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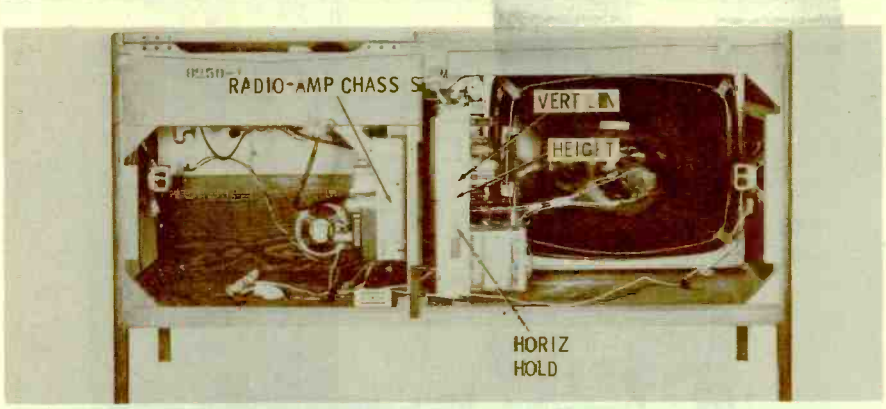
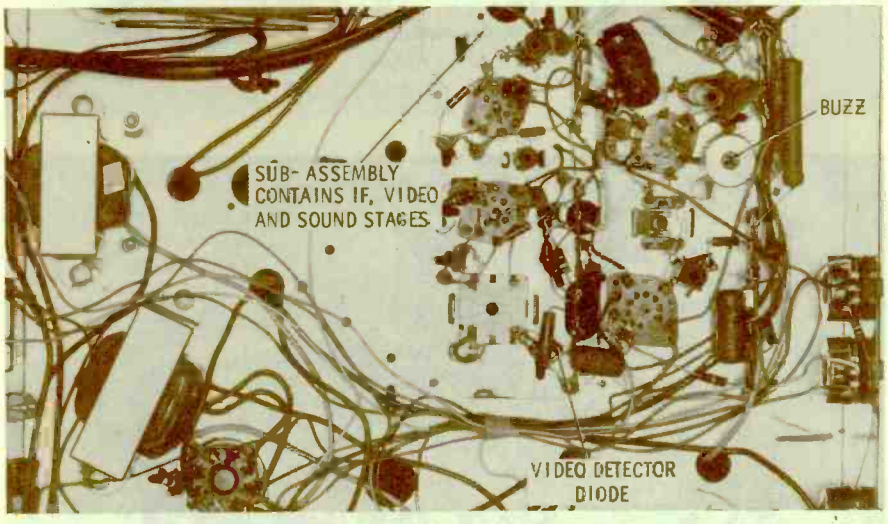
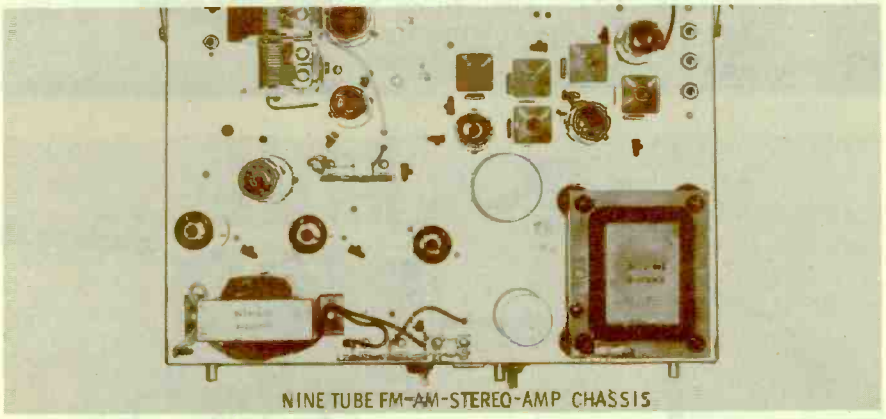
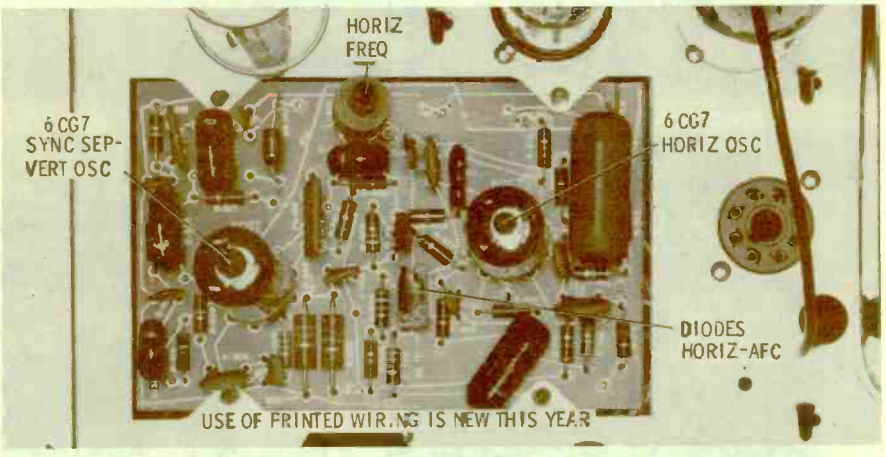
PREVIEWS of new sets

Bradford






NINE TUBE FM-AM-STEREO-AMP CHASSIS



Bradford
Model 96735A
TV Chassis 23S33
FM-AM-Stereo Amplifier
Chassis 8AS3

This Bradford "stereo theatre" combines a 23" TV chassis, a four-speed stereo phonograph, and an FM-AM-stereo amplifier chassis. The radio-amplifier section uses a total of nine tubes, including two 6BQ5's for audio output—one for each channel—and a 6CA4 as the B+ rectifier.

A single silicon rectifier develops B+ for the TV chassis, and a 4.7-ohm fusible resistor protects the circuit in case of overload. The series-string tube-heater circuit contains a 46-ohm dropping resistor—a good item to check if the tubes fail to light.

The TV chassis drives a 23AWP4, 92° picture tube. The model shown here is equipped only for VHF. The Model 96743A uses the same chassis, but is factory wired for both VHF and UHF. A 2FS5 RF amplifier and a 5FG7 mixer/oscillator are used in the tuner of this set.

Different from previous Bradford receivers is the use of a printed-circuit board. Most of the tubes and components for the sync and horizontal multivibrator stages are mounted on this board—including the dual diode for horizontal AFC.

The channel selector, fine tuning, on-off-volume, contrast, vertical hold, and brightness controls are mounted at the front. Those for vertical linearity, height and horizontal hold are accessible from the rear of the chassis. A buzz control is mounted on the hand-wired sub-assembly panel; its exact location is shown in one of the photos.

A jumper, installed on the base of the picture tube, connects pin 6 to either pin 10 or pin 2 to obtain focus voltage. The focus jumper will seldom need to be changed, unless you install a new picture tube.

Included in the tube complement of this set are: two 6BZ6's, first and second IF amplifiers; 8BQ5, video output; 3BN6, audio detector; 12CA5, audio output; and 12W6, vertical multivibrator/output.

Tubes used in the horizontal stages are: 6CG7, multivibrator; 12DQ6B, output; 12AX4, damper; and 1K3, HV rectifier.

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Motorola
Model 19RT29CH
TV Chassis RCDTS-584B
AM Chassis THS-4101

The 584-series chassis in this 19" portable TV is also used, in slightly modified form, in many 23" and 27" models introduced lately by Motorola. This set has an unusual feature for a portable television: a five-tube, self-contained AM radio chassis.

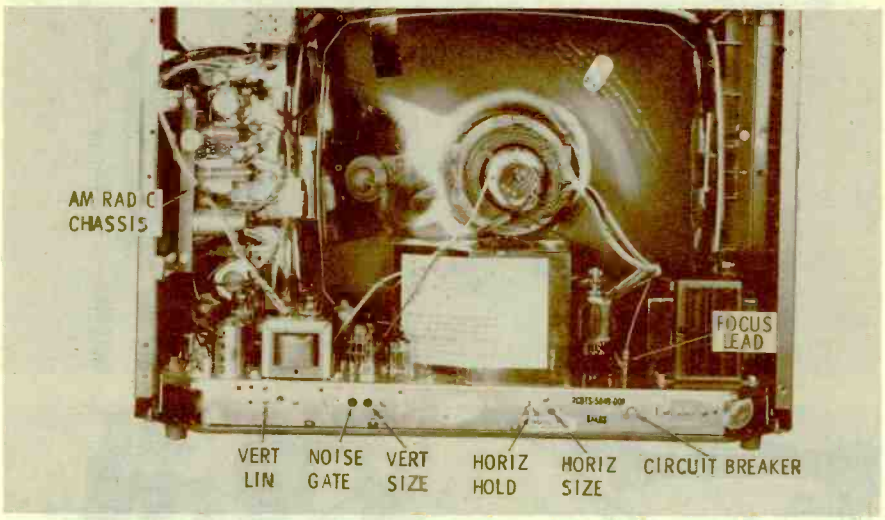
The TV chassis uses a 19XP4, 114° picture tube. Cone-type terminals are used for wiring connections throughout the set. Access to the inside of the switch-type tuner is fairly simple, once the chassis is removed from the cabinet. The tuner shield is a two-section unit, and either side of it can be snapped off —as shown in one of the photos. You'll find a number of different tuners used in this chassis line; the one in this set uses a 6GK5 as the RF amplifier and a 6BL8/ECF80 for the mixer and oscillator function.

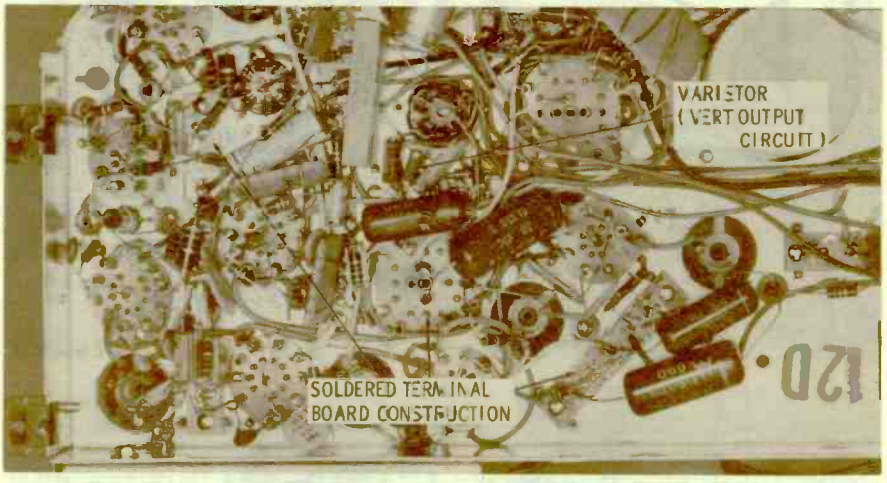
Motorola makes wide usage of the latter tube type—a total of four appear in this chassis. The other three serve as: third video IF amplifier/sync limiter, sound IF/vertical multivibrator, and horizontal AFC/multivibrator. Another tube type finds multiple use: 6GK6 sheet-beam tubes are used in the output stages of the video, audio and vertical sweep sections.

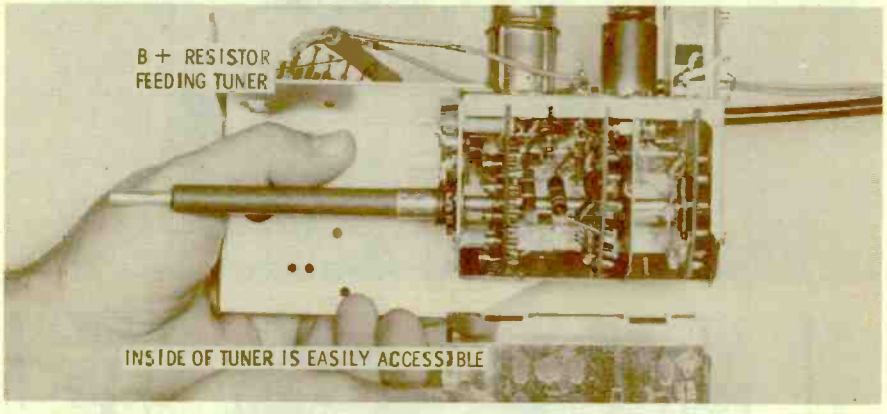
Two plug-in modules (easy to replace, if need be) are used—one in the horizontal sweep section, and another in the vertical multivibrator-output stage. The latter circuit has a *varistor* (see photo for location) in the output stage; its purpose is to limit the peak-to-peak voltage between plate and screen to 1800 volts, and thus prevent damage to the output tube or its associated components.

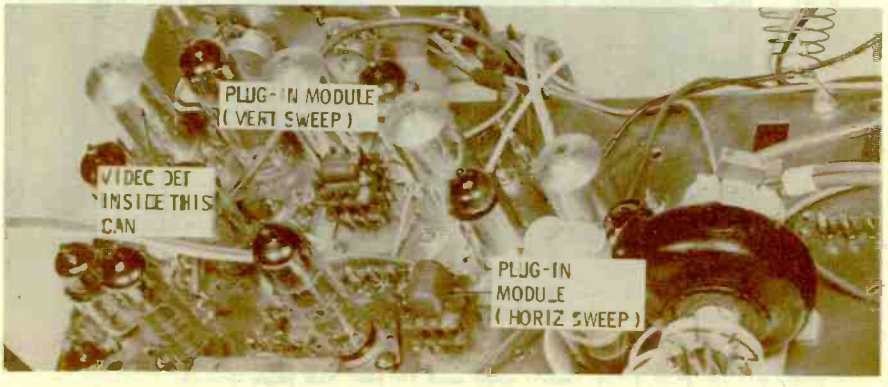
A 5DJ4 develops the B+ voltage for this receiver; protection for this rectifier and the other circuits is provided by a circuit breaker, wired in series with a thermistor.

The channel selector, fine tuning, off-TV-radio, volume (radio and TV), radio tuning, brightness, vertical hold, and contrast controls are mounted on a front panel. Other adjustments, mounted on the rear chassis apron, include vertical linearity, vertical size, noise gate (AGC), horizontal hold, and horizontal size.

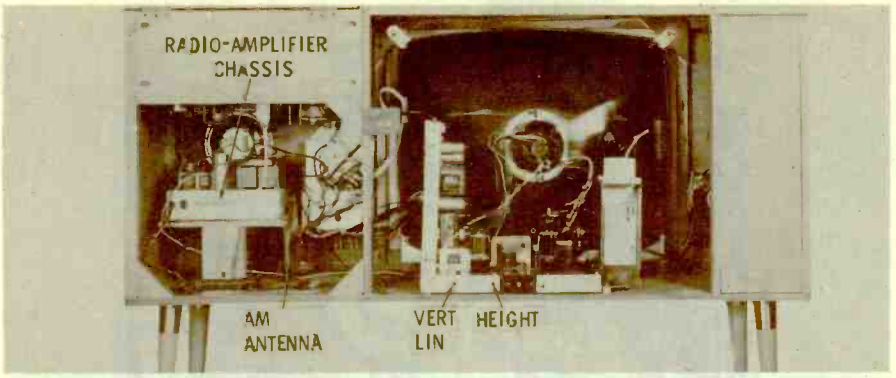


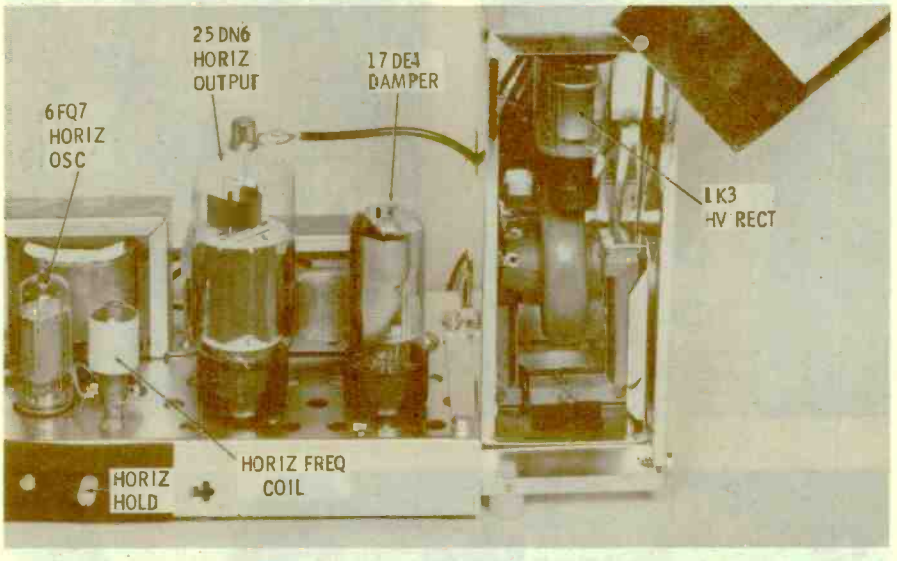


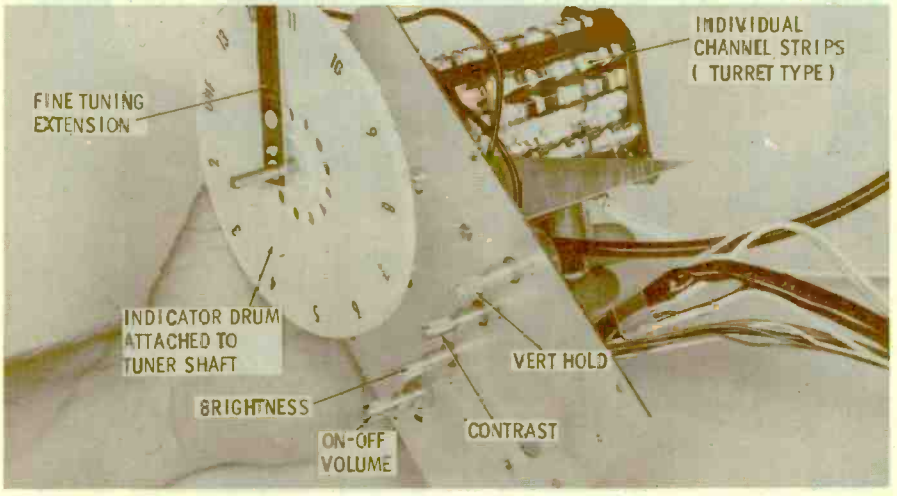




Muntz







Muntz
Model 23CP3
TV Chassis T37AB11
FM-AM-Stereo Amplifier
Chassis AS8031

This combination introduced by Muntz features a 23" television chassis, a FM-AM-stereo amplifier chassis, and a four-speed phonograph. The radio-amplifier chassis is completely self-contained, and has its own separate control panel. The L-shaped TV chassis is similar to those previously used in this manufacturer's TV line.

The turret-type VHF tuner in this model has a 2GK5 RF amplifier and a 5CG8 mixer/oscillator, and is mounted on a control panel which is separate from the TV chassis. The individual oscillator slugs are adjustable from the front of the cabinet, after the channel selector and fine tuning knobs are removed. You can pull the selector knob off easily, but to remove the fine tuning knob, you'll need to perform one extra step. This knob is held to the fine-tuning extension shaft by a single metal screw (see photo); the screw must be removed to release the knob.

Also on the front control panel are operating controls for on-off-volume, brightness, contrast, and vertical hold. The controls for vertical linearity, height, and horizontal hold are mounted on the rear apron of the chassis.

This receiver has two IF stages, using a 3BZ6 as the first IF amplifier and one section of a 5BW8 (pentode-dual diode) as the second. The dual diode portion of this tube serves as the horizontal phase detector.

The sound signal, taken off at the video detector, is "reflexed" back through the 5BW8 second IF, before it is fed to the sound IF amplifier—the triode section of a 6AW8. (The pentode section of this last tube is used in an unfamiliar application, as the audio output tube.) When servicing this chassis, remember the sound IF does not pass through the video output stage.

The B+ supply for this set uses a single silicon rectifier. The soldered-in rectifier can be replaced, if it becomes necessary, without removing the chassis from the cabinet. A 5-ohm, plug-in fusible resistor provides overload protection for the B+ circuit. A 25-ohm, 15-watt dropping resistor is used in the filament string.

Westinghouse ..... PREVIEWS of new sets

Westinghouse
Model H-P3001U
Chassis V2438-2

The Westinghouse portable TV shown here contains a 19CMP4, 114° picture tube, and comes equipped for both VHF and UHF operation. The VHF tuner is a turret type; as can be seen from the photo, the oscillator slugs may be adjusted from the front after the channel selector and fine tuning knobs are removed. In the same photo, notice the two small holes in the front of the cabinet, located directly below the contrast control. Through the left hole you can adjust the vertical linearity; the right one gives access to the height control.

A 3GK5 RF amplifier and a 6CG8A oscillator/mixer are used in the VHF tuner. The shaft of the separate UHF tuner is connected through a dial cord to a channel-selector knob mounted on the side of the metal cabinet. A 3AF4A/B functions as the UHF oscillator.

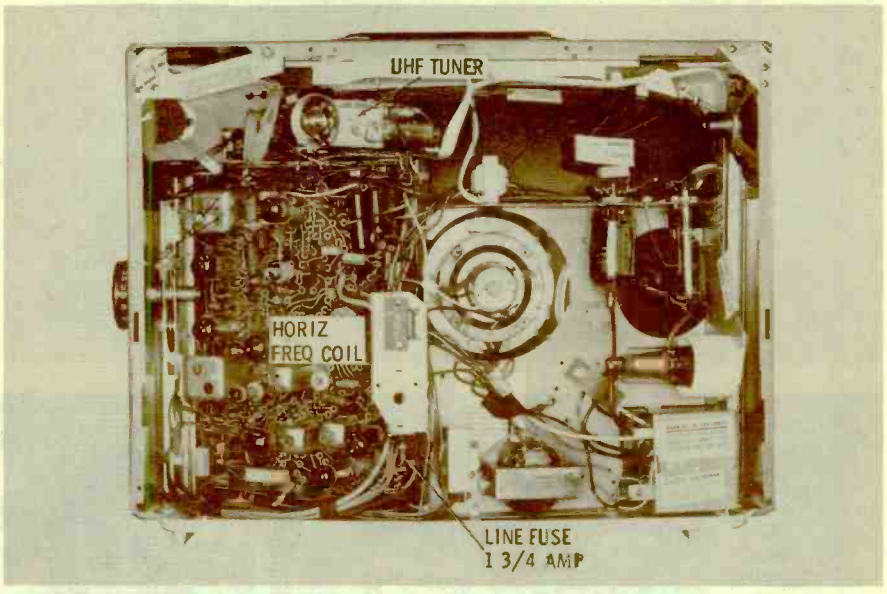
A single large printed-circuit board is used in this set, and the majority of the circuit components are on it.

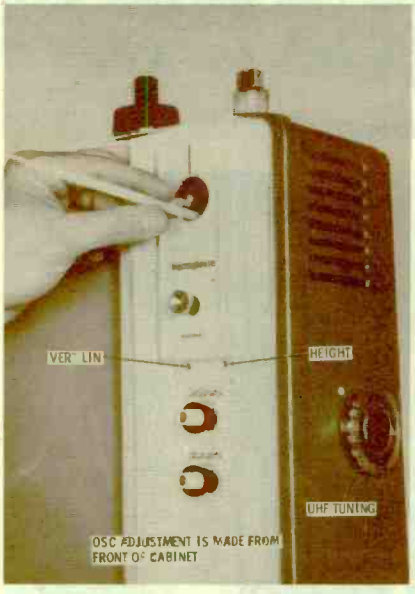
B+ is developed by a single silicon rectifier, wired in a half-wave configuration. Surge protection for the rectifier is provided by a 5-ohm, 7-watt resistor. A 1¾-amp, slow-blow line fuse is also used in this receiver.

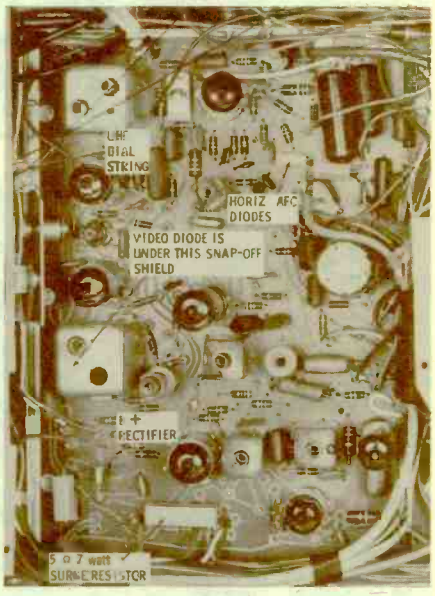
An array of new tube types appear in this set: 4HT6 first IF amplifier and 4HM6 second IF amplifier (both high-gain frame-grid tubes), 10JA8 video output/sync separator, 12FX5 audio output, 17JZ8 vertical multivibrator/output, 21-GY5 horizontal output, and 17DM4 damper.

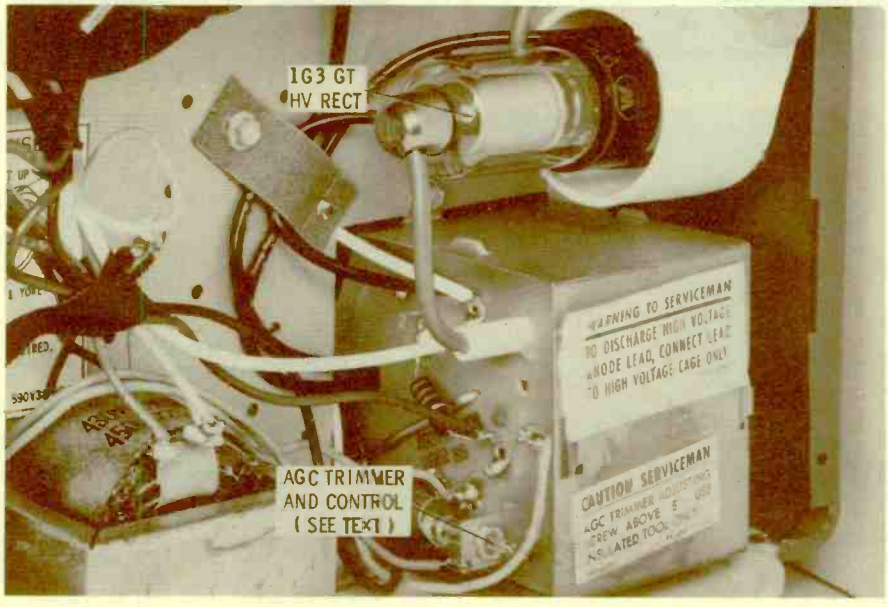
A 1N295A diode, located under a removable shield, is the video detector. Dual selenium diodes function in the horizontal AFC circuit. AGC is of the keyed type, and this circuit has an unusual feature: The keying pulse is coupled to the plate of the AGC tube through a trimmer capacitor that permits adjusting the amplitude of the keying pulse. This method of determining the AGC voltage level is the only control over AGC in this set. Be sure you use an insulated tool when adjusting the trimmer.

The width of the raster can be varied with a metal sleeve, located between the yoke and the neck of the CRT. As a final note, be sure to observe "hot-chassis" servicing precautions when working on this receiver.









See PHOTOFACT Set 583, Folder 2

Mfr: Philco **Chassis No.** 12J27

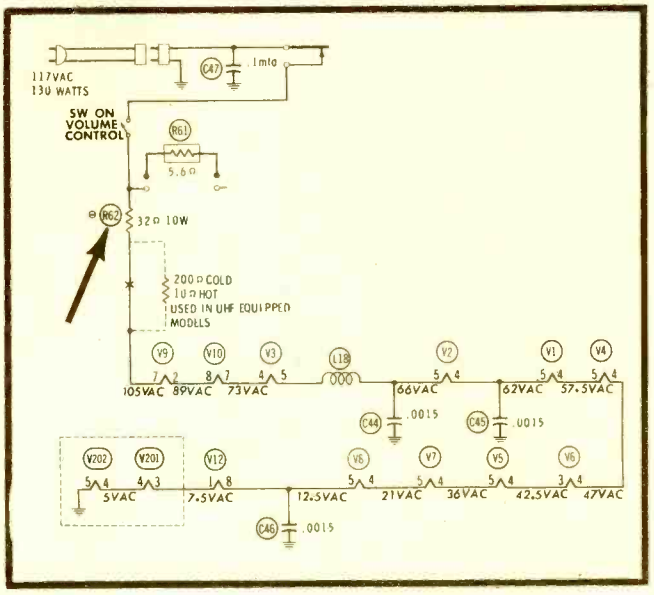
Card No: PH 12J27-7

Section Affected: All.

Symptoms: Set dead; tube filaments not lit.

Cause: Open resistor in series with filament string.

What To Do: Replace R62 (32 ohms—10W).



Mfr: Philco **Chassis No.** 12J27

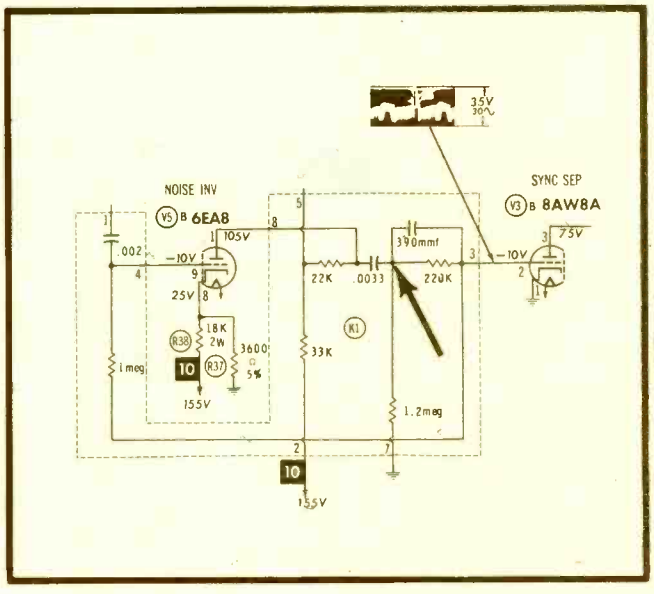
Card No: PH 12J27-8

Section Affected: Sync.

Symptoms: Intermittent horizontal and vertical sync.

Cause: Intermittent connection in component combination unit in sync separator stage.

What To Do: Repair connection between 1.2-meg resistor and printed wiring on combination unit.



Mfr: Philco **Chassis No.** 12J27

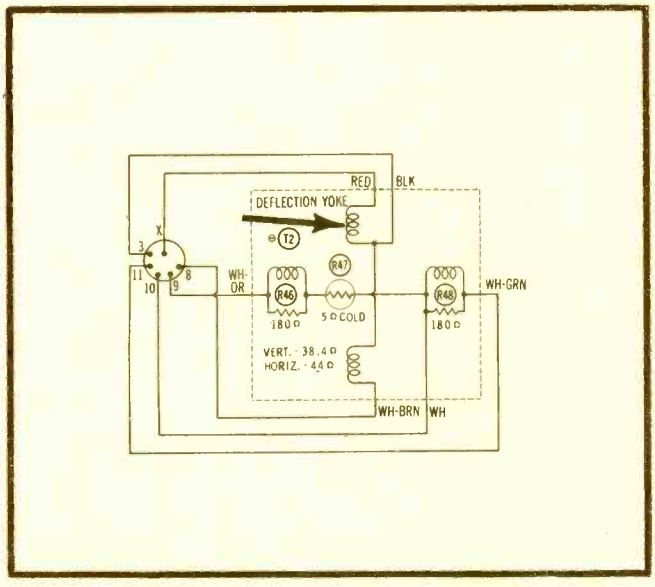
Card No: PH 12J27-9

Section Affected: Raster.

Symptoms: No raster; sound normal.

Cause: Horizontal winding of deflection yoke shorted to core, loading horizontal sweep circuit and killing raster.

What To Do: Replace T2.



See PHOTOFACT Set 583, Folder 2

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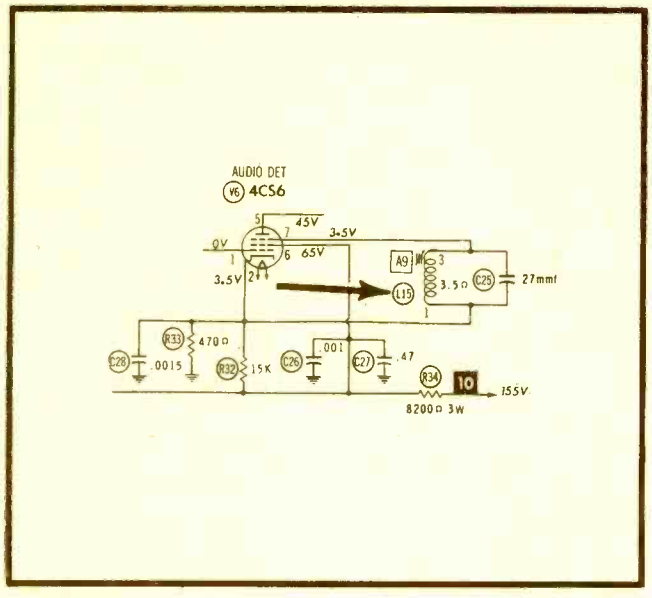


See PHOTOFACT Set 583, Folder 2

Mfr: Philco **Chassis No.** 12J27

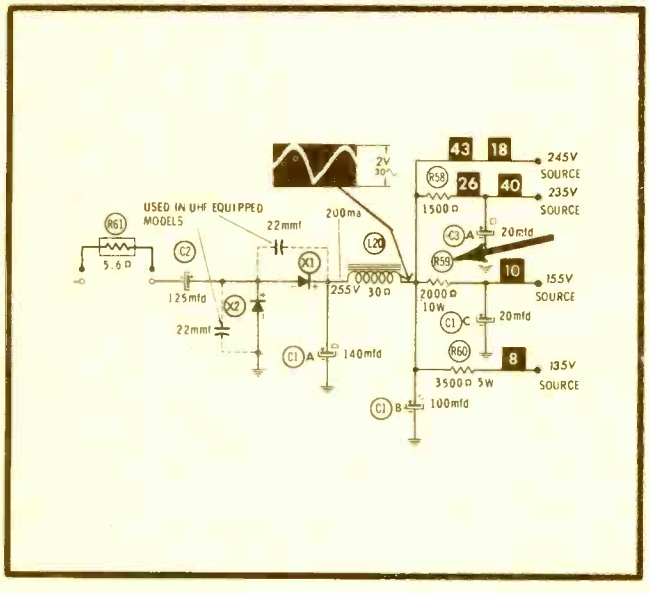
Card No: PH 12J27-10

Section Affected: Sound.

Symptoms: No sound.

Cause: Open quadrature coil in sound detector.

What To Do: Check for open connection where end of coil winding is soldered to terminal lug. Repair connection or replace L15.



Mfr: Philco **Chassis No.** 12J27

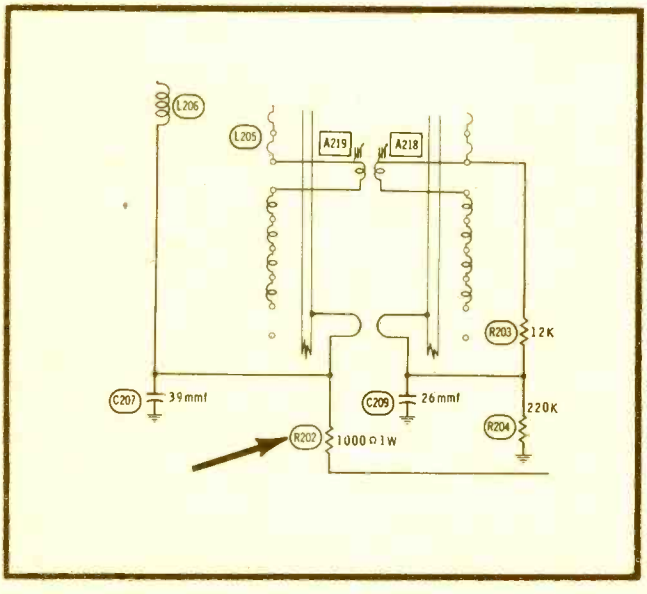
Card No: PH 12J27-11

Section Affected: All.

