FEBRUARY · 1957

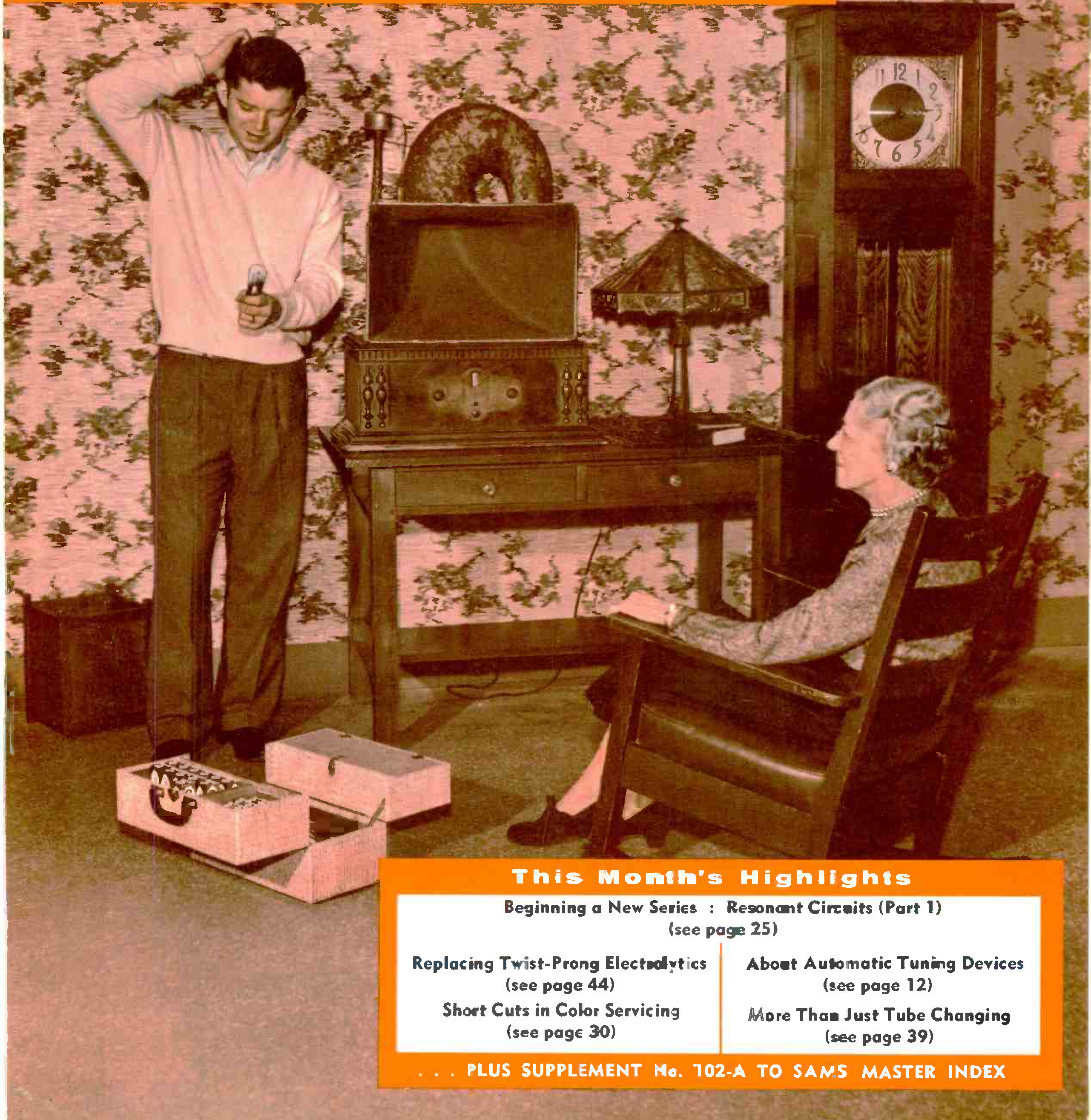
25 CENTS

Howard W. Sams

PHOTOFACT

PF REPORTER

FOR THE ELECTRONIC SERVICE INDUSTRY



This Month's Highlights

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(see page 39)

. . . PLUS SUPPLEMENT No. 102-A TO SAMS MASTER INDEX

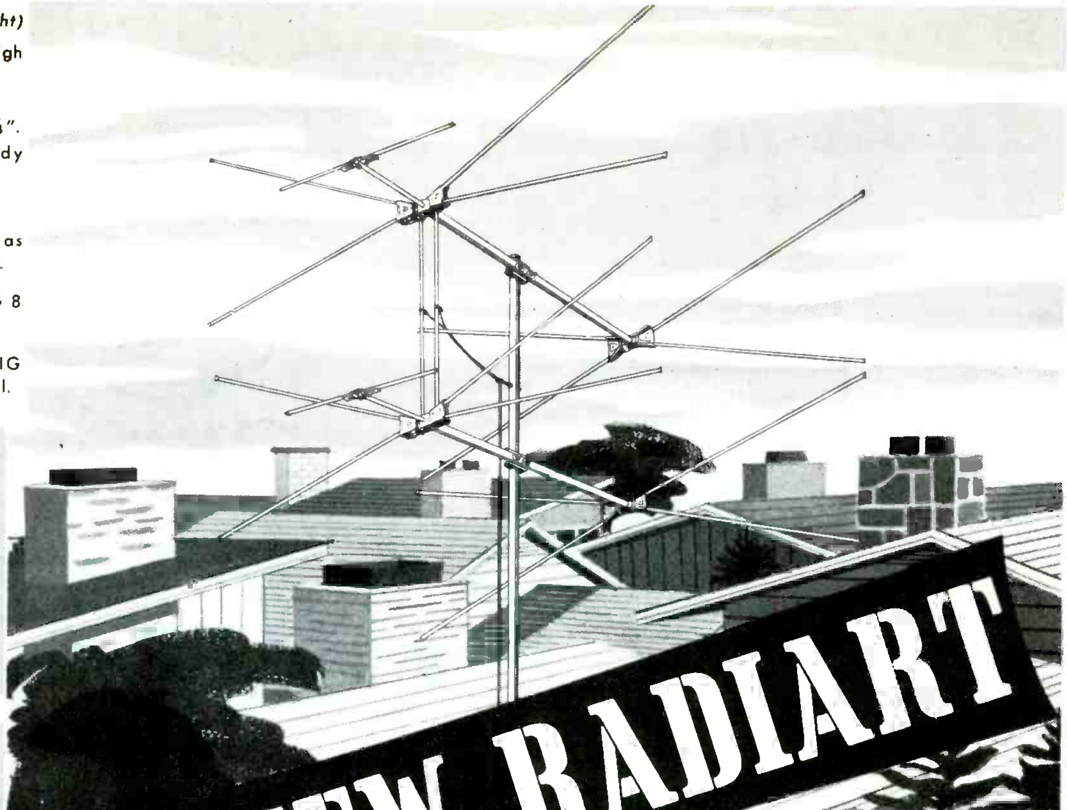
MODEL 280SW *(shown right)*

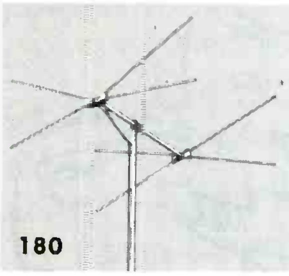
- Double stacked array PLUS high frequency elements.
- All Aluminum Construction.
- Mounts on any mast up to 1¾".
- QUICK-RIG design for speedy one man installation.
- Complete with stacking bars.

MODEL 180SW .... same as 280SW only not double stacked.

MODEL 180 .... QUICK-RIG 8 element "Lazy-X" Conical.

MODEL 280 .... QUICK-RIG double stacked "Lazy-X" Conical.





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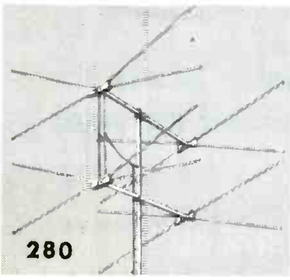
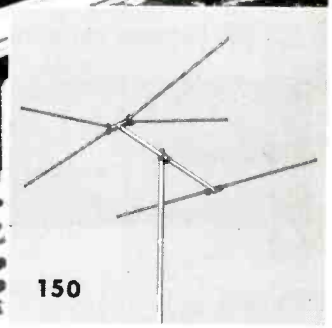


280

12 NEW RADIART TV ANTENNAS



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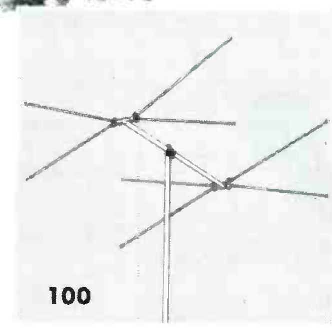

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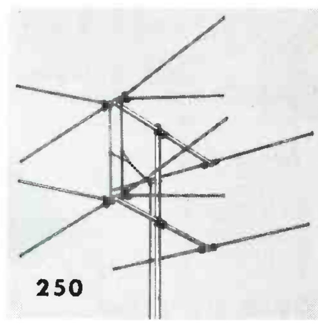

250

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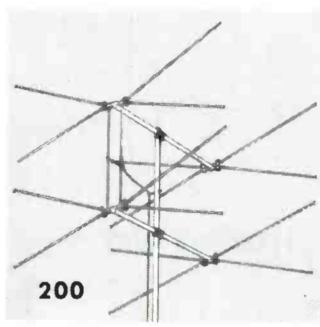

200

LZX 100 single array

LZX 101 single array, unassembled

LZX 200 8 element conical completely assembled, stacked array

LZX 201 8 element conical unassembled, stacked array

LZX 150 single array

LZX 151 single array, unassembled

LZX 250 6 element conical assembled, stacked array

LZX 251 6 element conical unassembled, stacked array

SUBSIDIARY OF CD CORNELL-DUBILIER ELECTRIC CORP.

THE RADIART CORPORATION / CLEVELAND 13, OHIO

PF REPORTER

for the Electronic Service Industry

PUBLICATION INFORMATION

Published monthly by Howard W. Sams & Co., Inc., at Indianapolis 5, Indiana.

Entered as second class matter October 11, 1954, at the Post Office at Indianapolis, Indiana, under the Act of March 3, 1879.

A limited quantity of back issues are available at 35c per copy.

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Coming in the MARCH PF REPORTER

SERVICE FACTS ABOUT TRANSISTOR RADIOS

The experiences of a service technician and the diagnosing procedures he developed after working with a number of different transistor radios.

RADIO FOR THE TV MAN

Photographs and drawings conduct you step by step through the alignment of one of the present-day versions of the 5-tube "superhet."

CHECKING OUTDOOR ANTENNA INSTALLATIONS

Practical pointers which will help you to get "plus" business in repairing winter damage to your customers' antenna systems.

PUBLIC ADDRESS SPEAKERS AND THEIR APPLICATIONS

An aid to the installer in selecting the type of speaker best suited for a particular application.

for all set replacement work!

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Letters to the Editor

Dear Editor:

I would appreciate your help in finding the solution to a trouble in a Scott Ravenswood model TV receiver. The trouble is in the sound. The picture is perfect and bright, but the sound is distorted to such a degree that you cannot make out what people are saying.

William C. Le Duc

Troy, N. Y.

Troubles in the audio section of a TV receiver can often be very hard to locate; however, the symptoms you describe point very strongly to incorrect oscillator alignment of the tuner. Since the Scott set uses a switch type tuner with incremental inductances for tuning, it will be necessary to follow the procedure outlined in the service literature to align the oscillator correctly.

Should alignment of the oscillator fail to eliminate the audio trouble, it is our suggestion that you align the entire audio IF and detector strip, and if trouble still persists, check the audio amplifier and output stages for trouble.

The audio stages may best be checked for distortion or other trouble by applying an audio signal to the grid of the audio amplifier and varying the signal level and frequency. Any distortion caused by the audio section should be noticeable at the speaker.

Alignment of the audio IF and ratio detector stages should reveal any trouble in these stages because an incorrectly operating stage will prevent a satisfactory alignment.—Editor

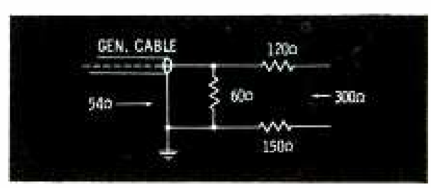
Dear Editor:

I have a sweep generator with 54 ohms of output impedance and I want to match it to 300-ohm line. What values of resistors should I use?

Gerard Leboeuf

Montreal, Canada

Use the network shown below. The resistors should be a non-inductive type, preferably carbon or composition units.—Editor



Dear Editor:

Would you please send me the dope on how to hook a Webcor record changer to a Philco TV table Model 22D4143?

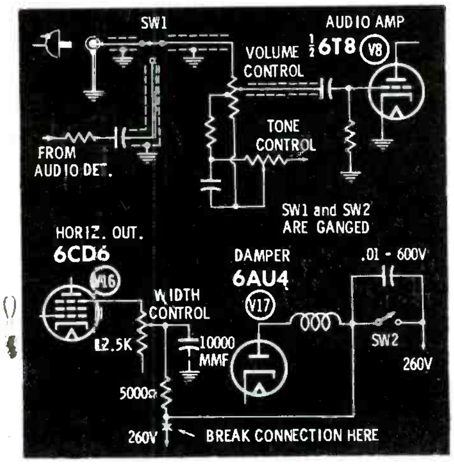
I read your PF REPORTER every month and it has helped me several times on servicing problems.

C. D. BRENNEMAN

Feather River Inn
Blairsden, Calif.

A phono plug and switch assembly may be added to the Philco receiver as outlined below. This type of hookup, however, will permit the major part of the TV receiver to function while the phono is being operated. The setup disables only the horizontal sweep and high voltage circuits and switches the input of the audio amplifier from the TV sound detector to the phono output.

It would be desirable to disable the B+ and filaments of the unused tubes, but this is quite involved and would require special switches.—Editor



Dear Editor:

I am now chasing down a new trouble in an RCA Victor CT-100. Symptoms are no color from station signal—yet the signal from my color bar generator comes through with normal color bars. I checked the output of the generator with my field strength meter and got about 500 microvolts. The station signals on channel 4 are about 1,000 to 1,500 microvolts. Can you give me any help on this?

M. W. DERAS

Lakewood, Calif.

We suspect that the receiver in your case is not at fault and that the difficulty lies in the antenna system. It seems likely that the gain of the system is down considerably at the color subcarrier frequency, which is about 70.83 megacycles for channel 4. We recommend that you check the orientation of your antenna and possibly try another in its place.—Editor

Electro-Voice POWER-POINTS THE WAY TO PLUS-PROFITS!

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The Package Deal With Extra Profit Built Right in! Power-Point Pete's CASH BOX is a self-contained point-of-purchase package containing two each of three Power-Point models and two each of three Power-Point mounts. You get the whole package, plus direct-mail merchandisers in color, at a merchandising price. THERE'S NO CHARGE AT ALL for some items! You get extra profits and you pass on an extra profit margin to your dealers, too!

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Electro-Voice ads in RECORD & SOUND RETAILING and THE BILLBOARD pre-sell your prime customers—record dealers! Eight thousand record dealers account for 85% of total phono and record sales. These are the people who can sell Power-Points in volume. They're the big-order customers you want. Go get 'em with—Electro-Voice direct mail pieces and these hard-sell ads! See them! Sell them! Profit along with them!

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Shop Talk

MILTON S. KIVER

Author of . . .
How to Understand and Use TV Test Instruments
and Analyzing and Tracing TV Circuits

Installation Precautions with Master Antenna Systems

In recent "Shop Talk" columns, we have shown how a master antenna system would be laid out on paper, and from this, installed in a building. Now let us turn our attention to some of the precautions which should be observed in order not to weaken the installation.

Antenna

Aside from the choice of an antenna and its location, which we will not go into, the next most important features concern the ruggedness of the antenna, its supporting structure and its grounding. It can be said without qualification that the antenna is the foundation for the entire system and if skimping, due to economy, is necessary, the antenna is definitely not the place where this economy should be practiced. Not only should the best possible antenna be chosen, but considerable attention should be given to the sturdiness of its supporting structure. For example, if aluminum tubing is used to support an antenna, insert a wooden dowel in the end of the tubing where it fastens to the boom. This will prevent pinching and provide a stronger support. Or, if the mast is to be fastened to a brick wall, do not drill into the mortar between the bricks—drill directly into the bricks. Although easier to drill, mortar provides less support than brick. Also, it is not advisable to fasten studs to the topmost row of bricks, since this is the weakest part of the wall. These are all small things, to be sure, but what they add up to is not insignificant.

Antenna Grounding

Antenna grounding is another facet of antenna installation. The mast must be thoroughly grounded with at least No. 8 ground wire run directly to a cold water pipe. Many installation men use the plumbing vent pipe which sticks through the roof top not only for grounding, but for support as well. Whether or not this will serve for grounding depends upon the resistance of this particular path to ground. It is not uncommon to find an insulating type of sealing compound used on the pipe joints, and in these instances the resistance of this path to ground may be so high as to render it useless for static discharge. Again, metal plumbing pipes are frequently connected to terra-cotta or non-metallic sewer pipes underground, and here, too, the resistance to ground may be quite high.

Probably the chief reason why

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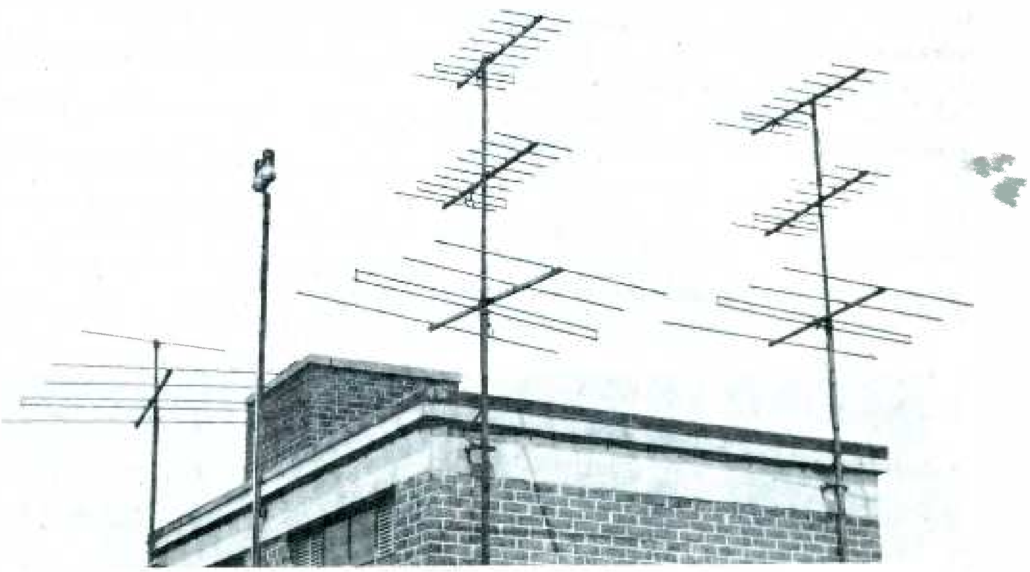


The seven antennas used in a 2,000-unit garden-apartment installation near New York City for the seven channels available in the area.

Courtesy Blonder-Tongue Labs., Inc.

Do you need a Degree for success in Electronics?

"Not necessarily," says Dick Brani, 33-year-old Field Engineering Instructor in Project Sage at IBM—Kingston, New York. "Oh, sure—I'm aware of my limitations to design electronic equipment even though I am qualified to maintain it. That's the biggest advantage of a formal degree. The point is . . . there are many responsible management positions opening all the time in IBM for men like myself . . . and comparable positions elsewhere would probably require an engineering degree."

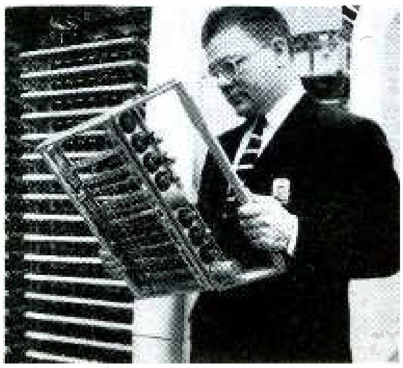
Some seven years ago, IBM took the initiative with respect to technical training within its own organization. It realized, even then, that a great number of intelligent and otherwise capable men were falling by the wayside merely because they lacked 4 years of college engineering. Statistics indicated that because of financial difficulty or improper high-school preparation, close to 50% of the potential engineers in the country became lost in the educational shuffle. While some people with less foresight ignored the fact or bemoaned it, IBM did something about it. Consequently, fellows like Dick Brani can now enjoy more satisfying, more rewarding work than ever before.

Great Interest in Mathematics. While Dick was attending Boys' High in Brooklyn, his principal academic interest was mathematics. And, like many other young fellows of that era, Dick was realistic about his future. He decided his best bet might be business accounting. When Dick graduated in 1940, he accepted a position with a New York banking firm. It was not until Dick entered the Army in 1943 that he had the opportunity to pursue a more advanced form of mathematics, an A.S.T.P. training program at Lehigh University. This all-too-brief experience convinced Dick that he should make his career in a field that was in some way related to electrical technology.

Postwar Education. Discharged with the rank of Staff Sergeant, Dick returned to Allentown, Pa., to marry a girl he had met while enrolled at Lehigh. During this period, he successfully supported his family and himself selling various lines of food. In the evening, however, Dick continued his study of radio, TV, and electronics at the Allentown Branch of the Temple Institute. In two years' time, he graduated and secured an F.C.C. license. His technical career was beginning to take shape.

IBM Looks Especially Good. Glancing through an issue of *Time Magazine* one evening, Dick happened to read an article about Thomas J. Watson, Jr., the president of IBM. The story emphasized Mr. Watson's great faith in the future of electronic computers . . . the wonderful promise it holds for the ambitious, intelligent young man. Some time later, Dick spotted a classified ad describing IBM's association with Project Sage. Phil-

Brani trouble shooting Magnetic Drum Frame.



Brani studies computer pluggable unit.

Dick explains computer logic to a Systems Class.

33-year-old Dick Brani feels that technicians can grow into more responsible positions.

adelphia was one of the work locations available after training. That was all Dick Brani needed.

Asked to Become an Instructor. When Dick was three-quarters of the way through his nine month computer systems course, he was invited to remain at Kingston as an instructor. "It was like a bolt out of the blue," he recalls. "I knew I'd enjoy teaching, but I always thought it was out of the question. I accepted all right, and I can't tell you how much I've enjoyed helping these fellows and watching them grow within the organization. For instance, there's a fellow in my class right now whose education is limited to correspondence school. He's in the top third of his class, and has a real future with IBM—all because he has the native talent and is willing to work."

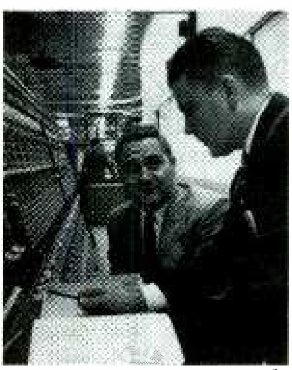
What Does Dick Brani Teach? "Actually, I teach three separate courses for technicians in field engineering. One is computer systems testing, which is for the more advanced student. This training lasts for 33 weeks—a long time, perhaps, but it's well worth it. Another is a program of 24 weeks' duration that deals with computer input-output units. Finally, I teach a course in computer units displays. This also lasts for 24 weeks. Each one of these courses is an education in itself." Experience has shown that IBM's educational programing is most successful. Men accepted receive their training with no strings attached—no contracts. Upon graduation the road to success is wide open in *all* divisions of the corporation.

The World's Largest Electronic Computer. "This computer is really fantastic. It contains approximately 1,000,000 parts, and it's housed in a building 4 stories tall. Information is filtered in from Texas towers, picket ships, reconnaissance planes—even ground observers. Every object in the sky is analyzed. Then it checks each object against available traffic data and identifies it as either friendly or hostile. It can make suggestions, but it can't send a Nike missile against a 'baddie.' Only authorized personnel can make that decision."

What About Dick's Future? "Well, right now, I'm doing work that most technicians couldn't touch with a ten-foot pole. I know of few companies where technicians are actually doing engineering work. I guess it's a matter of approach. Both kinds of companies will get the job done, but IBM prefers to think in terms of the man, encouraging him to grow into more responsibility. You might say that IBM gets more out of the man, and in the final analysis, it seems a lot more efficient from the corporation's and employee's viewpoint. Personnel policy at all levels—management, engineering, or technical—is the same. The future is wide open."

