OCTOBER, 1961 35 CENTS

PF REPORTER

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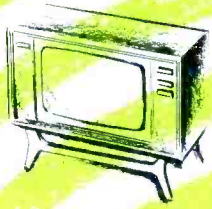
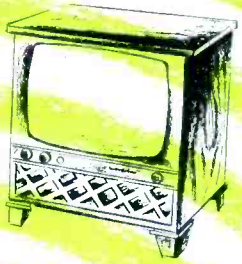
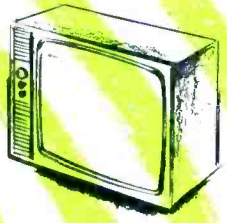
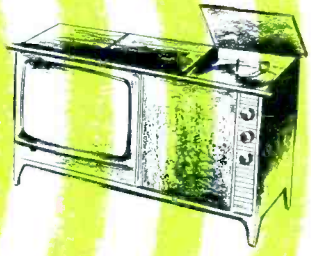







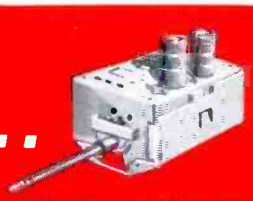
Highlights of 1962 TV Lines

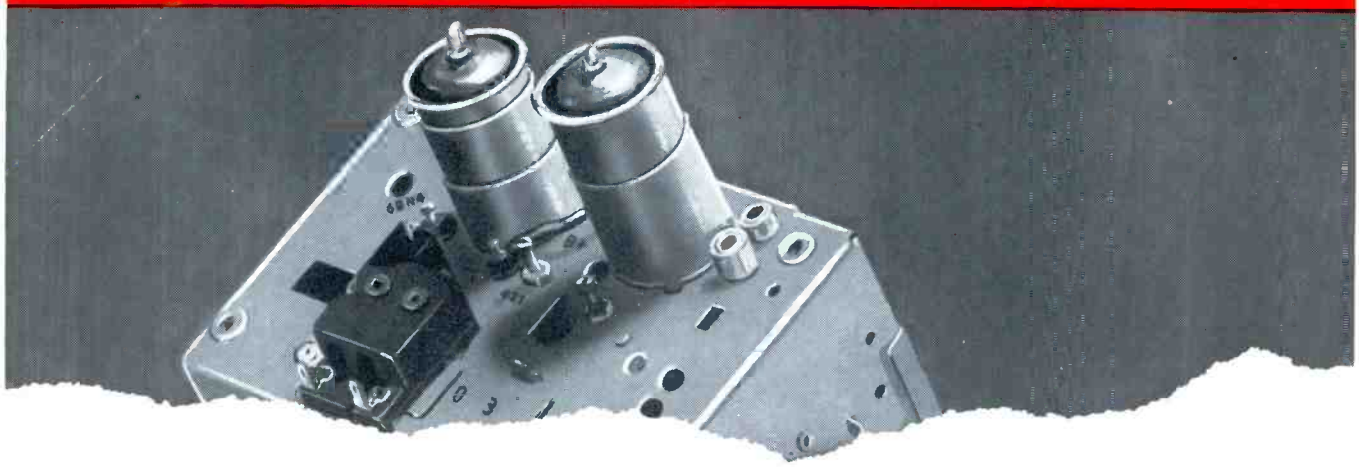
Phono Cartridge and Needle Replacement Guide

Blast Those TV Intermittents

Painless TV Alignment

Standard Made It...





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Highlights of 1962 TV Lines

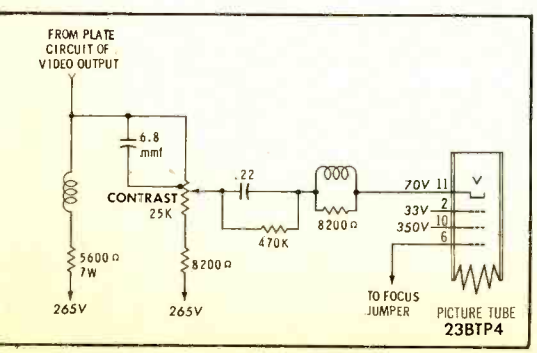
Another cycle of new TV models is in full swing. The '62 sets are already pouring into the market; by next summer, over 6 million are expected to be in use. What do these new models have to offer, and what trends in receiver design do they reveal? Since these questions are of great interest to service dealers and technicians, the next eight pages are devoted to presenting the answers. Thumbnail reports on each manufacturer's line bring out the main points of interest, and a large chart provides a quick reference to the key technical features of all new chassis on the market. If you're a serviceman, this information will help you get ready for future service calls. If you sell sets, here's a chance to learn about the major selling points of all lines.

One major development is missing from this report—the sudden upswing of interest in color TV this fall. This story will be saved until next month's issue, which will be devoted entirely to color.

ADMIRAL

Flagship of the '62 fleet is the *SP23 Life Tested* chassis, which appears in several versions (20A8, -B8, and -D8) in nearly all 23" receivers of both the *Imperial* and *Masterpiece* series. Most of these sets use a new 92° picture tube, the 23BTP4, with a bonded *and tinted* safety shield; however, several models released since the beginning of the season have a similarly-constructed 27" tube. A few "leader" 23" models use a different chassis, the 19B8B, with a nonbonded 92° picture tube. The 19" receivers in the line include a half dozen chassis, divided evenly between *Thinman* portables and *Spectator* compact sets. (Remote-controlled versions of these types are called *Sportsman* and *Viceroy*, respectively.)

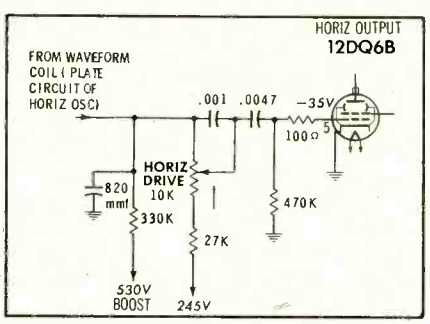
Portables have series-string tubes and vertical chassis, but all other black-and-white sets are transformer-powered units with horizontal chassis. Almost identical circuit designs are used throughout the line. The most noticeable new features are high-resistance DC coupling between the video output stage and the CRT—which Admiral calls *Automatic Picture Contrast Restoration*—and the new *Picture Guard* circuit employing a 6K11 or 6Q11 *Compactron* triple triode as a sync separator, AGC keyer, and noise inverter. (A schematic of this circuit appears on page 24 of last month's PF REPORTER.)



Aside from the *Compactron* and new 'FG7, 'GK5, and 'FQ5 tuner tubes, the only unfamiliar tube is a 6EW7 in the vertical multivibrator and output circuit. This tube has a standard 9-pin miniature base, topped by a glass envelope as big as that of a 6SN7. One reason for this beefed-up vertical sweep tube is the increased high voltage in the *SP23* chassis—a maximum of more than 22 kv.

ANDREA

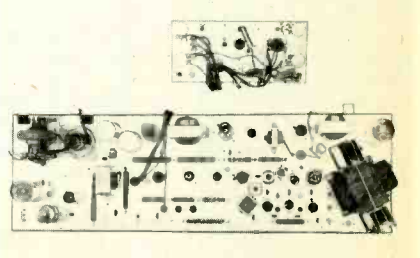
A new 19" compact set was introduced last winter to supplement the basic line of 23" receivers. It uses a VT-119 chassis, which is almost identical to the VT-123 employed with 23" picture tubes. The circuits in both chassis, which are virtually unchanged from those of the previous VS-123 and VR-123 series, include several unconventional features. For example, the horizontal drive control (see schematic) is a potentiometer in the sawtooth-forming network between the horizontal oscillator and output stages. Also, the input signal for the sync section is obtained from the video detector and fed through a "sync preamp" triode before being applied to the sync separator. In addition, a built-in resistive attenuator pad is provided in the antenna-input circuit as a FRINGE LOCAL adjustment.



CURTIS MATHES

One of the longest horizontal chassis now on the market has the shortest chassis number: 6. The newest models equipped with this unit, collectively known as the *Super G* series, are the 96-, 106-, 196-, 206-, and 216-23.

In its present form, Chassis 6 differs from the original version in only a few respects. It uses a new 23AHP4 picture tube, the latest type of turret tuner, and a 3DG4 low-voltage rectifier instead of a 5U4GB or 5V3. Also, a 6DE7 dual triode has replaced the former combination of a 6C4 and a 6EM5 in the vertical sweep section. However, this circuit is wired as a blocking oscillator and independent output stage, just as before—a configuration seldom seen in the new sets of today.



DU MONT

The 23" and 27" receivers in the new "800" series contain a reworked version of the hand-wired, side-mounted vertical chassis used in previous models. Now in production are the 120612-A (with manual control) and -613A (with remote) for consoles and lowboys, and the 120614-A (manual) and 615A (remote) for *Home Entertainment Center* combinations. The latter units have no audio circuits on the TV chassis, but play through the 40-watt stereo amplifier in the radio-phono section. The 1962 line also contains two 19" sets—a portable and a table model.

A new feature, standard on all full-sized sets, is *Electronic Eye* automatic

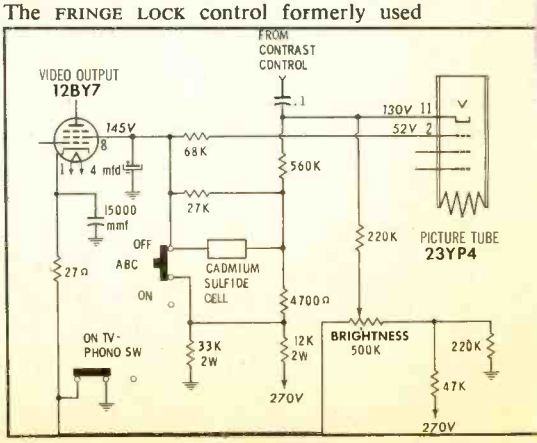
CHASSIS NO.	NO. TUBES	PWR XFMR	CRT TYPES	DEG DEF	BOND SHLD	HAFC TYPE	HOSC TYPE	KEY AGC	WIDTH CTRL	MAX KV	WIR-ING	PROTECTED CIRCUITS LINE	B+	SWP	FIL	REM AVL
ADMIRAL																
16A9, -B9B, -C9, -G9B	14		19XP4	114		⋈	M	✓		15.5	P		✓			✓
16D9, -E9, -F9	15	✓	19XP4	114		⋈	M	✓		15.5	P		✓			✓
19B8B	16	✓	23AUP4	92		⋈	M	✓	sleeve	22	P		✓			
20A8, -B8, -D8	16	✓	23BTP4	92	✓	⋈	M	✓	sleeve	22	P		✓			✓
ANDREA																
VT-119	18	✓	19AFP4	114	✓	tube	B	✓	coil	15.5	H			✓		
VT-123	18	✓	23GP4	110	✓	tube	B	✓	coil	17	H			✓		
CURTIS MATHES																
6	18	✓	23AHP4	92		⋈	S	✓	sleeve	22	H	✓	✓		✓	
DUMONT																
120612-A, etc.	17	✓	23YP4; 27VP4	92	(23")	tube	M	✓	pot	20	H	✓		✓	✓	✓
EMERSON																
120572-C	16		19XP4	114		⋈	M			NA	P		✓			
120587-A, etc.	16	✓	19XP4; 23CP4	110	(23")	⋈	M	✓	jumper	18	P		✓		✓	✓
GENERAL ELECTRIC																
LW	16	✓	19ZP4	114		⋈	M		coil, sw	16	P			✓	✓	
MW	16	✓	19BHP4; 23NP4	114		⋈	M		coil, sw	20	P	✓		✓	✓	✓
MAGNAVOX																
30 Series	20	✓	23MP4; 21CEP4; 24AHP4	114 110		⋈⋈	M	✓	pot	20	H			✓	✓	✓
33 Series	17	✓	21DLP4; 23ASP4; 24AUP4; 27XP4	90 90		⋈⋈	M	✓	coil	20	H			✓	✓	✓
34 Series	18	✓	19YP4; 23MP4	114		⋈⋈	M	✓	coil	20	H			✓	✓	✓
35 Series	16	✓	23ASP4; 27XP4	90		⋈⋈	M	✓	coil	20	P	✓				
36 Series	17	✓	19BTP4; 23MP4	114		⋈⋈	M	✓	coil	20	P	✓				
MOTOROLA																
TS-440	16		19XP4	114		⋈	S	✓	pot	19	P		✓			
TS-436	17	✓	19XP4	114		⋈⋈	S	✓	pot	19	H	✓	✓		✓	✓
TS-441	17	✓	19AFP4	114		⋈⋈	S	✓	pot	19	H	✓	✓		✓	
TS-448, -50	17	✓	19XP4	114		tube	S	✓	pot	19	H	✓	✓		✓	
TS-570	17	✓	23AHP4; 23YP4	92		tube	S	✓	pot	23	H	✓	✓		✓	✓
TS-576	17	✓	23MP4	114		tube	S	✓	pot	23	H	✓				✓
MUNTZ																
J Series	12		assorted	asst.		tube	M			NA	H		✓			✓
OLYMPIC																
LV	14	✓	19XP4	114		⋈	M	✓		12	H			✓		
LLA	15	✓	23AHP4	92		⋈	M			13.5	H		✓		✓	
LB, LC, LE	16	✓	23AHP4	92		⋈	M	✓		17	H		✓		✓	
PACKARD-BELL																
88-13 Series	16	✓	19YP4	114		⋈	M	✓	coil	18	H	✓				✓
98D14, -5, -6	18	✓	23MP4; 27VP4	114 92		⋈	M	✓	coil	NA	H	✓				✓
PHILCO																
12J27	14		17DRP4; 19ABP4	114		⋈	M	✓	pot	18	P		✓			✓
12N50	16	✓	23BVP4	92	✓	⋈	M	✓	pot	20	P		✓		✓	
12N51	16	✓	19BLP4	114		⋈	M	✓	pot	20	P		✓		✓	
12N51A	16	✓	23BNP4	110	✓	⋈	M	✓	pot	20	P		✓		✓	
12N52	16	✓	19ABP4	114		⋈	M	✓	pot	20	P		✓		✓	✓
12N53, -4	16	✓	23BNP4	110	✓	⋈	M	✓	pot	20	P		✓		✓	✓

brightness control (ABC). This circuit includes a cadmium sulfide photoconductive cell, mounted on the front panel of the receiver, which responds to changes in room lighting by varying in resistance.

The unit is wired into the video output stage in such a way that it can control the brightness by affecting the grid-cathode bias on the picture tube, and also change the contrast by affecting the screen voltage of the video output stage. An ABC ON-OFF switch can be used to cut the special resistor out of the circuit, restoring normal operation of the conventional brightness and contrast controls.

A redesigned video IF strip uses two 6EH7 tubes and one 6EJ7—internally-shielded, 9-pin, frame-grid pentodes. These tubes provide increased gain in fringe areas, and the 6EH7's have a semiremote cutoff characteristic which enables them to handle very strong input signals and high AGC voltages in metropolitan areas.

A new tube type, the 6HS8, has taken the place of the 6BU8 in the AGC keying-sync separator-noise inverter circuit. The FRINGE LOCK control formerly used



CHASSIS NO.	NO. TUBES	PWR XFMR	CRT TYPES	DEG DEF	BOND SHLD	HAFC TYPE	HOSC TYPE	KEY AGC	WIDTH CTRL	MAX KV	WIR-ING	PROTECTED CIRCUITS LINE	B+	SWP	FIL	REM AVL
RCA																
KCS 137	16		19AYP4	114		⊣⊢	B	✓	coil	20	P		✓			✓
KCS 138	16		19AXP4	114		⊣⊢	B	✓	coil	18	P		✓			
KCS 136	17	✓	23BJP4	92		⊣⊢	B	✓	coil	22.5	P	✓	✓			✓
			23BKP4; 23BLP4	92	✓											
SETCHELL-CARLSON																
C-117	17	✓	17DSP4	110	✓	⊣⊢	M	✓		15	H	✓		✓		
C-219	17	✓	19BRP4	110	✓	⊣⊢	M	✓		15	H	✓		✓		
362	22	✓	19BRP4; 23CP4	110	✓	⊣⊢	M	✓		17.5	H	✓				
X162	22	✓	23CP4	110	✓	tube	M	✓		17.5	H	✓				
159	22	✓	23YP4	92	✓	tube	M	✓		18	H	✓				
			27VP4	92												
SILVERTONE																
.51780 etc.	14		19AXP4; 19AYP4;	114		⊣⊢	M			16	P		✓			✓
			23ALP4	114												
.50420, etc.	14		23AHP4	92		⊣⊢	M			16	P		✓			
.51800, etc.	15		23AHP4	92		⊣⊢	M			16	P		✓			
.52400, etc.	15		19AYP4;	114		⊣⊢	M	✓		20	P		✓			✓
			23BQP4	114	✓											
SYLVANIA																
546 Series	16		19AUP4	114	✓	tube	M	✓	pot	18	P		✓			
550 Series	16		19XP4	114		tube	M	✓	pot	18	P		✓			
			23CP4	110	✓											
555 Series	17		23BGP4; 23BHP4	110	✓	tube	M	✓	pot	19	P		✓		✓	✓
TRAV-LER																
1180-32	15		19XP4	114		⊣⊢⊢	M	✓		18	H		✓			
1180-12	16		19XP4	114		⊣⊢⊢	M	✓		18	H		✓			
1179-22	17	✓	19XP4	114		⊣⊢⊢	M	✓		18	H		✓		✓	
1070-52	17	✓	23MP4	114		⊣⊢⊢	M	✓		18	H		✓		✓	
1078-191 (Com.)	26	✓	23AHP4	92		⊣⊢⊢	M	✓	sleeve	18	H		✓		✓	
WELLS-GARDNER																
S16	14		19BFP4	92		⊣⊢	M			16	H		✓			
S14	14		19XP4	114		tube	B			16	H		✓			
S15	14		23AHP4	92		⊣⊢	B			16	H		✓			
S19, R19	14		23AHP4	92		tube	B			18	H		✓			✓
N13, N20	17	✓	23MP4	114		tube	B	✓		20	H		✓		✓	✓
WESTINGHOUSE																
V-2416 Series	15		19AHP4	114		⊣⊢	M		sleeve	15	P		✓			
V-2409 Series	16	✓	19ACP4	114		⊣⊢	M		sleeve	15	P	✓			✓	✓
V-2414 Series	16		23FP4A	114		⊣⊢	M	✓	sleeve	16	P		✓			
V-2417 Series	17	✓	23FP4A	114		⊣⊢	M	✓	coil	16	P	✓			✓	
ZENITH																
16G20, -H20	16	✓	19BDP4	92		⊣⊢	S	✓	sleeve	15-16	H	✓	✓		✓	✓
16G27, -H27	16	✓	19AJP4	114		⊣⊢	S	✓	sleeve	18	H	✓	✓		✓	✓
16G21, -H21	16	✓	21CXP4	90		⊣⊢	S	✓	sleeve	20	H	✓	✓		✓	
16G22, -H22	16	✓	23ANP4	92	✓	⊣⊢	S	✓	sleeve	22	H	✓	✓		✓	✓
16G23, -H23	16	✓	23ANP4	92	✓	⊣⊢	S	✓	sleeve	20	H	✓	✓		✓	✓
16H28	16	✓	23AFP4	92	✓	⊣⊢	S	✓	sleeve	22	H	✓	✓		✓	✓
17G28	17	✓	23AFP4	92	✓	⊣⊢	S	✓	sleeve	22	H	✓	✓		✓	✓

NOTE: Some lines include additional chassis carried over from '61—see text. Check marks indicate chassis has certain features. **BOND SHLD** is bonded safety shield on CRT, and **REM AVL** means some models are available with remote control. **NO. TUBES** refers to VHF models; includes CRT. Letter symbols are as follows: **HOSC TYPE**—M, multivibrator; B, blocking oscillator; S, sine-wave oscillator. **WIRING**—H, hand; P, printed. **ANY COLUMN**—NA, data not available.

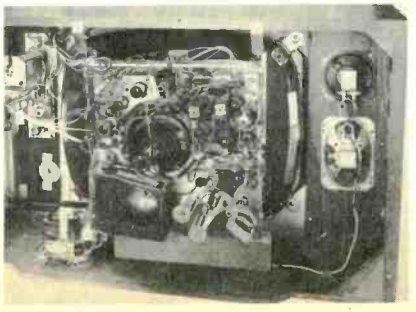
in this stage has been discontinued, but the AGC DELAY and DUMONITOR controls are still used.

Another innovation in the '62 line is a circuit breaker in the power-transformer primary circuit.

EMERSON

Many of the latest sets are equipped with a vertical, transformer-type chassis descended from last year's 120530-C. The most recently-added chassis numbers are 120587-A, -88B (UHF), and -89-C in 23" sets, and 120593-A in 19" units. This series includes several TV-AM-FM-phono combinations, one with wireless remote control. Lowboy and portable models are also available for remote operation.

The 120587-A and related chassis have a redesigned video IF strip using high-gain 6GM6 tubes in the first two stages, and some sets have a 6GW6 horizontal ouput tube instead of the usual 6DQ6B. Also new is a *Perm-Lok* tuner with a 6GK5 RF amplifier. This unit has no conventional fine-tuning control, but provides for preset fine tuning adjustments.



A group of 19" combination models uses Chassis 120572-C or -73-D, a revamped version of the two-piece transformerless chassis used in some '61 sets.

GENERAL ELECTRIC

An "early bird" in the '62 line, the 19" *Celebrity* portable using Chassis LW, was introduced last winter. (For details, see *Previews of New Sets*, September, 1961 PF REPORTER.) Since then, a larger MW chassis has appeared, and is being used in most of the new receivers this fall—19" compacts, consoles, and combinations. A few additional models have the deluxe U5 chassis, carried over from '61.

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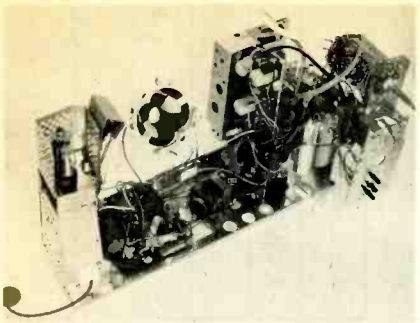


The *Hy-Power* MW chassis is generally similar to last year's M6; the most notable difference is that a 6DT6 sound detector has been adopted in place of the ratio detector formerly used. Also new are speakers with aluminum voice coils, *Daylight Blue* CRT's, a 6JC8 mixer-oscillator tube in some tuners, a series-connected video detector, and a 4-kv increase in high voltage to a maximum value of 20 kv.

Among the features being continued from last year are a customer-operated PICTURE WIDTH control (tapped width coil and switch), horizontal retrace blanking, a *Picture Tube Guard* (spark gap) protecting the CRT accelerating anode, and sonic remote control.

The unmarked, rectangular device on

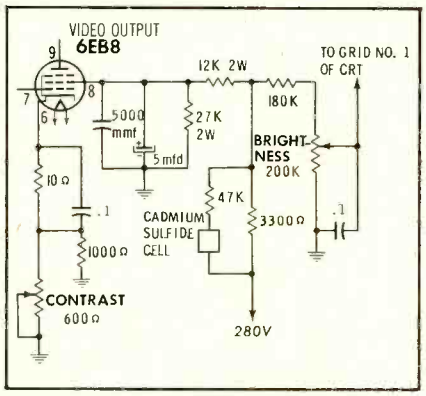
the front panel of receivers with power tuning is a *rocker-button* channel selector. When the light-colored area at the bottom is pressed, the tuner advances to the next programmed (active) channel; pushing on the dark area at the top causes the tuner to stop at all channels, programmed or not. The power-tuning system also includes *AFT* (a preset fine-tuning arrangement).

MAGNAVOX

Ranging from 19" compacts to massive *Spectacular Stereo Theater* 27" combinations, the present model line-up makes use of five different sizes of picture tubes. Following past custom, the line includes a couple of all-new chassis and several revisions of previous units. Those carried over into '62 are the 30, 33, and 34

series, which account for a variety of models in all styles (including combinations and remote-equipped units). New types of tuners, with the 6GK5 RF amplifier, are used in most of these receivers; in addition, many models have the *Magnalux* automatic brightness-contrast circuit which first appeared this spring. Its key component is a cadmium sulfide cell which varies the resistance of a B+ voltage divider according to the level of room light. This circuit governs the contrast by adjusting the screen voltage of the video amplifier, and simultaneously varies the voltage applied to the brightness control in the grid circuit of the picture tube.

Magnalux is also included in some models of the 35 and 36 series. These are 90° and 110° versions, respectively, of the new printed-circuit chassis which was pictured in July *Previews of New Sets*. This low, U-shaped vertical chassis

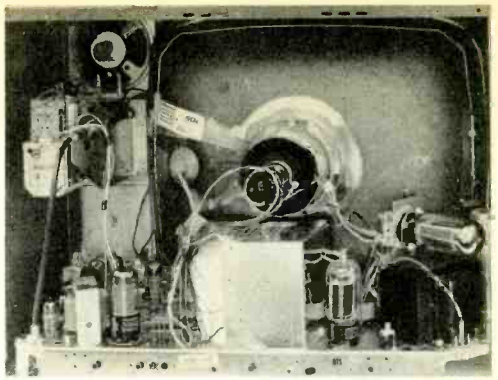


has several features to simplify servicing, including "swing-out" mounting, component symbols stamped on the wiring side of the printed board, and conductor paths marked on the component side. Both chassis use a new 9-pin audio output tube, the 6GC5; in addition, the 36 series has a 6GW6 horizontal output tube.

MOTOROLA

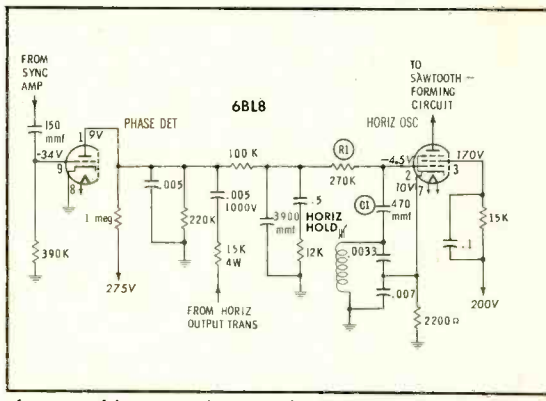
A junior edition of the familiar hand-wired, horizontally-mounted *Golden M* chassis appears in all the new 19" sets, with two exceptions—the *Astronaut* all-transistor portable, and one other portable using a revised version of last year's *PLAcir* printed-circuit chassis. Four series of compact 19" sets are offered (see chart); they differ only in details such as cabinetry, CRT types, tuners, and horizontal AFC systems. The latest 23" chassis (TS-570 and -576) follow the same basic style of construction as in recent years; however, they feature increased high voltage and other refinements.

Most 23" and some 19" models have a new customer control, the PICTURE OPTIMIZER. This is simply a 7000-ohm pot in the video-detector load circuit; its function is to vary the video bandwidth. Another circuit innovation concerns the AFC for the sine-wave horizontal oscillator. The reactance-tube stage has been eliminated, and the frequency is governed by regulating the discharge of an RC network in the oscillator-grid circuit (C1 and R1) with a relatively wide-swinging DC control voltage. Some 19" sets introduced early this year utilize a com-



mon-anode dual selenium diode to develop the AFC voltage, but all later chassis use a triode tube for this purpose.

All sets except carryover models have two or three 6BL8 triode-pentodes in the main chassis; the new four-wafer *Golden M Custom-Matic* and other switch tuners



also use this new tube type in the mixer-oscillator stage. Incidentally, most tuners have a 6FY5 frame-grid triode RF amplifier.

Several other new tubes appear as "alternate types" in various chassis. These are similar to, but not interchangeable with, older types employed in the same stages. Alternate pairs are as follows: 6HL8-6BL8 in several applications; 3GS8-3BU8 AGC-sync tubes; 6AL3-6AF3 dampers; 3A3-3AW3 high-voltage rectifiers; and 5DJ4-5U4GB low-voltage rectifiers.

MUNTZ

All present models use the same basic "J" chassis, which obtains its name from its shape—a long, narrow horizontal section with a vertical extension at one side. The actual chassis number varies according to the model. Substantially the same circuitry is used with both 90° and 110° picture tubes. The 23" and 19" sizes of

CRT's are gradually displacing 21" and 17" units, although some of the latter are still in the line.

The latest type of turret tuner is being incorporated in current production. Also, a remote-controlled model—with 2-button, sonic-type transmitter and transistorized receiver — was introduced a few months ago. TV-stereo combination models (with or without radios) are available.

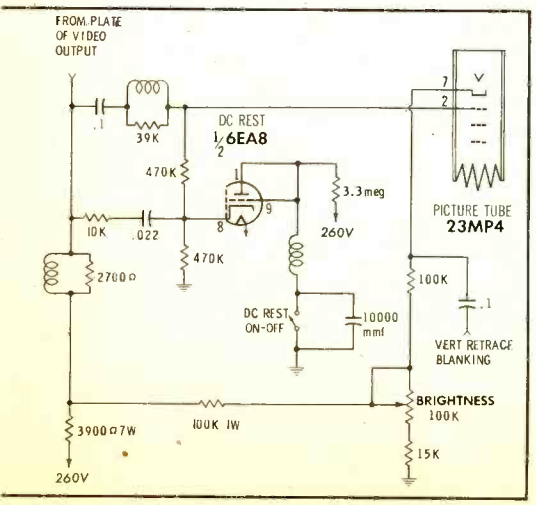
A completely new "metropolitan" chassis is being prepared for introduction in the near future. This unit will contain only 7 tubes, but some of them will be multipurpose *Compactrons*. High-power stages may employ *novar* tubes.

OLYMPIC

Concentrating on 23" combinations, this line boasts a series of *Sound Control Center* units which can independently furnish TV, radio, and phono entertainment

to three different rooms all at once (using auxiliary speaker enclosures). One of the lower-priced models has a simpler arrangement in which either the radio or the phonograph can be played simultaneously with the TV.

There are three different series of 23" models, each including table TV's and consoles as well as combinations. The *100* (leader) series uses the LLA chassis, which has two IF's (a 6BZ6 and a frame-grid 6EJ7) and a triode-type sync separator. The LB and similar chassis in the *High Fidelity 200* series have an additional 6BZ6 IF tube, plus a 6BU8 as a sync separator and AGC keyer. The top-of-the-line *Custom 500* series, featuring Olympic's *3-D Sound*, uses a chassis basically similar to the LB, equipped with three push-button audio tone selectors. All chassis are transformer-powered units,

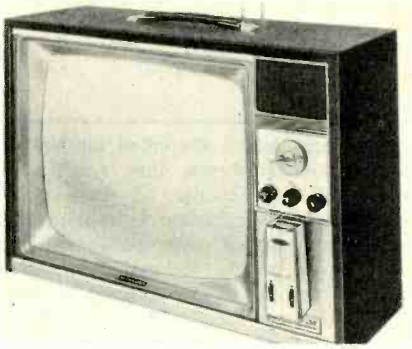


physically almost the same as last year's designs.

One 19" portable, also transformer-powered, is included in the '62 line. This model has an automatic timer which can be set to turn the receiver off at any time during a three-hour period.

PACKARD-BELL

Wireless remote control is being offered this year for the first time. Available in both 2- and 4-function types, the new ultrasonic system is called *Roto-Remote* because the transmitter is keyed by means



of thumb wheels instead of push buttons.

The latest editions of the *Rangefinder 88* chassis, numbered 88-13C through -F, are used in the *Astronaut* series of 19" sets. These vertical chassis are similar to 88's of past years, except for minor details. Some have a 6GK5 tuner and a 6EW7 vertical sweep tube. Certain models are equipped with a three-hour sleep-switch timer that opens the power-transformer primary circuit to turn the set off; still others have a 2-function remote unit. Various 19" compacts and one 23" table model are designed for mounting on an *Intenna* base—a stylish stand or teacart containing a built-in dipole antenna.

The 23" line-up includes some models with different versions of the 88 chassis, and a new *Award* series of deluxe models using the 98D14, -15, and -16 chassis. Special features of these sets include a two-stage video amplifier, a DC-restorer stage, and a horizontal retrace-blanking amplifier; also, some models offer automatic brightness control. The DC restorer can be disabled by a switch, actuated by pushing in on the brightness-control knob.

At the top of the line, the 98D15 chassis features *Complete Remote Computer Control*, a wired remote system including all major customer controls. (This is not to be confused with the *Computer Dial*, an illuminated channel indicator used in many sets.) Another super-deluxe model is a 27" lowboy console using the 98D14C chassis.

The term *Convertible TV* is applied to many *Award* models, indicating that they have provisions for quick field installation of a wireless remote unit whenever the owner wishes to add this feature.

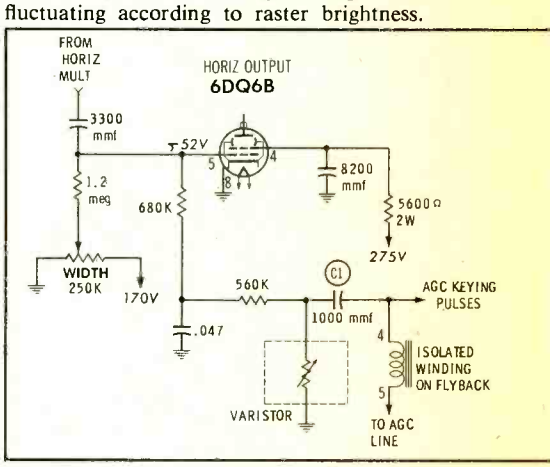
PHILCO

Although the new "K"-line chassis look much the same as their 1961 counterparts, closer study reveals many interesting innovations. In all sets except "briefcase" portables, both sweep circuits have automatic compensation for the effects of brightness changes. The portables now include *Automatic Picture Pilot* (keyed AGC), a contrast control in the screen circuit of the video amplifier, and extra-high-gain 4EH7 and 4EJ7 tubes in the two IF stages.

The 12N50 chassis series — a horizontal, transformer-powered *Cool Chassis* design—extends through the whole line-up of 23" and compact 19" models. The 23" sets come in three series: *Super 90* (12N50 chassis) with 90° picture tube; *Deluxe* (12N51A) with 110° CRT; and *Custom* (12N53,-4) with several features aimed at heightening picture and sound quality. As for portables, a single chassis (the 12J27, with 450-ma series-string tubes) serves for both 17" and 19" models.

The tuner in the 12N50 series, one of the few cascode types now in production, has a 6ES8 frame-grid RF amplifier. Portables use a new switch tuner with a 3GK5 neutralized triode. Remote controls are of the *Directa* wireless type, except for the *"New-Matic II,"* squeeze-bulb unit used in some portables.

A *varistor* in the 12N50-series chassis prevents the width and high voltage from fluctuating according to raster brightness.



On dim scenes, or when the brightness control is turned down, the decreased load on the HV supply causes an increase in the positive-pulse voltage fed from the horizontal output transformer to the *varistor* (see schematic). Since the resistance of this unit goes down when the voltage across it goes up, it allows the stronger pulses to place a relatively heavy charge on C1. This increases the negative DC voltage at the grid of the horizontal output tube, and thus reduces the input to the flyback system. Conversely, an upward shift in brightness causes an automatic increase in horizontal drive. Notice the unusual width control, which governs the average output-tube bias.

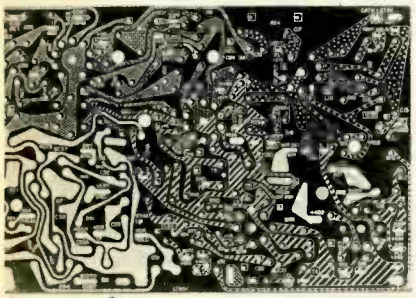
Brightness compensation for the vertical sweep is provided simply by interconnecting the brightness-control circuit and the grid-bias circuit of the vertical output tube.

The *Custom* chassis has a BLACK LEVEL control which gives the viewer an option of DC or AC coupling from the video amplifier to the picture tube. (The former yields richer black tones and a truer gray scale, if customer controls are accurately adjusted.) The AC-DC switch circuit also includes compensation for contrast-level variations. Two brightness controls (main and auxiliary)

make it possible to obtain correct brightness under all conditions.

Custom sets also feature an unusually high CRT accelerating-grid potential of 650 volts. The video amplifier is a 6HZ8 *Intensi-Tube*—a 9-pin "super-miniature" with 6SN7-sized envelope and 8-watt plate-power rating. Incidentally, all 110° sets (including portables) have a 6- or 13FD7 vertical output tube which is similar to the 6HZ8 in physical appearance.

Other new tube types this year, besides the ones already mentioned, are



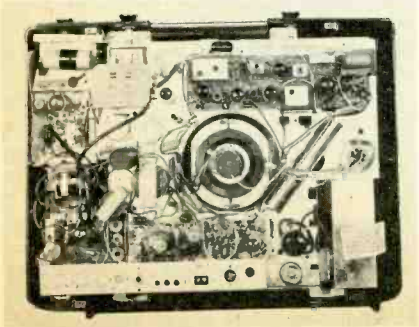
the 11JE8 audio output-keyed AGC tube in portables, and the 6JE8 used as a video amplifier-sync separator in the 12N50, -1, and -2 chassis.

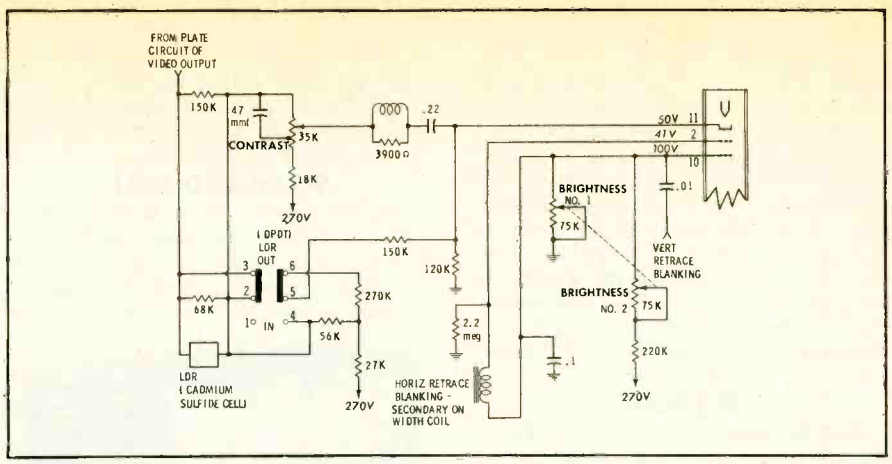
All sets have *Trace-Coded*, "sectionalized" circuit information. The foil-conductor paths marked on the component side of each printed board are not all solid lines, as before; instead, five different patterns are used to indicate various functional sections of the receiver. A new *TV Trace* booklet, keyed to these markings, is available to provide trouble-shooting suggestions.

RCA

Radical changes in physical layout, and an abundance of new tube types, are the most quickly-noticed features of the latest 23" chassis (KCS136) and two new 19" units, the KCS137 and -8. Besides these all-new designs, the '62 line-up includes several carryover models (mostly 17" and 19" sets), using updated versions of last year's KCS130, -2, and -3 chassis. The entire new group of receivers comprise the *New Vista* line, so named because all tuners use a *nuvistor* triode RF amplifier.

