

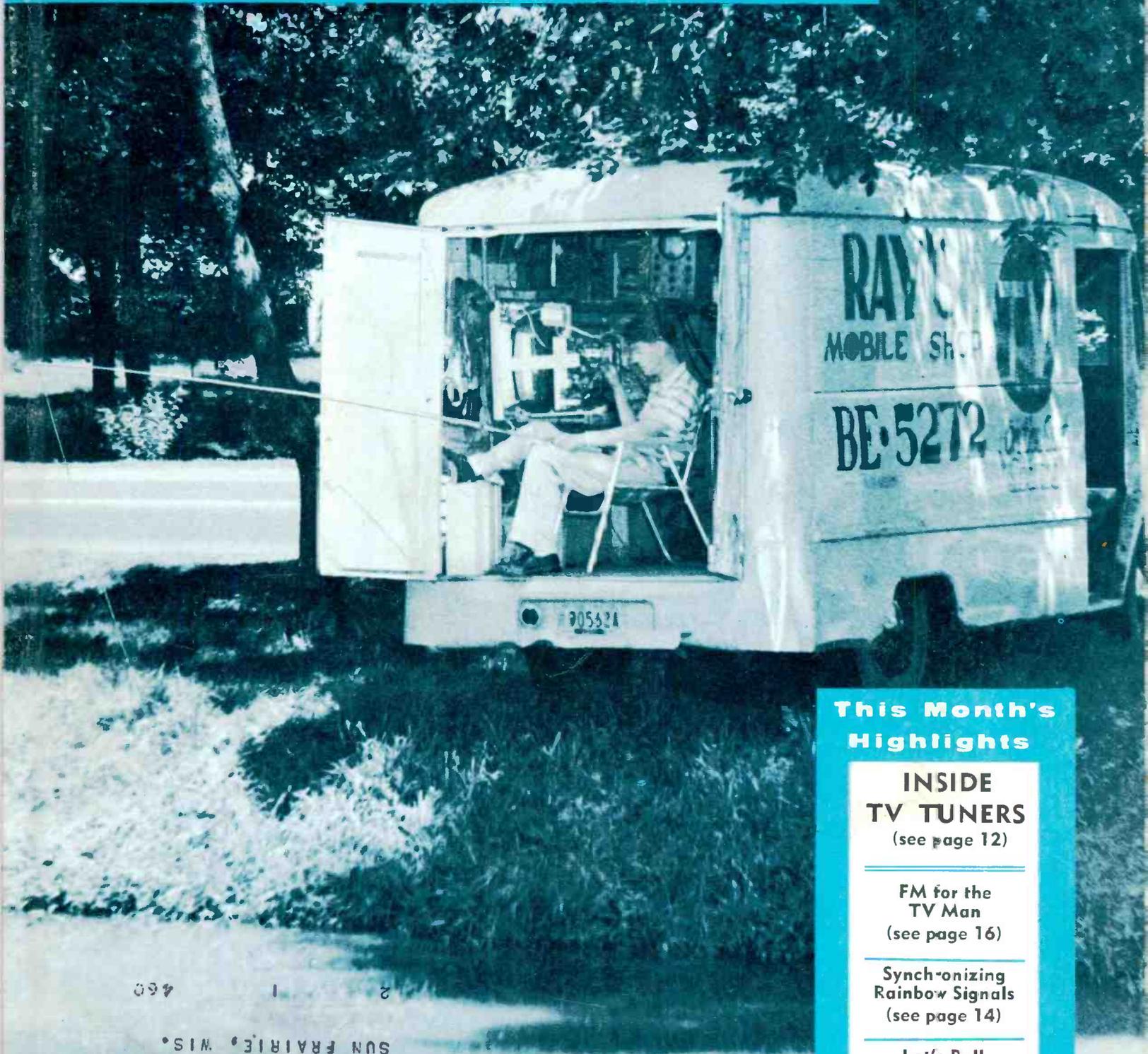


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# REPORTER

FOR THE ELECTRONIC SERVICE INDUSTRY

AUGUST 25 CENTS



## This Month's Highlights

### INSIDE TV TUNERS

(see page 12)

FM for the TV Man  
(see page 16)

Synchronizing Rainbow Signals  
(see page 14)

Let's Pull Less Chassis  
(see page 21)

460 1 2

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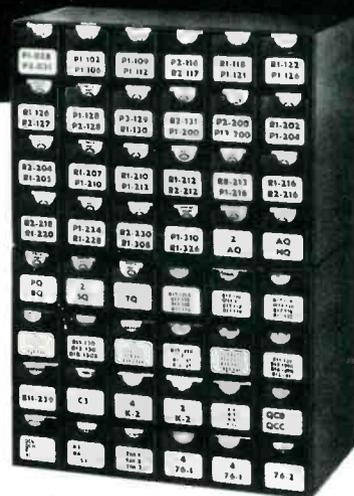
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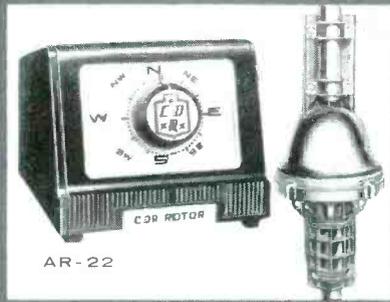


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Dept. 362, 401 N. Broad St., Phila. 8, Pa.

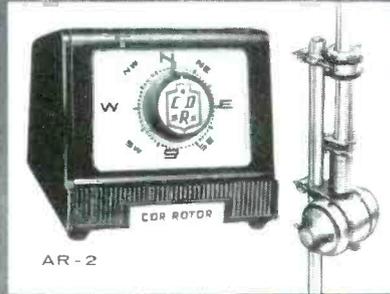
In Canada: International Resistance Co., Ltd.  
Toronto, Licensee

*give them*



AR-22

*what they want...*

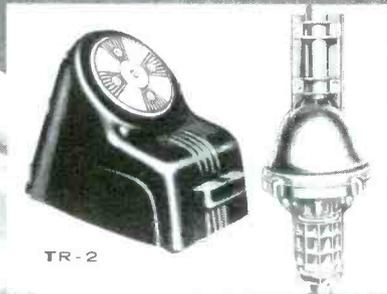


AR-2

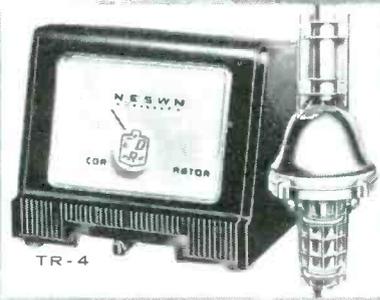
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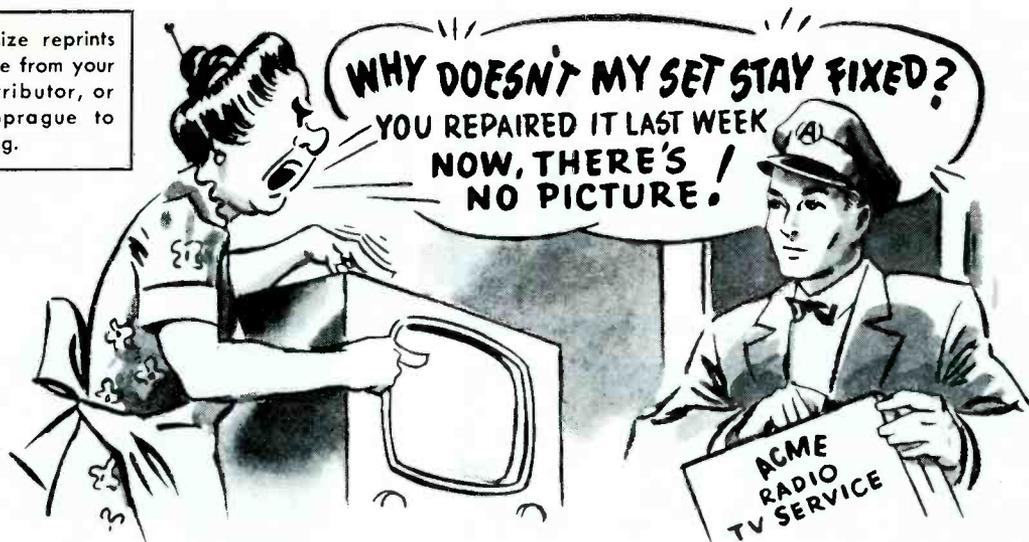


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Such a thing is easier to understand because most of us are more familiar with automobiles than with today's highly complicated TV and radio sets. But such unconnected troubles occur in TV and radio nevertheless—and because they are

so hard to explain in non-technical terms, it is always embarrassing to your service technician when they do.

His continued business existence is based on gaining the full confidence of you and other set owners like you. He isn't in business to "gyp" you or to overcharge you. His success is based on doing each and every job to the level best of his ability, at a fair price for his skilled labor. It's only when you patronize the shops that feature "bargains" at ridiculously low prices that you need worry. Good radio and TV service can't be bought on the bargain counter! Set owners who recognize this aren't likely to get "gypped."

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North Adams, Massachusetts



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## next month

### BASIC INDUSTRIAL ELECTRONICS

The first of a series, Part 1 covers  
the major differences between indus-  
trial and radio-TV servicing, includ-  
ing variations in the related sche-  
matic symbols.

### SERVICING HORIZONTAL-OUTPUT AND HIGH-VOLTAGE SYSTEMS

A detailed coverage of various  
horizontal sweep-circuit designs,  
plus the trouble symptoms and serv-  
icing hints applicable to each type.

### ESSENTIALS OF TAPE-RECORDER SERVICING

Information to guide the techni-  
cian in recognizing and repairing  
troubles in home tape recorders.

### BASIC PROPERTIES OF THE COLOR SIGNAL

An article dealing with the uses  
of color-bar generator signals in  
troubleshooting a color receiver.

VOLUME 7, No. 8



AUGUST, 1957

# PF REPORTER

FOR THE ELECTRONIC SERVICE INDUSTRY

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USE HANDY CARD AT BACK TO ENTER YOUR SUBSCRIPTION

# Sylvania

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# TV Tuner

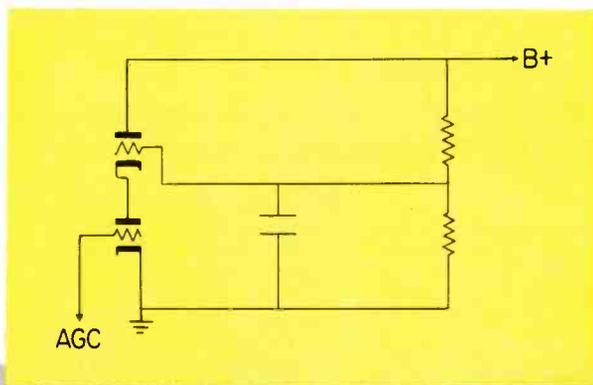
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# Tubes

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“R-X metered” at



Simplified schematic is a typical cascode circuit in which double-triode amplifiers are tested for transconductance and plate current under actual operating conditions. In this way, Sylvania offers you maximum assurance of proper circuit performance when you repair TV tuners. Regardless of make or model TV, Sylvania tuner tubes mean dependability backed by industry's most exhaustive dynamic testing program.

Type by type, Sylvania's own JEMC (Joint Engineering and Manufacturing Committee) establishes test conditions which represent the most realistic measure of a tube's ability to stand up in the sets you service. Their working knowledge of the needs of TV tuner manufacturers eventually means greater service profits through less call-backs for you.





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applications in TV sets. Cascode types are subjected to series Gm and series Ib tests in typical circuits. In addition, all types are checked both before and during life tests for serviceability at high and low line voltages.

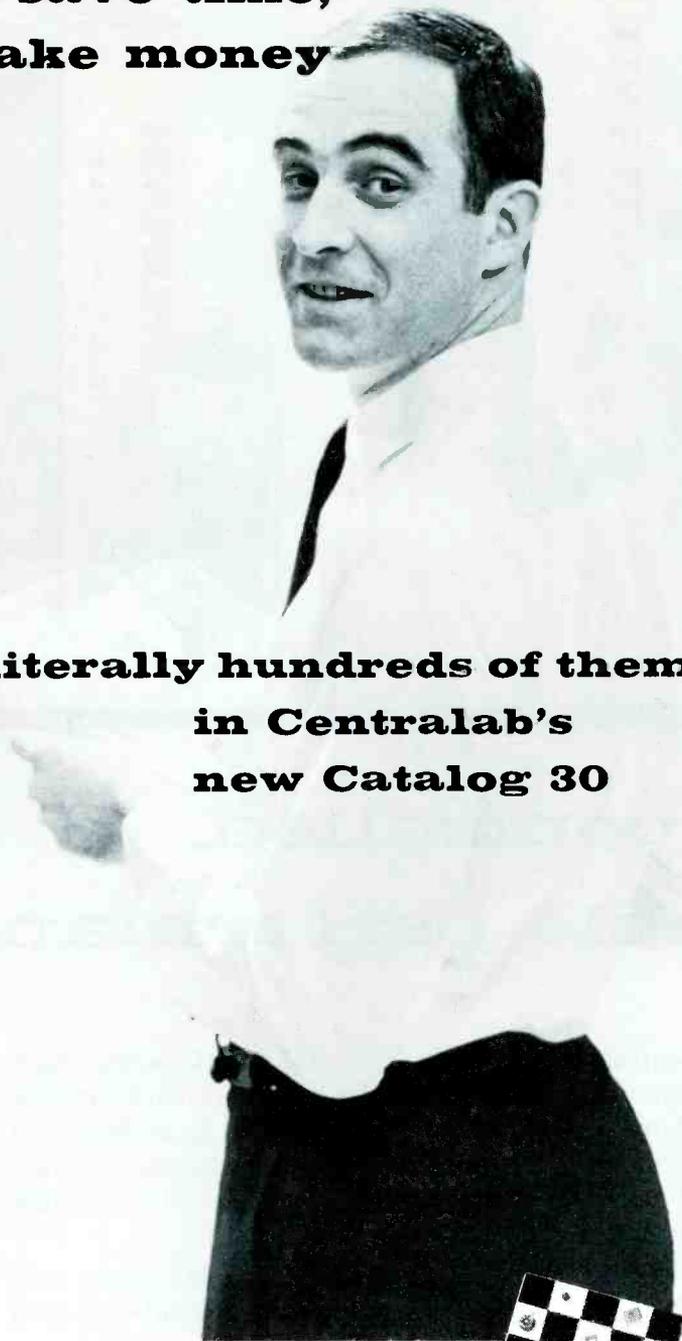
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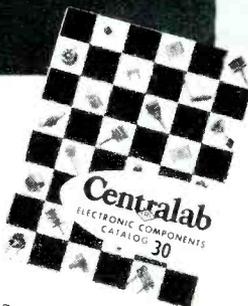


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*Letters to the*

**EDITOR**

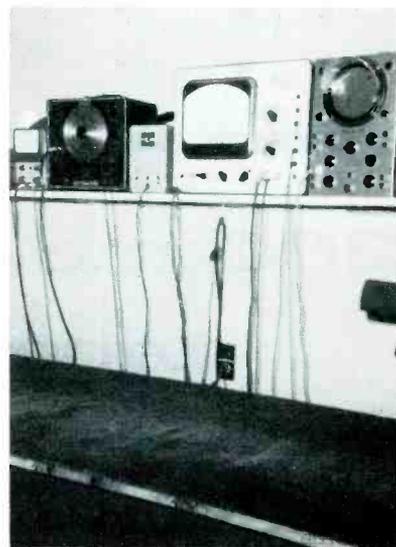
Dear Editor:

Over a period of years, various magazines have presented several suggestions for dealing with the maze of test leads which clutter the work bench. One method was presented on page 32 of your June issue.

Modestly, I believe I have the best solution yet. As you can see from the accompanying photo, the work bench is pulled out from the wall about 8", and the leads are simply dropped between the wall and the bench.

H. E. SANDERS

Sanders' TV Service  
Rock Hill, S.C.



*An excellent idea, Mr. Sanders, and one we are sure our readers will find helpful. As a further improvement, why not add some sort of trim along the back edge of the bench to prevent tubes, tools and miscellaneous items from being pushed back and off the bench?*  
—Editor

Dear Editor:

The article "Troubles in Video Amplifiers, DC Restorers, and Picture Tubes," which appeared back in your November 1955 issue, is in my estimation the best you have ever published. I use it over and over again.

I have a Philco receiver that has a very clear picture but there is a light spot along the left edge. What causes this?

WILLIAM J. HEFHEINZ

Tallahassee, Fla.

PF REPORTER • August, 1957

A bright line along the left side of a TV picture is generally due to some malfunction in the damper circuit—perhaps caused by a faulty damper tube; misadjusted horizontal drive, linearity or width control; or by a faulty boost filter capacitor. Incidentally, some of our newer readers may be interested in knowing that back copies of many issues—including November, 1955—are available at only 35¢ each.—Editor.

Dear Editor:

In "Shop Talk" in the June issue, diagrams for Figs. 3 and 4 were apparently reversed. Trying to find that demodulator in Fig. 3 gets to be pretty rough, son!

MORRIS MILLER

Florence, Texas

Thanks, Mr. Miller, for pointing out our "goof." Our proofreader is now "persona non grata,"—in the doghouse, that is.—Editor

Dear Editor:

In your April issue, page 30, you showed a picture of a record-changer support rack. Who makes it, and where can I buy one like it?

EDWARD GAMBA

Gamba's TV Service  
Concord, Calif.

Dear Editor:

... where can I obtain a "Turntable Support Rack" as pictured?

RONALD C. GREENWOOD

Seattle, Wash.

The particular rack pictured became a part of our lab equipment several years ago and is no longer available; however, similar racks are available from General Cement (Model 5205) and JFD (Model 79-3).—Editor

Dear Editor:

I prefer white diagrams on a colored background. Why not brighten up the pages of your magazine as you have been doing, instead of taking advice to go back to the old black and white?

Ed Dew

Alki TV  
Seattle, Wash.

Thanks for your comments, Mr. Dew. Actually, to insure both readability and attractiveness, we will continue to present schematics in one of three different ways: black and white; in reverse; and overprinted with a color screen.—Editor

August, 1957 • PF REPORTER

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...the odds are 4 to 1  
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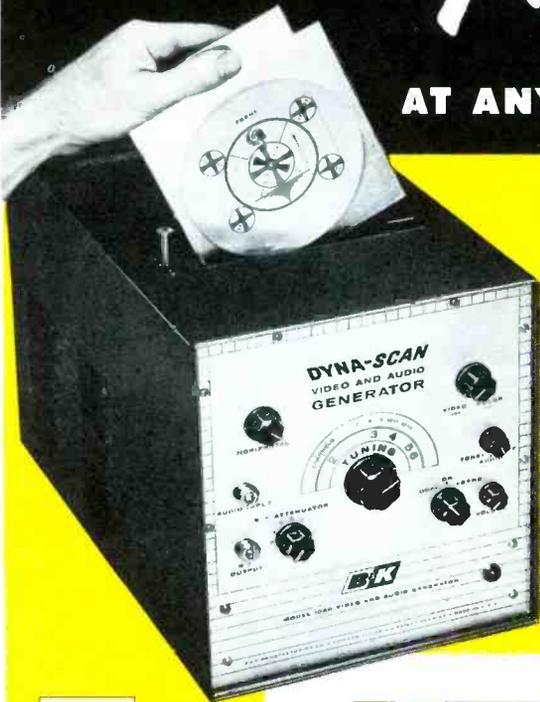
Ask your Centralab distributor about these versatile controls. Complete information on these and other top-quality Centralab components can be found in Centralab's new catalog 30.

**Centralab**

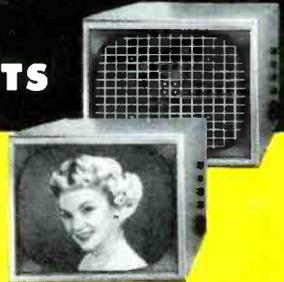
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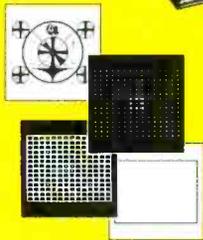
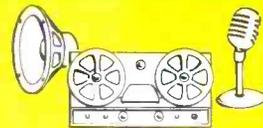
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Provides FM sound carrier. Has built-in audio tone generator plus input for tape, tuner, mike



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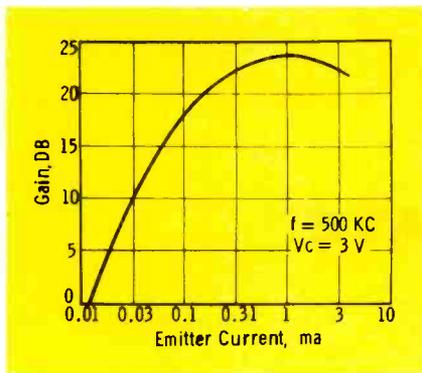


Fig. 1. Common-emitter amplifier gain as a function of emitter current.

### AGC for Transistor Circuits

The purpose of AGC is, as we know, to regulate the over-all gain of a system so that the output signal amplitude will be as steady as possible. AGC is employed in every commercial receiver, regardless of cost, and when transistor receivers were developed, they too possessed an AGC circuit. Because transistors are current-operated devices, however, regulation of transistor gain means that current must be supplied by the AGC circuit, and this, in turn, means that power must be expended. Because of this latter requirement, some of the methods which are employed in transistor receivers differ markedly from the control methods found in vacuum-tube receivers.

One of the most popular methods of varying the gain of a tran-

sistor is emitter-current control. Fig. 1 illustrates how the gain varies for a common-emitter amplifier as the emitter current is varied. It can be seen that a fairly sizeable current variation is required if a relatively wide gain characteristic is to be achieved. When a class-B detector is employed, the necessary current variation is obtainable. A commercial circuit utilizing direct emitter current control of several IF amplifiers is shown in Fig. 2. Note that there is a direct connection between the emitter of the detector and the emitters of the controlled stages.

The second detector X3 is biased close to cutoff so that with no received signal, very little current will flow from emitter to collector. The stage uses an n-p-n transistor, so current flow is carried out principally by electrons.

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

**MILTON S. KIVER**

In the outer circuit, electrons will travel from the collector to the 9-volt battery through the volume control, and from the negative terminal of the battery, via ground and C1, to the emitter. Thus, a voltage will be established across C1, its value depending upon the amount of current through X3, rising when the current increases and falling when the current decreases.

This voltage, which is positive, is applied to the emitters of the two IF stages. The transistors in these stages, being of the n-p-n variety, possess an input bias which makes the base positive with respect to the emitter. However, the AGC voltage, which is brought to these stages via R1 and R2, is positive; and since it is applied to the emitters, it will tend to work against the normal bias. Hence, when the signal increases, more current will flow through X3 and more voltage will be developed across C1. This, in turn, will reduce the current passing through X1 and X2 and decrease the gain of these two stages.

R1 and R2 are unequal in value, producing a larger control current at X1 than at X2. This is a normal practice, since the signal is greater at X2, and too large a correction at X2 could lead to excessive distortion on strong signals.

