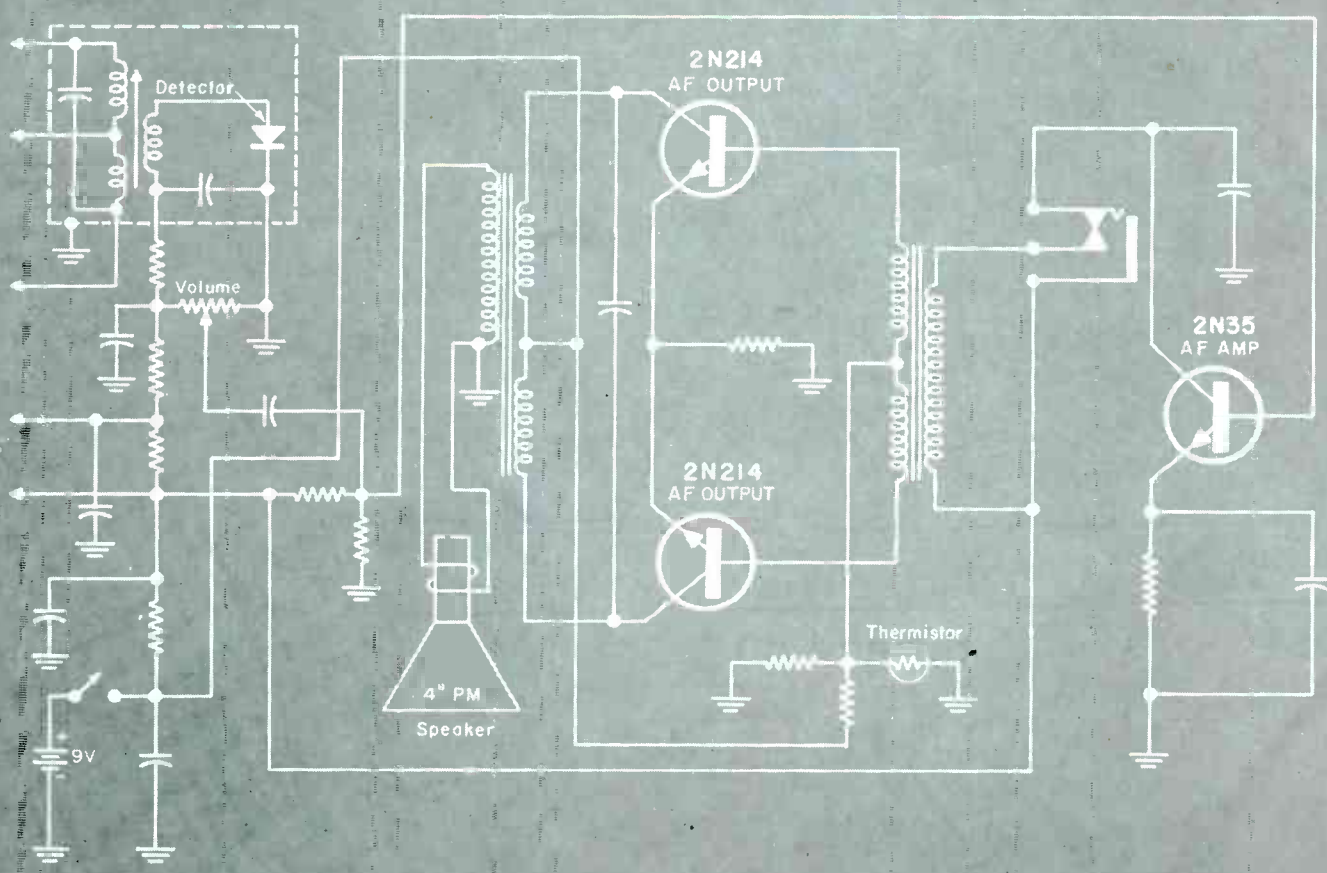
MARCH, 1957

SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE



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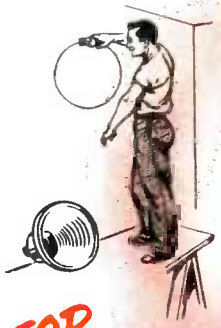

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Vol. 26 No. 3

SERVICE

MARCH, 1957

The Technical Journal of the Television-Radio Trade
Including RADIO MERCHANDISING and TELEVISION MERCHANDISING
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COVER CIRCUIT

FEATURES

CIRCUIT DIAGRAMS

DEPARTMENTS

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Published Monthly by
Bryan Davis Publishing Company, Inc.
52 Vanderbilt Ave., New York 17, N. Y.
Tel.: MUrray Hill 4-0170
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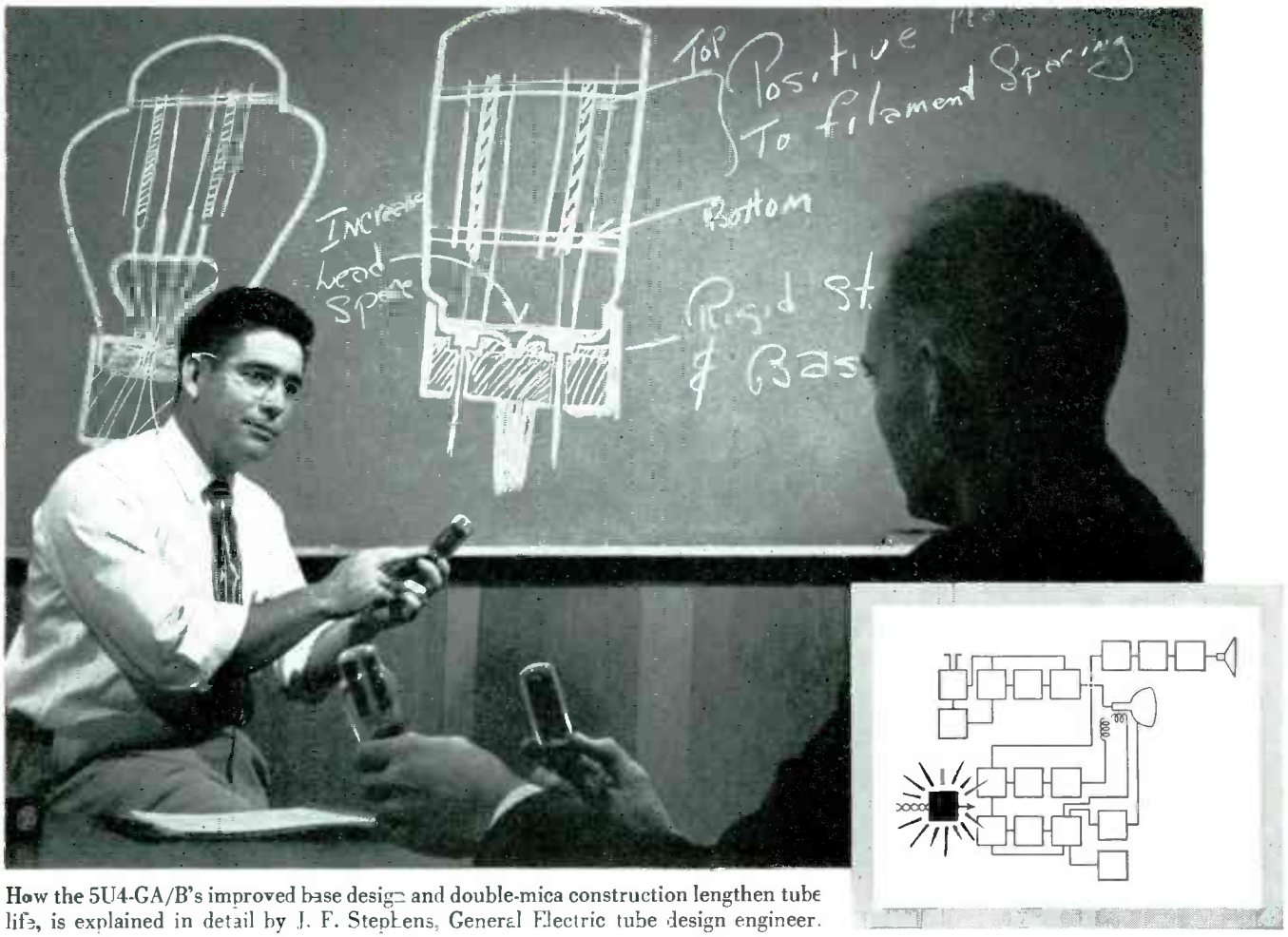

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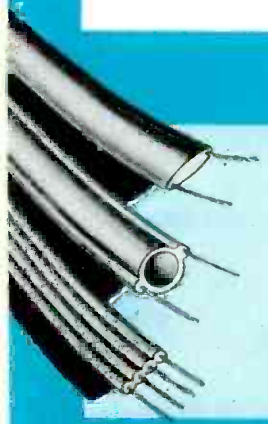

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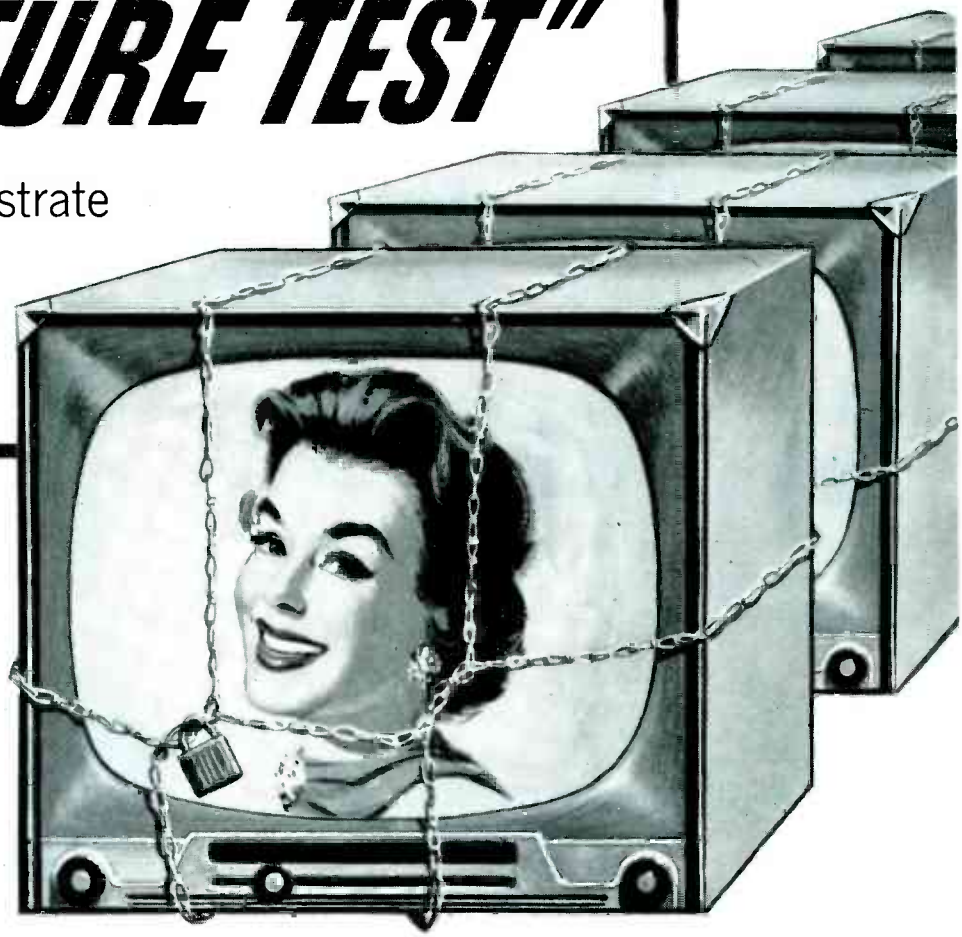

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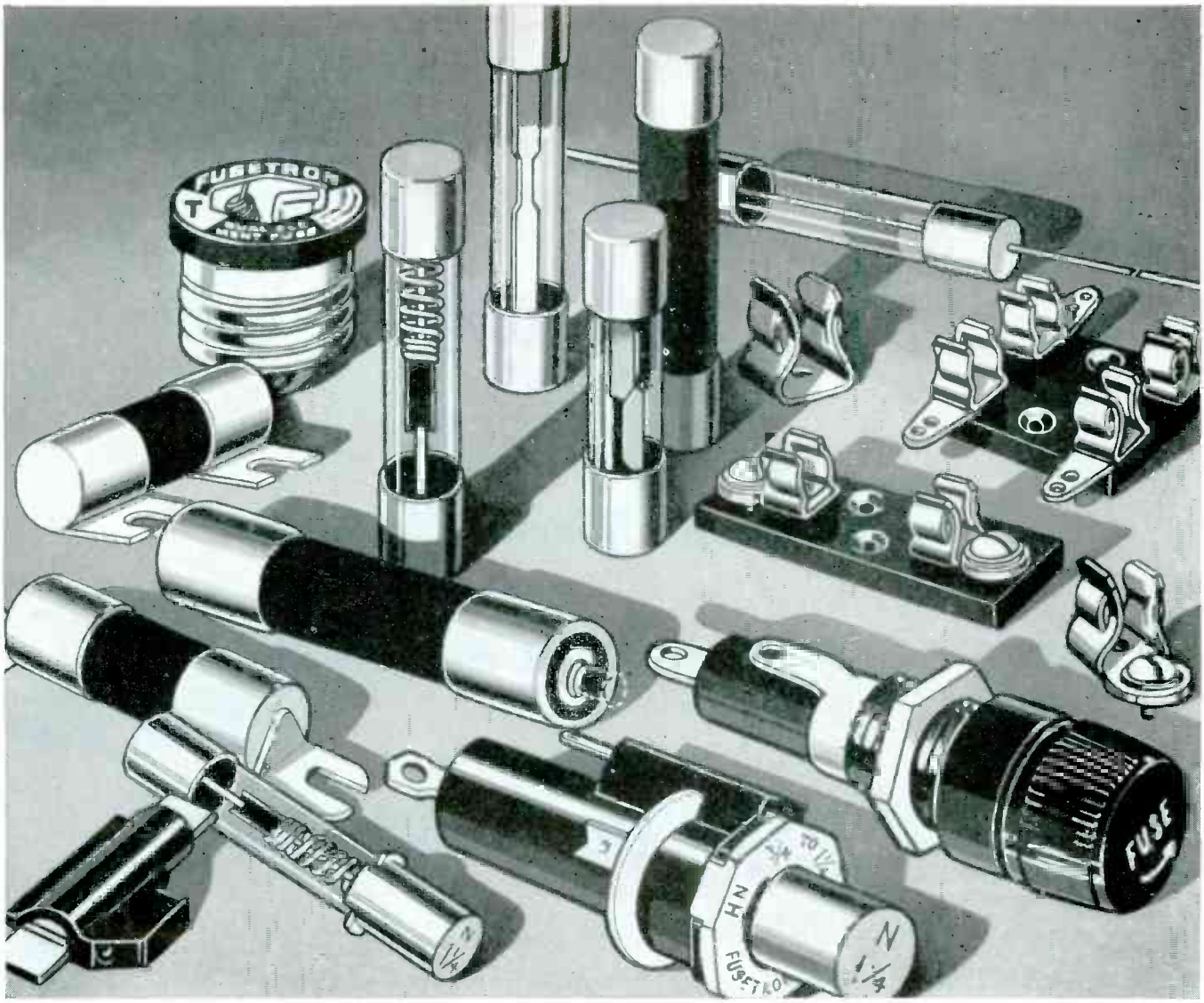

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S-357

SERVICE

The Technical Journal of the Television-Radio Trade

Mounting Opportunities in Service Engineering

THE OUTSTANDING GROWTH RECORD established by closed-circuit and community-TV, sound systems and two-way communications in industry, education and commerce, has developed a boom market for the talents of *service engineers*.

The closed-circuit field, which a year ago had slightly over 1000 installations to its credit, now boasts over 5000. And before the year is out, at least 20,000 c-c systems will be in operation in churches, lecture halls, schools, banks, department stores, factories, highways and tunnels (for traffic control), hospitals, parking lots and even apartment houses and private homes.

A few years ago, because of high costs and equipment complexities, closed-circuit interest was low. Today, thanks to the development of simplified pickup and receiving-chassis tubes, and highly-efficient circuits, we have a sight and sound tool that can perform tasks previously thought impossible.

At the rate that c-c system popularity is spreading, the closed-circuit business eventually will involve the total use of more equipment than in entertainment TV, not only in TV receivers, but in cameras, remote controls and coax cables.

Actively tied in to the c-c networks, and equally important to the *service engineer*, are the community-TV systems operating either as an antenna pickup-coax line service, or as a closed-circuit subscription service in small communities. Both systems have demonstrated their effectiveness in thousands of areas blacked out by valleys and mountains.

MOBILE, FIXED AND MICROWAVE* two-way has also become a pace-setting activity for *service engineers*, due to the evolution of streamlined components, accessories and systems.

No longer is there a knob-twiddlers' nightmare to worry about; equipment has been simplified, not only for operation, but installation and service. Also, standardization is now widely practiced in chassis and part design to minimize replacement inventory requirements.

Those who have had experience in TV repair have found that their background is ideal for commercial two-way. There are no new basic technical laws to know; only a supplementary knowledge of the electronic refinements that have been developed for the higher-band equipment is required.

TESTING TWO-WAY is no more involved than checking a TV set. But, as in TV, it is not only mandatory to have a complete assortment of test instruments and tools, but to be thoroughly familiar with their application in narrow and wide-band troubleshooting.

Two-way is no longer just a key communications tool for planes, boats, police and fire cars and taxis; it has also become a vital means of contact for many others in a constantly-expanding market. To illustrate: Recently, a plant covering several acres installed 3-watt 154-.57-mc two-way radios on foot-powered tricycles for department foremen to alert them and hurry them to trouble areas. Others now using two-way on a wide scale are hotels, hospitals, delivery services, conventions and traffic centers.

During 1956, over 170,000 applications were filed with the FCC for two-way authorization. The present rate of filing indicates that at least 200,000 more plan to use two-way during 1957.

COMMERCIAL SOUND is also expanding sharply and creating a very active field for *service engineers*. Not only are calls for installation, maintenance and servicing climbing to a new high, but the need for initial and replacement components, equipment and accessories is heavier than ever.

Contributing to the marked success of commercial sound are the giant strides in product and system development and design. Fixed and portable speakers now available can produce more power over wider or controlled angles with less distortion than ever; microphones are lighter, smaller and more immune to surrounding noise, and phonos and tape recorders are more compact and capable of excellent speech and music reproduction. Modern commercial-sound coax cables, carefully engineered, fit every need in fixed and mobile indoor-outdoor systems. Also playing a major role in the progress march are transistorized amplifiers and preamps.

THE REMARKABLE GROWTH of sound, TV and communications in the industrial, commercial and institutional fields will receive headline attention at the huge March IRE convention in the New York Coliseum.

As in the past, we'll be at this national show—this year in booth 4512, fourth floor—eager to talk to you about the mounting opportunities in *service engineering*. We look forward to your visit.—L.W.

**See page 28, this issue, for an exclusive report on the service engineering of microwave two-way systems.*

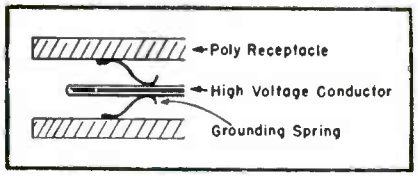


FIG. 1: **CROSS-SECTION** of one type of high-voltage interlock.

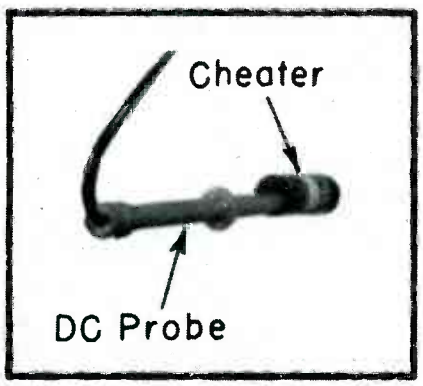


FIG. 2: **HIGH-VOLTAGE** dc **probe inserted into tubular cheater to measure picture-tube voltage.**

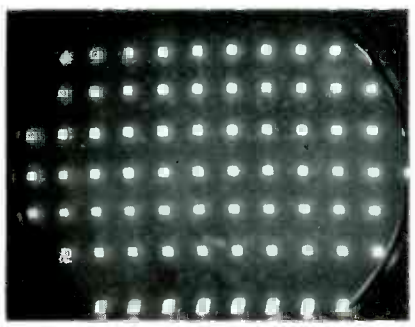


FIG. 3: **WHITE-DOT pattern on screen of picture tube.**

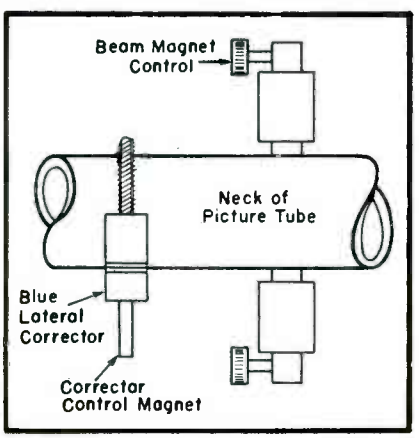


FIG. 4: **BEAM MAGNETS that are provided with small control knobs. Blue lateral corrector magnet slides in mounting strap.**

The Installation of

How To Choose A Location For The Set

HV and Purity Adjustment Procedures . . .

WHEN A COLOR-TELEVISION receiver is to be installed, the first consideration is its location. One must explain to the set owner that a color-TV set is not only much more critical than b-w models, but that color receivers cannot be moved arbitrarily from one place to another. Stray magnet fields vary in a room due to wall and floor piping, steam radiators, etc. Even the earth's magnetic field can have some effect upon the purity adjustments of a color picture tube.