Sets containing the *Power Pack* (KCS-138) or *Deluxe Sportabout* (KCS137) chassis are physically larger than "briefcase" types, with a less crowded chassis





arrangement and a simplified method of disassembly. However, they qualify as true portables because of their lightweight design, featuring a transformerless power supply with polarized line plug. Many of the 450-ma series-string tubes in these sets are completely new: 2CW4 RF amplifier, 5GM6 second video IF, 5EW6 third video IF, 10HF8 video output-sound IF, 6GX6 sound detector (similar to the 6DT6, but with higher output), 6GY6 keyed AGC-noise inverter (also a modified 6DT6), 8FQ7 horizontal oscillator, 17GW6 horizontal output, and 17DM4 damper. The 4BZ6 first IF, 4AV6 sync separator, and 13EM7 vertical output tubes are also somewhat rare types.

The KCS136 *Magic Monitor* chassis, used in most 23" sets this year, is electrically very similar to the new 19" units, but is laid out horizontally as shown in June *Previews of New Sets*. In addition, it is transformer-powered, and uses 6.3-volt versions of the above-listed tubes. The high-voltage rectifier is a 3A3 which produces a maximum output of 22.5 kv. Three different types of 92° picture tubes are used. Two have bonded-shield construction, and one of these is also glare-proofed. Many models include a *Magic Eye* automatic brightness-contrast control (see schematic), which uses a *light-dependent* resistor (cadmium sulfide cell) to vary the resistance in series with the contrast control. This unit also affects the cathode voltage of the CRT, thereby adjusting the brightness. A manual brightness control is also provided. Using two ganged potentiometers, it maintains a constant voltage between the control grid and accelerating grid of the low-Eg2 picture tube. All sets, with or without the *Magic Eye*, have *Automatic Scene Control* — high-resistance DC coupling between the video output stage and the CRT.

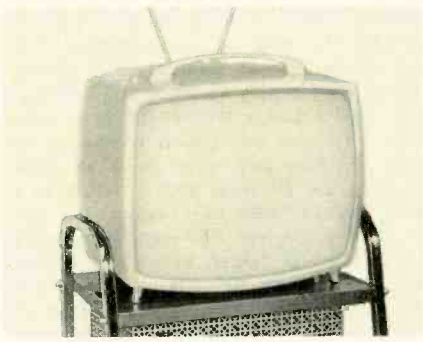
The *Automatic Channel Equalizer* (keyed AGC) circuit has been modified to include more extensive noise cancellation, thus dispensing with the separate triode noise inverter used last year. Negative noise spikes are developed in the screen circuit of the AGC tube and fed to the grid of the sync separator to cancel out positive noise pulses at that point. In addition, the negative noise signal is applied to the suppressor grid of the AGC tube to prevent development of excessive AGC bias in noisy areas.

A new remote-control system, with a partially transistorized receiver, is available in both 23" and 19" sets. Also, a UHF tuner with a built-in two-stage IF amplifier is available for field conversion of this year's VHF-only 23" models.

SETCHELL-CARLSON

Many familiar features of past lines have reappeared this year in updated form, and there is a newly expanded series of 19" models including a portable, furniture-styled table TV's and a console. An unusual accessory for the portables is a *PorT-a-Voice* stand, which has a built-in 8" speaker in a bass-reflex enclosure.

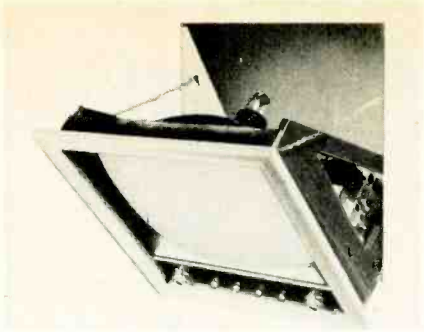
The *Custom Unit-ized* series of large consoles and combinations is again using Chassis 159, which has seven plug-in TV subassemblies, plus provisions for plugging in an assortment of accessories — stereo amplifiers, FM and AM radios, and



additional speakers. This chassis has been modernized with a new *Adjustomatic* tuner (using a 6GK5 RF stage) and a choice of either 92° or 114° horizontal-sweep units. This chassis is available without a cabinet, for custom built-in installations.

Chassis X162 (available in one console model) also uses the *Unit-ized* TV-circuit sections, but it has no provision for adding accessory components other than an AM radio.

Other "furniture" models this year (both 19" and 23") use Chassis 362, which is similar to last year's one-piece Chassis 361—except for a new 6GK5 tuner and a redesigned vertical sweep circuit. Setchell-Carlson, long a proponent of separate vertical multivibrator and output stages, has finally adopted a combined circuit using a 6HC8 tube. This



new triode-pentode tube has a 6SN7-sized envelope and a standard 9-pin miniature base.

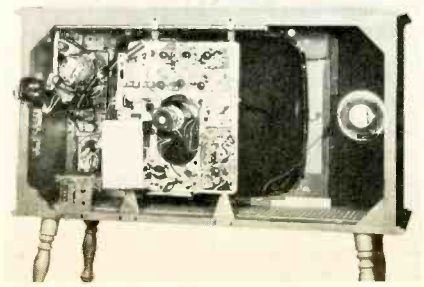
The new 19" portable has the same curve-side styling as previous 17" models. Its C-219 chassis is somewhat similar to, but yet distinct from, the C-117 used in this year's 17" portable.

SILVERTONE

A type of vertical chassis newly introduced last year, with 450-ma series-string tubes mounted facing the CRT, is extensively used in the '62 models. This chassis pivots outward to give access to

tubes and components on the front side; however, the CRT leads in some models must be unplugged before the chassis can be swung out farther than shown in the photo.

Two basic versions of the "tubes front" chassis are in production. One series, including chassis numbers ending in .51780, .51840, etc., has two video IF's, simple AGC, and a triode-type sync separator. The other series, represented by the .52400 chassis, is used in "step-up" models; it has three IF's, a 4GS8 keyed AGC-sync separator tube (an improvement on the 4BU8), and a horizontal drive control consisting of a variable cathode resistor in the horizontal output stage.

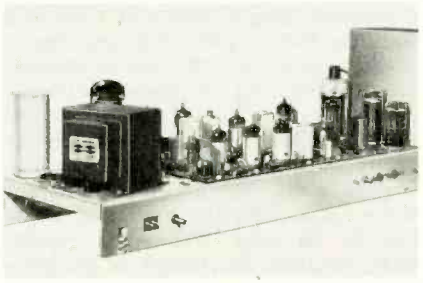


The '62 line-up includes two additional chassis series, both based on older designs with conventional vertical-chassis layout (tubes facing rearward) and 600-ma series-string tubes. The .50420 chassis has two IF's, while the .51800 series has three. Neither series includes keyed AGC.

All of the latest sets are using a new switch or turret tuner with a 2- or 3GK5 RF amplifier; a 10- or 13EM7 vertical sweep tube; and fewer component-combination units than in models of a few years ago.

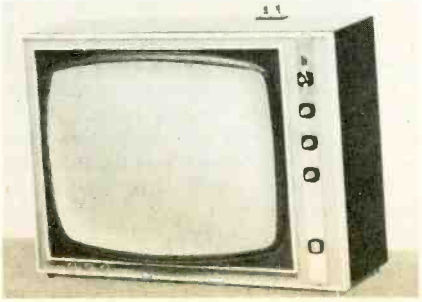
SYLVANIA

This season marks the most far-reaching change in this manufacturer's chassis design in over four years. A transformer-powered *GT-555* chassis with a spacious horizontal layout has been introduced in the *Picture Computer TV* line, which covers most 23" models. (This chassis is also beginning to appear in 19" sets.) The *Flexi-Core* power transformer has several new features, such as welded construction and *Mylar* insulation between layers, to reduce size and weight. The tuner, yoke,



and other subassemblies plug into the main chassis. One large printed board, spanning the middle of the chassis, contains all but the sweep-output and power supply circuits. Simplified wiring paths are indicated on top of the board in a 5-way color code: Red for B+, dashed red and white for plates, green for signal grids, solid white for ground, and dashed green and white for all others. In addition, tube sockets are surrounded with code letters (P, G1T, etc.) to designate elements. The circuits are virtually unchanged from 1961 designs, except that the series-string tubes have been replaced with their 6.3-volt counterparts. This has led to the introduction of one new type, a 6ET7, for the video output and horizontal AFC circuits. One important change is the adoption of a 6EM7 vertical sweep tube to supersede last year's 10EG7.

The bulk of the 19" sets and a few 23's continue to use the transformerless *S-110* chassis in its most recent versions (546 and 550 series). Also, the *dualette*

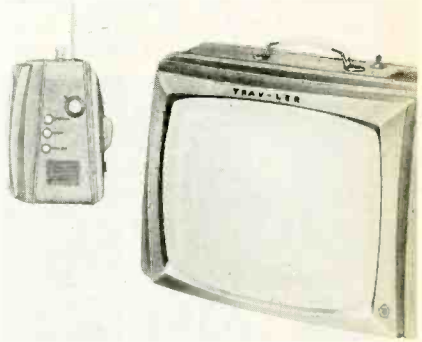


17" portable, using Chassis 543, is still available this year.

All 19" and 23" sets have a horizontal linearity coil, which forms part of a pi-type filter in the plate circuit of the damper.

TRAV-LER

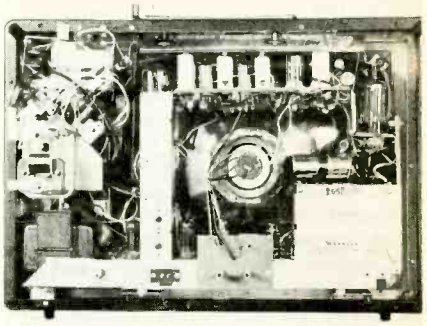
The units shown in the chart are representative samples of a large group of newly-introduced chassis. They differ from older chassis in having a new switch-type tuner with a 6GK5; also, the series-string portables now feature a cir-



cuit breaker protecting the B+ supply.

To supplement the types shown in the chart, many chassis have been carried over from the '61 season—particularly those used in 23" consoles and combinations. A 19" set with wireless remote control appeared as a late 1961 model, and is scheduled to be included in the '62 line as well.

All the latest chassis are using a 'BU8 AGC keyer-sync separator-noise limiter tube. Most receivers of all sizes employ



the lightweight double-deck chassis shown in the photo, although some larger models use a wide, horizontally-mounted single-deck unit.

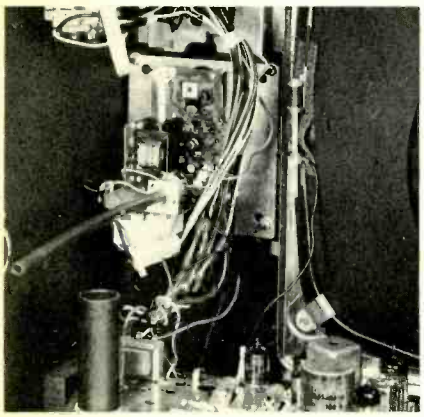
Some chassis are used in *Trav-Ler* branded sets, while other similar units are marketed under a variety of private-label brand names.

WELLS-GARDNER

A wide variety of chassis types appear in sets bearing several different private labels; a cross-section of the latest series are listed in the chart.

Most 19" receivers have a simplified transformerless design, with two video IF's and no sound IF stage. Some use 92° picture tubes, a vertically-mounted chassis, 3BZ6 IF tubes, and a 135-volt B+ supply; others are 114° sets with a horizontal chassis, higher-gain 3DK6 tubes in both IF stages, and 250-volt B+.

The S15 and related chassis are side-mounted vertical units. They are electrically the simplest of all 23" types, with circuitry similar to the 19", 92° series. All other 23" sets have some form of the long, narrow horizontal chassis that has recently characterized the Wells-Gardner line. Many of these are "S" series like the S19, with a 92° CRT; the newest versions have two 3DK6 video IF's and a dual-triode sync circuit. Others are 114° "N"-series units, mostly equipped with extra features such as a two-stage video amplifier (following a three-stage IF), and a 6BU8 AGC keying-sync separator-noise limiter tube.



All "N" chassis, and phono-combination models in the "S" series, are transformer-powered. Wireless remote control is available in both lines.

In line with a general trend now occurring in the industry, the CRT anode voltage in many new models is 2 (or more) kv higher than in comparable models of the '61 line.

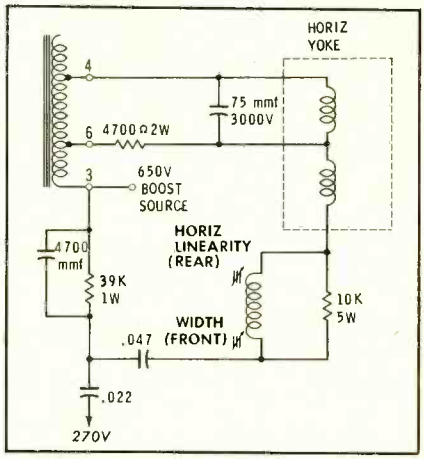
WESTINGHOUSE

Imaginative new features are plentiful in the '62 sets. For instance, portables using Chassis V-2416-7 and -9 have an *Instant-On* circuit which keeps the filaments operating at half power while the set is turned off. A semiconductor diode, connected into the 450-ma filament string, passes alternate half cycles of line voltage. When the set is turned on, a dual switch shorts across the diode and completes the B+ input circuit, producing immediate operation. By the way, this and other sets in the new V-2416 series closely resemble the earlier V-2384.

Compact 19" *Trendsetter* and *Decorator* receivers are equipped with Chassis V-2409 (a carryover from '61), which is like the V-2416 except for having a transformer-type power supply. The 2-button *Remote Director* wireless remote control used in some of these sets is a new design, with a mechanically-operated transmitter and an all-transistor receiver. *Mobil-Sound*, offered in the V-2409-8 version of this chassis, enables any AM broadcast radio to pick up the TV "sound track" for quiet listening or convenient "chairside" volume adjustment. The AM signal is the output of a miniature transistorized oscillator inside the TV cabinet, modulated by the TV audio. The wireless remote control can turn the *Mobil-Sound* broadcast feature on and off as part of the volume-stepper switch function.

Certain *Trendsetter* models are concealed inside *Curio Chest* cabinets with folding doors, available in four different furniture styles. Remember this feature if you ever walk into a customer's home and can't find the TV set!

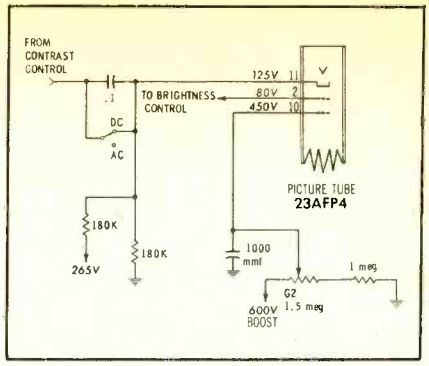
In the 23" division, a few "leader" models use the transformerless V-2414 chassis, a unit comparable to the V-2376 which appeared in the '60 line. Remote-equipped sets have either of two transformer-type chassis continued from last year—the V-2411 with a 2-button remote system, and the V-2389 with a 4-button system. Remaining 23" models, all manually tuned, use the V-2417—a revision of the V-2411. The most newsworthy feature of this latest chassis is a combination width and horizontal linearity coil in series with the horizontal windings of the yoke. The width section simply modifies the strength of the yoke current according to the slug setting. On the other hand, the linearity section uses a permanent magnet to produce a non-linear effect on the current passing through it. The interaction between the field of the magnet and that of the coil can be varied by turning the linearity slug; in this manner, the unit can compensate for nonlinear-sweep problems such as stretching of the left side of the raster.



The V-2417 also utilizes a new method of obtaining AGC keying pulses. A 5" length of cable with two conductors (one connected to the flyback and the other to the keying-tube plate) functions as a coupling capacitor.

ZENITH

Gradual change is the keynote here; the new chassis are very similar to the



'61 types, and also display only minor differences among themselves. The most important variations are listed in the chart. Corresponding chassis types from the G (spring) and H (fall) series are paired together in these listings, since the two groups are nearly identical. However, there have been a few changes in technical features this fall; for example, all 23" sets in the H series are using three high-gain, frame-grid tubes in the IF strip (two 6EH7's and a 6EJ7).

All chassis except the -20 group now use a 3DG4 low-voltage rectifier and a 6GN8 video output-sound IF tube. In the latter application, the 16G20 has a 6AW8, and the 16H20 introduces a new 6DX8. Another new tube type in the 16H20 is a 6BL8 in the sine-wave horizontal oscillator circuit.

Differences between the -22 and -23 versions of the 23" sets center around the higher CRT-anode voltage of the -22, which requires the use of higher-rated components such as 6CQ4 or 6DE4 dampers.

A number of high-end sets are equipped with the new *Gold Video Guard* turret tuner, which features a gold-platinum-silver alloy on all contact surfaces, a 6FY5 frame-grid triode RF amplifier, and preset fine tuning. Conventional bandswitch and *Target* turret tuners are also installed in many models.

The deluxe 17G28 chassis, introduced last spring, has an extra 6AL5 dual diode which operates as a DC restorer and horizontal blanking clamper. (The second section provides a shunt to ground for any positive voltage fed to the CRT control grid from the blanking circuit.) This feature has been dropped from the fall line; the new deluxe 16H28 chassis has, in its place, a simple AC-DC switch that gives the viewer a choice of direct or capacitive coupling from the video output stage to the picture tube. Since DC coupling requires fairly precise adjustment of the brightness control to set up the correct black level in the picture, the AC position of the switch is recommended for viewers who prefer ease of adjustment to more accurate gray-scale reproduction.

The deluxe chassis also has a PEAK PICTURE control (variable video detector load resistor) and a G2 potentiometer for adjusting the accelerating-anode voltage on the CRT to the optimum value of 450 volts. No other sets in this line have this feature, since they use low Eg2 picture tubes with less than 100 volts on the accelerating anode. ▲

Average $2.85 more profit on every 21″ tube

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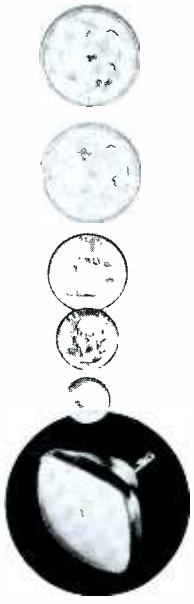

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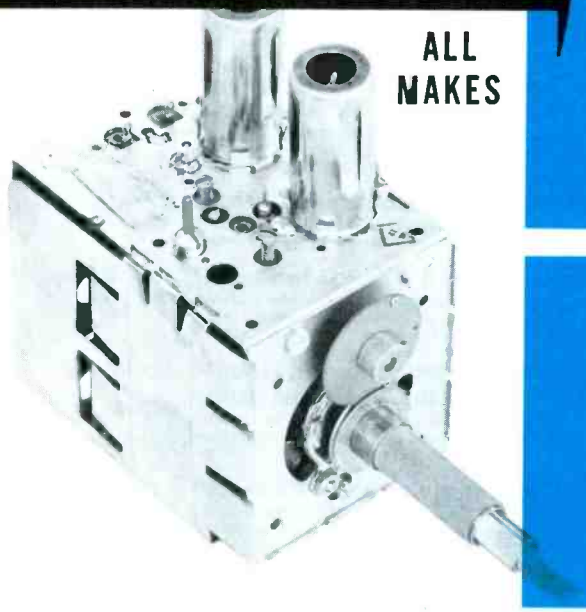

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ABOUT THE COVER

Once again, the TV industry has brought out an array of new models for the fall and winter season. To familiarize you with the latest developments in TV design, this issue leads off with an eight-page special section packed full of facts about all the newly-introduced lines.

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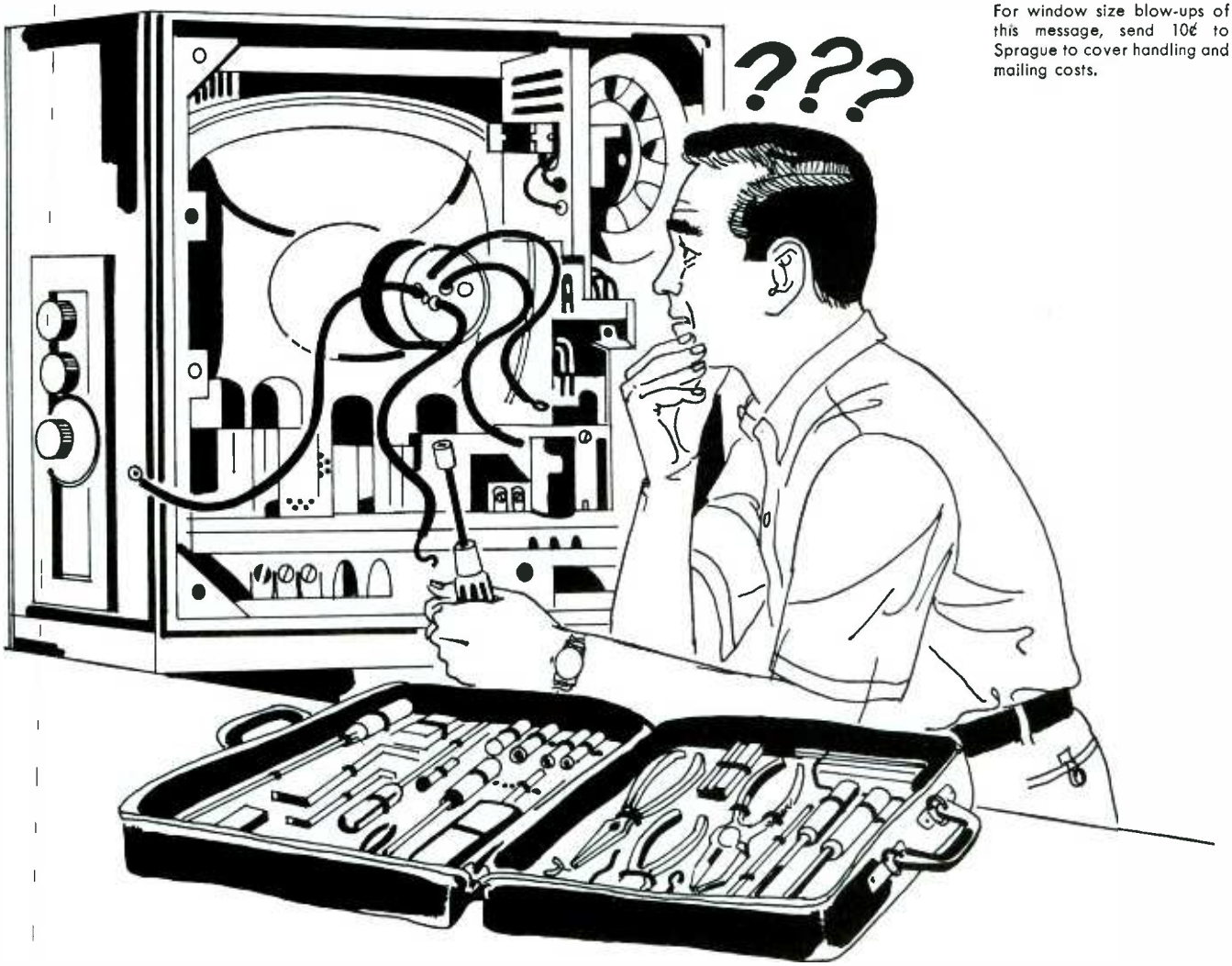

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TRAINING is the first big difference. The tinkerer guesses, but the expert technician KNOWS—because he spent years in the study of electronic theory and its application to television techniques.

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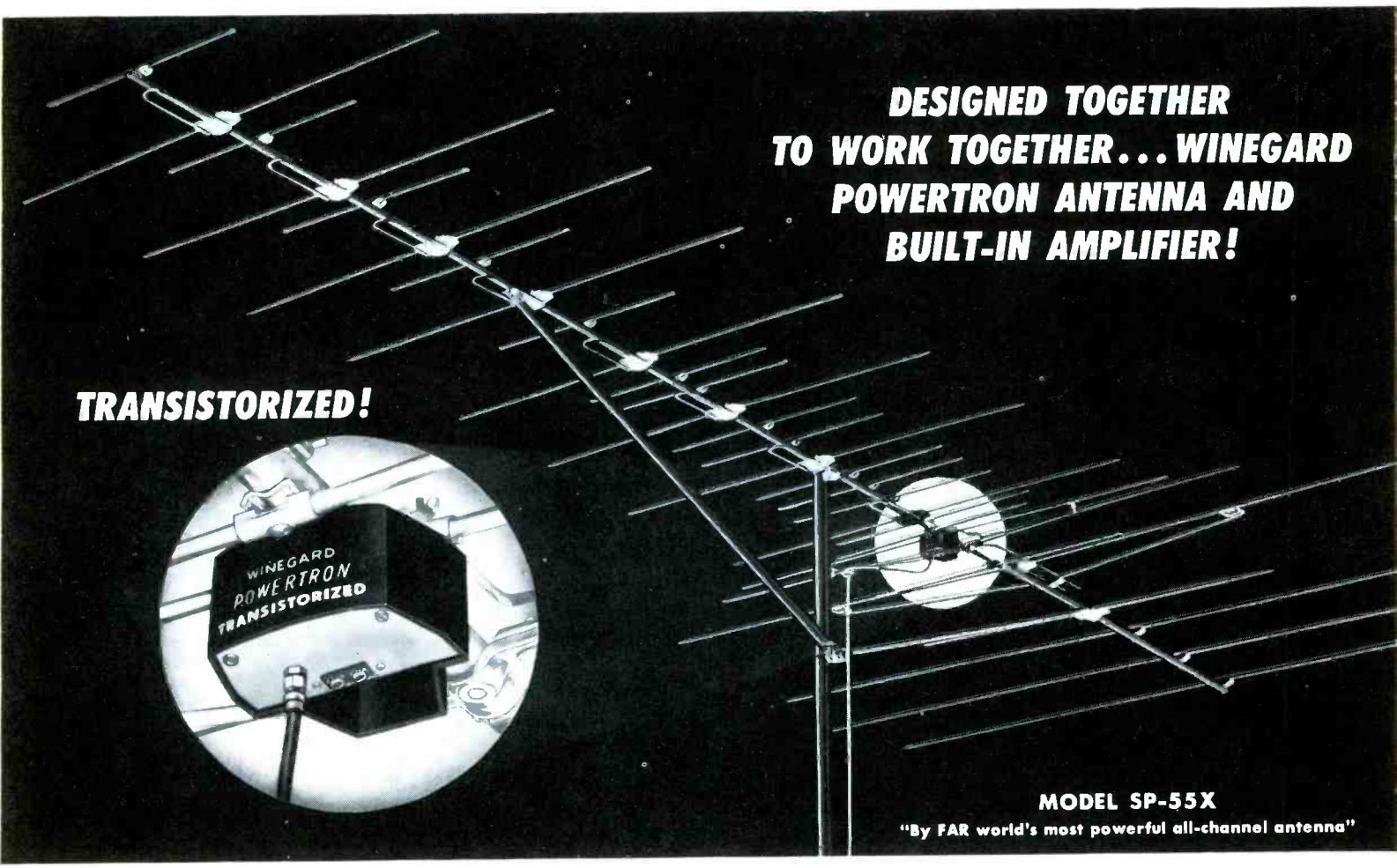

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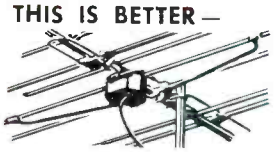

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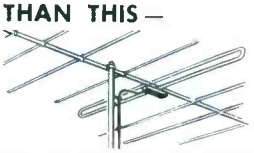

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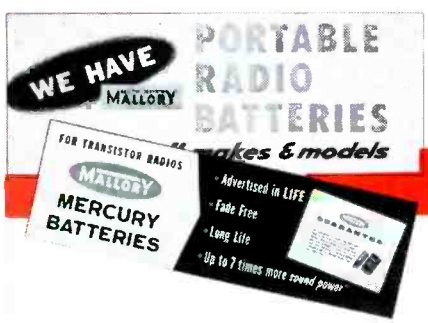

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from this new counter-top dispenser. A balanced stock of Mallory Mercury Batteries for all popular transistor radios . . . in new re-usable plastic jewel boxes. Packs fed one at a time. Guarantee boldly featured.

ADVERTISED IN
LIFE

LIFE ADS REACHING
34 MILLION PROSPECTS

Consistent Mallory advertising in LIFE—telling them . . . and selling them.

Mallory Mercury Batteries . . . the ***sound power**** battery . . . now come to you with a new *salespower program* to help you cash in on the booming transistor radio battery business. It's a big market . . . over 15 million transistor portables in use today, thousands more every month. And Mallory Mercury Batteries have the performance . . . the promotion . . . and the profitability . . . that lead the field.

New national advertising that pre-sells millions of customers this *different* battery.

New guarantee against leakage, unique in radio batteries . . . heavily promoted in national advertising.

New promotional materials—store banners, window displays, dealer ad mats, counter cards.

A new point-of-sale merchandiser—puts every dealer in the Mercury Battery business . . . balanced inventory . . . minimum investment . . . attractive display.

Plus . . . the unequalled performance of the most powerful batteries on the market. Up to seven times more sound power. Non-fading performance. Two years or more storage life.

And . . . high profit per sale . . . several times that of ordinary batteries.

See your Mallory distributor now. Get ready for the big battery selling season . . . with the fastest growing battery line!

*T.M.

with the Mallory '61 Program

Distributor Division
Indianapolis 6, Indiana

P.R. MALLORY & CO. Inc.
MALLORY

AND SELL 'EM AT HOME, TOO . . .
from the Mallory Mercury Battery Service Kit. Only 2″ x 5″ x 7″, it fits easily in a corner of tube or tool caddy. Stocked with fast-moving Mallory Mercury Battery assortment to fit most popular transistor sets.

NEW GUARANTEE AGAINST LEAKAGE . . .
Display the Mallory guarantee that protects your customers. We guarantee to repair the radio and replace the batteries, free of charge, if Mallory Mercury Batteries should ever leak and damage a radio set.

LETTERS TO THE EDITOR

Dear Editor:

I'll be very pleased if you can tell me where I can get some information on stereo FM (multiplex) systems.

ROMANO MOGLIA

St. Petersburg, Fla.

We're cooking up a feature article on this subject, with a highly practical slant, for the December issue.—Ed.

Dear Editor:

Have you considered covering the electrical systems of cars as you have done for radio, TV, and industrial electronics? I have been reading your magazine for the past five years but don't recall any article dealing with the above subject.

D. FORDE

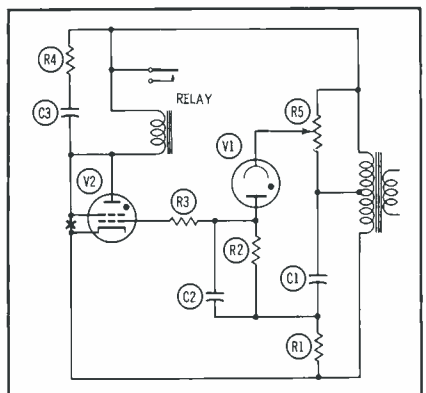
Boston, Mass.

We don't feel that conventional automotive electrical systems are within our scope, but we have thought of doing an informational article on transistorized ignition systems when they become more widely used. Okay?—Ed.

Dear Editor:

In skimming through the July issue, I was stopped on page 62 when I saw the thyratron tube V2 in Fig. 4. How could it work with the cathode and plate shorted together? Evidently, this wire connection is superfluous.

In actual circuits of this type which I have worked on, R4 would not be placed



in series with C3 where it would reduce the filtering action of the latter. Instead, this resistor (usually on the order of 1000 ohms) would be directly in series with the thyratron plate. Then, if the relay became shorted, little damage would be inflicted on the tube. However, if the circuit were wired as in Fig. 4, a shorted relay would place the full supply voltage across V2 and probably damage it.

M. G. GOLDBERG

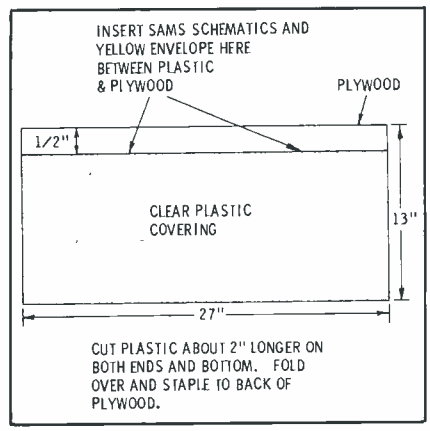
Beacon Radio & TV Service
St. Paul, Minn.

The cathode-plate connection is not only superfluous — it doesn't belong on the schematic! Our face is about the color of an overdriven thyratron; all the same, we thank you for passing along the additional information.—Ed.

Dear Editor:

Since schematics are easily soiled and damaged through frequent bench use, I have made several "Sams Savers" to protect the PHOTOFACT Folders I use in my shop. They work so well that I thought I'd write to you and pass the idea on to other servicemen.

The protector is very simple to make. All you need is a 27" x 13" piece of ¼" plywood as a base for the older schema-



tics (or a shorter piece for the Folders covering newer models) and a piece of clear plastic to serve as a cover. I prefer the type of plastic used in making auto seat covers, since it's heavier than most other kinds.

I've enclosed a sketch of this service aid. It doesn't look like much, I'll admit —but it certainly saves wear and tear on one of the finest "tools" a TV shop can own.

JOHN B. HUCKALY

John's Television Service
Eunice, La.

Sounds like a good suggestion, John. We'd like to hear what other PHOTOFACT *users think of the idea.—Ed.*

Dear Editor:

Your efforts to help servicemen earn a little extra money by repairing small appliances (page 30, August issue) may result in some unhappy housewives. According to the wire table published in this article, the average iron or toaster (which draws approximately 1000 watts) would require a #8 wire. Try it on *your* wife! Generally speaking, such appliances use a #16 asbestos-wrapped cord. And the sloppy, inconvenient type of cord termination shown in the article can be easily avoided with a 2" strip of *Scotch* No. 27 thermosetting glass tape.

If the serviceman really plans to add small-appliance service to his line, let's not mislead him into thinking he can do it with a handful of parts and no other equipment. When you consider the necessity for wattmeters, temperature-sensing devices, service manuals, and the special tools required for some of the more

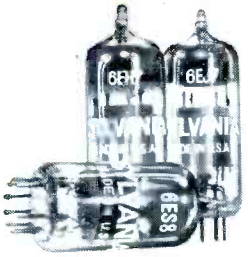
•Please turn to page 22

"STRIP"

and

"STRAP"

...your 2 key words to profit protection



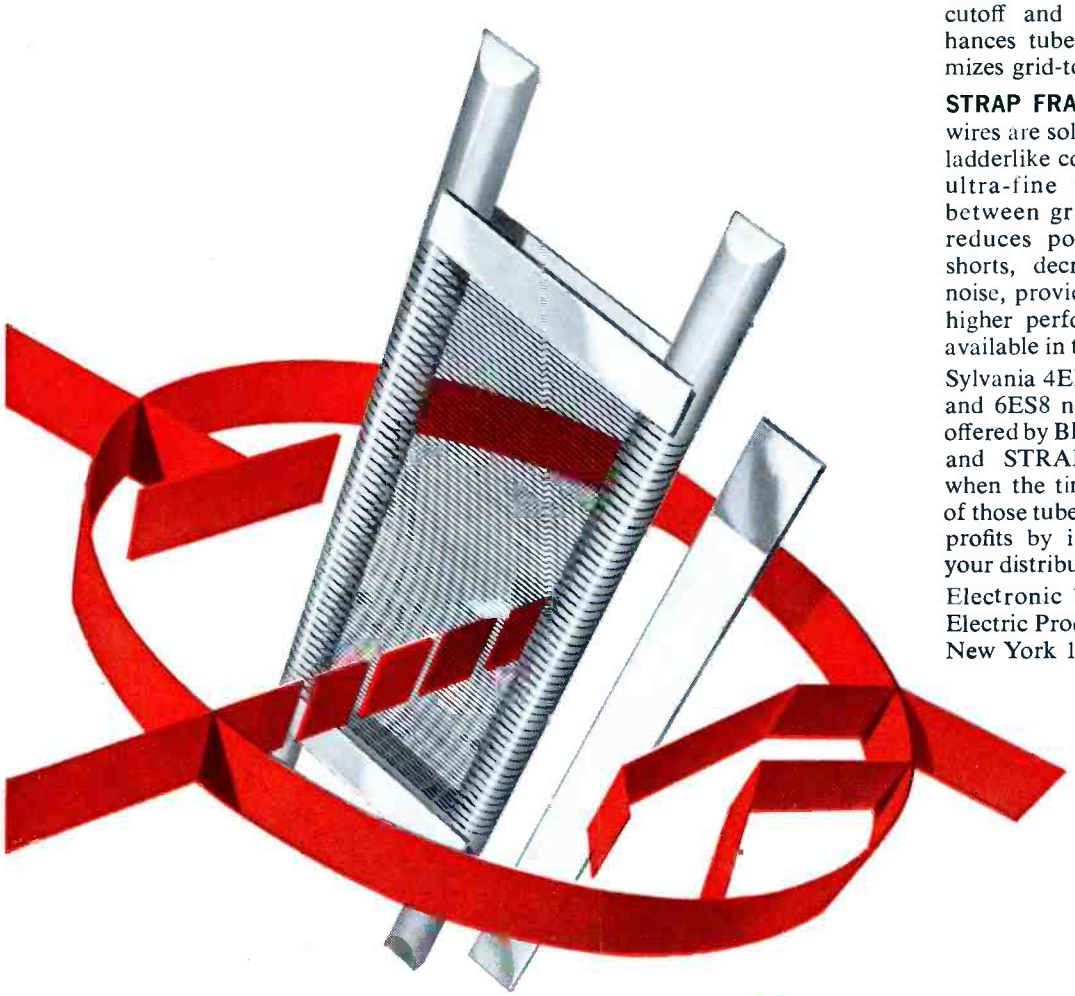
"Strip" is the new BIKINI CATHODE construction. "Strap" is the new FRAME GRID design. Both . . . developed by Sylvania . . . are creating new excitement, bringing new performance standards to TV sets.

BIKINI CATHODE—a precast film-strip of active materials is bonded, by a special Sylvania technique, *only* to the 2 flat surfaces of the cathode sleeve. Results: eliminates stray emission from the sides of the cathode for improved cutoff and noise characteristics, enhances tube-to-tube uniformity, minimizes grid-to-cathode arcing.

STRAP FRAME GRID—grid lateral wires are solidly supported by a sturdy, ladderlike construction enabling use of ultra-fine wire and tight spacing between grid and cathode. Results: reduces possibility of grid-cathode shorts, decreases microphonism and noise, provides unusually high Gm . . . higher performance than ever before available in tubes for TV sets.

