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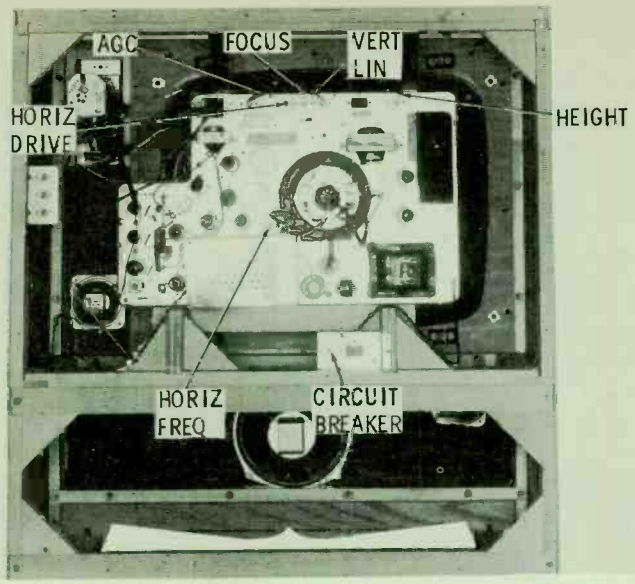
Hoffman



Hoffman Model B3683 Chassis 350

A 23" picture tube with bonded safety glass, and operational controls clustered in the upper right-hand corner, are the outstanding features of this chassis line. The tone control also serves to switch the TV audio to an external amplifier jack, at the same time, connecting a phono input jack to the audio system of the TV. Turning the control clockwise automatically switches to TV operation.

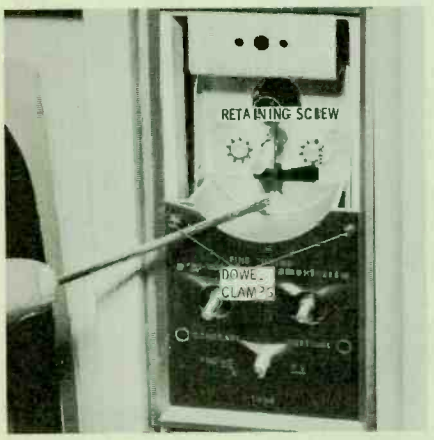
The chassis is an 18-tube (no semiconductors), transformer-powered unit with conventional wiring. The tuner provides VHF reception only, although a special conversion kit is available for adaptation to UHF. One version of the tuner uses the newer frame-grid type RF amplifier, a 6ER5. Some of the less common tube types used are a 6BJ8, 6BN8, EL84/6BQ5, and 6DA4/6DE4. Overload protection is provided by a circuit breaker connected in series with the AC line. All setup controls are clearly labeled, which is always helpful to servicemen.

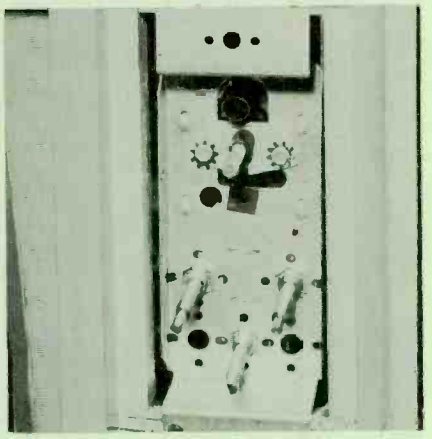
Disassembly is not difficult. The most complicated part of the job is removal of the tuner and control panel. The top part of the knob escutcheon is held to the bottom by two plastic dowel pins and two hooked plastic feet. Pull the channel-selector knob off, hook the tips of your fingers under the bottom edge of the escutcheon, and carefully pull outward to disengage the two dowel pins. One retaining screw holds the bottom part of the escutcheon.

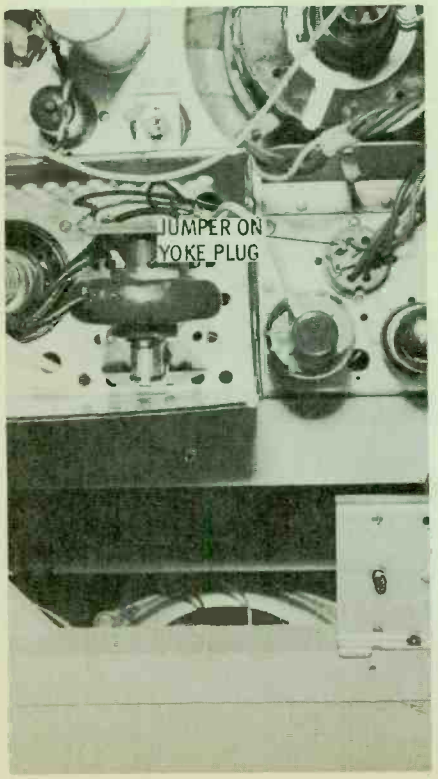
After the escutcheon has been taken off, the four screws holding the tuner and control bracket can be removed. Tilting the panel at an angle will permit it to be slipped through the cabinet.

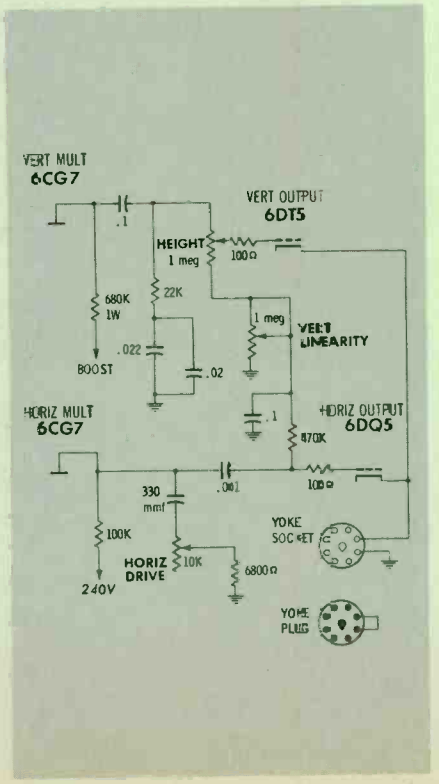
The deflection circuits in the entire 1960 line of Hoffman receivers are a little unusual. For one thing, the jumper on the yoke plug serves to complete a path to ground for the cathodes of both the vertical and horizontal output tubes.

Furthermore, as shown in the partial schematic, the horizontal drive control is in the wave-shaping network of the horizontal discharge tube. Adjustment of this control varies the amplitude and shape of the drive signal applied to the horizontal output stage. Also, the grid circuits of both the horizontal and vertical output stages share the same grid-leak bias resistor (the vertical linearity control). It follows then, that any change in the setting of the horizontal drive control will necessitate a change in the setting of the vertical linearity control.









Magnavox Model 1MV188L Chassis V-29-12-11

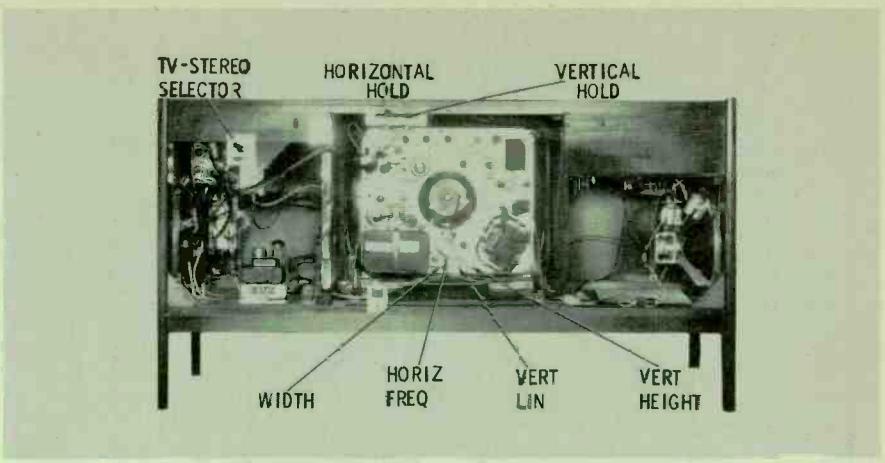
Here's a set that provides a whole wall of home entertainment. It contains a 19-tube, VHF chassis with a 21", 90° picture tube, AM-FM tuner, four-speed phono, and stereo amplifier. Sliding doors on both the top and front enclose the tuner, phono, and picture tube. The front doors seemingly block off the speakers when opened for TV operation, but the impression is false because the speakers are actually on the sides.

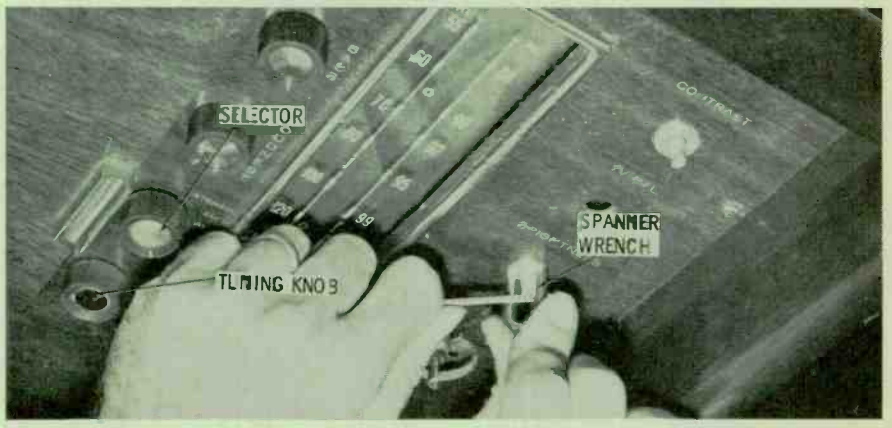
Viewing the back of the set, you can see the "strung-out" positioning of the various chassis. The subchassis for the tuner and control panel and the AM-FM tuner are located in the upper left-hand corner of the cabinet. Directly beneath the radio tuner, you'll see the stereo amplifier chassis. The horizontal and vertical hold controls are mounted on an "L"-shaped bracket, and are adjusted by means of thumbwheel knobs protruding through the back. A TV-stereo switch mounts on a special rear-mounted bracket.

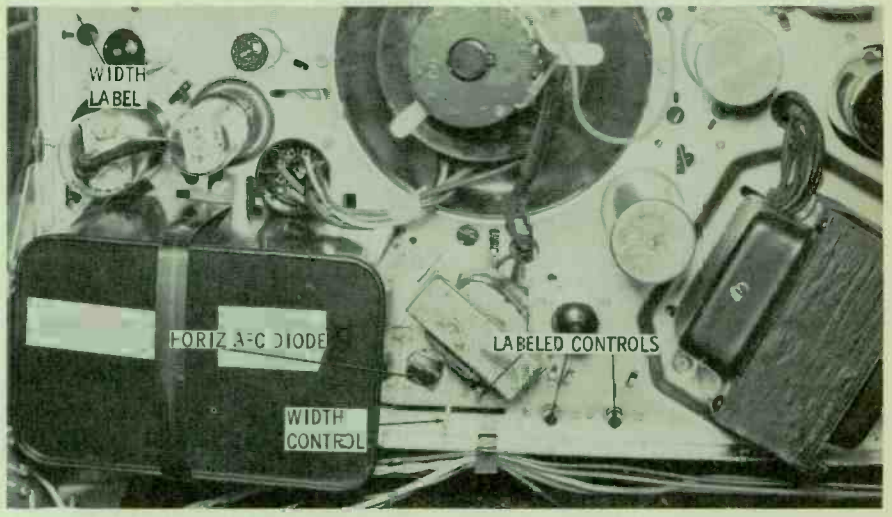
A special spanner wrench is required to remove the control-panel subchassis, which is held to the top of the cabinet by two special nuts that screw through the cabinet and fasten to the bushings for the contrast and brightness controls. Use of the TV-balance control and the TV-radio position of the selector switch, located in the control compartment, make it possible to receive stereo sound telecasts, using AM or FM for half of the stereo signal.

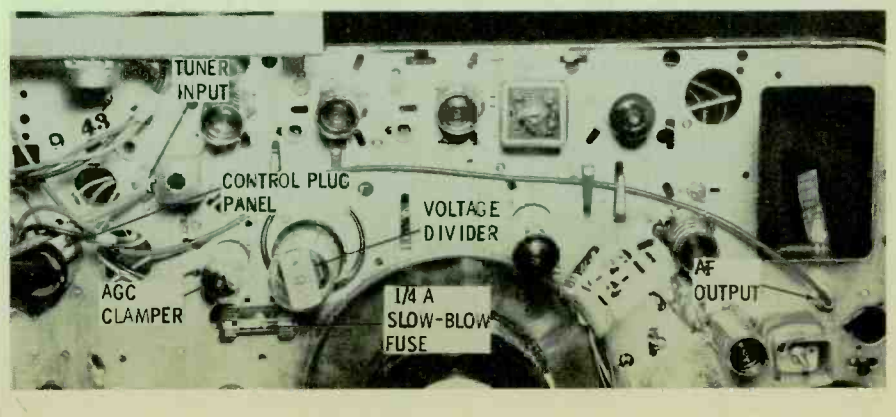
While the chassis is transformer-powered and conventionally-wired, it is split functionally. The lower part contains the power supply and deflection circuits, which are protected by a ¼-amp, slow-blow fuse. A length of #24 wire protects the 6.3-volt filament circuit. Don't be fooled by the empty hole next to the label for the width control. This chassis does have a width control, but it is of the sliding lever type, and is located just to the right of the cage with the other controls.

The top half of the chassis contains the remaining TV circuits, with the exception of those for RF and audio. This may fool you if you aren't careful, since the tubes for the audio circuits *are* there. As far as this chassis is concerned, however, they serve only as an AGC clamper and a voltage divider. The long, green lead running across the chassis is from the output of the audio-detector, while the plug in the upper left-hand corner is the audio input from the radio tuner.

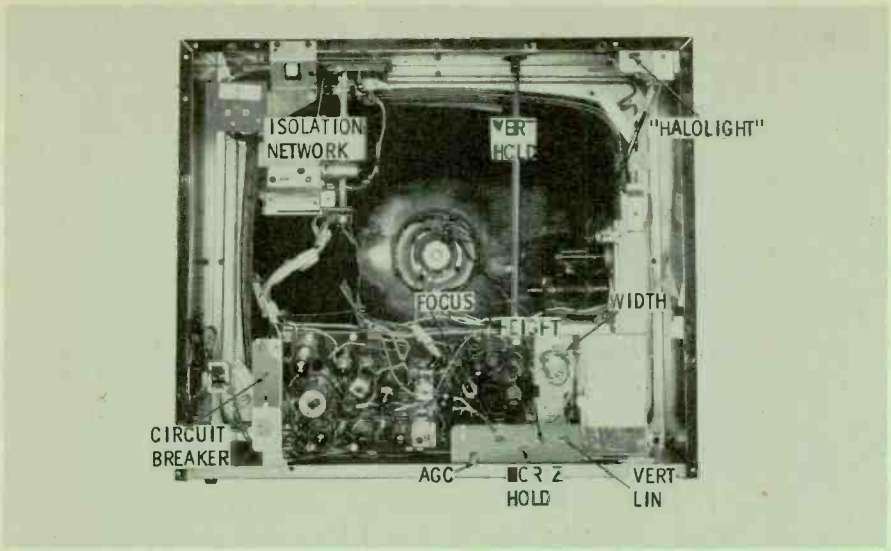


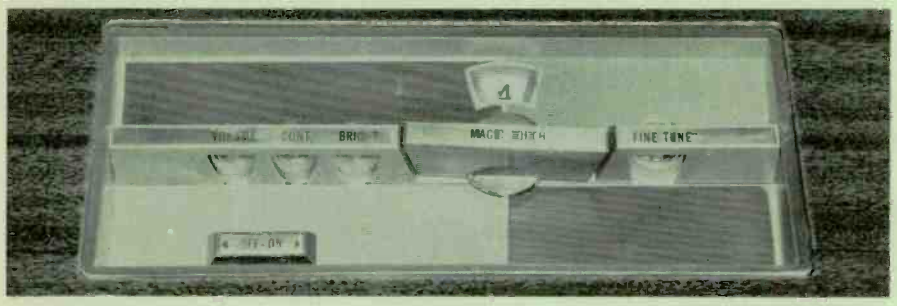


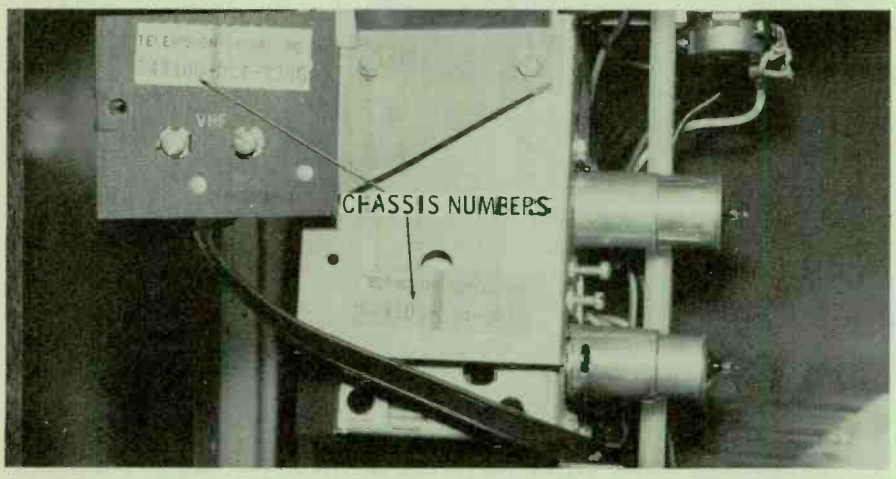


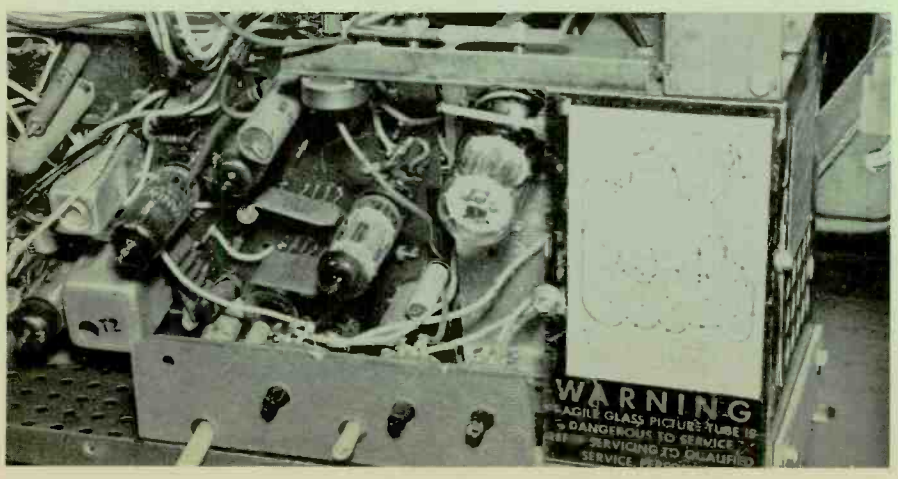


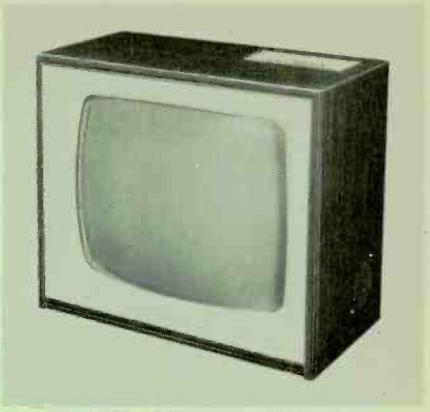
Sylvania











Sylvania Model 23T14M Chassis 1-544-1

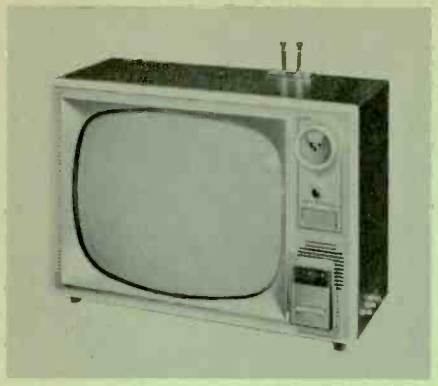
This 23" table model with simulated wood finish emphasizes the "full picture" concept by utilizing the entire front of the cabinet for the picture tube and the *Halolight* feature. Since a laminated plastic safety glass is bonded directly to the face of the tube, there is no cleaning problem.

The isolation network between the "hot" chassis and cabinet is in a handy location where it can readily be checked for defects. With the switch turned on and the power disconnected, you should get a reading of from 470K ohms to 3 megohms between the AC plug and chassis. Mounted on the left support for the printed board are the germanium rectifier, audio output transformer, and circuit breaker. Some versions use two 500-ma silicon rectifiers in place of the germanium unit; be sure to use the original type when making replacements. Vertically-mounted on the right is the conventionally-wired portion of the chassis, which is comprised of the vertical (with a 10EG7 tube) and horizontal deflection circuits. All remaining circuits are located on the printed board, which sets at a slight angle along the back edge of the cabinet. Chassis coded "run 01" and higher have no focus control; instead, there is a focus terminal strip (located below the 10EG7 tube) providing boost, B+, and ground potentials.

Customer controls are top-mounted and recessed. The off-on switch is of the slide type, and the *magic touch* bar-type knob actuates a ratchet to change 1, 2, or 3 channels at a time—depending on how far it's rotated. While we're talking about this knob, it's secured with an Allen screw, which must be loosened before it will come off. The tuner must be removed to make RF oscillator adjustments.

The chassis number is part of the serial number, and is decoded as follows: The preliminary "1–" is taken for granted; the first three digits define the basic chassis (544 in this case); the next digit shows the run number (1 in this case); and the following 2 digits designate the coding of the run (00 for this chassis).

Although the printed board contains no component identification markings, or any other circuit-tracing aid, it does have a feature you'll like; component leads are long enough to permit the connection of test instruments. You'll also like the series string hookup/tube-location guide on the rear of the cage.



Zenith Model 2010C
Chassis 16D25Q

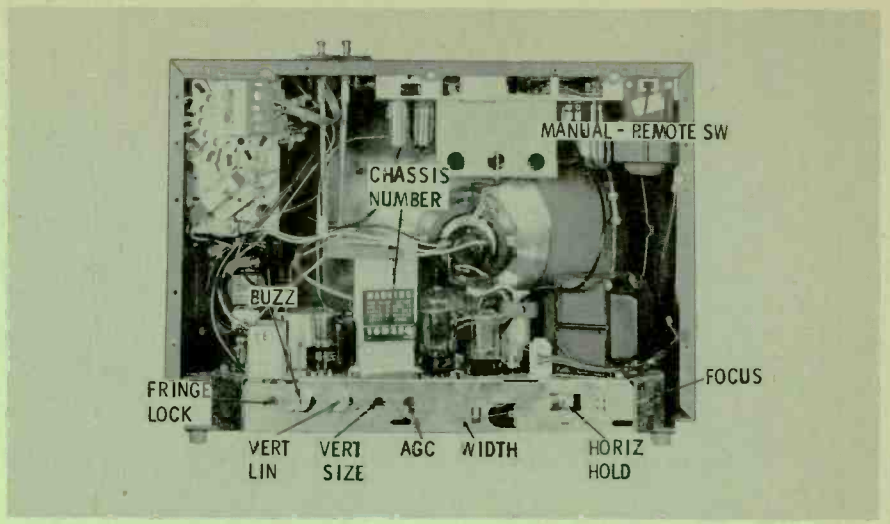
This 17" table model is one of six using the same basic chassis, marking Zenith's entry into the use of 110° deflection systems. The set is equipped with the *Space Command* 300 remote-control system, which utilizes supersonic sound to turn the set on and off, select one of three volume ranges, and select channels.

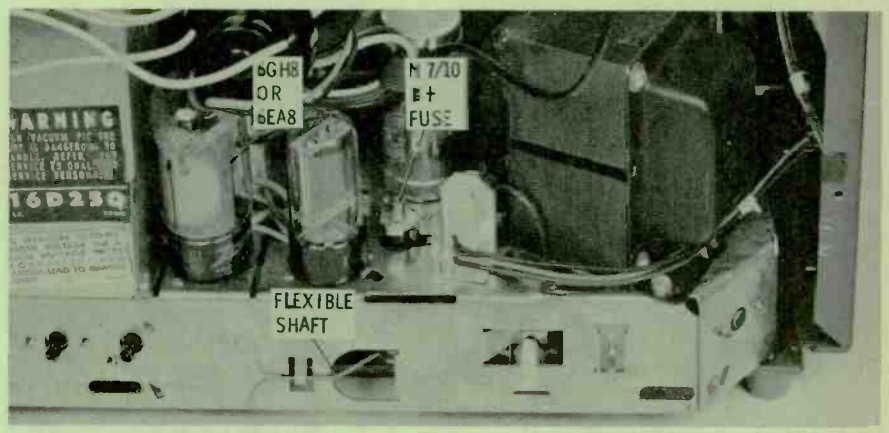
The weight, for such a small set, is amazing — greater per cubic inch than anything we've seen recently. When the back is removed, the reason is quite obvious; two chassis, each with husky power transformers, plus the tuner with its power-tuning unit, are used. The conventionally-wired chassis utilizes dip-soldered terminals, and all setup controls are well marked and easily accessible on the rear apron.

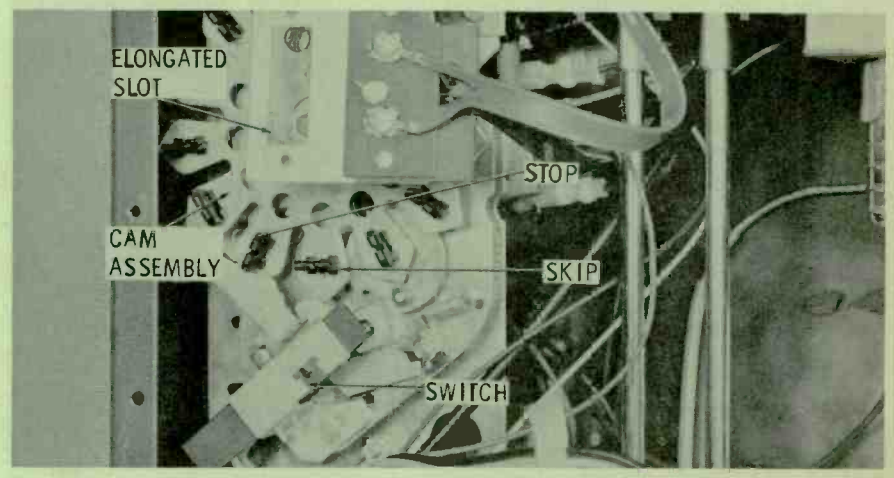
A 7/10-amp, type N, slow-blow fuse is used in the B+ supply. There is also a 1½" length of #24 wire connected in series with the green lead of the power transformer to provide filament-circuit protection. The newest tube type in this receiver is the 6GH8 horizontal oscillator, the equivalent to a 6EA8, which may be used in some versions of this chassis. Observe caution when servicing the horizontal circuits; there are two different designs used, and while not radically different, there are several differences in values and connections. The flexible, spring-type shaft for the width control looks as though it might be difficult to adjust. We were pleasantly surprised to find it offers no problem at all.

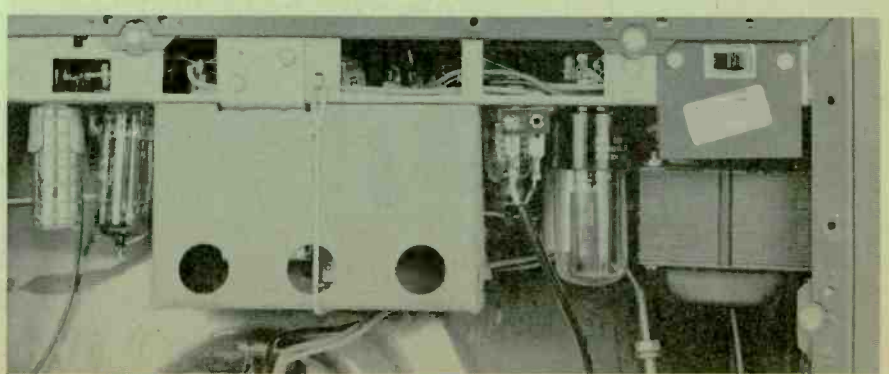
The programming setup for the power-tuning unit is quite simple. Rotating the spring clip for any particular channel counterclockwise permits the motor-energizing switch to remain closed, and the channel to be skipped. In the clockwise position, the clip actuates a cam which opens the switch and stops the tuning cycle. Stop positioning can be varied by loosening the three metal screws in the elongated slots, and rotating the entire cam assembly.

The remote-control chassis (S-47043), located in the upper right-hand corner of the cabinet, contains the manual-remote switch. Overload protection is provided by a ¾-amp, slow-blow type fuse connected in series with the AC supply and located directly below the switch. Curiosity got the best of us, and we removed the cardboard "house" at the center of this chassis. All it conceals are two relays; so unless you are nosey, too, you'll probably never have to remove it.









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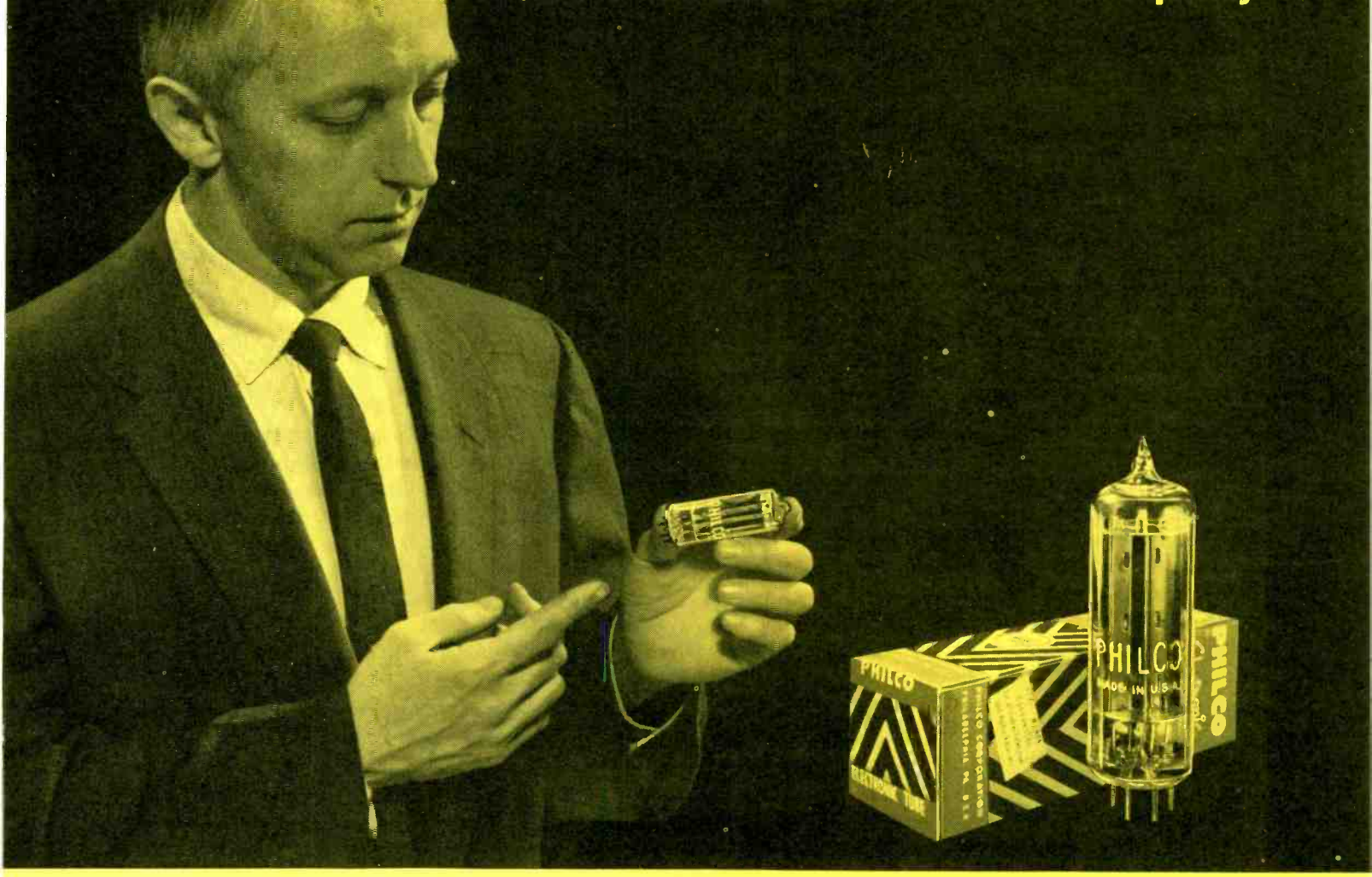

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ABOUT THE COVER

Those of you who found last August's cover funny will probably go into hysterics this month. Most of you, we hope, will be more inclined to have feelings of pathos along with your smiles. After all, with the coming of the spring rains, you could easily find yourself in this situation, and bulldozers don't come along every five minutes!

Letters to the EDITOR

Dear Editor:

I have been a subscriber for the last couple of months and already like your magazine very much.