Accordingly, the importance of a permanent receiver location should be stressed to avoid the possibility of callbacks to readjust the purity controls. It is also necessary to point out that color-picture tubes may not have as much brightness as black-and-white tubes. Therefore, bright lighting can desaturate the vividness of reproduced colors, and the area in which the set is located should be one where the light falling upon the screen of the picture tube is at a reasonably low level. Also, since room lighting can affect color results, set owners must be queried on the type of lighting that will be generally used for program viewing. The three-color guns in the picture tube can be balanced up satisfactorily for subdued daylight, but when the screen is viewed under artificial illumination, the screen will then appear to have a color tint. This tinting may appear reddish, greenish, or bluish, depending upon whether tungsten light ing, fluorescent lighting, or perhaps shaded floor lamps are used.

Thus, if the customer decides that most of the program viewing will be during evening hours, and the installation is being made in the daytime, the proper procedure is to darken the windows, and adjust the picture-tube balance for the condition of evening illumination that will normally be used.

Mechanical Considerations

Practically all color-TV receivers require some disassembly of the cabinet during installation, to gain access to various service controls. The backboard can be removed in the same manner as in b-w receivers. In addition, the top of the cabinet may be removable. Some receivers have one side of the cabinet hinged, so that it can be swung open like a door. Other receivers have the top and both sides of the cabinet removable. In any case, the receiver should be inspected to determine what extent of disassembly is possible, to facilitate access to the service controls.

A number of color receivers have a high-voltage interlock, as well as a power-line interlock built into the backboard. When a high-voltage interlock is provided, it is essential to insert a high-voltage cheater before operation of the receiver is attempted with the backboard removed. The high-voltage interlock shorts out the second-anode voltage to the picture tube, and no raster can be obtained with the interlock shorted. If operation is attempted without a cheater, the flyback fuse, at least, will be blown.

A common type of high-voltage interlock is diagrammed in Fig. 1. When the backboard is removed from the receiver, it will be observed that

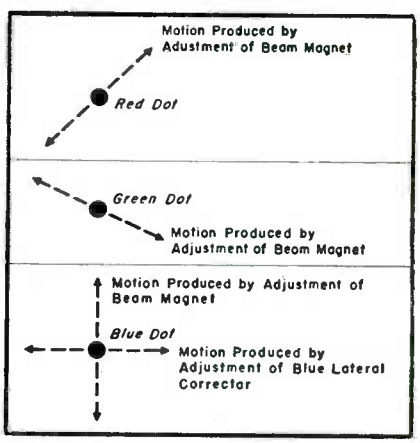


FIG. 5: **DIRECTIONS OF COLOR dot motion produced by adjustment of the static convergence controls.**

COLOR-TV Receivers

(Electrical, Mechanical and Electronic Considerations) . . .

Preliminary Convergence Steps . . . Degaussing

by ROBERT G. MIDDLETON

Chief Field Engineer, Simpson Electric Company

a polystyrene tube (mounted on the backboard) is pulled out of the interlock. Removal of the poly tube permits the flat grounding springs in the receptacle to contact the high-voltage center pin, and thus short out the high-voltage power supply.

A suitable type of cheater for such an interlock is illustrated in Fig. 2. The tubular construction of the cheater facilitates measurement of the high voltage, inasmuch as a high-voltage *dc* probe can be inserted through the cheater to contact the high-voltage center pin, as shown. One must insert the high-voltage cheater before turning the receiver on, or the flyback fuse will be blown. In case the flyback fuse is too heavy, the output transformer will burn out.

Another type of high-voltage interlock used involves a lever on the back of the high-voltage cage; this lever is normally pressed down when the backboard is in place. When the backboard is removed, the lever springs out and shorts the high-voltage power supply. This type of interlock is cheated by means of a wire-trigger arrangement provided on the cage; after the backboard is removed, the operator presses the lever down in place, and hooks the trigger wire over the lever. The receiver can then be operated with the backboard off.

When the backboard is replaced, the trigger is automatically released, so that the interlock will become effective in case a do-it-yourself customer should attempt to tamper with the receiver. One must always be certain that the interlock has been cheated before turning the set on with the backboard removed.

High Voltage Adjustments

The high-voltage power supply in a color-TV receiver operates at 20,000 to 25,000 volts, the correct value being specified in the service notes. It is necessary to adjust the value of the high voltage to the correct value, or it will be found impossible to obtain proper convergence of the color picture tube. Most receivers provide a *high-voltage-adjust* potentiometer, which should be set to supply the specified value of high voltage. A high-voltage *dc* probe can be used to indicate this value, if a tubular cheater is utilized, as shown in Fig. 2.

When a receiver does not utilize a tubular cheater, indirect methods of high-voltage measurement must be employed. For example, a test resistor may be made accessible through a cutout window in the high-voltage cage. A *dc* voltmeter may be connected across this resistor, and the *high-voltage-adjust* pot adjusted to obtain the specified voltage drop across the test resistor. In a typical case, the correct voltage drop across the resistor is .9 volt; the receiver service notes will usually provide necessary instructions.

The high-voltage supply in a color-TV receiver must be treated with considerable respect. Not only is the

(*Continued on page* 50)

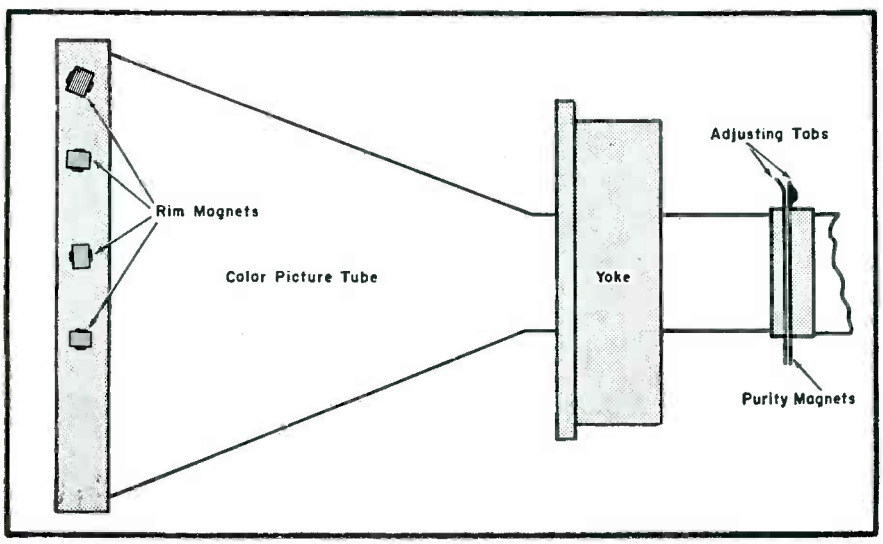


FIG. 6: COLOR-FIELD purity can be obtained by sliding yoke on neck of picture tube, adjustment of the purity magnets, and by adjustment of the rim magnets.

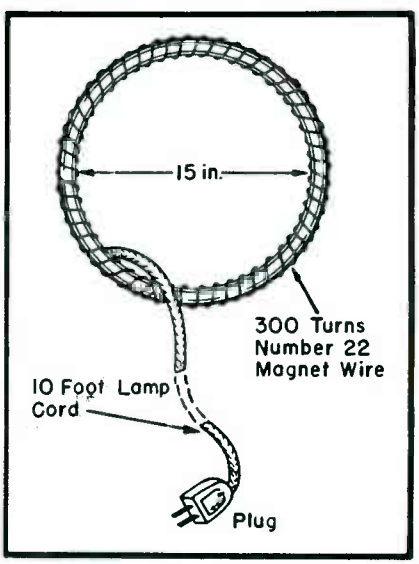


FIG. 7: DEGAUSSING coil. Completed winding is covered with plastic tape.

Seven-Transistor Printed-Wiring Portable

Complete Analysis of Circuitry For Transistorized Superhet With AF Driver And Class-B Push-Pull Audio

[See Front Cover]

TESTING THUNDERBIRD CHASSIS in the lab, left to right: E. W. Merriam, Sylvania service manager; Stewart Korkow, **engineer, and** Thomas Vanacore.

THE TRANSISTOR, unknown outside the laboratory a few short years ago, is rapidly becoming a vital factor in not only industrial and defense activities, but in consumer products.

Because of their small size, transistors started a miniaturization trend in the design of radio sets. Almost overnight the race was on to introduce the *smallest* radio receiver, and the so-called *pocket radio* was born.

From a design standpoint, transistors made possible a prestige portable radio, but the resultant small cabinet provided less than adequate space for a *prestige* speaker. In short, to achieve the ideal miniaturization effect, designers had to sacrifice big speaker performance. If a big speaker

by THOMAS VANACORE

Engineering Manager, Home Radio Design, Sylvania Electric Products, Inc.

was used, miniaturization was forfeited.

A study of this problem was made in our labs and engineers found that they could obtain the required portability and still include a larger speaker (a 4-inch model) by using new cabinet styling.

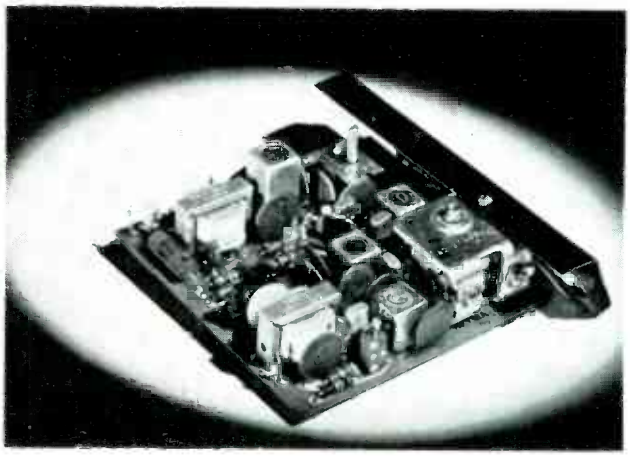
The speaker was installed in a hinged cover of the cabinet and the chassis was placed in a base protected by a clear-plastic cover that is removable (via two set screws) to facilitate servicing.

The set uses seven *npn* transistors. The circuit, a superhet with a local oscillator, uses a two-stage *if* amplifier operating at 455 kc.

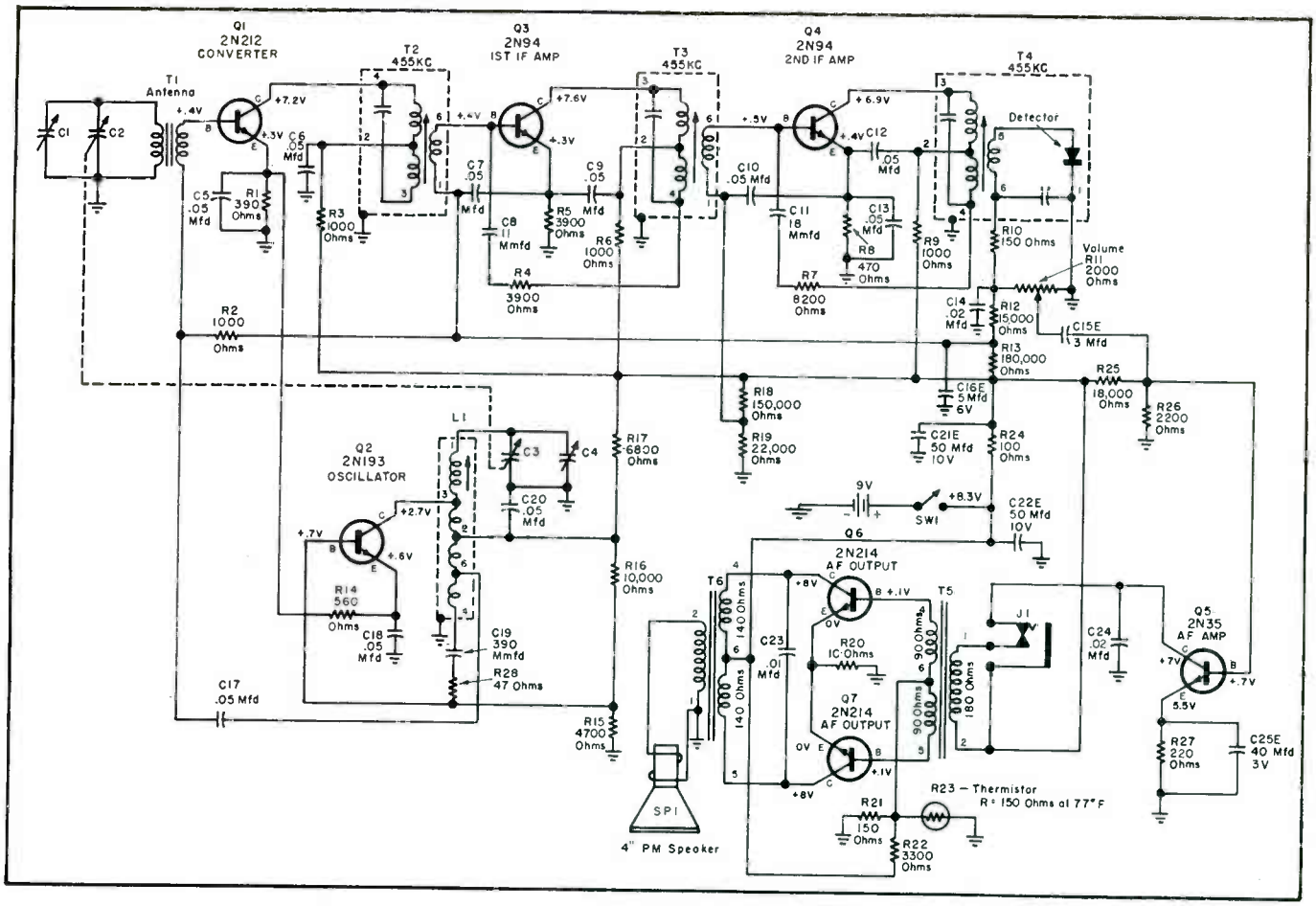
The transistor complement consists of a 2N193 local oscillator, 2N212 mixer, two 2N94's as *if* amplifiers, 2N35 *af* driver, and two 2N214's in class B push-pull output. Both audio stages are transformer coupled. The second detector is a 1N295 diode, and, with the diode filter capacitor, is built into the third *if* transformer.

The power supply consists of six *pen-lite* batteries in series.[1] The no-signal battery drain is approximately 9 ma, rising to approximately 42 ma

[1] *Types 915, 1015 carbon-zinc cells, or E502, ZM9 mercury cells may be used.*



ABOVE: TRANSISTOR RADIO in its plastic cabinet with speaker in hinged cover. Top view of complete chassis is at right.



COMPLETE CIRCUIT DIAGRAM of Sylvania transistorized portable.

on a sustained tone at 200-*mw* output and 10% distortion. Maximum power output is about 325 *mw* with high distortion.

A jack connected in the output circuit of the driver stage provides for *private* listening. A hearing-aid type of ear plug can be inserted in this jack. Simultaneously, the battery supply to the output stage is disconnected, thus reducing battery drain appreciably and extending battery life.

All components are mounted on a printed-wiring circuit panel, 4 3/16"x 4 1/16" x 1/16", with circuitry plated on both sides and through the holes. The components are assembled on the panel, and the panel is solder dipped.

Circuit Description

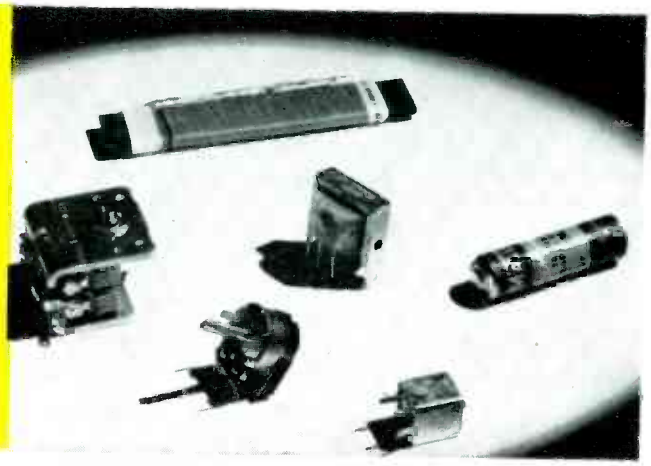
To achieve as much gain as possible in the conversion process a separate mixer-oscillator front end was chosen; single transistor converters are still wanting in conversion gain.

Oscillator: The oscillator has its tuned circuit in the collector. Feedback is obtained by a closely-coupled tickler connected back to the base in a grounded-emitter transistor configuration. Because of its miniature size, the free Q of the tank circuit is of the order of 25-30. Consequently, the collector is tapped well down on the tank circuit to maintain the requisite operating Q. Injection voltage is taken from a tap on the tickler and fed into the mixer base, in series with the secondary of a ferrite loop antenna. The optimum value for this injection voltage is approximately .05.

Initial forward bias is set by voltage dividers consisting of 6800, 10,000 and 4700-ohm resistors (R_{17}, R_{16} and R_{15}) and is, of course, set so that the oscillator is self starting. The degree of feedback and the operating circuit Q are set so that oscillations will be maintained down to .9 *v* per cell, at which point, or sooner, other receiver characteristics will dictate battery replacement.

Mixer: The mixer is biased to approximately a class-B operating condition to achieve adequate signal conversion. This biasing is obtained by means of a series resistance in the emitter and an *agc*-voltage-divider network. Under no-signal conditions the mixer base is approximately 50-*mv* negative with respect to the emitter, thus placing the operating point at cutoff for all practical purposes. It will be noted that the oscillator

(*Continued on page* 60)



MINIATURE components used in transistorized portable radio.

Test Equipment DEVELOPMENTS

An Industry Progress Report on Test Equipment

THE WIDESPREAD ACCEPTANCE and use of black and white television and the steadily increasing use of color television, coupled with greater use of electronic circuits and devices throughout industry, has developed the need for better and more accurate test equipment. . . . Quick and accurate testing of electron tubes have now become an important requirement for those servicing electronic equipment. . . . The increasing use of electron tubes for specialized purposes, the more exacting requirements placed on tubes, coupled with the fact that qualified technical personnel have very great demands upon their time, make it mandatory that the instruments used for testing tubes be not only more accurate, but easier and quicker to use than ever before.

In the same manner, such instruments as 'scopes and even multimeters must be made better, more accurate and more foolproof. It is no longer practical to have Service Men wait while an instrument is being repaired, thereby wasting valuable manhours. Instruments must be equipped with protection devices so that simple mistakes will not burn them out or disable them. — *Herbert D. Johnson, The Hickok Electrical Instrument Company.*

THE INCREASING COMPLEXITY of modern electronic gear demands test equipment of maximum versatility; a need prompting the appearance of more and more multipurpose instruments. . . . In addition, there is a growing need for test equipment that simplifies test procedures; such equipment not only leads to faster, more accurate work, but also effectively *upgrades* the Service Man by enabling him to work intelligently on more complicated chassis.—*Walter E. Gilbert, Philco Corporation.*

WITH THE ADVENT of color-TV receivers utilizing vestigial color-sideband reception, the need for −6 db chroma settings for color-bar generators has become evident. Also being provided is a −15 db chroma output to check color lock on weak burst signals. . . . Likewise, with the advent of (G-Y) color detectors, service work requires a (G-Y)/90° test signal. . . . The need for quick tests of burst gating has guided design thinking into provision of the red bar immediately following the horizontal blanking pedestal, since the red bar extends into the blacker-than-black region, and provides a definite test of abnormal gate delay. — *Robert G. Middleton, Simpson Electric Company.*

THE TREND is unmistakably toward automation in instrument operation, as evidenced by the introduction of automatic voltmeters, automatic troubleshooters and automatic tube testers. . . . Automation of instruments must result in a tremendous time saving in the performance of routine operations and also in the reduction of the possibility of error.—*Murray Rifkin, TeleTest Instrument Corporation.*

INSTRUMENT DESIGN TODAY and for the future is slanted towards simplification of circuitry, components and controls. This means that instruments are being reduced in size through functional cabinet design and through the use of more efficient and reliable components.

The engineer and Service Man are continually seeking instruments which will permit them to make their measurements as rapidly and as accurately as is possible. Instruments of the future will seem small in comparison to the instruments of yesterday and today.—*Richard C. Crossley, Electro Products Laboratories.*

IN THE PAST SEVERAL years, we have witnessed the advent of a vast microwave network for communications and TV. . . . The TV industry has grown to great proportions and has been launched into color. . . . The bandwidth requirements of communications systems for commercial applications have enlarged considerably. The wider bandwidth requirements of all devices applicable to these systems have brought about the use of sweep generators designed to permit the presentation of an amplitude versus frequency plot in graph form on the face of a 'scope.

There are two definite trends:

The design of sweep generators having all of the characteristics of the old accepted reliable signal generator, with the additional feature of having

(*Continued on page 34*)

[See Pages 16, 18, 22, 24, 25, 28, 42 and 44 For Technical Analyses of Component, B-W/Color-TV, Transistor-Radio and Service-Engineering Test Instruments]

Dealers Prove *Winegard* Color 'ceptor SELLS BEST!

Thousands of dealers have proved conclusively that the Winegard Color 'Ceptor outsells any comparable TV antenna! This is the simple test that has convinced them: They've shown their customers the glistening *gold-anodized* Color 'Ceptor right alongside competitive types . . . and, when given the chance to choose for themselves . . . the vast majority of their customers invariably selected the Color 'Ceptor! The explanation's simple! *Eye appeal* is what clinches the sale. Your customers are no different than you. They are used to buying products that present a *finished*, quality appearance. They instinctively reject an item that is dull, drab and lifeless.

Anodizing Is Much More Than a Mere Beauty Treatment

The diamond-hard toughness of this anodized finish provides positive resistance against corrosion—*prevents the Color 'Ceptor from ever turning black and ugly*, and locks in, permanently, all the superb performance engineered into the Color 'Ceptor. You can sell this longer-life feature as a big advantage—and it makes real sales sense to your customers.

Second to None in Performance

A Winegard Antenna *broke all long-distance reception records* in 1956 (see Radio-Electronics Magazine, Jan. '57). Equipped with optional signal-boosting Power-Pack and patented "Electro-Lens"* focusing, the gold-anodized Color 'Ceptor is unbeatable for long-distance reception . . . and clear, watchable pictures. Black-and-White or color! *If the Winegard Color 'Ceptor won't bring in a station you want to see . . . nothing will!*

Free Display Creates Sales Boom!