Sylvania 4EH7 and 4EJ7, 6EH7, 6EJ7 and 6ES8 now feature the advantages offered by BIKINI "strip" CATHODES and STRAP FRAME GRIDS. So, when the time comes for replacement of those tube types, protect your service profits by installing SYLVANIA. At your distributor's now!

Electronic Tubes Division, Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

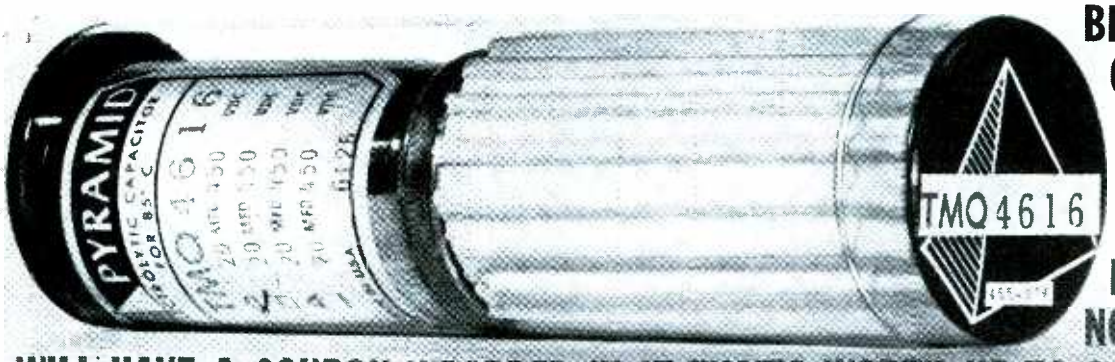


SYLVANIA

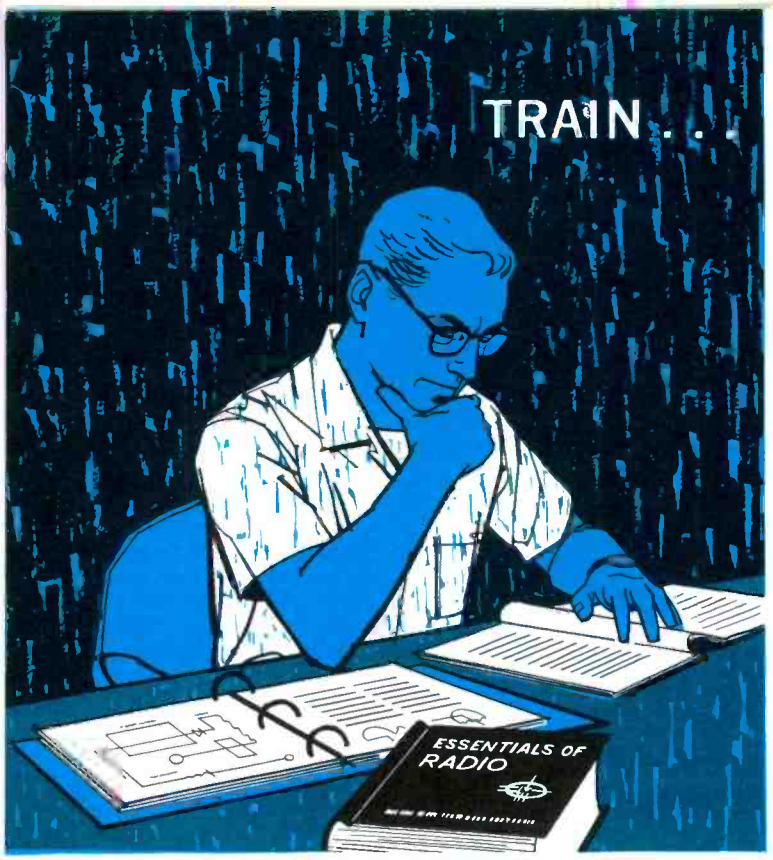
SUBSIDIARY OF

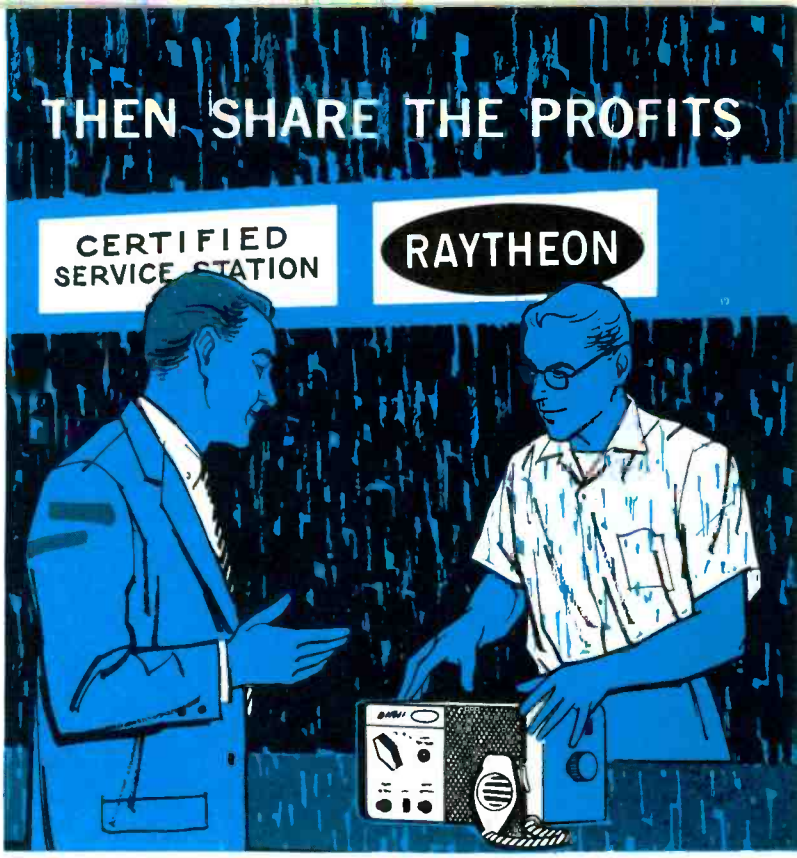
GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM



BEHIND THIS CAP IS A COUPON WORTH UP TO $2.00 ■ EVERY PYRAMID TWIST-PRONG ELECTROLYTIC YOU BUY FROM NOW TO DECEMBER 31, WILL HAVE A COUPON WRAPPED IN IT THAT'S WORTH UP TO $2.00! IT'S OUR WAY OF CELEBRATING WITH YOU THE MERGER OF PYRAMID WITH MICAMOLD TO FORM THE GENERAL INSTRUMENT CAPACITOR DIVISION ■ JUST GO TO YOUR PYRAMID DISTRIBUTOR, PICK THE TWIST-PRONG VU-PAKS YOU NEED FROM HIS CAPAC-O-MAT RACK, UNROLL THE WRAPPER AND CASH IN THE COUPON. COUPONS RANGE IN VALUE FROM 5c TO $2—AND EVERY VU-PAK HAS ONE! BUT THAT'S NOT ALL. YOU GET A RELIABLE, PYRAMID ELECTROLYTIC THAT MEETS EVERY REQUIREMENT YOU SET FOR A TWIST-PRONG, SO YOU'RE A WINNER TWO WAYS. SEE YOUR DISTRIBUTOR TODAY. GENERAL INSTRUMENT CAPACITOR DIV., GENERAL INSTRUMENT CORP., DARLINGTON, S.C.





IN THE BOOMING COMMERCIAL TWO-WAY AND CITIZENS BAND RADIO SERVICE BUSINESS

HERE'S HOW RAYTHEON WILL HELP YOU — Now Raytheon can train you and franchise you as a Certified Raytheon Service Station operator, qualified to service Raytheon's expanding line of commercial two-way and citizens band radio equipment, as well as other brands. There are 2.5 million units in use today, and the number is growing every day!

TRAIN TO SERVICE — Raytheon's Communication Technician's Correspondence course will give you a thorough groundwork in the operation, installation and maintenance of this equipment. On completion of the course, you will be qualified to take the exam for the FCC Class II license which is required for servicing CB and commercial two-way radio. The cost is $96.00 and it is available either direct or through your local Raytheon distributor.

PROFIT AS A RAYTHEON CERTIFIED SERVICE STATION — Then, with Class II license and adequate test equipment you can become one of a national network of independent service facility operators franchised to service Raytheon Ray-Tel CB equipment. Operating a Certified Service Station, you'll be reimbursed by Raytheon for all authorized parts and labor required in repair of in-warranty Ray-Tel units.

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RAYTHEON

RAYTHEON COMPANY

DISTRIBUTOR PRODUCTS DIVISION

Letters

(Continued from page 18)

common appliances, I'd suggest that he either get into this business wholeheartedly, or leave the things entirely alone.

JOHN A. CROCKER
Fort Wayne, Ind.

P.S.: We're in it, up to our necks!

APPLIANCE RATING (MAX. WATTS)	WIRE SIZE TO USE (GAUGE NO.)
1200	18
1800	16
2400	14
3600	12

Here is a revised chart which should cheer up the housewives, and also set the record straight in regard to the wire situation. The figures are based on the current-carrying capacity of flexible cords (types AFS, AFSJ, HC, HPD, HSJ, HS, and HPN) as recommended by the National Electrical Code of 1956.

These ratings are for not more than three current-carrying conductors in any one cord. Wires with other types of insulation may be rated lower.—Ed.

Dear Editor:

The beginning of the fourth paragraph in the August article, "Where'd the Boost Go?" says, "The output stage, flyback transformer, and yoke must be operating normally for proper development of boost voltage." This could be a little misleading, since boost voltage *will* be developed with the yoke disconnected from the circuit. Also, I believe that a discussion of boost should also mention high voltage, since this will be missing when there is no boost, or lower than normal if boost is lower than it should be. However, it is possible for the boost voltage to be normal, or even greater than normal, with no high voltage at all. This will happen in a normal circuit if the yoke is disconnected.

Here is a very convenient test to make if you suspect that either the flyback or the yoke is causing a loss of boost voltage. Merely disconnect the yoke; if it is defective, boost will rise to at least the normal value, but there will be no high voltage. If boost voltage does *not* return during this test, it can be assumed that the yoke is good and the trouble is in the flyback. By the way, this discussion does not apply to direct-drive circuits.

ROBERT FEURER
Marion, Ill.

We could split hairs over the word "proper" in the paragraph you quoted from, but it makes more sense to agree with you—boost will be nearly normal if the yoke is open, except in a direct-drive circuit. However, some high voltage will likewise be developed. It obviously won't be up to normal, since the energy normally stored in the yoke is absent; but it may be as much as half the normal amount. Thanks for volunteering your help.—Ed.

Dear Editor:

You did not throw a curve ball last April, as Bob Hill charged in the August *Letters* column. You *balked!* You are way off base when you list a sweep and marker generator over a tube checker. Everybody will agree that a VTVM or a good VOM comes first, but a good tube checker comes next. I took a poll of all the shops around us, and they all agree.

We have a standing rule in our shop that, if a set is brought in for bench service, all tubes are run through our transconductance tube tester. You would be surprised at the number of "half tubes" we find operating in sets—tubes with shorts, and those with high-resistance grid leakage. Our tube checker has saved the day on many a service problem.

We have no need for a sweep generator, although we do the bench work for five other TV service companies. (We had both sweep and marker generators at one time, but we sold them both for $50 just to get them off the bench.) Even our scope gets very little use. About 95% of the troubles in TV, radio, hi-fi, and car radio sets are found with our tube checker and VTVM. Our shop has been in business since 1948, and with these instruments, we will still be in it for many years to come.

CHARLIE BENNETT
Service Manager
Miller's Music & Hi-Fi Store
Baltimore, Md.

No doubt about it—tube testers are a big help in finding troubles. But, for troubleshooting the real toughies, our choice is still a scope and generator.—Ed.

Dear Editor:

I wonder how many of your readers have noticed that the *Subject Reference Index* card in your July issue is labeled with the wrong month (June). Don't feel unhappy about this; I have bad days, too, and I guess these are to be expected once in a while. I haven't found any real faults in PF REPORTER since your first issue in January, 1951. Times have changed since then. but so has your magazine. That's what I like about it—always something new.

WILLARD ROBERTS
Jacksonville, Ark.

You were the first to tell us of the goof on the card, Will. Glad to hear it didn't change your opinion of us. Many thanks for your consoling thoughts.—Ed.

Dear Editor:

I agree with John J. Zeder; I like your articles but some of them make us read too far to get to the "meat."

DELWIN IRELAND
Star, Idaho

Now all we need to know is how you like it—rare, medium, well done, or charred to the bone?—Ed.

What type of TV Lead-in Cable do you need?

Your Belden Jobber has it!

Convenient lengths in coils and spools

WELDOHM . . two and a half times the flexing life and one and a half times the breaking strength of ordinary lead-in. Resists pulling, whipping, twisting. 300 Ohm. No. 8230.

PERMOHM* . . for use under conditions of extreme salt spray, industrial contamination, rain, and snow. Gives stronger, clearer signals. 300 Ohm. No. 8285.

STANDARD 300-OHM LINE . . offers low losses at high frequencies. Also ideal for use with FM receiving antennas. No. 8225.

DECORATOR CABLE . . this new 300-ohm lead-in cable is of ivory color—blends into any interior decorating arrangement. No. 8226.

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CELLULINE* . . excellent resistance to sun, abrasion, and wind. Installation easy . . no end-sealing necessary. Gives strong UHF and VHF TV pictures. 300 Ohm. No. 8275.

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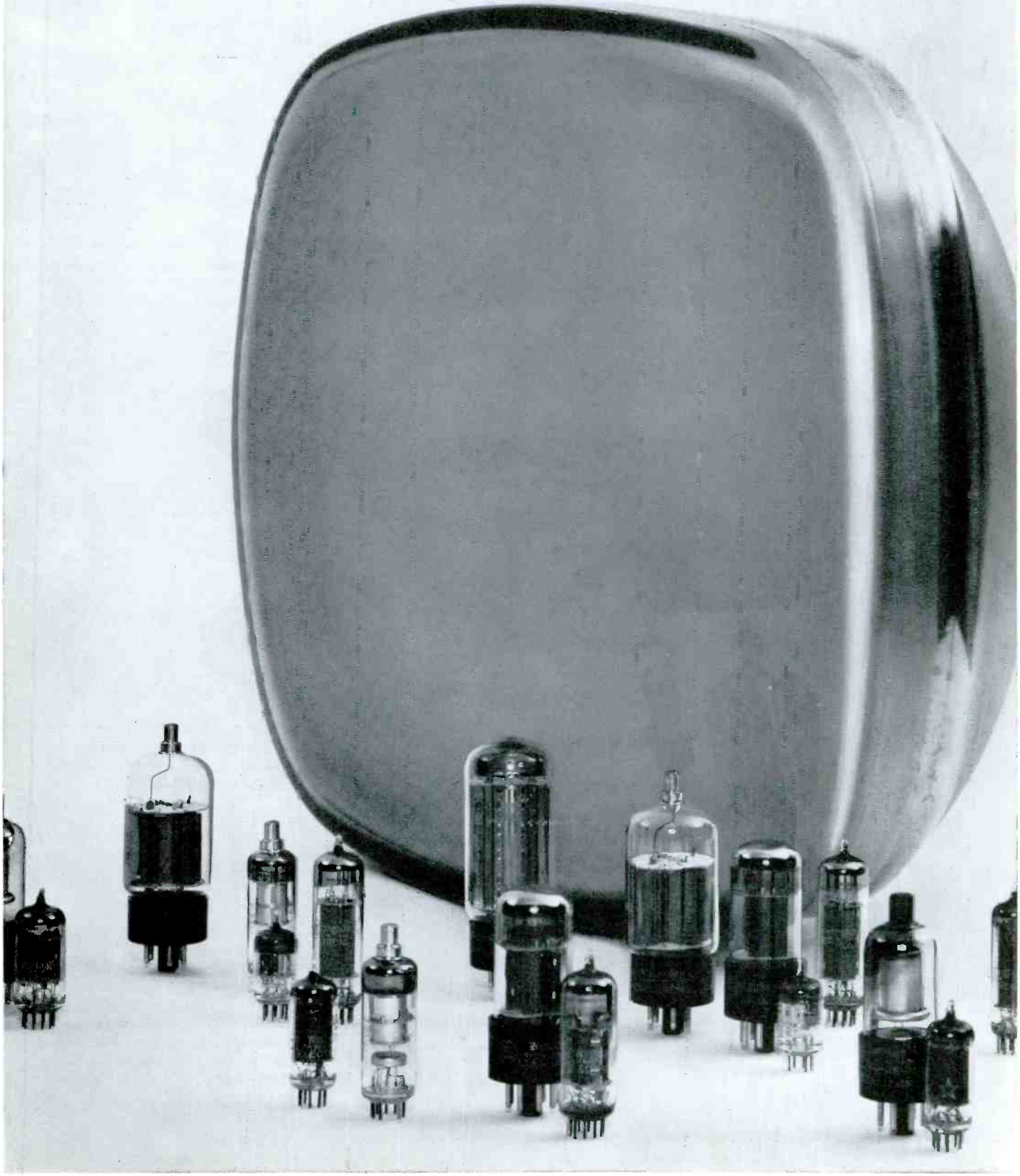
ATTENTION SERVICEMEN—DEALERS!

WESTINGHOUSE ANNOUNCES



A NEW MARKETING CONCEPT IN ELECTRONIC TUBE DISTRIBUTION

Your Westinghouse electronic tube distributor will soon benefit from a dynamic new marketing program. He will be able to extend to you many of the benefits of this unique plan which will generate greater profitability and promote sound business relationships between manufacturer-distributor-dealer. Here are the important facts concerning this program:

1. HIGHER PROFIT MARGINS—Westinghouse tube production facilities have been developed over the years to where they now have no peer in craftsmanship and manufacturing skill. This results in exceptionally fine product quality, which together with competitive product cost ratios afford the opportunity to produce favorable, realistic and constant profit margins.

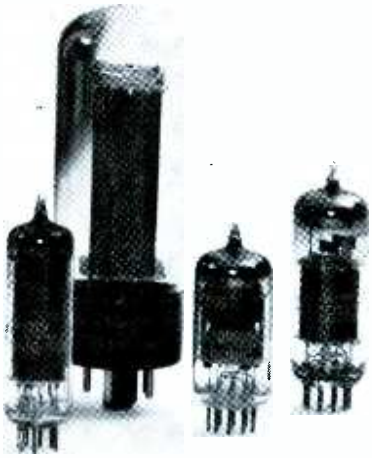
2. THE ULTIMATE IN FINANCING PLANS—At long last: a plan that recognizes the fiscal needs of the distributor and is based upon sound principles of money management. A financially responsible distributor can now buy Westinghouse electronic tubes with a flexible line of credit which allows him to maintain complete con trol of his own business affairs.

3. EXPERT MARKETING COUNSEL—To help solve distributor problems related to distribution patterns, co-op advertising, promotional and merchandising programs, Westinghouse has installed a team of experienced marketing executives. A key member of this team is our advertising agency, McCann-Erickson, Inc., with its complete marketing services and nation-wide facilities.

4. EXCLUSIVE FINANCIAL COUNSEL—To help solve problems in the areas of credit control, inventory turnover, cash flow and operating ratios, Westinghouse offers to franchised distributors the counsel of financial experts. These money "trouble shooters" are Westinghouse corporate treasury officials, in offices strategically located coast-to-coast.

5. FAST TIE-LINE SERVICE—To reduce inventory problems and to minimize out-of-stock risks, Westinghouse has developed a new, improved order processing method in field offices and at the factory. A franchised distributor's order is filled within one hour of receipt.

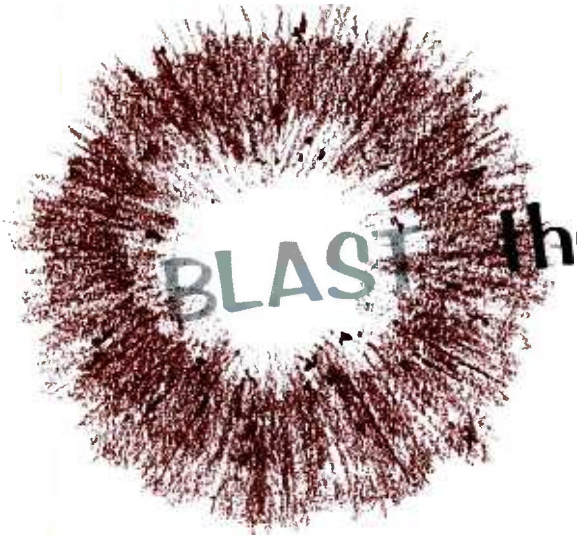
6. INDUSTRY INNOVATIONS—Westinghouse is constantly developing new ways to package and merchandise electronic tubes to distributor . . . to dealer . . . to consumer. For example, the bold, distinguished package design coming soon for all Gold Star tubes.



Westinghouse Electric Corporation, Electronic Tube Division, Elmira, N.Y.
You can be sure . . . if it's Westinghouse.

Westinghouse

THERE'S NEW *POWER* IN WESTINGHOUSE TUBES



those TV Intermittents

Special techniques for ferreting out troubles in "hibernations."
by Jack Darr

"When intermittent come in door, profit fly out window."
—OLD CHINESE PROVERB BROUGHT UP TO DATE

Continual servicing of intermittents is, without a doubt, the best method ever devised for reducing the net income of a TV service shop. However, there are ways of dealing with intermittents that will reduce the total bench time consumed. From over 30 years of experience, I can tell you that the best way is the *methodical* attack. Haphazard, hopeful "twiddling" will get you nowhere. Look at the problem calmly, and see if there isn't a handle on it somewhere. My favorite approach is the "Three-I" method: Interrogation, Investigation, and Information. To this might be added a fourth I, "Inspiration", but most intermittents are fixed by the first three. Most inspirations generally prove to be entertaining, but entirely incorrect!

Interrogation

Question the customer carefully. He's been watching the set act up for quite a while before he called you, and the more information you can get, the easier your job is going to be. Explain to him that the more facts you have on *exactly* how the set has been acting, the less time you'll have to spend on it, and the lower the service charge will be. This will usually make him *very* cooperative! Get *all* the symptoms: Does the trouble show up when the set is first turned on, after it's been on for five minutes, after two hours, or when? Does it affect the picture, sound, raster, or what? Is any kind of popping or frying noise heard when the trouble shows up? Is there a smell of something burning? Can operation be brought back to normal by jarring the set? Does the trouble happen at the same time every day, or at odd intervals? You're going to get some pretty weird answers, but the skilled technician becomes adept in translating replies like "It goes *gizzledewhop* every time I step on this board right here!", or "The picture goes BRRRRPPPP!"

To win the cooperation of the customer, choose your words carefully. For example, *never* inquire, "What's the matter with the set?" Just as an experiment, I deliberately used this phrase on 20 service calls. On 17 of them, I was told, "That's what we called *you* for, to find out!" You'll get much better results from asking specific questions such as, "Is the trouble in the picture, the sound, or both at the same time?" Does the screen go dark, or does the picture go away and leave the screen a smooth white?" "Does the sound go off when the picture goes out?" and so on. About three or four questions like this, and the technician can "sectionalize" the trouble within a remarkably small area of the set, thus speeding the job up tremendously.

Be leery of accepting an intermittent with a time limit for delivery. Explain to the customer that because the trouble isn't there all the time, it's going to be hard to find. You can say, "There are hundreds of connections, and it could be any one of them." Or you can tell him you could fix the set in five minutes if it were completely dead and stayed dead; but as it is, you'll have to take a little extra time to be sure that you have found the trouble. In other words, phrase your answers to convey the idea that you know exactly what's wrong with the set, but the repair is going to take longer than usual because the TV set won't cooperate with you. Never give a customer the impression that you're stuck, even if you are. Make a special effort to hold back the words, "We might not find the trouble." Let him believe that if this stubborn TV set will just show up the trouble while in your shop, you'll find it in no time! Try to get the owner to feel that you and he are working together against the bull-headed TV set. And don't think it doesn't pay

· *Please turn to page 87*

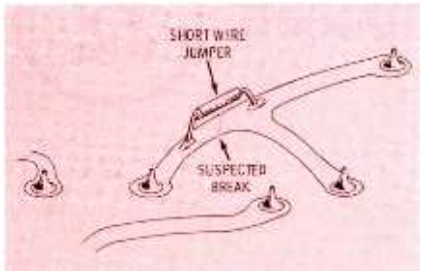


Fig. 1. Use a bridge of hook-up wire to check for a crack in PC conductor.

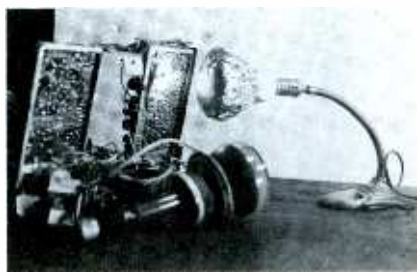


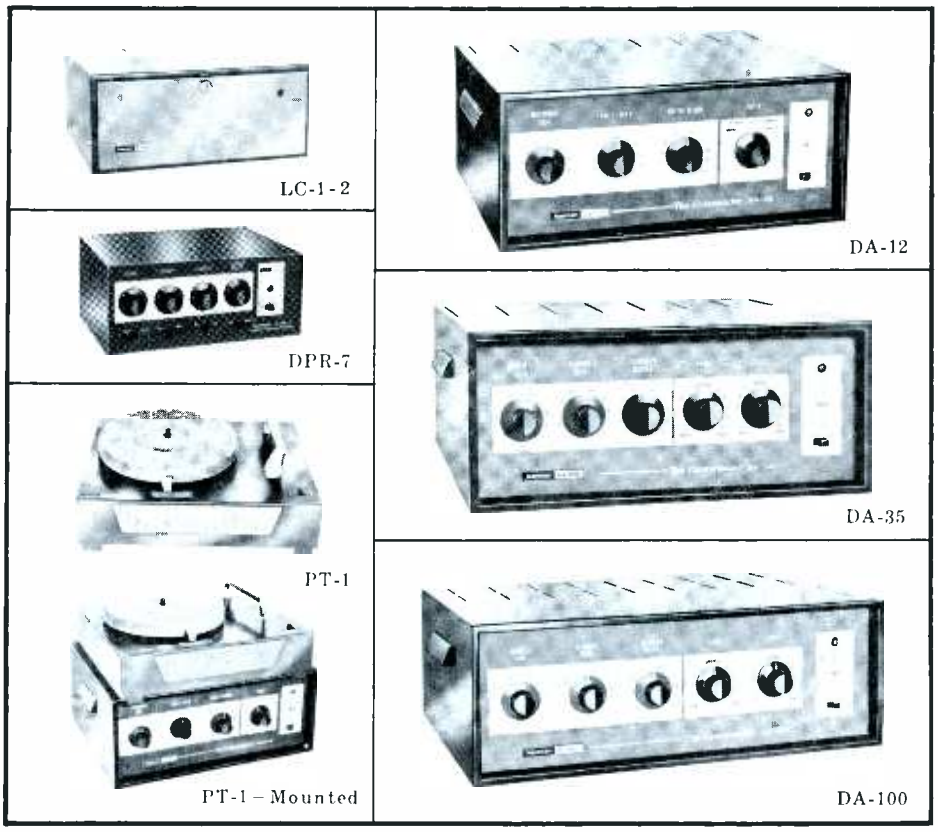
Fig. 2. Heat lamp wrapped with aluminum foil makes set "intermit" in shop.

Harman-Kardon Enters The Sound Field Because...

...the sound industry is on the threshold of an exciting new era of growth. However, the ever-expanding use of sound places new demands upon the operational capabilities of equipment. It calls for new and higher standards of performance. The continued progress of our industry should not be impeded by equipment that is the result of old habits and customs; by equipment that simply does not measure up to the needs of the day and does not consider in toto the soundman's point of view.

The popular priced Commander Series is the first of a line of commercial and industrial sound products to be introduced by Harman-Kardon. In subsequent months additional lines will be presented. This equipment is the result of a new and refreshing approach to practical application requirements. Harman-Kardon brings to the sound field the full resources of a dynamic, successful organization, plus a superb engineering staff steeped in many years of experience in commercial and industrial sound. It is no accident that the Commander Series is in fact "deluxe" equipment at a popular price. This reflects the modern and highly efficient production techniques that have long been used to manufacture equally outstanding values found in Harman-Kardon high fidelity products. They also reflect the remarkable level of performance demonstrated by H-K's universally acclaimed Citation line. As you can see, the ingredients of quality, dependability, and a maintenance of high level of performance—so important in sound work — are not new to us at Harman-Kardon.

We urge you to carefully consider the new Harman-Kardon commercial and industrial sound equipment. Talk it over with your distributor or write to us for the full story. You'll quickly discover why the new Commander Series will do more, do it better, and for longer.



A SOUND APPROACH to Commercial and Industrial Application...

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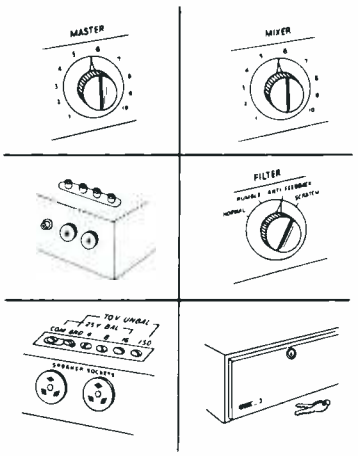

The Commander Series shown above includes the following: Model DA-12, 12 Watt PA Amplifier—$75.00 List; Model DA-35, 35 Watt PA Amplifier —$119.95 List; Model DA-100, 100 Watt PA Amplifier —$187.50 List; Model DPR-7, Combination Mixer/Preamplifier — $75.00 List; Model PT-1, Phonograph Top —$37.50 List; Model LC-1 and LC-2, Locking Panel Covers: Model LC-1 — $8.50 List, Model LC-2 — $9.00 List.

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STOCK GUIDE FOR TV TUBES...

This edition has been enlarged to reflect the continual increase in the number of active tube types. Even so, it omits over 50 of the rarest types, which many shops do not find it practical to keep in stock. To simply the chart as much as possible, common radio and hi-fi tube types used in TV combinations are omitted: so are special color and UHF types.

The figures on a gray background suggest a stock of 350 tubes which should account for over 90% of your replacement needs, and should minimize your risk of being "caught short" even if you travel all day without refilling your tube caddy. However, if you prefer a more limited caddy stock, the other set of figures (on white background) will help you decide which types to cull out. These figures indicate the number of tubes of each type you could expect to find in a random sample of 1000 tubes taken from all TV sets now in service. Where the usage figure is well below 1 per 1000, a dash is shown. To scale down your stock, you can omit many "dashed" types, and also reduce quantities of other types. In so doing, keep in mind three other factors besides usage rates which influence the demand for various tubes:

1. Relatively high failure rate of power output and similar types.
2. Your specialization in certain makes of sets, such as regional brands.
3. Average age of sets containing a particular tube type.

Temporary substitution of available types for rare types, as outlined in the Howard W. Sams book, **Tube Substitution Handbook, Vol. 3**, can also help you reduce stock requirements.

Another way to ease tube-stock headaches is to use only the latest –A or –B versions of various tubes. Types in common use are listed in the chart.

PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE
29	2	1B3GT	–	1	5AS4	24	3	6AX4GTB	1	1	6CU6	–	1	6FY5	–	1	10HF8
11	2	1G3GT	–	1	5AS8	4	1	6BA6	1	1	6CU8	3	1	6GH8	–	1	11JE8
5	1	1J3	1	1	5AT8	2	1	6BA8A	–	1	6CW4	–	1	6GK5	1	1	12AF3
2	1	1K3	–	1	5AV8	3	2	6BC5	2	1	6CX8	–	1	6GK6	5	2	12AT7
–	1	1S2A	–	1	5AU4	2	1	6BC8	2	2	6CY5	1	1	6GM6	19	2	12AU7
7	2	1X2B	–	1	5B8	3	2	6BE6	1	1	6CY7	1	1	6GN8	1	1	12AV5GA
2	2	2BN4	1	1	5BK7A	–	1	6BF6	1	1	6CZ5	–	1	6GW6	1	1	12AV7
–	1	2CW4	1	1	5BR8	2	2	6BG6GA	1	1	6DA4	–	1	6GX6	8	2	12AX4GTB
3	2	2CY5	–	1	5BW8	2	1	6BH8	–	1	6DB5	–	1	6GY6	4	2	12AX7
–	1	2FH5	4	2	5CG8	–	1	6BJ8	5	1	6DE4	–	1	6HF8	–	1	12AZ7A
–	1	2GK5	2	1	5CL8A	1	1	6BK5	4	2	6DE6	–	1	6HJ8	1	1	12B4A
2	1	3A3	1	1	5EA8	6	2	6BK7B	1	1	6DE7	–	1	6HL8	7	2	12BH7A
1	1	3AL5	–	1	5EU8	4	2	6BL7GT	2	1	6DG6GT	–	1	6HS8	1	1	12BQ6GTB
3	2	3AU6	–	1	5EW6	–	1	6BL8	4	1	6DK6	1	1	6J5	–	1	12BR7
–	1	3BC5	–	1	5GH8	2	2	6BN4	–	1	6DM4	11	2	6J6	–	1	12BV7
3	2	3BN6	–	1	5GM6	8	2	6BN6	2	1	6DN7	–	1	6JE8	9	2	12BY7A
4	2	3BU8	–	1	5J6	2	1	6BN8	18	3	6DQ6B	4	2	6K6GT	3	2	12C/-CU5
19	2	3BZ6	2	1	5T8	6	2	6BQ5	2	1	6DR7	–	1	6K11	1	1	12CA5
9	2	3CB6	35	3	5U4GB	11	2	6BQ6GTB	–	1	6DS5	1	1	6S4A	–	1	12CU6
2	1	3CS6	6	2	5U8	10	2	6BQ7A	–	1	6DT5	–	1	6SL7GT	2	2	12D4
1	1	3CY5	3	2	5V3	1	1	6BR8A	9	2	6DT6	36	3	6SN7GTB	1	1	12DB5
1	1	3DG4	–	1	5X8	–	1	6BS8	–	1	6EA5	1	1	6SQ7	8	2	12DQ6B
2	1	3DK6	2	2	5Y3GT	6	2	6BU8	1	1	6EA7	9	2	6T8	–	1	12DT5
6	2	3DT6	–	1	6AB4	–	1	6BW8	7	2	6EA8	13	2	6U8A	–	1	12ED5
–	1	3GK5	2	1	6AC7	–	1	6BX7GT	5	2	6EB8	1	1	6V3A	–	1	12GC6
–	1	3GS8	–	1	6AF3	3	1	6BY6	–	1	6EH7	9	2	6V6GT	2	1	12L6GT
–	1	4AU6	3	1	6AG5	1	1	6BY8	–	1	6EJ7	6	2	6W6GT	2	1	12SN7GTA
–	1	4AV6	–	1	6AG7	28	2	6BZ6	1	1	6EM5	6	2	6X8A	1	1	12W6GT
1	1	4BC8	2	1	6AH4GT	2	1	6BZ7	2	1	6EM7	2	2	7AU7	–	1	13DE7
–	1	4BN6	3	2	6AH6	4	2	6C4	2	1	6ER5	–	1	7EY6	–	1	13DR7
1	1	4BQ7A	1	1	6AK5	73	3	6CB6	2	1	6ES8	1	1	8AW8A	–	1	13EM7
–	1	4BU8	35	2	6AL5	2	2	6CD6GA	–	1	6ET7	–	1	8BA8A	–	1	17AX4GT
3	2	4BZ6	5	2	6AM8A	2	1	6CF6	–	1	6EU8	2	1	8BQ5	2	1	17D4A
·	1	4CB6	4	2	6AN8A	32	3	6CG7	–	1	6EV5	1	1	8CG7	–	1	17DE4
·	1	4CS6	17	2	6AQ5A	8	2	6CG8A	3	1	6EW6	–	1	8CX8	–	1	17DM4
–	1	4DE6	3	2	6AS5	1	1	6CL6	–	1	6EW7	–	1	8EB8	2	1	17DQ6B
–	1	4DT6	1	1	6AS8	1	1	6CL8A	–	1	6FD7	–	1	8EM5	–	1	17GW6
–	1	4EH7	2	1	6AT6	–	1	6CM6	2	1	6FH5	–	1	8ET7	2	2	19AU4GTA
–	1	4EJ7	1	1	6AT8A	5	2	6CM7	–	1	6FG7	–	1	8FQ7	–	1	22DE4
–	1	4ES8	5	2	6AU4GTA	2	1	6CN7	–	1	6FM8	–	1	8GN8	–	1	25AX4GT
–	1	4EW6	62	2	6AU6	–	1	6CQ4	–	1	6FQ5	1	1	9AU7	–	1	25BK5
–	1	4GS8	3	2	6AU8A	2	1	6CQ8	–	1	6FQ7	–	1	9BR7	–	1	25BQ6GTB
2	1	5AM8	1	1	6AV5GTA	3	2	6CS6	–	1	6FS5	2	1	10DE7	–	1	25CD6GB
1	1	5AN8	9	2	6AV6	–	1	6CS7	–	1	6FV6	–	1	10EG7	–	1	25DN6
6	2	5AQ5	14	2	6AW8A	2	1	6CU5	–	1	6FV8	–	1	10EM7	2	1	25L6GT

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Shop Talk by Allan F. Kinckiner

PAINLESS TV

Many servicemen approach an alignment job with about as much eagerness as a small boy going to the dentist. Thus, poor alignment of TV sets is a widespread condition which goes largely uncorrected. Considering the many phases of receiver operation that can suffer from misalignment, this situation is not very complimentary to the TV service industry.

The problem is aggravated by the fact that customers are often not overcritical of picture quality, although they can be (and are) quite critical otherwise. There is no reason why servicemen must accept this attitude at face value; instead, they should recognize that they are far better qualified than their customers to judge picture quality and decide whether realignment is needed. Even though customers may not specifically complain about picture quality, they are able to recognize and appreciate the improved picture which realignment can provide.

In fairness to servicemen, it should be mentioned that signs of poor alignment seen in actual practice are not always as readily apparent as they are in textbook examples.

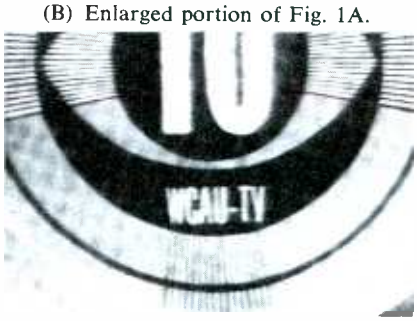
Visible Symptoms

Live telecasts and videotaped shows are the only types of regular programs which lend themselves well to judging the need for alignment. Other types of broadcasts, particularly films, are likely to contain smears or other defects which make them unreliable for indicating whether or not the bandwidth is normal. Of course, a test pattern—if available—is by far the most useful transmission for this purpose. By the way, the photos in Fig. 1 were taken early in the morning, the only time I can tune in a broadcast test pattern. If you're lucky enough to have a pattern available during working hours, or if you own a piece of test equipment that enables you to generate your own test pattern at will, you have a distinct advantage in checking the alignment of receivers that go through your shop.

(A) IF bandwidth of 3.5 mc.

(B) Enlarged portion of Fig. 1A.

