OCTOBER • 1957 25 CENTS

PF REPORTER

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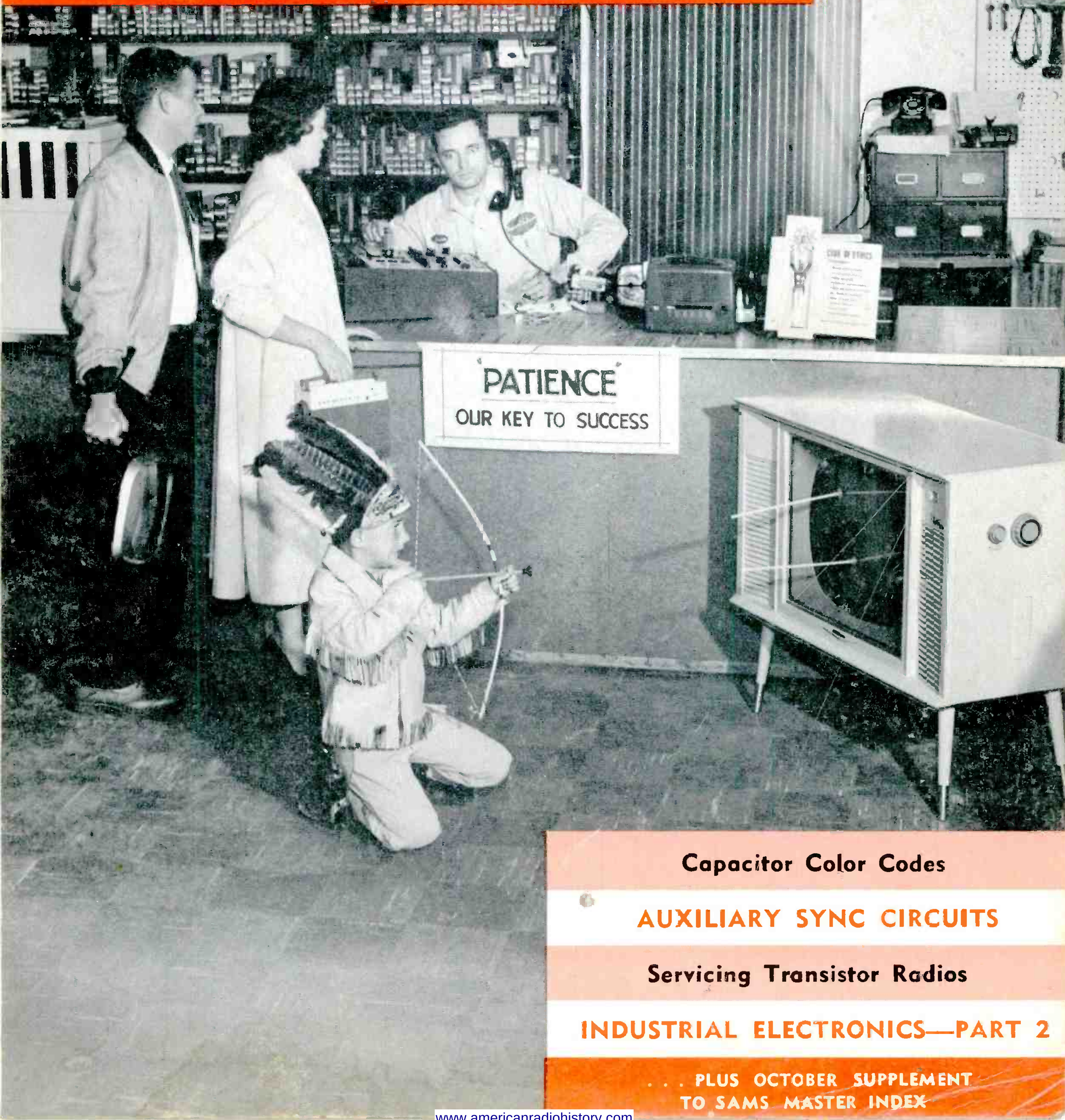
FOR THE ELECTRONIC SERVICE INDUSTRY



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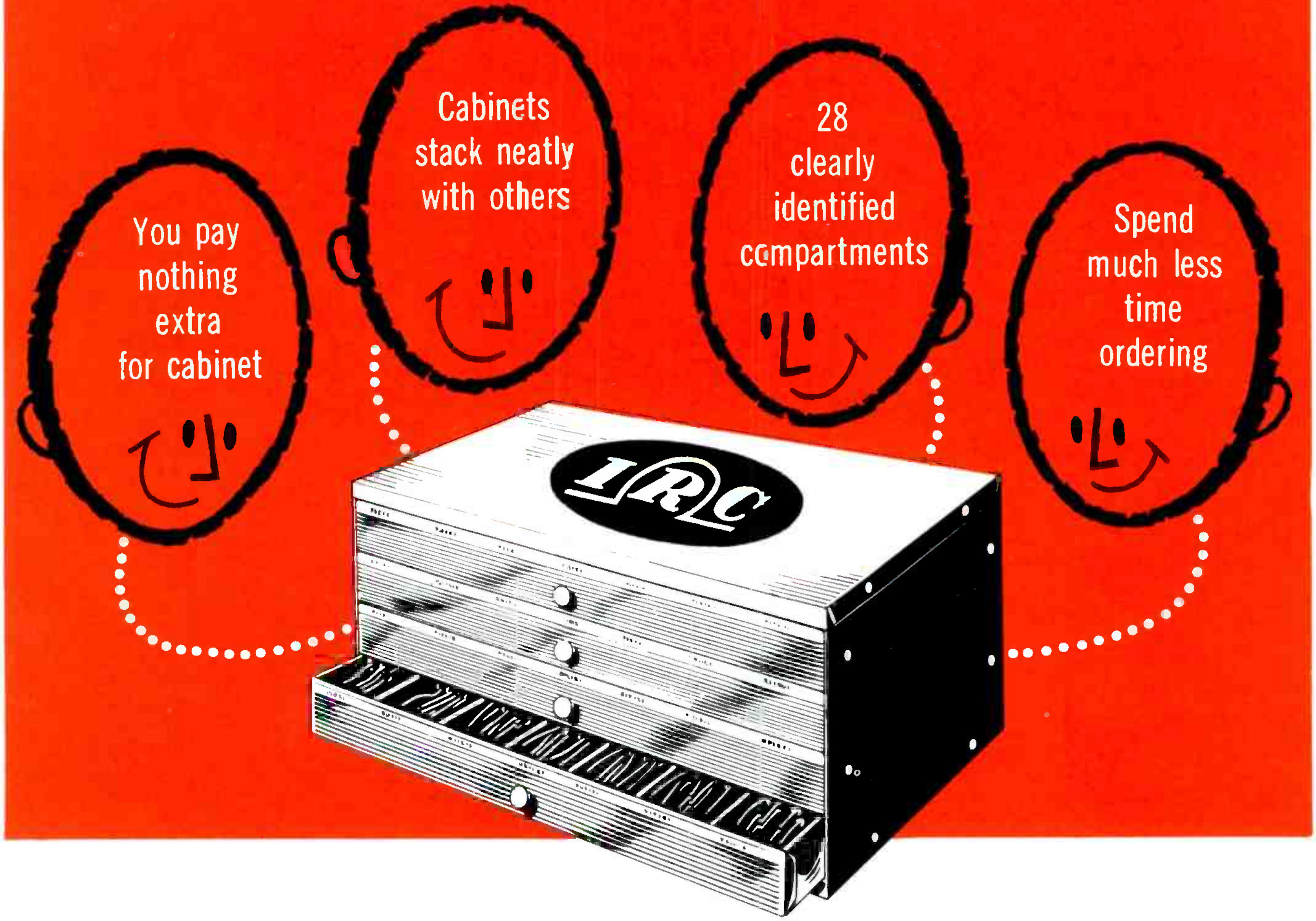

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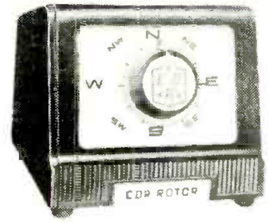
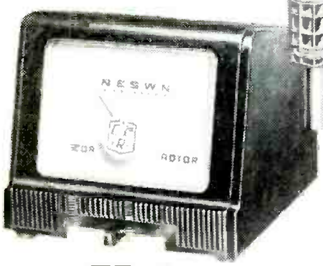


AR-22

TR-2



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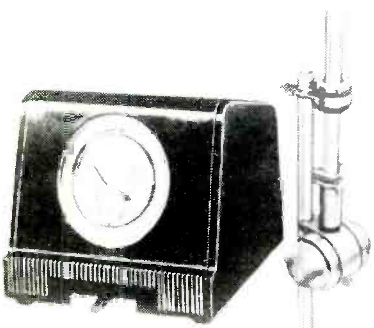
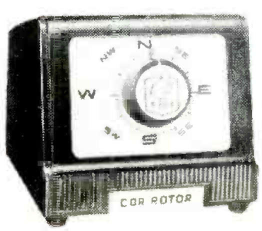


TR 11 and 12



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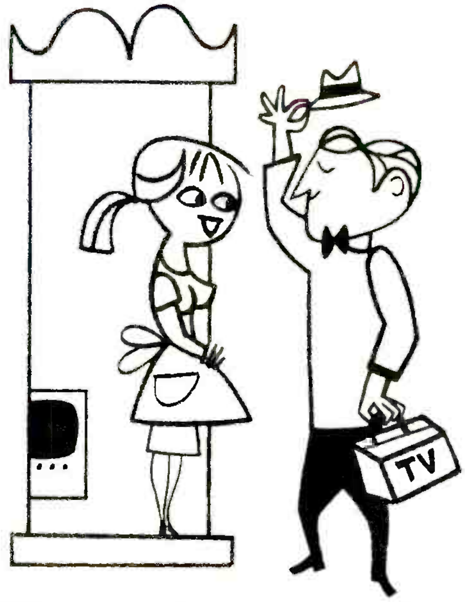

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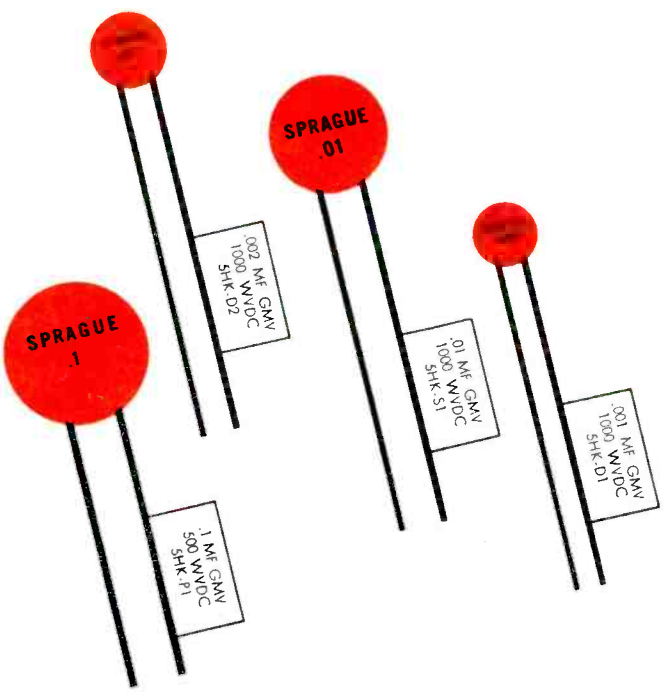

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next month

HIGHLIGHTS OF 1958 TV SETS

A picture story previewing many of the features you'll be seeing next year, with suggestions for practical servicing techniques that will save time.

KEEPING UP WITH VERTICAL SWEEP

An article describing a revised blocking oscillator and output circuit that is becoming more frequent in its appearance in modern TV sets.

ALIGNING VHF TUNERS

You won't want to miss Part 4 of "Inside TV Tuners," outlining the requirements for tuner alignment, including the equipment used, symptoms which indicate the need for alignment, and the reasoning behind some of the steps used in actual procedures.

VOLUME 7, No. 10 — OCTOBER, 1957

PF REPORTER

FOR THE ELECTRONIC SERVICE INDUSTRY

CONTENTS

SUBJECT REFERENCE INDEX

Letters to the EDITOR

Dear Editor:

Recently, I serviced an RCA KCS66C that would lose horizontal sync after about 30 minutes of operation. Adjustment of the hold control would not correct the condition, but turning the horizontal frequency slug would; however, a ragged vertical white streak then appeared at the center of the screen. All voltages and resistances were normal, and in an effort to stabilize the oscillator, I readjusted the transformer until the first peak in the waveform was quite a bit lower than the other. While loss of sync no longer occurs, I know the trouble has not been cured. Can you help me?

V. F. Riddle

Birmingham, Ala.

It would seem that some component in the frequency-determining circuit is changing value during operation. Normally, the signal with equal peaks will be obtained with the frequency and phasing slugs at about center range. Should either slug be adjusted toward one extreme, the jagged white streak would be a natural occurrence.

Components that could cause the trouble are the .01 mfd capacitor across the stabilizing coil, the coil itself, or the 330-mmf mica feedback (which is the most likely suspect.)—Editor

Dear Editor:

On several occasions, we have observed CRT screens which light up after the set has been turned off. Often, this may not occur until the set has been off for 30 minutes or more. It is not just a dot of light; instead the entire screen flickers on and off. Also, the condition does not occur each time the set is turned off. Can you give us an explanation, please?

Frank Knight

Frank's TV Service
Mansfield, Ark.

The capacity between the coatings of the picture tube is capable of holding a charge for quite some time, thus maintaining a certain amount of 2nd-anode voltage after the set is turned off. This charge can only diminish by a transfer of electrons, which are in short supply with no heater current. As a small supply slowly builds up, they are drawn to the screen and cause it to fluoresce, sometimes hours after the set has been turned off.

If you will install a switch that will ground the CRT cathode when the set is turned off, the tube will conduct heavily until the B+ filters have discharged and the anode current thus produced will discharge the anode capacitor.—Editor

Dear Editor:

The picture on page 16 of your July issue seems to be reversed, making a "lefty" out of Jim Schiffner. I thoroughly enjoy reading your magazine and find many helpful articles in every issue.

John Steriner

Chambersburg, Pa.

You're right.—Editor

Dear Editor:

Just read "TV Waveforms" published in your July issue. How you expect to teach anyone about waveforms is beyond me. You say in the article that a scope "having fairly good wide-band response was used." It takes a bandwidth of at least 1.7 mc to properly display horizontal sync pulses. I am wondering if the scope used would even show audio signals properly.

If you want to upgrade the technician, waveforms should be shown as they really are. Gone are the days when 20,000 ohm-per-volt meters were used in high-impedance circuits.

Lou Theleman

Monterey Park, Calif.

You are very observant! Some of the waveforms shown do indicate that a narrow-band scope was used, but actually this was not the case. The lab-type instrument used has a switch so that it may be used in either wide-band or high-sensitivity applications. To get the desired effects, some of the waveforms were photographed with the switch in the high-sensitivity position, and therefore the response was down somewhat at the higher frequencies. In addition, the sweep frequency was offset slightly and the intensity was far above normal. We were more interested in getting the various pecularities than ideal waveforms because we felt that they would be more helpful to the practicing technician.—Editor

Dear Editor:

The schematic in the August "Coffee Break" shows a grounded-grid lead in a detector diode. How come? Have found your articles very informative.

D. Mastro

Mastro TV
Portsmouth, Va.