### Controlled Stage as AGC Amplifier

The foregoing method of control, as previously stated, requires a relatively large variation in current. This means that a class-B

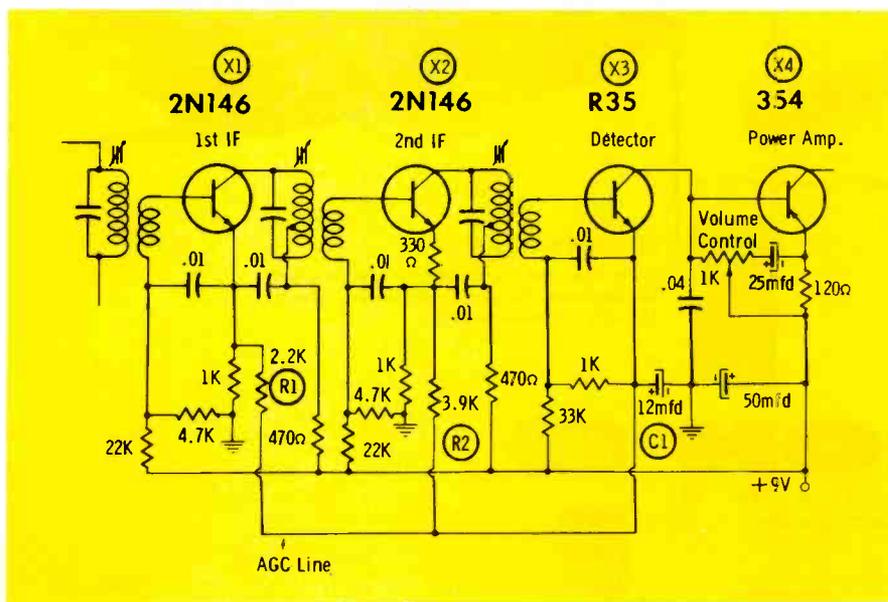


Fig. 2. A Motorola circuit employing direct emitter-current control for variation of gain.

• Please turn to page 50

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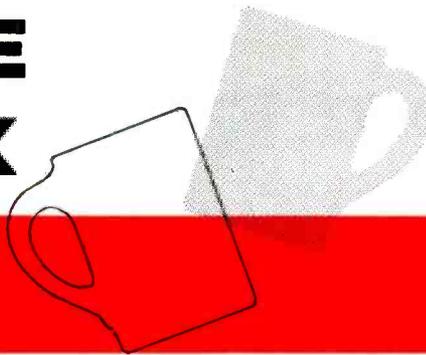


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# COFFEE BREAK

by Verne M. Ray



## Bud Tackles His First Color Set

At the coffee shop one morning, Tony barely had time to get seated before Bud blurted out, "The next time you send me out on a color set, you might at least forewarn me! I didn't have a color-bar generator or anything."

"Color set!" Tony stammered. "Gee whiz, I'm sorry, Bud. I completely forgot that the Johnson's have a color set now. I suppose she didn't mention it when she called because she assumed I'd remember."

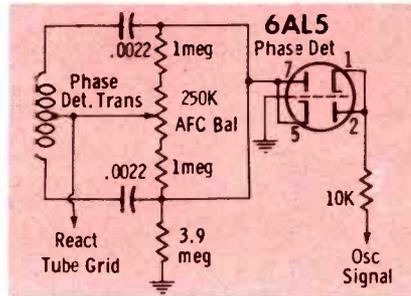
Bud's eyes twinkled as he said, "Don't let it worry you, old pal—everything's all taken care of. You're looking at a color expert, man!" Bud was certainly in his glory. Even though he had attended several clinics and read many articles dealing with color TV, this was his first encounter with an ailing color set.

Tony sipped his coke thoughtfully. "Well, I'll be darned," he remarked finally. "So your book learning paid off, eh? Say—what did Mrs. Johnson say when you showed up instead of me? I think she expected me to make the call."

"Now that you mention it, she did act sorta funny when she met me at the door," Bud said as he reconstructed the scene in his mind. "I guess she was surprised to see me. The biggest surprise, though, was when I got my first look at the set!"

A worried look momentarily flashed across Tony's face as he said, "I hope you didn't let Mrs. Johnson know that you were unaware of the situation."

"I didn't," Bud assured, "but I was a little afraid of fumbling somewhere and giving myself away. To distract her attention, I asked her to look in the paper and see what was being transmitted in color. Meanwhile, I got the set turned on and was able to tune in



a reasonably good picture."

"That was smart thinking, Bud," Tony complimented. "What was the complaint, anyway? She didn't say much of anything over the phone."

"I wasn't able to get any color on the set for a while," said Bud. "A generator sure would have come in handy. Luckily, the program on channel six was in color, and I finally got it to show up after reorienting the antenna with the rotator. That's when the real trouble became apparent—loss of color sync. You know, a black-and-white picture with color stripes running diagonally across the screen."

Tony moaned, "Oh brother—you sure didn't get an easy one. There must be at least five stages that could cause that trouble."

"Yeah," Bud agreed, "that's what I was thinking when I first saw the symptoms. The old black-and-white theory really came in handy, though," he said as they started back toward the shop.

Tony didn't get the connection. "How is that, Bud?" he asked. "Seems to me you were dealing with circuits that have no counterparts in monochrome sets."

It wasn't often that Bud had a chance to lord it over Tony. A smile creased his face as he said, "True enough, but there is a similarity in symptoms. You know how you can tell whether the trouble is in the oscillator or sync stages when a picture isn't locked in horizontally. If the diagonal

lines are steady, the oscillator is synchronized—but at the wrong frequency. If they change in number and move around, the oscillator frequency is drifting, indicating loss of sync."

Tony was genuinely impressed. "Bud, I've got to hand it to you. As far as color sync goes, I never broke it down that way—but I can see that it sure would help. Which condition did you find?"

"Luckily," said Bud as they walked into the shop, "this one was merely off frequency, or I probably would have had a lot more trouble. I hoped that a simple adjustment might take care of it and immediately thought of the AFC balance control in the diode phase detector circuit. I got the back cover off and adjusted the control. The number of lines changed slightly, but I couldn't get the color to lock in. That's what gave me a clue to the cause of the trouble."

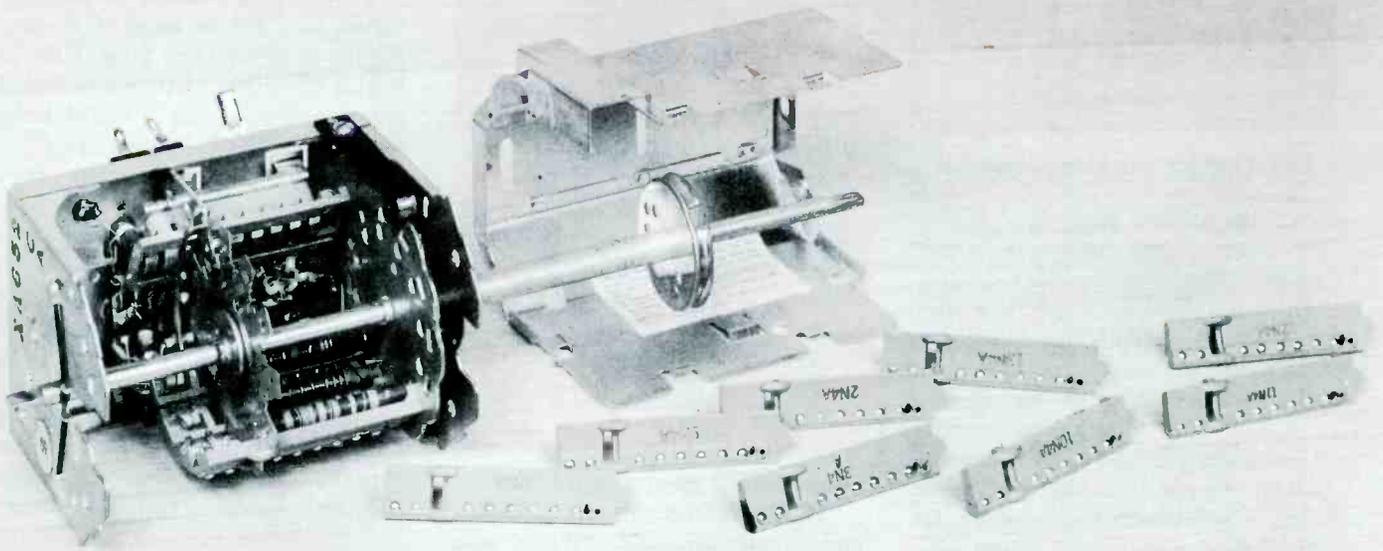
Bud pulled a schematic out of the file and pointed to the AFC balance control. "You see, this control must be set to balance the voltages across the two diode load resistors so that the proper correction voltage will be applied to the reactance-tube grid. Naturally, if adjustment of the control doesn't correct the oscillator frequency, one of the diode circuits is likely to be defective. So I changed the 6AL5 tube, readjusted the balance control and the color snapped in as pretty as you please. Total time in the house was about 40 minutes."

Tony threw his arm over Bud's shoulders. "Good work, Bud," he said sincerely. "Not much point in asking if Mrs. Johnson was satisfied."

"She was tickled," reported Bud proudly. "Thought it was wonderful the way young fellows like me could analyze and repair such complicated electronic units. As far as she's concerned, I'm an expert. Boy—if she only knew!"

"Don't sell yourself short," Tony cautioned. "I'd say you were an expert, too, but not just because you fixed the set. Much of it was in the confidence and ingenuity you showed in tackling the job—you *thought* like an expert, and therefore you *acted* like an expert." ▲

# inside TV tuners



## part 1 Input and RF Amplifier Circuits

by Calvin C. Young, Jr.

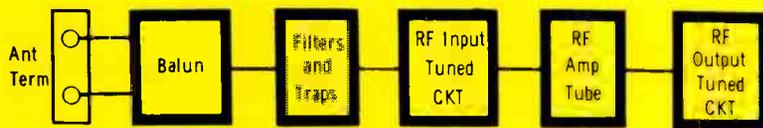


Fig. 1. Block diagram of the input and RF stages in a TV tuner.

A VHF television tuner must be able to select any one of 12 channels, each 6 mc wide, within the frequency ranges of 54 to 88 and 174 to 216 mc. In addition, it must reject signals in the 88- to 174-mc range utilized by amateur, FM and other radio-frequency services. On top of this, it must amplify received signals and convert them to the intermediate frequency of the receiver while maintaining a high signal-to-noise ratio. The tuner should also provide a high degree of rejection to signals within the IF band of the receiver.

That the tuner is, therefore, not a simple, one-circuit, five-component network is obvious; however, if we analyze it step-by-step and function-by-function, we can simplify any discussion of its circuits. We'll start with the input and RF circuits (Fig. 1).

### Input Circuit

The first circuit that an incoming RF signal encounters in a TV set is a matching network often called a *balun*. For those who may not be familiar with this term, *balun* is a derivative of the phrase balanced-to-unbalanced, *bal* from the first part and *un* from the last. The next time you see the word used to define a circuit, you will immediately know that it is being used to match a balanced-to-unbalanced impedance condition. But, let's get into the problem of understanding just how a balun works.

There are two types of balun networks in general use: 300-ohm balanced input to 300-ohm unbalanced output (Fig. 2) and 300-ohm balanced input to 75-ohm unbalanced output (Fig. 3). Part A in each figure is the circuit as it appears on a schematic. From this

it would seem that transformer action would take place; however, a balun network is not a transformer. Electrically, it consists of two sets of parallel lines, each having a characteristic impedance of 150 ohms. Because of space considerations and the necessity of having lines which have wide-

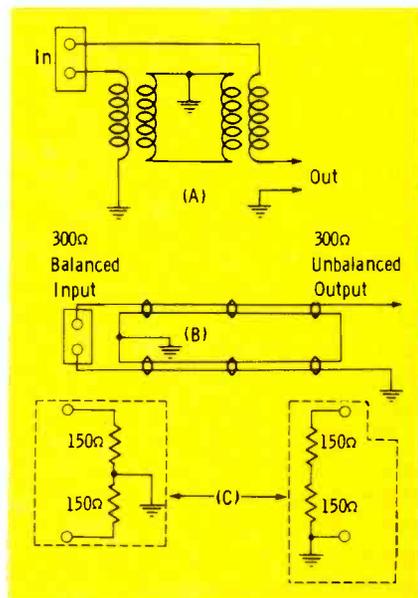


Fig. 2. Balun used to match 300-ohm balanced and unbalanced impedances.

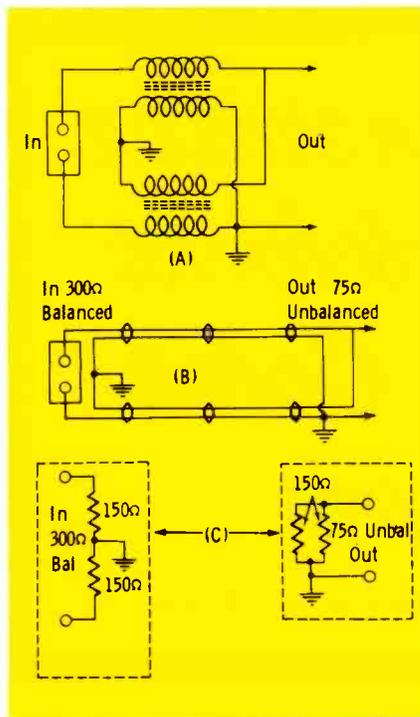


Fig. 3. Balun used to match 300-ohms balanced and 75-ohms unbalanced.

band characteristics, the lines are of the lumped form. That is, they will be wound on forms using very fine wire evenly spaced (Fig. 4), or will consist of a ceramic core material with toroid windings (Fig. 5). Such a unit is wound so that there will be no mutual coupling between windings.

In Figs. 2 and 3, part B is the configuration of baluns using 150 ohm lines, while part C uses resistors to illustrate how the balanced-to-unbalanced match is achieved. The length of the tuned lines in the balun shown in Fig. 2 has been adjusted so that when the output is loaded with a 300-ohm resistor and the balanced input fed by a 300-ohm transmission line, the standing-wave ratio will be close to unity at all frequencies within the VHF television bands. In this way, the balun network effectively matches the antenna to the RF amplifier stage for all channels.

In Fig. 3, notice that the input is connected in the balanced 300-ohm configuration, while the output has the 150-ohm lines connected in parallel to give a 75-ohm unbalanced configuration. As far as physical construction, this network is identical to the one in Fig. 2, the only difference being the manner in which they are connected. This feature was utilized

in some early model tuners to provide either a 300-ohm or 75-ohm input impedance.

### Filter Networks

From the balun, an incoming signal must pass through filter circuits located ahead of the RF circuit. These circuits vary from the simple series-parallel arrangements shown in Figs. 6 and 7 to the complex series of traps shown in Fig. 8. The function of the filter circuit is to trap out signals which are outside of the TV band limits (54 to 216 mc) plus interfering signals which fall within the limits of the TV bands. In this last category, a series resonant circuit (L3 and C5 in Fig. 6 or L4 and C3 in Fig. 7) is generally tuned to short circuit any interfering FM signal (88-108 mc). The parallel resonant circuit formed by L4 and C4 in Fig. 6 or L3 and C1 in Fig. 7 is designed to prevent signals lower than 54 mc from being developed at the input of the RF circuit.

The more complex filter network in Fig. 8 is designed to do the same job as the simpler networks; but since it utilizes more tuned LC networks, more effective elimination of unwanted signals is provided. In this network, L7 and C6 form the FM trap, L6 and C5 the adjacent channel picture trap and C4, L4 and L5 determine the lowest frequency which can be passed from the antenna terminals to the RF amplifier input. In this setup, A3 and A4 are adjusted to produce the bandpass curve for the low end of the TV band as shown in Fig. 9. As you can readily see, all frequencies below 52 mc are very rapidly attenuated by this circuit.

### RF Input Circuit

The first circuit tuned to the desired signal frequency is found at the control grid circuit of the RF amplifier. A simplified drawing of this RF input circuit is

• Please turn to page 56

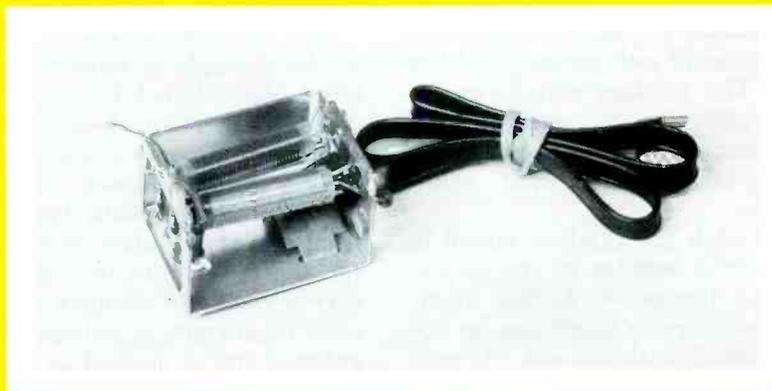


Fig. 4. Popular type balun network.

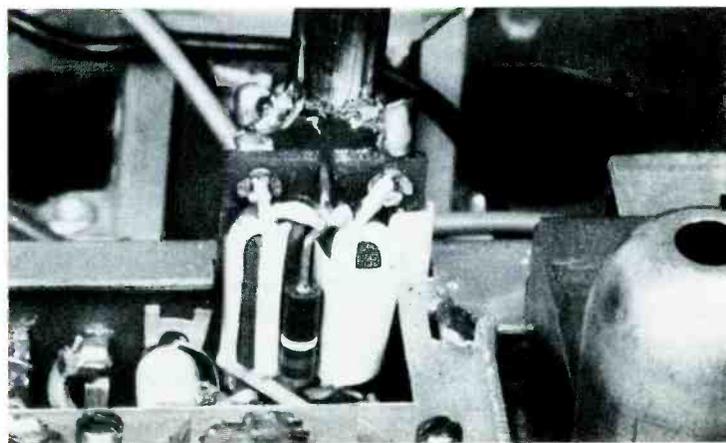


Fig. 5. Balun with toroid windings.

# How a Rainbow Generator Sidelocks in Color Sync

by Robert G. Middleton

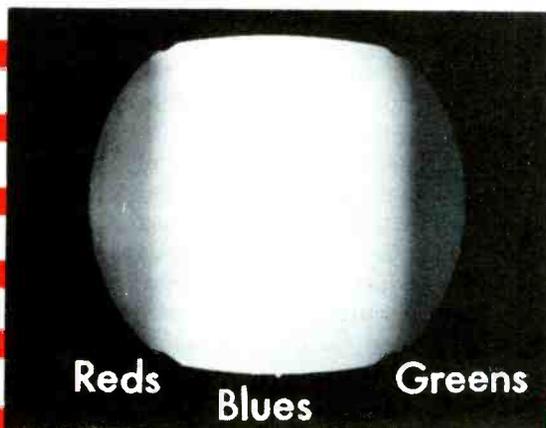


Fig. 1. The rainbow signal is a simple and economical color test signal.

Of all the various color test patterns, a rainbow display is the simplest and most economical type to produce. Such a display, also termed a color-difference spectrum, and shown in Fig. 1, is characterized by a progressive succession of red, green, and blue hues. The rainbow signal can be easily generated by means of ordinary alignment equipment using a modulator-type output cable (Fig. 2).

Although the rainbow signal is incomplete because of the exclusion of luminance levels, much practical service work can be accomplished with its aid. Its numerous applications are as follows:

1. Adjustment of the color-phasing control.
2. Alignment of the quadrature transformer.
3. Checks of the burst-gating circuits.
4. Tests of matrix gains.
5. Adjustment of the color-AFC circuits.

## Sidelock—What It Is and How It Works

The rainbow generator signal is more accurately defined as an offset color subcarrier since it is actually a CW signal having a constant or fixed frequency of 3.579545 mc minus 15,750 cycles, or 3.563795 mc. That is, during the course of each horizontal scan-

ning interval of 63.5 microseconds, it goes through one less alternation or cycle than the receiver's reference oscillator does. Yet, the rainbow signal locks in color sync. How is this possible?

Let us look at Fig. 3 which shows a simple arrangement of a burst phase-detector circuit. This is similar to phase detectors used in black-and-white television circuitry. The 3.579545-mc burst signal is compared with the signal from the color-subcarrier oscillator. If the phase of the color-subcarrier oscillator changes, a difference or correction voltage is developed and is applied in turn to the grid of a reactance tube. The reactance tube responds by correcting the phase of the subcarrier oscillator, holding its frequency to exactly 3.579545 mc.

In servicing the phase detector, a burst signal is applied and the balance control is adjusted to produce zero volts between the reactance-tube grid and ground. The system is then in good balance for locking in color sync.

Next, let us consider the situation in which a rainbow signal of 3.563795 mc is applied to the burst phase detector. We find, possibly to our amazement, that the bias on the reactance-tube grid is again zero volts, and that this particular frequency locks in color sync. The rainbow signal has a frequency which is 15,750 cycles lower

than the subcarrier oscillator frequency, yet the phase detector is responding as if the signal had the same frequency as the subcarrier oscillator. How can color sync occur even though this frequency difference exists?

First of all, we must realize that the difference is very slight—only one cycle out of more than 200 during a horizontal scanning period. Furthermore, as a result

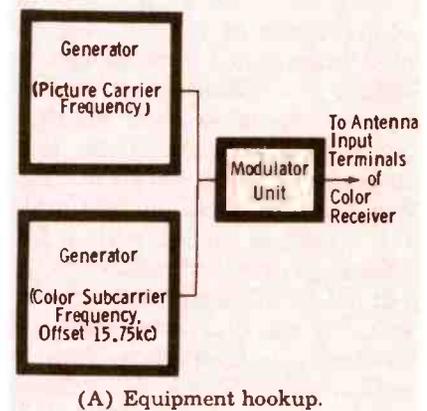


Fig. 2. A rainbow signal can be produced with conventional generators.

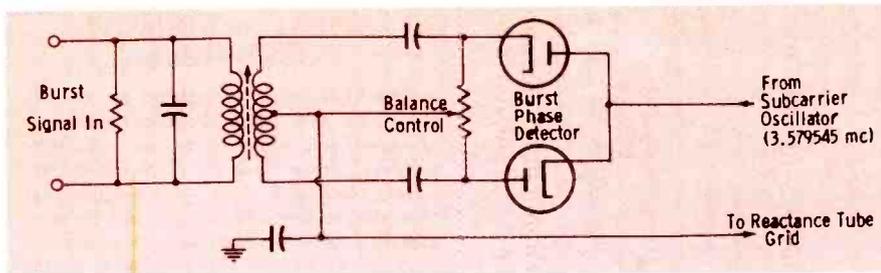


Fig. 3. The balance control is adjusted to produce zero volts to ground when a 3.579545-mc burst signal is applied to the phase-detector input.

of the burst-keyer action, only a small portion of the rainbow signal is used to achieve synchronization. Fig. 4 shows how the rainbow signal will be admitted to the burst phase detector only as a sample, in a brief interval following the horizontal sync pulse. Because of this gating action, the rainbow signal is sampled following each horizontal scan, immediately after occurrence of the horizontal sync pulse. Thus, although the rainbow signal completes one less cycle than does the reference signal during the scanning interval, it returns to its original phase during the sampling period. For a short time then, both the rainbow and reference signals are in phase, making possible the synchronization of the reference oscillator at the true burst frequency.

To make the facts clearer, let us look for a moment at Fig. 5. Here the voltage from the color subcarrier oscillator and from the rainbow signal are shown in vector form. The rainbow signal has a lower frequency than the color subcarrier oscillator, and hence the rainbow voltage vector rotates clockwise, as indicated. Because the rainbow signal is 15,750 cycles lower in frequency, it returns to its starting phase during each horizontal retrace period.

Since the rainbow signal is admitted to the burst phase detector only at this time, the phase detector is not "aware" of the fact that the rainbow signal has an "incorrect" frequency. As far as the phase detector is concerned, it is receiving a burst signal which has the same phase (and therefore effectively the same frequency) for the brief duration of the gating interval. Thus, the color sync circuits react to this sample of the rainbow signal just as if it had a "normal" frequency of 3.579545 mc.

Of course, color sync lock is dependent upon the fact that the rainbow signal returns to burst phase during the sampling period. If we attempt to obtain color sync lock on a rainbow signal having a frequency of 3.579545 mc minus 20,000 cycles, we shall not meet with success. But, if we lower the frequency of the rainbow signal further to exactly 3.579545 mc minus 31,500 cycles, we shall again obtain color sync lock, and two color-difference spectrums will be displayed on the screen of the color picture tube.