Symptoms: No raster or sound; tube filaments lit.

Cause: Open resistor in series with 155-volt B+ line.

What To Do: Replace R59 (2000 ohms — 10W); check for short from 155-volt line to ground.



Mfr: Philco **Chassis No.** 12J27

Card No: PH 12J27-12

Section Affected: Pix and sound.

Symptoms: No picture or sound; raster normal.

Cause: Plate-load resistor of RF amplifier increased in value; usually looks scorched.

What To Do: Replace R202 (1000 ohms — 1W); check RF amplifier tube V201 (3GK5) for intermittent short. If tube is okay, check C207 (39 mmf) for short.

See PHOTOFACT Set 527, Folder 2

Mfr: RCA **Chassis No.** KCS131C

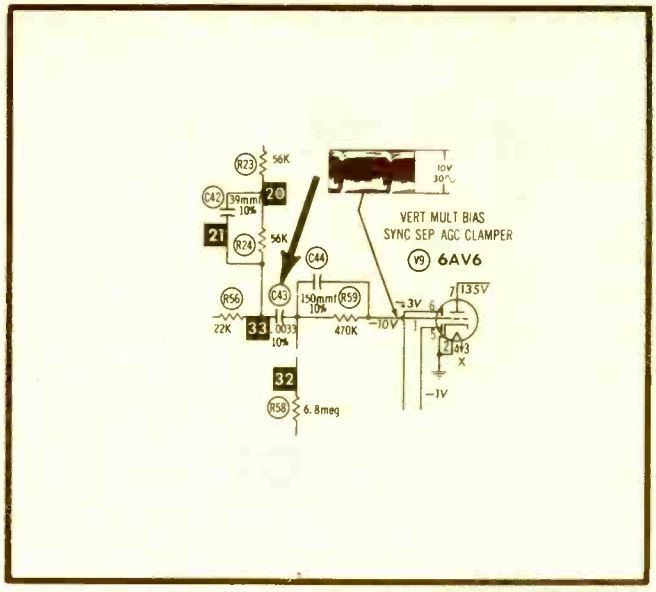
Card No: RCA KCS131C-1

Section Affected: Sync.

Symptoms: No vertical or horizontal hold. Positive voltage at grid (pin 1) of V9 (6AV6).

Cause: Leaky coupling capacitor in grid circuit of sync separator.

What To Do: Replace C43 (.0033 mfd).



Mfr: RCA **Chassis No.** KCS131C

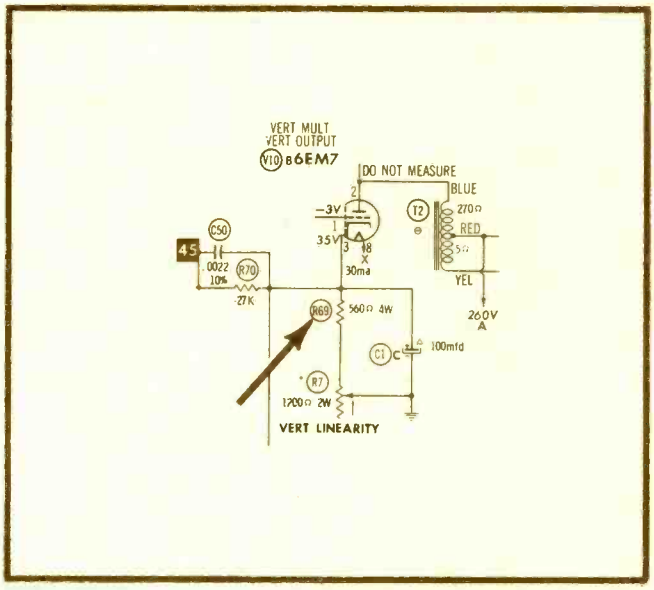
Card No: RCA KCS131C-2

Section Affected: Raster.

Symptoms: Vertical sweep collapses intermittently.

Cause: Cathode resistor in vertical output stage overheats and opens intermittently.

What To Do: Replace R69 (560 ohms—4W).



Mfr: RCA **Chassis No.** KCS131C

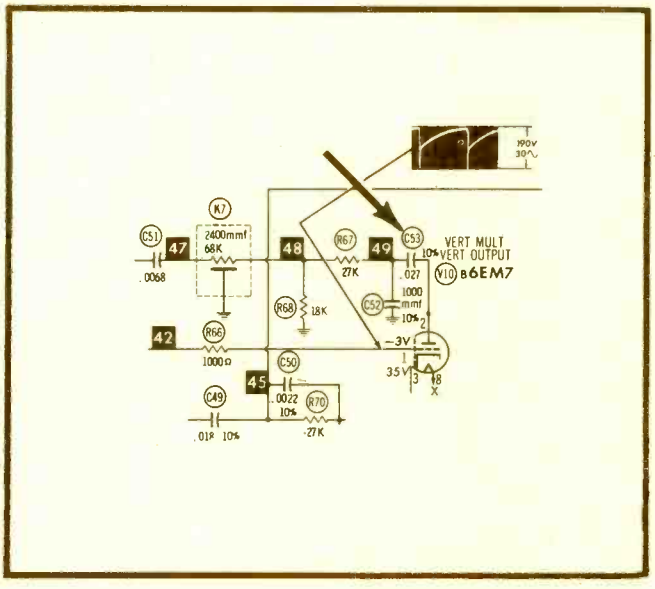
Card No: RCA KCS131C-3

Section Affected: Raster.

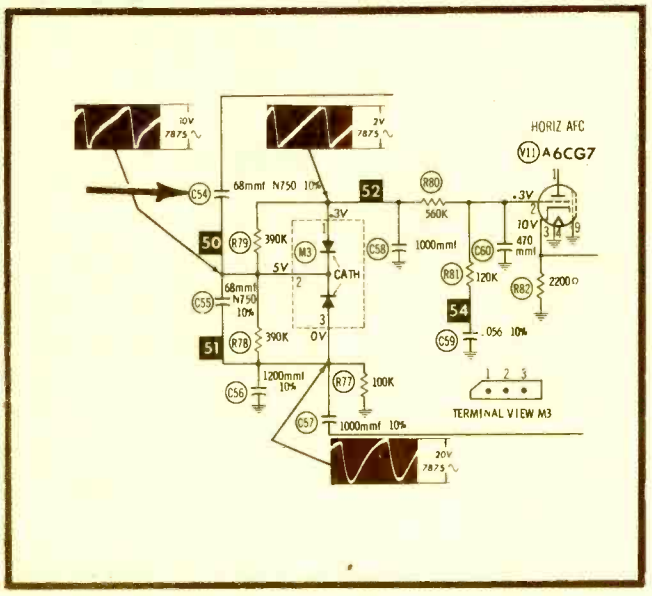
Symptoms: No vertical sweep.

Cause: Shorted feedback capacitor in vertical multivibrator.

What To Do: Replace C53 (.027 mfd).



See PHOTOFACT Set 527, Folder 2



See PHOTOFACT Set 527, Folder 2

Mfr: RCA **Chassis No.** KCS131C

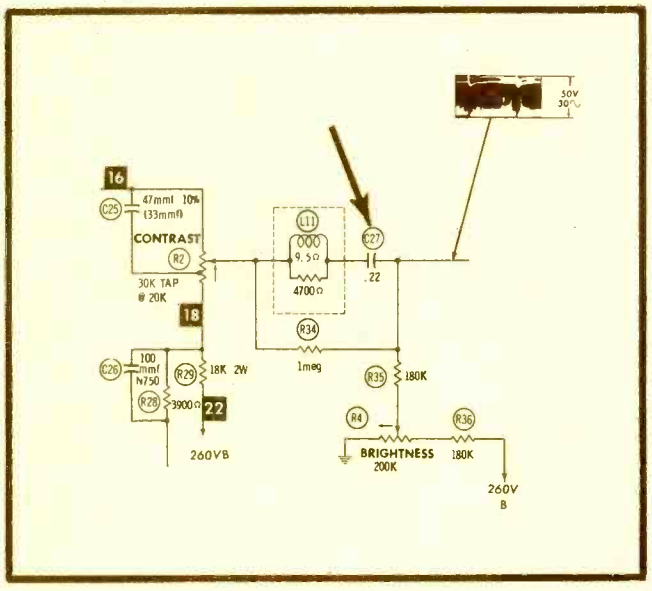
Card No: RCA KCS131C-4

Section Affected: Sync.

Symptoms: Horizontal oscillator frequency drifts out of hold-control range.

Cause: Leaky coupling capacitor between sync separator and horizontal AFC phase detector.

What To Do: Replace C54 (68 mmf, N750, 10%).



Mfr: RCA **Chassis No.** KCS131C

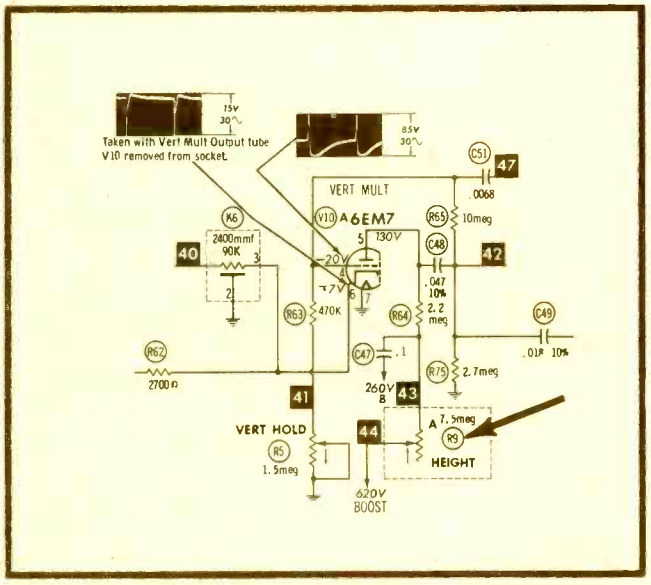
Card No: RCA KCS131C-5

Section Affected: Raster.

Symptoms: No raster; voltage at pin 11 of CRT too high.

Cause: Shorted coupling capacitor between video output stage and CRT.

What To Do: Replace C27 (.22 mfd).



Mfr: RCA **Chassis No.** KCS131C

Card No: RCA KCS131C-6

Section Affected: Sync.

Symptoms: Vertical jitter.

Cause: Defective height control.

What To Do: Replace R9 (7.5 meg).

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VOLUME 13, No. 2 FEBRUARY, 1963

CONTENTS

ABOUT THE COVER

When the sensitivity of a transistor radio doesn't live up to expectations, there are many possible reasons for this complaint. Corrective measures are surprisingly simple, as pointed out in the article beginning on page 36.

Two outstanding products by the HIDDEN 600* who plan for your future:

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- Sprague Difilm Capacitors can't be beat! Dual-dielectric construction combines the best features of both Mylar® polyester film and special capacitor tissue. And for additional reliability, Difilm capacitors are impregnated with Sprague's HCX®, a solid impregnant which produces a rock-hard capacitor section—there's no wax to drip, no oil to leak!

- **BLACK BEAUTY Molded Tubulars** are actually low-cost versions of the famous Sprague high-reliability capacitors used in modern military missiles. They're engineered to withstand 105°C (221°F) temperatures . . . even in the most humid climates! And their tough, molded phenolic cases can't be damaged in handling or soldering.

- **ORANGE DROP Dipped Tubulars** are the perfect replacement for radial-lead capacitors now used by leading manufacturers of TV sets. Leads are crimped for neat mounting on printed wiring boards. Extremely small in size, they'll fit anywhere, work anywhere. And they're double-dipped in epoxy resin for extra protection against moisture.

***The "Hidden 600"** are Sprague's 600 experienced researchers who staff the **largest research organization in the electronic component industry** and who back up the efforts of some 8,500 Sprague employees.

Get your copy of Catalog C-614 from any Sprague distributor, or write Sprague Products Co., 105 Marshall Street, North Adams, Massachusetts.

SPRAGUE®
THE MARK OF RELIABILITY

65-294R2

WORLD'S LARGEST MANUFACTURER OF CAPACITORS

For window-size blow-ups of this message, send 10¢ to Sprague Products Co., 105 Marshall St., North Adams, Mass., to cover handling and mailing costs.

HOW TO BE SURE OF GOOD TV SERVICE...

1. Beware the Service "Bargain." If you shop around for cut-rate prices or extra-liberal service contracts, you're *asking* for trouble. A "something-for-nothing" offer usually means cut-rate parts and sub-standard service methods. The *reputable service dealer* spends years in study and training—thousands of dollars on test equipment, tools, and service manuals—countless hours in keeping up-to-date on new developments and service techniques. Because of this heavy investment, he can't *afford* to offer "bargains."

2. Rely on a Fully Qualified Independent Service Dealer. Well known and highly regarded by your friends and neighbors, his professional training and experience have made him a real technical expert. He takes pride in his work. He wants to stay in business. And he stakes his reputation and his future on satisfying *you*. So he'll use only component parts of the highest quality and latest design—plus his thorough knowledge and keen skills—to do the job right. Depend on him; he can't *afford* to let you down!

Your TV set provides you with a wealth of entertainment. Keep it in the best repair . . . at lowest cost . . . by calling your local TV-RADIO Service Dealer at the first sign of trouble!

THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,
DISTRIBUTORS' SUPPLY SUBSIDIARY OF SPRAGUE ELECTRIC COMPANY, NORTH ADAMS, MASSACHUSETTS FOR . . .

YOUR INDEPENDENT TV-RADIO SERVICE DEALER

63-342 R1

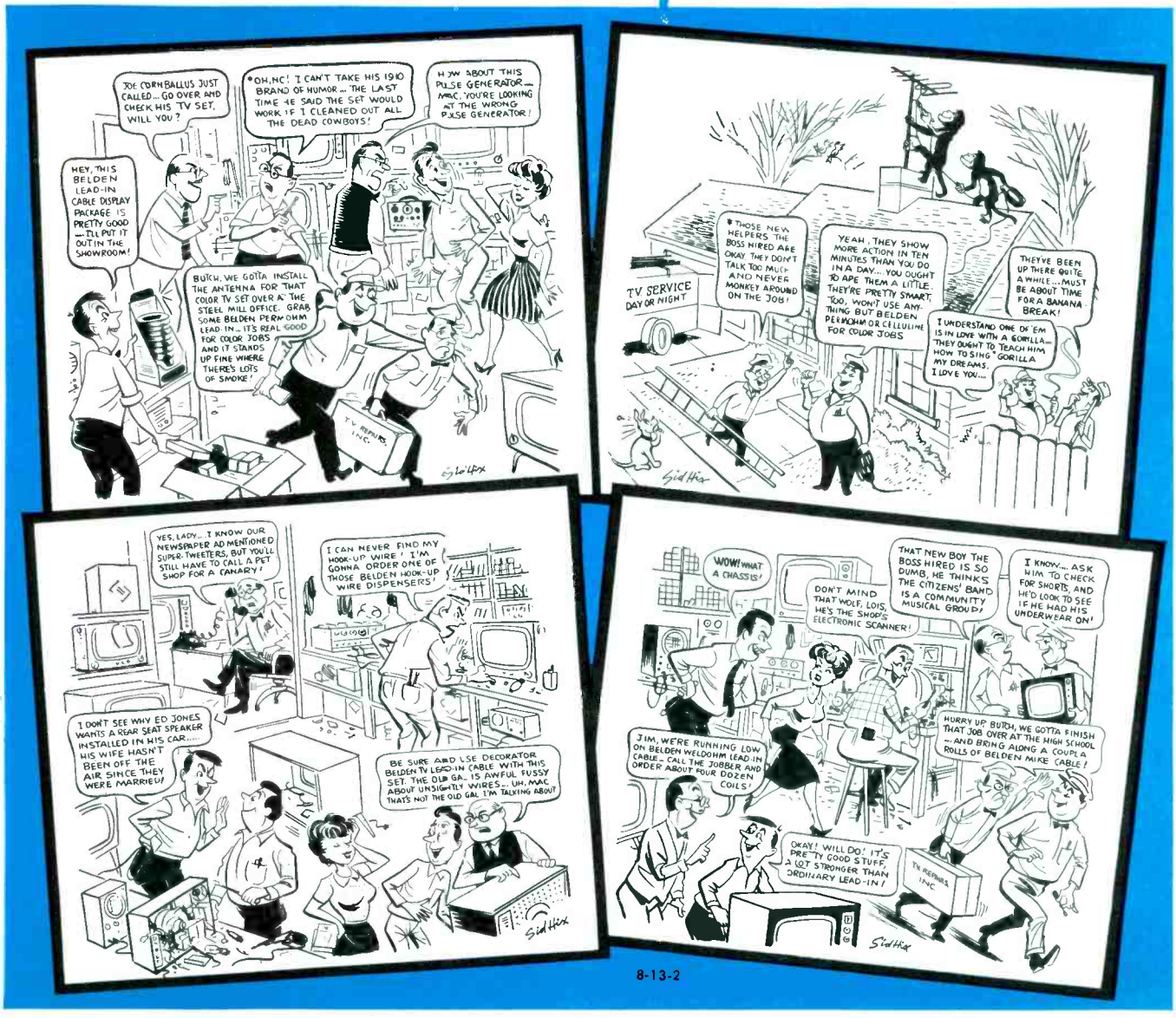
Belden
TV lead-in cables
give better pictures
(and cartoons, too!)

Instead of running an ad about how good Belden lead-in cables are, we thought you might enjoy re-reading some of the recent cartoons we have published. Besides, you already know that Belden Weldohm* is strong and flexible... Permohm✓ and Celluline✓ give better color TV pictures... and Permohm gives better signals in spite of industrial contamination and salt spray . . . don't you?

*Belden Trademark—Reg. U.S. Pat. Off.
✓Belden Trademarks and Patents—U.S. Patent No. 2782251 and 2814666

Belden
WIREMAKER FOR INDUSTRY
SINCE 1902 — CHICAGO

power supply cords • cord sets and portable cordage • electrical household cords • magnet wire • lead wire



LETTERS TO THE EDITOR

Dear Editor:

I'm past 70 years of age, and feel younger than most men do at 50—thanks to my interest in electronics. I remember entertaining over 100 friends by receiving KDKA's first broadcast, on a homemade set.

A. E. SHERRILL

Midwest City, Okla.

Ah, electronics—that fountain of youth, where current flows eternal!—Ed.

Dear Editor:

In your December, 1962 *Video Speed Servicing*, I believe there is an error. The resistor that should be replaced is R59 instead of R61, isn't it?

GEORGE CHANAKA

Washington, D. C.

You're right, George. R59 is the plate resistor for V9A. Better note this point on your copy of Video Speed Servicing *Card No. PH 12N51-3.—Ed.*

Dear Editor:

I was introduced to PF REPORTER by a friend who loaned me the entire set of issues for 1957, 1958, 1959, and 1960. They were more valuable to me, from a servicing standpoint, than a course I took which cost more than $250. I study each of your articles with great care.

RAY A. DILBECK

Etowah, Tenn.

Glad you're enrolled in our "school," Ray. You may step to the head of the class.—Ed.

Dear Editor:

I like the article "Calibrating Your Own Scopes and Generators" (December, 1962). However, in the chart of WWV signals, you failed to mention the binary-digit transmission that occurs six times each hour.

M. F. BARKER

Concordia, Kans.

Since this binary transmission can be interpreted only by special receiving equipment, we doubt if any practical serviceman would have need for the data. However, for those who are interested: Following each period of 440-cps tone signal, a short transmission is added which contains special signals for the benefit of other time stations around the world. This transmission consists of a series of binary pulses — "bursts" of 1000-cps tone — occurring at a rate of 100 pulses per second.—Ed.

TAKE 9 NUMBERS... AND YOU'VE GOT IT

B	I	N	G	O
SG-20HP4D	20CP4A	21ATP4A	24AVP4	SG-21XP4A
17BRP4	SG-24AEP4	21BAP4	SG-20CP4D	24TP4
20DP4	21BTP4	SG-24CP4A	20HP4C	21CEP4A
21AMP4A	SG-21FLP4	21XP4	SG-21ACP4A	24YP4
SG-17BJP4	21AUP4	21CMP4	20DP4C	SG-21AUP4B

WHAT HAPPENED TO ALL THE OTHER "NUMBERS"?

Who needs them? They're all gone . . . finis, kaput, raus mit, ausgespilt! NOW, with PHILCO Star Bright 20/20 Picture Tubes, 9 basic types do the job of 91 numbers that you needed before. That means that just about all of the popular tube replacement jobs can be done with just 9 Philco CR Tube numbers.

That's only part of the story. It's important that just one tube replaces 19 you needed before . . . but it is equally important to you that you can meet most ANY tube need . . . from 10" sizes up to 27" tubes with just 30 Philco "universal" tube numbers.

This saves you time. Saves you money. It means that your Philco Distributor will have the tube you need IN STOCK . . . when you need it!

Philco Star Bright 20/20 Picture Tubes give you a big advantage in customer satisfaction . . . with clearer, brighter pictures. Every Philco Star Bright 20/20 Picture Tube is made from all new parts and materials, except for the envelope, which, prior to re-use is inspected and tested to the same exacting standards as a new envelope and of course, every one still carries a full year warranty!

Stop in at your Philco Distributor today. Nine Philco Star Bright CRT numbers are all you need to win . . . on most replacement jobs.

PHILCO Factory-Supervised Service®

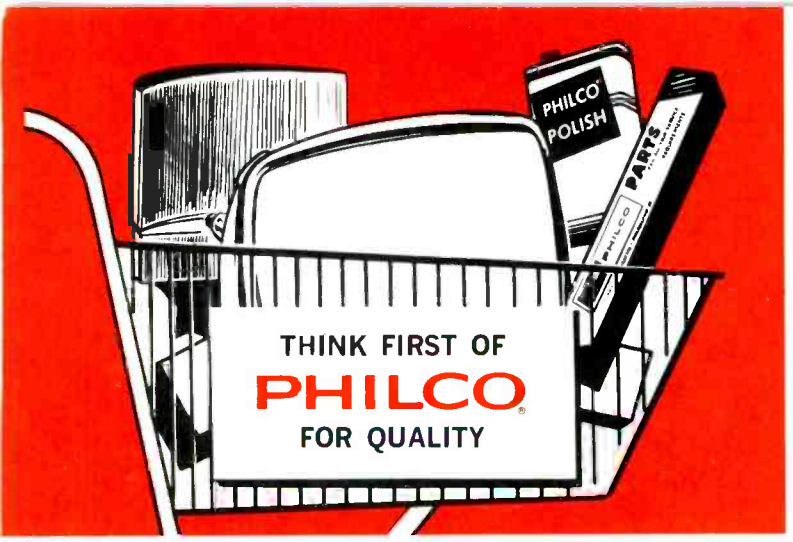
DEPEND ON YOUR PHILCO DISTRIBUTOR

. . . your one-stop-shopping center for all your tubes, parts and accessories.

PARTS AND SERVICE OPERATIONS

PHILCO®

A SUBSIDIARY OF Ford Motor Company

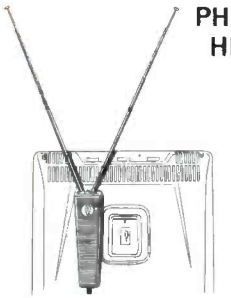


PHILCO QUALITY TESTED RECEIVING TUBES

A complete line of receiving tubes to fit any make, any model TV or radio, manufactured to exact Philco standards, thoroughly tested and each with the famous Philco "extra"—"satisfied customers".

PHILCO FURNITURE POLISH

Make your customers smile with delight when you give their hi-fi or TV cabinet that "factory-fresh" look with Philco Furniture Polish. Specially created for your TV and radio, and other fine furniture. Gives a bright, glowing sheen impossible with ordinary waxes.

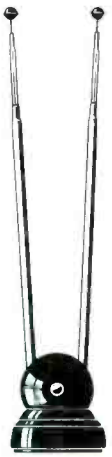


PHILCO DELUXE HIDE-ATENNA

Mounts on back of any television receiver. Telescopes out of sight when not in use. The best performing, trouble-free antenna available. Chrome finished. 39" elements fitted into Ivory plastic base. Spring-loaded pressure plate holds elements in positive position.

POPULAR PRICED ANTENNA

Deluxe model "rabbit-ear" antenna with 3 sectional collapsible elements. Polished styrene base. Twin-X lead with open spade lugs for easy installation.



PHILCO "8" BALL AUTO RADIO TOP COWL OR FENDER MOUNT ANTENNA

Excellent for general replacement as well as new installations. Triple chrome plating over brass. Adjusts to any angle up to 35°. Three sections telescope into 22" length, extend to 56". 54" low-loss lead, fully shielded.

DEPEND ON YOUR PHILCO DISTRIBUTOR

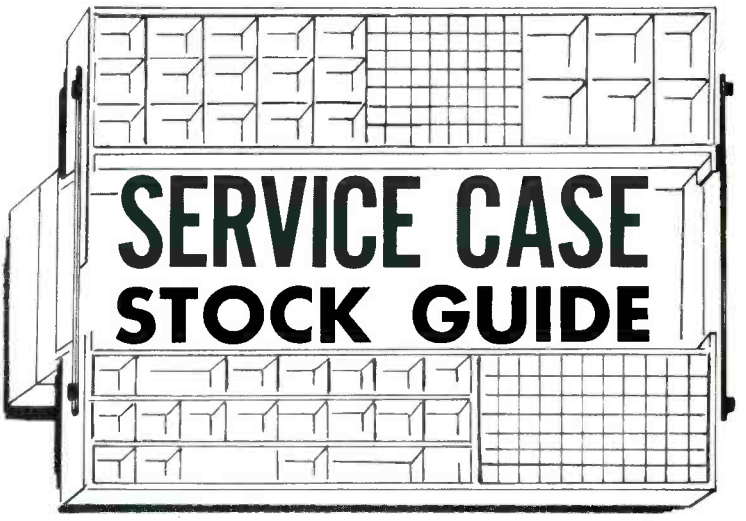
Your one-stop-shopping center for all parts and accessories.

PHILCO Factory-Supervised Service

PARTS & SERVICE OPERATIONS

PHILCO

A SUBSIDIARY OF Ford Motor Company



To do an efficient job of in-home servicing, you need strong arms (so you can carry in all the equipment you're likely to use), or strong legs (so you won't mind going back out to the service vehicle for equipment you didn't bring in the first time).

Seriously, having a good stock of equipment available on home calls will allow you to take advantage of every opportunity to repair a set right on the spot.

Hand Tools

Regular screwdrivers:

- 3/32" (for set screws)
- 3/16" (3", 6", and 10" long)
- 1/4" (3" and 6" long)

Phillips screwdrivers:

- No. 1 (3" and 6" long)
- No. 2 (3" and 6" long)

Hex-head wrenches:

- Set of 1/4", 5/16", 11/32", 3/8", 9/16"—all 6" long; also 1/4" (3" and 10" long)

Other items:

- Diagonal cutters
- Long-nose pliers
- Gas pliers (6")
- Adjustable wrench (6")
- Screw-holding screwdriver
- Allen-wrench set
- Bristo-wrench set
- Clutch-head screwdriver
- Soldering gun (100W or 100/135W)
- Soldering-aid tool
- Solder (hank)

Service Aids

- Cheater cord
- Extra cheater cord with alligator-clip ends (optional)
- Drop cloth
- Flashlight
- Tube puller
- Large setup mirror
- Small inspection mirror
- Pad of invoice forms
- Clip leads (jumpers)
- Neon-bulb tester for AC line voltage
- Alignment tools (few basic types)
- Tube-socket adapters (octal; 7- and 9-pin)
- Tube-pin straighteners (7- and 9-pin)
- Earphone with test clips (also with phono plug)
- Plastic insulating tape
- Spare sheet-metal and wood screws for cages and covers

Such opportunities are increasing, as a result of the continuing trend to design sets so more components are accessible without removal of the chassis from the cabinet. Even when you can't complete a repair in the home, a good stock of tools and service aids will help you to do a better job of diagnosing the fault; thus, you'll be able to give a more accurate estimate of the bill. Furthermore, you'll be able to pull the chassis with less of a struggle than if you try to "get along" on a mere fistful of tools.

Of course, this idea of being well equipped can be carried to the point of being ridiculous. You can avoid the necessity of pulling a trailer behind your truck to hold all the equipment if you'll scrutinize your list of "nice to have" items and weed out all but the paying passengers. To help you arrive at a trim but versatile stock, we've prepared this check list of items frequently needed for home servicing. Tubes and fuses are not enumerated in detail, since stock guides for these parts appear from time to time in PF REPORTER. As for the rest of the equipment, we don't claim to have compiled a complete list; but we have mentioned those items which we find useful ourselves. You can cram most of this equipment into one rather large case, or you might prefer to divide it among two or three smaller kits so you can leave some of it in the service vehicle until you actually need it.

Chemicals

- Control cleaner
- Tuner cleaner
- HV insulator
- General-purpose cement
- Lubricant (silicone or graphite)
- CRT glass cleaner
- Cabinet touch-up (liquid or stick)
- Aquadag paint for CRT's
- Yoke remover
- Chilling spray

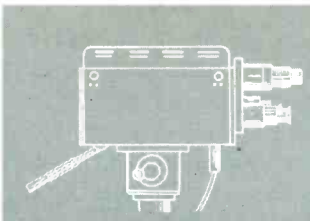
Small Test Equipment

- VOM (20K ohms/volt)
- Tube tester (grid-circuit type, with or without emission check)
- Signal injector (transistorized noise generator)
- Rectifier-circuit tester and fuse substitutor
- Electrolytic substitution box

Components

(for substitution tests or completing repairs)

- Box of assorted resistors 1/2W, plus 1W in values under 3000 ohms)
- Tubular capacitors (600V) in popular values: .001, .005, .01, .02, .047, .1, .25
- Fuses (kit of popular types)
- Fusible resistors (5 ohms, 7.5 ohms; others optional)
- Rectifiers two 500-ma silicon, two 500-ma selenium
- Selenium AFC dual diode, common-cathode type
- CRT brighteners for 90° and 110° bases, series and parallel type
- Spare shields for 7- and 9-pin miniature tubes



The Electronic Scanner

25th Anniversary

Mr. Harry Silverstein (left), president and founder of **Vaco Products,** is shown receiving a plaque in recognition of his 25 years of service with the company. Mr. Roy Vetzner, vice president of the company, made the presentation at a recent plant meeting attended by employees, officers, and directors of the firm.

Stereo FM Booklet

Reasons why an outdoor antenna is vital to good Stereo-FM reception are the subject of a booklet recently published by **JFD Electronics.** "A Guide to Better FM-Stereo Performance" clarifies many points, such as why an antenna designed especially for stereo reception aids the subcarrier to "lock in" the receiver's multiplex circuits. The booklet can be used as a promotional piece by JFD antenna dealers.

FTC Enters Hi-Fi Picture

The Federal Trade Commission has received, at its own request, a report from the Electronic Industries Association (EIA) containing "information useful in developing a true definition of high-fidelity sound reproduction." The report was a factual summary of the views of 154 members of the sound and music industry, the result of a survey conducted by EIA.

Play Mono or Stereo

An eye-catching display card is being offered to phonograph-needle dealers by **Jensen Industries,** to help call attention to their new lower-priced CRA-55XD diamond needle. The display includes an illustration showing how to install the new needle, and points out that it is made from a precision-ground, gemstone diamond. Six individual needle packets are arranged in stair-step fashion on the lower left side of the card.

New Line of Compactrons

Sylvania's Tube Division is producing a number of compactron receiving tubes for television sets. Some of those already available are: 5BM3 low-voltage rectifier; 6GE5, 6GV5, 17GV5, and 21GV5 horizontal output amplifiers; 6FM7, 13FM7, and 17JZ8 vertical oscillator-output tubes; and 17BE3 damper. Multipurpose compactrons 6AL11, 12AL11, 6G11, and 6AS11 are also included. Sylvania expects to add to these in the near future.

Boosting Battery Sales

A new display will help dealers who sell **Burgess** flashlight batteries. Using it, prospective customers can test their old batteries, select the correct replacement, and even pretest the new ones. The three-color display holds 48 size D, 12 size C, and 12 size ZZ cells, and is easily reloaded from the top, to insure a constant supply of batteries.

Record-Changer Gauges

A unique printed card, offered by **Shure Brothers,** permits easy and inexpensive tests of record-changer performance. Using pennies, paper clips, and cutouts from the printed card, the technician can construct six different gauges that have enough accuracy for practical tests of needle pressure, bearing friction, turntable leveling, arm set-down, turntable speed, and record clearance. The cards can be used by dealers as inexpensive gifts to their hi-fi customers.

Independents Key to Industrial Growth

Speaking at the annual NARDA (National Appliance & Radio-TV Dealers Association) meeting, Raymond W. Saxon —**RCA** Vice President of Marketing—indicated that servicing holds the key to further business gains. Calling on dealers to take a fresh look at the servicing part of their business, Mr. Saxon said, "Now is the time to restore what was once a profitable segment of this business. RCA plans to support the independent servicing industry by continued factory- and distributor-sponsored training programs."

Electrolytic Replacement Manual

The **Sprague** electrolytic replacement guide has been revised, updated, and expanded. The new manual, K-106, now covers 256 makes of television and radio sets manufactured from 1947 through July, 1962; over 2450 different capacitors are listed. The manual cross-references the original part number to the correct Sprague number, making the selection of a replacement quick and easy. Also included is the list price of each unit.

Finding a New Head

Servicemen and dealers will be interested to know that replacement data covering tape-recorder heads is now being included in PHOTOFACT Folders. **Nortronics** was the first manufacturer to participate in this service for technicians, which will make locating a replacement head much simpler. The data lists the recorder manufacturer's part number and the Nortronics replacement unit, in addition to other pertinent head information.

A New Home

Tenna Corp., maker of automobile radios and accessories, recently moved into this large (100,000 square feet) manufacturing and office building. Location of the new plant is at 19201 Cranwood Parkway, Warrensville Heights, Ohio — a part of the Greater Cleveland metropolitan area. With this move, all of Tenna's operations are now combined under one roof, with the exception of a subsidiary in Puerto Rico.

Pain-Killing Sound

Absolute freedom from noise is a feature of new four-track stereo tape recordings developed by a division of **Ampex** for use in the audio-analgesia field. Audio analgesia is a musical form of anesthetic being used by many dentists to relieve pain and relax the patient. The music was selected and tested in dental applications by Dr. Wallace J. Gardner, music consultant to Ampex on audio analgesia.

Long, Long Life

In a recent series of life tests, **Amperex** chalked up an enviable record of one million tube-hours with zero failures. The tests were made on certain frame-grid types. A detailed description and analysis of how these reliability tests were conducted appears in a brochure, "Guaranteed Reliability with Amperex Premium Quality Frame-Grid Tubes."

SENCORE
SIMPLIFIES COLOR SERVICING

NEW! CA122
COLOR CIRCUIT ANALYZER

A simple approach to a complex problem

Here is an instrument that is designed to eliminate the guesswork in color TV servicing. A complete analyzer that provides all required test patterns and signals for testing from the tuner to the tri-color tube. Additional analyzing signals for injection at each stage including audio, video and sync, brings to life a truly portable and practical TV analyzer for on the spot service; virtually obsoleting other analyzers with the advent of color. Sencore's simplified approach requires no knowledge of I, Q, R-Y, B-Y, G-Y or other hard to remember formulas. The CA122 generates every signal normally received from the TV station plus convergence and color test patterns.