The 6AL5 has often been shown to have what appears to be a grid, but it isn't a grid at all. Pin 6 connects to an internal shield which is always grounded for best performance.—Editor

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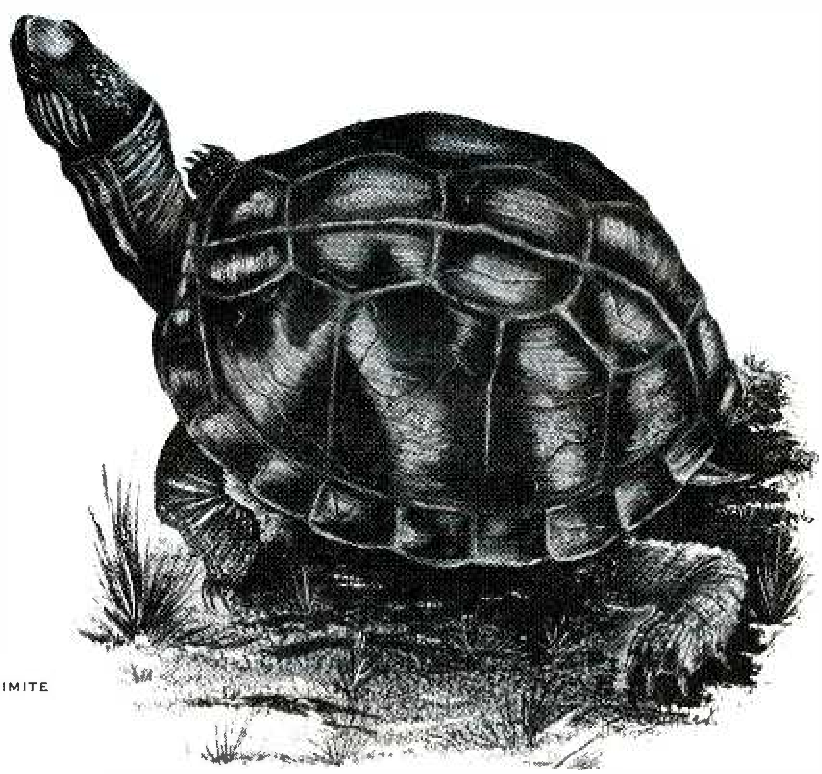

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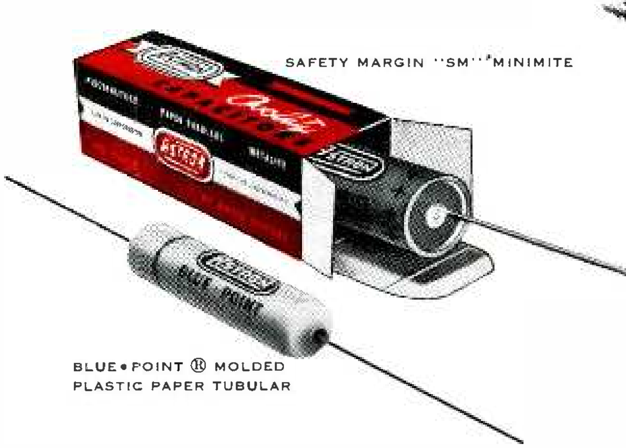

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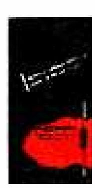

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Dear Editor:

I have a Silvertone (chassis 100-700-10) with insufficient brightness. All voltages appear to be normal, including 2nd-anode potential. A new picture tube did not alter the performance. Any information you can provide would be appreciated.

MILTON E. VERDOOT

Green Bay, Wisc.

Sounds like a misadjusted or defective ion trap. Suggest you substitute one having the correct magnetic strength.—Editor

Dear Editor:

The text in reference to Fig. 10 of the "Shop Talk" column in the June issue states that both halves of the input signal will give correct polarities in the output. While it is true that the polarities will be correct, only the positive half cycle of the input will give true reproduction. For conduction, the emitter-base junction of a transistor has to be biased in the forward direction. Without some amount of bias in addition to signal bias, the negative half cycle of the input can only cause the output signal to reach the supply voltage level. In this case, the output signal due to the negative half cycle of input is not a function of the amplitude of the input.

C. E. RODGERS

Torrance, Calif.

The entire circuit of Fig. 10 should be operated class A. This was not specifically stated, nor was a suitable biasing network shown. With proper biasing, both halves of the input signal will be effective in causing current to flow through the circuit.—Editor

Dear Editor:

I have a Philco TV Model 22BU4000, Code 130 in the shop that has me up a tree. At first, channel 46 did not come in at all, but channels 52 and 34 came in good. I tried substituting tubes, and when I put in a new 6T4 in place of the 6AF4, channel 46 came in perfect, but after about an hour the set went out on channel 34. After tuning the set off-channel and then back, channel 34 would come in for a few minutes and then go out suddenly. Could you help me with this problem?

JAMES P. GRACE

Elkhart, Ind.

Since Reader Grace has pretty well eliminated tubes as the source of this intermittent trouble, it is our suggestion that he replace the entire UHF tuner in this set.—Editor

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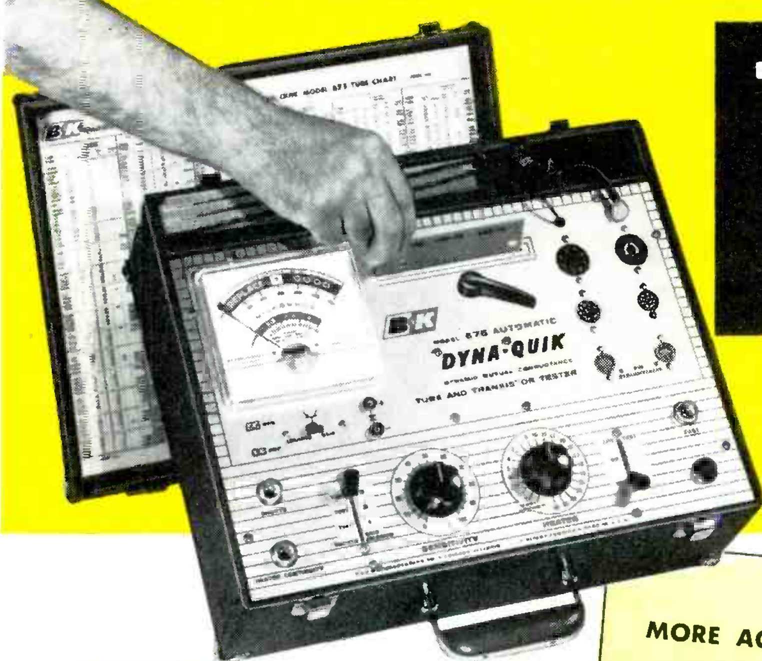

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Shop Talk

MILTON S. KIVER

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

Transistorized Sync Stages

A portion of the video signal in a television receiver is taken from the video amplifier section and fed to the sync separators where the sync pulses are divorced from the rest of the signal. In vacuum-tube circuits this usually requires two stages. The same separating action can also be accomplished with transistor circuits, suitable examples of which are discussed in this article.

A two-stage transistorized sync separator which functions satisfactorily is shown in Fig. 1.* Both transistors are connected as common-emitter amplifiers, although the first transistor is a p-n-p unit, while the second is of the n-p-n variety. To maintain the steep vertical sides of the sync pulses, it is desirable to use high-frequency units. A low-frequency transistor would not pass the higher order harmonics, and would cause sloping of the sides of the pulse, thereby degrading the timing accuracy of the sweep oscillators.

Within the circuit of X1, we find a combination of fixed and self-adjusting bias in the emitter leg. The fixed bias, which drives the emitter-base circuit into conduction, is furnished by a 20-volt battery. The self-adjusting bias is developed by the emitter current flowing through R1. The voltage developed across this resistor opposes the battery voltage and the combination of R1 and C1 tends to keep X1 cutoff at all times except when the negative-going sync pulse is active. At this time the cutoff bias is overcome, current flows and C1 is recharged. This flow of current will produce a positive-going sync pulse across R2. The values of E2 and R2 are chosen so that the collector is not driven to saturation; this enables the pulse amplitude across R2 to vary according to variations in input signal. The emitter current likewise varies with changes in the strength of the incoming signal so that the bias is kept at the proper level for sync separation on all signals, strong or weak.

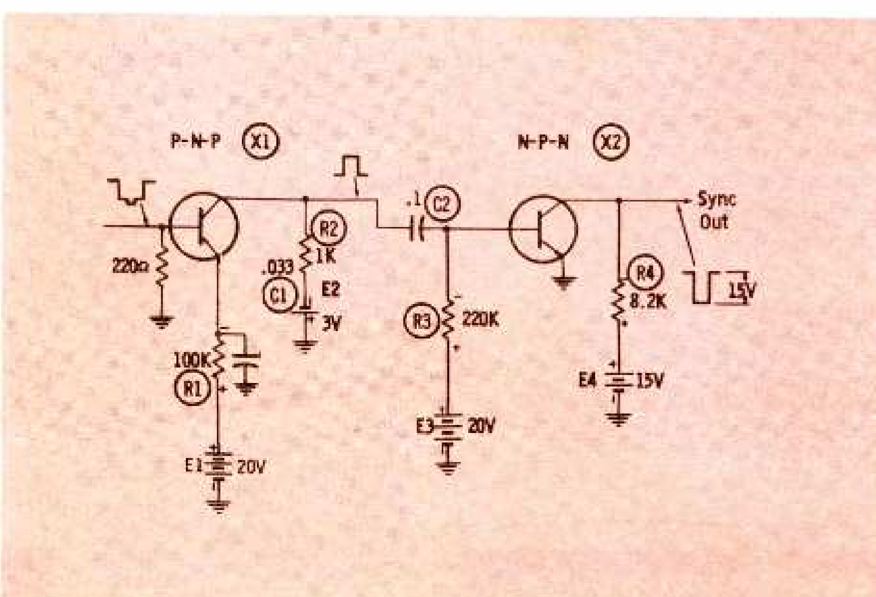
The second stage, containing transistor X2, is used to amplify and limit the amplitude of the pulses appearing across R2. X2 is biased so that it is driven to saturation by the sync pulse tips of any usable signal. This not only establishes the sync pulse amplitude at a relatively fixed value, but it also serves to clip off noise spikes greater than sync.

In order to insure that the foregoing saturating action is achieved even with weak signals, a combination of fixed and variable bias is employed. (If only one type of bias were used, it would have to be set so that X2 would be heavily overdriven on strong signals. Under these conditions it is found that the sync pulses tend to broaden considerably and could introduce a phase shift when applied to some types of horizontal phase detectors.) The fixed bias is furnished by battery E3, while the variable bias is developed by C2 and R3. When the incoming signal tends to drive X2 far beyond saturation, the base-emitter circuit develops a voltage across R3 (with the polarity indicated) which reduces the extent of the overdriving.

The final output pulse has an over-all amplitude of 15 volts which, it will be noted, makes full use of the battery voltage applied to the collector. This action is possible because transistor characteristics are linear down to practically zero volts. Output pulse polarity is negative; if a positive-going pulse were desired, a phase inverter could be used.

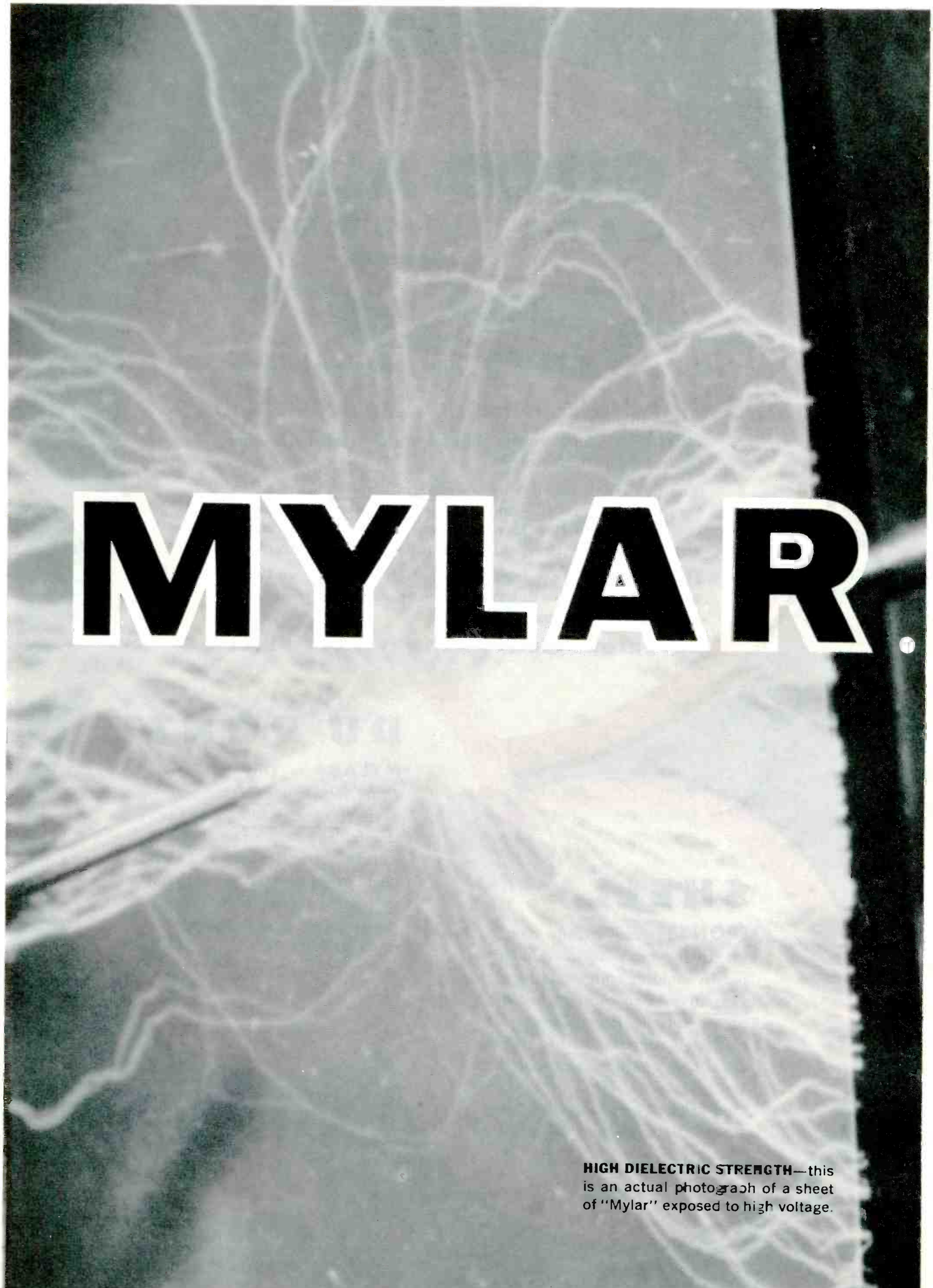
• *Please turn to page 70*

* "Transistorized Sync Separator Circuits For TV Receivers" by H. C. Goodrich, RCA Review, December, 1955.



(Courtesy RCA Review)

Fig. 1. A two-stage transistorized sync separator.



HIGH DIELECTRIC STRENGTH—this is an actual photograph of a sheet of "Mylar" exposed to high voltage.

Troubled By Color Codes ?

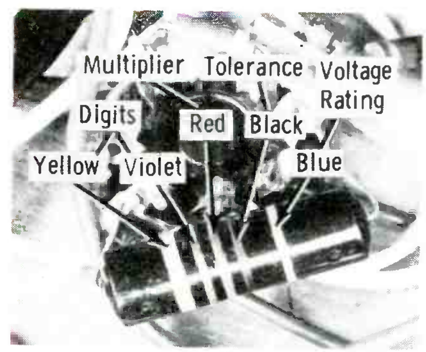
The "age-old" problem of deciphering color codes is still to a great extent unsolved by neophyte and old timer alike. For the most part, this is due to the fact that the code has been expanded to provide additional information for a greater variety of units.

In this article, we have selected the various capacitor types in current use to show the variety of color codes you are most likely to encounter.

The Paper Tubular

Molded paper tubular capacitors, at the discretion of the manufacturer, may have their value, tolerance, and working voltage expressed typographically or by colors. In the case of color, you will generally find five or possibly six color bands on the body of the component.

To read the color code in the proper sequence, orient the unit so that the closely-spaced group of four color bands appears at the left. Reading from left to right and referring to the chart, we find that the unit pictured has a value of 4,700-mmf, a tolerance of ±20%, and a 600 working-voltage rating. The voltage rating will be indicated by either one or two color bands. One band indicates a rating of less than 1,000 volts, while two indicates 1,000 volts or more. Adding two zeros to the one or two significant figures will give the voltage rating.

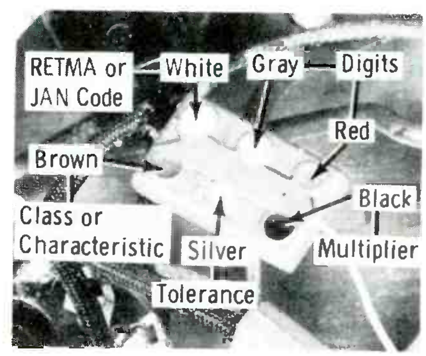


The Mica

Today, we find an increasing number of molded-mica capacitors using the RETMA 6-dot system. One can recognize this system by first orienting the unit so that the arrow on its body points to the right. If the dot in the upper left-hand corner is white, the code follows RETMA standards.

Using the chart, the second color dot in the upper row represents the first significant figure of the capacity value (gray or 8 in the example shown). Interpreting the other data, we find that this unit is an 82-mmf, ±10%, class-B mica, coded under RETMA standards. The class designation reveals certain design requirements involving the Q and temperature coefficient.

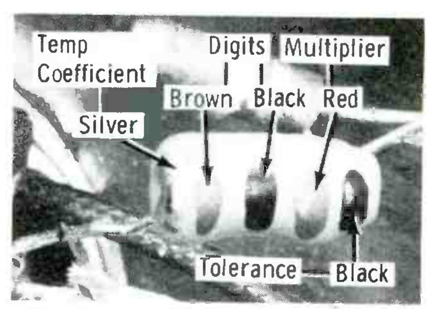
The JAN or Joint-Army-Navy 6-dot system is also employed for mica capacitors and differs from the RETMA system only in that the first dot is black instead of white.