How do you handle technical inquiries to the *Troubleshooter* column? Do you answer questions only in print, or do you also reply personally?

PAT N. KELLDORF

Taylor, Texas

Welcome aboard! You'll be glad to learn that the Troubleshooter sends a personal reply to each technical query. This service is without charge. The most interesting and widely applicable questions are chosen to appear in print.

As you can imagine, we get a substantial volume of requests for help. Therefore, although we try our best, we can't promise to come up with a solution for a problem while you keep a set waiting on the bench. Our ability to help is also limited to drawing conclusions from the facts you give us. If we could make further tests ourselves, we could pinpoint the trouble to the extent of saying, "Change Part X." Since this is seldom practical, our normal way of handling the situation is to suggest a troubleshooting procedure which we think will lead you to the source of the trouble.—Ed.

Dear Editor:

To the practical, everyday service technician, Milton S. Kiver (bless him) is the best, without a doubt.

WILLARD B. THOMAS

Jamestown, N. Y.

Dear Editor:

I'm enthusiastic over the articles in recent issues of PF REPORTER. They are more thorough and don't take readers' prior information for granted. One particularly good article is "Scoping Video and Vertical Troubles" by Milton S. Kiver in the January issue.

A little more detailed information on waveforms, such as exact directions for hooking up test equipment to obtain them, would be a welcome sight.

ALBERT LESK

Los Angeles, Calif.

If you liked the January "Shop Talk" column, you'll be delighted with this month's installment — which tells you how to isolate troubles in the horizontal sweep section.—Ed.

Dear Editor:

Seldom do I write to express my opinions of magazine articles, even though almost everything in your editorial columns receives my attention. However, an item in your January issue merits a word.

Your "Statement of Advertising Policy (page 12) is to be commended both in purpose and in text.

KENNETH G. BUSH

Ken Bush Radio & TV
"Service With a Conscience"
Buffalo, N. Y.

So is your motto!—Ed.

Dear Editor:

The enclosed order to extend my subscription takes the place of a thousand words to let you know how pleased I am with PF REPORTER. I'm sure your back issues are just as interesting; how far back are these available, and how can I get them?

IGNACE DITCHKUS

Essex, Md.

We have some copies of most issues published since February, 1956. Those not available are: October, 1956; February, March, August, November and December, 1957; January through April, 1958; and June, 1958. All others are available at 50c per copy, postpaid.

We've advised Mr. Ditchkus about issues prior to 1956, some of which are still in stock. Information about their availability will gladly be furnished to other readers on request.—Ed.

Dear Editor:

A word of caution in regard to the foam-rubber service-bench pad suggested on page 54 of the January PF REPORTER: Some types of foam rubber present a possible internal-combustion hazard after exposure to heat. This danger is such that even the 150° heat of a laundry dryer is sufficient to start the deterioration of foam rubber.

This material should work quite well for the purposes you have shown, as long as hot soldering irons, heat lamps, hot tubes, etc., are kept away from it.

CARL FISHER

Fisher Radio and TV
Carbondale, Kansas

Thanks for pointing out the possible danger in using a material which may be combustible. Luckily, its main use around the shop (protecting picture tubes and cabinets from scratches) doesn't involve heat. It would be a good idea to keep foam-rubber pads out of the working area when not in use, not only to keep them away from sources of heat, but also to keep them cleaner.—Ed.

Dear Editor:

We have been featuring our automatic "punch-card" tube tester in our advertisements to the public, stressing its accuracy and dependability. By offering free, automatic tube testing, we feel that we have taken a step toward eliminating the "Do-It-Yourself" tube tester and putting the tube business back in the hands of TV-radio service dealers, where it rightfully belongs.

JOHN L. PEER

Peer Appliance Co.
Orchard Lake, Mich.

The thousands who have bought unneeded tubes should be impressed by

• *Please turn to page 22*

YOU'RE AS SUCCESSFUL GENERAL ELECTRIC'S

AS YOU WANT TO BE WITH NEW PSM* METHOD!

*PROFITABLE SERVICE MANAGEMENT

Earn the good things of life for yourself and your family by following the Profit signposts on every page of General Electric's PSM* Method! The engraved Certificate which says you have completed this instruction program, will mean new success for you as a TV technician.

Says Dr. John K. Pfahl of Ohio State University, under whose direction the new General Electric program was prepared: "The electronic service dealer must be, at the same time, a technician, good businessman, and sales manager." You learn step-by-step how to realize these aims, by following General Electric's Profitable Service Management Method. You are shown how to *assure* a satisfactory profit margin, not merely hope for it—how to increase business by methods others have found unfailingly effective.

In the LP record "Sounds of Success" you will hear from the lips of experienced TV technicians just how they have built greater incomes. After completing the two volumes of instruction that make up the study course, a questionnaire is available to check your acquired knowledge, prior to receiving your Certificate.

All come handsomely packaged for your bookshelf. Check the highlights of General Electric's PSM* Method given below! Then see your G-E tube distributor! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.*

HERE ARE SOME OF THE MANY SUBJECTS YOU WILL STUDY:

BOOK NO. 1. "SOUND BUSINESS PRACTICES"

BUSINESS FOR PROFIT: Your reasons for owning a business...How much money should you make?...How to make your business profitable.

PLANNING YOUR BUSINESS: Planning expansion...Cash planning...Shop planning.

ORGANIZING YOUR BUSINESS: Overhead costs...Pricing...What it costs you to make a service call...What it costs you to make a shop repair...Inventory control...Credit organization...Choosing a form of organization.

CONTROLLING YOUR BUSINESS: Why use records?...What records are needed...Taxation...Use an accountant.

BOOK NO. 2. "SELLING ELECTRONIC SERVICE"

ARE YOU ATTRACTING NEW CUSTOMERS?: Attracting new business...Businesslike appearance...Effective selling...Good identification...Basic market research.

PROMOTING YOUR BUSINESS: Advertising technique...Advertising campaign planning...Special offers...Seasonal planning...Customer contact.

KEEPING YOUR CUSTOMERS SATISFIED: Customer relations...Customer grievances...Guaranteeing repairs...Building new customers.

Progress Is Our Most Important Product

GENERAL ELECTRIC

311-401

ELECTRONIC TECHNICIANS . . .

Add a quick source of extra profits with free training in servicing the

GUIDE-MATIC

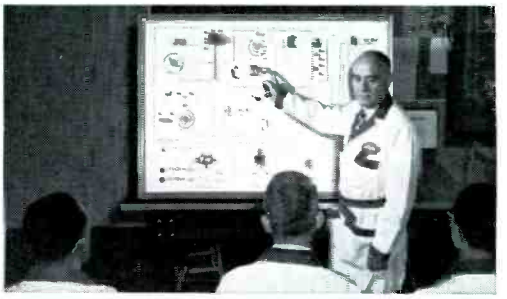
POWER HEADLIGHT CONTROL

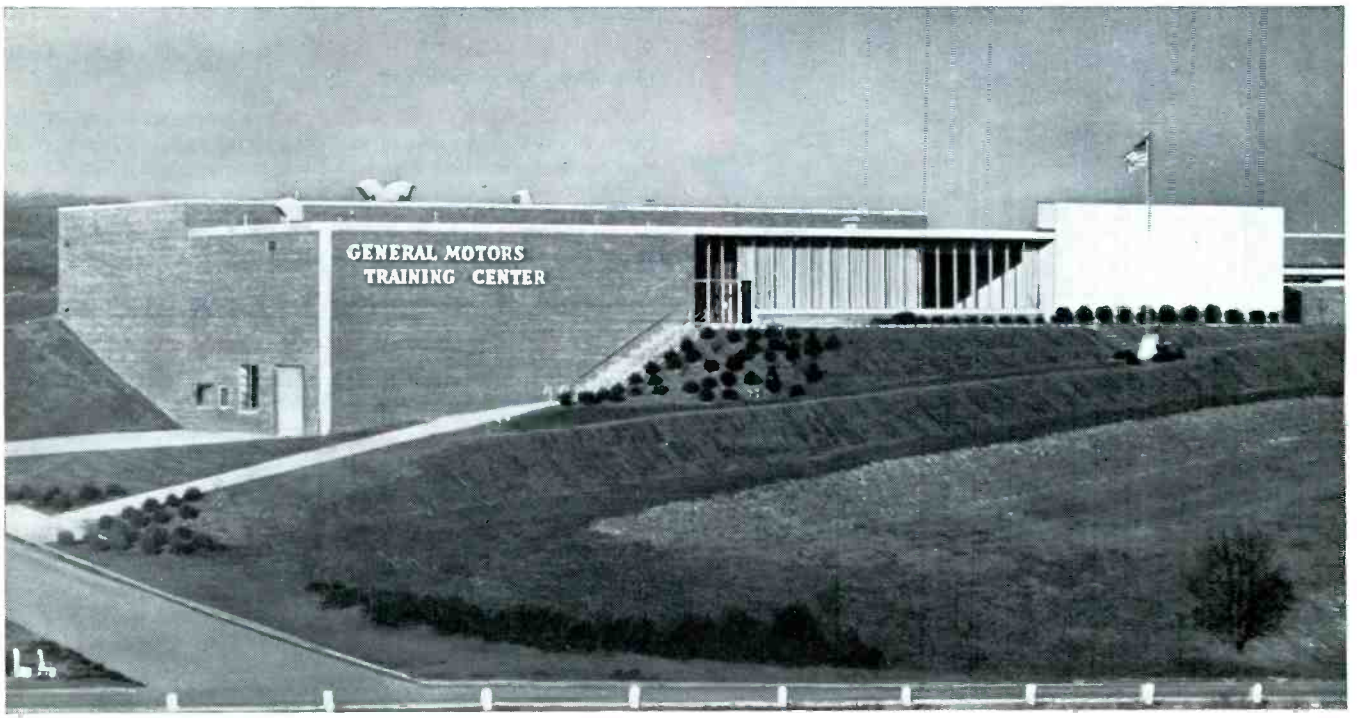
Simple when you know how it works, Guide-Matic could be your fastest growing source of new business for years to come. And it only takes one day of factory-style training to learn the skills of fast, accurate trouble-shooting and quick service to factory specifications.

The course itself won't cost you a cent . . . it's free to qualified electronic technicians. Your only outlay is for transportation and the usual living expenses. It's worth it to have a Guide Lamp diploma proving that you're fully equipped to give fast, efficient service to all the Guide-Matic and Autronic-Eye owners in your area. Twilight Sentinel automatic light switch training is also included. If you are in the electronics service business, come yourself, or send your technicians. There is one of 30 GM Training Centers near you.

Do a reliable service job with an approved tester. It is required for fast testing and accurate on-the-car adjustment. For information on testers or training schedules, ask your UMS Distributor or write Guide Lamp Division, General Motors Corp., Anderson, Ind.

Jumbo-size operational panel of Guide-Matic circuit puts all parts out front for better, more efficient instruction.





GUIDE LAMP DIVISION

GENERAL MOTORS CORP.
ANDERSON, INDIANA

Here is the new Standard Coil Tuner Replacement and Repair Program that enables you to offer better service to your customers at greater profit. Now Standard Coil Products provides the tools that will enable you to cash in on the profitable tuner repair and replacement market.

TUNER REPLACEMENT LISTING IN SAMS PHOTOFACT

Starting in January, Standard Coil tuner replacement listings will appear in all Sams TV Photofact. Tuner replacement information will be right at your finger tips. Standard Coil is the *only* manufacturer ever to provide this service.

NEW TV TUNER REPLACEMENT GUIDE

Lists original equipment TV tuners with the Standard Coil equivalent replacement for each. Also includes major mechanical replacement parts for all Standard Coil Tuners —those used in original equipment as well as the universal replacement. Eliminates all guesswork—minimizes your tuner repair and replacement problems.

48 HOUR FACTORY GUARANTEED REPAIR SERVICE

Standard Coil's special service department set-up assures factory guaranteed repairs—*on a 48 hour in-plant cycle!* All repaired tuners carry a *six month warranty* on defective workmanship and parts failure (excluding tubes). Gives you more time for additional service calls—promptly returns your customer's set to like new operating condition.

DEFECTIVE TUNER TRADE-IN ALLOWANCE

Tuners which can *not* be repaired can be traded in against a new replacement tuner which carries a full *twelve month factory guarantee.* See your Standard Coil Distributor for complete details on how trade-ins can increase your tuner sales and profits—create greater customer satisfaction.

JUMP ON THE STANDARD COIL PROFIT WAGON TODAY!

For additional details, see your authorized Standard Coil Distributor or write to:

Standard

Coil Products Co., Inc.

2085 North Hawthorne Avenue, Melrose Park, Illinois

Radio & TV Service owner JIMMY HULL says:

"Mallory replacement parts

Put an end to call-backs with these quality Mallory products...

TC TUBULAR ELECTROLYTICS

Economically priced Mallory filter capacitors, service proved for top performance in coupling and bypass applications. Also special TCX type for −55° C.

FP ELECTROLYTICS

The original 85° C capacitor. New shock-resistant construction. Etched cathodes—standard at no extra cost—give hum-free performance. For chassis or printed circuit mounting.

RMC DISCAPS®

Made by the world's largest producer of ceramic disc capacitors. The quality standard for original equipment. In a handy 3x5" file card package. ®Trademark of Radio Materials Company, A Division of P. R. Mallory & Co. Inc.

STA-LOC® CONTROLS

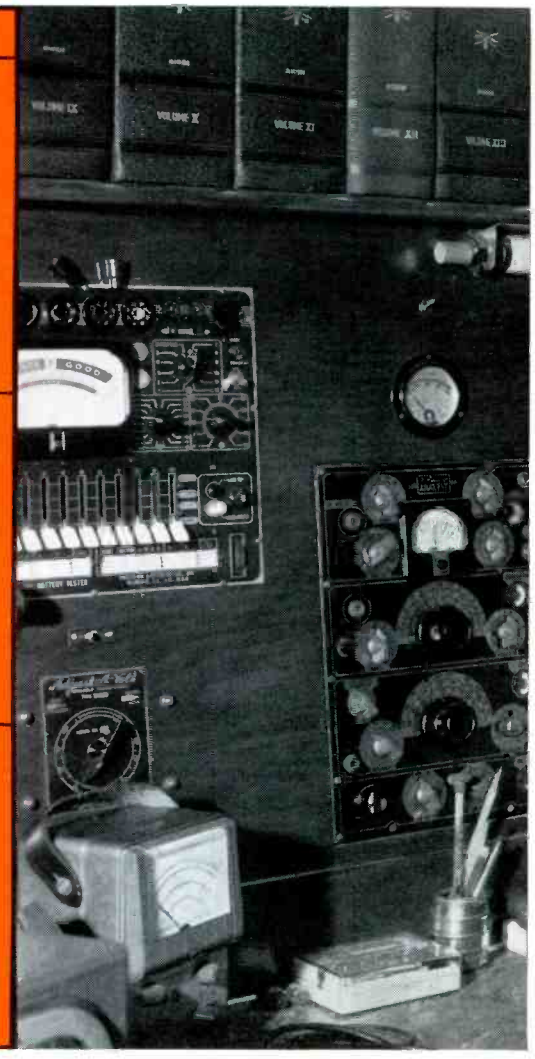
No waiting, no shopping. Any of over 38,000 types of single or dual controls custom-built by your distributor in just 30 seconds.

GOLD LABEL® VIBRATORS

The quietest vibrator ever made . . . for the best in auto radio servicing. Buttonless contact design gives longest life, surest starts.

MALLORY MERCURY BATTERIES

Unmatched for transistor radios . . . give steady power, last several times longer, stay "alive" for years when idle. The battery that's "first" in space in U. S. satellites.

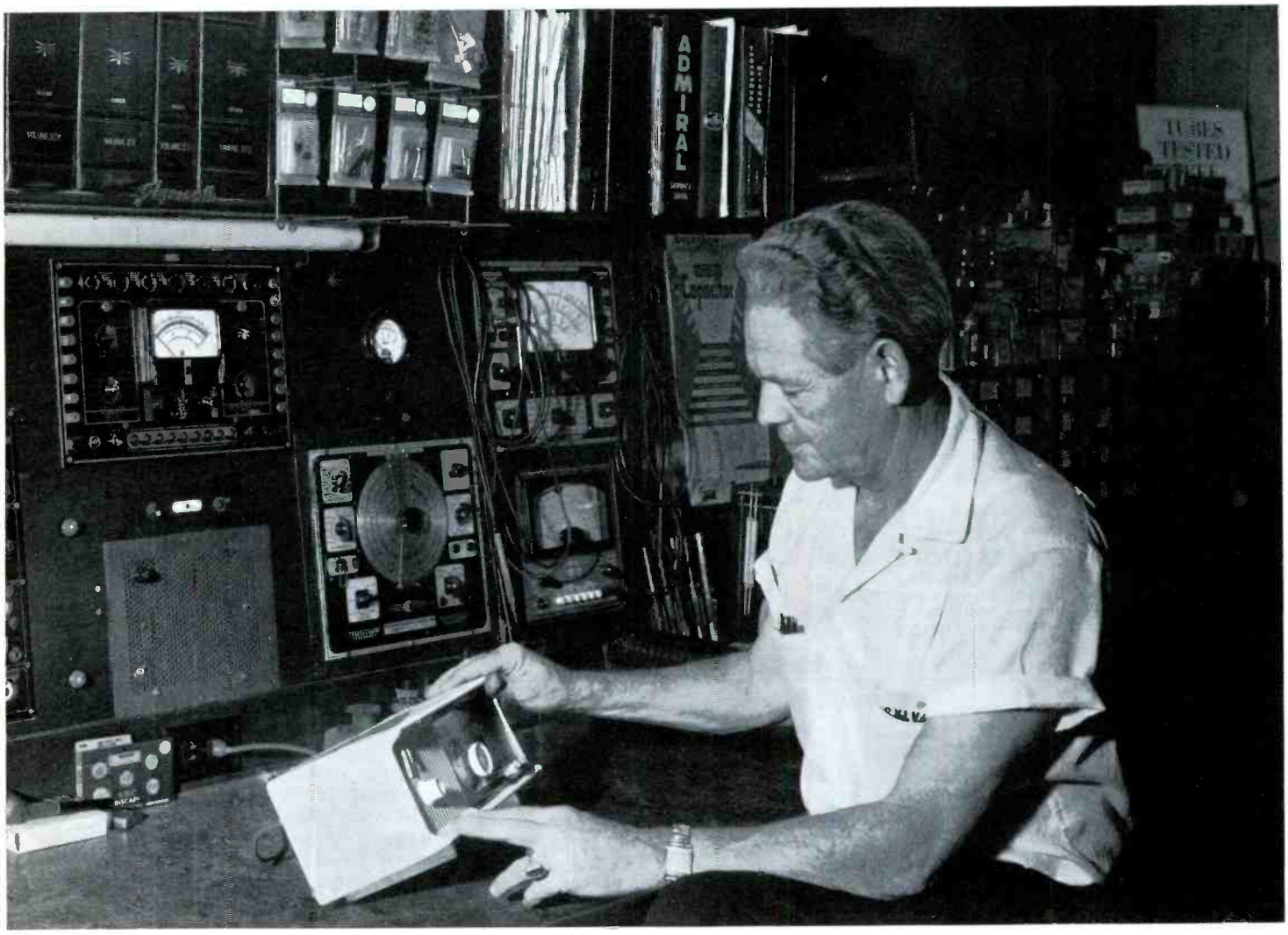


"For the past 35 years, I have built my business on customer satisfaction—satisfaction *guaranteed* or their money back. There are two reasons why I feel safe in making this offer: I personally check all sets for proper operation before delivery to the customer . . . and I use only the most dependable replacement parts. I prefer Mallory components because they always deliver the kind of performance that backs up the guarantee I offer my customers."

Like service technicians across the country, Jimmy Hull knows that he can depend upon quality throughout the wide line of Mallory components. For instance, there's the Mallory Gem—a tubular capacitor unequalled in coupling, buffer, filter and by-pass applications. Gems are loaded with extra-service features. *Moisture-proof case* protects against change of capacity or insulation resistance. *Locked-in leads* won't open or loosen when pulled, even under soldering-iron heat. *Conservative ratings* assure complete reliability and long life.

Mallory Gems are available in all popular ratings. Get them in the handy "Five-Pack" that keeps your stock clean and orderly with kink-free leads. What-

guarantee customer satisfaction"



ever your component needs, see your Mallory distributor; he has the widest line of quality Mallory products . . . at sensible Mallory prices.

Distributor Division

P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Jimmy Hull owns and manages Hull's Radio & TV Service in Evansville, Indiana, serving an area within a 60-mile radius of the city. An early wireless operator, Jimmy has been in service work from the crystal set days to the present highly complicated color TV sets. Before going into business for himself he was the only radio service man for Sears, Roebuck & Company within a 100-mile radius of the city for eight years.

Letters

(Continued from page 14)

your offer of something better.

Whatever method you may use to test customers' tubes, you always have something to offer which is lacking in any self-service operation—your own professional analysis of the test results. Skilled judgment and a high-quality instrument form a hard-to-beat combination—something you can crow about in your advertising.—Ed.

Dear Editor:

Please advise which issue of PF REPORTER contained "Video Speed Servicing" data for the General Electric Model 17T026, a 17" portable.

Is the issue available?

JOSEPH A. SPALLA
Plaza, No. Dakota

This model, an "MM" line receiver, has not been covered in the "Video Speed Servicing" column; however, you will find it in the newest Howard W. Sams book coverage, "Video Speed Servicing—Vol. 3."—Ed.

Dear Editor:

The written portion of Card No. MA 25-6 in the December *Video Speed Servicing* feature, concerning the Magnavox 25 Series chassis, says to make sure that R62 (1 meg—1W) is connected between R61 and the blocking transformer. However, the schematic shows R62 connected between R61 and the 590-volt boost B+ source. Which is correct?

CHARLES H. WAGENMAN
Hempstead, L. I., N. Y.

The text suggests adopting the later-production version of the circuit, while the schematic shows the early-production version you are more likely to find in sets displaying this vertical sweep fault.

In future coverages, all circuits will be shown in their late-production form, if production changes were made for the purpose of improving receiver performance. Circuit alterations for adapting a set to accommodate a new-type picture tube, etc., do not fall into this category.—Ed.

Dear Editor:

Your fine magazine has been coming to my door for four years now — and it will sure continue. I'm changing my job, however, and need your help.

I've been servicing radios and TV's for an appliance store the last several years, letting the newer developments in audio and stereo slide by with little attention. A few jobs — some phonos, a couple of hi-fi amps, and one stereo amplifier — I just got by on. Now, suddenly, I've been asked to start an audio service department, and I wish I had studied more of the material available.

At the moment, I have the normal complement of TV test instruments — a good VTVM, 5" oscilloscope, a signal tracer, a good tube tester. I sold my generators; they were old and erratic. I

• Please turn to page 91

GET more! DO more! MAKE more!

PROFIT PROFESSIONALLY ON EVERY CALL WITH

NEW B&K LOW-COST PROFESSIONAL Model 550 DYNA-QUIK

DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER

Model 550

NET $119.95

Every service-technician now can easily check tubes the B&K professional way! Only with a *genuine dynamic mutual conductance tube tester* can you make a complete and accurate test under the actual dynamic operating conditions of the TV set. The compact new "550" is not just an emission checker. *It completely checks more tubes faster*—with laboratory accuracy. And the cost is so amazingly low, it pays its way over and over again! Take a tip from thousands of professional servicemen—*use B&K Dyna-Quik*. There is nothing like it.

Get More for Your Money

—IN SPEED, ACCURACY, AND VALUE

Save Customers

—SAVE CALL-BACKS, SAVE COST

Sell More Tubes

—MAKE MORE MONEY PER CALL

MODEL 550 DYNA-QUIK TUBE TESTER

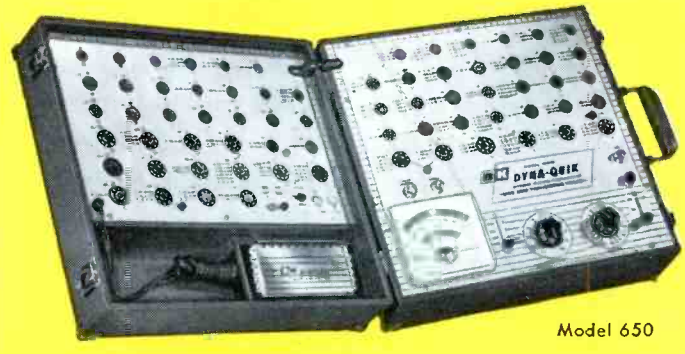
Tests Each Section of Dual-Section Tubes Separately

Great new value in professional quick-check at small cost. Provides **more** tube sockets to test **more** tubes faster. Accurately checks most of the TV and radio tubes usually encountered in everyday service work. Tests each section of dual-section tubes separately. **Measures true dynamic mutual conductance.** Checks tubes for shorts, grid emission, gas content, and leakage. Completely tests each tube in seconds, checks average TV set in a few minutes, in home or shop. One switch tests everything. Fast, convenient reference listings on socket panel. Patented circuit provides automatic line voltage compensation. 7-pin and 9-pin straighteners on panel. Handsome, luggage-type carrying case. Net, $119.95

MODEL 650 DELUXE DYNA-QUIK

Today's Finest Portable Tube and Transistor Tester

Accurately checks over 99% of the tubes most widely used in television receivers, plus popular home and portable radio tubes. Tests over 600 tube types. Lists over 125 most popular tube types, with settings, on socket panels for maximum operating speed. Complete listing in fast, index-type selector. **Measures true dynamic mutual conductance.** Tests each section of multiple tubes separately for GM, Shorts, Grid Emission, Gas Content and Life. Includes 16 spare sockets and ample filament voltages for future new tube types. **Transistor Section** checks transistors, diodes, and selenium rectifiers. Luggage-type carrying case. Net, $169.95



Model 650

See Your Distributor or Send Now for Bulletin ST24-R

B&K MANUFACTURING CO.

1801 W. BELLE PLAINE AVE • CHICAGO 13, ILL.

Canada: Atlas Radio Corp., 50 Wingold, Toronto 10, Ont.
Export: Empire Exporters, 277 Broadway, New York 7, U.S.A.

GARROWAY'S BACK

...with a buy-the-best, buy-now message boosting G-E BLACK-DAYLITE Picture Tubes!

It's safe to count on the big lift popular Dave Garroway will give your business! And smart to plan ahead, in order to squeeze every penny of sales value out of the advertising dollars General Electric is spending. So... make sure that picture-tube and service prospects who see Dave Garroway know *you* install General Electric tubes!

Identification's easy, with the attractive new displays and other promotions General Electric has for you. They tie in your store or shop with Garroway; they will keep your phone busy with more jobs, tube installations, profits. See your G-E tube distributor! *Distributor Sales, Electronic Components Div., General Electric Co., Owensboro, Ky.*

Install the PROFIT PAIR 

that millions

On **TODAY**
over NBC-TV starting April 20.
Week after week 3,800,000
television set owners from
coast to coast will learn why
picture quality starts with
their serviceman who installs
General Electric tubes!

Progress Is Our Most Important Product

know by name!

GENERAL ELECTRIC

311-402

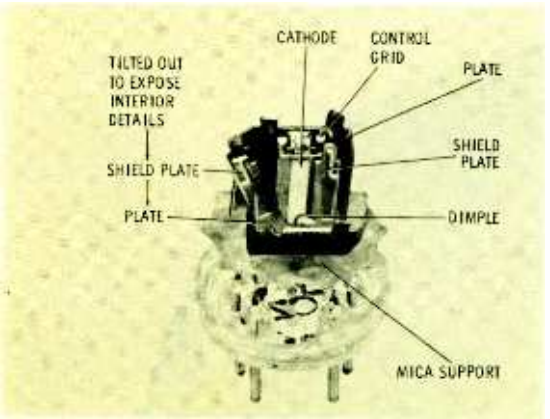


Fig. 1. 6ER5 RF amplifier tube cut apart to show *Guided Grid* assembly.

1960 CROP OF NEW TV TUBES

In our continuing search for information on rare new tube types, we found that about two dozen types have been added to the roster during the past season — not as many as in previous years, but enough to warrant your special attention. So, one month in advance of our regular *Stock Guide for TV Tubes* feature, here is a roundup of the latest tube types to come into actual use.

RF Amplifiers

The industry has taken another step forward in tuner design, introducing several new RF amplifier tubes that outperform previous types. The most unusual tubes in this category are the 6ER5, 6ES5 and 6FH5 used in the new *Guided Grid* series of Standard Coil turret tuners. This manufacturer, seeking to improve the *Neutrode* tuner design, found that a triode-type RF amplifier could be made more efficient by placing extra elements (called *shield plates* or *grid guides*) in the area between control grid and plate. Fig. 1, a cutaway view of a 6ER5, shows how the U-shaped shield plates surround the sides of the grid structure like a pair of brackets. When grounded, these additional plates serve to reduce grid-to-plate capacitance, making it easier to neutralize the tube in a *Neutrode*-type circuit.

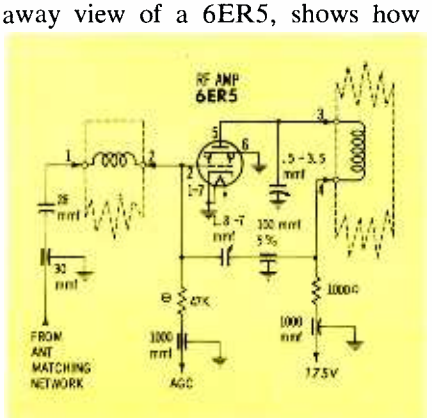


Fig. 2. *Guided Grid* RF stage bears close resemblance to *Neutrode* circuit.

The shield plates also confine electron flow to a small area corresponding to the "dimple" in the plate (pointed out in Fig. 1). The "dimple" fits very close to the grid-cathode assembly, thereby maintaining very small cathode-to-plate spacing. This holds electron transit time to a minimum and increases the efficiency of VHF amplification. Since the shield plates are not directly in the path of electron flow (as a screen grid would be), they do not add to internally-generated tube noise; in fact, they actually reduce such noise by discouraging random electron flow "sideways" from the control grid.

Guiding the flow of plate current without intercepting it, the shield plates function somewhat like the beam-forming plates in a beam-power pentode. Accordingly, they're shown in a similar manner on a schematic (see Fig. 2). As you'll note from this diagram, the circuit surrounding the *Guided Grid* tube is very similar to a *Neutrode* RF amplifier. The new-style tuner is also a great deal like recent-model *Neutrode* units in physical appearance (Fig. 3); but, in keeping with a current trend, it is markedly smaller. Dimensions of the GG-series tuner chassis are 2¼" wide by 2⅝" high by 3⅝" long.

We have already mentioned that three different *Guided Grid* tubes are on the market, and the question naturally arises, "What's the difference between them?" The 6ER5 and 6ES5, although both designed for the same purpose, differ in details of construction. To be more specific, the 6ER5 has a new *frame-grid* type of control-grid structure, while the 6ES5 does not. Fig. 4 is a greatly enlarged photograph of a frame grid and a conventional receiving-tube grid (not from a 6ES5), for purposes of comparison. Note that the frame grid at left, also known as a "strap-frame" grid, has metal cross braces welded between unusually heavy upright grid supports. The rigid construction of this grid-support assembly makes it possible to employ finer grid wire, higher winding tension, and closer spacing between turns than would be feasible in a conventional grid, where the grid wire must contribute to the mechanical stability of the support assembly.

The frame grid can be placed extremely close to the cathode because of the tight mechanical tolerances permitted by the new method of construction. This has the ad-

• *Please turn to page 85*

Fig. 3. Standard Coil GG Series turret tuner measures 2¼" x 2⅝" x 3⅝".

50% OF ALL TV SETS MADE TODAY ARE PORTABLE AND TOTE-ABLE TYPES. THIS WILL ADD UP TO $3,500,000 IN EXACT REPLACEMENT ANTENNA VOLUME IN 1960 FOR FORWARD-THINKING DISTRIBUTORS AND DEALERS WHO PREPARE FOR IT TODAY! . . . WITH THE JFD EXACT REPLACEMENT ANTENNA MERCHANDISING PLAN.

Model TA359 List, $4.50
Exact Replacement for RCA, Motorola, Magnavox, 1956-7-8 Portable TV Sets

Model TA362 List, $9.75
Exact Replacement for GE Designer and Hotpoint "Flair" 1958 Portable TV Sets

WHERE WOULD YOU GET **ANY** AND **EVERY** ANTENNA REPLACEMENT FOR PORTABLE AND TOTEABLE SETS?

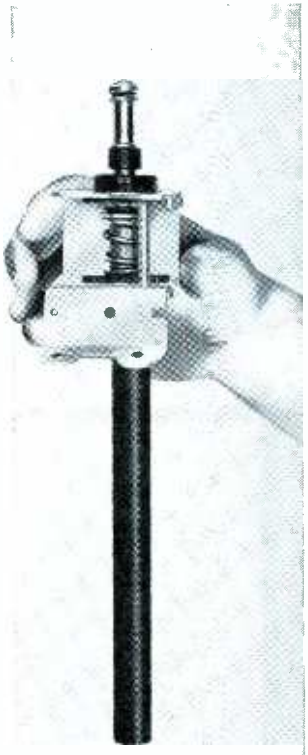
JFD* OF COURSE!