We obtain color sync lock for a double rainbow, because the rainbow vector then makes two complete revolutions during each horizontal scan, and returns to its starting phase during each burst interval. In other words, we can obtain color sync lock on any rainbow signal, provided its frequency is offset from the color subcarrier by an exact multiple of the horizontal scanning rate. When the rainbow signal has a frequency which is not exactly offset in this manner, we will not obtain color sync; instead, the rainbow pattern on the screen of the picture tube tears up into a drifting array of diagonal color stripes, much as the picture tears up into a number of diagonal stripes when horizontal sync is lost in black-and-white reception.

As the rainbow signal rotates

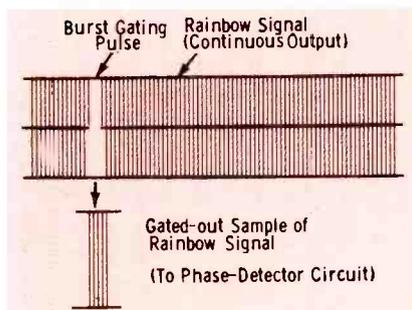


Fig. 4. Only a sample of the rainbow signal is fed to the phase detector.

through 360°, it represents all the colors of the chroma spectrum, as shown in Fig. 6. This is a chroma sweep signal, sometimes called a *linear phase sweep*, because the uniform phase change of 360° takes place during the horizontal scan interval. The chroma spec-

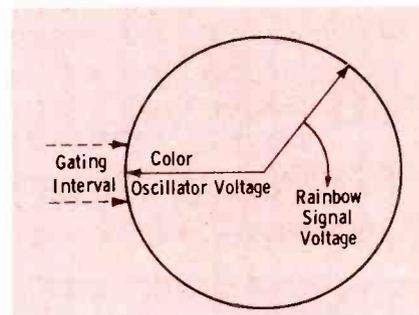


Fig. 5. For color sync, the rainbow signal must return to color oscillator phase during the gating interval.

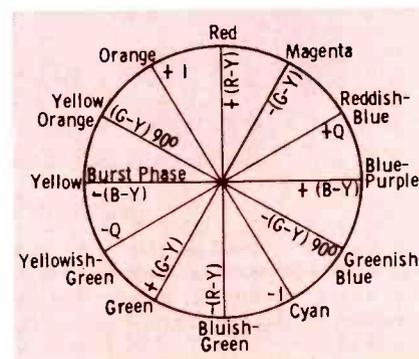


Fig. 6. Progression of the rainbow signal vector, and the colors it represents.

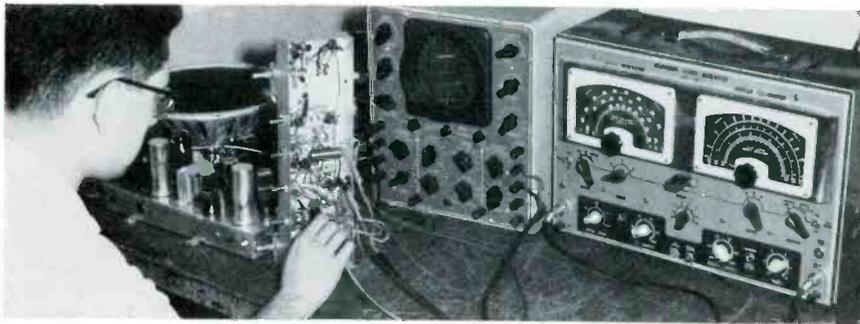
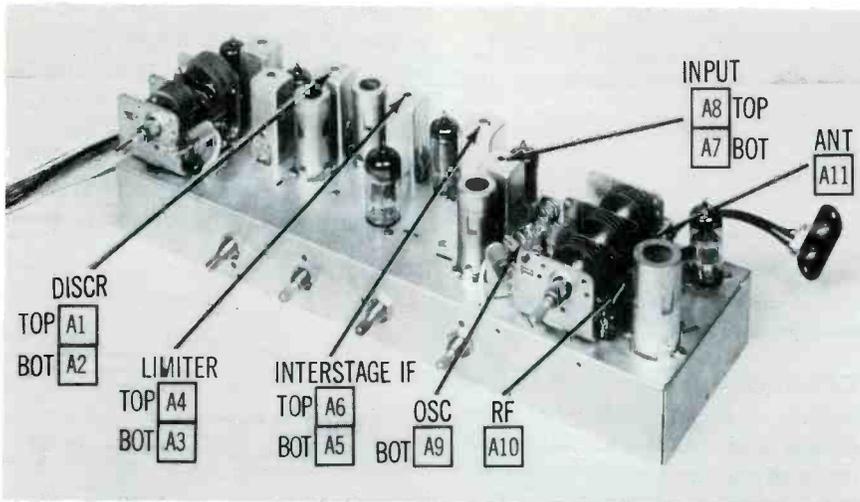
trum, of course, does not display the colors of an *optical rainbow*, because there is no Y (luminance) signal provided. In addition, the yellows are not reproduced because this portion of the signal occurs during retrace time.

Perhaps one of the most important servicing points to remember is the fact that the color sync circuits can be as well adjusted on a rainbow signal as on a standard NTSC signal. In other words, the color-AFC balance control can be adjusted for zero volts DC output, and the adjustment will be as accurate as if a 3.579545-mc color-burst signal were utilized in the test.

Of course, it is essential that the rainbow signal be exactly on frequency if the adjustment is to be made accurately—it must be crystal-controlled at exactly 3.563795 mc (or burst frequency less some other small multiple of the horizontal-scanning rate). ▲

## VISUAL ALIGNMENT TECHNIQUE

The hi-fi boom has stirred up new interest in FM radio broadcasting, and servicemen in many areas can expect to be doing more work on high-quality FM tuners. Although these are more complex than AM radios, they should not be completely strange to the technician because they are similar in many respects to the sound sections of TV sets. If alignment of an FM radio is necessary, it can readily be performed with television test equipment, using the procedure shown on these pages.



### EQUIPMENT SETUP

To align the IF and detector circuits of an FM set, a visual method employing a sweep generator and oscilloscope is most satisfactory. The scope waveform not only serves as an indicator for peaking the various adjustments, but also reveals any abnormalities in the frequency response of the IF and detector stages. The procedure is much like television IF alignment, but simpler. The sweep width required is much less than for TV—only about 0.5 mc, and only one marker (at the IF center frequency, 10.7 mc) is needed.

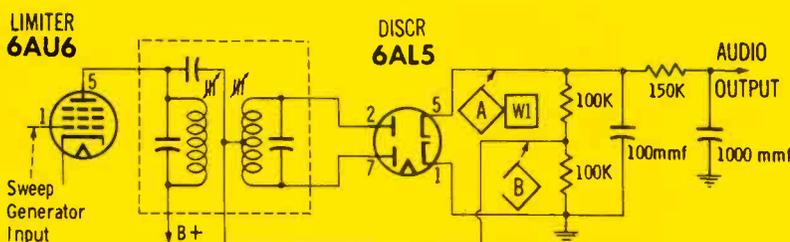
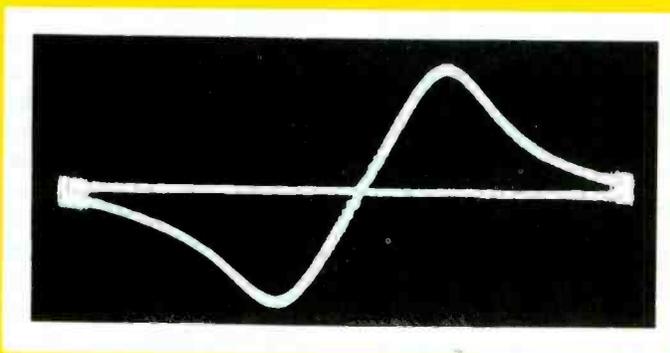
# FM for the TV man

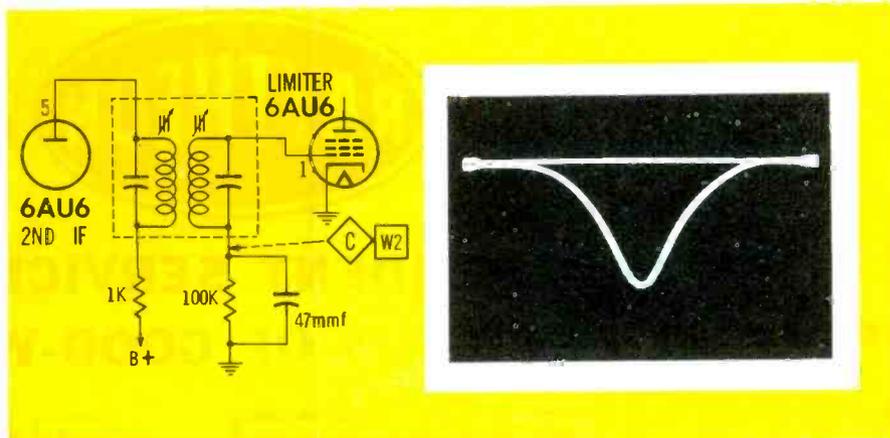
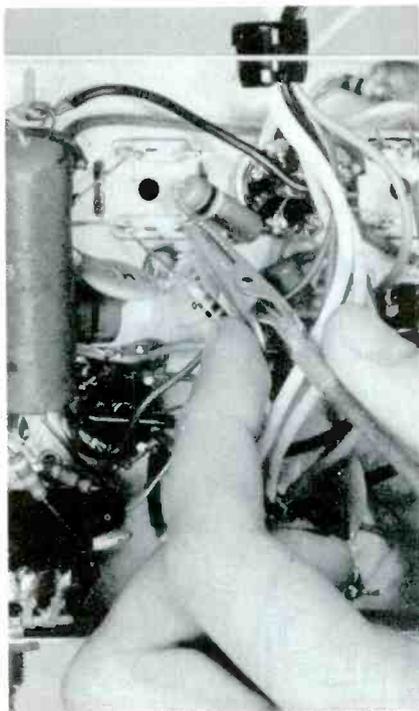
## DISCRIMINATOR ADJUSTMENTS

Many FM sets use a discriminator type of audio detector, preceded by a limiter stage. For discriminator alignment, the "hot" lead of the sweep generator is hooked to the grid of the limiter—usually through a .01-mfd capacitor—and the detector output signal at point A is observed on the scope. If the sweep generator is supplying a 60-cps sinusoidal driving voltage to the horizontal input of the scope and sweep blanking is utilized during the return trace, waveform W1 will be obtained. The detector primary slug A1 is then adjusted for best height and symmetry of the S-curve, and the secondary slug A2 is turned until the 10.7-mc marker is located at the intersection of the curve and the base line.

If the scope is swept with a 120-cps internally generated signal, a butterfly-shaped response curve will be obtained. The discriminator transformer is adjusted for a symmetrical waveform with the 10.7-mc marker at its center.

As an alternate method of aligning the primary, the scope lead can be attached to point B to obtain a waveform similar to W2 on the opposite page. The primary slug is adjusted for maximum peaking of the waveform.





### IF ALIGNMENT

Since the limiter tends to level out variations in the amplitude of the IF output signal, it is desirable to monitor this signal at some point ahead of the limiter during IF alignment. Fortunately, a voltage proportional to the strength of the IF output is developed across the limiter grid resistor. Look for this component to be connected at one lug of the limiter input transformer, and attach the scope lead to the junction (point C). Inject a sweep signal at the grid of the mixer, and tune the IF slugs A3 through A8 for maximum peaking of W2. Be sure that the 10.7-mc marker remains exactly on the peak of the waveform.

### RF ALIGNMENT

For RF alignment, a VTVM is substituted for the oscilloscope at point C, and a marker generator or other source of unmodulated signal is attached to the terminals through an isolating resistor. Use 120 ohms in each generator lead in balanced antenna input circuits and 270 or 300 ohms in the "hot" lead for unbalanced inputs.

The RF sections of most FM receivers contain three trimmer-tuned tank circuits. These should be aligned in the following order: oscillator, RF, and antenna. Signal input frequency should be as specified in the related service data, usually 106 or 108 mc. The trimmer adjustments may interact and require "rocking in."

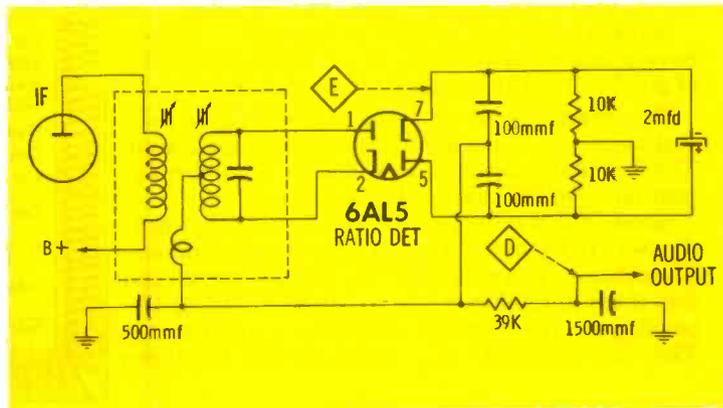
Tracking adjustments may also be needed in order to calibrate the low end of the band. On most sets, this involves compressing or expanding the coils in parallel with the trimmers and peaking the VTVM reading at a specified frequency—perhaps 88 or 90 mc. Only slight adjustments should be made, and the results should be checked each time a coil is moved.



### RATIO DETECTOR ADJUSTMENTS

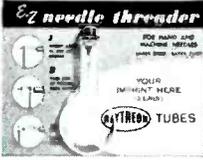
Alignment of FM radios using ratio detectors is simpler than for those having discriminators. Since there is no limiter stage to affect the output amplitude of the IF signal, the entire IF and detector alignment can be accomplished while the test signal is injected at the mixer and the output measured at the detector. For adjustment of the detector transformer secondary, the scope lead is connected to the audio output of the receiver (point D) where an S- or butterfly-shaped curve will be observed, depending on the sweep frequency of the scope.

All other adjustments are made while observing a waveform similar to W2, which can be obtained at point E. One end of the stabilizing capacitor in the detector output circuit must be disconnected in order to obtain the desired peak in this response curve.



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**\$1,000.** In a recent survey, 1,000 men and women in New York City were asked what they would buy with a \$1,000 gift. In the order of popularity, their answers were: Vacation, payment on a new car, clothing, color TV set; automatic washer; hi-fi equipment; air conditioner. With 116 out of 1,000 choosing color TV, and with people likely to have spare money this fall as they complete payments on 1955 cars, it would seem that color TV will continue its slow and steady growth.

### \$ & ¢

**Cutting Service Costs.** A cost reduction campaign by Normandy Radio & Television in New Orleans revealed that costs of TV service can be cut by changing operating techniques and buying new equipment. Here are their methods for boosting net profit as described in *Electrical Merchandising*:

1. Cut travel time and mileage by delivering sets only on 3 scheduled days each week and handling only pickups on the other 3 days. Thus, the firm's trucks no longer flit back and forth over the town, because their routes are carefully laid out for minimum mileage beforehand. The schedule is relaxed only occasionally, such as when a pickup happens to be right next door to a delivery.

2. Contract work for retail stores was dropped as being the least profitable, even though this was a big-volume operation. This made the same work force and equipment available for individual consumer jobs which paid better.

3. A complete shop survey showed that money could be saved by replacing existing equipment which was inadequate or high in operating cost.

4. The owner himself took over control of buying. Careful watching of inventory records permitted buying safely in maximum quantities, with corresponding price savings. Cash discounts are always taken when allowed on bills.

5. Unprofitable savings programs were dropped. Thus, the saving and selling of scrap was abandoned because the time and effort involved in collecting and marketing the scrap had not paid off.

### \$ & ¢

**Tax Tip.** Expenses for books, tuition, out-of-town travel and living expenses for refresher courses and color television serv-



**BY JOHN MARKUS**

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

icing courses that are necessary to maintain your present position or level of earning are now considered deductible as a business expense on your federal tax return. If the trip to the school is part educational and part social, you may allocate your travel and living expenses accordingly, but deduct the entire cost of the course.

Curiously, education which helps you prepare for a *better* job, *advances* your earning capacity, or establishes you in a *new* trade is *not* deductible.

### \$ & ¢

**Decisions.** In working with people, no matter whether they are your employees or your customers, remember that decisions based on insufficient information can do you a lot of harm. Take time to get the facts. Get the other side of the picture. Listen patiently to explanations, and ask sympathetic questions until you feel that you completely understand the problem at hand. Now, when you make a decision, the chances are excellent that it will be respected even if it does not completely satisfy the other party.

As one example, employees are human. They will accordingly resent even implied criticism for something that is not their fault, such as running into three "dogs" in a row on home TV calls or leaving the called-but-no-one-home card at the front door of a home where the family uses only the back door. Ask for the facts before you even think of criticising.

### \$ & ¢

**Leisure Time.** As working hours get shorter, more and more people are seeking part-time or even

second full-time jobs to occupy their leisure time. Some do this to boost their income; some do it because they would otherwise spend too much for entertainment in their leisure time. A few seek extra work simply because they have no hobby to follow and become bored with too much leisure time.

One advantage (or disadvantage) with the television and radio servicing business is that there is no leisure time problem. You can work as long as you wish each day simply by varying the amount of advertising you do. No one will lay you off when you reach 65; you have a job and a business that can be handled even from a wheelchair in old age. Your hobby is your work, so there is no worry about what to do after 65.

### \$ & ¢

**Expansion.** An acute shortage of appliance servicemen is predicted for the early 1960's by Kelvinator's general service manager, Robert S. Geran. The increasing sales of automatic washers, dryers, air-conditioners and dishwashers, combined with the attractions of other careers, will bring about this shortage of appliance servicemen.

Here, then, is a potential direction of expansion for a TV service business. Good TV troubleshooters need very little additional training to handle most appliance repair jobs, once a library of service manuals is built up. True, some TV men will scorn mechanical jobs like replacing washer transmissions, but there is usually at least one chap around the shop who enjoys this type of work. Find the man who fixes his own car, and you'll have the makings of a topnotch appliance serviceman.



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# LET'S PULL LESS CHASSIS

by Art Margolis

Back in 1947, in the days of 32-tube receivers, uneducated set owners, pioneering TV servicemen and a confusing multitude of circuits, our TV service firm formulated the policy that if a TV set didn't respond to repair efforts within an hour, the chassis should be pulled.

That "hour" policy is, of course, still feasible today—but with 14-tube TV's, a more understanding clientele, ten years of experience under our belts and an excellent knowledge of boiled-down circuits, policy must be altered to fit the need. This is especially true since the one major consumer annoyance that has not changed is the misery the customers undergo without their daily TV.

There are both advantages and disadvantages to doing chassis jobs in the home. The trick is to weigh the pros and cons of each individual situation to determine if it is worthwhile to make the attempt.

## Can't Do a Good Checkout

In broaching the subject to our men, the first objection was, "You can't properly check out a chassis in the house."

This is true, but there are times when a thorough checkout is not absolutely necessary. Recently for example, I was called in to repair a two-week old Admiral. There was no audio or video, only a

raster. I went through the routine tube checks without finding anything wrong. With the help of a couple of tube adapters, I began in the tuner and started reading voltages. I didn't find any discrepancies until I arrived at the audio amplifier which was mounted on a printed circuit board. The plate voltage checked okay, but the 140 volts that was supposed to be present at the cathode just wasn't there. Then I noticed a charred resistor. I could just make out the color code—330 ohms. I turned off the TV and replaced the resistor. My hour was up.

I turned the TV back on. The new replacement started to heat up. Before it could char I turned off the set. I was now in a quandary—should I take it to the shop or not? I decided no, and pulled the chassis out of the cabinet to see what I could find.

I checked the resistance from cathode to ground and got a reading of 330 ohms! Beaming my flashlight from behind the printed board, I traced out the skeleton wiring. The cathode went to a few places. One by one the legs were eliminated as I found the resistance to ground increasing when measured from the other end of various components. The only leg that remained at low resistance was one that led to the screen of the audio IF which measured zero ohms to ground. There was a

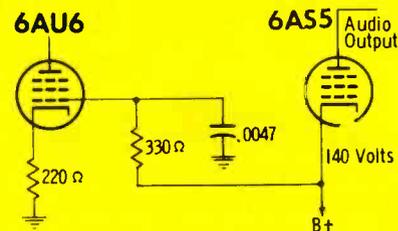
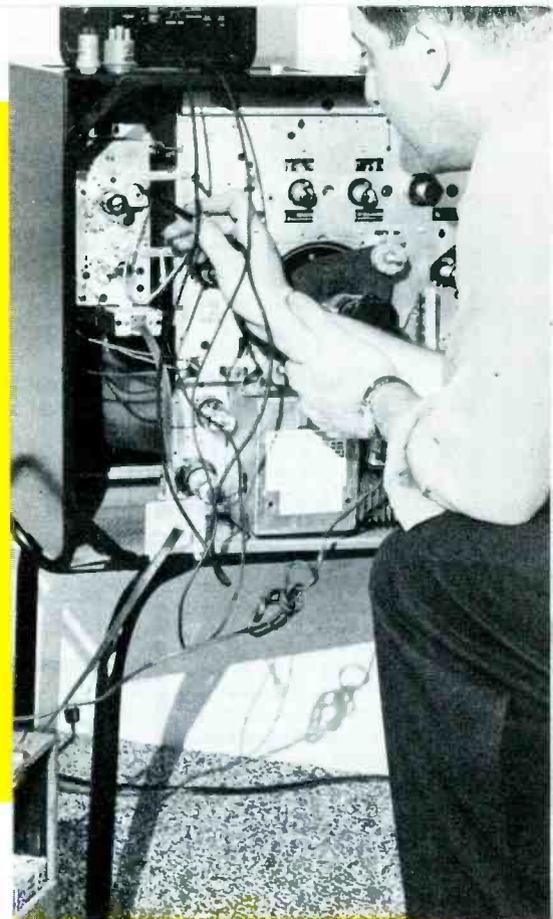


Fig. 1. The shorted .0047 shunted B plus to ground. I read zero volts at the audio output cathode instead of 140 volts.

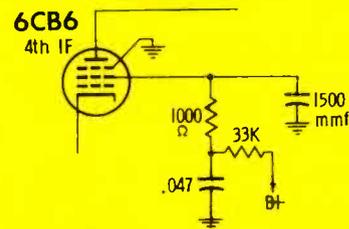


Fig. 2. The shorted .047 shunted the screen voltage to ground, making the picture negative.

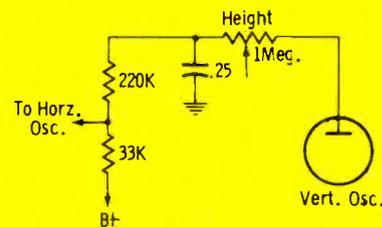


Fig. 3. The shorted .25 caused heavy current through the 220K resistor.

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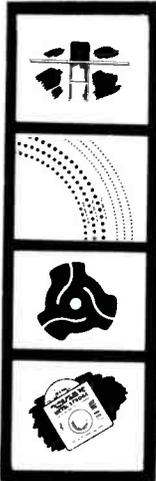
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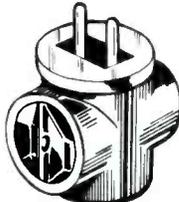
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.0047 from there to ground. Disconnected from the circuit, it read zero ohms (see Fig. 1).

I installed a new capacitor and turned on the set. The sound and pix came in fine. Total time for the job was about an hour and forty-five minutes. No doubt a checkout at this point wouldn't have hurt a bit, but the fact that the TV was practically new lowered the chances of further troubles. I covered myself by explaining that to the customer.

Another time worth taking the risk of a repair job without a checkout is on a callback, especially if the original call was expensive, like the one in which I had replaced a metal CRT in a 16" RCA. About two weeks later, we received another call on the set. On arriving, I found a very unhappy set owner and a weak picture with a tendency to go negative.