The CA122 offers more for less money:

TEN STANDARD COLOR BARS: The type and phase that is fast becoming the standard of the industry. Crystal controlled keyed bars, (RCA type) as explained in most service literature, offer a complete gamut of colors for every color circuit test.

WHITE DOTS: New stabilized dots, a must for convergence, are created by new Sencore counting circuits.

CROSS HATCH PATTERN: A basic requirement for fast CRT convergence.

VERTICAL AND HORIZONTAL BARS: An added feature to speed up convergence, not found on many other color generators.

SHADING BARS: Determines the ability of the video amplifier to produce shades (Y Signal) and to make color temperature adjustments. An important feature missing on other generators.

COLOR GUN INTERRUPTOR: For fast purity and convergence checks without upsetting color controls. Insures proper operation of tri-color guns, preventing wasted time in trouble shooting circuits when CRT is at fault.

A must for color . . .

a money maker for black and white TV servicing

ANALYZING SIGNALS: RF and IF signals modulated with any of the above patterns for injection into grid circuits from antenna to detector. IF attenuator is pre-set for minimum signal for each IF stage to produce pattern on CRT thus providing a check on individual stage gain. Sync and video, plus or minus from 0 to 30 volts peak to peak, have separate peak to peak calibrated controls for quick checks on all video and sync circuits. Crystal controlled 4.5 mc and 900 cycles audio simplify trouble shooting of audio circuits.

NEW ILLUMINATED PATTERN INDICATOR: A Sencore first, offering a rotating color film that exhibits the actual color patterns as they appear on color TV receivers. Locks in with pattern selector control.

You'll pay more for other color generators only.

Dealer Net **187.50**

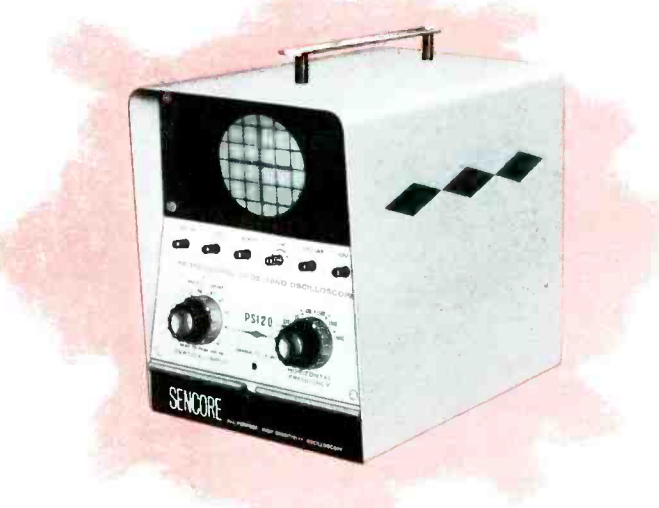
NEW! PS120 PROFESSIONAL WIDE BAND OSCILLOSCOPE

A portable wide band 3 inch oscilloscope for fast, on-the-spot testing. An all new simplified design brings new meaning to the word portability . . . it's as easy to operate and carry as a VTVM. Though compact in size, the PS120 is powerful in performance: Vertical amplifier frequency response of 4 MC flat, only 3 DB down at 7.5 MC and usable to 12 MC, equips the technician for every color servicing job and the engineer with a scope for field and production line testing. AC coupled, with a low frequency response of 20 cycles insure accurate low frequency measurements without vertical bounce. Sensitive single band vertical amplifier; sensitivity of .035 volts RMS for one inch deflection saves band switching and guessing. Horizontal sweep frequency range of 15 cycles to 150 KC and sync range from 15 cycles to 8 MC (usable to 12 MC) results in positive "locking" on all signals. New exclusive Sencore features are direct reading peak-to-peak volts —no interpretation; dual controls to simplify tuning; lead compartment to conceal test leads, jacks and seldom used switches. Rear tilt adjustment angles scope "just right" for easy viewing on bench or production line.

Size: 7"w x 9"h x 11¼"d. Weight: 12 lbs.

Dealer Net **124.50**
(with low cap. probe)

Kit **74.50**



A must for servicing color TV in the home . . . lowest priced broad band scope. All hand wired — all American made

SENCORE

SIMPLIFIES SWEEP CIRCUIT TROUBLE SHOOTING

SS117
SWEEP CIRCUIT ANALYZER

For Color and Monochrome Testing

A professional trouble shooter that helps you methodically walk the trouble out of "tough-dog" sweep circuits in monochrome and color receivers. The SS117 provides a positive but simple push button test on all circuits indicated in the block diagrams. These time-consuming circuits are checked step-by-step with tried and proven signal injection and substitution methods. All checks can be made from the top of the chassis or from under the chassis when it is removed from the cabinet.

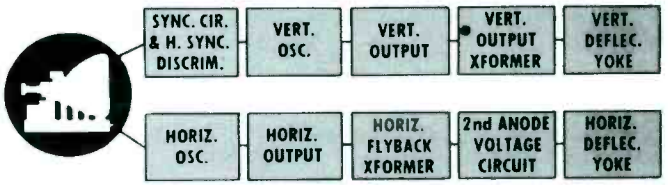
TV horizontal oscillator check is made by substituting a universal oscillator known to be good. Horizontal output check consists of a cathode current and screen voltage test. The TV horizontal yoke is checked by substituting a universal yoke from the SS117 and viewing brightness or restoration of 2nd anode voltage. Horizontal flyback is checked dynamically in circuit by measuring the power transfer to the yoke when TV is turned on. TV horizontal sync can be used to control the SS117 horizontal oscillator, providing a positive check on sync from the video amplifier to the TV oscillator. Vertical circuits are tested by simple signal injection from vertical yoke to oscillator for full height on CRT. The SS117 with the CA122 Color Analyzer provides a complete TV analyzer for virtually every stage in monochrome or color receivers.

External checks for AC, DC, peak to peak voltage readings and DC current in the upper right hand corner save using a separate VTVM. Accurate 2nd anode measurements up to 30,000 volts are made with a sensitive 300 microamp meter and the attached high voltage probe. AC outlets, all steel construction and mirror in the cover makes every servicing job easier.

Size: 10¼" x 9¼" x 3½". Wt. 10 lbs.

Dealer Net **89.50**

The SS117 checks them all



FREE—A 33 RPM half hour permanent record packed with every unit explains each test.

FOR FASTER MORE ACCURATE TUBE TESTING

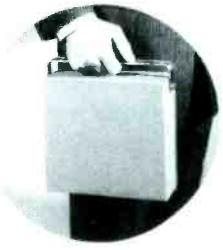
TC114 MIGHTY MITE
TUBE CHECKER

This is the famous Mighty Mite, acclaimed by over 25,000 servicemen, maintenance men and engineers as "the best they've ever used." A complete tube tester that is smaller than a portable typewriter yet finds tubes that testers costing hundreds of dollars miss, thus selling more tubes and reducing call backs. A real money maker for the serviceman and a trusty companion for engineers, maintenance men and experimenters. The Mighty Mite has been acclaimed from coast to coast as the real answer for the man on the go. Even though the Mighty Mite weighs less than 8 pounds, new circuitry 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. Thus, too, it checks for cathode current at operating levels and shorts or leakage up to 120,000 ohms between all elements. And it does all this by merely setting four controls labeled A, B, C, & D with new type easy grip knobs. Check these plus Sencore features... Meter glows in dark for easy reading behind TV set...The new Mighty Mite has large size Speedy-Setup Tube Chart inside of cover—cuts setup time for even faster servicing. New stick proof D' Arsonval meter will not burn out even with shorted tube...Rugged, all steel carrying case and easy grip handle.

The improved Mighty Mite will test virtually every radio and TV tube that you encounter, nearly 2000 in all, including foreign, five star, auto radio tubes plus the new Compactrons, Novars, Nuvistors and 10 pin tubes. Has larger, easy-to-read type set-up booklet for faster testing.

Size: 10¼" x 9¼" x 3½". Weight: 8 lbs.

Dealer Net **74.50**



Fast, Accurate . . . never lets you down

A must for color

TM116 TUBE TESTER MODERNIZING PANEL

New tube adapter for testing Compactrons, Novars, Nuvistors and 10 pin tubes in any tube tester except cardomatic types. Plugs into octal socket of your tube tester enabling you to test these new tubes in the same manner that your tester checks conventional tubes. Tube set-up chart included with each adapter.

Dealer Net **24.95**

SMALL APPLIANCES

...a service sideline

What type of problems can be expected?— by Fred G. Biesecker

When summer rolls around and a shortage of radio-TV repair jobs seems likely, the serviceman often wonders what he is going to work on. Why not small household appliances? This could be a very profitable sideline, because there is an abundance of this type of equipment in need of repair.

What additional equipment will you have to acquire for small-appliance servicing, and how difficult will it be to procure parts? Considering the test equipment you already have on hand, you may need very few other instruments. Additional items you might acquire are: A surface-temperature meter, a wattmeter, or possibly a special appliance-testing meter. You probably have the small wrenches and tools needed for disassembling these units.

Appliance parts can sometimes be procured through your local radio-TV parts distributor; many of these firms handle small appliances in addition to their electronics lines. You can also contact appliance manufacturers and local distributors who handle this type of equipment; the sooner you do this the sooner you'll find out what parts are available locally and what ones will have to be ordered by mail. Any service literature you can obtain at the same time will be valuable later.

Common Troubles

The four most common small-appliance breakdowns occur in AC cords, AC plugs, heating elements, and thermostats. Let's examine each of these, and see what faults are usually encountered.

AC Cords: These are available in a variety of colors and sizes. Some small appliances use the common cheater cord like that found on television sets, while others use larger wire that has a heavy rubber insulation. Electric irons and heaters use an extra-heavy asbestos-insulated cord. One important fact should always be kept in mind: Stranded wire is used in line cords for all household appliances to withstand the effects of constant flexing and bending.

The line cord should be checked any time an appliance is in the shop for repair. Check to see if the insulation is cracked, worn, or frayed. Take the cord in your hand and flex or bend it to check for an intermittent connection — especially near the end. If you have any doubt about the cord, replace it.

Plugs: A frequent trouble is a broken wire inside the plug, caused by constant flexing and bending of the cord; it can be hard to detect if you're not expecting it. With the appliance turned on, bend the plug back and forth, watching for signs of intermittent operation.

Often, the original equipment has a molded plug that can't be repaired. If trouble appears in this type of plug, clip it off and replace it. There are several shapes and sizes of replacement plugs, as shown in Fig. 1. If you use a plug in which screws hold the wires, make very sure the fine strands of wire do not short to each other. A sure way of preventing this is to tin the leads with solder before installation.

Thermostats: A thermostat is a relay that can be set so its contacts close at a definite temperature; in other words, it converts the expansion of heated metals into movement that controls electrical devices. Several sizes and shapes of thermostats can be seen in Fig. 2. They, too, are easier to replace than to repair. (This could be called a "rule of the road" in repairing small appliances: Time and money are often saved by replacing a faulty part rather than trying to repair it.)

Heating Elements: The heating element of most small appliances is a resistance wire—usually nichrome —connected directly across the

• *Please turn to page 73*

Fig. 1. Replacement plugs are available in a variety of shapes and sizes.

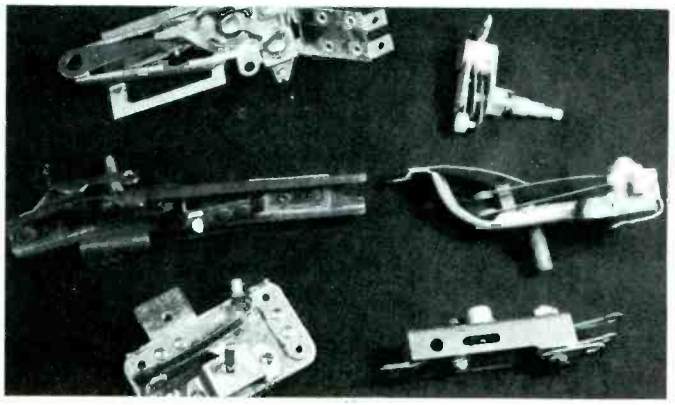
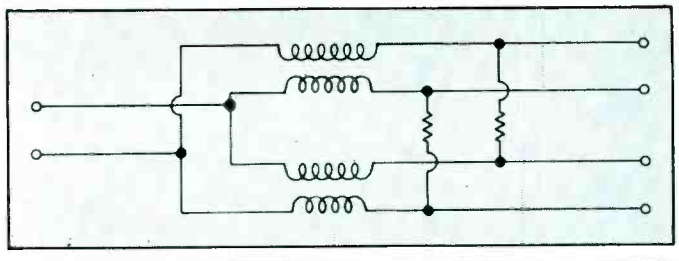


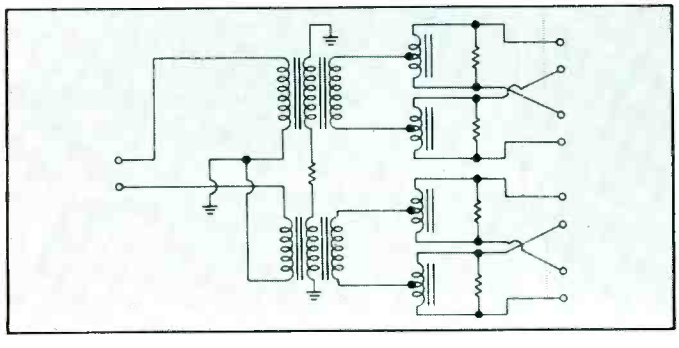
Fig. 2. Typical thermostats used with electric irons to control temperature.

THE SECRET'S IN THE CIRCUIT

BLONDER-TONGUE TV/FM COUPLERS

You can't tell a coupler by its case. However, a view of what's inside can tell you why a coupler will deliver clean, interference-free signals to a multi-set installation. Examine the circuitry of Blonder-Tongue couplers. Compare them with ordinary units. It's easy to see why they are the best selling quality couplers on the market.





THE TIME TESTED BLONDER-TONGUE A-102

This is the champion performer among all 2-set couplers judged on the basis of its popularity with technicians and TV viewers. The A-102 offers 12 db isolation *with only 3 db insertion loss*—half the insertion loss of the average 2-set coupler! Designed for both TV and FM, it is especially effective in weak signal areas. For FM stereo, this low loss hybrid type unit is the answer. A look at its circuitry will tell you why. • patented bifilar transformers • backmatched for precise impedance match • heavy conductors end burnouts. List $3.20

NEW COLOR-ENGINEERED COLOR-4

Where a color TV set is one of the sets receiving signals from a single antenna, the Color-4 is the only answer. This super deluxe 4-set coupler offers maximum interset isolation (16 to 24 db), excellent impedance match and only a 6.5 db insertion loss. The Color-4 uses ferrite broadband transformers in balanced bridge design and it has a voltage standing wave ratio of less than 1.5. Result: Lower inherent insertion loss, less smear and ghosts, sharper pictures than any other 4-set coupler.

- Ferrite broadband transformers in balanced bridge design
- VSWR of outputs and inputs no greater than 1.5.
- Backmatched

List $9.95

BLONDER-TONGUE TV & ANTENNA COUPLERS

NEW BLONDER-TONGUE ALL CHANNEL SET-2. The SET-2 is one of the few couplers available today that can deliver full power signals to two UHF, or a VHF and UHF receivers operating from the same antenna. Effective straightforward resistive circuit provides 12 db interset isolation with 6 db loss. While it's effective on VHF and FM, the low loss A-102 is a better choice for FM stereo. List $3.20

BLONDER-TONGUE A-104 FOUR SET COUPLER. Inductive — resistive coupler for VHF and FM. Feeds 4 VHF receivers from one antenna, or mixes 4 antennas into one line. Isolation: 12-20 db. Loss: 7.5 db. List $4.50

BLONDER-TONGUE A-105-HI-LO COUPLER. Combines low and high band VHF antennas and provides separate low and high outputs from a common line or antenna. Less than 0.5 db loss. List $4.10

BLONDER-TONGUE A-107 UHF-VHF ANTENNA COUPLER. The choice in UHF areas throughout the country. It combines VHF and UHF antennas, or provides separate VHF and UHF outputs from a common line or antenna. Less than 1.0 db loss. List $4.75

INDOORS OR OUTDOOR. Blonder-Tongue couplers are the easiest to install. Patented stripless connectors assure rapid, positive installation—no stripping, no splicing twinlead. Weatherproof, *non-breakable* case permits installation indoor or outdoors.

For the right coupler at the right price, contact your Blonder-Tongue parts distributor or write Dept. PF-2

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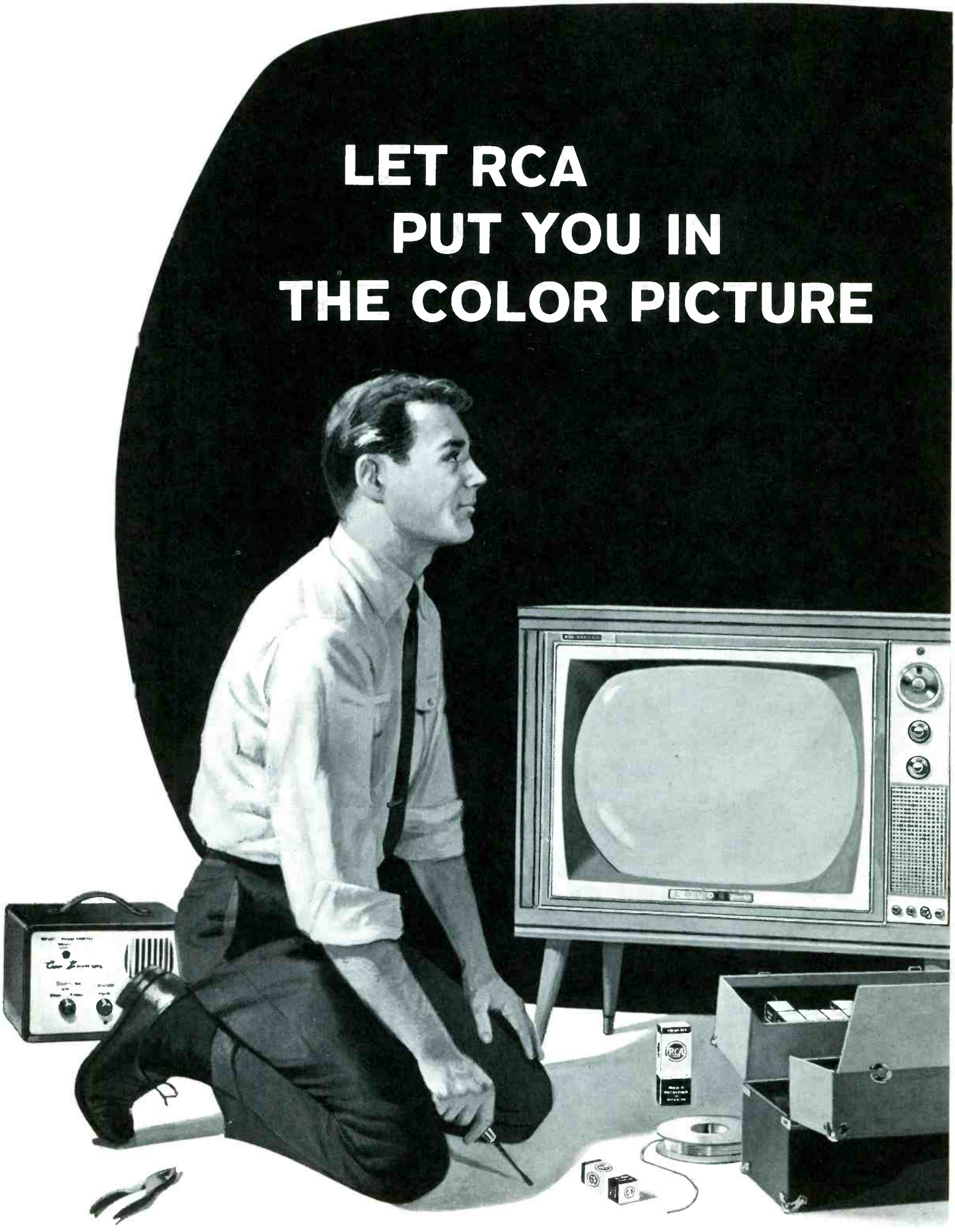
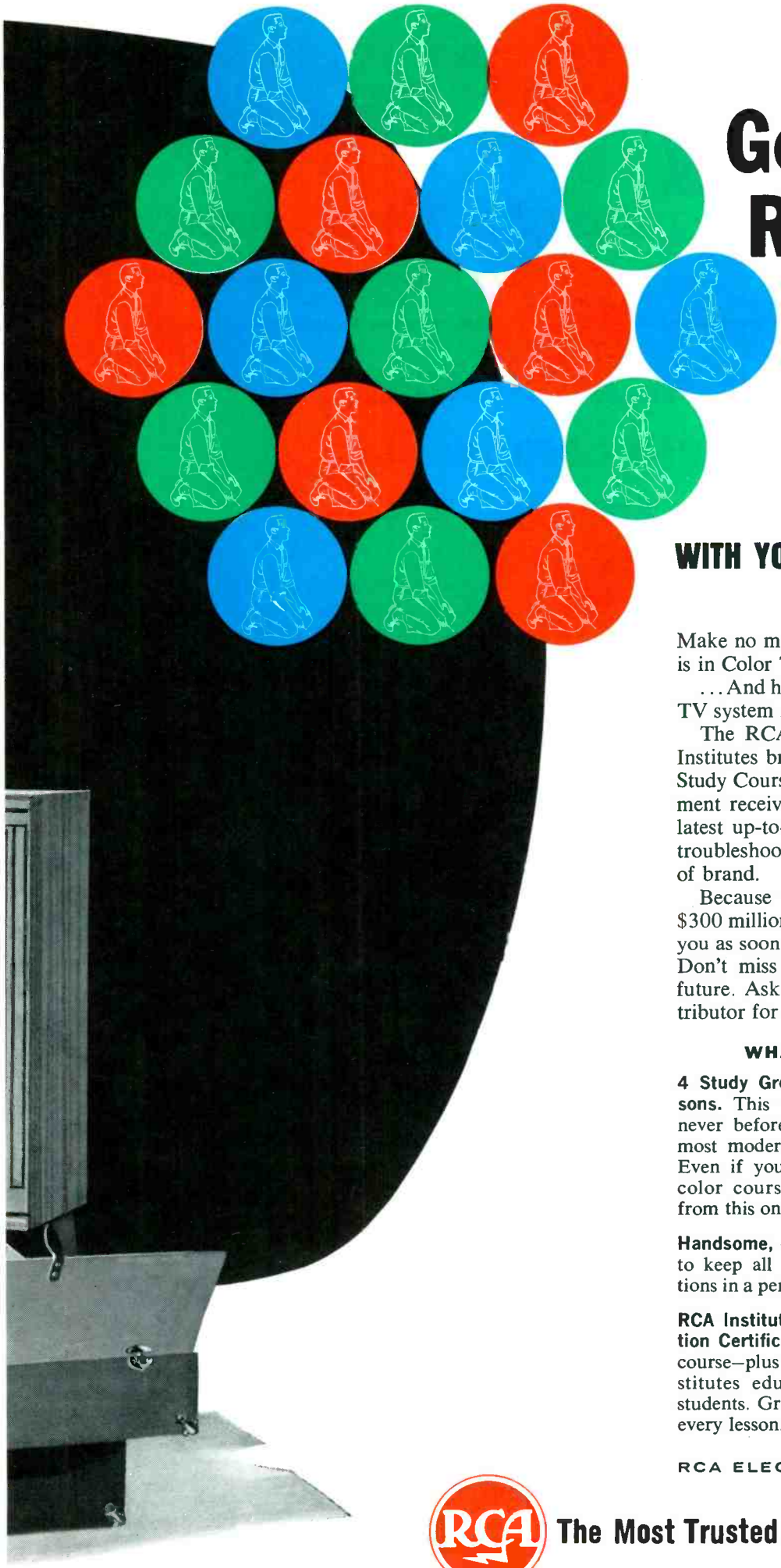
LET RCA PUT YOU IN THE COLOR PICTURE





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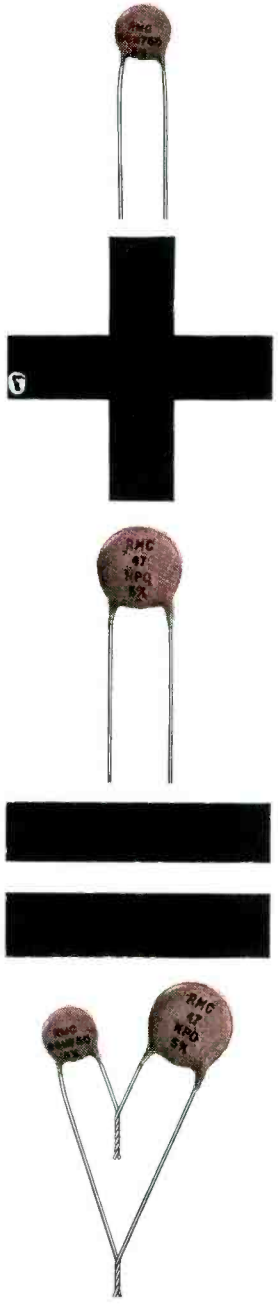
Getting "*unusual*" coefficients in temperature compensating ceramics



When you're putting a temperature stabilizing ceramic capacitor in an oscillator circuit to eliminate frequency drift during warm-up, you'll find sometimes that the standard negative coefficient of the capacitor just doesn't match what your circuit needs. Instead of an N750—the usual standard value—you may need an N150 or N300. But you just can't get those odd values every time you look for them.

There's a simple way to tailor-make your own compensating capacitor, by paralleling standard NPO (zero coefficient) and N750 (negative 750 parts per million per degree) units.

Here's how it works. Multiply the capacity you need in mmfd by the desired temperature coefficient. Then divide the answer by 750. The result is the mmfd value of the N750 unit in the parallel combination. To find the value of the NPO unit, subtract the N750 value you've just calculated from the total capacity you need.

Suppose you're looking for 100 mmfd with a temperature coefficient of N330. The calculations go like this:

(1) Multiply: $100 \times 330 = 33{,}000$.
(2) Divide: $33{,}000 \div 750 = 44$ mmfd; this is the N750 value.
(3) Subtract: $100 - 44 = 56$ mmfd; this is the NPO value.

Get yourself a standard 47 mmfd NPO (Discap® CNO-447), the nearest standard value to 44 mmfd, and a 56 mmfd N750 (Discap CN7-456). Twist the leads together, solder them in place . . . and you're in business.

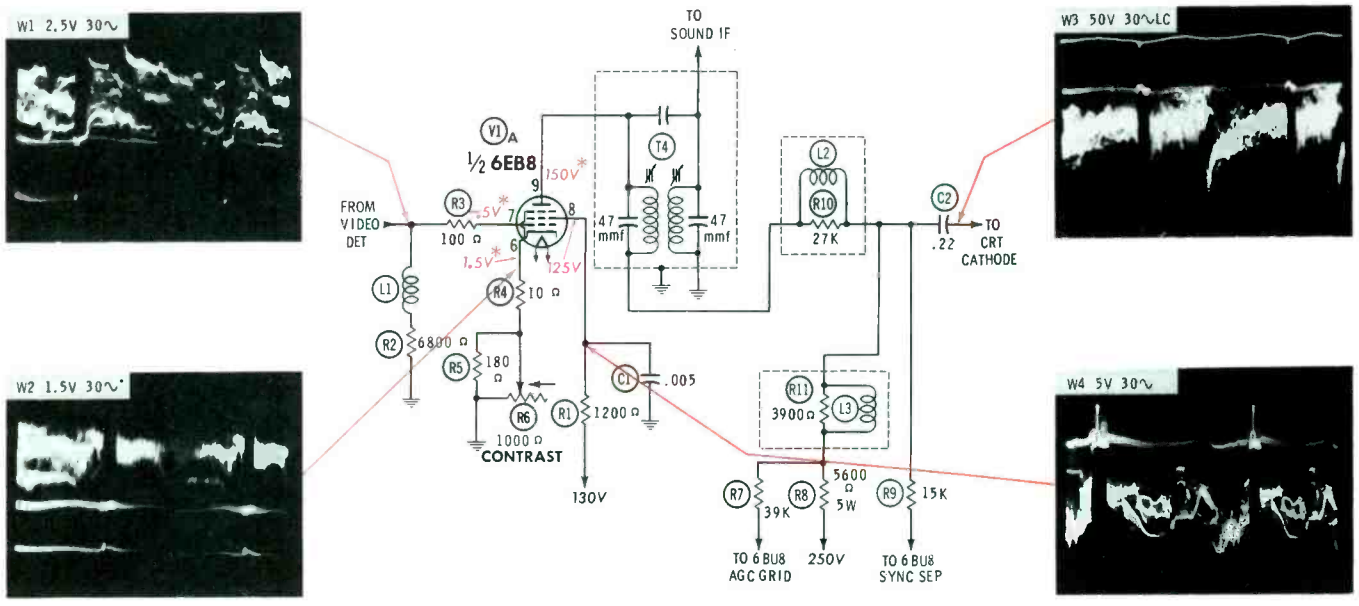
And here's another tip. Make sure you use Discaps whenever you need a ceramic capacitor. They're made by Radio Materials Company, a Mallory division, world's largest manufacturer of ceramic capacitors. They're available in every imaginable rating at your Mallory distributor . . . in temperature compensating, general purpose, buffer, miniature, high voltage, trimmer and feed-through types. Most popular types come in the handy file card five-pack.

Make your Mallory distributor your headquarters for Discaps, for Mallory electrolytics, tubular capacitors, controls, resistors, batteries, silicon rectifiers, switches and vibrators.

RF REPORTER Symfact

Video Output

Contrast Control at Cathode



DC VOLTAGES taken with VTVM, on inactive channel; antenna terminals shorted. * Means voltage varies with conditions. See "Variations."

WAVEFORMS taken with wide-band scope; controls set for 50-volt p-p video to CRT. Low-cap probe (LC) used where direct probe distorts signal.

Normal Operation

In most TV receivers, single stage amplifies output signal of video detector to adequate level for driving CRT. Contrast control determines peak-to-peak value of video output. In circuit shown here, control is in cathode circuit of video amplifier and regulates gain of stage by determining bias. This particular circuit has video detector load (R2 and L1) directly coupled to grid of video output; some others have capacitive coupling, with high resistance in grid circuit. Intercarrier sound signal is also amplified by V1A, and then coupled to sound IF via T4 in plate circuit (which also traps 4.5-mc interference out of CRT input). Video amplifiers are characterized by peaking coils, primarily in plate and detector load circuits. Together with stray capacitances, they form resonant circuits at frequencies just above 3 mc, to prevent loss of output near high end of video range; shunt resistors broaden resonant peaks to prevent spurious oscillation. Signal for sync separator is ordinarily tapped off from voltage divider in plate circuit; if set uses keyed AGC, its input is similarly taken from video-amplifier plate (through isolating resistor).

Operating Variations

PIN 7 W1 amplitude is moderately affected by RF signal strength and AGC-control setting. DC voltage depends mainly on signal input, and typically ranges from –2.5 to –3.5 volts (more negative in some sets). Adjusting contrast control causes grid voltage to fluctuate several tenths of a volt.

PIN 6 Reducing contrast setting increases cathode resistance, so DC voltage rises to 2.5 volts at minimum contrast (without signal). Value is only about .3 volt at maximum contrast. Incoming signal, by increasing bias on tube, reduces cathode current and lowers DC voltage to one-third of no-signal value at same contrast setting.

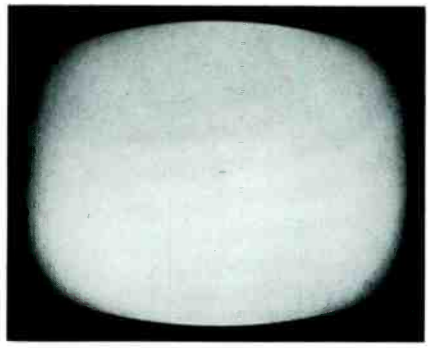
PIN 9 DC voltage on schematic is for moderate contrast setting that produces 50-volt peak-to-peak amplitude of W3. Sharp drop occurs at high contrast settings, to as low as 80 volts; toward minimum contrast, DC at plate rises gradually to 170 volts. With signal present, plate voltage is much higher—averaging nearly 200 volts.

SYMPTOM 1

No Video

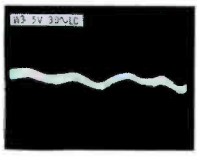
No Snow; Slight Audible Noise

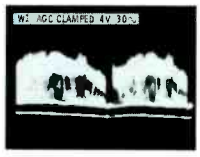
L2 Open



Symptom Analysis

Screen is completely blank at all positions of channel selector. Brightness control works normally, so short in CRT seems improbable. Rotation of contrast control has no effect. Trouble could be broken signal path in IF or video, dead oscillator-mixer, or too much AGC. R10 overheats.

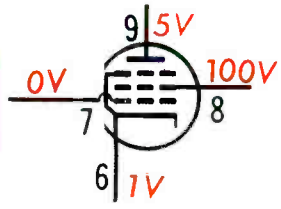




Waveform Analysis

No video appears in W3, even when CRT base socket is unplugged. Input to video amplifier (W1) is also missing; this would be clear evidence of trouble in detector or earlier stage, except for one fact: video amplifier is vital to operation of keyed AGC system. When AGC-clamping bias is applied to tuner and IF's, weak picture appears. W1 then has more than sufficient amplitude, and nearly normal shape, although amplitude of W3 is still far below normal. Obvious low gain encourages further check of video amplifier.

Voltage and Component Analysis



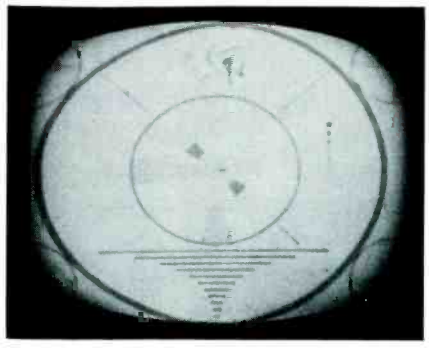
Defect lowers plate voltage of V1A to only 5 volts. Such drastic drop occurs because, with coil open, most of plate-supply voltage is dropped across R10; tube acts as low resistance because lack of signal removes bias. Trouble would have been less serious if R10 were smaller portion of plate-circuit resistance. Similar defect in set without keyed AGC would not have killed picture, but here a chain reaction occurs: Voltage at junction of R7-R8 rises, making AGC tube conduct so hard it cuts off RF-IF stages.

SYMPTOM 2

Weak Video

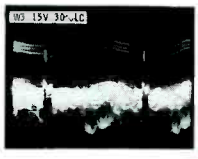
Contrast Control Has No Effect

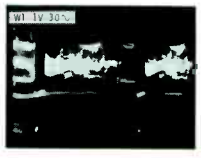
R6 Open



Symptom Analysis

Failure of contrast control to affect picture is excellent sign of trouble in video output stage. Sound, which also passes through this stage, seems unaffected. However, this fact does not exclude possibility of trouble in sound-signal path, because reduced gain ahead of detector may hardly affect volume.





Waveform Analysis

Obvious fault in W3 is amplitude of only 15 volts, regardless of contrast setting. W1 is barely 1 volt peak to peak, even at optimum setting of AGC control. As in Symptom 1, this weak input to V1A does not mean RF-IF trouble, but is consequence of improper signal being fed back from video-output plate to keyed AGC system. Strength of W1 can be brought up to normal, without distortion, by using bias box to clamp AGC line; but W3 shows little improvement. Check of contrast control proves it is inoperative.