Only when you buy a JFD Exact Replacement Antenna do you get the original unit that JFD supplies to manufacturers for their TV portable or "tote-able" sets. And when you install a JFD Exact Replacement Antenna *you* make a *full* profit on the sale and the installation—bring customers back to *your* shop because only you are equipped to replace a broken antenna.

Only $11.95 puts you back in profitable indoor antenna business. That's all it costs for the No. PA500 JFD Exact Replacement Antenna Merchandising Kit that gets you started in this new multi-million dollar service market.

Remember, next to receiving tubes, the antennas of portable and "tote-able" sets require the most frequent replacement.

See your JFD distributor today for your PA 500 kit and any and every antenna replacement need.



Model TA370 List, $6.25
Exact Replacement for Admiral 1959-60 Portable TV Sets

Model TA360 List, $7.65
Exact Replacement for GE, Hoffman, Hotpoint & Emerson 1957-8 Portable TV Sets

*Beginning with set 467 in December, JFD Exact Replacement Antennas will be listed in SAMS PHOTOFACT folders for your service reference.

Model TA369 List, $8.25
Exact Replacement for RCA 1960 Portable TV Sets

Pioneers in electronics since 1929

JFD ELECTRONICS CORPORATION
6101 Sixteenth Avenue Brooklyn 4, New York

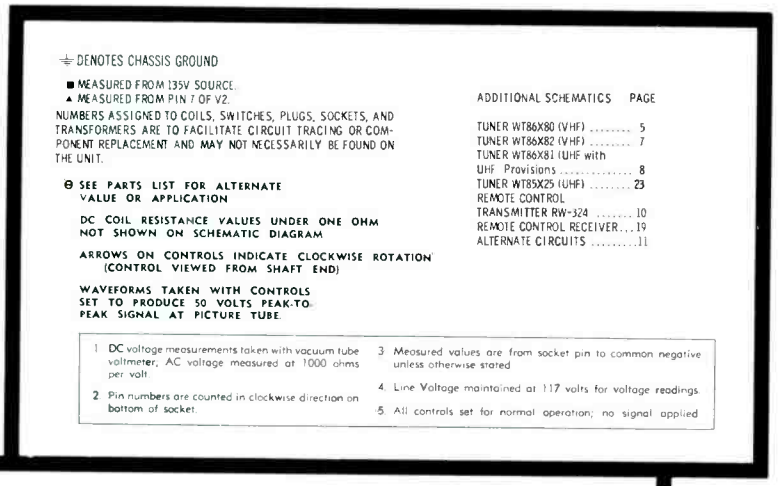
JFD CANADA LTD.
51 McCormack Street
Toronto, Ontario, Canada

JFD INTERNATIONAL
15 Moore Street
New York, N.Y.

SERVICE DATA

Service data provides the guiding hand and holds the key to speedier, more profitable servicing, no matter what the job is—safety glass cleaning, tube replacement, dial-cord stringing, disassembly, circuit analysis, alignment, etc.

On any shop job, arrange to have ALL the available information at your fingertips, including production change bulletins, alternate schematics, and correction notices, as well as the regular folder and schematic. Read on to learn how service manuals can save you time and trouble.



⏚ DENOTES CHASSIS GROUND

■ MEASURED FROM 135V SOURCE.
▲ MEASURED FROM PIN 7 OF V2.

NUMBERS ASSIGNED TO COILS, SWITCHES, PLUGS, SOCKETS, AND TRANSFORMERS ARE TO FACILITATE CIRCUIT TRACING OR COMPONENT REPLACEMENT AND MAY NOT NECESSARILY BE FOUND ON THE UNIT.

Θ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

DC COIL RESISTANCE VALUES UNDER ONE OHM NOT SHOWN ON SCHEMATIC DIAGRAM

ARROWS ON CONTROLS INDICATE CLOCKWISE ROTATION (CONTROL VIEWED FROM SHAFT END)

WAVEFORMS TAKEN WITH CONTROLS SET TO PRODUCE 50 VOLTS PEAK-TO-PEAK SIGNAL AT PICTURE TUBE.

ADDITIONAL SCHEMATICS PAGE

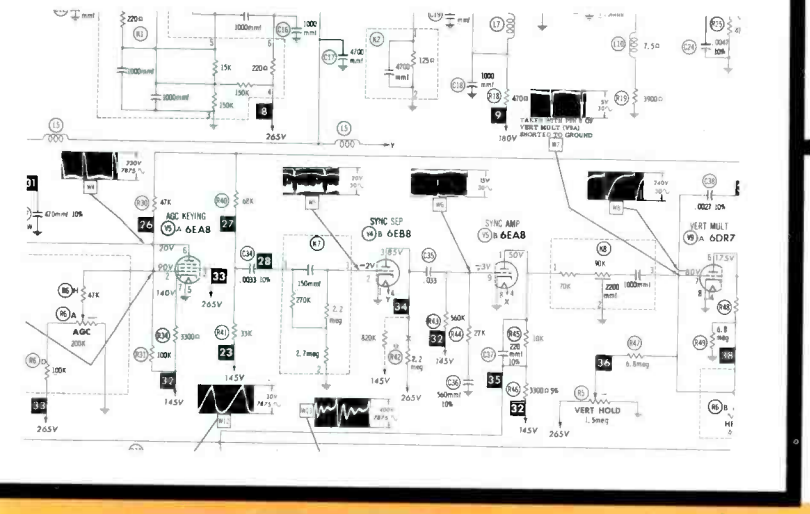
1. DC voltage measurements taken with vacuum tube voltmeter, AC voltage measured at 1000 ohms per volt.
2. Pin numbers are counted in clockwise direction on bottom of socket.
3. Measured values are from socket pin to common negative unless otherwise stated.
4. Line Voltage maintained at 117 volts for voltage readings.
5. All controls set for normal operation; no signal applied.

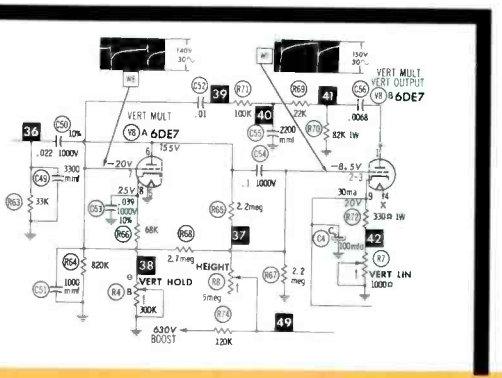
NOTE THE NOTES

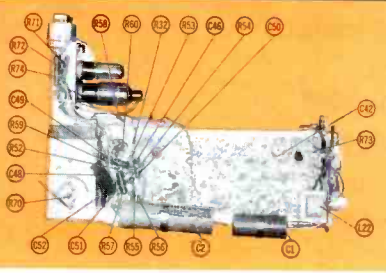
Pay particular attention to all schematic notations. They explain conditions of voltage measurement and waveform reproduction, as well as identify reference points, equipment used, component and circuit variations, and other points you need to properly interpret information gained through trouble-shooting.

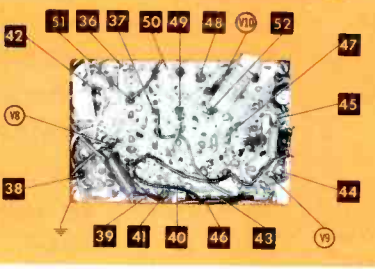
ANALYSIS TOOLS

Key waveforms and voltage measurements are provided on most schematics. However, be sure to duplicate as accurately as possible the operating conditions specified in the notes. Even then, some voltages and waveforms will vary because of signal differences, control settings, etc.









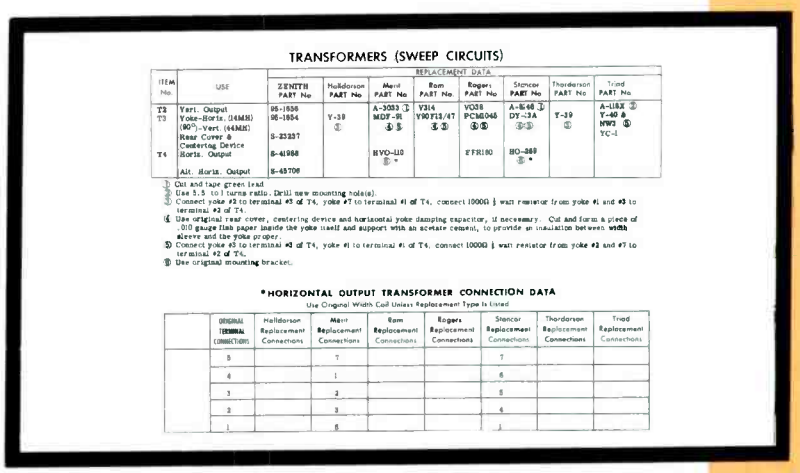
SPECIAL PHOTOS

Photographs or pictorial diagrams save time in locating components which cannot be readily found by circuit tracing; in addition, they enable you to determine the item number and schematic location of a component from its physical position.

FOR BOARD SERVICING

CircuiTrace is the printed-board identification system used in PHOTOFACT Folders. Photos of the boards are keyed numerically to the schematic. Most other manuals provide some form of pictorial presentation to aid in circuit-tracing.

SPEEDS REPAIRS



TRANSFORMERS (SWEEP CIRCUITS)

ITEM No.	USE	REPLACEMENT DATA: ZENITH PART No	Hallicrafters PART No	Merit PART No	Ram PART No	Rogers PART No	Stancor PART No	Thordarson PART No	Triad PART No
T2 T3	Vert. Output Yoke-Horiz. (14MM) (90°)-Vert. (44MM) Rear Cover & Centering Device Horiz. Output	96-1936 96-1934 8-23337 8-41988	Y-39 ①	A-3033 ① MDF-91 ④ ⑤ HVO-U10 ⑤ *	V314 Y90F13/47 ① ②	VO38 PCM6046 ② ⑥ FFR180	A-8668 ① DY-3A ③ ⑤ BO-869 ⑤ *	Y-29 ②	A-118X ② Y-60 ⑤ NW3 ⑤ YC-1
T4	Alt. Horiz. Output	8-45706							

① Cut and tape green lead
② Use 5.5 to 1 turns ratio. Drill new mounting hole(s).
③ Connect yoke #2 to terminal #3 of T4, yoke #7 to terminal #1 of T4, connect 1000Ω ½ watt resistor from yoke #1 and #3 to terminal #3 of T4.
④ Use original rear cover, centering device and horizontal yoke damping capacitor, if necessary. Cut and form a piece of .010 gauge fish paper inside the yoke itself and support with an acetate cement, to provide an insulation between width sleeve and the yoke proper.
⑤ Connect yoke #3 to terminal #3 of T4, yoke #1 to terminal #1 of T4, connect 1000Ω ½ watt resistor from yoke #2 and #7 to terminal #2 of T4.
⑥ Use original mounting bracket.

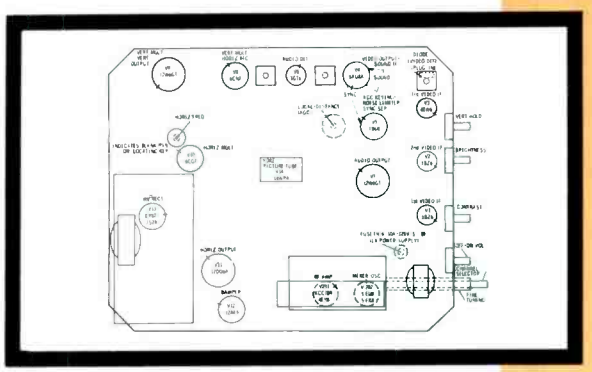
*HORIZONTAL OUTPUT TRANSFORMER CONNECTION DATA

Use Original Width Coil Unless Replacement Type Is Listed

	ORIGINAL TERMINAL (CONNECTION)	Hallicrafters Replacement Connections	Merit Replacement Connections	Ram Replacement Connections	Rogers Replacement Connections	Stancor Replacement Connections	Thordarson Replacement Connections	Triad Replacement Connections
	5		7			7		
	4		1			8		
	3		2			5		
	2		3			4		
	1		8			1		

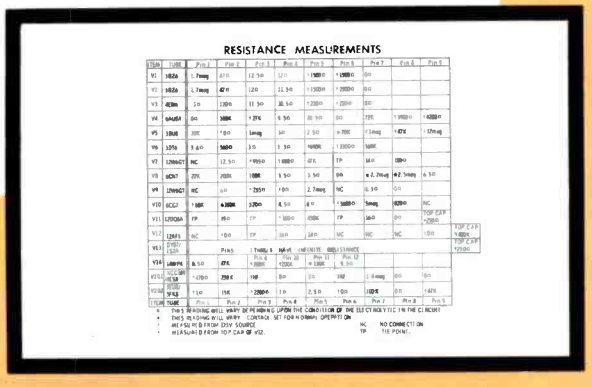
REPLACEMENT DATA

Check parts lists for more specific information on component values, ratings, and special characteristics. Alternate values, and notes concerning circuit variations, are also provided. In addition, replacement parts are listed, and definite, detailed installation instructions are given.



LAYOUT DIAGRAMS

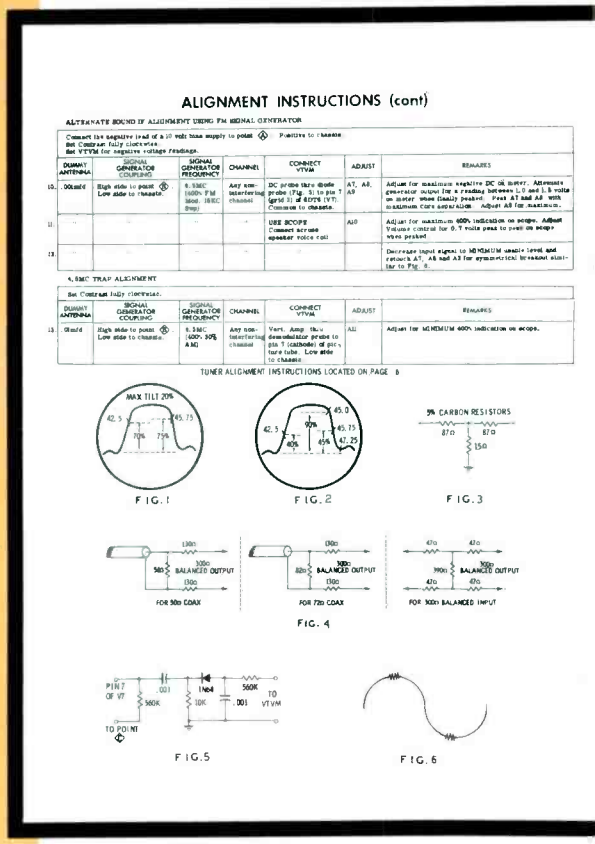
Chassis layout diagrams provide tube functions and types, item numbers and their locations, plus the locations of controls, fuses, diodes, rectifiers, and sync and sound takeoff points.



RESISTANCE MEASUREMENTS

RESISTANCE CHECKS

Resistance measurement charts are extremely useful, especially when parallel paths make it difficult to compute what the actual readings should be. These have already been thought out for you. In circuits containing controls, be sure to note the conditions of resistance measurements given in the chart.



ALIGNMENT INSTRUCTIONS (cont)

ALTERNATE SOUND IF ALIGNMENT USING FM SIGNAL GENERATOR

Connect (+) negative lead of a 20 volt bias supply to point (A). Positive to chassis.
Set Contrast fully clockwise.
Set VTVM for negative voltage readings.

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
10. .001mfd	High side to point (A) Low side to chassis	9.5MC (600- FM Mod. 15KC Dev)	Any non-interfering channel	DC probe thru diode probe (Fig. 5) to pin 7 (grid 2) of 6U7A (V7). Common to chassis.	A7, A8, A9	Adjust for maximum negative DC ok meter. Alternate generator output for a reading between 1.5 and 1.8 volts on meter when finally peaked. Peak A7 and A8 with maximum core separation. Adjust A8 for maximum.
11. "	"	"	"	USE SCOPE Connect across speaker voice coil	A10	Adjust for maximum 600% indication on scope. Adjust Volume control for 0.7 volts peak to peak on scope when peaked
12. "	"	"	"	"		Decrease input signal to MINIMUM useable level and retouch A7, A8 and A9 for symmetrical bracket similar to Fig. 6.

4.5MC TRAP ALIGNMENT

Set Contrast fully clockwise.

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
13. .01mfd	High side to point (A) Low side to chassis	4.5MC (600- 30% AM)	Any non-interfering channel	Vert. Amp. thru demodulator probe to pin 7 (cathode) of picture tube. Low side to chassis	A11	Adjust for MINIMUM 600% indication on scope.

TUNER ALIGNMENT INSTRUCTIONS LOCATED ON PAGE 8

FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

ALIGNMENT DATA

Alignment is an exacting science. Even when detailed alignment instructions are carried out with precision, erroneous adjustments can be made. Manuals providing the most complete information will include step-by-step procedures, photo and schematic callouts of all alignment points, circuit-connection details, and response waveforms to show you the results you should achieve.

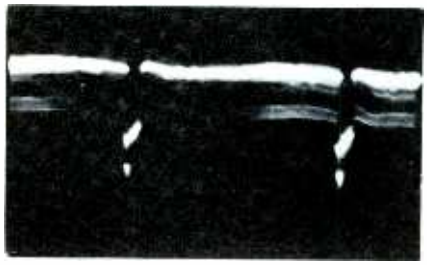


Fig. 13. Normal waveform at noise-limiter grid of 3BU8 sync separator.

Tough Dog

JOE A. GROVES

Types of Separators

Essentially, there are two types of tubes used as sync separators. One is a triode (or half of a dual triode), and the other is a multielement type which may be either a pentagrid tube (6BY6, 6CS6, etc.) or the more recently-developed –BU8 design. For all practical purposes, the –BU8 functions the same in a sync separator circuit as does a pentagrid tube.

There are two outstanding differences between these classes of sync-separator tubes. One is the much higher gain of the multielement tube (which explains why practically all triode-type sync circuits have two stages, while multielement tubes are often used in one-stage sync sections.) The other outstanding difference is in the field of noise immunity. Triodes have no built-in element to control or eliminate noise pulses; thus, the stage following a triode-type sync separator must generally serve as a pulse clipper as well as an amplifier. On the other hand, the pentagrid and –BU8 tubes do have a built-in noise-cancellation feature and consequently don't require use of a separate clipper stage. In some receivers, a multielement-type separator may be followed by another sync stage for some purpose other than pulse clipping; for example, the typical 3BU8 circuit in Fig. 12 incorporates a phase-inverting circuit to provide pulses of both positive and negative polarities for driving a dual-diode horizontal AFC circuit.

3BU8 Circuit Analysis

No. 1 Grid

In order to prevent noise interference from appearing in the separated sync pulse, the first or inner control grid of the 3BU8 (pin 7 of V5B in Fig. 12) is fed a composite video signal of negative pulse polarity. This signal is much lower amplitude than the one of positive pulse polarity fed to the No. 3 or separator grid (pin 9 of V5B). The signal to pin 7 comes directly from the video detector, while the separator signal comes from the plate circuit of the video output stage. Due to the proximity of G1 to the cathode, its low-amplitude signal is sufficient to exert control. It has adequate strength to cut off V5B whenever the 100% modulation level of the incoming signal is exceeded — for example, when any noise pulse rides in on top of a sync pulse. The interruption in plate current clips the unwanted pulse out of the separated sync signal at the plate.

Controls are often inserted into the No. 1 grid circuit to vary the tube's cutoff level. These controls are given various names, such as *super range finder* (as in Fig. 12), *fringe lock, sync stabilizer,* etc. The No. 1 grid circuit in Fig. 12 also regulates conduction of the other section of the 3BU8, which is used as an AGC keying tube.

The amplitude of the composite video signal fed to the noise-limiter grid under normal conditions is highly attenuated, on the order of about .5 volt peak to peak. Fig. 13 shows the signal present with the *super range finder* control advanced to obtain a usable waveform. Fig. 14 shows what happens to the same signal as the control is advanced to its extreme setting. Note the highly distorted signal caused by allowing insufficient bias to remain on pin 7 of V5B. When this condition exists, proper operation of the sync circuit is impossible. By actually viewing the waveform on the grid, as we do with the scope,

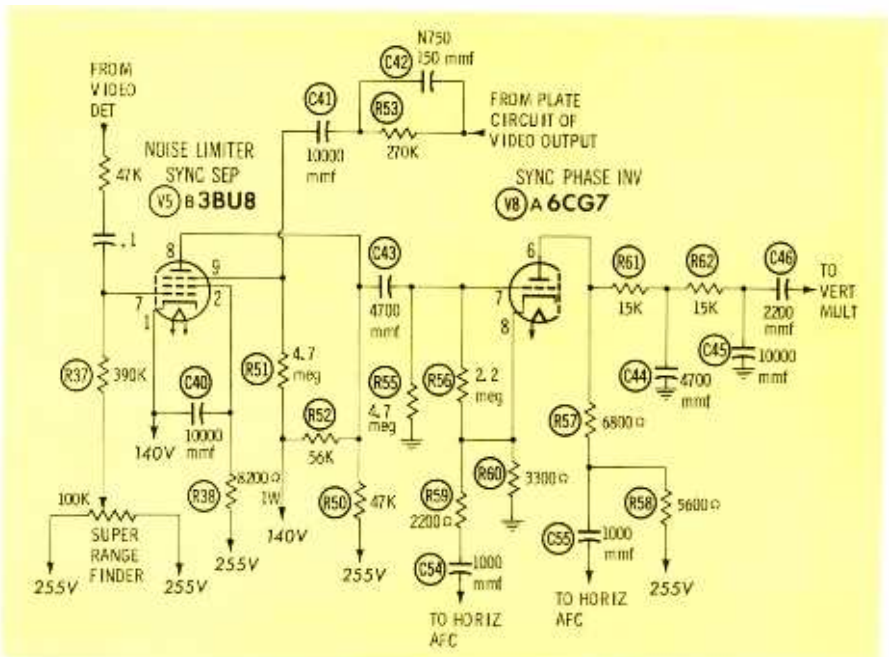


Fig. 12. The 3BU8 sync separator contains a built-in noise-limiting feature.

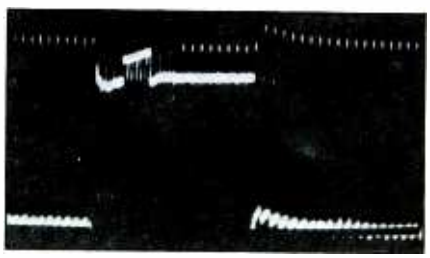


Fig. 1. Sync-input waveform expanded to show details of vertical pulse.

Sync Troubles

Scope waveforms reveal the inner workings of 6BU8 sync separators and sync amplifiers.

we can pinpoint an improper control setting or any associated component failure.

Screen Grid

Essentially, there are only two things which might happen at pin 2 of the 3BU8. One of them involves a change in value of the screen resistor, R38 in Fig. 12. This can most readily be noted by measuring the screen voltage. The effect upon the signal would be a decrease in the amplitude of the separated pulse when resistance increases, while a decrease in resistance would cause failure of the separator to remove all of the video information from the separated pulse. To see why this occurs, we must revert to a point of tube theory which states that the screen-grid voltage is the determining factor in the gain of the tube, having a much more pronounced effect than plate voltage. It therefore follows that decreased resistance means greater screen voltage and thus more tube conduction. With the same relative grid bias, the net result is improper separation. Conversely, when the resistance goes up, voltage goes down—and so does amplification.

The second possible source of trouble is the screen bypass capacitor C40. In some areas, and under various circuit conditions, an open capacitor might go undetected. There are times, though, when it does make a difference, creating a so-called "dog." Fig. 15 shows the waveform appearing at the screen when the capacitor is open. Scope frequency is 30 cps, and the peak-to-peak amplitude of the waveform is 27 volts. Under normal conditions, only a slight B+ ripple voltage should be present; but here is a condition where the screen grid becomes almost 27 volts more positive than normal whenever a vertical sync pulse appears in the input signal. The reason is simple. The tube's conduction normally decreases during vertical sync-pulse time, due to the longer period of greater-than-usual bias. This in turn reduces screen current, and would cause the voltage on this element to increase if it were not for the filtering action of C40.

The effect of an open C40 on the circuit is not so simple. For one thing, the No. 1 grid loses control completely, no matter what the setting of the *super range finder*. The net result is no noise immunity. Another effect is more obvious—unequal amplification of the vertical and horizontal pulses, to a far greater degree than evident in Fig. 1 (repeated for your convenience). This, however, may have little effect upon the stability of a particular set. If in doubt, don't forget that you can look with the scope and see what's going on in the screen circuit.

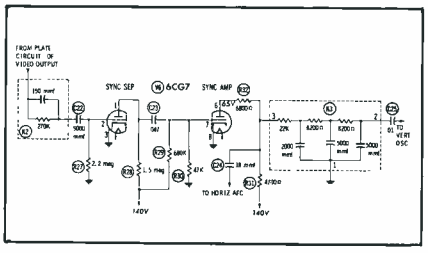


Fig. 4. This widely-used sync circuit is comprised of two triode stages.

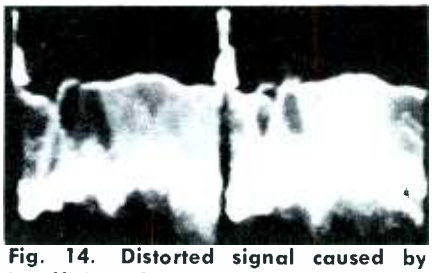


Fig. 14. Distorted signal caused by insufficient bias on the limiter grid.

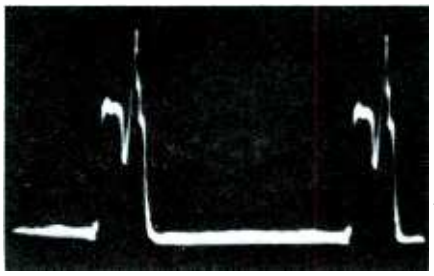


Fig. 15. Pulses of voltage appear at screen of 3BU8 when C40 opens.

Sync Amplifiers

By a sync amplifier, I mean a stage *following* separation of sync and video signals. I'm old-fashioned enough to think of any so-called "sync amplifier" *ahead* of the separator as being basically just another video amplifier.

"Following" stages come in an assortment of types, with different names and purposes. One of the simplest sync amplifiers is often referred to as a clipper. (For an example of this type of circuit, see Fig. 4—also shown again.) Basically, this is a stage for moderately

• *Please turn to page 78*

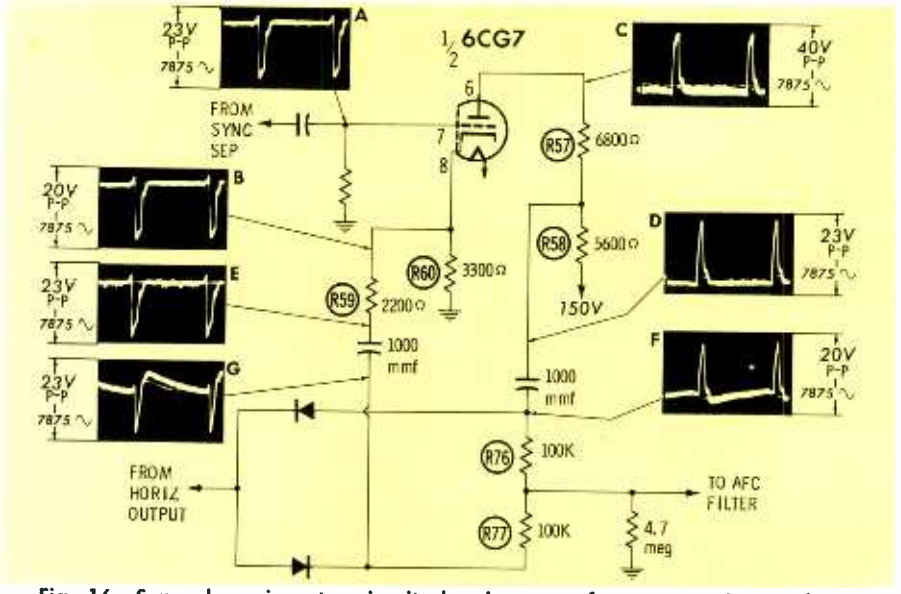


Fig. 16. Sync phase inverter circuit showing waveforms at various points.

BY MELVIN WHITMER

MAINTAINING CLOSED-

In the January issue, closed-loop control systems were described as electronic devices that automatically sense and correct errors in manufacturing processes. The term "closed-loop" indicates continuous feedback from the output side of the circuit to the input side—the same sort of action you have observed in the AGC and AFC circuits of radio and TV sets. As you know, a breakdown of an AGC-controlled amplifier or AFC-stabilized oscillator demands the use of a special troubleshooting technique. This statement holds equally true for all other closed-loop systems.

The best plan of attack is illustrated by an episode in the legend of Paul Bunyan, the master logger of all time. Early one spring, starting operations in the Round River country, he noticed that the riverbanks began to look strangely familiar after several days of riding logs downstream. He did a little scouting around and discovered he was back where he had started; the river was flowing in a circle! So, making two great slashes from bank to bank with his double-bladed axe, he hitched Babe the Blue Ox to one side of the break and took hold of the other end himself. Tugging mightily, they straightened the river out and made it flow down toward the sawmill.

Servicing a closed-loop electronic circuit doesn't take such legendary strength as Paul's feat, but it does depend on the same principle of *breaking the loop* before trouble can be isolated. Two problems immediately arise: Where should you break the loop, and what should you do after it has been broken? Let's answer these questions by reviewing the temperature-control system used for the water distillation unit described in the January issue. Fig. 1 is a block diagram of the system, and Table I outlines the step-by-step servicing procedure.

The servicing of complex and unfamiliar industrial closed-loop circuits can be greatly simplified by following such a carefully-planned and methodical procedure. In general, you'll be wise to follow the four-step sequence given below:

1. Make preliminary inspection of wiring, tubes, and other components; look for signs of overheating.
2. In complex equipment, localize trouble to one particular closed-loop circuit.
3. Break the loop at the error-sensing device and inject a test signal.
4. Signal-trace step-by-step around the loop.

Service Publications

The manufacturer aids the technician in following a prescribed procedure by providing service literature. This may consist of anything from a one- or two-page instruction sheet to a service manual of several volumes. Charts of typical troubles, compiled from field experiences, may be included to call attention to the most likely causes of specific malfunctions. In addition, service literature describes the theory of operation of the equipment in language understandable to the technician. This section of the manual presents, in full detail, the interrelationships among various sections of the control loop. Of course, the technician is expected to understand the fundamental principles of closed-loop operation before reading the service manual.

Some manuals provide a complete step-by-step procedure for troubleshooting the equipment. Table I is an example of the format most often used for charts of this type.

Preventive Maintenance

One type of service generally overlooked by the television technician just entering the industrial electronics field is preventive maintenance. The real enemy of automation is unscheduled shutdowns, and plant management devotes much time to modernizing production lines by analyzing and improv-

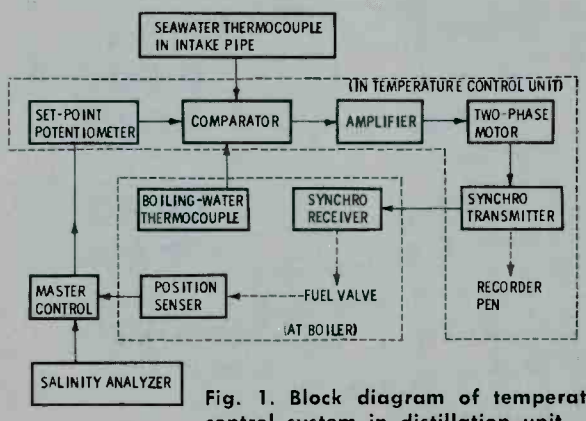


Fig. 1. Block diagram of temperature control system in distillation unit.

Table I—Troubleshooting Procedure for Temperature Control System.

STEP	ACTION	INDICATING DEVICE	OBSERVATIONS
1.	Disconnect boiling-water thermocouple from temperature control.	Portable potentiometer connected to thermocouple output lead.	Millivolt reading should agree with value given in temperature-versus-voltage chart. If reading is zero, replace thermocouple.
2.	Disconnect seawater thermocouple from temperature control.	Same as for Step 1.	Same as for Step 1. If both thermocouples check normal, proceed to Step 3.
3.	Disconnect input lead to temperature-control unit from master control. Rotate shaft of set-point potentiometer.	Recorder pen.	If pen moves when potentiometer is readjusted, amplifier and motor are normal; proceed to Step 4. If pen does not move, amplifier or motor is defective.
4.	Disconnect synchro receiver from fuel valve. Rotate shaft of set-point potentiometer.	Synchro-receiver shaft.	If shaft of synchro receiver turns when potentiometer is adjusted, replace fuel valve. If shaft does not turn, synchro system is defective.

LOOP CONTROL SYSTEMS

ing control reliability. In a factory using hand-assembly methods, the shop foreman can shift workers around to make up for absenteeism or anything else which unbalances the work load. But, once automation equipment is installed, the production line either performs or grinds to a halt; there is no in-between.

Naturally, anything that helps to assure continuous operation of the automated equipment is welcomed by management, and preventive maintenance provides some assurance of trouble-free operation. The best procedure is to set up a periodic system of maintenance inspections so the equipment may be checked and routine repairs performed at the user's convenience. A preventive-maintenance routine consists mainly of cleaning, visually inspecting, and adjusting the equipment. The time intervals between such operations will have to be established by experience, unless the equipment manufacturer makes specific recommendations in the service literature.