(C) IF bandwidth of 2.75 mc.



(D) Enlarged portion of Fig. 1C.

Fig. 1. Effect of bandwidth on picture detail.

My purpose in presenting Fig. 1 is to demonstrate the value of test patterns in judging the IF bandpass and picture quality of TV sets. Part A of this figure shows the result of aligning a receiver to its correct 3.5-mc bandwidth. Fig. 1B is an enlargement of the vertical wedge in this pattern, to show the sharply-defined video information at the small end of the wedge. When I narrowed the bandpass of an identical receiver to 2.75 mc, it presented the "softer" picture shown in Fig. 1C, with high-frequency information blurred as illustrated in Fig. 1D. Incidentally, the antenna used with these sets gave a slight ghost that showed up on the test patterns, but was not very objectionable on programs.

Several persons were "view-tested" using these two sets. First, the narrow-bandpass receiver was tuned to a regular program, and nobody complained about picture quality. However, when both receivers were operated side by side, the same viewers readily noted and approved of the sharper pictures on the properly-aligned receiver. This goes to show that the average viewer is not a good judge of picture quality except when viewing on a comparative basis. Generally, it takes a fairly bad case of misalignment, such as the severe ringing in Fig. 2, to prompt a customer complaint.

Audible Symptoms

Set owners seem to be more sensitive to sound troubles caused by faulty alignment than they are to the corresponding picture troubles. In early split-sound receivers in particular, it was relatively easy to determine the need for realignment by noticing the poor tracking

ALIGNMENT

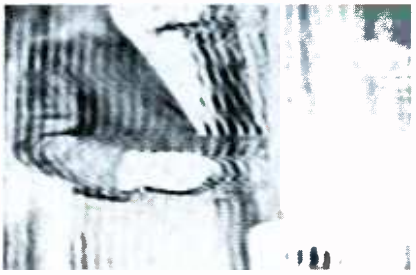


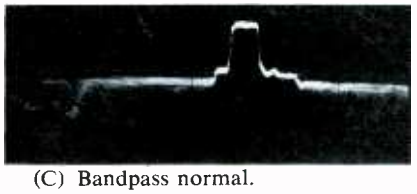
Fig. 2. Severe ringing—one alignment fault customers will complain about.

between sound and picture. Even so, the once-frequent complaint, "If I tune for good sound I get a poor picture, and I lose the sound if I tune for a better picture," was not always accurate. Sometimes what the customer called a "better picture" was only a more contrasty picture with rather poor definition.

The drift-proof 4.5-mc sound IF in intercarrier receivers provides greater leeway in fine-tuning adjustment, and thus makes these sets less prone to the complaint of poor tracking. This is true even on receivers having poor alignment. However, less than normal bandwidth can still cause a complaint of weak sound, as in one Motorola

(A) Rounding—bandpass too narrow.

(B) Ringing—bandpass too wide.



(C) Bandpass normal.

Fig. 3. Bandwidth affects sync pulse.

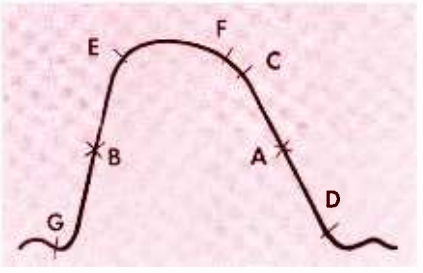


Fig. 4. Seven major points universally used to evaluate IF response curves.

TS-537 I serviced not long ago. The picture seemed acceptable even when examined critically. After other troubleshooting procedures failed, I decided to look at the IF bandpass. It was found to be less than 2.5 mc at the "6 db down" points on the curve. Realigning the IF strip to its normal 3.5-mc bandwidth not only cleared up the sound, but also gave improved picture clarity I had not suspected was lacking.

More on Diagnosis

Visible symptoms of misalignment are not limited to smear and ringing, but extend to other troubles not ordinarily associated with alignment deficiencies. A good example of this is critical sync, which can be due to attenuation of low video frequencies when the picture carrier is too low on the IF-bandpass curve.

Sometimes incorrect bandwidth is not caused by simple misalignment, but by component defects in the RF-IF stages. This bears out the importance of thoroughly checking the condition of these circuits before attempting to align a set. Here are several examples of troubles which caused suspicions of misalignment:

1. Severe ringing in a Silvertone, due to a bad 6CB6 in the third video IF stage.

2. Smear in an RCA KCS47, due to a shorted screen-bypass capacitor in the second IF.

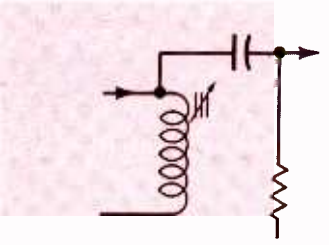
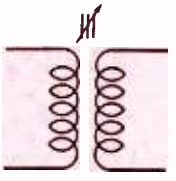


Fig. 6. Tuned coil and capacitor give same results as bifilar transformer.

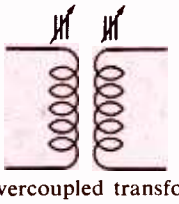
3. A classic condition of poor tracking between sound and picture in a Motorola. When the fine tuning was adjusted to bring in good sound, the picture broke into various patterns (herringbone, ringing, or unsteady sync); but the picture was faultless when the sound was tuned out. This trouble was eventually found to be caused by an open screen bypass in the sound IF circuit.

The same kind of defects as those created by poor alignment can also result from faults in the video am-

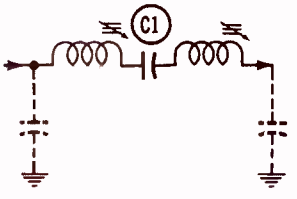
• *Please turn to page 80*



(A) Bifilar-wound transformer.



(B) Overcoupled transformer.



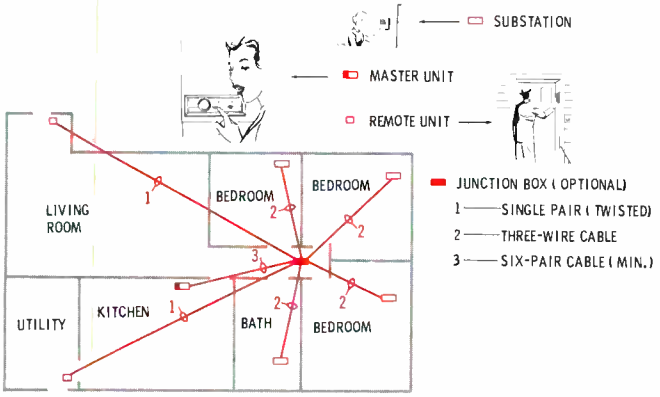
(C) Series-tuned network.

Fig. 5. Basic IF coupling networks.

PLANNING

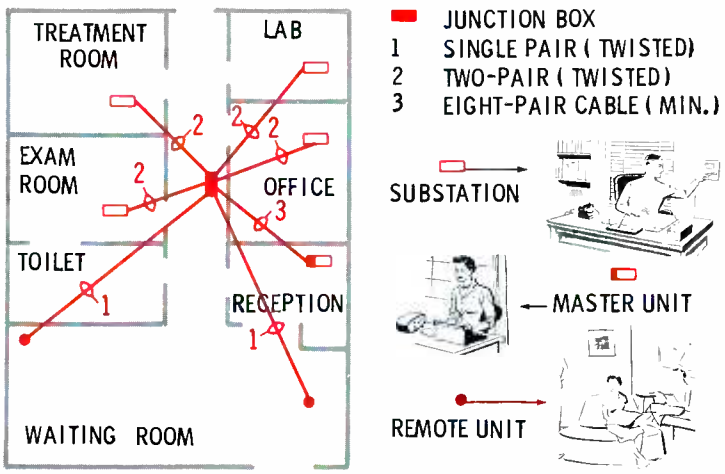
What kind of an intercom system would you plan for a home, farm, factory ,office ,or store? Obviously, there is no universal system that automatically fits the needs of such a wide variety of applications. However, all systems have one common purpose—adequate communications between two or more points. Therefore, if you are well informed about what's available in the way of intercom equipment, and if you check to see what's expected of a proposed system, you'll experience little difficulty in planning a suitable installation.

Here are suggested layouts for five typical intercom systems. After studying them carefully, you will see they can easily be adapted to fit practically any intercom job.



A home intercom may be a simple two-station system for answering the door, remote baby-sitting, or calling the family to dinner. On the other hand, it may be a larger system that pipes music to every room, in addition to permitting two-way conversations. The kitchen is a favorite location for the master unit, because it's the normal center of activity. When you're wiring a system into a new house, it's advisable to allow for future expansion by running wires to the basement, attic, garage, etc., before walls are finished.

When installing wireless units that simply plug into the AC line, connect a .1- to .5-mfd, 600-volt capacitor between the two fused ("hot") lines of the 220-volt entrance lead. This will assure operation on any branch circuit.

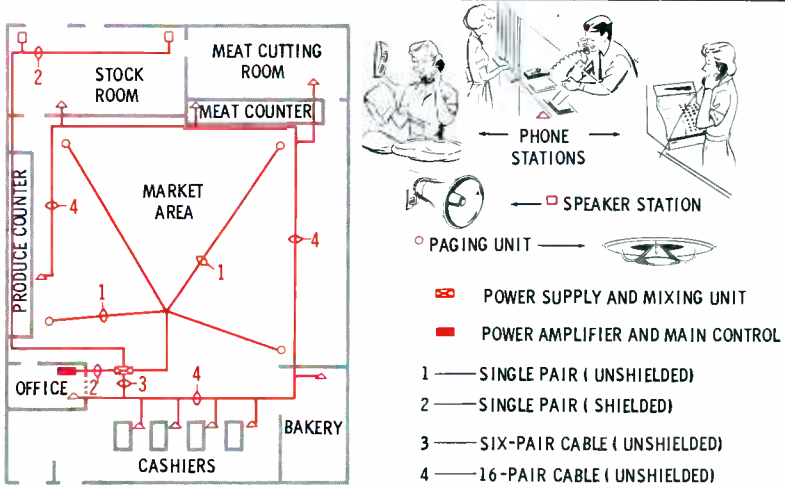


Doctors, dentists, realtors, and other professional people generally require an office-intercom setup similar to this. The equipment basically consists of a master unit operated by a receptionist, several substations equipped with press-to-talk switches for two-way communications, and a couple of extra remote speakers to carry music and announcements to a waiting room. Selective calling and privacy are important; therefore, equipment should be chosen accordingly.

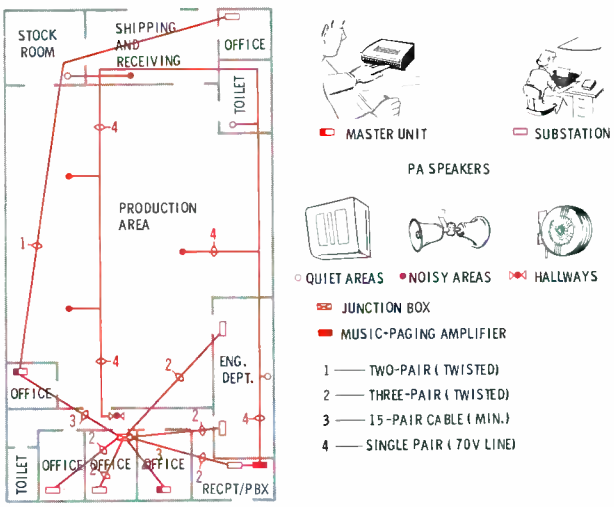
If the office is leased or rented, you may not be permitted to install leads within walls. In this case, the system can be wired through decorative conduit along wall moldings and in other inconspicuous places. Additional costs for such material must, of course, be figured into your original estimate.

For many retail stores such as this supermarket, an intercom system is no longer a luxury, but a necessity. This example uses a combination of push-button phones and "talk-back" speakers, plus a background-music and paging system for the entire store. Intercom phones are located at key points throughout the building to provide private communications between any two points. Speakers in the stock room can either reproduce or pick up sound; their operation is controlled in the office.

This type of system also finds applications in banks, bowling alleys, and many other places of business. As an installation hint, always use coded leads to insure proper phasing of the speakers.

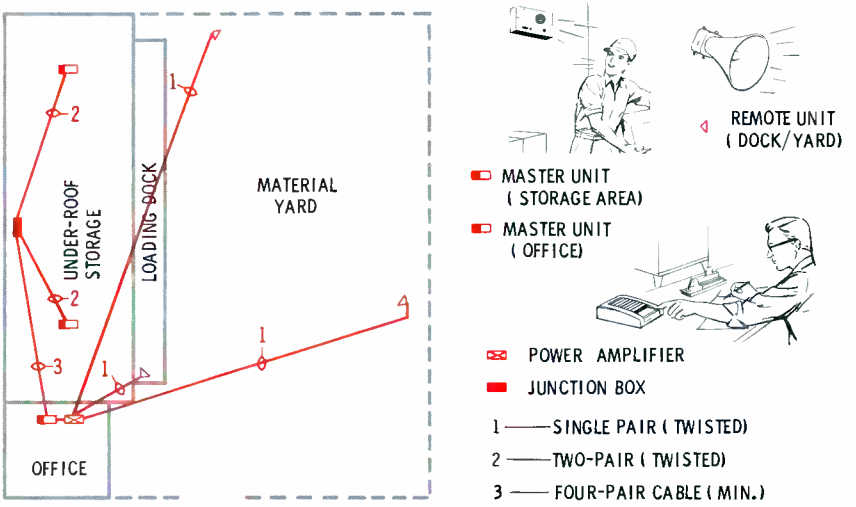


Intercom Installations



Somewhat more complicated systems are usually needed in industry. In a manufacturing plant, for example, a combined intercom and PA system may serve several offices (with more than one of them originating calls), a noisy production area, and a number of isolated departments on one or more floors. In addition to music provided by radio, records, or tape, such a system may also include microphone inputs, alarm devices, timed tone signals, etc. The accessories are no problem, however, if you follow the installation instructions supplied with the equipment.

When wiring the intercom, use shielded cable or twisted pairs, and keep the runs spaced well away from power lines. Especially in the larger systems, make it a habit to use junction boxes with all terminal connections coded and diagrammed. By making it unnecessary to use a separate ground wire for each circuit, the junction boxes cut down on the number of conductors required; they also provide convenient access points to the wiring system for servicing.



This type of intercom-system layout is equally well suited for dairies, baking companies, freight yards, waterfront warehouses, and other combined indoor-outdoor locations. Three master control units are provided; one is located near the telephone in the front office, and two are positioned in the storage area for material handlers. Each master unit can receive and originate communications with other masters or with "talk-back" speakers on the dock and in the yard. These speakers may be equipped with individual volume controls, and some types also may have a "signal-in" device that flashes a light or sounds a buzzer at one of the master units.

In planning a system of this type, figure on using special weatherproof speakers in all yard locations; also use weather-protected or buried leads for outdoor runs. Remember that all installations must conform with local building and electrical codes.

ITEM CHECK LIST

INTERCOM EQUIPMENT

- MASTERS
- SLAVES
- REMOTES

ACCESSORIES

- POWER AMPLIFIERS
- MIXING UNITS
- RADIOS—AM/FM
- PHONO OR TAPE RECORDER
- MICROPHONES
- PREAMPS
- AUTOMATIC TIMERS
- TONE AND VOLUME CONTROLS
- POWER MONITORS
- SPECIAL SWITCHES
- SIGNAL OR ALARM DEVICES

PA EQUIPMENT

- SPEAKERS
- MATCHING TRANS.
- BAFFLES AND ENCLOSURES

INSTALLATION MATERIAL

- WIRE AND CABLE
- FASTENERS OR CONDUIT
- JUNCTION BOXES
- PANELS AND GRILLES
- MISC. HARDWARE

LABOR CHECK LIST

ESTIMATING TIME

- SURVEY
- CUSTOMER CONSULTATION
- MATERIAL LIST
- FLOOR-PLAN DIAGRAM

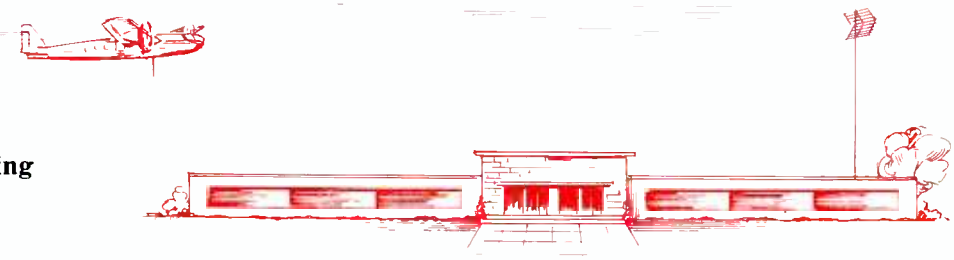
INSTALLATION TIME

- SECURING MATERIAL
- POSITIONING EQUIPMENT
- MOUNTING SPEAKERS
- RUNNING CABLE
- WIRING SYSTEM
- CODING TERMINALS

MISC. TIME

- WIRING DIAGRAM
- OPERATIONAL CHECK
- MATERIAL AND LABOR INVOICE

Schoolroom TV Takes to the Air



The serviceman's role in equipping schools to receive TV lessons broadcast from an airplane . . . by Jack Beever

The instructional television program now operating from a transmitter 26,000 feet up in an airplane bids fair to teach TV technicians some new tricks in UHF broadcast pickup. Whoever heard of UHF-TV programming on a consistent day-to-day basis at a 175-mile range?

A little history of this project is important, and a little forecast might also be interesting. The whole thing started with the famous "Stratovision" experiments of the late '40's, when TV broadcasts were made from a B-17 flying over the eastern Pennsylvania and Maryland countryside at heights up to 30,000 feet. TV watchers of that time reported snow-free pictures at ranges up to 225 miles.

In view of this experience, a group of forward-thinking educators, using Ford Foundation funds and aided by the Westinghouse "Stratovision" experience, proceeded with a plan to broadcast instructional television from an aircraft flying over east-central Indiana. The Midwest Program on Airborne Television Instruction (MPATI) utilizes two DC-6B airplanes as flying television stations, each transmitting on two UHF channels, 72 and 76. One is flown in a figure-8 pattern ("orbited") over Montpelier, Ind., while the other is maintained as a standby.

The project became a source of great interest to television antenna, set, and distribution-system makers, and much cooperation was extended in equipping schools to pick up the early test phases of the program. This fall marks the first full schedule of broadcasts.

The usual reaction to this story is, "Wow, what an expensive way to mount a transmitting antenna!" In actuality, the cost of covering the same area by relays and tower-mounted transmitting antennas would be a great deal more—the flying transmitters are the most economical!

Let's look a little into the future: Educators in other parts of the country are watching this development with intense interest. If it goes as planned, other operations will follow; the economics of the system force it. The interest of the 13,000 schools in the present coverage area (Fig. 1) is high, and great sums of money have been spent in equipping the schools with reception gear. This is a happy precursor of what can happen elsewhere—and an omen of what will be required of TV technicians in the way of know-how.

The problems of reception from this flying transmitter are somewhat different from those involving a fixed, ground-based transmitter. The nature of the problems also varies greatly according to the range at which signals are received. Some special difficulties are caused by the aircraft's motion, which is a figure-8

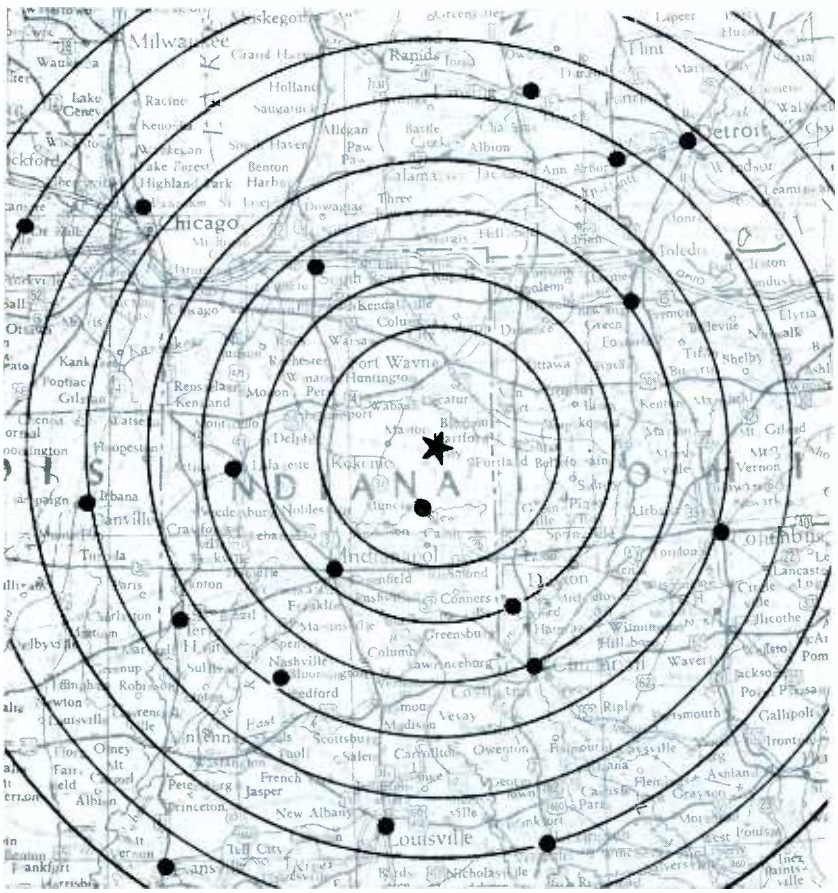


Fig. 1. Signals from flying TV transmitter are reaching most of this area.

pattern, about 20 miles long from top to bottom of the 8, and usually flown so that the 8 heads into the prevailing wind. Fig. 2 illustrates the different conditions of reception that may exist at varying ranges. The drawing is deliberately out of scale, in order to point up the different angles. For example, the aircraft is about five miles over the surface of the earth, but the antenna at point D is 200 miles away from the center of the orbit.

The four locations illustrated in Fig. 2 cover almost every practical difference in situation. Although approximate ranges are assigned to each category of reception, these figures do not represent hard and fast rules. To illustrate this point, the conditions existing at D in Fig. 1 may quite easily occur within 50 miles of the aircraft, if the receiving site happens to be on the "wrong" side of a hill so that the antenna can't "see" the aircraft, or can see it during only part of its orbit. Conversely, point C could have point-B conditions if C were on top of a good-sized hill or building. Therefore, the only accurate way to "pigeonhole" a given location into one of the four reception categories is to check the signal actually received at that location.

The Technician's Part

Once the installer of a receiving system knows what type of reception he is dealing with, he can choose components that will give the desired performance in that situation.

Antennas are first on the list. Installations out in the fringes, 150 to 200 miles away from the aircraft, demand high-gain antennas—perhaps parabolic types with apertures (reflector dimensions) of six feet or even larger. High towers may be needed; in this case, it is important to check the building and safety codes carefully and watch for FAA lighting requirements. This is the kind of installation you'll run into at point D of Fig. 2.

Point C calls for somewhat the same kind of installation, but the signals are likely to be much more variable, since the antenna may have line-of-sight when the airplane is on the near side of its orbit and be below line-of-sight when on the far side of the orbit. This will result in fades every ten minutes or so, depending on the flight pattern.

These conditions will apply at their worst over only a small band of territory, about 10 miles wide. Installations here will require equipment with highly effective automatic gain control.

The area of point B is in continual line of sight, and moderate-gain antennas such as corner-reflector, dipole-on-screen, and yagi types should suffice. High-gain antennas should be avoided at the nearer end of this range because of their sharp directivity, which may cause signal variations as the plane enters and leaves the major lobe of the antenna pattern. Corner re-

· *Please turn to page 68*

COMMON REASONS FOR POOR MPATI RECEPTION

In actual field testing, the following causes of substandard performance have turned up most frequently:

Poor antenna location. Surprisingly, an antenna mounted on a flat school roof has been found to perform better when located on the side away from the airborne transmitter. Many technicians have been unquestioningly choosing the "logical" mounting spot on the side facing the airplane, but an antenna in this location is more likely to pick up signal reflections from the ground or other distant surfaces. This causes ghosting or periodic fading of the signal. A large, flat roof might seem to be a troublesome source of reflections; however, if it is sufficiently close to the antenna, it seems to act as an anti-reflection screen.

This point explains another unusual fact about MPATI antennas: To minimize pickup of reflected signals, the antenna should be no higher than necessary to obtain adequate signal strength. Installers are used to "reaching up" for ground-based TV signals, and thus are running into trouble due to excessive antenna height.

Inadequate checking of signal strength. Since UHF-TV field-strength meters are not readily available, the only practical way of evaluating a single-set installation is to observe the picture. However, a more accurate method — using a VHF field-strength meter—is advisable when a complete antenna-distribution system is being installed. The meter is connected to the output of the mast-mounted UHF converter head. Since it is more sensitive than the eye, it can detect slight signal fluctuations due to the orbiting pattern of the plane. Relative freedom from these fluctuations is more important than high signal strength in assuring good system performance.

Besides its usefulness in judging antenna sites, the field-strength meter provides an accurate way to peak the alignment adjustments in the UHF converter used with the distribution system.

Poor choice of VHF channel for converter output. UHF converters used with distribution systems are available with output on any VHF channel from 2 to 13. Conversions should be carefully selected to avoid co-channel or adjacent-channel interference with nearby commercial VHF stations. For example, channels 2 and 10 are preferred in the Indianapolis area, where stations are broadcasting on channels 4, 6, 8, and 13.

Loose coaxial-cable connections. Careless installation of coax fittings has been at the root of many reception problems. Use of a special crimping tool is recommended for positive results.

Overheated system components. In some cases, distribution amplifiers and related units have been installed in attics of schools. During the warm months, these closed-up spaces (especially ones with flat roofs) often become so hot that the equipment overheats and blows fuses. To prevent future service problems, school officials should be urged to permit installation of components in upper hallways, custodians' closets, and other relatively cool and accessible locations.

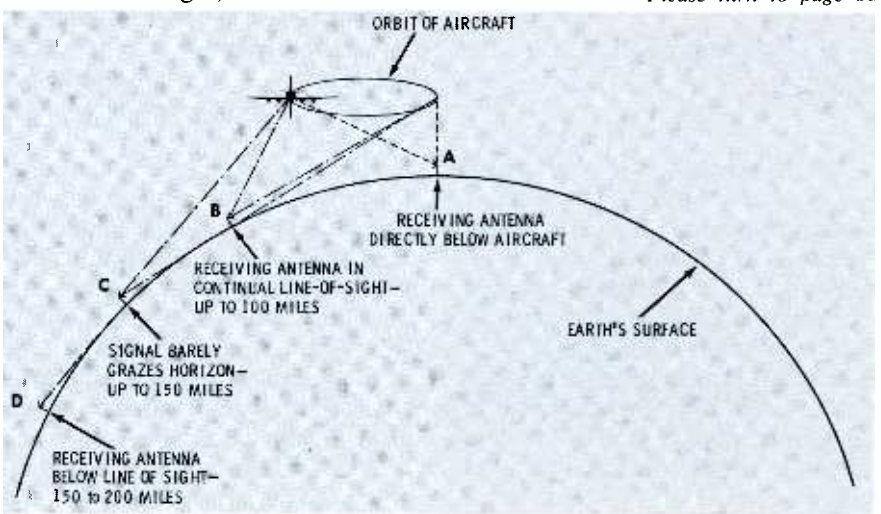
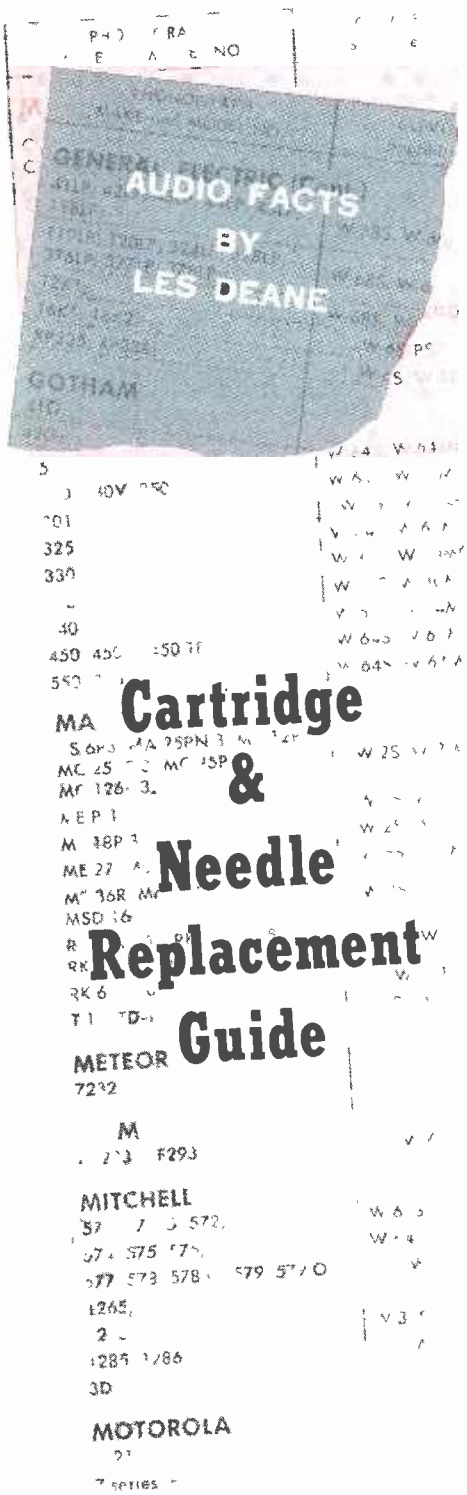


Fig. 2. The four types of receiving sites all present different problems.



The "front end" of a phonograph—its pickup cartridge and needle—is often responsible for such trouble symptoms as no output, record skip, audio distortion, reduced volume, or excessive hum. If you get the job of putting the instrument back into working order, you'll frequently be faced with the problem of choosing a replacement—one that not only works, but also satisfies your customer.

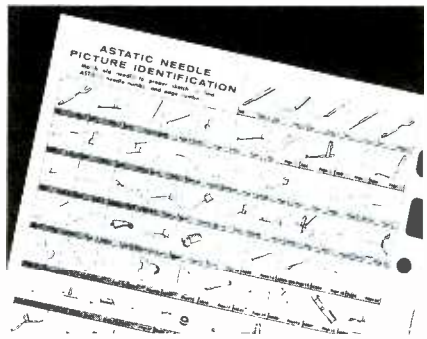
In many cases, the customer will rely solely upon your judgment; other times, he may request a certain brand and type, ask if a higher-quality component is available, or want to know if an inexpensive one will work just as well. So that you'll be able to obtain the *right* replacement and answer your customer's questions, let's take a glimpse at what's available in today's cartridge and needle market and investigate the procedures for selecting a replacement.

Needles

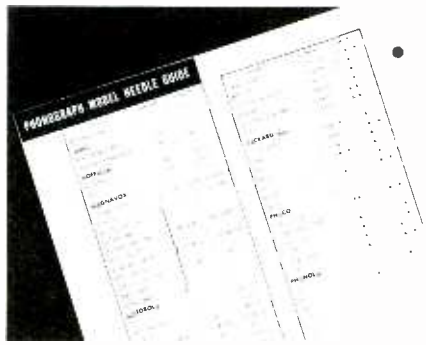
Portable record players, automatic changers, and turntables for both mono and stero reproduction all have the common problem of needle wear. In addition, needles often break or their tip materials become chipped as a consequence of abuse or accidental damage. When these failures occur, you can usually detect them by a close visual inspection, or by making a temporary substitution. After establishing that the cartridge is in good condition and a new needle is all that's called for, you must decide on how and where to obtain a replacement. Incidentally, needles come with three basic tip materials besides the inexpensive steel type—precious metal (usually osmium), synthetic jewel (usually sapphire), and genuine diamond. Replacements will sometimes be available in all three types, and since the material governs the life expectancy of the needle and record, it's a good idea to mention this option to the customer.

You may prefer to obtain a needle from the original-equipment manufacturer. To help you determine the one you need, service data for the equipment will generally include a part number for the needle in question. You can use this number as a guide in obtaining a replacement.

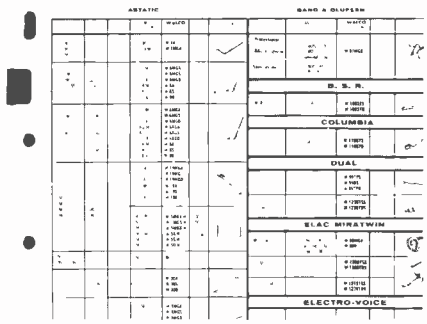
About a dozen different manufacturers produce replacement needles of both the general and exact-duplicate types. Almost 200 different designs are included in each line, and seldom will you find a type that cannot be replaced from this extensive collection. PHOTOFACT Folders recommend replacements taken from a few of these leading manufacturers' lines. In addition, all major manufacturers supply replacement guides to their dis-



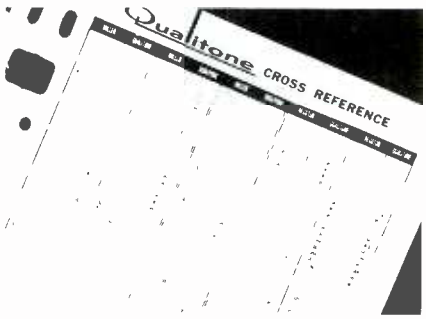
(A) From sketches of needles.



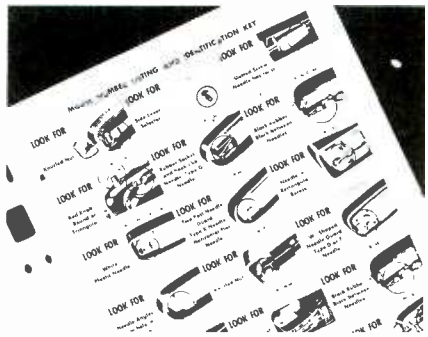
(B) From phono model numbers.



(C) From cartridge model numbers.



(D) From needle cross-reference.



(E) From pickup-head photos.

Fig. 1. Charts and guides help you pick replacements several different ways.

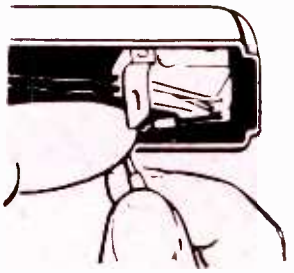
tributors. As shown by the examples in Fig. 1, these guides can help you locate a replacement by several different methods. For instance, you can identify the original needle type and its replacement by referring to pictorial illustrations (Fig. 1A). You need only know the phonograph manufacturer and model number in another reference method (Fig. 1B). A replacement can also be found if the original cartridge manufacturer and model is known (Fig. 1C); or, another needle manufacturer's type can be cross-referenced to the particular brand desired (Fig. 1D). In still another method, the needle may be identified by pictures of various pickup heads (Fig. 1E).

Some needle manufacturers package kits that include a selected group of popular types. Others make available individual packages for various brand-name phonos such as G-E, RCA, Webcor, etc. If you don't already have a stock of replacement needles, Chart I lists some of the most popular, fast-selling types which should be included in your selection. Each type is pictured, with replacement numbers listed for the leading needle producers.

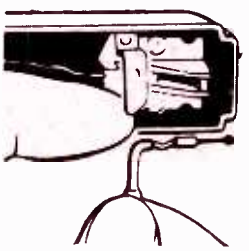
Replacement Hints

The needle replacement must fit the cartridge connection, and it must have the proper tip size (normally 3 mils for standard 78's, 1 mil for microgroove LP's, .7 mil for stereo records, and 2.5 mils for all-purpose use); furthermore, its shape must match that of the original so it will meet the record grooves at the proper angle and maintain a certain tone-arm height. In addition, the replacement may require dual tips or a special protective guard. Its shank may also have to be extra sturdy—especially if the tone arm and cartridge are exceptionally heavy. Some needles are not replaceable as such, but are an integral part of the cartridge; in this case, of course, an entire new assembly must be obtained.

Generally, you'll have little trouble removing the original needle and installing a replacement. The old crystal-type cartridges usually have a simple thumbscrew arrangement—although, in the case of a turn-over design, you may have to remove the crystal in order to reach



(A) Releasing spring.

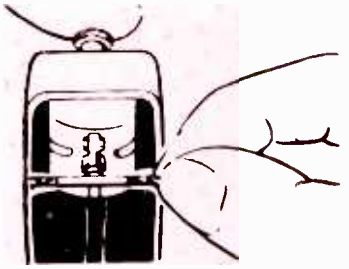


(B) Lifting out needle.

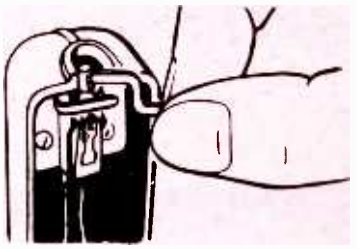
Fig. 2. Spring-clip mounting for Sonotone three-speed turnover needles.

a small set screw holding the two needles. Many ceramic pickups have needles that are merely forced into the cartridge. These so-called friction-held units are easily removed by slipping a knife blade or your fingernail under the heel of the needle shank. A replacement is installed by holding the shank with your fingers and pushing it gently into the cartridge chuck until it seats.

Many needles are held by knurl-head or conventional screws on



(A) *General Electric* type.



(B) *Astatic* type.

Fig. 3. The other examples of needles held in place by spring-type mounts.

the underside of the tone arm; however, they are no more effort to change than those found in the old crystal cartridges. If the needle is clip-mounted, you will most likely be able to remove the entire clip and needle with your fingernail. When putting the new needle in, fit the clip assembly into the cartridge slot (usually at the rear) and then snap it into place, making sure the shank tracks with the guide.

Some types, held in by a spring

• *Please turn to page 75*

Chart I Standard Replacements

ORIGINAL NEEDLE	ASTATIC	DUOTONE	ELECTRO-VOICE	FIDELITONE	JENSEN	PHILCO	QUALITONE	RECOTON	WALCO
	N640-1S	517	3105	A-1	JPS-30LP	325-8199	1317	317	W-30MGS
	N561-1S	560	2902	A-98	M74LP	325-8184	1310	310	W-44MGA
	N350-1S	661	2728	A-179	G-1	325-8156	1418	418	W-68MGS
	N8-1S	594 (RMP)	3000	A-193	CRA-55LP	325-8141	1464	464	W-64MGS
	N302-7S	733	2604	A-229	E-98X	325-8232S	1506	506	W-101STS
	N601-7S	735	3005	A-233	CRA-57X	325-8244S	1504	504	W-104STS
	N7-7S	824	2420	A-267	CRA-55X	325-8253S	1513X	516	W-108STS
	N644	647 (WC-10)	3109	AC-186	JPS-35	325-8194	1427	427	W-35TPS
	N676	737	3212	AC-238	S-71X	325-8246S	1503	503	W-103STSS
	N562	816	2906	AC-253	M77X		1520X	533	W-117STSS
	N676	857	3213	AC-255	S-71X		1522X	522	W107STSS
	91T	698 D/S	76	AC-260	E-37			490SD	W-202TPS

QUICKER SERVICING

smoothing out the "pie crust"

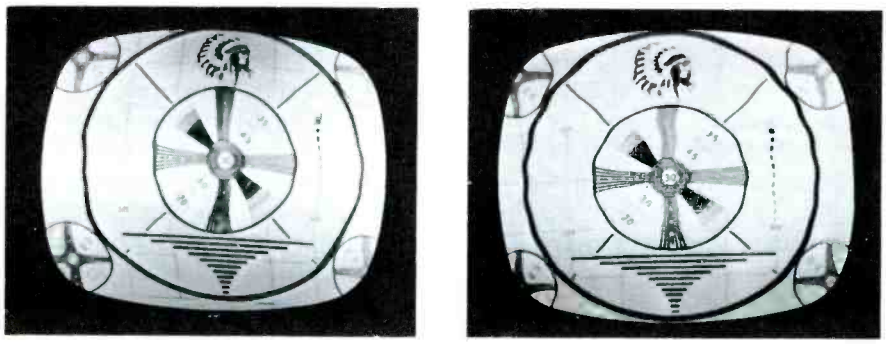


Fig. 1. Which one of these test-pattern photos displays piecrust effect?