Voltage and Component Analysis

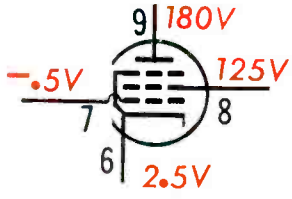


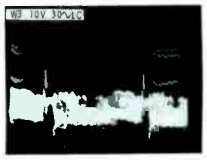
Plate voltage of V1A is too high for "no-signal" conditions, pointing to insufficient plate current. Bias on tube is excessive, even though grid voltage is normal, because too much voltage is being developed in cathode circuit—and contrast control fails to change it. Some receivers do not include shunting resistor like R5; if control in such a set became open, CRT screen would present blank raster, and VTVM would read nearly full B+ voltage at cathode. Shorted tube, or wear resulting from long use, could disable R6.

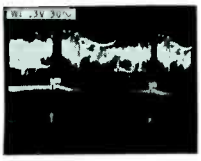
SYMPTOM 3

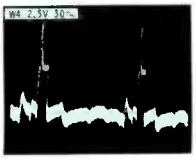
Washed-Out Video

Distorted Sound

R1 Increased in Value







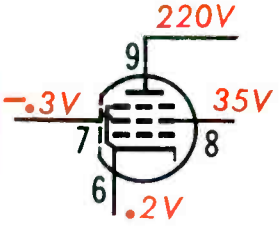
Waveform Analysis

W3 measures only 10 volts at high contrast setting, whereas normal maximum amplitude is 70 to 80 volts. Vertical sync-pulse tips are level with horizontal blanking pulses. As in preceding symptoms, DC plate-voltage rise is passed along to AGC tube; therefore, too much AGC bias is produced, almost cutting off IF's. Clamping returns W1 to normal, but does not improve picture. Distorted W4 calls attention to trouble at screen; positive spikes occur whenever negative vertical sync pulses in W1 reduce screen current.

Symptom Analysis

Picture is paler than Symptom 2. Contrast control is operative, but must be advanced to maximum to obtain picture. Absence of snow in picture indicates front-end stages are probably okay. AGC control is ineffective in increasing contrast. Sound is garbled; another important effect is weak vertical sync.

Voltage and Component Analysis



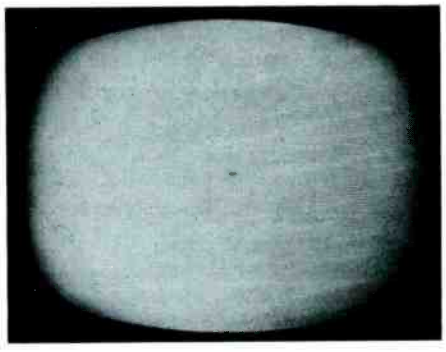
Very low voltage at pin 8 nails down trouble in screen circuit. Lack of adequate DC voltage at screen causes sluggish flow of plate current; thus, plate voltage rises toward B+, while cathode voltage falls nearly to ground potential. R1 must increase to more than 50K before picture becomes as weak as shown; further increase kills video and sound. Check for short in tube or C1 if R1 develops this trouble. In this set, C1 incompletely bypasses screen (note normal W4); if it opens, only effect is poor sync in fringe areas.

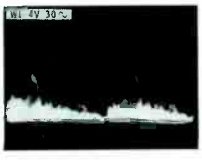
SYMPTOM 4

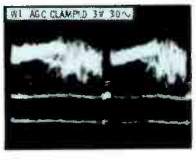
No Video

Intermittent, Garbled Sound

R8 Open







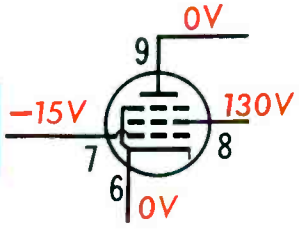
Waveform Analysis

W3 is devoid of video, but a suggestion of sync-pulse signals is visible—accounting for shadowy blanking bars on screen during warmup. While W3 consists partly of stray sweep-signal pickup and hash, some of it is developed by capacitive coupling of W1 through dead video amplifier stage. Strong W1 input is present, but it shows severe sync compression, as though IF stages were overdriven. When AGC line is clamped, W1 is restored to nearly normal shape, but W3 is little improved, and no picture appears.

Symptom Analysis

Raster is completely empty of video; although brightness control is operative, contrast and AGC controls have no effect. If horizontal hold happens to be out of adjustment when set is first turned on, faint diagonal bars will be seen during warmup period only. Resetting fine tuning improves sound.

Voltage and Component Analysis



Zero volts at plate is proof of open circuit between plate and B+; however, traces of sync pulses in W3 suggest signal path is complete from plate of V1A through C2 to CRT. Resistance checks based on this reasoning swiftly locate open R8. No screen current is flowing, because of highly negative grid voltage—a consequence of excessive IF gain. AGC tube is inoperative since open R8 removes positive voltage from keying-tube grid, biasing it into cutoff. If R8 increases in value, picture becomes overdriven and smeared.

TOUGH DOGS

LOSE THEIR BITE

A fresh attack on bench jobs bogged down in complications . . .

by Thomas A. Lesh

Why do certain TV sets turn into "tough dogs" and bite into your profits? Generally, they earn the label of "dog" when they fail to respond to your usual trouble-shooting techniques. Unless you have an exceptionally flexible method of trouble analysis, certain types of service problems may trip you up and cause you to waste valuable time looking in the wrong places for the defect.

Intermittents are the most notorious deceivers, but there are other situations that tend to develop into "dog" cases. Symptoms such as touchy sync can't always be easily tied in with any specific stage; such faults make it difficult to isolate even the approximate trouble area, much less determine the exact circuits to check. Tough problems also arise when the suspected circuit has unfamiliar features such as complex voltage dividers or cross-connections with other stages; if you don't understand the purpose of a component or network, you naturally won't know what part it might play in producing trouble symptoms.

Conversely, the more you know about the normal functioning of electronic circuits in general, the fewer "dogs" you'll have, because you'll be better able to draw useful conclusions from groups of related test measurements. Even in highly unfamiliar circuits, you can work from whatever basic facts you do know; then you won't miss such shouting clues as a tube being biased into cutoff by a DC voltage upset in the grid or cathode circuits. By trying to figure out the circuit to the best of your knowledge, you can avoid being intimidated by circuits (such as AGC) that generally have a reputation for toughness.

When something about a TV trouble seems out of the ordinary, or tests at different points appear to give contradictory evidence, you can "curb that dog" by analyzing the situation carefully to find out exactly which indication is inconsistent with the expected actions. It may take a good bit of persistence to outsmart a "dog"; the clue that solves your puzzle might not emerge until you have weighed many factors that don't appear at first to be related. As soon as you're aware that a set is going to present a tougher problem than normal, you'll hasten the solution by keeping written notes of the tests made. Then, if you begin to feel thoroughly confused, stop and ponder the data you've gathered, while studying the schematic and perhaps looking in your reference file for ideas. Frequently, one off-value voltage or distorted signal will explain another, and you'll be able to figure out a chain of cause and effect that will greatly simplify the process of trouble analysis. At the very least, you should come up with a handful of strongly suspected trouble spots that will enable you to plan a fresh attack and obtain more evidence.

To illustrate how "putting two and two together" can lead to more purposeful troubleshooting, here are some analyses of cases that had several PF REPORTER readers stumped—to the point of requesting help. Instead of giving a condensed, to-the-point diagnosis, as in the "Troubleshooter" column, we'll take the analyses in slow motion for a more detailed picture of the thought processes involved.

Busy AGC

Many technicians are bullied by keyed AGC circuits, even when they know how these should normally operate. Because the picture stages and the AGC network form a closed loop, so many voltages and signals are upset by AGC trouble that it may be hard to figure out which ones are significant. AGC-bias substitution and other isolation tests help to some extent, but such procedures are not infallible. Thus, the bench man may succeed in isolating a fault to the AGC stage, but wonder how to proceed from there. Yet, the clues that are available from circuit tests can put the answer practically in his hands.

One technician found conclusive proof of a fault in the AGC circuit of an RCA Chassis KCS133 which lost all video and sound after the first few seconds of operation. He could pull the keying tube or temporarily ground *CircuiTrace* point 16 (Fig. 1), and picture and sound would return—although with no control over AGC. In addition, he measured –150 to –200 volts on the AGC line, so the IF amplifiers were obviously being biased deep into cutoff. He also found only about +30 volts on both the cathode and the grid of the keying tube —somewhat less than the readings on the schematic.

Now, what can we figure out on the basis of these facts? First, to maintain –150 volts on the AGC line, the keying tube would have to run "wide open." We know this condition is not being brought about by excessive video input signal, because the video IF amplifiers are blocked, and there *is* no

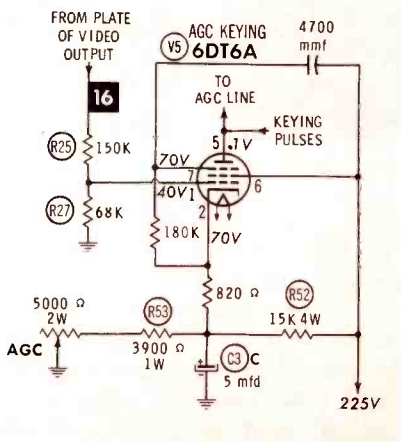


Fig. 1. Excessive AGC output was due to lack of proper bias on keying tube.

video signal. Therefore, we may suspect improper DC bias on the AGC tube. The grid and cathode voltages are nearly equal, so the tube is operating at practically zero bias. According to the schematic, the effective bias should be 30 volts under no-signal conditions. Of course, this can be reduced by using the AGC control to lower the cathode voltage; but, by the same token, turning the AGC control in the opposite direction should increase the cathode voltage and correct any overconduction of the keying tube. In this case, however, the technician found that resetting the control was not much help.

As in other keyed AGC circuits, both the grid and the cathode are operated at potentials more positive than ground, to facilitate DC coupling to the grid from the plate of the video amplifier. This feature tends to complicate the bias problem. DC voltages for the grid and cathode are derived independently, from separate voltage-divider networks; so, if one voltage shifts while the other "stays put," bias troubles result.

Measurements of grid and cathode voltages with respect to ground would come in handy to help us decide whether to look in the grid circuit or the cathode circuit for trouble. For the grid to be responsible for the high level of tube conduction that exists, the grid voltage would have to be well above normal; however, it is already *less* positive than normal. Apparently, then, the loss of bias stems from an abnormally low cathode voltage—and we should look in the cathode circuit for trouble.

Specifically, we need to find out what could reduce the voltage at the junction of R52 and R53. A decrease in value of R53, or an increase in R52, would do the trick; past experience tells us a change in R52 is more likely. But first, one other very likely source of trouble—severe leakage in C3C—needs to be checked. A low-resistance DC path to ground through this capacitor would not only pull down the cathode voltage, but would also cause the AGC control to lose much of its effect. Considering that both these symptoms are present, we'd almost bet on C3C. By quickly disconnecting it and substituting another similar value electrolytic, we could easily find out if we're right.

Where's the Connection?

Good service technicians generally make note of all the secondary symptoms that may accompany a complaint; in quite a few cases, this supplementary information furnishes a short cut to finding the trouble. (Some examples were shown in "Visual Symptoms Tell a Story," in the December, 1962 PF REPORTER.) At other times, however, added symptoms only provide a distraction, because the technician can't see how they are related to the main symptom. Combine this confusion with an unusual symptom in an unfamiliar circuit, and you have the ingredients for a "dog."

One reader, perplexed by horizontal instability in a Zenith Chassis 19R22 (Fig. 2), described the condition as being similar to "hunting" of the horizontal AFC circuit, giving a wavy appearance to all upright lines in the picture. However, he noticed that the condition was unaffected by disabling the horizontal AFC phase detector; furthermore, the horizontal scanning lines in the raster appeared uneven, or ragged at the edges, on vacant channels. From this added evidence, he concluded he didn't have a sync problem. But he wasn't too familiar with the sine-wave horizontal oscillator used in this set, and he was further thrown off balance by the fact that the horizontal instability got worse as the brightness control was turned down. Thus, the simple question, "Where can I scope the chassis to find this trouble?" turned into a real poser.

It doesn't seem that the horizontal oscillator and the brightness control circuit would have much in common, but careful study of the schematic reveals a couple of possible paths for interaction in this set. The more direct of these is via the 245-volt B+ line. In Fig. 2, note that the brightness control is in the CRT cathode circuit, which also carries a video signal. The lower the brightness setting, the closer the arm will be to the 245-volt end of the control. If the B+ line were not well filtered, traces of video (or hum) could possibly appear at the plates of the horizontal oscillator and the AFC stages. These unwanted signals could cause slight disturbances in the horizontal oscillator, leading to displacement of some scanning lines.

We could easily check a suspicion of this by scoping the 245-volt line directly at the plate of the horizontal oscillator. More than the normal 1-volt ripple, or random pulses of high-frequency hash, would be signs of incomplete filtering. If the higher video frequencies were the only problem, they could be suppressed by connecting a small capacitor (1000-mmf ceramic) from the 245-volt end of the brightness control to ground.

A less direct source of interaction between the horizontal sweep circuit and the brightness control is via the flyback and boost circuits. With the brightness turned down, the flyback would be more lightly loaded, and its operating conditions would change. It's pos-

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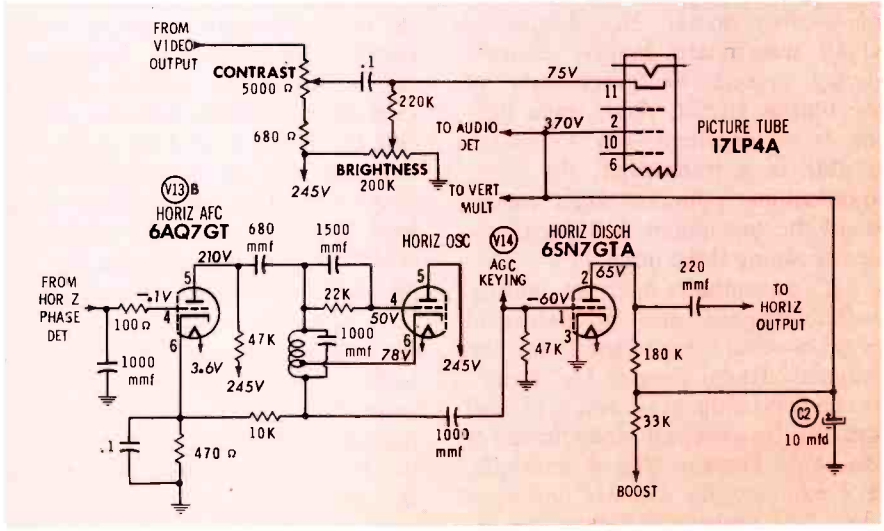
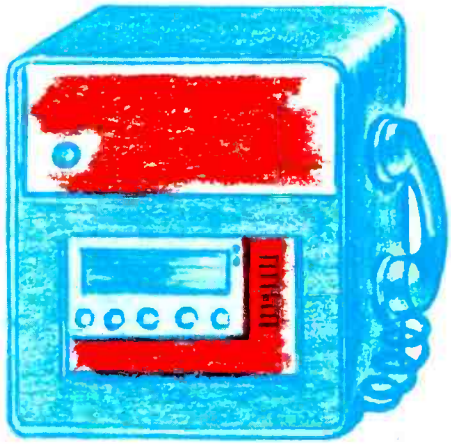


Fig. 2. Horizontal instability grew worse with brightness turned down.

TUNING HF Transmitters

Adjusting the tuned circuits is an excellent troubleshooting method.

by Forest H. Belt



Some servicemen seldom see or hear of a high-frequency radiotelephone. Others — particularly those near ocean, lake, or river ports—are frequently called upon to service these units. Each radiotelephone consists of a transmitter and receiver, usually operating at frequencies between 2 mc and 20 mc. The receivers ordinarily are sensitive, selective superheterodyne types, which offer few problems to the experienced communications technician; except for frequency, they are little different from broadcast receivers, or from VHF communications receivers.

The transmitter, however, may be another matter. High-frequency (HF) transmitters involve unusual tuning procedures, particularly in the output circuit. And, since tuning is an excellent way to isolate trouble in a transmitter, the communications technician must understand the techniques and peculiarities of tuning these units.

HF transmitters used in marine radiotelephones and in industrial systems—and those used in the Amateur Radio Service by "hams" —are similar in most respects, and can all be serviced and tuned in the same manner. As an example, let's examine the circuits and tuning of a typical 150-watt marine radiotelephone transmitter.

Tuning the Buffer-Driver

A simplified schematic diagram of the buffer-driver stage is shown in Fig. 1. The crystal-controlled signal is coupled from the oscillator by C1 to the grid of buffer-driver tube V1. When the transmitter is on "standby" (ready to operate), the plate and screen voltages are applied to the tube; but there can be no conduction until the cathode circuit is completed through the contacts of keying relay K1. When the keying relay closes, V1 conducts and amplifies the signal.

Channel switch S1 is set for the desired channel. Other sections of this switch choose the desired crystal in the oscillator section, which controls the frequency. Sections B and C select the correct trimmer (C6 through C10) and the proper coil tap (on L2 or L3) to form a resonant tank circuit at the chosen frequency. The buffer-driver plate load can be tuned for maximum efficiency on each channel, by adjusting the associated trimmer.

A metering point is provided in the cathode circuit, primarily for testing whether the stage is operative. For checking the effects of tuning, a better metering point is at the PA grid—the grid-drive metering point. The buffer-driver plate tank should be tuned for a maximum transfer of energy into the grid of the power amplifier.

In actual practice, the best beginning for overall transmitter tune-up is to tune the buffer-driver for maximum PA drive on each channel. This assures that the power amplifier (which depends on grid current to develop its bias) will not be damaged during subsequent adjustment. Incidentally, a precaution is in order: You'll notice that B+ is present on both sides of the buffer trimmers; so, to avoid a nasty shock, be sure to use a screwdriver with an insulated handle.

Some HF transmitters, instead of having a trimmer-and-coil combination for each channel, use broadband coils to cover *groups* of frequencies. In Fig. 2, a buffer-driver is shown which uses this type of plate-tuning circuit; the plate tanks consist of one capacitor (C6) and a coil for each group of frequencies in the marine HF band. With this arrangement, you merely set the trimmer to mid-range and then adjust each coil for maximum PA-grid indication; for each, use a channel whose frequency is near the center of the coil's range. If any coil has to be set near the end of its slug travel, you can retune trimmer C6, but then you'll also have to adjust each of the other coils.

As mentioned before, tuning has proved to be the quickest way to make sure an RF circuit is functioning properly. If the buffer-driver stage fails to respond to tuning, first check to see if the oscillator is functioning—by checking for a negative DC voltage at the oscillator grid. If this is inconvenient, another method is to meter the cathode current of the buffer stage while wiggling the oscillator crystal in and out of its socket. If the oscillator is functioning, the cathode current of the buffer stage will change when the crystal is removed from its socket. Next, you can watch for the very slight dip in buffer cathode current that will normally occur when the plate tank is being tuned. If these tests prove the oscillator and buffer are okay, perhaps the trouble lies in C5 or in the PA stage itself.

Understanding the Output Network

The output tuning system is probably the least understood section of HF transmitters. To see

why, let's consider the antenna for a moment.

Most high-frequency transmitters are designed to feed a straight-wire antenna—hung in "free space." Such an antenna should function as a quarter-wave radiator, similar to a VHF whip, but the physical length at HF frequencies introduces a problem. For example, a long-wire antenna for the ship-to-ship frequency of 2638 kc would be approximately 350′ long. At one of the higher ship-shore radiotelephone frequencies—8023.5 kc—a resonant quarter-wave antenna would measure more than 115′. This is a wide range of antenna lengths, any of which are too long for practical use on shipboard.

The answer to this problem is to provide, within the transmitter, an inductance that will add to the physical length of a practical antenna to make it resonant to the desired frequency. Since most transmitters cover several frequencies, a tapped coil can be used and the correct tap set for the amount of inductance needed.

But the problem is not entirely solved, even yet. Suppose a 60′ antenna is provided—a common length. A practical coil will not cover the range of inductance needed to resonate the antenna at all the frequencies from 2 mc thru 20 mc. So a compromise is reached: The lower frequencies are coupled to the antenna in such a way — called "current-feeding" — that the antenna acts as a quarter-wave radiator. The higher frequencies are fed to the antenna so it acts as a half-wave radiator—called "voltage-feeding" the antenna. Because of these differences, a change in procedure is necessary in tuning the higher-frequency channels.

One more point should be considered by the communications technician who is tuning a high-frequency transmitter. At frequencies above 4 mc, the loading effect of the antenna affects the tuning of the power-amplifier plate tank. Therefore, tuning procedures are divided into three categories: the 2-4 mc range, where the antenna doesn't affect the final stage; the 4-6 mc range, where antenna effects must be considered; and the above-6 mc range, where the antenna must be voltage-fed, altering the tuning procedure.

Tuning the Output Stage

The first step in tuning the power amplifier is to check the PA drive on each active channel of the transmitter to be sure it is sufficient. Fig. 3 shows a simplified schematic of the power amplifier. L1 is the grid load for RF signals, while R1 acts with C1 to develop grid-leak bias from grid current that is drawn on positive peaks of the input signal. In practical transmitters, V1 may actually be more than one tube. In one 150-watt transmitter, four tubes are used—in parallel—for the power amplifier stage. The tubes are paralleled element to element, except that each tube has parasitic-suppression networks (R3 and the R2-L2 combination) and each has its own cathode-bypass capacitor (C3 and C4).

The plate and screen circuits receive B+ from the modulator stage, with the voice modulation already impressed on it, to provide combination plate and screen modulation. L3 serves as an untuned plate load, but the RF energy is coupled by C6 to the plate tank circuit.

Fig. 4 depicts the two output circuits used in a typical wide-range, high-powered HF transmitter. The circuit in Fig. 4A is used for frequencies from 2 mc to 6 mc; above 6 mc, the circuit in Fig. 4B is used. Switching between the circuits is automatically taken care of by channel-selector switch S1. Now, let's see what steps must be taken to properly tune these output circuits.

2 mc to 4 mc

As long as S1 is turned to channels which operate on frequencies between 2 mc and 6 mc, the circuits are connected as shown in Fig. 4A. The plate-tuning tank consists of coil L4 and one of capacitors C7 through C9.

For frequencies below 4 mc, the antenna is best disconnected during PA plate tuning. The PA cathode current is the monitoring point throughout the PA and antenna tuning procedures.

To start the procedure, the tuning capacitor is set to mid-range. From the F section of S1, taps for L4 are provided so the PA tuning capacitor and L4 will resonate at the frequency which occupies that channel. This tap is moved up or down on L4 until the point is found

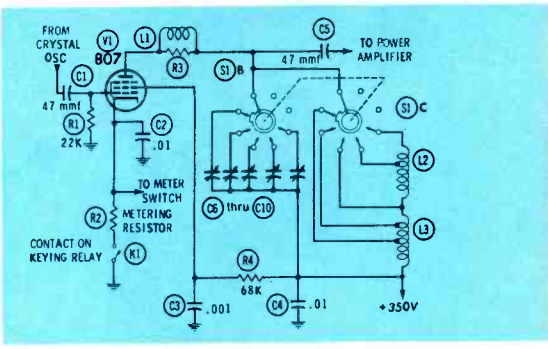


Fig. 1. Buffer-driver stage with separate trimmer for every frequency.

where the PA cathode current is at its minimum, which indicates resonance of the power-amplifier plate tank. These steps are repeated for each channel frequency below 4 mc, before proceeding to antenna adjustments.

With all channels below 4 mc tuned for minimum plate current, the antenna - coupling adjustment should be reduced to minimum, and the antenna reconnected. No further adjustments need be made to the plate tanks.

Next, antenna coupling is increased until a slight rise is noted on the PA cathode meter. This rise occurs because the antenna is beginning to draw power from the power amplifier, resulting in higher average plate current. Now the antenna is getting some of the energy, so the antenna-tuning control can be adjusted for resonance at the channel frequency. This point can be determined by noting the current in the power amplifier. Since PA current rises as more energy is being radiated by the antenna, the antenna-tuning control should be adjusted for maximum.

Coupling can then be increased bit by bit, readjusting the antenna tuning each time—for these controls have a certain amount of interaction. Each model of transmit-

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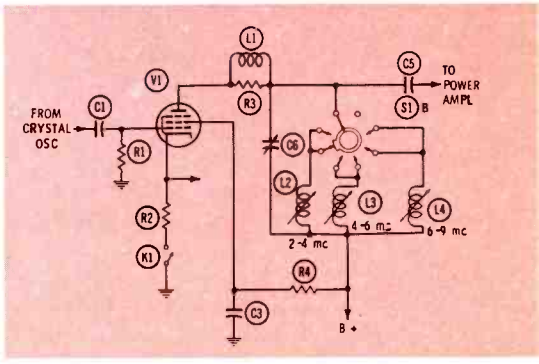
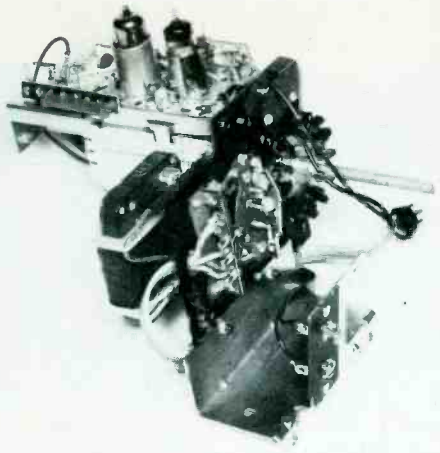
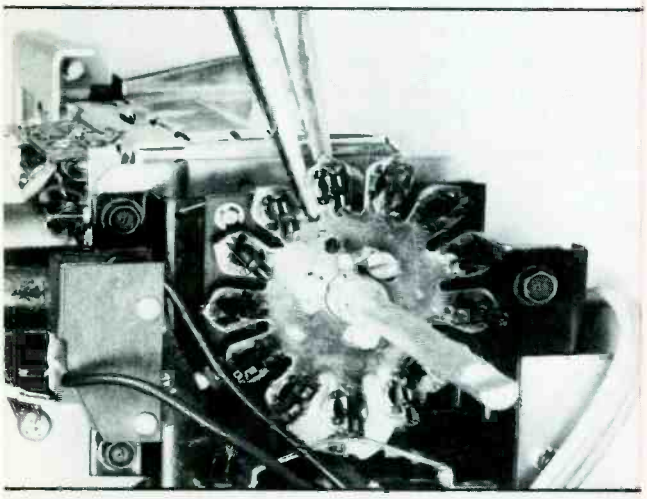


Fig. 2. Less complex buffer-driver with coils for groups of channels.



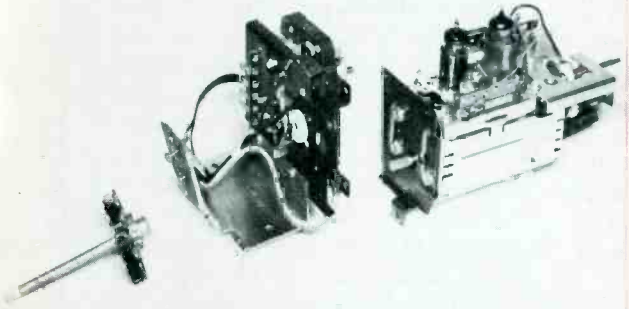
Disassembling Motorized TV Tuners

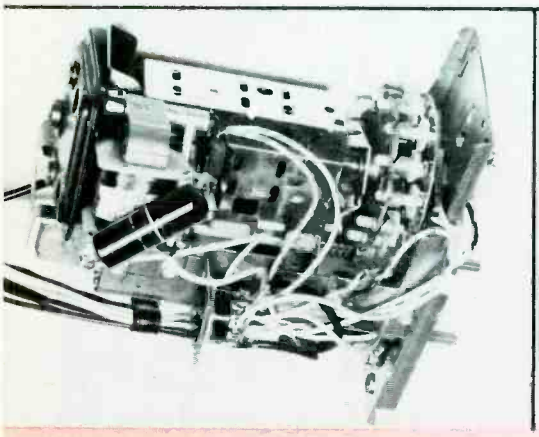


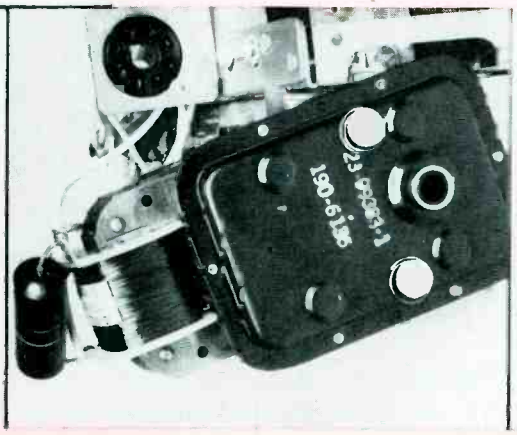
This tuner has its remote-control assembly mounted on the rear, and held in place by three ¼" hex-head screws. The channel-indexing wheel is held to the tuner shaft by a small set screw. When this screw is loosened (with long-nose pliers), the wheel can be removed along with the coupling shaft. After the wheel and shaft are slipped out of the way, removing the ¼" screws will release the motor-and-switch bracket.

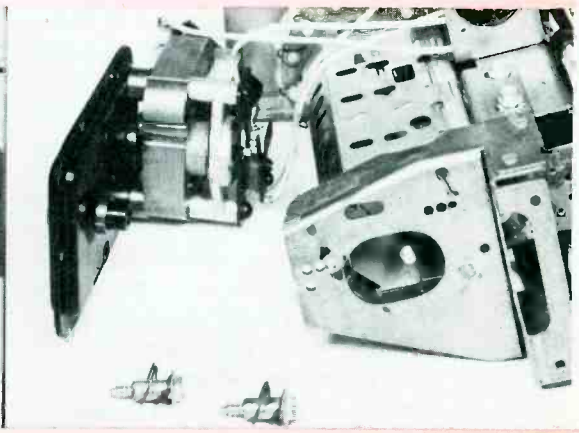
Before disassembly is started, it is wise to mark the tuner and coupling shaft with a colored crayon. This precaution can prevent incorrect reassembly, in case the position of the tuner drum or the remote assembly is shifted while the two components are apart. In some tuners, however, you needn't be concerned with this, because a flatted side on their shafts makes it impossible to attach the remote unit incorrectly. If you're not sure of the shaft type, don't take a chance—mark the right position at the start.

When reassembling this type of remote control, don't tighten the ¼" screws until you've made sure the indexing wheel is correctly installed just behind the indexing-switch bracket.



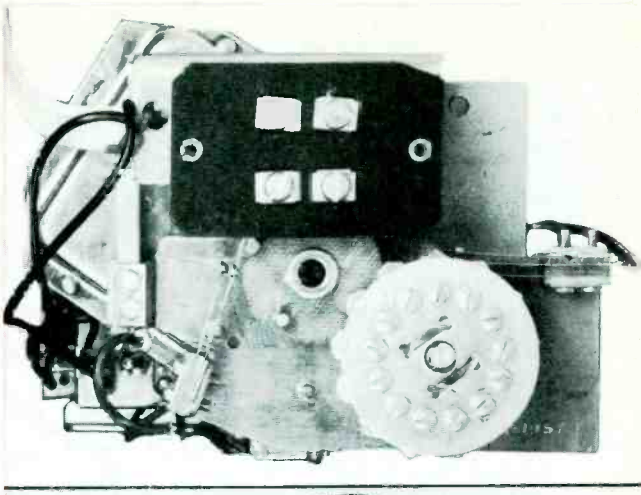


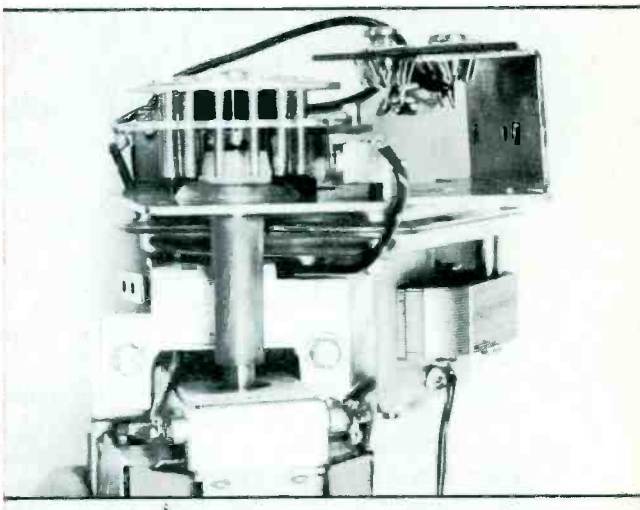




The indexing wheel for this remote-control assembly is located on the front of the tuner, and the motor is mounted separately on the rear. Removal of the motor-and-gear-train assembly is a bit simpler than in the unit discussed before; only two metal screws need to be removed to unfasten the motor from the tuner. These screws, however, have spacers and pressure springs to form a nonrigid shock-absorbing mount, eliminating the possibility of the motor binding. (Shock mounting is accomplished in some similar units by the use of rubber grommets.) The gear-train box on this remote connects directly to the tuner shaft by a coupling cam (a part of the gear box).

For the average TV customer, who likes to sit back and adjust the receiver with the flick of a switch, remote control is a good idea; for the serviceman, however, it can create problems. One of these is the purely mechanical problem of working on tuners that have a remote-tuning apparatus attached. This unit always consists of the same major parts—motor, drive mechanism, switches, and relays. However, these electromechanical components differ in the manner by which they are removed from the tuner.



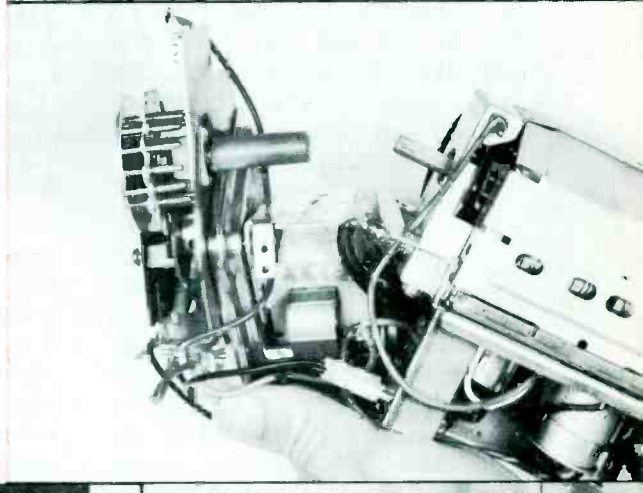


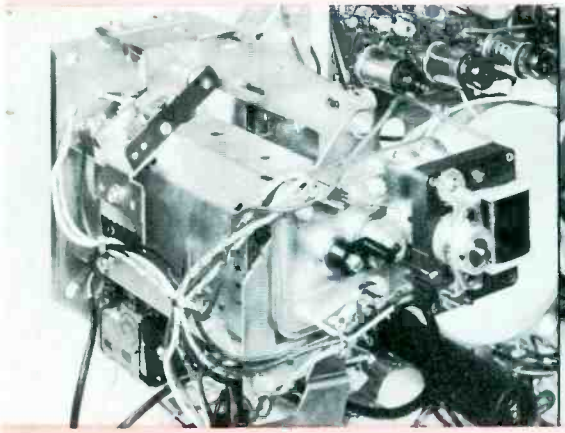
This different type of remote control has the indexing wheel, switches, and motor attached to a single assembly. Two metal screws (¼" heads) are used to fasten the complete unit to the tuner. Several smaller parts on the main assembly — switches, cams, or index wheel — can be individually replaced.