Table II is a typical preventive-maintenance schedule listing the normal time intervals at which various components in a control system should be checked. A speeded-up schedule should be adopted for equipment operating under unfavorable conditions (for example, in a dusty or corrosive atmosphere).

Relays — Contacts normally wear away with use, and some pitting is to be expected. However, when high spots narrow down the useful contact area, *careful* filing is necessary. Eventually, the contacts may wear enough to allow the armature (movable part) of the relay to touch the coil core or other mechanical stop. Industrial relays usually have replaceable contacts, or else the manufacturer provides contact replacement service; therefore, if you find it necessary to replace a relay for some reason, do not discard the old one. Always check for loose connections before deciding a relay needs service or replacement.

Springs on relays may weaken, either from overheating or from repeated operation, and should be checked by placing weights on the armature until the armature drops. This test should be made when the relay is new, and the results recorded for comparison with later weight tests. Solvents and oils should never be used in cleaning industrial relay contacts — just a soft brush or air.

Solenoids — In a solenoid, the armature must move freely through the center of the coil. Dirt, sludge, grime, or other foreign matter (metal filings, etc.) may cause sticking or freezing of the solenoid.

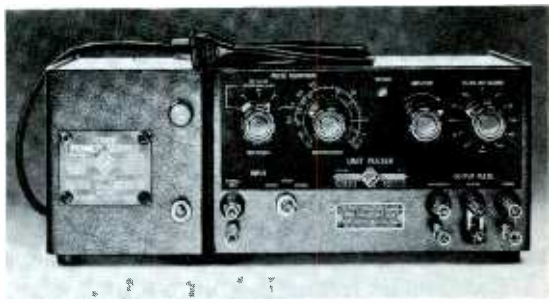


Fig. 4. General Radio Co. *Unit Pulser* for signal-injection testing.

Motors—Brushes are regular replacement items and should be checked for amount of wear. The rate of wear depends on the cleanliness of the air and the type of machine powered. (Chippings from lathes and milling machines increases the rate of wear.) Another factor is the condition of the commutator, the part of the armature which makes electrical contact with the brushes. A scored or uneven commutator literally grinds the brushes down. Commutators may be cleaned with sandpaper, but *never* with emery cloth.

Bearings should be checked by trying to "wiggle" the armature or by measuring the vibration of the motor at rated speed. The vibration method may also disclose other possible sources of trouble. An instrument made by the Vibroscope Co. for checking mechanical vibra-

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Fig. 2. Vibration analyzer for use in preventive maintenance of motors.

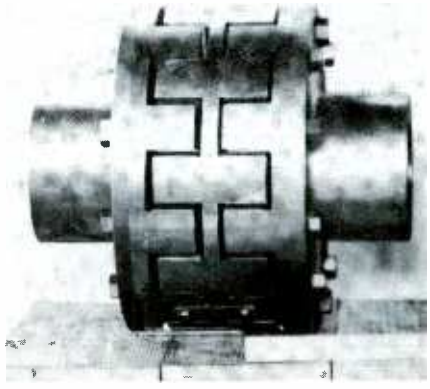


Fig. 3. Brownstein flexible joints for coupling motor to a 50-ton load.

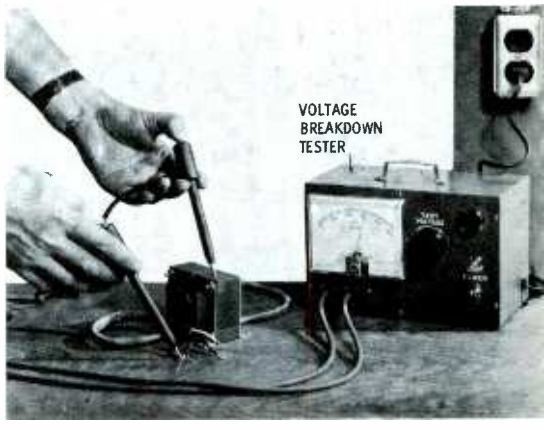


Fig. 5. Pulse-voltage source tests components for arcing or breakdown.

Shop Talk

TROUBLESHOOTING

by Milton S. Kiver

The horizontal deflection system is noted for being unusually difficult to service when some component other than a tube goes bad. It is one of the most complex circuits in a TV receiver, since it must produce not only a sweep signal for the yoke, but also the high DC voltage for the anode of the picture tube. Further complexity arises from the automatic frequency control of the horizontal sweep oscillator; AFC trouble will throw the oscillator off frequency and lead to a host of symptoms ranging from lack of synchronization (Fig. 1) to the so-called "Christmas-tree" effect (Fig. 2).

Thus, when you suspect trouble in the horizontal system, it is particularly important to reach for the right test instrument. As a guide to making the proper choice of equipment, pay particular attention to the symptoms exhibited by the image on the screen—or lack of an image, as the case may be. Drawing the right conclusions from your initial observations will save you hours of effort in tracking down the trouble.

About 90% of all horizontal sweep troubles will fall into one of the following three categories:

1. No raster.
2. Distorted image horizontally.
3. Unstable sync.

(Note: Raster distortion and sync instability may both be present at the same time. When the sync problem is solved, the distortion may disappear. If it does not, the remaining trouble automatically falls into category No. 2.)

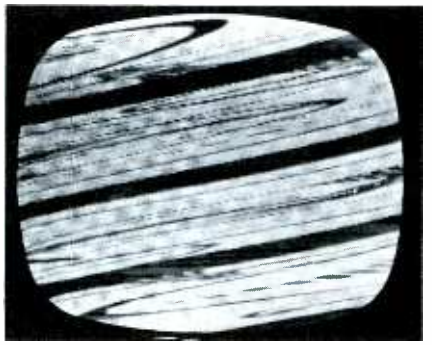


Fig. 1. Simple horizontal sync loss.

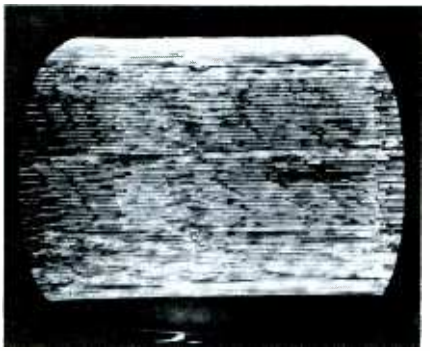


Fig. 2. "Christmas-tree" effect due to severe horizontal frequency error.

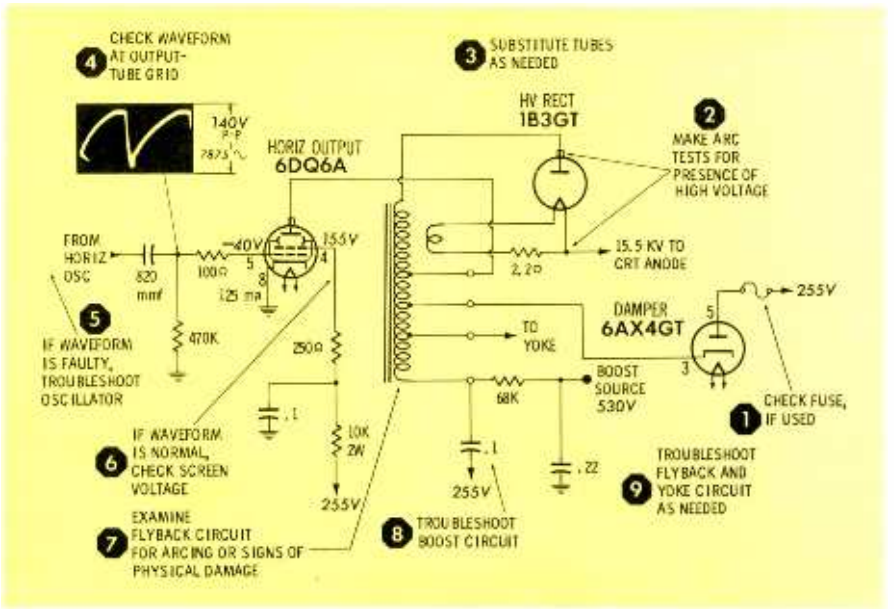


Fig. 3. Steps in troubleshooting a condition of "sound but no raster."

No Raster

A complete lack of raster on the screen can be due to a defect in either the horizontal sweep system (and high-voltage circuit), or in the low-voltage power supply. In the latter case, the sound will disappear along with the raster. The power supply can be checked by using the procedure suggested in this column last November.

In receivers with series-connected tube filaments, the "dead set" symptom can be caused by a burned-out tube anywhere in the receiver. This fault can be pinpointed with an ohmmeter or filament checker, or by using a VOM or VTVM to measure the AC voltage drop across each tube filament in the set. If one of the filaments is open, the full value of the line voltage will appear across it. Not to be overlooked is the series dropping resistor normally employed in filament strings.

If normal sound is present, or should you fail to find any defects in the filament or B+ supplies, immediately turn to the horizontal sweep and high voltage circuits in search of the trouble. Don't overlook the fuse employed in many TV sets to protect the sweep circuit! After checking this fuse, your first concern should be whether or not the picture-tube anode is being supplied with high voltage. The simplest test you can make (even quicker than substituting tubes) is to unplug the anode connector from the CRT, grasp it with a well-insulated tool, hold it ½" to 1" from the chassis, turn on the receiver, and see if a spark jumps across the gap. If the spark is absent or weak, further isolate the trouble by unplugging the plate-cap lead of the high-voltage rectifier and attempting to draw an arc from this lead to a well-insulated screwdriver held in free space. Presence of an arc about ¾" long at the rectifier plate lead,

THE HORIZONTAL SECTION

but none at the CRT anode lead, indicates a breakdown in the rectifier circuit; otherwise, you can assume the horizontal sweep system is defective. In either case, proceed to check the appropriate tubes by substitution.

If this does not remedy the trouble, an excellent place to begin troubleshooting under the chassis is at the grid of the horizontal output tube. Measure the negative DC bias—or, better still, use an oscilloscope to view the grid waveform. If indications are normal, the trouble must lie in the output stage or beyond. If conditions are *not* normal, the trouble may be in the horizontal oscillator.

The reason for hedging in the latter statement is as follows: The horizontal drive waveform will have a smaller amplitude than normal, even though its shape may appear correct, if the plate-supply voltage for the oscillator is less than normal. The oscillator often receives its plate voltage from the boost B+ line. A defect in the horizontal output or damper circuit can, by lowering boost, affect the oscillator and upset conditions at the grid of the output tube. Thus, you would look for the trouble beyond this tube, and not ahead of it, in this special case.

Boost B+ is readily measurable at the point where the voltage is taken from the damper circuit. When the raster has disappeared because of a horizontal sweep failure, it is doubtful if the potential on the boost line will be anywhere near normal. It *can* be, however, so exercise the usual amount of care when measuring boost. Check the voltage *across the boost capacitor*—not the cathode voltage of the damper. In most modern sets, the pulse voltage present at the damper cathode is sufficient to damage your voltmeter.

The raster will not necessarily disappear when the horizontal drive signal is somewhat weaker than normal. Even if the peak-to-peak amplitude of this signal is as much

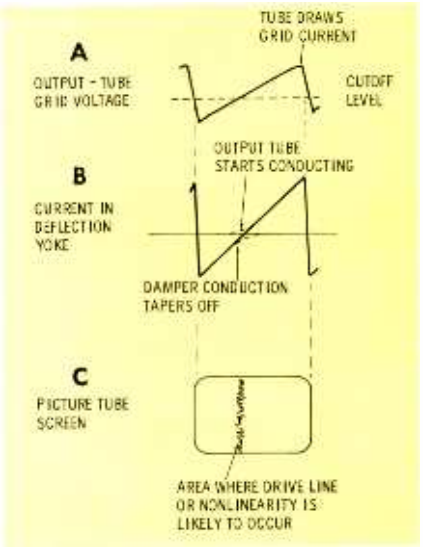


Fig. 4. Both output tube and damper supply horizontal deflection current.

as 25% below the value given in service data, the receiver will still produce a fair amount of high voltage, and generally, some semblance of an image. Nevertheless, a defective waveform at the output-tube grid (or none at all) usually points to a need for repair in circuits prior to the output stage.

To repeat a vitally important point, the drive-waveform test quickly isolates a horizontal sweep trouble to either the oscillator or output sections. In the former case, a blank screen typically indicates that the oscillator or its discharge circuit has stopped functioning completely — and further waveform, voltage and resistance checks are needed to find out why. In the latter case, waveform and voltage tests are somewhat limited by the high pulse voltages present in the output circuit; however, two DC voltages —those on the output-tube screen grid and the boost B+ line—are safe to measure and do provide valuable information. Visual inspection of the flyback and yoke circuits is also advisable to detect arcing, charring, or other signs of trouble. Among other useful servicing techniques inside the high-voltage cage are replacement of capacitors suspected of being bad, ohmmeter checks to locate open circuits, and tests with specialized instruments to reveal shorted turns or related troubles in the flyback and yoke. Fig. 3 summarizes a number of suggestions for troubleshooting a "no-raster" condition.

Distorted Image Horizontally

In this second category of hori-

• *Please turn to page 79*

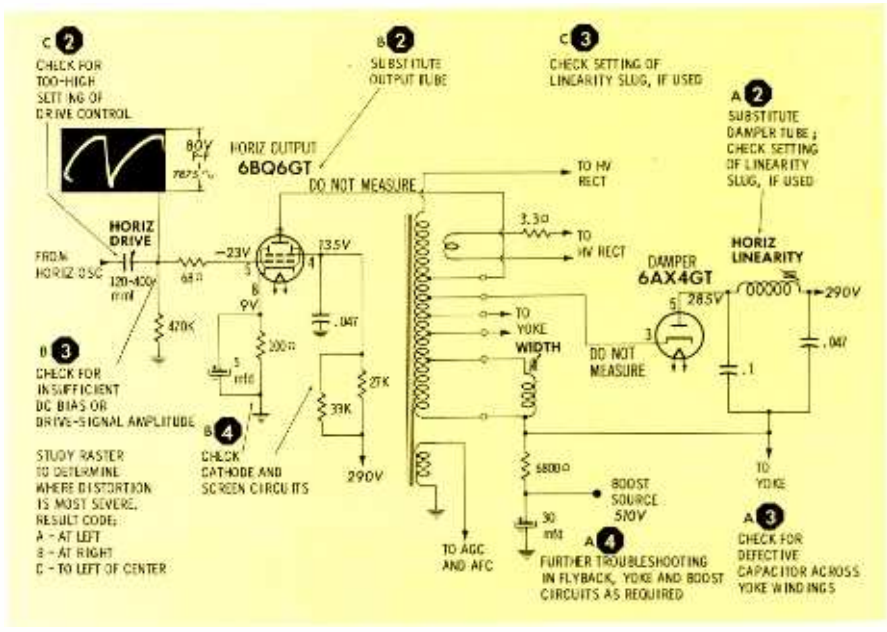
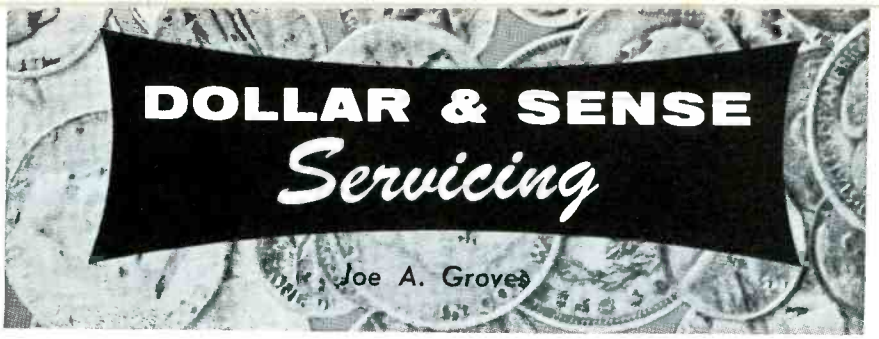


Fig. 5. Raster gives clues to cause of nonlinear horizontal deflection.



Impulse Selling. What is it? Merchandising in its most subtle form. It means selling something by just displaying to attract attention.

Ever bought a cigar or piece of candy when paying a restaurant check? If so, you've been "impulse sold." Try it with such items as record accessories, tape recorder accessories and supplies, batteries, etc. Be neat, however, and don't overcrowd the display area. The whole idea is to let the silent salesman, the customer's impulse, make the sale.

$ & ¢

Profit Builder. Buy a scope. Learn to use it. Speed service. Save time. Make money. Simple, huh?

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Keep That Dollar Working. One of the most exasperating feelings a shop owner can have is to see a growing quantity of dust-covered tube cartons building up on his shelves. Every faded carton represents good money tied up and *not* producing any return.

While there is no way to forestall having *some* dead stock, there are definite steps you can take to keep it at a minimum. Rigid inventory control is a must; no successful business can get along without it. A *perpetual* inventory system provides an excellent answer to this need. Faithfully maintained, it will show the movement of every item listed, and provide the information you need in deciding where to increase stock, where to decrease, and where to deplete the stock completely.

Following such a plan will permit you to keep your dollars working for you more of the time. In recent years, there has been a trend for distributor salesmen to initiate such a system for tube inventories. They start by making a list of all tubes currently in stock. Then, they compute the desired quantity for each type from past usage figures. On subsequent calls, the salesman checks the stock and automatically orders the tubes required to bring the inventory to the desired level. As new tubes are introduced, and older types move more slowly, he will suggest changes. While this assures the distributor, to some degree, of getting your tube business, the increased savings and more rapid turnover of stock is even more beneficial to you.

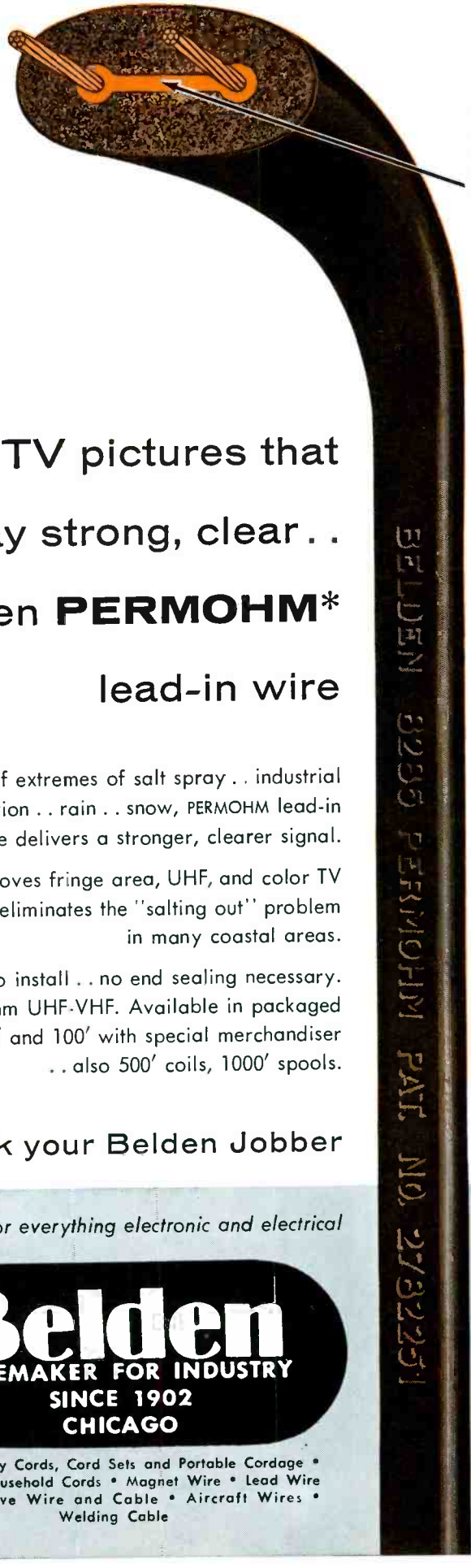
This may solve your tube inventory problem, but what about other components? The key to a *complete* inventory control system is to include everything you stock—capacitors, resistors, dial cord, etc. You'll learn, from the usage record, where you can save money by buying in large quantities. You'll be amazed to find that over the years you can tell when to order what. It would be silly to order a large stock of batteries in March, wouldn't it? Or would it? When will you miss your first battery sale this spring, by not having the particular battery the customer asks for?

$ & ¢

Telephone Tips. Answer that phone promptly! If possible, don't let it ring twice. Remember, it seems like a long time between rings when *you* are calling. If the caller has to wait any length of time, he may become disgruntled with your service even before the initial contact has been made. It's possible to give the impression that you don't want the caller's business by letting the phone go unanswered.

$ & ¢

Needle Switch. One sales-service outlet boosted phono-needle sales 25% when responsibility was transferred from sales to service. This sounds reasonable, since the average customer doesn't have any conceptions regarding needle wear, selection of a replacement, or installation requirements. The service department can provide all the answers, and thus close more sales. The point is, any serviceman who can discuss the merits of such products intelligently can successfully bolster his income by stocking and selling them.



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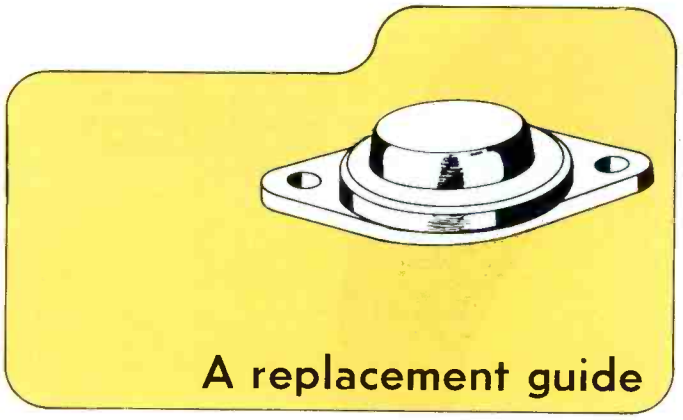
QUICKER SERVICING

by Calvin C. Young, Jr.



AUDIO POWER TRANSISTORS

A replacement guide for

Although many different types of power transistors are used in the audio output stages of auto radios, the various types are not grossly unlike each other. They differ in power gain, but are fairly similar in many other characteristics. Thus, it is often possible to substitute one type for another, if the performance of the replacement unit is carefully checked. We do not recommend unlimited interchanging of transistor types, any more than we endorse substitution of one tube type for another as a regular practice. However, if you are unable to obtain an exact replacement for a power transistor, you can usually obtain a working substitute by using the cross-reference guide on this page in conjunction with the careful testing procedure given below.

Referring to the substitution chart, select a replacement transistor. Install it, using a layer of silicone compound on each side of the mounting washer. (In grounded-collector circuits, apply the compound directly to the transistor case and the heat sink.) Set the bias control for minimum transistor current; then apply power and wait for the circuit to stabilize (about 15 minutes). Next, adjust the bias to the level required to obtain proper transistor collector current (see Fig. 1.) If the correct current reading can be obtained, and the voltage at the base, emitter, and collector are normal, you can proceed to the final check.

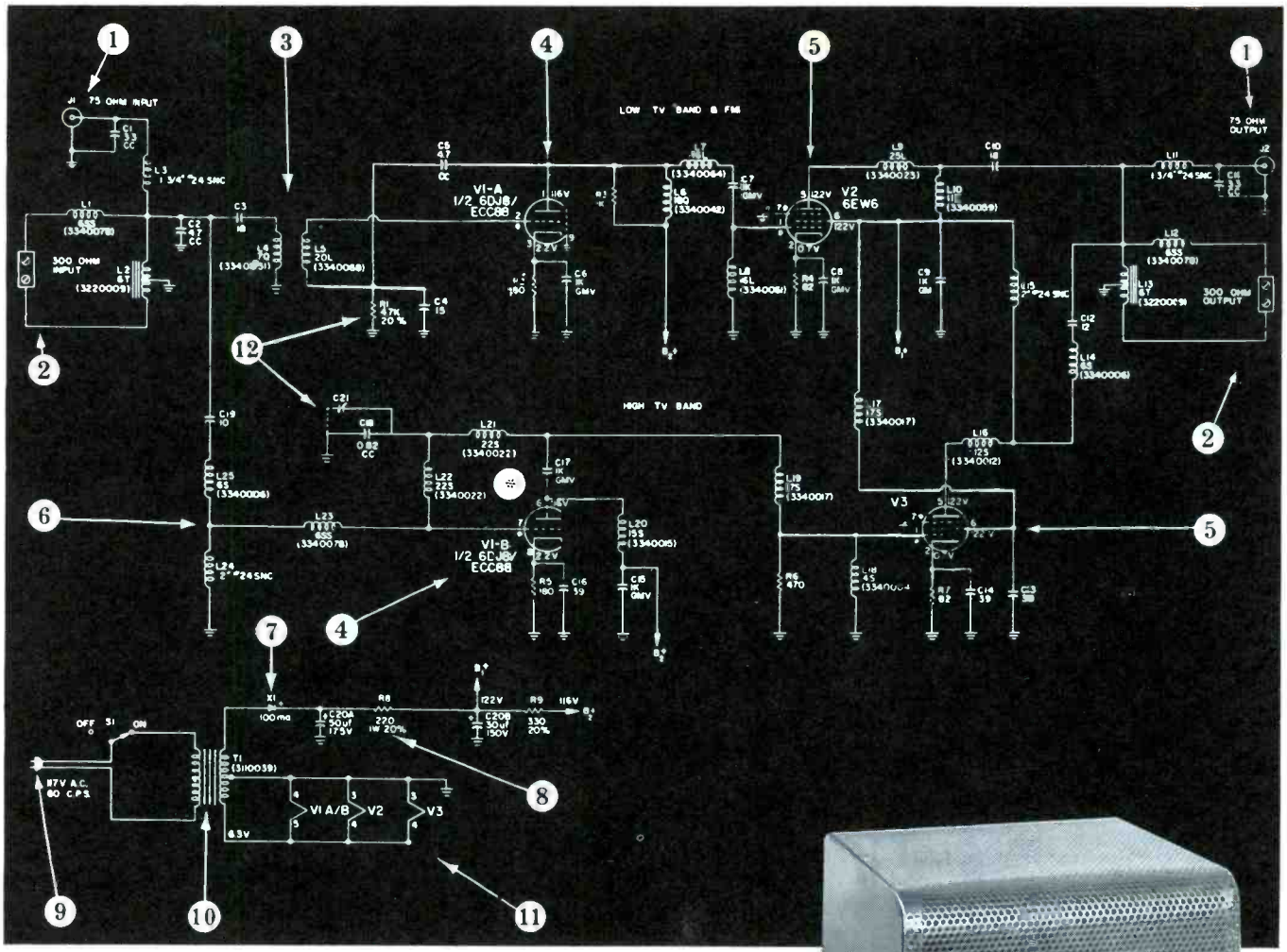
Checking Results of Substitution

Consult service literature for the value of speaker impedance in ohms, and temporarily replace the speaker with a 10-watt resistor of this value. Inject a sine-wave audio signal at the driver or audio amplifier stage. Connect an oscilloscope across the 10-watt resistor, and adjust the signal-generator level until clipping of the signal

Table 1 — Cross-Reference Chart of Audio Power Transistors.

Original	Amperex	CBS	C-D	Delco	GE	Philco	Raytheon	Sylvania	Tung Sol	Workman
AR-4	2N1314/0C26	2N155	2SB26	———	2N242	AR-12	2N155	2N242	2N242	——
AR-5	2N1314/0C26	2N155	2SB26	———	2N242	AR-12	2N155	2N242	2N242	P-25
AR-6	2N1314/0C26	2N236A	2SB26	———	2N236B	AR-12	RSP-1117	2N236B	2N242	P-40
AR-7	2N1314/0C26	2N236A	2SB26	———	2N236B	AR-12	RSP-1117	2N236B	2N242	P-40
AR-8	2N1314/0C26	2N236A	2SB26	———	2N236B	AR-12	RSP-1117	2N236B	2N242	P-40
AR-9	2N1314/0C26	2N236A	2SB26	———	2N399	AR-13	2N257B	2N399	2N242	P-40
AR-10	———	2N236A	2SB26	———	2N399	AR-12	2N257B	2N399	2N242	P-40
AR-11	2N1314/0C26	2N155	2SB26	———	2N155	AR-12	2N155	2N285A	2N242	P-40
AR-12	2N1314/0C26	2N236A	2SB26	———	2N236B	AR-12	2N257B	2N242	2N242	P-40
AR-13	2N1314/0C26	2N236A	2SB26	———	2N399	AR-13	2N257B	2N242	2N242	P-40
MN-25	2N1314/0C26	2N235A	2SB26	DS-503	2N399	AR-12	2N257B	2N236B	2N242	——-
DS-501	———	———	———	———	———	———	———	2N677	———	——
DS-503	———	2N235A	2SB26	DS-503	2N235A	AR-12	2N257B	———	2N278	P-40
CTP-1104	2N1314/0C26	2N235A	2SB26	DS-503	2N235A	AR-12	2N257B	2N235A	2N242	P-12
CT-1124	2N1314/0C26	2N236A	2SB26	DS-503	2N257	AR-12	2N257	2N242	2N242	——
1124	2N1314/0C26	2N236A	2SB26	DS-503	2N257	AR-12	2N257	2N242	2N242	——
2N176	2N1314/0C26	2N235A	2SB26	DS-503	2N176	AR-12	2N257	2N176	2N242	P-25
2N155	2N1314/0C26	2N155	2SB26	DS-503	2N155	AR-12	2N155	2N155	2N242	P-25
2N235B	2N1314/0C26	2N235B	2SB26	DS-503	2N235B	AR-12	2N155	2N235B	2N242	P-40
2N285	———	2N155	2SB26	DS-503	2N285A	AR-12	2N155	2N285A	2N242	P-40
2N399	———	2N399	2SB26	DS-503	2N399	AR-12	21257W	2N399	2N242	P-40
2N401	———	2N155	2SB26	DS-503	2N401	AR-12	2N155	2N401	2N242	P-25
2N419	———	2N236A	2SB26	DS-503	2N419	AR-12	2N157	2N419	———	P-40
2N1007	2N1314/0C26	2N235A	2SB26	DS-503	2N235A	AR-12	2N157	2N1007	———	P-40

the secret's in the circuit!



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*U. S. Patent 2,761,023—triode neutralization circuit

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peaks begins to appear in the waveform. Measure the rms voltage across the 10-watt resistor and calculate the audio power output.

From a data manual, determine the maximum permissible power output for the replacement transistor and compare this figure with the measured value of output power. If your test figure doesn't exceed the limit specified for the substitute type, you can assume it will be safe to leave the new transistor in the circuit. If a transistor in a push-pull stage fails, it should be replaced with one having characteristics very closely matched to the other unit in the push-pull pair; otherwise, a complete new matched pair of transistors will have to be installed. This is necessary since both halves of a push-pull stage must be balanced to obtain undistorted output. It may be easier to install a matched pair of transistors of a substitute type than to attempt to match an existing transistor.

The final test of a replacement unit is to reconnect the speaker and tune the radio to a strong local station. If you hear clean, undistorted sound of adequate volume, you have successfully substituted the output transistor.

RCA Fuse Replacement Data

Fuse protection of some RCA TV receivers can be improved by replacing the older nonchemical fuses with the newer chemical-type fusible surge limiter, RCA part number 105041. The following types of fuses can be thus replaced.

.25	amp	(cartridge)	72104
.25	amp	(pigtail)	73600
.3	amp	(cartridge)	78214
.3	amp	(pigtail)	77935
.45	amp	(cartridge)	78798

Use clips (RCA stock number 105575) to install chemical units in place of pigtail-type units.

Tuner Burns Fusible Resistor

This failure, reported by John R. Dobbs of Arlington, Mass., happened in a 1957-vintage, 21" Admiral receiver. It could just as easily have occurred on any other set using Admiral's disc-type tuner (a combination turret and incremental-inductance unit).

The customer's original complaint was a completely inoperative receiver. Since the set employs a series filament hookup, a selenium-rectifier power supply and a fusible surge-limiting resistor, the first action taken on the home service call was to check the fusible resistor. It was blown, so a new 7.5-ohm unit was selected and installed. Not wanting to blow out another fusible unit just to prove the existence of a short circuit, the technician removed the damper tube before applying AC power. This step removes considerable DC current drain from the B+ supply and allows basic operation of the rectifier to be checked. When a DC voltmeter indicated a nearly normal voltage at the output side of the filter, it was decided to take a chance on reinstalling the damper tube. The B+ voltage was monitored throughout the 10-second warm-up period. Sound and picture came on normally, and B+ voltage settled down to a normal full-load value.

The tuner was set to receive one of the high-band VHF channels available in the area. Deciding that operation on the other active channels should be checked, he began rotating the channel-selector knob. Everything was fine as he turned across the high band; however, when he reached the low band, everything began to happen at once. Smoke began boiling out of the fusible resistor, and the receiver went completely dead.

With the tuner still in the same position as it was when the trouble broke out, the serviceman once

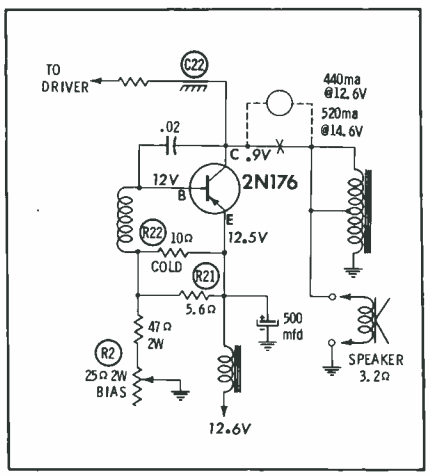

Fig. 1. Bias control must be reset whenever power transistor is replaced.