The first thing the customer growled was, "I thought you fixed this TV—it sure cost me enough!"

My heart sank as the tubes all checked out fine. I thought, "If I try to pull this one, sparks are going to fly." I removed the chassis, put it on the floor and hooked up my CRT and yoke extension cords. The only pleasant thing about the setup was the fact that the chassis was still spotlessly clean from the previous call.

I began checking voltages in the video IF's. When I arrived at the screen of the last IF, I measured zero volts instead of B+. I checked resistance to ground. A thousand ohms! The .047 to ground was the culprit (see Fig. 2). I replaced it and the video snapped into place. The customer lost his belligerent attitude and paid the new charges without a whimper.

### Customer Over Your Shoulder

Sure, when you work in a customer's home, there is more pressure on you than in the quiet confines of your shop. You constantly need to maintain your set-side manner. However, I personally am not real fond of carrying large metal monsters. I feel it is easier to put on a show for the customer than it is to carry the chassis.

This brings one particular Westinghouse set to mind. I was puff-

ing when I arrived at the door. The set was owned by a newly-married couple living in a fourth-floor apartment with no elevator service. Checking the set, I found there was no vertical sweep. I shuddered as I envisioned myself lugging this baby down the stairs. I wouldn't even allow myself to think of the delivery.

The two vertical tubes were fine. I pulled the chassis out on the floor. He took my left shoulder, she took my right. They were fascinated, and kept firing a barrage of questions. I began reading voltages in the vertical circuits. On the plate of one-half of the vertical multivibrator there was supposed to be 135 volts; instead, there was nothing (see Fig. 3). I checked resistances in the B+ leg. The first component was the 1-meg height pot; it was okay. Next was a 220K-ohm resistor; it was wide open, so I replaced it. Before turning on the set, I checked resistance from the low side of the pot to ground and measured about 2,000 ohms! I gingerly turned on the switch. The 220K started to get warm and still there was no vertical sweep.

I scratched my head and thought, "to pull or not pull?" My hour was way past due. The couple parroted away at me, but I thought again of those four flights of steps. I started checking components on the plate side of the 220K, disconnecting them one by one. After a while I came to a .25 filter. It measured 2,000 ohms. After replacing it, vertical sweep came out fine.

As I walked down the steps I felt very glad that I was only carrying my tool box and not that 21" chassis. It was worth standing a little customer pressure to save the hauling.

### Can't Get Your Price

Another realistic objection against repairing sets in the home is the matter of price. Unfortunately, set owners often become shocked when you ask for more money to locate a 1/2" component than for finding a cold tube. The additional labor and know-how seems to escape their perception—that is, unless you do a good selling job. I've found that the best way to overcome this obstacle is

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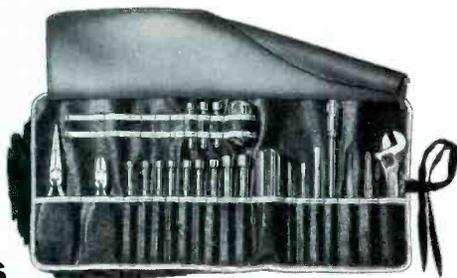
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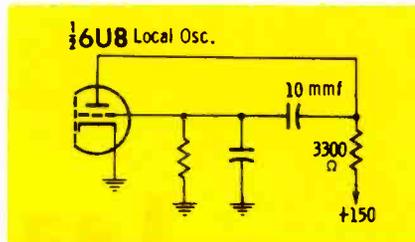


Fig. 4. The 6U8 oscillator section shorted, causing the 3,300-ohm resistor to open, resulting in a snowy picture.

to thoroughly inform the customer of all possibilities before pulling the chassis out of the cabinet.

Not long ago, for instance, I was examining a 21" Emerson. There was no audio or video, only a raster. I checked all related tubes—no dice. I decided to go component hunting, but before I removed a single chassis bolt I smiled and explained, "I'm going to have to troubleshoot the underside of the chassis. Before I start, I'd like you to know that this work is a bit more difficult than checking tubes. The labor will be quite a bit higher." She thought it over, decided it sounded reasonable and gave me the go ahead.

I brought in a tube tester and VOM. When I checked the 6U8 oscillator-mixer, a short was indicated. I turned on the TV and checked the 6U8 socket voltages. There was no B+ to the oscillator plate. I checked B+ going into the tuner; it was okay. Tediously I took the tuner apart. The rest of the repair was visual. A 3,300-ohm plate resistor was charred badly. I replaced it using tweezers and a low-wattage iron (see Fig. 4).

To help the effect along I gingerly lifted the charred resistor with the tweezers as if it were infected and dropped it in an ash-tray. The customer remarked, "My goodness, you look like a surgeon." When the set was all together again and perking prettily, I had no trouble in collecting a reasonable service fee.

Another set of circumstances when I find I'm able to complete a chassis job on the premises and still get my price is on commercial jobs. One evening I arrived at a bar about 7:00 P.M. The bartender had a 21" RCA that sounded good but had no vertical sweep.

I checked tubes to no avail. I

PF REPORTER · August, 1957

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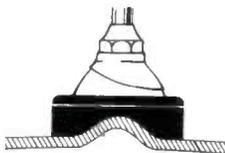
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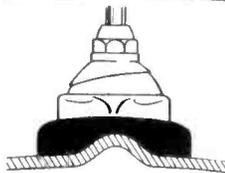
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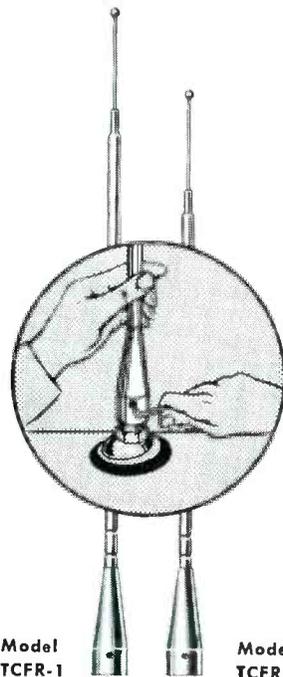
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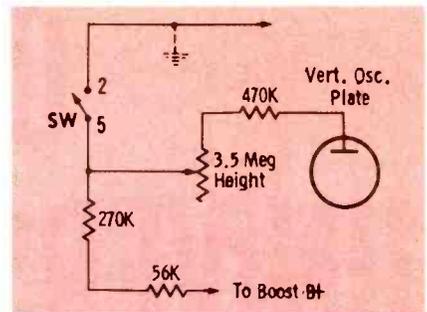


Fig. 5. The oscillator plate supply shorted to ground due to a lack of insulation at contact #2.

looked around. The TV was 8' off the ground on a platform, the lighting was dim and two drunks were already pawing at my tube caddy. I had almost decided to pull this one, when the bartender pleaded, "Please buddy—there's a big fight on at ten. If there's no TV, I'll lose half my trade."

So working like a doctor on a kitchen table, I went at it. After setting up, I found no B+ on the plate of the vertical oscillator. I checked the resistors leading in and found them alright.

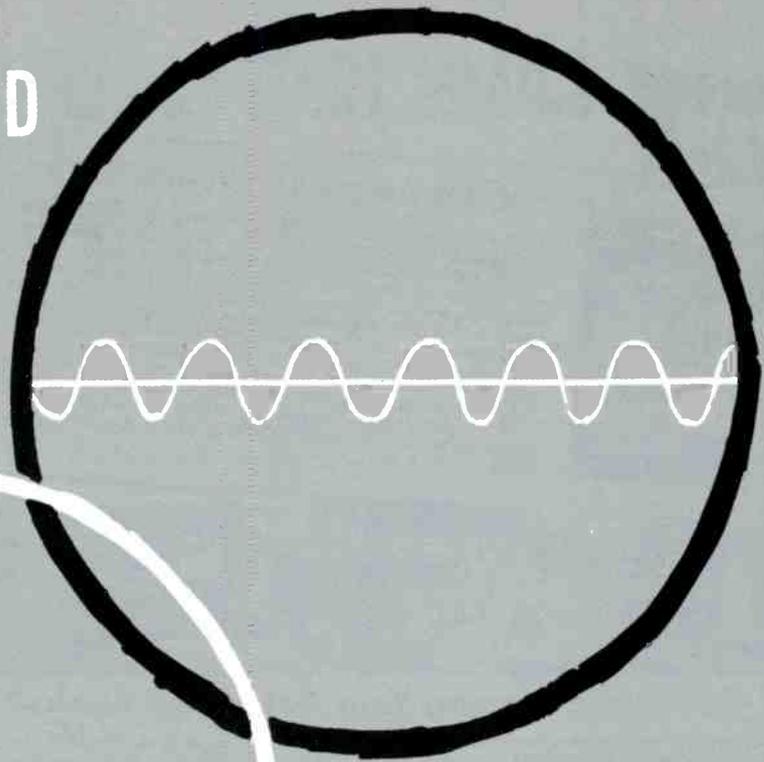
A squint at the schematic showed the plate was fed from boost B+. I read voltages at the damper; they were within tolerance. Gradually I headed for the vertical oscillator plate. I went over a 56K, then over a 270K and the voltage was gone. I turned off the set and read resistance at that point to ground—a dead short!

There were three leads off that point. I crossed over a 0.1—there was +270 on the other side, which was normal. The second lead went to the height pot—it was intact. The third lead led to the phono switch where it went into #5 and came out of #2. There was the trouble. The wire coming out of #2 had no insulation left on it (Fig. 5) and was shorting to ground. I installed a new wire, and the picture spread out prettily. I not only received the charges I asked for, but a healthy tip in the bargain.

#### Fear of Failure

Probably one of the strongest reasons for not wanting to fix a chassis in the home is that we are afraid we will fail to do the proper repair job unless we are surrounded by ideal conditions. But so what if things do snafu? If the repair can be completed in the

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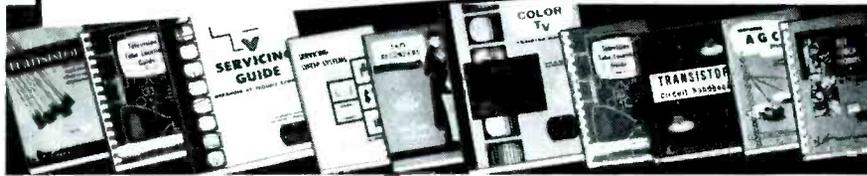
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**TV Tube Location Guides.** Shows tube positions and functions in hundreds of TV receiver models; helps locate faulty tube quickly; cuts trouble diagnosis and replacement time.

Vol. 6. Covers receivers produced in 1955-1956. 236 pages; 5 1/2 x 8 1/2" **\$2.00**  
Vol. 5. Covers receivers produced in 1953-1954. 200 pages; 5 1/2 x 8 1/2" **\$2.00**

**Color TV Training Manual.** Prepares the service technician for Color TV work. Covers principles of the Color TV system; Color receiver circuits; installation and servicing of receivers. Includes color blocks outlining use of color test equipment. 260 pages; 8 1/2 x 11"; 300 illustrations. **\$6.95**

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**Key Checkpoints in TV Receivers.** Time-saving information on how to make quick tests at key points in TV receiver circuits to determine the section in which the trouble lies and how to check overall performance of the receiver to insure against callbacks.

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house, you're in clover. If it can't, what'll be the terrible results?

Usually nothing. And the fact that you have tried mightily makes it much easier to sell the customer on the difficulty of the job. Like the time I was working away on a living room floor on a 16" RCA. There was no audio and the five tubes in the circuit all checked good except that the 6AU6 was a little microphonic. I changed it, but the set still didn't sound off.

I informed the set owner that his job now came under another category, and he gave me the go-ahead. I pulled the chassis out on the floor and began looking for a voltage or resistance clue. After about an hour I had found none. All DC voltages and resistances were on the button.

The set owner was extremely interested. He was enthralled by the needle movements of the VOM and the click-click of the solder gun. About the only remaining components that could cause the condition were the sound IF transformer and the sound discriminator transformer. I trimmed up both of them. Sure enough, I received a wee bit of audio. The customer perked up. I concluded that one or both of the transformers had shorted turns.

I stood up and explained that to him. I finished my pitch with, "It's gonna have to be hospitalized."

He answered, "You're the doctor, do what you think is best."

I took the chassis into the shop, changed the transformers, aligned the audio and returned it to a very satisfied set owner.

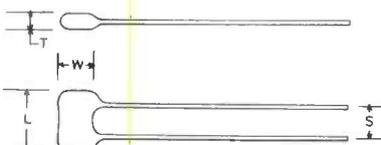
Now don't get me wrong. I still believe in pulling chassis, but the only time a chassis should be pulled is when there is an advantage to it. To me, it's worth the risk of doing without a checkout, having a customer hanging over my shoulder, using a little sales pitch to get my price and maybe not looking the hero if I don't succeed, if I can effect a repair right then and there.

For smoother customer relations, and more recommendations, in the interest of building and maintaining a healthy TV service business, I find it's best to pull less chassis. ▲

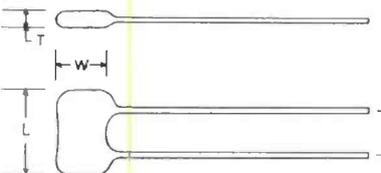
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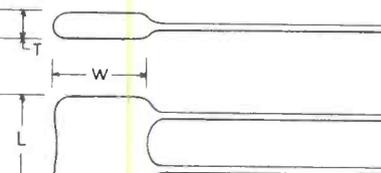
**Dimensional Diagrams**



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Over 151 mmf.	1 5/32	5/16	1 1/4	1 5/4



TYPE D-20	L.	W.	T.	S.
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TYPE D-30	L.	W.	T.	S.
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# Notes On

## TEST EQUIPMENT

Latest Information on Application,  
Maintenance and Adaptability  
of Service Instruments

by Leslie D. Deane

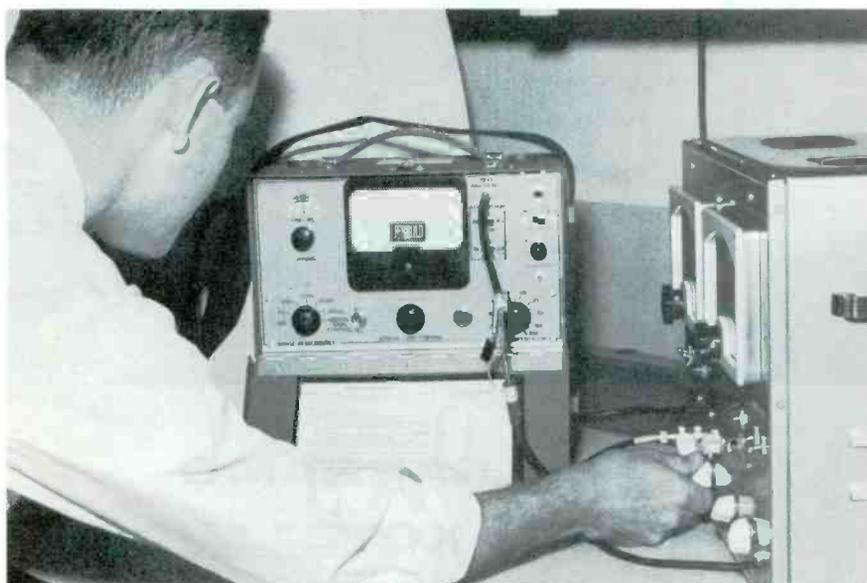


Fig. 1. Jerrold Model 704B field-strength meter being used to calibrate the microvolt output of a signal generator.

### Calibrated Field-Strength Meter

The military-looking instrument pictured in Fig. 1 is manufactured by Jerrold Electronics Corp. of Philadelphia. Called Model 704B, it finds its primary application in the measurement of field signal intensities which may be of particular interest to the service technician who installs or repairs TV and FM antenna systems.

Specification features are:

1. Power Requirements—Normal line operation, 105 to 125 volts AC, 50/60 cps, power consumption 55 watts; DC operation using vibrator accessory Model 704A-6V, 5.5 to 6.5 volts DC, power consumption 30 watts;

fuse protection provided for both AC and DC supplies.

2. Frequency Range—54 to 220 mc continuous-tuning.

3. Sensitivity—5 microvolts minimum for full scale deflection, maximum 3 volts.
4. Accuracy—over-all held to  $\pm 0.8$  db operating at 117 volts AC or 6 volts DC.
5. Input Impedance—72 ohms direct, 300- to 72-ohm matching transformer supplied with instrument.
6. Meter Range—six ranges are provided; 100, 300, 1,000, 3,000, 10,000 and 30,000 microvolts; extended ranges of 0.1, 0.3, 1 and 3 volts are available using built-in RF attenuator.
7. Signal Monitoring Provisions—both earphone and video output jacks available on front panel.

I had the opportunity to check out one of these units recently, both in the field and in the laboratory. Before I report on my experiences, however, I believe a brief description of the meter is in order.

Fig. 2 shows a simplified block diagram of the instrument. The signal is first applied to the 72-ohm antenna input jack on the front panel of the instrument. For conventional 300-ohm antenna lead, the matching transformer provided with the meter should be used. If signals greater than 30,000 microvolts are to be measured, the calibrated attenuator network may be switched into the input circuit. Actually, two separate switch assemblies make up this network. Each switch will attenuate the input signal by a factor of 10 times—thus, with one switch in the meter reading is multiplied by 10, and with both switches in the reading is multiplied by 100.

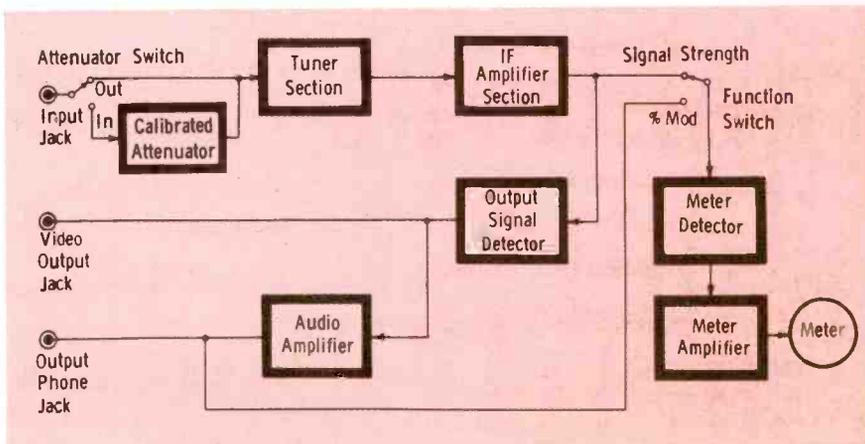


Fig. 2. Simplified block diagram of the Jerrold field-strength meter.



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A special continuous-type tuner with a gain variation of less than 3 db from 54 to 220 mc is employed in the tuner section. I found that this section also contains two adjacent-channel traps. Adjacent picture and sound carriers are attenuated 45 db below the desired signal level.

A three-stage IF system tuned to 25 mc and having a .6 mc bandwidth is used in the IF amplifier section. Gain variations of the tuner are corrected in this section by the tuner-compensator control. A separate calibration chart is furnished with each instrument and gives factory-calibrated settings for the compensation control at all VHF channel frequencies and at check points of 90, 110, 130, and 160 mc. The manual gain control and range selector switch can also be found in the IF amplifier section of the unit.

From the IF section, a major portion of the signal passes through a function switch. With this switch in Signal Strength position, the signal is applied to the meter detector and amplifier circuits. The meter movement is then actuated by the peak RF carrier levels of the detected signal. With the function switch in the % MOD position, the percentage of amplitude modulation present in the FM carrier can be read directly on either of two meter scales. The 0 to 100 scale represents 0 to 10% modulation while the 0 to 300 scale represents 0 to 30%.

Auxiliary detector and audio amplifier circuits provide either video or sound monitoring of the input signal. The detected signal is applied to the video output jack for observation on a scope. From the detector, the signal is also amplified and applied to the output phone jack, or amplified and fed back to the meter circuit for measurement of amplitude modulation.

To illustrate a practical application, I recently made use of the Model 704B in the installation and orientation of a roof-mounted TV antenna. Using the 300- to 72-ohm matching transformer, I connected the twin-lead from the antenna to the input of the field-strength meter. I then moved the entire antenna assembly to several pos-

sible mounting positions on the roof while observing the field strength indications of a signal from a distant TV station. Surprisingly enough, I noted a relatively large change in signal strength for the different locations. After choosing the mounting spot, I next rotated the antenna for a maximum signal position for three desired stations as indicated on the meter.

The instrument is handy for measuring and locating sources of interference, balancing master antenna systems, and taking general field intensity surveys. In the lab, I also made use of the Jerrold unit by calibrating the output attenuator of a signal generator in microvolts (Fig. 1).



Fig. 3. A new handy portable dot generator.

### New Portable Dot Generator by Admiral

The instrument pictured in Fig. 3 is the Model TE-100 dot generator manufactured by the Special Products Division of Admiral Corp., Chicago. The generator will provide both dot and bar output patterns for color convergence and monochrome linearity adjustments.

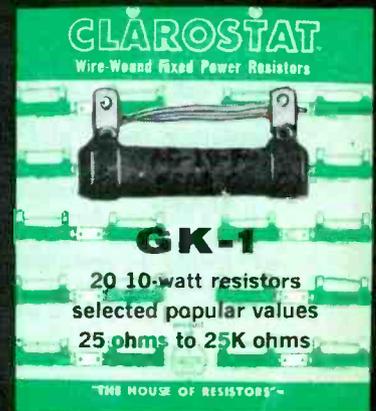
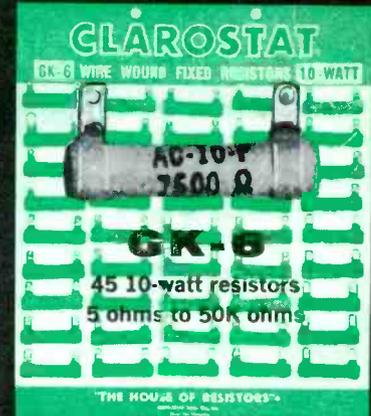
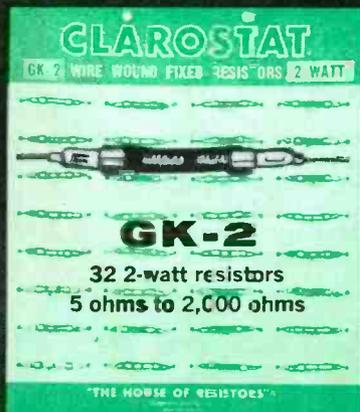
Specification features are:

1. Power Requirements—117 volts AC, 60 cps, power consumption 18 watts.
2. Video Output—white dot, vertical bar and horizontal bar patterns; output cables provided for both color and monochrome receivers.
3. Synchronization—external sync signal obtained from receiver under test, sync cable provided.
4. Over-all Size and Weight—height, 8", width 5", depth 8", weight 6½ lbs.

I had the opportunity to test the Model TE-100 on a color tele-

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Use a common negative dual capacitor, each section having the *same* voltage rating and *twice* the capacity rating as the unit being replaced. Use the two positive leads *only*—don't connect the negative lead (or the can) to anything, just insulate them well!

Assuming sufficient physical space, the same thing can be done with two single capacitors—by connecting the negative leads together and insulating them, and the cans, carefully. Use the two positive leads.

Of course, for an exact replacement or temporary repairs such as above, you ought to use Mallory FP Capacitors. They're tougher, longer lived, and plenty dependable—but, you probably know that from experience. See your Mallory Distributor today—lay in a working replacement stock.