Just recently, Dick bought a home in Saugerties, near Kingston, where his wife Betty and their three children, David, 9, Sharon, 7, and Paul, 3, enjoy a pleasant, contented life together. Occasionally, in the summertime, Dick plays softball with his co-workers. But his family is—and always will be—his predominant interest.

What About You? Opportunities in the Project Sage program of long-range national importance are still growing. If IBM considers your experience equivalent to an E.E., M.E. or Physics degree, you'll receive 8 months' training, valued at many thousands of dollars as a Computer Systems Engineer. If you have 2 years' technical schooling or the equivalent experience, you'll receive 6 months' training as a Computer Units Field Engineer, with opportunity to assume full engineering responsibility. *Assignment in area of your choice.* Every channel of advancement in the entire company is open. All the customary benefits and more. WRITE to: Nelson O. Heyer, Dept. 8602, IBM, Kingston, New York. You'll receive a prompt reply.



At the Maintenance Console.

At home Dick plays with one of his three children.

Customer Engineers: opportunities are also available, locally, for servicing IBM machines, after training with pay. Consult your nearest IBM office.

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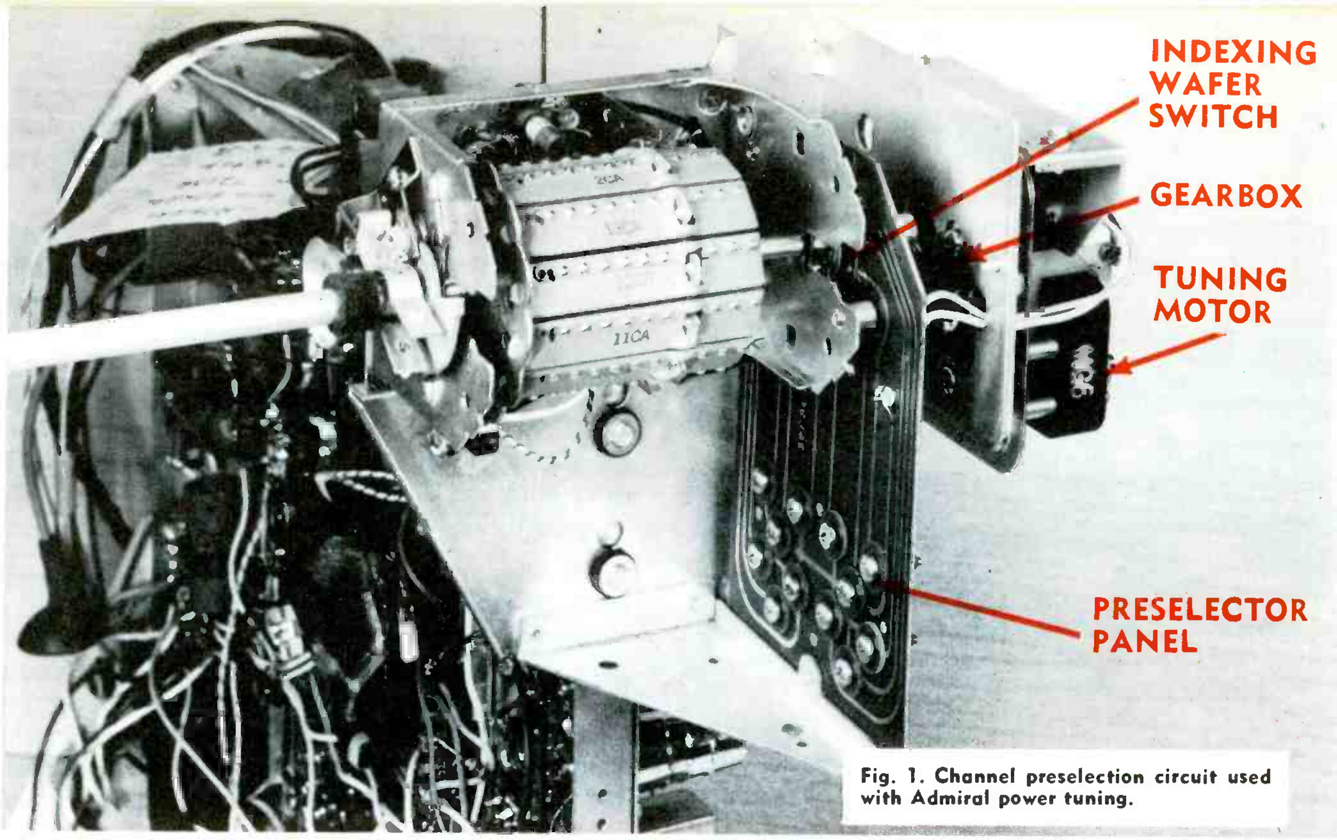

Fig. 1. Channel preselection circuit used with Admiral power tuning.

About These Automatic Tuning Devices

Automatic tuning systems are enjoying a great surge of popularity in the television industry this year, with some form of motorized tuning being offered as an optional feature on many brands of TV sets. The main components of a typical automatic tuning device are a small electric motor geared to the tuner shaft and a group of switches and cams used to start and stop the motor. In most sets, one of these motor-control switches is mounted so that the viewer can change channels by pushing a button on the front or top of the cabinet. As a rule, provisions are also made for some kind of remote-control switch which is generally furnished as a separate accessory.

A detailed description of the operation and maintenance of one automatic channel selector (Philco "top touch tuning") was given in "Examining Design Features" in the May, 1956 issue of PF Reporter. Other motorized systems operate in somewhat the same manner as the Philco device and call for similar repair procedures.

Oscillator Adjustment

Automatic tuning devices on sets already in the field may be expected to need repairs only occasionally, but every new motorized receiver needs some checking and adjustment during the initial installation to insure proper tuner operation. Manufacturers emphasize that the oscillator slugs in the tuner must be aligned so that the fine-tuning control will seldom need adjustment to bring in a satisfactory picture. The reason for this is simple: If the set user has to adjust secondary controls each time he switches channels, he might as well not have an automatic tuning device.

The slugs can normally be adjusted from outside the cabinet. The fine-tuning control should be set in one position and left there while the various slugs are being tuned. Each one should be rotated until sound volume is near maximum and sound bars or graininess appear in the picture, and then the slug rotation should be reversed just enough to clear up the picture. The order of adjustment is not critical in turret tuners, but the design of switch-type tuners requires that the oscillator slugs be adjusted in descending numerical order.

Preselector Adjustment

Another important adjustment required on most automatic tuning systems is the setting up of a preselector device which causes the tuning mechanism to stop only on active channels. In order to explain how the preselection is accomplished, let' us review the operation of a typical automatic tuner.

A tuning cycle is started when power is furnished to the motor through a push-button switch. As soon as the tuner has left the on-channel position, an internal hold-in switch closes and the motor continues to receive power after the push button is released. When the next desired on-channel position is reached, a metal tab or cam associated with that channel opens the hold-in switch and the motor stops. The device can be set to prevent cams for unused channels from opening the hold-in switch, with the result that the tuner will continue to rotate past these positions.

Setting up the preselector involves only a series of simple mechanical adjustments, but it is fruitful to note the variety of ways in which the adjustments are made in different automatic tuning systems.

Philco

The Philco device previously mentioned incorporated a wheel with a ring of snap-in plastic buttons. If reception on any channel was not desired, the button corresponding to that channel was removed. This system had the disadvantage that spare buttons were easily misplaced. Later models of Philco receivers have non-removable switches in place of the buttons. These are set by means of a push-pull lever that is accessible from the rear of the receiver.

General Electric

The General Electric "U"-line receivers have a bi-directional automatic tuning system with twin control buttons to provide for either clockwise or counterclockwise rotation of the tuner shaft. This system includes a preselector device called a "program wheel" which is mounted in the upper left corner at the rear of the receiver. This wheel contains 13 radial slide switches, one for each VHF channel and one for UHF tuning. When any one of these is positioned toward the outer rim of the program wheel, it acts as a cam and opens the hold-in switch when the associated channel position is reached. Sliding a switch toward the hub of the wheel moves it out of reach of the hold-in switch and causes the related channel position to be skipped by the automatic tuner.

Admiral

Admiral "power tuning" (Fig. 1) employs an indexing wafer switch on the tuner shaft, rather than a group of cams, to accomplish preselection. This switch is wired into a panel containing 12 printed circuits—one for each VHF channel. A tab on the wafer switch lines up with one of these printed circuits whenever the tuner is in a specific channel position.

A gap exists in the foil of each printed circuit, and a screw is driven into the fiber panel at the center of each gap. On every screw is mounted a "washer" which is actually a tiny printed wiring board having a conductive ring on the side facing the fiber panel. Tightening a screw places the ring in contact with the conductive foil, completing one of the circuits. Whenever the tuner is passing through any of the channel positions that correspond to tightened screws, the printed circuit functions as a short across the motor-energizing switch and the channel is bypassed.

The tips of the Phillips-head adjustment screws face the rear of the receiver and are slotted so that the screws can be reset with an ordinary screwdriver. Each one is labeled with the number of the channel that will be bypassed when the screw is tightened.

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How to Set Up and Adjust the New Motorized TV Tuners

by Thomas A. Lesh

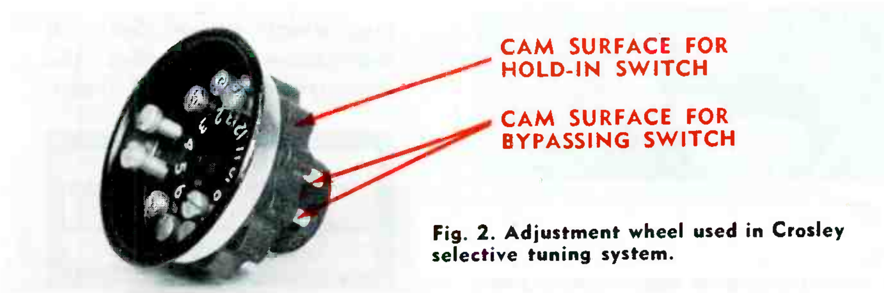


Fig. 2. Adjustment wheel used in Crosley selective tuning system.

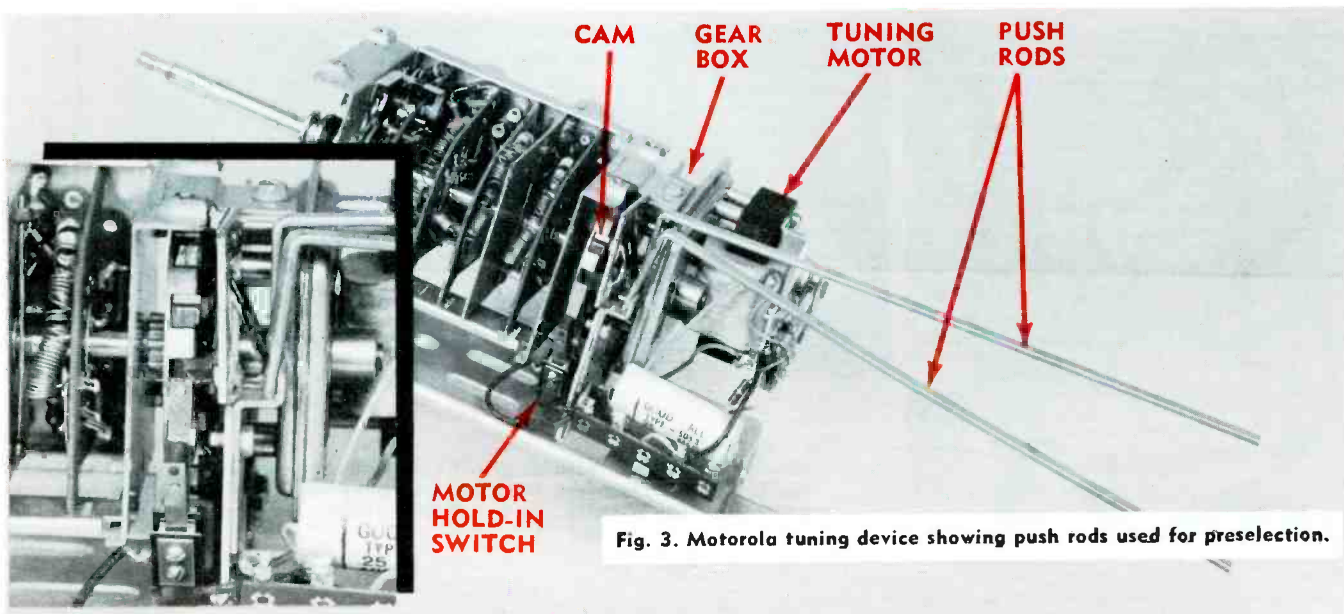
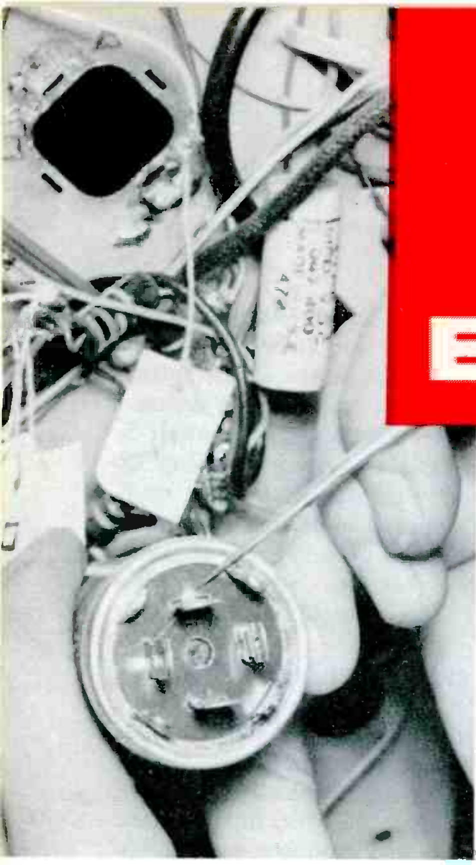
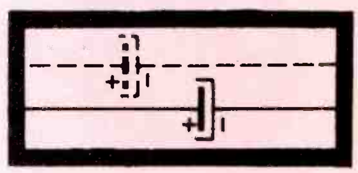


Fig. 3. Motorola tuning device showing push rods used for preselection.

REPLACING *Twist-Prong* ELECTROLYTICS

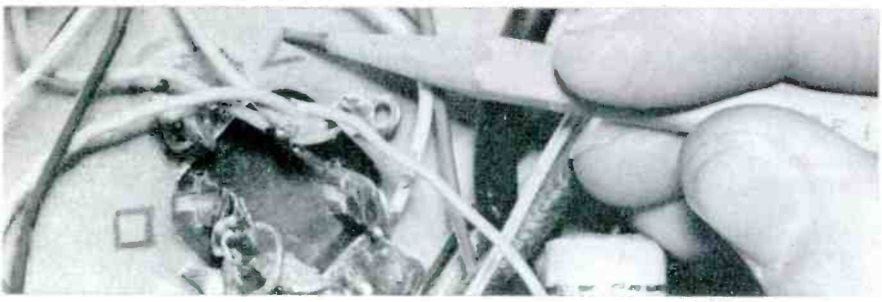


The replacement of a multisection electrolytic capacitor is not always as easy as it looks. Problems involving the identifying of terminal and lead connections, the straightening of mounting prongs and the replacement of insulators will often arise. Here are a few tips which should help all technicians, including the neophyte and the old-timer.



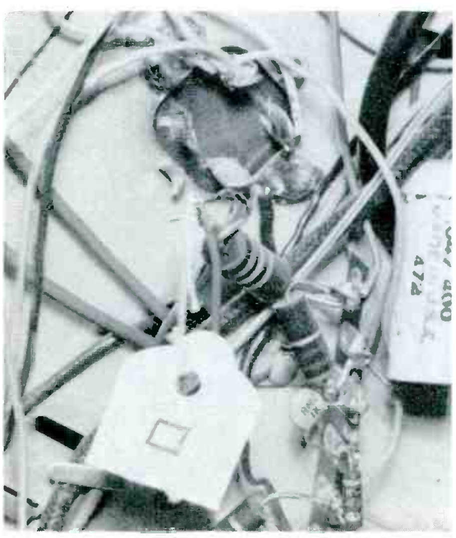
TERMINAL IDENTITY

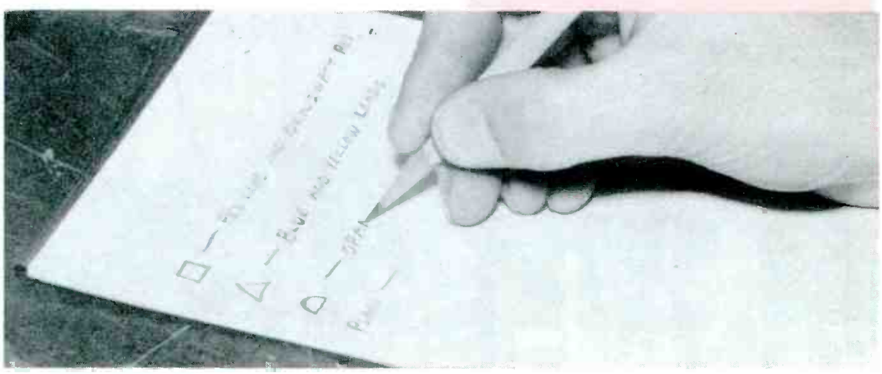
A small cut-out in the shape of a square, triangle, or half-moon can usually be found at the base of each positive terminal on all multisection electrolytics. These cut-outs key the individual terminals to corresponding value markings stamped on the body of the capacitor. The one terminal not bearing a cut-out symbol is designated by the uncoded value on the body.



ORIENTATION

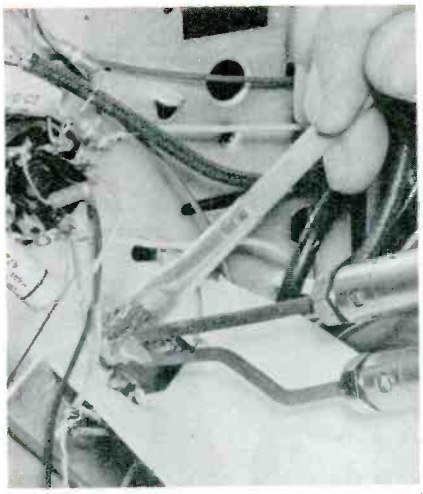
The position of the original unit should be indicated on the chassis, and the replacement part oriented accordingly. This is especially helpful when lead lengths are short.





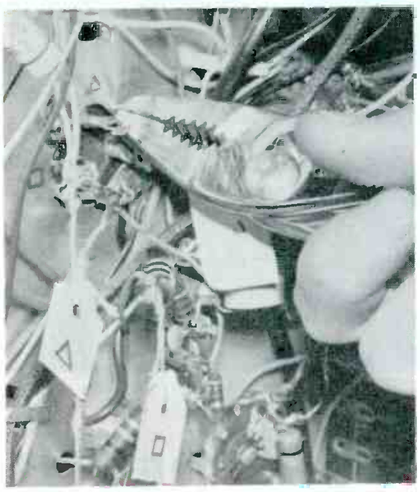
IDENTIFYING LEADS

Here are suggested methods of marking leads for quicker and easier replacement. All leads removed from any one terminal should be twisted together and coded with a string tag or adhesive sticker. An alternative is to keep a check list on notepaper.



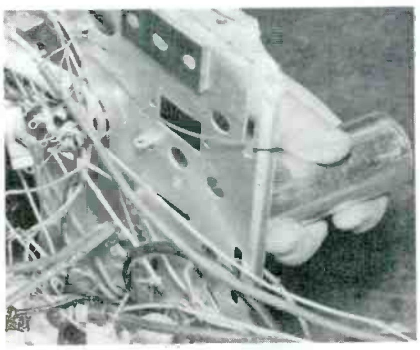
SOLDERED PRONGS

Remove as much excess solder as possible from all soldered mounting prongs. In this operation, it is advisable to protect the chassis wiring from solder droplets as shown.



STRAIGHTENING PRONGS

Use only sturdy slip-joint pliers to straighten both soldered and nonsoldered mounting prongs. If difficulty is encountered when straightening the prongs, it may be necessary to cut or twist them off as close to the chassis as possible.

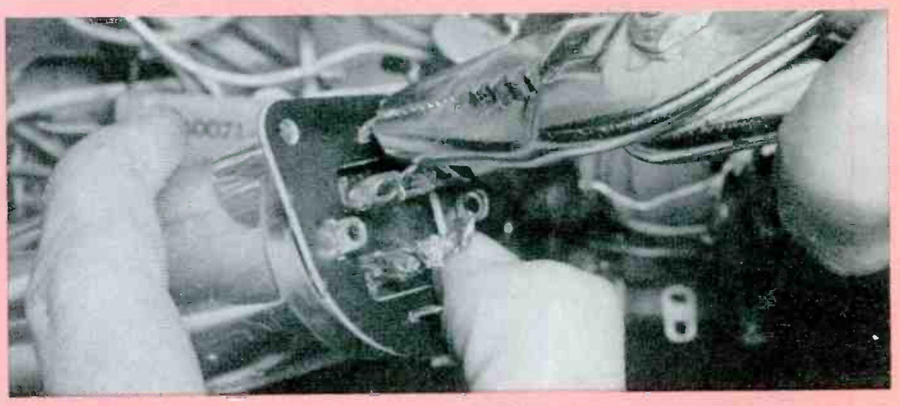


REMOVING THE CAN

As a final step in removing the original unit, heat each soldered prong while moving the capacitor back and forth until all prongs are free.

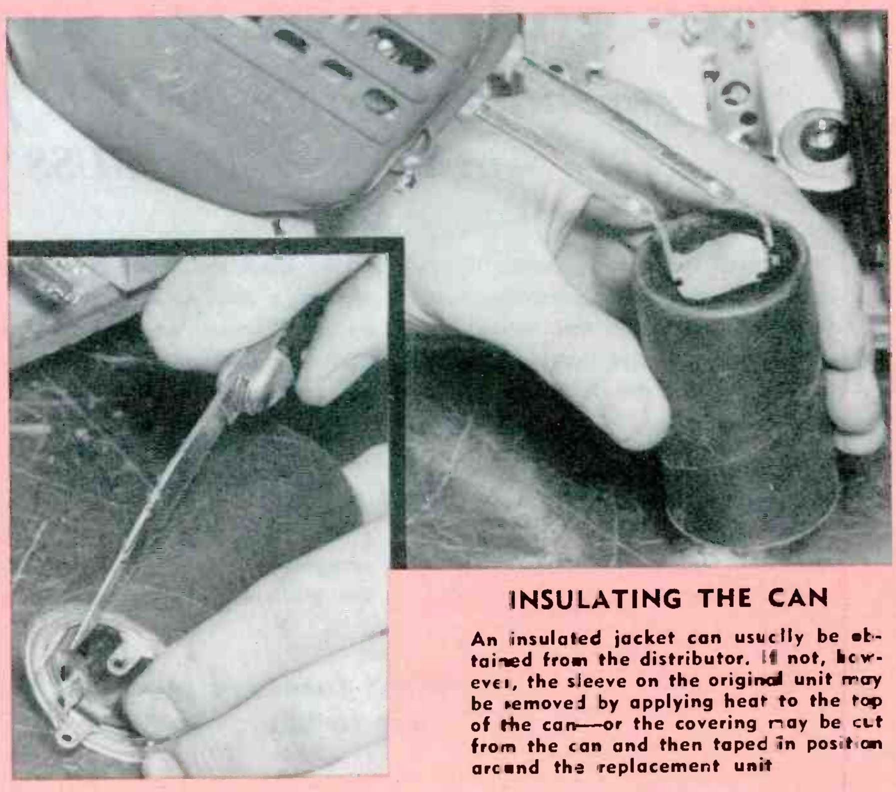
INSULATED ELECTROLYTIC

Replacing the insulated type of electrolytic presents a somewhat different problem. Here, the twist-prongs are inserted through an insulated disc. The disc, in turn, is riveted to the chassis—like a tube socket. Rather than straightening the prongs and possibly damaging the insulator, it is easier to knock out the rivets and remove the entire assembly.