The clue that points to profit!

All the skilled deductions of a super sleuth will only confirm what servicemen already know — that a caddy full of Tung-Sol tubes is the clue that points to profit. Made to industry's highest standards, Tung-Sol tubes provide original equipment performance for all radio, tv and hi-fi service. Fewer callbacks mean more profit. Tung-Sol tubes mean fewer callbacks — so use more Tung-Sol tubes! Tung-Sol Electric Inc., Newark 4, N. J.

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again checked the resistance of the B+ load circuit—and found a dead short this time! Just for curiosity's sake, he switched the tuner back to a high-band channel, and the short disappeared. Repeated switching back and forth produced an alternation between "short" and "no short" conditions.

At this point, there could be no doubt about the source of the trouble. A short in the B+ circuit was occurring within the tuner on low VHF channels only. When the tuner shield was removed, a thorough visual check revealed the condition shown in Fig. 2. Somehow, a plate-circuit coil in the low band RF amplifier circuit had become shorted to a grounded lead on the turret.

This trouble, while not difficult to solve, could have gone unrepaired in the home and could possibly have wound up as a "dog," if it hadn't been for the serviceman's thorough test procedure. If you don't already do so, make it a hard and fast rule to check all channel-selector positions and all operating-control settings on every set you service.

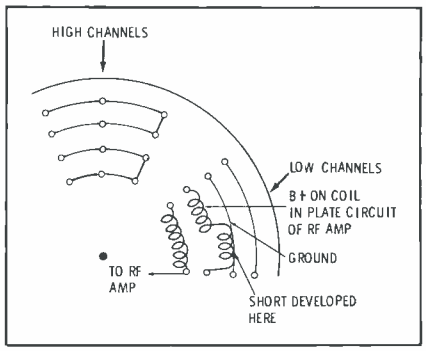

Fig. 2. B+ fusible resistor blew out because of shorted coil in disc tuner.

Remote Service for Remote Unit

One of the things becoming more apparent every day is that there are a lot more sources of supersonic sound, and a lot more of it floating around, than most of us realize.

Take the case we recently heard about as an example. One of the better customers of a local shop called to complain about a remotely controlled set that kept turning itself off. It seems their boy was home from school due to illness, and the TV had been placed in his room to help pass the time. The remote transmitter had been placed at his bedside.

The customer was questioned about the possibility of some toy being the source for the "wrong-frequency noise," since the unit operated on the supersonic sound principle. The answer was "No, he's not doing anything—just lying quietly in bed."

A little more conversation established that he was wearing a chain about his neck, with a medal strung on it. At the technician's suggestion, the medal was moved along the chain to see if it might be the source of the trouble. The answer came back, and a chuckle along with it, "That's it!"

Net results: A well-satisfied customer, a happy serviceman who avoided making a call that might well have cost him more than he could charge, and of course, the benefit of the type of humor we could all use a little more of these days.

Take a tip from us: Think just a bit when you get a call to service an erratic remote control unit. ▲

FEDERAL TAX RETURNS

for service shop owners

All income, unless specifically exempted by law, must be reported on your Federal income tax return. This includes income from your business, salaries or wages, bonuses and tips, interest and dividends, rents and royalties, and other similar items.

At the same time, you are entitled to deduct expenses incurred in the production of this income. As the operator of a business, you may make deductions for wages and salaries, operating expenses, and the cost of merchandise sold. Deductions are also allowed — under certain limitations — for depreciation, (wear and tear, exhaustion, obsolescence) and amortization.

Only the owner of a piece of property is entitled to the deduction for its depreciation. Deductions are determined by reducing the cost of the propery by the estimated salvage value at the end of its useful life. The difference is prorated over the remaining life of the equipment in actual use—not necessarily over its inherent useful life. For example:

Estimated useful life of voltmeter to taxpayer	3 years
Cost of voltmeter July 1, 1959	$100.00
Estimated salvage value at time of disposal	25.00
Amount to be depreciated over 3-year period	75.00
Depreciation per year 1/3 of $75.00	25.00
1959 depreciation deduction 1/2 year	12.50

The cost of oscilloscopes, signal generators, sweep and marker generators, tube testers, etc., can be depreciated in the same manner. Small hand tools (such as pliers, screwdrivers, etc.), having a useful life of less than one year, are not included in the depreciation schedule, but are charged to supplies.

To decide which shop improvement should be "capitalized and depreciated" and which ones should simply be charged to "repairs and maintenance," the following rule may be applied: Any cash outlay which prolongs the life of an asset or increases its value is usually considered a capital expenditure subject to depreciation. An example of this would be the application of a new roof on a building or the installation of a new or rebuilt motor in a car or truck. If the vehicle is used partly for business and partly for personal use, the operating expense and the depreciation should be prorated according to the actual mileage driven for each purpose. No deduction is allowed for personal use.

The "straight line" method of computing depreciation is most commonly used, but other types, such as *declining* balance or *sum of the digits* may be used to permit depreciation at a faster rate when the asset is newer. No set rule for determining the life of an asset is available, since the term "useful life" depends upon the extent and severity of usage by the owner.

The Small Business Tax Revision Act of 1958 provides that a taxpayer (except a trust) may choose to take an additional first-year depreciation allowance on tangible personal property, new or used, acquired by purchase after December 31, 1957 and having a useful life of six years or more.

This additional allowance, amounting to 20% of the cost of such property, may be obtained only in the first taxable year for which a depreciation deduction is allowable under the Internal Revenue Code. In determining the cost of property on which the additional allowance is based, such cost does not include the trade-in allowance in a non-taxable exchange; in other words, the additional allowance is 20% of the "boot" paid. For example:

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4	NLW 10-15	10	15
3	NLW 50-15	50	15
3	NLW 100-15	100	15

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9/1/59 Cost of new signal generator		$360.00
Trade-in allowance		60.00
"Boot" paid		300.00
Additional depreciation allowance, 20% of $300		60.00

The regular depreciation is computed as follows:

Cost or basis of old generator		$240.00
Less: Depreciation allowed or allowable		150.00
Unrecovered cost		90.00
Allowed on trade		60.00
Unrecognized loss on trade		30.00
9/1/59 Cost of new generator (6 yr. life)		$360.00
Add loss above		30.00
Basis for depreciation		390.00
Less: Additional 1st-year allowance	60.00	
Salvage value	60.00	120.00
Balance subject to depreciation		270.00
Annual depreciation (1/6 x $270)		45.00
Depreciation for 1/3 year from 9/1/59 (purchase date) to 12/31/59		15.00
Additional 1st-year allowance		60.00
Total depreciation for 1959		75.00

If the trade-in allowance on the old generator *exceeds* the unrecovered cost, the purchase price of the new generator must be *reduced* by the non-recognized gain on the old generator.

There are special rules for the additional first-year allowance for partnerships and corporations; their decision to take the allowance must be made within the time prescribed for filing the return for the taxable year, including extensions of time for filing.

One return in every four has a mathematical error in it. Check and double-check all computations. File your return as early as possible, and be sure it is properly signed. ▲

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The low initial cost of AC-DC radios puts the technician in a sad position. He must either repair them for peanuts, or forego the work and lose customers. The best way out of this situation is to develop a technique for expediting the analysis and repair of these "poor relations" of the radio family. Here is a sequence of tests that will enable you to dispose of most small-radio troubles in a minimum of time.

The very first check should be for the purpose of revealing whether or not there is a dead short across the AC line. An ohmmeter connected across the power plug (with the switch turned *on*) should read in the vicinity of 200 ohms, representing the cold resistance of the tube string. Any lower reading calls for additional checks before the set is plugged into the power line. An infinite reading usually suggests a burned-out tube, although it could also mean an open line cord or switch.

Transformerless half-wave power supplies may be wired in either of two ways. In some sets, one leg of the power line is connected directly to the chassis; in others, this "low" side of the power line goes to a B-minus or common-reference point which is isolated from chassis by an RC network (usually consisting of 470K ohms in parallel with .1 mfd). The former arrangement naturally presents a greater shock hazard than does the latter, but both can be dangerous. To evade this danger, use an isolation transformer or else take care to insert the power plug into the AC receptacle with the earth-ground side going to chassis or B minus. How do you know when the line plug is correctly polarized? Take a neon lamp and bridge it from chassis or B minus to some point at or near earth ground. (Your bare hand may be a suitable test point!) If the lamp glows, reverse the plug.

By the way, be sure to check any "isolation transformer" for primary-to-secondary isolation before using it! A friend of mine slipped up on this point. He says the results felt as if two of his molars were being pried loose with no anesthetic!

Most troubles in AC-DC radios stem from defective tubes, particularly open heaters. Often, you can fix a set by merely finding the tube with the open heater and replacing it. The quickest check, when the set is out of the cabinet, is to apply power, set an AC voltmeter to the 150-volt range, connect one lead to B minus, and probe the heater connections of each tube in turn. An open heater in a tube will cause the meter pointer to register full line voltage at one heater connection, but zero at the other. Tubes with three heater pins, such as the 35Z5, 35W4, etc., can be assumed to have open heaters if you measure the full line voltage at one connection and zero at any other. Those tubes between a burned-out one and the B-minus end of the string, being isolated from the "hot" side of the AC line, will appear completely dead.

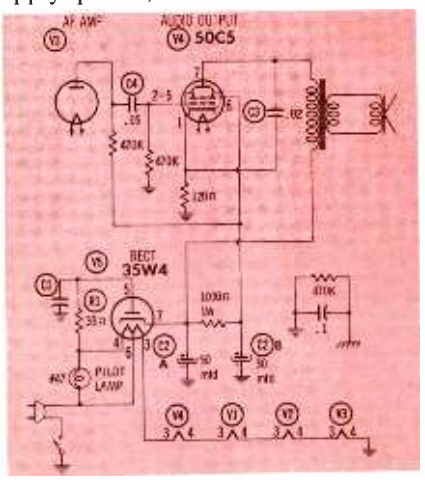

Fig. 1. Power-supply, filament, and audio circuits of typical AC-DC radio.

It's too bad the set has to be disassembled to make the above test, but let's face it—not much servicing can be done on today's AC-DC sets without taking the chassis out of the cabinet. I make exception, of course, to those shops endowed with a mite-sized leprechaun who, at a word or crack of the whip, can crawl right inside the cabinet, locate and remove the tubes for test, and return them to their proper sockets to the lilting refrain of "Whistle While You Work." There are not enough of these little men to go around, so the rest of us had better forget this dodge. Plucking two knobs from the front and unscrewing a few chassis bolts from underneath is not too great a price to pay for ease of procedure.

Next to filament burnout, the most often encountered fault in AC-DC sets is a defective power supply. The B+ circuits of these receivers are fairly uniform, generally following the layout shown in Fig. 1. In some receivers, the 35W4 is replaced by a selenium or silicon rectifier, and the pilot light is omitted; however, this discussion will concentrate on the more familiar circuit using a tube. Most of it will apply as well to sets equipped with semiconductor rectifiers. Some power supplies incorporate a small, quarter-watt surge resistor R1 in series with the plate of the rectifier. Others do not have this resistor, and depend only on the pilot light and its associated portion of the rectifier filament for surge protection. Some use both a resistor and a pilot lamp, as in Fig. 1.

No more fireworks for me!

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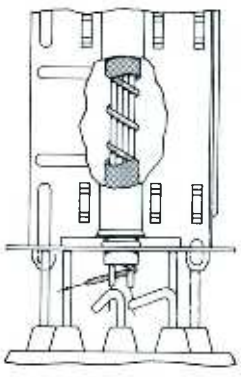
Typical of the many design features of CBS dampers is this new anchored heater-cathode insulator. Actually a tungsten coil coated with insulating material, it is mechanically anchored to prevent any movement that might lead to heater-cathode shorts. As a secondary precaution, the coil has fewer turns to minimize cathode-to-insulator contact, yet maintain perfect heater-cathode spacing.



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Whenever a set comes to the bench with a burned-out or charred surge resistor, or blown pilot-light section of the rectifier, stop—look—and investigate thoroughly before replacing them! A shorted C1 is the usual culprit in these cases. Remove the rectifier from its socket and check this capacitor with an ohmmeter. A reading of anything less than infinity is a warning to change C1. Of course, the short may lie elsewhere—for example, in C2 or C3. (A resistance reading of 20K to 30K ohms across C2 is normal.) In any event, be sure you have found the short before replacing the resistor and rectifier.

The pilot light's brightness is a good indication of the rectifier's efficiency. What we call a weak rectifier generally means one incapable of passing enough current. In AC-DC radios, this condition "starves" the pilot light and causes it to burn less brightly. If a pilot light continues to burn dimly after a few minutes of operation, and the set is performing weakly, the rectifier is probably in poor condition.

A weak set is often afflicted with low B+ voltage. The electrolytic filter capacitor C2 is a prime suspect in these cases. Hum may, or may not, be present. If the condition clears up when a good capacitor is bridged across the suspect, it is reasonable to assume that C2 should be changed. If the condition remains the same, the filter capacitor is not necessarily good; it still may be leaky. A rough check for this condition can be made by using a dummy output tube—one of the same type as used in the set, with its plate and screen pins removed. Replace the output tube with the dummy, turn the set on, and take a reading across C2A, the first section of the electrolytic can. Make note of the DC voltage, and then remove the power without disconnecting the meter. If C2A is leaky, the meter will rapidly return to zero. A good capacitor, discharging through the high resistance of the meter, will cause the pointer to return more slowly to zero. Each section of C2 should be tested in turn. If one is found faulty, it is best to replace the entire unit. Experience shows that this is the best procedure, since good sections often become fouled up soon after a defect develops in one.

With DC output normal, but still no signal coming from the speaker, two quick checks (not even requiring meters) can pinpoint the faulty section. It helps to consider the set as being made up of three sections: power supply, RF, and audio. Since the power supply has already been checked and found OK, your attention can be focused on the RF and audio sections. To check the audio, turn the volume control to maximum and touch its "high-side" connection (or the center arm) with a clip lead or a finger. A good audio section will respond to this introduction of AC by a loud hum issuing from the speaker.

The RF section (antenna, converter, IF, and detector stages) can be checked by closely watching the pilot light as the set is tuned throughout the broadcast band. The light should grow dimmer when a strong station is tuned in, and should be brightest when no station signal is being received.

The foregoing two checks serve to draw your attention to the de-

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WR-49B SIGNAL GENERATOR

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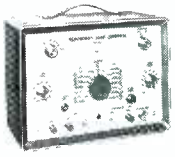

WR-69A TELEVISION/FM SWEEP GENERATOR

For visual alignment and troubleshooting of TV rf, if/vf circuits and other electronic equipment. IF/video frequency ranges 50 Kc to 50 Mc, TV channels 2 to 13, plus FM range—88-108 Mc. Sweep width 0-12 Mc or more. Output level—0.1 volt or more. Attenuation ratio 60 db or more below maximum output. $295.00* (including all cables instruction book).

WR-70A RF/IF/VF MARKER ADDER

To be used with WR-69A, WR-99A or similar electronic equipment. Eliminates waveform distortion due to overloading receiver during visual alignment techniques by adding markers after the rf signal is demodulated. $74.50* (complete with cables, instruction book).

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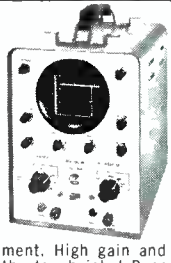

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RADIO CORPORATION OF AMERICA

Electron Tube Division **Harrison, N. J.**

fective section. In those sets not employing a pilot light, you will have to rely on the audio check and a little shrewd thinking to spot the faulty section. It helps to remember that the RF and audio sections of a set rarely conk out at the same time, provided the power supply is functioning as it should. So, it is safe to assume that the RF is at fault when the audio is normal, and vice versa.

Finding the faulty stage within the faulty section is another matter. Signal tracing is a good procedure for the audio section. This can be performed with an AC meter of fair sensitivity (5000 ohms per volt or better). Unless the instrument has a built-in isolation capacitor in series with one lead, install an external capacitor — preferably .1 mfd at 600 volts.

With the meter set to its lowest AC scale, apply the probe to the plate of the first audio tube. Tune the set to a strong local station, and watch for the meter pointer to move in unison with audio modulation. This response will be noted if all circuits leading up to the audio stage are OK. If not, find out why not. First try replacing the tube; then move the test lead from the plate of the first audio amplifier to the grid of the output tube. The same fluctuating meter response should be noted here. If the response is weaker, change the coupling capacitor. Before moving to the plate of the output tube, be sure to change the range of the meter to accommodate the higher audio voltages expected. The 60-volt range should be sufficiently high. A hefty signal at the plate of the output tube, but no output from the speaker, indicates an open circuit in either the secondary winding of the output transformer or the voice coil of the speaker. This is a frequent fault in small sets.

If the preliminary checks suggest that the fault is somewhere ahead of the volume control, a continuity check of the antenna comes next; then you should check the converter. See if you can obtain a negative DC reading at the oscillator grid; this will tell you if the oscillator is functioning. A changing negative DC-voltage reading at the signal-input grid, as the set is tuned through the band, will tell you that the AVC circuit is also functioning.

If caught without a VTVM—say, during an "on-the-spot" repair in the home—you can still check the oscillator with a less sensitive meter. Setting a VOM to the 150-volt DC range, touch the probe to the anode of the oscillator (pin 6 in a 12BE6) and watch the meter while you short across the oscillator coil with a clip lead or screwdriver. If the voltage dips slightly, this indicates that the bias on the tube has been reduced—in other words, the tube was oscillating. AVC action can be identified with the same meter. Monitor the plate voltage of the IF tube as the set is tuned through its range. It should tend to dip between stations, and rise on strong stations. If the converter or IF tube is weak, you may not find a clear-cut indication of AVC action.

Another common problem in small radios is distorted or mushy output. The cause is normally a gassy output tube or leaky coupling capacitor (C4 in Fig. 1). A quick way to determine which component is causing the trouble is to measure the DC voltage at the grid of the output stage. If there is a positive reading, one of the above two components is almost certainly to blame. Leaving the meter connected to the grid, momentarily short the plate of the audio amplifier (V3) to B minus. (B+ is protected by the high value of the plate load resistor while making this test.) If the grid voltage drops to zero, the capacitor is bad; if it remains slightly positive, the tube is bad.

Once in a while, you can expect to run across an unusual case which will try your patience and challenge your ingenuity — in other words, you'll get your share of "dogs." But you can expect a lot more of the ordinary, run-of-the-mill cases which, if efficiently handled, will keep the cash register from getting rusty. An uncounted number of small radios are lying around waiting for hospitalization. Someone is going to make a buck fixing them. I hope it is you. ▲

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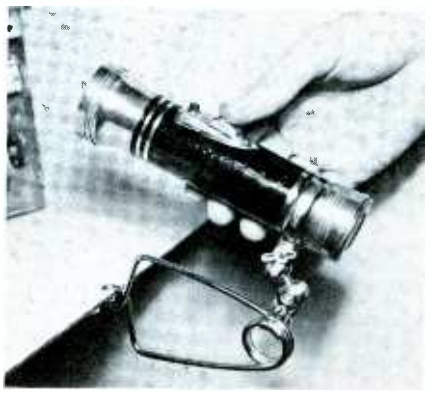
TIPS for TECHS

Stand-Off Eye is Good Grommet

Need a feed-through grommet for a cable or group of wires? If you don't seem to have one large enough on hand, borrow the "eye" insulator from an antenna lead stand-off and try it for size. No doubt it will do the trick.

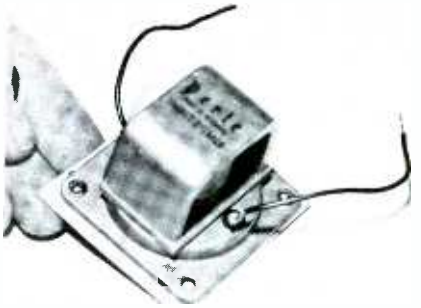
Extra Uses for Heat Lamp

Most radio-TV shops have at least one heat lamp for finding thermal intermittents. Such a lamp is also handy for several other purposes. For example, you can always use it to "put the heat" on slow-drying touch-up jobs (go easy — paint and varnish blister easily). Or you might use it to quickly dry out a "steamy" TV that has just been brought in from the cold outdoors. (That moisture collection starts corona jumping in every direction!) You'll discover other uses, too.



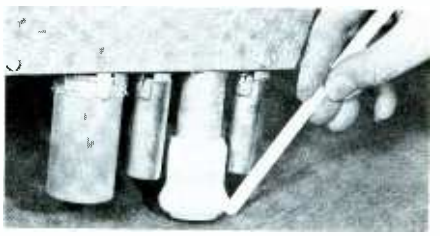
Bench Clamp for Flashlight

One of those clamps like the kind photographers use on floodlights also comes in handy as a flashlight holder. By fastening the flashlight as shown, and clamping it to the edge of the bench, you can angle the beam anywhere you need it for soldering or testing.



Guard for Speaker Cone

To prevent an unmounted speaker's cone from being punctured by other parts and tools, cut a guard from cardboard and fasten it over the cone with the mounting screws. This keeps the speaker mounting screws from being misplaced, too.



Use for Crutch Tip

A heavy crutch tip placed over an electrolytic of an auto radio keeps tubes and other parts from resting on the bench. Forced over the handle of a screwdriver, it can be used to tap vibrators or other intermittent parts.

Washer Locks Pencil Tip

To keep the screw-on tip of a pencil soldering iron from working loose, remove the tip, drop on a lockwasher and screw the tip back in place. This eliminates the annoyance of having to dig out a pair of pliers to tighten up the hot tip every time you use the iron.

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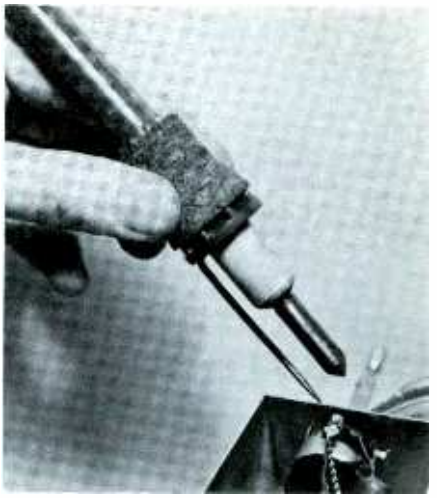


Soldering "Eye-Opener"

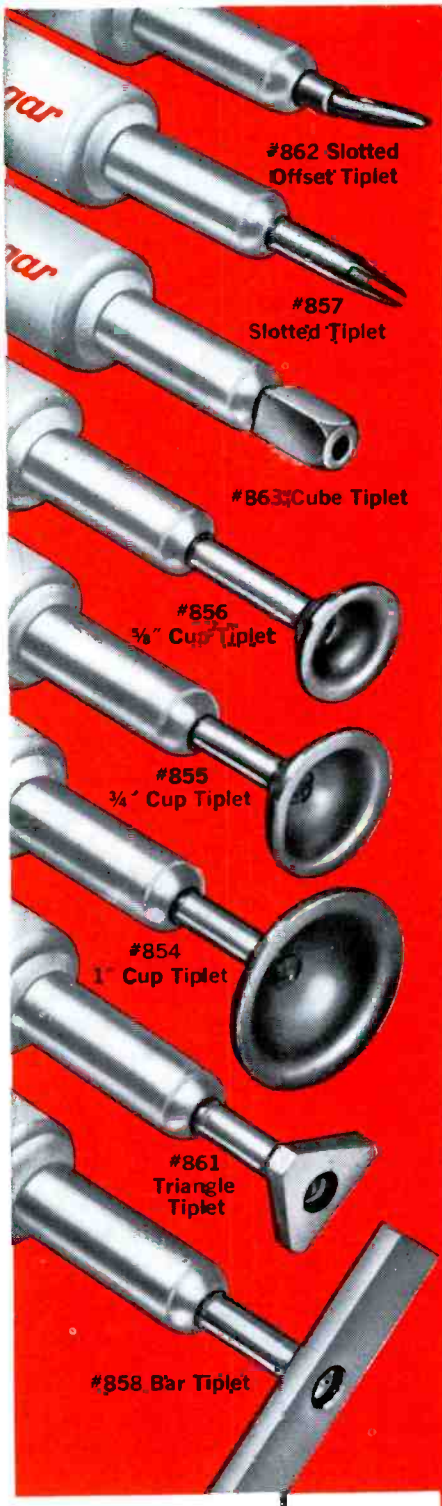
If you have a tough time cleaning lug eyes of solder to insert a wire, why not give your iron an "eye-opener"? Take a 3½" piece of wire clothes-hanger and make a round loop in one end to fit over the neck of the heating element for your pencil iron. Then file the other end to a point, slip the opener over the element, and screw the element back into the handle. Now you can heat the solder-clogged eye and insert the opener before the solder hardens—all with one hand.

Hanger for Soldering Pencil

Ever wish there were some way you could hang up your pencil iron when it isn't in use? Just put some plastic wood into the end of the barrel and insert a cup hook as shown before the composition filler hardens. This is much better than hanging the pencil up by its electric cord—a practice followed by some unthoughtful technicians.

Stand-Off As Guy-Wire Anchor

Lacking a guy-wire antenna anchor? A stand-off of the screw-in variety with the insulator removed makes a good substitute. Just screw the standoff in as you would a regular anchor ond attach the guy wire securely. This is much better than using nails or some other fastener that might pull out easily.



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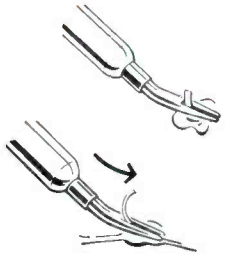
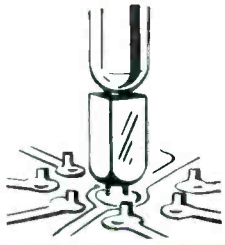
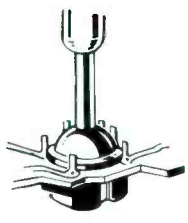


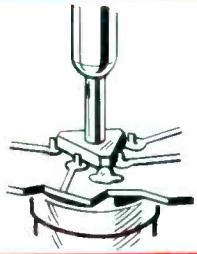
Offset Slotted Tiplet straightens leads, tube tabs and small wires bent close to board.



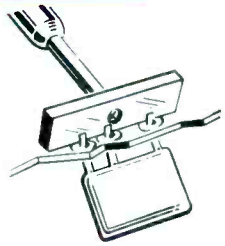
Cube Tiplet removes center pins of tube sockets and harness leads.



Cup Shaped De-Soldering Tiplet removes solder from circular multi-lug components in one operation.



Triangle Tiplet melts solder on leads of electrolytic capacitors simultaneously.



Bar Tiplet simultaneously melts solder on all multiple straight line network components.

Selling TV Distribution Systems

How to make a convincing bid for master-antenna installation work.

by Jack Beever

This writer has worn quite a few pencils to stubs telling electronic technicians how to plan and install television distribution systems. However, you need to know more than *how* to do the job—you have to *sell* it first, and what you have to sell, primarily, is service.

Selling a service is different from selling a product. Not only is it intangible, but it must be sold to people who do not understand the technology you are selling—yet they are required to make a decision on the impression you make *and your written proposals*. The last words are italicized because the man who says "yes" to your bid may have to judge you solely on the written material you submit—and never forget, contracts are not necessarily given to the lowest bidder. As often as not, the bid will be awarded on confidence in the bidder's know-how.

Let us look at the market. It encompasses every structure that temporarily or permanently houses a number of people. This includes apartment buildings, hotels, motels, schools, hospitals, dormitories, old people's homes, and prisons. It covers a different phase, also—groups of single-dwelling units fed from a single antenna site. The first are by far the most numerous, and can be subdivided into existing buildings as well as those to be constructed. The phase of selling which usually baffles the beginner is the new construction market, largely because the chain of command is not known to him.

Almost without exception, *every new multiple-dwelling building plan specifies TV wiring*. The whole thing starts with someone's decision to have a building constructed. The next step is to commission an architect to design the building, and he is the one who specifies the locations of the TV outlets. He may or may not indicate the general wiring plan for TV distribution, but if he does, *this does not fix the plan*. It is subject to change for any logical reason.

When the design of the building satisfies all parties, a general contractor enters the picture. He assumes *responsibility* for erecting the building, although his company does not necessarily do all the work. Usually he handles the heavy construction and subcontracts such things as heating, plumbing, plastering and electrical work. *The TV system is usually part of the electrical contract,* and the electrical contractor will install all boxes and conduit. Furthermore, he usually insists on pulling the wire through the conduits. He is rarely foolish enough to think he can handle the specialized job of installing antennas, tap-off units, amplifiers, splitters, and other parts of a TV system. These jobs he subcontracts to someone like you, if you can convince him you can handle it.

Knowing these facts, you can plan an effective selling program. Start with the architect, but try to get to him before he gets the job of designing a new building. He has a problem, and if you can help him, you'll be helping yourself. He is not a TV distribution expert, but he must specify the TV system. He does this by copying a specification usually given him by someone connected with a manufacturer. It does not always fit his particular job, and quite often he overspecifies,

Fig. 1. Sample proposal for the installation of a TV master antenna system.

Electrical Contractors, Inc.
1212 Olyphant Drive
Megapolis, Pa.

Attention: Joseph Blandings, Manager
Subject: Master Television Antenna System Installation, Page 1 of Proposal.

Gentlemen:

Master Technicians, Inc., is pleased to submit the following proposal for the installation of a TELEVISION MASTER ANTENNA SYSTEM at the CHADWICK ARMS, 6322 Brookwood Lane, Megapolis.

We will supply and furnish all equipment and services necessary to install a Master Antenna System designed to provide signals at each of 263 outlets from Channels 2, 5, 11 and 13 at the above building. Outlets are to be provided at all points specified in the electrical plans issued to us on May 17, 1959, dated April 5, 1959, with final modification of plans dated April 27, 1959.

We will supply all necessary antennas, amplifiers, distribution equipment, coaxial cable, hardware and metal cabinetry with locks for the amplifiers.

We will furnish the labor necessary to install the equipment described above, with the exception of installing the cable in the conduit provided. We will perform this work according to standard practices and adjust the system to meet standard tests.

We will guarantee and maintain the system for one (1) year from the date of final adjustment and balancing of the system.

Page 2 of Proposal

Description and specifications governing installation of the system are listed on an attached sheet and become a part of this proposal.

All the above, we will furnish and supply to you at the Chadwick Arms for the sum of _____ dollars and _____ cents ($0000.00).

It is understood and agreed that you will furnish any consents or permissions that may be required by, or permitted by the management, or by Laws and Ordinances pertaining to this work. It is understood and agreed that you will provide AC outlets capable of supplying uninterrupted 117V, 60-cycle electrical service (except for emergency cutouts) at our amplifier locations.

The above prices are effective for a period of sixty (60) days from the date of this proposal.

The equipment for this system is manufactured by_____ Corporation, which has been continuously producing this type of apparatus for a period of _____ years, and is recognized as a reputable manufacturer.

When this equipment is installed under our supervision, we will guarantee to provide reception at each outlet equal to, or superior to, that provided by the use of an individual antenna for each set under these same conditions.

Payments will be made as follows:

60% payable upon delivery of complete equipment to building.

40% payable when system is completed and final inspection shows it to be in good working order.

Page 3 of Proposal

In order to evidence your agreement and understanding of the details outlined herein, please sign the carbon copy of this proposal, which will then become an agreement between us, and return same to our office.

Very truly yours,

_____
(Company Name)

_____
(Authorized Signature)

Approved, Confirmed, Accepted

_____

_____

_____

_____

Dated_____

DESTROYED—NOT FIRST QUALITY!

...why General Electric cannot ship recovered or rebranded receiving tubes!

One area in every General Electric tube plant is given over to destruction. Here steel jaws chew to fragments all tubes that aren't (1) brand-new production, (2) proved first-quality by extensive tests.

No recovered receiving tubes, no "seconds" can leave a G-E factory. Be quality-safe! Buy only from your G-E tube distributor! *Distributor Sales, Electronic Components Div., General Electric Co., Owensboro, Ky.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

311-302

adding unnecessary costs.

A letter to local architects—offering your services in laying out the TV-wiring specifications for a building and detailing your abilities, the type of equipment you install, and the kind of performance you guarantee—can only do you good. Such letters may result in inquiries for advice. Offer to call on them and discuss their problems without charge, knowing full well that you may not get the job. In many cases, however, *your* specifications will be used, and quite naturally they will describe the apparatus you use, "or equivalent." This puts you in a favorable position when the subcontract comes up, since it is so much easier for the prime contractor to accept your bid if it fits the specifications exactly.

Your next step is to send letters to electrical contractors, describing your organization, explaining what you can do, and ending with an offer to bid on any jobs he gets. Telephone and personal follow-up calls are worthwhile here, since you can learn a lot by talking to other people. Find out how they handle TV-outlet work, who they work with, etc. These people usually use a reporting service such as Dodge Reports, which keep them up to date on building starts. Possibly you can arrange to be "cued in" on jobs in your line, or if your business warrants it, subscribe to such a reporting service yourself.