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vision receiver the other day. When setting up the instrument for this operation, I noticed that it employed a slightly different method for injecting the video signal into the receiver than that used for conventional generators. Two output cables are supplied with the instrument—one for color and one for monochrome receivers. On one end of each cable is a picture tube base-socket adapter and on the other, an Amphenol connector which plugs into the rear of the Model TE-100. Two separate leads also extend from the Amphenol end for external sync and ground.

After selecting the output cable with the color picture tube adapter, I connected the apparatus

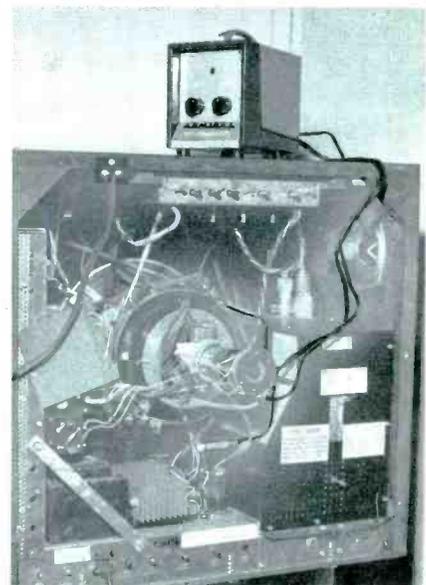


Fig. 4. Connections for color convergence adjustments using the Model TE-100.

as shown in Fig. 4. With the adapter on the picture tube base, I attached the ground lead to the TV chassis and clipped the external sync lead to the hot horizontal yoke lead. Following operating instructions, I was then able to obtain satisfactory bar and dot patterns by placing the function switch in the desired position and adjusting the sync control on the front panel of the instrument.

After working with this piece of equipment, I found its most desirable feature lies in its small, lightweight construction, making it ideal for home service calls. In addition, operating the generator is greatly simplified because of its few operating controls.

PF REPORTER • August, 1957



Fig. 5. Using the Sencore Model FP22 vacuum tube preheater saves testing time.

### Sencore Vacuum Tube Preheater

Service Instruments Corp. of Addison, Ill., has recently developed a new vacuum tube preheater. Pictured in Fig. 5, the Model FP22 is primarily designed to save the technician time when checking tubes which are suspected of causing trouble after prolonged periods of operation.

Instrument features:

1. Power Requirement—117 volts AC, maximum current load 10 amps.
2. Filament Voltages—all values up to 35 volts including those required for 450- and 600-ma tubes.
3. Tube Accommodations—14 miniature and 6 octal type sockets are provided.
4. Quick Heat Operation—built-in switch provides 10% increase in normal filament voltages.
5. Straighteners—both 7 and 9 pin miniature tube straighteners provided on front panel.

I made use of this piece of equipment in connection with an analysis of gassy vacuum tubes in TV receivers. The unit proved very helpful when testing tubes from conventional series string receivers. I found that defects such as gas often show up on a tube checker only after the tube has heated for a considerable length of time. In receivers employing series filament arrangements, when one tube is pulled for testing, the entire string goes out and all other tubes become cold before they can be inserted into the checker. Using an instrument such as the Model FP22, tubes can be preheated, thus overcoming this problem and perhaps saving the technician time in curing a trouble caused by an inter-

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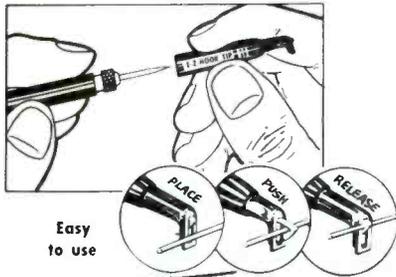
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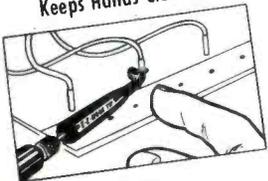
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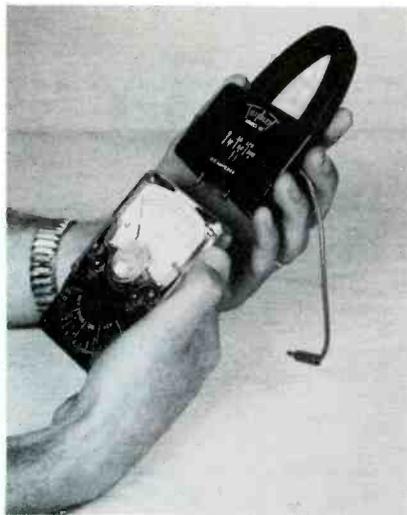


Fig. 6. New Triplet ammeter adapter fits right on pocket-size VOM.

mittent tube.

The "Kwik Heat" switch located on the front panel hastens warm-up time by increasing filament voltages approximately 10%. This quick heating treatment usually causes gassy conditions and intermittent shorts to show up in the tube immediately. By inserting test leads in the filament pin connections of various tube sockets, I noted that the instrument could be used as a source of AC power for external applications. The manufacturer cautions, however, that these voltages are not isolated from the power line.

### Clamp-on Adapter Measures Current Without Breaking Circuit

The photograph in Fig. 6 shows the new Model 10 AC Clamp-on Ammeter Adapter being attached to the Model 310 Volt-Ohm-Milliammeter. This unit, manufactured by Triplet Electrical Instrument Co., enables the technician to measure AC current in any single-wire conductor by simply clamping the jaws of the adapter around the wire under test. Features of the Triplet Model 310 VOM were covered in the "Notes on Test Equipment" column of October, 1955.

The clamp-on jaws of the new adapter are actually part of a core assembly for a small built-in transformer. A thumb lever on the side of the Model 10 permits the user to open the jaws so that the core can encircle the wire conductor. A slide type switch on the front of the adapter selects the



Fig. 7. Checking line current with line separator and clamp-on adapter.

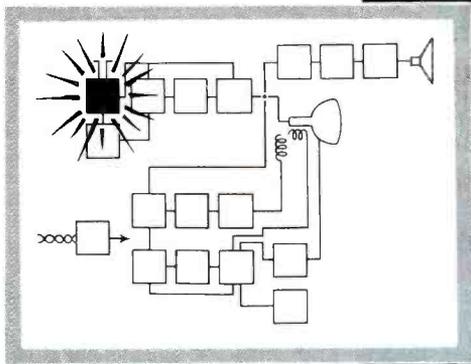
range of current desired—0 to 6, 12, 30, 60, 120, or 300 AC amperes.

The Triplet Model 101 Line Separator, which is another accessory, divides ordinary two-wire conductors at AC wall outlets and, when used with the Model 10, increases ammeter sensitivity by either 10 or 20 times. The current range of the meter can thus be reduced to a full scale deflection of only 300 milliamps.

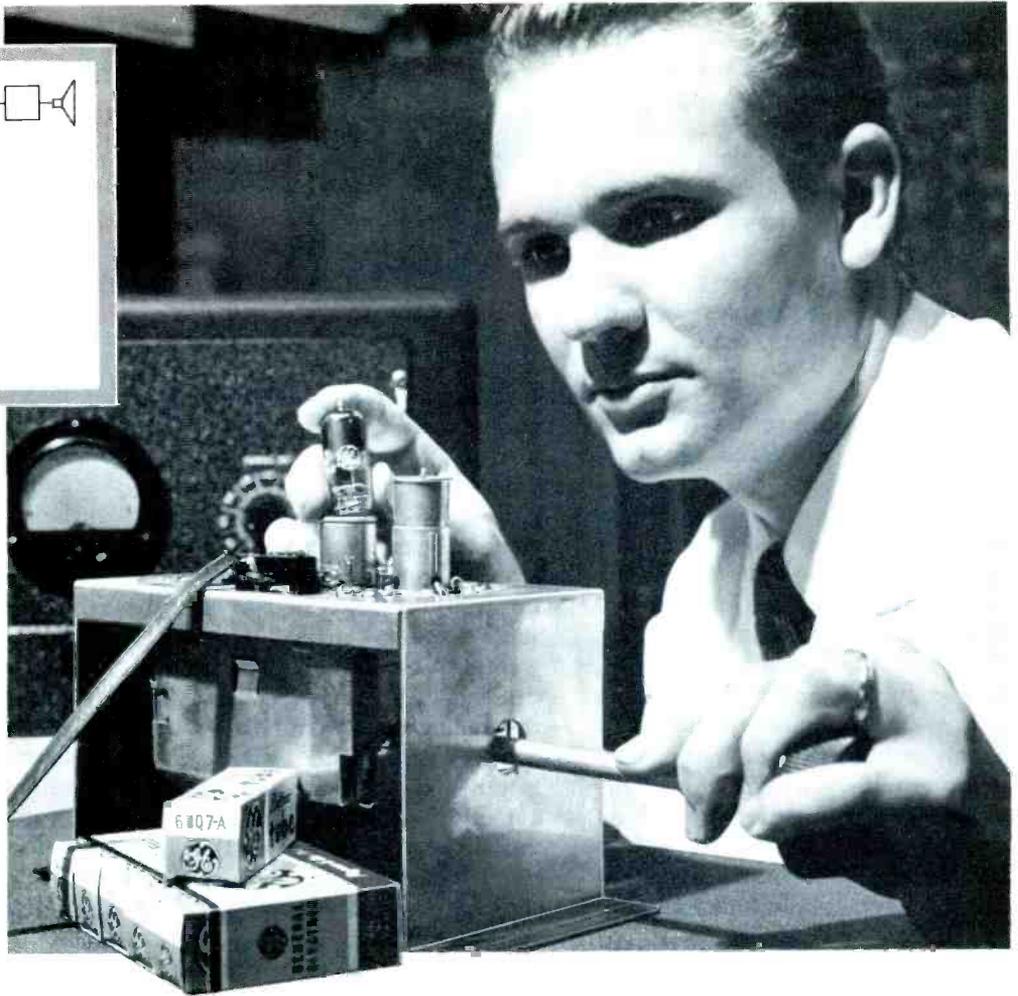
When I used this clamp-on ammeter in the lab, I attached the adapter to the meter and inserted the short red test lead into the VOM jack of the Model 310. I next placed the selector switch of the meter on the 3 ACV position as per instructions. Setting the adapter switch on its highest AC ampere range, I was then ready to use the instrument.

My first test was to check current flowing in several single-wire conductors within one of our power-line fuse boxes. I checked the accuracy of the meter-adapter combination by breaking one of the tested lines and measuring current with a standard calibrated ammeter. I found by comparison that the device is highly accurate for all practical applications.

In working with this instrument, I also learned that the Model 10 could be used with any volt-ohm-milliammeter having a 3 volt AC scale at 5,000 ohms per volt. Such a meter is pictured in Fig. 7 where adapter Models 10 and 101 are being employed to measure AC line current drawn by a television receiver. ▲



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r-f-amplifier tube life. To this end, tests of 6BN4's, 6BQ7-A's, 6BS8's, and other G-E types are performed at max plate dissipation in circuits most conducive to grid emission, in order to establish that grid emission and gas current are negligible. Also, heater-cathode shorts have been sharply reduced throughout the r-f-amplifier group, further prolonging tube life.

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It's a rather common occurrence to have a customer say something like, "The picture went out on Ed Sullivan's show last night, but we were so interested that we sat and listened to the sound anyway." In many such cases no harm was done; however, there are times when such action by the customer can have very serious consequences. Examples of this came to light on some recent service calls.

### Flyback Failure Destroys Components in Video IF Strip

In one case, the customer reported over the phone that the picture had gone out. Following this there had been an "awful odor," so they turned the receiver off. When the technician arrived, he was further informed that the picture had begun to flop and twitch and otherwise acted crazily in the middle of a quiz show. This had been accompanied by a loud popping noise from the speaker, but the set owner had been engrossed in the show and had continued to use the set until the picture failed with a loud crack, and the sound died out completely. The customer also reported that in a few seconds an acrid odor



# QUICKER SERVICING

by Calvin C. Young, Jr.

emanated from the set, and it wasn't until then that the set was turned off.

The technician immediately pulled the chassis and made a fast visual check which revealed several charred resistors in the video IF strip. Without further ado, the chassis was taken into the shop.

Since the cathode resistors in three of the four video IF stages were charred, all four tubes were checked with a high-quality tube tester and all were found to be defective. Closer examination of the IF strip revealed that the circled components in Fig. 1 all showed signs of damage from excessive current. In addition, the 2-mfd AGC filter had exploded and blown bits of paper and foil around the underside of the chassis, the .22-mfd capacitor was

leaky, and almost every resistor in the AGC line was badly charred with the exception of the 100K unit, which had a blistered look, and the 18K, which measured much higher in value.

At first, the technician couldn't figure out any reason for the failure of these components when there was no apparent damage to the plate-load resistors in the video IF strip. Then, it suddenly dawned on him—the positive terminal of the 2-mfd AGC filter was grounded and the negative terminal connected to the AGC line. The presence of a high positive voltage on the AGC line could cause the capacitor to explode! Since such a voltage would make the control grids of the first three IF tubes highly positive with respect to their cathodes, a consider-

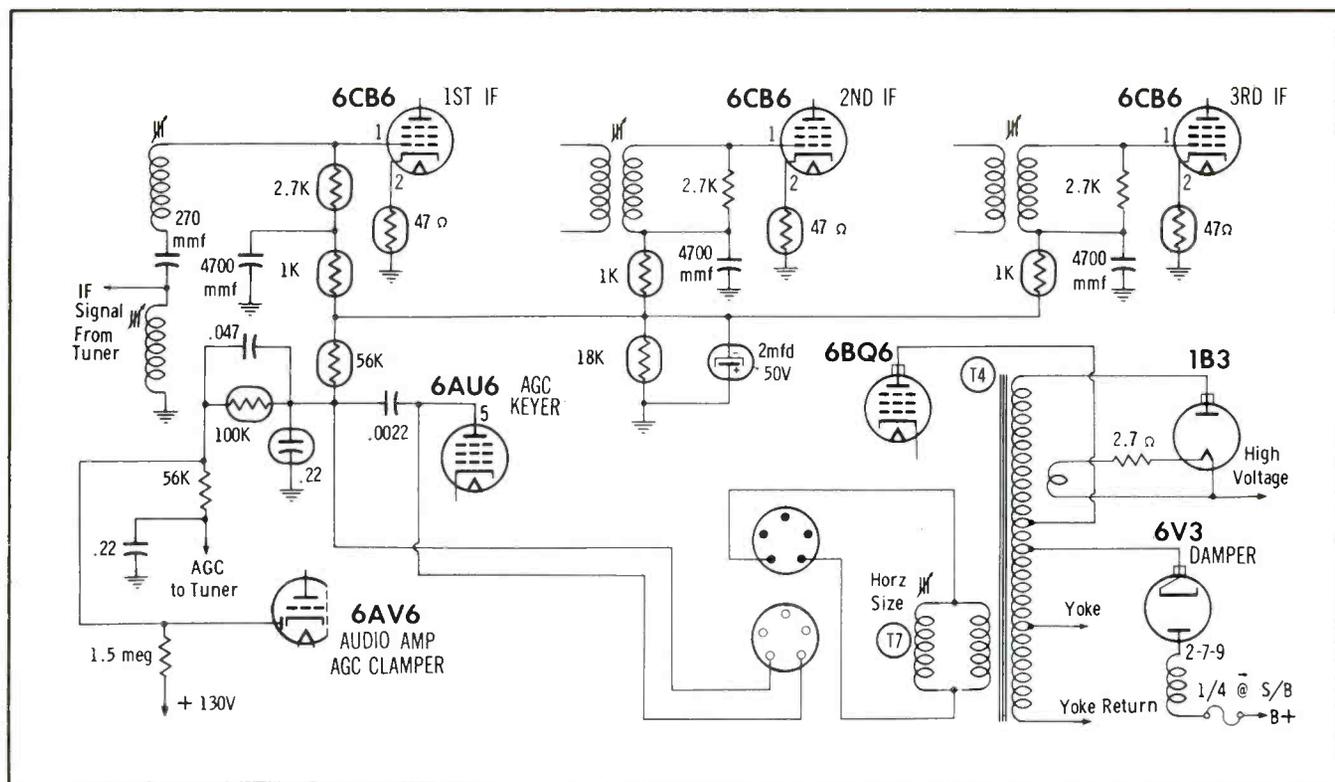
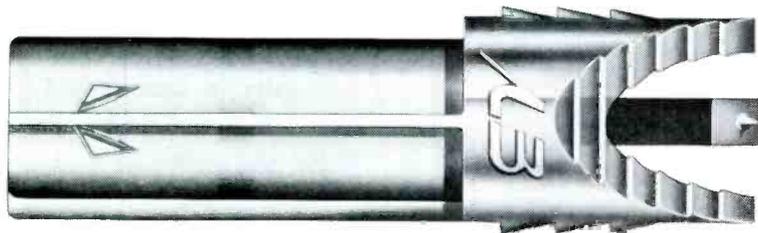


Fig. 1. Continued operation with a defective flyback resulted in the chain-reaction failure of the circled components.

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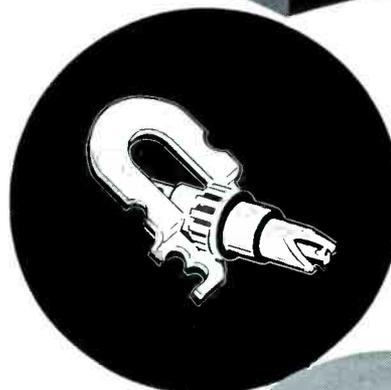
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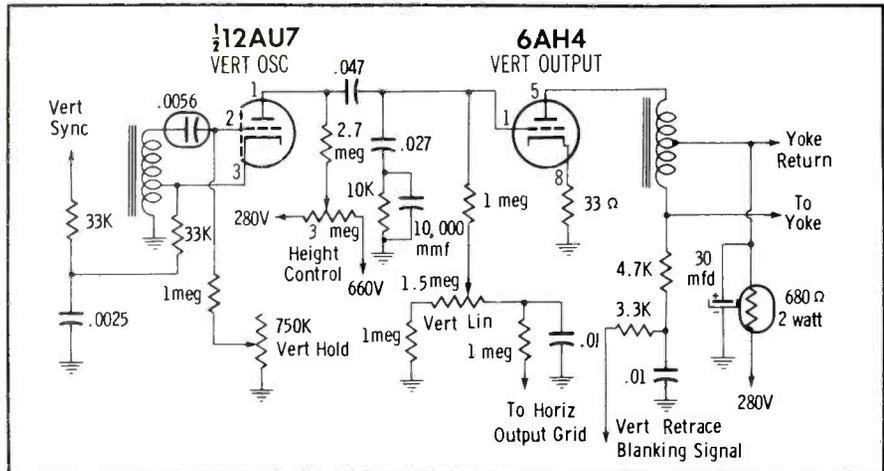


Fig. 2. Defective components in this vertical sweep circuit played a part in damaging the picture tube.

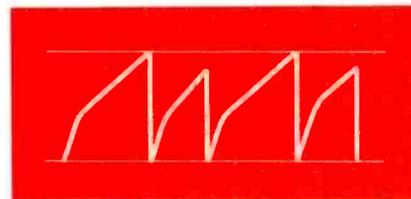


Fig. 3. Waveform of the signal at the grid of the output tube in Fig. 2.

Loss of Vertical Sweep  
Results in Damaged CRT

The customer's description of the trouble in this case was a loss of the picture. When the technician arrived in the home, the receiver was still in operation and there was a very bright horizontal line across the screen. The brightness was immediately turned down—but, as feared, the phosphor coating was burned where the beam had been intensely concentrated. Questioning of the customer revealed that the vertical sweep had been in the process of failing for more than a week. To avoid a later misunderstanding, the customer was shown the damage to the picture tube and informed that continued operation with the bright line on the screen had been the cause.

able amount of grid current would flow, causing the resistor and IF tube failures. The defective fourth IF tube was just a coincidence.

The only possible source of a high positive potential on the AGC line was the flyback transformer. Resistance checks proved that the AGC winding had shorted to the primary and thus placed the boost B+ potential on the AGC line. The short finally resulted in the 1/4-amp slow-blow fuse failure which prevented further damage to the horizontal sweep section.

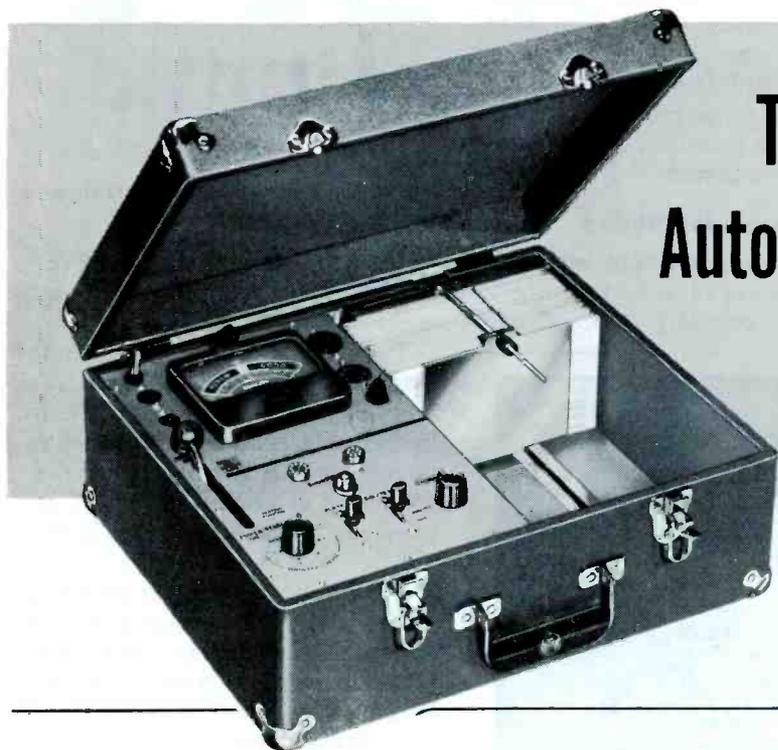
In case you wondered, the RF amplifier and its associated circuit components were not damaged. The diode clamper section of the 6AV6 shunted the tuner AGC circuit, conducting heavily, and preventing the tuner AGC bias from becoming positive. The technician checked the tuner and the 6AV6 to make sure that the tube had not failed and allowed heavy current to damage the tuner.

After replacing all four IF tubes, the video IF strip was realigned because the technician knew that the replacement of so many components in the IF circuit would most certainly affect its frequency response.

Next, the technician substituted new tubes in the vertical oscillator and output stages in an attempt to restore vertical sweep action. When this was unsuccessful, the chassis was removed and taken into the shop. A series of voltage measurements disclosed that B+ was not getting to the plate of the 6AH4 output tube. Further checks revealed that the 680-ohm, 2-watt resistor from B+ to the tap on the vertical output transformer was open (see Fig. 2). Replacement of this resistor, however, failed to restore circuit operation, and a scope analysis of the signal at the control grid of the 6AH4 indicated that the time duration of every other cycle was only about half that of the alternate cycles (Fig. 3).

This led the technician to sus-  
PF REPORTER • August, 1957

an announcement of utmost importance to the service industry...



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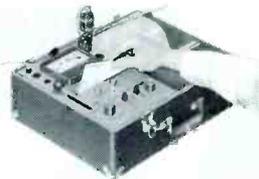
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COMPONENTS DIVISION

CAMDEN, N. J.

pect some component in the oscillator stage. A resistance check of the oscillator transformer provided no clues, so a new unit was substituted for the .0056-mfd capacitor at the oscillator control grid. This restored the vertical circuit to normal operation.

Whether the 680-ohm resistor failed before or after the .0056-mfd capacitor is a point which could be argued; however, the picture tube was damaged because the customer continued to operate the receiver after the vertical sweep failed.

This points out that many customers haven't been properly instructed about turning a set off when it isn't functioning normally. You will be doing your customer a favor if you advise him that continued operation of an obviously defective receiver is an invitation to a big repair bill because of the possibilities of chain-reaction component failures.