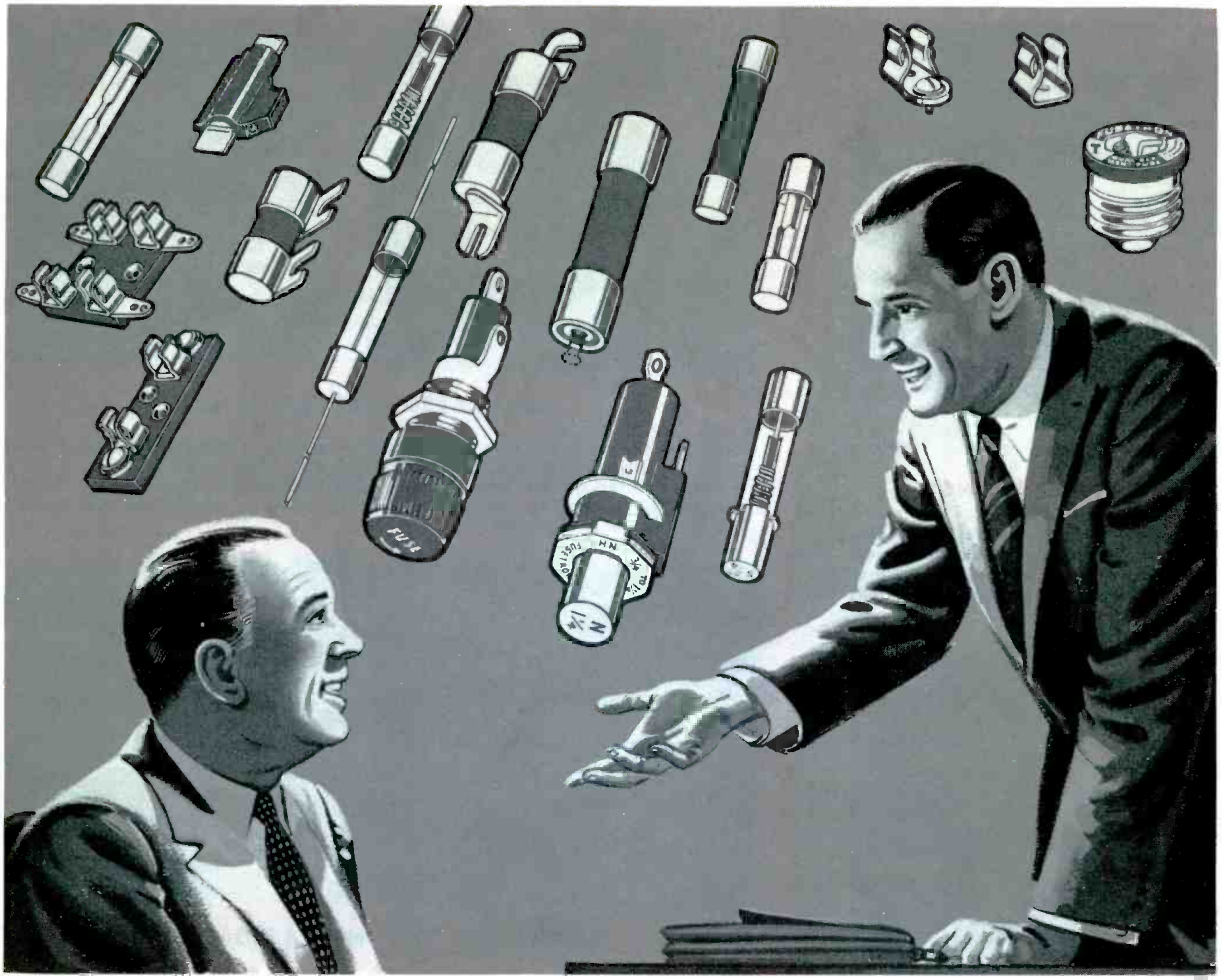
MOUNTING THE INSULATED CAN

When replacing this type of unit, first mount a new insulator disc to the replacement can and then mount the unit on the chassis. Self-tapping metal screws or small nuts and bolts may be used in place of rivets.



INSULATING THE CAN

An insulated jacket can usually be obtained from the distributor. If not, however, the sleeve on the original unit may be removed by applying heat to the top of the can—or the covering may be cut from the can and then taped in position around the replacement unit.



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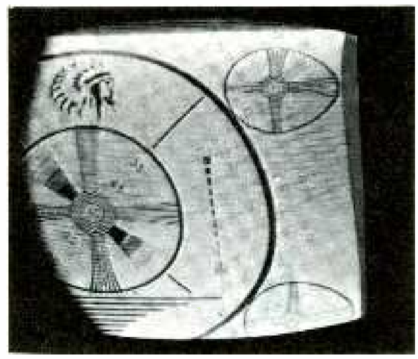

Fig. 2. Horizontal pulling in picture, but not in raster.

by Calvin C. Young, Jr.

Fig. 1. Installing foam-rubber pad.

Phono Hum Pickup

As the public becomes more and more hi-fi conscious, many people often try to make changes in their home music systems in an effort to improve the reproduction of recorded music. One change sometimes made is the replacement of a crystal or ceramic cartridge with a magnetic or variable-reluctance unit. If this is done properly, the system will usually operate satisfactorily, but there may be some undesirable side effects.

Recently, after such a change, a customer complained of a loud low frequency hum from the speaker whenever a single record was played. His comment was a well-worn phrase, "We never had that before"—and in all probability they hadn't, because the hum was due to pickup by the new magnetic cartridge. There is a very simple remedy for a trouble of this kind—merely increase the distance between the cartridge and the turntable by a fraction of an inch. This puts the magnetic cartridge far enough away from the turntable to prevent hum pickup or make it negligible.

A foam-rubber pad made for this purpose is shown being installed on the spindle of a changer in Fig. 1. This type pad can be obtained at low cost, and in addition to isolating the magnetic cartridge from the turntable, also cushions the record drop onto the turntable, prevents record slippage, lessens damage to grooves on records and damps out motor rumble.

Horizontal Pulling

A Hallicrafters Model 17810M television receiver was recently brought into the shop because the raster was small and out of focus. The selenium rectifiers in the set were several years old and therefore were immediately suspect. They proved to be weak and their replacement restored the raster to normal brilliance and size. However, a bending effect on objects in the background of the picture was soon noticed. Door jams, windows, telephone poles and even people were distorted, making it a strain to watch the picture. By moving the centering lever, the right edge of the raster was brought into view (Fig. 2), and it was seen that even though the picture showed evidence of pulling, the raster was straight.

Since the raster was not affected, it was decided that operation of the horizontal oscillator and output stages was normal and that the trouble might be in the video amplifier or sync amplifier stages. Accordingly, the tubes in the video amplifier, sync amplifier, RF and IF stages were checked. The RF amplifier had a small amount of leakage between heater and cathode and both IF amplifiers tested weak, so all three were replaced. No noticeable improvement in the picture was obtained. The video detector crystal shown in the circuit of Fig. 3 was checked by comparing its front and back resistance to that of a new unit. The resistance ratio of the old unit was 20K to 500 ohms, while that of the new crystal was 200K to 1K ohms. Substituting the new crystal, however, did not remedy the hum problem.

The coupling capacitors in the video and sync stages were checked and the .05-mfd sync

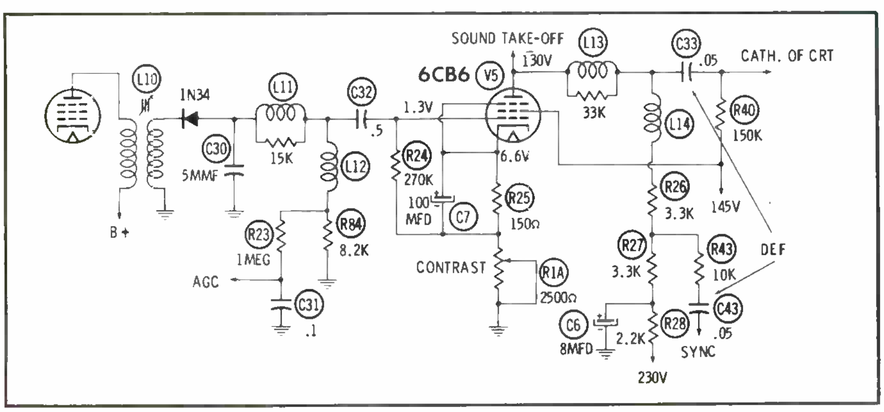

Fig. 3. Video section of Hallicrafters TV receiver.

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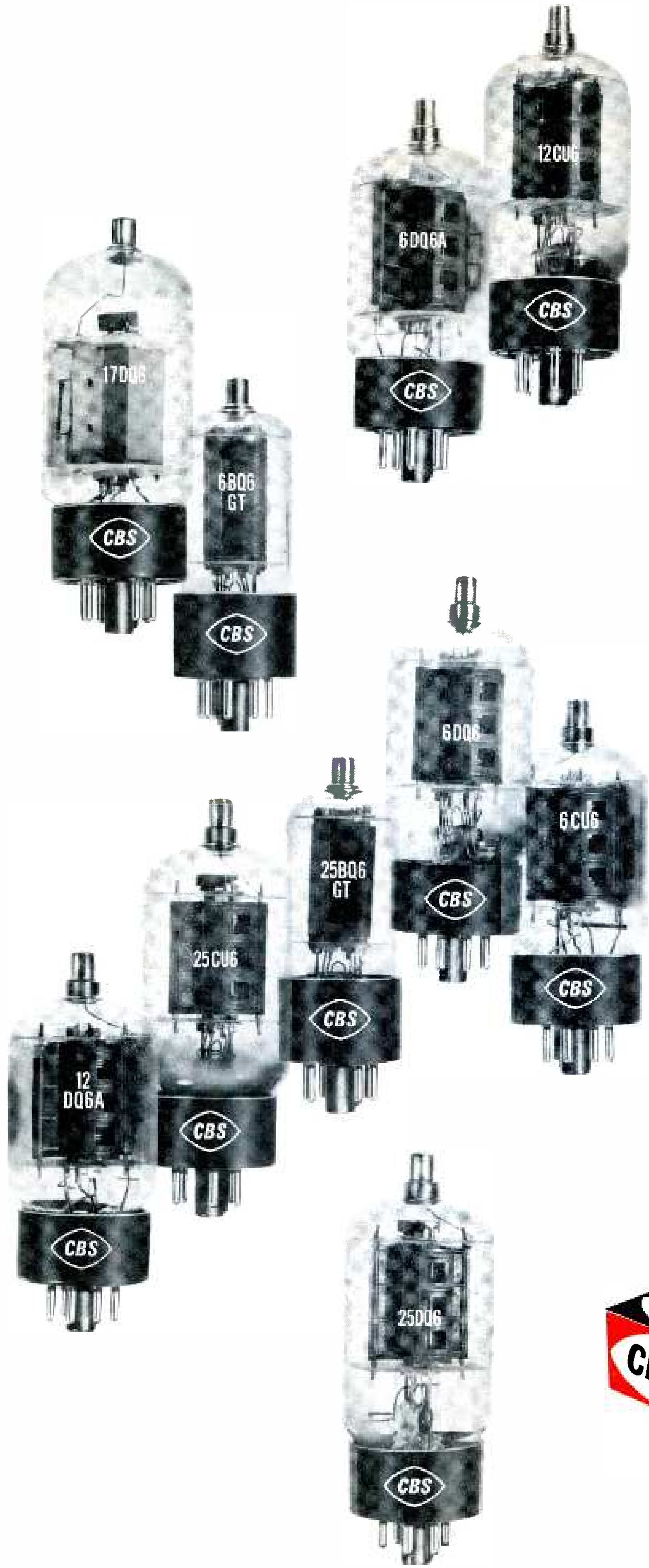

From the originator
of the 6BQ6GT • 6CU6 • 6DQ6

TIPS ON REPLACING HORIZONTAL AMPLIFIERS

No one tube satisfactorily replaces the 6BQ6GT, 6CU6, and 6DQ6 . . . or their heater-voltage variations. CBS knows because, foreseeing the need for each of these three families of horizontal amplifiers, CBS originated the 'BQ6, 'CU6, and 'DQ6. The latter two were designed: 1. With increasingly greater safety margins to combat high voltage and heat. 2. With improved sweep characteristics.

In general, replacement of each tube should be with the original type. But in some sets, larger, wider-angle picture tubes using higher voltages place overloads on the original horizontal amplifiers. Here replacement should be a step upwards at a time: 'CU6 for 'BQ6 . . . 'DQ6A for 'CU6. Following these rules will give reliable safety margins and neither too little nor too much sweep, especially important in receivers with no horizontal width control.

Another good rule is to replace them all with CBS tubes. The reason is logical. It's better to use CBS originals . . . because CBS has had more experience in making them better.

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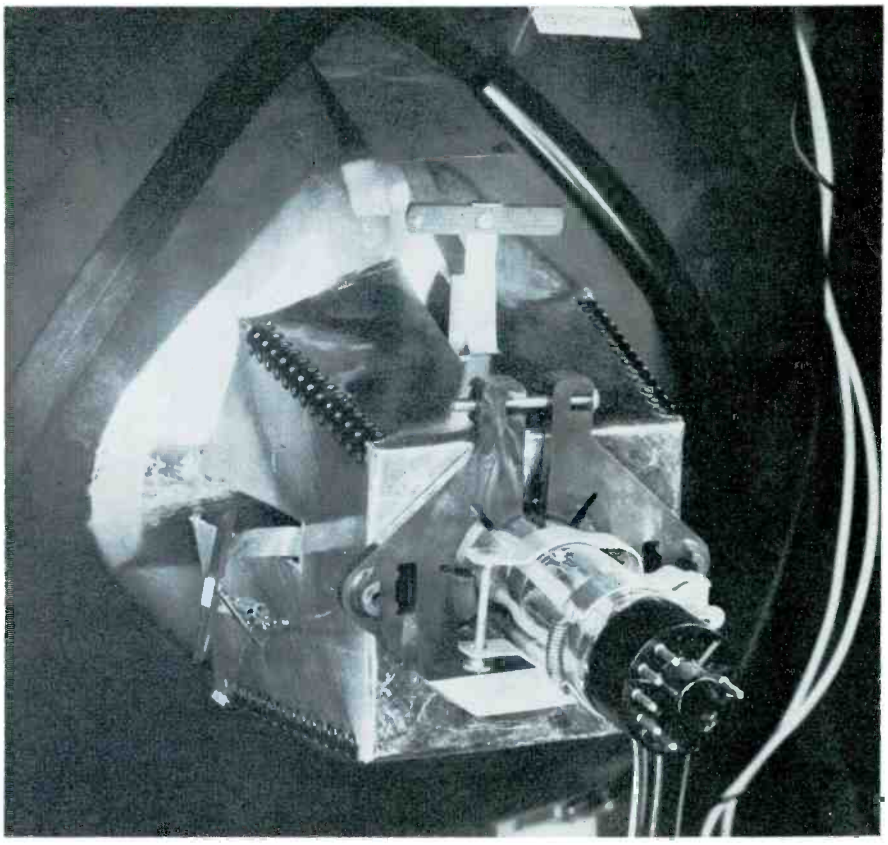

Fig. 1. Shield to cut down yoke radiation in Sylvania Chassis 1-533-7.

Latest Sylvania Sets

If you are faced with the job of servicing one of the new Sylvania TV chassis of the 1-533-7, -8, and -9 series, you will encounter a number of unusual physical features. Among the most interesting of these is a shield (Fig. 1) which encloses the yoke. Made of a fiber material and covered with metal foil, the shield restricts the radiation of interference from the yoke windings.

The chassis itself is divided into two sections cabled together—a main section mounted horizontally on the floor of the cabinet and a "control plate" suspended by three bolts inside the top of the cabinet. The tuner and the operating controls are mounted on the control plate, and the knobs are located along the top border of the front panel. The speaker is situated underneath the rim of the picture tube and faces forward. The leads for the speaker and "HaloLight" lamp, as well as those for the various picture-tube connections, must be unplugged in order to free the chassis for removal. A portion of the front panel comes off to give access to the mounting screws for the control plate.

The on-off switch and the channel selector are both actuated by levers which operate in the same manner as the carriage-return handle on a typewriter. The working parts of the on-off switch operate on a rocker principle, and the switch position is shifted each

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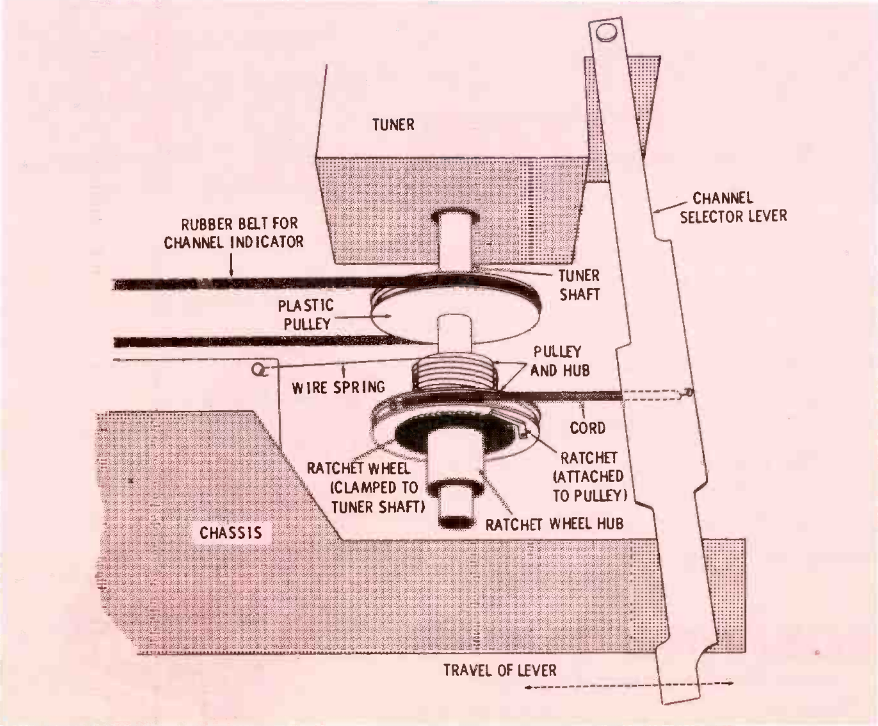

Fig. 2. Lever-operated tuning device in Sylvania Chassis 1-533-7.

When the picture symptom is "unstable sync"—check into that sync separator, sync amplifier, video if, and video amplifier, *and use RCA Tubes when you replace.*

Designed and built to some of the tightest electrical tolerances in the tube business, RCA Tubes are the answer for replacement types that *fit the circuit.* Take the RCA-12AU7 and 6SN7-GTB, as examples. In these types, plate current cutoff characteristic is extremely uniform from tube to tube. And stability is excellent—even under wide variations in heater voltages. When you replace—go 100 per cent with "RCA's", and watch your bench-time drop. When you order—tell your distributor "RCA only" and watch your profits grow.

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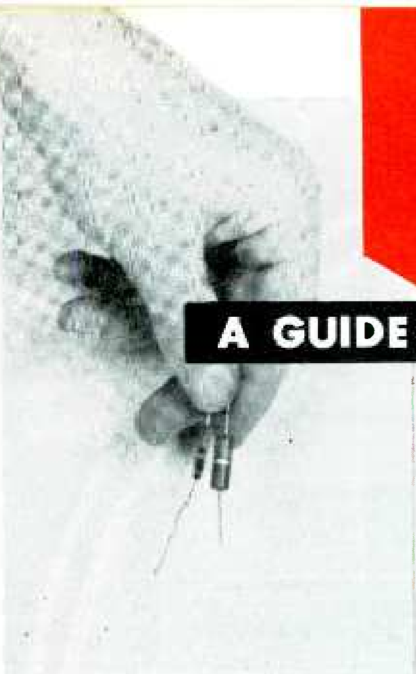

Special Resistors in TV Sets

A GUIDE FOR DETERMINING STOCK REQUIREMENTS

In an attempt to answer the two questions, "What circuits most often contain special type resistors?" and "What ohmic values and wattage ratings do these components have?" we have just completed a survey of 85 models of TV receivers built during the last four years. With the object of compiling some kind of systematic information about the special types of resistors that are employed in these sets, representative models of 37 brands of receivers were carefully studied.

While we feel that it is impractical to go so far as to recommend that definite quantities of certain resistors be kept in stock, we do hope that the following information will help the reader to determine his own stock requirements for special resistor types.

Special resistors, which we will define as all those except 10%- or 20%-tolerance composition or carbon units, can be classified into two broad categories: (1) 5%-tolerance composition resistors and (2) wire-wound types. The former will be dealt with first.

5%-Tolerance Resistors

The average set surveyed used a total of 99 resistors, of which 6 were gold-banded 5%-tolerance units. Most of the latter were rated at ½ watt, but there was a small percentage of 1- and 2-watt units. The number of gold-banded resistors varied considerably from set to set—one model had 28, and several receivers contained none at all.

One important reason why some receivers have many more 5% resistors than others is that certain circuits in which these components are often found (for instance, keyed AGC systems) are not universally used. Another factor is that some manufacturers tend to use more 5% resistors than others do. In the survey, we found no one circuit in which a

Table I—Frequently-Used 5% Resistors

(values in ohms)

47	5.6K	100K
1.5K	8.2K	150K
2.2K	10K	180K
3.3K	22K	330K
4.7K	39K	1 meg

5% resistor was invariably used. A manufacturer may avoid using special parts by designing circuits so that the need for critical resistance values is minimized, or else he can test resistors drawn from regular 10%-tolerance stock and use those which are within 5% of the rated value.

In the following list are three general categories of circuits in which 5% resistors are most often found:

1. Voltage dividers, usually from B+ to ground.
2. Balanced loads, as in dual-diode sound detectors or AFC circuits.
3. Frequency-determining RC circuits, or applications where shunt capacitance vitally affects frequency response.

The most important circuits in the first category are:

A. Grid voltage supply for the second stage of a cascode RF amplifier.

B. Grid voltage supply for the audio output tube when this stage is used as a B+ voltage divider.

C. All voltage dividers associated with keyed AGC circuits or with AGC delay networks. These may be found in the plate, grid, or cathode circuits of the keying stage.

The second category includes:

A. Ratio-detector load.

B. Loads in plate and cathode circuits of a sync phase splitter, across which pulses of opposite polarities are developed for horizontal AFC.

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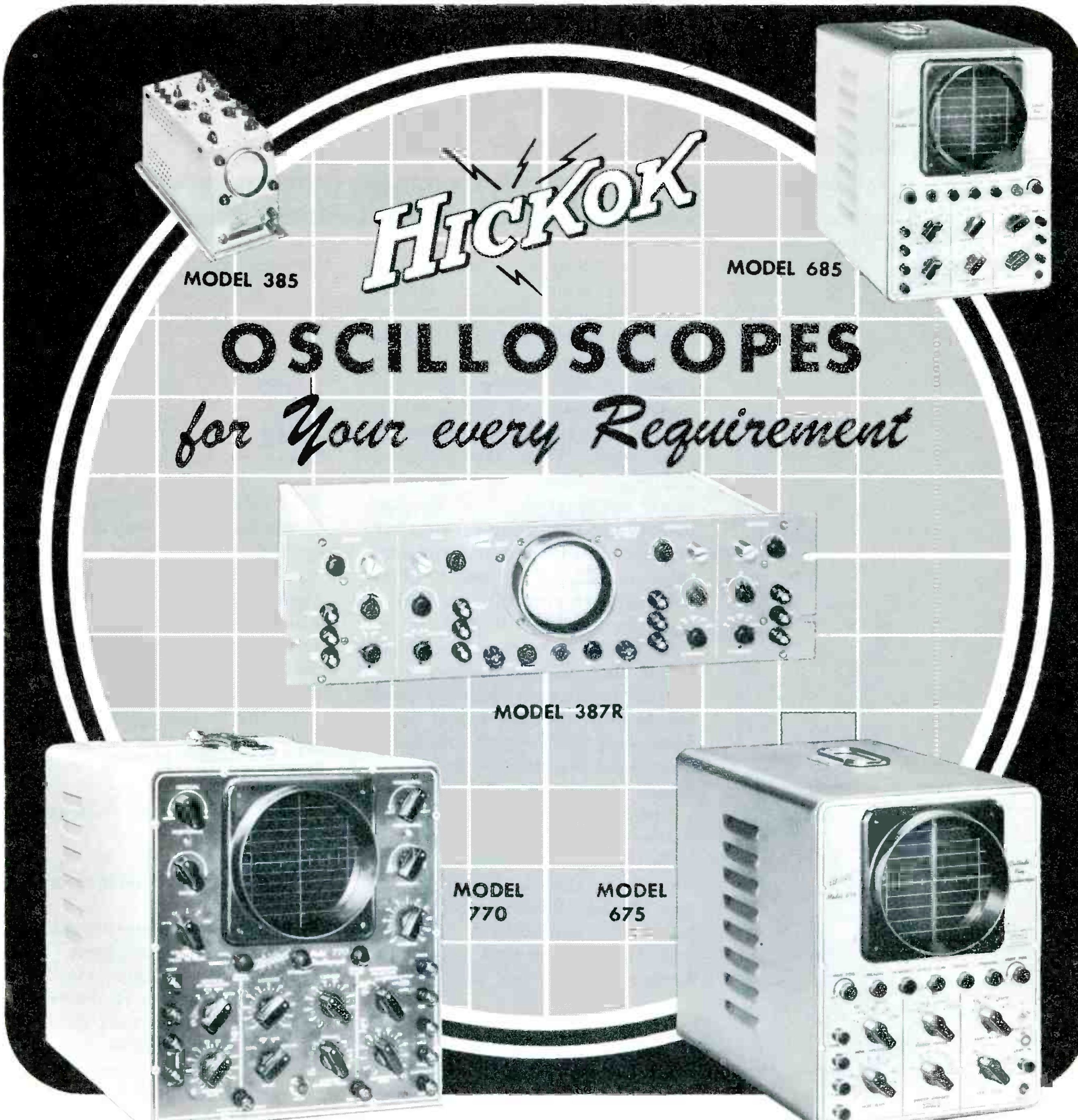

Model 770: Wide Band DC Amplifiers (0 to 5 MC). 10 MV RMS per inch sensitivity. New flat-face 5″ tube permits a more linear reading as well as facilitates photography for permanent records of any pattern or series of patterns. An illuminated calibrated screen is backed with a green filter which reduces reflections. Excellent pulse response, built-in voltage calibrator and unusual stability are features every engineer will appreciate.