Here's the display that has sold thousands of Color 'Ceptors for dealers all over the nation. By getting the beautiful gold Color 'Ceptors out where folks can see them . . . dealers are building antenna sales volume they never realized existed! In fact, many dealers report they are now making more money selling Winegard antennas than they are on TV sets!

Get Full Information Now!

Don't you think it's time you shared in the spectacular success of America's most-wanted TV antenna? The coupon below will bring you eye-opening details. Mail it today!

Winegard company

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Name _____

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☐ I'm interested in the complete line of new 1957 Winegard antennas.

Company _____

Address _____

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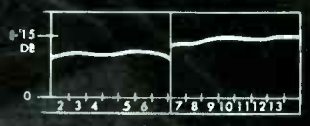
Gold Anodized

Winegard Color 'ceptor TV Antenna

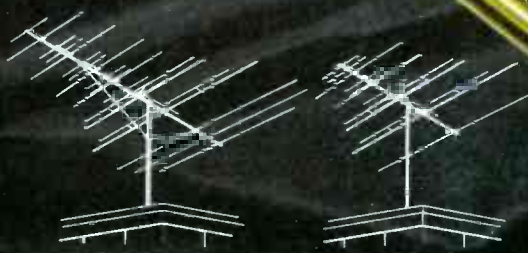
all 12 VHF Channel Reception For Both Black-and-White and Color

Color so bright they sell on sight!

Note:
Each gold Color 'Ceptor you instal helps sell another. Once folks see these bright gold antennas sprouting up in their neighborhood, they won't be satisfied until they own the gold antenna, too!



Gain Chart
CL-4X with Power-Pack



Color'Ceptor Model CL-4X — $44.90

Color'Ceptor Model CL-4 — $29.95

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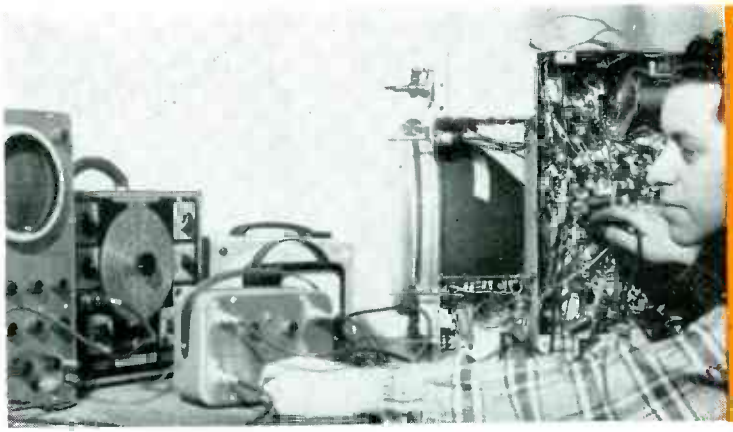
- Completely non-corrosive gold-anodized finish.
- Power-Pack—up to 47.1% more sensitivity.
- Pat. 'Electro-Lens'*—clearer pictures at greater distance.

Winegard Color 'Ceptors are consistently advertised in leading national magazines your customers read!

Winegard Co.

3000 Scotten Blvd., Burlington, Iowa
Cable Address: Western Union JRWCO

*Pat. No. 2,700,105 Copyright USA, 1957



The Modern Trend in TV ALIGNMENT

MODERN TV ALIGNMENT with a sweep generator, marker adder and 'scope. (Courtesy Lou's Radio and TV, Whitestone, L. I., N. Y.)

How To Use Sweep Generators, Bias Supplies and Marker Adders To Align B-W and Color-TV Chassis

by NORMAN CROWHURST

EXPERIENCE has emphasized that only through the use of accurately-recorded traces is it possible to align TV chassis.

This technique is certainly more effective than experiments with final alignment by looking at the picture on some of the best local channels and trimming to get the best results.

With many TV sets, if you try aligning by looking at the picture, you will find yourself getting further away from a good picture, instead of approaching a better one. Maybe, after extensive (and expensive—in time) experience, you would acquire the *touch*. But a different touch is needed for each type of receiver. It is far simpler to see *exactly* what you are doing through the use of test equipment, which in this instance would be a sweep generator. Then you can follow the alignment procedure given on data sheets and be sure of getting the best results.

Modern black and white sets, and especially the new color receivers, necessitate the use of a sweep generator for accurate alignment.

In using the sweep generator, there are some precautions one must follow. The first thing necessary is a steady trace to look at. For this we must have synchronization between the sweep generator and a 'scope. It is not possible to rely on the internal synchronization of the 'scope, because the response at both ends of the trace should be zero, or a nearly horizontal line. This makes internal synchronization difficult; if the sync control is not turned up sufficiently, the pattern tends to drift from side to side across the screen, and if enough sync is used to hold the pattern, it may pull the trace out of shape, or cause it to dance between two or three alternative positions. This is due to the fact that any stray pulses that may float around can also serve to trigger control when it is turned up to be so sensitive.

If the sweep generator is provided with a sync terminal, it should be connected to the external sync terminal on the 'scope, and the appropriate 'scope switch turned to make use of this. Then, by using the appropriate speed setting on the 'scope, the pattern will be solidly locked to the sweep generator.

Now we have a solid trace. The question is; just what are we looking at? This can be partly determined by connecting the output from the sweep generator to the correct point indicated on the receiver; if you are aligning the video *if*, it will be the point where the frequency changer is connected to the first video *if;* while the 'scope will be connected to the video detector. But is the trace giving a true response of this section?

It is important to check the *agc* and see what it may be doing to the trace, or alternatively what you may be doing to the *agc*. On the latter point, we must be careful to see that the connections, both at the signal injection point and the pickoff point, do not short circuit the *agc* line in the video *if*. Using the 'scope on

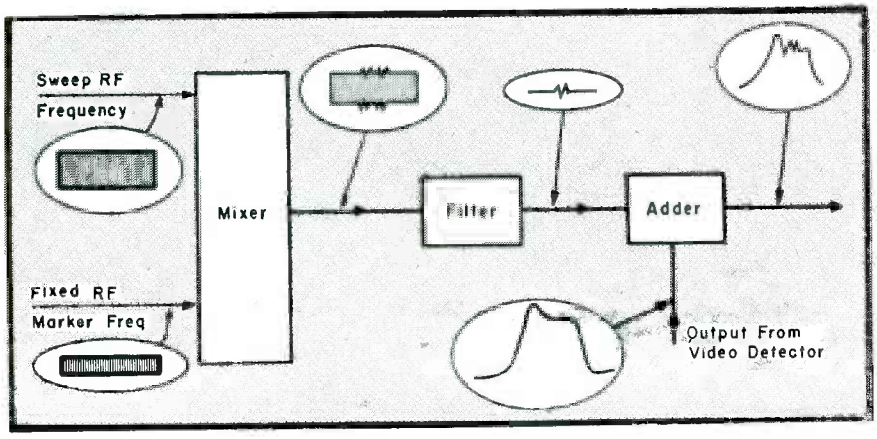
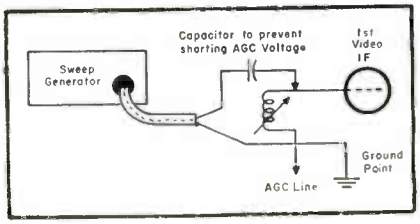


FIG. 1 (below): **IF THE sweep generator does not have an internal capacitor to prevent possible short-circuiting of the set's** AGC **bias, an external bias should be installed.**

FIG. 2 (left): **ESSENTIAL PARTS of a marker adder, showing how the marker is added to the 'scope trace after the sweep frequency has been through the receiver. Output of adder goes to 'scope.**



its *ac* input will take care of the pick-off point. For the other point, we must make sure that the return to ground does not short the *agc* in the set; if it does, a capacitor must be inserted and any convenient small value will do. Or we should be sure that the sweep generator has a capacitor built in.

But even when the *agc* is operating correctly it can still interfere with the curves taken by sweep generator. The *agc* tries to some extent to follow the change in output signal amplitude during the period of the sweep. The best solution for this is to use a substitution voltage to control solidly the *agc* bias, so that the video *if* operates at a constant and controllable gain. Some sweep generators are provided with an internal bias for this purpose, while an alternative means is a separate bias-supply unit now being made available for this purpose.

An advantage of the separate bias supply unit is that there are several individually controlled outputs. This means that the *avc*, *agc* and, in the color receivers, the chroma voltages can be independently adjusted and set for specific values to suit the receiver. This is of particular value in repetitive alignment work on the same type of receiver. But, there are many instances where more than one voltage is required to be substituted at the same time. Such a unit will save the need for carrying batteries or other cumbersome temporary bias-supply units to aid in this kind of work.

However, most important in the use of sweep generator traces for alignment is to know exactly where you are on the frequency scale. Most sweep generators come with a calibrator crystal which provides specific marker points at predetermined frequencies. These frequencies are accurate because of the high accuracy of the crystals. But, even with this aid, it is difficult to interpolate exactly the frequency you want to know.

It is much more convenient to have an adjustable marker that can be set to a specific frequency that may be required, and for this purpose normal signal generators have been used.

There is, however, one serious disadvantage to this procedure. In mixing the marker frequency in with the sweep frequency, the marker frequency passes through the test section of the receiver, as well as the sweep frequency. Consequently, the response curve traced will be invalidated by the presence of the marker signal. In particular, it will tend to fill in the slots made by traps.

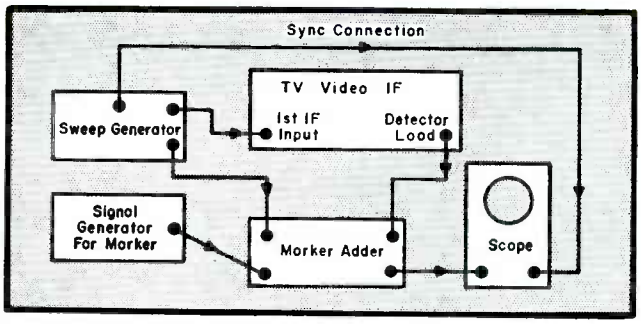
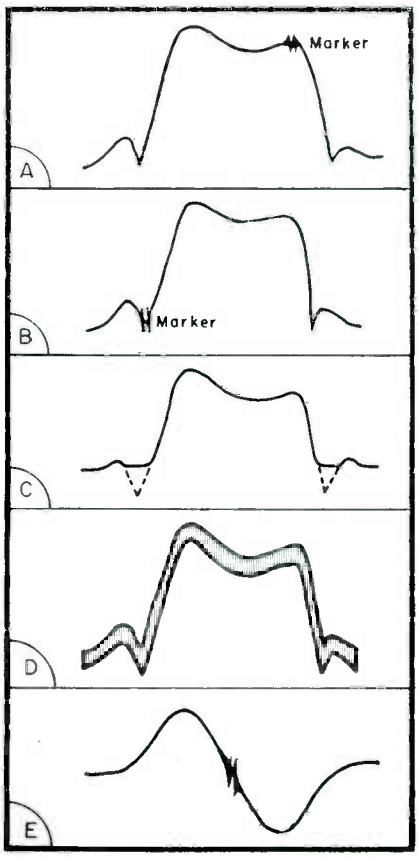


FIG. 3: COMPLETE SETUP for using a sweep generator with a marker adder for aligning the video section of a TV receiver.

Then you may want to mark the precise frequency to which a trap is tuned. In theory, of course, if the marker frequency coincides with the trap frequency, the marker should disappear. But, in practice, the presence of the marker beat, immediately adjacent to the trap frequency, often spoils the trace, so that the effectiveness of the trap does not show up.

These disadvantages can be overcome by adding the marker *after* passing the test signal through the set. In this way the marker serves to put a pip on the screen at the predetermined frequency, without in any way interfering with the performance of the set by its presence. To do this requires a separate sample from the sweep generator, which is combined with the marker generator to produce a beat effect at the correct marker frequency. The *rf* is then filtered out from this beat and it is added to the output from the set presented on the 'scope trace.



This adding, of course, has to be done electronically, so that no mutual interference takes place. It requires a comparatively simple additional instrument, known as a *marker adder*.

The marker-adder can produce pips all over the place, due to every kind of beat imaginable. Both the signal generator (used for marker) and the sweep generator have harmonics. Then there are live TV channel frequencies and the receiver front-end oscillator. But this confusion is easier to resolve than it might at first seem.

Beats between the marker generator and other fixed frequencies (front-end oscillator or TV channels) will only appear momentarily, spread all across the screen, as the marker is adjusted.

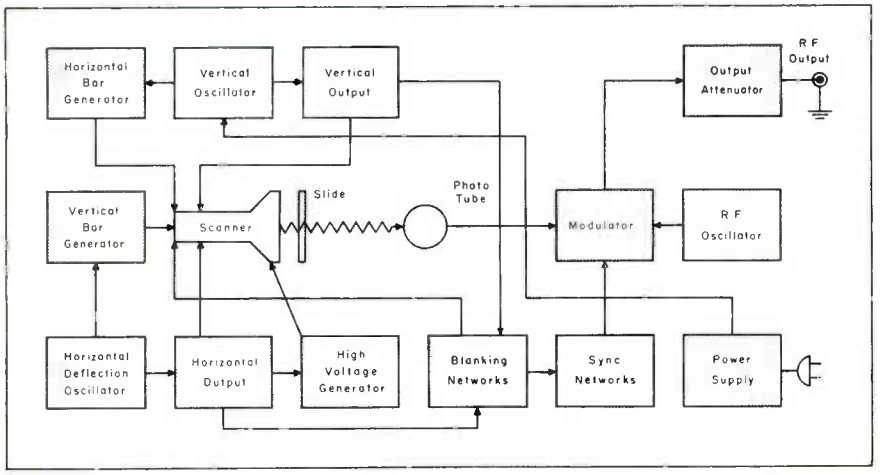
Beats between the sweep generator, or its harmonics, and other fixed frequences will not move when the marker generator frequency is adjusted. And beats between incorrect harmonics of the marker generator and the sweep generator will move differently from the correct marker, either twice as fast, or in the wrong direction.

Thus, it is relatively simple, by a touch of the marker generator frequency dial, to identify the right pip that must be watched.

Size of pips is also important. This should be adjusted, on the appropriate control of the marker adder, to be as small as possible while still clearly visible, so as not to obscure any important details of the response trace.

FIG. 4: RESPONSE CURVES illustrating use of a marker, particularly with marker adder. Curve a shows result obtained when marker is at a selected point on response curve. Results obtained when the marker is at a trap frequency is shown in b. Adding the marker at the input (as normally done at the sweep generator) which causes fill-in of the response at traps, so that their frequency or effectiveness does not show up, is illustrated in c. A beat between the marker generator frequency and some other fixed frequency will spread the whole trace; this is shown in d. A marker used to identify the center point of an FM discriminator response trace appears in e.

COLOR-TV Convergence-Alignment Adjustments With



BLOCK DIAGRAM of B and K test-pattern video generator.

by RALPH G. PETERS

IN THE INSTALLATION and servicing of color-TV receivers and b-w TV chassis, too, test patterns in the form of resolution or an Indian Head, white dot and white-line cross-hatch, are extremely helpful. They can be used for alignment and convergence adjustments.

To provide such patterns, there has been developed a picture and pattern video generator[1], which produces a modulated *rf* carrier containing sync pulses and video information to drive a TV set.

The patterns are produced via a flying-spot scanning and transmission system.

Many of the TV circuits in this instrument are quite familiar because they are used in most TV receivers. However, there are some new circuits, especially those used in the process of changing a picture or pattern to an electrical signal.

Certain materials have the ability to emit electrons when they are exposed to light, much the same as the cathode of a conventional electron tube does when it is heated. These are known as photoemissive materials. When a photoemissive material is used as the cathode of a diode, any light striking the tube will cause the cathode to emit electrons. These electrons, flowing through the diode load resistor, cause a voltage to be developed across the resistor.

As the small spot of light from a *crt* sweeps across a slide from right to left, light energy can pass through transparent portions of the slide. When the dot passes over parts of any opaque letters painted on the slide, the pattern blocks the light energy. Therefore, during some parts of the dot's sweep across the slide, light energy strikes the photoemissive cathode of the phototube, while at other times it does not. This energy develops a varying voltage across a load resistor. Thus, part of the copy on the slide has been changed to an electrical signal; when light energy is transmitted through the transparent portion of the slide, a voltage is developed across the resistor, and when information on the slide blocks the light, no voltage is measured.

The cathode-ray, or *scanner* tube, used in this generator was designed to match the spectral response of a photomultiplier pickup tube. The phosphor behind the faceplate of the tube stops emitting light almost immediately after the electron stream ceases its bombardment. An ion trap with a bent electron gun on the scanning tube is used to prevent ion burn of the phosphor.

In operation, the dot of light produced by the scanner starts at the top of the faceplate, sweeps across to one side, is blanked while it returns to the other side (retraces), sweeps across to one side, is blanked while it returns to the other side (retraces), etc., until it finally reaches the bottom of the screen. It is then blanked and returned to the top of the screen. If copy on the slide is placed over the face of the scanner tube, the dot of light and photomultiplier tube translates the entire pattern, spot by spot, into a video signal.

Amplification of the photocurrent emitted by the cathode of the photomultiplier tube occurs as follows: The electrons from the cathode (pin *11*) are attached to the first *dynode* by the positive voltage on pin *1* of the pickup tube; this dynode is made of a special, secondary-emission-prone material. Secondary emission is the emission of electrons from a material when other electrons strike it. For each electron striking the dynode, two or more electrons are emitted by it. Thus, the current given off by the first dynode is larger than the original cathode current, and amplification has occurred. The electron stream from the first dynode is attracted to the second dynode (pin *2*) by a higher positive voltage, where further amplification takes place. The electrons from the second dynode are, in turn, attracted to the third dynode (pin *3*). This process continues to dynodes four, five, six, seven, eight, and nine. Finally, the very large electron stream from the ninth dynode is fed to the plate (pin *10*). When the current arrives at the collector, it is approximately one million times larger than it was when it left the cathode. The successively higher voltages for the various dynodes are supplied by a voltage-divider network consisting of ten fixed resistors and one variable resistor with values of 15,000, 22,000, 33,000 and 500,000-ohms (pot). A multiplier-gain control controls the total gain of the multiplier tube by varying the voltage *difference* between the various tube elements.

A 5100-ohm resistor serves as the plate load of the phototube. A decoupling network consisting of a pair of capacitors (10 and .1 mfd), and two resistors (4700 and 10,000 ohms) keep the boosted B+ line *clean* by bypassing the video signal to ground. The output of the multiplier tube is coupled to the grid of the modulator section of a 12AT7 through a .05-mfd paper capacitor, where it is mixed with the *rf* carrier from the Hartley-oscillator section of the 12AT7.

A 35-mmfd variable serves as the *rf* tuning control; it varies the resonant frequency of a *vhf* tank circuit consisting of a 5.6-mmfd ceramic, a variable capacitor and an *rf* oscillator coil, over the channel 2 through 6

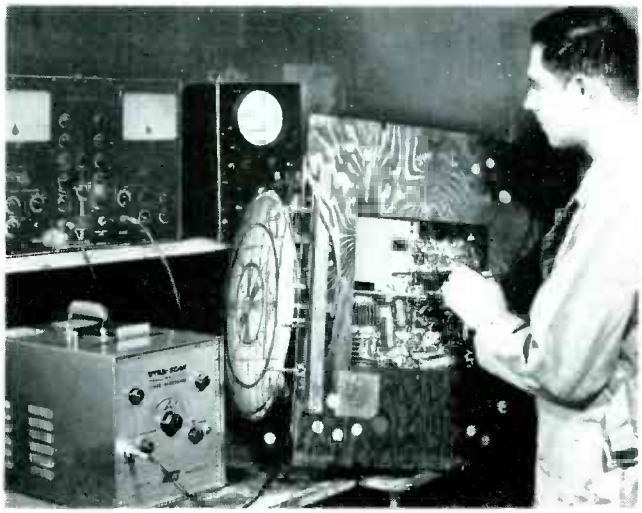
[1] *B and K* model 1000.

a Flying-Spot Scanner Test-Pattern Generator

range. The *rf* carrier generated by the *vhf* oscillator is coupled to the cathode of the modulator through a 5.6-mmfd ceramic.

The amplitude-modulated *rf* output from the modulator is coupled to a 1000-ohm *rf* attenuator through a 100-mmfd capacitor. The output from the *rf* attenuator is direct-coupled to the *rf* output jack on the front panel of the generator. The attenuation provided has been found to be sufficiently effective to reduce the output to a point where the displayed picture falls into snow. This has been found useful for testing the sensitivity of receivers in fringe areas.

In addition to video information, horizontal and vertical synchronizing pulses also are transmitted on the *rf* carrier to assure proper picture display. These pulses are coupled to the grid of the modulator through a 22,000-ohm resistor and are derived from the horizontal and vertical output stages. The vertical pulse is taken from the vertical output transformer through a .005-mfd/220,000-ohm wave-shaping network.



CHECKING VERTICAL and horizontal linearity of a TV chassis using an Indian head transparency in video generator. (Courtesy B&K)

Horizontal-Deflection Osc

A 6CG7, serving as the horizontal deflection oscillator, is a conventional cathode-coupled multivibrator whose frequency is largely determined by a ringing circuit using a ringing coil and a .005-mfd capacitor in the plate circuit of one of the triode sections of the tube. Small variations in the frequency of the horizontal oscillator can be made by adjusting a 50,000-ohm pot, the horizontal control on the front panel, which is used to sync the horizontal oscillator to the horizontal oscillator in the TV set. The output of the multivibrator is shaped into the proper sawtooth waveform by a 390-mmfd capacitor and a 10,000-ohm resistor.

The sawtooth from the horizontal oscillator is coupled to the 6BQ6/6CU6 horizontal output amplifier through a .005-mfd capacitor. This beam-power amplifier serves the dual function of providing driving power to the horizontal deflection coil in the deflection yoke and supplying *hv* pulses to a 1X2 high-voltage rectifier.

Horizontal Sync Pulses

Sharp pulses that appear in the secondary of the width coil are used as horizontal sync pulses; they are coupled to the grid of the modulator stage through a network of four resistors: 100,000, 22,000, 47,000 and 10,000 ohms, where they modulate the *rf* carrier. A 1N48 germanium diode helps to shape these pulses for proper waveform.