It's easy as pie to correct the TV picture trouble known as "piecrust effect"—if you accurately diagnose the condition in the first place. Unfortunately, many servicemen take a wrong turn on this vital first step; they misinterpret the symptom, and end up groping in the dark.

Are you sure *you* can recognize piecrust effect when you see it? Try your hand at spotting this symptom in Fig. 1. Both test patterns are disturbed by telltale wiggles in vertical lines of the picture; however, only one photo represents the "real thing." The other symptom is due to a completely different cause. Study both pictures carefully, and look for clues that will tell you which one shows true piecrust distortion.

If you're not sure whether to pick A or B, perhaps a review of troubleshooting hints will help you decide. The wiggles in the picture mean that some of the horizontal lines in the raster have shifted to the left or right of their normal position, so it's logical to look in the horizontal AFC or oscillator circuit for the trouble. Four different types of circuits which can develop piecrust disturbances are shown in Fig. 2. Naturally, many variations of these circuits are in use, but comments referring to the basic circuits will apply equally well to all related types.

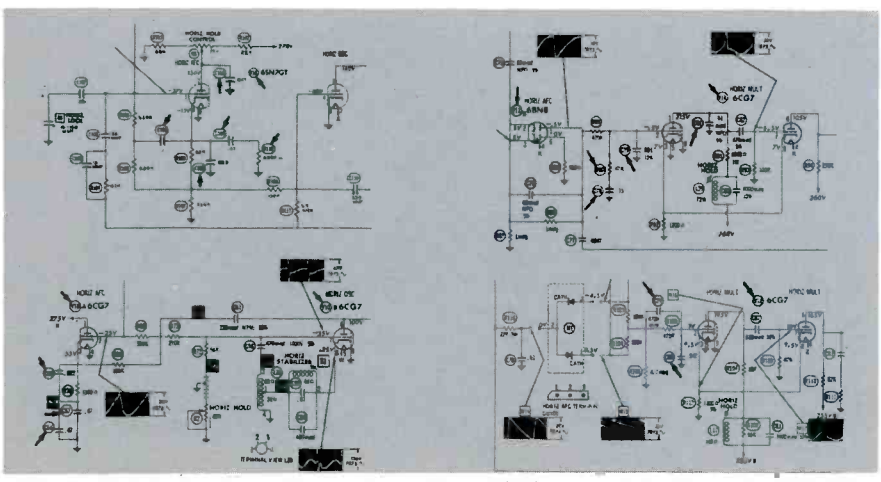


Fig. 2. Heavy arrows point to components which can cause piecrust symptom.

Note the heavy arrows in Fig. 2. These point to the components which can cause piecrust troubles. Look closely, and you'll see that all these parts (other than tubes) are either bypass capacitors or portions of filter circuits. If you clip out and replace all these parts, the trouble should be cured. Whoa, now! This is a crude way to repair a set; furthermore, all your effort will be in vain if the defect isn't a genuine piecrust condition. Remember, certain other troubles can also produce a series of wiggles in the raster. A few examples are improper B+ filtering, heater-cathode leakage in some tube, or even vertical sync or sweep signals seeping through to the horizontal oscillator.

True piecrust effect is distinct from all these other faults. It is most often traceable to a "hunting" action in the horizontal AFC stage, which causes wavering of the control voltage fed to the horizontal oscillator. Another frequent cause is a microphonic AFC or oscillator tube.

Armed with these facts, let's have another look at the test patterns in Fig. 1. Note that A has fewer and more irregular ripples than B. It also displays a slightly darker background at the top and bottom, but you can't always rely on this discoloration as a definite clue—it may not be present in some cases. The relatively large number of ripples in Fig. 1B, which occur at fairly regular intervals, mark this pattern as a true piecrust effect.

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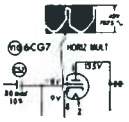
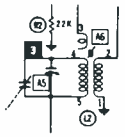
FAMOUS "STANDARD NOTATION" SCHEMATICS

- Uniform symbols in each schematic; same circuit layout form each time



- Voltages at tube pins and test points
- Waveforms at appropriate points on TV schematics
- "CircuiTrace" identification numbers for printed circuits
- Schematic items keyed to chassis photos and parts lists
- Special capacitor and resistor ratings
- Coil and transformer color codes or terminal identification

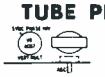


- Test points labeled
- Special currents shown (B+, horizontal output cathode, horizontal output screen)
- Alignment adjustments and test points labeled
- Tube functions shown
- Control and switch functions shown
- Switch sequence indicated
- Power supply "sources" shown
- Fuse ratings indicated
- Coil resistance over 1 ohm shown
- Coding of electrolytic capacitors shown

REPLACEMENT PARTS LISTS

- Lists standard, locally available replacement parts
- Includes notes for special installation or other considerations
- Includes ratings and/or measured values for assisting in selection of replacement parts
- All parts keyed to chassis photos and schematics for quick reference

TUBE PLACEMENT DIAGRAMS



- Shows tube types and functions; top and bottom views shown
- Includes filament connections on series string
- Indicates TV sound and sync paths
- Tube failure check charts included
- Shows blank pin or locating key on each tube
- Includes fuse locations and ratings.

ALIGNMENT INSTRUCTIONS

- Gives step-by-step easy-to-follow alignment data
- Procedure makes use of standard service-type equipment
- Alignment frequencies are shown on chassis photos near adjustment number—adjustments are keyed to schematic and photos

"CIRCUITRACE" FEATURE

- Invaluable printed board servicing aid—indicates points on board photo and schematic for quick, easy measurement of components, or test locations

FULL PHOTO COVERAGE

- All chassis views are shown in actual photographs
- All parts are numbered and keyed to the schematic and parts lists
- Test and alignment points indicated

FIELD SERVICE NOTES

- Outlines procedure for "in the home" adjustments
- Gives hints on quick access to pertinent adjustments, safety glass removal, etc.

"BONUS" FEATURES

- Disassembly instructions
- Dial cord diagrams
- Record changer and tape recorder "exploded views" for easy mechanical parts replacement or service

"PLUS" ADVANTAGES

- ★ Citizens Band Radio coverage
- ★ Tube Test data—provides setting for testing new tubes
- ★ Color TV Course "Bonus" beginning in Set No. 541
- ★ Eligibility for membership in "PEET" with ownership of a PHOTOFACT Library

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If you have trouble identifying this symptom on an actual receiver, try switching off channel and looking for evidence of 60- or 120-cycle hum. (For descriptions of this trouble refer to last month's *Quicker Servicing* column, "Track Down That Visible Hum.") Also change the tubes in the horizontal AFC and oscillator stages. If you're fairly certain by this time that you're dealing with a piecrust symptom, grab a capacitor and resistor substitution unit, and jumper the parts pointed out in Fig. 2. There's no need to cut them loose for testing, since an open component is usually at the root of a piecrust problem. When you hit the faulty part, the symptom should immediately disappear.

Make sure of the visual symptom and then jumper a handful of components in the horizontal AFC and oscillator circuits—not even Betty Crocker knows a simpler way to trim off a piecrust!

Power Resistors On Tap

It isn't at all unusual for a serviceman to encounter an open resistor of fairly high wattage. Filament- and screen-dropping resistors and B+ dividers seem to have a strange knack of opening. The *Big 20* power-resistor substitution unit produced by Sencore, Inc., of Addison, Illinois comes in handy at such times. It provides multiples of 1, 10, 100, and 1000 times the following resistance values: 2.5, 5, 7.5, 10, and 15 ohms. The unit is rated at 20 watts on all settings—high enough to allow safe substitution for any standard power resistor used in a radio or TV receiver.

After the two switches of the *Big 20* are set to the desired value, the permanently-attached test leads can be connected across a suspected open resistor, and the equipment turned on to see if the substitution unit restores normal operation. Incidentally, the clips are well insulated, so they can be attached or removed from the circuit while the power is on. If the value of the suspected resistor is unknown, the *Big 20* can be set to one of the higher ranges and connected to the circuit; then, various values can be selected during operation to determine the size of resistor needed to restore normal circuit voltages.

Rotator Troubleshooter

Want a slick way to isolate the trouble area in an antenna-rotator system? Channel Master Corp. of Ellenville, N.Y. has developed an automatic control unit, Model CM-9526, that can be substituted for any popular type of rotator control box. If a "no rotation" symptom can be corrected by temporarily installing the CM-9526, the trouble is obviously in the original control unit; if the trouble still remains, further checking of the rotator and cable is necessary.

The CM-9526 is designed for 1-rpm operation; therefore, if it is installed in a 2-rpm system, only one-half circle of rotation can be obtained. However, this is sufficient for troubleshooting purposes.

If the unit restores a 1-rpm system to normal operation, it can be left as a permanent replacement for the original control box. It can also be used to convert any 1-rpm manual-type rotator system to automatic operation. ▲

Wake Up

A new day is dawning in electronics.

Transistors are here to stay... they are now being used everywhere; in radio, television, Hi-Fi, intercom, and in nearly all new electronic equipment...

Why put off transistor circuit servicing any longer... there's gold in them thar hills. But you must be equipped to do the job fast and efficiently. Here are the tools that you will need.

NEW SENCORE TRANSI-MASTER

This Tester will analyze the entire circuit in minutes and test transistors in-circuit or out of circuit. Here is how you can pin point troubles step by step with the TR110.

First, check the batteries with the 0 to 12 volt meter. If the batteries are O.K., check the current drain with the 0 to 50 milliamp meter. A special probe is provided so that you do not need to break the circuit. Excessive current indicates a short; low current indicates an open stage or cracked board. All PF schematics indicate average current.

If trouble is not located by now, isolate the trouble to a specific stage by touching the output of the harmonic generator to the base of each transistor and note spot where sound from speaker (or scope where no speaker is used) stops or becomes weak. The generator becomes a sine wave generator for audio stages to help find distortion.

If trouble points to a transistor, check it in a jiffy with the exclusive in-circuit power oscillator check provided by the TR110. A special probe is also provided for this.

If the transistor checks bad in-circuit, remove it and give it an out of circuit check with the oscillator check or the more accurate DC check. The DC check is provided for comparison reasons, experimental or engineering work and to match transistors in audio output stages. Beta (current gain) is read direct or on a good-bad scale for service work.

DEALER NET, ONLY **$49.50**

Tests all transistors in-circuit or out-of-circuit

Model TR110

***It's a* COMPLETE TRANSISTOR TESTER**

- **SIGNAL TRACER • VOLTMETER**
- **BATTERY TESTER • MILLIAMMETER**

NEW SENCORE TRANSISTOR AND DIODE CHECKER

Here is a low cost tester that has become America's favorite. The TR115 provides the same DC out of circuit checks as the TR110; leakage and current gain. Beta (circuit gain) can also be read direct or as good or bad. Opens or shorts in the transistor are spotted in a minute. The TR115 checks them all from power transistors to the small hearing aid type. Japanese equivalents are listed also. This famous tester is used by such companies as Sears Roebuck, Bell Telephone and Commonwealth Edison. New circuits enable you to make service checks without set-up charts even though charts are provided for critical checks.

Model **TR115**
Dealer Net
$19.95

SENCORE BATTERY ELIMINATOR AND TROUBLE SHOOTER

For replacing batteries during repair.

Many servicemen say that they wouldn't service transistor circuits without this power supply. The tried and proven PS103 is a sure fire answer. It can be used to charge the nickel cadmium batteries as well. Dial the desired output from 0 to 24 volts DC and read on meter. Low ripple insures no hum or feedback. Total current drawn can also be read on the PS103 by merely flicking the function switch to milliamps. The PS103 is the only supply that will operate radios with tapped battery supplies such as Philco, Sylvania and Motorola. No other supply has a third lead.

Model **PS103**
Dealer Net
$19.95

Now in stock at your Authorized Sencore Distributor

ALL PARTS SENCORE® MADE IN AMERICA

SENCORE

ADDISON, ILLINOIS

DOLLAR & SENSE *Servicing*

by JOE A. GROVES

SERVICE VEHICLES
BUY OR LEASE?

About this time every year, many service dealers begin to think about getting a new truck or station wagon. With new models in dealers' showrooms and winter coming on again, it's easy to build up enthusiasm over this idea. If you're in a shopping mood, now is the time to give serious consideration to a question which may never have occurred to you before: "Should I *buy* or *lease* that new truck?"

Unfortunately, many owners of one- and two-man shops have never given a thought to the possibility of obtaining a service vehicle on a lease. They've simply considered leasing as being practical only for a big shop with a fleet of trucks. This conclusion has generally been based on assumptions rather than facts. Actually, leasing offers advantages to some companies (both large and small), while it doesn't to others.

Basic Questions

A service vehicle is a tool. As such, you're interested only in the work it can do. Whether you should purchase the vehicle or lease it depends on your answers to several questions. For one thing, how long do you want to use the vehicle? Many dealers prefer to use a truck only a year or two before trading it for a new one. This helps build an "image" of a successful business. Others choose to get all the miles they can from a vehicle before laying out cash for a new one. If you favor the latter point of view, you can depreciate your truck to junk value in a period of four or five years, and leasing can't possibly compete. On the other hand, if you believe in using only newer vehicles, you should investigate various leasing plans.

Another factor that should be taken into account is wear and tear. If the truck is driven over 15,000 miles per year, or if it's subjected to hard use, leasing may offer the best deal. However, if the vehicle is driven a nominal number of miles per year and is well cared for, leasing costs may be prohibitive, since depreciation charges are based on national averages.

Also to be considered is the trade-in market for various vehicles in the area where you live. Many service dealers prefer panel trucks or vans. Both styles traditionally have a lower trade-in value than pick-up trucks and station wagons, and in some areas where there is little demand for them, it's virtually impossible to trade them in without "taking a beating" on the deal. On the other hand, large leasing companies such as those listed here are able to take advantage of national marketing. This enables them to sell the vehicle in an area offering the top dollar at the expiration of the lease, and thereby reduce your total cost of depreciation. Incidentally, even smaller towns have new-car dealers and leasing firms who are affiliated with national organizations. To find out who offers leasing in your area, look under "Trucks-Motor-Rental" in the *Yel-*

Corvair 95

Standard

Chevrolet offers four six-cylinder and two V8 engines, optional AC generators with output up to 62 amps at relatively low engine speeds, turn signals, and an added automatic choke on "Corvair 95" series.

Econoline

Ford "Econoline" vans and pickups give choice of two six-cylinder engines and have three-speed manual shift. "F-100" series offers six types of transmissions and either six- or eight-cylinder engines.

F-100

Metro-Mite

International "Metro-Mite" series offers 200 cu. ft. body with a four-cylinder engine, and 250 cu. ft., six-cylinder version. The C-100 pickup has a 7′ body and option of three six and one eight-cylinder engines.

C-100

Panel

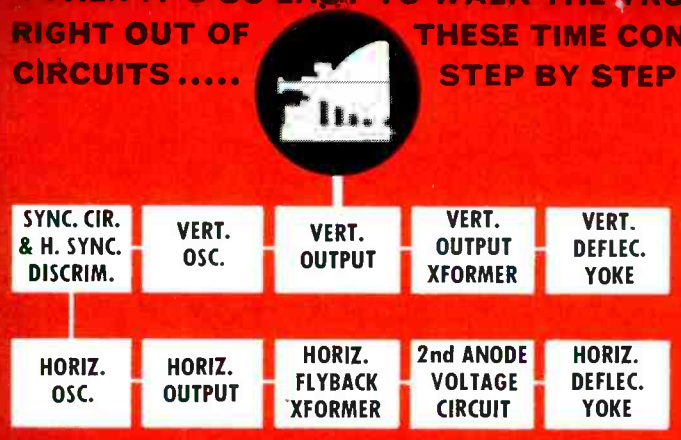
Volkswagen panel has 170 cu. ft. of cargo space. The pickup has 23 cu. ft. of storage space and fold-down side panels. Both are equipped with a four-cylinder, air-cooled engine and four-speed manual transmission.

Pickup

Can you afford to guess

AT SWEEP, SYNC OR HIGH VOLTAGE TROUBLES?

WHEN IT'S SO EASY TO WALK THE TROUBLE RIGHT OUT OF CIRCUITS..... THESE TIME CONSUMING STEP BY STEP.....



PUSH BUTTON TESTING . . .
for Color and Black and White

NEW, IMPROVED SENCORE
SWEEP CIRCUIT ANALYZER
MODEL SS117

How many times do you ask, "Why do I take so long finding that sweep trouble?" How often have you wondered whether weak horizontal sync was caused by defective sync circuit, horizontal oscillator, or sync discriminator? Can you quickly isolate adequate width or low 2nd anode voltage to the oscillator, output, flyback transformer, or yoke? How many times have you changed a good yoke by mistake?

The SS117 will pinpoint troubles like these in minutes with tried and proven signal injection, plus yoke substitution for dynamic in-circuit tests. Error proof push button testing enables you to make all tests from the top of the chassis without removal from cabinet for maximum speed and profit on every job.

Here are the checks the SS117 makes . . .

- Horizontal Oscillator: Checked by substituting 15,750 variable output universal oscillator from SS117. Signal can be injected at any spot from horizontal output grid to horizontal oscillator to determine defective component.
- Horizontal Output Stage: Checked by reliable cathode current and screen voltage checks made with adapter socket and two push buttons,
- Horizontal Output Transformer: Checked for power transfer in circuit and read as good or bad on meter.
- Horizontal Deflection Yoke: Checked by direct substitution with adjustable universal yoke on SS117.
- Vertical Oscillator: Checked by substituting 60 cycle synchronized oscillator.
- Vertical Output Transformer: By simple signal injection for full height on picture tube.
- Vertical Deflection Yoke: By signal substitution for full height on picture tube.
- Sync Stages: Checked by synchronizing triggered horizontal SS117 oscillator from any stage. If oscillator synchronizes, sync is O.K.
- 2nd Anode Voltage: A new dynamic check using simulated picture tube load. C.R.T. does not need to be operating for current tests. No interpretations—read direct from 0 to 30 KV.
- External Circuit Measurements: By applying from 0 to 1000 volts AC or DC to external meter jacks. Meter will read DC or peak-to-peak volts. 0 to 300 milliamp scale also provided for measuring horizontal fuse current.
- New features include: Large 0 to 300 microamp meter for minimum circuit loading; all-steel carrying case with full mirror in adjustable cover; two 115 volt AC outlets in cable compartment.

Size: 10¼" x 9¼" x 3½". Wt. 10 lbs.

Model SS117 Dealer Net **$89.50**

Sencore Sam says . . . How can you miss . . .

EACH PACKAGED UNIT CONTAINS:
- An Easy to Follow Instruction Book Especially Prepared and Edited by H. W. Sams.
- A complete 33 RPM, 10 inch Permanent Record on "How to Simplify Sweep Circuit Trouble Shooting."

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SENCORE
ADDISON, ILLINOIS

low Pages of your phone book.

It is important that you consider whether or not your need for a specific vehicle will last for the duration of a lease. Various types of contracts are available for terms ranging from one to three years. If there is any question of needing the vehicle for a specified period, you should either buy it or have a lease drawn with provisions to buy the vehicle if you desire. Either of these alternatives will permit you to dispose of the vehicle if you no longer need it; this relieves you of your obligation to pay a monthly rental fee for unnecessary equipment.

What is Buying?

Everyone is aware of what's involved in buying a truck. You make a down payment (perhaps handled entirely by the trade-in) and finance the balance over a period of up to 36 months at a fixed interest rate. At the end of the three years, you own the truck, which is worth approximately one-fourth its original price. When you compare your total payments (including interest) with the trade-in value at the end of three years, you may be amazed to discover the small amount of net worth you've gained from your investment. However, as was pointed out, you've had the use of the vehicle—and of course you *own* it, whatever it is worth.

What is Leasing?

There are two basic types of leases. The most popular is known as the *Finance Lease*. The company simply provides a vehicle for your use; you take care of all maintenance and regular operating costs such as insurance, gas, oil, and tires. The other type, the *Maintenance Lease,* is available with several options that include the cost of upkeep, insurance, oil changes and lubrication, total depreciation, etc. However, under any option, you still pay for the gasoline and any oil that must be added between changes. Recent studies have shown that it is impractical to have a *Maintenance Lease* for a vehicle driven less than 17,000 miles per year when the contract is for a two-year period or less.

Finance leasing provides you with the vehicle of your choice for X dollars per month for a period of one to three years. At the end of the contract, you have no equity, but you also have made no initial investment. A typical rental fee for a vehicle which retails for $2000 will run from $55 to $65 per month during the first year or 18 months, but will progressively decrease if the contract extends longer.

The monthly fee is based on three things: A percentage of the purchase price, a return on the leasing company's investment, and depreciation. The latter, which constitutes the biggest part of the monthly rental fee, is held in an escrow account by the leasing firm. At the end of the contract, the vehicle is sold by the leasing firm. The sale price and depreciation reserve are then added together and subtracted from the original price, and the balance in reserve is returned to you. If the truck has suffered from high mileage or misuse which results in a lower selling price and a deficiency in the depreciation allowance, you make up the difference; however, this seldom happens.

Because of the wide variety of leases available, it is wise to contact various leasing companies to determine the plan best suited to your individual needs.

Coming to a Decision

As a businessman, your first and

WORTH SHOUTING ABOUT!

NEW IMPROVED MIGHTY MITE

NEW IMPROVED MIGHTY MITE

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NEW IMPROVED MIGHTY MITE

Reaching New Peaks in
Performance, Portability and Price

MiGHTY MiTE II

They're shouting from the hill tops. Technicians, engineers and test labs all say that the original Mighty Mite finds the tubes that large expensive testers miss. And now . . . here is the new improved Mighty Mite! Designed for the present and far into the future. Tests all of your present tubes plus the new RCA Nuvistors and Novars, GE Compactrons and Sylvania 10 pin tubes.

67.50 DEALER NET

Remember . . . there is only one Mighty Mite

A complete tube tester that is smaller than a portable typewriter yet outperforms testers costing hundreds of dollars. A real money maker for the serviceman and a trusty companion for engineers, maintenance men and experimenters.

Even though the Mighty Mite weighs less than 8 pounds, new circuity by Sencore enables you to use a meter to check grid leakage as high as 100 megohms and gas conditions that cause as little as one half microamp of grid current to flow. Then too, it checks for emission at operating levels and shorts or leakage up to 120,000 ohms between all elements. This analytical "stethoscope" approach finds troublesome tubes even when large mutual conductance testers fail. And it does all this by merely setting four controls labeled A, B, C, & D.

Check these plus Sencore features: Meter glows in dark for easy reading behind TV set • Stainless steel mirror in adjustable cover for TV adjustments • Rugged, all steel carrying case and easy grip handle • Smallest complete tester made, less than one foot square. Mighty Mite II will test every standard radio and TV tube that you encounter, nearly 2000 in all, including foreign, five star, auto radio tubes (without damage) plus the new GE Compactrons, RCA Nuvistors and Novars and Sylvania 10 pin tubes.

Mighty Mite II also has larger, easy-to-read type in the set-up booklet to insure faster testing. Why don't you join the thousands of servicemen, engineers, and technicians who now own a Mighty Mite tube tester? Tube substitution is becoming impossible and costly with nearly 2000 tubes in use today. Ask your authorized Sencore Distributor for the New Improved Mighty Mite. Size: 10¼" x 9¼" x 3½". Wt. 8 lbs.

MODEL TC114

Sencore Sam says . . . "They all agree . . . the Mighty Mite is the real answer for the man on the go."

SENCORE ADDISON, ILLINOIS

foremost concern is to see that your money is invested wisely. Therefore, you need to consider more than the total cost of a truck under both the lease and buy options. Naturally, total cost plays its part —and in some cases, it is the deciding factor. However, it's possible for a slightly higher total cost of a lease to be more than offset by increased revenue from a different investment of capital.

For example, let's assume you have computed the depreciation, gas and oil expense, insurance, repairs, and service charges on your present vehicle for last year's operation. Also, you have divided the sum of these figures by the number of miles driven to find the cost per mile. Assume that the resulting figure is 8.81¢ per mile, and that a leasing quotation based on the same number of miles shows a cost of 9.33¢ per mile. At first glance, buying appears more economical; if the computations were based on 10,000 miles, for example, you would save $52 per year by owning the vehicle. On the other hand, if we consider that the vehicle costs $2000, at least $650 must be invested in a down payment. Ask yourself another question: "Can I make or save more than $52 (the additional cost of leasing) by investing $650 in something other than a truck—say, in merchandise or equipment?" If the answer is a resounding "Yes," the lease, although more expensive, may afford the best solution. However, if you can spare the capital, you'll probably be better off buying the truck.

In making your final decision, determine what you have previously spent to operate your truck. Next, check with the various dealers in your area to see what kind of a deal you can make. Then compare the best figure with the arrangements offered by various leasing firms. With all these facts at hand, you should have little trouble deciding what's best for you.

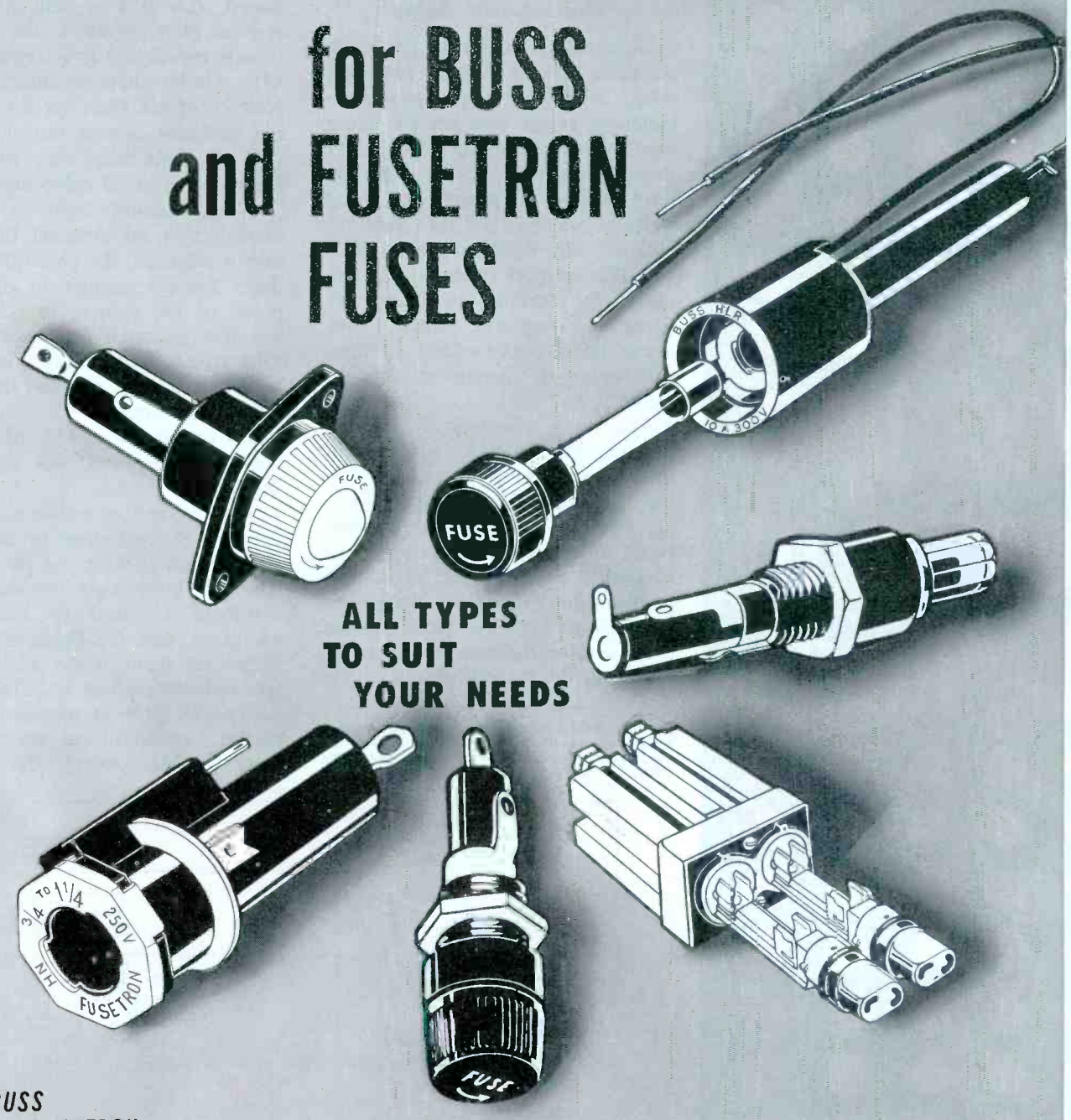
National Leasing Companies

Avis Rent-A-Car System
17 Irvington St., Boston, Mass.
Ford Authorized Leasing System
250 Ford Dealers Across Country
Hertz Truck Leasing
501 10th Ave., New York, N.Y.
Service Leasing Corp.
650 Madison Ave., New York, N.Y.
Wheels, Inc.
6200 N. Western Ave., Chicago, Ill.

For local leasing firms, consult the Yellow Pages of your phone book. ▲

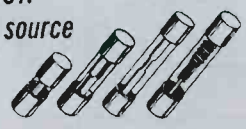
Fuseholders

for BUSS and FUSETRON FUSES



ALL TYPES TO SUIT YOUR NEEDS

BUSS and FUSETRON FUSES: One source for all your fuse needs.



Get full data for your files, write for BUSS bulletin, Form SFB—it gives a comprehensive picture of the complete line of fuses and fuse mountings of unquestioned high quality.

BUSSMANN MFG. DIVISION, *McGraw-Edison Co.,* **UNIVERSITY AT JEFFERSON, ST. LOUIS 7, MO.**

SERVICING
INDUSTRIAL ELECTRONICS
by ED BUKSTEIN

Electronic Control of Lighting

Driving home from work one of these fall evenings, perhaps you'll notice the street lights wink on. Later, you may attend a show, and watch the house lights dim as the program begins. There's a good chance that both these actions are being controlled by electronic circuits similar to those used in countless other industrial and commercial applications.

Photoelectric Relay

Illumination controls maintain adequate lighting in many factories, offices, and other work areas. Photoelectric relays turn on the room lights when the natural (daylight) illumination falls below a certain level, either at sunset or during overcast weather, and turn them off automatically when no longer needed. Illumination controls are also useful for turning on emergency lights in hospitals, street lights, tower lights of broadcast stations, field lights at unattended airfields, etc.

Fig. 1 is a schematic of a typical illumination control. Grid current in the control tube charges C1 during the half-cycles of supply voltage when the grid end of the power-transformer secondary is more positive than the opposite end. The path and polarity of the charge are indicated in Fig. 2A. Note that the lower end of the transformer is returned to the cathode circuit of the control tube through potentiometer R1, which determines the charge accumulated by the capacitor.

During the opposite half-cycles of supply voltage, the capacitor partially discharges through the phototube, as shown in Fig. 2B. If daylight illumination is weak or absent, the phototube conducts only slightly, and only a small portion of the charge leaks off the capacitor. Since most of the charge is retained, the grid is held negative, and the plate current of the control tube is insufficient to energize relay M1. Under these conditions, the contacts of M1 short out R3, allowing sufficient current flow to energize M2. This heavy-duty contactor keeps the artificial lights turned on.

When natural light is bright enough that no artificial illumination is required, the phototube conducts heavily enough to dissipate much of the charge on C1. The negative potential on the control-tube grid is thus reduced, and M1 is energized. This removes the short circuit from across R3 and transfers it to the coil of M2, which becomes de-energized and turns off the lights.

The removal of artificial lighting causes a sudden drop in the total illumination striking the phototube. The light level might fall below the threshold required to keep M1 energized, and the lights might be turned on again, if the control system did not include stabilizing circuitry. To prevent repeated on-off cycling, an additional set of contacts on M1 grounds the tap of

Editor's Note: This article has been adapted from the new Howard W. Sams book, "Industrial Electronics Measurement and Control," by Edward Bukstein.

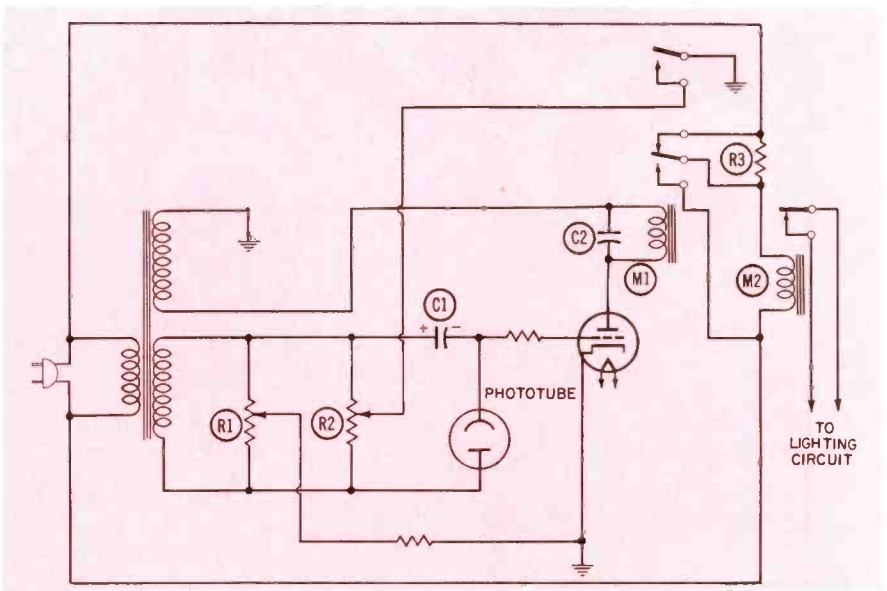


Fig. 1. Photoelectric "light switch." Assume dim light falling on phototube.

This RCA guarantee on Mercury Batteries makes it easier than ever to sell this high-profit line of batteries.

With their long life, fade-free performance and outstanding reliability, Mercury Batteries are the smartest, most economical battery buy your customers can make. Get the most out of the booming transistor radio market by displaying and promoting GUARANTEED RCA Mercury Batteries.

Contact your Authorized RCA Distributor for new sales-building promotional material featuring this RCA guarantee.

The Most Trusted Name in Electronics

More good news! The popular, fast-selling VS 323 and VS 300A zinc-carbon types now carry this same guarantee!

potentiometer R2. The tap is normally positioned near the grid end of R2 to limit the charge that can be accumulated by C1, and thus to reduce the grid bias. M1 then remains energized until the daylight illumination of the phototube becomes insufficient to keep C1 discharged.

C2, connected across the coil of M1, charges during positive alternations of the AC plate-supply voltage (assuming adequate daylight illumination). This charge keeps M1 energized during negative alternations of voltage, when the tube cannot conduct.

Light-Dimming Control

In auditoriums, theaters, etc., a means of varying the brightness of the lights is required. Although they can be dimmed by connecting rheostats in series with the lights, the rheostats would have to be high-wattage types that generate a large amount of heat. A more satisfactory method is to connect the load winding of a saturable reactor in series with the lights. The basic circuit is shown in Fig. 3. A portion of the supply voltage is dropped across the reactor, and the remaining voltage appears across the lights. Since the amount of voltage across the reactor can be varied, the voltage across the lights (and hence their brightness) can likewise be controlled.

The amount of voltage across the saturable reactor in Fig. 3 is determined by the inductive reactance of the load winding. This reactance, in turn, depends on the amount of DC current passing through the control winding.

A practical light-dimming circuit is shown in Fig. 4. As in Fig. 3, the load winding of the saturable reactor is conected in series with the lights to be controlled. The supply voltage will therefore divide; a portion will appear across the saturable reactor, and the remainder will appear across the lights. Since some of the supply voltage will be dropped across the reactor even when its core is completely saturated, the line voltage will receive *full* line voltage at maximum saturation.

A thyratron rectifies and controls the current through the control winding of the saturable reactor. In turn, the bias voltages across resistors R2 and R4 control the thyratron. The voltage across R2 attempts to drive the grid positive, and the voltage across R4 attempts to keep it negative. The actual bias is therefore equal to the *difference* voltage across R2 and R4 in series.

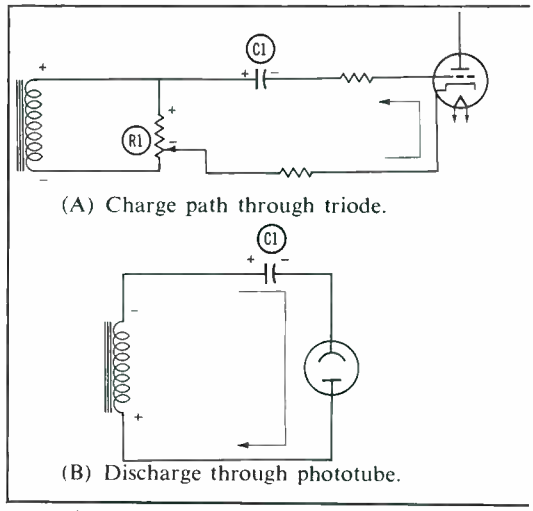


Fig. 2. Action of C1 in Fig. 1.

Potentiometer R1 is used to dim or brighten the lights. When the tap of R1 is moved below the setting shown in Fig. 4, the following changes occur in the circuit:

1. Less input voltage is available to rectifier V1, and less rectified voltage therefore appears across its load resistor R2.
2. The lower voltage across R2 constitutes an increase in thyratron bias. Because of this higher bias, the plate voltage of the thyratron must rise before ionization can occur.
3. Since the thyratron now fires *later* during each positive alternation of plate-supply voltage, a lower average current flows through the control winding of the saturable reactor.
4. The reactor core is now less saturated than before the setting of R1 was changed;

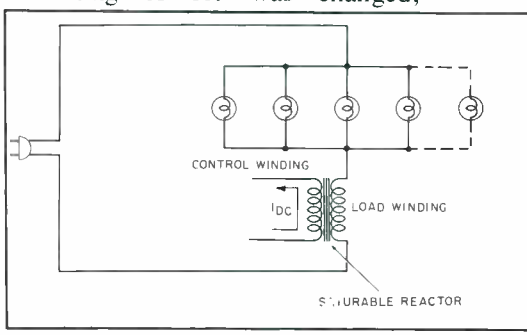


Fig. 3. Saturable reactor in series with lights controls their brightness.