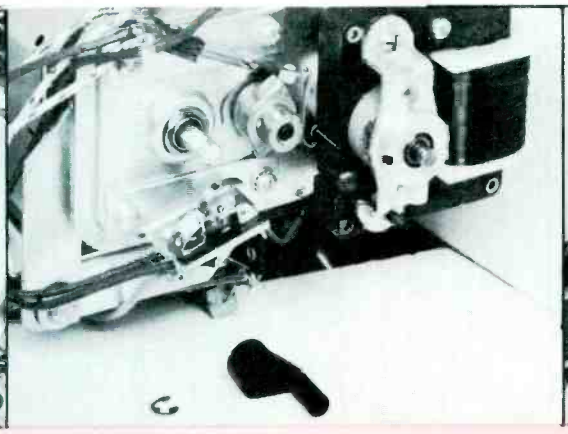
Notice the small coupling sleeve which connects the motor to the tuner shaft; it's made from a fiber-like material. This is one of those tuner shafts with flat edges on both sides, so take the precautionary measures mentioned before and mark the shafts.

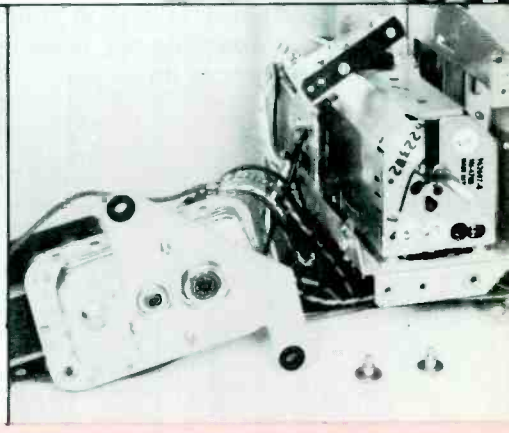
The hex-head screws located around the indexing wheel are used to select the channels on which the tuner will stop. When these screws are turned all the way in, the threaded ends contact and open the indexing switch, which opens the motor circuit and stops tuner rotation. Indexing needn't be disturbed when you remove the control assembly from the tuner.

It's a good idea, since the remote control has a number of switches and wires, to be sure all the wires are dressed properly away from any moving part.









This remote control has separate indexing and motor units, and appears to be a little more involved than the others. But, as in all such jobs, a closer look—before you start taking it apart—can make your job a lot easier.

Removing the motor-switch assembly is a two-step procedure: First remove the small "C" washer holding the standby-switch actuator (a black plastic crank) and slip the actuator from the tuner shaft. Next, remove the two screws that hold the motor-gear train assembly to the tuner; the assembly can then be pulled off the tuner shaft. The two screws have spacing sleeves like one of the other remotes, and use rubber grommets for shock mounting.

QUICKER SERVICING

by Wayne Lemons

BOOSTING SENSITIVITY in TRANSISTOR PORTABLES

Transistor radios often exhibit that "not quite right" quality which makes the technician wonder whether there is trouble in the set or if perhaps it is just suffering from design limitations. Unfortunately, it is easy for him to tell the owner the radio is performing "as well as can be expected" and let it go at that. However, the customer often knows "it's not as good as it used to be," and a better answer is needed to keep him happy. That answer may be among the following hints on how to find and cure faults that limit transistor-radio sensitivity. We shall discuss the effects of misadjustment and component failure, as well as the "design" angle.

Align and Track

Except for weak batteries, perhaps the most common cause of poor sensitivity is poor alignment or tracking. This occurs even with new radios, causing one radio to be less sensitive than another of the same model. Therefore, an overall alignment check is a good way to start troubleshooting any radio that is not performing up to par.

Aligning

A tunable signal generator and an output meter are the best instruments to use for peaking the IF transformers. A good alternative to the output meter is a milliammeter in series with the power supply, since most transistor radios have class-B output stages and draw the most current when the output from the radio is at maximum. A simple noise generator will sometimes suffice as a signal source, because only a slight touch-up is likely to be necessary. It is unusual for the transformers to be far off frequency; ordinarily, they simply are not all on the same frequency.

Tracking

The term "tracking" means the proper adjustment of the antenna, RF, and oscillator circuits so the sensitivity of the radio is constant from one end of the dial to the other. A noise- or harmonic-type generator has definite advantages for determining whether a set needs tracking adjustments. More specifically, the use of a harmonic generator makes it unnecessary to "rock" the tuning capacitor of the radio while making adjustments. Just turn the generator on and allow it to radiate into the radio—it is not even necessary to make a direct connection.

Tune the radio to the low-frequency end and see if you can peak the oscillator *trimmer* for maximum noise. If you can *peak* the noise with the trimmer, there will be no need to adjust the oscillator coil—unless the dial calibration has been drastically upset. If you can't find a noise peak, then set the trimmer near the midpoint of its rotation and adjust the oscillator coil for maximum noise output from the radio.

After peaking the low end, turn the radio dial to the high-frequency end and adjust the antenna and RF trimmers for maximum noise. Once you get peak noise at both ends of the dial, the radio is tracking and will have its best sensitivity over the entire band. If the radio will not adjust for a peak at either or both ends, look for trouble in the antenna coil, oscillator coil, or tuning capacitor.

The noise- or harmonic-generator method of tracking has the advantages of being both fast and accur-

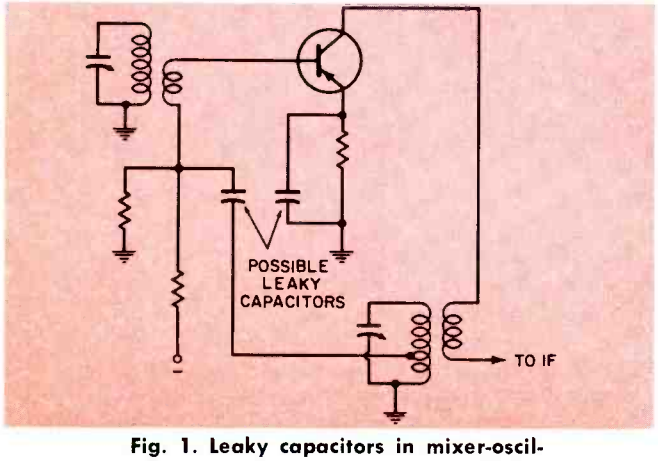


Fig. 1. Leaky capacitors in mixer-oscillator stage can cause low sensitivity.

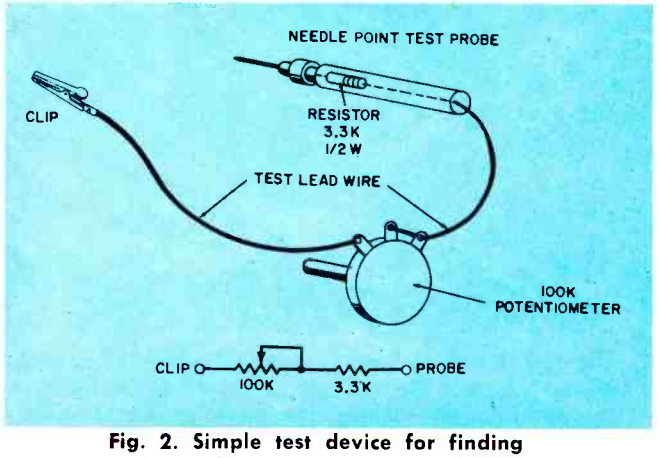


Fig. 2. Simple test device for finding optimum bias on a transistor stage.

ate. You can "track" a radio, or determine that it doesn't need it, in less than two minutes—once you get the "hang" of it. Each radio you repair should be given an alignment and tracking check, if you want the radio to be really "hot."

Electrolytics

Open electrolytic capacitors are a common cause of low sensitivity. Often, an open electrolytic will cause "motorboating," but in other cases it will simply reduce the audio output level.

There is no simpler or more dramatic way of checking electrolytics than by the "shunt" method. When you have a weak radio, and tracking seems normal, try bridging across each electrolytic in the circuit, both coupling and bypass. If you get a noticeable improvement, it is likely the capacitor you shunted should be replaced.

Leaky electrolytics in certain circuits can also cause loss of sensitivity. (A couple of examples are pointed out in Fig. 1.) To check a leaky capacitor in a transistor radio, one end must usually be disconnected. However, measuring the voltages on transistor elements—especially the bias voltages—will often pinpoint the faulty unit.

Transistors

The "universal" replacement transistors introduced by several manufacturers and packagers often work as well or better than the originals, but on occasion they can also cause lowered sensitivity. Just because a transistor has the same or greater beta than the original transistor is no assurance that it will have as much or more gain in a specific circuit. This is especially true of mixer, IF, and RF transistors because the input and output impedances of the circuit, and the internal capacitances of the transistor, usually have more effect on actual gain than does the beta.

Bias Voltages

Transistor bias is measured between the base and emitter, and is usually .15 volt or less. However, if the schematic calls for .2 volt bias and you have only .09 volt, it does *not* necessarily indicate that anything is wrong with the circuit, even though too little or too much bias can definitely reduce transistor gain.

The device shown in Fig. 2 can be used to determine whether the existing bias is correct. (If you own a resistance substitution box, it can be used in most circuits to accomplish the same thing.) The resistor in the probe prevents accidentally shorting some circuit, and furnishes isolation so the device won't cause instability in the circuit when it is connected.

To use the bias checker, connect the clip to one side of the battery power supply, and touch the probe to the base connection of the stage you wish to check. Slowly turn the shaft through its range, while listening for increased output from the radio. If there is no improvement, connect the clip to the other terminal of the battery and repeat the procedure. If there is still no improvement, or if it is only slight, it is safe to assume the bias voltage on that stage is okay. If there is a significant improvement at some potentiometer setting, measure the potentiometer resistance and connect a resistor permanently into the circuit.

These bias tests should be made with a weak station tuned in, to make sure you are not merely defeating the AGC action by changing transistor bias. You should also check for defective parts in the circuit, because an open or off-value resistor, a leaky coupling or bypass capacitor, or a defective transistor can cause incorrect bias on a stage.

IF Transformers

Low sensitivity can often be attributed to either poorly designed or defective transformers. Some early transistor sets used transformers that were deliberately mismatched to prevent oscillation in the IF stages. The sensitivity of some of these old sets can be improved by replacing the original IF transformer and transistor with newer types. However be sure to change both, since replacing one without the other may not be effective. Obviously, this is an expensive way to repair a radio, and may not be worth the time and effort; but if cost is no object, sensitivity can often be appreciably increased in this manner.

If the set squeals and whistles after the new transformer-transistor combination is installed, you may have to neutralize the circuit; Fig. 3 shows how this can be done. Most circuits of this type can be satisfactorily neutralized with a 5-mmf capacitor; then the transformer can be peaked without causing "birdies" or "howling" effects.

In well-designed modern sets, defects in IF cans often reduce sensitivity. For instance, a transformer with even one shorted turn will seldom peak properly, and is not likely to transfer the signal as it should. When you are unable to bring an IF transformer to a sharp output peak, it is a good indication the unit is defective. If the slug hasn't previously been adjusted (it may still be sealed, for example), you shouldn't have to turn it much more than a quarter turn to obtain a peak in receiver output.

Don't, however, let yourself be fooled by what seems to be a signal loss through an IF transformer; all transistor IF cans display a *voltage* loss. If you are injecting a signal, or using a signal tracer, you will find more voltage at the input (collector circuit) than at the output (base circuit), because the base circuit has a much lower impedance. Always remember—a transistor IF transformer reduces the signal *voltage,* although the signal *current* is stepped up.

Emitter Bypassing

Almost any emitter resistor that is not bypassed will lower the gain of that stage. In RF, mixer-oscillator, or IF circuits, the value of bypass capacitors may be .1 mfd, or less. They can be tested with a similar capacitor, by the same "shunting" method suggested for electrolytics. Leaky bypasses can also alter the bias on a transistor

• *Please turn to page 78*

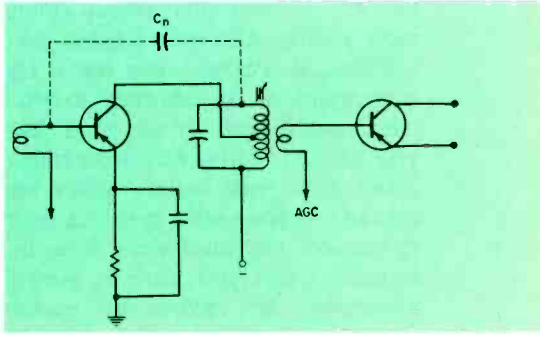


Fig. 3. Neutralizing capacitor Cn can be added to suppress IF oscillations.

by K. V. White

minimizing INCOME TAX PROBLEMS

In theory, figuring his income-tax payment is simple for the self-employed television serviceman. He merely deducts his cost of doing business from his gross income, and pays a portion of whatever is left to the Federal government.

In actual practice, however, the problem is somewhat more involved. Every business has certain costs that apply only to that particular operation. The television service business has income-tax problems that are different from those of the doctor or grocer across the street, and every television serviceman has individual tax circumstances that set him apart from other television servicemen.

There are a number of important factors that are likely to affect *your* tax return. Some of these factors, if you understand them more clearly, may even lighten your tax burden. Perhaps you use a tax accountant or an attorney to prepare your returns. If so, good. But you should still know something about how your income taxes are figured. Anyone who prepares your returns for you must work from information that you provide. And a knowledge of income-tax procedures may help you find ways to keep your records more efficiently throughout the year, and result in easier tax-return preparation.

The factors of income-tax preparation most important for you to understand are: record keeping, estimating taxes, figuring deductions, and calculating depreciation. Let's take a more detailed look at these four vital areas of income-tax procedure.

Record Keeping

For tax purposes, it is important to note the statute of limitations on tax-return investigations, because this indicates the length of time you should retain your bookkeeping records. The normal time limit on investigation of tax returns is three years. However, if more than 25% of your *gross* income is not reported for some reason, the statute of limitations is extended to six years. If there is evidence of fraud, there is no limitation. Therefore, you shouldn't be in a rush to throw out your old records, since the Internal Revenue Service has a number of years after the *due date* of your return to start asking questions.

The government doesn't specify the particular method you must use in keeping your books, as long as it is permanent, systematic, and consistent. The requirement, then, is that your tax be figured in accordance with the method you *regularly* use to keep your records. You can use the check list shown in Table I as a refresher to help determine the effectiveness (for tax purposes) of your bookkeeping system.

Table I
Tax Record Check List

Do you
(1) maintain records of all taxes withheld?
(2) keep detailed records of payroll taxes?
(3) keep receipts for entertainment and travel expenses?
(4) show purchase date and cost of each asset?
(5) classify your accounts and post every expenditure to the correct account?
(6) pay as many of your bills as possible by check?
(7) deposit *all* business receipts in a bank account separate from your own?
(8) reconcile your bank statement as soon as it is received?
(9) keep copies of your tax returns?

Estimating Taxes

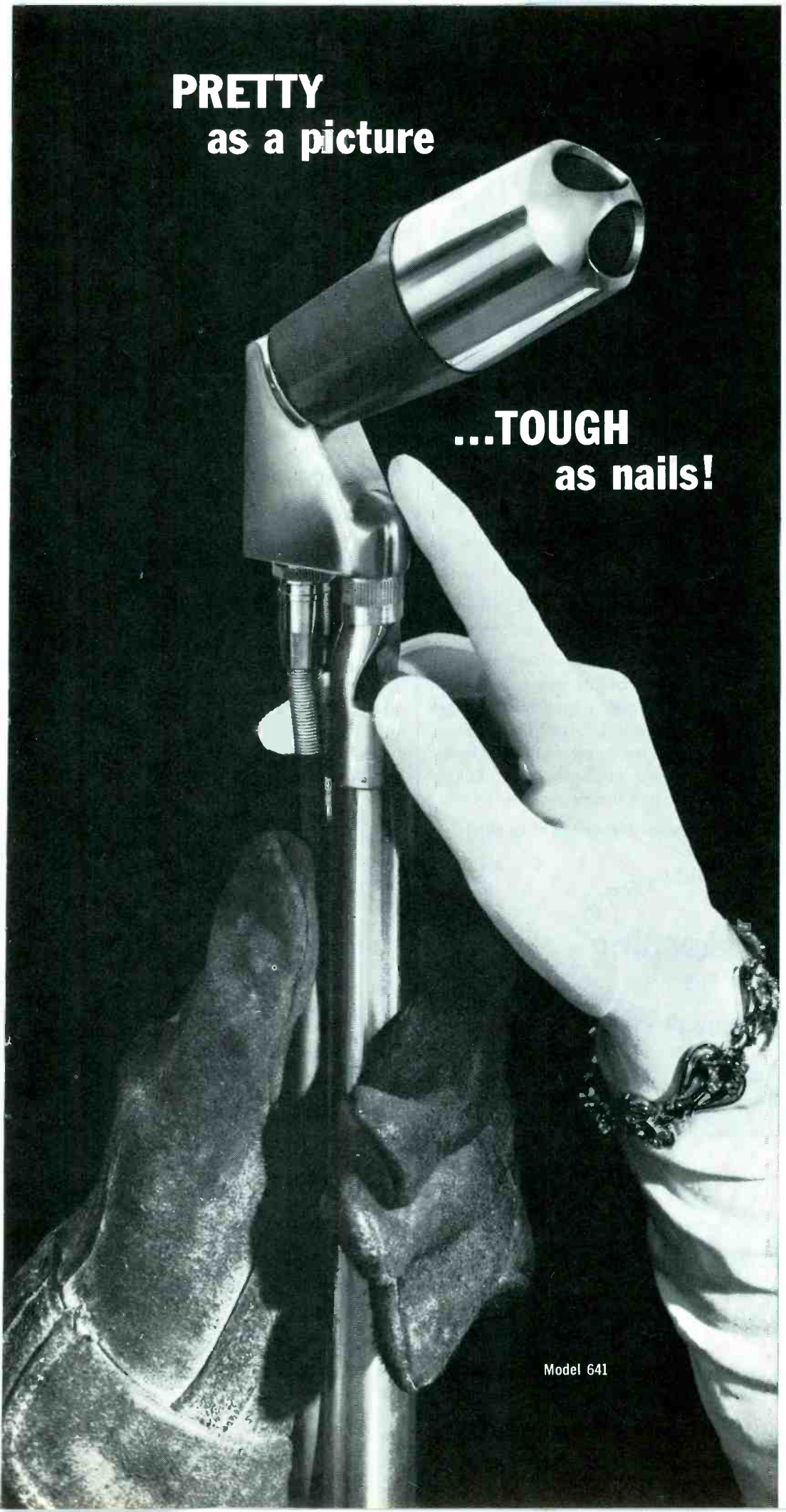
The requirement that self-employed servicemen must estimate and pay their taxes in advance is usually looked upon with great distaste. However, it is not necessarily as bad as it sounds. Under some circumstances, penalties may be charged for an incorrect estimate, but there are ways of avoiding this risk.

Who Must Estimate

An independent serviceman, whose income is not subject to withholding tax, must file an estimate if his *gross* income is greater than $600 multiplied by the number of his exemptions, plus $400.

For example, suppose you are married, have four children, and a gross income of $4000 or more. (6 exemptions $\times$ $600 = $3600. $3600 + $400 = $4000.) Therefore, on April 15th you must file a Declaration of Estimated Tax. At this time, you may pay your full estimated tax for the year. Or, you may pay only ¼ of it at that time, and follow up with quarterly payments on July 15 and October 15 of the current year, and on January 15 of the following year.

You may wonder, "What happens if I underestimate my tax for the year?" The penalty regulations for underpayment have been designed specifically to discourage such deep thinking. If the Internal



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Revenue Service finds any payment less than 70% of what it should have been, you may be assessed a penalty of 6% on the amount of underpayment. However, this does not necessarily mean you will be assessed a penalty if you have a better business year than you expected when you estimated your tax. There are several ways to avoid a penalty.

Methods of Estimating

You may file amended returns. If you check your income rate each quarter, and find it running higher than you expected, you may file an amended return and make additional tax payments. Bear in mind that your payments must always amount to at least 70% of the actual tax.

You may base your estimate on last year's income. This method is probably better for most television servicemen, because it eliminates much of the guesswork that may be involved in making an estimate. Furthermore, although you still make quarterly payments, you are *not liable* for a penalty at the end of the year if your income happens to exceed last year's.

Under this plan, if your income falls off during the year, you may file an amended return at the end of any quarter and pay a smaller amount. However, *if you file for a reduced tax,* take care to stay within the 70% limitation. By the same token, if your income goes up, you should file an amended return and pay the additional amount.

You may base your estimate on last year's actual tax. This differs from the above plan in that this method does not consider the current year's deductions. Simply divide the amount of tax that you paid the previous year by four, and pay at least 70% of that amount each quarter. When you file your return on April 15th of the next year, you will have to make up whatever amount, if any, is necessary to pay your full tax, but no penalty will apply.

You may base your estimate on known earnings. In other words, you can figure your actual income from January 1st to March 31st, the first quarter. Multiply this amount by four to arrive at an estimated annual figure, and compute the annual tax you should

pay for the year. Divide the annual tax figure by four to determine the quarterly payment, and be sure you pay at least 70% of that amount each quarter.

You may pay 90% of the tax due on your total current earnings at the end of each quarter. This method is favored by some accountants. However, it is tricky and complicated, and is advantageous *only* if you have your highest rate of income during the first quarter of the year, with no likelihood of continuing at that rate. Otherwise, it may be difficult to meet the higher tax payments later in the year.

No matter what system you use to figure your estimate, your total tax liability will be the same. Depending on your own circumstances, however, one particular method may be easier for you to handle during the tax year. All five methods should be considered, and the one chosen that is best for *you*.

Deductions

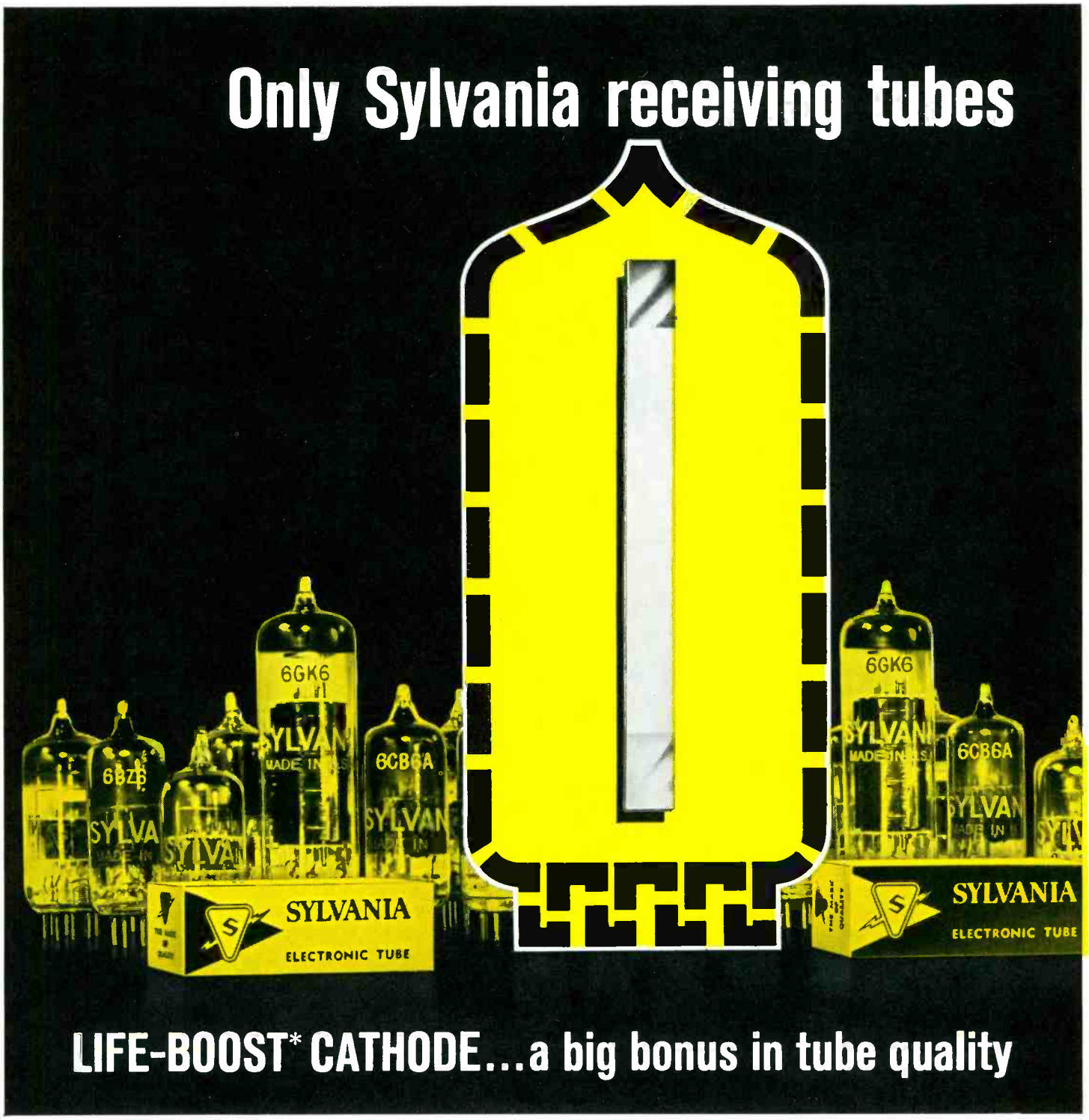
Naturally, deductions will vary from one service business to another, and certain of them are easily overlooked. Before pointing them out, however, a word about proving deductions: A cancelled check is *not* proof of a deductible expense. In the suspicious eyes of IRS, a cancelled check means only that a check has been cashed in the amount shown, not necessarily for the purpose claimed. If you want to be safe, therefore, you should have an invoice to back up every cancelled check.

Let's look at some typical deductions:

Office Space—If you operate your business from your home (and own the property) you may take part of the *depreciation* as a business deduction. For instance, if you have a seven-room home, and use one room as an office and shop, you can figure depreciation for the entire house and use 1/7th of it as a business deduction.

If you rent your home, and work from there, you may deduct a share of the rent. You can also deduct the proportionate cost of heat, light, repairs, depreciation, or any similar items not paid for by the owner.

Telephone Service—If you have a telephone that is used for both business and personal calls, you may de-



Sylvania's exclusive LIFE-BOOST Cathode is putting new life into tubes—and sales. This latest evidence of Sylvania leadership in tube technology offers benefits you can really sell: it virtually eliminates performance slump, a major cause of profit-stealing callbacks. Besides stability, it produces significantly better tube life and uniformity. More than 90 types already have LIFE-BOOST, with more on the way...and it's being heavily promoted in national magazines and by mail. *Trademark

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duct a proportionate amount of the cost. If you have a separate phone for business, you may deduct the entire cost.

Vehicle Expenses—If you use your automobile partly for business, you may deduct a portion of the cost of gas, oil, insurance, license, repairs, tires, and depreciation. Simply figure what portion of its use can be classified as "for business."

Salaries and Wages—If you have others working for you, their pay must meet certain requirements in order to qualify as a deductible business expense. Their wages must be for necessary work actually performed, must be reasonable in amount, and must be paid or incurred during the tax year. The only "catchy" point in this list is the stipulation that compensation paid must be reasonable. If pay is excessive, only the part that is *not* excessive will be allowed as a deduction. In other words, if you pay your wife $100 a week just to answer your telephone, you could be in trouble —at least with IRS.

Supplies—Materials that are used in the operation of a television service business are, of course, deductible. This includes office supplies, chemicals, solder, and other items not resold.

Conventions and Meetings—If you attend a convention or business meeting that has to do with television servicing, you may deduct the expenses of travel, hotel bills, meals, and so on. You may also deduct the cost of entertainment, *provided* you can prove the entertaining was for the purpose of increasing your business.

There are a few *don'ts* to observe in this connection: *Don't* deduct the cost of taking your wife along with you. *Don't* deduct the cost of entertaining casual acquaintances. *Don't* deduct personal expenses, such as sightseeing tours or a side visit to Aunt Mabel.

Special Education — If you attend classes specifically to improve your skills as a serviceman, the cost is deductible. However, if you attend a course on bird watching, for example, the cost is not deductible, because this would not increase your business or professional skill.

Interest—You may deduct all interest paid or accrued on any indebtedness of your business.

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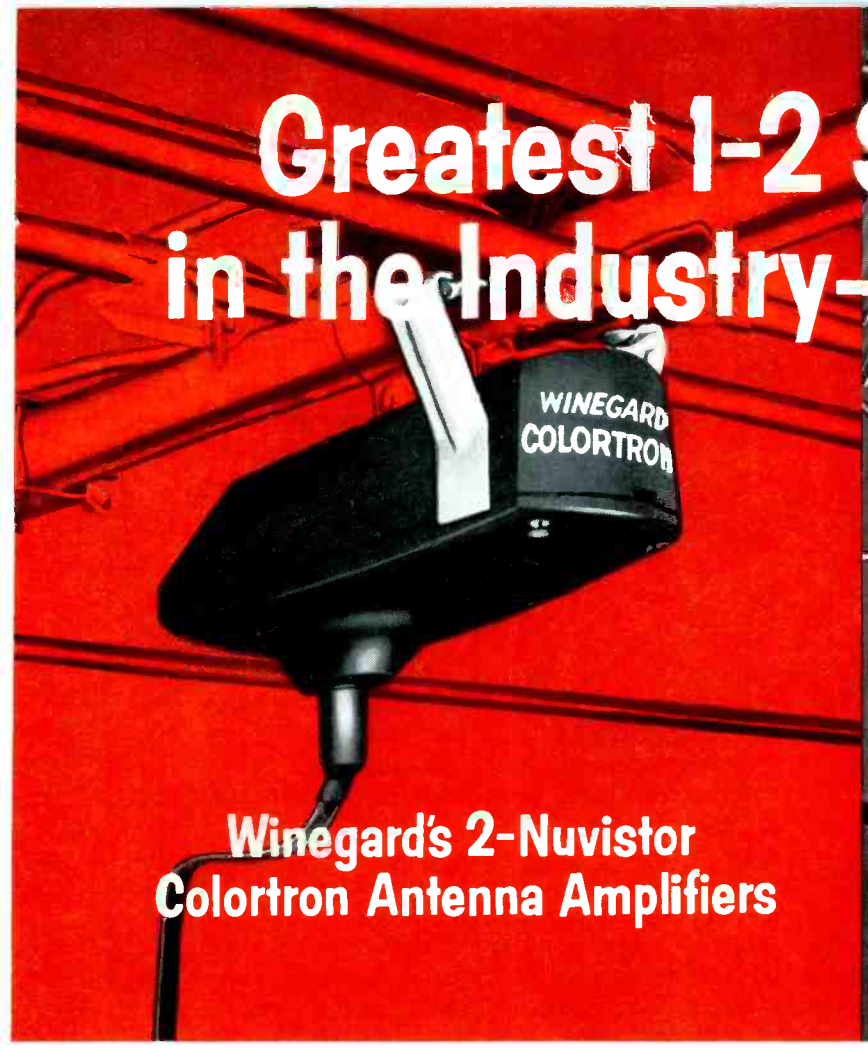

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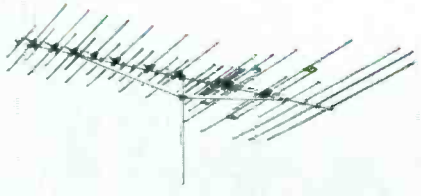

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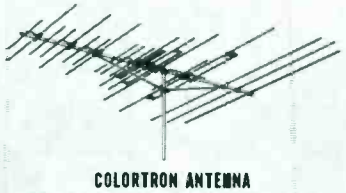

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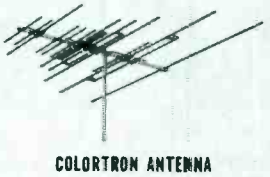

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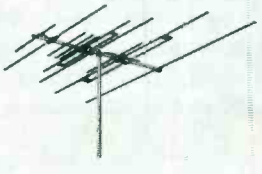

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Table II

Item: Signal Generator		Cost: $300		Salvage: $50
Tax Year	Cost (less salvage)	Rate	Deduction	Remaining value (incl. salvage)
1962	$250	20%	$50	$250
1963	250	20%	50	200
1964	250	20%	50	150
1965	250	20%	50	100
1966	250	20%	50	50

Other Taxes—Various local, state, and federal taxes (other than income) may be deducted, as long as they pertain to your business.

Depreciation

A discussion of deductions would not be complete without a definition of capital expenditures. Since they may be deducted only by using depreciation allowances, the distinction between them and regular business deductions is important. Capital expenditures consist of money spent to acquire new property that will have a useful life of more than one year for money spent for permanent improvement which either increase the value of the property or prolong its life. Such a purchase is *not* a business *expense*.

There are several approved methods of computing depreciation. Primarily, they differ only in the amount that may be depreciated each year. The most common is the "cost-less-salvage" plan (Table II) in which the cost of the asset is recorded, a useful life is specified (say, five years for a test instrument), and a salvage value is assigned (what it's worth at the end of its useful life). The salvage is subtracted from the cost, and the remainder is divided by five, to determine the yearly depreciation figure. A tax accountant, with a knowledge of your circumstances, can tell you if another plan is better for you.

Conclusion

The Internal Revenue Service has over 50,000 agents auditing income tax returns. You may be sure that your return will at least be added up to see if it is mathematically correct. If something is found that appears to warrant further investigation, your return will be turned over to an investigator, and you will be called upon to answer some pointed questions. If you want to be able to give sound answers to those questions, there are only two secrets: keep good records, and know what you are talking about.

These suggestions will not make a tax expert out of you, but it may put you on firmer ground in the event the man from IRS should come to call. ▲

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27 assorted front controls	5 SPST on/off switches
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40 assorted universal shafts for singles and dual concentrics	1 DP on/off switch

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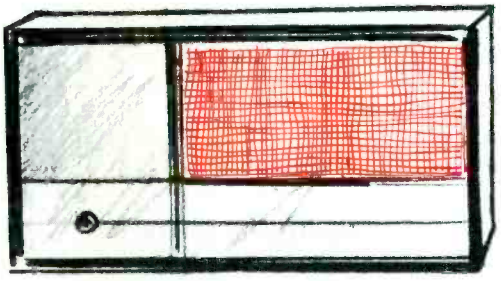


Space - saving arrangements give flexibility in planning.

by George F. Corne, Jr.

One of the major trends in high-fidelity system design during the past several years has been toward smaller speaker enclosures, because more people are discovering they can find room for these space-saving cabinets.