You are now in a position to follow up on the sources of information. Do not wait for them to call you; when you hear of a building

Fig. 2. Sample outline describing equipment and service offered in proposal.

DESCRIPTIONS AND SPECIFICATIONS
OF A MASTER ANTENNA SYSTEM TO BE INSTALLED
AT THE CHADWICK ARMS, 6322 BROOKWOOD LANE

The Master Antenna System shall permit a simple connection of an EIA (Electronic Industries Association) standard television receiver to any of the outlets installed, and shall provide reception on Channels 2, 5, 11 and 13. The system will be capable of handling additional future channels.

ANTENNAS:

Antennas shall be of the yagi type, individually tuned for each channel in use. Each antenna shall be matched to coaxial cable before the down-lead proceeds to the amplifiers.

Antennas shall be mounted on metal masts of galvanized steel or aluminum rigidly fastened to coping or other solid walls above roofline, or on terraces or setbacks, approved by you. Installation shall meet existing building codes or regulations and shall be located to give best possible reception from the choice of existing available sites. An electronic survey shall be conducted by the installer to determine the best location for the antennas.

AMPLIFIERS:

Amplifiers are designed for continuous duty, and consume a maximum of————watts of power when operated at 117V, 60 cycle A.C.

The amplifiers shall be mounted in a metal cabinet with lock, on the east side interior wall of the elevator penthouse.

DISTRIBUTION:

The distribution system is designed to present a minimum of 20-db isolation between adjacent receivers on any line and greater isolation to all other receivers.

Outlets are fed from fifteen risers originating in the amplifier enclosure, radiating in the dead space above the ceiling of the 16th floor to the entries of the riser conduits. Riser and radiating cables shall be of RG-59/U cable or equivalent.

Outlets will be mounted in 2" x 4" standard electrical outlet boxes supplied and installed by the electrical contractor. All risers will be terminated in 75-ohm terminating devices at the end of the cable most remote from the amplifier.

OUTLET DEVICES:

Outlet devices shall provide isolation between receiver and line and between receivers, and shall provide signal strengths consistent with good engineering practice, based on existing conditions.

CABLE:

Cable shall be of coaxial type, nominal impedance 75 ohms, and shall meet JAN specifications. All cable shall be new and manufactured since 1954.

UL APPROVAL:

All electronic equipment shall be UL approved and shall be electrically grounded to the satisfaction of your electrical engineer.

GUARANTEE:

Full maintenance shall be provided for one (1) year. Under this arrangement, the installer will supply a guarantee (except against fire, theft, or malicious or negligent damage by others) of the equipment itself, and will answer every service call, relieving building management of any responsibility for system operation other than the transmission of complaints.

ACCESS:

A mutually satisfactory schedule for access to areas of the building necessary for installation or maintenance must be provided the installer-maintainer.

THIS SHOP IS MAKING MONEY

with CLAROSTAT RTV controls

Radio and television repair shops in all parts of the country are increasing their profits with Clarostat RTV controls—the controls that are *right* for the job, *right* from the carton.

RTV controls are manufactured as matched replacements under rigid quality control standards at the factory. Clarostat offers the direct replacement for practically every radio and TV set control ever produced. RTV controls can save you many hours per man per week, raising your output and multiplying your profits.

Always ask for CLAROSTAT!

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GET THE COMPLETE DETAILS ON RTV CONTROLS FROM YOUR DISTRIBUTOR

CLAROSTAT MFG. CO., INC.

DOVER, NEW HAMPSHIRE

In Canada: CANADIAN MARCONI CO., LTD., Toronto 17, Ont.

start, find out who is doing the work and call on them, offering to bid. They will invariably welcome your bid; they like competitive offers.

Your bid itself is not within the scope of this article, but some things associated with it are. Before submitting a bid, do some investigating. Find out what competition has charged in the past. Look over some of the existing jobs to get an idea of competitive installations. What you find may modify your bid. *Do not bid too low just to get a job under your belt.* This will usually frighten the contractor; he'll think you don't know what you are doing and find some reason for throwing out the bid. After all, it doesn't make sense to lose money on your work. If possible, drop in on the contractor before the bid is awarded. He may be unsure about some point in your proposal which a little conversation can straighten out. But, above all, have a good proposal in the contractor's hands. A sample proposal is given in Fig. 1. Do not copy it, but use a similar style and, naturally, the right names.

Submit your proposal in duplicate, preferably in one of the imitation leather binders available at stationers (the kind with the soft metal tabs for holding the paper). Enclose with the proposal any apparatus descriptions and other material that adds support.

Notice how the sample proposal guarantees that reception at each outlet will be equal to or better than single-antenna reception under the same conditions. This is a key phrase; no more, nor any less, should be guaranteed. A properly signed copy of such a proposal, when returned to you, becomes a binding legal agreement.

Attach to this proposal (if using the folder, bind it with the proposal) a detailed outline of your specifications. A sample is given in Fig. 2. This is merely a description of the job you are going to do, but do not get careless; stick pretty closely to the kind of language used here.

Once this package is in the hands of the contractor, all that remains are the follow-up calls. Use common sense here; do not fail to follow up, but don't make a nuisance of yourself, either. A lot depends on your judgment of the other fellow, and they are all different. After all, they're human beings, too! ▲

PUBLIC RELATIONS

by W. C. Pecht

How are *your* "Public Relations"?

Sorry, I didn't mean to pour salt on an old wound. I just thought if you had the time, we might work out a program to endear us to the hearts of those whom we serve.

Obviously, the first step in such a program would be to direct favorable publicity toward the service industry itself.

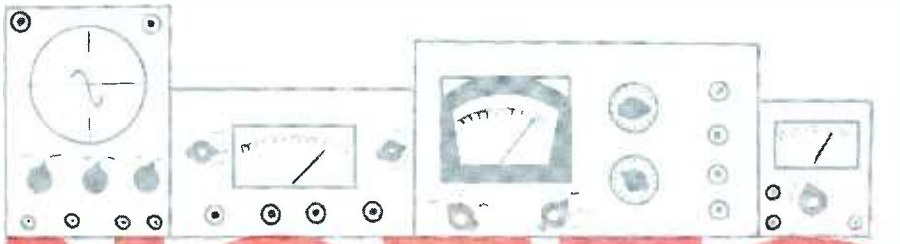
Another thing we could do is TV spot commercials every fifteen minutes in a late, late, late show, we could have a man in a white doctor's coat, with the spotlight on his forehead, claim that "for that tired eyeball, those jumpy nerves from watching out-of-sync pictures, call your independent serviceman and remember, with doctors who know best, it's westerns two to one."

Then, a national beauty contest. No . . . not physical beauty . . . mental beauty. Each contestant has the electrodes of an encephalograph (better look that one up, it's a brain wave indicator) attached to his head, and the one that produces the prettiest pattern on a "scope" wins a trip to the Siberian salt mines (all expenses paid), a mink-lined tube-caddy, and an autographed picture of Frothingham Sturdley, the inventor of the self-stripping tuner slug, the hollow-ground chassis edge, and the one-jolt pilot light. He was given a medal and an annuity for life by the Framis Foundation for his work on the repair-proof knob and the plastic which dissolves when you try to clean it . . . with anything . . . even water. A great man, really great.

Some florist might be sold on the idea of creating a new flower for the profession and call it the "Repairman's Rose" or the "Tube Jockey Jonquil." How about the "Oscillator Orchid" or the "Selenium Sweet Pea?" On second thought, the odor of burning selenium doesn't tend to engender a spirit of aesthetic appreciation; in fact it . . . oh well, you can't pick a winner every time.

Soap operas on daytime radio, new songs, new dances all based on the life of man's best friend, the TV repairman, will elevate you to your proper place in your community. Just imagine "John's Other Test Probe" on radio, or songs such as "Insulation Is Funny, It Smells Something Like Money" or "When I Said You Had a Chassis Like Lassie, I Didn't Mean You Were a Dog." The teenagers won't be able to resist a dance called the "sync slink" or "the vertical roll."

There it is, your glorious future . . . oh, no, not mine . . . I've been thinking about becoming a part-time buggy-whip salesman. ▲



NOTES ON TEST EQUIPMENT

by Les Deane

Specialized VTVM

Fig. 1. The Arkay audio VTVM preamp comes either wired or as kit.

With public interest in hi-fi on the increase, many service shops are now called upon to test and repair audio equipment involving much more than a mere radio-phono combination. Those who have seriously gone into this phase of servicing, however, have found that they need specialized test instruments before they can successfully tackle any and all audio jobs.

The instrument pictured in use in Fig. 1 is a typical example of an instrument primarily designed for audio work, yet one which also, on certain occasions, is useful in radio and TV servicing. The Model AV-20 is an Audio Vacuum Tube Voltmeter made by Arkay International of Richmond Hill, New York.

Specifications are:

1. *Power Requirements — 105/125 volts, 60 cps; power consumption approximately 11 watts; transformer for AC line isolation and standby switch provided.*
2. *AC Measurements—10 rms ranges from 0 to .01, .03, .1, .3, 1, 3, 10, 30, 100, and 300 volts; maximum sensitivity 10 mv full scale; input impedance 1 megohm at 1 kc.*
3. *Frequency Response — 10 cps to 400 kc ±1 db on all ranges up to 100 volts; 10 cps to 40 kc ±2 db on 300-volt range.*
4. *DB Measurements — 10 ranges from –52 db to +52 db; direct-reading scale (–12 to +2) provided; zero db equals 1 mw of AC power across 600 ohms.*
5. *Amplifier Function — instrument serves as preamplifier with amplification factors from 0 to 50 db in 6 different ranges; output impedance 1000 ohms; input/output jacks provided on front panel.*
6. *Panel Meter — 200-ua movement; full-wave bridge operation; edge lit, 6-inch face with 3 individual scales; movement accuracy within 2%.*
7. *Size and Weight—7¾" x 6½" x 4½", 4½ lbs.*

The Arkay Model AV-20 comes complete with test leads and manual in either kit or factory-wired form. With the kit, you also receive detailed wiring instructions, parts list, and several large drawings of the various assemblies. Having the opportunity to use a factory-wired version in our lab, I found the instrument very useful for measuring a wide range of signal levels in audio equipment.

An audio VTVM is much like any other VTVM except it is designed to measure AC voltages only, and therefore its prime application is in audio work. The sensitivity of a conventional VTVM rarely goes below 1 volt full scale with an over-all accuracy of around ±5%. The AV-20 features a very sensitive range of .01 volts full scale, but since the manufacturer did not specify the instrument's over-all accuracy, I performed some calibration tests of my own. Using an industrial-type voltmeter with a rated accuracy of ±2%, I compared about a dozen readings and calculated that the Model AV-20 was within ±3% of this particular standard. Incidentally, I obtained no differences at all on the 1- and .3-volt ranges.

Fig. 2. The AV-20 has a large edge-lit meter with both rms and db scales.

METER RANGE	AMPLIFICATION		MAXIMUM VOLTS	
	POWER GAIN	MULTIPLICATION FACTOR	INPUT	OUTPUT
.01V	50 db	X316.2	.01	3.2
.03V	40 db	X100	.03	3.0
.10V	30 db	X31.62	.10	3.2
.30V	20 db	X10	.30	3.0
1.0V	10 db	X3.162	1.0	3.2
3.0V	0 db	X1	3.0	3.0

Fig. 3. Specifications for preamplifier with *Arkay's* audio test instrument.

From the front-panel view in Fig. 2, note the three separate connectors across the bottom; each is a combination binding post and banana-type jack. The one on the left labeled INPUT is used for voltage measurements and also as an input for the built-in amplifier. The one on the right is used only as an output connection when the unit is being employed as a preamplifier. The center one, of course, is common ground. The small slide switch directly above the ground jack acts as a function selector with three positions — meter, standby, and amplifier. The other two knobs on the panel are for the range selector and power switch.

In making use of the voltmeter function, I measured generator signals in several pieces of audio equipment and checked ripple voltage present in the output of various power supplies. One should remember, however, that any instrument calibrated to read rms voltages, such as the AV-20, is only accurate for pure sine waves. The *root-mean-square* (rms) value of a symmetrical wave is 70.7% of the actual peak value. If you measure voltages with odd wave shapes, such as square, sawtooth, or pulse signals, the meter reading obtained will only be relative and not a true indication of either rms or peak amplitudes.

I also found the Arkay VTVM useful for making decibel measurements. For those of you familiar with power ratings in db, you might be interested to learn how these readings are obtained. The meter has a direct-reading scale of from –12 to +2 db, while its range selector has 10 individual positions corresponding to db levels from –40 to +50. When measuring db, the reading on the scale is either added to or subtracted from the figure indicated by the range

Dependability is a built-in feature of all Delco Radio Service Parts!

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Delco's popular 8-inch "Hi-Fi" speaker, No. 8007, provides the most power and tonal range for the money. Designed for replacement use and high fidelity audio systems, it's a good, fast seller with price and quality appeal.

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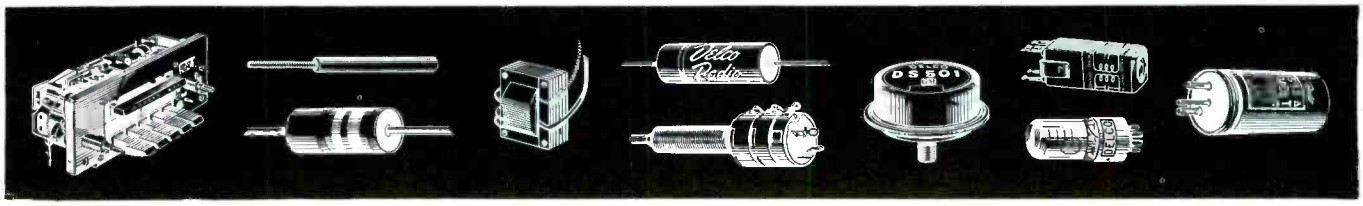


position selected. For accurate and precise readings, one should bear in mind that the load value must equal the calibrated impedance of the db function—or 600 ohms. Naturally, readings across loads other than this standard will only be relative. (For a simplified explanation of the db, review the article entitled "Understanding the Decibel" — August, 1959.)

An additional feature of the Model AV-20 is its capability of performing as a preamplifier for use in the design and repair of audio systems and components. I found this to be a big help when tracing low-level signals and checking the outputs of components such as phono cartridges and microphones.

A table outlining the specifications of the built-in amplifier is shown in Fig. 3. It shows the various levels of amplification obtained with the range selector in different positions; to avoid signal overloading and clipping, the input signal for each range must not exceed the value shown in the maximum voltage column. An amplification factor of nearly 320 can be obtained with this unique feature of the instrument.

As long as I had the unit, I decided to check the amplifier's harmonic and intermodulation distortion characteristics. Employing a commercial test instrument, I came up with harmonic distortion figures ranging from .7% to 2%, depending, of course, on the range of amplification selected. A test for intermodulation distortion disclosed readings of from .8% up to 1.1%, which indicate that the amplifier circuit is relatively distortion-free, and can be used successfully in audio troubleshooting.

First Aid For CRT's

When a customer's picture tube fails, he'll often turn to you and say, "Is there anything you can do with it, or will I have to have a new one?" Is your answer positive, or do you tend to beat around the bush? If you have a portable instrument such as the one pictured in Fig. 4, you can counter with the clear-cut answer, "We'll sure find out soon enough!"

Testing and attempting to repair a picture tube in front of the owner not only justifies an additional charge for this service, but also makes it easier to promote the sale of a new tube—especially if its need is doubted by the customer.

The unit being used in Fig. 4 is the Model 440 Cathode Rejuvenator Tester, designed and produced by B & K Mfg. Co., Chicago. The *CRT* will test and/or rejuvenate black-and-white as well as color picture tubes, including newer 110°, low-anode-potential types, and those requiring special filament voltages.

Specifications are :

1. *Power Requirements — 105/125 volts, 50/60 cps; power consumption 5.8 watts with no load; transformers provide line isolation.*
2. *Elements Test — continuity and*

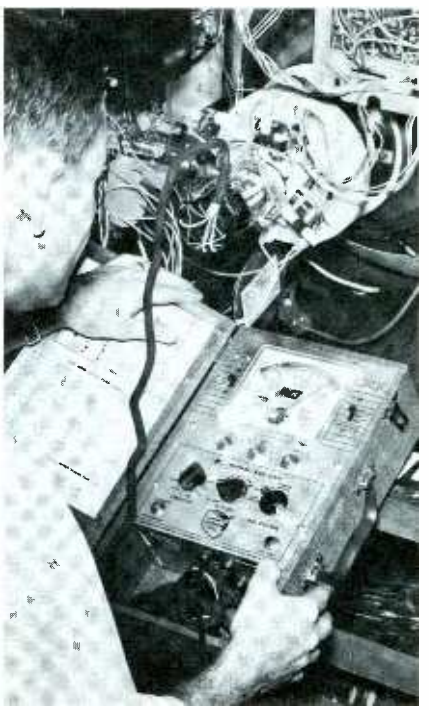


Fig. 4. The Model 440 can test and rejuvenate all tubes including color.

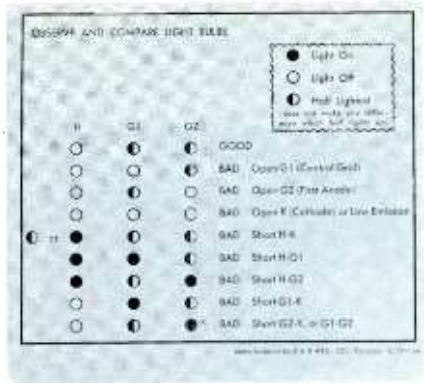


Fig. 5. Easy-to-read chart for continuity and shorts test of the B & K unit.

shorts indicated automatically by 3 neon bulbs on panel; shorts removed and open elements repaired by rejuvenating functions.

3. *Emission Test—cathode emission measured and indicated on* GOOD-BAD *scale of panel meter; rejuvenator restores beam current by reactivating cathode; three levels of rejuvenation intensity provided.*
4. *Cutoff Test — CRT bias required for cutoff indicated by setting of calibrated control on panel.*
5. *Life Test—relative life expectancy determined by fall-off rate of cathode emission as heater voltage is removed;* LIFE TEST *button provided on panel.*
6. *Other Features—12-position heater switch, function selector,* HI-LO *G2 switch, and color gun selector provided on front panel; 4½" meter has* GOOD-BAD *scale, 0-1000 scale, and* CUTOFF *indication; 3 socket adapters and set-up data supplied for special tube types.*
7. *Size and Weight—leatherette case 14" x 8" x 4¾", 10 lbs.*

During my lab examinations, I found the manner in which this instrument detects shorted and open elements of a tube quite interesting. The whole idea hinges around the three neon bulbs directly beneath the panel meter. The one on the left is labeled "H" for heater, in the middle is "G1" for control grid, and the one on the right is "G2" for first anode. With the selector switch in the continuity/shorts position and the test cable connected to the base of a CRT, shorted, leaky, and open elements are automatically detected and identified by the "glow, no-glow" combination of these bulbs.

A key for figuring out bulb indications is given in a special comparison chart in both the instruction manual and inside of the instrument's detachable lid (see Fig. 5). Notice, for example, that it shows if the "H" bulb is out while bulbs G1 and G2 are half lit, the tube is good—a sure sign that there are no shorted or open elements. If the tube is not shorted, but very low on emission, you may encounter the same indication produced by an open cathode—all bulbs completely out. Such a defect, of course, will be caught during the emission test.

I found the operating procedures for testing a picture tube relatively simple. With the heater switch set for the proper filament voltage, and the function selector in its first position, the shorts test is performed as just discussed. If the tube passes this test, the function selector is then advanced to EMISSION, and cathode emission is automatically registered on the meter. Incidentally, the small slide switch, identified as G2 and located just to the left of the meter, should be placed in its HI position for all tubes except the special types noted in the setup data. Since these uncommon tubes normally operate with a potential of only about 50 volts between control grid and first anode, they must be given special consideration. When these tubes are tested, the G2 switch *must* be placed in its LO position.

The cutoff test is accomplished by merely flipping the selector to the CUTOFF position and adjusting the control in the center of the panel until the meter pointer reaches a designated mark on the 0-to-1000 scale. The cutoff point is then indicated by the setting of the panel control, which is calibrated by an area marked *good* over the center portion of its rotation.

A life expectancy test may be performed when the instrument is set up to read cathode emission. After noting a tube's emission reading, the small button in the lower right-hand corner of the panel is depressed. Evaluation is based on the speed with which the meter pointer falls to zero.

Fig. 6. Three socket adapters for different bases furnished with the 440.

Versatility of this instrument is reflected by the three tube-socket adapters supplied in the lid. You'll also find a chart of tube types with special bases and those requiring low voltage for the first anode. The adapter sockets are coded A, B, and C (Fig. 6). Narrow-neck 110° tubes are thus tested by employing one of the accessory adapters, connecting one end to the standard socket of the test cable, and the other to the base of the tube.

From the list of specifications, rejuvenating functions of the B & K unit are obvious; however, I made several experiments to check its capabilities in this respect, and found that cathode emission in a weak tube could definitely be restored and, in most cases, shorts and opens could be corrected.

A Real "Pal"

Ever have a customer refuse to let you take his TV set out of the house? Most of them aren't quite that bad, but it often seems like they expect you to bring your entire array of test equipment into their home and fix the set on the spot. Although you and I both know this is highly impractical, having a portable tube tester and a multimeter available on house calls is often convenient and profitable. The problem, though, is finding units that are small and easy to carry.

Hickok Electrical Instrument Co. of Cleveland, Ohio, has helped matters considerably by designing a multitester small enough to fit in a tube case, yet it can do the jobs most often called for in the customer's home. The Model 820 in Fig. 7 is fittingly named the *Tube Caddy Pal*. It functions as both a tube-transistor tester and vacuum tube volt-ohmmeter, and comes supplied with tube setup data and three 4′ test leads.

Specifications are:

1. *Power Requirements — 115 volts, 50/60 cps; power consumption 15 watts; transformer-operated for AC line isolation.*
2. *Tube Tester — all popular types checked for shorts, leakage, gas, grid-emission, and contact poten-*

tial; sensitivity of grid-cathode leakage 30 megohms, heater-cathode 50 megohms, and grid to screen or plate 100 megohms; 2 ua ranges of 0 to 1 and 0 to 5 for grid current tests; contact potential range 0 to 1.5 volts across 4.7 megohms; 11 prewired test sockets provided on panel; self-storing tube data card supplied; CRT-1 accessory adapter available for checking shorts, leakage, and gas in picture tubes.

3. *Transistor Tester — current gain and leakage measured between collector and emitter with base circuit open; checks both* PNP *and* NPN *units including power types; gain and leakage read on separate meter scales; 4 test jacks and* PNP-NPN *switch provided on panel.*
4. *Voltmeter — vacuum tube circuit with 4 DC ranges from 0 to 1.5, 15, 150, and 750 volts; input resistance on all ranges 10 megohms; range selector and polarity-reversal switch provided.*
5. *Ohmmeter — vacuum tube circuit with 3 ranges of R x 1, 100, and 10K; center-scale calibration 100; zero- and ohms-adjust controls provided on panel.*
6. *Size and Weight—steel case 3½" x 8½" x 6", 4¾ lbs.*

When I first heard about the *Caddy Pal*, I expected it to be an inexpensive VOM housed in the same case with a simple filament checker. However, much to my surprise, I found it contained a sensitive VTVM in addition to a tester that would check tubes for those hard-to-detect troubles such as grid emission, leakage, contact potential, and gas. As noted in the specifications, the instrument also features tests for transistors and picture tubes.

The extremely compact design of the Model 820 is a direct result of the manufacturer's technique in miniaturization. To give you a clearer impression of the unit's appearance, partial views of its front panel are shown in Fig. 8. The ON-OFF switch is part of a 12-position

Fig. 7. Hickok's space-saving instrument is most useful on home calls.

rotary unit, which incorporates settings for heater voltages as well as a PNP-NPN transistor selector. By the way, since the instrument has its own built-in power supply, the operator need never worry about battery replacements.

Referring to Fig. 8A, notice that only a single knob is employed to select all test functions (except for polarity reversal, which is accomplished by a small slide switch near the center of the panel). The OHMS ADJ. control has a dual purpose — conventional calibration of the meter on all resistance ranges, and current limiting during transistor tests. For low-power transistors, the control is set to the extreme clockwise position, and for power types, to the full counterclockwise position.

This photo also shows that two separate jacks are provided for collector elements when checking transistors. The +VTVM jack is used for power types, while the one labeled LOW POWER is used for all others. Although not completely visible in Fig. 8A, the entire upper section of the 820 panel is devoted to tube test sockets.

As you have undoubtedly surmised by now, the *Caddy Pal* is neither a cathode-emission or conductance-type tube tester; but since weak or burned-out tubes are usually quickly discovered during simple substitution tests, the unit performs critical "fringe" checks often overlooked in the customer's home. For example, two or more tubes with a slight amount of leakage or gas can easily slip through a substitution check, but still cost you a profitless callback later.

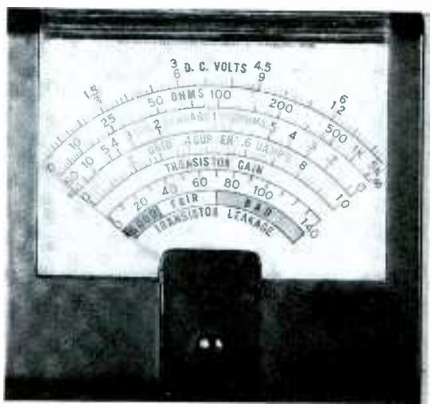


Fig. 8. Operating controls and meter dial of Model 820 *Tube Caddy Pal*.

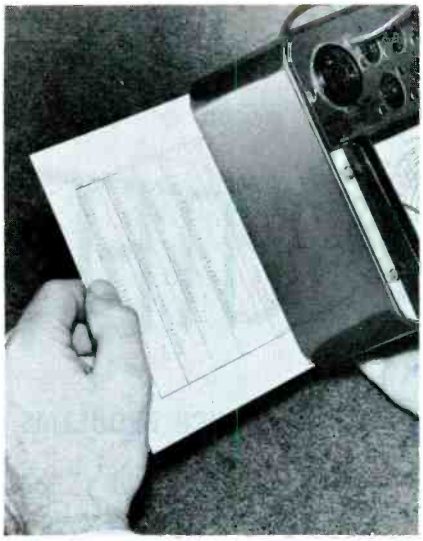
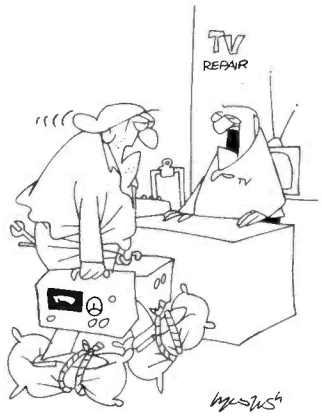


Fig. 9. Plastic tube data card fits behind the tester for easy reference.

In looking through the Hickok manual supplied with the instrument, I found an entire section set aside for the definition of various terms such as "grid leakage," "H-K leakage," and "contact potential." The most interesting to me was the explanation of contact potential. In essence, this is the definition of a static charge which develops between the grid and cathode of a tube due to a thermoelectric effect. This charge, or potential difference, will range from .25 to 1.5 volts for various amplifier tubes.

Contact potential is especially critical in high gain amplifiers such as TV tuner tubes, and unbiased stages such as sound limiters. I found that the Model 820 can be used to detect the amount of this undesirable effect and thus help you choose proper tubes for these applications.

Tube data, including designations for the correct test sockets and heater voltages to use, is printed on a sturdy plastic card furnished with the instrument. The card slides in and out of a built-in compartment on the back of the case as illustrated in Fig. 9. ▲



"Congratulations Smith, 30 calls in one day!"

THE TROUBLESHOOTER

ANSWERS YOUR SERVICE PROBLEMS

Slip into Bars

A Motorola Chassis TS-410A-07 is about to drive me nuts. The picture breaks up horizontally at various periods of time between turn-on and 15 minutes later.

Scoping the horizontal circuit, I find all peak-to-peak amplitudes low with no apparent distortion. The only place where voltage varies is at the plate of the first section of the multivibrator. It drops about 20 volts. I've checked all capacitors and resistors in the multivibrator and AFC circuits.

FLOYD M. NEILL
Independence, Missouri

Production Change Bulletin 76 (in PHOTOFACT *Folder 217-1) contains the answer to the lower peak-to-peak waveform amplitudes. The chassis you have (coded –07) contains modifications to reduce drive-signal amplitude. By the way, waveform W11 in* PHOTOFACT *Folder 194-9 for this set should be shown at pin 1 of V13 instead of pin 4.*

Make certain the ringing coil circuit is adjusted as outlined. Also, you might short across L22 and C81 during warm-up to make certain this circuit isn't causing the trouble.

You are using a good troubleshooting technique when you monitor voltages and waveforms during warm-up. The change in plate voltage may be the tip you need. Reduced voltage means longer conduction and lower frequency. If the bars slope down and to the left when sync is lost, it proves this theory. C79, C80 and R73 would be the prime suspects. Note that C80 is a 10% mica capacitor and should be replaced with an NPO ceramic or 10% mica of the same value.

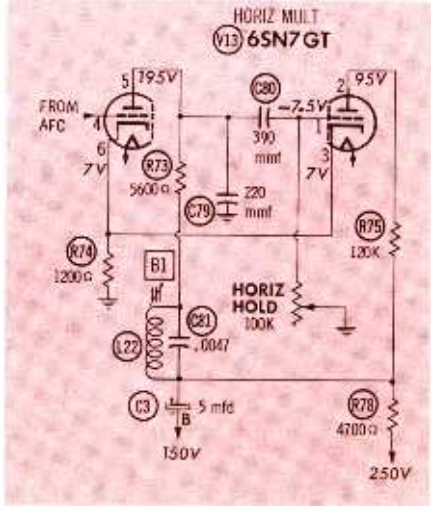
Make sure the voltage on pin 4 isn't changing and causing the change in plate voltage. If it is, look for AFC troubles by monitoring W9 and W10.

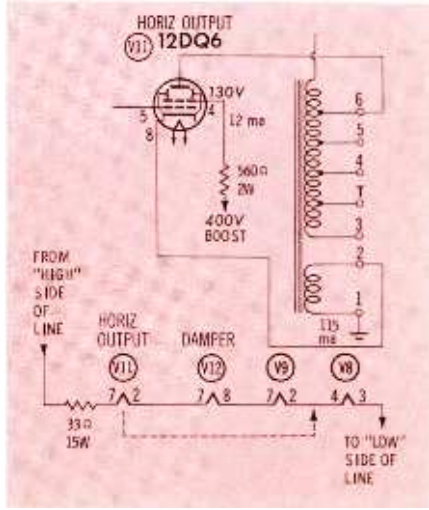
Redo Boo-boo

I am having trouble with recurrent heater-cathode shorts in the horizontal output tube of a Westinghouse Chassis V-2374-1 (PHOTOFACT Folder 450-2). Tubes short after a period of a few days. All voltages and cathode current seem to be within tolerance. Any assistance you can give will be appreciated.

HUGH S. PARKS
Springfield, Missouri

The regenerative pulse applied to the cathode from the separate winding on the flyback, and the electrical placement of V11 near the high end of the series filament string, may hold the key to a solution. The pulse on the cathode is roughly 50 volts peak to peak. Under normal line-voltage conditions, 93 volts rms is applied to the filament. A high





line-voltage condition could easily raise the peak voltage difference between heater and cathode to above 200 volts (the maximum rating for a 12DQ6). The simplest solution would be to move the filament of V11 to a different location in the series string, where the AC potential above ground would not be so high. The damper V12 will be "promoted" to the high end of the series string, but its ratings are high enough to withstand the increase in heater-cathode difference voltage.

More Bars

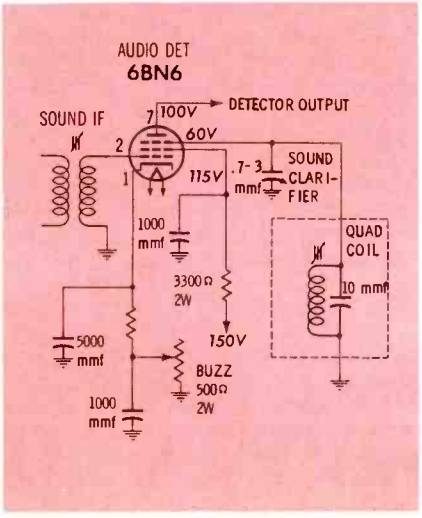
I have an Admiral Chassis 18X4CZ (PHOTOFACT Folder 280-2) with five evenly spaced black bars running from the top of the screen to the bottom. They are about the same width as the normal appearing sections of raster between them. I've substituted all tubes and 'lytics, have disconnected B+ to audio and video, and have tried a new flyback, vertical output transformer, and yoke. No change.

ROBERT D. CHENEY
Detroit, Michigan

Rough! With several places to start, there's no indication of which would be best. Vary the contrast control to see if the black level changes. If it does, the trouble is entering the video circuit ahead of the output stage; if it doesn't, you can forget the RF-IF section and video detector. See if changing the horizontal-hold control setting has any effect. It's possible you have multiple scanning lock-in (several pictures side by side). Determine whether or not the bars are related to signal by switching off-channel. These checks should lead toward the general area of the trouble. Use of a scope is the best way to track down the source of hum modulation, once you know where to begin.