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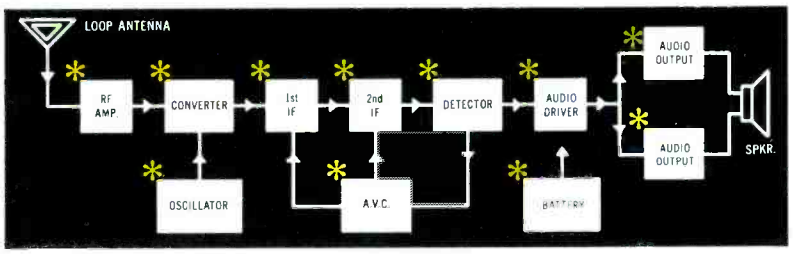

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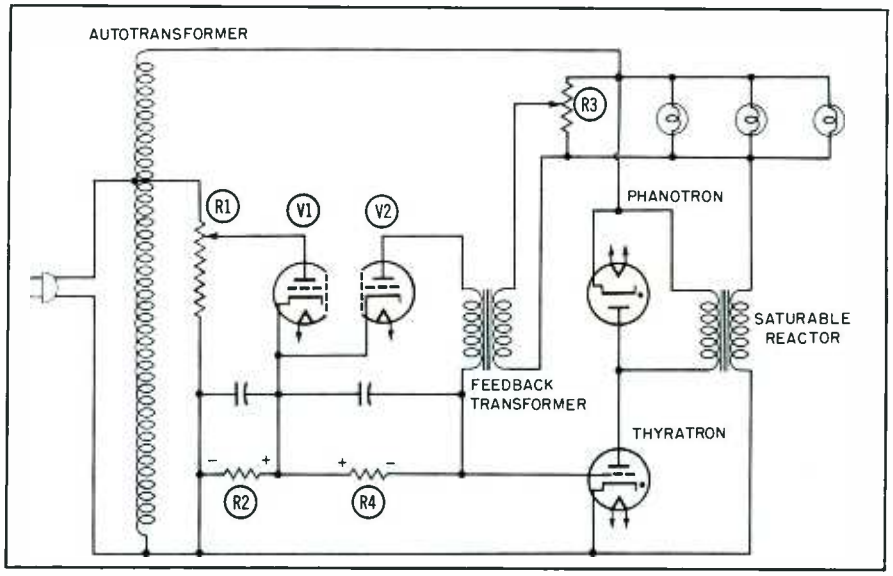

Fig. 4. Practical dimming circuit includes features to increase stability.

therefore, the inductive reactance of the load winding is greater.

5. More supply voltage is dropped across the load winding of the reactor and less across the lights. The lights therefore dim.

Moving the tap of R1 upward will produce opposite changes and brighten the lights.

Because the thyratron can conduct only during positive alternations of plate-supply voltage, a phanotron (gas-filled diode) is connected across the control winding of the saturable reactor to provide the following action: When the thyratron conducts (positive alternation of plate supply), current flows through the control winding of the saturable reactor and establishes a magnetic field. When the thyratron stops conducting (negative alternation of plate supply), this magnetic field begins to collapse. As it cuts across the control winding, a counter emf is induced in the winding. This counter emf is negative at the cathode of the phanotron and positive at the plate. As a result, the phanotron ionizes and provides a path for current to flow, with the counter emf acting as a voltage source. In this manner, current flow is maintained through the control winding during the half-cycles when the thyratron cannot conduct.

A feedback transformer connected to potentiometer R3 samples the voltage across the lights. The secondary voltage of this transformer, rectified by diode V2, appears across R4. This feedback helps to stablize the circuit against line-voltage variations by counteracting the voltage change they cause across R2. In addition, the feedback circuit keeps the brightness constant if more lamps are added in parallel or if some are cut out of the circuit. Inserting more lamps would ordinarily result in dimmer light from each lamp, because the increased current would produce a greater voltage drop across the reactor. However, the feedback circuit compensates for the decrease of lamp voltage by reducing the drop across R4. Since the thyratron then operates at a lower bias, it fires at a lower plate voltage (earlier during the positive alternation of plate supply). Higher average current then flows through the control winding of the reactor, and the core becomes more saturated. As a result, the reactance of the load winding is decreased, and so is the voltage across this winding. Because less supply voltage is dropped across the reactor, the individual lamps do not dim even though more have been added in parallel. The feedback circuit produces the opposite action when lamps are removed from the circuit.

Conclusion

The two circuits just described are typical examples of the systems most commonly used for illumination control. An understanding of their operation, coupled with a logical approach to troubleshooting, will provide the basic background needed for servicing devices of this type. ▲

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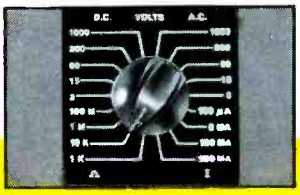

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The Electronic Scanner

South River Expands

Tooling facilities of the recently-liquidated **Penn Television Products Co.** have been purchased by **South River Metal Products Co., Inc.** As a result, **South River** will now produce the line of mounting hardware formerly manufactured by **Penn.**

Battery Display Offered by Samco

A point-of-purchase display carton containing 116 batteries has been introduced by the **Electronics Div.** of **The Sampson Co.** This counter unit contains an assortment of the seven most popular battery types. Also included is a battery information and cross-reference guide, plus Samco battery-dealer window streamers.

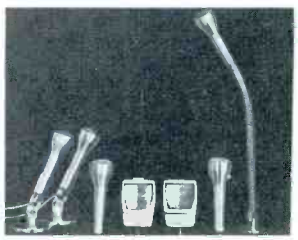
New Type for Radio-Electronic Master

Effective with next year's 26th edition, the **Radio-Electronic Master**—one of the largest and best-known industry-wide component - replacement guides—will use complete new typesetting facilities just installed in the plant of its producer, **United Catalog Publishers, Inc.**

New Symbol and Slogan for Aerovox

Aerovox Corp. has modernized their trademark, which is to appear with the slogan, "Technical Leadership—Manufacturing Excellence," to "reflect the development of new products and advanced manufacturing techniques necessary to fulfill the more stringent demands of the rapidly-expanding electronics industry." Charles Golenpaul (seated) and Matthew Simon, Vice-President and Sales Manager of the Distributor Division, are shown examining the new design.

200,000 Mikes in Two Years



Just as a clue to how well things are going in the audio and commercial - sound segments of our industry, **Sonotone Corp.** has announced that over 200,000 "Ceramikes" have been sold in the past two years. In addition, **Sonotone** has sold over 10 million ceramic phono cartridges during the past 15 years.

JW Electronics Moves to Indiana

Mr. Wade Horn, owner-manager of the **JW Electronics** tuner-servicing company, has announced the completion of the firm's move from Chicago into newly-built larger quarters in Bloomington, Ind.

Impulse-Buying Display by Switchcraft

A 2' x 4' pegboard display unit for stereo/hi-fi accessories is now available through **Switchcraft** distributors. Designed to hold as many as 40 "skin-packaged" adapters, connectors, and interconnecting cords, the "M-40" merchandiser is available to the dealer with his choice of components, or as a separate item.

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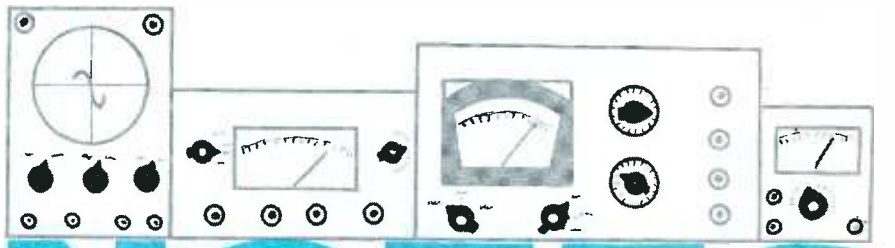

NOTES ON TEST EQUIPMENT

by *Les Deane*

Combo Power Package

Fig. 1. Paco offers regulated, variable-voltage power supply in kit form.

The Model B-12 Regulated Power Supply (Fig. 1) is a new bench instrument manufactured by Paco (a division of Precision Apparatus and subsidiary of Pacotronics, Inc.) of Glendale, L. I., N. Y. This unit simultaneously supplies regulated B+, a bias potential, and AC heater power.

In addition to its uses as a handy servicing tool, the B-12 also serves as a versatile source of power for calibrating, designing, or experimenting with electronic circuits and systems. It comes either in kit form or prewired.

Specifications are:

1. *Power Requirements — 105/130 volts, 50/60 cps; power consumption less than 50 watts with no load; line-isolated and fused; power switch and indicator provided on panel.*
2. *Regulated Output — variable DC from 0 to 400 volts; maximum continuous load 100 ma (intermittently 125 ma) up to 200 volts; maximum continuous load 150 ma from 200 to 400 volts; output variation less than .3% (or .3 volt) from 0 to 100 ma, and less than .4% (or .5 volt) with ±10V line-voltage fluctuations; output impedance less than 10 ohms from DC to 1 mc; output voltage and current monitored on panel meter.*
3. *Bias Output — continuously variable DC from 0 to 150 volts, also regulated; maximum load 2 ma; output voltage monitored on panel meter.*
4. *AC Output — two 6.3V (rms), 3-amp heater supplies; can be paralleled for 6.3V at 6 amps, or placed in series for 12.6V at 3 amps; one supply center-tapped; isolated terminals provided on panel.*
5. *Panel Meters — 2½" D'Arsonval movements; voltmeter scales 0 to 150 and 0 to 400 with range selector on panel; milliammeter scale 0 to 200 with smallest scale division 10 ma.*
6. *Size and Weight—8½" x 13" x 7¼", 17 lbs.*

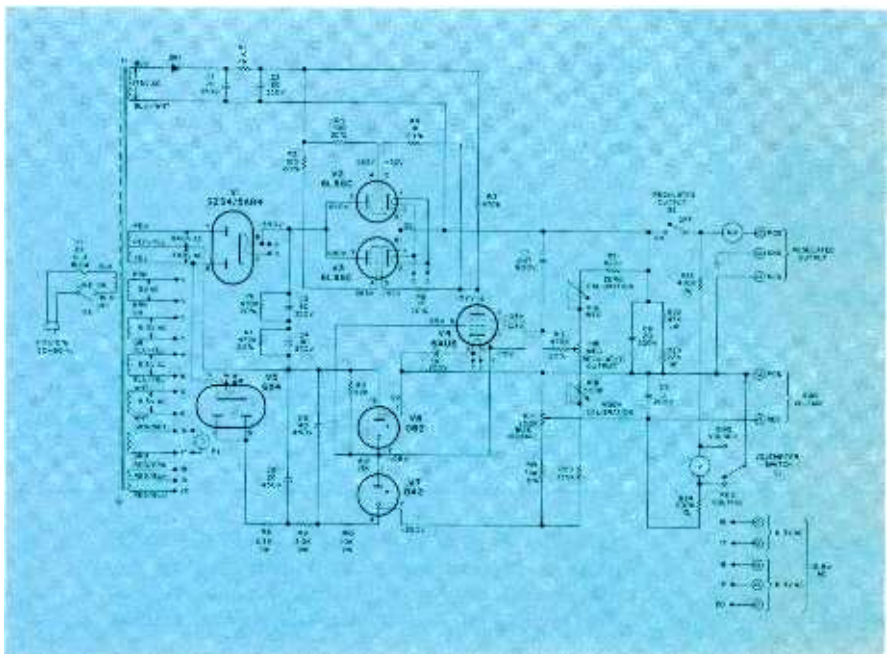

Fig. 2. Manufacturer's schematic of B-12. Note unusual regulation circuit.

The meter in the upper right section of the front panel monitors output voltage, while the one on the left is a milliammeter. Of the 10 universal-style binding posts across the bottom of the panel, two are for bias, five are for AC heater power, and three (+, —, and chassis ground) are for the regulated B+ output.

Separate controls are provided for varying the two DC voltages, and in the center of the panel are three switches—a toggle line switch, a slide type for selecting voltmeter ranges, and another toggle which merely removes power from the REGULATED OUTPUT terminals.

Although the instrument is not capable of handling B+ loads imposed by most TV sets, I found it well suited for powering TV tuners and remote units, radios and radio chassis from combos, audio amplifiers, and other similar gear. The bias feature is also convenient for troubleshooting AVC and AGC faults, clamping points for alignment, and many circuit-design applications.

I was interested to see if the supply could be used for powering transistor portables. After trying this in the lab, I found it did an excellent job; regulation was still good at the low voltages involved, and the AC ripple content was not even detectable. However, since the smallest division on the meter scale for the main regulated supply was 10 volts, I found it more accurate to use an external voltmeter when monitoring such low levels of voltage.

This new Paco unit is more than just a simple AC to DC converter with added tube-filament supplies. Its unique circuit, which employs five vacuum tubes and two gas-filled voltage regulators, is shown in Fig. 2. Considering the regulated B+ output first, note that the power transformer feeds AC to full-wave rectifier V1. In the output circuit of this rectifier, a pair of 6L6GC's act as series regulators. These tubes, in turn, have a control tube (V4, a 6AU6). Notice, too, that the screen voltages of V2 and V3 plus the plate voltage for V4 are supplied by a separate rectifier circuit.

If the voltage across the output terminals attempts to change, an increase or decrease in potential is immediately produced across R18. This varies the control-grid voltage of V4, and conduction of this stage affects the bias on the

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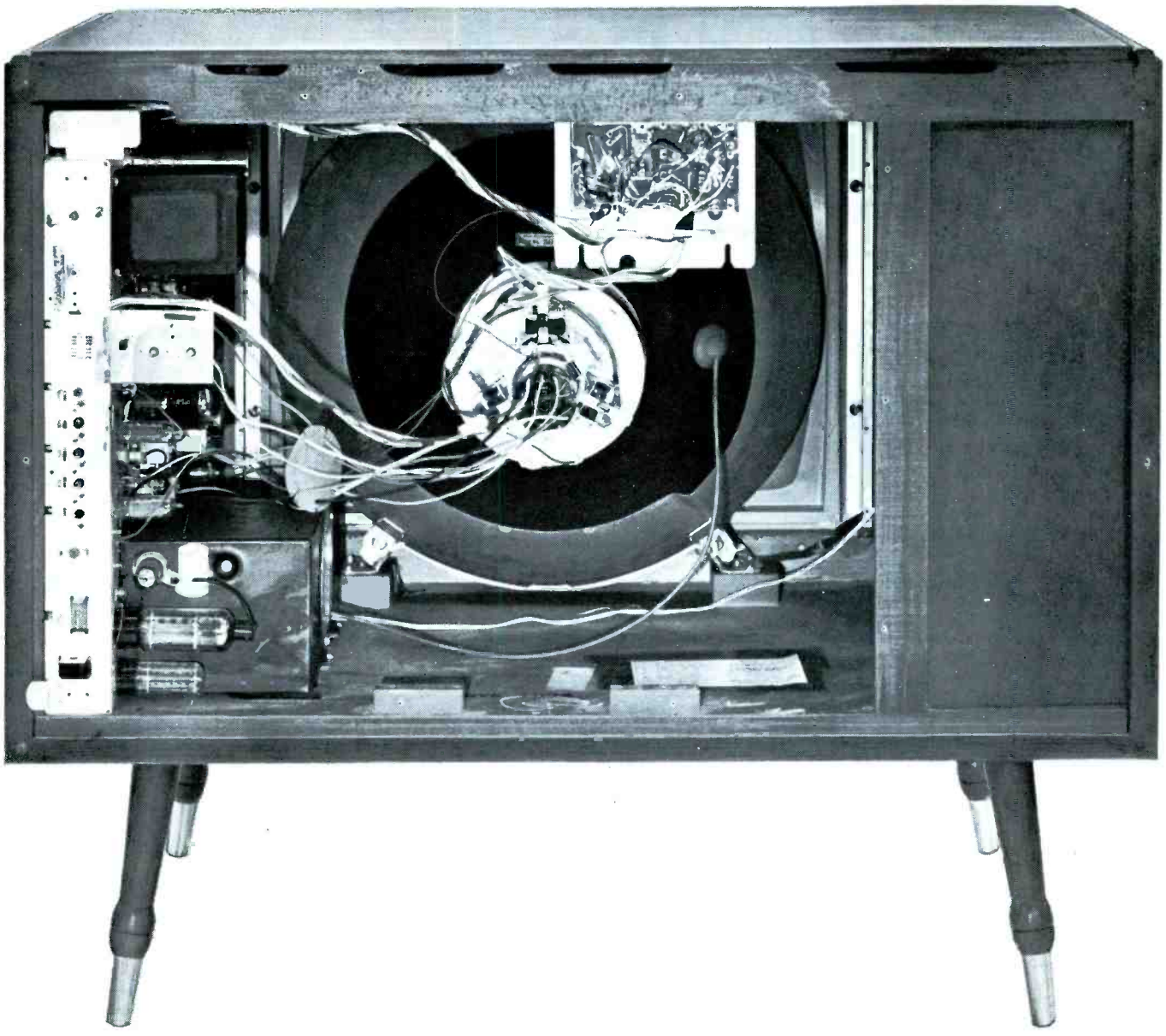

control grids of V2 and V3. These two regulators then cause a load-current change in the whole system that effectively restores the output voltage to its original value.

The bias section relies upon V5 for rectification and V6 and V7 for regulation. Note that the positive output terminal of the bias supply is directly connected to the negative or common side of the main DC output circuit. Control R14 affords panel adjustment of the potential applied to the output terminals.

Two 6.3-volt windings on the power transformer make up the AC filament supply. Connections for series or parallel arrangements of these windings are illustrated right on the panel.

"Watts" Cookin'?

If you'd like to know whether an amplifier is "cookin' on the front burner" or not, try adding a touch of the "ingredient" pictured in Fig. 3 to your next troubleshooting recipe. The instrument shown here is the Model 260 AC Volt-Watt Meter recently introduced by EICO, Inc. of Long Island City, N. Y. Useful in hi-fi and general audio work, the 260 is essentially an AC voltmeter and audio wattmeter. A single wattage scale and a direct-reading db scale provide all power readings, since the unit has built-in compensation for various standard load impedances. As with all EICO products, the unit is available in either kit or factory-wired form.

Fig. 3. New EICO 260 meter reads rms volts and power in dbm or watts.

Specifications are:

1. *Power Requirements—105/125 volts, 50/60 cps; power consumption 15 watts; regulated supply fused and line-isolated;* ON *indicator on front panel.*
2. *AC Voltmeter—11 full-scale ranges of .01, .03, .1, .3, 1, 3, 10, 30, 100, 300, and 1000 volts rms; input impedance 2 megohms shunted by 15 mmf; frequency response flat from 10 cps to 150 kc, –3 db to 500 kc; accuracy ±4% of full-scale deflection; maximum input (AC + DC) 1500 volts.*
3. *Wattmeter—7 full-scale ranges of .15, 1.5, 15, and 150 milliwatts, and 1.5, 15, and 150 watts; internal loads of 4, 8, 16, and 600 ohms provided, with maximum power rating of 40 watts for 4, 16, or 600 ohms, and 80 watts for 8 ohms; maximum power for external loads 150 watts; frequency response flat from 10 cps to 100 kc; accuracy ±5% of full-scale deflection.*
4. *DB Meter—7 ranges from –30 db to +52 db, based on bdm standard (zero db equals 1 mw of AC power*

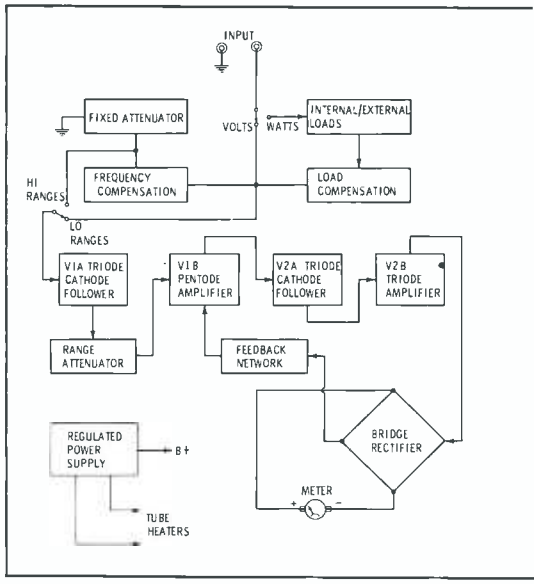

Fig. 4. The 260 is basically a VTVM with load and frequency compensation.

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Jefferson City, York Radio and Television
Joplin, Russell Belden Electric Co.
Kansas City, Walters Radio Supply, Inc.

NEBR., Omaha, Omaha Electronics Co.

N.H., Laconia, Laconia Electric Co.
Nashua, Gate City Electric Co.

N.Y., Albany, Seiden Sound, Inc.
Binghamton, Stack Electronics, Inc.
Bronx, W. Bergman Co., Inc.
Buffalo, W. Bergman Co., Inc.
Radio Equipment Corp.
Hempstead, Standard Parts Corp.
Rochester, Rochester Radio Supply Co.
Syracuse, Morris Electronics of Syracuse, Inc.
Utica, Associated Electronics Supply

OHIO, Akron, The Sun Radio Co.
Chillicothe, Buckeye Electronics Distributors, Inc.
Columbus, Buckeye Electronics Distributors, Inc.
Whitehead Radio Co.
Coshocton, Wagner's Supply
Dayton, Srepco, Inc.
Stotts-Friedman Co.
East Liverpool, United Electronics, Inc.
Lancaster, Buckeye Electronics Distributors, Inc.
Lima, Hutch & Son
Mansfield, Wholesaling, Inc.
Toledo, Lifetime Electronics
Mainline Dist., Inc.
Warren Radio Co.
Warren, Rem Electronics
Youngstown, Armies Electronics
Glen Electronics

PA., Butler, E and E Supply, Inc.
Erie, Warren Radio, Inc.
Harrisburg, Radio Distributing Co.
Philadelphia, Radio Electric Service Co.
Pittsburgh, Lafayette Radio Electronics
M. Leff Parts Co.
Radio Parts Co.
Tarentum, Huston TV Parts
Wayne, High Fidelity House

TEXAS, Austin, Service Electronic Supply

UTAH, Salt Lake City, Manwill Supply Co.

VA., Portsmouth, Distributors, Inc.

WASH., Seattle, F. B. Connelly Co.
Seattle Radio Supply, Inc.

W. VA., Beckley, Chemcity Electronic Dist., Inc.

WIS., Appleton, Valley Radio Distributors
Fond du Lac, Harris Radio Corp.
Madison, Radio Distributors
Satterfield Electronics, Inc.
Manitowoc, Harris Radio Corp.
Milwaukee, Allied Radio of Wisconsin
Radio Parts Co.
Electronic Enterprises, Inc.
Portage, Satterfield Electronics, Inc.
West Allis, Marsh Radio Supply
Wisconsin Rapids, Satterfield Electronics, Inc.

across 600-ohm load); meter scale −20 to +2, giving direct readings on 1-volt range of voltmeter and 1.5-mw range of wattmeter; other positions of range switch calibrated in number of db to be added or subtracted; internal circuit provides automatic dbm compensation for power-db readings taken across other standard impedances (4, 8, or 16 ohms); manual provides correction charts for other than standard loads.

5. *Panel Meter—200-ua DC movement; 4½" face with 4 individual scale arcs (full-scale readings 1V, 3V, 1.5W, and +2db).*
6. *Size and Weight—8½" x 5¾" x 7⅜", 6 lbs.*

The 260 has only two front-panel knobs—a combination function and load selector on the left, and an 11-position range switch on the right. No test leads are supplied; instead, the two input terminals are universal binding posts suitable for pin or banana plugs, clips, or bare-wire connections. An extractor-type holder for the ½-amp line fuse is located on the rear apron of the case, while a calibration adjustment is reached through an access hole (covered by a removable button) on the right side.

The block diagram in Fig. 4 shows how the 260 is equipped to handle a broad range of power and voltage inputs. With the function selector in the VOLTS position, the internal-external loading provisions for power measurements are bypassed. The applied AC voltage is coupled to the grid of cathode follower V1A (the triode section of a 6BL8)—either directly or through a frequency compensator and fixed attenuator, depending on whether a high or low range is required for the measurement.

The output of V1A is divided by a range attenuator and applied to the grid of amplifier V1B (pentode section of the 6BL8). It then passes through both sections of V2 (12AT7). The first half of this tube is a cathode follower serving as a buffer; the second is an amplifier. From V2, the voltage to be measured goes on to the meter rectifier. The DC output of this full-wave bridge produces meter deflection. The scales are calibrated in rms values of voltage or power for a pure sine-wave input. The calibrating control is incorporated in a degenerative feedback path between the rectifier bridge and the cathode circuit of V1B.

To measure power, an internal or external load with some standard value of impedance is switched in ahead of the voltmeter circuit. The function switch provides a choice of eight load positions. A load-compensating attenuator, ganged with this switch, adjusts the input to the voltmeter section so that the same wattage and db scales can be used for all load impedances.

Using an audio generator as a sine-wave source, I found it a very simple matter to check audio-amplifier characteristics with the 260. By substituting one of the internal loads for the speaker system of an amplifier, you can quickly obtain output wattage or db readings. Other applications of the 260 include testing audio amplifiers or individual stages for gain, frequency response, hum, and power consumption; checking resonant frequencies of speakers; and measuring outputs of phono cartridges, tape heads, etc. The 1-kv range of the voltmeter also makes the unit useful for reading exceptionally high AC potentials, such as secondary voltages of power transformers.

Meter-Minded?

Triplett Electrical Instrument Co., of Bluffton, Ohio, has introduced a new vacuum-tube voltmeter. The Model 850, pictured in Fig. 5, offers a wide selection of voltage- and resistance-measuring ranges, plus an easy-to-read meter with 7" scale and 200-ua movement. Scale markings are unusually large and clear; also, peak-to-peak AC voltages are indicated in red. The unit is housed in a black plastic case with etched aluminum panel.

Specifications are:

1. *Power Requirements — 117 volts, 50/60 cps; power consumption 6 watts; one internal 1.5-volt cell (NEDA no. 14) supplied;* OFF-ON *switch and indicator provided on panel.*
2. *DC Voltmeter — 8 full-scale ranges of .5, 1.5, 5, 15, 50, 150, 500, and 1500 volts; input resistance 11 megohms; polarity-reversal switch and zero-center scale provided; accuracy ±3% of full-scale deflection.*
3. *AC Voltmeter — 7 full-scale ranges of 1.5, 5, 15, 50, 150, 500, and 1500 volts rms; also 7 full-scale ranges of 4, 14, 40, 140, 400, 1400, and 4000 volts peak to peak; minimum input impedance .83 megohm;*

Fig. 5. Meter face covers two-thirds of front panel in Triplett Model 850.

GE ELECTRONICS

ONE G-E 21FLP4 PICTURE TUBE REPLACES 13 TYPES

FILLS 25% OF YOUR REPLACEMENT NEEDS

The General Electric 21FLP4 just released. Here's the only picture tube you need for one out of every four replacements. It replaces 13 tube types. Thirteen replacement tubes you *don't* have to order—pick up—pay for—or carry in stock to meet your customers' requirements. It's almost like getting a 13-tube inventory in one picture tube! Quick availability for more of your replacement needs.

The General Electric 21FLP4 is a low-voltage electrostatic focus tube which does not require an ion trap magnet. Saves time and work on service calls and in the shop. The General Electric high-resolution electron gun and deep-cushion phosphor screen help provide the long-lasting, brighter picture your customers want.

The General Electric 21FLP4 replaces these 13 tube types:

21ALP4	21BAP4	21CBP4B
21ALP4B	21BNP4	21CMP4
21ATP4	21BTP4	21CVP4
21ATP4A	21CBP4	21CWP4
	21CBP4A	

Get full details on this 21-inch 90-degree "universal" replacement picture tube from your General Electric tube distributor. General Electric Company, Distributor Sales, Electronic Components Division, Room 8238B, Owensboro, Kentucky.

A FEW WILL DO

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GENERAL ELECTRIC

frequency response 15 cps to 3 mc (to 250 mc with RF probe); accuracy ±3% of full scale; db conversion chart provided in manual.

4. *Ohmmeter—ranges R x 1, 10, 100, 1K, 10K, 100K, and 1 meg; center scale 10; zero and ohms adjustments provided on front panel.*
5. *Optional Accessories — high-voltage and RF probes; leather carrying case.*
6. *Size and Weight — 6⅜" x 7⅝" x 3¾", approx. 5 lbs.*

When I unpacked the 850 for examination, I found an altogether new look in Triplett meters. Instead of having a tall, narrow case and only one large selector knob (as in previous models), this VTVM is wider than it is high, with two main controls. The one at the left is a function selector having five positions (OFF, AC, −DC, +DC, and OHMS); at the right is a range switch with eight different positions. The instrument may be set upright on the bench or else operated in a flat position, resting on four rubber feet attached to the rear panel; it can also be tilted back about 65° by using its pivoted handle as a support.

Only one test cable is employed for all measurements. This probe, which is connected to the Model 850 through a coaxial jack, is a very slim unit with a thumb-operated slide switch for selecting either AC/ohms or DC operation. A separate ground lead is permanently attached to the meter.

Some of you who are not too familiar with meter circuitry, but realize that VTVM's use DC meters, have shown interest in learning exactly how these instruments measure AC voltages. To clear up this point, let's examine the AC input circuit of the Model 850 (Fig. 6). Note that the isolation resistor in the probe is bypassed for AC operation, and that DC blocking capacitors are placed in series with the applied voltage. The two diode sections of a 6AL5 rectify the input signal and produce a DC output proportional to the peak-to-peak value of the AC. This output is then applied to a voltage-divider network, where a certain portion—depending upon the range selected—is tapped off and fed to the grid of a triode stage in the measuring circuit.

In this conventional circuit, employing a 12AU7, the meter movement is connected between the two cathodes. The DC bias change on one grid, produced by the rectified voltage being measured, causes unequal conduction in the two triode sections. This results in a difference of potential on the cathodes and likewise across the meter terminals. Deflection of the meter is calibrated so that indications of AC voltages are read directly on the appropriate scale.

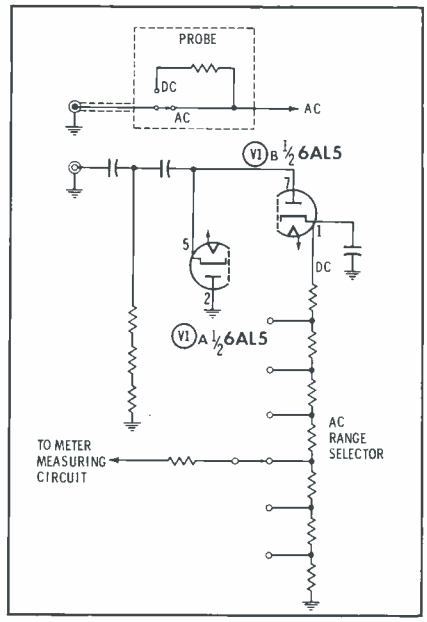

Fig. 6. AC-to-DC conversion circuit of the new Triplett Model 850 VTVM.

Always keep in mind that an instrument of this type actually measures peak-to peak values of AC inputs. The rms values on the meter scale are merely calculated from peak-to-peak results obtained with pure sine waves.

Peak-to-peak measurements afforded by the Model 850 make the meter useful for checking the amplitude of non-symmetrical waveforms such as video, sync, and sweep signals. Through several experiments in the lab, using typical TV waveforms, I found the peak-to-peak readings on the meter even more accurate than many obtained by using a scope and separate calibrating voltage. The loading effect of the meter will, of course, vary with the signal frequency and the impedance of the circuit under investigation; however, I found that attenuation due to loading seldom exceeded 5% of the total amplitude. ▲

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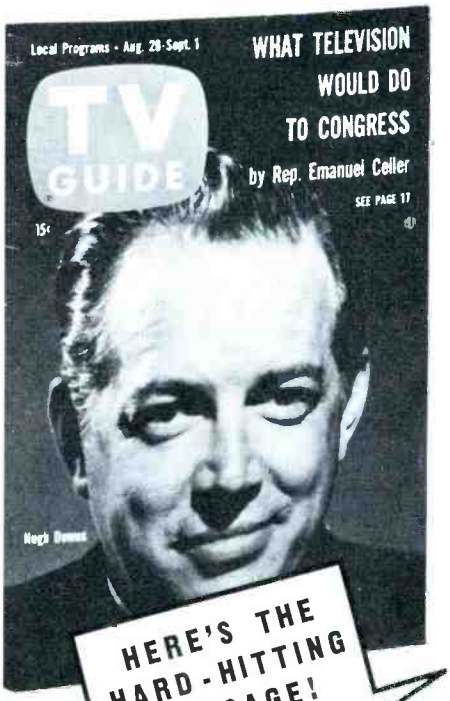

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TV GUIDE

America's biggest-selling weekly publication, reaching more than 7,500,000 TV families . . . an ad each month, every month for a full year . . . to bring the "PEET" Program to the attention of the American public . . . to build dynamic support and demand for services of "PEET" members. There's never been a consistent national ad program like this for the electronic servicing profession . . . with so many valuable tie-in promotional aids available (shortly to be released to the thousands of present "PEET" members)!

NOW MORE THAN EVER IT PAYS TO BE A MEMBER IN THE "PEET" PROGRAM!

HERE'S HOW TO APPLY FOR "PEET" MEMBERSHIP

If you now own a PHOTOFACT Library, or have a Standing Order Subscription to PHOTOFACT, you can apply at once for membership in the powerful "PEET" Program, designed to build prestige and business for the Service Technician who qualifies. Ask your Sams Distributor about "PEET" or write to Howard W. Sams.

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☐ Send me full details on the "PEET" Program, designed to build prestige and business for the Service Technician who qualifies. Include full information on the Easy-Buy Plan and Free File Cabinet deal.

☐ I'm a Service Technician: ☐ full-time: ☐ part-time

My Distributor is:_____

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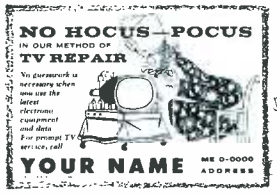
You can keep your fall advertising program swinging along by using a wide variety of ads to keep folks guessing about what you'll come up with next. If your promotional plans call for newspaper advertising, change ads every issue and repeat them every so often to obtain the best results. The whimsical cartoons featured in all of this month's ads will draw fresh attention to each new message.

Check with your printer to see if you should order newspaper mats ($1.75 per set of 5), reproduction proofs ($1 per set), or both ($2.50). Then, fill in the handy coupon on page 90 to order either this month's selection or the entire program of 60 ads. (With the latter, you receive a comb-bound book of proofs.) To be sure of getting your ads in time for your promotion, mail the request as early as possible.

ES-44 1⅞" x 5"
No punches are pulled in this message, which jabs at the "sore spot" of dissatisfaction with slow TV repairs — and promises prompt service from you.

ES-54 1⅞" x 4¼"
This ad, pitting kids against parents in an all-too-familiar viewing debate, is sure to help you increase used-set sales.

ES-56 1⅞" x 5¼"
Alerted by this "poster," set owners are encouraged to call you to cast out the "devil" responsible for short circuits.



ES-7 3¾" x 2⅝"
Here's a humorous way to remind people that you're a wizard at TV servicing because you use professional equipment and techniques.

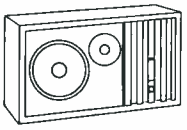
ES-60 3¾" x 2⅝"
This is no "shaggy dog" story; it gets right to the point and tells prospective customers of your complete facilities for hi-fi, radio, car radio, and TV service.

So Compact...

jensen LOUDSPEAKERS

X-10

A startling achievement—an ultra-compact (7¼" H, 13" W, 4⅝" D) 2-speaker system capable of sound you'd expect from a much larger unit. Volume control on front. Perfect for FM Multiplex, very low cost stereo, other-room extensions.



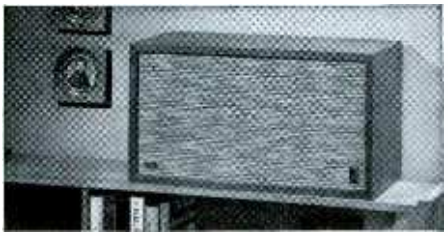
X-10 2-speaker 2-way system for use with amplifier having 4, 8, or 16 ohm output. Power rating 6 watts. Adequate room sound with 1 watt to speaker.
In Oiled Walnut.....**$29.75**

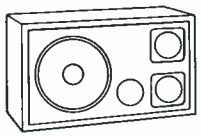
So Big in Sound...

jensen LOUDSPEAKERS

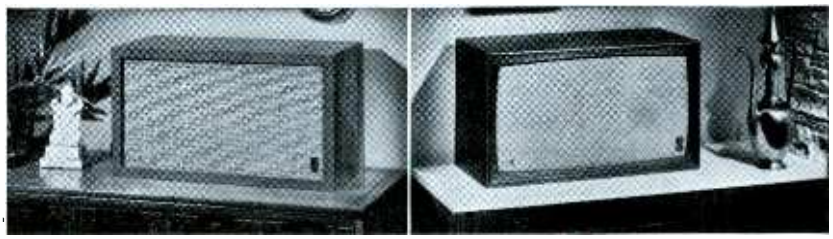
TF-2 ..... TF-3

Strikingly beautiful compact bookshelf systems—perfect for every stereo or mono hi-fi need. Recent "blindfold" tests by audio experts proved a preference for the TF-3 *and* TF-2 over "rated" systems costing much more. Make your own careful comparison. You will be delighted with such big sound in small space.

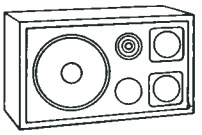




TF-2 3-speaker 2-way system. Full size Flexair* woofer for distortion-free bass response, plus two special direct radiator tweeters giving extended smooth highs. 13½" H, 23¾" W, 11⅞" D.
In Oiled Walnut.....**$79.50**
Unfinished Hardwood.....**$64.50**



TF-3 4-speaker 3-way system. Covers full frequency range with Flexair* woofer in Bass-Superflex* enclosure, two coloration-free midrange units, and the sensational Sono-Dome* Ultra-Tweeter. 13½" H, 23¾" W, 11⅞" D.
In Oiled Walnut.....**$99.50**
Decorator Styling.....**$109.50**
Unfinished Hardwood.....**$79.50**



*T.M. Reg.

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In Mexico: Universal De Mexico, S.A., Mexico, D.F.

Schoolroom TV

(Continued from page 37)

flectors are good here, since almost all their gain is in the vertical plane. They have a flat, wide pattern — very narrow up and down, but broad from side to side.

Point A is somewhat of a stinker, since the aircraft can be in any direction from the receiving antenna, including straight up! It can be at any distance from 5 to 25 miles, and the lobes of the transmitting antenna itself can be cutting across the receiving antenna. This calls for a special kind of antenna, the turnstile—an omnidirectional type which receives equally well from any direction. Consisting of a pair of interconnected dipoles mounted at right angles to each other, this design is embodied in a familiar type of FM radio antenna. (If you need an antenna of this type for UHF, write the author for constructional details—there's too much verbiage involved to describe it in this article.) Installations under point-A conditions should also have excellent AGC, because the signal strength can change by 20 db (tenfold) during each orbit.

