalog sheet describes new isolation boosters for color TV.
114. *VECTOR* — Short-form catalog lists current measuring and socket change adaptors, Vectorboard, terminals and accessories.

SPECIAL EQUIPMENT

115. *ATR* — Literature about DC-AC inverters up to 600 watts load.
116. *CBC* — Catalog of power controls.
117. *PHILMORE* — Supplement No. 671 about tuners, kits, remote controls, etc.
118. *WINDSOR ELECTRONICS* — Booklet entitled "The Open Door to TV Profits."

TECHNICAL PUBLICATIONS

119. *ALCO ELECTRONICS*—28 design ideas for use with isolation relays.
120. *CLEVELAND INSTITUTE OF ELECTRONICS* — Free illustrated brochure describing electronics slide rule and four lesson instruction course.
121. *3 M COMPANY* — "Taping Tips for Electronic Servicing," a 32-page booklet for professionals and hobbyists.
122. *PHILCO* — Information about Tech Data & Business Management service. Also, free parts catalog.
123. *RCA INSTITUTES* — New 1967 career book describes home study programs and courses in television (monochrome and color), communications, transistors, industrial, and automation electronics.
124. *SAMS, HOWARD W.* — Literature decribing popular and informative publications on radio and TV servicing, communications, audio, hi-fi, and industrial electronics, including special new 1967 catalog of technical books on every phase of electronics.

TEST EQUIPMENT

125. *B & K* — New 1967 catalog featuring test equipment for color TV, auto radio, and transistor radio servicing, including tube testers designed for testing latest receiving tube types.
126. *COLETRONICS* — Flyer sheet about a new tube-tester adaptor.
127. *EICO* — New spec sheet describes model 100A4 multimeter with DC sensitivity of 100K ohms per volt.
128. *HICKOK* — Quick reference catalog No. 67D gives brief descriptions and prices for complete test equipment line. Also, specificaiton data on Models CR-35 CRT tester, GC-660 color generator, and 860 Injecto-Tracer.
129. *JACKSON* — New catalog showing 5 new "Service Engineered" test instruments.
130. *LECTROTECH*—Two-color catalog sheet on new Model V6-B color bar generator, the latest improved model of the V6. Gives all specs and is full illustrated.
131. *MERCURY* — All-new 16-page test instrument catalog.
132. *PRECISION APPARATUS*—Illustrated catalog describing signal generators, oscilloscopes, and meters.
133. *SECO* — Operating manual for the HC8 in-circuit current checker.
134. *SENCORE* — 8-page full color catalog plus a new 4-page supplement catalog.
135. *SIMPSON* — Catalog 2076 featuring a VOM with a temperature range and a 22-range VOM chart recorder.
136. *TRIPLETT* — Literature sheet on the new model 600 transistorized VOM.

TOOLS

137. *ARROW*—Catalog sheet showing 3 staple gun tackers designed for fastening wires and cables up to ½" diameter.
138. *BERNS* — Catalog sheet on pin crimpers for making repairs to picture tubes and installing cable on standard phono plugs.
139. *DIAMOND* — 16-page booklet, W-68, lists wrenches, pliers, snips, and electronic tools.
140. *ENTERPRISE DEVELOPMENT*—Time-saving techniques in brochure from Endeco demonstrate improved desoldering and resoldering methods for speeding and simplifying operations on PC boards.
141. *KRAEUTER* — Tool selection guide describes entire plier and wrench line.
142. *VACO* — Catalog SD-66X describes 5 tools available with imprinting for promotional use.
143. *XCELITE* — Bulletin N567 lists two sets of nut drivers with color coded handles and plastic cases.

TUBES AND TRANSISTORS

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

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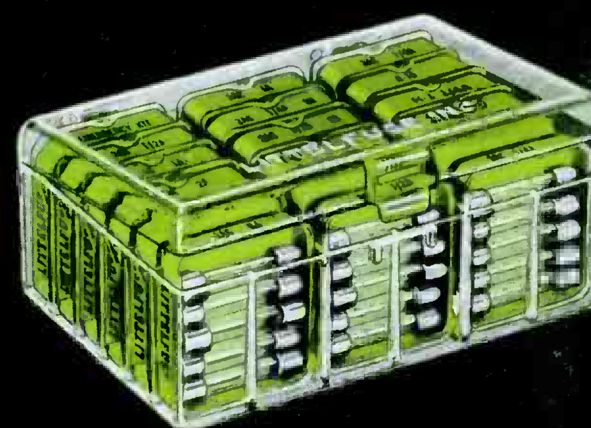
(Note: Code letters CCM, NTE, and TS indicate *Color Countermeasures*, *Notes on Test Equipment*, and *The Troubleshooter*, respectively.)

See the caddy

See the fuse box through the caddy



See the fuses through the fuse box through the caddy

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