Model 387R: Industrial's 3″ scope in a rack mount style with identical horizontal and vertical amplifiers. DC to 500 KC response and a 10 MV RMS per inch sensitivity. Recurrent and driven sweep, internal or external locking, non-frequency discriminating ten-to-one gain control, full screen deflection without low or high frequency distortion are ideal features designed to permit versatile use of this equipment in all phases of electronic work.

Model 675: Features a vertical wide band frequency response from 1 cycle to 4.5 megacycles, at a 20 MV RMS per inch sensitivity. A new type circuit technique has replaced the need for dual sensitivity. The vertical attenuator is frequency compensated in decade steps. The recurrent sweep has a frequency coverage from 10 to 100,000 cycles with vernier control. Illuminated calibrated screen and other features qualify the **675** as a high-quality 5″ 'scope.

Your inquiry is invited. Technical details are available at your request.

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BY JOHN MARKUS

Editor-in-Chief, McGraw-Hill Radio Servicing Library

Monthly Service. Contract service at $3.80 per month is working out well for Lee Radio & TV Service in Macomb, Ill. It works like this: The customer pays the fee on or near the first of each month, just as for a utility bill. This rate saves the customer about $12 a year in relation to a reported national average servicing cost of $57.40 per set per year. The rate goes up about $1 more per month for 24″ or 27″ sets, VHF-UHF sets, those with radio-phono combinations and those with special round picture tubes. This service contract is being made available to other shops, and is reportedly being used by shops in some 600 different cities.

On the basic contract, average yearly outgo is figured at $18.90 for parts and $8.58 for shop overhead expense, leaving $18.10 per contract per year for labor and profit. Five hundred such contracts, requiring anywhere between 1,000 and 2,000 service calls per year, would thus bring in a total of around $9,000 for labor and profit—yet require relatively few calls per working day.

$ & ¢

Doorbells. Holding your thumb down on a doorbell is one way to make a customer mad. A short jab is enough. Stepping away from the door and taking off your hat as the door opens are two nice gestures that automatically instill confidence in you. These rules have worked for salesmen, and are therefore particularly important if you are canvassing for new business or visiting a customer for the first time.

$ & ¢

Motels. Three out of four new motels feature built-in master antenna systems for TV. Special ruggedized tamper-proof sets with alcohol-resistant finishes are generally used in preference to standard consumer models. Picture tubes are either 17″ or 21″ and coin-in-the-slot attachments are disappearing. Service is usually contracted for by the year. Here is a rapidly expanding market for service work that may well merit your attention and consideration if there are motels or hotels in your area.

Wages. In the last 10 years the weekly wage of the average factory worker has jumped from $50 to $80. Allowing even half of this for price increases during the period, these workers are still getting around $20 more a week without spending any additional time on the job. Generally, however, professional people and small businessmen have not done as well. This is particularly true in TV and radio servicing, which is essentially a small professional business.

The answer to this is not simple. The independent serviceman can increase his hourly rate for labor, of course, but many customers have already complained about the cost of service work. Efficiency can be increased—to do more jobs per working day—but many servicemen have chosen their profession because it permits them to enjoy a certain amount of freedom from the pressure of working every minute of the time. Business expansion is a logical but not always acceptable answer because such expansion adds to responsibility and many times lessens the efficiency of the shop.

A logical answer is a bit of give-and-take in every direction for the purpose of increasing your servicing income. Study to improve your technical know-how so that each job can be done faster. Employ an assistant to do the simpler jobs at a lower hourly rate than your own, while billing your customers at a moderately boosted hourly rate. Buy new test equipment when it will improve working efficiency enough to pay for itself within one to two years. Renovate your entire business operation, from working clothes right on up through shop appearance, so that customers will sense a higher-class operation. Spend more time selling the customer on the *quality* of your work before presenting the bill.

The honest frontal attack as outlined above, with such additions as are appropriate for your own situation, can keep your take-home income in line with the times. Little improvements in all directions can easily add up to the equivalent of a 10% raise per year if put into effect with moderation and good judgment.

$ & ¢

False Alarms. When the trouble on a home call turns out to be something simple like an improperly set control or a plug half out of the wall outlet, there is often customer objection to paying the minimum call charge. One way to build good will and overcome this objection is to give the customer a slip entitling him to credit for part or all of that amount when real trouble develops in the future. You might specify that the credit applies only on jobs running over a certain minimum, such as $7.50 or $10.00. This practice insures that you will keep the customer, because he will naturally want to take advantage of the credit slip.

$ & ¢

Progress? According to a recent announcement, the Army Signal Corps is no longer for the birds. Pigeons, that is. The facts are these: The Signal Corps is halting all pigeon training activity and retiring some 1,000 birds because progress in electronic communications has "virtually ended any peacetime need" for pigeons. Thus the cost of progress.

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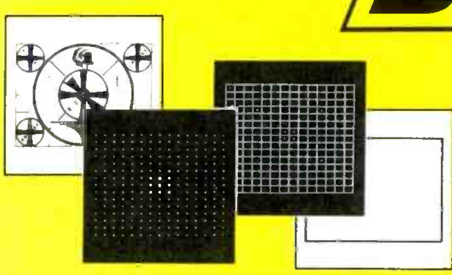

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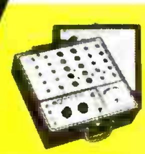

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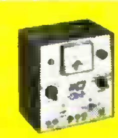

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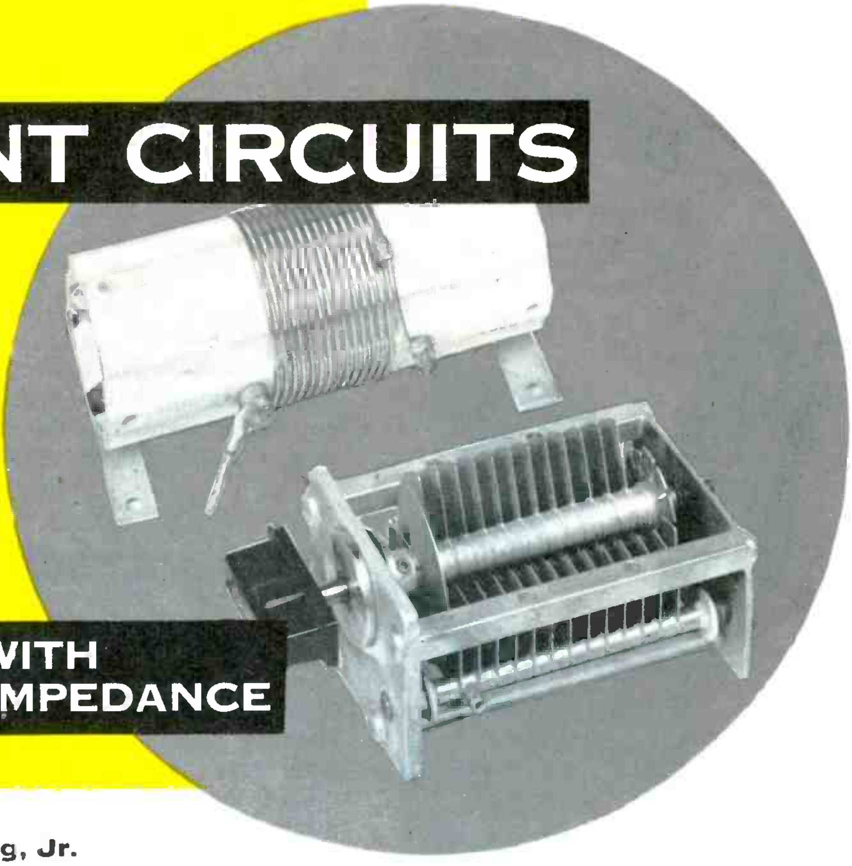
RESONANT CIRCUITS

PART 1

WORKING WITH REACTANCE AND IMPEDANCE



by Calvin C. Young, Jr.

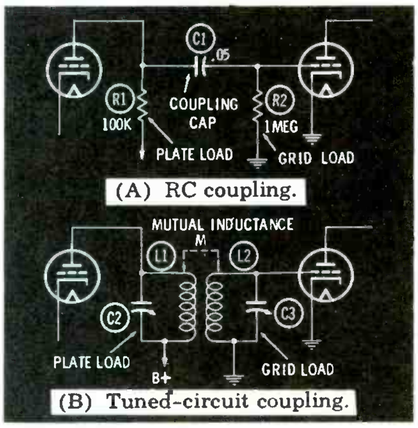
To the old-timer in radio and TV servicing, resonant circuits are fairly familiar "critters." To the neophyte, however, they may present somewhat of a mystery. The material in this series of articles is designed to help both —for the old-timer, it will serve to sweep out any of those mental cobwebs that may have gathered over the years; for the newer serviceman, it will shed light on many of his questions.

In order to present this subject in a manner that will insure full understanding, it will be necessary to deal with some basic mathematics from time to time. However, each problem presented will be of a practical nature and each will be fully worked out.

A prime function of a resonant circuit is to serve as an interstage coupling device. We can begin this discussion by drawing an analogy between coupled resonant circuits and the RC circuit which may also be used as a means of connecting stages. In the RC circuit of Fig. 1A, a capacitor is used to conduct the desired AC signal from the plate circuit of one stage to the grid circuit of the next stage. At the same time, the capacitor keeps the DC plate voltage out of the grid circuit of the second stage. The resistors R1 and R2 in the RC circuit serve as plate and grid loads, respectively.

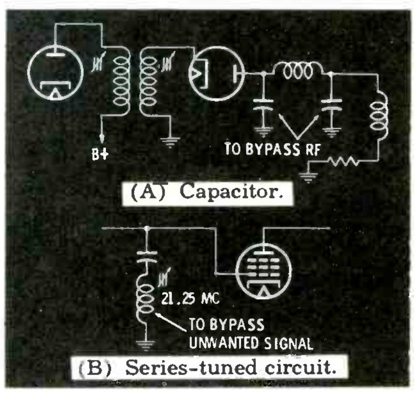
The combination of L1 and C2 in Fig. 1B has the same general function as R1 in Fig. 1A; L2 and C3, the same as R2; and M, the same as C1. Each resonant circuit serves as a load across which a signal is developed. M represents the mutual inductance between the two coils, and it will be dealt with in detail later in this series.

Capacitors may be used in some circuits to bypass unwanted signals, but this can also be accomplished by a tuned circuit. In Fig. 2, this function of both a capacitor and a series tuned circuit is illustrated. In the video detector stage of Fig. 2A, two capacitors are being used to bypass to ground the unwanted RF signals above 4 mc, the upper limit of video frequencies. The series tuned circuit of Fig. 2B is a trap in the grid circuit of a video IF amplifier stage, and its function is to bypass an interfering signal of one particular frequency. This is a job which a capacitor alone could not accomplish. The properties of a series resonant circuit that enable it to bypass or attenuate one signal frequency without seriously affecting any other frequency will be better understood after the important properties of reactance X, impedance Z, and figure of merit Q are discussed.



(A) RC coupling.
(B) Tuned-circuit coupling.

Fig. 1. Types of interstage coupling.



(A) Capacitor.
(B) Series-tuned circuit.

Fig. 2. Frequency bypass devices.

Reactance and Impedance

The reactance X_L of an inductor refers to the opposition offered by the inductor to AC current flow and is expressed by the formula:

$$X_L = 2\pi fL \qquad (1)$$

where X_L = reactance in ohms,
f = frequency in cycles per second,
L = inductance in henries,
π = 3.1416

The reactance X_C of a capacitor refers to the opposition to AC current flow presented by the capacitor and is stated by this formula:

$$X_C = \frac{1}{2\pi fC} \qquad (2)$$

where X_C = reactance in ohms,
f = frequency in cycles per second,
C = capacity in farads,
π = 3.1416

To familiarize the reader with X_L and X_C, let us deal with the following example: A video amplifier stage employs a peaking coil in the plate circuit and a coupling capacitor from that plate to the next grid. The value of the peaking coil is 250μh (microhenries) and that of the capacitor is 0.1 mfd (microfarad). Find X_L at 4 mc and X_C at 100 cycles.

$$X_L = 2\times3.1416\times4\times10^6\times250\times10^{-6}$$
$$X_L = 6280 \text{ ohms.}$$
$$X_C = \frac{1}{2\times3.1416\times100\times0.1\times10^{-6}}$$
$$X_C = \frac{1}{6.28\times10^{-5}}$$
$$X_C = 15{,}930 \text{ ohms.}$$

If we were to calculate the reactance of the peaking coil and of the coupling capacitor at 100 cycles per second and 4 mc respectively, we would find that X_L at 100 cycles is very low and that X_C at 4 mc is also very low. Referring to the video amplifier stage shown in Fig. 3, and remembering the values of X_L and X_C just stated, it can be seen how the peaking coil causes high frequencies to receive more amplification than lower frequencies.

The coil L1 is in series with the load resistor R1, but at low frequencies the reactance X_L of the coil is very low and the total load impedance is effectively equal to the resistance of R1 alone. Moreover, the reactance X_C of coupling capacitor C1 is relatively large—hence some voltage division takes place across the series combina-

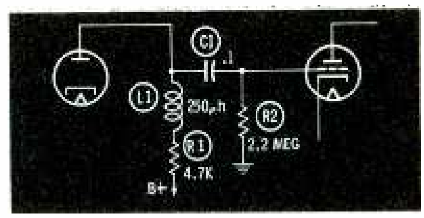


Fig. 3. Frequency peaking circuit.

tion of C1 and R2.

At the higher frequencies, X_L rises and there is a greater value of total plate load impedance. At the same time, X_C becomes negligible and most of the signal voltage appears across R2. The peaking coil and the coupling capacitor are in a sense similar in function to tuned circuits since they shape and limit frequency response.

Now that we have discussed the reactance of capacitors and inductors, it is time to describe the impedance of circuits made up of resistance, inductance and capacitance. The impedance of a series tuned circuit such as the one il-

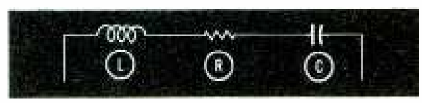


Fig. 4. Series-tuned circuit.

lustrated in Fig. 4 may be calculated by applying the formula:

$$Z = \sqrt{R^2 + (X_L - X_C)^2} \qquad (3)$$

where Z = impedance in ohms,
R = resistance in ohms,
X_L = reactance of coil in ohms,
X_C = reactance of capacitor in ohms

For most practical radio applications, R is the DC resistance of the coil. When dealing with very high frequencies, the resistance effect produced by the capacitor must also be considered; to simplify this explanation, however, we will let R equal the resistance of the coil only.

To acquaint the reader with the calculation of impedance Z of series tuned circuits, let us consider the following example: A television receiver employing a 28.1-mc trap at the control grid of the first video IF amplifier is shown in Fig. 5. You will notice that this circuit is the same as the one in Fig. 4 except that the DC resistance of the inductor L1 is not indicated by a separate symbol. The capacity of C1 is 18 mmfd and the inductance of L1 is 1.8μh. A measurement shows the resistance of L1 to be 0.16 ohms.

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To find the impedance at resonance (28.1 mc) of the series tuned trap network shown in Fig. 5, let us first find X_L and X_C using equations (*1*) and (*2*).

$$X_L = 2 \times 3.1416 \times 28.1 \times 10^6 \times 1.8 \times 10^{-6}$$
$$X_L = 316 \text{ ohms.}$$
$$X_C = \frac{1}{2 \times 3.1416 \times 28.1 \times 10^6 \times 18 \times 10^{-12}}$$
$$X_C = \frac{1}{3.18 \times 10^{-3}}$$
$$X_C = 316 \text{ ohms.}$$

Combining the values obtained for X_L, X_C and R in the formula for impedance Z given in equation (*3*), we find:

$$Z = \sqrt{.16^2 + (316 - 316)^2}$$
$$Z = \sqrt{(.16)^2}$$
$$Z = .16 \text{ ohms.}$$

It may be seen from this example that the impedance of a series tuned circuit is equal to the DC resistance when the circuit is at resonance. At any frequency other than the resonant frequency of the series tuned circuit, X_L and X_C are not equal and therefore Z will have a higher value than that found at resonance. Referring again to the circuit of Fig. 5, let us figure the values of X_L, X_C and Z at 26.1 mc (2 mc below the resonant frequency of the circuit).

$$X_L = 2 \times 3.1416 \times 26.1 \times 10^6 \times 1.8 \times 10^{-6}$$
$$X_L = 294 \text{ ohms.}$$
$$X_C = \frac{1}{2 \times 3.1416 \times 26.1 \times 10^6 \times 18 \times 10^{-12}}$$
$$X_C = \frac{1}{2.95 \times 10^{-3}}$$
$$X_C = 339 \text{ ohms.}$$

To calculate the impedance Z of the circuit at the new frequency of 26.1 mc, we use the same impedance formula (3) and the same value of R as we did before. Since R is so small in comparison with the reactances, it is ignored and the impedance becomes the difference between X_L and X_C.

$$Z = \sqrt{(.16^2 + (294 - 339)^2}$$
$$Z = \sqrt{(.16)^2 + (-45)^2}$$
$$Z = \sqrt{.0256 + 2025}$$
$$Z = \sqrt{2025}$$
$$Z = 45 \text{ ohms.}$$

Since we have determined that the Z of this tuned circuit at 2 mc off resonance is actually a very small value even though it is almost 300 times the value of Z at resonance, let us see just how this impedance will affect the operation of the grid circuit in which it

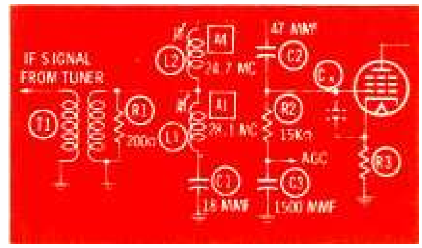

Fig. 5. Input circuit of video IF amplifier.

is located. Again referring to Fig. 5, we see that the series tuned circuit we have been discussing is in parallel with the secondary of an untuned transformer which is also in parallel with a 200-ohm resistor. In addition, another series tuned circuit consisting of L2, C2 and C_X is connected in parallel with the secondary of transformer T1. The resistor R2 is an isolation resistor between the control grid and the AGC system and does not contribute anything as a grid load; however, it does act as the DC return path between the grid and ground. The dotted-in capacitor C_X is the input or grid-to-cathode capacitance of the IF amplifier tube plus the stray capacitance of the wiring between the grid and ground. The total value of this capacitance varies but is generally about 10 mmfd.

Transformer T1 is a low-impedance link coupling between the RF tuner and the IF strip. The impedance of the transformer is further shunted by R1 and by the impedance of the trap consisting of L1 and C1. This combination may be considered to be a low impedance signal source which has a high signal current flowing through it. The series tuned combination of L1, C2 and C_X is the low-impedance load into which this signal source feeds, and it is resonant at 24.7 mc. This means that at or near 24.7 mc, relatively large currents flow through the series circuit of L2, C2 and C_X, and consequently maximum voltage is developed across C_X. As a result, the frequency response is peaked at a frequency of 24.7 mc.

This discussion has taken us through the calculations for X_L, X_C and Z in a series tuned circuit. The figure of merit Q and the characteristics of parallel tuned circuits, which are different in many ways from the characteristics of series circuits, will be discussed in subsequent issues. ▲

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COLOR

SHORT CUTS in COLOR SERVICING

Saving Time in Convergence and Purity Adjustment

by Verne M. Ray

In order that the title of this article will not be misleading, it should be stated that this material is not a short-order course on color TV. As a matter of fact, without any previous training or education on the principles of color TV, this article will be of little value to you. On the other hand, the practicing service technician who has learned the fundamentals and is now, or very soon will be, working with color receivers should profit from the data presented here.

Obtaining Color Purity

Obtaining optimum color purity is often tricky but rarely difficult. Mainly, conditions of impurity are caused by three things: (1) a change in the effect of stray magnetic fields on the electron beams because of a change in receiver location or orientation, (2) magnetization of a portion of the metal bell of the picture tube caused by exposure to a fairly strong magnetic field, and (3) improper static or DC convergence—a condition readily noticeable in a monochrome picture.

Impurities resulting from the first cause usually appear at the very edges of the screen and can be corrected by adjustment of the equalizing magnets mounted around the rim of the picture tube. This is not always true of impurities resulting from the second cause. Very often, a magnetized portion of the picture tube will affect the beams in such a way that contamination takes place an inch or more from the edge or even somewhere near the center of the screen. In such cases,

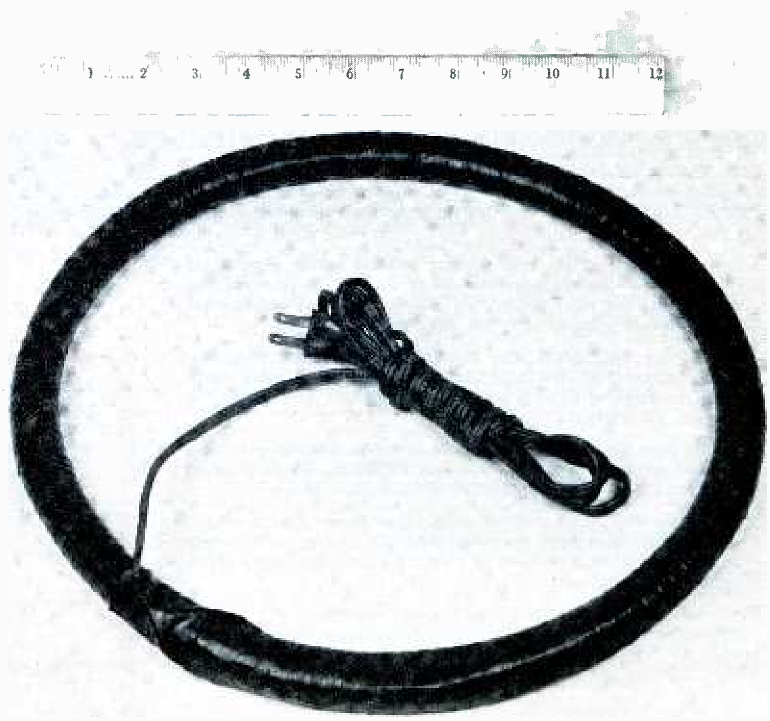

Fig. 1. Degaussing coil to demagnetize color tubes.