Single-Set Installations

Even if only a single receiver is being connected to an antenna, many precautions must be taken to compensate for the extreme attenuation produced by the transmission line on the upper UHF channels. Flat lead-in cable is unsatisfactory, since any moisture or dirt which collects on the insulation will produe a low-resistance leakage path between the conductors and will tend to short out the signal. This effect can be greatly lessened by using round, foam-filled 300-ohm twin-lead of the same type commonly used in present UHF areas.

Here are several other pointers on minimizing signal losses: (1) Keep the lead run as short as possible; trim off all excess length. (2) Do not splice the cable. (3) Avoid running the lead-in within *three feet* of other antenna, phone, or power lines. (4) Use 7" stand-off insulators to keep the lead-in spaced well away from the building, and install no more stand-offs than necessary to provide secure support. (5) Do not crimp the stand-off "eyes" against the cable.

Distribution Systems

If more than just a few television sets will eventually be installed in a school, it is cheaper to install a signal-distribution system than to depend on an individual antenna for each set. The system converts the incoming signals to VHF before applying them to the various receivers. Thus, since only one master UHF converter for each channel is required, VHF-only receivers can be used in place of all-channel models at a saving of $30 to $35 per set. In addition, the system provides amplification which results in plenty of signal strength, in spite of multiple-set connections and long lead runs.

A system for the present MPATI setup consists essentially of two UHF antennas (one for each channel), two UHF converters of the fixed-tuned type, a distribution amplifier or amplifiers, cables, and tap-off devices. Coaxial cable is used everywhere except between the antenna and converter. This one connection is generally made with unshielded line (round 300-ohm lead) to minimize UHF signal losses.

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GENERAL ELECTRIC TV IS MORE RELIABLE THAN OTHER LEADING BRANDS

PROOF—A recent study of 5050 TV sets under service contract showed that General Electric TV needed 20% less service than the second best of the leading television brands.*

PROOF—The same study also showed that the average of other brands required 63% more service (factory faults requiring service inside set) than General Electric.*

*This study covers the first 90 days of use of new TV sets purchased in 1960. All sets included were under service contract to the Planet Electronics Corp., a prominent independent service company in New York City. The leading brands of television receivers were included. The results were tabulated and reported by Audits & Surveys Company, Inc., a leading research organization. If you wish additional information on this survey, write to General Electric Company, Room 112, Building #5, Electronics Park, Syracuse, N. Y.

What this means to you: Facts prove that once a General Electric television set is fixed, it stays fixed! Fewer repeat calls mean more free time for you to make more calls to new customers. Fewer repeat calls mean fewer irate set owners. Fewer repeat calls mean more customer satisfaction and an enhanced reputation for you. The word spreads about the quality of your work. Your reputation grows and so does your business.

Progress Is Our Most Important Product

GENERAL ELECTRIC

TELEVISION RECEIVER DEPARTMENT, SYRACUSE, NEW YORK

Dual antennas and converters are needed because both channels must be available at the same time. If local VHF or UHF stations are also to be viewed, they can be added to the system at slight additional cost.

Certain points essential to the acceptance of a system are checked off in Fig. 3, which shows a block diagram of a typical reception hook-up. Antenna requirements (at the top of the list) have already been discussed. When the best possible antenna arrangement has been made, it's time to determine what characteristics the UHF converter must have in order to maintain a good noise figure for the system. Primary factors are the noise figure of the converter itself, and the ratio of signal to noise in the VHF-channel output.

All installations need a converter with a good noise figure—as close to 10 db as possible. To take advantage of this noise figure, the lead between antenna and converter must be kept as short as possible. As previously mentioned, signal losses in transmission lines at UHF are terrible—about five times worse than on high VHF channels, and about eight times as bad as on low-channel VHF.

Bear in mind that if the noise figure is 10 db, the noise will be about 3.3 microvolts in the converter itself. Producing really good pictures (with a signal-to-noise ratio of 40 db) will require 100 times as much signal—or 300 microvolts. If a system receives 330 microvolts *at the antenna,* and uses a 50′ tubular down-lead, about 6 db will be lost in the lead. This will leave the converter only 165 microvolts to work with, and will result in a signal-to-noise ratio of 34 db — or 50 to 1 instead of 100 to 1.

Antenna-mounted converter-mixer units are available to cut lead losses in situations such as this. The UHF oscillator in some models is on a separate chassis inside the building, with its output signal carried up to the mixer by cable.

Converters used should have crystal-controlled oscillators to insure frequency stability — a fact noted by the MPATI people in their recommendations. It is distracting to students if the fine tuning of the receiver has to be adjusted during a broadcast because of local-oscil-

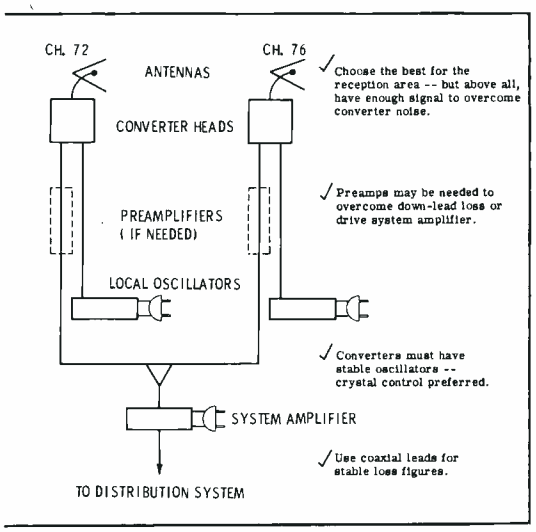


Fig. 3. Distribution-system components used for receiving MPATI programs.

lator drift.

If signal strength at the converter output is so low that less than 1000 microvolts are delivered to the input of the system distribution amplifier, then it's a good idea to reamplify them right at the converter output, using a low-noise preamplifier. Units of this type are also available for mast mounting.

The distribution system itself is fairly conventional, except that the need for AGC may be more critical. This is best judged after checking signals "straight off the antenna"—if variations of 10 db or more are observed, the main amplifiers should be AGC-controlled.

The installer should find out what the school may be considering in the way of closed-circuit television; this field is becoming very active in schools, and educators are looking to the future. Officials of a particular school may want the wiring to conform to a CCTV plan not yet in effect. Special classroom outlets are available which allow the cable to be used as a CCTV camera input or output, as well as for feeding broadcast TV programs into the room. Systems using these outlets are laid out somewhat differently from conventional systems and are extremely flexible.

Once an installer has carefully determined what the school wants to do, he can then consult with a manufacturer of distribution-system equipment; engineering advice is usually free, but generally requires that the installer work through his local distributor. ▲

THE TROUBLESHOOTER

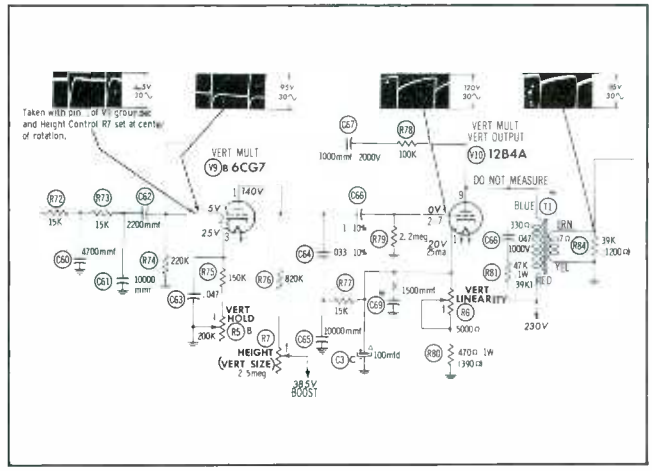
answers your service problems

Channel 5 Shrinks!

I'd appreciate your help on an Artone using a Trav-Ler Chassis 1053-69. Channels 2, 4, and 11 do fine, but when the set is tuned to channel 5, the picture pulls up about 3" from the bottom.

JIM'S TV SERVICE
Collinsville, Ill.

Since the picture shrinks only on channel 5, it sounds like tuner trouble. Check B+ to see if it drops drastically on channel 5. If so, there's probably a short in the channel-5 section of the tuning wheel. Since channel 6 is not used in your area, try tuning its oscillator slug to channel 5. If you receive a full-sized picture, you'll know the tuner is at fault.



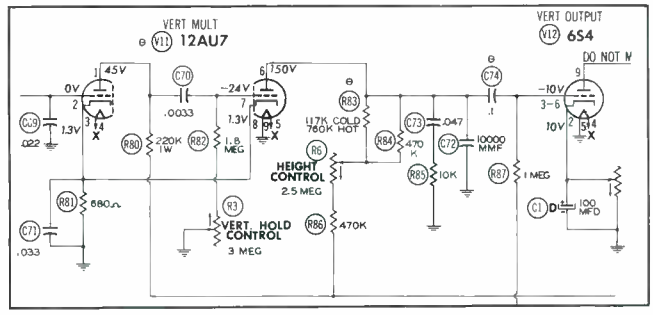
If the trouble persists, make critical voltage and waveform-amplitude measurements in the vertical circuits, checking to see if switching the tuner to and from channel 5 causes an appreciable change.

Warm-Up Roll

When a Philco Model 22D4151 is first turned on, the picture drifts down fairly rapidly. It slows down and stops after about 5 or 10 minutes. What would you do?

CARL H. MILLER
N. Wildwood, N. J.

Drifting vertical hold during warm-up can be caused by many different things. The components most likely to be causing your trouble are C70, R82, C71, R81, and temperature-compensating resistor R83. If you substitute for R83, be sure to use an exact replacement.



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WITH

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ET-1
Mixer/Oscillator
Converter PNP

ET-2
IF Amplifier PNP

ET-3
AF Amplifier
PNP-6V

ET-4
AF Amplifier
PNP-12V

ET-5
AF Amplifier
PNP-9V

ET-8
Mixer/Oscillator
Converter NPN

ET-6
AF Power
Amplifier PNP

ET-7
AF High Power
Amplifier PNP

ET-9
IF Amplifier NPN

ET-10
AF Amplifier
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Radio Switcheroo

A customer wants to take the radio out of a truck which has the negative battery post grounded and install it in another truck with a positive battery ground. The radio is a 12-volt model with a vibrator. What changes would have to be made?

WALTON A. VONMAONEN
Lynnville, Iowa

None; since the radio does not have a transistor, you can install it in any automobile or truck regardless of which battery terminal goes to ground. None of the 12-volt auto radios were designed with a synchronous vibrator; therefore, polarity doesn't make any difference.

Station Repeater

A Motorola Model 52M1U portable picks up our two local stations (1290 and 1440) all up and down the dial. However, even the strong New York stations won't come in anyplace. There must be a simple explanation, but it escapes me.

S. ANDERSON
West Islip, N.Y.

Chances are the oscillator section of the 1R5 isn't working. Vary the tuning gang and measure the oscillator grid voltage at pin 4. It should range from —5 to —15 volts if the oscillator is working. Be sure to try a replacement 1R5 and make sure it is receiving the proper filament and B+ voltages. Oscillator coil L2 may be defective if everything except the negative voltage on the grid checks out OK.

Eats 6U8's

An RCA Chassis KCS104 knocks out a 6U8 sync separator-AGC keyer every two or three months. The filament doesn't go bad; the AGC section just quits working. There doesn't seem to be anything wrong in the circuit, so what can I do?

EUGENE ACOSTA
Bronx, N.Y.

Repeated failure of the 6U8 in the AGC keying and sync separator circuits in some of these receivers has always been a problem. It results from damage to the tube by the applied pulses, and seldom indicates a defect in the receiver. The best solution is to use one of the newer tubes designed for this application, such as a 6EA8 or 6GH8. The latter is possibly the best replacement in this particular stage.

5642 Query

Are the two 5642 tubes in a Sylvania Model 7140MA supposed to glow a purplish color? This is my first experience with these tubes. The set has a very faint picture, but I don't know whether to suspect the tubes or not.

THOMAS C. SHIPLEY
Hyattsville, Md.

It isn't unusual for these tubes to have a slight purple glow during normal operation. However, any excess glow would indicate higher-than-average gas content. In order to tell whether or not the rectifiers are causing the dim picture, measure the high voltage. If it is below normal, you can suspect trouble in the high-voltage doubler circuit.

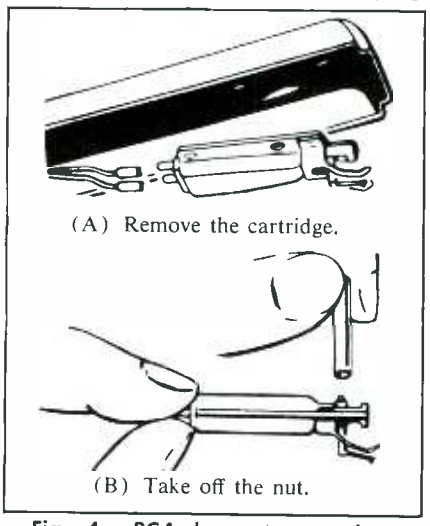
Cartridge and Needle Replacement

(Continued from page 39)

arrangement, are removed as illustrated in Figs. 2A and 2B. As in A, you first push the retaining spring back with the tip of your finger; then, by holding the butt end of the needle, carefully lift it out of the cartridge as shown in B. A couple of other spring mountings are shown in Fig. 3. To remove the dual-type needle shown in A, the button on top of the tone arm is held down; then the needle assembly is turned at a right angle to the cartridge, and slid forward and out. The button is also depressed while a new needle is being put in. Make sure that the tips on a new needle are properly positioned to conform with the operating indications on the button. You can remove the needle shown in Fig. 3B by holding the butt end of its shank between your fingertips; pull it to one side and out from under a retaining spring. Follow these instructions in reverse order to install a new needle.

Another needle-replacement job that may take a little "doing" is illustrated in the drawings of Fig. 4. Here, the cartridge must first be removed and disconnected from the tone arm (Fig. 4A). With a small wrench, the hex nut on top of the cartridge is then removed (Fig. 4B). The needle is now free to be lifted out.

Needles in some of the newer stereo cartridges are held in only by friction—but in a different manner from the vertical shank needles. In most cases, you'll find it easier to change the needle if you unplug



(A) Remove the cartridge.

(B) Take off the nut.

Fig. 4. *RCA* hex-nut mounting.

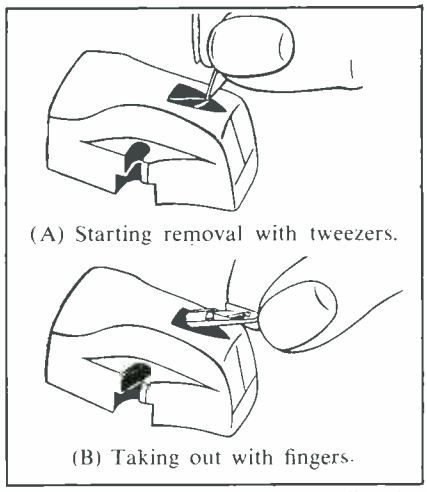


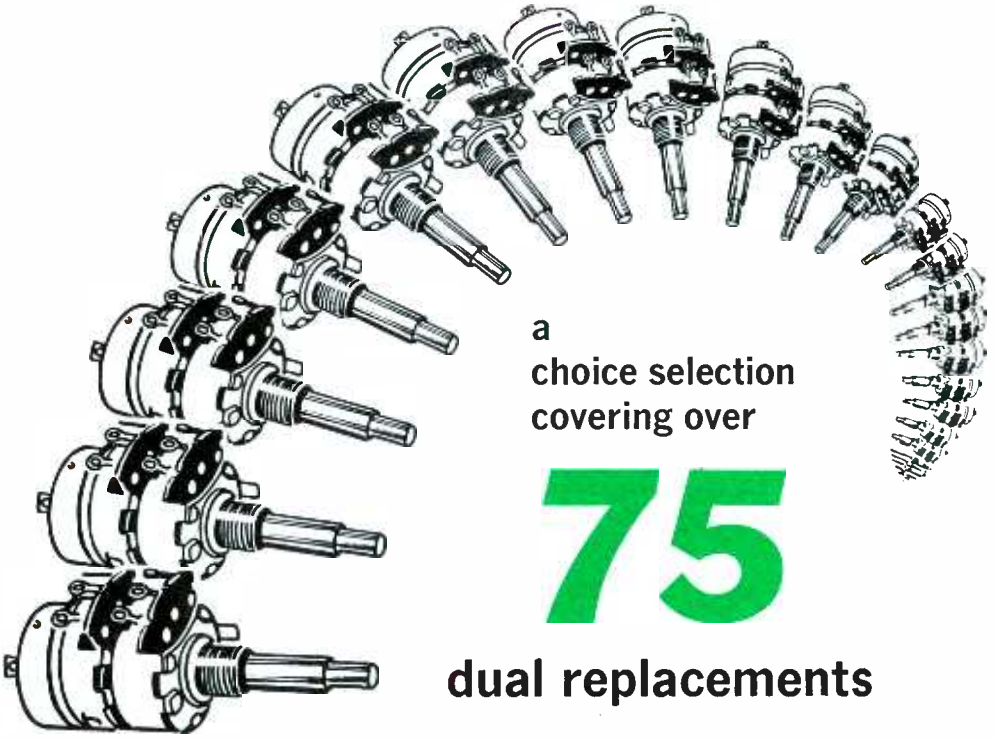
Fig. 5. "Pull-out, push-in" needles for some *Electro-Voice* and *Shure* units.

the cartridge from the tone arm. As shown in Fig. 5, you can pull out the needle-guard assembly by using a pair of tweezers or a pointed tool until you can reach it with your fingers. When installing the new unit, avoid coming in contact with the needle tip as you apply pressure to seat the assembly.

Cartridges

The other "front-end" component of a phonograph is the cartridge or pickup which transforms minute vibrations into electrical signals for the amplifier system. If you suspect a dead or very weak cartridge, you can easily check its output by placing your finger first on the "hot" lead in the tone arm, and then on the needle shank. If the unit is defective, you'll notice a difference in noise output from the amplifier. A good test record and a sensitive scope or VTVM can spot other cartridge deficiencies.

As an aid in selecting a replacement, some original units are labeled as to manufacturer and model number. You also may be able to identify the cartridge by its physical design. This information can be useful when you are referring to a cross-reference guide covering several cartridge manufacturers. Such a pictorial guide and listing is shown in Fig. 6A. Part numbers can also be obtained from service data on the equipment using the cartridge. A replacement can then be found by using a guide like that pictured in Fig. 6B. In the reference guide of Fig. 6C, model numbers of various phono manufacturers are keyed directly to each replacement cartridge.



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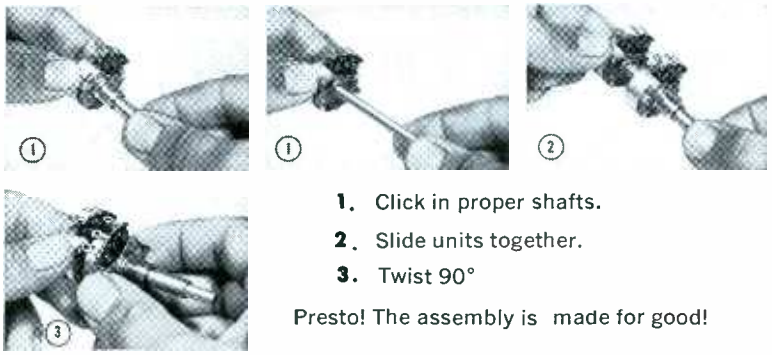


1. Click in proper shafts.
2. Slide units together.
3. Twist 90°

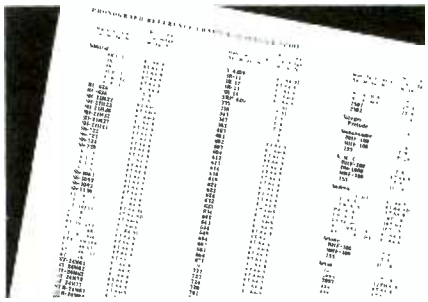
Presto! The assembly is made for good!

CLAROSTAT

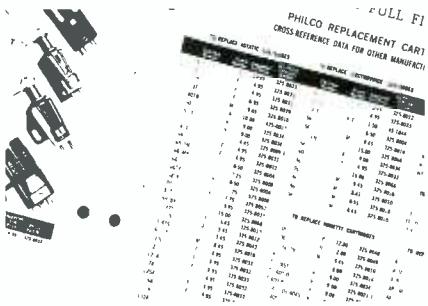
CLAROSTAT MFG. CO., INC. DOVER, NEW HAMPSHIRE

Replacement kits containing only a few cartridges with universal mounting hardware are now available. The kits are made up so that each cartridge has a number of applications. Producers not featuring a full line of general or exact replacements are also making their new cartridges relatively small and with standard mounting provisions. Therefore, you may be able to offer your customer a replacement from a higher-quality line. When recommending a cartridge of this type, however, let the characteristics of the entire phono system dictate the quality and price of the replacement. Don't "shoot the moon" if the system is only average; by the same token, be careful not to recommend an inferior cartridge for a good high-fidelity system.

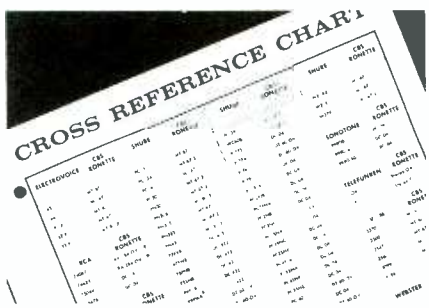
For those engaged in phono repair work, a stock of popular cartridges not only saves frequent trips to the distributor's, but is also very convenient for substitution testing both in the customer's home and at the bench. However, since it is impractical for the average serviceman to maintain a complete line of phono cartridges, we suggest that your replacement stock be governed by the phonos serviced in your particular area.



(A) *Sonotone* data.



(B) *Philco* data.



(C) *CBS-Ronette* data.

Fig. 6. Original pickup is identified and replacement noted in these guides.

Replacement Hints

Aside from the differences in monophonic and stereo applications, one of the first considerations in choosing a replacement cartridge is its "physical fitness." Will the unit fit inside the tone arm? Is there clearance for a needle-selector knob? Do the mounting centers line up? Generally, the replacement should also be of the same basic type as the original—for example, ceramic or variable-reluctance — and the needle or needles should be suitable for playing records recommended for the phonograph. Weight of the replacement will also have a bearing on tracking force; therefore, differences here should be kept within reasonable bounds.

Just as important as physical aspects are electrical characteristics such as the frequency response and output voltage of the replacement. An original unit with a frequency range of from 50 to 18,000 cps

should not be replaced by a cartridge with a more limited response —say, from 75 to 7000 cps. If a change must be made, it's better to increase the response when possible.

The output voltage for most standard replacements can normally be classified as either high (2 to 5 volts) or low (below 1 volt). This, of course, does not apply to certain high-fidelity pickups designed to produce outputs in the millivolt range. About the only time you are apt to run into trouble with output voltage is when you attempt to replace an older high-output cartridge with one of the newer low-voltage types. The result will be a great reduction in over-all volume from the instrument and often more noticeable hum. This mismatch can sometimes be overcome, however, by changing the value of a series resistor or by bridging a coupling capacitor in the amplifier input circuit.

Some of your customers may inquire if their monophonic systems can be used to play stereo recordings. They can, but the lack of vertical compliance in the cartridge and the difference in needle size will soon ruin the records. If a customer wants to play stereo records on a mono system, or plans to convert to stereo in the near future, it would be wise to recommend a stereo replacement cartridge. Provided you find a unit that has sufficient output and will mount properly, you can merely combine the two outputs to feed the single amplifier cable. While you're at it, you might wire the tone arm for future stereo operation by running a pair of shielded cables (one for each channel) back to the rear connectors. If the customer so desires, you might also install a switch at this point for selecting either a single- or dual-channel output from the cartridge.

Most of the cartridges you'll encounter will be held in the tone arm by a spring clip or simple screw arrangement. Standard mounting centers for all units are either 1/2" or 7/16", and many in the replacement line will have provisions for both dimensions.

After you have installed any new cartridge, always check the tone arm adjustments — especially for tracking force. This can be accomplished by using a small gram scale and referring to recommended figures in the service data. Fig. 7 shows typical tone-arm adjustment points for several well-known phonographs. ▲

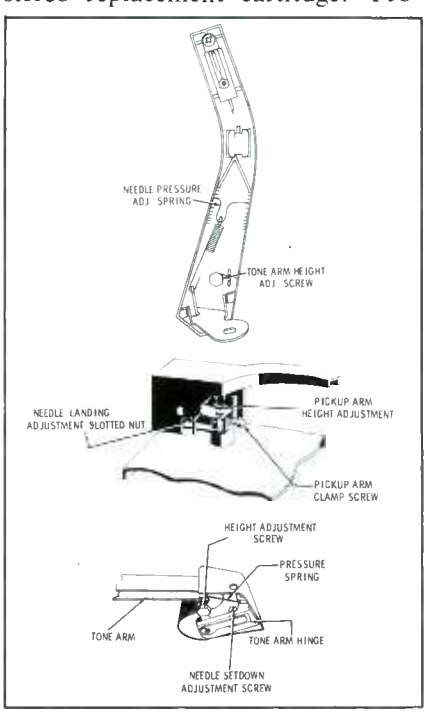


Fig. 7. Replacements are not complete until tone-arm adjustments are made.

Painless TV Alignment

(Continued from page 33)

plifier. For instance, a smeary picture can be produced by an increase in value of a video-amplifier load resistor, as well as by narrow IF bandpass. Picture ringing may be due to a defective video peaking coil rather than excessive IF bandpass.

The technician, like the layman, is readily deceived by the appearance of the picture. A sweep generator and scope give a far more positive indication of misalignment. However, if a quick check of bandwidth is necessary, it is possible to obtain this information by viewing the composite video waveform at the plate of the video amplifier. A 7875-cps sweep rate is used, and the scope trace is expanded so that the corners of the horizontal sync pulse can be clearly seen. Rounding (Fig. 3A) indicates that the over-all bandpass is too narrow, while ringing (Fig. 3B) results from excessive bandwidth. In most cases, correct alignment should provide the normal pattern of Fig. 3C.

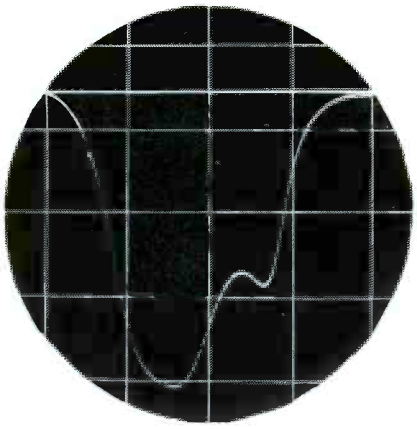
There are several cautions to observe in making this test. First of all, the scope must be a wide-band unit. In addition, the antenna used with the receiver must give flat response over the full bandpass of the received channel. (To check this point, try all channels available in the area.) Finally, the waveform of Fig. 3C can be expected only if the receiver has an over-all bandpass on the order of 3 mc or better. A number of sets, especially portables, are designed for fairly narrow-band operation; thus, they will normally round off the corners of the sync pulses. In some models, this effect is reduced by making up for narrow IF bandwidth with additional high-frequency peaking in the video amplifier. Thus any servicemen who tries to realign the IF for broader bandpass is likely to be stuck with a bad case of ringing.

Remember, the sync-pulse check is strictly a "quickie" test which becomes valuable only after a bit of experience.

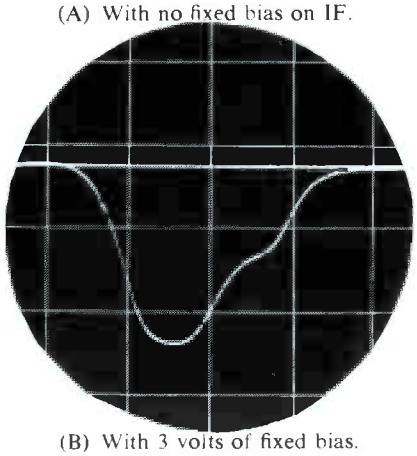
Facts About IF Response

All TV sets have five IF-bandpass requirements in common, as demonstrated by Fig. 4. Point A, the picture-carrier frequency, should be set at approximately 50% of maximum amplitude. Point B, at the 50% level on the other side of the curve, should generally be more than 2.5 mc but less than 4 mc away from point A—depending on set design. (The difference between A and B is the "bandwidth" referred to elsewhere in this article.) The trace from point C to point D (0.75 mc either side of the picture-carrier frequency) should be a relatively straight line to insure accurate low-frequency reproduction. The top of the curve, between equal-amplitude points E and F, should be relatively flat; also, the shoulders should be well-rounded (except in a few receivers with very wide bandpass). Finally, the sound-carrier point G, 4.5 mc away from point A, should dip to a very low amplitude. Points A, B, and G are the most critical.

Three basic types of tuned circuits, which differ in both gain and frequency bandpass, are used for coupling between IF stages. The bifilar-wound transformer (Fig. 5A) is probably the most common. It has a relatively narrow bandwidth, tunes to a single peak with one core, and has a gain of unity.



(A) With no fixed bias on IF.



(B) With 3 volts of fixed bias.

Fig. 7. Curve involving simple AGC.

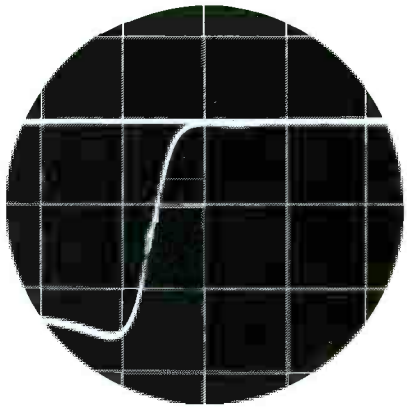
Fig. 5B shows an overcoupled, double-tuned transformer, which has a wider bandpass, provides some transformer gain, and tunes to a flat or double-peaked response. The series-tuned network in Fig. 5C includes two coils with capacitive, but not inductive, coupling. In addition to coupling capacitor C1, there is usually a length of coax connecting the coils; this introduces stray capacitance represented by the dotted-in capacitors on the schematic. Each coil is tuned separately to a frequency determined by its inductance and the total capacitance. This network is adaptable to a variety of response patterns — wide and flat, tilted, or fairly sharp. Usually, the gain is less than unity.

Most receivers use at least two of these circuits in the IF section, and some sets use all three types. When bifilar transformers are employed, they are usually peaked to certain frequencies, and the overall bandpass is finally shaped with one of the other circuits. Variations of all three circuits are sometimes used to take care of special requirements for broadening or sharpening the response. The bifilar transformer itself is a variation of the tuned-choke (inductive-capacitive coupling) network shown in Fig. 6.

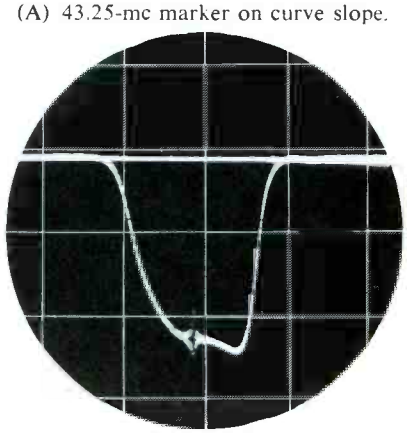
Choosing an Alignment Method

The two most common sweep-alignment methods differ mainly in how the sweep signal is fed to the receiver. In the over-all technique, the sweep signal is at channel frequency, with markers at IF. The sweep is coupled to the receiver antenna through a matching network, and the markers are loosely coupled to some point in the IF strip. This method has the advantage of convenience in injecting the sweep signal, but it also has a few drawbacks. For one thing, you cannot be sure of accurate results unless the RF response of the tuner is correct. The fine tuning must also be very accurately adjusted, so that the local oscillator is operating on the correct frequency. Furthermore, not all sweep generators provide the separate marker output required for this method.

The alternate technique, wherein the sweep signal is capacitively coupled into the mixer by way of a floating shield or insulated metal strip, has the disadvantage of being



(A) 43.25-mc marker on curve slope.



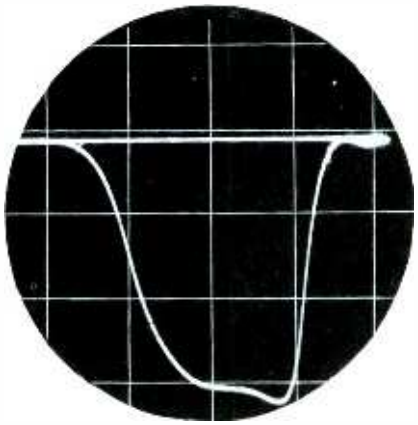
(B) Curve should look like this.

Fig. 8. Major frequency error.

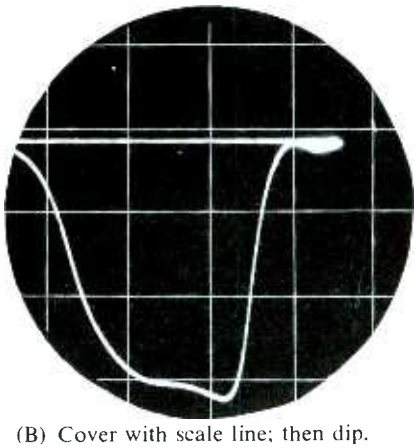
subject to distortion caused by the local oscillator on certain tuner settings. However, this disadvantage is easily overcome by disabling the oscillator (more about this later) or by selecting a channel where the bandpass curve is obviously not being affected by the oscillator. On checking all channels, you will usually find that a fair proportion of them are undisturbed by oscillator operation. An important advantage of this alignment method is that it can be used with virtually all sweep generators and scopes in general use. The marker generator does not have to be a separate piece of equipment, but can be an integral part of the sweep generator.

Alignment Bugbears

Certain annoying effects crop up in practically every alignment setup. Two of the most common problems are spurious beats (pips) produced by the local-oscillator signal, and hash on the response curve caused by radiated horizontal pulses. The oscillator interference can be removed by wrapping a strand of fine wire from the grid pin to the cathode pin of the oscillator tube. Hash due to radiated horizontal pulses is merely a nuisance, and it



(A) Find trap frequency with marker.



(B) Cover with scale line; then dip.

Fig. 9. Using scale to tune traps.

often can be ignored unless it is strong enough to compete wth the markers. In this case, you can minimize it by keeping the "hot" scope lead to the video detector as short as possible, in addition to connecting a 500- to 1000-mmf capacitor across the vertical terminals of the scope to bypass the pulses. Another way to get around the problem is to kill the horizontal oscillator *momentarily* while checking marker points. There are other means of eliminating the hash, such as disabling the horizontal output stage, but these measures are not often necessary.

How to Simplify Alignment

Any trick that reduces the amount of equipment used in alignment will make the process that much easier.

Skip the Fixed Bias

In checking the alignment of a receiver that uses the voltage developed across the video-detector load as AGC bias, you can check the alignment without using a bias box — if you keep the sweep-generator output at a very low level. Here's proof: Fig. 7A is the bandpass curve of a receiver of this type, obtained without using fixed bias.

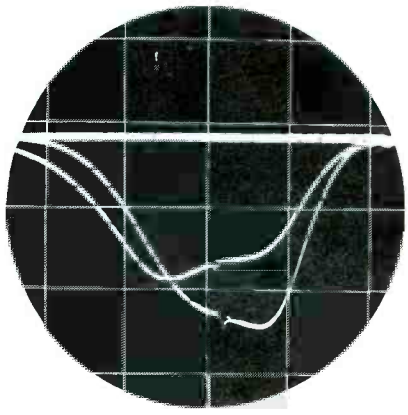


Fig. 10. Low and high curves—seen before and after peaking one adjustment.

Applying 3 volts of AGC-override bias to the same receiver resulted in the curve of Fig. 7B. Both waveforms display a tilted bandpass which reveals the need for alignment. In addition, both curves have less than normal amplitude at the picture-carrier frequency (note the barely perceptible marker on the left skirt), further indicating the need for realignment.

When no fixed bias is applied to the AGC line, it is important that the signal at the video detector be kept low enough to avoid peak-flattening in the curve or a tendency toward IF oscillation. The best precaution is to set the scope sensitivity so that 2 volts equal 2" of deflection (on a 5" scope), and then keep the sweep-generator output low enough to avoid exceeding this waveform height.

Check for Proper IF Range

As soon as you have set up the alignment equipment and obtained a rough curve, tune the marker generator to approximately 1 or 2 mc below the picture-IF frequency, and make a quick frequency-range check. If the marker falls on top of the curve, you can proceed with alignment. If it does not, the curve may be a spurious beat signal, or the local oscillator may be incorrectly tuned for an over-all RF-IF check; on the other hand, regeneration or gross mistuning in the IF strip may be indicated. Fig. 8A shows an odd result of this check on a set that seemed badly in need of alignment. The marker is at 43.25 mc. My doubts that mere misalignment could cause such a severe frequency shift were confirmed when, on further examination, I discovered that someone had replaced the

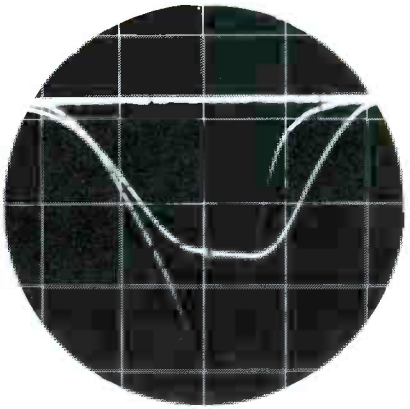


Fig. 11. VTVM alignment might not reveal enormous peak in middle of curve.*

12AU7 video detector with its industrial equivalent, a 5814. Installing a new 12AU7 shifted the bandpass back to the normal range, as shown in Fig. 8B.

Use Scope Scale to Tune Traps

Much has been written about techniques for viewing markers in trap notches. Removing the bias box, expanding the trace horizontally or vertically, and increasing the sweep signal are among the suggestions that have been advanced. By and large, these tricks are a waste of time. A trap notch can actually be adjusted with the marker turned *off*. Here's how: Before removing the marker, first set it to the trap frequency and detune the trap so that the marker rides up into view (Fig. 9A). Next, using the horizontal centering adjustment of the scope, shift the entire waveform until the marker coincides with a vertical scale line on the scope face. Then, turn the marker generator off, if you like (it isn't necessary to

(A) Size comparison with match.

(B) Wand being used to check tuning.

Fig. 12. Tuning wands for alignment.

do so), and tune the trap so that the curve dips at this line as shown in Fig. 9B.