Drifting and Dreaming

The sound in an Olympic chassis GD (Run 5 and higher, covered in PHOTOFACT Folder 417-2) drifts in much the same manner as described in your November, 1959 "Video Speed Servicing"



column for an Emerson. Do you think the same alteration would work in this set? Repeated adjustment of the *sound clarifier* removed the buzz.

HAROLD A. JONES

Baltimore, Md.

The sound clarifier *trimmer has a range of .7 to 3 mmf; therefore, a very small change in capacitance is enough to compensate for the drifting. Adding a capacitor, as in the Emerson, would probably increase the capacitance in this Olympic circuit too much. It would be better to try replacing the 10-mmf capacitor shunting the quadrature coil with one of the same value, but having a temperature coefficient of N750.*

Shaky Grid?

A frying sound in a Webcor Model 2110 tape recorder is proportional to recording level. Scoping the amplifier, I find a 60-cycle ripple in the output of the preamp stage. Shorting the grid of the first section doesn't have any effect, but disconnecting the plate of the same section eliminates the ripple. I substituted several 12AX7 tubes to no avail. Using a 12AU7 as a replacement cured the trouble, but cut the gain. I'd like to restore the amplification to normal.

JIM WOODWARD

Donaldsonville, La.

Sounds like microphonic trouble in the 12AX7. It could be due to vibration pickup from the tape-drive motor which, in turn, is setting up element vibrations within the tube and generating a noise signal with a basic 60-cps waveform. Newer Webcors are using a 7025 as a preamp. You might try one of these, or an ECC83; both types are more ruggedly constructed. Typical operating characteristics are similar to those for a 12AX7—approximately the same gain, and a far better signal-to-noise ratio.

Where'd It Go?

A Truetone has only 1000 volts at the CRT anode, yet the high-voltage rectifier can supply normal output if the HV anode lead is connected to another set. Another set's high-voltage output is killed by attempting to feed it to the picture tube of the Truetone.

A. LYLE BRADLEY

Waynesboro, Va.

Sounds like a bad CRT, but it could be something less serious. Clean the area around the second-anode connection to be sure dirt or carbon deposits are not bleeding the voltage to ground. Excessive beam current in the CRT could overload the HV supply, so measure all pin voltages to see if they are normal. If necessary, substitute a new CRT.

Conversion Headache

Narrow picture and poor linearity are the problems in a Radio Craftsman Model 207 (PHOTOFACT Folder 184-13.) Someone has converted the set to use a rectangular 24" CRT rather than the round, metal 24" originally used. I am enclosing the hook-up sheets (which were given to the customer) for the new flyback, yoke, and width and linearity coils. The horizontal output tube was changed from a 6BQ6 to a 6CD6.

ANTHONY M. STRAKA

Vandergrift, Pa.

Conversion to a 90° system from the original 70° system was a must when a rectangular 24" tube was chosen for replacement. The technician who converted the sweep circuits did a good job, except for selection of the new yoke. The mismatch of the replacement he used is causing the narrow picture and lack of linearity. A 90° yoke with inductances of 12 millihenries (horiz.) and 47 millihenries (vert.) will solve your problem. A .5- to 4.5-millihenry coil will serve in both the width and linearity applications. When the circuit has been corrected, measure the drive signal, screen voltage, and cathode current of the 6CD6 to make sure it is operating within rated limits.

Ohm's Law at Work

I must run a rotor lead 750 feet. Will I need a step-up line transformer to supply adequate voltage to the motor? If so, what turns-ratio should it have, and where can I get it?

PETERSON TV SERVICE

South Beloit, Ill.

Take a different approach to the problem. Use Ohm's law to compute the voltage drop due to line loss, after measuring the current drawn by the rotor while under load. Four- and five-lead rotor cables have a resistance of 8 ohms for 750 feet, and eight-lead cable has a resistance of 12 ohms. If the loss is great enough to appreciably reduce the voltage at the rotor, figure some way of reducing line loss, such as parallelling two cables.

Compute the wattage requirements for the transformer used in the rotor, and if necessary replace the conventional 117- to 24-volt step-down unit with one of higher rating.

Drugstore Pills

A Philco 18B3002 came in with a snowy picture and poor sound. The resistor in the B+ line to the cascode RF amplifier grid was burned open, but the tube was good. Replacement of the resistor eliminated the snow, but the sound is still poor. Adjustment of the volume control doesn't affect the sound; instead, it causes the picture to smear!

CHARLES W. SHAW

Hyattsville, Md.

Sounds like a do-it-yourselfer has replaced an RF amplifier that had a heater-cathode short. See if he didn't plug the volume control into the video test socket, rather than its own socket a few inches to the left. The plug fits both, and could be easily interchanged by some unsuspecting soul.

Human Error

Both tube placement charts in PHOTOFACT Folder 176-3 show V13 to be a 6SN7 instead of the correct 6SL7. This caused some trouble recently when an apprentice changed to the 6SN7 after all tubes had passed muster.

MERRILL L. CRANE
Hudson, Wisconsin

Thanks for the tip. New printings of this Folder will show the correction.

Hot CRT

A National Model 1625 arcs from the picture tube to the grounding strap and also to the mounting strap. Any ideas?

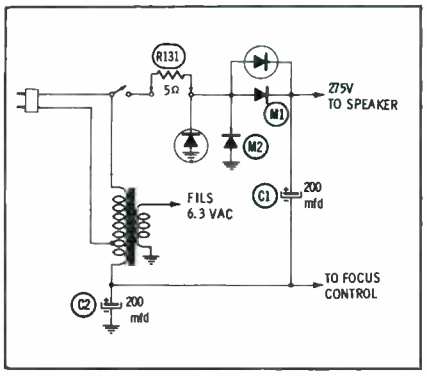
JOSEPH L. MONAK
Cleveland, Ohio

The inner and outer coatings of the CRT act as the plates for a high-voltage filter capacitor, the glass bulb of the tube serving as the dielectric. Make sure the outer coating is clean and intact (not flaked off). See that the grounding strap is making good contact with the outer coating. If this doesn't help, perhaps leakage within the 1B3 rectifier is causing the trouble.

Pop Goes The Cap

The power supply of a Motorola Chassis TS-602YA has been altered to use only two selenium rectifiers, and these have gone bad. I replaced them with two silicon rectifiers, but since then have had trouble with the fusible resistor burning out. When I jumpered it to check voltages, I heard a sizzling sound and C2 let go with a steam jet for about two minutes.

R. E. RUMPF
South Bend, Indiana



The full-wave voltage doubler circuit used in this chassis, and the characteristic differences between selenium and silicon rectifiers hold the clues to this problem.

Silicon rectifiers have sufficient current capabilities to replace M1 and M2, omitting the circled rectifiers. It is mandatory, however, to change the series resistance of R131 to 7.5 ohms. Failure to do so has caused M2 to short. Jumpering R131 placed 120 volts AC across C2, causing it to blow. Installation of a 7.5-ohm fusible resistor and replacement of the damaged rectifiers (M1 and M2) and C2, should solve the problem.

Bench Xmitter

I would like to have a loop antenna to radiate alignment signals in my shop. Any ideas?

PAUL CAPITO

Erie, Pa.

A straight piece of wire about a foot long will do nicely. Just connect the "hot" lead of your generator to one end. If you want more signal, wrap one or two turns of wire around a cigar box lid. Beware! It's illegal to radiate a signal more than 100'. Keep the antenna small and stay "off the air."

Data Tip

I need service information for a Freed-Eisemann Model 700-120. Can you help?

J. BELLBER

New York City

The data in PHOTOFACT *Folder 201-8 is for a Silvertone chassis, which is very similar.*

Repeater

A CBS Chassis 817 burns out a 5U4 about every 3 months. Any suggestions?

LEWIS BICEK

Robbinsdale, Minn.

This must be due to excessive drain on the 5U4. Check the current through the choke coil; 230 ma is normal. If your reading is high, you have a partial short in one of the B+ loads. Carefully check the horizontal output and damper circuits for excessive current, since they account for most of the drain on B+. Measure all applied AC voltages on these stages to find out if tube ratings are being exceeded. Try varying the AC line voltage on this last test, and note any significant changes which might provide a clue to the trouble. Also, be sure the input filter capacitor is okay, and hasn't been replaced with one which could lead to the application of voltages that exceed the peak inverse rating of the 5U4.

Anyone for Rolls

An RCA Chassis KCS109A develops a vertical roll after about 10 minutes of playing. It can be stopped for a short while, but finally goes completely out of control.

CHARLES J. DORAN

Galveston, Texas

We've been literally flooded with requests for help on vertical roll troubles lately. Yours is typical, so we'll use it to outline a general troubleshooting procedure which can be followed in every case.

Intermittent troubles are most likely due to thermal conditions; therefore, analyze them under both normal and abnormal situations. Many newer sets incorporate temperature compensating resistors in the voltage supply circuits; others take special precautions to locate

temperature-sensitive circuits in an isolated area of the chassis.

In running down the trouble, determine if the cause is confined to the oscillator or the sync circuit. Disabling the oscillator and checking the amplitude and shape of the applied sync pulse is a good way to start. If the signal is abnormal, you'll know the defect is in the sync circuits. Rolling which can't be stopped with the hold control indicates trouble in the oscillator circuit. The output of the integrator network should be disconnected during this test, since a leaky capacitor in the coupling circuit can cause uncontrollable roll.

If the trouble is definitely isolated to the oscillator stage, attention should be directed first to the components forming the RC timing circuis. These include the coupling capacitors and the grid resistors. In those circuits using the vertical output tube as part of a multivibrator circuit, careful tests for capacitor values and leakage will disclose the cause of the trouble in many cases. Use of a scope to check all waveforms in the circuit is most helpful in providing definite clues.

180° Out

I've cured an AGC trouble in a Magnavox Chassis V-21-10DC, but the picture still locks in with the horizontal blanking bar in the center of the screen. Waveforms W12 and W13 check okay, but the waveform at the other connection of the diode doesn't match the reverse of W12. I substituted capacitors in the AFC and sync circuits to no avail.

ROBERT G. BAKER

Santa Clara, Calif.

Sounds like someone changed the AFC diode before you got the chassis. It's normal practice to replace the dual unit with single components; see if one diode isn't connected in reverse. You're so right, the waveform not shown on the schematic should be the same as W12, except for polarity.

Speed Up

With a Norelco Model EL3516G/53, distortion occurs when recording music. I get ringing in the waveform at the plate of the second AF amp when feeding a square wave into the input. Disconnecting C9 stops the ringing, but doesn't improve the sound. Everything else in the amplifier checks okay. Tests were made with the stop button in and speed selector at 1 7/8".

ADOLPH MLECZKO

Chicago, Ill.

C9 is part of a regenerative feedback circuit to boost high frequency response at slow speeds, so the ringing you mention is normal with a square-wave input. Even with compensation, the 1 7/8 ips speed is only for voice recording. For better results, speed up the recorder. If distortion is still present, give the tape heads a good cleaning, and check the tape transport mechanism for possible troubles.

Tough Dog Sync

(Continued from page 31)

amplifying the relatively low-amplitude pulse from the triode separator. In the amplifying process, it is also possible to increase noise immunity by biasing the stage so that the tube is cut off by negative peaks of the input signal, and/or driven into saturation by the positive peaks. Although such operation slightly reduces the gain of the stage, the amplifier is designed to produce output sync pulses of adequate (and constant) strength.

Another common type of sync amplifier is the phase inverter (shown in Fig. 12), which feeds both positive and negative sync pulses to a phase-detector type of horizontal AFC system. This circuit is shown again in Fig. 16, along with a detailed waveform analysis to aid in understanding the operation of the stage. First, note that the amplitude of the incoming signal W16A is 23 volts peak to peak. It follows that the amplitude of the signal developed at the cathode must be lower than that of the input signal, since a cathode-follower stage has a gain of less than 1. In addition, the input and cathode-output signals are of the same polarity. These facts are evidenced by W16B, which has a 20-volt peak-to-peak amplitude. On the plate, however, we see that we have achieved a gain of approximately 2 and a normal polarity reversal, as evidenced by W16C. Since our two output signals now have the correct polarities to feed the horizontal AFC circuit, the only requirement still to be met is to provide equal (or nearly equal) amplitudes of the two signals. This is accomplished by splitting the plate load between two resistors (R57 and R58) and adding R59 in the cathode circuit. Waveforms W16D and W16E show the pulses on the input side of the AFC coupling capacitors, while W16F and W16G show the signals developed across R76 and R77 as affected by the sawtooth feedback voltage through the conduction of the AFC diodes.

In the third and final installment, we'll go into integrating circuits and troubles, and summarize with an over-all sync trouble analysis. ▲

Troubleshooting Horizontal

(continued from page 35)

zontal-system defects, an image is visible, but it possesses some distortion such as nonlinearity, foldover, or a series of vertical ripples. Sufficient high voltage is present, and the picture is securely locked into horizontal sync.

To tackle and isolate this defect, the technician must understand the complementary functions performed by the horizontal output and damper tubes. When a sawtooth wave is applied to the grid of the output tube, grid current flows for a short time during the positive peak of the wave, as indicated in Fig. 4A. The resulting grid-leak bias, along with the negative excursion of the drive signal, keeps the output tube cut off for some time after the beginning of each sawtooth cycle; so this tube does not even begin conducting until the electron beam has traveled from the left side of the screen to almost the center. (See parts B and C of Fig. 4.) This being so, what is providing deflection power during this period?

The answer is to be found in the damper tube. Immediately after beam retrace, the damper begins to conduct, liberating the energy which was stored in the flyback circuit during output tube conduction. The damper circuit is designed to parcel out this energy so that the current through the yoke to decrease linearly—in turn, permitting the scanning beam to move at a steady rate from the left side to the center of the screen. When most of the available energy is dissipated, the output tube swings into conduction. The electron beam may be anywhere from 30% to nearly 50% of the

"You'll do very well as shop supervisor, Charlie. Already the boys are beginning to hate your guts!"

way across the screen at this time; generally, the higher the deflection angle, the farther the beam will have traveled. For the remaining portion of the sweep, deflection current is supplied through the output tube.

To the TV technician, this sequence of events carries the key to servicing problems involving horizontal distortion. If the picture is compressed or full of ripples on the left-hand side, the cause is most likely confined within the damper-tube circuit (including everything beyond the plate of the horizontal output tube). On the other hand, if the right side of the image is distorted, the most likely place to look for trouble is in that portion of the horizontal sweep system extending from the horizontal oscillator up to, and including, the output stage.

Among the defects most often seen in the left side of the raster are waves or ripples caused by a defective capacitor in the deflection yoke, foldover stemming from a defective damper tube, or alternate light and dark stripes caused by misadjustment of the linearity coil.

Also occasionally seen in this area are thin, dark vertical stripes (Barkhausen oscillations); these occur while the output tube is cut off, just after the beam has just returned to the left-hand side of the screen — but the cause centers around the output tube!

Distortion at the right side of the raster usually takes the form of foldover or compression. The most common causes of this symptom are a defective output tube, decreased grid resistance in the output stage, or leakage in the oscillator-to-output coupling capacitor. Output-tube trouble occasionally produces another type of disturbance, called *snivets*. This symptom somewhat resembles Barkhausen oscillation, but affects the right side of the raster instead of the left side.

If the changeover from damper to output-tube conduction is not made smoothly during each horizontal sweep cycle, irregularities will appear in the area of the raster indicated in Fig. 4C. A surplus of DC bias voltage on the output tube, often due to excessive drive-signal amplitude, will delay the beginning of output-tube conduction. The result is a vertical wrinkle or foldover (white line) in the raster—the well-known "drive line" that shows up when the horizontal drive adjustment is advanced too far.

If the horizontal output tube starts conducting too soon during each cycle, the sweep rate will momentarily be speeded up — and the left-central area of the raster will have a stretched-out appearance. Adjustment of the horizontal linearity coil (if one is provided) can be helpful in eliminating this symptom.

"Who's handling our advertising?"

TABLE I—Instruments for Isolating Horizontal Sweep Troubles

SECTION	PRIMARY TESTS	SECONDARY	
		1	2
HORIZONTAL SYSTEM	SCOPE	VOM OR VTVM	SIGNAL INJECTION
AFC	SCOPE	VOM OR VTVM	——

Fig. 5 gives several hints for using visible symptoms as a trouble-shooting guide. If viewing the raster distortion does not make the source of trouble immediately evident, an oscilloscope is useful as an auxiliary tool to gain further information. Checking the output-tube grid waveform quickly confirms or denies any suspicion that the trouble might be arising at a point ahead of the output stage.

Summary

The purpose of the foregoing discussion has been to help you employ your test instruments to maximum advantage when faced with trouble in the horizontal deflection system. With the above facts in mind, you should be able to determine almost at once whether the trouble lies ahead of or beyond the grid of the horizontal output tube. This may still leave much to do, but at least it will guide you to the troubled section.

In general, horizontal-circuit troubleshooting can be done most efficiently when test instruments are employed in the order outlined in Table I.

Here are some additional pointers to assist you in your work on horizontal systems.

1. Before completely unsoldering a horizontal output transformer you suspect of being bad, try disconnecting the yoke, width coil, and high-voltage plate cap, in turn, to see if this does not bring back some evidence of normal operation. Shorted turns in the yoke or width coil can load the transformer to the point where boost B+ and high voltage cannot be developed. A short in the high-voltage rectifier stage can have the same effect.

2. Remember that the AFC network can throw the oscillator off frequency or load it down to such an extent that no oscillations develop. In nearly all cases, it is possible to disable the AFC circuit to permit free-running of the oscillator.

3. It is advisable to check horizontal output, high-voltage rectifier, and damper tubes by substitution because of the high peak voltages to which these tubes are subjected.

4. The screen-grid voltage of the output tube has a very important effect on the operation of this stage. This voltage should be checked carefully and early in the trouble-shooting procedure.

5. Make use of any specialized test instruments you have, or if other receivers in operating condition are available, use them to supply substitute signals for the receiver being worked on. (Readers desiring additional information on this technique should refer to the March, 1959 issue of PF REPORTER.)

The foregoing discussion does not by any means exhaust the subject of horizontal-system servicing; however, it does describe a straightforward method of tracking down even hard-to-find troubles to help you avoid being led off into fruitless side paths. ▲

Industrial Electronics

(continued from page 33)

tion is shown in Fig. 2. Binding or unusual "stiffness" in turning the shaft by hand may indicate dry bearings, dirt inside the motor, or improperly set flexible joints. The purpose of these joints is to permit slight misalignment between motor shaft and machine shaft. As shown in Fig. 3, they consist of toothed couplings with hard rubber or plastic between the contact surfaces.

Thermal devices—Temperature-sensitive devices provide protection, temperature control, and time delay. Preventive maintenance usually consists of checking to see if the units are actuated at the rated temperature or conform to the specified delay time. Some of these devices are sealed and cannot be checked internally; however, external wiring checks and actuation tests can always be made.

Electronic parts—As you know from television servicing experience, you cannot judge the condition of resistors, capacitors, and transformers by looking at them, unless they have been burned or otherwise damaged physically. However, visual inspection of electronic equipment does help you discover accumulations of dirt, loose wiring, or signs of overheating before these conditions bring about serious damage.

Fig. 6. Tong ammeters measure current without directly contacting circuit.

A widespread practice is to replace vacuum tubes on a preventive maintenance basis after every 1000 hours of operation (or in accordance with directions given by the manufacturer)—although some experts doubt the advisability of this procedure. The important thing, of course, is to take steps which will minimize loss of time due to unscheduled failures. When one hour of "down time" costs a manufacturer thousands of dollars, the cost of a tube becomes insignificant.

Interlocks — Equipment doors often operate interlocks which are provided for the safety of personnel. Smooth operation of door latches, accurate mechanical alignment of switch parts, and good condition of contacts are all essential to the reliability of interlocks.

Fig. 7. Millivoltmeter checks thermocouple output, other small voltages.

Fig. 8. Electronic micrometer, used with scope, is accurate within .0001".

Test Equipment

Troubleshooting industrial equipment requires special test equipment in addition to the usual array of multimeters, oscilloscopes, and signal generators. A few of the wide selection of specialized instruments available are described in the following paragraphs.

Pulse generator — Automatic equipment employs pulses of voltage as the principal means of signal transfer from stage to stage. The meaning of a particular pulse may be assigned either by the designer at the time of construction, or by the person operating the equipment. Troubleshooting such equipment requires a reliable source of pulses, such as the instrument shown in Fig. 4, with provisions for adjustment of various pulse characteristics such as amplitude, duration, and repetition rate. Closed-loop systems using pulses as "bits" of information are serviced by breaking the loop at the electronic input and injecting pulses that simulate the ones normally found at this point.

Table II — Preventive Maintainance Schedule for Industrial Equipment.

Biweekly (or as required)	Air filters
Monthly	Magnetic, thermal, and motor-operated devices
Ever 1000 to 3000 hrs. (depending on usage)	Electron tubes; ignitrons; semiconductors
Every 6 months	Resistors, capacitors, transformers, etc.; mechanically-operated devices; flexible connectors; interlocks; gaskets

Pulse generators serve other purposes in addition to signal injection. As an example, Fig. 5 shows a test setup for subjecting a transformer to high-voltage pulses. You may remember the effect of an arcing horizontal output transformer. Similar problems develop in the relays, heavy inductive loads, and thyratrons used in many industrial circuits; defects like arcing or break down cause troubles which are often difficult to analyze. When used as a breakdown-voltage tester the pulse generator provides solutions for many of these troubles.

Tong ammeter—Want to measure current without cutting a conductor? Simply clamp the meter around the conductor as shown in Fig. 6. Motor controls, welder controls, and induction heaters, with their heavy currents, provide ample opportunities to use a tong ammeter in which the *lowest* full-scale reading is on the order of 10 amps.

Potentiometer — Does your VTVM measure millivolts? Most commercial units do not. However, special instruments are available for measuring the faint outputs of thermocouples and delicate trans-

Fig. 9. Example of test-bench setup for industrial servicing.

ducers. Fig. 7 shows a portable potentiometer of this type, built by Allegany Instrument Co., Inc. A standard cell (exact voltage known) is used to calibrate a voltage divider (potentiometer); then, a sensitive galvanometer indicates when the voltage at the arm of the pot is exactly the same as the unknown voltage being fed into the unit.

Dynamic micrometer—For measuring very small dimensions, the Electro Products unit shown in Fig. 8 provides an oscilloscope display. Measuring devices of this type are accurate to within one ten-thousandth of an inch.

Test Bench — The most important aim of an industrial troubleshooting service is to get a customer's electronic system back into operation at the earliest possible moment. To expedite service, it is a good idea to obtain spare units for equipment owned by steady customers (especially those with service contracts). Then, when trouble strikes, you can simply isolate the trouble to a particular subassembly and replace this whole section. The defective unit may be repaired later in your shop, where you are not so pressed for time and you can enjoy the convenience of a well-planned test setup. One example of a test bench setup is illustrated in Fig. 9. General Radio power supplies furnish voltages for the subassembly, and the generators (General Radio) provide the input signals for signal-tracing equipment with the Tektronix oscilloscope. ▲

Have a New Mailing Address?

If so, notify us by the 15th of the month to assure uninterrupted delivery of PF REPORTER.

Please be sure to give us both your old and new address, including your postal zone number. (Or better yet, enclose a current mailing label with your new address.) Send to:

PF REPORTER
Circulation Dept.
2201 E. 46th Street
Indianapolis 6, Ind.

1960 TV Tubes

(Continued from page 26)

vantage of increasing the useful gain of the tube. However, the heavy grid structure, close to the cathode, results in a relatively large input capacitance for the tube. This is why the 6ES5, which has a precisely wound conventional grid, has less input capacitance than the 6ER5.

The unequal values of interelectrode capacitance indicate that the 6ER5 and 6ES5 cannot be freely interchanged without some loss in performance, unless tuner alignment is touched up afterwards. Nevertheless, these two types of tubes are sufficiently alike to permit *temporary* substitution of one for the other without changing any circuit components or supply voltages.

The third type of *Guided Grid* tube, the 6FH5, is not recommended for interchange with the other two types. First introduced in the Magnavox 32 Series chassis, it is specially modified for improved operation with plate-supply voltage obtained from a low B+ source of 125 to 135 volts. The 6ER5 and 6ES5 will also operate satisfactorily at this level of voltage, but are said to give better results in fringe areas if operated at higher plate-supply voltages—up to a maximum of 175 volts.

Series-string versions of the above-named tubes, with heaters in the 2-volt class, are also being used in many of the new TV chassis.

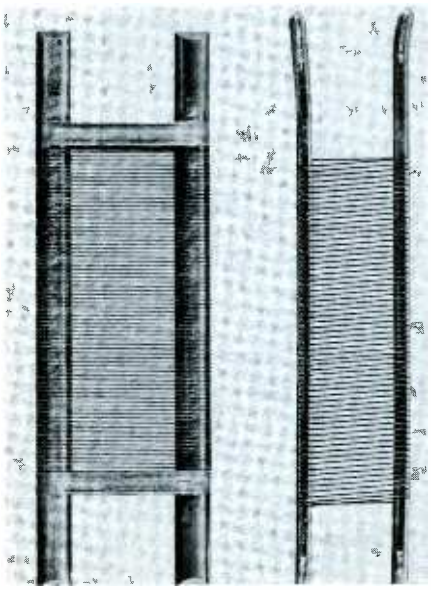


Fig. 4. Amperex frame-grid structure compared to conventional tube grid.

Hot Cascode

A long line of dual-triode tubes (6BC8, 6BS8, etc.) have descended from the original 6BQ7 cascode RF amplifier; among the latest in this group is one with frame-grid construction. This tube, the remote-cutoff 6ES8, appears in most '60 Motorola sets and in the General Electric U4 chassis. Transconductance in each of its two sections is rated at a fantastic 12,500 micromhos—just about double that of a normal 6BQ7 section. Since the base connections of the 6ES8 are the same as for earlier cascode tubes, it's a great temptation to try boosting the gain of older tuners by installing the new frame-grid tube. But take our word for it—the results are disappointing. In operating characteristics, the 6ES8 is too different from its predecessors to provide a gain in efficiency. In fact, it is likely to detune the RF amplifier enough to cause serious deterioration of the picture.

An interesting sidelight on the

6ES8 is its ability to operate with an unusually low plate voltage. For example, the series-string version of this tube (4ES8) is employed in the Motorola portable chassis TS-434, which has a B+ supply potential of only 135 volts. The RF stage runs merrily along with only about 65 volts on the plate of the first stage, and an additional 60 volts across the second stage.

Adoption of a frame grid is not the only innovation in the cascode-tube field. Halfway through the '60 model year, RCA introduced a new chassis (KCS129YA) incorporating a 6FW8 RF amplifier. Its design, though not so radically new as the 6ES8, is still an advancement over the previously-used 6BQ7A.

Tetrode News

Over the past several years, 2–, 3–, and 6CY5 tetrode tubes have almost completely replaced –BC5 pentodes as RF amplifiers in TV tuners. Omitting the suppressor grid reduces internal noise — a problem in pentode RF stages — and effectively boosts the signal-to-noise ratio. Since the tetrode still has a screen grid, however, it boasts a lower plate-to-grid capacitance than a triode. This means it does not require neutralization, as does a high-gain triode stage.

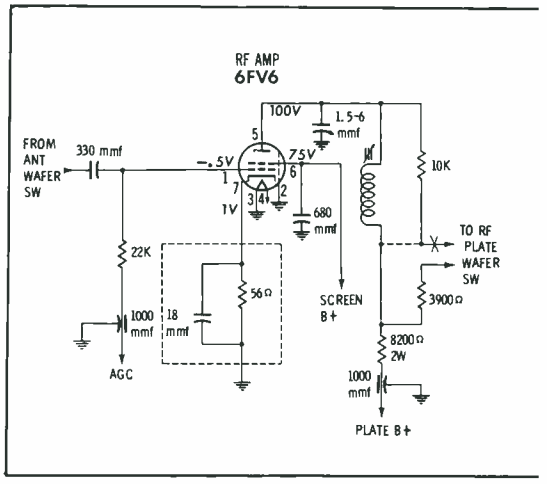


Fig. 5. RF stage of RCA's latest tetrode tuner employs cathode resistor.

With tetrode tuners becoming so popular, it would be natural to expect improvements on the basic 6CY5 design. So it's not surprising to learn that some '60 Westinghouse 21″ sets (Chassis V-2378 and –9) have a new 6EA5 tetrode RF amplifier, and some of the portables (Chassis V-2384) have its 450-ma series-string version, the 3EA5. Although generally similar to the –CY5 series, the –EA5's are modified for operation at higher plate and screen voltages.

A high percentage of the tuners in '60 RCA sets use another new tetrode, the 6FV6. The main design improvement in this tube concerns the cathode circuit. The original 6CY5 had the cathode and an internal shield tied together and connected to both pins 2 and 7—an arrangement frequently used in tuner tubes to minimize lead inductance at VHF. On the other hand, the 6FV6's cathode and shield are brought out to separate base pins so that the cathode may be placed above ground potential. Fig. 5, a schematic of RCA's KRK85A tuner, shows a 56-ohm resistor and an 18-mmf capacitor wired between cathode and ground.

The idea behind this modification is to provide a small amount of degeneration in the cathode circuit, thereby minimizing distortion of RF response at different AGC bias levels due to Miller effect.

Substituting a 6CY5 for a 6FV6 would be permissible in an emergency, but because of the different cathode connections, the cathode resistor would be shorted out. This could lead to poorer performance than the customer has a right to expect of his set.

Come to think of it, this last statement applies to many field substitutions of one tube type for another. A fall-off in performance may not be immediately spotted by the serviceman, but the customer is likely to notice a slight deficiency in picture quality as he continues to use the set.

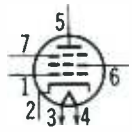
Other Rare Tubes

You never know when or where you're going to find a strange tube type in a new TV set—unless you avidly follow our *Previews of New Sets* column. We make a habit of pointing out unfamiliar tube types, in order to spare you the nasty surprise of encountering one unexpectedly on a home call.

To give you further background information on the latest tube designs, we've prepared thumbnail sketches of all types not previously covered either in last October's *Stock Guide* list or in the June, 1959 coverage, "Keeping Posted on TV Tubes." The information given this month includes the numbers of the TV chassis in which each tube has appeared, the circuit function of the tube, the nearest equivalent (if there is one), other pertinent facts, and—to top it off—a base diagram for each type covered.

Although most of the tubes in this listing are now considered "rare," a few of them will soon become important enough to be included as regular items in the *Stock Guide*. It doesn't take long for a tube to rise to popularity. A case in point is the 6EB8; a rarity last summer, it was adopted as the standard video-output tube for all RCA and Zenith (and some Motorola) 1960 models. The number in service should be approaching two million by now! *Moral*: Keep an eye on *Stock Guide* to stay informed about tubes you can't afford to leave out of your caddy.

4EW6



MOTOROLA CHASSIS TS-434

3rd VIDEO IF

This is a 600-ma series-string version of the 6EW6, a very sharp-cutoff pentode (with Gm=14,000) used in high-gain, non-AGC-controlled IF stages. Basing is the same as the 3CB6, 3DK6, etc., but these other types are not recommended for substitution purposes because of different heater power and the likelihood of distorting IF frequency response.

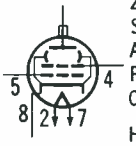
6AX4GTB

ZENITH "D" & "E" SERIES CHASSIS

DAMPER

Maximum peak inverse plate voltage is higher than for the 6AX4GTA—now 5000 instead of 4400 volts. The 6AX4GTB will replace previous 6AX4 designs; in some cases, it can also replace a 6DE4.

6DQ6B

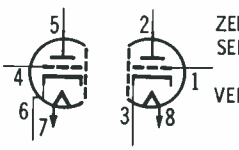


ZENITH "D" & "E" SERIES CHASSIS -- ALSO IN LATER PRODUCTION RUNS OF MANY OTHER CHASSIS

HORIZ OUTPUT

Several maximum ratings are higher than those of the 6DQ6A now widely used in 110° sweep systems. Maximum DC cathode current (design-center value) has been pushed up from 140 to 175 ma; peak positive-pulse voltage on the plate is up from 6000 to 6500 volts; and maximum plate dissipation is up from 15 to 17.5 watts. The 6DQ6B will replace older 6DQ6 and related types. Just to show how far this tube design has evolved, the original 6BQ6GT type was an 11-watt tube with 110-ma maximum DC cathode current.

6EA7

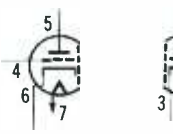


ZENITH "D" & "E" SERIES CHASSIS

VERT OSC-OUTPUT

This octal-based, dissimilar dual triode has the same base-pin connections as the 6DN7 used in General Electric 110° receivers; however, the operating characteristics of these two tubes are not similar enough to make them interchangeable.

6EM7

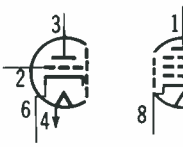


ZENITH "E" SERIES CHASSIS

VERT OSC-OUTPUT (ALTERNATE TYPE)

In the very latest Zenith sets, you may find either a 6EA7 or a 6EM7 in the vertical section. In general, you can use either type of tube in this particular circuit without making any wiring changes; however, if you have trouble with one type, try the other.