#### Knobs for Radios

Getting a replacement knob for a radio has always been quite a problem, especially the plastic



Fig. 4. Knob assortment that features a variety of sizes, colors and shafts.

types for table models which vary considerably in knob design and control-shaft lengths.

The introduction of a knob-assortment kit by Colman Tool and Machine Co., Amarillo, Texas, has greatly reduced this problem, however. This kit not only offers a variety of sizes and colors, but provides a complete interchangeability of knobs and shafts as well. A sample assortment is shown in Fig. 4. The desired color and knob style are chosen, and then fitted to a shaft of correct style and length. The knob and shaft are then pressed together into a single, permanently-bonded unit.

The octagon-shaped cutout in the knob and the end of the shaft

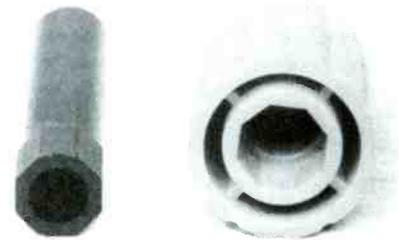


Fig. 5. Details of Colman knob assembly.

(Fig. 5) both have a slight taper, so that once assembled they will not come apart. In addition, the knobs and shafts are made of dissimilar plastics, and in a short while they actually fuse together, adding further to their structural rigidity. Metal bands are supplied on the ends of all knobs designed to fit the half-round style of control shaft.

In all, there are ten knob styles and ten shaft lengths in the Colman line. Each knob style is available in eleven colors and the shafts are supplied in either black or white to give an almost unlimited flexibility in the choice of combinations. ▲

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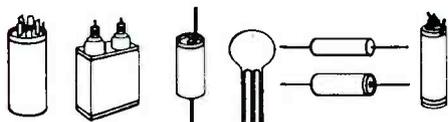
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# servicing

## new designs

by Thomas A. Lesh

ing of the speaker at low frequencies will be increased. When mounted on feet and placed next to a wall, the enclosure operates on a bass-reflex principle. The bass response is extended below the resonant frequency of the speaker and also reinforced above this frequency.

The feet can be installed in two positions, edge or side down, providing a choice of two port openings. Both positions should be tried with the purpose of tuning the enclosure as closely as possible to the resonant frequency of the speaker. If the port is of the wrong size, an unpleasant "boom" instead of a smooth bass response may be obtained.

Because of the hexagonal shape of the enclosure, it will fit neatly into one corner of a room and thereby function as a corner driver. When the unit is operated with the feet mounted flat side down, sound is fed into the corner by the bottom port and then reflected in such a manner that the walls of the room act as virtual extensions of the speaker. As a result, the bass response is extended to very low frequencies.

All three arrangements which have been described can provide pleasing hi-fi sound under the right conditions, and a "proper" installation of the convertible speaker enclosure is determined strictly by the listener's taste.



Fig. 1. This new RCA speaker enclosure is converted from an infinite baffle to a bass reflex cabinet by attaching legs.

### Convertible Speaker Enclosure

It's not easy to pick out a group of separate components that will give satisfying results when assembled into a hi-fi system. Selection by trial and error is often helpful; for instance, a listener may try out several different types of speaker enclosures before he finds the one best suited to his speaker, amplifier, and listening room. As an aid to such experimentation, the Components Division of RCA has come out with a "Custom Convertible" speaker enclosure (Type 300W1 or 301W1) which can perform either as an infinite baffle, a bass-reflex cabinet, or a corner horn. This enclos-

ure is designed to accommodate a 12" speaker with a resonant frequency between 40 and 80 cps—for example, the RCA 501S1 or 502S1. An adapter panel that will permit the use of an 8" speaker is an optional accessory.

The cabinet has an open bottom and removable feet. When the latter are taken off and the cabinet is set flat on the floor, the port is covered and the enclosure behaves as an infinite baffle. Since the volume of air inside the cabinet is limited, loading of the speaker is reduced at low frequencies; thus, the bass response is not as strong as it would be with other types of enclosures. This moderate bass sensitivity is pleasing to many listeners, especially in an acoustically "live" room.

If an extended and reinforced bass is desired, however, the cabinet can be raised off the floor so that the opening is utilized. This port provides acoustic coupling between the internal cavity and the outside air; hence, load-

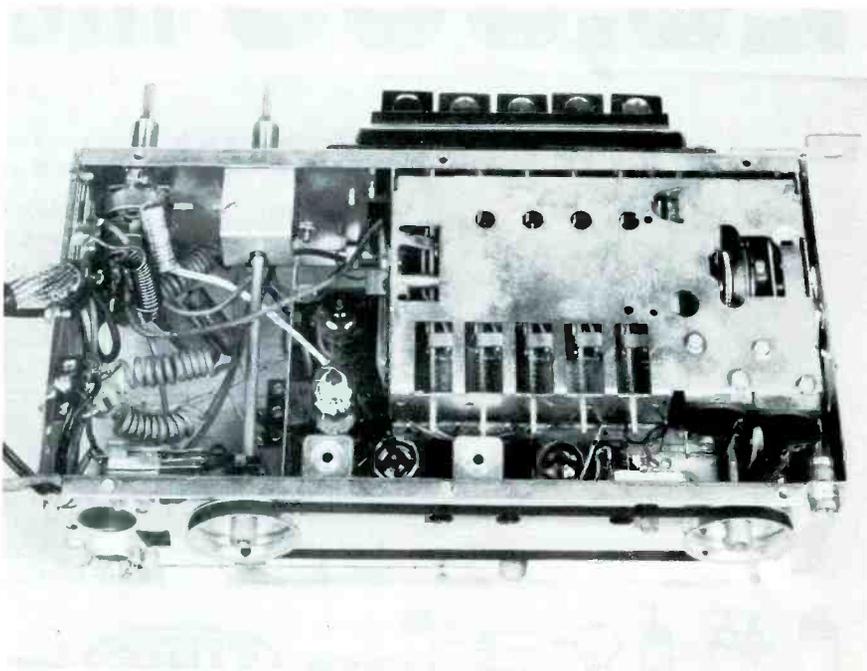


Fig. 2. Manual tuning shaft on the 1957 Cadillac radio controls the tuner through a belt drive and also operates a motor switch for a power-operated antenna.

# how long would it take you to solve this service problem?

## PHOTOFACT

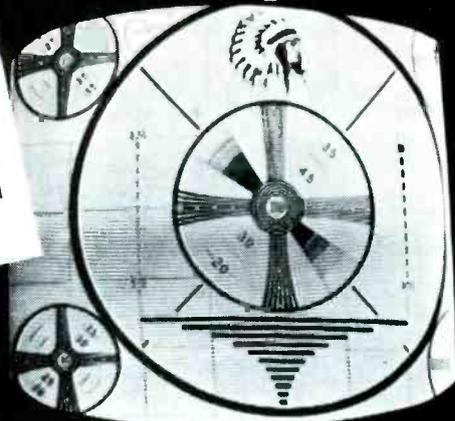
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### SYMPTOM:

Horizontal Foldover affecting the right side of the screen, accompanied by an overall reduction in width

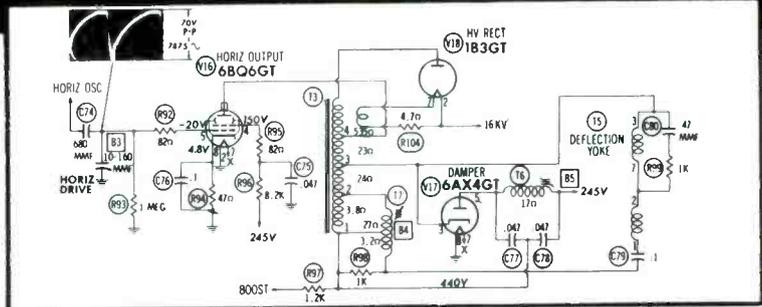


Let's look at this problem: When the foldover occurs at the right side of the picture, the trouble usually originates in the horizontal discharge or output circuits. Look for the following possible causes:

1. Defective tube in the flyback circuit
2. Leaky coupling capacitor (C74)
3. Misadjusted or defective drive control
4. Open or leaky capacitor (C76) in the cathode of the output stage
5. Incorrect value of the grid resistor (R93) in the horizontal output stage
6. Open or leaky screen bypass capacitor (C75) in the output stage
7. Incorrect value of the cathode resistor (R94) in horizontal output stage
8. Incorrect value of the screen resistor (R96) in horizontal output stage
9. Defective yoke or flyback transformer

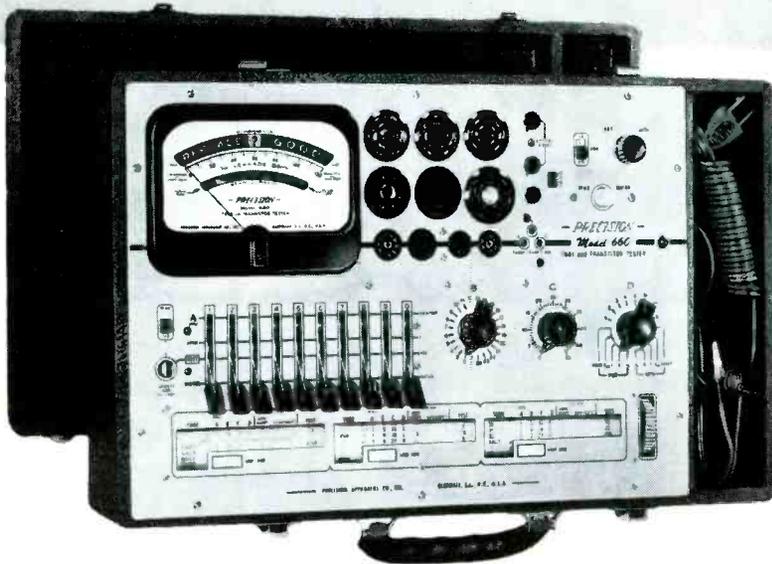
With the applicable PHOTOFACT Folder at your fingertips, you'll trouble-shoot and solve this problem in just seconds. Here's-how:

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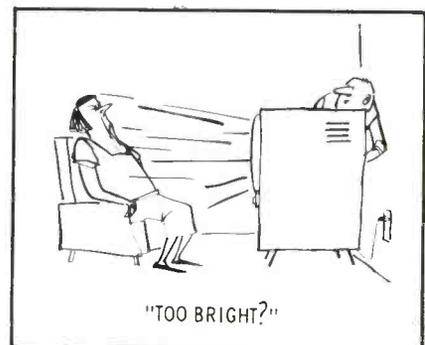
### Radio With a Belt in the Back

A novel feature of the new Cadillac Model 7268005 auto radio (Fig. 2) ties in with its tuning system. The manual tuning control is conveniently located on the driver's side of the radio, next to the volume control. When rotated, it drives the tuning mechanism through a belt-and-pulley arrangement mounted on the back panel of the receiver. This same control is also used for another function—when the tuning knob is pushed or pulled, it activates a motor switch and raises or retracts a power-operated antenna. Because of the flexibility of the belt drive, the antenna control is independent of the tuning system.

In addition, this 1957 model radio is equipped with the new Delco Series F2 tuning mechanism, which features both push-button and search tuning. Mechanically, the F2 system differs considerably from the Series F1 tuner that has been in use for several years. Fig. 3 is a simplified drawing of the F2 tuning linkage. The RF circuits are permeability-tuned by movable cores, the positions of which are controlled by a pivoting double bar called a treadle. As the top of the treadle is moved forward, the cores are pushed into the coils and the receiver is tuned to a lower frequency.

Push-button tuning is of the familiar mechanical 5-button type. Whenever a button is pressed, it pushes against the bottom bar of the treadle and moves it to a position which is predetermined by the setting of a cam. At the same time, a lever disengages a clutch on the treadle shaft, disconnecting the treadle from the manual tuning gears so that it can pivot freely.

These gears consist of a worm



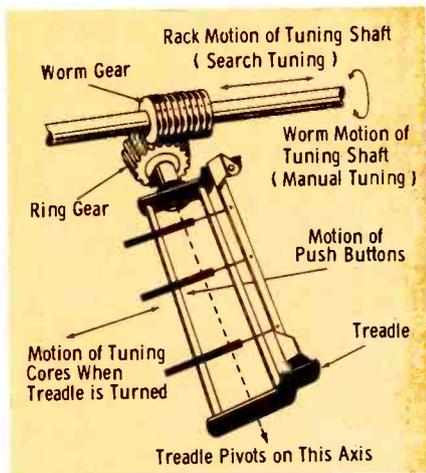


Fig. 3. Basic parts of Delco F2 tuning mechanism move as shown.

on the tuning shaft and a ring gear on the treadle shaft. During manual tuning, the belt drive rotates the worm, which slowly revolves the treadle. But during electronic search tuning, the worm does not rotate at all; instead, its shaft is pulled lengthwise as indicated in Fig. 3, and the worm and ring gears perform as a rack and pinion except that the "rack" (worm) is the driving member.

The energy which produces this lengthwise motion of the tuning shaft is stored in a strong spring. Some of the details of the spring drive are visible in Fig. 4. The front end of the power spring is anchored to a fixed point, and the rear end is linked to the worm gear through an operating arm. The spring is stretched and released at the beginning of the search-tuning action. As it compresses, the operating arm pulls on the worm and thus turns the ring gear and treadle. When most of the tension of the spring has been spent, an ear on the operating arm strikes a tab on a limit switch. This energizes a power solenoid that pulls on the operating arm and restretches the spring.

This recocking action occurs whenever the spring mechanism runs down, regardless of the position of the treadle. As soon as the spring is fully extended, the solenoid lets go and the spring begins to compress again. Approximately two cycles of spring operation are required for a full sweep of the broadcast band.

Each time the tuner reaches the high end of the band, a second limit switch energizes a treadle

August, 1957 • PF REPORTER



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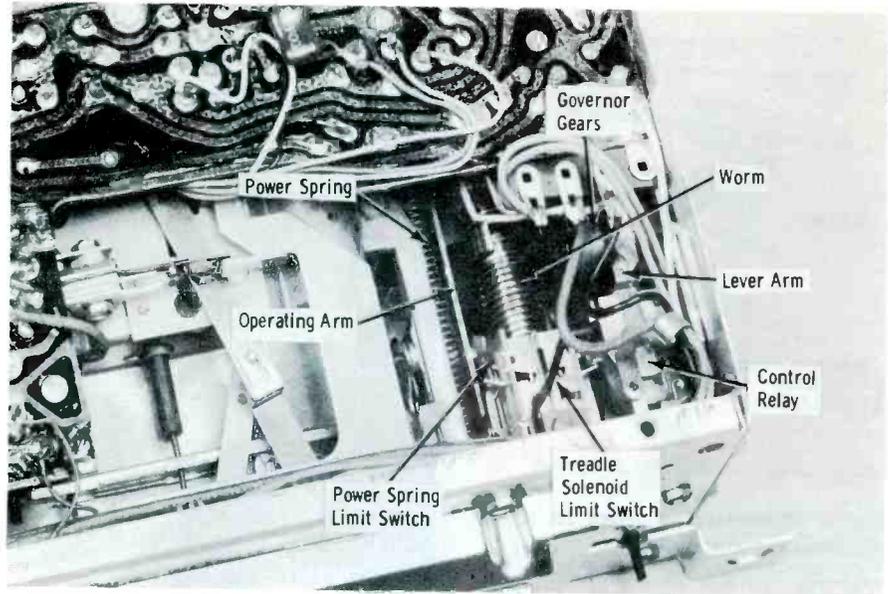


Fig. 4. Motorless Delco F2 search tuner is powered by a spring-and-solenoid arrangement, with a control relay to stop the tuner on stations.

solenoid which resets the treadle, driving the cores all the way into the tuning coils. When this action is completed, the solenoid releases the treadle and search tuning resumes immediately. Every time either of the two solenoids kicks in, the declutching lever is momentarily activated in order that the treadle and the spring-drive mechanism can be independently repositioned.

You may be wondering by now why the spring does not compress rapidly after being recocked and released. The rate of compression is held to a constant, gradual pace by a centrifugal-friction type of governor attached to a train of gears. These are meshed with a second worm gear on the tuning shaft (not visible in the illustrations), which also operates on a rack principle during search tuning. The governor gears are equipped with a ratchet to prevent them from being turned in

reverse during recocking of the power spring.

At all times when the mechanism is not actively searching, the gear train is held stationary by a lever arm attached to a control relay. Touching the "wonder bar" on the front panel of the radio energizes the relay, which lifts the lever away from the gears and allows them to turn. Then the power spring is able to move the tuning shaft at the rate determined by the governor. As soon as a station signal is received, a trigger tube cuts off the tube that supplies current to the relay, and the latter is deenergized. The lever arm then drops into the gear train and stops the tuner in the "on-station" position.

The governor gear train is also responsible for preventing lengthwise "creeping" of the tuning shaft during manual tuning. The gears are held stationary by the relay arm, and they permit rotary

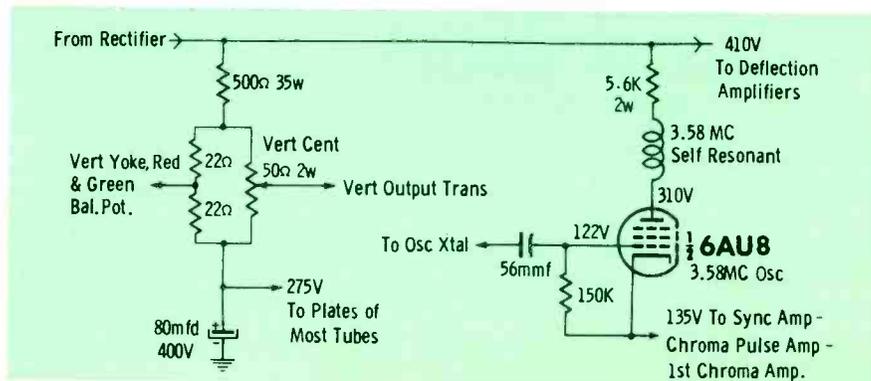


Fig. 5. The color oscillator of current Motorola sets also serves as B+ divider.

but not lengthwise motion of the tuning shaft.

Mechanical adjustments may occasionally have to be made to such components as the clutch, limit switches, relay arm, and gears in order to maintain smooth operation. Experience with several F2 tuners indicates that the power solenoid may fail to cock the spring fully if the input voltage is only 12 volts or less. As it attempts to stretch the spring, it draws continuous heavy current and may blow the fuse. If you encounter a tuner that stalls in this manner, check for low "A" voltage from the car's electrical system. It may be necessary to replace the power solenoid to ensure positive operation of the spring-drive mechanism under all conditions.

#### Color Oscillator Drops B+ Voltage

Most technicians are familiar with the use of the audio output tube as a "dropping resistor" in the B+ circuit of some TV receivers. This tube is placed in series with the plate circuits of several other tubes, and its cathode potential is therefore approximately 125 volts above ground potential.

An interesting variation of this scheme is utilized in the Motorola TS-905A color TV chassis, where a B+ potential of 135 volts is needed for a few circuits. In search of a stable source for this voltage, designers decided upon the 3.58-mc chrominance oscillator. This tube is connected between the 135-volt bus and the B+ rectifier output. Fig. 5 is a diagram of the main elements in the B+ distribution system, including the oscillator plate circuit. ▲



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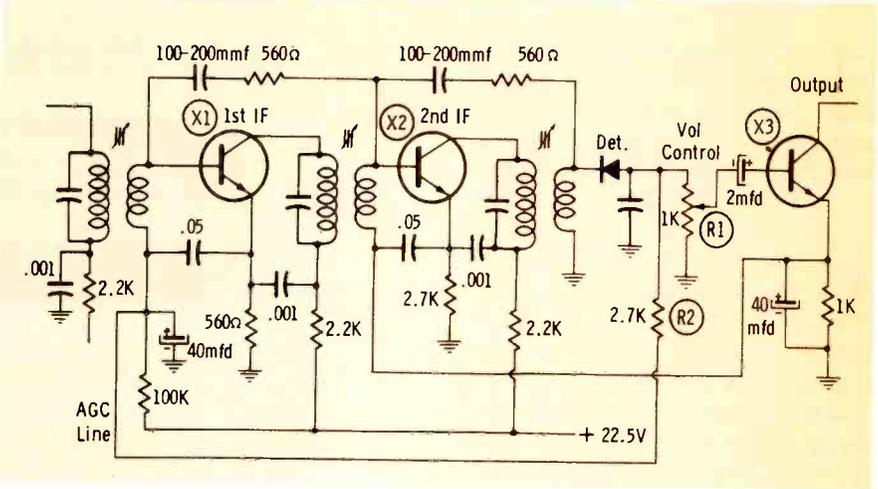


Fig. 3. The AGC voltage in this circuit is applied to the base of X1. Changes in base current are amplified and appear as larger changes in emitter current.

power detector or its equivalent must be employed, seemingly eliminating the choice of a germanium diode detector—yet such a unit is attractive from a cost standpoint. To get around the inability of the germanium diode to provide the required power, the controlled stage itself can be called upon to serve as a DC amplifier for the AGC current. By feeding the AGC voltage to the base of

the controlled stage, the resulting changes in the base current are amplified and appear as larger changes in emitter current.

A typical circuit illustrating this method of control is shown in Fig. 3. A germanium diode is employed as the detector and is connected to produce a negative voltage across the volume control R1. This voltage is then fed via R2 to the base of the first IF amplifier.

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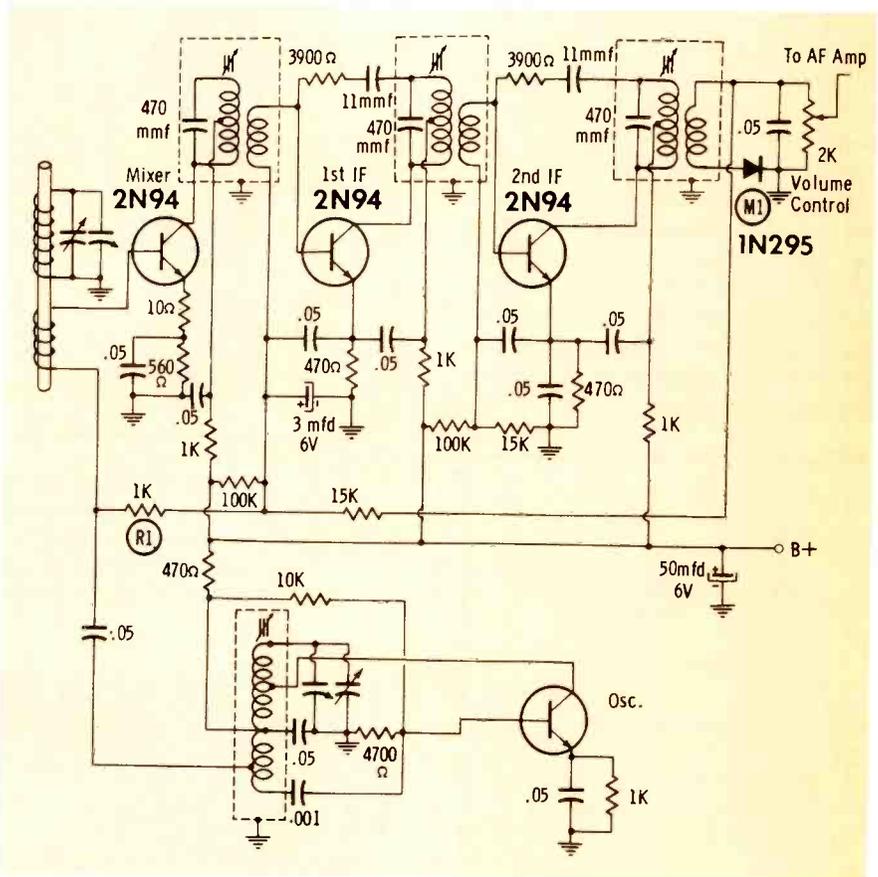


Fig. 4. In this Zenith Model 500, AGC is applied to the mixer and 1st IF stages.