Purpose of 6W4 Damper

The basic purpose of the 6W4 damper is to suppress oscillation in the horizontal-deflection coil during the time the horizontal-output amplifier is cut off. In addition, it supplies the *boostrap* or boost B+ voltage for the photomultiplier tube and the vertical output.

A horizontal linearity coil varies the characteristics of a pi-filter consisting of a linearity coil, .05-mfd and .1-mfd capacitors which vary the current through the horizontal-output amp and the damper. Since any change of the average current through the horizontal output amp changes its operating point, movement of the slug in the pi-filter controls the linearity of the horizontal sweep.

Vertical-Deflection Osc

One half of a 6CM7 serves as the vertical-deflection oscillator; it is a conventional blocking type operating at 60 cps. As in all blocking oscillators, the frequency of operation of the vertical oscillator is determined by the *rc* time constant of its grid circuit. A 60-cps sine-wave-sync signal is coupled to the grid of the first half of the 6CM7 from the high-voltage secondary of the power transformer through a 1-megohm resistor and a 6200-mmfd capacitor. Accordingly, the oscillator is synchronized to the line frequency. A 3-megohm vertical-size control varies the plate voltage on the oscillator section of the 6CM7.

The second triode section of the 6CM7 serves as the vertical output stage, which amplifies the sawtooth output of the vertical oscillator. The operating point is varied by a 5000-ohm pot and hence the linearity of the vertical-output amplifier.

RF Carrier Modulation

The vertical output pulse is integrated into a sharp pulse by a .005-mfd capacitor and 220,000-ohm resistor. This pulse is coupled to the grid of the modulator through 22,000 and 47,000-ohm resistors where, together with the video information and horizontal sync pulses, it modulates the *rf* carrier.

The integrated vertical sync pulse also is coupled to the cathode of the scanner tube through a .1-mfd capacitor, where it blanks the tube during the time the trace is returning to the top of the raster.

Crosshatch Video Patterns

A neon (NE-2) and 6C4 serve as oscillators which provide a crosshatch video pattern on the face of the flying spot scanner tube for checking the horizontal and vertical linearity of the scanner sweeps.

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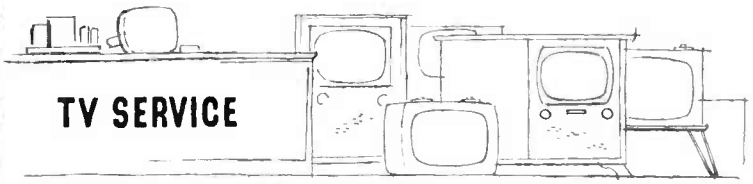

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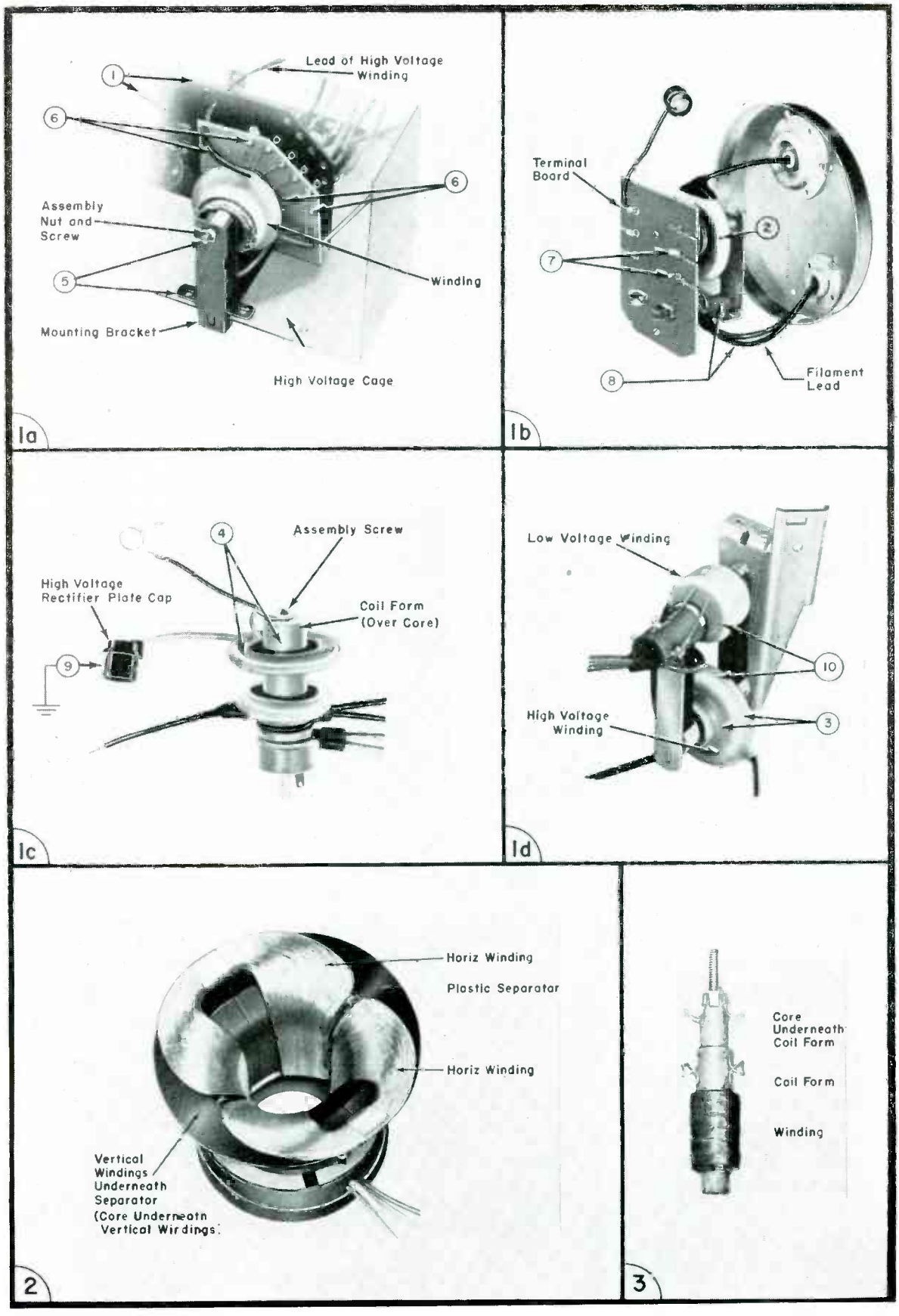
Troubleshooting Arcing

Trouble	Visual-Aural Indications	Cause	Remedy
Arcing from *hv* lead to ground point. **(See circled number 1 in Fig. 1a at right)**	White flashes across screen; intermittently dark raster; blooming; hissing, crackling, popping, or sizzling sounds.	The *hv* lead is dressed too close to the *hv* cage, mounting bracket, terminal, lead, or other ground point; excessive high-voltage due to circuit fault in horizontal-oscillator or horizontal sweep system.	The *hv* lead should be redressed away from the ground point. A high dielectric sheet of plastic should be used; also an acrylic spray or anti-corona dope between arcing points. The horizontal oscillator and sweep circuits should be checked.
Arcing at one point in the *hv* winding of the flyback transformer. **(See circled number 2 in Fig. 1b at right)**	Anti-corona wax softens; dark raster, no raster, or blooming.	Shorted turn (s) in flyback winding; solder (or other foreign particles) trapped in winding; turns of winding cross instead of being parallel.	Flyback transformer should be replaced.
Arcing between outer edges of winding layers or between windings of flyback transformer. **(See circled number 3 in Fig. 1d at right)**	White flashes across screen; intermittently dark raster; blooming.	Frayed wire insulation; turns of winding layers cross instead of being parallel.	Acrylic spray should be applied or the flyback transformer should be replaced.
Arcing or corona from the *hv* winding of the flyback transformer to the core. **(See circled number 4 in Fig. 1c at right)**	Dark raster, no raster, or blooming.	Coil form insulation breaks down; threads of assembly screw result in tendency to arc.	Mylar sheets should be placed between coil form and core. Non-threaded-mounting screw should be used. Flyback transformer should be replaced. (*Note: DC arcing is whitish in color and occurs in a straight line between two points, whereas corona is ac, has a blue-green color, and zig-zags between two points.*)
Arcing from an assembly screw or nut on the flyback transformer to a ground point. **(See circled number 5 in Fig. 1a at right)**	May be no raster indication; dark raster or blooming; crackling or popping sounds.	Screw or nut builds up static charge since it is metallic and in a strong magnetic field.	Edge of screw or nut should be filed off. A blob of solder should be applied around arcing area. High-dielectric plastic sheets, acrylic spray or anti-corona dope should be applied between arcing points.
Arcing between two winding leads of flyback transformer or between leads of high- and low-voltage windings. **(See circled number 6 in Fig. 1a at right)**	Dark raster, no raster, or blooming.	Improper lead dress of winding leads; frayed insulation of leads.	Leads which arc should be moved away from each other. High-dielectric plastic sheet, acrylic spray or anti-corona dope should be applied between arcing points.
Arcing between two terminals on terminal board of flyback transformer. **(See circled number 7 in Fig. 1b at right)**	Dark raster, no raster, or blooming.	Breakdown of insulation on terminal board; moisture or dirt accumulation on terminal board.	Terminal board should be thoroughly cleaned with carbon tet. Acrylic compound should be sprayed on board. It may be necessary to replace the flyback transformer.
Arcing from filament lead to the *hv* winding or to the core. **(See circled number 8 in Fig. 1b at right)**	No raster or blooming.	Improper filament lead dress.	Filament lead around core should be tightened. Plastic sheets should be placed around lead. Flyback transformer may have to be replaced.
Corona from rectifier plate (or flyback transformer lead) to core or low-potential point. **(See circled number 9 in Fig. 1c at right)**	No raster; blooming.	Improper lead dress; excessive high voltage due to circuit fault.	Lead causing arcing should be redressed. All voltages in the horizontal oscillator and sweep systems should be checked for circuit defects.
Arcing between high and low voltage windings of flyback transformer. **(See circled number 10 in Fig. 1d at right)**	No raster; blooming.	Flyback transformer constructed improperly; excessive high voltage due to circuit fault.	Flyback transformer should be replaced. One should check for faults in horizontal oscillator or output circuits.
Arcing between yoke windings, winding layers, or windings and core. **(See Fig. 2 at right)**	Trapezoidal pattern.	Insulation breakdown of windings or separator between windings.	Yoke should be replaced.
Arcing between width coil and its core. **(See Fig. 3 at right)**	No raster, or intermittent raster.	Breakdown of coil-form insulation.	Width coil should be replaced.

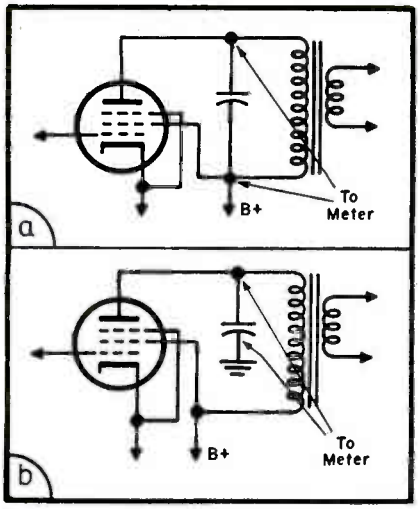
and Corona Problems

by JESSE DINES*



(*Illustrations courtesy Ram Electronics*)

*Author of *Servicing TV Sweep Systems.*



◀ FIG. 1

FIG. 2 ▶

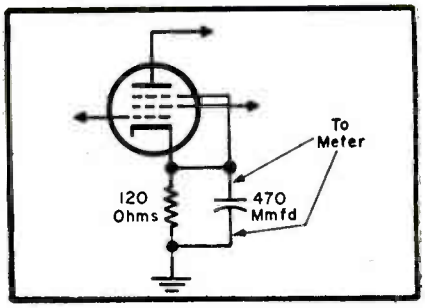
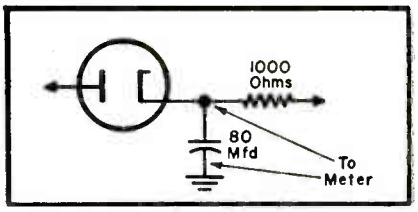


FIG. 3 ▶



FIGS. 1-3: THREE TYPICAL circuits that illustrate how false-defect readings for capacitors can be obtained because of circuitry. In a of Fig. 1 the transformer shunts the capacitor and a short could be indicated; as connected in b, a satisfactory test on the capacitor would obtain. If the if amplifier employs a cathode bypass (Fig. 2) the capacitor would check bad in the low position on a test instrument, but good in the high position. Fig. 3 shows a high-capacity power-supply filter, where the capacitor could show up as defective, because the value of the capacitor is too large to test.

Localizing Capacitor Troubles with In-Circuit Checks

by R. D. WENGENROTH

MANY OF THE more difficult servicing problems are caused by shorted and open capacitors.

Detection of these defects when the components are in the circuit not only simplifies the troubleshooting job, but enables one to pinpoint the problem accurately. To make such checks with one recently-devised instrument*, leakage and bridge circuits have been incorporated. The bridge circuit provides measurements of capacity and resistance; the leakage-resistance circuit measures leakage resistances from 30 to 10,000 megohms directly on a meter; and an electrolytic leakage circuit measures leakage directly on the same meter, and at the proper operating voltage.

In addition there is a *quick-check* circuit which provides a speed test of capacitors. When the test leads are connected across the capacitor, while it is still in place in the circuit, the meter will read *good* unless the capacitor is open. Next a push button is depressed and the meter will read *good* unless the capacitor is shorted.

In making an in-place test the capacitors must not be shunted by either a low-value resistor or a low resistance coil. A shunt resistor of 25 ohms, for example, results in a *bad* reading for any capacitor. Figs. 1 to 4 show several circuits where the foregoing problem can obtain. In Fig. 1*a* we have a circuit where a transformer shunts the capacitor making it appear shorted. However in *b* of Fig. 1 the capacitor is not shunted and will check okeh. Other examples of circuits in which false *bad* readings can be obtained are shown in Figs. 2, 3, and 4. When the *bad* reading is obtained, the circuit should be checked for low-resistance shunts across the capacitor checked; the usual precaution taken in ordinary ohmmeter checks of resistors.

While the quick-check circuit finds shorted or open-circuited capacitors rapidly, there are some types of failures that do not show up. Most of these must be checked with one end of the capacitor disconnected.

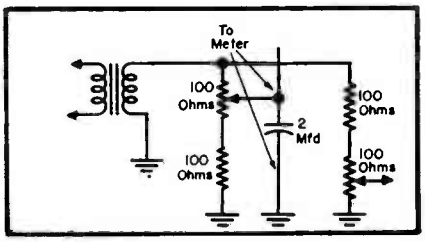
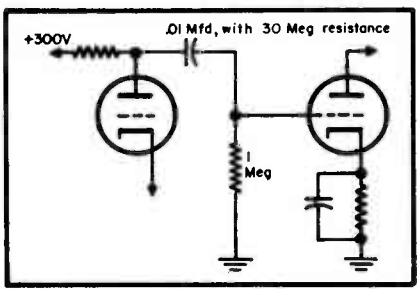


FIG. 4: COLOR-TV shading-control circuit. Here the capacitor could show up as defective because of the low resistance across the capacitor.

FIG. 5: COUPLING CAPACITOR which requires special insulation test.



In addition, new components that have been on the shelf for a long time must also be checked. As an example, an electrolytic should be tested before it is installed if it has been on the shelf a few months. The film formed when the capacitor was made tends to break down when the capacitor is not in use; after a unit has been on the shelf a few months its leakage current may be high and its capacity low. The film usually reforms quickly when proper operating voltage is applied. By connecting the capacitor to a *c-r* analyzer, and operating it in a leakage test position, the film can be reformed and the leakage current checked without danger to the set being repaired. Measurement on the bridge circuit will show if the capacity is high enough and the power factor low enough for safe operation in the set.

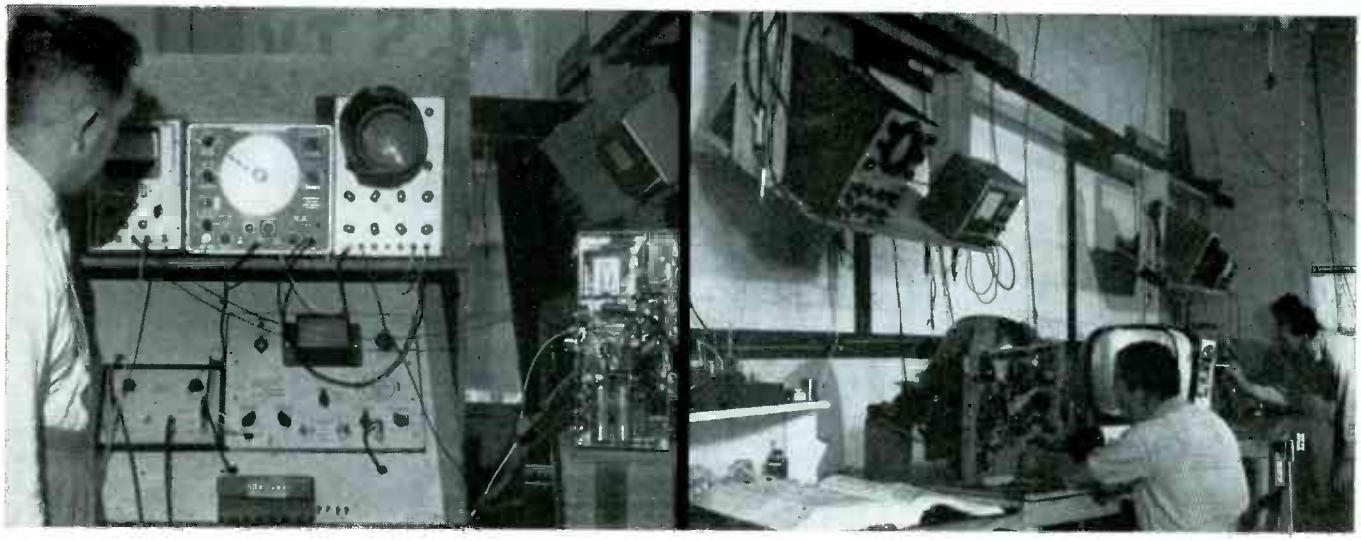
A second important use of the leakage test and capacity-power factor bridge is in the maintenance of commercial equipment such as *pa* systems, where poor components must be removed before they cause a failure. The leakage current and power factor of capacitors both increase as the capacitors age. Units which are high in either leakage or power factor are likely to fail before the next routine maintenance period.

In Fig. 5 we have a circuit where the leakage resistance of the capacit r may be too high to measure with a

(*Continued on page 47*)

*Pyramid *model CRA-2.*

Below: **MOBILE TEST** equipment bay equipped with an array of instruments for TV servicing. Right: **OVERHEAD CONVEYOR**-mounted test equipment racks that serve further to facilitate TV set repair.



TV Service Shop With Overhead Test-Equipment Racks and Mobile Benches

by AL REYENGA
Al's TV, Contra Cost County, California

We specialize in TV service and use double-decked mobile benches, that we built, for all repairs. One deck is a workbench surface and the other is for storage. These benches have been mounted on casters so that they can be moved about the shop.

When a television receiver comes in for service, the chassis is put on top of one of these mobile benches and the cabinet and knobs are placed on the lower deck. The mobile bench can be turned around easily to gain access to the front, back or sides of a chassis. Or when the chassis is mounted on its side on the mobile bench, we can get at the top or the bottom of the chassis.

The mobile benches are lined up against a wall so that one can go from one set to another or move them as desired. When sets are given the *cooking-in* treatment to determine if the repairs have been effective, the mobile bench can be set aside with the receiver plugged in.

Receivers being checked can be connected to a multiplexed television antenna system. Four separate outdoor antennas are used, the outputs of which are fed to a TV signal distribution system. Signals are available at any of six locations in the shop.

To facilitate checking of TV sets, an overhead conveyor with two movable racks of test equipment was designed. Several instruments can be put on each one of these overhead racks which can be moved back and forth. Generally, a vacuum-tube voltmeter and 'scope are mounted on each of the two instrument carriers.

In addition we have a mobile test equipment center, equipped with quality test equipment, which can be wheeled around to the most convenient positions. Through the use of mobile test benches and mobile servicing equipment, we get most utility from the equipment on hand.

Our staff consists of three partners; Roy Whitfield, Bob Carscadden, and ye author. In addition, a girl is employed who takes care of the office. All three make outside calls and take their turn at the benches.

Among the instruments used in our shop are six tube testers. We, like others in our field, have found that tubes are the major cause of TV set troubles. We believe in *critical* tube testers. Futhermore, we like to use tube testers which test tubes quickly. One of the tube testers we use is a mutual-conductance type to check merit.

In addition to testing tubes for electrical merit and short circuits, we employ two grid-emission testers which serve to locate those tubes which check out okeh on the general-purpose tube tester, but which cause trouble in many TV applications.

To provide us with a test pattern for checking TV sets, we now employ a video signal generator which transmits a test pattern or a picture as required to the sets being serviced. We found that this generator enabled us to determine picture size more conveniently.

Incidentally, we always carry a large inventory of tubes to insure speedy service.

Our shop is located in the town of Concord, with a population of over 25,000, about 40 minutes away from San Francisco, via the freeway. Concord is served by both the Sacramento Northern Railway, a subsidiary of the Western Pacific, and by the Southern Pacific. New freeways are being built about us, so our town will soon have even better transportation.