The Insulated Ceramic Tubular

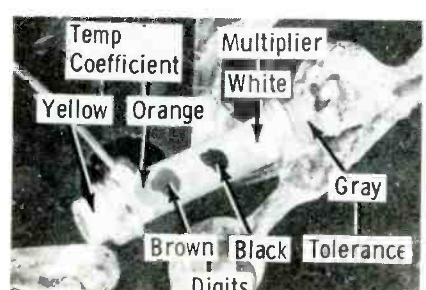
Constructed with radial leads, this style of capacitor generally uses a 5-dot system as shown and is oriented by placing the color dot closest to one end of the unit on the left. Referring to the chart and reading from left to right, we find that the capacitor is a bypass or coupling, 1,000-mmf unit, having a value tolerance of ±20%.

In some instances, this style of capacitor may use a 6-dot color code, which is discussed under the non-insulated ceramic tubular type.



The Non-Insulated Ceramic Tubular

This type capacitor is currently coded with either a 5- or 6-dot system. The 5-dot system is identical to that given for the insulated-tubular or disc-ceramic. The 6-dot system, however, involves an extended temperature coefficient. The color dots or stripes will either be grouped slightly toward one end of the body or the first color dot will be larger to indicate the starting point. The first two colors are used to express the temperature coefficient and, in the example shown, these two colors are yellow and orange. Taking a look at the chart, we find that this unit is an N2200, 1-mmf capacitor, having a tolerance of ±0.25 mmf.



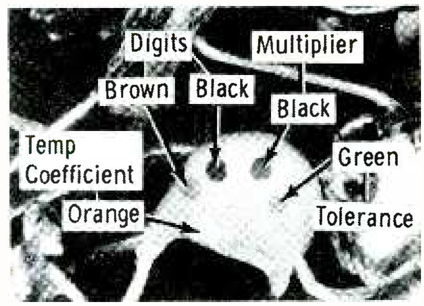
The Insulated Ceramic Disc

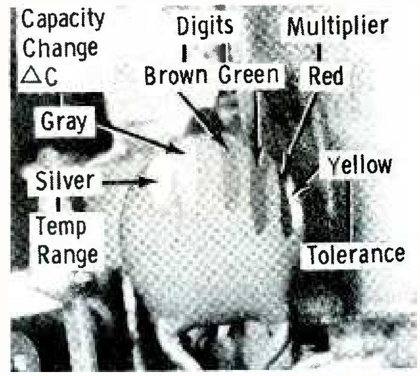
Although this type of capacitor is usually typographically marked, it may be color-coded with 5 dots or stripes. Using the chart, and reading from left to right with the unit oriented as shown, we find that this unit is an N150, 10-mmf capacitor, having a tolerance of ±0.5 mmf.

The term NPO means negative-positive-zero or a zero temperature coefficient. With this designation, capacitance remains constant regardless of temperature change.

The abbreviation PPM/°C in the chart stands for "parts per million per degree centigrade." In other words, if a temperature coefficient is given as N150, capacity will *decrease* 150 parts per million with every degree of *increase* in operating temperature. If the letter P precedes the number, capacity then *increases* with temperature rise.

A few late-model receivers are using a new 6-dot code on this style of capacitor. The first two colors represent the maximum capacitance change within a specified temperature range rather than a two-color temperature coefficient. The first color under this system will always be gold, silver, or brown. Reading the code for the unit pictured, we find that it has a △C of ±15% within a temperature range of −30°C to +85°C, a value of 1,500 mmf, and a GMV tolerance (guaranteed minimum value, −0% to +100%).



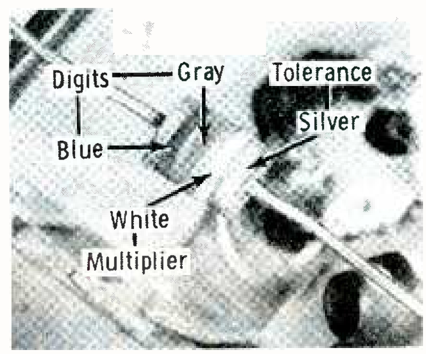


The Miniature-Molded Ceramic

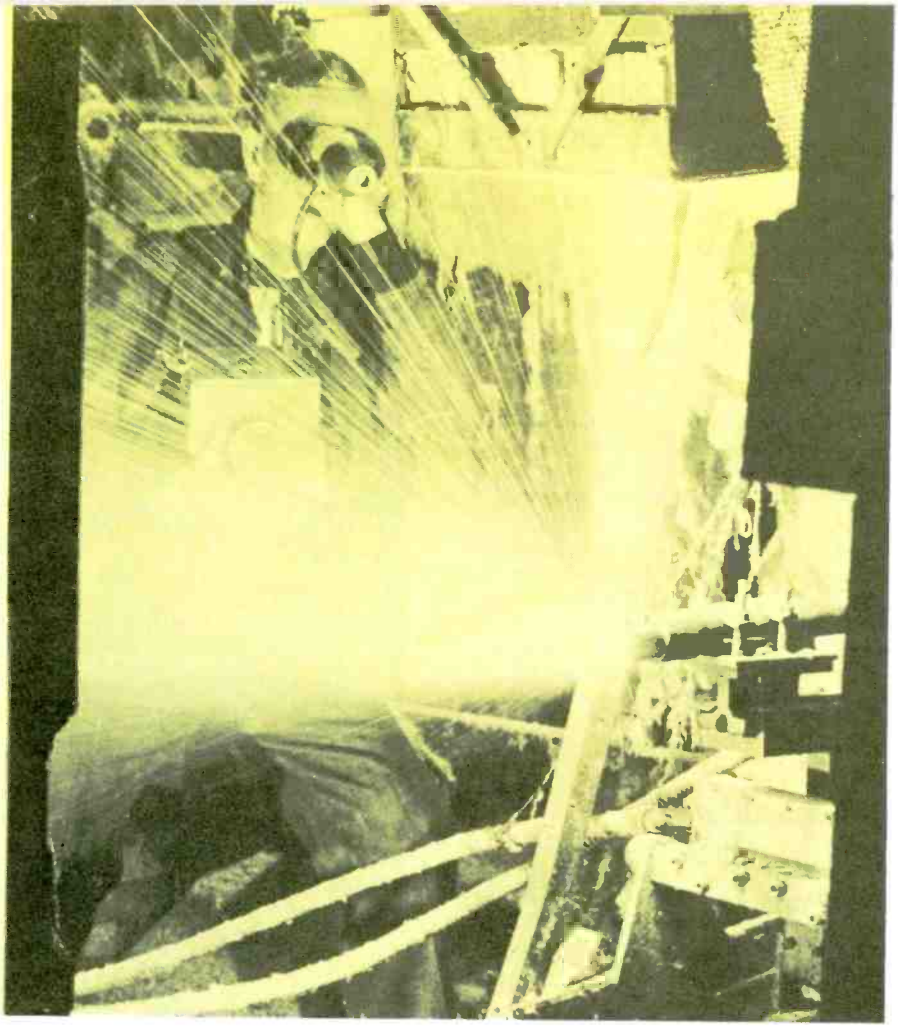
About half the size of a standard ¼-watt resistor, these low-valued capacitors are found in a limited number in RF-coupling applications. The markings for such units have not been completely standardized and may encompass the use of one to four color bands. A present-day capacitor of this design, however, generally uses a 4-dot system as illustrated. In this arrangement, the last color band is always gold or silver, indicating a value tolerance of ±5% or ±10%, respectively.

Reading the bands and referring to the chart, we find that this capacitor is a 6.8-mmf unit with a tolerance of ±10%.

Capacity values for some of the units having less than four color bands are given in the chart. In this case, tolerance is assumed to be ±20%.



Color Marking	Digit	Multi	Value Tolerance	CERAMIC TYPES ONLY: Under 10 MMF	Single-Color Temp. Coeff. PPM/°C	Two-Color Temp. Coeff.: Sig. Fig.	Two-Color Temp. Coeff.: Mult.	Two-Color: △C and Temp. Range	Molded Miniature (Value)	Class or Characteristic (Molded Mica)
Black	0	1	±20%	±2.0 mmf	NP0	0.0	N1		—	A
Brown	1	10	±1%	±0.1 mmf	N033	—	$N10^1$	+10°C to +85°C	1.0 mmf	B
Red	2	10^2	±2%	—	N075	1.0	$N10^2$	±4.7%	2.2 mmf	C
Orange	3	10^3	±3%	—	N150	1.5	$N10^3$	±7.5%	3.3 mmf	D
Yellow	4	10^4	GMV	—	N220	2.2	$N10^4$	±10%	—	E
Green	5	10^5	±5%	±0.5 mmf	N330	3.3	P1	±15%	4.7 mmf	F (JAN)
Blue	6	10^6	—	—	N470	4.7	$P10^1$	±25%	—	G (JAN)
Violet	7	—	—	—	N750	7.5	$P10^2$	+33%	—	—
Gray	8	10^{-2}	—	±.25 mmf	P030	—	$P10^3$	+47%	—	I (RETMA)
White	9	10^{-1}	±10%	±1.0 mmf	Gen. Appl.	—	$P10^4$	+75%	—	J (RETMA)
Gold	—	10^{-1}	±5%	—	—	—	—	−55°C to +85°C	—	—
Silver	—	10^{-2}	±10%	—	Bypass & Coupl.	—	—	−30°C to +85°C	—	—
Grn-Gold	—	—	—	—	—	—	—	—	0.5 mmf	—
Blue-Gray Silver	—	—	—	—	—	—	—	—	0.68 mmf	—
Brn-Green	—	—	—	—	—	—	—	—	1.5 mmf	—



heat-sensing and temperature-controlling devices

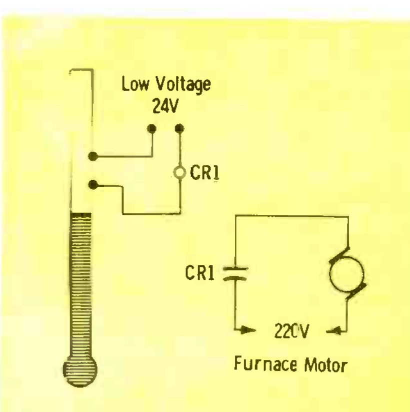


Fig. 1. Basic construction of a mercury temperature switch used to actuate a furnace control relay.

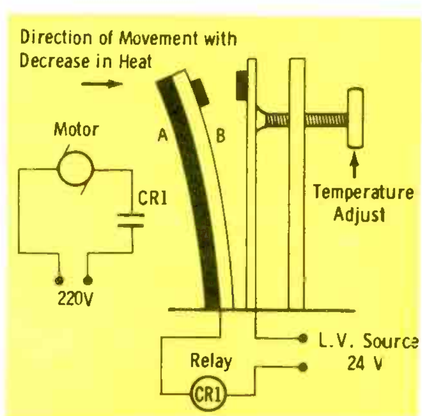


Fig. 2. The contacts of a bi-metal thermostat will open and close over a predetermined temperature range of 2° to 3°F.

SERVICING INDUSTRIAL ELECTRONICS

PART-2

by Melvin Whitmer

Man's first contact with the usefulness of heat probably came from cooking, which can be done successfully at many different temperatures with a minimum of control. The formation of bronze and steel was undoubtedly the next step forward in the use of heat. Although melting requires very high temperatures, the accuracy needed is satisfied by watching the color of the molten metal. Thus, man still did not need exact temperature indicators.

The conquest of metal forging was a great step forward, but it was the last step to be taken for many years. In the late 1700's Lavoisier, known to the world as the father of modern chemistry, began to drive heat into its final submission. His ideas may seem strange to us, but he used heat correctly in the separation of many chemicals. To Lavoisier, heat was a fluid, something tangible, but at the same time weightless, volumeless, and inseparable from physical bodies. He called this subtle fluid, "Caloric." Its properties should remind us of another medium theorized as responsible for the transportation of radio waves.

Heat has since been shown to be nothing more than a level of energy. Chemicals separate because heat adds enough energy for the molecules to overcome the bonds which hold the chemicals together. Liquids boil at different temperatures, and it is this property which makes their separation possible. A common example is the isolation of alcohol from water. Alcohol boils at 180° and water at 212°; thus distillation is possible only by careful control of the temperature. As the alcohol boils off, the vapor is passed through a condenser where it returns to a liquid state.

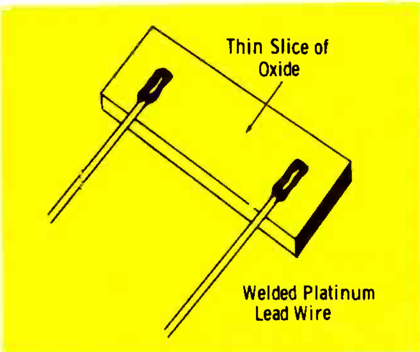


Fig. 3. Simple sketch of a thermistor.

As industrial processes required better control of heat, sometimes within only a few degrees, the ingenuity of man was called upon to devise electro-mechanical and electronic sensing units. Early devices could indicate the temperature on a calibrated dial, but could not actuate a control. The thermometer dates back to the 1500's, but its use as an electro-mechanical device is the product of the last 50 years.

Mercury is a good conductor of electricity, and it also responds readily to changes in temperature; therefore, it can be used as a simple control. The construction of the mercury temperature switch is shown in Figure 1. The bulb contains a reserve supply of mercury which extends into a narrow column with contacts placed permanently in the glass wall. This early switch was built for the control of only one temperature and could not be varied to suit the customer's needs.

The thermometer switch was replaced by a more flexible control—the bi-metal thermostat. Figure 2 shows its construction. The bar labeled AB is constructed from two different metals, with B expanding more than A as temperature increases. When the bar AB cools, B will contract more than A and the bar will bend toward the contacts, which close when a predetermined temperature is reached. The temperature control is variable—with an upper limit of around 400°F—and will maintain a selected temperature within 2° to 3°F.

The thermistor is a relatively new device used to control temperatures ranging up to 1000°F and which has the ability to detect temperature differences of .05°F. Its construction is similar to a printed circuit resistor, but metal oxides rather than carbon compose the resistive elements. A sketch of the thermistor is shown in Figure 3. A thermistor can respond to the infrared radiation which is emitted by every mass. Even bodies which are considered cold, if they are above absolute zero, provide a characteristic radiation often called Black Body Radiation. The thermistor absorbs this energy and changes its resistance for each change in radiation intensity. The thermistor also emits energy itself, since it is a mass, and com-

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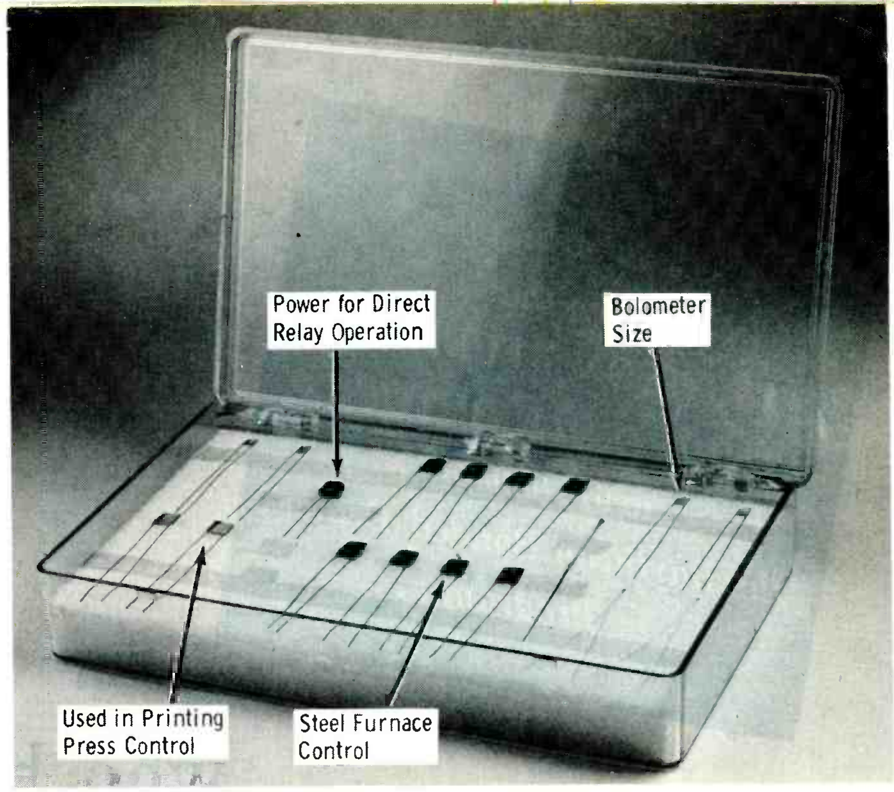

Courtesy Glenite Thermistor Kits, Thermistor Division, Gulton Industries Inc.

A sample kit of thermistors for various applications. Several are painted black to increase their absorption characteristics.

Heat is detected through the infra-red window and the signal generated passed directly into a preamplifier. Notice the very short distance between senser and preamplifier.