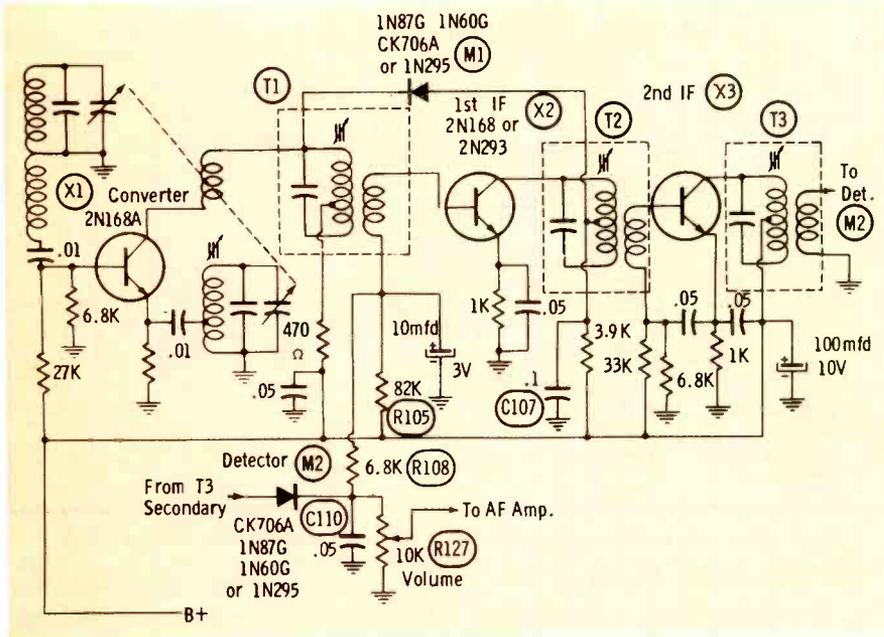


Fig. 5. An AGC system that is supplemented by an auxiliary diode, M1.

Since this stage uses an n-p-n transistor, a negative voltage at the base will oppose the normal bias, and as the signal tends to increase, the AGC voltage will become more negative and reduce the gain of the stage. By the same token, a drop in signal will decrease the AGC voltage and permit the gain of the stage to rise.

In Fig. 3, a small positive voltage, fed back along the AGC line from B+ through R3 and R2, biases the diode in the forward direction. This is done to shift the operating point to a more linear portion of the characteristic curve and reduce distortion on weak signals.

In Fig. 4, a similar AGC system is used to apply the control voltage to the bases of the mixer and 1st IF stages. R1, the 1K-ohm isolation resistor is employed to prevent any undesirable interaction between the two controlled stages, and a 3-mfd capacitor at the 1st IF take-off point filters the AGC voltage.

#### Supplementary AGC By Second Diode

In DuMont's Model 1210 transistor radio, the foregoing AGC circuit is supplemented by an auxiliary diode as shown in Fig. 5. The normal AGC network extends from the detector via R108 to the base of the 1st IF, an n-p-n transistor. The control voltage developed across C110 and R127 is negative, and works against the

B+ voltage present at the top of R105.

Further examination of the circuit reveals a similar germanium diode, which affects the gain of the converter stage, connected between the center tap of T2 and the top end of the primary of T1. On strong signals, the amount of AGC voltage fed to X2 is quite high, and conduction through the transistor is reduced sharply (thereby, of course, lowering the gain and tending to counteract the effect of the stronger signal). This causes the positive voltage at the collector to rise, in this instance, toward a value of 8 volts. Actually, 8 volts would occur only if the transistor ceased conducting completely; however, the value does get slightly above 7.5 volts, and when it does, M1 will conduct because the anode will be more positive than the cathode. The potential on the latter element is normally about 7.5 volts, obtained from the connection at T1.

When M1 conducts, it acts as a resistor in series with the .1-mfd capacitor C107. This combination loads the primary of T1 and reduces the signal fed to the 1st IF and all subsequent stages. On moderate and weak signals, the current passed by X2 is enough to keep its collector potential below 7.5 volts. In such cases, M1 cannot conduct and T1 is permitted to pass its full signal on to the 1st IF amplifier.

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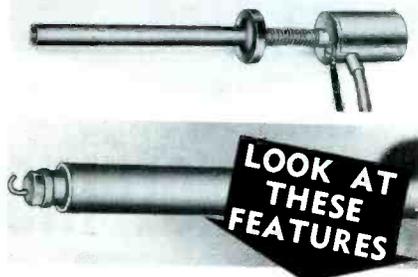
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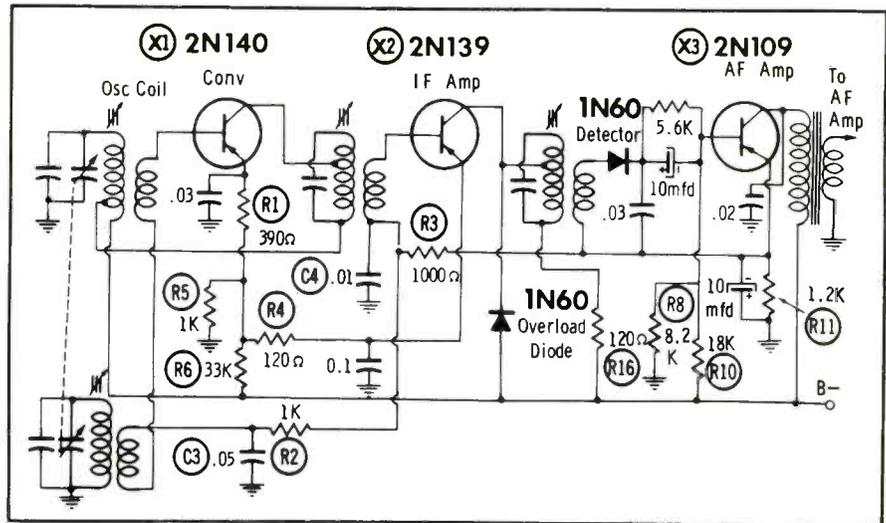


Fig. 6. An overload diode is used in the AGC system of this RCA Model 8BT7.

**Overload Diode**

An overload diode is also employed in one of RCA's recent transistor receivers, although its effect here is confined to the 1st IF stage (see Fig. 6). The diode is connected between the collector of the IF stage and the negative side of the power supply. With weak and moderate signals, the voltage drop across R16 provides a reverse bias of about .12 volts. Hence, the impedance of the diode is very high compared with the other circuit impedances. However, when the signal excursions become very large, the diode is driven into its forward conduction region, placing a relatively low shunting impedance across the

output transformer and reducing the signal applied to the detector stage. It is claimed that this action permits satisfactory operation at signal levels up to 1 volt per meter.

The AGC system in this receiver differs somewhat from those previously discussed and, for that reason, warrants some further examination. The detector cathode is connected to the base of X3, while the anode has a DC path through the input coil to the emitter. By this arrangement, the base of X3 is driven positive as the IF signal input to the detector is increased. This results in a decrease in collector current which in turn reduces the voltage

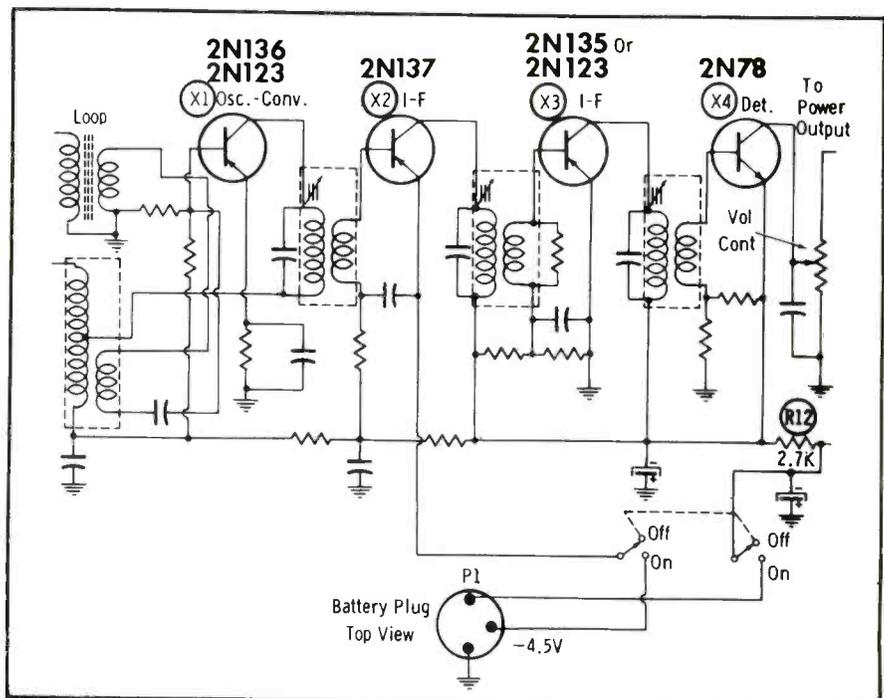


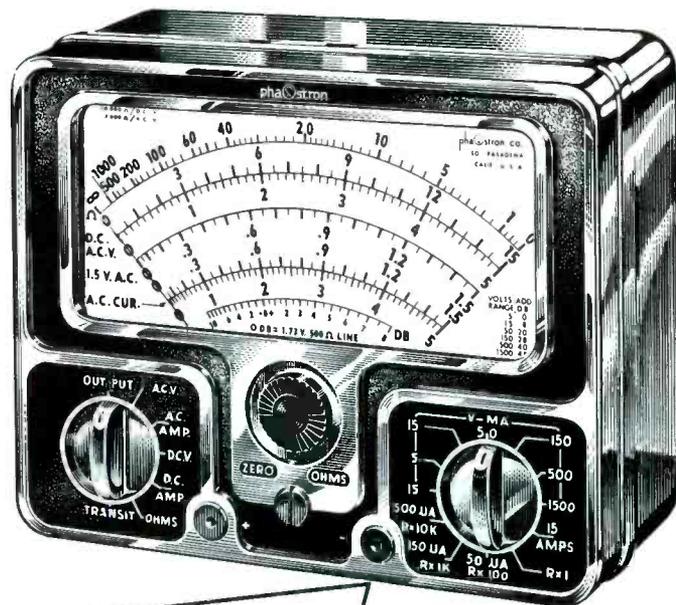
Fig. 7. The GE Model 675 transistor radio employs an AGC system based on X4 current through R12, changing the supply voltage to previous stages.

drop across R11, and the emitter of X3 becomes less negative or more positive. The bases of the IF and converter stages are connected to this emitter through the filter networks of R2, C3 and R3, C4, respectively. When the input signal to the detector increases, the bases of the IF and converter transistors are driven in the positive direction, their collector currents decrease and the gain of these stages is reduced. A decrease in signal strength has the opposite effect, with a subsequent rise in gain.

Note, too, that the emitter of the IF stage is returned to the junction of R4 and R6, while the converter emitter element attaches to the junction of R4 and R5 through R1. R4, R5, and R6 form a stable voltage-divider network across the main B— line, and since the emitters of the IF and converter stages are connected into this network, their voltages tend to remain constant irrespective of the received signal level. Since the collector current depends upon the base-to-emitter voltage, a more nearly constant emitter voltage will make any change in base voltage more effective in changing the collector current.

#### Source-Voltage AGC

Another interesting method of AGC control is found in the circuit of Fig. 7. In the detector stage X4, the emitter bias comes from the B— supply through R12. X4 does not draw current until a signal is received. With no signal, therefore, the voltage drop across R12 is due entirely to the current drawn by the previous RF and IF stages. When a signal is received, X4 draws current in proportion to the strength of the signal and the voltage drop across R12 will rise accordingly. As a result, the supply voltage to the converter and IF amplifiers will be less negative on a strong signal than on a weak signal. This changing bias voltage will vary the gain of X1, X2, and X3, although it will have its greatest effect on X2 since the emitter is returned to a fixed voltage tap on the battery (4.5 volts). The converter and 2nd IF will be controlled to a lesser degree since



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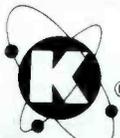
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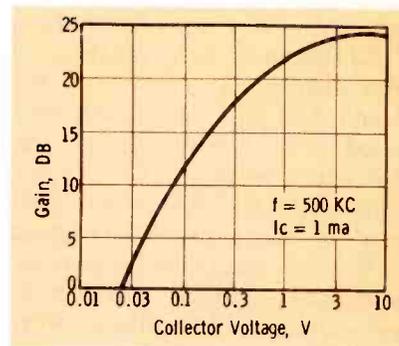


Fig. 8. Common-emitter amplifier gain as a function of collector voltage.

the voltage on all elements of these transistors change in unison. Thus, we achieve the over-all action of an AGC system without actually employing a conventional AGC network.

#### Collector-Voltage Control

It is also possible to vary transistor gain by altering the collector voltage, although for this method to be effective, it is necessary to reduce the collector voltage to a fairly low value. This is illustrated by the curve shown in Fig. 8. The greatest usable control range extends from about .03 volt to 1 volt. If the collector voltage cannot be successfully reduced to these values, this type of control will not be as effective as emitter current control.

A typical circuit utilizing collector voltage control is shown in Fig. 9. The AGC line is connected to the transistor base and as the base voltage varies, it alters the current through the transistor. A fairly high-valued resistor is present in the collector lead, and the current variations through this resistor vary the collector voltage and thus the stage gain as indicated in Fig. 8.

Offhand, this method of control might appear to be exactly the same as emitter-current control, with the possible exception that a relatively high-value resistor is used in the collector circuit. The resistor is an integral part of this method of control and is necessary, of course, to reduce the collector voltage to a level where changes in collector voltage will materially affect gain. However, there is yet another marked difference and that concerns the polarity of the AGC voltage which is fed to the base. It is opposite in polarity to the AGC voltage

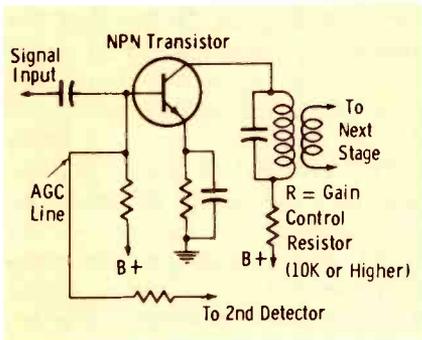


Fig. 9. An illustration of collector-voltage control for AGC action.

used in the previously described systems. That is, when the signal increases, the AGC voltage tends to drive the transistor stage harder, further increasing its current. This will cause a greater drop across the collector resistor and a decrease in gain. By the same token, when the signal level drops, the AGC voltage tends to decrease the current flowing in the collector circuit. This raises the collector voltage and with it, the stage gain.

Note carefully that the AGC voltage acts in consort with the signal level, rather than against it, as in conventional systems. For an n-p-n transistor, where the base must be positive with respect to the emitter, collector-voltage control requires that the AGC voltage drive the base even more positive when the signal level rises. With a p-n-p transistor, the AGC voltage, under the same conditions, would become more negative.

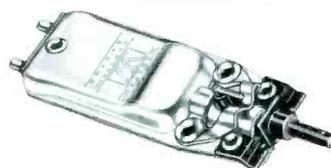
For the service technician, the best method of differentiating between the two methods of control is to determine what happens to the AGC voltage as the signal level changes. If the voltage appears to drive the transistor harder as the signal level rises, look for a relatively high-value resistor in the collector circuit. This must be present or the desired variation at the collector will not be obtained. From a practical standpoint, collector-voltage control systems are comparatively rare because of the low value to which the collector voltage must be driven before effective variation in gain is achieved. This limits the amount of output signal to fairly low values; thus, the emitter method of control is more flexible in this regard. ▲



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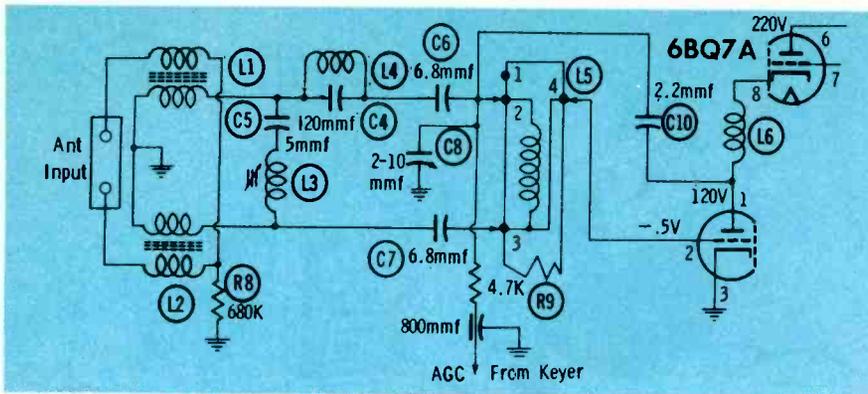


Fig. 6. Input circuitry used in a cascode type tuner.

shown in Fig. 10. Notice that the inductance (part of a turret strip) is in series with the input and stray capacitance (dotted in) of the RF amplifier tube, thus forming a series circuit which is resonant at a frequency governed by the inductance of the coil on the turret strip. Although the overall impedance of a series tuned circuit is low at resonance, the individual reactances are very high. Thus, the series resonant circuit is used to satisfy two conditions, i.e., its low over-all impedance matches the output impedance of the balun and the high capacitive reactance acts as the input signal load.

For cascode RF stages using the 6BZ7 tube, the Q of the input circuit is about 4.4 at 60 mc because of tube and circuit loading.

Since

$$\text{Bandwidth} = \frac{\text{Freq.}}{Q}$$

it may be seen that the input bandwidth at 60 mc is about 14 mc. As the input signal frequency increases, so does the bandwidth, and at the high end of the VHF range (200 mc), bandwidth is about 48 mc. This wide input bandwidth makes it necessary to include the aforementioned filter networks ahead of the RF amplifier and thereby prevent the passage of unwanted signals.

Looking back at the formula, it would seem that the need for the filter and trap networks could be eliminated by simply increasing the Q of the circuit and reducing the input bandwidth to the desired 6 mc. However, in order to increase the circuit Q, the input capacity of the tube would have to be increased. If the resonant frequency is to remain the same, the inductance must be decreased. This would make the selection of inductance values too critical for production purposes; therefore, it is customary practice to construct the RF input tuned circuit so that extremely wide bandpass is achieved, and then include the filter and trap networks previously mentioned to narrow the bandpass as needed and prevent the passage of unwanted signals.

#### AGC for Tuner

The AGC voltage to the tuner is applied to the input grid of the



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RF amplifier stage to prevent overloading of the IF stages under strong signal conditions. The AGC voltage is always applied through an RC decoupling and isolation network to prevent interaction between AGC-controlled stages.

Usually, the AGC action on the RF section is delayed until its output signal is on the verge of overloading the video IF section. If the tuner AGC voltage changed at the same rate as the IF AGC voltage, excessive noise would be developed during the reception of moderate strength signals. With a suitable AGC delay to the RF stage, however, the video IF section will provide most of the necessary gain, allowing the RF stage to operate at a level which provides the most favorable signal-to-noise ratio.

When the AGC voltage applied to the RF stage reduces the gain to a very low level (because the incoming signal is strong), the stage will be operating on the nonlinear portion of its transfer curve and it will be susceptible to intermodulation from a strong undesired signal. A remote-cutoff RF tube greatly reduces this tendency. Unfortunately, high-transconductance, low-noise tubes do not have a remote-cutoff characteristic and other measures must be utilized to simulate the condition. In the case of cascode RF amplifier stages, for example, the tube can be made to perform as though it possessed a remote-cutoff characteristic by returning

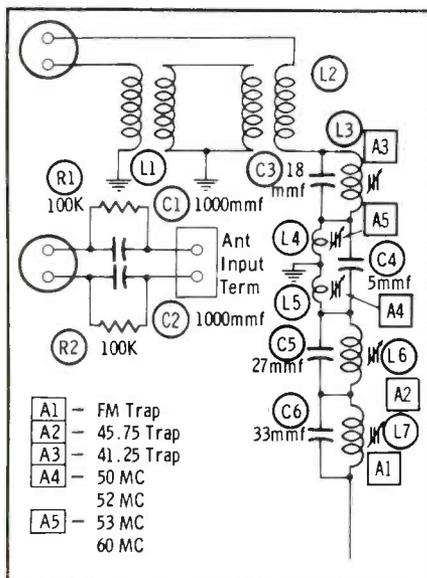


Fig. 8. Input circuitry for a tuner which uses a pentode RF amplifier.

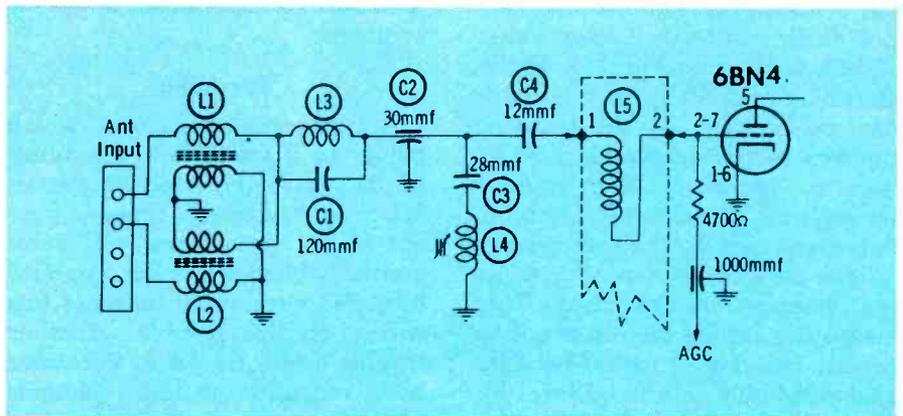


Fig. 7. Input circuits used in a neutrode tuner.

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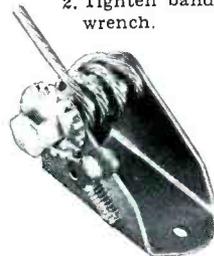


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the control grid of the second section to B+ through a large value of resistance (see Fig. 11). If the circuit is hooked up in this manner, the voltage on the plate of the first section increases as AGC bias is increased. The current through the B+ dropping resistor decreases, causing the grid voltage on the second section to rise as the cathode voltage rises. This means the second section is not as readily cutoff as it would be if its grid were held to a fixed level by returning it to ground. Naturally, the B+ regulation must be good if

the desired operation is to be achieved.

### Servicing

A common symptom which points to a trouble in the tuner is an extremely snowy raster. When this symptom appears, nine out of ten servicemen will automatically change the RF amplifier tube and more often than not this will cure the trouble. Another trouble easily traced to the tuner is no reception on high channels with normal reception on low channels. The experienced tech-

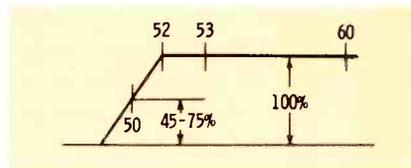


Fig. 9. Idealized response curve shaped by low-end filter circuit.

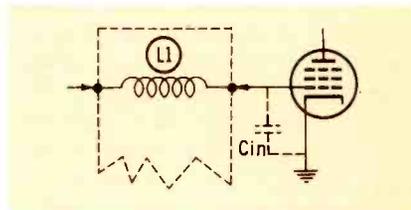


Fig. 10. Simplified RF amplifier input.

nician automatically changes the converter tube, and more often than not, this is enough to restore normal operation.

However, how many technicians know just what to do when interference from an FM station, or interference at an IF frequency, is getting through to the RF stage? If you have followed this discussion carefully, you will realize that adjustments of the traps in the input circuits will minimize or completely eliminate the effects of this interference.

Dirty contacts on the switches associated with the tuned circuits can increase distributed capacity, narrowing bandwidth and causing degradation of the signal.