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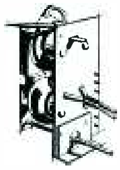
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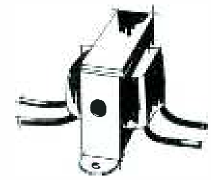
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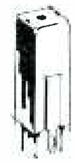
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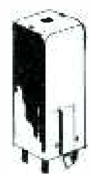
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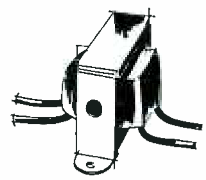
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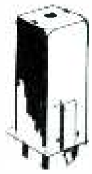
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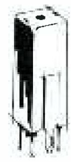
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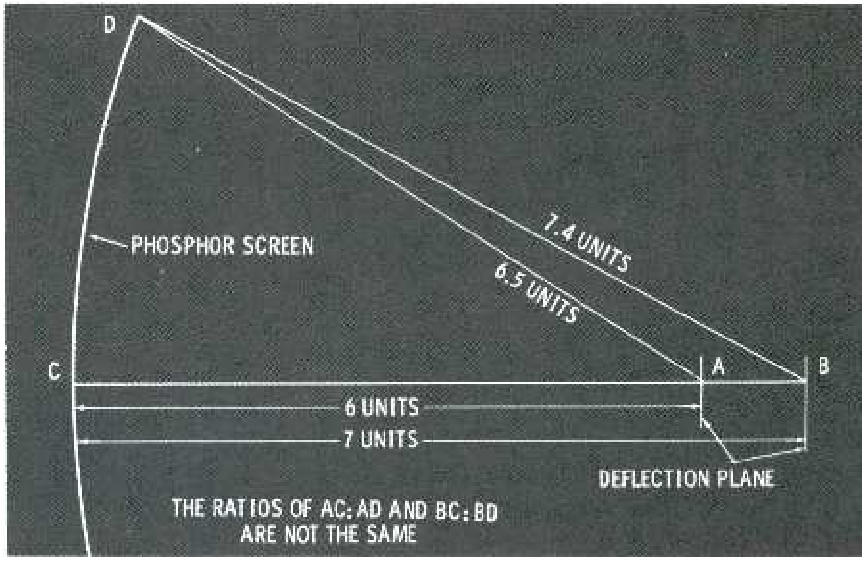


Fig. 2. Geometric drawing showing that a change in the deflection plane of a color picture tube changes the ratio between the distances to the center and to the edge of the screen.

the only cure is to employ a standard degaussing procedure.

A degaussing coil such as that shown in Fig. 1 is comprised of approximately 425 turns of #20 enamel-covered copper wire which has been heavily wrapped with insulating tape. An 8′ line cord is connected to the two ends of the coil.

Before employing the coil to demagnetize the picture tube, make sure that the equalizing magnets are protected by slipping them away from the tube and into their housings. Keep the coil at a distance of at least 6′ from the receiver when plugging it into the wall socket, and approach the front of the receiver slowly, holding the coil broadside to the screen. At a distance of about 6″, move the coil slowly over the entire screen area for approximately 2 minutes. Retreat to a distance of 6′ and remove the plug. Adjustment of the equalizing magnets for optimum edge purity should complete the job.

In a minimum number of instances, degaussing the tube and adjusting the equalizing magnets will not eliminate all contamination. The technician must then assume that (1) someone has tampered with the position of the deflection yoke and/or the purity magnet (or that one or both of these components were not correctly positioned initially), (2) the picture tube or some associated component is defective, or (3) a magnetic field too strong for the equalizing magnets to overcome is being generated nearby. In order to arrive at a logical solution, the technician should determine whether or not optimum purity had ever been obtained while the receiver was operated in its present general location. If it had, and if you can be assured that no one has tampered with the receiver, the first supposition does not seem logical. However, just to make sure that stray fields have not affected the positions of the beams in the gun structure due to a change in the orientation of the receiver, the purity magnet should be adjusted for best results.

If the contamination cannot be eliminated in this manner, you may decide that the deflection yoke needs to be repositioned, but *do not* change the yoke position until all other possibilities have been eliminated—unless you are prepared to completely readjust the dynamic convergence controls. As shown in Fig. 2, moving the deflection plane toward or away from the phosphor screen will change the distance ratio to the center and to the edges of the screen from the deflection plane; therefore, both the static and dynamic convergence forces would have to be changed to produce superimposed beam registrations.

Before altering the yoke position, you might check for the presence of a comparatively strong alien magnetic field with an ordinary compass. Chances are that if there is such a field being generated nearby, it will not have the same polarization as the earth's magnetic field. If the compass needle does not align with the earth's poles when held several feet away from the receiver, the presence of a strong alien field is indicated. Employing a magnetic shield or eliminating the source of the field are about the only plausible corrective measures which might be taken.

Dynamic Convergence Adjustments

One of the most difficult tasks involved in color TV work is that of obtaining beam convergence at all points on the screen. The time and effort required to go through the complete convergence adjustment procedure might well be compared to an IF alignment job as it existed in the early days of monochrome TV. Fortunately, the comparison can be carried further in that convergence adjustments, like alignment adjustments, are quite stable and seldom require attention.

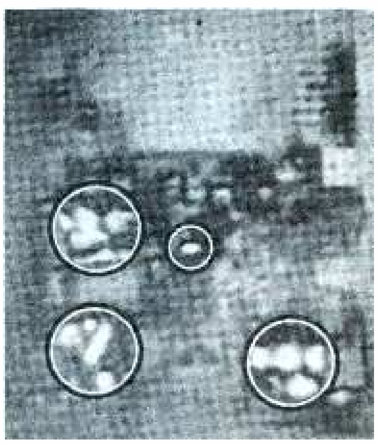
For example, receivers which have been properly set up and installed in customers' homes, and those received from the factory or distributor, usually have very satisfactory beam convergence. If it does happen to be off somewhat, the condition is most likely to be the result of a change in the physical placement of the convergence yoke or lateral correction magnet because of jarring or vibration which occured while the receiver was being transported from one place to another. For this reason, it would be well to check the positioning of such components before assuming that the dynamic convergence controls need adjusting. These controls require an extremely precise setting, and the least bit of "knob twisting" may cost you an hour or more in making the proper corrections.

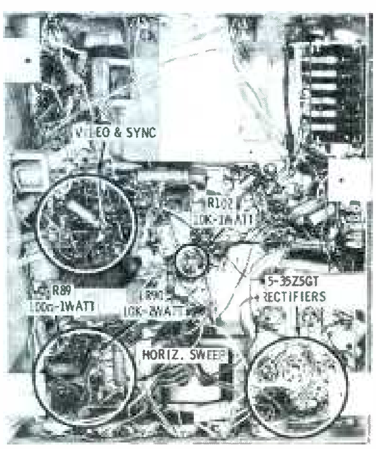
Although adjustment of the dynamic convergence controls will not often be necessary, it seems likely that a technician will have to adjust these controls at some time or another. Actually, there are no real short cuts in this procedure, but the author has found

Introducing "Eva"

Not long ago, a method of visually checking heat radiation was developed by the engineers at Baird Associates, Inc. of Cambridge, Mass. An optical instrument known as the Evaporograph utilizes the infrared portion of the electromagnetic spectrum to form a "heat picture" of the field being viewed. A camera, incorporated in the instrument, can be used to record what the operator sees.

A comparison of the Evaporograph and standard-type photos will point out the "hot spots" on the underside of an Emerson Model 585. For example, the large 10K-ohm, 2-watt resistor used as the screen-dropping resistor for the horizontal-output stage shows up in the lower, left-hand corner as an illuminated oblong area, indicating considerable heat dissipation from that component. Other areas having high heat radiation as seen with "Eva" are at the lower right and upper center where the 25Z5GT rectifiers and the video and sync circuits are respectively located.





through actual practice that the entire convergence setup can be completed in less than 30 minutes by a person who is thoroughly familiar with the action provided by the adjustment of each control.

Bear in mind that the purpose of adjustments for dynamic correction is to obtain identical relationships between the related dots in the three patterns and *not* to immediately achieve dot or beam convergence. When the geometric relationship between the dots of the three patterns is the same at all points on the screen, overall beam convergence can be obtained by manipulation of the DC or static convergence adjustments.

The first step toward achieving vertical dynamic convergence is to adjust the tilt and amplitude controls associated with the red and green guns so that their dot

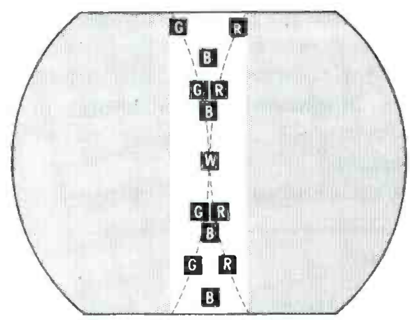


Fig. 3. Relationship between dots in the center row without dynamic correction.

patterns can be eventually converged to produce a vertical center row of yellow dots. This is one of the more difficult steps in the procedure, and it may require several alternating minute changes in the control settings before the dot relationships are satisfactory. To help you complete this step with a minimum loss of time and effort, here is a system the author has employed successfully on several occasions.

Before dynamic convergence correction, the relationship between the dots in the vertical center row should be similar to that shown in Fig. 3. Note that the rows of red and green dots bow inward at the center of the screen. When the vertical amplitude (or vertical parabola) controls for these two colors are advanced to the extreme clockwise positions, the red and green vertical center rows should bow out toward the sides of the screen. Adjustment of

the vertical tilt controls for these two colors will cause the maximum spacing between the two rows to occur at different points along a vertical center line. If the tilt controls are adjusted so that maximum spacing occurs at the screen center and the top and bottom dots of the same color are in the same vertical plane, the two rows should become very nearly parallel when the two amplitude controls are turned in a counterclockwise direction. (See Fig. 4.)

At this point, only a slight retouching of the vertical tilt controls should be required for optimum results, and the accuracy of the control settings may be checked by noting whether or not a vertical center row of yellow dots is produced when the DC or

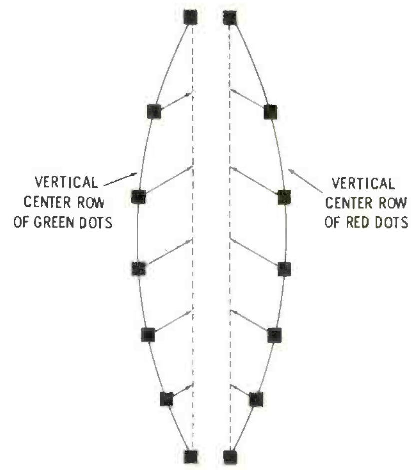


Fig. 4. Appearance of red and green rows when amplitude and tilt controls have been adjusted for maximum displacement at screen center.

static adjustments are used to converge the red and green beams. You may still try to improve on the settings of the tilt and amplitude controls, but when the best results have been obtained, these controls *should not require readjustment.*

The procedure for obtaining horizontal dynamic convergence is different from the foregoing procedure in that the blue pattern is used as a guide for adjustment of the red and green circuits. With the horizontal amplitude controls for red and green at minimum and the control for blue at maximum, the blue horizontal phasing or tilt circuit should be adjusted so that maximum displacement of the blue dots along a horizontal center row will occur at screen center and appear as shown in Fig. 5. Counterclockwise movement of the blue horizontal amplitude control should result in a straight and level row of blue dots across the screen.

Once this condition is achieved, the dynamic convergence controls for blue should *not* be adjusted thereafter. The red and green horizontal amplitude and phasing controls can then be adjusted so that the spacing between each of their dot patterns and the blue pattern will be the same all along the horizontal center row. The accuracy of these adjustments can be checked by again converging the dot patterns through the use of the DC or static convergence controls.

Here is a hint for obtaining a close setting for the red and green horizontal phasing adjustments. With the horizontal amplitude controls at the extreme clockwise positions, adjust the phasing controls until maximum dot movements are noted in the associated patterns. This should occur when

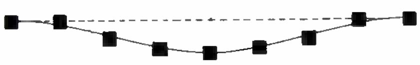


Fig. 5. Maximum displacement of blue dots at screen center indicating proper setting of blue phase adjustment.

the phasing slugs are at or near the center of their ranges. This should be very close to the correct setting, and care should be exercised because very little or no action will be observed in the dot patterns as a result of further phasing adjustments if the settings of the amplitude controls are very far from their extreme clockwise positions. The reason for this is that the amount of signal which reaches a particular phasing circuit depends on the setting of the corresponding amplitude control, and the action produced by phase changes becomes less noticeable as the signal amplitude is reduced.

The best advice that can be given for obtaining good results with dynamic convergence adjustments is to complete each step with as much accuracy as possible, but do not repeat a step once it has been completed satisfactorily. Too many technicians make the mistake of "back tracking" to "touch up" certain controls in an effort to improve convergence. The usual result is that convergence suffers in direct proportion to the amount of readjustment, and in most cases the procedure must be repeated from the very beginning.

Color Temperature Adjustments

The phosphors used in color picture tubes are such that when each is properly energized, screen illumination will match the appropriately filtered light given off by a tungsten filament heated to a temperature measured in degrees Kelvin. The illumination produced when the filament is heated to 6,500°K most nearly matches daylight and has become a light standard known as Illuminant C. Although chosen by the NTSC as the most acceptable white for color TV, this standard is not strictly adhered to by manufacturers of color picture tubes. For example, the 21AXP22A is designed to provide an illumination equivalent to that given off by the tungsten filament when heated to a temperature of 8,200°K. The diagram in Fig. 6 shows that while the chromaticity of this illumination is within the achromatic area, it leans somewhat toward blue. Yet it is often more acceptable or pleasing than an absolute white.

The ability of a color receiver to reproduce a monochrome picture depends to a great extent on the proper adjustment of the screen and background controls. Note that the lower temperatures on the curve in Fig. 6 begin in the red area, and that progressively higher temperatures would lead us through chromaticities of orange, yellow, white, and finally blue-white. Consequently a temperature measured in degrees Kelvin may be used to define the chromaticity of a color-tube screen which is reproducing a monochrome picture. If the image appears to have a somewhat reddish hue, it may be said that the color temperature is too low. A bluish or bluish-green cast would indicate that the color temperature is too high. An image that appears to be achromatic (having no hue) has exactly the proper color temperature.

If the color temperature is incorrect, the contrast and brightness controls should be set for

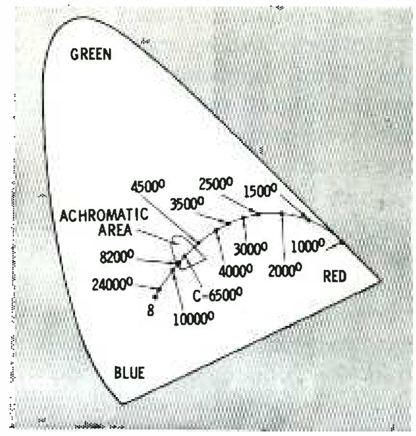


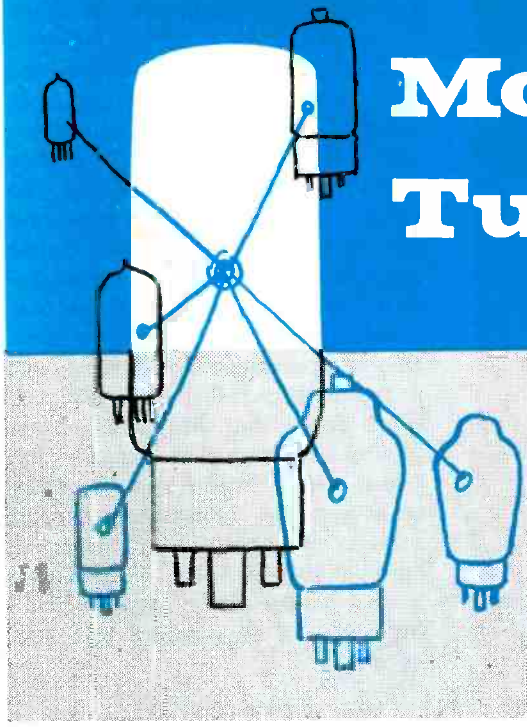
Fig. 6. Temperature gradients plotted on chromaticity diagram.

normal monochrome reproduction and the background controls adjusted so that the highlights in the image appear to be white. The screen controls should be adjusted so that the lowlights will appear as shades of gray. Alternate adjustments between the two sets of controls may be necessary in order for the correct color temperature to be maintained at any normal setting of the brightness control.

Conclusion

A combination of theoretical knowledge and practical experience is necessary for anyone who desires to become proficient at something. This certainly applies to a technician's ability to quickly and accurately make setup adjustments on a color receiver. For those of you who now have a fairly good theoretical background in color TV, I strongly suggest that you put this knowledge into practice as soon as possible. This suggestion is not meant to spur you headlong into the business of color TV servicing, but rather to encourage you to obtain a representative receiver and practice on the setup adjustments until you can go through the complete procedure without once looking at the instructions.

Once this is done, you will have won the biggest part of the battle; for unlike black-and-white TV, setting up and adjusting a color receiver seems to be much harder for most technicians than actual trouble shooting—probably because servicing techniques ingrained through long practice with black-and-white sets are paying off. ▲



More Than Just Tube Changing

Selected Case Histories from the Notebook of an Experienced TV Technician

by H. M. Layden

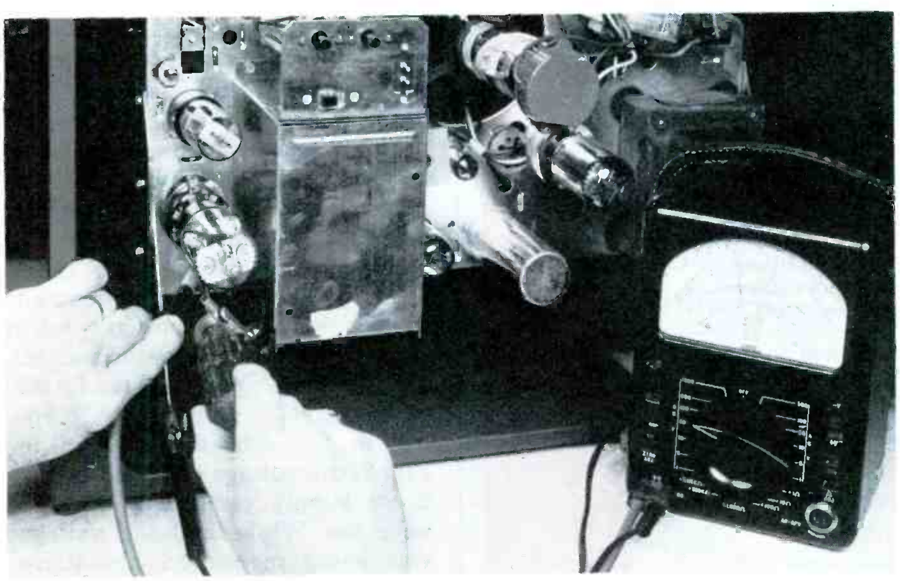


Fig. 1. Adapter socket and VTVM being used to check horizontal-output tube bias.

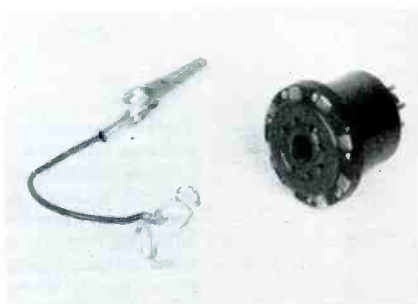


Fig. 2. Adapter socket and plate lead.

The day is over, and you are shooting the breeze with the fellows at the local parts distributor's when, from somewhere out of the smoky haze, you hear a snatch of hilarious conversation: "That joker is just a tube changer. A salesman just sold him a 'pan' for grid leaks and got paid in advance!" Outwardly, you can't restrain a smile, but inwardly you begin to reflect on some of those "tube changing" jobs that added more than a mite of gray to your own hair, and engraved deeper the furrows in your brow. In our business no job is profitable unless it stands up, and the customer is kept satisfied. Much of our work involves tube changing which, if it is to meet these two requirements, demands a certain amount of "know how." Let us examine some cases in point.

Check That Drive Voltage

An Admiral receiver (it could have been any other make) had no high voltage. The 6BG6 showed the tell-tale purple glow which is often a symptom of a gassy tube. Our "tube changer" spotted it right off, replaced it, and was quickly on his way to the next service call. But wait, there's more to the story. A week later the set conked out again. The replacement 6BG6 had gone the way of its predecessor. This "callback" was on the house, and there was nothing to be done but try to cure the trouble this time. An adage we might all profitably adopt is, "Look warily on all quick tube failures." Gassy tubes get that way from heat—the heat liberates gases from the metal elements used in the tube. The usual cause of tube overheating is improper bias.

Suspecting that this tube had been operating with improper bias, the technician checked the grid drive. This can be done from the top of the chassis, as illustrated in Fig. 1, if an adaptor socket and a plate extension lead are available. (An eight-pin adaptor socket and an extension lead are shown in Fig. 2. Notice that the extension lead can be used for both the 6CD6 type and the 6CU6 type of output tubes since both connector sizes are provided on one end.) The drive was 6 volts low because the drive trimmer was screwed down tight! An adjustment cured the trouble, and more important, the job stood up. Now it has become routine for this technician to make such a check whenever a horizontal output tube is changed, and this severe case of "call-back-itis," which had been a plague for so long, is showing signs of responding to treatment.

Vertical Trouble Caused by Low Boost

Many recently produced sets use the boost voltage in the vertical sweep system. This has altered the analysis of symptoms shown on the picture-tube screen. For instance, the picture on the screen of a Magnavox showed lack of height, even with the controls open all the way. A new vertical output tube seemed to cure the trouble. A short time later, however, the same symptom appeared again. Voltage readings were taken through an adaptor socket, and the plate potential was found to be about 25 volts low. According to the schematic shown in Fig. 3, the voltage obtained at the boost supply point was also 25 volts low. While the boost voltage was being monitored, the drive trimmer was backed off until the voltage agreed with the recommended value. The height was now more than adequate, and the controls were adjusted for proper height and linearity. Evidently the first replacement tube had had enough "oomph" when installed to spread the raster, but this new tube vigor was lost after a short time. It was most important in this case to monitor the boost while adjusting the drive trimmer, because if the boost voltage is raised too high, the plate dissipation rating of the output tube might be exceeded, and we would still be faced with repeated tube failures.

No Drive Trimmer

Some new set designs have eliminated the adjustable drive trimmers. In one of these sets, the complaint was drive lines in the picture and lack of height. The vertical output circuit was being fed from the boost voltage. This imposed a certain amount of loading, through the boost supply, on the horizontal output circuit. If this loading effect diminishes, as

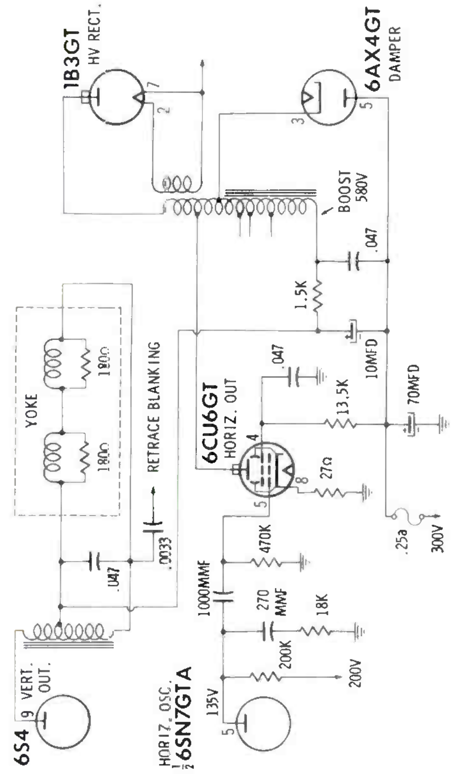
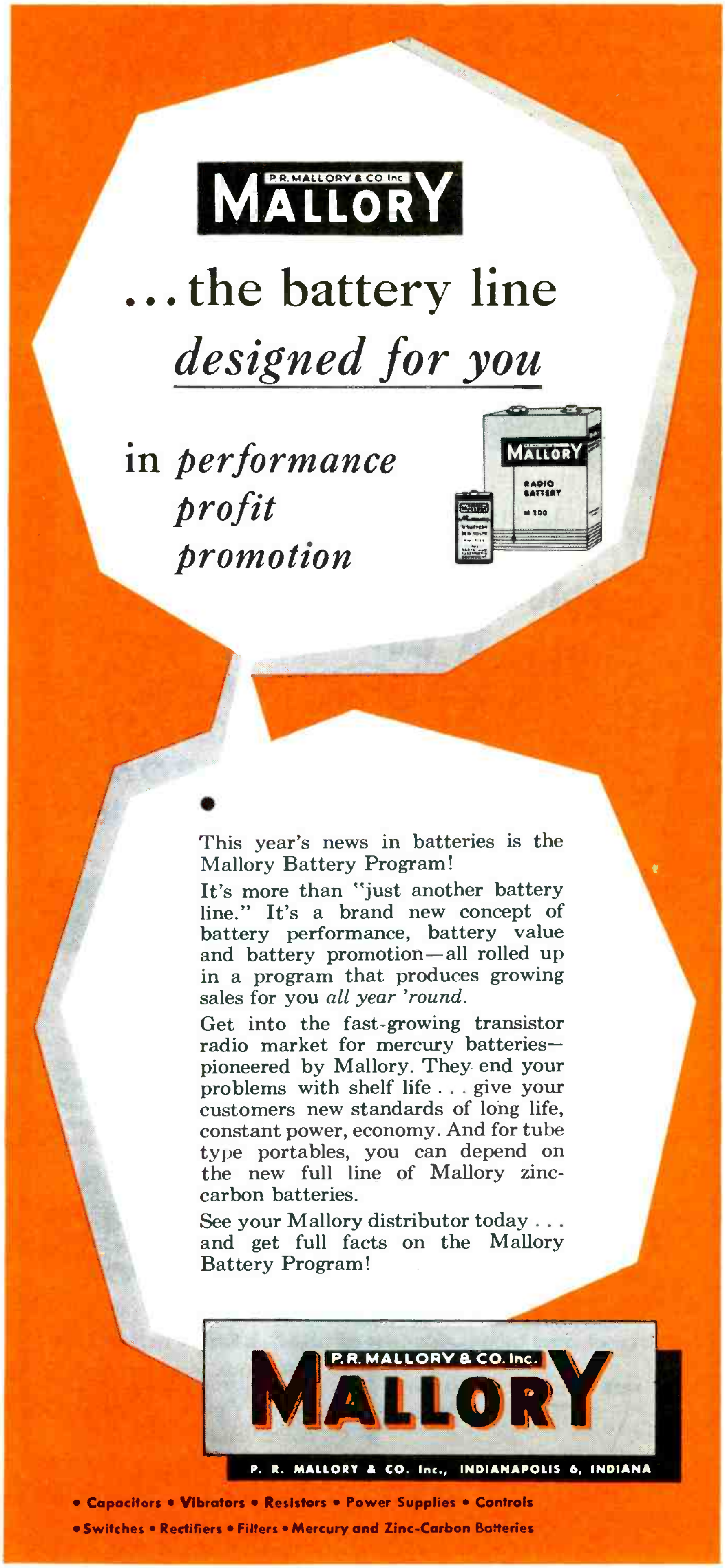


Fig. 3. Vertical sweep and boost circuits in Magnavox receiver.

when the vertical output tube's emission decreases, drive lines appear in the raster. A new vertical output tube was the remedy here, for both lack of height and the drive lines. It can't be stressed often enough how important it is to have adequate service literature at one's fingertips when confronted with today's complicated circuitry. It goes without saying that the tube changer must also know what he is doing.