Courtesy Servo Corporation of America

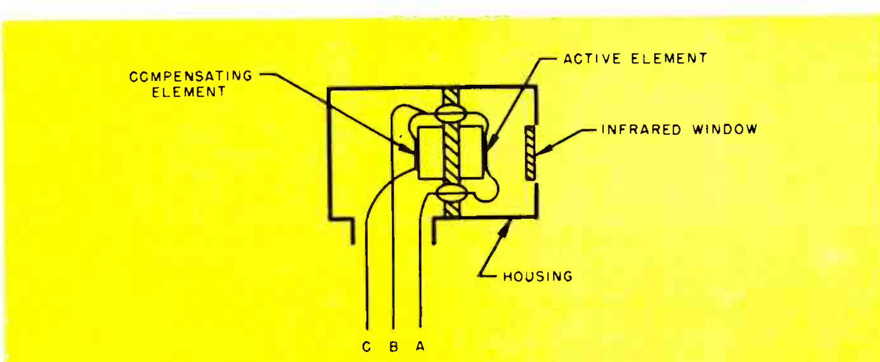

Fig. 4. Internal makeup of a bolometer.

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THEORY OF AUXILIARY SYNC CIRCUITS

Noise Limiters and Sync Preamps and How They Work

by Thomas A. Lesh

TV sets of just a few years ago often included what might be called "auxiliary" sync stages—separate noise limiter tubes, sync preamplifiers, etc. Circuits of this type have not been receiving much attention lately, being victims of the trend toward simplified and standardized TV circuitry. Nevertheless, a great many sets still in service have unusual sync circuits, and these can slow you down during troubleshooting if you're a little rusty on their theory of operation. Thus, here is a short refresher course on sync circuits which have sometimes been used to supplement the standard dual-triode or pentagrid arrangements commonly used today.

Fig. 1 is an example of the familiar dual-triode circuit, in which the sync-processing function has been pretty well reduced to essentials. The first stage is a sync separator that receives at its grid a signal composed of video information and positive sync pulses. The video is stripped off as the signal passes through the tube, and negative-going sync pulses are delivered at the plate. The second stage is an amplifier that "cleans up" the pulses and boosts them to sufficient height for application to the horizontal and vertical sweep circuits.

The pulses at the grid of this second stage are negative and normally drive the tube into cutoff. The resulting "sync clipping" action trims the pulses to a constant peak level and thus removes any amplitude irregularities that might have passed through the sync separator. In some cases, the sync amplifier also serves as a phase splitter, providing pulses of two polarities required by some types of horizontal phase detectors.

The operation of the dual-triode system in fringe areas is sometimes disturbed by strong noise pulses. If these pass through the sync stages, they can falsely trigger the sweep oscillators. In addition, they can interfere with the normal grid-leak biasing of the sync separator by placing an ex-

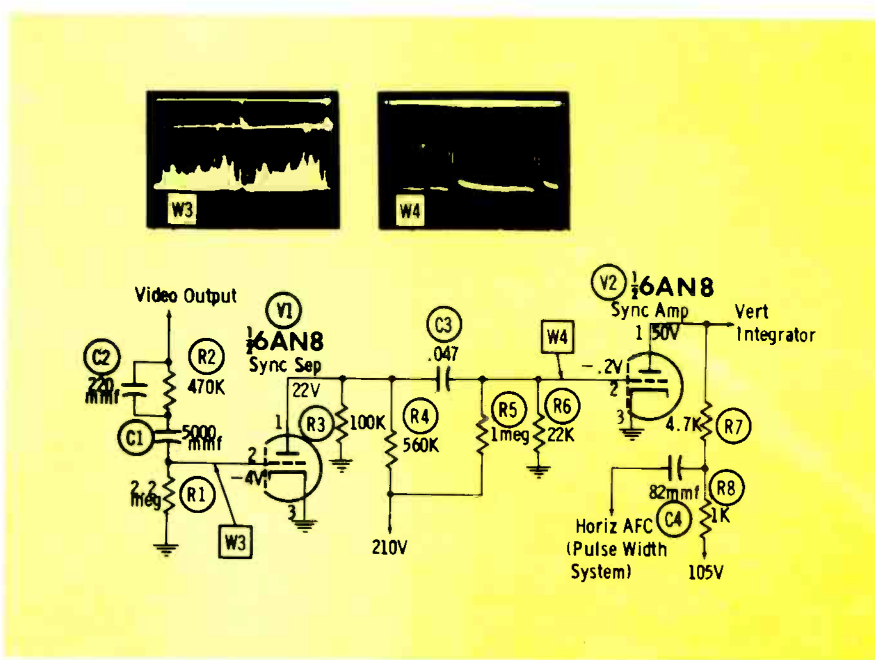

Fig. 1. Typical dual-triode sync section—Truetone Model 2D2423A.

cessive charge on the grid capacitor (C1 in Fig. 1). When considerable noise is present, the charges induced by the noise pulses drive the grid voltage excessively negative. As a result, the sync pulses at the output of the separator are reduced in amplitude and are less effective in controlling the sweep oscillators.

This situation can be remedied by cancelling out the noise pulses as they reach the sync separator. A circuit for this purpose is included in some current model TV sets, usually in the form of a pentagrid tube that combines the functions of both the separator and canceller. The main input, applied to the No. 3 grid, is a composite video signal (sync positive) from which a negative sync output is developed in the same manner as in the triode-type separator. The No. 1 grid of the pentagrid tube receives a secondary input signal—composite video of low amplitude and inverse polarity taken from the video detector load circuit. The tube is cut off by any strong noise pulse that appears in this secondary signal.

An occasional sync pulse is removed from the output, but the loss of a pulse here and there has much less of an effect on synchronization than the uncancelled noise pulses would have. The pentagrid circuit has been described from time to time in the pages of PF Reporter; the most recent discussion was in "Servicing New Designs," April, 1957.

Noise Inverter

A forerunner of the pentagrid circuit is the separate noise-inverter stage still found in many receivers in the field. Its purpose is the same as that of the secondary circuit in the pentagrid tube—to introduce pulses that will cancel the noise pulses entering the separator. Instead of cutting off the separator tube, however, the noise inverter simply feeds a negative spike of voltage to the separator grid to counterbalance each positive noise spike that appears in the main input signal at this grid. If no high-amplitude noise is present in the video signal, the noise inverter produces no output and therefore does not affect the sync separator.

A separate triode section used as a noise inverter is shown in Fig. 2. Notice that the plate of the inverter V13A is connected to the input circuit of the sync separator. Since the cathode resistor R34 serves also as part of the video detector load, the inverter is cathode-driven by a sync-negative, composite video signal of low amplitude. The grid of V13A receives no signal, but obtains a negative bias voltage from the grid circuit of the horizontal output tube.

The "Noise Cancel" control is used to establish a grid voltage which will keep the tube cut off at all times except when a noise spike in the input signal extends beyond sync-tip level. Such a spike produces a pulse of cathode voltage which is negative enough to drive V13A into conduction. The resulting short burst of plate current develops a negative pulse of output voltage, which nullifies the positive noise pulse that simultaneously reaches the sync separator grid circuit.

The following procedure is used in adjusting the "Noise Cancel" control: Tune in the strongest signal available, and then turn the control to the maximum counterclockwise position, thereby applying maximum bias to the grid of V13A. Next, advance the control setting until pulling or sync loss is observed, indicating that V13A is conducting on normal sync pulses and reducing sync amplitude at the separator grid. Finally, back off the control until the picture returns to a stabilized condition.

Several varieties of noise inverter and limiter circuits have been employed from time to time. Instead of taking the inverter input from the video detector load, some manufacturers have tapped off a small portion of the video amplifier output signal (sync positive) and applied it to the grid of a triode inverter, which is biased so that the positive noise spikes on the grid drive it into conduction. Another variation is to connect a diode across the sync separator input so that noise voltages above a preset level will be shunted to ground by conduction of the diode.

Intermediate Sync Amplifier

Fig. 2 also illustrates another type of special sync circuit, an intermediate stage between sync

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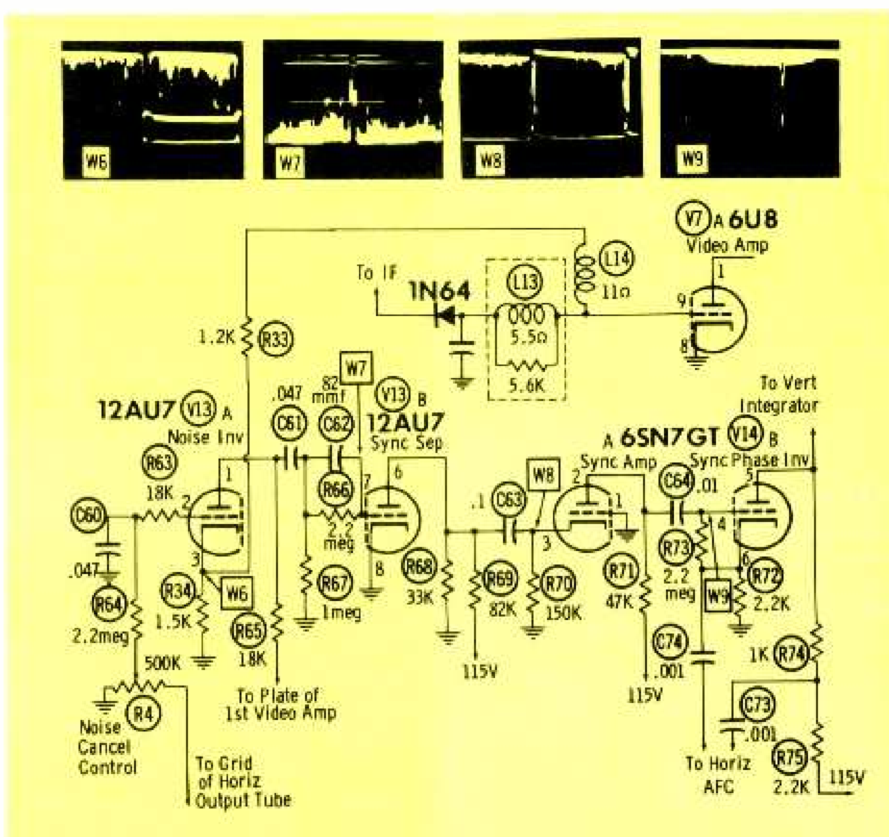

Fig. 2. Sync section plus triode noise inverter—Stromberg-Carlson Model 621.

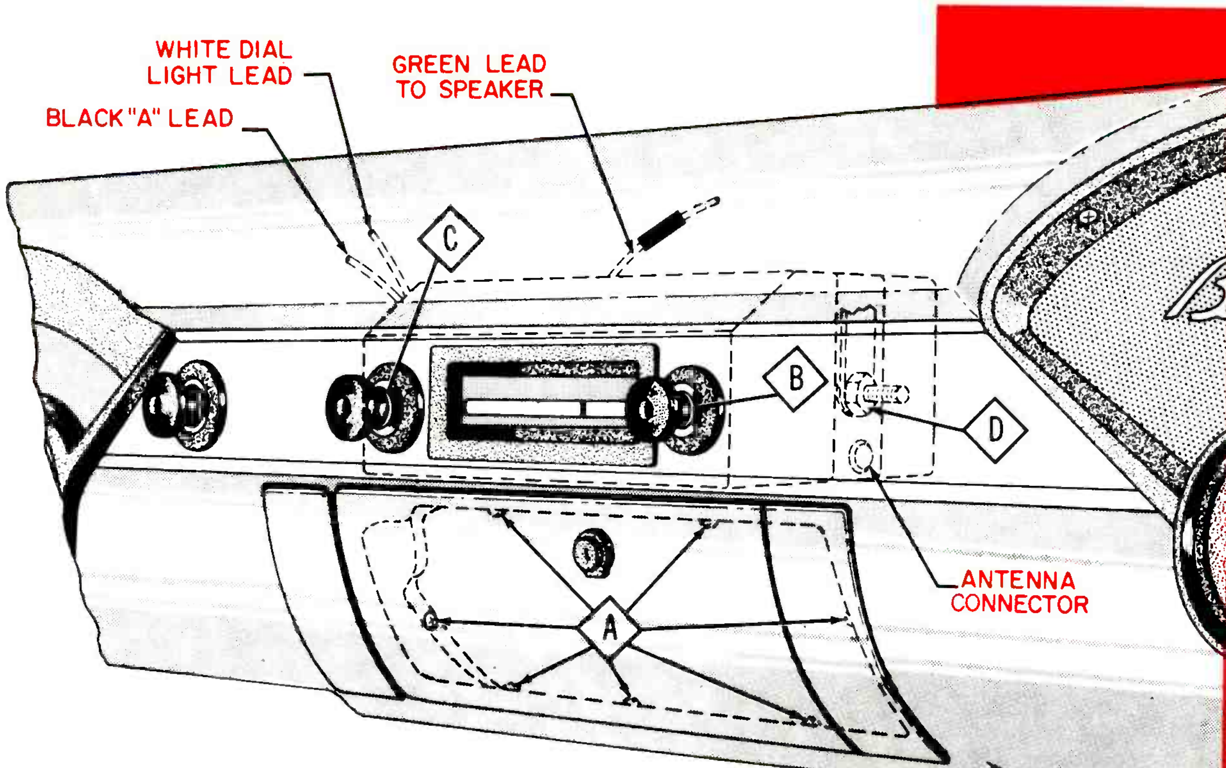

Fig. 1. Phantom view of dash showing position of radio chassis.

Removing Radio from 1955 Chevrolet

Removing an auto radio is basically more a physical task than anything else; however, it is one which can require some time and effort due to the awkward position in which the technician has to place himself in order to reach the screws, nuts and bolts under the dash panel. A knowledge of the correct procedure and the exact tools for removing radios in specific makes of cars will help to reduce the time and effort involved in these tasks.

The following is the procedure for removing radios in all 1955 Chevrolets except the Corvette. A list of the tools that are required is also included.

Removal Procedure

Main Chassis (Refer to Fig. 1.)

STEP 1

Take out 7 Phillips-head screws (A), using stubby-type Phillips screwdriver, and remove glove compartment.

STEP 2

Remove rubber bumper on end of glove compartment door guide and take off door.

STEP 3

Remove 4 push-on knobs and two felt washers.

STEP 4

Remove the 11/16" lock nut (B) from the selector shaft using an 11/16" box-end wrench, and the 5/8" lock nut (C) from the volume control shaft using a 5/8" box-end wrench.

STEP 5

Remove the volume and selector escutcheons from the shafts.

STEP 6

Pull out the antenna lead from the right side of radio chassis.

STEP 7A (Applies only to pushbutton and signal-seeking models.)

Disconnect the power-supply plug from the left side of the power supply chassis and the black "A" lead at the snap connector, located between the main chassis and the power-supply chassis.

STEP 7B (Applies only to manual tuning models.)

Disconnect the green lead to the speaker. A snap connector is provided in the lead for this purpose. NOTE: In cars equipped with a rear-seat speaker, this lead is connected to the speaker control unit.

STEP 8

Remove the white dial-light lead from the upper left-hand terminal on the fuse block located on the firewall to the left of the steering column. Disconnect the black "A" lead from the terminal labeled "RADIO" on the fuse block.

EDITOR'S NOTE: This article is based on material from the book, "Instructions for 1955 Auto Radio Removal," published by Howard W. Sams & Co. Of all the makes of cars covered in the book, the 1955 Chevrolet was selected because of its popularity.

STEP 9

Remove the 7/16" nut (D) from the right side of chassis using a 7/16" box-end wrench. Support chassis with hand while removing nut.

STEP 10

Pull chassis back toward firewall until control shafts clear the dash, then rotate chassis until shafts are facing upward. Remove chassis as shown in Fig. 2.

Power Supply and Speaker Unit (Refer to Fig. 3.)

The power supply, audio output stage and speaker are combined into one unit and located to the right of the radio chassis on push-button and signal-seeking models. Only the speaker is mounted separately in manual tuning models. The removal procedure is the same for both types.

STEP 11 (Applies only if rear-seat speaker is employed.)

Disconnect the lead (or leads) to the rear-seat speaker control unit.

STEP 12

Detach the antenna lead from the clip attached to the right-hand mounting bolt (E). Remove the two Phillips-head bolts (E) from the bottom of dash using a 3/8" box-end wrench to hold the nuts and a Phillips screwdriver to loosen the bolts. Take off the antenna clip on the right side.

STEP 13

Steady chassis with one hand and remove two Phillips-head screws (F) from the top of the speaker-grill bezel.

STEP 14

Remove the power supply chassis (or speaker) by lifting the chassis up and back, then move sideways to the position which was occupied by the glove compartment and lower the unit toward the floorboard.

Tools Required

2—Phillips screwdrivers, 1 stubby type and 1 regular length.
1—11/16" box-end wrench.
1—5/8" box-end wrench.
1—3/8" box-end wrench.