While we are close to San Francisco, natural topography puts up some obstacles as far as TV reception is concerned. On the San Francisco peninsula, south of San Francisco,

(*Continued on page 35*)

THIS MONTH IN SERVICE

SIX ALL-UHF AREAS PROPOSED BY FCC--In its first major move to develop TV areas that will be all-veryhigh or all-ultrahigh, the FCC issued a ruling that would make six telecasting centers completely uhf. . . . Changes involve the Vail Mills-Albany-Schenectady-Troy area where channel 10 would be deleted and channel 6, now used by WRGB would be assigned to Syracuse; WRGB would be required to operate on channel 47. . . . Elmira, N. Y. would also become all-u, channel 30 being substituted for channel 9, and channel 37, now assigned to Auburn, would be shelved. . . . Springfield, Ill., was also slated to become all-u through the deletion of channel 2 and the addition of 26 and 36; the channel-2 assignment was booked for St. Louis as the fourth vhf channel in that city. . . . For Peoria, Ill., channels 35 and 31 were proposed; WIRL-TV, holding channel 8, would have to shift to a higher band. . . . Evansville, Ind., was also scheduled to go all-u through a shift of channel 7 to Louisville and the assigning of 31 as the new channel for WTVW-TV. . . . The sixth area to be affected would be Fresno, Calif., where KFRE-TV has been asked to shift from 12 to 30. . . . Hearings on the proposed shuffle, scheduled for April in Washington, are expected to provide the exact dates when the changes will go into effect. . . . FCC has suggested the changes to give it some actual experience in the operation of all-u zones, in connection with its elaborate long-range program that would shift all, or a substantial part of, TV from the veryhighs to the ultrahighs.

257 TV STATIONS CAN NOW TELECAST COLOR--According to NBC, there are 257 stations now equipped to transmit color programs; 136 are said to be tied into the network and able to serve over 37-million TV homes or about 96 percent of the total number of TV homes in the country. . . . This number of network stations was noted as a 30 per cent boost over a year ago and is expected to increase to 146 by July and to 153 by the first of next year.

SERVICE MEN AND DISTRIBUTORS PLAN COOPERATIVE PROGRAM--Officers of the National Electronic Distributors Association and service associations in the east convened a few weeks ago to review a cooperative program that would improve working relationships. . . . Points discussed were methods of purchase, handling of surplus, importance of branded merchandise, replacement part and test equipment requirements, association member activities and educational programs. . . . According to association and distributor spokesmen, the meeting was so productive that a second conference on a national scale has been scheduled, and invitations have been sent not only to service associations throughout the country, but to members of NEDA and RETMA. . . . The meeting is expected to develop a concrete schedule for the operation of the coop plan.

CONNECTICUT STATE ASSOCIATION HOLDS THIRD ANNUAL CONVENTION--The Television Service Association of Connecticut recently celebrated its third birthday during a one-day convention in New Haven. . . . The meeting featured talks by industry and association heads, and the election of officers. All incumbents were reelected: Francis E. Silverman, president; Thaddeus Gryguc, vice president; Deana Gould, secretary and Benjamin Cohen, treasurer.

NEW ASSOCIATION FORMED IN POCONOS--The Pocono Electronic Service Association, composed of radio and TV Service Men in Pennsylvania's Pocono Mountains, was organized a few weeks ago. . . . First president of the organization is Harry M. Andrew. Serving with him is Augie Lockwith, as secretary. . . . The new group announced plans to set up a local advertising program and distribute an association newsletter.

PRSMA ELECTS OFFICERS FOR '57--At the recent annual election meeting of the Philadelphia Radio Service Men's Association, William Poole was reelected president. Others named were Fred Cohen, vice president; A. P. Greben, recording secretary; William P. Humes, treasurer, and Leonard Shaw, corresponding secretary.*

*See page 52, this issue, for additional news on association activities.

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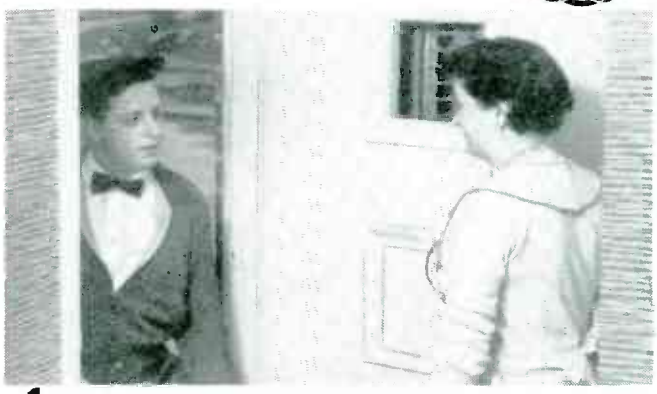
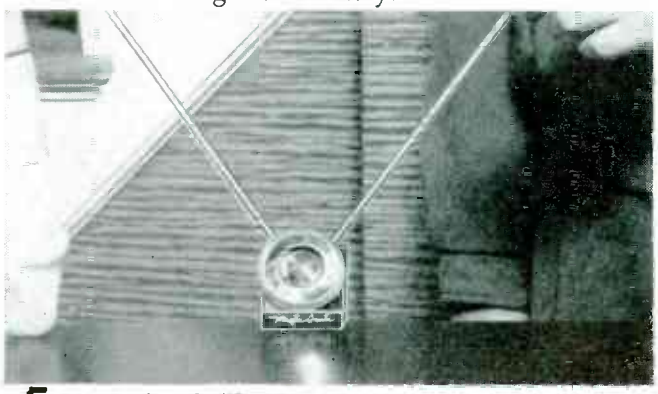


1 TAKE the JFD Magic Genie with you in your tube caddy on your next service call. It's conveniently small and compact.

2 USE the Magic Genie to check the picture after you have serviced the set.

3 YOUR customer is sure to ask about it. This is your invitation to tell the fabulous Magic Genie story.

4 SHOW your customer how much more beautiful the Magic Genie looks than the old ugly indoor antenna sitting on top of her TV set.



5 DEMONSTRATE the way dipoles rotate and adjust in any direction for powerful black and white and color reception.

6 CLINCH the sale by pointing out the Magic Genie unconditional money-back guarantee backed by JFD's 28 years of electronic know-how.

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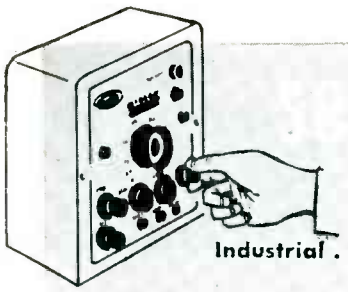
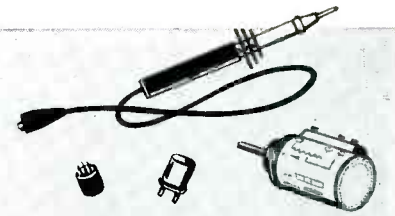
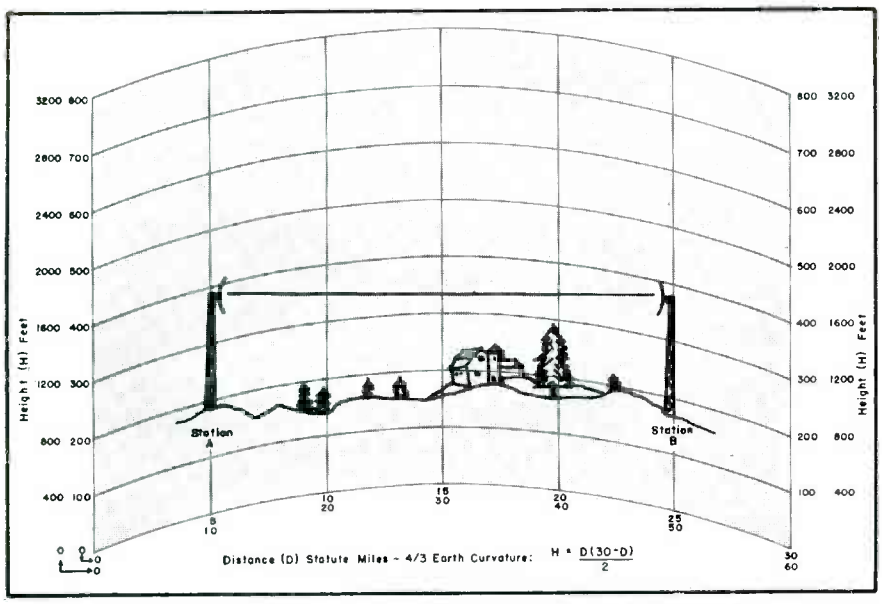


FIELD AND SHOP NOTES



Industrial . . . Commercial . . . Institutional

Communications . . . Audio . . . Television Installation . . . Maintenance . . . Repair



PROFILE MAP used to determine if a suitable microwave path is available between two points.

by GEORGE VASS

Field Engineer, Product Service Section

Communications Product Department

General Electric Company

Service Engineering The Microwave Network To Insure Reliability: System Maintenance, Replacement Component and Instrument Requirements

THE INDEPENDENT SERVICE ENGINEER who has been thinking of microwaves as another area for his endeavors should consider all aspects of the contract penalty clause (found in many microwave agreements to insure reliability in performance) before making a decision that microwave servicing holds some dangerous pitfalls.

It has been said that a *little knowledge can be a dangerous thing;* this is especially appropos in microwave service. Just the *little* knowledge that microwave penalties are heavy, as far as insured reliability is concerned, could well lead a meager-informed engineer away from what might be a valuable adjunct to his regular communications service business.

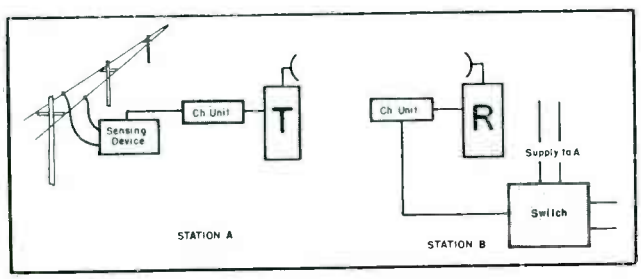
In the first place, a microwave user, in purchasing a new system, buys it with the expectation that its reliability will exceed that of other types of communications.

He backs up this expectation with heavy penalty clauses in maintenance contracts; clauses which may *indicate* that the service station would be liable to pay a high rate of *fine* for every minute the system remains off the air, if the system should fail.

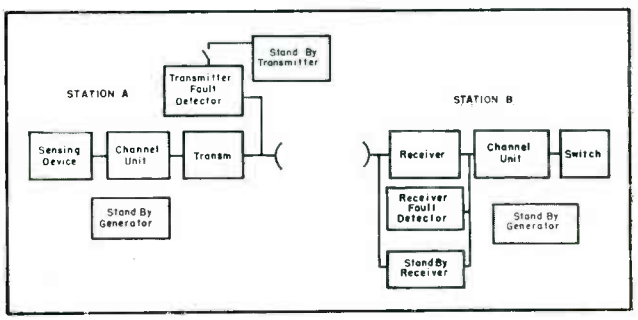
Certainly, the demand for reliability can be justified. To illustrate:

Utility *A* may purchase power from utility *B* when *A* has a load demand exceeding its producing capability. If *A* starts purchasing power *before* it is required or continues to purchase power *after* it is needed, it costs that much extra money and certainly can cut into *A's* profit. The means of communication, then, between *A* and *B*, *must* be reliable. The maintenance

(*Continued on page* 30)



SIMPLEST TYPE of microwave system consisting of only microwave transmitter (A) and receiver (B), and channel and indicating devices. Sensing unit provides transmitter with information which is transformed into intelligence at receiver to open or close a supply switch.



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Service Engineering

(*Continued from page 28*)

penalty is a form of *insurance* against such loss.

But it should be made clear that the *insurance* the user requests should not be a nightmare for the *service engineer*. This insurance has been *designed* into the original equipment. And it is this additional design, now being provided by microwave manufacturers, that provides the *service engineer* with the assurance that he personally will not be paying the insured's claim.

Let us consider a simple system between *A* and *B*. Before the selection for the microwave stations are made, a survey must be made between *A* and *B* to make sure that a microwave path is available, and that adequate clearance above all obstacles can be achieved. By doing this, good quality transmission is insured and excessive fading can be avoided. Once the site has been selected and the buildings, towers and roads built, they become the fixed portion of the system. Changes to improve reliability become too expensive to be practicable. The variables, therefore, must be in the types and amount of equipment used.

The simplest system might well consist of only the microwave transmitter, receiver, channel and indicating devices. But the reliability of such a system would be low, since there are no indicating devices to show that the system is operating properly. In addition, there is no secondary power supply, should the prime source fail, and no standby equipment. With additional equipment, the system's reliability can be increased. The installation of an additional receiver and transmitter permits failure of either of the normal units, since the system will remain in operation as the standby units take over. Also, should the station power fail, the system would remain in operation as the standby generator would supply the necessary power. Reliability could be increased further by additional equipment. If necessary, and the degree of reliability demanded it, we could also produce a second microwave path and provide this second path with its own standby equipment.

Actually, the greater the demand for reliability, the bigger the benefit is to the *service engineer*. The possibility of being called out in the middle of the night to replace a tube or a fuse is reduced. The standby units perform this service function until available time for repair obtains.

Standby units represent additional units that, from time to time, need service. Therefore, what the *service engineer* loses in night-time work he will make up in volume because of the availability of more equipment to be serviced.

In more complex systems than the one described between utility *A* and *B*, several of the microwave channels themselves may be devoted to reliability. For example, one channel may be used to transmit service information to a central location, which will immediately sound an alarm should a unit switch to standby and also indicate which unit it is and where it is located. The equipment fundamentally tells the *service engineer* not only where the trouble is, but the nature of the problem. Or, one microwave channel may be devoted to the *service engineer* so that he can talk to any portion of the system without disrupting the operating channels.

In still more complex systems there are switching units which can change repeaters into terminals.* Hence, in many cases, normal communications are only slightly disrupted while repairs are made to the disaster station.

The maintenance procedures established by the *service engineer* will, of course, depend upon the reliability

(*Continued on page 33*)

**This technique has been applied in the G.E. 2000-mc Quadriphase equipment.*

VEHICULAR COMMUNICATION antenna, which can be mounted on any body surface from horizontal to vertical plane. Antenna is comprised of three parts; base, spring and whip. Each of these components can be purchased separately. Base features an aluminum 2" diameter swivel with bakelite mounting insulator and steel back-up plate; it has ⅜"—24 threading to accept rod or spring. Designed for 96" maximum whip length, the spring will bend through a 100° arc. Spring includes a center braid. Whip (96" taper-ground stainless steel) fits directly to either base or spring. (Model M1; The Antenna Specialists Company, 12435 Euclid Ave., Cleveland 6, O.)

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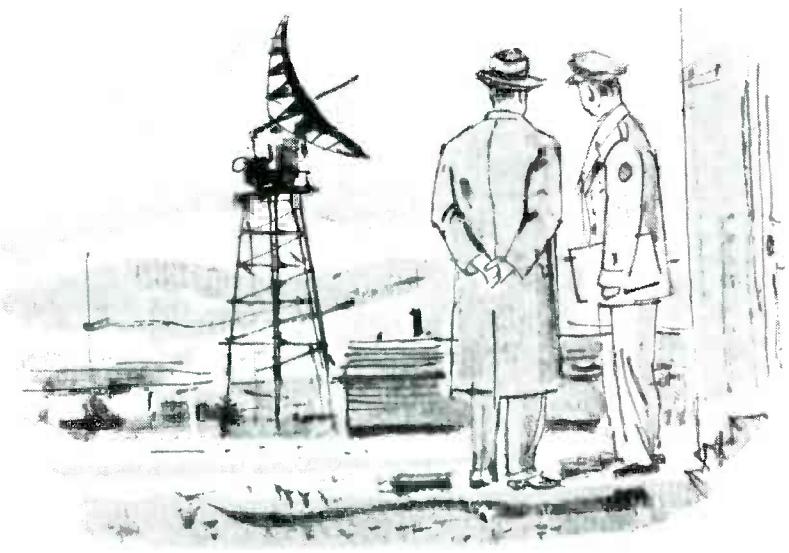

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RCA SERVICE COMPANY, INC.

(*Continued from page* 31)

demand of the system being maintained. Through routine maintenance of normal and standby equipments the *service engineer* can prevent *off-the-air* calls. For example, if he is visiting station *A* on a service call, he can start up the standby generator to test it and make sure that it will be ready to *go* if called upon.

The inventory of parts required to maintain a microwave system does not impose the same problem today as it did originally. It is an advantage to the mobile service organization when the parts in their stock can also be used in microwave servicing. The manufacturers of complete communication lines have also strived to design their equipment around duplicate parts. In the line of equipment[1] that we have developed, the service parts section has been able to adopt microwave parts into a chain of automation developed primarily for mobile service parts without expanding the system; a system developed to process and ship orders the day they are received. Hence, rather than become a burden on inventory, the *service engineer* may find that his profits on parts will increase because of the faster turnover.

The *service engineer's* test equipment stock may well present a greater problem than his parts stock. The one essential item the *service engineer* must have in his test equipment stock to service the microwave links is a 'scope. This piece of test equipment is not too important in mobile service and, therefore, may not be readily available for microwave service. The microwave 'scope should have wideband characteristics and an expanded sweep. Such a 'scope, a rather expensive item, does represent a large capital investment for a small service organization. But, the equipment is essential and the *service engineer* should consider this cost in his overhead calculations and adjust his microwave service charges so that it can be liquidated.

In mobile service the sense of hearing is relied upon. Through experience the *service engineer* can tell whether or not his system is operating satisfactorily by listening. In microwave servicing he relies upon the *sense of sight*. In many ways relying on sight makes microwave ser-

(*Continued on page* 48)

[1]*G.E. Quadriphase microwave and Progress-Line mobile equipment.*

Test Equipment Report

(*Continued from page* 14)

the ability to sweep the entire spectrum under test.

The evolution of the 'scope from the simple pictorial display device to a device that provides a display having a quantitive meaning for measurement purposes.

The old point-by-point methods of measurements were adequate for the old narrow bandwidth days, but we are living in a new wide-band era and new test equipment and test methods are required if we are to keep pace with industry.—*Caywood C. Cooley, Jerrold Electronics Corporation.*

FUTURE TEST equipment should be primarily of a *specialized* nature. The unit should present the utmost in usefulness and simplicity in accomplishing a specific job. . . . This approach makes it possible to keep one well equipped with the newest aids.—*E. A. Bramsen, Seco Manufacturing Company.*

THERE ARE TWO main influences strongly affecting instrument design. The first one and the most obvious is that standard test instruments need to have greater accuracy than hitherto. In other words, the day of the two-to-five per cent accuracy in the mid-range of the instrument has gone by. There is a strong demand now for instruments in the range of one-tenth to one per cent accuracy, particularly in *ac* instruments.

The second influence is the desire for more and more versatile equipment. In other words, it is not satisfactory to put out a single function instrument, if at all possible. This may be clearly viewed when one looks at the number of vacuum-tube voltmeters recently announced. These voltmeters are not only simply vacuum-tube voltmeters; they are also able to make numerous other types of measurements. The price of this more versatile gear, of course, has to be more; however, there seems no doubt that Service Men prefer to pay more and acquire the versatility in one instrument.—*Fitzroy Kennedy, Spencer-Kennedy Laboratories, Inc.*

THE FUTURE OF TEST INSTRUMENT DEVELOPMENTS for the TV Service Man appears in those products which can produce daily profits for his business. The use of time and labor saving

devices are a *must* for the successful TV Service Man—*Carl Korn, B&K Manufacturing Company.*

EFFORTLESS CHECKING and measuring with exceptional accuracy: To me it seems to be the clearly indicated trend in test instruments. There is less time than formerly for fussy readings and involved computations. Earlier equipment called for elaborate manipulations, complicated readings and painful translations into practical terms. But no more.

A case in point is a recently-developed *lc checker.* The original idea was an easier means of checking capacitors and other components even in their own circuitry, without disconnecting units, in some instances. Encouraged by the enthusiastic reception of the basic idea, there has been designed a new version—that is simpler, faster, smaller, more accurate, and still at within-reach price; typical of the general trend in test equipment.—*Charles Golenpaul, Aerovox Corporation.*

•

TV Service Shop

(*Continued from page* 25)

and in San Francisco, indoor antennas often suffice as there are no mountains between the major stations, channels 4 and 5, and viewers. We in Concord, however, are on the east side, or the mainland side, of San Francisco Bay. Between us and the bay are several ridges that rise approximately 1,000 feet in height and therefore prevent line-of-sight conditions between San Francisco and Concord. Channel 13, on the other hand, is located on top of Mt. Diablo, over 3,000 feet high, which is almost within high-power rifle distance of Concord. However, channel 13 is to be moved to the San Joaquin Valley east of here soon, so we will be deprived of that particular channel. Many of our customers are able to pick up signals from stations on channels 3 and 10 in Sacramento, which is about 70 miles away.

We buy only advertised brands of tubes, parts, and test equipment. No off-brands, no surplus, no dubious merchandise for us. In this highly competitive industry, if you want to keep your customers and if you want your customers to refer others to you, we have found that you must not only know your business technically, but you must use only the highest quality parts and tubes.

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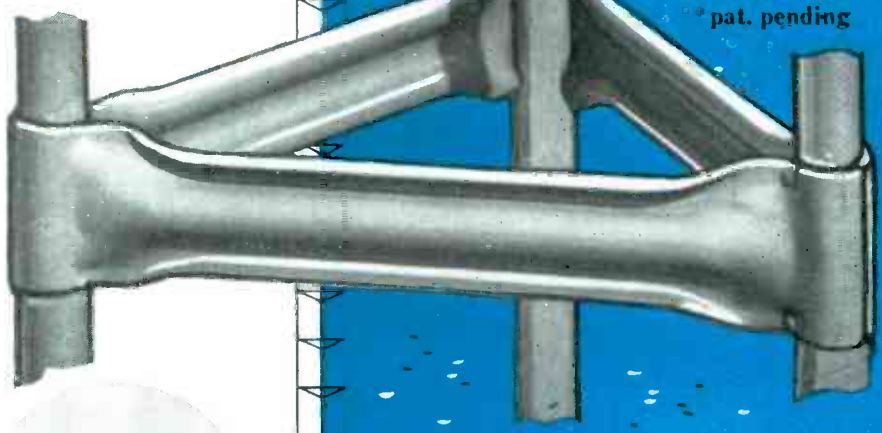

the "Magic Triangle"*

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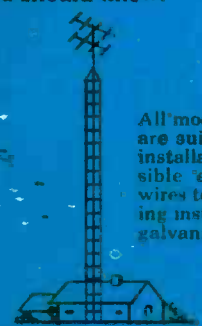
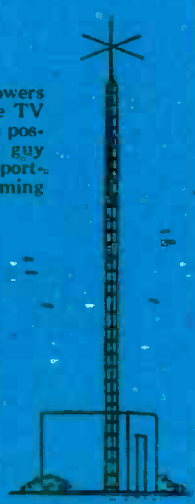


All models of Rohn Towers are suitable for home TV installations . . . makes possible elimination of guy wires to give a self-supporting installation of gleaming galvanized steel!