Dispense With the VTVM

Many alignment instructions specify using a VTVM for adjusting coils or transformers which are peaked at one definite frequency. Why not use the scope instead, since you'll eventually have to hook it up anyway for the final response check? With the sweep generator and scope set up as usual, place the marker at the resonant frequency of each coil in turn, and tune the slug for maximum amplitude of the waveform at the marker. At first, you will probably find it a little hard to ignore other portions of the waveform which may be rising faster than the marker, but you can soon train yourself to concentrate on the one point you are interested in at the moment. Fig. 10 shows how the curve is likely to shift, as well as grow in amplitude, when one slug is turned.

The scope method of pre-peaking has many advantages over the use of a VTVM. As the various stages are aligned, the over-all bandpass begins to take on its ultimate shape before your eyes. In addition, the scope catches faults in the curve (such as the extremely high peak in Fig. 11) which could conceivably be missed if a VTVM were used.

Use Tuning Wands

To aid in final shaping of bandpass curves, I use the home-made tuning wands shown in Fig. 12. These units, smaller than any I have seen commercially available, were made out of small powdered-iron cores (from old radio IF transformers) and 1/8″ brass slugs, fastened on 1/16″ nylon rods.

If the bandpass of a video IF section does not look quite right on the final response check, I dip each end of the wand into various coils while watching the scope for improvement. If a coil responds well to insertion of the powdered-iron tip, I tune its slug farther into the coil form; on the other hand, an improvement obtained with the brass tip tells me to back off the slug. In this way, I almost effortlessly prove to my satisfaction that I've done the best possible alignment job. ▲

TV Intermittents

(Continued from page 26)

to be just a bit of a ham actor. It does!

If you happen to have a loaner TV, this might be the place to use it—especially for one of your better customers, or one who puts up a fuss at losing use of the set for a few days. Tell the customer, "We may have trouble getting the thing to act up at the shop, and we don't want you to miss Gunsmoke!" Besides keeping him pacified, this is a dandy way to sell second sets or new portable TVs, if you're also a dealer.

Investigation

The second I is Investigation. You might as well go ahead and pull the chassis; you'll have to, anyhow, in 90% of all intermittent troubles. When you get it out of the cabinet, go over it very thoroughly, looking for burned resistors, loose solder joints, and anything that could cause the trouble. A careful physical examination has cured many an intermittent.

Information

The last I is Information. Before you do anything else, get out the service data on the set, and look it over closely — paying particular attention to the stages where the trouble seems to be located. Don't overlook a component in another circuit which, because of interlocking action or connections through power supplies, could be at the root of the trouble. For instance, one well-known chassis has a typical intermittent AGC trouble which is caused by an open grid resistor in the audio stage. The defect fouls up the 150-volt line, since the audio tube is part of a stacked B+ circuit. This, in turn, affects the screen voltage on the AGC keyer.

Another good idea is to clip an extra sheet of paper to the service-data folder for making notes on intermittent symptoms and their causes. Such troubles often become chronic, and show up in almost all of a particular run of sets.

Types of Intermittents

There are two basic species of intermittents — the "jar" type, where the trouble can be made to show up by hitting the cabinet or

chassis, and the "electrical," where jarring does no good at all. Most of the latter type are more accurately called "thermal" (caused by heat), but "electrical" is one of those misnomers which seems to have stuck.

"Jar" Intermittents

Let's take the easier type first. If the set produces the trouble when jarred, there is definitely a "loose connection" somewhere, and "it shouldn't be too hard to find." Quotes here are from the customer, not the technician! The first rule for working with a problem of this type is another old Chinese proverb: "Softly, softly, catchee monkey." In other words, put down that sledge hammer! Much as it relieves your bad disposition to bang on the set as hard as you can, this won't help you find the trouble. After making a tentative diagnosis of where the trouble is, *gently* tap each part around that stage with the eraser on a common pencil, an insulated tuning tool, or something similar, meanwhile listening for noise or watching for flashes on the screen. A soldering-aid tool with a pointed, split end is very handy for moving, pulling and twisting component leads. Check for loose solder points, blobs of solder hanging down under terminal boards close to the chassis, and cracked wiring on PC boards.

Tube sockets, especially the wafer type, are happy hunting grounds for this kind of trouble. If you find loose pin contacts, take the tube out, and spring the contacts back together to restore a firm grip. A squirt of spray cleaner into tube sockets is also a good idea.

PC-board intermittents can sometimes be pinned down by tacking a jumper of hook-up wire between two points (Fig. 1). If this stops the noise, leave it there! (Modify it as necessary to make a professional repair, of course.) Caution: If you have *one* trouble like this, there may be more, so if a jumper doesn't cure the trouble right away, leave it in place and try another. You may find two or three bad conductors. Use light, solid, plastic-insulated wire, in pieces as short as possible, and be sure they are well soldered into place.

Thermal Intermittents

These are real headaches! The basis of this trouble lies in thermal expansion of capacitors, resistors, PC boards, terminal strips, or even the whole chassis, putting a strain on components or connections. Usually, the set will play normally for hours with the chassis out on the bench; without the heat-trap effect of the cabinet, the temperature never goes high enough to trigger the trouble. Thus, you may have to apply extra heat. Cover the chassis with several thicknesses of cloth or a cardboard box (leaving a hole so that you can see the screen, if you have picture trouble), and let it cook.

You can apply localized heat by fastening a piece of aluminum foil over the end of a standard heat lamp, with a 1" circle cut out of the middle (Fig. 2). This will let you heat suspected areas without burning up other parts. An old gooseneck desk lamp is very handy for this purpose. If you're lucky enough to have pinned the trouble down to a single stage, you can also heat individual parts by holding the tip of your soldering iron close

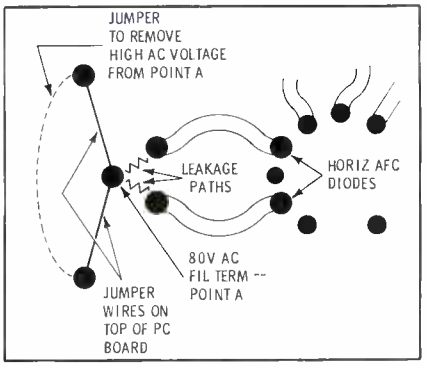


Fig. 3. Horizontal sync trouble was due to leakage across a damp PC board.

to them, and watch or listen for the trouble to show up.

Just the opposite procedure — artificial cooling — can also help you deal with thermal troubles. If the set acts up when first turned on, but plays perfectly after a brief period (say ten minutes) of operation, you can waste a lot of time waiting for the thing to cool down after each test. One easy way to speed up cooling is to spray the suspected component or area of the chassis with one of the chilling chemicals, sold in aerosol cans under various trade names.

You can also put the set in front of the cold-air outlet of your air conditioner, or direct a fan on it. One exasperated technician put a whole TV set in his home freezer to locate a "cold" intermittent. He found it, too!

Any kind of equipment in metal cabinets can have peculiar troubles. A classic case of this type was noted in an old PA system. It worked perfectly for about a half hour, and then went completely dead. There were no burned parts or bad tubes, and the unit played for hours on the bench. After some time, I discovered that when the amplifier was reassembled, the center lug on the master gain control was very close to the metal cabinet. You guessed it; after the amplifier had been operating long enough for the chassis to heat up, thermal expansion caused the input to short to ground.

Another common thermal trouble shows up on large tubes — 5U4, 6BG6, 6AX4, and so on. These tubes run so hot that the solder in the base pins sometimes crystallizes. Picture tubes also seem prone to develop the same defect. Thermal expansion and contraction can make a beautiful intermittent out of this condition! Such cases are

always immediately apparent on visual inspection; the offending pin looks gray and crumbly instead of having the smooth, shiny appearance of a good solder joint. Resolder or crimp the pin.

Time Constants

You can get many clues from knowing the length of time that elapses before the trouble appears. By all means, ask the customer about this; but you'd better check his estimate by timing the set with a watch. Customers have a bad habit of exaggerating about time! One lady insisted her TV set "took 15 minutes to light up." Timed, it came on in two minutes and 40 seconds.

Different defects display different time constants, generally (but not invariably) following this rough rule of thmub:

1-2 minutes, tubes. A tube reaches operating temperature in a matter of seconds, but it takes about two minutes for the whole structure to warm up to the point where thermal expansion can cause interelement shorts, opens, and comparable troubles.

2-5 minutes, leaky capacitors. If a capacitor has slight leakage, made worse by heating, it usually falls within this time limit. On the other hand, purely "physical" trouble, in which thermal expansion of the chassis pulls the capacitor open, generally takes longer to appear.

5-15 minutes, resistors. This means the "drifters" — resistors which change value when heated. The trouble often isn't due to current flowing through the resistor itself, but to heat from a nearby component such as a large dropping resistor.

The time constant of an open capacitor is almost the same as that of a resistance drift, but the two troubles can be distinguished from each other by the characteristics of the "cut-out." An opening capacitor will cause the symptom to appear suddenly, while a drifting resistor will cause a very gradual change in operation.

Electrolytic Capacitors

Electrolytics are responsible for some of the most puzzling intermittents — bending, weaving, loss of vertical sync, etc. A loss of filtering efficiency allows unwanted pulses, hum, and hash to get into places where they can cause trouble.

An electrolytic capacitor is made of rolled-up aluminum-foil plates, separated by a porous material saturated with electrolyte. The connections to the plates are made through small aluminum tabs which are usually spot-welded to the foil. If this joint becomes loose through electrolytic action, the capacitor becomes intermittent. Heavy surges of current, such as would be caused by shunting a new capacitor across the old one with the power on, will sometimes cause the defective connection to weld back together. This "heals" the capacitor, and the trouble disappears.

One valuable tool for hunting bad electrolytics is a capacitor-substitution box. These units typically have a resistor in series with the test capacitors so they will charge only slowly when connected across the suspected part. This eliminates the sudden surge which might cause healing of the old electrolytic.

The best way to use one of these devices is to hang the low-capacitance probe of a scope on the B+ line in the vicinity of the stage

where the trouble seems to be. If you can see more than just a trace of hum, hash or pulses on the B+ line, begin shunting electrolytics in that branch of the power supply. When you hit the right one, the scope pattern will drop to a straight line and the trouble will go away.

Diagnosis

In my opinion, 99% of the "knack" for successfully servicing intermittents is a matter of correctly diagnosing the problem. The only way to cope with intermittents (outside of sheer luck, which is also useful) is to sit down and make a cold, calm, *logical* analysis of the symptoms, and from these, make a *tentative* diagnosis. Notice the emphasis on "tentative." Being in a hurry to form a definite opinion slows up the job more than anything else you can do. If you begin work with an idea solidly implanted in your head that the trouble has "got to be" in a certain stage or part, you'll be completely incapable of making an intelligent diagnosis. You will often actually overlook symptoms that point toward another stage or part, because they don't fit in with your preconceived notion of where the trouble will be found. Therefore, the most valuable asset you can have in this type of work is a *completely* open mind! Always be ready to discard your original theory entirely and substitute another one, if the evidence is against your first idea.

Let's Get Down to Cases

Here are some "horrible examples" of intermittents the writer has personally run into during his checkered career:

Intermittent collapse of vertical sweep. This was due to a spot of electrolytic corrosion on the height control. Controls of any kind left unmoved for a long time may develop corrosion like this, because of electrolytic action between dissimilar materials.

Severe bending and weaving, plus very bad horizontal sync, when the set was first turned on. This trouble showed up only in the home, early in the morning. After a warm-up of 30 minutes, the set played perfectly for an indefinite period. Operation was faultless at all times in

the shop. The cause was moisture condensation on a PC board, due to using an open-flame gas heater in the home on chilly mornings. This caused leakage from an 80-volt AC (filament-string) terminal located between two horizontal AFC terminals on the board (point A in Fig. 3), which upset horizontal sync. After the chassis has warmed up enough to dry off the film of moisture, the symptoms disappeared and could not be brought back. The cure: Clean the PC board, spray it with several coats of acrylic plastic, remove the wire jumpers from point A, and make a new wire jumper to bypass this terminal.

If you want to know how I *really* found the cause, I'll tell you. The chassis was standing on edge, with the bottom of the PC board toward me, producing the customary perfect picture. I looked at it in the mirrow, and heaved a tremendous sigh of utter despair. The moisture from my breath hit just the right place, and the picture suddenly buckled and fell out of sync! I found that I could literally "blow it out of sync" by breathing on it! (Electronic halitosis?)

Intermittent loss of high voltage. I could smell a distinct ozone odor and hear a characteristic corona hiss. However, no corona was visible. It was finally located by observing the set in a pitch-dark room. As the raster faded, a "ring of fire" appeared around one of the two special 2-megohm HV filter resistors. Paint on the resistor had concealed the fact that it was completely broken in two. Contact between the halves remained OK, however, until the set warmed up.

Intermittent loss of picture and raster. In this one, the "king of them all," the raster shrank to half the normal width, fell out of horizontal sync, stayed for three to five seconds, and then disappeared. This happened after two hours and fifteen minutes of operation, in the home only. If a technician was watching, it played for an indefinite period. In the shop, this set was under actual observation for a total of more than 120 hours without developing the trouble. *All* parts in the high-voltage section (including the 1B3 socket), plus the horizontal sweep tubes, yoke, flyback, and oscillator transformer, were replaced. Line voltage was measured at the home (7 miles out in the country), and the AC input to the set was varied in the shop, without uncovering any clues.

The cause was finally found to be a thermal short in the picture tube, between the accelerator grid (pin 10) and filament or cathode—probably between the side rods or base leads. Here's an analysis: The short overloaded B+ boost; this affected the plate supply to the horizontal *oscillator;* a drop in drive-signal amplitude then lowered boost still further and extinguished the raster. Enough drive evidently remained to keep the plate of the horizontal output tube from running red hot. A cure was accomplished by installing a special transformer-type CRT brightener which isolated the shorted elements from ground. The same picture tube is still in use, four years later. Total net loss of income? Incalculable! Luckily, this set was one in a million. It's made me grateful for one thing, though; since it was on my bench, all other troubles have seemed simple by comparison. ▲

PRODUCT report

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

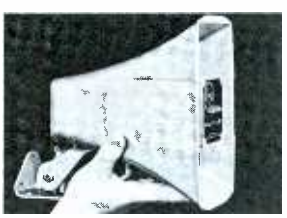
Picture-Tube Brighteners (43G)

As implied by the slogan, "If the base is right, the boost is right," **Perma-Power** "2-Brite" picture-tube brighteners can be installed on any black-and-white CRT without concern for heater voltage or current ratings. Three base styles are supplied: Duodecal (Model C-202); small, wire-pin 110° (Model C-212); and Sylvania-type 110° (Model C-222). List price of each model is $3.75.

Audio Control and Amplifier Units (44G)

In **Fisher** "Stereo Master Control-Amplifiers," dual-channel power amplifiers are combined with input, preamp, and control facilities. Many unusual features are included, such as a "stereo dimension" control, a center-channel speaker output requiring no third amplifier, and an internal switching system for tape monitoring. The Model X-101-B (shown) has a music power output of 26 watts per channel, and is priced at $189.50; the more elaborate X-202-B, with 35-watt output per channel, is $249.50.

Paging Speaker (45G)



A compact, weatherproofed sound projector for paging, the **Electro-Voice** Model PA15, has a program-power capacity of 15 watts and a sound-dispersion pattern 120° wide. Frequency response is 350-13,000 cps, with normal voice frequencies emphasized to make spoken announcements more intelligible. The die-cast housing has a neutral tan finish. List price of the standard 8-ohm version is $30; optional at extra cost are a 45-ohm version and another with a built-in 70.7-volt matching transformer.

Tube-Tester Modernizing Panel (46G)

The **Sencore** Model TM116 "Tube Tester Modernizing Panel" adapts any tester (except an automatic card-operated type) to make the same tests on "Compactrons," "novar" tubes, "nuvistors," and 10-pin miniatures as on conventional tubes. Tests are made by plugging the adapter into an octal socket on the main tester and referring to a chart provided with the adapter. The dealer net price of the TM116 is $24.95.

21" Picture Tube (47G)

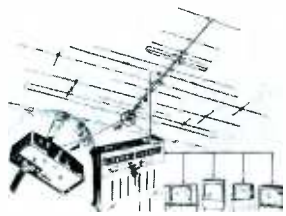
A new "universal-type" picture tube, the **General Electric** 21FLP4, can be satisfactorily substituted for any of the following types: 21CBP4, -A, -B, 21ALP4A, -B, 21ATP4, -A, 21BAP4, 21BNP4, 21BTP4, 21CMP4, 21CVP4, and 21CWP4. Equipped with a straight gun, the tube requires no ion-trap magnet. The phosphor is a new high-temperature type designed for improved picture clarity and brightness. List price is $45.90.

Mobile Antenna and Base (48G)

A lightweight, stainless steel ball and spring mount for mobile communications antennas, **New-Tronics** Model NTS-1, fits standard mounting holes and can be installed by one man. Similar units are available in cadmium-plated or chrome-plated steel. Another new product, the Model CB-27 telescoping whip antenna, collapses to 27" and extends to 60". The top section of this antenna has an etched scale for accurate tuning to either the 27-mc Citizens band or the 28-30 mc amateur band.

Transistorized Antenna Amplifier (49G)

Mounted directly at the antenna terminals, the **J F D** "Transis-Tenna" TV/FM signal amplifier increases the signal-to-noise ratio and drives one to four receivers. The transistorized circuitry is powered by four size D cells located in a combination power supply and multiset coupler (mounted indoors). The amplifier system is included as an integral part of 30 new antenna models, and is also available separately.



High-Fidelity Speaker Systems (50G)

The design of two new **H. H. Scott** compact speaker systems emphasizes multiple crossover networks, with separate mid-range and tweeter controls for precise adjustment of the system to match its "acoustic environment." The Model S-3 incorporates a low-resonance 10" woofer and wide-dispersion mid-range and super-tweeter units; the larger Model S-2 contains a high-compliance 12" woofer, two dual-cone mid-range units, and a super-tweeter. Prices east of the Rockies are: S-3, $129.95; S-2, $199.95.

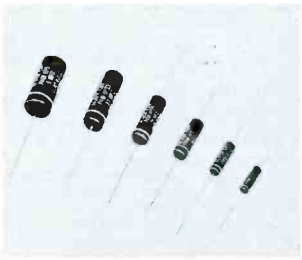
CB Transceivers (51G)

A front-panel switch on the **Gonset** G-12 Series "Citizen's Communicator" simultaneously tunes the transmitter and superhet receiver to any one of four preset, crystal-controlled channels in the Class D Citizens band. The gimbal-type mounting bracket lends itself to a variety of fixed and vehicular installations. The speaker and power supply are built into the 4½" x 7" x 10" case. Two types of power supplies are offered: 12V DC/117V AC in Model 3316, or 6V DC/117V AC in Model 3329.

Private TV-Listening Device (52G)

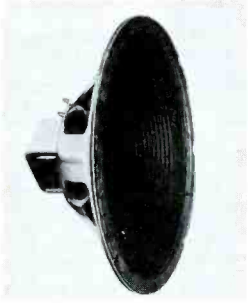
The **Telex** "TV Listener" permits quiet enjoyment of radio and TV wherever sound from a speaker would be annoying. Two earsets can be plugged into the plastic case of the unit at once; volume is adjusted simultaneously in both channels by a front-panel control. A 15' cord with alligator-clip terminals connects the device to a receiver or amplifier. The earset furnished with the "Listener" can also be used with transistor radios. List price is $14.85.

Molded Tubular Capacitors (53G)



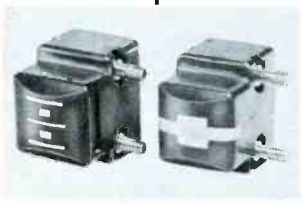
Featuring a dual dielectric (paper and polyester film), a solidified "Fixfil" impregnant, and molded plastic cases, **Cornell-Dubilier** Type PKM "Black Cat" tubular capacitors are obtainable with voltage ratings of 200, 400, 600, 1000, and 1600V over a capacitance range of .001 through 1 mfd. Standard tolerance is ±20%, but closer-tolerance units are available.

Speakers for Electronic Organs (54G)



The sustained very-low frequency notes generated by electronic organs tend to break down conventional speakers. Therefore, **Utah** has introduced two 12" speakers designed to withstand this type of service. Models OR 12J-8 (with 8-ohm voice coil) and OR 12J-16 (16-ohm) both have 6.8-oz. Alnico V magnets and are rated to handle 15 watts of peak audio power.

Replacement Tape Heads (55G)



Two series of magnetic heads for tape recorders have been announced by **Sonotone.** Monophonic record/reproduce heads in the RH-2 series have a list price of $10 each, and matching EH-2 erase heads are $9. Four-track stereo record/reproduce heads (RH-4 series) are $28.50; these also have matching erase heads (EH-4 series —$13.50). Stereo units feature a balanced-winding magnetic circuit for low hum sensitivity.

Transmitter Test Equipment (56G)

A combined T-pad power attenuator and noninductive load-resistance bank, the **Seco** Model 511A "Attenu-Load," is useful as a dummy load for a transmitter, as well as for coupling the transmitter to any load that requires a 10:1 power reduction. The 511A permits using the companion Model 510 transmitter tester at RF power levels up to 50 watts.

Soldering Tools (57G)

A "Kormat" wire-solder dispenser and a 100-watt Model 8100B soldering gun are included in a new **Weller** kit. The hand-held, thumb-operated dispenser handles all sizes of solder from .028" to .074", and reloads in 30 sec. This Model WK81 soldering set is offered at a special combination price of $9.95.

Aerosol Sprays (58G)

A new "Sargent" line of electronic chemicals and finishes in 16.4-oz. aerosol spray cans has been introduced by the **Sargent-Gerke Co.** Items available include "Red Insulator" for high-voltage circuits, tuner cleaner, parts cleaner, clear acrylic plastic, penetrating oil, degreaser, squeak stopper, enamels, lacquers, metallics, stop-rust, and specialties. Supplied with each can is a removable plastic extension tube for pinpoint applications.

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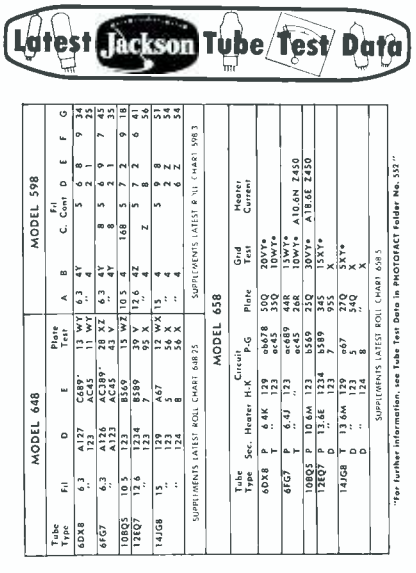


ANTENNAS AND ACCESSORIES

1G. JFD—New 1961 *Exact-Replacement Antenna Guide Wallchart for Portable and Toteable TV Sets.* Gives TV-receiver model number, manufacturer's antenna part number, and model number of corresponding JFD exact-replacement antenna. Also Form 940 dealer catalog illustrating and describing 1961 line of TV antennas, mounts, masts, *Mardi Gras* TV tables, accessories.

2G. JERROLD—Special bulletin on determining *system noise figure*, for use in eliminating snow from TV pictures; also new literature on transistorized *Powermate TV-FM Preamplifier. See ad page 86.*

3G. R-COLUMBIA—Complete literature on new, time-saving strapless chimney mount. *See ad page 70.*

4G. WINEGARD—4-page brochure giving full description of all-channel, transistorized *Powertron* antennas. *See ads pages 14-15, 48.*

AUDIO AND HI-FI

5G. CBC ELECTRONICS—Catalog sheets on hi-fi cables and plug adapters, kit for precision soldering, multiple AC outlet boxes, audio accessories, and CRT brighteners.

6G. CENTRALAB — Two-color brochure describing full line of L and T pads, lever switches, and hardware for the sound market. *See ad page 75.*

7G. EICO—New 32-page catalog of kits and wired equipment for stereo and monophonic hi-fi, Citizens band transceivers, ham gear, transistor radios, and test equipment. Also, "Stereo Hi-Fi Guide," and "Short Course for Novice License." *See ad page 72.*

8G. GENERAL ELECTRIC (Receiving Tube Dept.) — 12-page bulletin ETD-26622, "High-Fidelity Audio Tubes," giving specifications and manufacturing information. *See ad page 63.*

9G. JENSEN MFG. — Brochure LX on ultra-compact Model X-10 two-way speaker system, with cabinet dimensions of 7-1/4" x 13" x 4-5/8" and power rating of 6 watts. *See ad page 67.*

10G. ROBINS—New replacement guide for magnetic heads used in home tape recorders. *See ad page 64.*

11G. SONOTONE Phonograph Reference Chart and Service Guide, listing recommended replacement cartridges for 1777 models of record players made by 85 manufacturers. *See ad page 87.*

12G. SWITCHCRAFT—New catalog A-401 of audio accessories, including description of *Stereo Speaker Selector Switch* (part no. 670)—a three-position unit for connecting two pairs of remote speakers (either or both pairs) to a stereo amplifier.

13G. UNIVERSITY — Technilog; 12-page catalog of *Modular Microphones;* 16-page guide to speakers and speaker systems; catalog of public-address loudspeakers and accessories.

14G. UTAH—New catalog sheet describing D series of shallow speakers with *Dual Diameter* magnets. *See ad page 42.*

COMMUNICATIONS RADIO

15G. MOSLEY—Catalog sheets CB-1-B and CB-2-C covering line of Citizens band antennas; list of distributors carrying these units in stock; dealer price sheets. *See ad page 92.*

COMPONENTS

16G. AEROVOX—Bulletin NPJ-118 on *Bi-Electric* tubular bypass capacitors with combination *Mylar*-paper dielectric. *See ad page 89.*

17G. BUSSMANN — Bulletin EFA on two new fuse assortments including practically all types needed for TV sets and other electronic equipment. Each assortment comes in metal display stand with special inventory feature; stand can be hung on wall or stood on bench. *See ad page 49.*

18G. CLAROSTAT—Flyer on *Uni-Tite* Service Center, an assortment covering more than 75 replacement needs for dual concentric controls. *See ad page 77.*

19G. CORNELL-DUBILIER — *Service Selector*, a 40-page catalog of replacement capacitors, test instruments, vibrators, power supplies, antenna rotators.

20G. G-C ELECTRONICS — 400-page combined catalog FR-62 of all electronic components and service aids, including chemicals, hardware, test equipment, antennas, communications gear, audio accessories, microphones, etc. *See ads pages 80, 88, 94.*

21G. MERIT—Catalog sheet giving specifications and prices for new line of input, interstage, and output transformers for transistor circuits. *See ad page 82.*

22G. SPRAGUE—Catalog C-457 of capacitors, printed circuit components, and wire-wound resistors (designed to hang on wall). *See ads pages 11, 12.*

SERVICE AIDS

23G. BERNS—Data on 3-in-1 picture-tube repair tool, on *Audio Pin-Plug Crimper* that lets you make pin-plug and ground connections for shielded cable without soldering, and on *ION* adjustable beam bender. *See ad page 90.*

24G. CASTLE—Leaflet describing fast overhauling service on television tuners of all makes and models. *See ad page 79.*

25G. INJECTORALL—1961 catalog of electronic chemicals, including new No. 20 *Lens Kleen* (for removing scratches from plastic TV safety windows) and No. 30WC *Renew Spray* (for polishing cabinets and removing scratches); also pocket-sized catalog, "Open the Door."

26G. MERCURY TV TUNER—Information sheet describing immediate tuner-exchange service, 24- to 48-hour tuner repairs, and additional services; states prices and announces new seven-month warranty. *See ad page 90.*

27G. PRECISION TUNER—Information on repair and alignment service available for any TV tuner. *See ad page 64.*

28G. SARGENT-GERKE—Catalog of service chemicals in aerosol spray cans; also spray-paint color cards. *See ad page 56.*

SPECIAL EQUIPMENT

29G. ATR—Information on inverters for operating standard 110-volt AC PA systems in mobile applications; an example is Model 12U-RHG which delivers 150-watt, 110-volt continuous output from 12-volt storage-battery source. *See ad page 18.*

30G. ACME ELECTRIC — Catalog sheet 17-BLO1 on portable and rack-mounted DC power supplies with continuously variable output from 0 to 45 volts, stablized within ±1%; maximum current output 2.5 amps. *See ad page 93.*

31G. STANDARD ELECTRICAL — 40-page catalog of *Adjust-A-Volt* variable transformers, with illustrations, descriptions, electrical ratings, specifications and dimension diagrams.

32G. TERADO—Catalog sheets on power converters for obtaining 110-volt AC from auto battery or other mobile DC supply; information on battery chargers also provided.

33G. VIRGINIA—Data sheet on new, lower-cost *Classroom TV Stand*—a rack with tubular metal frame, mounted on casters, which holds TV set approximately 5' off floor for viewing in schools, hospitals, institutions, and industry. *See ad page 84.*

TECHNICAL PUBLICATIONS

34G. GRANTHAM — Booklet entitled, "Careers in Electronics," outlining training courses available. *See ad page 13.*

35G. HOWARD W. SAMS—Literature describing all current publications on radio, TV, communications, audio and hi-fi, and industrial electronics servicing. *See ads pages 22, 41, 65, 68.*

TEST EQUIPMENT

36G. B & K—Catalog AP18-R, giving data and information on Model 960 *Transistor Radio Analyst*, Model 1076 *Television Analyst*, *Dynamatic* 375 VTVM, *V O Matic* 360, Models 700 and 600 *Dyna-Quik* tube testers, Models 440 and 420 CRT Cathode Rejuvenator Testers, Model 160 Transistor Tester, Model 1070 *Dyna-Sweep* Circuit Analyzer, and B & K Service Shop. *See ads pages 53, 55, 57, 60.*

37G. METREX—Serviceman's guide, "Cramful of Shortcuts," dealing with troubleshooting, alignment, and calibration of radio, TV, hi-fi and related equipment; also manual for operation of new *Genie* pocket-size signal generator. *See ad page 92.*

38G. SECO—Literature on test equipment, featuring complete Model 107 tube tester which meets specifications for Federal Stock Classification; also, booklet, "Selling and Servicing Citizens Band Equipment." *See ad page 91.*

39G. SENCORE—New booklet, *How to Use the SS105 Sweep Circuit Troubleshooter*, plus brochure on complete line of *time-saver* instruments. *See ads pages 43, 45, 47, 95.*

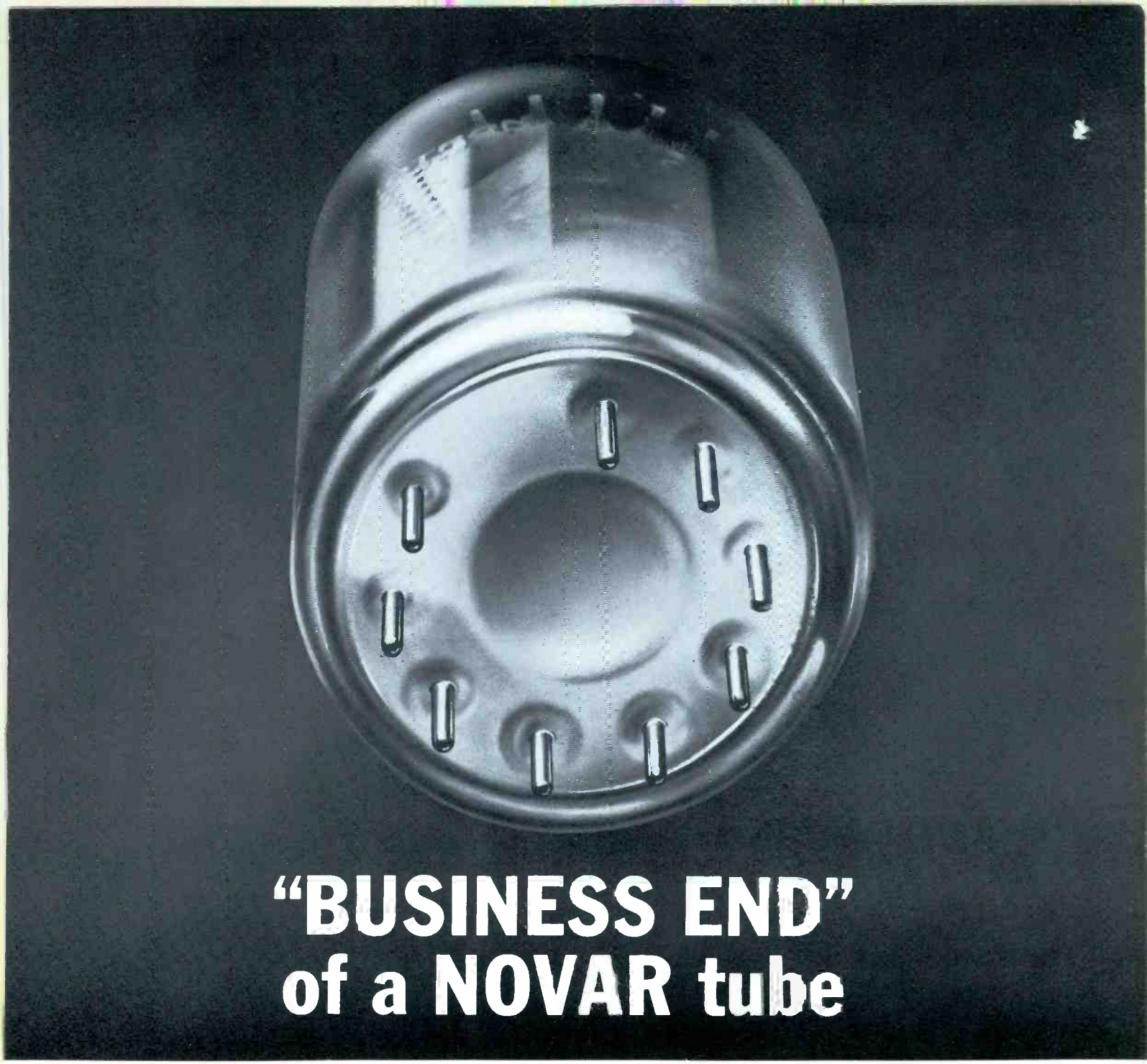
TOOLS

40G. CHAMPION—New catalog No. 361, listing *Long Reach* pliers, *Little Champ* precision pliers, *HeatSorb Clamp* (heat sink), and other tools; also Form SA-1 brochure on sales aids and displays. *See ad page 62.*

41G. XCELITE — Descriptive folder on *Seizer*—forceps-style pliers with jaws that lock shut. *See ad page 52.*

TUBES

42G. SAMPSON — *Hitachi* receiving-tube manual, giving extensive specifications, basing diagrams, and outlines for complete tube line; also catalog sheet with color photos and descriptions of *Hitachi* broadcast-band and two-band transistor radios. *See ad page 76.*



"BUSINESS END" of a NOVAR tube

You're looking at the base of one of RCA's remarkable new novar tubes... the first in a new family of tubes that will mean better business for you through reduced call backs.

This new base—with 9 widely-spaced, heavy-gauge pins—characterizes novar, RCA's line of large all-glass integral base tubes designed to do the work of conventional tubes with molded bases. Because novars *outperform* these conventional types, they are being selected for use in more and more radio and TV receivers as well as hi-fi equipment. From present indications, novar should become the standard of the industry.

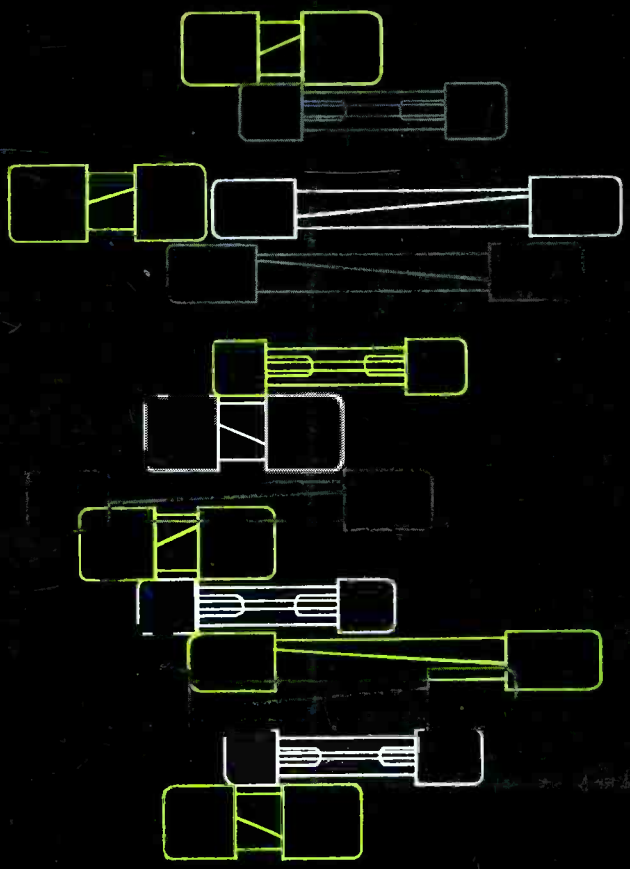
Look for novar, RCA's latest contribution to electron tube design. Your Authorized RCA Electron Tube Distributor now has RCA-7868 novar and will soon have many other types to support your servicing business.

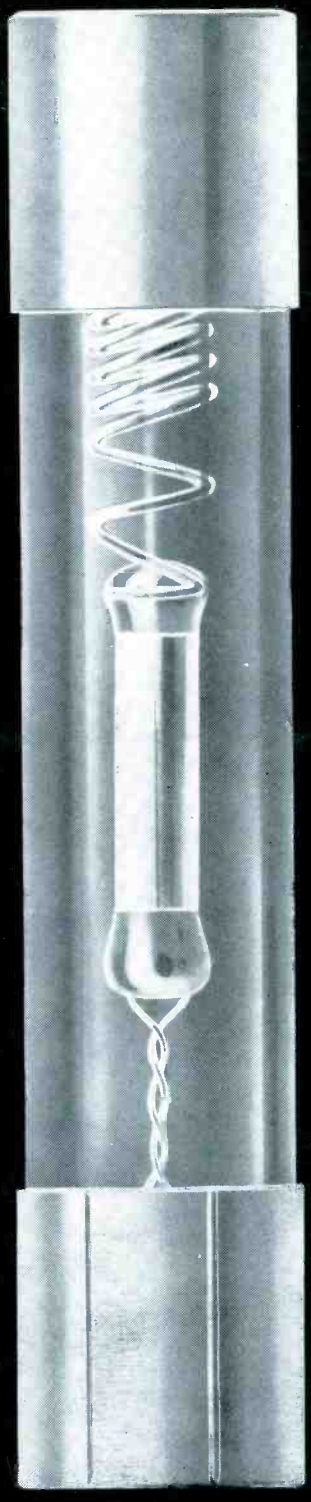
RCA ELECTRON TUBE DIVISION, HARRISON, N.J.

RCA® The Most Trusted Name in Electronics

WHAT'S IN A FUSE?

Only a fuse element, glass & caps?
No! Every fuse carries
with it the skill and quality of its manufacturer.
You can't reach out and touch or taste this,
you can't even be sure it will do
its job when needed except
by purchasing from a company
that has the know how of 30 years
of manufacturing fine fuses.





BURTON BROWNE ADVERTISING

LITTELFUSE

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