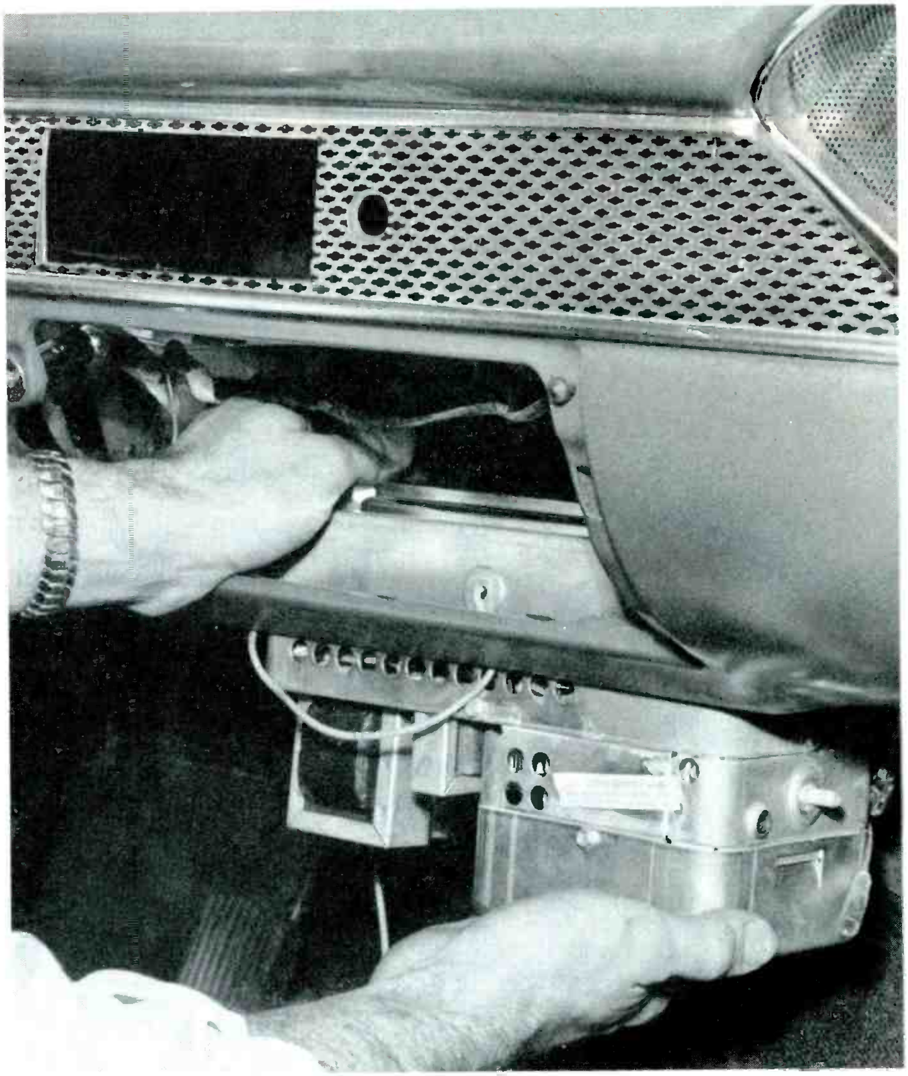

Fig. 2. Removing chassis.

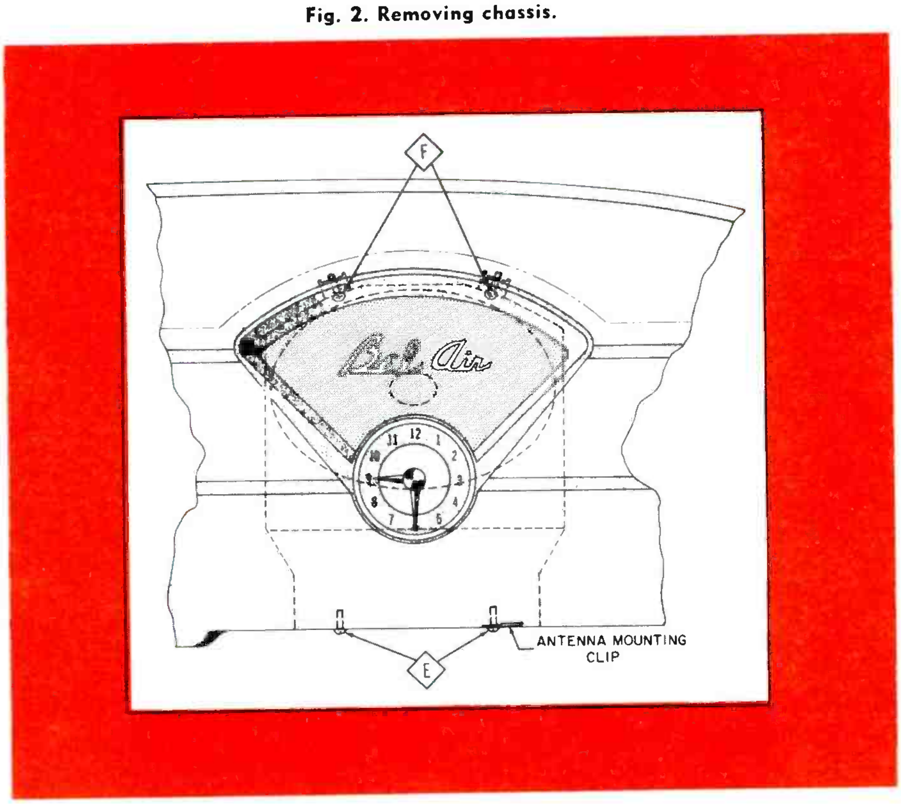

Fig. 3. Phantom view showing position of speaker unit.

servicing new designs

by Thomas A. Lesh

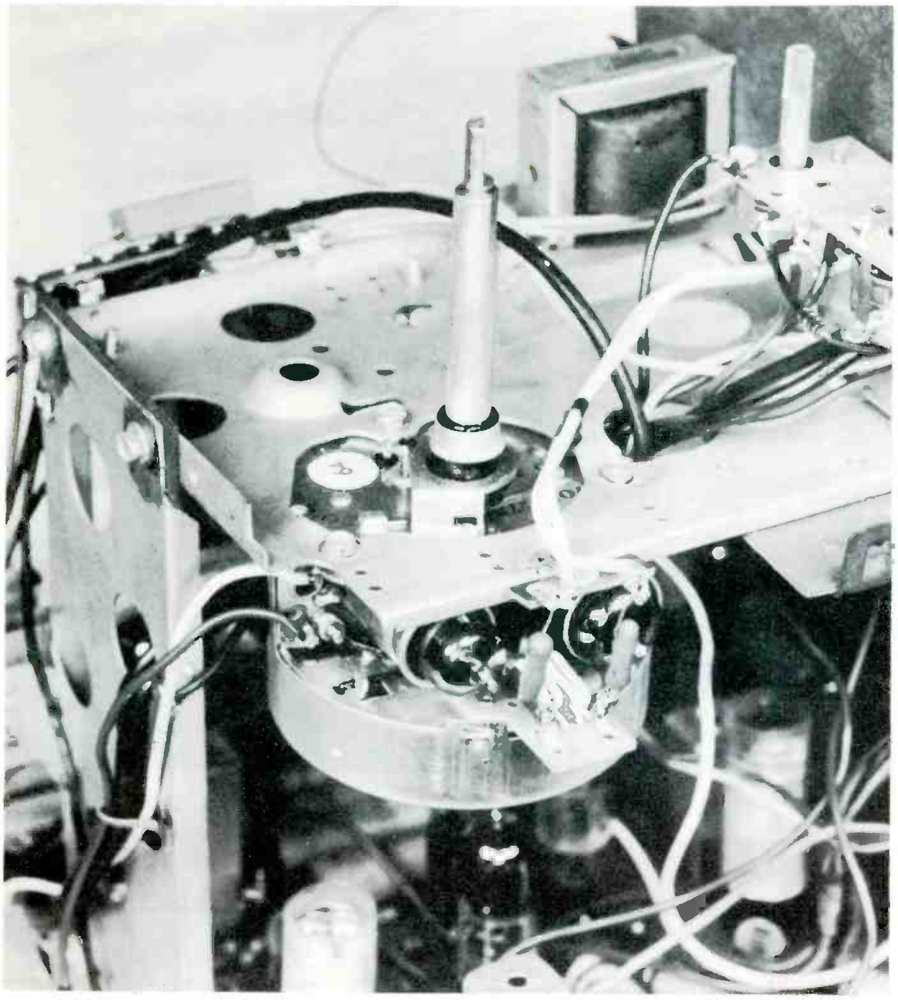

Fig. 1. New compact version of Standard Coil tuner in Airline Model GTM4031A.

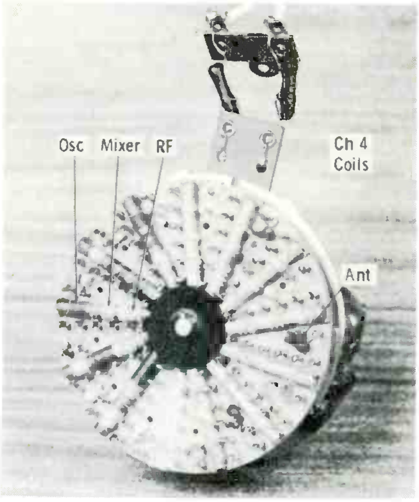

Fig. 2. Bottom view of new tuner showing tuner coils mounted on wheel.

Smallest TV Tuner

What appears to be an oversized potentiometer mounted on the upper deck of the TV chassis in Fig. 1 is actually a VHF tuner —one that sets a new record for compactness. This unit is a new version of the Standard Coil Neutrode tuner, electrically identical to previous models (except for some changes in component values) but radically changed in physical construction, in that it conforms to the compact layout requirements of the newest TV sets.

How has a complete television tuner been squeezed into such a small package? Let's disassemble the unit and find out. The tuner can be removed from the TV chassis by unsoldering a half-dozen connections and taking out three ¼" hex-head screws. When the cover is slipped off, the bottom view of the tuner is as shown in Fig. 2. Fastened to the underside of the tuner chassis is a movable wheel which serves as a mounting board for all the tuning coils. Oscillator, mixer, and RF coils for individual channels are wound on coil forms which are arranged like spokes on the wheel, and an antenna coil for each channel is separately mounted at a considerable distance from the other coils associated with that channel. (Note the positions of the Ch. 4 coils in Fig. 2.) This arrangement permits an extremely compact design while still preserving the necessary isolation between the antenna input circuit and the other tuned circuits.

Oscillator adjustment slugs are located inside the coil forms and can be reached through a hole in the tuner cover. In the Airline set shown in Fig. 1, adjustments are made from the right side as viewed from the rear of the receiver.

In Fig. 3, the wheel is shown removed from the tuner chassis. Note that contact buttons and springs similar to those on turret tuners are employed to make connections between the two parts. The tuning shaft, which is fastened to the wheel, is thrust through a hole in the center of the chassis and locked in place so that the buttons will be held in contact with the springs. The wheel is guided into the correct on-channel positions by a spring-loaded detent rod which rides on the rim of a detent gear fastened to the wheel.

Details of the procedure for removing the wheel from the tuner are as follows: First, a C-shaped retainer ring is pried out of a groove near the tip of the tuning shaft (see Fig. 4), and then one screw on the top wall of the tuner chassis is taken out so that the fine tuning shaft and its cam (Fig. 5) can be slipped off the main shaft. The next operation is to free the main shaft by removing

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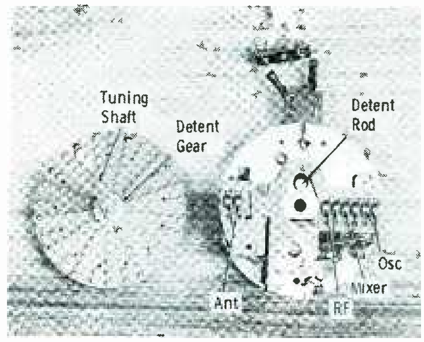

Fig. 3. Wheel removed to show contacts.

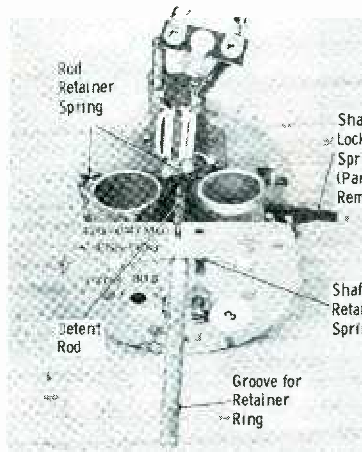

Fig. 4. Components which must be loosened or removed to free the coil wheel.

the retainer and locking springs that fasten it to the chassis. The locking spring is disengaged by grasping the tab at its outer end with pliers and pulling outward.

To simplify removal of the wheel and tuning shaft assembly, the detent mechanism should be loosened in order to relieve the pressure on the detent gear. This is easily done by freeing one end of the rod retainer spring—the left end as seen in Fig. 4 is most convenient. Normally, it is not necessary to disassemble the detent mechanism any further than this.

Inside the tuner chassis, the main shaft passes through the cam follower and its spring, both of which are shown in Fig. 5. One ear on the follower projects through the top wall of the tuner and is held against the cam by spring tension. When the cam is turned by the fine tuning shaft, the follower is driven back and forth, causing the second ear on the follower to open and close the movable plate of a book-type fine tuning capacitor. Whenever a coil wheel is removed from one of these tuners, the technician should make sure that the follower and spring are correctly positioned before he reinserts the tuning shaft into the chassis.

The most important feature of this new tuner is that the wheel, which lies flat against the end of the chassis, has taken the place of the bulky turret used in previous models. All the waste space formerly occupied by the hollow interior of the turret has therefore been eliminated.

Receiver Design Minimizes Tube Failures

Several new design features aimed at lengthening the life of receiving tubes are included in the transformer-powered TS-544 chassis used in some 1958-model Motorola TV sets.

For example, there is the "Tube Sentry," a small component which is simply a Globar resistor fastened to a thermal switch. The resistor is in series with one primary lead of the power transformer, and the switch is connected in the DC output lead of the 5U4GB rectifier tube. Since the switch is open when cold, the B+ circuit is not completed until the resistor heats up sufficiently to close the switch. This action does not take place until approxi-

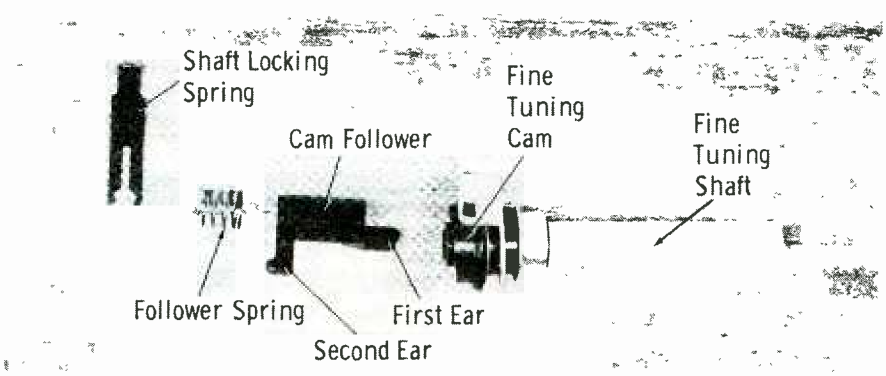

Fig. 5. These components fit around the tuning shaft. (C-ring not shown.)

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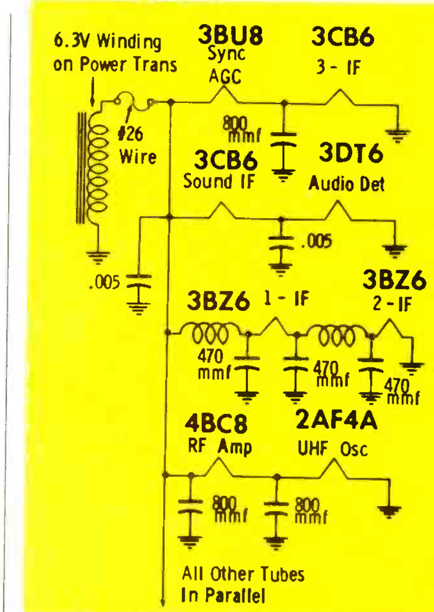

Fig. 6. Series-parallel hookup across 6.3-volt filament supply in Motorola TS-544.

mately 35 seconds after the receiver is first turned on. All tube filaments are then allowed to warm up thoroughly, permitting a cloud of electrons to build up around the heated cathode and thereby protecting the emitting surface against the initial shock which would result when plate voltage is applied.

Since the TS-544 chassis has a power transformer, it is surprising to find several 600-ma series-string tubes such as the 3CB6 in this set. Several pairs of these tubes are wired across the 6.3-volt filament winding of the power transformer in the manner shown in Fig. 6. This type of hookup is used in all-channel models; for VHF-only sets, a 6BC8 is substituted for the 4BC8 and 2AF4A in series.

Series-string tubes were used in this unconventional way for one good reason: Field experience has revealed a noticeably lower failure rate for the reduced-voltage, 600-ma tubes than for the 6.3-volt versions of the same types.