Loose Output Tube

The vertical chassis design used in many current TV receivers has contributed to tube replacement problems. One such problem proved most irksome before it was licked. The raster would grow



progressively dimmer, and after an hour or so of operation, the picture would be practically washed out. It was found that jarring the set would momentarily restore the brightness and clear the picture. After much wasted time in pulling the chassis and monitoring the voltages, it was noticed that the horizontal output tube, an oversized 6BQ6, tended to loosen in its socket due to the fact that it was mounted in the horizontal plane. This mounting made it top heavy, and with no base clamp to support it, the tube pins were not making good contact in the socket. A base clamp was installed to cure the trouble. It is indeed ironic that the base clamp, so deserving of servicemen's ire in the past, now comes to their aid!

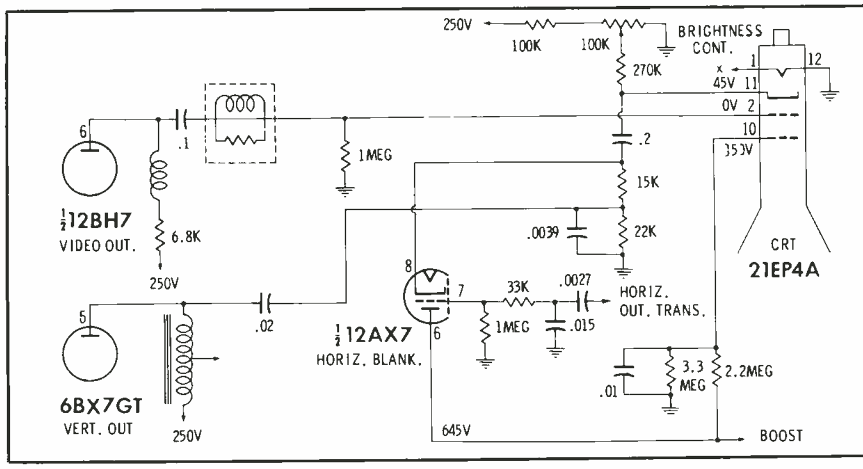


Fig. 4. Blanking-amplifier circuit in GE receiver.

Handyman Fixers

The service technician has more than simple tube replacements to plague him. "Tube changers" of the handyman variety often bug up a set and the service technician is called upon to restore normal operation. A set with series-connected filaments is a case in point. This set had gone dead, and the "expert" (handyman) was called. Well, he got it going, but with very weak sound. He then told the customer that the receiver would have to go into the shop to restore the sound, but she decided to get another opinion before letting him take the receiver. The service technician was called in and he noticed that with the volume control at maximum the sound was barely audible. He also noticed that the first audio tube did not appear to light up as brightly as the other tubes in that string. An examination of this tube revealed it to be a 6AV6, a 300-ma tube, while the filament hookup called for 150-ma tubes. A 12AV6 fixed everything. In the new 600-ma series-string sets, this kind of an error is not as likely to occur, but it would be well to keep this type of trouble in mind when dealing with the older series-string receivers.

Picture Tube Trouble?

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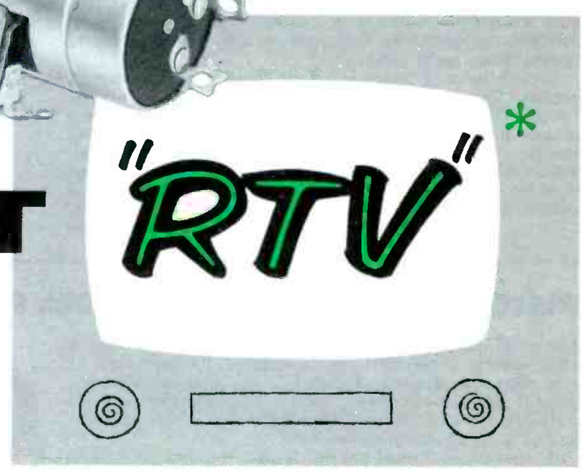

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In a GE about two years old, the picture was so dark that it could barely be seen. No amount of control adjustment would increase the brightness. After checking the second-anode voltage and the bias on the picture tube, the tube itself became the suspect. A further check, however, for first-anode potential, identified the trouble. The first-anode potential was very low. A check of the schematic (Fig. 4) revealed that this voltage was being applied simultaneously to the first anode of the picture tube and to the plate of one section of a 12AX7 which served as a blanking amplifier. An internal short in this section of the tube caused heavy conduction and lowered the plate potential as well as the voltage applied to the first anode of the picture tube. A simple replacement of the 12AX7 restored normal brightness and receiver operation.

Surveys have disclosed that tube replacements cure more than 75% of today's TV troubles. But it most certainly doesn't follow that any handyman can make the replacements. As pointed out in the six cases given here, it takes a serviceman with "know how" to really do the job. ▲

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. . . on some of the problems you've met and overcome in your servicing work? Or, on some of your ideas, time-savers, shop-hints, etc.?

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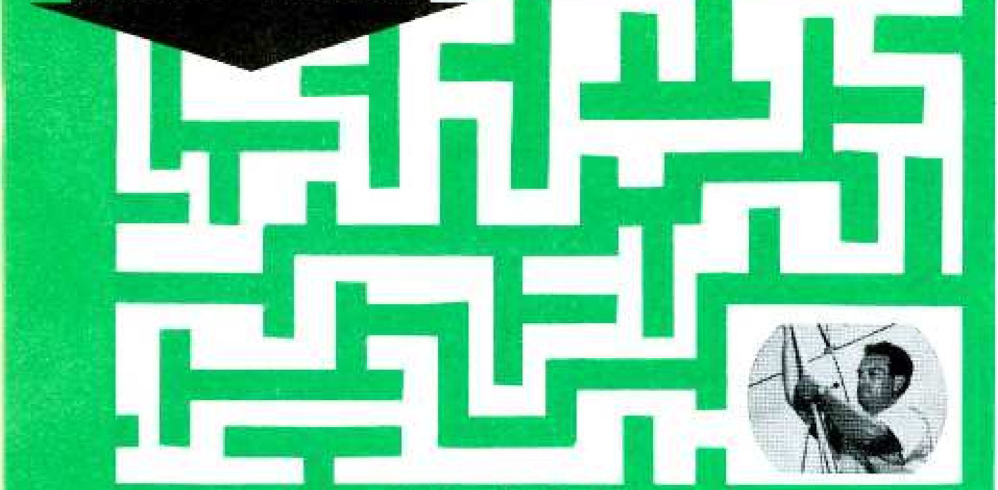
trouble shooting with GEORGE

THE CASE OF THE ELUSIVE PICTURE



by Leslie D. Deane

Although we usually find George Fleiback faced with solving a difficult servicing problem, generally speaking, he has been very successful in his role of a television repairman. He has the "know how" due to a good theoretical background, but at times he does things the hard way. George realizes, however, that mastering the easy way and the "tricks of the trade" will only come through years of practical experience.

Let's drop in on George right now and see what he's up to. There he is—way in the back of the shop with his hat and coat on. Maybe he's been out on an interesting service call.

No, it seems he has just completed an antenna installation on the roof, so that he has a new antenna system for his service bench. Prior to this time, George was using several rabbit-ear antennas placed along a shelf directly above the bench. However, they kept tipping over and also picked up quite a bit of local interference, so he decided to put in a permanent and more reliable system with a few signal outlets at convenient spots along the bench.

But George is not going to have a chance to test the system right away—he had promised a service call for this afternoon and the antenna job took him a little longer than anticipated.

Twenty minutes later we find George eager to solve a new case for a most anxious client. The clues were apparent—a 20-inch TV set had sound but no raster. George removed the back, plugged in a cheater cord, and visually scanned the chassis as the set warmed up. He could detect no further clues so he proceeded to check for high voltage. The arcs he drew from the high-voltage supply and from the plate cap of the high-voltage rectifier tube were very weak.

After George had substituted the horizontal-oscillator, horizontal-output, damper and high-voltage rectifier tubes, much to his disappointment the high-voltage condition was not improved. Well, he thought, it could possibly be the horizontal AFC detector. If this tube were defective, it might cut off the horizontal oscillator. He replaced the AFC tube but, alas, to no avail.

As somewhat of a last resort, our modern Sherlock Holmes then substituted the vertical oscillator and output tubes, thinking that perhaps the vertical circuit was pulling down the boost voltage. This also failed, so he was forced to pull the chassis and return to the shop with the case still unsolved.

On reaching the shop, George staggered in with the chassis and set it down on the bench. From his service literature file, he picked out the folder covering the set and pulled up a stool. With the schematic (partially shown in Fig. 1) laid out in front of him, he checked first to see if any drive signal was present on the grid of the horizontal-output tube. Using his trusty scope, George found what appeared to be a normal waveform at this point. Having no calibrator, he couldn't be sure if the signal was of sufficient amplitude, but at least he had determined that the oscillator was operating.

George then decided to take a few voltage measurements. Placing the negative test lead of his voltmeter on B—, he discovered that the screen voltage of the horizontal output tube was approximately 70 volts below that specified in the service literature. Moving the negative test lead to chassis ground, he then checked the B+ voltage supplying the screen. This voltage measured almost 30 volts above the given value. George knew he had measured the screen voltage from B— so he decided to check this negative supply. Here he found no negative potential whatsoever. Scratching his head with the probe, he again examined the schematic and thought to himself, "Do you suppose the trouble is in

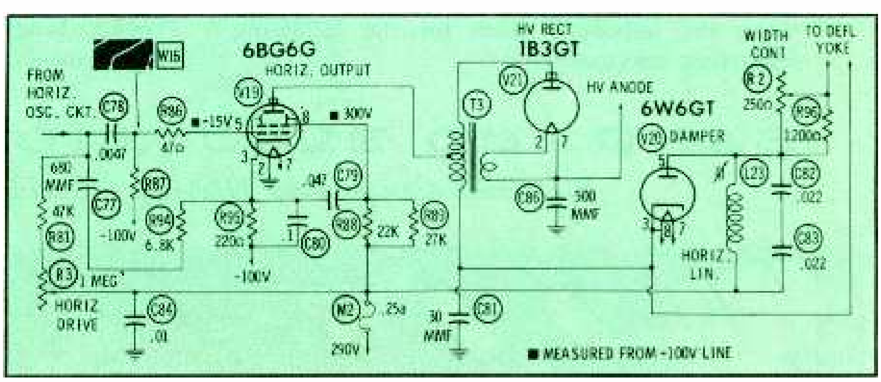


Fig. 1. Horizontal-output circuit which George examined.

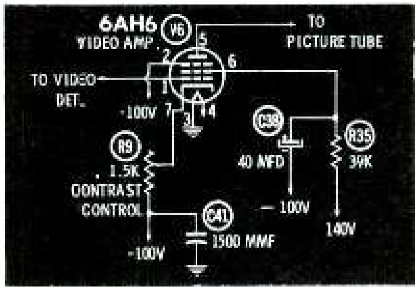


Fig. 2. George found the trouble in this video-amplifier circuit.

the low-voltage power supply even with relatively normal sound?" Before going any further, George felt that he had better change the low-voltage rectifier tube which he had neglected to do in the customer's home.

On substitution of this tube, George found that he could now draw a sufficient arc from the high-voltage supply. He then connected the anode cap to the picture tube, turned the set back on, and waited confidently to adjust the front panel controls.

He waited, and he waited. He varied the brightness control but still no raster. As he was about to check the position of the ion trap on the neck of the picture tube, he turned the contrast control counterclockwise to its minimum position. Lo and behold, a flash of light flickered on the face of the picture tube. Recognizing this odd phenomenon as an important clue, he quickly turned his attentions to the IF, video, and AGC circuits on the schematic. At this point George even suspected the picture tube, but since he had obtained a flash of light by varying the contrast control, he thought he would first examine the video amplifier circuit (see Fig. 2).

He could see that the cathode of the video amplifier returned to the negative 100 volt supply. On measuring this voltage, he noticed that it would vary from zero to a negative 40 volts depending on the contrast setting. With no further delay. George replaced the faulty component and the set returned to normal operation. Slowly pushing his stool back from the bench, he exclaimed, "Boy oh boy! What next?" Would you have been able to repair this set in the customer's home? For a complete explanation of the solution to this troublesome case, turn to page 65. ▲

Special Resistors in TV Sets *continued from page 21*

C. Load resistors for dual-diode or dual-crystal horizontal AFC circuits.

In the third category are:

A. Grid, cathode, and plate resistors in IF stages.
B. Video detector load.
C. Plate load of video amplifier.
D. Grid resistor in vertical blocking oscillator.
E. Various resistors in vertical multivibrator.
F. Resistors in cathode of pulse-width horizontal AFC circuit.
G. Resistors in horizontal multivibrator and discharge circuits.

If a resistor in one of the foregoing circuits must be replaced, we recommend that the new part should be very close to its rated value. Even though the original resistor might not be a gold-banded type, the possibility exists that it could have been specially selected by the manufacturer for accuracy of value.

The service technician who has a fair-sized stock of 10%-tolerance resistors can usually, by actual measurement, find one which is near enough to rated value to be an acceptable replacement for a 5% type. Practically speaking, the only difference between 5% and 10% ratings is that any one resistor picked from a large inventory of the former type is guaranteed to be within 5% of the labeled value, while a varying percentage of the latter type may be anywhere from 5% to 10% off this value. Purely by chance, some 10% units may be closer to the nominal value than some 5% units.

It is worthwhile to maintain a separate stock of gold-banded resistors if you do not wish to bother with this "hunt-and-check" method. For the benefit of those readers who might be interested in maintaining a stock of these parts, we have prepared Table I. It is a list of the 15 values of ½-watt, 5% resistors which were most often used in the receivers covered in our survey.

Wire-Wound Resistors

Only a small percentage of the resistors used in TV sets are wire-wound. Several of the receivers surveyed had none whatsoever of this type, and no set contained more than 7. On the average, there were 3 per set. In many receiver designs, 2-watt composition resistors have been found adequate for quite a few applications where wire-wound units of higher wattage might be expected.

Out of a total of 255 wire-wound resistors counted in the survey, there were over 150 separate stock items. With but a few exceptions, there are no consistently used values which we would recommend as being items to keep in the parts cabinet; however, we will mention the approximate range of values and wattages normally found in each of the circuits where wire-wound resistors are often used.

Wire-wound resistors most frequently perform the functions of bleeders, surge limiters or dropping resistors in B+ circuits. A tremendous variety of resistor ratings are found in these circuits because the ratings are selected to match the specific current and voltage needs of each receiver. Resistance values usually lie somewhere between 100 ohms and 22K ohms, and wattage ratings may be 4, 5, 7, 10 watts or even greater.

The plate circuit of the video output tube in most sets is returned to B+ through a load resistor of relatively high wattage. A 5- or 10-watt wire-wound resistor is sometimes used here, and its usual value is in the range of 4K ohms to 7.5K ohms. Though a resistor of this type is slightly inductive, its reactance is taken into consideration when the circuit is designed. An exact type replacement should be used so that the frequency response of the stage will not be affected.

Wire-wound resistors are often used in the screen grid and cathode circuits of the horizontal output tube. The screen resistor, if wire wound, is typically a 5K- to 15K-ohm unit rated at 5 or 10 watts. A wire-wound resistor is found less often in the cathode circuit than in the screen return and, when used, the cathode resistor is generally a 100- to 150-ohm, 5-watt type.

One wire-wound resistor which is not a high-wattage type is

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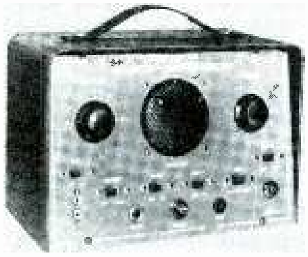

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found in the filament circuit of the high-voltage rectifier in many receivers. This is a precision, non-inductive component, usually rated at only ½ watt. Our survey indicated that the two most commonly used values are 1.5 and 4.7 ohms, but we found about a dozen different resistance values in use.

Among the highest-wattage resistors found in any TV sets are the 15- to 25-watt, cement-coated surge-limiting resistors included in series heater strings. Thermistors (special resistors which decrease in resistance as the temperature rises) were required in older type series strings in which the different tubes had various warm-up times; however, ordinary wire-wound resistors with values from about 33 to 50 ohms are satisfactory for use with modern 600-ma tubes having a controlled warm-up characteristic.

Wire-wound resistors are also useful as surge limiters in the selenium-rectifier input circuits of transformerless TV sets. Resistors in this function usually have values of 5 to 10 ohms. In some sets, an ordinary wire-wound resistor rated at 15 watts is used, but an increasing number of sets have a fusible plug-in unit with a rating of only 5 watts. This special component is designed so that a moderate overload will burn it out before more expensive components sustain any damage. The survey indicated that a 7.5-ohm resistor is the most widely used fusible type and that the 5-ohm value is next in popularity.

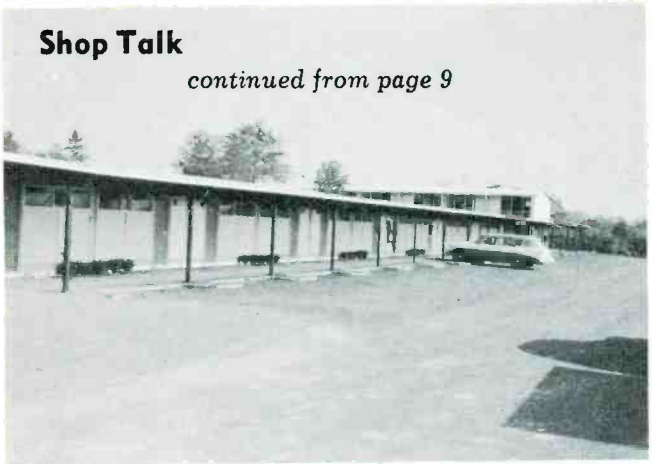
Some of the receivers we surveyed also had wire-wound resistors in the following miscellaneous circuit applications:

1. As a series resistance in the boost circuit.
2. Across the width coil.
3. As a part of the B+ filter.

Although the majority of independent service shops probably find it impractical to maintain a complete stock of special resistors, it is helpful to have an assortment of these parts on hand to satisfy as many replacement needs as possible. We believe that the information in this article will be of assistance to the reader in deciding what resistors to keep in stock. ▲

Shop Talk

continued from page 9



Courtesy Blonder-Tongue Labs., Inc.

These photos cover a 40-outlet system in the Howard Johnson Motor Lodge in Springfield, N. J. System uses Blonder-Tongue VHF amplifier strip and separate power supply and mixing circuits.

grounding to the vent pipe is not the most desirable method is because this pipe not only passes through the interior of the building, but also connects to all or most of the other plumbing pipes located within the building. A lightning discharge striking the antenna will thus pass down one or all pipes and if a lower resistance path is offered by water or gas pipes closely adjacent to the plumbing, the high voltage may jump or arc across to these other pipes with the possible hazard of fire or explosion.

Lead-in Lines

So much for the protection of the antenna. For lead-in line, shielded coaxial cable is recommended in nearly every instance for a number of reasons. First, a shielded line is less susceptible to interference that may induce a voltage in the line on its way to the distribution amplifier. Second, a shielded line will not ordinarily alter its characteristics with weather changes, such as rain or snow. Twin lead lines encased in polyethylene are quite susceptible to such changes. Third, shielded lines may be passed near or through metallic surfaces without having their characteristics affected. This is not true of the unshielded 300-ohm twin lead lines. Fourth, shielded coaxial cables are more rugged, hence they are less likely to break, crack, or otherwise become physically impaired. For the same reasons, coaxial cable is used for the dis-

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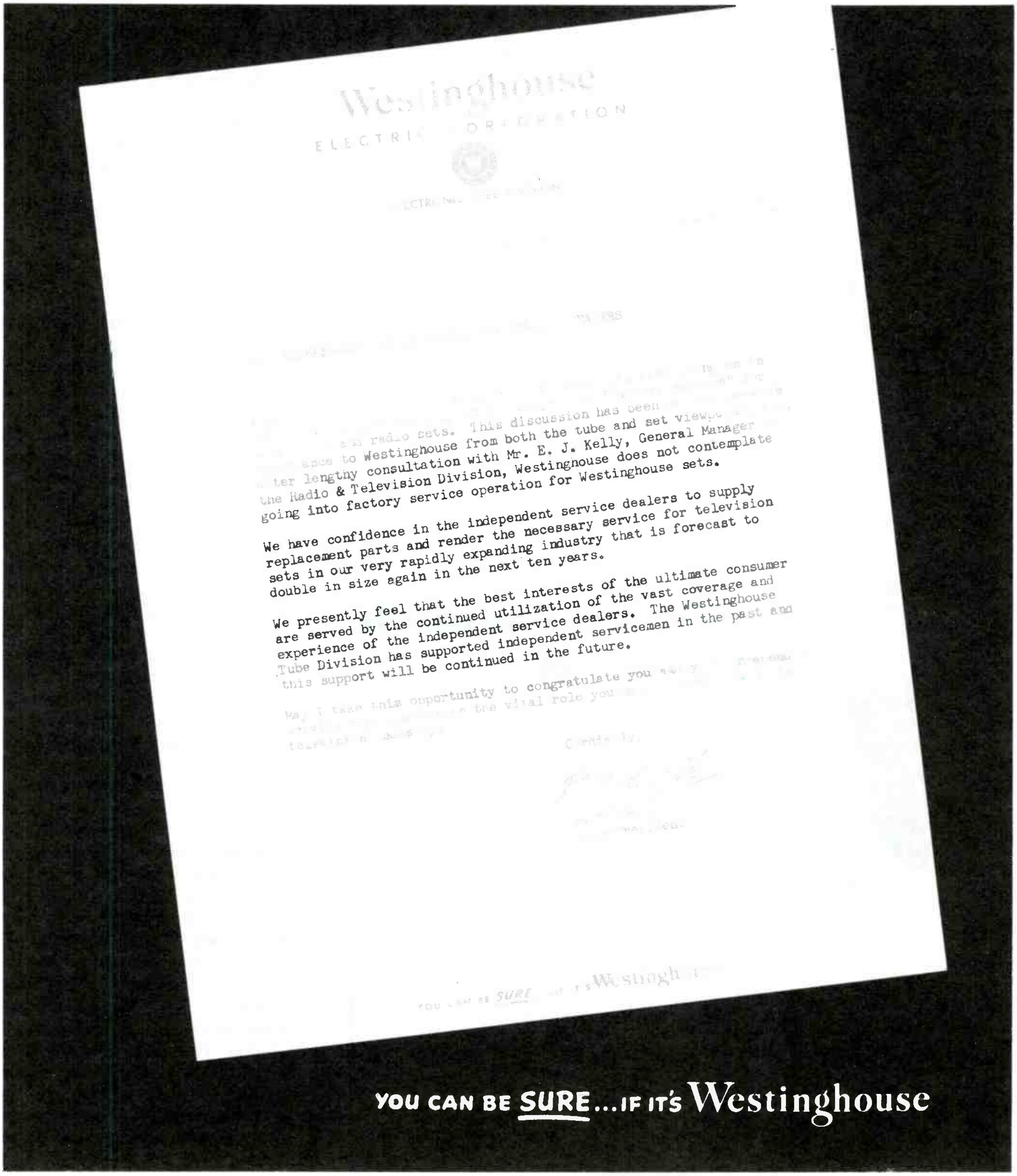

radio sets. This discussion has been
to Westinghouse from both the tube and set viewpo
lengthy consultation with Mr. E. J. Kelly, General Manager
the Radio & Television Division, Westinghouse does not contemplate
going into factory service operation for Westinghouse sets.