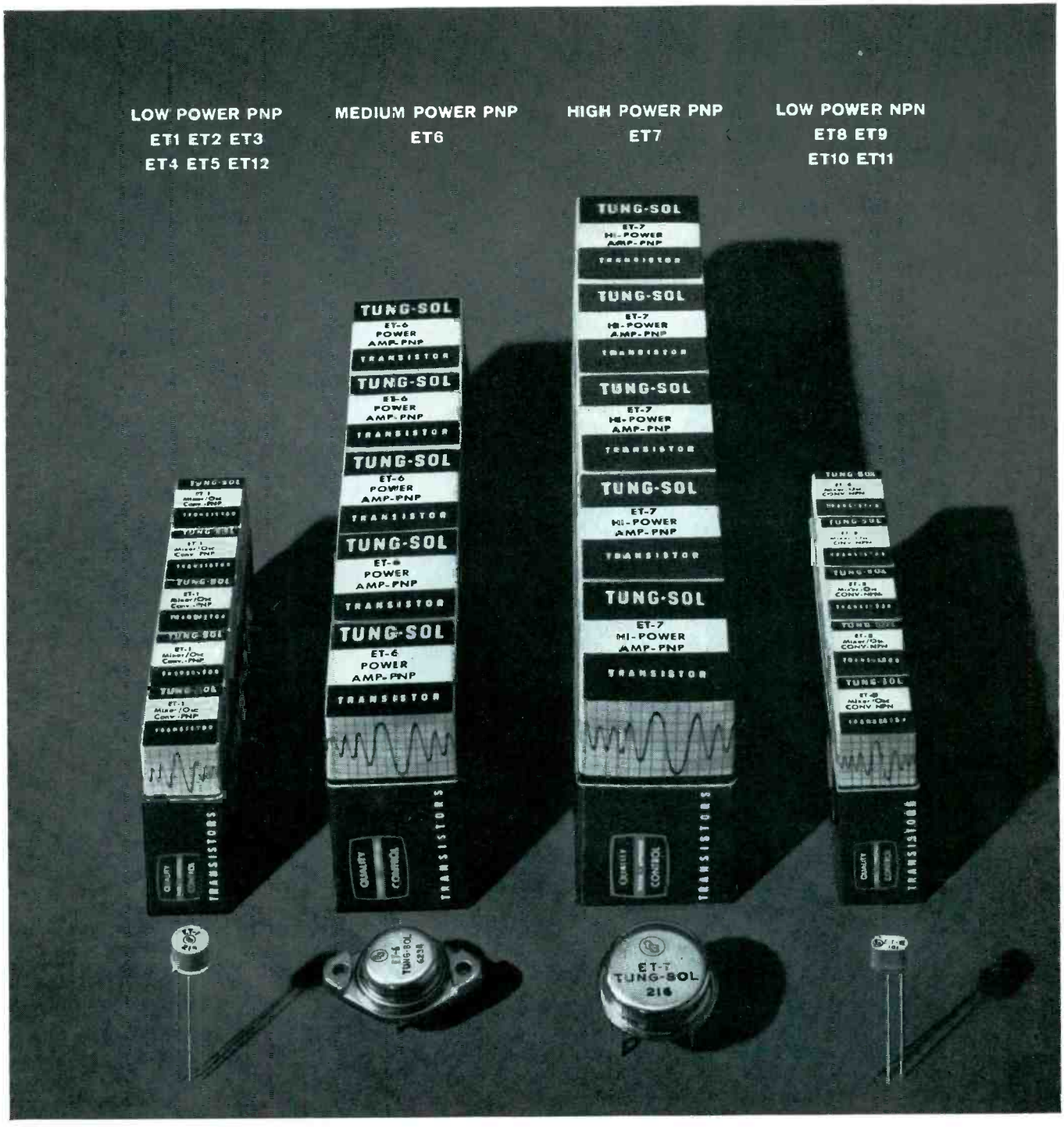
High-fidelity systems used to be purchased mostly by serious music lovers, who insisted on near-perfection in reproduction of music. These audio fans didn't particularly care how large the speaker enclosures had to be, just so they were able to handle the low bass tones in hi-fi recordings. Recently, however, high fidelity has greatly broadened its appeal to people who are not that interested in fine music. They welcome high-quality audio equipment into their homes only if they can find room for it in locations where it will not be too conspicuous.

Finding the necessary space can be a real problem, because modern homes and apartments have little room to spare for large, bulky pieces of furniture. Even when there is plenty of space, from a man's point of view, the lady of the house often quells the idea of owning high-fidelity equipment in massive-looking cabinets; she insists on small, dainty furnishings, and wants the hi-fi to match the decor.

Problems due to a scarcity of space have been further compounded by the advent of stereophonic sound. Stereo systems not only require two sets of speakers instead of one, but also demand rather critical placement of speakers if a pleasing stereo effect is to be created in the favorite listening area. The location of speakers in the room, as well as the distance between them, makes a great difference in how the music sounds.

Separate high-fidelity components lend themselves better to limited space than ready-made consoles, because they allow more flexible arrangements. For example, dual speaker enclosures can be placed on either side of a doorway or other wall opening; or, they can be built into a wall, closet, bookcase, or room divider. Small speaker systems obviously can be adapted more easily to a variety of clever space-saving layouts—another reason for their steadily rising popularity.

Manufacturer	Home Entertainment Enclosures		
	Bookshelf	Wall	Ceiling
Argos Products Co. 600 S. Sycamore St., Genoa, Illinois	X	X	X
Approved Products Mfg. Co., Div. of Wico Corp. 2907 N. Pulaski Road, Chicago 41, Illinois		X	X
Citroen Electronics Corp. 729 N. Highland Ave., Los Angeles 38, California	X		
Cletron Electronics Corp. 1350 W. Fifth Ave., Columbus 12, Ohio	X	X	X
Components Specialties Inc. 9 Kees Place, Merrick, L. I., New York		X	
EICO Electronic Instrument Co., Inc. 33-00 Northern Blvd., L.I. City 1, New York	X	X	
Electro-Voice, Inc. Buchanan, Michigan	X	X	
Fisher Radio Corp. 21-24 44th Drive, L. I. City 1, New York	X	X	
Fourjay Industries 2801 Ontario Ave., Dayton 14, Ohio	X	X	X
Jensen Manufacturing Co., Div. of The Muter Co. 6601 S. Laramie Ave., Chicago 38, Illinois	X	X	
Lowell Manufacturing Co. 3030 LaClede Station Road, St. Louis 17, Missouri		X	X
Oaktron Industries, Inc. Route 3, Highway 69 South, Monroe, Wisconsin		X	X
Quam-Nichols Co. Marquette Road at Prairie Ave., Chicago 37, Illinois		X	X
Sherwood Electronic Laboratories Inc. 4300 N. California Ave., Chicago 18, Illinois	X	X	
Soundolier Inc. 9380 Watson Industrial Park, St. Louis 26, Missouri	X		X
University Loudspeakers 80 S. Kensico Ave., White Plains, New York	X	X	
Utah Electronics Corp. Huntington, Indiana	X	X	X
V-M Corporation Benton Harbor, Michigan	X	X	
Wald Inc. 119 Prospect Ave., Burbank, California		X	X
Wilder Engineering Products 1253 W. Diversey, Chicago, Illinois	X	X	X



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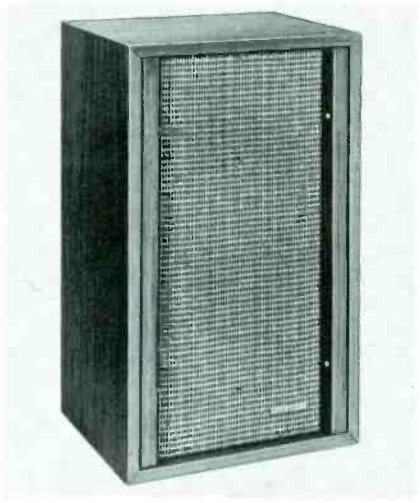

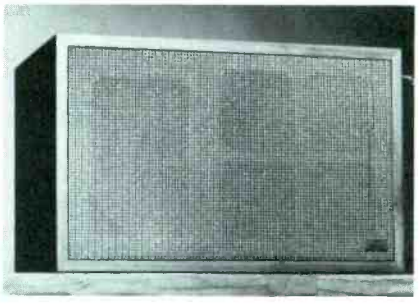

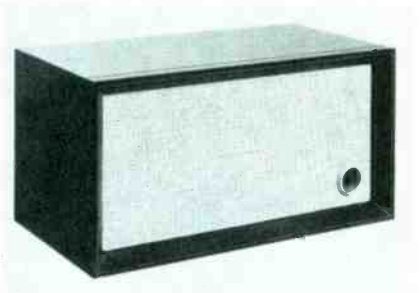

High-fidelity bookshelf enclosures have been on the market for several years. They can be placed in either an upright or a horizontal position.

Space-Saving Types

This trend toward compact units has gone far enough that small "bookshelf enclosures" are now extremely popular among the speaker systems on the market. Many enclosures of this type measure less than 14" high, 24" long, and 12" deep.

To shrink enclosures down to this size, designers have had to compensate for the losses in low-bass response that tend to result from the decreased volume of air within the cabinet. The most important developments in this direction involve changes in woofers and in the methods of acoustically matching them to the enclosures. One common technique is to mount a rather stiff cone in a highly flexible suspension, so the whole cone

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2 PATTERN SELECTOR
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3 AUTOMATIC DECONVERGENCE
Simplifies static and dynamic convergence. No digging into set

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Produces each color one at a time for accurate color set-up

5 COLOR GUN KILLER
Automatically enables the technician to actuate any combination of the 3 guns

6 DEMODULATOR ALIGNMENT
Makes alignment extremely simple, without going into the color set

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Produces Patterns, Burst, and Colors Individually—Provides dot pattern, crosshatch, vertical lines, horizontal lines, burst signal, and individual colors—one at a time—on the TV color set—for fastest, easiest check. Unique window-viewer on front of the instrument panel shows you each pattern as it should be—gives you an exclusive display standard to use as a sure guide for quick, visual comparison.

Provides Accurate, Individual Color Display—Produces Green, Cyan, Blue, B—Y, Q, Magenta, R—Y, Red, I, Yellow, and Burst—one at a time. All colors are crystal-controlled and are produced by a precision delay-line for maximum accuracy. Each color is individually switch-selected—no chance of error.

Provides Accurate NTSC-Type Signal—Color phase angles are maintained in accordance with NTSC specifications.

Makes Convergence and Linearity Adjustments Easy—Highly stable crystal-controlled system with vertical and horizontal sync pulses, assures the ultimate in line and dot stability.

Simplifies Demodulator Alignment—The type of color display produced by this instrument provides the ultimate in simplicity for precise demodulator alignment.

Provides Automatic Deconvergence—Eliminates the necessity for continual static convergence adjustments. The instrument automatically deconverges a white into a color dot trio without digging into the color set to misadjust the convergence magnets. It also deconverges a white horizontal or vertical line into red, green and blue parallel lines. This greatly simplifies dynamic convergence adjustments.

Provides Exclusive Color Gun Killer—Front-panel switch control makes it easy to disable any combination of the three color guns. Eliminates continuous adjustment of the background or screen controls, or connection of a shorting clip inside the receiver. The switch also selects the individual grids of the color tube and connects to a front-panel jack to simplify demodulator alignment.

Provides Switch-Selected R.F. Signals—Factory-tuned, for channels 3, 4, and 5—for open channel use in your area.

Model 850 also includes other features that make it invaluable for home and shop use. Net, **$199.95**

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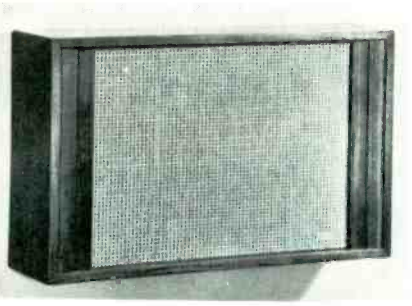
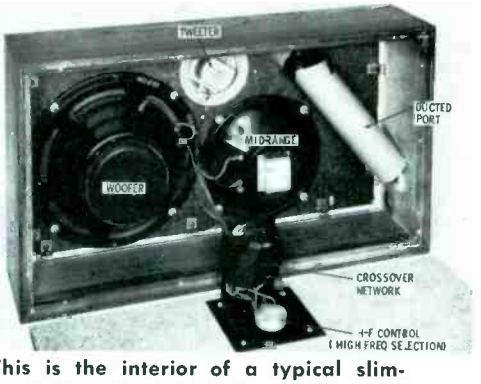


New developments in woofers have made it possible to reduce the depth of bookshelf systems to six inches or less. Some of these slim units can be hung on a wall; a few have legs so they will look attractive when placed on the floor.

can move freely back and forth like a piston—in spite of the relatively great air resistance encountered inside a small, sealed enclosure. Such a speaker is capable of delivering strong, clean bass sound despite the limitations of a small cabinet. In some bookshelf units, bass output is reinforced by means of a ducted port, which is similar in principle to the bass-reflex arrangement used in many larger enclosures.

A newer trend is to reduce the depth of the cabinet through the design of slimmer woofers. Some of these new speakers use a flat, disc-like radiating element, with a flexible edge suspension instead of a cone. Others have inverted construction, with the voice coil and magnet "cupped" inside the cone. Enclosures using these "slim-line" speakers are only 4" to 7" in depth, and can be mounted on the wall—although many users still prefer to place them on shelves or furniture.

Some enclosures of both the bookshelf and the slim-shelf type come close to being miniaturized versions of the large enclosures that



This is the interior of a typical slim-shelf enclosure containing woofer, mid-range, and tweeter speakers in a three-way system. In operation, the cabinet is airtight except for the ducted port, which has dimensions carefully chosen to reinforce bass response.

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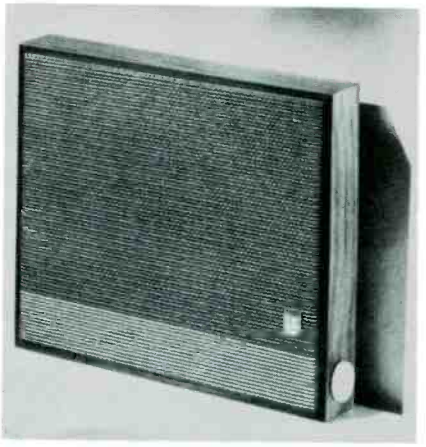
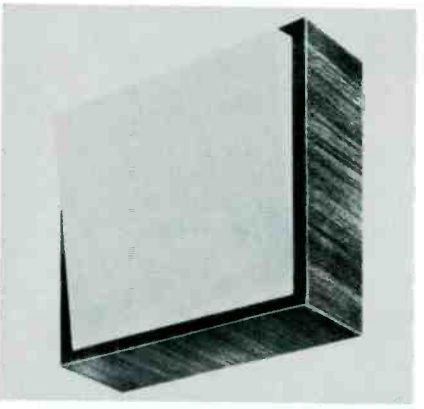
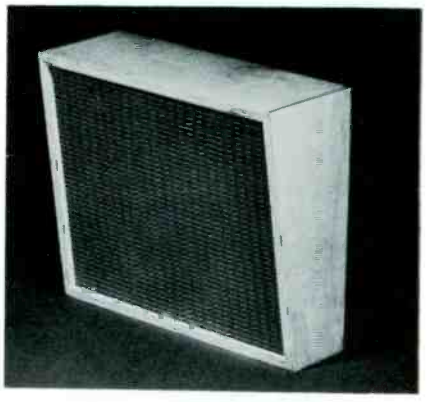
were popular in the past. They are quite suitable for use as the main speakers in a high-fidelity system. In fact, a monophonic system using a large speaker enclosure can be converted to stereo, with reasonable results, by adding one of the better bookshelf systems in conjunction with the additional amplifier.

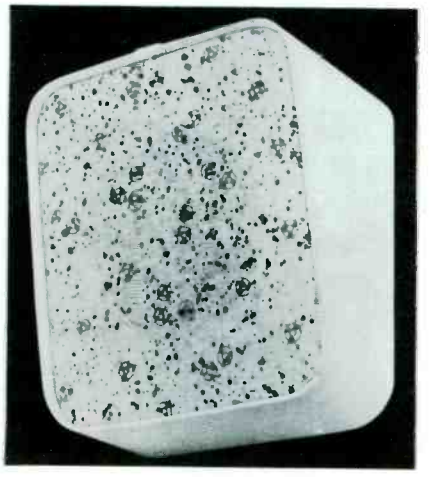
There are other enclosures intended mostly to be used with inexpensive extension speakers having less power-output capability and more limited frequency response than the elaborate systems. They may be placed in parallel with existing hi-fi speakers, either as extensions into other rooms, or as "wing" speakers to heighten the stereo effect obtained from modest-sized consoles.

Requiring even less space than the smallest two-way systems, and even more modestly priced, are the various types of baffles designed to accommodate one speaker. Many of these are adequate for use as hi-fi extension speakers, while others are used principally in background-music and intercom systems. Baffles are usually made for either surface or flush mounting on walls or ceil-









Among the extension-speaker housings items pictured, the extremely thin cabinet is free-standing, while the others are designed to be fastened to the wall. The round-cornered baffle, styled for kitchen use, is painted white.

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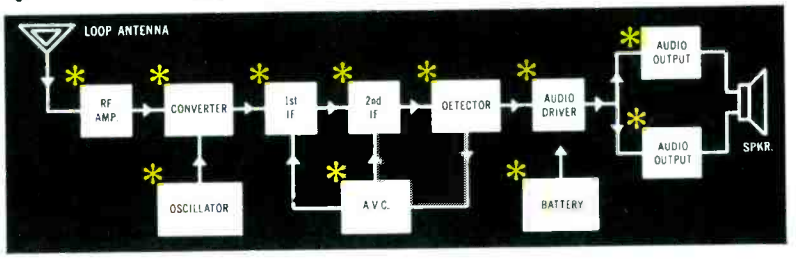

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BUILT-IN METERED POWER SUPPLY FOR EASY SERVICING

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SIMPLIFIES IN-CIRCUIT TRANSISTOR TEST WITH NEW DYNA-TRACE SINGLE-POINT PROBE

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Includes high-input-impedance vacuum-tube voltmeter, which is so necessary for transistor radio servicing.

TESTS ALL TRANSISTORS OUT-OF-CIRCUIT

Meter has "Good-Bad" scale for *both* leakage and beta. Also has direct-reading Beta scale, calibrated 0-150. Assures quick, accurate test. Also automatically determines whether transistor is NPN or PNP. Meter is protected against accidental overload and burn-out.

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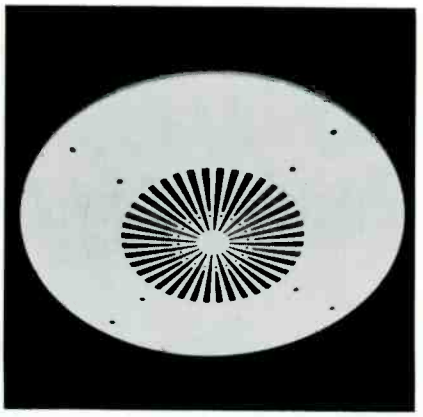

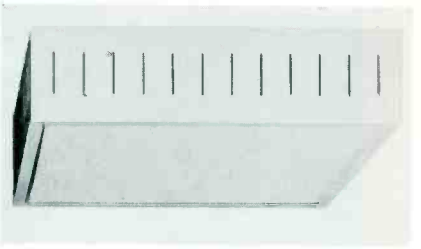

Some speaker enclosures and baffles can be mounted in or on ceilings, and can provide high-fidelity music in areas where a floor- or shelf-mounted speaker system would be in the way.

ings, and are supplied in various finishes and styles to match their surroundings.

What's Inside

Many of the compact enclosures have three or even more speakers. Such a cabinet may contain one woofer, as large as 12"; one or two midrange speakers, from 3½" to 8" in diameter; and one or more small tweeters. These are wired in a *three-way* system, with a built-in crossover network dividing the audio signal into three bands. Each speaker is fed only the particular range of frequencies it is best able to handle, with a smooth transition from one range to the next. Typical crossover points vary from 600 to 2000 cps between woofer and midrange unit, and from 4000 to 10,000 cps between midrange and tweeter. There are even *four-way* systems having an additional crossover in the mid-frequency region.

Some high-fidelity units available in space-saving cabinets are *two-way* systems. These contain only a woofer and a tweeter, with a crossover point at approximately 2000 to 5000 cps. This type of enclosure occasionally contains a *coaxial* speaker, which has woofer and tweeter cones mounted on a single frame. Higher-price speakers of this type have dual voice coils, while some others use one coil to drive both cones.

Power Requirements

The audio power requirements of high-fidelity bookshelf units in the medium and upper price brackets are usually about 20 to 30 watts. If attached to a lower-powered amplifier, they will still deliver plenty of sound to please most users; however, an amplifier rated at no less than 10 watts is generally recommended. The impedance of most enclosures is 8 ohms, although other impedances such as 4, 12, and 16 ohms are available. Simpler bookshelf systems, and speakers to be used in baffles, can be purchased in a great variety of ratings to match the driving power and impedance of different amplifiers.

Summary

As a guide to obtaining further information, this article includes a chart of manufacturers whom you can contact for specific data on their lines of space-saving enclosures. By investigating what's available, you'll be able to give well informed answers to customers when they ask, "We want hi-fi, but where can we find room to put it?" ▲

"You realize, of course, there's a slight additional charge for these fringe-area calls?"

NOTES ON TEST EQUIPMENT

by Forest H. Belt

More Color—NTSC Style

A number of color TV serviceman prefer the NTSC type of color signal for servicing chroma circuits in color TV, but they have frequently complained of the cost of such instruments. In the Model 661 *Chrom-Aligner* color generator (Fig. 5), Hickok has provided such an instrument at a price considerably less than for previous models.

Specifications are:

1. *Power Required — 105-125 volts AC, 60 cps, 40 watts.*
2. *RF Output — TV channels 3 and 4, video carriers only; fixed-tuned; unbalanced output, approximately 75 ohms with* GAIN *control fully clockwise.*
3. *Video Output—Choice of: 15 horizontal bars, 20 vertical bars, crosshatch (15 horizontal with 20 vertical bars), or approximately 300 dots; color signals including six separate bars of color (yellow, red, magenta, blue, cyan, and green) and four phase-test signals (R—Y, B—Y, G—Y(90°), and —G-Y); available at separate video jack or modulated on either video carrier.*
4. *Controls and Terminals—rotary* FUNCTION SELECTOR *switch (includes power switch), rotary* HUE SELECTOR *switch, toggle* CHANNEL SELECTOR *switch, toggle* CHROMA *on-off switch,* RF ATTENUATOR *potentiometer,* VIDEO OUTPUT *and* GROUND *jacks, permanently attached* RF OUTPUT *cable, pilot lamp.*
5. *Size, Weight, Price — 11 1/16" x 15" x 8⅛"; 18½ lbs; $349.50.*

The Model 661 generates a test signal considerably different from the NTSC color-bar signal produced by the Hickok Model 656XC generator that was covered in October, 1962 "Notes." Whereas that unit provides several bars of color simultaneously, the Model 661 produces one single large color bar at a time, covering about ⅔ of the screen. However, the phase of the 3.58-mc signal is carefully controlled to produce only the exact color indicated on the panel switch of the instrument. Thus, the signal meets the specifications for an NTSC type generator, without the complex mixing circuitry necessary to show all the color on the screen simultaneously. In addition, the instrument provides the dot, vertical-bar, horizontal-bar, and crosshatch patterns necessary for color TV convergence.

In addition to the standard primary and secondary colors, the Model 661 furnishes R-Y, B-Y, –G-Y, and G-Y (90°) signals for chroma-circuit and demodulator alignment. The R-Y and B-Y signals can be used in conjunction with a color-gun killer to make demodulator adjustments without using a scope, and can help troubleshoot demodulator defects that cause wrong colors to appear on the screen.

Fig. 2 shows a simplified block diagram to facilitate an analysis of how the Model 661 works. This generator uses the stable blocking-oscillator divider arrangement now found in the majority of dot-bar generators to develop the vertical and horizontal bars, crosshatch, and dot patterns. A crystal-controlled 315-kc master oscillator initiates actions in the entire frequency-divider chain. At the proper points in the frequency chain, horizontal and vertical sync pulses are taken off and fed to a sync mixing and shaping stage, before being mixed with the video signals.

To form the vertical bars, a portion of the 315-kc signal is tapped off and sent to a video shaper; the horizontal bars are formed in the same stage,

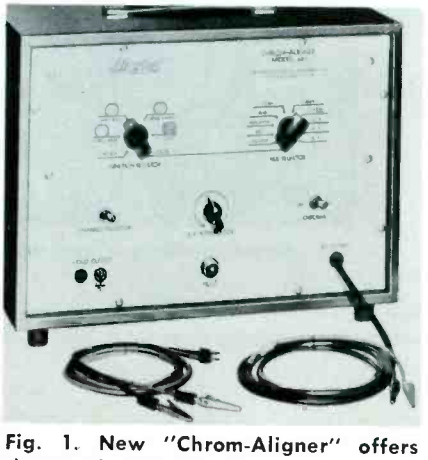

Fig. 1. New "Chrom-Aligner" offers choice of color-TV alignment signals.

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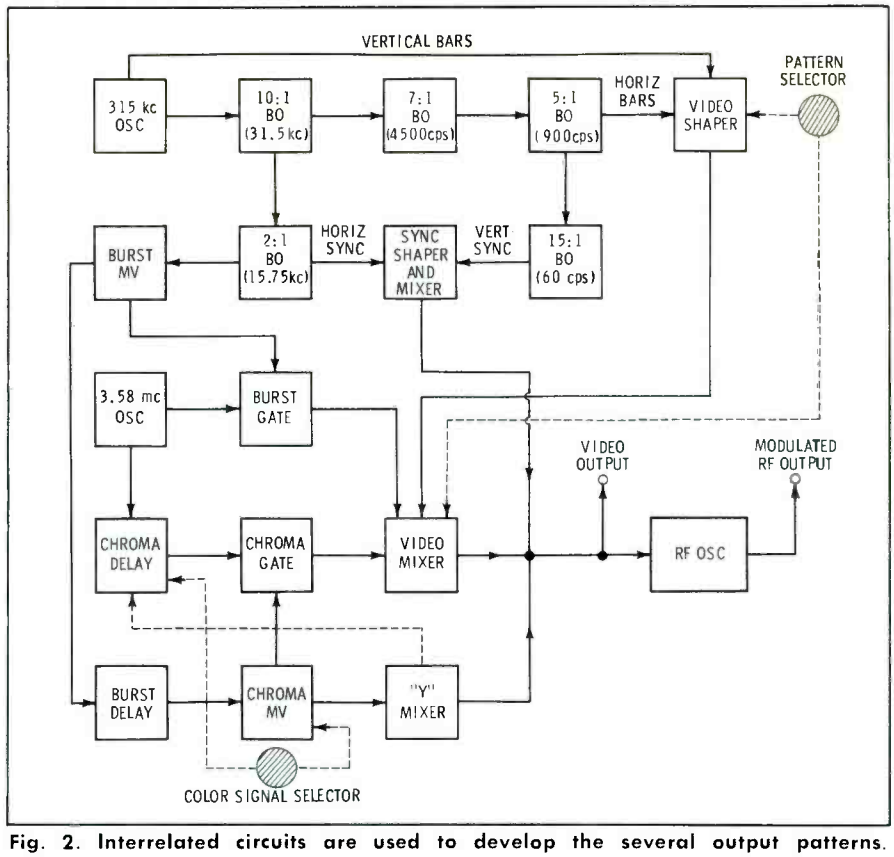

Fig. 2. Interrelated circuits are used to develop the several output patterns.

from a signal that originates in the 900-cps blocking oscillator. The job of the shaper is to time the duration of the sharp video pulses that form the lines in the convergence patterns. The FUNCTION selector switch turns the unit on and chooses vertical or horizontal bars, crosshatch, or dots; the final clockwise position of the same switch actuates the chroma sections, after which the HUE SELECTOR takes over the function of choosing the color signals.

In the color circuits, the burst multivibrator has two purposes: to control the timing of the burst (the color-sync signal that follows each horizontal sync pulse), and to set the starting time for each color bar. The multivibrator action is controlled by the 15,750-cps blocking oscillator. The color-sync signal is formed in a burst-gate stage, which allows a small "burst" of energy from the crystal-controlled 3.58-mc oscillator to reach the video mixer just after each horizontal sync pulse.

Meanwhile, the chroma delay network—a system of capacitors, coils, and resistors — shifts the 3.58-mc signal to exactly the correct phase to create the color picked by the HUE SELECTOR. At the same time, the chroma multivibrator is triggered by a slightly delayed pulse from the burst multivibrator and actuates the chroma gate circuit, allowing a pulse of chroma energy to pass to the video mixer. The chroma multivibrator controls the width of the chroma "bar," and also the amplitude of Y signal that joins the chroma signal just after the video mixer. Thus, the chroma delay network determines the hue of the color bar, and the chroma multivibrator controls its width and saturation.

When the pattern selector is set for color, the deflection sync, chroma, color sync, and Y signals all combine at the video output jack. When the pattern switch is set for convergence patterns, only the deflection sync and video are present. Whatever signal appears at the video jack is also supplied to the RF oscillator, producing a modulated signal for the RF output cable.

Sometimes it is difficult to understand the relationships among the various hues and colors that appear on the screen of a color set. However, understanding them is the first step to being able to analyze receiver troubles involving improper color rendition: if you know what colors are missing, it is often a clue to where the fault lies. The color-phase wheel in Fig. 3 will help to clarify these relationships.

The colors shown in the color wheel correspond to the color bars produced by the 661. Beginning with yellow (which is first on the HUE SELECTOR switch), the colors are shown in the order of their phase difference, assuming the color-sync burst to be zero phase. The length of each line is proportional to the Y-signal level, but is not as important to color-TV servicing as the phase relationships.

Knowing the order in which these chroma signals appear in relation to one another can help a great deal when you must adjust demodulator phasing. Since this usually involves two or more adjustments, it is not uncommon to find the demodulators still do not "track" after you've made the simplified adjust-

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To introduce you to the opportunities and profits of CB Servicing with the GC Optimizer, we offer for a limited time, this coupon worth a full 5.00 toward the purchase price. Simply fill in your name and address and present it to your GC Distributor.

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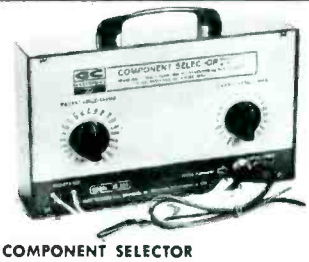

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Small but powerful. Tests Compactrons, Nuvistors, Ten-Pin Sylvania, Novars, Foreign Tubes, Hybrid Auto Radio Tubes, some Industrial Tubes and Selenium Rectifiers. Tests and *reactivates CRT Tubes;* over 1,750 tubes, black and white or color—quickly and accurately.

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Part No.	Suggested Dlr. Net
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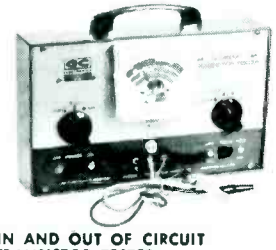
Tests PNP, NPN, Power Transistors, diodes and rectifiers (semi-conductors). All transistors; operates as a SIGNAL GENERATOR of 400 CPS (approx.) audio signal; also acts as a POWER SUPPLY — BATTERY ELIMINATOR, gives an indirect battery test through substitution.

Part No.	Suggested Dlr. Net
36-568	49.50



IN AND OUT OF CIRCUIT TRANSISTOR TESTER

Tests all common NPN, PNP transistors, provides an indication of collector to emitter shorts, collector to base shorts, condition of collector junction, DC current gain, crystal diodes and rectifiers. Provides an "In-Circuit" test to determine transistor's ability to oscillate as a blocking oscillator.

Part No.	Suggested Dlr. Net
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TRANSISTOR TESTER

For testing PNP, NPN, power transistors, diodes and Rectifiers (Semiconductors). The Tester's basic measurement capacities are Open Test, Short Test, Leakage—ICO, Gain—BETA, Out of Circuit. Operates on 2 penlite batteries which should last for life under normal operating conditions.

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POWER SUPPLY AND BATTERY ELIMINATOR

Extended operation of units without batteries. Allows operation at higher or lower than normal output voltages, giving technicians better analysis of relative performance. Checks current drain; OPTIMUM FULL WAVE rectification through 2 heavy duty silicon rectifiers.

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For service repairs on Transistor, Auto, and conventional Radios and Hi-Fi Stereo sets. Makes trouble shooting quick, easy through signal injection method, isolating defects to a specific stage.

Part No.	Suggested Dlr. Net
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Just off the press... GC Supplement Catalog No. FR-62-S. 48 pages of new test equipment, tools, antennas, phono drives, etc. Free with this coupon—Write: GC Electronics Co., Dept. No. 17, 400 So. Wyman St., Rockford, Illinois, USA.

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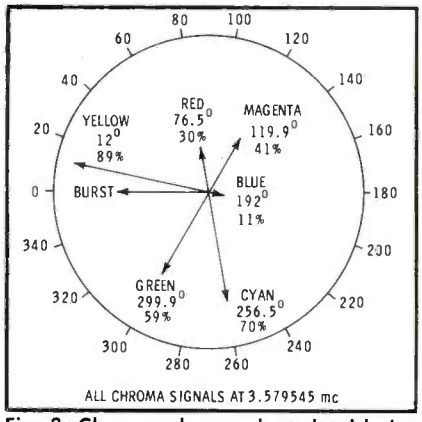

Fig. 3. Chroma-phase color wheel helps understand demodulator problems.

ments using the special phasing signals provided by the 661. To clarify this point, and to show how a knowledge of phase relationships can help solve the problem, here's the case history of a color-TV service problem that occurred recently in one of our lab sets.

The set—an older chassis—had been repaired, and we went through the complete chroma bandpass and color-AFC alignment procedures. Then, to finish the job, careful demodulator alignment was undertaken. Using the B-Y signal from the Model 661, and with the red and green CRT guns disabled, one demodulator coil was adjusted for the normal all-blue raster. Next, the R-Y signal was used, with the blue and green guns disabled, to adjust the other demodulator coil for an all-red screen. Each of these steps had to be repeated three times to reach a point where both were correct, as the adjustments had some interaction.

However, when the job was completed, and we checked all color hues, we found that every color was okay except yellow; it was green, instead. So, figuring the yellow color signal was somehow having the same effect as a green signal, we looked at the color wheel. In other words, somewhere in the color circuits a slight phase shift was taking place, and was affecting only the yellow bar. Since demodulator adjustments seemed normal by usual standards, the bandpass alignment was carefully rechecked. A slight touchup solved the problem. It seems slight misadjustment of one coil in the chroma bandpass amplifier was "slowing up" chroma signals that closely followed the burst of color sync, "pulling" the yellow signal near to the green sector. A knowledge of chroma phase helped reason out this problem.

We mentioned using the R-Y and B-Y signals. In addition, the Model 661 furnishes two other standard alignment signals—G-Y(90°) and -G-Y. The -G-Y has approximately the same phase as the magento color, since it is the direct opposite of the green signal, and magenta is exactly opposite in phase to green. The G-Y(90°) is exactly what it says — a chroma signal 90° removed from the phase of the green signal. All

four of these signals have special uses in alignment of demodulator circuits in modern color television receivers.

Controlled Power

A heavy-duty, controllable, fully isolated power transformer is a convenient addition to any serviceman's work bench. The Standard Electrical Products *Adjust-A-Volt* Model IV1-4M AC power supply—pictured in Fig. 4—has all these characteristics.

Specifications are:

1. *Power Required—120 volts AC, 50-60 cps.*
2. *Output Voltage—From 0 to 140 volts AC, continuously variable; up to 550 watts; isolated from power-line input circuit.*
3. *Panel Meter—0-150 volts AC.*
4. *Controls and Terminals*—ON-OFF *toggle switch; thermal circuit breaker* RESET *button; three-terminal AC socket; large voltage-control knob; pilot lamp.*
5. *Size, Weight, Price — 9½" x 7½" x 8¼"; 17 lbs; $79.50.*

One of the more common uses for a variable line-voltage transformer is to check AC-DC radios — especially those of the three-way portable variety — for intermittent operation caused by abnormal line-voltage conditions. The receiver being tested is connected to an adjustable source of 60-cycle AC, which is then varied to see how the receiver operates, first above normal voltage and then below. This procedure has two chances to reveal a fault.

First: Certain component breakdowns seem to appear only under the strain of operation. With the voltage supply to the components in question higher than normal, they are more likely to display their faulty characteristics. This "stress" procedure can also cause certain borderline components — those on the verge of breakdown—to show their defects, thus reducing the possibility of a future callback. The latter components *might* have lasted a considerable length of time, under normal operation, but the serviceman has no way of knowing when a line-voltage surge might affect the set.