In another effort to increase tube life, a 3A3 has been employed as a high-voltage rectifier in place of a 1B3GT. The 3A3, a heater-cathode tube developed for color TV, is expected to have a long service life in the TS-544 high-voltage circuit, which develops a nominal 18.5 kv for the anode of a short-neck 90° picture tube. ▲

Notes On TEST EQUIPMENT

Latest Information on Application, Maintenance and Adaptability of Service Instruments

by Leslie D. Deane

Intermittent Troubles?

The instrument shown in operation in Fig. 1 is helpful in solving those stubborn intermittent problems we all dread but so often encounter in the servicing field. Manufactured by Winston Electronics, Inc. of Philadelphia, the unit is identified as the Win-Tronix Model 828 Intermittent Condition Analyzer.

Using various probe techniques, the Analyzer operates on a signal monitoring principle, and is especially designed to isolate mechanical or electrical intermittents in a minimum amount of time.

Specification features are:

1. *Power Requirements—105 to 125 volts AC, 50/60 cps, power consumption 20 watts.*
2. *RF output—television signal frequency for channel 2 adjustable for channels 3 and 4 or radio signal frequencies of 545 and 1090 kc.*
3. *RF Modulation—TV sound carrier of 4.5 mc and audio modulation of 400 cycles.*
4. *Signal Monitoring Provisions—audio output from built-in dynamic speaker or phone jack, attenuator control and gain switch provided on front panel.*
5. *General—built-in power outlets provide Medium, 10-volt line boost and High, 20-volt line boost; intermittent probe and attachments supplied with unit.*

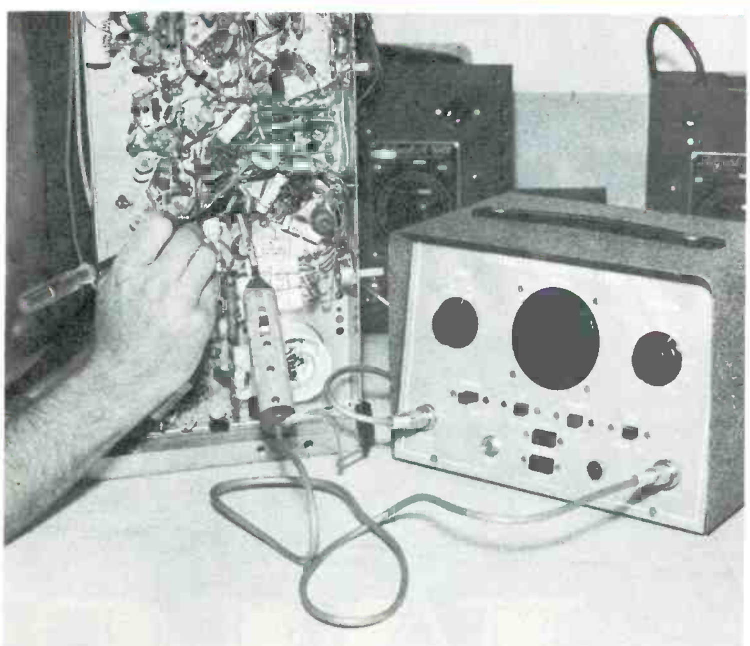

Fig. 1. New Win-Tronix Analyzer aids in quickly isolating intermittents.

When I examined this outfit in the service lab the other day, I'm happy to say there were no intermittent TV chassis laying around. However, to properly acquaint myself with the instrument and its operation, I decided to introduce or simulate such a condition in a test receiver.

The usefulness of such an instrument naturally depends upon how it is employed and the interpretation of results, so my first task was to read the instruction manual carefully and completely. In doing so, I found several suggested steps that the technician might take to prepare the ailing set for intermittent testing. First, eliminate all obvious sources of trouble by giving the chassis wiring a complete visual inspection. Next, to duplicate the temperature and voltage conditions which exist in the customer's home, the heat from a 250-watt infrared or a 200-watt incandescent lamp should be directed at the under-chassis components. This will raise the ambient temperature, simulating the condition which exists when the chassis is in its cabinet. In order to force the intermittent to appear, it may also be advisable to increase the line voltage slightly. For this express purpose, the Analyzer has two AC outlets conveniently located on the front panel, one for increasing line voltage by 20 volts and the other by 10.

Returning to my little experiment, I introduced a poor contact in the sync separator circuit of the test receiver. I noticed that the slightest vibration would now throw both vertical and horizontal sweep oscillators off frequency. This type of symptom, according to the instruction manual, indi-

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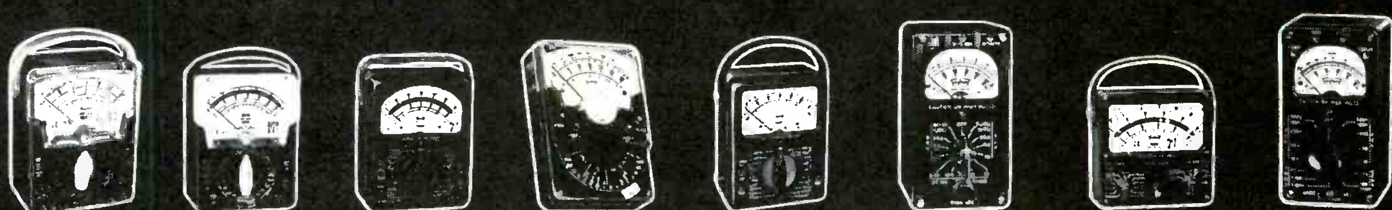


631 | 630-NA | 630-A | 310 | 630-T | 666-HH | 625-NA | 666-R

cates a mechanical intermittent.

Following instructions for this condition, I connected the RF output cable of the Analyzer to the antenna terminals of the receiver —thus feeding in a channel 2 RF signal modulated by both 4.5 mc and 400 cycles. I then connected the cable from the intermittent probe to the *tracer in* jack on the front panel of the instrument. Setting the Analyzer's switches and controls as recommended, I flipped the probe switch to the video/audio position and touched the probe tip to the sync output circuit. Monitoring the 400-cycle signal with the instrument's speaker while probing components and wiring, I immediately detected the faulty condition.

Had the intermittent condition been of an electrical nature, any popping or abrupt change in signal level could have been traced from the output back through the circuit by placing the probe at different points. As the probe is moved past the defective circuit, the intermittent noise should cease to be heard.

If connecting the intermittent probe directly to the suspected circuit temporarily causes the trouble to disappear, then it may be necessary to employ an indirect method of coupling. The two probe attachments pictured in Fig. 2 will help solve this problem. The small ring type, shown attached to the probe, is called an Electro-Wand. This unit is designed to slip over miniature tubes in various sections of the receiver, pick up intermittent noises by capacitive coupling, and is also handy for signal tracing without removing the chassis from its cabinet.

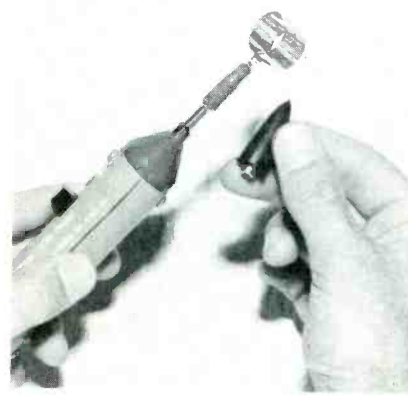


Fig. 2. Attachments for Win-Tronix intermittent probe pemit signal sampling without direct circuit contact.

The other attachment, known as an Electro-Probe, is a metal probe tip insulated with thick pliable rubber. The insulated tip is placed against circuit components without making any electrical contact with the suspected circuit, and can be moved from stage to stage in order to isolate the intermittent.

Probe Your Meter

The Futuramic Company of Chicago, Ill., now has a complete line of meter test probes, four of which are designed for use with conventional volt-ohm-milliammeters, plus two recently-developed units for use with vacuum-tube voltmeters. These probes are especially designed to open up new fields of application for your meter. Through their proper use, the technician can realize more utility from such instruments.

In general, the units are sturdily constructed and very attractively designed. Each probe has a gold-plated steel housing and extra-long leads for maximum serv-

icing convenience. The four VOM probes are pictured in Fig. 3. Fig. 3A is the high-ohms probe, type 261. I found that this unit will extend the limits of an ohmmeter by converting the R × 10,000 ohm range to an R × 100,000 ohm range, making it possible to read resistance values up to 200 megohms. Practical servicing applications may consist of measuring leakage in capacitors, transformers, tubes and sockets; measuring insulation resistance in high-voltage circuits, lightning arresters, isolation networks, wiring harnesses, etc. The 261 probe can be used with most VOM's having a center-scale indication of 12 ohms and a 7½ volt internal battery.

The test instrument identified in Fig. 3B is the type 262 signal-tracing VOM probe which, when used in conjunction with a conventional volt-ohm-milliammeter, makes possible the measurement of signal voltages and thus the isolation of weak or inoperative stages in radio or TV sets. Checks can be made in almost any section of a television receiver, in many cases without pulling the chassis from the cabinet. The probe is capable of detecting signals from 60-cycles to 200 megacycles and is adaptable to any 20,000 ohm-per-volt meter.

The Futuramic type 263 polarity-reversing probe (Fig. 3C) provides an extra convenience for the technician in that it will reverse the polarity of any measured voltage quickly and easily. The probe will handle all voltages commonly encountered in radio and television servicing up to a value of 500 volts DC or peak-to-peak. It can be used with any VOM and will provide either a positive or negative indication with a flick of the finger-tip switch.

The range-splitter probe type 264 is pictured in Fig. 3D. This particular probe actually increases the utility of a meter by providing an extra 500-volt range where it is needed most. When measuring voltages between 250 and 400 volts on certain VOM's, it may be necessary to take the measurement on a 1,000-volt scale. A high degree of accuracy is sometimes difficult to obtain under these circumstances. By using this new

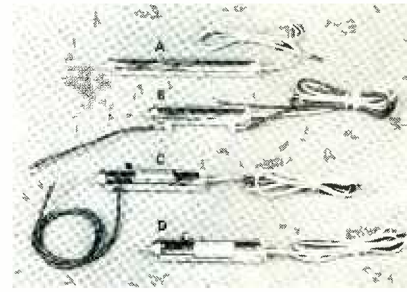


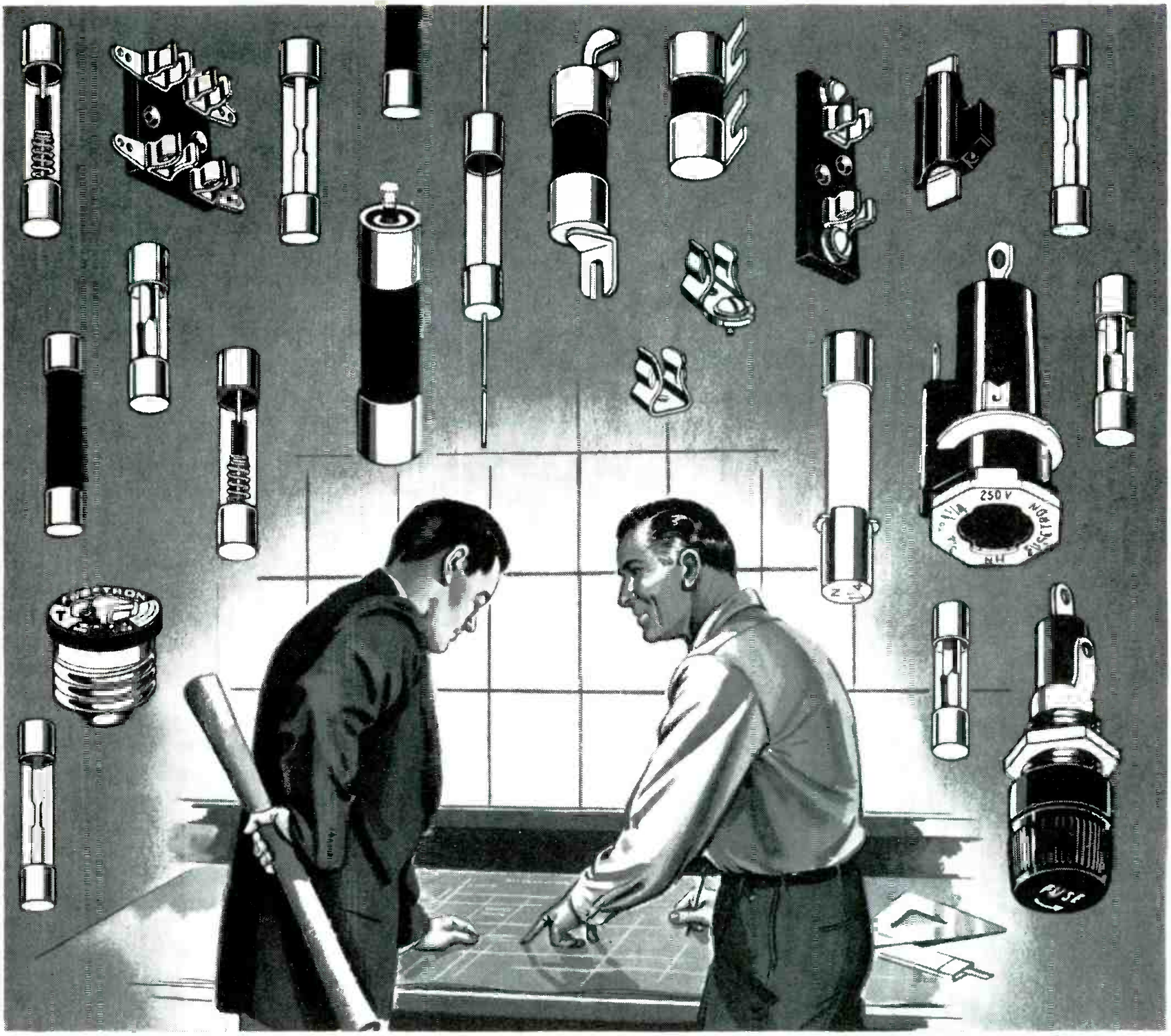
Fig. 3. Futuramic multimeter probes. (A) type 261, high-ohms probe; (B) type 262, signal-tracing probe; (C) type 263, polarity-reversing probe; and (D) type 264, range-splitter probe.

probe, the original 50-volt scale of the meter becomes a 500-volt scale. Voltages between 250 and 500 volts can then be read on the upper half of the scale where the meter is more accurate and the value can be more clearly interpreted. The range-splitter features a finger-tip slider switch for conveniently switching the additional range in or out of the circuit. The probe is suitable for use with many popular 20,000 ohm-per-volt VOM's having voltage scales of 2.5, 10, 50, 250, and 1,000.

In addition to the multimeter probes illustrated in Fig. 3, Futuramic has also designed a high-ohms probe for use with certain VTVM's. This probe, known as type 265, permits the measurement of resistance values up to 10,000 or 20,000 megohms, depending upon the scale calibration of the instrument with which it is used.

The probe houses a type Y-10 transistor battery and one penlight cell. It not only makes possible the measurement of higher resistances, but can also increase the accuracy of measurements between 100 and 2,000 megohms by placing the meter indication on an expanded portion of its scale. Similar in outward appearance to the probes pictured in Fig. 3, it can be adapted to any VTVM having an R × 1 meg scale, an input resistance of 10 megohms, and an internal battery supply of 1.5 volts.

The type 268 peak-to-peak VTVM signal-tracing probe is the latest addition to the Futuramic line. Shown in Fig. 4, this device makes it possible for your VTVM to indicate peak-to-peak voltage values directly on the DC scales of the instrument. Readings ob-



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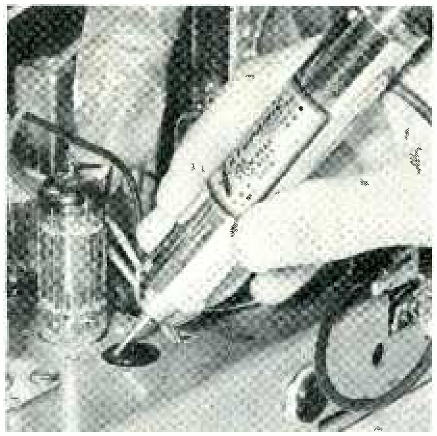

Fig. 4. Futuramic's type 268 is used with VTVM to measure peak-to-peak signals.

Fig. 5. Eby's new Trans-Tester converts milliammeter to transistor checker.

tained by using the probe should compare to those given in the service literature for peak-to-peak waveform values.

To avoid possible damage to the diodes built into the probe, measured values are limited to 100 volts peak-to-peak. The 268 can be employed with most popular VTVM's having an input resistance of 10 megohms.

I recently made use of this particular probe in connection with an analysis on loss of picture and sound in TV receivers. Following procedures outlined in the instruction sheet and using one of our TV test chassis, I decided to troubleshoot for loss of signal caused by a fault I had purposely introduced into the 1st IF amplifier stage. The first step called for a check at the video amplifier stage. Here, I pulled the tube and placed the probe on the input grid contact of the empty socket. With the probe's short ground lead connected to chassis, a normal indication is approximately 2 to 6 volts. I obtained a zero indication at this point which meant that no signal was reaching the video amplifier.