Communication towers, heavy duty towers, fold-over towers are also available. The Rohn catalog shows a *complete* line including all types installation equipment, bases, roof towers, tubing and dozens of accessories.

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CATALOGS—BOOKS

THE HICKOK ELECTRICAL INSTRUMENT CO., 10521 Dupont Ave., Cleveland 8, O., has published a bulletin (form 415) describing a portable electronic volt-ohmmeter. Equipment has a curved plastic face and is designed to lie flat in normal use. Has a single-unit, multi-function range selector that is color coded to facilitate use. All *dc* ranges are zero-center design. No batteries are required.

° ° °

ROGERS ELECTRONIC CORP., 49 Bleeker St., New York 12, N. Y., has released three pages of reference sheets listing exact yoke, coil, flyback and transformer replacements for Admiral TV sets. Close to 200 Admiral chassis numbers are covered, along with 34 yoke and 32 flyback part numbers designated by the set manufacturer. All are cross-referenced.

° ° °

UNIVERSITY LOUDSPEAKERS, INC., 80 South Kensico Ave., White Plains, N. Y., have issued a bulletin covering uses for portable soundcasting systems. Two models are discussed: *portable* with a hand microphone and *pistolgrip*, a combined loudspeaker-microphone unit.

° ° °

SERVICE INSTRUMENTS CORP., 171 Official Road, Addison, Ill., has announced a new system of distribution on transistor charts and booklets featuring up to six mailings a year for $1.00. Information released will include data on transistors and test methods developed for new crystal diodes, selenium and silicon rectifiers.

° ° °

THE SEMICONDUCTOR PRODUCTS DEPARTMENT, General Electric Co., Syracuse, N. Y., has published a 64-page transistor manual. Nineteen circuit diagrams ranging from a one-transistor audio-amplifier to a six-transistor superhet receiver are included with complete parts list. A cross-reference chart for replacement of transistors in current transistorized radios of all manufacturers is also included. Booklet is priced at fifty cents.

° ° °

HOWARD W. SAMS AND CO., INC., 2201 East 46th St., Indianapolis 5, Ind., has announced the release of a TV trouble-shooting handbook, entitled *Pin Point TV Troubles in 10 Minutes*, published by the educational book publishing division of Coyne Electrical School, Chicago, Ill.

Handbook describes a system for locating TV receiver troubles, which is said to make it possible to analyze over 700 problems which may cause 70 basic types of faulty pictures . . . Explanations of circuits and designs used in the majority of all TV receivers produced since '53 accompany the tables of symptoms and causes. Illustrated and described are methods for checking performance of various parts or components. . . . Contains 299 pages and is priced at $3.95.

Small Store-Office Announce-Music Sound-System Installation-Repair

by JACK DARR

AN INCREASING NUMBER of small factories, stores, doctor's and dentist's offices are installing commercial sound systems to provide for *background* music and message distribution.

The design and installation of such systems represent an ideal opportunity for the radio-TV Service Man; the installations are simple and a substantial of percantage profit obtains.

The primary consideration in a sound setup is the overall quality of the system; the *purity* of the sound reproduction and serviceability of the major components.

One part of the system where quality pays off is in the record changer and its cartridge. The best that the estimate will stand should be bought.

One should always use a diamond needle; even the best of the synthetic jewels (sapphire or ruby) will wear out in a comparatively short time under the long continuous service demanded of this type of installation—8 hours a day or more, every day. The diamond also serves to protect the records from damage by worn needles and provides a very good selling feature.

In many systems that we have installed, 6 x 9 oval *pm*'s were found to provide very good results. In our jobs we've used the auto-radio rear-seat speaker types which come in kit form with metal grilles. The speakers have a common 3.2-ohm voice coil and are rated around 5 watts. The grilles make it possible to give the installation a professional appearance.

Typical Installations

One installation completed recently was made in a dentist's office building which had a reception room, three operating rooms, a laboratory and an office.

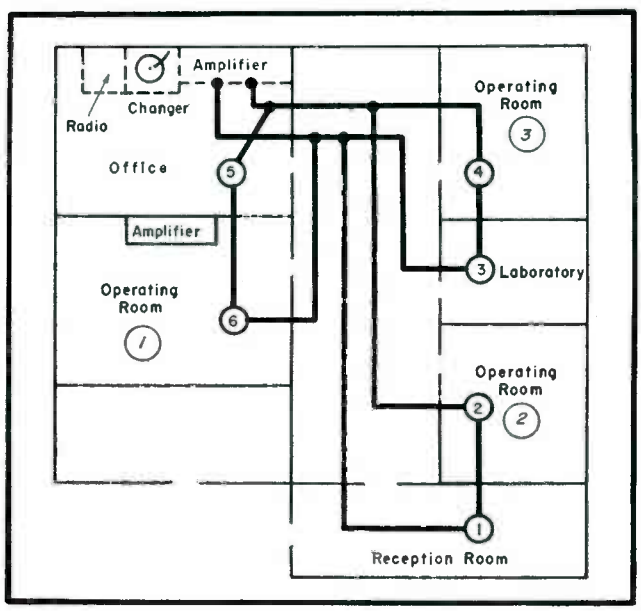
All ceilings were covered with celotex tile (12″ square), and the attic was insulated with *rock-wool* blankets. Only a moderate volume of sound, but with good fidelity, was required. To meet this specification, the speakers were installed in the ceiling of each room. Wiring was run through an attic, dropped into an air-conditioner closet and then through the wall into the office, the original location chosen for the amplifier. (Later the amplifier was moved into an operating-room area for greater convenience in making volume adjustments; it was installed on a high shelf on the wall.)

To install the speakers, holes were cut through the ceiling, from below, using a small sabre-blade power saw.[1] This tool was found invaluable for this type of work; on this job alone six holes were cut through the ceiling in

(*Continued on page 54*)

[1] *Wen 550.*

AMPLIFIER installed in store. Record changer is visible behind amplifier. Upper controls are bass, gain and treble; control in center at bottom of panel is radio-phono switch.



FLOOR PLAN of dentist's office building in which sound system was installed. Circled numbers indicate position of speakers mounted in ceiling. Dashed outline shows original location of amplifier in office, which was moved later to operating room 1, as shown. Speakers were connected in series-parallel to raise impedance.

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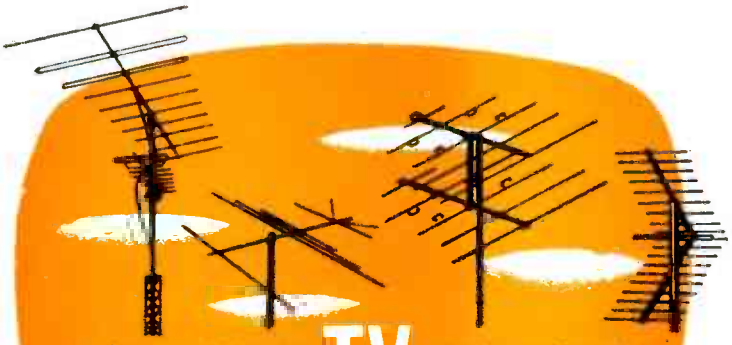


UHF-VHF TV ANTENNA DIGEST

DESIGN • APPLICATION • INSTALLATION • SERVICE

Design—Application Report on Variable-Control PW-Tuning-Element Indoor Dipole*

INDOOR ANTENNAS usually face a number of receiving variables that can affect performance.

Transmitted signals are often scattered and attenuated, and thus the antenna is beset with more than one signal due to multiple reflections. Since these signals differ in both amplitude and phase, they give rise to standing waves. In addition, antenna orientation is affected by varying planes of polarization. Furthermore, it is difficult to predict the net result of all these effects. Often, movement of an indoor antenna only a few feet produces an entirely new pattern of reception which changes for each channel.

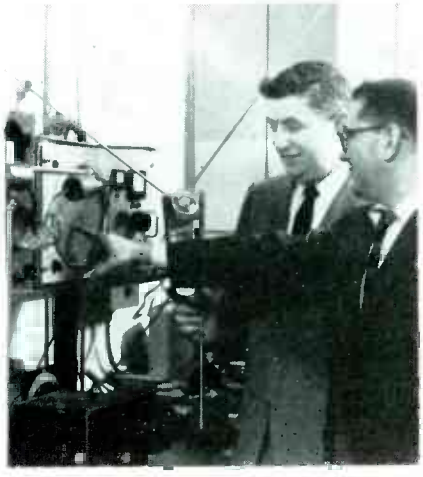
To solve these problems, antenna engineers have introduced a number of innovations in the design of the basic dipole. Some of these developments have revolved about the use of a stub to tune the antenna; in some types the stub has been located in the antenna aperture. Loading of the dipole has also been tried to achieve resonance.

Recently in another approach to the problem, an antenna[1] was built with a printed-wiring configuration that could serve not only as a stub, but for antenna loading. And to make the antenna adaptable to the variable conditions in a room, a 12-position switch was tied into the printed-wiring assembly.[2]

The printed-wiring tuning element developed for the antenna is shown in Fig. 1. The equivalent circuit of this item is detailed in Fig. 2 (p. 46). On the lower channels, the circuit is largely inductive and on the higher channels mostly capacitive. This circuitry has the effect of providing an impedance which approximates the conjugate of the antenna impedance; this, it is said, serves to decrease the losses in antenna reactance. When the printed-wiring section is placed across the dipole terminals, it acts like the conventional stub; however, it is claimed to be more effective due to its location outside of the dipole's sphere of action.

The selector switch is used to establish a circuitry link that will pro-

(*Continued on page 46*)



CHECKING PERFORMANCE of pw tuning-element indoor antenna in JFD antenna lab, left to right: Ed Finkel, sales manager and Simon Holzman, chief engineer, antenna development.

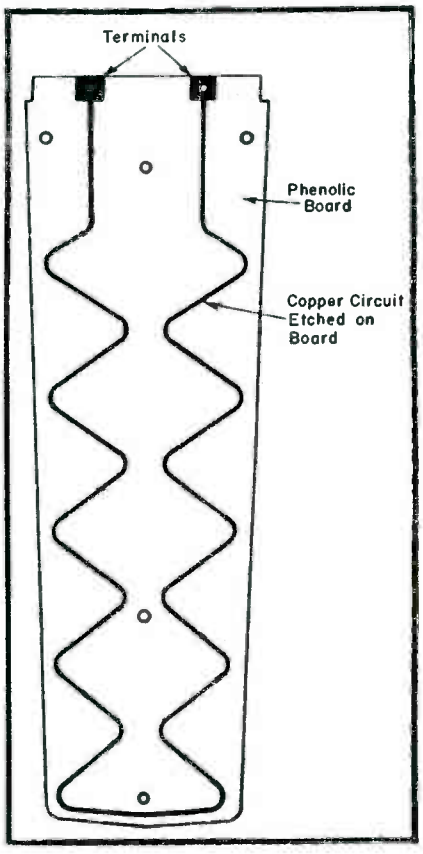


FIG. 1: PRINTED-WIRING tuning element of indoor antenna.

*Based on field notes prepared by the antenna development department of JFD.

[1]*JFD Magic Genie.*

[2]*The various positions are numbered for reference to facilitate resetting.*

UHF Oscillator Tubes

by J. W. RUSH

Circuit Development Supervisor, General Electric Company

When one is concerned with the use of vacuum tubes, he often fails to remember that they function differently as amplifiers and oscillators. In many cases the tube will amplify, but fail as an efficient oscillator at the same frequency. In the development of a new oscillator tube and in the servicing of a production type, a clear understanding of the requirements of an oscillator is necessary. Unfortunately, in most cases these requirements can not be easily determined or measured.

In general, an oscillator tube should have a low amplification factor, reasonable transconductance, and low interelectrode capacitances. These data can be found in the tube manual. However, these factors alone do not sufficiently define the oscillator performance of the tube.

One of the tubes predominantly used as an *uhf* oscillator is the 6AF4; the 2AF4, the 6AF4A, and the 6T4 have also been designed for the same applications. Most of the critical factors that determine the oscillator performance of a tube are best determined at the highest frequencies, and since the 6AF4 was designed for *uhf* service, this tube makes a good *case study*.

Before a tube can be evaluated as an oscillator, the proper test procedures must be determined. It has been found that the usual power output tests are useless to describe a local oscillator tube. Since the fundamental requirement of such an oscillator is to inject a signal into a mixer, it is necessary to evaluate the tube with respect to its ability to operate in this function. The level of oscillator injection into the common diode mixer is measured by the magnitude of diode mixer current.

For the sake of simplicity and circuit reproducibility, it is easier to evaluate an oscillator as a function of grid current. The values of grid current can then be used to predict the

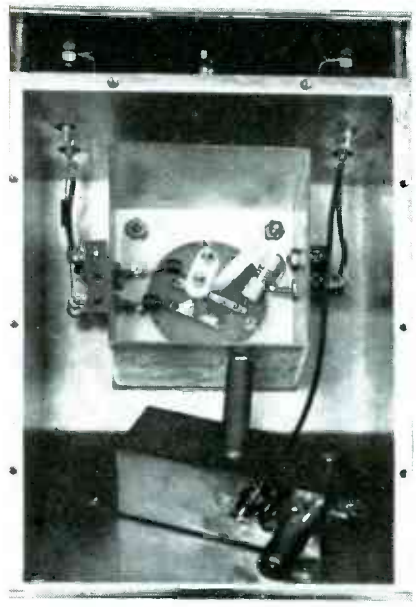


FIG. 1: OSCILLATOR test unit for 6AF4 uhf tubes.

diode mixer currents when the tube is used in a similar circuit.

During the manufacture of any vacuum tube, the usual static characteristics, such as I_p, G_m, and μ, are carefully controlled. If the tube is to be used as an oscillator and the grid current can be correlated with the static characteristics, no special testing would be required.

To control the oscillator grid current of the 6AF4 in production and to insure a high quality tube, a standard oscillator test circuit is used. Fig. 1 shows the bottom view of this tester; Fig. 2, the circuit diagram. Two parameters are measured; oscillator grid current, and frequency of oscillation. The grid current is measured by a current meter, I_g, and the frequency is determined by a wavemeter schematically shown in the lower part of Fig. 2.

Tests have revealed that high plate current tubes give good oscillator activity. In the test oscillator it was found that the high plate current tubes were low in frequency. The frequency of oscillation must be controlled as well as the level of oscillation.

It has been pointed out that the usual static tube tests are inadequate in the plant and in the service shop. The question then arises: "How can Service Men test the 6AF4 or similar types?" The usual procedure is to replace the tube and see if the set performs. However, the proper procedure requires a more careful analysis. Unfortunately, the difference between marginal operation and designed performance cannot be easily determined. This, in most cases, leads to the assumption that the tube is at fault. When a *uhf* tuner is new, the tube is good, the circuit elements are clean, the contacts, if present, are clean and properly lubricated, and the Q of the resonant elements are high. Under these conditions, the tuner is performing properly. After a period of time the elements become dirty, the contacts are scratchy due to long use, and the tube has aged somewhat. As the efficiency of the overall circuit falls due to these causes, the plate current climbs. Under these conditions, the life of the tube is affected, and the tube finally fails due to this cumulative effect. When a new tube is inserted, the oscillator activity rises to an acceptable value and the TV set begins to perform properly. The plate current of the new tube is somewhat higher than when the tuner was new, and the second tube will fail sooner than the first.

If the Service Man is plagued with a TV set that is *using 6AF4's*, several things can be done. The *uhf* tuner should be properly cleaned, and if any sliding contacts are used, they must be cleaned and properly lubricated. A new 6AF4 should be inserted and the tuner reassembled. All tuner shields or covers should be replaced. As in most cases, any electrical tests are meaningless if the tuner

(*Continued on page 53*)

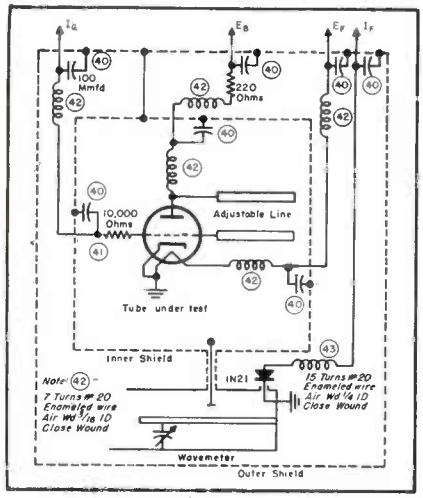
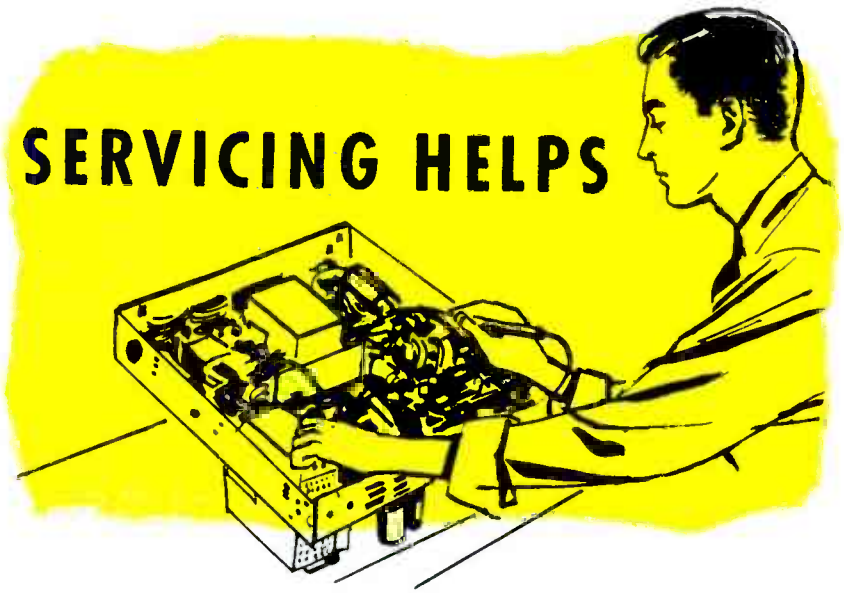


FIG. 2: CIRCUIT DIAGRAM of 6AF4 test oscillator.

Transistor Replacements . . AGC Transistor-Circuit Changes . . Transistor Audio Distortion Cures



WHILE TRANSISTOR failures have been found to be comparatively low, Service Men should maintain a basic inventory of replacement transistors as these items are not always available on the open market.

Reporting on the variety of special types used, the Magnavox service department noted that in the AM-2 personal portable, fourteen different types were specified, as shown below in table 1.

AGC Transistor Circuit Modifications

TRANSISTOR CIRCUITRY is new and improvements are continually being discovered. In the Zenith 7XT40 chassis (*Royal 500 series*) engineering has improved the *agc* system as well as other portions of the circuitry.

Originally the bias bleeder on the first *if* stage was 100,000 ohms and 15,000 ohms plus a 2000-ohm volume control from B+ to ground. The *agc* bypass of 3 mfd was at the junction of the 100,000 and 15,000-ohm resistors which meant that 15,000 ohms was in series with the *agc* current. During production the amount of *agc* was found to be insufficient. The bias bleeder was then changed to 100,000, 4,700, 4,700 ohms and 5,000 ohms for the volume control. The *agc* bypass of 16 mfd was put between the two 4,700-ohm resistors. This increased the amount of *agc* applied to the first *if* stage and at the same time served to maintain approximately the same *dc* operating point.

In the event you do not wish to modify the circuit as described, it is suggested that when servicing sets which exhibit *agc* and overload problems, the bias bleeder of the first *if* stage should be changed. The original circuit had 100,000 and 15,000-ohm resistors. These values should be changed to 47,000 and 4,700 ohms, respectively. This in effect supplies more *agc* voltage to the mixer and first *if*. In addition, the lower impedance bleeder will reduce the variation in current drawn by these transistors.

On a receiver that seems to be excessively sensitive and possibly exhibits some characteristics of 910 or 1365-kc tweet, it can be cooled off in the following manner. The initial run of these units had a 560-ohm resistor bypassed with a .05-mfd capacitor in the emitter leads of the 2N94 mixer. Later, a 10-ohm resistor was put in series with the 560-ohm resistor; but this 10-ohm resistor was not bypassed. Still later, a 22-ohm resistor was substituted in place of the 10-ohm resistor. In the circuit presently being used, the 560, 10 ohm and 22-ohm resistors have been eliminated and in place of them Zenith is using a 3900-ohm resistor bypassed with a .05-mfd capacitor in the emitter lead of the mixer.

In the Zenith 7XT40Z1 models, the 2200-ohm bias resistor in the 121-17 second *if* transistor was 4700 ohms. It has been changed to 2200 ohms to reduce tweet, by slightly lowering gain.

Curing Audio Distortion in Transistor Radios

IN THE RCA transistor model 8-BT-10K audio distortion has been found because the 3600-ohm resistor (R_{13}) has increased in value. This resistor is in the bias circuit of the output transistors, and because the output transistors are in a class *B* circuit, even a small increase in bias may result in distortion.

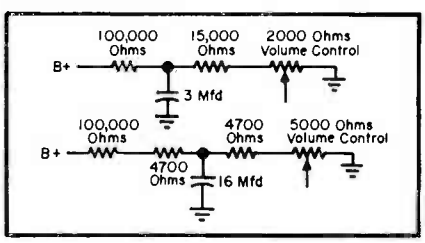
For best results, a selected resistor should be used for replacement. Use

(*Continued on page 47*)

Application	Model CR729AA°	Model CR729A	Model CR729CA
Converter	2N172	2N172	2N252
First if	2N145 or 2N146	RO2 or RO3	2N253
Second if	2N146 or 2N147	RO3 or RO4	2N254
Second detector°°	1N295	1N295	1N295
Audio driver	2N238/310	2N238/310	2N238/310
Audio output (2)	353	2N185	2N185

°*Chassis not stamped with model number are CR729AA.* °°*Germanium diode.*

Table 1: Assorted transistors used in Magnavox AM-2 portable.