Repeated RF tube failure often makes a technician wonder if a circuit defect is the cause, or if the tube is normally short-lived. Let's consider the cascode RF amplifier tube. The small input capacity and high transconductance features of the 6BQ7, 6BZ7 and 6BK7 tube types is made possible by the very close spacing between the grid and cathode and the use of very fine wire for the grid. Because of its location and delicate construction, the grid is subject to warping or sagging as a result of heat from the filament or contamination from material boiled off the cathode, either of which makes the tube susceptible to rapid failure.

Resistance changes in the voltage-divider network which supplies the grid of the second section can cause that half of the tube to draw excessive current and shorten the life of the tube. It is a good idea to inspect for this condition if the second replace-

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independent  
survey  
shows



Why do electronic technicians prefer Quam speakers? In filling out their survey questionnaires, they mentioned such reasons as:

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- Adjustable mounting bracket
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*first*  
again!

Brand Name Surveys of Chicago, Illinois, asked 22,000 service technicians from coast to coast, "What brand of replacement speakers do you prefer?" Overwhelmingly, from Maine to California, the preference was for Quam. In fact, twice as many servicemen now prefer Quam as the next most popular brand—and as many prefer Quam speakers as the other three leading brands combined! This is the fourth consecutive year in which Quam has led the Survey.

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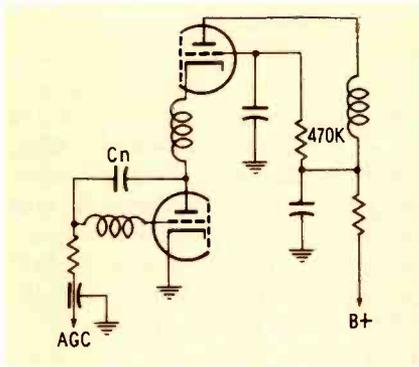


Fig. 11. Cascode amplifier wired to extend the cutoff range of second section.

ment tube fails within a short time.

Lightning damage to the tuner is not uncommon. Very often the balun and trap networks will be destroyed or badly damaged, and even though the receiver may function in this condition, it cannot do so efficiently.

Have you ever wondered about the resistor-capacitor combination used between each side of the balun and the antenna terminals (Fig. 12) in some tuners? Very often the set will have a transformerless power supply, and the resistors are used to provide a leakage path for static voltages

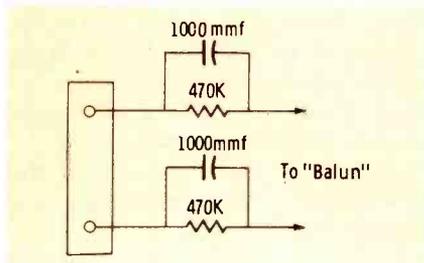


Fig. 12. Isolation network used at the antenna inputs of some sets.

developed on the antenna. At the same time, they serve to isolate the "hot" chassis from earth ground. Without the network, only the low resistance of the balun coils would be connected between the chassis and the grounded antenna mast. Never, under any circumstances, remove this network from a receiver—it does not interfere with the gain, so there is no need to remove it. The foregoing explanation of tuner input circuits should help you to understand the reasons behind most of the troubles that develop in this network and thus to be better prepared for that next tuner repair. ▲

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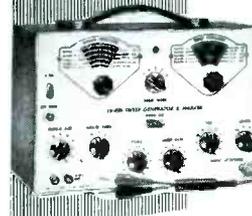
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See the 50 EICO models of tests instruments and hi-fi equipment IN STOCK at your neighborhood distributor. Write for FREE Catalog PF-8

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EICO BROOKLYN 11, N. Y.



## Let's Talk Business

### Getting Good Publicity Is Easy

"That guy must have a relative on the paper—he's always getting publicity!"

The radio-TV servicemen who haven't made this statement aloud have probably thought it silently at one time or another as they noticed how a competitor always seems to be mentioned in the editorial columns of the local newspaper. The truth of the matter is that if the competitor *did* have a relative on the paper, he would be getting less publicity than he has been—newspaper people are that way.

Securing valuable free publicity in one's local newspaper is not too difficult for the shop owner who understands newspaper activities and what justifies "news items" about himself or his business. There's no question of the value of such publicity, for the oftener one's firm name appears in publicity mediums, the more recognized it will become as one of the leading radio-TV shops in the community. Here, from the practical experiences of a number of shop owners, plus suggestions from newspapermen themselves, are the easy-to-follow avenues toward securing such mentions in any newspaper, be it large or small.

Know the newspaper people personally—that always makes it much easier. All of us take a greater interest in the doings of people we know than in individuals who are just a name to us. The same thing applies to every newspaper reporter. The latter survives on contacts which provide him with news, so it will pay to take the trouble to be such an individual.

Support the local newspapers, for it is only natural for them to favor firms which make their continued profitable existence possible. Asking for free space in a newspaper (which exists by selling space) when we do not support that institution, or do so only

on a most meager basis, is making a request we should expect to have denied.

Learn what constitutes news insofar as local newspapers are concerned. Each editor has his own standards in addition to those which are more less generally recognized. Study what he prints—that's his idea of news. When we know and understand the events which constitute real news and deserve space in our local newspaper, then we can be sure of tailoring our activities to those requirements.

Tell the paper the news. All sorts of things which constitute legitimate short news items happen in repair shops every month. Chances are, however, that no one on the paper will find out about them unless someone tells them. Call the editor or city editor and tell him what has happened; he wants personal and business news all the time, but he can't keep in daily touch with every business in the community.

Work with the newspaper on its promotion events and you'll find an eagerness on the part of the staff to return favors; in fact, the staff will go out of its way to run items about the business and its personnel under such circumstances. Directly promote contests with the newspaper. The radio and TV business offers excellent opportunities for contests at any time. These are always reader interest events for any newspaper. A few dollars spent on prizes for such a co-sponsored contest will result in many times that amount of mention in newsprint.

Work directly with the editorial department instead of handing items to advertising salesmen to finagle into the editorial columns. Editors and reporters instinctively have a dislike for such tactics because they have a taint of pressure. Even the smallest village newspaperman is proud of the freedom of the press—and he

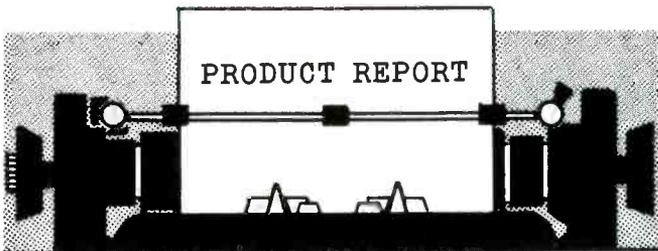
really backs away when any element of pressure arises for space.

Keep your eye on national news and look for opportunities to tie it in with your business. Many small businessmen secure reams of free publicity through such activities. It takes a specific knack which can be developed by concentration on the idea. Newspaper editors are always interested in local angles applicable to national human interest stories.

Get in on local events whenever a possible tie-in can be worked. Hospital or school dedications, visits of celebrities, anniversaries of public officials, etc., automatically make news which can be employed by an alert shop owner to his own advantage. Presenting a commemorative plaque or some such item, for example, to a retiring public official, can result in a picture of the presentation and an accompanying story.

Take over the publicity chore for the local amateur radio clubs, for their activities are always newsworthy to any publication. If we regularly handle this assignment for our local newspaper and the clubs, we soon become the editor's contact for anything in those fields. Thus, he is always receptive to the publicity items about our business from time to time. And, fortunately, the electronics business is news today.

Watch for slack periods in the newspaper's routine—there are always regular days of the week when a newspaper has a big job in finding enough local items to print. Find out when those occur in your local community and make that the time to work up an item or two about the business. Any publicity always has a better chance of being printed when there is plenty of space available. One final bit of advice: Keep calm about the items the paper does run. Maybe you won't like the way an item is written, but remember that it's better than not having it printed at all. Also, when we express our displeasure, we can be fairly sure the newspaper won't be anxious to print additional items in the future. On the other hand, if you take time out to thank the editor for his cooperation, you'll be remembered fondly. ▲

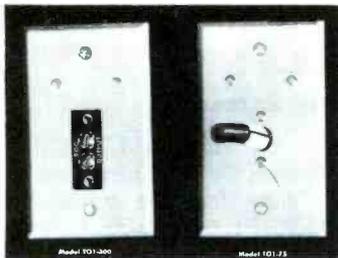


### Additions to Speaker Systems



"Loudspeaker Building Block Systems" by Electro-Voice, Inc., Buchanan, Mich., are designed to improve the frequency response of existing loudspeaker installations. For example, Model BB1 adds very high audio frequencies to low-cost coaxial or woofer-tweeter systems. This package includes the T35B VHF driver (shown), a 3,500-cps crossover network, level control and wiring harness. Seven other "Building Block" systems are also available for adding mid-bass, treble, or very high frequencies to various speaker installations of both low-cost and deluxe construction.

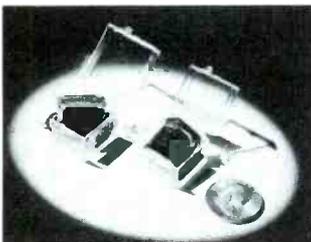
### Master Antenna Outlet Boxes



New single and double outlet boxes for master antenna systems that use RG-11/U or RG-59/U cable are available from Blonder-Tongue Labs., 9-25 Alling St., Newark, N.J. Models TO1-75 (single, recessed mounting) and TO2-75 (double, on-wall mounting) have 75-ohm output and coaxial plug-type connectors. Alternate versions, Models TO1-300 and TO2-300, are equipped with internal matching networks to provide 300-ohm outputs.

All units feature strain relief for the cable and 17-db isolation between TV set and line. Net costs are \$2.50 for single types and \$5 for double types.

### Miniature Transformers



Gramer Halldorson Transformer Corp., 2734 N. Pulaski Rd., Chicago, Ill., is now marketing an extensive line of miniature audio transformers for use in transistorized circuitry. The 32 items in the line are divided into two series: a 150-milliwatt, 0.6-oz. type measuring  $2\frac{1}{32}'' \times \frac{3}{4}'' \times \frac{5}{8}''$  and a 300-milliwatt, 1.1-oz. type measuring  $1\frac{3}{16}'' \times 1\frac{5}{8}'' \times 1\frac{3}{16}''$ . Their sleeve-type lead insulation is easily removable for printed-circuit applications. A special introductory package containing one each of the 32 types, plus an application chart, is now available.

August, 1957 • PF REPORTER

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**CATALOG D-57**

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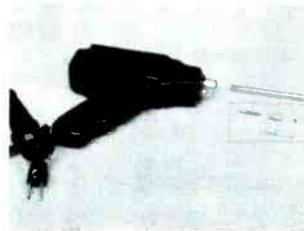
### Transistor Circuit Simulator



The LF-1 Transimulator developed by Sprague Products Co., North Adams, Mass., enables the user to make up complete test circuits for transistors more quickly and easily than with conventional breadboard circuitry.

All elements needed to provide a wide variety of transistorized audio amplifiers are contained within the unit, and components are connected together to form the desired circuits by turning a group of selector switches. Net price of the LF-1 is \$79.50.

### New Soldering Gun



Gregg Electric Co., Lawrence, Mass., is manufacturing a 250-watt transformer-type soldering gun that features easy disassembly for tip replacement. No tools are required for this job, since finger

pressure is sufficient to tighten both the tip and the removable barrel. Oxidation at the end of the electrode is no problem because the small rod which serves to extend the electrode into the tip can be readily replaced. Other features include a trigger-activated microswitch and a choice of barrel lengths and tip shapes.

### Nut Driver Shaft Extension

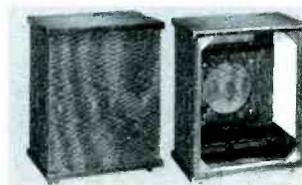


A snap-in 6" extension shaft, a new accessory for use with the 99-PR and 99-JR screwdriver and nut driver kits made by Xcelite, Inc., Orchard Park, N.Y., provides an addi-

tional 6" reach for work in inaccessible spots.

One end of the new 99-X10 extension has winged prongs and fits into the socket of the universal handle supplied with the kits. The other end features a socket fastener which receives all the interchangeable nut driver shafts and single-ended screwdriver blades.

### Speaker Enclosure



A new "Californian" hi-fi speaker enclosure, available either in factory-built form or as a pre-finished kit, is being introduced by Argos Products Co., Genoa, Ill. Interior design uses

the "Bass Ultraflex" principle, licensed by Jensen Mfg. Co. The top of the cabinet is finished with hard, stain-resistant "Panelite" in either blonde or mahogany color.

Net prices are as follows: For Model DSE-1, which accommodates a 12" or 15" speaker, \$52.50 (kit DSE-1K, \$37.50). For Model DSE-2, used with 8" or 12" speaker, \$42.00 (kit DSE-2K, \$30.00).

### Super-Cardioid Microphone



when high-fidelity reproduction is desired.

Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill., has introduced a new super-cardioid, unidirectional microphone, the Model 330 "Unitron," designed to be used mainly for high-quality tape recording and public address work

### Automatic Tube Tester



tester for operation. The new equipment (Model WT-110A) comes equipped with 200 cards which are captive-mounted to keep them in correct sequence. Additional cards are to be made available for new tube types and, in addition, the technician can easily punch out new cards using a master card and data supplied by the manufacturer.

RCA Components Div., Camden, N.J., has developed a 24-lb. portable transconductance tube tester featuring automatic selection of test circuits. Pre-punched data cards similar to those used in electronic computers are simply inserted into a slot to set up the

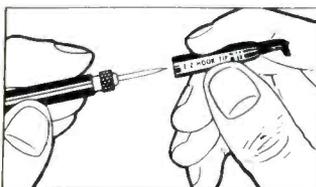
### Transistorized Intercoms



"Teletalk" intercoms. Among the features of the new models are printed wiring, combination light and buzzer annunciators, two-tone cabinets, plug-in junction boxes, and a "priority override" to interrupt conversations in emergencies. An "Administrative" 2100 series and a more elaborate "Executive" 3100 series are both transistor-equipped. Related 2000 and 3000 series are furnished with tubes instead of transistors.

Transistorized "Teletalk" intercommunication systems are currently available from Webster Electric Co., Racine, Wis., for use as replacements for, or additions to, existing

### Self-Holding Test Prod



slipped on or off the prod as desired, being held in place by a spring-type collet of stainless steel. The nylon shell of the tip is made in both red and black for use on positive and negative leads, respectively.

E-Z-Hook Test Products, 1536 Woodburn, Covington, Ky., is now producing a miniature tip that converts a standard test prod into a self-holding connector. This tip may be

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TUBE TYPE	FIL. D. CIRCUIT	TUBE TYPE	FIL. D. CIRCUIT	TUBE TYPE	FIL. D. CIRCUIT
5CQ8	5.0 A129 A127	5CQ8	5.0 A129 A127	5CQ8	5.0 A129 A127
6680	12.6 123 127	6680	12.6 123 127	6680	12.6 123 127
6681	12.6 A123 A127	6681	12.6 A123 A127	6681	12.6 A123 A127

TUBE TYPE	SEC.	A.	B.	C.	D.	CATH. SHORTS	E.
5CQ8	P	5.0	4	X	236	7	30
	T	5.0	4	X	19	8	30
6680	T	6.3	9	-	12	3	9
	T	6.3	9	-	67	8	9
6681	T	6.3	9	-	12	3	9
	T	6.3	9	-	67	8	9

Latest Chart Form 648-18, 115/715/561-8, 49-3

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Bulletin VA312 on variable voltage adjustor and Bulletin 308 on voltage stabilizer.
- 2H. ANCHOR  
Literature on connecting cables, replacement parts, service aids, (CRT ext. cables adapters, pilot light). See ad page 48.
- 3H. B & K  
Bulletin 1050 describes the new "Dyna-Scan" audio, video, color-display generator. Also Bulletins C15 and S16 on the "Color-Scan" and "Audio-Scan" accessory kits for owners of Model 1000. See ad page 8.
- 4H. BUSSMANN  
Television fuse chart Form TVC. Shows components protected and proper fuse for all TV and auto radio sets. See ad page 20.
- 5H. CHICAGO STANDARD  
Stancor television transformer replacement guide and catalog library. See ad page 27.
- 6H. CLAROSTAT  
Form 754488 describes "Fixtohm" deposited carbon precision resistors, 1/2, 1, and 2-watt ± 1% tol. See ad page 33.
- 7H. E-Z-HOOK  
A convenient reference sheet titled "How to build the Five Most Useful Scope Probes" gives the schematic, mechanical component layout, and a brief description of five scope probes you'll find most useful in your servicing. See ad page 36.
- 8H. EICO  
12-page catalog shows how to save 50% on electronic test instruments and hi-fi equipment in both kit and factory-wired form. See ad page 59.
- 9H. ELECTRO-VOICE  
"ABC's of Microphones," a primer on microphone application. See ad page 39.
- 10H. ERIE  
New D-57 16-page distributor catalog for Erie-Corning switches. See ad page 61.
- 11H. GENERAL CEMENT  
24-page "Spray-Koat" brochure plus new product supplement No. S-58. See ad page 42.
- 12H. IRC  
DLR-57A (form S-035a) replacement parts catalog. See ad 2nd cover.
- 13H. JACKSON  
Condensed catalog sheet listing all products. See ad page 64.
- 14H. JENSEN INDUSTRIES  
Dealer needle promotion. Assorted "Jenselluids" to perk up needle sales. See ad page 52.
- 15H. KEDMAN  
Catalog sheet describing 4 screw-driver displays, and specifications of 14 kinds of screwdrivers in the company's line. See ad page 51.
- 16H. KINGSTON  
"Puts Money in the Pockets of TV Servicemen," a 4-page, two-color brochure, gives details on the operation of the Kingston Absorption Analyzer. See ad page 54.
- 17H. LITTELFUSE  
Up-to-date cross-reference card showing new limited current fuse in sets and list price for each fuse. See ad 4th cover.
- 18H. MERIT  
Form No. 602 lists exact replacement flybacks. See ad page 48.
- 19H. PERMA-POWER  
Technical bulletin No. S129 describing the K101 TV tube restorer and its circuitry. See ad page 59.
- 20H. PHAOSTRON  
Illustrated catalog lists complete line of custom panel meters. Includes comparison chart of Phaostron instruments vs. other brands plus dimensions and features. See ad page 53.
- 21H. QUAM  
New catalog sheet (S577) on full line of PA, intercom and outdoor speakers. See ad page 58.
- 22H. R-COLUMBIA  
Bulletin No. 30 on "Metal Strobe," the all-metal phonograph speed-determining tool; also Bulletin 28 on dripless lubricating oil and Bulletin 31 on magnetic service lamps for TV, radio and phono service. See ad page 22.
- 23H. RCA ELECTRON TUBE DIV.  
Folder describing new RCA color television "Pict-O-Guide."
- 24H. SCOPE-PROBE  
Literature on a new probe incorporating many new features of interest to servicemen. See ad page 52.
- 25H. SENCORE  
New two-color line folder describes low-cost time-saving equipment and accessories. See ads pages 50, 51.
- 26H. SHURE  
New general catalog 57. See ad page 47.
- 27H. SOUTH RIVER  
New 1957 catalog of antenna mountings and accessories plus magnesium ladders. See ad page 57.
- 28H. TRIPLETT  
Literature on the Model 10 clamp-on ammeter which tests every current-carrying circuit. See ad page 31.
- 29H. WARD  
Folder titled "The Shape of Things to Come." See ad page 26.
- 30H. XCELITE  
Catalog of new items. See ad page 24.

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...with refreshing profits from  
**RCA BATTERIES!**

"Cool" profits are yours when you stock and sell popular RCA Batteries during these summer dog days. Right now the portable radio season is at its height. So what is more natural than to display and merchandise RCA Batteries if you want your profits to soar as high as the temperatures.

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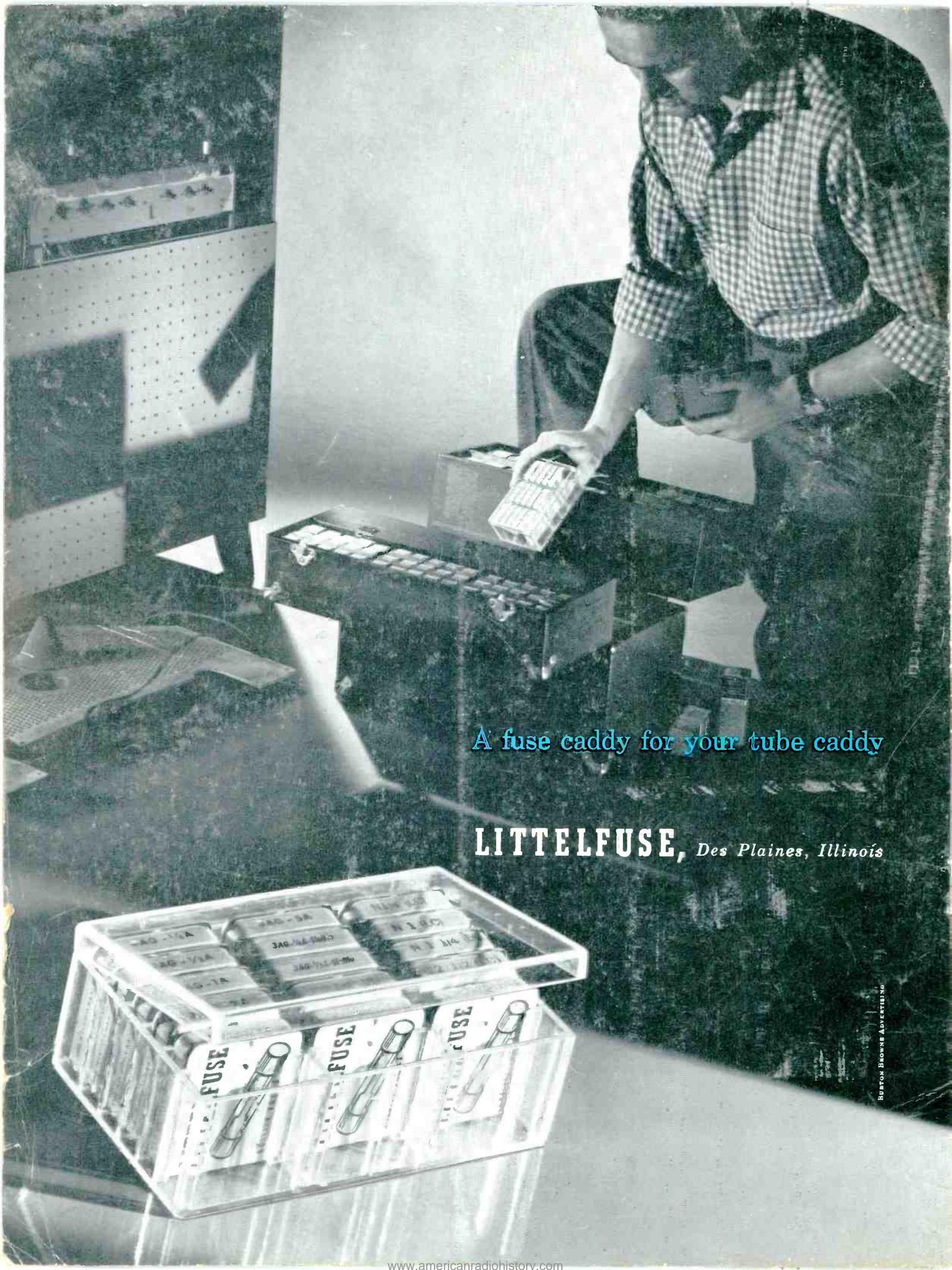
*(Portable illustrated is RCA Victor Model 7BX9.)*



**RADIO CORPORATION of AMERICA**  
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