The next check point took me to the input of the video detector stage. Again I found a zero indication which naturally pointed to trouble toward the front end. A normal indication at the detector input would have been about 2 volts.

Continuing, I then pulled the last IF amplifier tube and measured the input grid signal on the proper socket pin. If the signal was reaching this stage, I should detect a peak-to-peak reading of from .2 to .3 volts. No signal was present, however, so I proceeded with the recommended signal-tracing approach.

Tuning the receiver off-channel, I raised the mixer-oscillator shield until it no longer made contact with the chassis. With my fingers still in contact with the shield, I applied the probe to the video detector input. Here, a voltage indication would eliminate the mixer and all following stages. When I still obtained a zero reading, however, the trouble was then isolated to either the first IF stages or the mixer. A few quick voltage measurements then pinpointed the fault to the 1st IF amplifier circuit.

The 268 is also useful in localizing trouble in sound, sync, sweep and high-voltage circuits. Procedures for signal-tracing these sections are covered in the instruction sheet packaged with each unit.

Check Transistors On Your Own Meter

The relatively small bench instrument pictured in Fig. 5 is the Eby Trans-Tester transistor tester, manufactured by Eby Sales Co., New York City.

Upon examination of this piece of equipment, I found that it operates in conjunction with any VTVM, VOM, or multimeter capable of accurately measuring currents between 0 and 10 ma. Two separate jacks are mounted on the front of the unit for connection of the meter test leads. In addition, two molded transistor sockets are provided—one for n-p-n and one for p-n-p types. The unit is self-powered by four 1½-volt penlight cells and is used in determining current gain by measuring collec-

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One of a new series of full-page ads appearing in TV GUIDE

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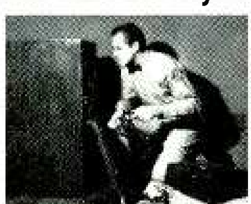

He actually bets his family's bread and butter he'll do a better job for you . . . his business success depends upon it.

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tor current at two different bias levels.

To check a transistor, I first connected the test leads of a commercial VOM to the jacks provided. Leaving the gain switch of the instrument in the off position and placing the meter selector on a 1-ma range, I inserted a p-n-p transistor in the proper socket. Referring to the characteristic chart given in the operating instructions, I noted the reading should not exceed .75 ma for low-gain transistors and 2 ma for high-gain units. The particular one tested produced a reading of 0.5 ma which eliminated the possibility of a short or open. I next moved the gain switch to the on position and observed the meter indication. The current had increased to approximately 0.8 ma, providing a net gain of 0.3 ma. This figure was satisfactory according to the chart, which indicated that the increase should be at least 0.2 ma.

Millivoltmeter by Simpson

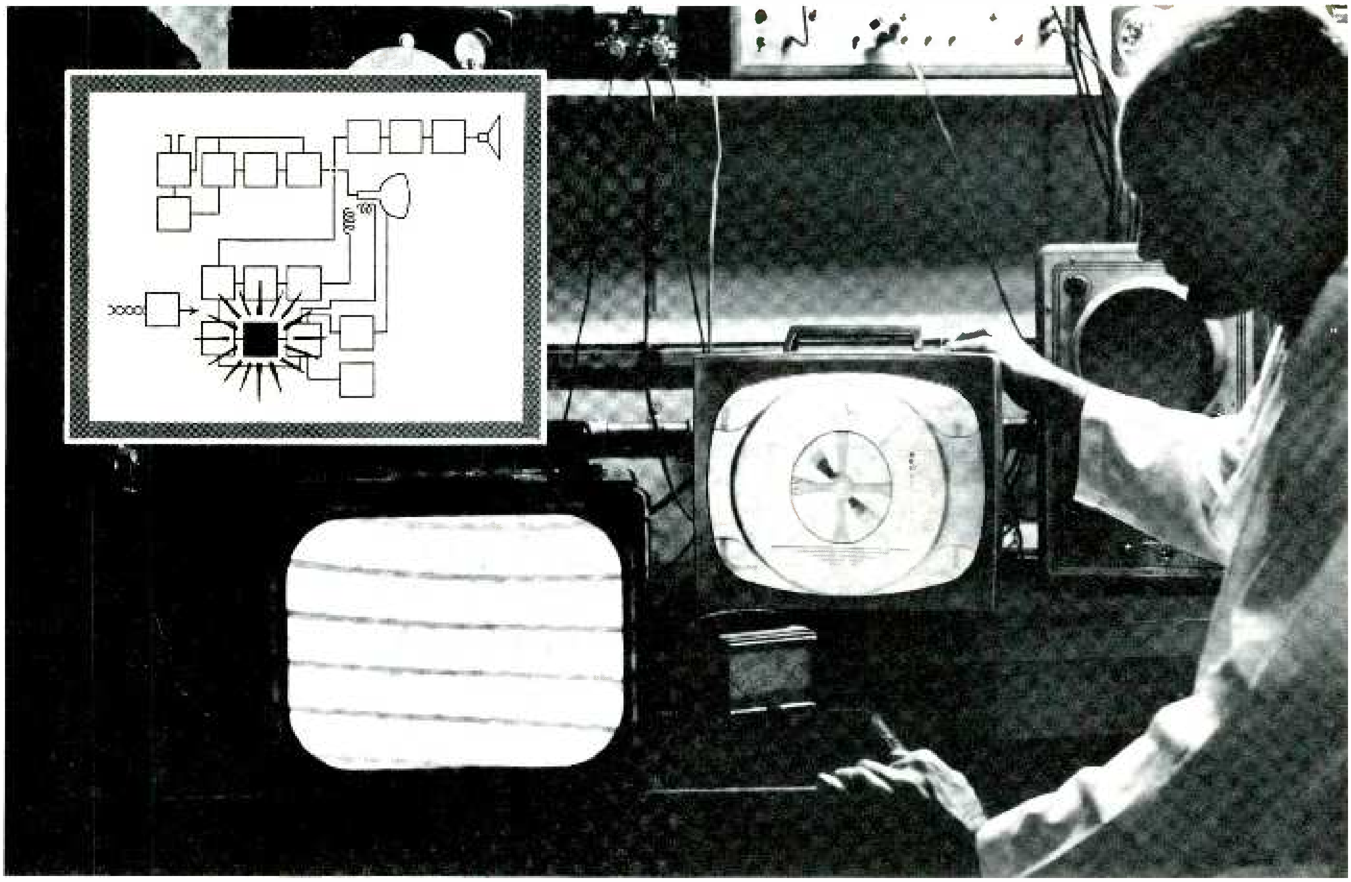
The pocket-size tester shown in Fig. 6 is the new Model 387 millivoltmeter manufactured by Simpson Electric Co. of Chicago, Ill. Especially designed for testing thermocouples in appliances, such as gas-fired hot water heaters, clothes dryers, furnaces, space heaters and gas refrigerators, the instrument is a highly accurate DC millivolt measuring device.

Specification features are:

1. *Meter Range—five individual ranges from 0 to 10, 30, 100, 300, and 1,000 millivolts, range selected by connection of test leads.*
2. *Meter Accuracy—±3% of full scale deflection at ambient temperatures of from 50° to 120° F, maximum deviation of ±5% from −55° to +185° F.*
3. *Test Leads—two 48" well insulated leads with alligator clips are provided.*
4. *Size and Weight—3" × 5⅞" × 2½", 1½ lbs.*

Fig. 6. Simpson Model 387 millivoltmeter.

Although I have had little or no opportunity to employ this piece of equipment on gas-fired apparatus in the lab, I did make use of it by theoretically converting the unit to a direct reading milliammeter. I didn't actually modify the instrument, but merely placed a precision 1-ohm resistor in series with various circuits drawing between 1 and 1,000 ma. With the test leads across the 1-ohm resistance, the meter automatically indicated circuit current in DC ma. This measuring technique might be applied to transistor circuitry to check collector current or other allied measurements. The internal resistance of the meter, however, must be considered before calculating transistor current from a given circuit load. ▲



Here General Electric Application Engineer C. L. Taylor shows what can happen when an old-style horizontal-oscillator tube is used in two different TV sets. Image at left is completely out of sync. To avoid this hazard, the cut-off and other electrical characteristics of General Electric tubes are held within limits that bring satisfactory operation in all television circuits.

Built-in high quality of G-E horizontal-oscillator tubes means fewer TV-servicing call-backs!

Call-back demands from television owners are cut when you install General Electric horizontal-oscillator tubes.

For example: tube microphonics in multivibrator circuits can cause eccentric sync, especially when a set such as a portable is moved or shaken. With G.E.'s 7AU7 and 12AU7, extra-heavy micas, the tight fit of grid side rods, plate, and cathode, and sturdy over-all construction result in minimum microphonics and a steady television picture.

Also, uniform tube-to-tube cut-off characteristics—achieved by care in grid manufacture and rigid testing—enable you to install General Electric types in any receiver knowing that minimum adjustment will be needed for superior picture performance.

Blocking-oscillator circuits require that a tube throughout its life be able to produce peak plate currents 10 to 15 times higher than average. In the 6CG7 and 6SN7-GTB, General Electric scores with a specially processed high-emission, long-life cathode. Peak current capabilities remain high; sync drift is avoided.

For every set, for every socket, G-E receiving tubes mean greater assurance of owner satisfaction . . . and your G-E tube distributor makes prompt delivery. Phone him today! *Distributor Sales, Electronic Components Division, General Electric Co., Owensboro, Ky.*

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GENERAL ELECTRIC

161-1A9

BY JOHN MARKUS

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

Sidelines. Today's transistor radios will sell themselves if given half a chance. This is particularly true of the new 7-transistor models, several of which have volume and tone comparable to that of table radios.

Let's take the new Philco 7-transistor model as an example. This comes with a fine leather carrying-case having punched holes in front of the loudspeaker, plus a shoulder carrying strap. The serviceman has the set hung over his shoulder, tuned to a snappy musical program as he rings the doorbell. He enters, and the odds are it won't take more than 60 seconds before the customer comments on the music coming from the little leather box. Here is the chance to hand over the set to the customer and say, "Why don't you and your family try it out while I'm working on your own set? The batteries are guaranteed to last a year, so don't worry about letting it run at full volume."

After finishing the repair job, it's easy to ask how they liked it, and swing naturally into the special offer being made on that set to the serviceman's customers. It may take an evening callback, when hubby is home, to clinch the sale, but the profit possibilities will make that well worthwhile.

Another profitable sideline is the case of the profit-minded Indianapolis serviceman who brings a table-model FM receiver along on TV home service calls, and plugs it in with the explanation that he likes music while he works. The unsuspecting set owner is usually intrigued by the high-quality FM music, and in many cases he's impressed enough to find out more about the unit. Before you know it, he's bought the radio. The technician gets a nice extra profit on the side, and the new FM station in town also gets a promotional boost.

$ & ¢

Names. The titles of television and radio service associations in the United States show considerable variation. A recent survey by "Guild News" points out that 52 of these associations use the word *technician* in their title, and 27 use *servicemen*. Three use *engineers*, and only two use *radiomen*.

With this much variation in established names, there is a real problem in getting any one name accepted by even just a majority of the over 200 associations in the United States. Looking into the future, it would seem that a broader title for an association, a service business and an individual in the business would stand the best chances for widespread adoption. "Guild News" suggests *Electronic Service Technicians* as a title which is accurate, offers long-time usefulness and carries prestige from the viewpoint of the customer.

$ & ¢

Fishing. Twelve service dealers in the communities surrounding Mineola and New Hyde Park on Long Island signed agreements to *go fishin' Wednesdays* this past summer. The arrangement was in effect from June 1 to August 31, and served to make the 5-day, 40-hour week a reality during these slower months of the year.

If you like the idea, now is the time to start the ground work for reaching such an agreement next summer in your own community.

$ & ¢

Question. "A short circuit, you say. And just how much will it cost to lengthen it?" asked the shapely blonde housewife of her TV repairman.

$ & ¢

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.

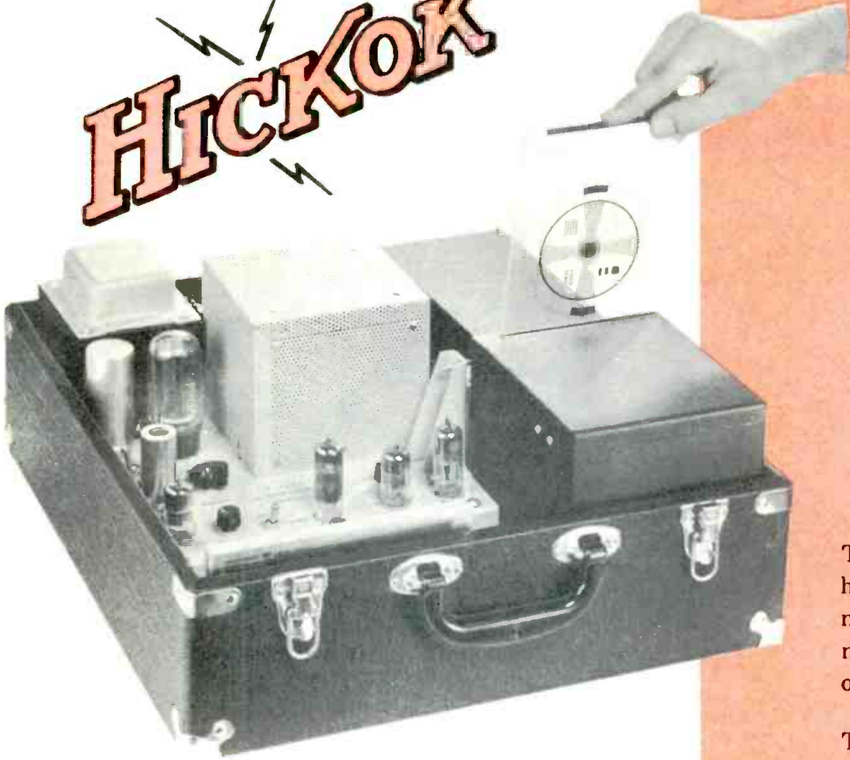
5. Unprofitable savings programs were dropped. Thus, the saving and selling of scrap was abandoned because the time and effort involved in collecting and marketing the scrap had not paid off.

$ & ¢

Vacations. This year, 99% of all companies in this country will give paid vacations to their employees, as compared with only 46% before World War II. Length of vacation usually increases with years of service, up to the maximum set by company policy. This year, 24% of the companies gave maximums of 4 weeks or more and 53% gave up to 3 weeks, generally after 10 years service.

How much vacation did you get this year? If you have been operating your own business for 10 years, you certainly should have taken 3 weeks, and you should begin thinking of 4-week vacations. Vacation is a logical part of overhead expense.

NEW HICKOK



Model 760

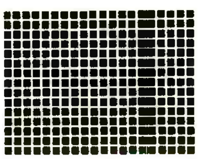
Video Scanner

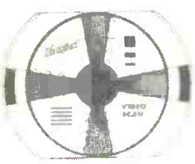
A COMPLETE
CABLE CONNECTED
TV TRANSMITTING STATION

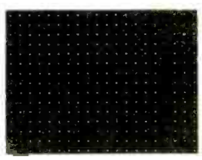
Greatly
Simplifies TV Servicing

This extremely stable and versatile TV trouble shooter has many uses in TV service. It features innumerable signals and displays normally not available to the TV technician. The 760 will instantly scan and produce a video or RF signal for any slide that is inserted into the unit.

Through use of the 760, any TV technician can quickly analyze the frequency response of picture definition capabilities of any TV receiver. For color television, the slide to produce white dots on the raster will enable a quick and accurate convergence adjustment. (This white dot pattern is the most stable pattern available in any generator.) A rapid check of horizontal and vertical linearity along with height and width adjustments are easily accomplished by viewing a slide. The unit provides an excellent check for the sync stability of a TV receiver. The ratio of video information to sync is adjustable and consequently can be varied to determine how well a television receiver locks-in on either high or low sync levels. The 760 has both RF or Video outputs sufficient to drive several receivers simultaneously.







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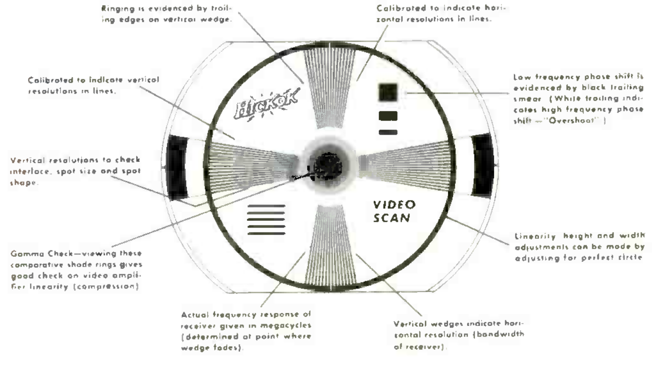
Characteristics

- * Patterns furnished are Bar, Dot, Standard Test Pattern and transparent blanks for grease pencil use.
- Optional patterns are Gamma, Square Wave and Burst Wave Forms.
- Will operate with any TV receiver—black & white or color.
- Generates and scans at the 525 line, 60 field, and 30 frame systems.
- Completely crystal controlled — sync to RETMA specifications.
- Horizontal sync contains front and back porch.
- Vertical pulse is serrated to maintain horizontal sync.
- RF channel selector covers channels 2 thru 6.
- Video output is 2 volts peak-to-peak with an impedance of 100 ohms.
- Video output either positive or negative.
- Resolutions well over 450 lines or band width in excess of 5 MC.
- The unit is comprised of 17 tubes including the CRT, photo-multiplier and rectifier.
- The sync level is variable to permit any combination of sync to video information. This is preset at the factory to RETMA standards.
- RF output of 100,000 microvolts is sufficient to drive several receivers simultaneously. With the aid of a distribution system an unlimited number of TV sets can be added.