We have confidence in the independent service dealers to supply replacement parts and render the necessary service for television sets in our very rapidly expanding industry that is forecast to double in size again in the next ten years.

We presently feel that the best interests of the ultimate consumer are served by the continued utilization of the vast coverage and experience of the independent service dealers. The Westinghouse Tube Division has supported independent servicemen in the past and this support will be continued in the future.

May I take this opportunity to congratulate you tribution of signal inside the building. In using such cables, care should be taken to see that they are not bent sharply, run over sharp edges, or subjected to temperature extremes. They should also be anchored securely on long runs to prevent any undue strain.

Signal Distribution Lines

Frequently, installations are encountered where it is more desirable to run the distribution cables outside the building than inside. In such instances, the cable should be fastened to the side of the building by means of cable clamps and made secure. The clamping may be made by standoff cable clamps, or the cable can be fastened to the window frame at each floor.

The latter procedure is quite feasible with coaxial cables because of their outer protective shield but is generally not advisable with twin lead. Inside a building, cables may be run vertically through hallways, stairwells, closets, or vents; horizontally, the cable may be run along an attic or through a basement. Here, standoff cable clamps are generally not required. Instead, the cable can be secured directly to walls or joists by means of U-shaped brackets or large staples. The only precaution to observe is not to force the brackets so tightly against the cable that the protective shield is broken or that the outer conductor is forced into contact with the inner wire.

When outside risers are employed, the tapoff is made on the cable just outside the window. For this purpose, it is generally good practice to leave a loop several inches long in the riser at each window so that a tapoff may be made either immediately or sometime in the future. This permits the cable to be spliced and a tapoff inserted without difficulty. The line into the apartment is then brought in through the window casing, if the latter is made of wood or aluminum, or below the window (through the side of the building) if steel casing is used. In the latter instance, the line would be brought in near the floor to appear as unobtrusive as possible.

Master Amplifier Installation

The most desirable location for the master amplifier will depend on the layout of the apartments in the building and the number of receivers to be serviced. In the following paragraphs, suggestions for possible locations will be given, based on the experience of master antenna system installers. Credit for these suggestions must go to the manufacturers of such equipment and to the servicemen who install them.

The equipment may be located outside or inside a building. If mounted outside a building, weatherproof housing is required. Also, the equipment should be fitted with a lock to prevent tampering by unauthorized persons. The latter feature is frequently required as well on inside installations. Whether mounted inside or outside, the equipment should be protected against electrical shock by suitable ground connections.

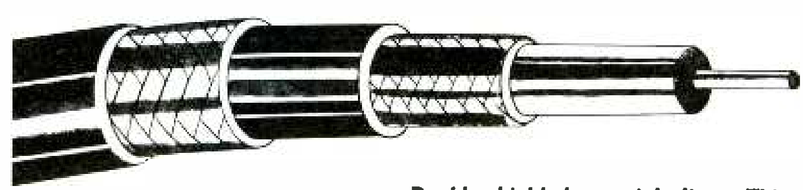
Mounting of equipment well above the ground (or floor) is desirable from the point of view of tampering, but there is also the problem of servicing to consider. Anything you do to make the equipment difficult to get at will mean more time for your servicemen.

For more specific suggestions on master amplifier location, here is what Jerrold Electronics Corp. has to say:

1. In elevator buildings up to 15 stories, the elevator penthouse or a nearby location will usually provide a good location, since short leads may be used from the antennas. The latter is important in order to maintain a fairly high signal-to-noise ratio in moderate or weak signal areas. Where the signal level is high, this is not as important a consideration.

2. In buildings over 15 stories, a central location is preferable, so that the number of tapoffs on the different riser cables can be kept about the same and well below the maximum of 20. While the latter figure is given with regard to Jerrold systems, it is equally true of most master antenna systems.

3. Groups of tall buildings may be supplied by a single master amplifier located in a central building. The most economical method can be figured out before-



Double-shielded coaxial line. This is particularly useful in high noise (electrical) or high signal areas.

hand. In any event, remember that a minimum signal strength of 1,000 microvolts per receiver is desired.

4. In garden-court developments, the best location for the master amplifier is generally near the center of the project.

5. When equipment is installed, always make certain it is supported by its own structure, and not by the cables which come into it or lead away from it.

6. Although it is generally unlikely that the master amplifier and its associated equipment will ever draw more than 400 watts, a duplex outlet with 10-amps capacity should be provided in order to accommodate a soldering iron or a test instrument from time to time. This power should be supplied from a line which will be free from interruptions or intermittently heavy loads.

Concerning the latter point, it is advisable that the power line be given a thorough check before deciding on its use. This check should be performed throughout a normal day because fluctuations may occur at one time of day and not at others. If significant voltage variations are found, either another line should be brought in or a voltage regulator used. As a matter of fact, line regulators are always recommended and should be installed wherever their cost can be carried by the installation.

Important, too, is RF interference on a power line, especially since we are dealing here with amplifiers that are capable of amplifying RF signals. A good check for such interference can be made by observing the performance of a test television receiver.

The foregoing has dealt with the master amplifier. Next comes the distribution system where the amplified signals are fed to the various risers. As a general rule, branching to provide risers should take place as near as possible to the master amplifier. In most instances, the master amplifier and the distribution equipment are usually located either at the roof or in the basement. If two or three penthouses are used, each one might be a distribution center.

Probably the greatest service aid that the installation crew can provide when installing the system is to tag all of the risers leaving the distribution center. Jot down on each tag such information as the number of each apartment tied into the line and the signal strength of the various channels. Also, a master plan for the entire building should be drawn up, giving signal level at each apartment outlet. If trouble then develops in the system, a field strength meter is practically all that is needed to isolate the source of the difficulty. Simply check the signal along a line until the point where it weakens or disappears is located.

Please note that signal levels change constantly, so before you conclude that a low level at an apartment outlet is due to some riser-line trouble, go back to the master amplifier and check there. Only when the output there is normal can you properly interpret abnormal results elsewhere in the system.

Remember, too, that the easier a system is to trace, the easier it is for less experienced personnel to service it. In these days when top-notch service technicians are hard to come by, this is of more than passing interest.

Another aid to service personnel is the use of a log at the distribution amplifier giving full details of amplifier signal levels found at each prior visit. This provides the man making a service call with a history of prior service and helps him in his present call. Each technician should be instructed to make an entry on this log after every visit. ▲

About These Automatic Tuning Devices

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Crosley

The 1957 Crosley receivers offer an automatic tuning system with front panel controls for both "consecutive" and "selective" tuning. This arrangement gives the operator a choice between checking all channels and rapidly selecting the most-used channels. A wheel of the type shown in Fig. 2 is mounted so that the numbered side faces the rear of the receiver.

Like other types of automatic tuning systems, the Crosley device includes a motor hold-in switch that is connected in parallel with the push-button switch during "consecutive" tuning.

The numbered wheel has a cam surface upon which this hold-in switch travels, and the cam is shaped so that the switch closes between channels and opens in the on-channel positions. Pushing the "selective" front-panel button places a bypassing switch in parallel with the regular hold-in switch. The tips of the adjustment screws serve as a cam surface for this bypassing switch. If a channel is to be bypassed, the appropriate screw is tightened so that the tip projects from the far side of the wheel. The bypassing switch is then lifted up into a closed position when it contacts this screw tip and is held closed during the interval when the hold-in switch is open. Thus, the motor is powered continuously as it passes by the undesired channel position. The adjustment screws corresponding to active channels are loosened so that they will not contact the bypassing switch.

Motorola

The Motorola automatic tuning system accomplishes preselection by means of a set of pivoting cams mounted on a wheel. Since this wheel is not readily accessible, the tuner is equipped with a pair of built-in push rods for the technician to use in setting up the cams. The rods, which are accessible at the back of the receiver, are visible in Fig. 3. During setup, the receiver should be turned off and the cams should be adjusted one by one while the tuner shaft is manually rotated.

For active channels, the "set" rod is pushed. This action swings a cam into such a position that it will open a switch and break the motor circuit each time a particular channel is reached. On the other hand, pushing the "cancel" rod positions the cam so that the motor switch is not intercepted and the channel is bypassed.

Some unique features are found in the Motorola automatic tuning system. One of these takes advantage of the fact that the rotor of the drive motor is magnetically thrust forward when power is applied. Auxiliary contacts are mounted on the rotor, and these complete sound-cutoff and picture-blanking as well as hold-in circuits while the motor is operating. The extra circuits prevent flashes and noises during the tuning cycle.

In addition, a spring-and-cam system called "Zero-In" fine tuning is used to return the fine-tuning capacitor to the center of its range each time the channel is changed. Thus, a temporary or accidental movement of the fine-tuning knob does not permanently affect the accuracy of the automatic tuning.

Conclusion

The electro-mechanical devices which are used in automatic tuning systems all work on similar principles, though the details of construction vary in different designs. Certain types of defects should be the first items checked in the event a motorized tuner requires trouble shooting. Failure to operate, or sluggish operation, is likely to be caused by inadequate clearance between parts, or by faulty lubrication. Sloppy operation (for example, failure to stop exactly on channel, or undesirable channel skipping) may be a result of worn cams or gears or sticking switch contacts.

This article has dealt only with the parts of automatic tuning systems which lie inside the receiver. We have emphasized the procedures necessary in getting these systems ready for operation and adjusting them for local conditions. A future presentation will describe some of the remote control units that are used to actuate automatic tuning devices. ▲

Servicing New Designs

continued from page 19

time the lever is pulled to the right.

The channel-selector lever operates a ratchet mechanism that enables the set user to rotate the tuner shaft one, two, or three channels at a time, depending upon the distance the lever is moved. A diagram of this device is presented in Fig. 2. The technician is cautioned against disassembling this system unless absolutely necessary, since the selector lever pulls against strong spring tension and the resetting of an "unsprung" ratchet system is somewhat tedious. (Note: The system does not have to be disassembled in order to remove the chassis from the cabinet.)

The main parts of the tuning device are a ratchet wheel clamped to the tuner shaft and a spring-loaded pulley wheel connected to the tuning lever by a cord. The two wheels are connected only through the ratchet. When the lever is pulled to the right (position shown in the diagram), the ratchet on the pulley snags one of the teeth on the ratchet wheel, the two wheels rotate together, and the tuner shaft is turned to a different channel position. When the lever is released, the spring (which has been wound up around the hub of the pulley wheel) turns the wheel counterclockwise and returns the lever to its rest position. The tuner shaft remains stationary, however, because the ratchet lets go of the ratchet wheel. An incidental feature of the tuner is a front-panel channel indicator driven by the tuner shaft through a rubber belt.

Fig. 3. Three types of construction in Emerson Model 1208.

Modular TV Circuits

Some production runs of the Emerson TV Chassis 120306 (Fig. 3) include three different kinds of construction in the same set—conventional, printed-wiring board and modular. The circuits arranged in modular form are the sync phase inverter, horizontal AFC, and horizontal and vertical oscillators. Two 6CG7 tubes are associated with the modules, but these are not visible in Fig. 3 because they are on the opposite side of the chassis.

Some sets of the same model contain a printed wiring board in place of the modular board. The manufacturer evidently intends to check in the field on the comparative performance of the two types of construction. Notice in the illustration that the mounting hole for the modularized board is half

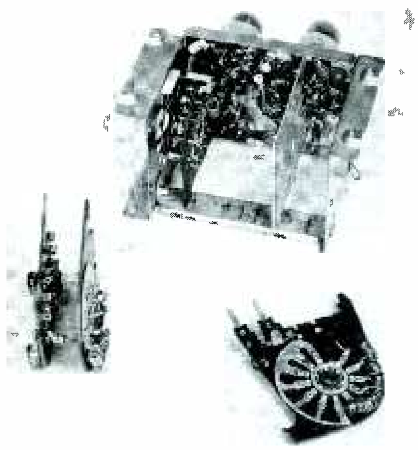


Fig. 4. Motorola tuner modularized with plug-in wafer switches.

again as big as the board itself. All this extra space is filled when printed wiring is used in place of the modules. This is a graphic demonstration that modular construction is highly compact as far as chassis area is concerned.

The construction of the Motorola tuner shown in Fig. 4 is also modular in a general sense. "Modules" do not have to be cubelike in shape—the definition can be applied to any subassembly of related parts which is replaceable as a unit. In the case of this tuner, the modular parts are the four wafer-switch assemblies, any one of which can be unplugged and replaced if it becomes defective. Each replacement assembly has its own part number and carries a list price of $2.80 to $5.05.

When one screw is loosened, the tuner shaft can be slid out to release the modules. These wafer assemblies are fitted with female plugs which are connected to prongs on the body of the tuner. The male plugs on the wafer in the foreground in Fig. 4 are antenna terminals.

The Motorola modularized tuners have been in the field for some time, but because of the nature of their construction, the plug-in feature is easily overlooked by anyone not familiar with its existence.

Portable Combo

The Emerson Model 1232 Port-O-Rama is a combined 8" television set, radio, and phono amplifier in a compact package. The chassis measures only 11" × 10½" × 7". Various construction features can be seen in Fig. 5, which

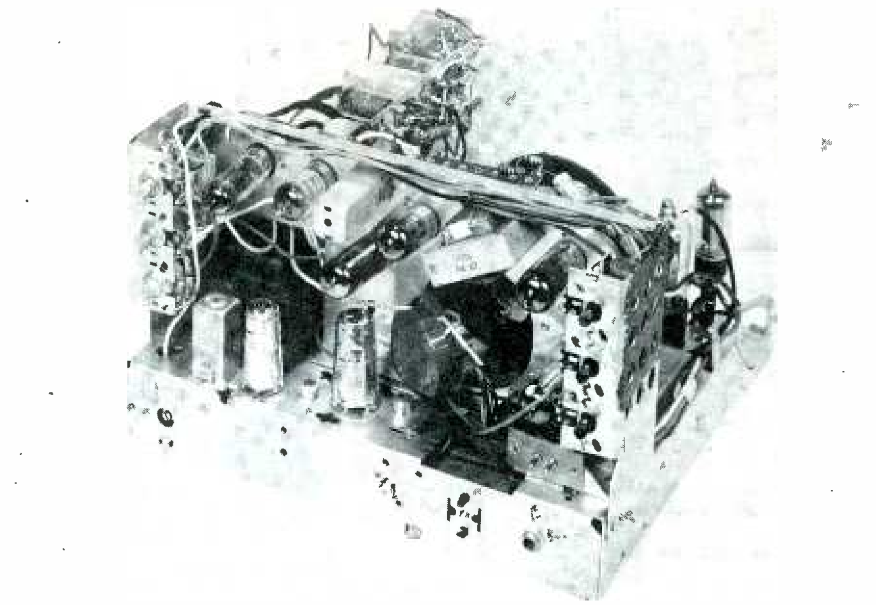


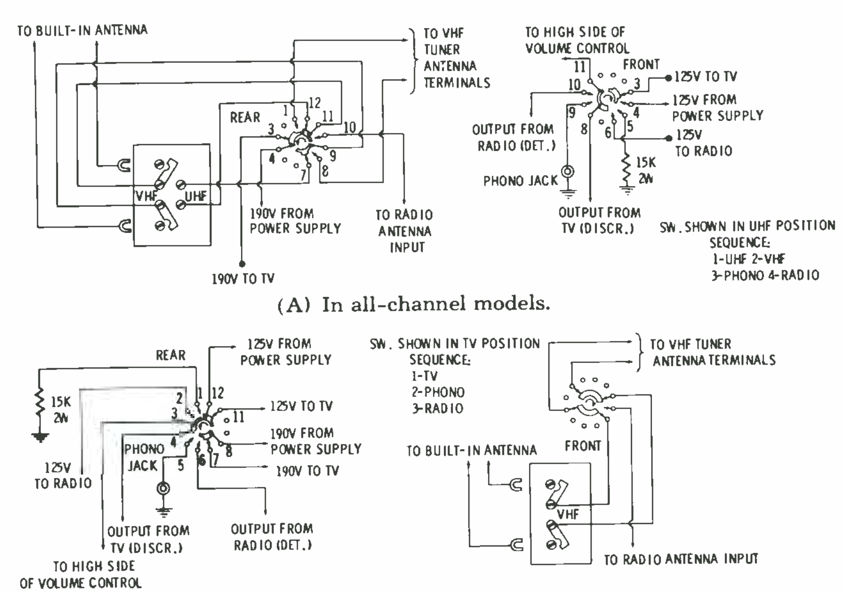
Fig. 5. Rear chassis view of Emerson Model 1232 Port-O-Rama.

is a rear view of the chassis with the picture tube and speaker removed. Most of the TV tubes and service controls are mounted on a vertical chassis and face toward the rear of the set. The bell of the picture tube occupies most of the right front portion of the chassis. Outboard of it, along the right edge, are mounted the horizontal output and high-voltage rectifier tubes and the speaker. To the left of the picture tube are the radio subchassis (on top) and the TV tuner (below). The off-on-volume, contrast, radio and TV tuning, and function selector controls are accessible from the front of the set.

Jacks for phono input and also for output to an external speaker are located on the rear apron of the chassis. Among the parts which are under the chassis are a pair of selenium rectifiers, the flyback, and some large capacitors.

The TV circuits on VHF models include 13 receiving tubes, with 2 additional tubes in the radio tuner. The picture tube is an 8DP4 with 36 sq. in. of viewing area. A power transformer and a selenium rectifier voltage doubler furnish B+ voltage, and the tube filaments are wired in parallel.

The TV-PHONO-RADIO function switch makes connections so that the appropriate input—from



(A) In all-channel models.

(B) In VHF-only models.

Fig. 6. Function-selector switch in Emerson Port-O-Rama receiver.

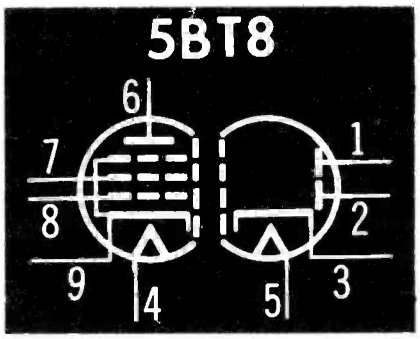


Fig. 7. Basing diagram of 5BT8.

the FM discriminator, AM detector, or phono jack—is fed to the volume control at the grid of the 6T8 audio amplifier. In addition, various switching is done in the B+ and antenna circuits. The switches in all-channel models are wired differently from those in VHF-only sets. (See Fig. 6 for schematics of the two different switching arrangements.)

A 125-volt B+ supply is fed to either the TV or radio tubes when they are in use. In the PHONO position, a 15K-ohm bleeder resistor is switched across the 125-volt supply terminals. At all times, the audio output tube receives a direct 180-volt B+ supply and the audio amplifier receives 125 volts.

An external-sound jack is wired across the built-in speaker. When an earphone or a remote speaker such as an under-pillow unit is plugged into the jack, the regular speaker is automatically disconnected.

To gain access to the chassis, the service technician should go through the following procedure: Take off all knobs, unfasten two screws underneath the front mask and lift the mask off. Then free the chassis by loosening four screws underneath the cabinet, and take off the leads to the AC interlock and the built-in rabbit-ears antenna. Pull the chassis out through the front of the cabinet.

New Dual-Purpose Tube

The 5BT8, a new pentode-dual diode, is used in Westinghouse Chassis V-2344-25-26 as an AGC amplifier and horizontal AFC tube. A basing diagram (Fig. 7) shows that separate cathodes are employed for the pentode and diode sections. The tube has a 600-ma heater for operation in series strings. ▲

Quicker Servicing

continued from page 17

coupler C43 and the .05-mfd video coupler C33 were found to be leaky and were therefore replaced, but the bending condition did not improve. Replacement of the defective tubes and components in the video IF, video amp and sync circuits, even though it hadn't cured the bending, had improved the shape and amplitude of the video and sync signals as viewed on the screen of the oscilloscope.

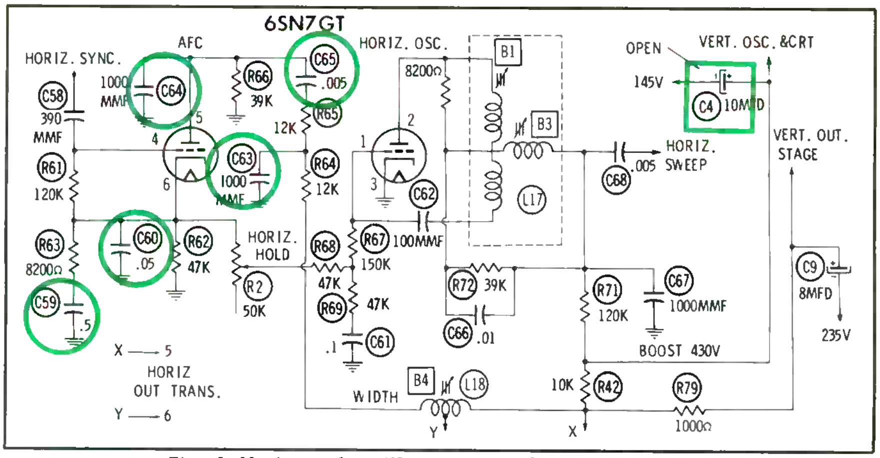


Fig. 4. Horizontal oscillator and AFC in Hallicrafters set.

Since the foregoing procedure had eliminated the video and sync circuits as possible sources of the trouble, the technician turned to the only remaining circuit which could cause bending in the picture—the horizontal AFC circuit. Past experience had shown that capacitor leakage or other capacitor defects in this circuit could cause picture bending; therefore, a systematic substitution of the capacitors circled in Fig. 4 was made. When substitution of these six capacitors failed to reveal the trouble, the technician was about ready to declare the set a "dog" and give up.

In one last attempt to locate the trouble, the technician began a point by point check of the horizontal AFC and associated circuits. Tracing the feedback network from the plate of the AFC circuit back to the transformer, he discovered that the boost B+ supplied both the vertical oscillator and output stages and realized that failure of either the 8-mfd or 10-mfd filter capacitor would allow the 60-cps vertical signal to vary the boost voltage slightly at a 60-cycle rate. This would cause the feedback signal to vary at the vertical sweep frequency and thus cause some picture pulling. A check of the two capacitors showed that the 10-mfd unit was open and replacement of this unit cured the trouble.

Inspection revealed that one section of the 10-mfd capacitor had failed at some other time and had been replaced by a single unit. This is always a poor practice. Whenever one section of an electrolytic fails, the entire unit should be replaced.

Fig. 5 shows the edge of the

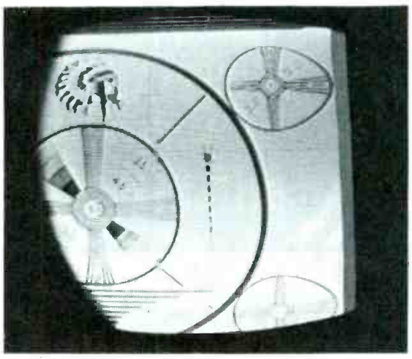


Fig. 5. Raster and picture edges after pulling condition was cured.

picture and the edge of the raster parallel as they should be, and comparison between Figs. 2 and 5 shows how much bending was present in the picture. Remember that in order to check for pulling or bending in a picture or raster the horizontal hold control may have to be turned slightly to shift the edge of the picture away from the edge of the raster.