(Above)

ORIGINAL (top) and modified agc bias-bleeder circuits (bottom) in Zenith transistor model 7XT40. Altered circuit was found to improve effectiveness of agc

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TV Antennas

(*Continued from page 41*)

vide the best signal reception for a particular channel at a specific location.

Examples of some of the switching arrangements possible are illustrated in Fig. 3. In *a* we find the stub completely disconnected and a simple dipole is in operation. In the arrangement in *b* only one half of the dipole is connected to the TV receiver. Both halves of the dipole are connected to the same leadin wire and the other is left open in diagram *c*. The *d* configuration shows the *ptw* element in series with one leg of the dipole. Fig. 3*e* illustrates the use of the printed-wiring element as a load on one side of the dipole. Another arrangement in which the unloaded side of the dipole is not connected to the TV receiver is shown in *f*.

Freedom of orientation is provided by ball and socket joints at the base

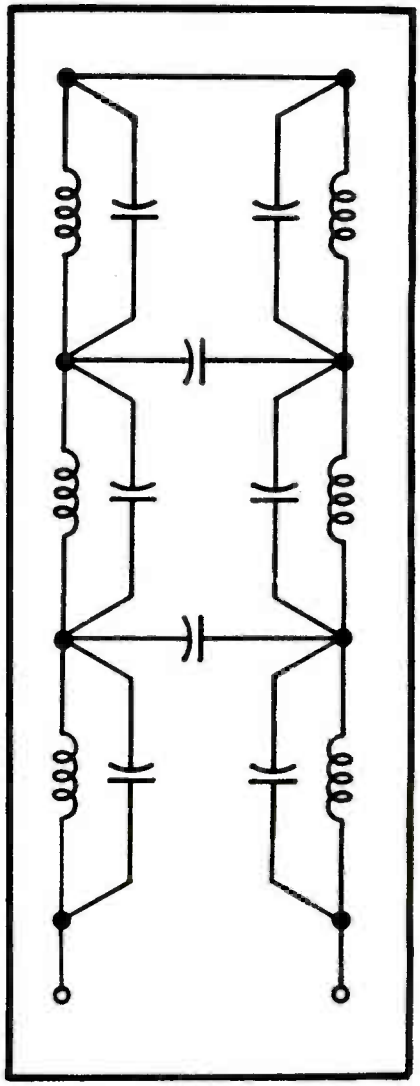

FIG. 2: EQUIVALENT CIRCUIT of the printed-wiring assembly illustrated in Fig 1 on page 41.

of the dipole. Soldered connections are used throughout, except at the base of the dipole where large area self-wiping contacts are used.

The antenna has been so designed that it can be mounted on the rear of wooden or metal cabinets through the use of wood screws, machine screws or adhesive.

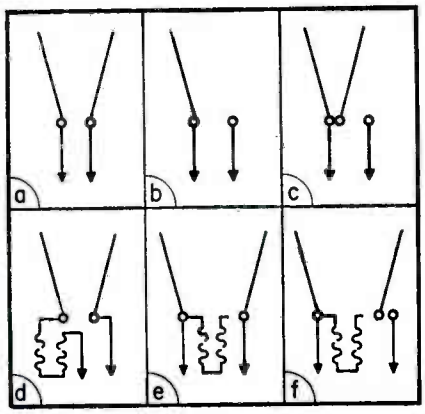

FIG. 3: EXAMPLES of switching available with pw element and dipoles.

Servicing Helps

(*Continued from page 44*)

of a resistor which is less than 3300-ohms can result in a large increase of no-signal current. Distortion will become noticeable if the resistance value is raised much above 3600 ohms.

Resistance measurements in a circuit containing transistors will often result in misleading indications and may possibly damage the transistors. All transistors should be removed from the chassis before making resistance measurements.

Collector or emitter-current measurements can be used to determine operating conditions if an accurate low-range sensitive voltmeter is not available for bias measurements. The no-signal emitter or collector current of each of the output transistors should be 1.5 milliamperes with a new battery. A bias voltage of −.13 volt is required at that current drain.

Localizing Capacitor Trouble

(*Continued from page 24*)

typical ohmmeter. Some ohmmeters would not provide an indication of a 30-megohm leakage resistance; in this circuit this leakage would apply 10 volts positive bias to the grid of the tube. A high-resistance ohmmeter circuit is needed for this measurement. The range must be high enough (30 to 10,000 megohms) to permit the acceptance testing of all types of capacitors, and for checking insulation of wires, cables, and transformers, too.

Service Engineering

(*Continued from page* 33)

vice *easier than mobile*. For example, with the 'scope the *service engineer* can see the whole pulse train that is being transmitted or received. He can, if he wishes, monitor any one pulse of the train; he can see the modulation or, with the aid of a calibrated dummy load, see how much power he is putting out. *Service engineers* who have had experience on both mobile communications and home television receivers are in a favorable position to accept microwave service with only a little additional training.

Simplified Controls Featured

In older microwave systems the number of adjustment controls far exceeded the number one would expect to find in a mobile system. In the newer type of microwave system[2], controls are at a minimum. There are no new laws. *Peaking the grids and dipping the plates* still hold true. The sequence of events which take place to produce the pulse train are automatic. There is no guess work. With the 'scope and its accessories, such as a marker generator, each pulse can be checked for proper position, and should any pulse be found out of position, one control can correct the difficulty. The days of microwave being a knob-twiddler's nightmare is a thing of the past.

[2]*Such as the* 2000-*mc Quadriphase.*

FREQUENCY METER, featuring transistorized circuitry, tuning mobile radio base station for peak operation on 150 mc. Meter can service multiple transmitter installations operating on from one to twenty channels in 25 to 470 mc land-mobile radio service frequency bands. (Type 5890-A; Allen B. Du Mont Laboratories, Inc., 750 Bloomfield Ave., Clifton, N. J.)

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Color-TV Installation

(*Continued from page* 11)

voltage relatively high, but the supply is regulated, and there is considerable current capacity in the circuit. Severe shock will result if the high-voltage is accidentally contacted by the operator.

Corona is a serious problem, and it is not practical to puncture the high-voltage lead to the picture tube to obtain a measurement. Long hot arcs, which may damage the output transformer, are usually encountered if one tampers with the insulation of the high-voltage system.

It should be noted that some color-TV receivers use a hydrogen bleeder tube, instead of a triode regulator, for high-voltage regulation. The bleeder-type regulator does not provide a service adjustment, and usually requires no attention during installation procedures. Unless there is a circuit fault which prevents adequate striking voltage from being applied to the regulator tube, the value of the high-voltage supply will be maintained correctly and does not require measurement. Of course, a weak high-voltage rectifier tube can cause the output from the flyback circuit to fall below the striking voltage of the regulator tube.

It is sometimes supposed that regulation is employed only in a color-TV receiver to compensate for changes in line voltage. Although this function is performed by the regulator, this regulator also serves to maintain the beam current constant as light and dark areas are scanned in the picture tube. The total beam current from the three guns is relatively large and unless regulation is provided, the picture tube will not operate properly.

A triode-type of high-voltage regulator requires adjustment, because the characteristics of the regulator tube vary as the tube ages, and are also somewhat different from tube to tube. For this reason, whenever a service call is made to check poor convergence on a receiver that uses a triode-type regulator, a preliminary check of the high-voltage value should be made.

The next step in the setup procedure involves the adjustment of the purity magnets, provided that the picture tube is in preliminary convergence. Unless it is known that the tube has been rough-converged before delivery, a check of static convergence should be made at this time.

In this operation, the output from a white-dot generator is applied to the antenna-input terminals of the receiver to obtain a dot pattern on the screen of the picture tube, as illustrated in Fig. 3 (p. 10).

In most cases, the screen controls (*red*, *blue*, and *green*) for the picture tube will have been adjusted to obtain visible output from all three guns. However, if the screen controls should be turned down so far that one or more of the guns is not producing visible output on the screen, the controls should be advanced as required; the three outputs should be balanced sufficiently at this point so that the dots appear white.

The screen controls for the picture tube may be mounted on the back of the receiver chassis, or in some cases they may be found under an access door or plate on the front of the receiver. Most receivers provide screen controls for *red*, *green*, and *blue* gun output, respectively, but one will encounter an occasional receiver in which the red screen current is fixed, and in this instance, controls are provided for the blue and green screens only.

Many receivers provide a range of red-screen control which prevents setting of the red screen current too high; but some receivers have a wider range of screen control, and in such cases it is important not to exceed the allowable red-screen current. When this possibility exists, the receiver service notes should be consulted for they will specify a measurement point in the receiver circuits to serve as a guide in adjustment of the red screen control. The red gun draws the heaviest current of the three, and if the permissible limit is exceeded, damage to the picture tube may result. In any case, the red-screen control should not be turned beyond the point at which the red dot blooms and looses focus when the customer's brightness control is turned to maximum.

The beam-positioning magnets or pots are adjusted, if necessary, to obtain good center-screen convergence. This check is required, because convergence and purity are interrelated to some extent, and if the convergence is poor, the purity adjustments cannot be made properly.

Most receivers provide three beam-positioning magnets and a blue lateral corrector magnet on the neck of the picture tube, as illustrated in Fig. 4 (p. 10). However, some receivers utilize pots instead of beam magnets for adjustment of static convergence. When pots are provided, these will be found mounted behind an access plate or door on the front of the receiver cabinet.

The dot motions resulting from adjustment of the static convergence controls are illustrated in Fig. 5 (p. 10). It will be noted that the red dot moves diagonally on the screen, and the green dot moves on an opposite diagonal. Hence, there is a crossover point for the red and green dots, and convergence occurs at this crossover point. Two controls are required for the blue dot; the beam magnet (or pot) moves the blue dot vertically, while the blue lateral corrector moves the blue dot horizontally. By suitable adjustment of these four static controls, the *red*, *green* and *blue* dots can be brought easily to good convergence at the center of the screen. If the pattern is out of convergence at the top and bottom, and at the sides of the raster, one should not attempt to obtain final convergence at this time, but proceed to the purity adjustments.

Three groups of adjustments are utilized in obtaining field purity, as illustrated in Fig. 6 (p. 11). These comprise:

(1) Position of the deflection yoke on the neck of the picture tube.
(2) Adjustment of the purity magnets on the neck of the picture tube.
(3) Adjustment of the rim corrector magnets. (In some receivers, an electromagnetic rim coil is used for edge-purity adjustment.)

Purity adjustment conventionally starts with the red field. The red gun, as noted previously, draws the heaviest beam current, and is somewhat more difficult to adjust than the green and blue guns. To obtain the red field, the white-dot generator should be disconnected and the blue and green guns disabled. In some receivers, the blue and green grid leads from the socket of the picture tube can be unplugged from their amplifier termi-

nals, and inserted into grounding terminals to *ground out* the blue and green guns. In other receivers, the grid leads cannot be unplugged, but 100,000-ohm resistors can be shunted from the lead terminals to chassis to ground out the blue and green guns. In still other receivers, the blue and green screen controls must be turned to minimum to disable the blue and green guns.

The customer's brightness control should be advanced as required to obtain satisfactory brightness of the red field. We are now ready to proceed with purity adjustments. In most cases, the deflection yoke will have been adjusted correctly prior to delivery of the receiver; however, it should be kept in mind that inability to obtain good purity can be due to improper location of the yoke. The yoke is mounted on slot-hole brackets, so that it can be slid along the neck of the tube; the yoke can also be adjusted vertically, and it is essential that the yoke be centered concentrically on the neck of the tube.

The purity magnets consist of two flat ring magnets mounted face-to-face. Each magnet has a projecting tab, and when these tabs are rotated to fall together, the purity field is at a minimum value; the fields from the two magnets then cancel. When the tabs are rotated 180° apart, the fields aid, and maximum strength of purity field is exerted. Not only must the strength of the purity field be adjusted suitably, but the purity assembly as a whole must be rotated on the neck of the tube to obtain proper orientation of the magnetic field. Good *edge* purity is obtained finally by adjustments of the rim magnets, or the rim coil, as the case may be. (Yoke and purity-magnet adjustments serve to produce an uncontaminated red field, out to within an inch or two of the screen edges.)

On some receivers the rim magnets can be moved away or closer to the picture tube; on other models, the rim magnets can only be rotated in their holders. Adjustment of these rim magnets serves to obtain an uncontaminated red color field out to the extreme edges of the screen.

Circumstances will arise frequently, in which good color field purity cannot be obtained, no matter how carefully the purity adjustments are made. This situation results from residual magnetism in the picture tube, shield, supports, or chassis. To cure for this difficulty the affected part must be degaussed. Residual magnetism usually arises from careless handling of magnetized tools, *pm* speakers, etc.

Degaussing is accomplished by means of a degaussing coil, as illustrated in Fig. 7 (p. 11). The coil comprises several hundred turns of insulated magnet wire (about No. 24) wound into an air-core coil about 15″ in diameter, and connected to a 10′ lamp cord and plug. The completed coil can be taped up, and when completed appears like a large *doughnut*. Degaussing coils are commercially available, if the operator does not wish to construct a coil.

A degaussing coil is usually applied by holding it flat against the face plate of the receiver, and plugging the coil into a 117-volt *ac* outlet. The coil should be held in this position for about a half a minute, and then one should slowly back away from the receiver. When the coil has been removed six or eight feet from the receiver, it may be unplugged.

ASSOCIATIONS

ARTSD, Columbus, Ohio

At the thirteenth birthday meeting of the Associated Radio-Television Service Dealers' Association, held recently, the officers for '57 were installed. At the ceremonies were *Jack Voigt*, president; *Paul Herman*, vice president; *Leo Loudner*, treasurer, and *Don Sisk*, secretary. Members of the board of directors, also at the celebration, were *Bill Ware*, *Herman Francis*, *Harold Cashdollar*, *Don Blazer*, *Dick Lytle* and *John Graham*.

Herman Francis has been named chairman of the advertising, publicity and public-relations committee. *John Graham* was reappointed editor of the association's monthly news bulletin.

RTG, Long Island, N. Y.

At a recent monthly meeting, the Radio and Television Guild of Long Island endorsed the principle of licensing of TV repairmen.

Full support was withheld pending three considerations which association members said they consider essential for effective licensing:

1) The television service industry must be assured of full representation in the preparation of any licensing bill within the state of New York.
2) An active member of the TV service industry should be a part of any permanent commission that might be established to supervise licensing.
3) Before any local licensing bill is passed an attempt should be made to obtain state or at least county-wide licensing.

RTA, Pasadena, Calif.

Setting up of an insurance program for a small business involving liability, property, and life insurance needs of a TV service and sales operation, was covered in a special talk by an insurance expert during a recent meeting of the Radio-Television Association, Pasadena, Calif. Up-to-date information on the new all-risk floater commercial liability policies was presented.

Also offered was a report describing a plan to consolidate the ten Service Men's associations in the Los Angeles County area into a single area organization.

TEN YEARS AGO IN SERVICE

The first statewide convention, featuring a series of talks and an exhibit of test equipment, accessories and components, was announced by the Federation of Radio Servicemen's Associations of Pa. . . . The Radio Servicemen's Association of the Upper Catskill Mountain-Susquehanna Valley area held its first meeting in Delhi, N. Y. . . . In view of the interest in apartment house master-TV antennas, the educational committees of associations programmed clinics headed by industry experts to review the types of antennas that could be used and installation techniques required. . . . A cross-indexed volume control guide was issued by Clarostat Manufacturing Co., Inc. . . . A 12-page engineering data folder describing carbon and wirewound variable resistors was announced by P. R. Mallory and Co., Inc. . . . *P. R. Dawson* was named renewal sales manager of Tung-Sol. . . . *I. J. Youngblood* was appointed vice president in charge of sales of Clarostat Manufacturing Co., Inc.

UHF Oscillator Tubes

(*Continued from page 43*)

is not properly assembled. There are several methods to determine if a tuner is working properly. The plate current to the oscillator should be checked for all positions of the tuning elements. Most tuners require from 15 to 25 *ma*, and this varies from tuner to tuner. To determine if the oscillator is tuning smoothly and properly over the *uhf* band, the diode mixer current should be checked. The current should be essentially uniform over the tuning range and free of any *holes* or sharp current changes. Most tuners will function satisfactorily if the diode current is between 250 microamperes and 2 or 3 milliamperes throughout the tuning range.

Oscillator Activity Checks

If the coupling network between the oscillator and the mixer is questioned, the oscillator activity can be checked over the tuning range by measuring the oscillator grid current. It should be about the same magnitude as the diode mixer currents. In most cases, it is difficult to obtain a current test point for the grid current. If a *vtvm* is available, the grid voltage of the oscillator can be measured using a 1-megohm resistor in series with the meter lead. If the grid resistor is known, the level of grid current can be determined. In most tuners, the lowest oscillator activity and highest plate currents exist when the tuner is near the high frequency end of the spectrum. If a particular service area contains *uhf* channels near the upper end, the tuner must be carefully serviced to provide the proper operation for these channels.

It has been said that the 6AF4 has given poor performance compared to the other tubes in a TV set. The relative short life is due to several factors:

(*1*) Small cathode and plate dictated by the high frequency requirements.
(*2*) Abnormally high cathode currents necessary to provide sufficient activity from inexpensive tuning elements.
(*3*) Abnormally high cathode temperature to provide the necessary high cathode currents.
(*4*) Abnormally high plate dissipation resulting from high plate currents.
(*5*) For the reduction of oscillator radiation, excessive shielding restricts heat radiation from tube.
(*6*) Unusually tight requirements on the stability of tube characteristics.

All of these factors contribute to short life and poorer performance prior to tube failure.

When one thinks of the tube and service problems associated with *uhf* he must remember that only a few years ago commercial glass vacuum tubes were not considered acceptable for FM or *vhf* TV service. With the efforts being put forth by the tube and tuner manufacturers, and with good service practices in the local areas, *uhf* service should become as reliable as the present day *vhf* service.

Audio

(*Continued from page* 39)

less than one hour. With hand saws, it would have taken a couple of days.

To avoid cutting the paper jacket with the sawblade, the insulation was moved. The grilles were then fastened to the underside of the tiles, using 1½" oval-head chromium-plated woodscrews, which went through the tiles into the furring strips to which the tiles were nailed. Cup washers were used on the heads of the screws to improve the finish of the job. The speakers were placed over the holes in the attic. It was not necessary to fasten them down, since the replaced insulation served to cover them up and hold them in place, too. And no sound could be radiated from the rear. Thus, each speaker had an infinite baffle; the combination of celotex tile and rock-wool insulation prevents any sound from the back of the speaker reaching the front.

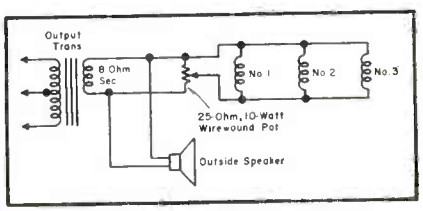
From the air-conditioner closet, speaker wiring (two-conductor plastic-insulated solid No. 20) was brought through a hole in the sheetrock wall to the back of the amplifier. On this job, a speaker-control panel was designed, using three of the selector switches which came with the speakers. This allowed the selection of any combination of speakers desired. However, later it was found best to provide all-room sound and so switching is no longer used.

Ten-Watt Amplifier

The amplifier used on this job was a 10-watt unit which, in addition to the regular input, featured an input for a radio tuner and crystal phono. As a radio set was on hand, connections were made from the speaker voice coil to the amplifier to allow radio programs to be fed into the system.

Fortunately, due to the low volume levels used, matching of the low impedance of the 3.2-ohm speakers to the 8 or 16-ohm output of the amplifier did not present a problem. A total of six speakers was used and connected in pairs; this developed a total impedance of around 2.1 ohms, and the 8-ohm tap on the amplifier was used. If it were necessary to produce a higher volume level, a better match (using individual matching transformers) would have been necessary.

In another installation made in a variety store, the owner wanted not only music fed to indoor outlets, but outdoors, too, to call attention to display windows. A fairly low level was desired inside, with a little more for



SPEAKER OUTPUT circuit in variety-store sound system. Outside speaker was connected directly to secondary and volume can be adjusted to level needed by master gain control of amplifier. Volume level of internal speakers, (1, 2 and 3) can be reduced by wirewound 25-ohm potentiometer.

the external speaker to override street noises. This was accomplished by installing a separate level control, so that the full amplifier output could be fed into the street speaker, while the indoor level could be turned down. A 25-ohm wirewound potentiometer was connected across the output and the three inside speakers were hooked up to the slider and the common terminal. Once again, while there was an obvious mismatch here, the results were satisfactory.

The amplifier used on this assignment was a straight 10-watt chassis, with a pair of 6V6's in the output, a 12AX7 as a phase-inverter-driver and another 12AX7 as a cascade preamplifier to provide enough voltage gain to operate the amplifier from a variable reluctance pickup or any other low-level cartridge. If one of the new high-output ceramics is used, a single triode may be substituted. A third 12AX7 was used as a degenerative tone-control stage. It was found to give sufficient control over bass and treble.

Amplifier Used As Radio

A circuit innovation on this amplifier made it possible to use the amplifier as a radio, too; thanks to a local station that provides a strong signal. A crystal diode in the input of the amplifier, linked to a vari-loopstick and a small trimmer for tuning, plus a section of fine wire for pickup, enabled us to obtain sufficient signal to operate the amplifier. A *spdt* switch permitted switching to radio or amplifier, only.

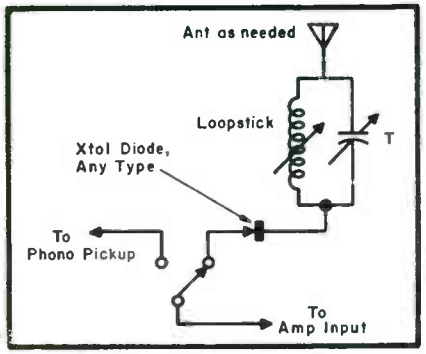
Speaker locations were different in this case. Three speakers were used to cover the area, and another in the front doorway. One was mounted at the rear of the store, another halfway up on a side wall, and the third part way down the opposite wall, nearer the front. With approximately the same level in each speaker, good coverage of the entire area can be obtained.