Fig. 4. Large control knob facilitates setting output voltage of transformer.

TUBE TESTER 88, $69.50 NET—locates all tube faults quickly, accurately with patented Seco grid circuit test that checks tubes 11 ways—also cathode emission test.

DELUXE POWER SUPPLY RPS-5, $69.50 NET—transistorized zener-regulated circuit maintains constant voltage over wide load fluctuation without overshoot—up to 30 V DC and 150 ma.

REGULATED TRANSISTORIZED SUPPLY RPS-2, $25.95 NET—constant voltage—adjustable 0-25 V. Bias tap—0-100 ma.

TRANSMITTER TESTER 510B, $48.95 NET—reads both positive and negative modulation peaks on 0-120% scale—also RF output in 0-5 watts and 0-400 ma. For Handy-Talkies too!

REGULATED TRANSISTORIZED SUPPLY RPS-4, $36.95 NET—constant voltage—meter ranges 0-1.5, 0-15 and 0-30 V DC—reads load in 0-30 and 0-150 ma. Taps for simultaneous biasing.

TRANSISTOR AND TUNNEL DIODE ANALYZER 250, $74.50 NET—complete transistor lab in one compact unit—even has VOM! Analyzes semi-conductors in or out of circuit—no set-up data needed.

ANTENNA TESTER 520A, $49.95 NET—reads Forward Power and Reflected Power directly in watts! Antenna efficiency reads in: SWR from 1:1 to 8:1, per cent, or GOOD-POOR. For 50 ohm coax.

New Look in Test Equipment

The look is bold, professional, functional. Handsome black cases, lustrous brushed aluminum panels, wide easy-to-read meters—"matched set" appearance and quality. It comes to you now from Seco. See the "New Look" display of Seco test equipment at your electronic distributor's and at the May Parts Show in Chicago. Look for the red velvet!

SECO ELECTRONICS, INC. 1221 South Clover Drive, Minneapolis 20, Minnesota
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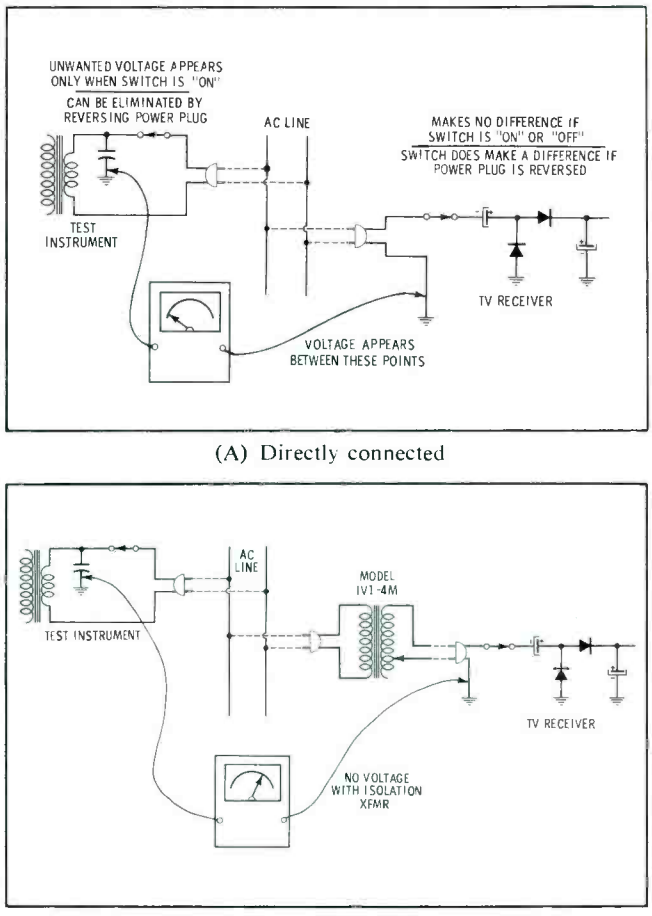


Fig. 5. You may have a "hot" chassis on the bench under a variety of conditions.

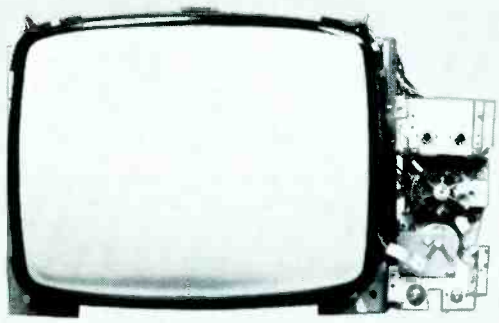
Second: At low line voltages, tube filaments cannot heat to the proper temperature, and cathode emission is weak. The result is inefficient operation, and sometimes (in certain circuits) complete failure. For example, the chief cause of intermittency in the three-way portables mentioned earlier can be traced to inadequate filament voltage for the oscillator tube—usually a 1R5. The fault, however, shows up only when line voltage is slightly less than normal. The filament voltage for the oscillator tube drops below the critical point and the oscillator stops, resulting in the complaint that the set "cuts out."

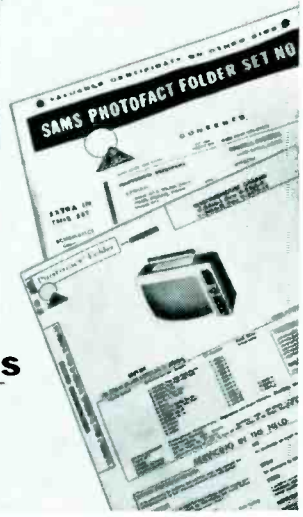
Troubleshooting faults in portable radios is by no means the only way a variable AC voltage source can be helpful. As another example, consider the case of a TV set we had in our lab. This set had an unusual history of developing an oddly intermittent raster during the late afternoon. After a day or two of seemingly normal operation on the lab bench, the unit was connected to the variable transformer. About twenty minutes of operation at reduced voltage brought the trouble to light: A capacitor in the horizontal oscillator circuit had changed value just enough to let the oscillator drop out of oscillation, unless the tube was heated up to full operating temperature. Come to find out, an electric heater was used in the owner's home through the early evening hours (in a downstairs playroom) and it was lowering the outlet voltage to only 105 volts. While the set would ordinarily operate under these conditions, the off-value capacitor caused the horizontal sweep oscillator to stop occasionally. This incident shows how a source of variable line voltage can assist in checking out known defects and uncovering certain unsuspected faults which may be waiting to appear.

The advantages of isolation are many. An AC-DC chassis, powered by an isolated transformer, has no dangerous potential between its chassis and ground or between its chassis and other test equipment. In fact, test connections can safely be made without fear that a "cross-connected" ground may damage a component, a meter, or an entire instrument.

looks innocent...but this chassis has a "tough dog"* repair problem

*no picture—raster okay—sound distorted





you may be able to solve the trouble in an hour or more.....or you can do it in minutes

With a PHOTOFACT® Folder by your side, the job takes just minutes. You use the Tube Placement and Tube Failure Check Charts (found in every PHOTOFACT TV Folder) and test the Video, AGC and IF tubes—they check okay. Adjusting the AGC control produces a weak picture, but the contrast control has no effect.

Referring to the Standard Notation Schematic, there is a normal waveform at the Video grid. There is a weak signal at the plate. Voltages are high. In just minutes, you've pinpointed the trouble. When comparing resistance with the handy chart, rotating the contrast control varies the reading, but you find it's high. The answer: A cold solder joint at the center of the control. Trouble solved—in just minutes—with PHOTOFACT!

YOU EARN MORE DAILY when you have PHOTOFACT at your fingertips. It's your time-saving troubleshooting partner for everything that comes into your shop. Just reach for the easy-to-find PHOTOFACT Folder you need for any model. It provides *everything* you want—complete, uniform, authoritative.

You get: Famous Standard Notation Schematics packed with all the service details you need; full Photo Coverage of all chassis views; Complete Replacement Parts Lists; Tube Placement Diagrams; full Alignment Instructions; actual Waveform Photos; CircuiTrace® for printed boards; Alternate Tuner data; Terminal Identification and Connections; Disassembly Instructions (including auto radio removal); Field-Servicing Notes; Dial Cord Stringing Diagrams; Changer and Recorder "Exploded Views"—plus dozens of other great features.

Own the complete PHOTOFACT Library—so you can instantly put your hands on all the quick help you need for any job on your bench! If you're not now a PHOTOFACT Library owner, you're more than paying for it in the time you lose every day. So take the *right* step to time-saving, profit-building servicing—see your Sams Distributor for details on an Easy-Buy PHOTOFACT Library and Standing Order Subscription—or send coupon today!

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The isolated bench transformer also serves as a safety precaution. Unpleasant—or even dangerous—voltages can sometimes develop between the chassis, cabinet, or leads of a test instrument and an AC-DC chassis plugged into the same AC supply. Depending on the power-circuit design of each instrument, these potentials can be present when the unit is on, off, or both. Thus, it is often difficult to predict which instruments will be affected, and when. The diagrams in Fig. 5 show why this is true.

In Fig. 5A the receiver and instrument just happen to be connected in such a way that an undesirable potential exists between the two pieces of equipment. The technician who grabs the ground lead of the test instrument, and then attempts to hold the receiver chassis in position while he connects the clip, is in for an annoying "tingle" if not an actual shock. Fig. 5B shows the same hookup using an isolation transformer. The technician can safely use the latter hookup without worrying about personal shock or damage to his equipment.

The Model IV1-4M is a completely enclosed unit, whose voltage can be varied continuously from zero through 140 volts rms. A large knob on the front panel connects to the shaft of a control rotor (see Fig. 6). The rotor contains a brush holder and a brush to contact bare portions of a toroidal transformer winding.

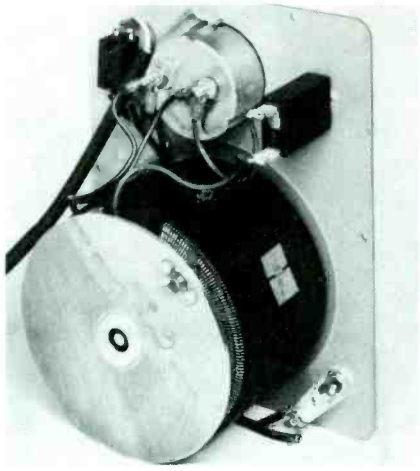


Fig. 6. Large metal rotor has brush to "tap off" desired secondary voltage.

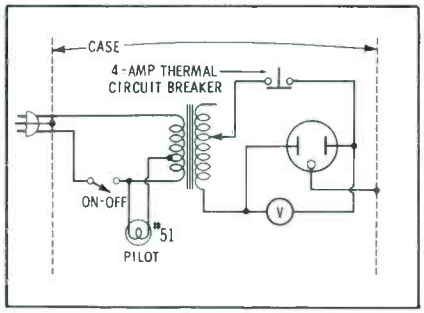
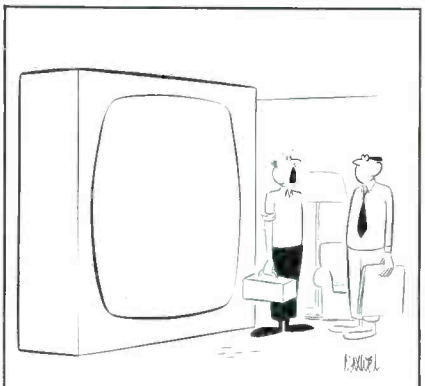


Fig. 7. Schematic of the Model IV1-4M.

Fig. 7 shows how the unit is wired. The meter on the front panel eliminates the need for a separate AC meter to indicate the output voltage of the instrument. The input plug is a three-way type which grounds the case to protect the user. The primary circuit includes a 6-volt #51 pilot lamp across part of the winding to show when the unit is on. The voltage from the secondary tap is fed through a protective circuit breaker to the voltmeter and the output receptacle. The outlet also accepts a three-way plug to accommodate any instrument that uses a three-wire power cable. The overload relay can be reset simply by pushing a button on the front panel. A handle, recessed when not in use, is an aid in carrying the unit from place to place. ▲



"Tell me where you got it and I'll fix it for nothing."

It's time somebody challenged the misleading propaganda about "hand wiring" in TV sets

The simple truth is that the much touted and advertised "hand wiring" in some television sets is an outmoded type of construction, not to be compared for reliability and trouble-free performance with modern copper-engraved circuit boards.

Once upon a time there was only one way to connect the various components in a television circuit.

That was to run a wire from one to the other and solder the connections by hand. If you go back far enough, you'll find that all television sets were once made this way.

The trouble is that in just one such set there has to be hundreds of these soldered connections, each requiring a hand operation. There is always a good chance that one or more won't be perfect . . . and sooner or later cause trouble. Hand placement of components and connecting wires can cause harmful performance and quality variations.

A better method from space technology

With the development of space electronics, there is a need for both more compact construction and *absolute uniformity and reliability*. So another method of building electronic circuits had to be perfected.

It's called the circuit-board technique.

Circuit boards are not new. They have been known in various forms for more than a quarter of a century. However, it is only within the past decade that the efforts of U. S. industry, including those of PHILCO, have led to the development of special raw materials, components, production equipment and techniques which have resulted in the wide adoption of the use of circuit boards as a more satisfactory and reliable type of construction than hand wiring.

All the circuits and connections are engraved in copper on one solid piece of rigid material. No more tangle of wires and no clumsy individual component placement and soldering.

Progressive television manufacturers—including Philco—naturally adopted this new and far better construction. Others who were unable or unwilling to switch to modern engraved circuits stayed with hand wiring.

This they had a perfect right to do.

However, we challenge statements that hand wiring means finer performance, fewer service problems and greater operating dependability.

Ask any informed television serviceman

Informed, up-to-date television servicemen will confirm the fact that modern circuit boards are more reliable than old-fashioned hand wiring. What's more, when servicing is required, it is far easier to find and repair troubles in a set utilizing circuit boards, which carry a complete circuit and component placement chart right on the face to assist in locating a test point or component. Repairmen do not relish floundering around in a "rat's nest" of "hand wiring" to trace a circuit fault.

There is another extremely important reason why Philco eliminated old-fashioned hand wiring from chassis circuits.

Some years ago, scientists studied the effects of heat on television-set components. They found that the life of tubes, condensers, transformers and other vital parts could be increased *many times* by decreasing operating temperature.

To put it another way, they proved that poorly designed television sets didn't wear out—they burned out.

Key to the Philco "Cool Chassis"

One way to prevent the burning out of television parts was to properly ventilate all parts of the set. So the famous patented Philco Cool Chassis was developed. The accurate placement of components on the circuit board provides accurate control of operating temperatures of all parts.

Today, based on our actual experience, we can make this statement—and challenge anyone to prove otherwise: **Philco Cool Chassis sets with modern, copper-engraved circuit boards, will give better performance, more reliable service, will require fewer repairs and cost less to maintain.**

We hope you will remember this when you buy your next television set. "Hand wiring," because of its association with *hand made*, sounds very good . . . makes good propaganda . . . but it simply does not make the best television sets. Not when we can *prove* the reliability, the performance and the ease of servicing Philco Cool Chassis TV with modern engraved circuit boards.

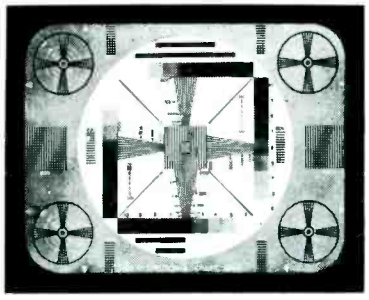
PHILCO®

A SUBSIDIARY OF Ford Motor Company

Reprinted from the Chicago Tribune—Monday, January 7, 1963

TV TIPS FROM TRIAD

NO. 20 IN A SERIES



Joe scowled at the burned power transformer facing him on the bench.

"Haven't we seen this chassis before, Bill?" he asked the Senior PTM.

"Right. We replaced the original power with another original a few months ago."

"The problem," Bill elaborated, "arises from the fact that the components are aging – capacitors act like resistors, resistors change value, line voltages are higher, and new rectifiers are more efficient. All of these things add up to increased current demands on the power transformer."

"What say we install one of those neat new Triad Triple X powers that Hank, our parts pusher, told us about the other day? He was sure sold on that 30% reserve resulting from the use of high-efficiency, grain-oriented steel laminations," said Joe.

"So, you *were* paying attention," commented Bill with a hint of a smile. "What else did he say?"

Joe continued as if he hadn't heard, "Grain-oriented steel, along with new engineering design, permits much greater flux density without saturation. Furthermore, it provides that extra reserve without the use of cumbersome radiating fins or other special ventilation."

Joe paused a moment, but quickly added with obvious enthusiasm: "By the way, did you notice the schematics in the Triad technical replacement handbook? It shows the rectifier winding tapped at 3.8 volts, so you can use the new 3-volt rectifiers, such as the 3DG4, as well as the 5-volt types."

"I'm overwhelmed," said Bill. "Get on that phone and rush order that R-91HA."

MORAL: Ask to see the new Triple X series of compact powers in 26 different voltage and current ratings at your favorite Triad Distributor. He's the one who has those good-looking red and white boxes on his shelves. Packed in each box is an instruction sheet containing a bonanza of schematic, technical, and installation data. These small (but mighty) Triple X powers will make your life more pleasant when you need a replacement for those tightly packed portable TV sets. They're equally fine for the larger roomier sets, too. Write Triad Distributor Division, 305 No. Briant St., Huntington, Indiana.

A DIVISION OF LITTON INDUSTRIES

THE TROUBLESHOOTER

answers your service problems

Shorts to Burn

In a Silvertone Chassis 528.50370 (PHOTOFACT Folder 510-2) with no vertical deflection, I found resistor R52 badly burned; so I replaced it, but the same thing happened again. I checked capacitors C2, C32, and C33, but all seem to be good. Can you tell me what's wrong?

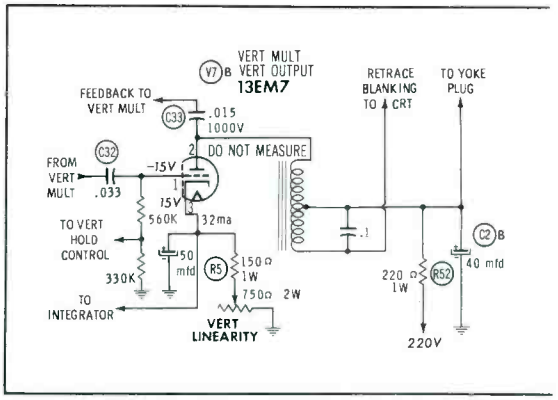
WILLIE SATTERFIELD

Edenton, N. C.

You are on the right track in checking C2 for a short. However, other components connected at this same point may be causing trouble. For example, a shorted vertical output transformer is a likely suspect; a yoke shorted to chassis is a logical second choice. Also, be alert for a short around the yoke socket, or a shorted 13EM7 tube.

From Top To Bottom

A Bendix Model C-200 television set (PHOTOFACT Folder 134-5) was recently brought into my shop because it was unable to receive channels 4, 5, and 7. By



adjusting the oscillator slugs, I was finally able to get channels 7 and 5, but channel 4 still was poor. However, when I touch a VTVM probe to the mixer grid, channel 4 comes in normally.

CLARENCE E. PAUL

So. Weymouth, Mass.

It sounds as if someone may have been "twiddling" with the tuner adjustments; therefore, I'd suggest a complete alignment of the tuner, especially of the oscil-

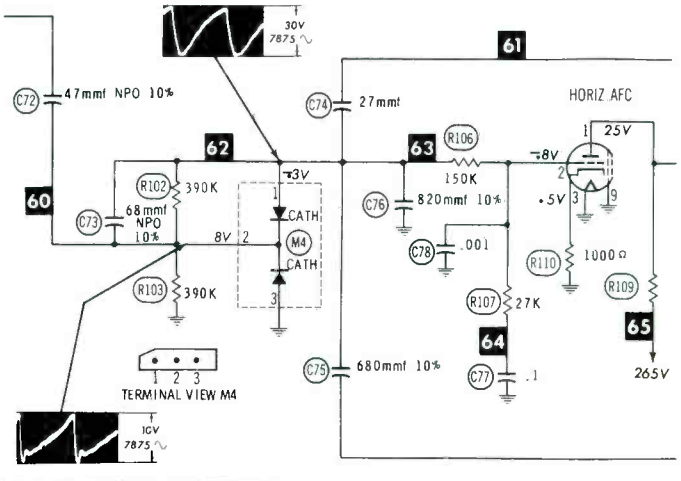
COLOR COUNTERMEASURES

Symptoms and service tips from actual shop experience

Chassis: RCA CTC11

Symptoms: Raster has shifted to one side of screen.

Tip: The customer's first complaint will probably concern the raster shift described above. You'll naturally use the horizontal centering control to return the picture to its proper position. However, if you run out of horizontal centering range (control set all the way to one end), or if you get a callback within a short period of time for this same complaint, you might well suspect trouble in the horizontal centering circuit. Before you check that circuit for trouble, replace the horizontal AFC diode; then fire up the set, and check to see if the raster has shifted back to its normal position (with the centering control back to its original setting). If it has, you've found the trouble, and there is no need to check the horizontal centering circuit. Defective AFC diodes have been known to cause this trouble in these chassis, without affecting horizontal sync.



WHY... SERVICE COLOR TV?

WHY WAIT? YOU CAN MAKE MONEY NOW!

...IF YOU'RE EQUIPPED – AND A WIDE BAND SCOPE IS A MUST

★ ★ ★ ★

OVER 750,000 SETS IN 1963

65% OF NBC PROGRAMMING IN COLOR*

LOWER PRICED 70° SETS TO BE INTRODUCED IN 1963

1,500,000 ALREADY IN USE

*PRIME TIME

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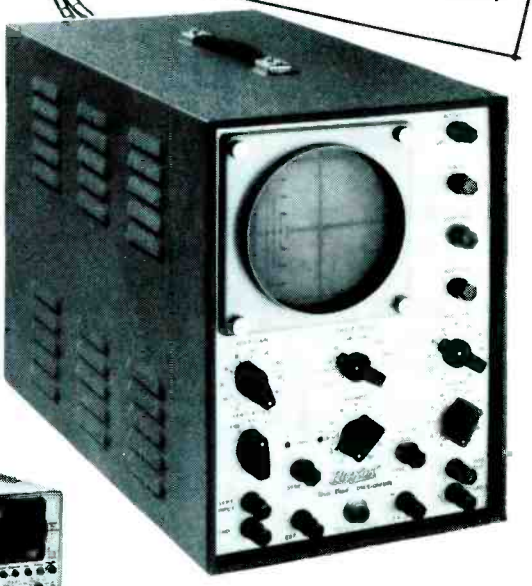

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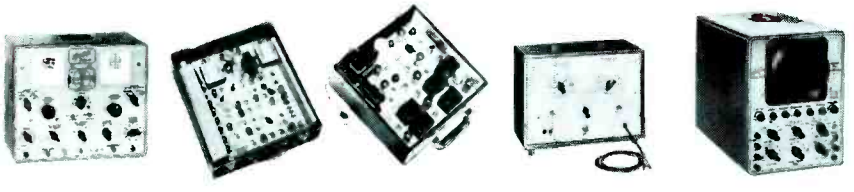


MODEL 615 MODEL 656XC MODEL 660 MODEL 661 MODEL 675A

THE HICKOK ELECTRICAL INSTRUMENT CO.
10566 DUPONT AVENUE • CLEVELAND 8, OHIO

lator and mixer coils. In this switch-type tuner, adjustment of any coil will affect the alignment of all channels below that frequency, so it is necessary to start alignment at the high end (Channel 13) and proceed to the lowest channel. Also note that some coils are "tuned" by a slight bending of the wires, so be careful not to disturb any coil inadvertently.

Positive Thinking

I'd like to know why the AVC voltage in the RCA Model 2BX63 radio (PHOTOFACT Folder 193-7) is positive, even though the set plays normally. I've always thought AVC voltage was negative, but in checking this voltage from R9 to ground, I find it to be about 1.5 volts positive.

EDWARD HARRISON

Calverton, N. Y.

AVC voltage on the RF amplifier grid of this receiver is normally positive, but only if it is measured with reference to ground. You'll find, however, that it is less positive than the cathode voltage of that tube. In this "three-way" portable, the tube filaments serve also as the cathodes. Since they carry a positive DC voltage determined by their positions in the filament string, the DC grid voltages must also be slightly more positive than ground, to maintain proper bias between grid and cathode. Except for this shift in reference point, the AVC system operates the same as in any other radio.

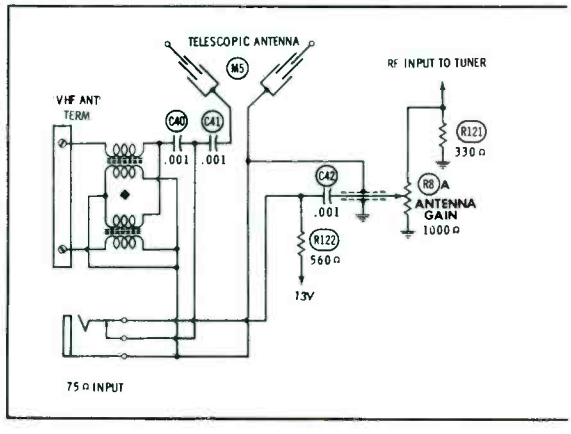
Deaf Rabbit Ears

I'm having trouble with a Sony Model 8-301W transistor TV set (PHOTOFACT Folder 588-2). No picture will come in on any channel, when I use the built-in telescopic antenna; sound is also very weak or nonexistent. However, when I attach an outside antenna, the picture and sound are normal.

WILLIAM FINSINO

Nanuet, N. Y.

Since reception is normal with an outside antenna, perhaps R8 — the antenna gain control — is not correctly set for use with the telescopic antenna. Also, be very sure you're in a locality that provides sufficient signal to drive this set to full video output with only a built-in antenna. If a lack of adequate signal strength doesn't seem to be the problem, you may have a defect in the RF stage or in the AGC system. ▲



Small Appliances

(Continued from page 22)

115-volt source. Formerly, the heating elements resembled large spiral springs, but recent types are flat ribbons. Sometimes heating elements are sealed into a complete unit; a faulty one must be replaced by an entire new unit.

In the case of "open" heating elements, there are three possible ways to make temporary repairs. One way is to scrape clean approximately two inches at the ends of the heating wires, twist the ends together, and wrap them with a thin conducting wire. Never use solder on a heating element, because the heat will cause the solder to melt.

Another way to mend a heating element temporarily is by joining the two loose ends with a mending sleeve. Prior to inserting the ends into the hollow sleeve, thoroughly clean the wire of rust and other foreign material. Then, with the aid of a crimping tool, crimp the sleeve tight.

The third mending method is to use a small 6-32 bolt, two flat washers, and a nut. Again, the ends must be cleaned. Bend a loop in each of the loose ends; then insert the bolt, with one washer on it, through the two loops. Place the other washer and the nut on the bolt, and tighten them.

"Ironing" Out Trouble

You'll want to develop a trouble-shooting procedure especially suited to small household appliances. As an example, let's go over the steps you'd take to repair that popular device—the electric iron.

The electrical circuit of an iron is simple, consisting of a heating element connected across the 115-volt source through the automatic heat control. Most heating-element troubles will be either opens or shorts, and continuity tests will locate these troubles quickly. If at all possible, don't waste valuable time trying to repair open heating elements, defective thermostats, or leaky water reservoirs. As pointed out earlier, it is less costly for the customer if you'll replace the entire part rather than try to repair the faulty one.

Suppose a customer brings an iron into the shop for repair, stating that the unit "will not heat up."

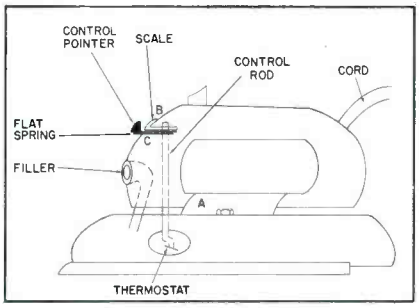


Fig. 3. Knowing construction of typical electric iron aids disassembly.

First, check the line cord and the plug; if these appear to be in satisfactory condition, the unit will have to be disassembled. Here is where the manufacturer's information comes in handy, for irons are usually difficult to take apart until you become familiar with them.

The construction of one typical steam-and-dry iron is shown in Fig. 3. To disassemble this unit:

a. Pry up curved aluminum cover A, and remove large nut located underneath.
b. With your fingernail, pull temperature scale B and spring C straight forward and out.
c. Pull small aluminum collar straight out, being careful not to bend it.
d. Lift handle straight up and off.
e. Loosen, but do not remove, two screws holding spade lugs attached to line cord.
f. Fig. 4 shows disassembled unit.

After disassembling the iron, we find the sealed element is open. We also discover we don't have this element in stock, so we order one immediately. (To maintain good customer relations, we also inform the customer of how long it will take to procure the new part.)

When the heating element arrives and has been installed, we must check the iron for satisfactory operation. This is where a surface-temperature meter is very helpful, and Table I shows the temperature

TABLE I

Fabric	Temp.
Synthetic	150°-185° F
Rayon	195°-240° F
Silk	250°-290° F
Wool	310°-350° F
Cotton	375°-405° F
Linen	415°-460° F

Fig. 4. Disassembled view shows parts that must be removed and reinstalled.

ranges you should expect for each setting of the iron's thermostat control.

Also, if ordinary tap water has been used in a steam iron, its passages, valves, and port holes may have become clogged. Before returning it to the customer, try cleaning it out by placing a small amount of white vinegar in the tank and heating the iron until the vinegar begins to boil. Disconnect the unit and let it stand for approximately 20 minutes, and then flush the tank with distilled water.

Coffee Maker

There are two general types of coffee makers—the percolator and the brewer—and either may be automatic or nonautomatic. Automatic units feature a thermostat, of either the adjustable or nonadjustable type. Open or shorted heating elements and faulty thermostats are the most likely troubles.

Fig. 5 shows several types of coffee-pot heating elements. Those at the top are flat (or plate) types, while those at the bottom are cylindrical. The plate type on the left is a sealed unit, and the one on the right is an older resistance-wire type, wound on a mica form. The encased cylindrical types use a similar heating element, but it is wound on a cylindrical form (of mica or ceramic) and mounted in an alumi-

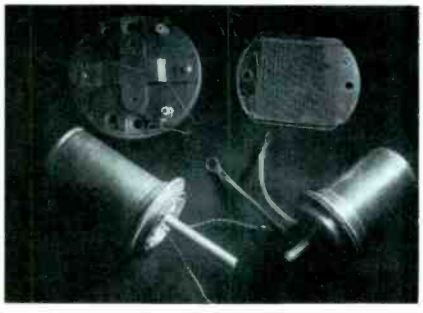


Fig. 5. Different types of heating elements found in coffee pots or urns.

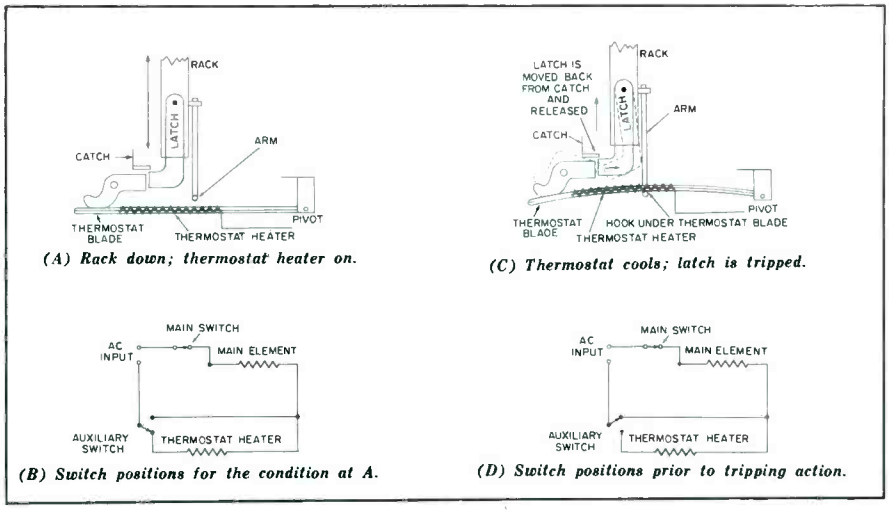


Fig. 6. Operation of electromechanical timing device in one type of toaster.

num cylinder. The element is inserted from the top, and a long bolt holds it in place. Be very careful, when handling this type of element, not to dent or mar the rim—this can cause leaks when the element is installed.

When servicing the nonautomatic type, check the heat fuse that protects the unit against damage if the pot boils dry. Always make sure there are no shorts before replacing this fuse.

Now and then you may be asked to repair a leaky aluminum coffee pot. Aluminum is difficult to solder without special techniques. However, if you use a clean soldering iron and a special flux (available from most appliance-part distributors) you can learn to solder aluminum with comparative ease. The mended spot can then be filed smooth and can be polished until it appears almost like the original finish. (A buffing wheel speeds this job considerably.)

Toasters

Two basic types of controlled heating elements are used in toasters. One is a thermostatic type (Fig. 6) in which the heat of the element eventually causes the thermostat to open, and in turn causes the toast to pop up.

Another type is controlled by a small wind-up mechanism. Pushing down the operating lever winds a small spring and turns on the heating element. When the spring unwinds, the latch is released, the toast pops up, and the heating element is turned off.

The most common toaster faults are the heating element opening or the thermostat (if one is used) becoming inoperative. Very seldom will an AC plug or cord have to be replaced, since toasters are usually left connected.

While a toaster is disassembled for repairs, all bread crumbs and foreign matter should be removed from the unit; if allowed to accumulate, they can cause latches and springs to stick. A few common faults—and their causes—are as follows:

Toast won't pop up or won't stay

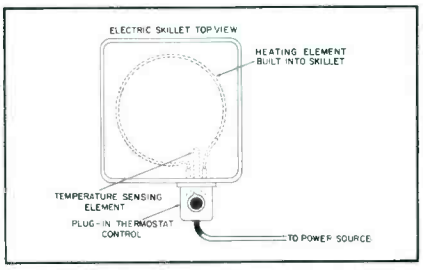


Fig. 7. The heating element and thermostat circuit in an electric skillet.

down. Check and clean all catches, levers, and latches. Check thermostat or timer.

Timing isn't right. Check mechanical action; usually a good cleaning will restore normal operation.

One side doesn't toast properly. Inspect the heating elements; you'll probably find that one doesn't glow, indicating an open element.

Electric Skillet

The electric skillet is a normally shaped skillet with a heating element inside or underneath the bottom. The thermostat and controls are either built into a large plug or mounted in the handle of the unit.

This appliance uses a sealed-unit element, as shown in Fig. 7. When trouble occurs, check the AC cord, the plug, and the thermostat; if they are satisfactory, the heating element must be bad. With the appliance disconnected from the 115-volt source, you can make a continuity test directly across the AC interlock, and proceed step by step through the thermostat to the heating element.

There is good reason for using a sealed unit, even though it makes repairing the element impossible. The skillet must be submersible in water, so it can be thoroughly washed without running the risk of developing shorts.

Therefore, cleaning, checking, and adjusting thermostats and replacing line cords are about the only servicing you can do to these skillets.

Conclusion

Servicing small electrical appliances is not difficult, and the only requirement for the radio-TV serviceman is a little familiarization. A bit of time spent now may help you increase next summer's service business more quickly than you think. ▲

Boosting Sensitivity

(Continued from page 37)

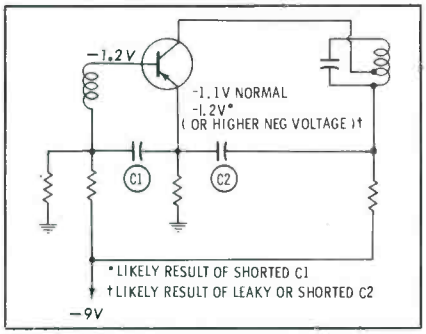


Fig. 4. Altered bias on the transistor is why faulty capacitor reduces gain.

and lower the gain; Fig. 4 shows how this can happen.