Replacing a 5U4-G in '54 and '55 Sylvania Sets

A good many of the 1954 and 1955 Sylvania television receivers employed either one or two 5U4-G tubes mounted on top of the power transformer as shown in Fig. 6. The tube plugged into its socket through a hole in the metal

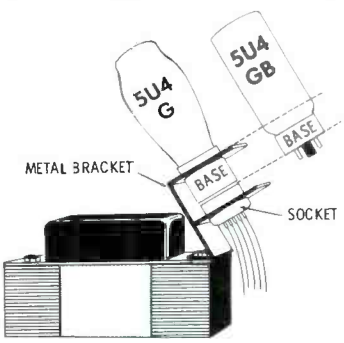


Fig. 6. Mounting of 5U4 tubes in 1954 and 1955 Sylvania receivers.

bracket. This hole is large enough to clear the base and the narrow part of the 5U4-G, but because a 5U4-GB has a shorter base and a larger bulb this tube will not fit down into the socket. The service technician should always have a couple of the 5U4-G tubes in the service caddy for use in such receivers.

Open 5U4 Filaments in Tech-Master Sets

On another TV call, both 5U4 filaments in a Tech-Master set were open and the balance of the tube filaments were lit up normally. Being a cautious soul, the technician pulled the chassis and tested all filter capacitors and the entire B+ and B− systems for shorts. None were found. It was noticed, too, that the fuse (which is shown in Fig. 7) was not blown. This puzzled the technician since he could not understand how both tube filaments could be burned out without having blown the fuse. Knowing that the fuse was good, the technician was now certain that neither a B+ nor B− short had occurred—yet what could have caused the trouble?

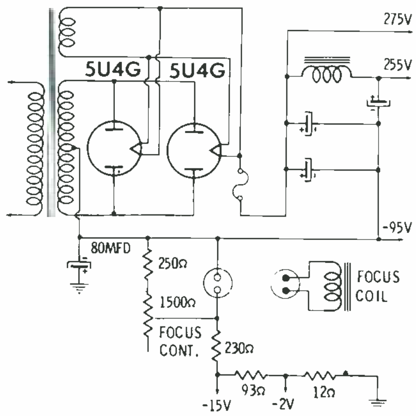


Fig. 7. Power supply of Tech-Master set.

While pondering the problem, the technician picked up the old 5U4 tubes, and suddenly he had a hunch about what had happened. One of the 5U4 tubes was an older G type while the other was a newer GB type. The older tube had probably failed, placing the entire load on the newer tube, which in turn also failed after a period of overloaded operation.

He replaced both 5U4 tubes with new 5U4-GB's and turned on the set for a test. After only a few minutes of operation, the picture and raster disappeared. The technician noticed a peculiar glow in the 6SN7 horizontal discharge tube, so it was replaced. This restored the receiver to normal operation, and the technician was now certain of his diagnosis. With the horizontal oscillator inoperative, the loss of horizontal drive had placed an additional load on the power supply. This added load was not enough to blow the fuse, but it was sufficient to burn out the 5U4GB which had remained as the sole power source after the 5U4G failure.

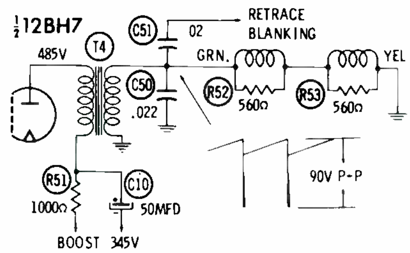
Replacing the Vertical Output Transformer

The vertical output transformer is used to provide the proper plate load for the vertical deflection amplifier and to supply the necessary sawtooth current for the vertical deflection coils. In fulfilling these functions, the turns ratio of the transformer becomes a very important factor. It is sometimes difficult to obtain an exact replacement transformer in which case it may become necessary to change the circuit so that an autotransformer may be used instead of an isolated-secondary type or vice-versa. In most cases, this means that the yoke is simply connected across the lower portion of the transformer winding as required to match the impedance of the vertical deflection coils.

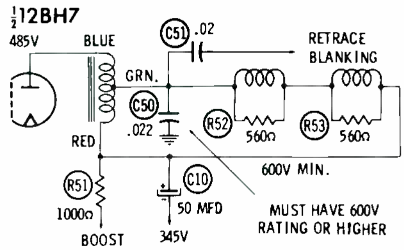
In an Olympic TV receiver using the TN chassis, this procedure resulted in a headache for reader S. W. Plummer of Cedar Rapids, Iowa. Mr. Plummer (*who received $5.00 for submitting this hint—Editor*) reports that he replaced the isolated-secondary type of vertical output transformer with an autotransformer in a certain set. In a few days he had a recall—the customer complained of intermittent loss of picture and raster accompanied by a popping noise from within the receiver.

By consulting the diagram in Fig. 8, you will notice that the secondary of the vertical output transformer was grounded, as was one end of the yoke in the original circuit. In the new circuit, both ends of the yoke are above ground and are connected to boost B+. Reader Plummer found that the .022-mfd, 400v capacitor (which had been more than adequately rated for the original circuit with only a 90-volt peak-to-peak signal present) was now breaking down due to the 485v DC from boost B+. Replacement of this unit with a 600-v capacitor cured the trouble.

Incidentally, when it is necessary to change circuit design, as it was in this case, you should always inspect the circuit for components which could break down due to increased voltages. Make it a general rule that any such units should be replaced with higher rated parts. ▲

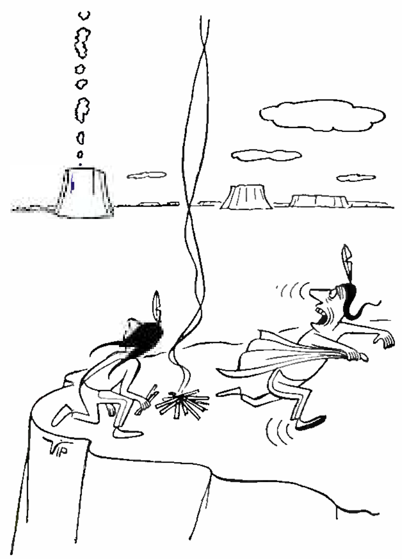


(A) Original transformer.



(B) Autotransformer replacement.

Fig. 8. Vertical output circuit of Olympic receiver using TN chassis.



"By golly, it is an emergency call . . . they're out of JENSEN NEEDLES."

TROUBLE SHOOTING WITH GEORGE

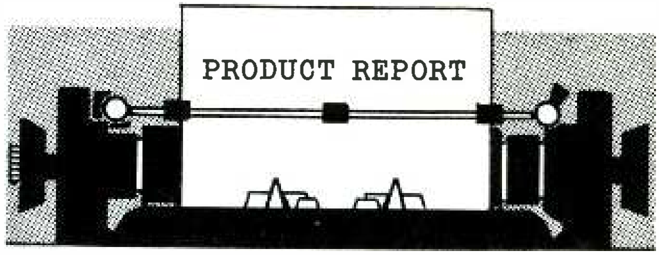
The Solution

After George had found the deficiency in the negative supply line, he removed the video amplifier tube from its socket and noted that the voltage now remained at 100 volts regardless of contrast setting. Yes, sad but true, George found that the 6AH6 video amplifier tube had a heater-to-cathode short. This effectively shorted the negative supply voltage to ground through the contrast control in the cathode circuit.

The first clue George had detected, that of insufficient high voltage, was very misleading. This condition actually resulted from both a loss of B— voltage and a weak low-voltage rectifier tube. When a negative supply like 100 volts is shorted to chassis ground, B+ will normally increase 100 volts with respect to chassis, providing the rectifier circuit is operating properly.

High voltage had been restored by replacement of the rectifier tube, but unknown to George, the negative supply was still out. This affected the AGC voltage and the operation of the video amplifier, which in turn resulted in improper bias for the picture tube. The picture tube was thus cut off and a raster could not appear on the screen.

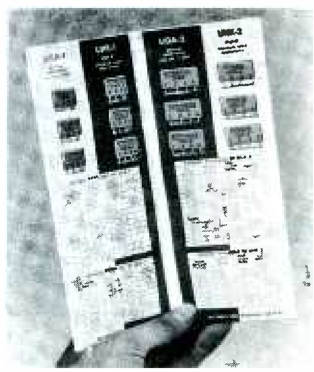
Considering only the apparent symptoms involved, George was ready and willing to accuse either the horizontal sweep or high-voltage circuit for the elusive picture. Had he replaced the low-voltage rectifier tube (which is sometimes the cause of high voltage deficiency), perhaps he would have been led to the root of the problem while in the customer's home.



AM Generator

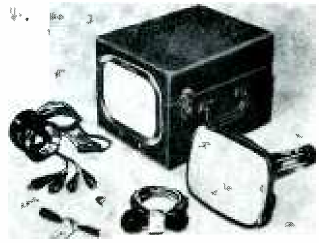
Model 290X, an AM signal generator with a quick-tuning feature, has been introduced by The Hickok Electrical Instrument Co., 10566 Dupont Ave., Cleveland, Ohio. Five frequencies most often used in broadcast receiver alignment (262 kc, 455 kc, 465 kc, 600 kc, and 1400 kc) are preset and can be selected by means of a front-panel switch. The unit also has provisions for crystal control of frequencies. RF output is variable from 2 to 200 microvolts, either unmodulated or with 400-cps modulation. Price is under $45.

Replacement Capacitor Kit



The "Universal" ceramic capacitors recently developed for the replacement market by Sprague Products Co., N. Adams, Mass., are now being sold in kits of 12 units. Each kit contains equal amounts of four different types—the UGA-1 and UGA-2 for general use and the UHK-1 and UHK-2 with high dielectric constant. Each capacitor has four leads and can be wired in various ways to obtain different values of capacitance. Wiring instructions are included in the kit, which is designated Model CK-4 and has a dealer net price of $3.96.

Picture Tube Substitution Kit



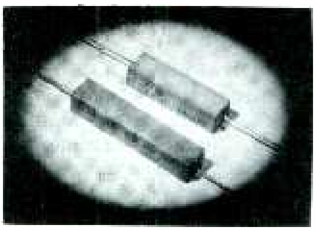
The latest model of the "Telecheck" CRT-substitution kit made by Telematic Industries, Inc., 16 Howard Ave., Brooklyn, N.Y., features an 8XP4 check tube with an 8″ screen and 90° deflection. Accessories included are a yoke that will work with many types of receivers, a set of extension leads and a plastic mask and yoke support, all enclosed in a carrying case. The kit is also available in a version for bench use (less tube and case) or in a deluxe version having a test speaker in addition to the other items.

Hi-Fi Speakers

The Duotone Co. of Keyport, N.J., is presenting a new line of high-fidelity loudspeakers under the trade name of DFF (Duotone Fidelity Focus). One 15" woofer, 4 different coaxial speakers, and 2 tweeters are included in the line. Coaxial units are priced at $53.97 and up.

The 12" Royal model illustrated has a frequency response of 35 to 18,000 cps and handles 25 watts of power. Magnet weight is 1.5 pounds.

Miniature Power Resistors



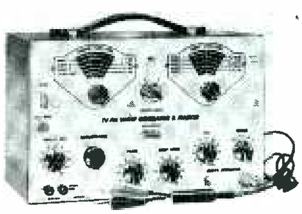
Clarostat Mfg. Co., Inc., Dover, N.H., has added square-bodied miniature power resistors to its "Greenohm Jr." line. The square shape with axial pigtail leads is preferred for certain assembly and wiring operations.

There are two series of square-bodied units. Series C7GL is supplied in values from 1 to 6,000 ohms at a rating of 7 watts, and Series C10GL is available in resistances from 1 to 11,000 ohms at 10 watts. Body length of the former is 1⅜" and that of the latter is 1⅞".

Portable Paging Speakers

Two types of battery-powered portable P.A. speakers have been announced by University Loudspeakers, Inc., 80 S. Kensico Ave., White Plains, N.Y. The "Powrpage" Model PP-1 weighs only 7½ lb. and is powered by 7 size "D" flashlight batteries. A microphone with an 11' extension cable is furnished. The Model PP-2 "Pistolgrip Powrpage" is a 4¼-lb. unit operated either from 6 size "AA" (pencil) batteries mounted in the handle or from an external 6- or 12-volt DC supply such as an ignition system.

Sweep and Marker Generator Kit



EICO, 84 Withers St., Brooklyn, N.Y., has just released a TV-FM sweep and marker generator available in kit form at $69.95 or factory-wired at $119.95. Range of the sweep generator is 3-216 mc on fundamental frequencies, and the marker generator covers 2-75 mc on fundamentals plus 60-225 mc in a calibrated harmonic band. A crystal marker generator, complete with 4.5-mc crystal, is provided for calibration of the variable marker. Sweep width is continuously variable from 3 to 30 mc.

PF REPORTER

INDEX TO ADVERTISERS

February 1957

PF REPORTER — CATALOG and LITERATURE SERVICE

valuable manufacturers' data available to our readers at no charge.

1B. AMERICAN ELITE (American Elite, Inc.)
Telefunken tube manual and name of nearest distributor. *See advertisement page* 28.

2B. B & K (B & K Mfg. Co.)
Bulletin 1000 describes new DYNASCAN picture and pattern video-generator. Explains its use in servicing black and white and color TV and how it acts as a closed circuit TV. Bulletin 750 describes new, low-cost, lab-type Test Equipment Calibrator Model 750 that checks instrument accuracy. Also Bulletin 500 on Dyna-Quick Dynamic Mutual Conductance Tube Tester and Bulletin 400 on CRT Cathode Rejuvenator Tester. *See advertisements pages* 24, 52.

3B. BUSSMANN (Bussmann Mfg. Co.)
New and very comprehensive book on fuses and fuse mountings used by the electronics industries. *See advertisement page* 16.

4B. CHICAGO STANDARD (Chicago Standard Transformer Corp.)
New 1957 STANCOR TV Transformer Replacement Guide & Library. *See advertisement page* 35.

5B. CLAROSTAT (Clarostat Mfg. Co., Inc.)
Series A47 & A47F 15/16" dia. composition element controls 500 ohms to 5 megohms. *See advertisement page* 43.

6B. CLEAR BEAM (Clear Beam Antenna Corp.)
Informative booklet on antenna kit merchandising with display hints entitled, "How to Pay Your Rent With One Minute Sales Promotions." Write for free copy. *See advertisement page* 47.

7B. CORNELL-DUBILIER (Cornell-Dubilier Electric Corp.)
Catalog 200D3-T covering tubular replacement capacitors. *See advertisement page* 58.

8B. EICO (Electronic Instrument Co.)
Free 1957 Catalog shows how to save 50% on electronic test equipment in both kit and wired form: describes VTVM's, scopes, generators, tube testers, etc. *See advertisement page* 61.

9B. HICKOK (Hickok Electrical Instrument Co.)
Brochure covering new Hickok VTVM kit which features large 9" meter. *See advertisement page* 22.

10B. IRC (International Resistance Co.)
New replacement parts catalog—DLR-57 (form S035-A). *See advertisement* 2nd cover.

11B. JENSEN (Jensen Industries, Inc.)
Brand new JENSELECTOR—a book containing the names of over 300 brands of phonographs and the needles used by each. *See advertisement page* 65.

12B. MALLORY (P. R. Mallory & Co., Inc.)
Battery replacement guide for portable radios. *See advertisements pages* 40, 41.

13B. PHAOSTRON (Phaostron Co.)
Catalog lists complete line of company's Custom Panel Meters. Illustrated. Includes comparison chart of Phaostron instruments vs. other brands and complete information on dimensions and features. *See advertisement page* 6.

14B. SAMS (Howard W. Sams & Co., Inc.)
Complete details on how to keep your Service Data Library up to date with the Sams Automatic monthly purchasing plan. Also complete details on the Sams popular Time Payment Plan. *See advertisements pages* 29, 50.

15B. SIMPSON (Simpson Electric Co.)
No. 2056 Test Equipment Catalog Bulletin and No. 2052 Panel Meter Catalog Bulletin, both 6-page illustrated bulletins on enameled stock. *See advertisement page* 57.

16B. SPRAGUE (Sprague Products Co.)
C-455 Service Catalog on popular radio and TV replacements. *See advertisement page* 2.

17B. TACO (Technical Appliance Corp.)
Condensed catalog on television antennas and installation accessories. *See advertisement page* 7.

18B. VOKAR (Vokar Corp.)
Circuit diagram for 6-transistor superheterodyne radio. Bulletin on Vokar IF-Kit 5000. *See advertisement page* 64.

19B. WINSTON (Winston Electronics, Inc.)
Free literature on Color TV Test Equipment. *See advertisement page* 49.

20B. WRIGHT (G. F. Wright Steel & Wire Co.)
Wright TV Guy Wire Circular. *See advertisement page* 63.

21B. XCELITE (Xcelite, Inc.)
Folder on new plastic transparent screwdriver kit with zipper; catalog on screwdrivers, nut drivers, pliers. *See advertisement page* 26.

SUPPLEMENT No. 102-A

FEBRUARY 1957

SUPPLEMENT to SAMS MASTER INDEX No. 102

File this Supplement with your 36-page SAMS MASTER INDEX. Together, they give you complete PHOTOFACT coverage.

For models and chassis not listed in this Supplement, refer to SAMS MASTER INDEX No. 102. If you haven't a copy, send for it today. It's FREE . . . just write to HOWARD W. SAMS & CO., INC., 2201 East 46th Street, Indianapolis 5, Indiana.

This Supplement is your handy index to new models covered in the latest **PHOTOFACT Sets 346 through 348.** It's your guide to the world's finest service data coverage of the current output of the new TV and Radio receivers, as well as models not previously covered in PHOTOFACT. It keeps you right up to date.

ALWAYS USE YOUR LATEST ISSUE OF THIS SUPPLEMENT *WITH* THE SAMS MASTER INDEX . . . TOGETHER, THEY ARE YOUR COMPLETE INDEX TO OVER 30,000 MODELS.

FILE WITH YOUR SAMS MASTER INDEX No. 102, DATED FEBRUARY, 1957

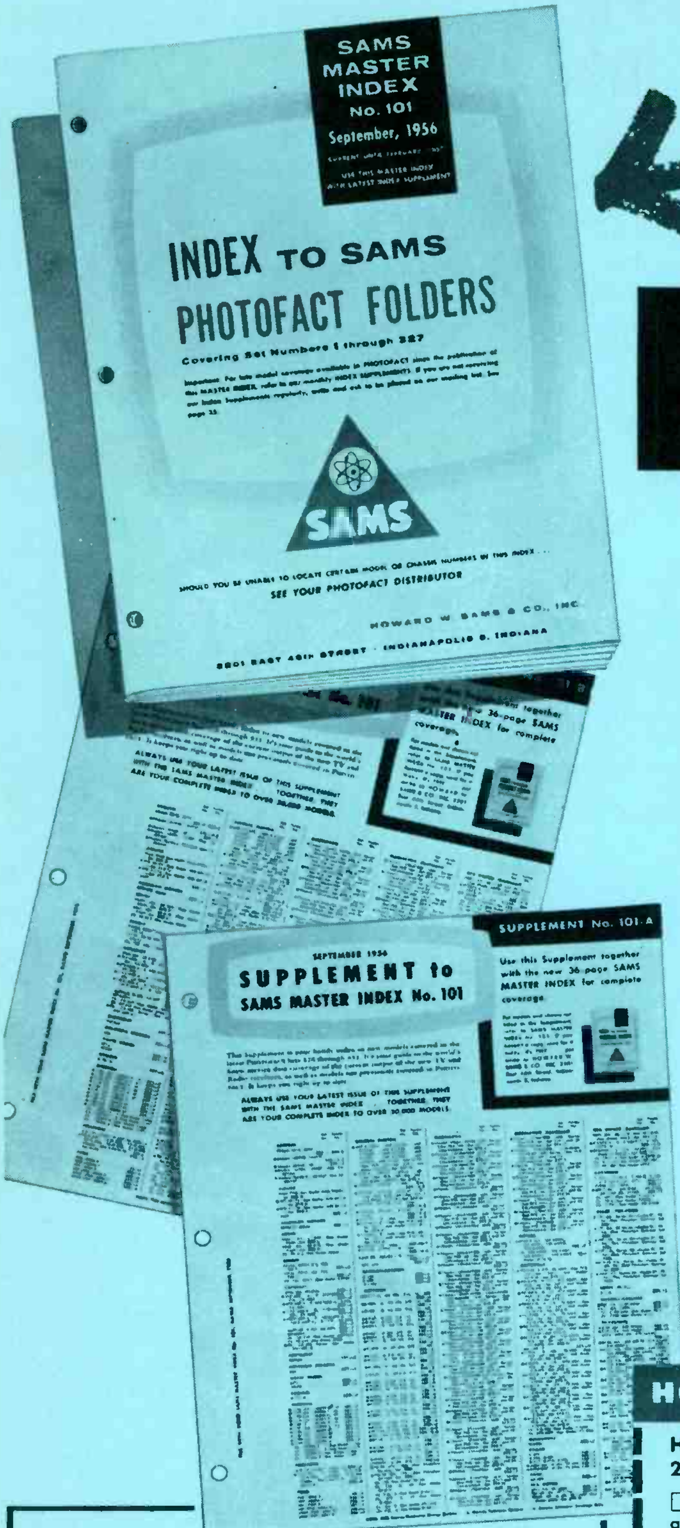
IMPORTANT: THIS SUPPLEMENT REPLACES JANUARY SUPPLEMENT No. 101-E

Discard prior supplement, since this issue includes all previous listings *plus* latest models

NOTE: PCB Denotes Production Change Bulletin. ● Denotes Television Receiver. S Denotes Schematic Coverage Only.

Free!

to Service Technicians Only



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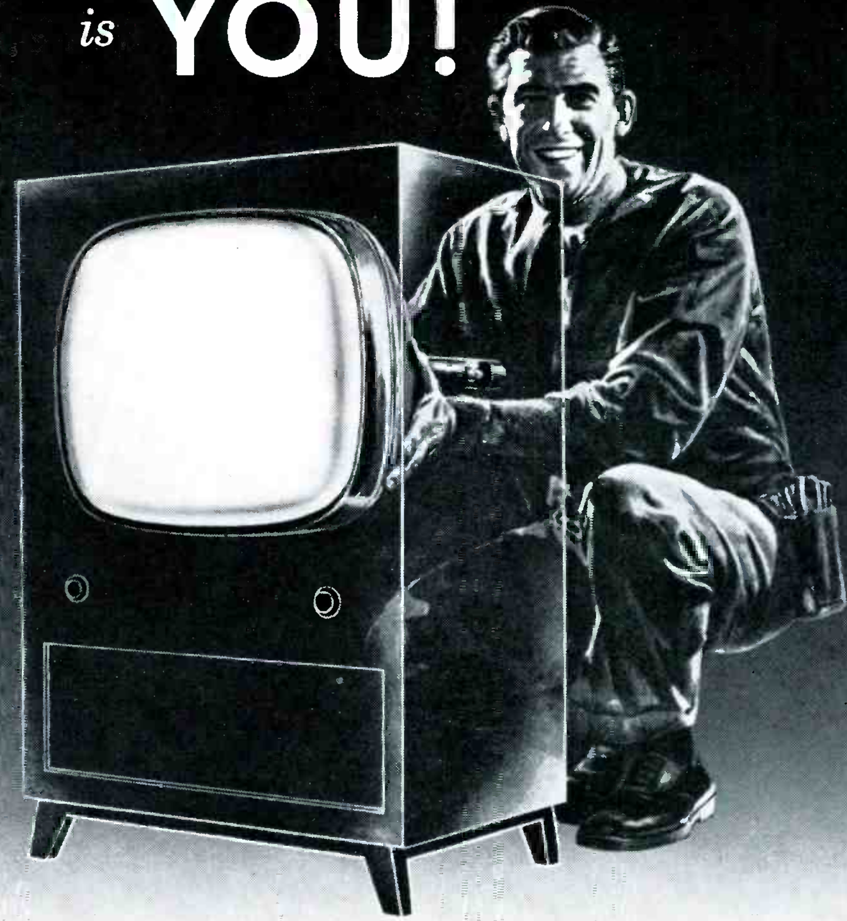
The Keynote of the 3rd Annual

NATIONAL TELEVISION SERVICEMEN'S WEEK*

is YOU!



Once again, RCA salutes its partners in the great electronic industry—*you*, the TV servicemen—whose neighborhood is America, whose business is America's entertainment! This year, RCA's salute to you is carried over network radio and TV, including March 16th TV Emmy Awards program and March 23rd Perry Como show; in the March 25th issue of Life, and the March 23rd issues of the Saturday Evening Post and TV Guide; in local newspapers; via displays, streamers and mailings, in every town and city from coast to coast. All America joins with us in a tribute to you—the men who help keep the nation's TV "rollin'"!

*REGISTERED WITH U. S. CHAMBER OF COMMERCE, MARCH 25 TO 30

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