The Initial Survey

When making the initial survey to determine speaker locations and levels, it was found best to do this during normal working hours, when average noise levels were present. A check made after working hours, with machinery silent and customers and clerks gone, would be of no value.

If noise level is high, it is better to use more speakers running at lower volume to get the needed coverage, than to attempt to cover the same area with one or two speakers, driven to a higher level. The one or two-speaker

(*Continued on page* 56)



RADIO-PHONO switch on home-built amplifier using loopstick with trimmer, crystal diode and section of wire for pickup. A small transistor amplifier could be used here, if needed.

Audio

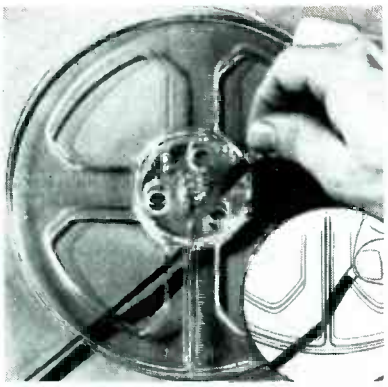
(*Continued from page 55*)

installation would only result in blasting near the speakers, and insufficient volume further away.

Baffles for the store speakers were plywood boxes. These can be made in the shop, using a sabre-blade saw to cut out round or oval holes, and also to cut the box walls to size, if need be.

Other Cabinet-Work Tools

Another very useful small tool for cabinet work is the vibrating-type sander[2]. These can be used to give a real professional finish to woodwork. Baffles may be painted, stained and varnished, or covered with plastic



QUICK-THREAD reel, designed to expedite loading of recording tape, supplied with 5" and 7" tape reels. Reel features a loading slot accessible at the outer edge of the reel. Tape is inserted in this slot and automatically guided to the hub. When loaded in this manner, it is claimed that the tape can be fastened without the fingers ever touching the reel. Each side of reel has an indexing area with a write-on surface to permit indexing of the reel. (Reeves Soundcraft Corp., 10 E. 52nd St., N. Y. 22, N. Y.)

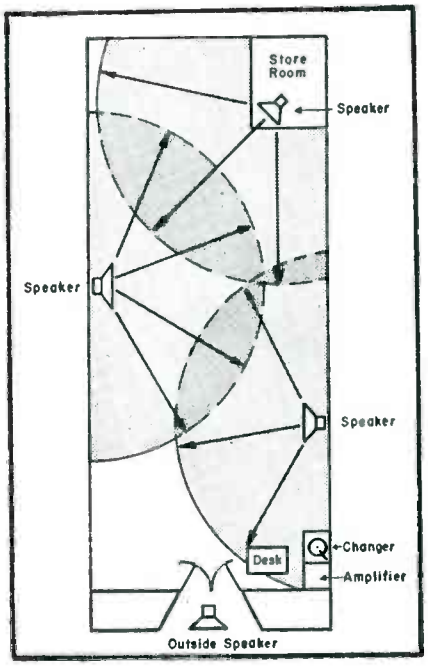
COAX 12" loudspeaker which is said to provide high flux density, low resonant frequency, and an elliptical cone tweeter. Uses a large Alnico V magnet and an 1-c **dividing network.** (CA-12; Sonotone Corp., Elmsford, N. Y.)

leatherette, as may be required.

To cover the speaker cutouts we used the metal grilles supplied with the auto-radio kits.

---

[a]*Wen or Weller.*



SPEAKERS in long narrow store building to provide adequate coverage. Semicircles indicate approximate distribution of each speaker. Amplifier and changer were located at front behind cashier's desk for convenience in operation.

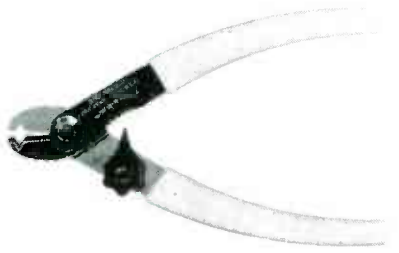
PHONO accessory merchandising unit. Products displayed include anti-static spray, anti-static wiping cloth, clip-on record brush that cleans grooves just ahead of the needle; anti-dust plastic record covers, and a sound kit with a stylus pressure gauge and turntable level to provide turntable and tone-arm accuracy. (Electrovox Co., Inc., 60 Franklin St., E. Orange, N. J.)

BENCH-FIELD TOOLS

WIRE STRIPPER-CUTTER

A WIRE STRIPPER-CUTTER, *Strip-Er-Clip*, with a safeguard said to prevent accidental nicking or cutting while wires are being stripped, has been introduced by Walsco Electronics Manufacturing Co., 100 W. Green St., Rockford, Ill.

Unit features a seven-stop gauge which adjusts to the correct wire size. Strips and clips all wires ranging from 14 to 26 gauge. Made of heat-treated tool steel. Jaws designed for use in cramped places.



SNAP-IN SHAFT DRIVER EXTENSION

A SNAP-IN SHAFT extension for Xcelite screwdriver and nut driver kits, said to provide an additional 6" reach, has been announced by Xcelite, Inc., Orchard Park, N. Y.

Shaft, 6" in overall length, has winged prongs on one end to fit into the socket of the combination handles of the Xcelite 99-PR and 99-JR sets. The other end of the shaft has a socket fastener like that in the handles to receive nut driver shafts and single-end screwdriver shafts in the kits.

SOLID JOINT PLIERS

TWO LONG-REACH solid joint pliers, a duck bill DB58 and a needle nose NN58, have been announced by Diamond Calk Horseshoe Co., Duluth, Minn.

DB58, an 8" duck bill plier, has a short nose and long handles. Enables user to grip objects in inaccessible places with little pressure on handles. Jaws are diamond scored.

NN58, an 8" long reach needle nose plier, also has diamond scored jaws. Nose is shaped for bending and making loops in wires.

INDUSTRY NEWS

WNBQ COLOR-COURSE MEETING

OVER 100 SERVICE MEN attended a recent color-TV course meeting at WNBQ-TV under the sponsorship of Allied Radio and RCA. Meeting featured a studio tour and lecture on color transmission. Reception problems and solutions were also covered by color experts.

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TV ACCESSORY CALIF. WAREHOUSING

THE COMPLETE LINE of Perma-Power TV tube briteners and voltage regulators is now being warehoused in Los Angeles and San Francisco. Sales in Los Angeles are handled by the Wes Alderson Co., 3050 Overland Ave., and in San Francisco by E. W. Brandt Co., 1355 Market St.

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NEEDLE TEST PROMOTION

ADVERTISEMENTS urging phono owners to check their present needle on a Duotone free needle tester have been scheduled for national consumer magazines by Duotone Needle Co., Keyport, N. J. Needle testers are available to Service Men from Duotone at no charge, according to Stephen Nester, company president.

° ° °

TV SET PLAN FOR SERVICE MEN

A MERCHANDISING PLAN, featuring a direct approach from factory to Service Men for the sale and service of TV sets, has been announced by the American Television and Radio Co., 300 East Fourth St., St. Paul 1, Minn.

According to *Albert Goffstein*, ATR general manager, the plan was introduced because the company believed that they could reach quality TV-set buyers through the TV Service Man, since the Service Man, by recommendation, based on his intimate knowledge, can influence and make a sale without too much selling effort.

The program provides for the franchising of selected TV Service Men, the number per city depending on population; it is estimated that one Service Man will be certified per each 25,000 population.

70th Birthday Celebration

JULIUS FINKEL, president of JFD, who will be guest of honor at a 70th-birthday testimonial dinner at the Hotel Commodore in New York City on March 30. Proceeds from the dinner will be used for the establishment of the Julius Finkel Free Loan Fund in Israel.

Transistor Portable

(*Continued from page* 13)

emitter current flows through the mixer-emitter resistor. This current is almost invariant over the tuning range and is rather substantial compared with the mixer current, thus serving to clamp the mixer operating point.

Antenna: The receiver antenna, a ferrite cored coil (loop), has a core that is a 4⅛" x ¾" x ⅜" ferrite slab upon which the coil is directly wound. The free *Q* at 600 kc is 215-300 and at 1200 kc it is 140-200. The secondary is bifilar wound with the low end of the loop coil to achieve as high a coupling as possible. The turns ratio was chosen to match the high tuned impedance of the loop to the low input impedance of the mixer at approximately mid-band. Performance over the remainder of the band is not appreciably affected.

Intermediate Frequency Amplifier: There are three *if* interstage coupling networks in this circuit; they are single-tuned circuits with substantially unity coupling between primary and secondary. To achieve this high degree of coupling, the secondary is bifilar wound with the start of the primary. The coil is completely enclosed in ferrite cups, and an adjustable ferrite slug is used to align the circuits to 455 kc. Thus, the high permeability, low-loss magnetic circuit simultaneously achieves close circuit coupling and high *Q*. The coil assembly, with an encapsulated silver-mica tank capacitor, is mounted on a phenolic terminal board, and the whole enclosed in a copper shield can. The first and second *if* transformer shields are ½" x ½" x ⅝"; the third *if* transformer shield is ½" x ½" x 1⅛". The taller shield is required because of the inclusion of the diode and first diode filter capacitors in this shield.

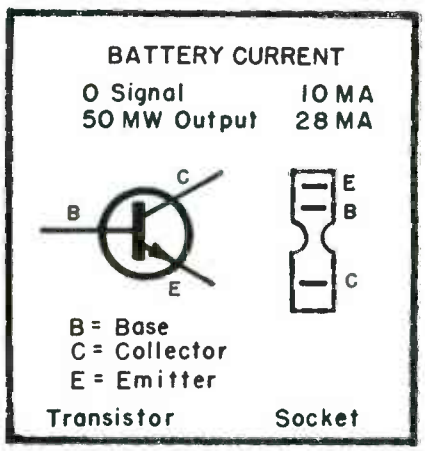
The impedance levels into which these circuits work are radically different. The output impedance of the mixer is about 100,000 ohms, and the input impedance of the following transistor about 800 ohms. Since the unloaded *Q* of the tuned circuit is 150, and the total tuning capacitance 160 mmfd, the unloaded tuned impedance at 455 kc is 325,000 ohms. To match the 800-ohm input impedance, therefore, a primary-to-secondary turns ratio of 20 is required. The effective tuned circuit impedance is thus halved, and to match the 100,000-ohm output impedance of the mixer about 80% of the primary turns are in the collector circuit.

In similar fashion the other tuned circuits are set up. For the second *if* tuned circuit the output and input impedances of the first and second *if* transistors are 30,000 and 600-ohms, respectively. With an unloaded tuned impedance of 240,000 ohms, the primary-to-secondary turns ratio is again 20, and only half the primary turns are in the collector circuit.

The third *if* transformer circuit is still different. The second *if* transistor output impedance is 20,000 ohms and the diode circuit impedance is 4000 ohms. With an unloaded tuned impedance of 80,000 ohms, the primary-to-secondary turns ratio is again 20, and the collector circuit is connected across 70% of the primary turns to obtain the required match.

Under the foregoing matching conditions, the effective operating circuit *Q*'s are considerably lower than the unloaded *Q*'s. For the first and second *if* transformers, the operating circuit *Q*'s are about 35; for the third transformer it is about 30. Actually, all adjustments finally must be made experimentally and the actual turns ratios and tapping points usually differ somewhat from the calculated values.

The third *if* transformer will bear some further explanation of its construction. In the process of demodulation, fairly strong second and third harmonics of 455 kc are generated. Because of circuit layout or proximity of components, these harmonics may couple into the mixer circuit. When this occurs, either oscillations or strong whistles (tweets) may be produced when the receiver is tuned through 910 or 1365 kc. Considerable effort was expended in printed-wiring panel layout to alleviate this difficulty. Inclusion of the diode and



TRANSISTOR SOCKETRY and current at terminal points.

first diode filter capacitor in the shield accomplished the final reduction of these spurious responses to an acceptable level.

Neutralization: As is well known, the grounded-emitter transistor configuration is the dual of the grounded-cathode triode. Consequently, most of the problems encountered in the early days of radio in building stable, high-gain, high-frequency amplifiers are with us again. Shielding, circuit isolation, and neutralization all play prominent roles once more in transistor receiver design.

Since the transistor is a two-way device, unilateralization is an essential requirement. Complete unilateralization, however, is not attempted; neutralization of the resistive component of the feedback is not employed because of its relatively low magnitude compared to the capacitive component. The capacitive component is neutralized by a series *rc* network, similar to the Rice neutralization method employed for triodes in the early days of the radio industry. Since the primaries of the second and third *if* transformers are approximately center tapped, the values of the neutralizing capacitance are of approximately the same magnitude as $C_{b'c}$, the collector-to-base feedback capacitance. The series resistors are used primarily to adjust the magnitude of the feedback voltage, and also to some extent, its phase. Properly neutralized, the tuned circuits may be aligned without reacting one upon the other, and with minimum change of input impedance with *agc* voltage.

Automatic Gain Control: In this transistor model, *agc* is obtained from the second detector in a manner analogous to that used in tube receivers. Detection can be performed with either diodes or transistors, but the advantages of a transistor detector were more than counterbalanced by its cost. Transistor gain may be controlled either by changing the emitter current or collector voltage. Both methods require control power, and hence *agc* is a more difficult problem with transistor amplifiers than with tube amplifiers. In this case emitter control is used. The control voltage from the diode detector is applied to the bases of the converter and first *if* amplifier. The resulting changes of base *dc* are amplified with consequent large changes of emitter current and gain. The second *if* amplifier is not controlled, to achieve a high level *if* output for linear detection, and simultaneously, sufficient power from the diode to satisfy the *agc* requirements.

Audio System: The audio system has two stages of amplification. The first stage is a high-gain, low-power-level, low-impedance driver amplifier working directly out of the second detector. The second stage is a high-gain, high-power-level class-*B* push-pull output amplifier driving the speaker. The driver is transformer-coupled to the output stage, and the latter is transformer-coupled to the speaker. Miniature type audio transformers are used.

Both output and driver transformers are wound on 1" x ¼" high-permeability laminated cores. The push-pull windings of both transformers are bifilar wound to achieve tight coupling and minimize the generation of crossover transient voltages when operation of the push-pull stage shifts from one transistor to the other. Since the output impedance of a class-*B* stage is a direct function of the power output, determination of the primary load impedance is a simple matter. The transformer primary impedance is calculated directly from the available supply voltage and required power output. The secondary impedance, of course, is matched to that of the speaker voice coil, which is 6.4 ohms.

Design of the driver stage transformer is considerably more complex, in view of the fact that maximum power gain and efficiency require primary and secondary matching. This condition, however, is seldom the prerequisite for acceptable distortion and is therefore not desirable. Low distortion without too much loss in gain can usually be achieved by a deliberate mismatch between the driver transformer secondary and the class *B* input circuit. An acceptable compromise is to specify a driver transformer secondary impedance to match the input impedance, determined by a measurement of the peak-driving voltage and peak-input current.

Other compromises, primarily sacrificing efficiency, are imposed upon the circuit designer to achieve stability and acceptable tonal quality.

The class-*B* output stage is subject to severe crossover distortion and thermal runaway. Crossover distortion is reduced by using sufficient forward bias, one to two milliamperes per transistor, to move the composite transfer characteristic out of the non-linear region, so that collector current does not approach cutoff. In other words, the output stage operation now tends toward class AB_2 rather than class *B*. Thermal runaway is controlled by the insertion of 8 to 10 ohms resistance in series with the emitters so as to decrease forward bias with increasing current. Further control is imposed by shunting a thermistor across the voltage divider resistor setting the forward bias.

COMPONENTS

PLASTIC ENVELOPE CERAMIC-MICA PACKAGE

A TRANSPARENT PLASTIC-ENVELOPE package for ceramic and mica capacitors, mounted on a printed index card whose tab indicates type number, voltage and capacitance, has been introduced by the Aerovox Corp., New Bedford, Mass.

Flap of plastic envelopes can be opened to remove one or more capacitors.

* * *

CARBON RESISTOR KIT

A PACKAGED CARBON RESISTOR kit, 5245, containing 30 plastic boxes of more than 80 of the most used ½, 1 and 2-watt values and including an all-metal bench or wall rack, has been made available by G-C Electronics Manufacturing Co., 400 S. Wyman St., Rockford, Ill.

* * *

ADMIRAL FLYBACK REPLACEMENTS

TWO REPLACEMENT flyback transformers, for use in Admiral TV receivers, have been announced by Rogers Electronic Corp., 49 Bleecker St., New York 12, N. Y.

Model *EFR 165* replaces Admiral part numbers 79D65-1, 2 and 4; model *EFR 166* part number replaces 79D65-3.

* * *

COAXIAL CONNECTOR

AN *rf* COAXIAL connector, *TRU-862*, said to eliminate need for extra switching in many *rf* and video applications, has been developed by Tru-Connector Corp., 416 Union St., Lynn, Mass.

Uses a quick-disconnect small connector that incorporates a single pole, double-throw switch.

* * *

CONVERSION KITS

FOUR KITS, for conversion from metal to all-glass picture tubes in older 21" TV sets, have been introduced by Colman Tool and Machine Co., Amarillo, Tex. Kit *C-6* has been designed for Wells-Gardner, Airline, Truetone, Firestone, Coronado, and Arlington sets; *C-7* for Arvin and Silvertone models; *C-8* for RCA 27" sets; and *C-9* for Crosley models.

* * *

GE YOKE REPLACEMENTS

FIVE REPLACEMENT YOKES, for latest model GE chassis, have been announced by Merit Coil and Transformer Corp., 4427 N. Clark St., Chicago, Ill.

Model *MDF-83* replaces GE part number RLD-013; *MDF-84* RLD-025; *MDF-85* RLD-041, -045; *MDF-86* RLD-042; and *MDF-87* RLD-052-067.

* * *

FLYBACK-DEFLECTION YOKE REPLACEMENTS

REPLACEMENT TV COMPONENTS for Airline, Coronado, Firestone, Hoffman, Raytheon and Truetone chassis have been announced by Chicago Standard Transformer Corp., 3501 W. Addison St., Chicago 18, Ill.

ADVERTISERS IN SERVICE
MARCH, 1957

TEST INSTRUMENTS

RC SUBSTITUTION BOX

AN RC SUBSTITUTION unit, *Handy* 36, has been announced by the Service Instruments Corp., 171 Official Road, Addison, Ill.

Unit contains 36 of the most often needed resistors and capacitors, including two large electrolytics. Each component can be individually switched so that it can be substituted for a suspected faulty part. Each part in the tester can be replaced individually if they should become defective due to excessive voltage or current. The unit is completely isolated.

RACK-MOUNTING DC POWER SUPPLY

A RACK-MOUNTING *dc* power supply, *NFAR*, featuring a panel for either permanent or semi-permanent rack mounting, has been announced by Electro Products Laboratories, 4500 N. Ravenswood Ave., Chicago 40, Ill.

Unit is said to produce filtered power with less than ¾% ripple at top load. A continuously variable source for voltage from 0 to 32 for current loads from 1 to 15 amps is provided. Other features include a circuit breaker and full-view meters.

TV Servicemen's Week Plaque

Plaque being distributed as part of the promotion plans for March 25 to 30 National Television Servicemens Week instituted by the RCA Tube Division.

PERSONNEL

TOM BROWN has been named distributor sales manager of Oxford Components, Inc., distributor division of Oxford Electric Corporation. *Brown* replaces *V. E. Wollang*, who resigned to join a midwest sales rep organization.

Brown

Atcherley

E. P. ATCHERLEY is now assistant to the sales manager for distributor sales, electronic products, of Sylvania Electric Products, Inc.

° ° °

IRVING I. SER is now general sales manager of Astron Corp. *Mario A. DeMatteo* has been appointed assistant sales manager. *Herman C. Bloom* has been named distributor sales manager.

Ser

DeMatteo

Bloom

Carpenter

DOUGLAS H. CARPENTER Co. has been appointed national sales rep for the Century Electronics Company line of TV test instruments.

° ° °

WILLIAM E. WHITTAKER, formerly technical service supervisor of Du Mont, has been appointed service manager for the receiver division of Allen B. Du Mont Laboratories, Inc. *Whittaker* will be responsible for service nationally on Du Mont TV receivers, phonographs, and radios.

° ° °

CHARLES R. OCHS has been appointed administrator of advertising and sales promotion for the RCA components division.

You are cordially invited to visit the SERVICE booth (4512-Fourth Floor) During the IRE National Convention-Radio Engineering Show At the New York Coliseum, N. Y. C. March 18 to 21

The Mighty Nine

TRIPLETT

TRIPLETT ELECTRICAL INSTRUMENT COMPANY
Bluffton, Ohio

Over a half-century of experience

Not once upon a time . . .

Right now the mighty nine Triplett VOMs stand out like giants.

For every application and in every price range there is a Triplett VOM exactly suited to you.

53 years reputation guarantees quality you can accept without question.

No other manufacturer offers so many and so much.

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"Authorized RCA Electron Tube Dealer"?

Ask your RCA distributor how *you* can enjoy the prestige and profit of this powerful service dealer program. It will pay you to check into the requirements at once—and identify yourself and your shop with the greatest name in electronics—RCA. Once you qualify, you can use the arsenal of promotion materials prepared exclusively for "Authorized RCA Tube Dealers"—outdoor and indoor signs, displays, direct mail, newspaper ad mats, radio scripts, decals —everything to tell your customers you're an "Authorized RCA Electron Tube Dealer"!

RCA RADIO CORPORATION of AMERICA
Tube Division, Harrison, N. J.

3rd Annual NATIONAL TELEVISION SERVICEMEN'S WEEK March 25-30

This is RCA's annual salute to its business partners—the TV-Radio Service Technicians of America. Big color ads in March 23rd issues of TV Guide and the Saturday Evening Post, and March 25th issue of Life—tributes on NBC network radio and TV shows, including March 16th TV Emmy Awards program and March 23rd Perry Como show. Be sure to have all your customers and prospects tune in these gala shows to see your NTSW tribute.