Some radios have unbypassed emitter resistors in the audio stages. There can't help but be a loss in audio gain when this circuit arrangement is used. In remote areas, where every little bit of gain is needed, it is often possible to coax some added performance out of a transistor radio by adding a 20- or 30-mfd bypass across each of these unbypassed resistors—as in Fig. 5.

The Diode Detector

When a radio is weak, don't overlook the possibility of a defective diode detector. This diode develops AGC voltage for the IF's and, in some sets, establishes operating voltages for other transistors. Certain diode troubles may affect DC biasing without altering the diode's apparent ability to detect audio signals.

Measuring the front-to-back ratio with an ohmmeter is usually a sufficient test for the diode. This ratio should be at least 5000:1; or in other words, if the forward resistance is 100 ohms, the back resistance should be at least 500K. The forward resistance should never exceed 150 ohms, and the back resistance should never be less than 300K.

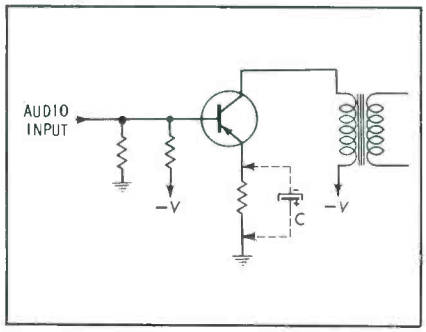


Fig. 5. A bypass capacitor across the emitter resistor will increase gain.

The Speaker

Though it doesn't happen too often, the speaker can also cause low volume. And it is embarrassing to work on a radio for an hour only to find this is the trouble. To get around this situation, you should keep a test speaker always handy, with a plug to fit transistor-radio earphone jacks. Since this jack is across the secondary of the output transformer, and automatically disconnects the internal speaker, you can simply plug in the test speaker for a positive check of the condition of the radio speaker. Use a speaker similar to the one in the set, so you don't create a problem where none exists.

An External Antenna

One of the oldest ways of increasing sensitivity beyond the design value is to add to its antenna. For inexpensive sets, this may be the only satisfactory way.

An external antenna can be connected directly to the antenna input coil through a small capacitor, as shown in Fig. 6. The capacitor is connected to the "hot" side of the antenna coil. If its value is kept small (2 mmf or less) it will not affect the tracking of the radio to a great extent. In fact, a couple of insulated wires about two inches long, twisted together into a gimmick, will often provide enough capacitance.

However, if you want more sensitivity, use a somewhat larger capacitor—perhaps 10 mmf or so. Then be sure to make the tracking tests explained earlier, and do them with the antenna connected. When you do this, the sensitivity of the radio will shoot up considerably; but if the external antenna is removed, you will have less sensitivity than previously (unless you retrack again).

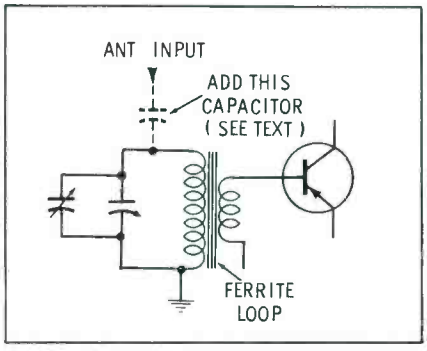


Fig. 6. A simple method of connecting external antenna to transistor radio.

Long wire antennas can be used inside metal buildings or trailer homes to improve reception. For people who use their transistor portables in boats far from their favorite station, a telescoping rod antenna offers considerable improvement—especially since the rod antenna eliminates the directivity of the internal loopstick.

When the radio is going to be kept in one spot inside a metal building (or anywhere else you need more sensitivity), you can staple a metal screen underneath the table or shelf where the radio normally sits and connect the added capacitor (Fig. 6) to the screen. This makes an effective, out-of-sight antenna.

A Final Word

Determining whether a radio really has trouble or merely suffers from poor design is an art that improves with experience. Never pass up an opportunity to check a known *good* radio. Using signal injection and an output-indicating device to check sensitivity, you soon will know what to expect from

various types of receivers. If you will jot down sensitivity information for every radio you service, it won't be long until you'll find you have developed a really accurate judgment of a radio's sensitivity.

Speedy Checker

The Model T-61 Tube Tester, built by PACO, is designed to eliminate wasted time and motion while testing receiving tubes. This unit will check most of the popular 7-pin, 9-pin, and octal tubes used in modern television and radio receivers.

In addition, the T-61 incorporates a special socket to accommodate an adapter for testing television picture tubes. Two CRT adapters —Models AT-1 and AT-2—make it possible to test all black-and-white picture tubes, and are available at extra cost. A special sector of the 4" meter scale is used to indicate CRT condition.

Testing of cathode emission is made simple through the use of prewired sockets and only three controls. One control provides heater voltages from .63 to 50 volts AC, covering the majority of tube types now in use. A second control selects the connections to the tube being tested. The third control calibrates the test circuit for each tube type, so cathode emission can be shown on a "Good-?-Replace" scale.

The fully isolated power transformer is protected by a fuse, located inside the portable case. A potentiometer "ganged" with the on-off switch allows the user to compensate for line-voltage variations. Bent tube pins can be repaired by using the straighteners on the front panel. The unit sells for $49.95 in kit form; the factory-wired version is priced at $69.95. ▲

Tuning HF Transmitters

(Continued from page 33)

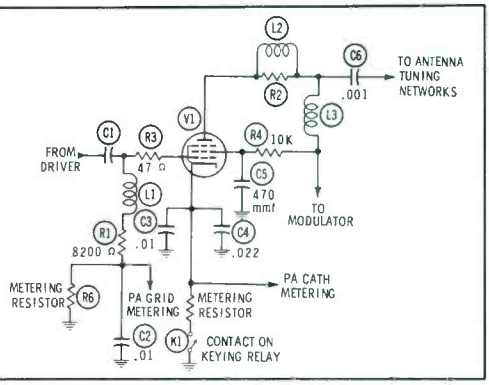
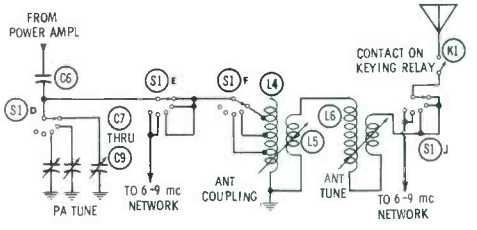


Fig. 3. Tube portion of output stage showing circuit and metering points.

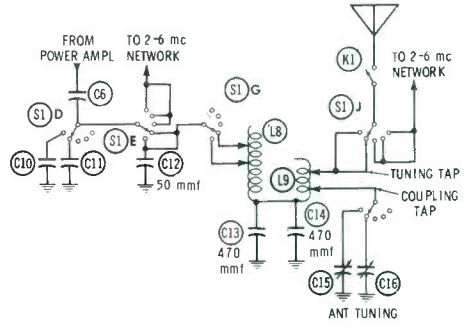
ter has a point of recommended (or critical) coupling, which should not be exceeded; for example, one particular transmitter can be "loaded out" to draw not more than 290 ma of PA cathode current. (If you don't know the value of critical coupling, you can come close by noting the point at which increasing the coupling fails to produce a corresponding increase in cathode current. That point is *beyond* the critical amount, and coupling should be reduced to 10 or 20 ma below that point.) Retune the antenna, and the job is done. Repeat the procedure for each channel below 4 mc.

4 mc to 6 mc

The same circuit—Fig. 4A—is used for frequencies in this range, but a slightly different tuning procedure is followed. It begins as



(A) 2 to 6 mc — current-fed



(B) Above 6 mc — voltage-fed

Fig. 4. RF output coupling networks.

before: The antenna is disconnected during preliminary adjustment of the plate tank—setting the coil taps on L4 and then finding the exact minimum PA current by tuning the corresponding capacitor. The antenna is then reconnected, and antenna coupling and tuning procedures carried out exactly as with the lower frequencies—except for one additional step: After each increase in coupling, the PA tuning capacitor must be "touched up" slightly because of slight detuning effects from antenna loading.

The 4-6 mc tuning procedure, then, is: With the antenna disconnected, "dip" the plate tank. Reconnect the antenna. Increase coupling, tune the antenna, and retune the plate tank. Repeat all steps until the amount of PA cathode current indicates coupling is at the critical value.

6 mc and above

The circuit in Fig. 4B is used to voltage-feed the antenna. Consequently, the tuning procedures are somewhat different. The connections are automatically made when channel switch S1 selects frequencies above 6 mc.

To start the procedure, disconnect the *tuning* and *coupling* taps from coils L8 and L9; this disconnects the antenna and the tuning capacitors, without removing the effects L9 has on the plate tank. Plate-tank tuning is handled as with other channels: capacitor C11 at mid-range; L8 tap set for minimum cathode current; C11 trimmed for exact minimum.

Antenna coupling and tuning begins with placing the tuning tap at the end of L9 farthest from C13 and C14, and connecting the coupling tap three turns away—toward the "cold" end. Then rotate antenna tuning capacitor C16 for maximum PA cathode current, thus resonating the antenna. If the plates of C16 are less than one-quarter meshed, move *both* taps toward the "cold" end of L9, one turn at a time, retuning C16 after each move. Move the taps only far enough to cause maximum PA current to occur when the plates of C16 are approximately one-half meshed.

To adjust coupling, move the coupling tap away from the tuning tap, one turn at a time, again retuning C16 after each increase in coupling. This keeps the antenna at resonance despite changes in the degree of coupling.

Since antenna adjustments can affect plate tuning, it is wise also to retune C11 for minimum PA current after each change in antenna coupling or tuning.

Increase the coupling, retuning the antenna and PA tank after each step, until the point of critical coupling is indicated by the PA cathode current. Then repeat the entire procedure for other channels in the 6-9 mc range.

Conclusion

As with any servicing procedure, adjustments in the RF section of the HF transmitter can be broken down into easily understood steps, greatly simplifying the entire job of troubleshooting. If any adjustment fails to respond, look for a fault which could cause such a failure. If in doubt, it is easy to start over and repeat the tuning steps. With a logical, step-by-step procedure and a reasonable understanding of the various steps, servicing these transmitters is not at all difficult. ▲

Tough Dogs

(Continued from page 31)

sible that an abnormal amount of ripple or hash would find its way onto the boost line and become mixed with the plate signal of the horizontal discharge stage. Checking the boost ripple waveform while turning the brightness control would give us some useful clues. C2C, the only filter common to the boost load circuit, is the first component we'd suspect if interference does appear on the boost line.

Kilroy Was Here

Signs of previous work on a circuit should wave a red flag of warning. If the past repairs weren't done right, or didn't hold up, you can expect complications that can turn a routine repair into a "dog" with rare or misleading trouble symptoms. Former repairs may have nothing to do with the present fault, but the possibility is worth checking.

A "no-raster" complaint in a Motorola TS-531 involved a situation of this kind. The technician found that two feedback resistors in the horizontal AFC circuit (R82 and R83 in Fig. 3) had been replaced. Suspecting additional problems in this area, he changed the capacitors in the related circuitry, as well as the AFC tube. In doing this, he undoubtedly weeded out the shorted part (most likely C78) that damaged the original resistors. But his troubles were far from being over.

He soon discovered that a normal raster would appear only when the horizontal AFC was disconnected from the horizontal multivibrator, or when the incoming sync pulse was grounded out at any point in the sync stages or at the AFC grid or cathode. Voltages throughout the sync and AFC circuits were far from normal. Overtime work on this set at night accidentally disclosed that an extremely dim raster could be just barely made out in a pitch-dark room. So, sweep and high voltage weren't dead, even though they were so weakened that boost was dragged down from 500 to 300 volts.

This fault looks like an open-and-shut case of unbalance in the AFC circuit. The multivibrator can run normally by itself, and the AFC can operate until a sync pulse is fed in; then an erroneous AFC output throws the multivibrator far enough off frequency to virtually disable horizontal sweep.

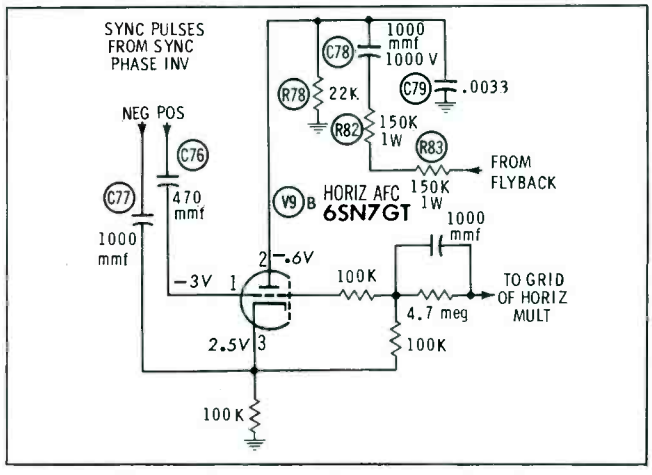


Fig. 3. Raster could be restored only by disabling AFC or removing sync.

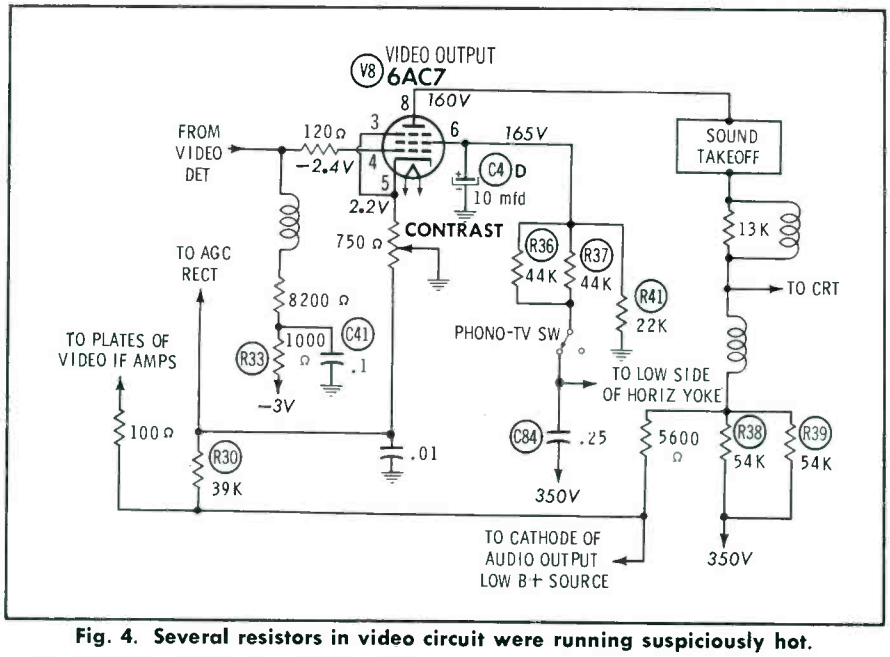


Fig. 4. Several resistors in video circuit were running suspiciously hot.

Something could be wrong with the sync-pulse waveforms fed into the AFC; in fact, the voltage upsets in the sync circuits imply as much. However, these waveforms would have to be considerably distorted, or one of the two horizontal-pulse signals would have to be completely missing, to produce such a violent effect on AFC action. Such a fault should show up plainly in scope checks at the plate and cathode of the sync phase inverter.

The most plausible assumption is that the original trouble may have produced further circuit damage. For instance, R78 may have risen greatly in value without appearing burned, and may be "warping" the feedback signal applied to the plate of V9B. Or one of the 100K resistors may have increased in value.

If the resistors are okay, then the sync stages must be analyzed with a fine-tooth comb to uncover the direct cause of the unusual voltages.

Trouble on the Way?

Quite a few sets still in use are so old that it's hard to tell where "run-down" performance leaves off and real trouble begins. One such receiver, a Hyde Park Model 20CD (vintage 1951 or 1952) was put into reasonably good operating condition by shop repairs; but the technician was worried to note a number of resistors running unusually hot. (Among these were R30, R36, R37, R38, R39, and R40 in Fig. 4.) Voltages in the related circuits were acceptably close to normal, except for a positive 3.5 volts on the grid of V8. The technician, somewhat unfamiliar with the unusual circuit features of this old set, understandably wondered if he was overlooking some borderline trouble that would soon result in a callback.

All of the resistors he named are portions of DC voltage dividers in various circuits, and are expected

to draw some bleeder current; so a moderate amount of heating would be normal. But the power dissipation in these resistors might actually be above normal, due to some fault or faults in the associated circuits. These possible troubles can be analyzed as follows:

The slight positive grid voltage on V8 suggests that the negative 3-volt fixed bias to the grid has somehow been disabled, perhaps by a short in C41 or by an open R33. The net result is less bias on V8, causing both plate and screen current to increase—not disastrously, but enough to cause greater than normal heating of R36, R37, R38, and R39.

There are additional factors that could contribute to excess heat in the resistors. R30, R38, R39, and R40 are part of a "stacked" B+ system, in which a low B+ voltage is developed at the cathode of the audio output tube. This point should be about 150 volts above ground, and the DC grid-cathode bias on the audio tube should be 6 or 7 volts. Erroneous voltages associated with the low B+ circuit could force some of the bleeder resistors to carry too much current.

Notice one other feature: The screen circuit of V8 is connected to the horizontal yoke circuit to obtain a DC operating voltage. Similar to boost in modern sets, this source is a by-product of flyback operation. A number of sweep-circuit troubles, particularly leakage in C84, could increase current through R36 and R37 without necessarily disabling horizontal sweep.

Not one problem, but several, may be the final story of this set. The best the technician can do is to make sure the basic operating conditions are as near as possible to normal, and then assume that continued heating of the resistors does not indicate a serious trouble.

Summary

"Tough" jobs are only as calamitous as the technician permits. A muzzle for these time- and profit-consuming jobs can be built around a sure knowledge of what's normal in a circuit and a habit of carefully observing each and every symptom. Judicious testing, coupled with a bit of "Sherlock Holmes" reasoning, can take the bite out of the most vicious tough dog. ▲

PRODUCT report

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

Speaker Enclosure (41W)

The Model HFS-6, a solid walnut speaker enclosure designed by **EICO,** contains a 10" woofer, an 8" midrange speaker, and a tweeter. It can be either wall-mounted or placed on a narrow shelf. The unit features a frequency range of up to 20,000 cps, an impedance of 8 ohms, and power capabilities up to 25 watts. Cabinet dimensions are 13½" x 23¼" x 5¾", and weight is approximately 25 lbs. The set is available in kit form at $52.50, or in the factory-wired version for $62.50.

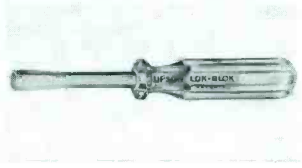
Wire Stripper (42W)

The Model WS-15, a thermal wire stripper for hand-stripping plastic and "Teflon" insulation, is available from **Contact, Inc.** This unit is handy for working in confined areas, because of its small size and light weight — 5" long, ⅝" square, and less than 3 oz. The .040" electrodes are easily changed by backing off the screws. The cork-insulated handles can be squeezed together to accommodate wires as small as AWG #32. The Model M-101-CD has five switch settings for various heat ranges, while the Model M-303-CD has a rheostat control; both units are rated at 100 watts.

Recorder Accessory Kit (43W)

For the tape recording enthusiast, a **Robins Industries** kit contains accessories for easier and better tape editing and splicing. Designated the Model TK-8DLX, the kit includes: splicer for single-, two-, or four-track stereo tapes, splicing tape, a tape threader, tape-holding clips, head cleaner, head and guide lubricant, tape-cleaning cloth, reel holders, reel labels, and a guidebook called "Tape Splicing and Editing." It sells for $15.00 complete.

Nut Drivers (44W)

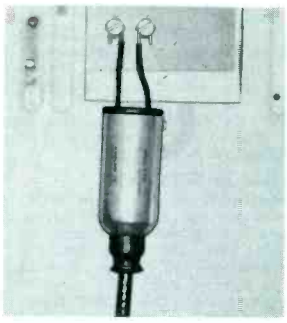


An assortment of nut drivers, available in nine sizes from 3/16" through ⅝", have been introduced by **Upson Brothers.** The hex shape of the hollow, tempered-steel shaft permits using an open-end wrench for extra torque. These tools also feature "sure-grip" handles of "Tenite" butyrate. The nut drivers can be purchased separately; in addition, sizes from 3/16" through ⅜" are available in a kit—part number ND-5—at a list price of $5.30.

Improved Woofer (45W)

A new parabolic cone design improves the bass response of the **Utah** Model G12P woofer. This 12" unit features a frequency response of from 25 to 1500 cps, a 1½" voice-coil diameter, an 8-ohm impedance, and a 30-watt peak output. It weighs less than 8 lbs., and has a list price of $39.15.

Matching Transformer (46W)

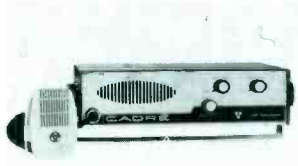


A balun-type 75- to 300-ohm matching transformer for attaching coaxial lead-in cables to TV and FM receivers, the **Winegard** Model T-73, comes in a gold-anodized aluminum housing. The 300-ohm terminal wires are already attached for quicker installation. A vinyl cable clamp is included for securing the cable to the back of the set. This 2″ unit, covering the 50-250 mc band, carries a list price of $3.00.

High-Intensity Lamp (47W)

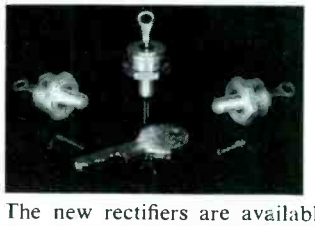
An automotive - type bulb (No. 1133) is used in the "Hi-Mag" series of lamps manufactured by **Swing - O - Lite.** Measuring only 2¼″ in diameter, the miniature head allows the lamp to fit into small spaces for concentrated light. A choice of 3-, 5-, or 7-power magnifiers adapt the unit for close inspection work or for viewing small blueprints and schematics. The device can fit several mounts, has a flexible arm with up to 45″ reach, and can be powered from an automobile by using a cigarette-lighter plug.

CB Transceiver (48W)



The Model 515, a transistorized, five-channel Citizens-band unit, is new from **Cadre.** Using modular construction, this unit includes AC and DC power inputs, variable squelch, and automatic gain control. Its weight is 6 lb., cabinet dimensions are 11½″ x 3¼″ x 5½″, and it has a list price of $187.50. A matching rechargeable battery pack—called the 500-1—adapts the transceiver to a lightweight portable unit. The pack (including a telescoping antenna) costs $29.95, and the 6-volt nickel-cadmium batteries are $10.95 each.

New Silicons (49W)



A new family of stud-base silicon rectifiers has been announced by **Delco.** The series has a basic current rating averaging 15 amps, over a temperature range of −65°C to +150°C. Maximum peak reverse-voltage ratings from 50 to 300 volts DC are available. The new rectifiers are available with either cathode or anode connected to base, and range in price from $1.20 to $2.70.

Plate Caps (50W)

Designed for color-TV applications, plate caps from **Oneida** have a 12″ flexible lead capable of withstanding voltages up to 30 kv. The cap connection is protected by an insulating shield, separated from the contact by a ⅛″ air gap to prevent damage from corona. Units are available for use with either ¼″ or ⅜″ caps, at a dealer net price of 60¢ each.

INDEX TO ADVERTISERS

CATALOG AND LITERATURE SERVICE

February, 1963

ANTENNAS & ACCESSORIES

1W. ANTENNACRAFT—Brochure describing anodized aluminum UHF antennas, Model SA-1483 (channels 14 to 83) and Model SA-7083 (channels 70 to 83), guaranteed for black-and-white or color reception. *See ad page 64.*

2W. B & K/MARK—Catalog HW19-R giving complete information on Mark "Super-Beacon" and "Beacon" base station antennas for Citizens-band operation, and on Mark "Heliwhip" antennas for mobile, marine, and amateur communications.

3W. BLONDER-TONGUE — Brochure explaining how to demonstrate and sell "Caddy-Pak" TV/FM boosters, in the customer's home. *See ad page 23.*

4W. JFD—Brochure on *LPV* log-periodic TV antennas and *Transis-tenna;* also bulletins and catalogs showing entire line of TV-FM indoor and outdoor antennas and accessories.

5W. WINEGARD — New 16-page manual, "How to Plan and Install Master Antenna Systems the Profitable Way." *See ad pages 45, 46.*

AUDIO & HI-FI

6W. ATLAS SOUND, Div. of American Trading & Production Corp.—Catalog No. 562 listing specifications of microphones and loudspeakers for public address, commercial, and industrial use.

7W. EICO—New 32-page catalog of kits and wired equipment: stereo and monophonic hi-fi, test equipment, Citizens-band transceivers, ham gear, and transistor radios. Also "Stereo Hi-Fi Guide" and "Short Course for Novice License." *See ad page 73.*

8W. OAKTRON—8-page catalog listing a variety of speakers, speaker enclosures, wall and ceiling baffles, line transformers, and auto rear-seat speaker kits and accessories. *See ad page 50.*

9W. SONOTONE—SAH-65 brochure listing specifications of microphones, Models CM-40 and CM-41, designed for tape recorders. *See ad page 75.*

10W. SWITCHCRAFT—Catalog 124 describing Model 352 stereo-to-monaural adapter which allows use of stereo headphones or microphones with monaural tape recorders. *See ad page 56.*

11W. UTAH—Sheet describing the "Sorcerer," a compact bookshelf speaker cabinet. *See ad page 78.*

COMMUNICATIONS

12W. CREATIVE PRODUCTS — Booklet "Tips For CB Users" — Find out how to make your own preventive maintenance.

COMPONENTS

13W. BUSSMANN—Bulletin EFA describing two fuse assortments designed to equip the dealer-serviceman with practically all the fuses he needs. *See ad pages 18-19.*

14W. PERMA-POWER—Latest *Britener* selector guide, showing the correct brightener to use with every type of picture tube in general use. *See ad page 68.*

15W. SPRAGUE—Chart C-457 (designed to hang on the wall) showing all popular TV/radio/hi-fi replacement components. *See ad pages 11, 12.*

16W. TRIAD—Catalog TV-62 listing a complete line of replacement transformers for TV, radio, and hi-fi. *See ad page 70.*

SERVICE AIDS

17W. CASTLE—Leaflet describing fast overhaul service on television tuners of all makes and models; also illustrated lists describing universal and original-equipment tuners. *See ad page 41.*

18W. CHEMTRONICS — Single sheet describing Tun-O-Lube cleaner, formulated to clean and lubricate controls and switches.

19W. ELECTRONIC CHEMICAL — Catalog and brochure listing electronic-chemical line, including new formula EC-44 for cleaning and lubricating electrical contacts. *See ad page 74.*

20W. PRECISION TUNER—Information on repair and alignment service for any TV tuner. *See ad page 82.*

SPECIAL EQUIPMENT & SERVICES

21W. ACME—Illustrated catalog sheet 24B01 listing specifications and applications for control-type magnetic amplifiers, including units with capacities from 5-1000 watts and voltage ranges from 24 to 160 volts. *See ad page 64.*

22W. ATR—Literature on 1963 series Karadios, including both transistor-powered an dtube types. All sets available as "universal" or "customized." *See ad page 14.*

23W. GREYHOUND—Brochure giving complete information on Greyhound Package Express, including rates and routes.

24W. PRECISION EQUIPMENT CO.—Literature describing a ready-to-use Wireless Intercom, by Bennett.

25W. VOLKSWAGEN — 60-page illustrated booklet "The Owner's Viewpoint" describing how various business enterprises use VW trucks in their operations; also booklet with complete specifications on VW truck line.

TECHNICAL PUBLICATIONS

26W. CLEVELAND INSTITUTE OF ELECTRONICS — "Pocket Electronics Data Guides" of conversion factors, formulas, tables, and color codes. Also, folder "Choose Your Career In Electronics" describing home-study electronics training programs including FCC license preparation. *See ad page 83.*

27W. HOWARD W. SAMS — Literature describing all current publications on radio, TV, communications. audio/hi-fi, and industrial electronics, including new Fall-Winter 1962 Book Catalog and descriptive flyer on 1962 *Test Equipment Annual. See ad pages 67, 78.*

TEST EQUIPMENT

28W. ANTRONIC—General catalog describing the Anchor Model T-475 *Reacto-Tester,* which repairs, analyzes, and tests every type of picture tube.

29W. B & K — Catalog AP20-R, giving data and information on Model 850 *Color Analyst,* Model 960 *Transistor Radio Analyst,* Model 1076 *Television Analyst, Dynamatic* 375 VTVM, *V-O-Matic* 360, new Model 625 3-in-1 *Dyna-Tester,* Models 600 and 700 *Dyna-Quik* tube testers, Model 420 and 440 CRT Tester-Reactivators, and Model 1070 *Dyna-Sweep* Circuit Analyzer. *See ad pages 51, 53, 54, 55.*

30W. HICKOK — Information about specifications of the new Model 677 Wide Band Oscilloscope; also "Scope Facts." *See ad page 71.*

31W. PACO—24-page catalog giving comprehensive descriptions of all available test equipment and stereo kits.

32W. SECO—Complete information on three new power supplies, each having a 0-30 volt range. All feature transistor-regulated voltage. *See ad page 65.*

33W. SENCORE—Complete literature on the CA122 *Color Circuit Analyzer* and the PS120 Wide-Band Scope. *See ad pages 20-21, 77.*

TOOLS

34W. BERNS—Data on 3-in-1 picture tube repair tools, 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 74.*

35W. ENTERPRISE DEVELOPMENT — Literature from Endeco on improved desoldering and resoldering techniques for use on PC boards. *See ad page 74.*

36W. EVERSOLE — Sheets describing and listing prices of DeSod desoldering tools for removing and replacing parts on printed-circuit-boards, including new tip for compactron sockets.

37W. UPSON—Sheet ND652 listing various assorted Hold-E-Zee nutdrivers. Available in sizes from 3/16" to 1/2".

38W. XCELITE—Brochure N163 describing 2 double-duty tool sets PS-7 and PS-12, having pocket-size nutdrivers and screwdrivers with "piggyback" handles in a see-through plastic case. *See ad page 52.*

TUBES & TRANSISTORS

39W. AMPEREX — 16-page semiconductor catalog describing Amperex Post Alloy Diffusion Process (PADT) of manufacturing transistors; also basic specifications on full line of semiconductors.

MODEL 648

Tube Type	Fil.	D	E	Plate Test
6AG11◆	6.3	AC6	A59	28YZ
		Nor—S switch in S position		
		AC3	A49	28YZ
		C8	7	57X
		C1	2	57X
6AV11◆	6.3	C3	AC67	65Z
		C4	AC59	65Z
		C2	A19	65Z
		Nor—S switch in S position		
6BF8	6.3	128	6	59X
		"	7	59X
		"	9	59X
		"	3	59X
		"	5	59X
		"	4	59X
6J11◆	6.3	AB79	C568*	45VX
		Nor—S switch in S position		
		AB39	C124*	45VX
17JZ8◆	17.	AC6	A348	25Z
		C9	A17	24YZ
		Nor—S switch in S position		

MODEL 658

Tube Type	Sec.	Heater	Circuit H-K	Circuit P-G	Plate	Grid Test	Heater Current
6AG11◆	T	6.4K	C6	o50	30R	10WY-	
	T	"	C3	o49	"	10WY-	
	D	"	C8	7	55U	X	
	D	"	C1	2	"	X	
6AV11◆	T	6.4K	C3	ec67	20Q	60WY-	
	T	"	C4	ec59	"	60WY-	
	T	"	C2	a18	"	60WY-	
6BF8	D	6.4K	128	6	15U	V	
	D	"	"	7	"	V	
	D	"	"	9	"	V	
	D	"	"	3	"	V	
	D	"	"	5	"	V	
	D	"	"	4	"	V	
6J11◆	P	6.4J	B70	C568	60S	5WY-	
	P	"	B34	C129	"	5WY-	
17JZ8◆	P	18.6K	C6	o340	34R	70VY-	
	T	"	C8	o17	24R	20XY-	A22.J Z450

MODEL 598

Tube Type	A.	B.	C.	Fil. Cont.	D.	E.	F.	G.
6BF8	6.3	4	—	5	9	Z	—	54
		4	—	—	8	Z	—	54
		4	—	—	7	Z	—	54
		4	—	—	3	Z	—	54
		4	—	—	2	Z	—	54
		4	—	—	1	Z	—	54

WHERE SILVERAMA® GETS A NEW FACE

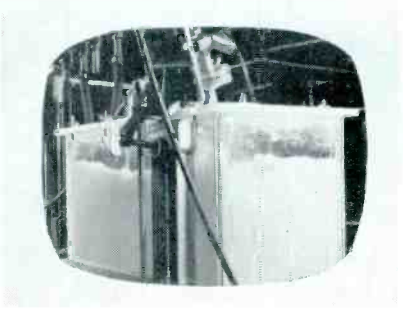
Complete rescreening means sharp, clear TV pictures from each RCA Silverama

These RCA Silverama picture tube bulbs are getting a new phosphor screen—the "face" they will one day show to your customers.

As they inch their way along this vibration-free settling belt in our Marion, Indiana picture-tube plant, a suspension of phosphor particles settles slowly from a chemical solution in each bulb, depositing a smooth new screen over the faceplate.

This is one of the final steps in the rescreening process. Prior to re-use each glass envelope has been rigorously inspected. Its exterior has been buffed and polished to mirror-smoothness. Then in a series of acid baths and water rinses, the interior has been scoured of its former coatings and delicately etched to restore it to the peak of its optical capability. Only when chemically clean inside and out is it ready for its new screen.

These exacting techniques—and the precision engineering behind them—provide every RCA Silverama picture tube with the best picture-making capabilities modern technology can produce. They are your assurance that you install the finest when you install Silverama.



Phosphor blending tanks. Here the proper blend of screen phosphor particles is mixed with a solution of ultra-pure demineralized water and settling chemicals. Mechanical blenders, providing a uniform suspension, help assure the perfectly even screen that characterizes Silverama.

Final screen quality and focus check. Here on an automatic test unit, a trained inspector examines a test pattern on a finished picture tube to determine screen quality and picture focus. This is but one of 26 different tests each Silverama must pass at this test unit before it is okayed for sale and distribution. Tubes failing a single test are automatically rejected.

RCA ELECTRON TUBE DIVISION, HARRISON, N. J.

RCA®

The Most Trusted Name in Television

Wall-mount fuse rack—
The Fusemaster—Part
#094047. 60 individual
compartments for 300 fuses.
Comes pre-packaged with
100 popular assorted fuses.

Complete self-service
instant inventory control ups
your counter sales by 155%.
Fuse Rack #890-73 plus
76 channels.

Fuse channels for flexible
inventory control and self
service for distributors
and dealers

An all inclusive LC fuse
caddy, #094041
new LC fuse types N & C
for 98% service calls

every step forward— is a step up...

Fuse Caddy for serviceman's
tube caddy—75 fuses plus
3 spare compartments—instant
stock control—nothing like it
before—order by #094037

All purpose fuse kit—56 odd
types—#094034—to add
completeness to line at a
minimum of space and cost
with maximum of service

Illustrated price sheets
One picture is worth
10,000 words

PROGRESSIVE MERCHANDISING FOR PROGRESSIVE PROFIT!

One call kit 45 fuses,
6 snap-on holders—#094029
One service call is all

Double drum dispenser—
Silent Salesmen
Double service to dealers
Double profit to distributors

Single drum dispenser
24-hour-salesman
Finger tip service for
distributor customers

LITTELFUSE

Des Plaines, Illinois