6EU8
5EU8 (600 ma)

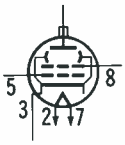


MOTOROLA '60 TUNERS

MIXER-OSC

Just when we thought all possible ways of rearranging the base-pin connections of a 6U8 had been tried, along comes still another arrangement. Other modifications have also been made, but the new base is the main distinguishing feature of this tube. Apparently, it fits better into Motorola's new compact-size tuners than any existing base-pin pattern.

6EX6

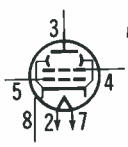


MOTOROLA
CHASSIS TS-558

110° HORIZ OUTPUT

This is the 6.3-volt version of the 21EX6 used in last year's Chassis PTS-546. As you can see, its base connections are *not* the same as those used in the –DQ6 family of horizontal output tubes. Current and pulse-voltage ratings are even higher than for the 6DQ6B.

6EY6

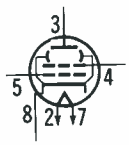


MOTOROLA
CHASSIS TS-558

110° VERT OUTPUT

A parallel-heater version of the 7EY6 employed in Chassis PTS-546, the new octal-based 6EY6 is unlike any other vertical sweep tube in previous use.

6EZ5



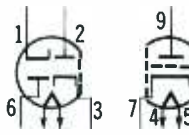
ZENITH
CHASSIS 18E20

VERT OUTPUT

As you'll note, this new octal-based vertical output tube has the same pin arrangement as the 6EY6; however, several of the 6EZ5's electrical ratings are somewhat higher.

This tube looks like a 6T8 with one of the three diode plates removed, but this isn't the whole story. Remember that the No. 2 and No. 3 diode plates of a 6T8 share a common cathode with the triode section of the tube. When the 6T8 was redesigned into a 6FM8, the removal of the third diode plate left one base-pin connection blank; so this pin was utilized as a separate cathode connection for the No. 2 diode. The new General Electric sound-detector circuit happens to be arranged in such a way that substituting a 6T8 for the 6FM8 will disable the detector.

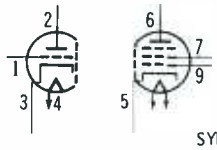
6FM8



GENERAL
ELECTRIC
CHASSIS M5

RATIO DET -
AUDIO AMP

6FV8

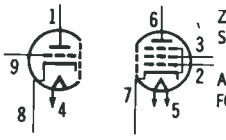


WESTINGHOUSE
CHASSIS V-2378,
-79, -84

NOISE INVERTER-
SOUND IF; ALSO
(V-2378, -9 ONLY)
SYNC AMP-VERT OSC

This new triode/pentode is designed to resist the development of interelectrode leakage as it becomes older. It has the same base configuration as the 6BR8, and would probably be satisfactory as a temporary substitute for that tube in certain applications.

6GH8

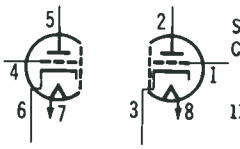


ZENITH "D" & "E" SERIES CHASSIS

ALTERNATE TYPE FOR HORIZ OSC

A further development of the 6U8A-6EA8 design, the 6GH8 is said to give better results than the 6EA8 in the horizontal oscillator section of most current-model Zenith sets. Its characteristics are not exactly the same as those of the 6EA8 and 6U8A, so it may not always work satisfactorily as a substitute for those tubes—especially in mixer-oscillator stages.

10EG7

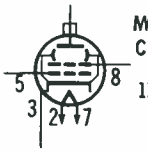


SYLVANIA CHASSIS 1-544-1

110° VERT OUTPUT

Here's another octal-based dissimilar dual triode of the same general class as the 6DN7 and 6EA7. It may work temporarily in place of one of these other tubes, but substitution for a prolonged period is not recommended because of the considerable electrical differences among these three types.

12GC6



MOTOROLA CHASSIS TS-433

110° HORIZ OUTPUT

The base configuration of this high-powered sweep tube is the same as that of the 6– and 21EX6; thus it is different from the 6DQ6A and related tubes. There is no adequate substitute for the 12GC6 at present. The most closely related type, the 21EX6, has a considerably different heater-power requirement — and that's an important matter in a series-string application.

This is the end of the new-tube story for 1960. As soon as we get a chance to evaluate next year's complete line of TV models, we'll be back with another report to bring you up to date on the evolution of tubes. ▲

Letters

(Continued from page 22)

have only four bare walls — no benches, shelves, or anything.

My problem is — what do I need? I have purchased several Sams books and manuals, and have been reading a lot of your back issues. They have helped a lot, but I would like further help on the following:

1. Where can I get plans for test and work benches, considering that the work will involve servicing all kinds of sound equipment, including both mono and stereo amplifiers, tape recorders, changers, etc.

2. As for test equipment, I'd like to have a breakdown of: (a) must have, (b) should have, (c) could use. Also, what about hand tools?

3. May I have copies of PF REPORTER indexes for the years 1956 through 1959?

4. Which books do you recommend I read to better equip myself for this new venture?

I know I've asked for a great deal, but I felt that if anyone could help, it would be you.

P.S. No fair printing this.

NAME WITHHELD

This letter is indicative of many requests asking us for help on audio and hi-fi servicing. To help lessen the problem, we'll continue to publish articles on the subject, as well as books and manuals on the various phases of this field. Meanwhile, if other readers engaged in audio and hi-fi work care to make comments or suggestions, we'd be happy to hear from them.—Ed.

Dear Editor:

Your fine magazine is considered MUST reading by most servicemen, and therefore, I would like to see you continue a program you started last fall. I refer to the stolen TV set list and the $100.00 reward offer.

Here in Marion County, a day rarely passes when some TV shop doesn't suffer a loss. Stolen sets, like any others, must be serviced eventually. If we all keep our eyes open, I'm sure many of them will turn up.

To help the cause, IESA will contribute $50.00 to help with the $100.00 payments. In addition, we are soliciting more from insurance companies, manufacturers, etc. We also plan to publish lists of stolen sets in *The Hoosier Test Probe*, IESA's official publication. Any other publications wishing to reprint them have our permission.

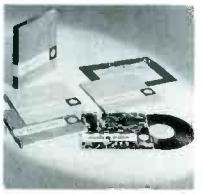
Sooner or later, some of these sets are bound to turn up in a service shop. And where else could a sharp-eyed technician pick up a quick $100.00 just for checking a serial number?

FRANK TESKEY
Teskey's TV Center
Indianapolis, Ind.

You'll find our latest list of stolen receivers on page 92. Every publication that picks it up is helping the cause.—Ed.

the ELECTRONIC SCANNER

Lots of help from manufacturers in the form of training programs these days: General Electric's Electronic Components Div., through their parts distributors, is making available a "Profitable Service Management" program, which includes a long-playing record of interviews with 30 successful service shop owners, plus accompanying textbooks, to help you in building your business for greater profits. Delco Radio-Guide Lamp is conducting 9 different one-week servicing courses in 30 General Motors Training Schools throughout the country. A 12-lesson correspondence course (prepared by the Radio-Television Training Assoc.) on business techniques is being offered through their distributors by Sylvania Electronic Tubes.



From other manufacturers: To improve the status of independent serviceman, Howard W. Sams & Co., Inc., has launched an industry-wide "PEET" program which has a three-fold purpose — to gain deserved recognition for the service technician as a reputable businessman; to develop and warrant public trust and confidence for qualified technicians; and to justify better earnings warranted by the business investment, training, and skill of properly qualified technicians. A free 17" x 22" red, white and blue display poster, courtesy of Sprague Products Co., contains a message to the consumer about the importance of independent serviceman in our American way of life to help improve public relations between indepenpent TV servicemen and their customers. Technical Appliance Corp. (TACO) is making available a giant 27" x 45" cloth banner for use in calling consumers' attention to the importance of a good TV antenna for best reception. RCA's Elec-

$100.00 REWARD

to the first person reporting the location of one or more of these stolen receivers.

ADMIRAL	475996	BF 91997	810292
7404297	246608	39925199	**SYLVANIA**
7337737	258067	D 725516	5421050322219
7464079	470549	197417	5375065332146
7459958	292105	BF 31274	542706052272
7464049	406884	BB 57107	5375065332125
6918674	440563	BE 96918	5433002564327
7115338	**HALLICRAFTERS**	D 275839	537506532227
7356615	342189	D 199104	5422002814324
7272250	**MOTOROLA**	C 918321	**ZENITH**
6882085	522285	**RCA**	9335197
7463241	L 4722516	A905365	9664276
7152726	549781	A 1837722	3906039
GENERAL	12486	230KR526SU	9471745
ELECTRIC	**PHILCO**	**SILVERTONE**	9523476
701965	BA 77594	50298	9499851

Contact Carl C. Schmidt, Inspector of Detectives, Indianapolis, Ind.

tron Tube Div. has a *Store Improvement Plan* to help you attract new customers, display your products and services more effectively, use your floor space more attractively, and increase the efficiency of your operation; in short, it is designed to help you give your shop *The Successful Look* both inside and out.

They say you never get "something for nothing." This is probably true, but there are several new programs that come mighty close. To wit: G-C Electronics Co., through their regular inside front-cover ad this month, incorporates "two - for - the - price - of - one" coupons on their line of electronic servicing chemicals (offer expires April 30th). There is no promise that this attractice young lady will be at your distributors to hand them out, however. For a limited time, you can get an Imperial Satellite flash-camera with the purchase of 35 Planet capacitors. You can also get a matched set of *Tool-a-Rama* servicing tools along with purchases of Raytheon tubes. You can build your set week by week if you prefer. Haven't yet converted your customers from the monophonic to stereo version of Shure Bros. Studio Dynetic tone arm and cartridge? Deadline has been extended from December 31, 1959 to May 31, 1960, so there's still time left.

The guy who keeps shouting "ole" with a southern accent is Hugh Lindsey, service manager at Curlee Appliance in Statesville, N. C. He won the all-expense air trip to Mexico City for he and his wife by submitting the best statement on "Why I like Mallory components" in the recent "Go Places with Mallory" contest. Joe Harris, salesman at Dixie Radio in Charlotte, N.C., also won a trip for two.

The beginning of this new decade also marks the 10th anniversary of the company which sold its one-millionth test instrument last fall, SENCORE, of Addison, Ill., according to Herb Bowden, president and founder of the company.

Mr. I. G. Tracy of Tracy Television Service, Tulsa, Okla., captured first prize in the Workman TV "Chance of a Lifetime" contest, a new Volkswagen truck equipped with Jackson test equipment. S & S Radio Supply (erroneously shown as Radio Supply in our Feb. ad) won second prize, a new Volkswagen, as Mr. Tracy's distributor. Victor Goss (the ad said Gass), counterman for S & S Radio Supply, won third prize—a $250 U.S. Savings Bond.

PRODUCT report

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

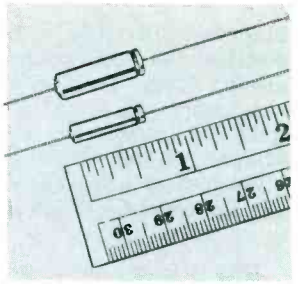
FM Radio Tuner (47N)

The *Hampton* Series 800 FM tuner, made by Shell Electronics Mfg. Corp., has a cathode-follower output circuit feeding dual output jacks, and a separate connection for attaching a multiplex adapter. Additional features are a tuning eye, Sickles front end, output-level control, and AFC with defeat switch.

Control With No Shaft (48N)

The compact, moistureproof Clarostat *Cap-Pot* is made of nylon and has a small, permanently-attached knob. The unit is inserted into a mounting hole from the front side and held in place by a lock nut screwed on from the rear. Power rating of all units is ½ watt at 40°C. Type A (5% tolerance) is available in values up to 5000 ohms; Type B (10% tolerance) to 10K.

Subminiature Electrolytics (49N)

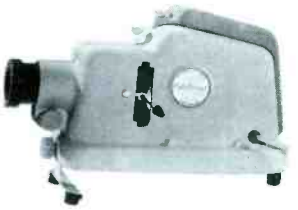


Cornell-Dubilier *Electomite* aluminum-foil electrolytic capacitors have unusually low DC leakage current, welded terminal connections, and exceptionally small, hermetically-sealed can-type cases. Nine different voltage ratings are available. Capacitance values range from 1 to 450 mfd at the lowest rating (3 WVDC), and from 1 to 18 mfd at the highest rating (150 WVDC).

Portable Tape Recorder (50N)

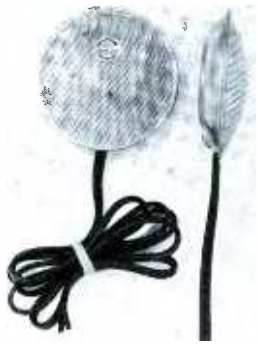
A transistorized, battery-operated tape recorder made in Austria, the Stuzzi *Magnette*, weighs 8 lbs. and measures 11" x 4½" x 8". Two tracks can be recorded on standard ¼" tape at either 3¾ or 1⅞ ips, giving a maximum playing time of 2 hours on each reel of tape. Net price is $269.50, including a microphone of the moving-coil type. The unit is available from Ercona Corp.

Needle-Wear Checker (51N)



Dealers or servicemen who maintain an adequate stock of the five best-selling types of Fidelitone phono needles will be given a "shadowgraph" projector, the *Comparator*, to help them demonstrate needle wear to customers. When a needle is placed in the machine, a magnified image is clearly shown on a small, nearby screen. The device is useful for displays as well as for quick tests.

Pillow Speaker (52N)



The shallow, strong stainless-steel case of the Wright-Zimmerman (New Brighton, Minn.) Model 300 dynamic speaker makes it especially suitable for under-pillow use. However, it is also serviceable in the living room as a personal radio-TV speaker — either for the hard-of-hearing, or for someone who wishes to listen at a low level without disturbing others. Impedance is 3.2 ohms; various cord lengths are obtainable on request.

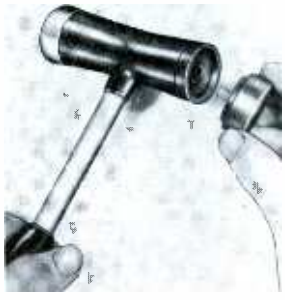
CRT Construction Feature (53N)

To increase the efficiency of its TV picture tubes and shorten warm-up time, Sylvania has adopted a new *Cloverleaf* configuration for the ceramic cathode support assembly. The change in design results in a 50% reduction in contact area between cathode and support, thereby cutting down on heat conduction away from the cathode. The new feature is being included in most types of CRT's available from this manufacturer.

Tape Splicer (54N)

The British-made *BIB* recording-tape splicer, imported by Ercona Corp., has two pivoted clamps that hold both tape ends in place while being spliced. Either "straight-across" or diagonal cuts can be made—one for editing or mending tape, and the other for trimming off ends. A razor-type cutter is stored underneath the body of the splicer. Retail price is $3.95.

Soft-Face Hammer (55N)



For cabinet repairs and other jobs where the work surface must be protected against marring, Vaco has designed a *Soft-Face Hammer* with three interchangeable nonmetallic tips. These are color-coded to indicate degree of toughness — yellow, (nylon) for extra-heavy work, dark grey for medium-heavy work, and light grey for delicate work. The head is shot-weighted, and the handle has a cushion grip. Retail price is $4.75.

Bonding Resin (56N)

The twin tubes in the General Cement *Epox-Cement* kit contain a base resin and a hardener. When these are mixed just prior to use, the resulting adhesive compound can be used to bond many substances (including metals, ceramics, wood, glass, and plastics) with a holding power of 3,000 lb. per sq in. The cement cures at room temperature, forming a waterproof material of high dielectric strength. The kit is designated Catalog No. 346 and has a list price of $3.25.

Limited-Power CB Transmitter (57N)

Purchasers of the Kaar Model TR326 *D-Phone* Citizens band transceiver may request a factory-installed circuit modification and a certification tag enabling the unit to comply with *Limited Radiation Regulations* (Part 15 of FCC Rules). The device may then be operated without a license, with output power restricted to 100 mw and antenna length limited to 5'. When a license is granted, the set can be restored to full power.

Miniature Carbon Controls (58N)

The diameter of Mallory's new Type MLC carbon potentiometers is only ½", but performance characteristics are the same as for conventional 15/16" controls. A miniaturized "floating-ring" switch, with a rating of 2 amps at 125 VAC, can be attached to convert the MLC into a combination on-off switch and volume control of compact size. Shafts are either steel or nylon.

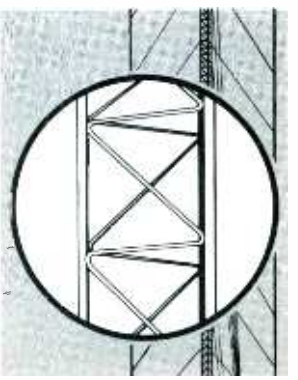
FM Auto Radio (59N)

The Motorola Model FM-900, a compact FM-only car radio designed for under-dash mounting, operates independently of the car's AM radio but can share an existing whip antenna. Equipped with 7 tubes and 3 power transistors, the receiver operates from a 12V negative-ground supply. Features include a 6" x 9" oval speaker, built-in rear-speaker fader control, AFC, dual limiters, and peak power output of 15 watts. Suggested retail price is $125.

Speaker Systems (60N)

ElCO has introduced three new high-fidelity speaker systems. The first two are three-way types; both have a 12" bellows-suspension woofer and an 8" mid-range unit, but one (the HFS-3) has a 3 1/2" cone tweeter and the other (the HFS-4) has a compression-driver horn tweeter. The third system, the HFS-5, is a two-way bookshelf-size unit with 8" and 3 1/2" speakers. All systems are available in walnut, mahogany, teak or unfinished birch; prices range from $47.50 to $98.50.

Communications Antenna Tower (61N)



A heavy-duty tower for communications radio antennas, the Rohn No. 45, can be erected as tall as 450' if guyed at 50' intervals and properly secured at the base. This tower, made of hot-dipped galvanized steel, is supplied in 10' sections with an 18" triangular cross section. The welded cross bracing is in a zig-zag pattern, different from that used in the previous heavy-duty tower (No. 40); however, sections of Type No. 45 are interchangeable with those of No. 40.

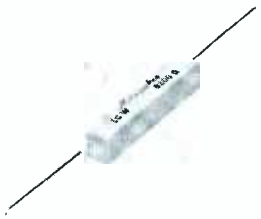
Monophonic Cartridge (62N)

Installing a Sonotone Model 11T one-channel pickup in a monophonic record player enables the instrument to play stereo records without groove damage. This turnover-type needle-cartridge combination features high vertical compliance, and has a .7-mil tip on its "LP" side instead of the usual 1-mil tip. Output is 1 volt; price is $4.95 with two sapphire tips.

Anti-Noise Plugs (63N)

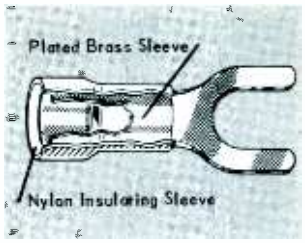
When a sound source is unplugged from an audio amplifier, careless handling of the plug often causes humming or thumping noises from the speaker. Switchcraft *Silent Plugs* eliminate this effect by automatically shunting the amplifier's input circuit when unplugged from the source. Types shown are Nos. 341 ($2.95), 49 ($1.50) and 169 ($1.75).

Power Resistors (64N)



Milwaukee Resistor Co. is now supplying ceramic-encased "bathtub" power resistors in values from 5 to 6000 ohms with a rating of 5 watts, and from 5 to 15,000 ohms at 10 watts, for replacement applications. In addition to having a ceramic covering, these components are waterproofed.

Solderless Terminals (65N)



In Waldom Electronics *Avikrimp* solderless terminal lugs, the barrel is reinforced by a tin-plated brass sleeve designed to grip the insulation of the wire and prevent it from working loose under conditions of severe stress or vibration. A nylon insulating jacket completely covers the brass sleeve and the barrel.

DC-to-AC Converter (66N)

The Webster Electric Model 12AS115 *Transistorized Power Converter* changes 12-volt DC power to 110-volt, 60-cps AC. Maximum continuous output is 100 watts at 120°F, corresponding to 13-amp input. Case dimensions are 4⅝" x 6½" x 3¼"; weight is 8 lb., 6 oz. A mounting base, suitable for either vertical or horizontal installation, is supplied, and a cigarette-lighter plug is available for drawing power from a car battery.

Intercom System (67N)

No special wiring is required for the Fanon FW-50 two-station intercom system, which utilizes the AC power wires for interconnection between units. A new circuit design eliminates "carrier buzz" and minimizes noise interference. One pair of units, with brushed brass finish, has a list price of $89.50.

MARCH, 1960

CATALOG AND LITERATURE SERVICE

ANTENNAS AND ACCESSORIES

1N. CHARLES ENG'R'G — Complete specifications for antenna systems using *Wizard* 300-ohm set couplers and flat twin-lead — without amplifiers in primary signal areas, or with amplifiers in fringe areas. *See ad page 97.*

2N. JFD — 1960 20-page replacement antenna guide for portable and toteable TV sets cross-references receiver models and manufacturer's antenna part numbers with model numbers of corresponding JFD exact replacement antennas. *See ad page 27.*

3N. TACO — Sample 12-page booklet, "A Guide to the Proper Selection of TV Antennas," available to servicemen for distribution to customers. Includes list of operating TV stations and information about TACO line of TV antennas.

4N. WINEGARD — Catalog sheet on line of *Precise-Match* couplers for use in supplying signal to two TV sets from one antenna, to one TV set from hi-lo antenna combination, or to TV and FM receivers via one line from two antennas. *See ad page 94.*

AUDIO & HI-FI

5N. DUOTONE — 4-part booklet explaining how to buy diamond needles, how to know when a needle is worn, how to identify existing needles in record players, and how to replace a worn needle. *See ad page 88.*

6N. EICO — 20-page catalog of kits and wired equipment for: stereo and monophonic hi-fi, test instruments, "ham" gear, Citizens band transceivers, and transistor radios. Also, free "Stereo Hi-Fi Guide" and "Short Course for Novice License." *See ad page 52.*

7N. JENSEN INDUSTRIES — Assorted *Jensellaids* to help servicemen gain new business selling phono needles, cartridges and accessories. *See ad page 70.*

8N. MULTITONE OF CANADA, LTD. — Descriptive pamphlet giving specifications for *Adaphone* personal listening attachments. *See ad page 78.*

9N. NORTRONICS—Descriptive sheets and price lists of stereo tape conversion kits, magnetic tape heads, and tape recorder accessories.

10N. PERMADYNE—Literature on extended-frequency-range dynamic headphones, both monaural and binaural types.

11N. ROBINS — 16-page illustrated catalog of complete product line including new magnetic bulk eraser, *M/M* recording heads, and record-changer bases.

12N. SHURE — Brochure on stereo hi-fi — with technical data, general features, and consumer benefits. *See ad page 76.*

13N. SONOTONE — Literature on CM-T10 *Matched Twin* microphones for stereo tape recording. *See ad page 67.*

14N. WRIGHT-ZIMMERMAN — Sheet describing "Baker's Dozen" offer — extra speaker and display rack furnished free with purchase of 12 personalized dynamic speakers. *See ad page 40.*

COMPONENTS

15N. ARCO — 4-page brochure containing specifications on *Elmenco* dipped Mylar-paper capacitors, with complete list of distributors. *See ad page 15.*

16N. CLAROSTAT — 1960 catalog on resistors, controls, and other resistive devices; also brochure on composition-element controls for radio and TV replacement applications. *See ad page 61.*

17N. CORNELL-DUBILIER — 1960 catalog of general-replacement and industrial-type capacitors. *See ads pages 45, 72, 73.*

18N. DELCO — General catalog of electronic parts. *See ad page 65.*

19N. MERIT—Exact Replacement Guide, covering 6,000 exact replacement parts for TV sets. *See ad page 47.*

20N. SPRAGUE — 40-page *Electrolytic Replacement Manual* No. K-104, with cross-reference of TV-radio manufacturers' part numbers to Sprague replacement catalog numbers. *See ad page 12.*

FUSES

21N. BUSSMANN — Bulletin SP-50 describing *Stak-Pak*, a fuse assortment that supplies the serviceman with fuses he needs on the job. *See ad page 55.*

RECEIVERS

22N. ATR — New literature on Customized *Karadios*, including many 1960 automobile listings as well as new lower prices for trim plates. *See ad page 14.*

23N. SETCHELL-CARLSON — Descriptive folder on new line of TV consoles, equipped for field conversion into stereo-AM-FM combination units by adding plug-in accessory subchassis and extra speaker enclosure.

SERVICE AIDS

24N. ANTRONIC CORP. — Promotion sheet giving full details on Anchor *Magna-Lite* "ten-pak" offer including 5-power light magnifier. *See ad page 88.*

25N. CASTLE TV TUNER SERVICE — Leaflet describing service for all makes, models of TV tuners. *See ad page 90.*

26N. DON BOSCO — Literature describing typical uses for servicing and testing electronic circuits with the *Mosquito*, a battery-powered transistorized tester.

27N. E-Z-HOOK—Convenient reference sheet titled "How to Build the Five Most Useful Scope Probes," with schematics, mechanical component layouts, etc. *See ad page 76.*

28N. PRECISION TV TUNER — Information on repair and alignment service available for any type of TV tuner. *See ad page 66.*

29N. YEATS — Folder describing new Model 5 appliance dolly, in addition to other types of dollies and various styles of protective pads. *See ad page 95.*

SPECIAL EQUIPMENT

30N. ACME ELECTRIC — Catalog 161-B01 describing applications of variable voltage adjustors in correcting for over- or under-voltage conditions on AC power line; also catalog 17-BL01 on portable and rack-type DC power supplies with output of 0 to 45 volts at current drain up to 2½ amps. *See ad page 96.*

31N. GUIDE LAMP — Information about *Guide-Matic* power headlight control; lighting units for cars, buses, trucks, and tractors; all-glass T-3 *Safety-Aim* sealed units; stampings, castings (plated), and plastics. *See ad page 18.*

32N. SUPEREX — Description of adjustable, screw-on filter to eliminate TV interference from Citizens radio equipment — either through tuner on Channel 2 or 6, or directly into IF stages on any channel. *See ad page 88.*

TECHNICAL PUBLICATIONS

33N. GERNSBACK—Descriptive literature on Gernsback Library books. *See ad page 90.*

34N. HOWARD W. SAMS — Literature describing all current publications on radio, TV, and hi-fi servicing. *See ads pages 44, 74, 75, 93.*

TEST EQUIPMENT

35N. B & K — Bulletin ST24-R, digest of information on Model 1075 *Television Analyst*, Models 1070 and A107 *Dyna-Sweep* circuit analyzers, Models 550, 650 and automatic 675 *Dyna-Quik* dynamic mutual conductance tube and transistor testers, and Model 440 CRT rejuvenator-tester. *See ads pages 23, 42.*

36N. HICKOK — Descriptive brochure on line of test equipment, including high-quality tube testers, transistor testers, and in-circuit transistor-radio tester. *See ad page 60.*

37N. KINEMATIX — Descriptive literature on *Twin Tone* signal generator for balancing of dual-channel stereo amplifiers.

38N. RCA ELECTRON TUBE DIV.—Flyer on line of electronic test instruments. *See ads pages 51, 69, 3rd cover.*

39N. SECO — Article reprint of "Take a Tube Tester Home" plan; two-color folder describing full line of test equipment and servicing aids; also information on dynamic tube checking and troubleshooting TV deflection circuits. *See ad page 63.*

40N. VIS-U-ALL — New 8-page Tube Substitution Guide listing over 400 tube types, including hi-fi, special-purpose and foreign tubes as well as common radio and TV tubes. *See ad page 90.*

TOOLS

41N. UNGAR — Latest catalog of soldering tools and accessories for printed-circuit and micro-miniature systems. Also, folders describing *Kleen-Tip*, thread-on heating units, and *mini-tips*. *See ad page 57.*

42N. VACO — New catalog sheets on line of *Compact* tools for electronic servicemen. *See ad page 95.*

43N. WELLER—Brochure announcing *Hardware Week* promotion for this spring, in which consumers who buy a heavy-duty soldering gun, power sander, or *Sabre Saw* will receive free one-year subscriptions to two publications in the home handicraft field. *See ad page 46.*

TRANSISTORS

44N. TUNG-SOL — *Similar-Type Transistor Reference Guide* in both booklet and wall-chart form, with cross-reference data, outline drawings, and (in booklet only) specifications of Tung-Sol transistors; also *Transistor Replacement Guide* with substitute-transistor recommendations for specific models of portable and auto radios. *See ad page 41.*

TUBES

45N. CBS — Latest issue of "Tech Tips" by Bud Tomer entitled "Simplex Simplifies Stereo." *See ads pages 49, 80.*

46N. GENERAL ELECTRIC — Interchangeability guide giving available substitutes for numerous types of foreign and American tubes; also specification and cross-reference chart on "Five Star" high-reliability tubes for critical applications. *See ads pages 16-17, 24-25, 59.*

KEEP PACE

with the demands of your profession

A complete, up-to-date library of RCA technical literature is as necessary a tool in your profession as a VTVM. It's a sure, simple, time-saving way to maintain your status as an expert!

1. **RCA TRIPLE PINDEX ($1.75)** • Base diagrams for 1500 receiving and 400 picture tubes, with cross references to many foreign and industrial types. Triplicate receiving tube breakdown shows you at least 3 diagrams at once.
2. **COLOR TELEVISION PIC-O-GUIDE ($4.50)** • RCA's John Meagher shows you how to troubleshoot and adjust color TV receivers. Problems are illustrated in full color, with easy-to-follow explanations of how to correct them.
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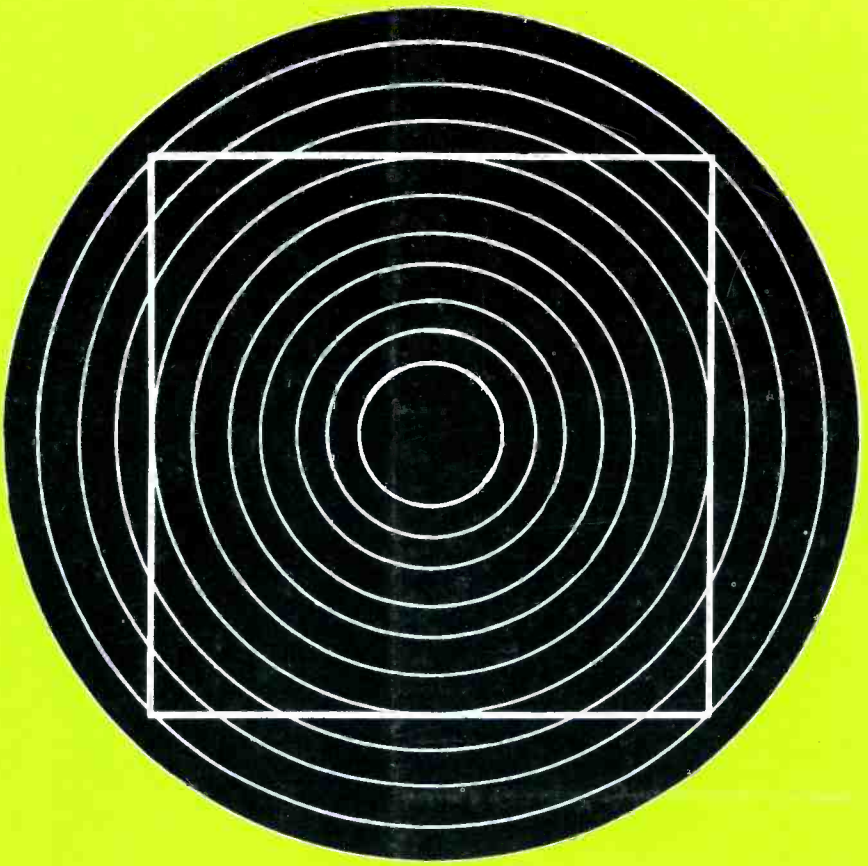
4. **RCA INTERCHANGEABILITY DIRECTORY—FOREIGN vs. U.S.A. RECEIVING TUBES** • Lists some 450 foreign receiving tubes (radio, TV, audio), with U.S.A. direct replacement or similar type where available.
5. **RCA RECEIVING TUBES AND PICTURE TUBES BOOKLET (30¢)** • A jam-packed 48-page booklet listing electrical characteristics and socket connections for more than 900 receiving and picture tubes used in standard AM, FM, TV, and audio amplifier sets.
6. **RCA PICTURE-TUBE REPLACEMENT AND INTERCHANGEABILITY CHART** • Lists 88 RCA Picture Tubes, and the 253 industry types they replace. Especially for the service technician.

Check with your Authorized RCA Tube Distributor THIS WEEK, to make sure you have *the latest editions* of these important publications—each a standard of the industry.

RADIO CORPORATION OF AMERICA
Electron Tube Division **Harrison, N. J.**

RCA Salutes the Man Behind Your TV Set during National Television Technicians' Week, March 21 to 26.



things are NOT as they seem . . .

This is a perfect square within the circle
—it is an optical illusion that the sides bend.

Things are not as they seem . . .
These two fuses look alike . . .
But they are not.

This fuse may burn out anywhere along the length of the filament even in the cap—this blown fuse is impossible to detect visually.

This Littelfuse has a controlled blowing point—the filament is plated throughout its length except in the very center—the fuse will always blow here. A blown Littelfuse can be detected immediately—a Littelfuse feature.

Littelfuse holds more design patents on fuses than all other manufacturers combined.

LITTELFUSE

DES PLAINES, ILLINOIS