Quickly and Accurately Permits These TV Receiver Checks:



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More Service Facts About
TRANSISTOR PORTABLES

by Leslie D. Deane

Fig. 1. Check points in an initial troubleshooting approach.

Transistorized radios are here to stay, and service shops all over the country will soon begin to realize a fair share of the potential servicing business they will bring. Although the prescribed servicing approach for these miniaturized circuits will not entirely obsolete existing test instruments or troubleshooting procedures, it will require certain new techniques and precautions.

In the March 1957 PF REPORTER, we gave consideration to batteries and their replacement, disassembly problems, tools, and bench power required in the servicing of transistor radios. In the June issue, we presented several hints and made suggestions for localizing troubles. This month we will continue with our practical servicing approach and deal more directly with measurements and component replacements.

Visual Inspection

Before digging into an inoperative transistor portable with a signal generator, meter, or a hot soldering iron, let's first consider a more simple, time-saving measure. When actually repairing these miniature radios, an intense examination of all components and wiring will prove to be more fruitful than any other initial troubleshooting procedure. Mainly, this is because the units are portable and will normally undergo rough treatment that often results in some form of physical damage. Then, too, transistors and certain other components can be easily ruined by careless, impromptu test methods; and even with reasonable care, there is some chance of damage being caused when circuit components are replaced or a soldering iron is applied to the delicate printed-wiring boards. With these considerations in mind, one can readily understand that a close visual inspection should be the first and most important step in troubleshooting a portable transistor radio.

Fig. 2. A needle-point probe is ideal for transistor-radio testing.

After testing the battery by substitution or measurement, regardless of the symptoms involved, the technician should check for some of the possible faults pointed out in Fig. 1. Troubles in the RF section of the receiver often can be traced to broken leads or a damaged loopstick. Improper

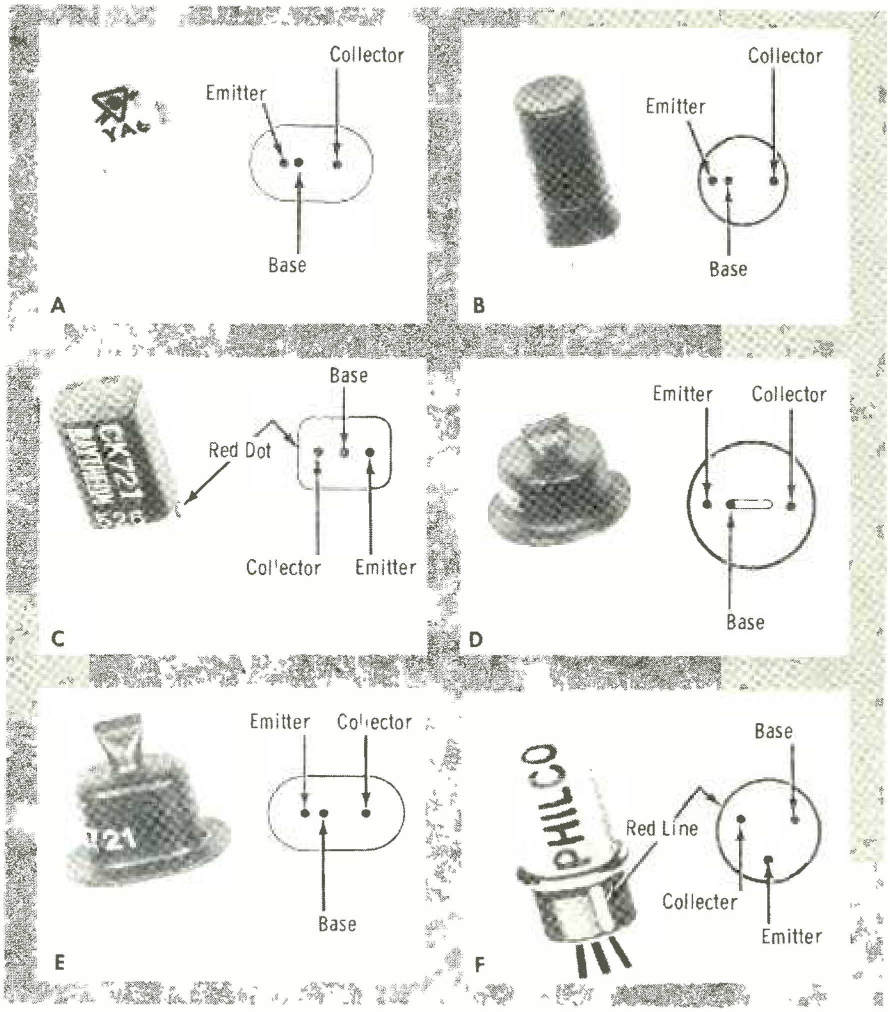

Fig. 3. Element connections for common portable-radio transistors.

ground connections, dirty or bent tuning-gang plates and improper lead dress in the converter section are also faults which can be located visually. Others are intermittent troubles caused by damaged or corroded contacts, shorts between the closely spaced components and printed wires, or broken conductors on the wiring board itself. If a broken or cracked wiring board is encountered, the break usually can be repaired with a nonconductive cement and reinforced with short pieces of wire. The wires should be soldered to both sides of all broken conductors after the cement has hardened.

The miniaturized on-off switches employed in many of the transistor portables are somewhat delicate and more prone to failure than those found in larger receivers. A damaged or worn switch may not open the supply circuit when in the off position, thereby shortening battery life. Due to the lack of a positive detent or click in the switch action, owners will often leave the set on unintentionally. This possibility should be explained to the customer if frequent battery replacements become necessary.

Voltage Measurements

At one time or another, most servicemen have been cautioned about the care one must exercise when metering transistor circuits. Actually, these warnings are not intended to discourage the technician from performing such tests, but rather to help prevent him from damaging a perfectly good transistor or some other component in the apparatus. The technician need not be a transistor specialist or an engineer to take voltage and resistance measurements in these portable receivers. All he needs to do is use a little common sense and become better acquainted with the ways in which a transistor or its affiliated components might be damaged.

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15	20	6000	10500	13500	24000	35000
25	40	4500	8000	10000	17500	25000
50	75	1750	3250	4250	8000	10000
75	100	1000	1500	2250	4250	6000
100	135	675	1250	1500	3000	4000
150	185	600	1000	1250	2500	3500
200	250	300	500	600	1000	1500
250	300	225	375	450	850	1200
300	350	200	350	400	750	1100
350	400	170	300	375	700	1000
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meters may be used for voltage checks in a transistor radio, a VTVM is highly recommended because its high input impedance provides better accuracy. A fair degree of accuracy is desired in the measurement of potentials between 0 to 1 volt and 0 to 25 volts.

When taking voltage measurements, remember that one slip of the test probe may ruin a transistor. Because of the close spacing between components in most transistor portables, it's a good idea to use a sharply-pointed probe insulated as shown in Fig. 2 Terminals in the set are usually small, rounded solder joints which are spaced closely together. A needle-point probe is less likely to slip from a smooth contact and will easily penetrate any varnish or lacquer coating the solder junction.

The average service technician is undoubtedly familiar with the basing connections for vacuum tubes. When taking voltage measments from the bottom of a tube socket, he counts in a clockwise direction from the reference point. Measuring voltages at the elements of a transistor, however, presents somewhat of a new problem. Being able to quickly identify base, collector, and emitter connections on various transistors will definitely speed the troubleshooting process.

Fig. 3 illustrates six of the most popular transistor types currently employed in portable radios. In each case, both a photograph of the transistor and a drawing of its lead positions are given. The most common type, pictured in Fig. 3A, has its base and emitter leads closely spaced at one end of the transistor body, while the collector is positioned at the opposite end. Bearing in mind that the center lead is always the base element, the technician should have little trouble in distinguishing between leads on this type of transistor. Connections for those units given in Figs. 3B, 3D and 3E are determined in a like manner.

The spacing between the three leads of the square-shaped transistor in Fig. 3C is equal. In this case, a red dot is located on the side of the unit adjacent to the collector terminal. The base element lead is located at the center,

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A code system is also used for the rounded style pictured in Fig. 3F. Here, a red line, painted on the body of the unit, lies adjacent to the collector terminal. In a clockwise direction from this point, one finds the base and emitter leads in that order when viewing the transistor from the bottom or lead end.

After eliminating the possibility of a weak or dead battery, the technician might decide to make a spot check of the AGC voltage. (For transistor radios, the term AGC is employed rather than AVC.) If the AGC system is operating properly, the voltage between the base and emitter elements of the controlled IF stages should vary as the tuning gang is rotated, indicating the general condition of the circuits up to and including the detector.

Using a reliable source of service information, one should be able to compare given voltage values with readings obtained from base, collector and emitter elements. Typical operating voltages for a conventional IF or converter stage are given in the diagram of Fig. 4. Two voltage ranges are given for each element—one for n-p-n and one for p-n-p type transistors. The negative voltage readings in Fig. 4 also typify those found in audio amplifier and output stages using p-n-p transistors. Fig. 5 gives typical voltage ranges for p-n-p amplifier and output stages when the collector returns to chassis ground rather than to the negative battery terminal.

Voltage values for n-p-n audio stages, where the collector returns to the positive battery terminal, are shown in the circuit of Fig. 6. All voltages given in Figs. 4, 5, and 6 are based on averages obtained from commercial portables employing the popular 9-volt battery supply.

If an accurate and sensitive voltmeter is not available, the technician can check the operation of a transistor circuit by measuring collector or emitter current. This procedure, however, requires a low-range milliammeter and additional reference data for comparative purposes.

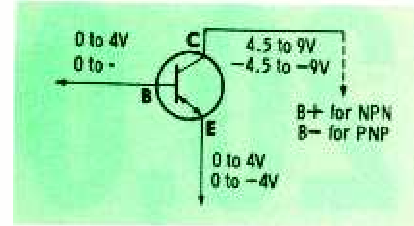

Fig. 4. Typical DC voltages for converter, IF, and some audio circuits.

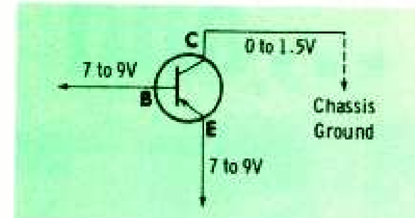

Fig. 5. Operating voltages for a conventional p-n-p audio stage.

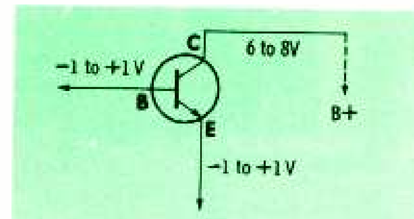

Fig. 6. Typical voltages for audio circuits employing n-p-n type transistors.

Resistance Measurements

Normally, when servicing a radio or TV receiver, the technician will seldom concern himself with the possibility of damaging a circuit component with an ordinary ohmmeter. When troubleshooting transistor circuitry, however, look out! There are two major components which can be permanently damaged by the internal battery voltage of what might be termed an ordinary ohmmeter. Transistors, for one, are particularly sensitive in this respect. The emitter-base circuit, for example, is biased in a forward direction and presents a relatively low-impedance path. Voltages which exceed the specified values should never be applied to the unit, not even for an instant. If they are, breakdowns will occur at the junctions of the dissimilar metals and cause permanent damage to the unit.

If the applied voltage rating of the collector element (known as the Zener voltage) is exceeded, the transistor may rupture and cause excessive reverse current to flow. The collector-to-emitter breakdown voltage for transistors employed in the average portable

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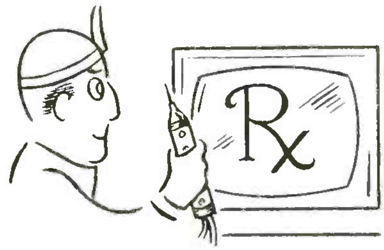

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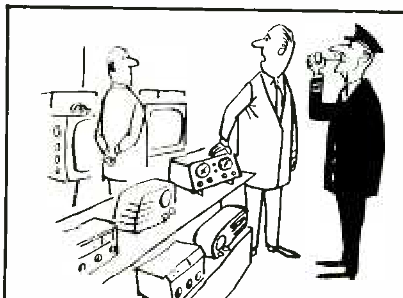
radio is from 10 to 25 volts. This might indicate that the use of an ohmmeter having an internal battery voltage lower than 10 volts is permissible. However, the ratings of a few transistors are as low as 4.5 to 6 volts. If a meter operates on an internal battery voltage higher than 3 volts, it's a good idea to remove all transistors from the circuit before making resistance measurements.

The other circuit components, which are perhaps even more prone to damage by improper voltages, are the miniature electrolytic capacitors (see Fig. 7). This stands to reason, for naturally the working voltages of these small units are lower by far than those of conventional electrolytics found in equipment using 100- to 300-volt power supplies. Generally, the ratings of the electrolytic capacitors in portable transistor radios range from 3 to 10 volts. Some receivers, however, may incorporate units rated as low as 2 volts and as high as 25 volts.

When connecting an ohmmeter across an electrolytic or across other components in a circuit containing these units, one should use a meter with an internal battery voltage which is lower than the rated value of the units involved. Never attempt to test one of these electrolytics with a conventional capacitor bridge. The potentials used in this type of instrument exceed the voltage ratings of the capacitors.

Another important point to keep in mind is that these capacitors are also polarized. Placing a voltage of the wrong polarity across an electrolytic is very likely to damage the unit. The technician should therefore check the polarity of his ohmmeter connections. After selecting the desired ohms



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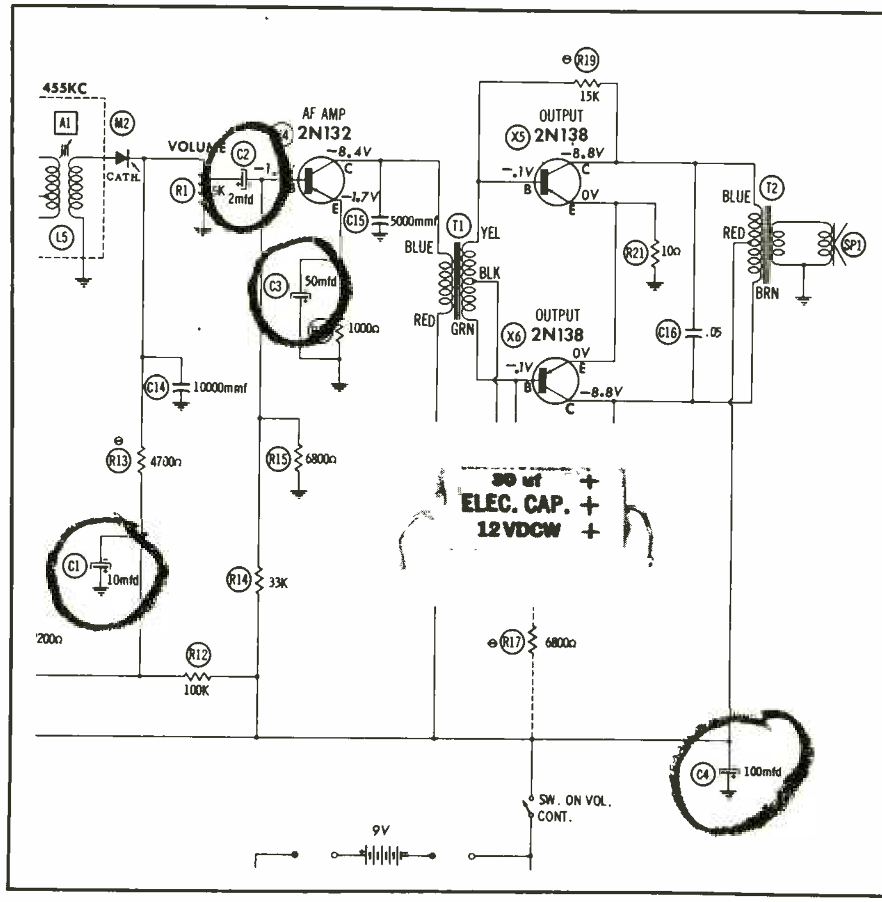

Fig. 7. Low-voltage electrolytics are found in all transistor portables.

scale, merely connect a voltmeter across the two test leads and determine which lead is positive and which is negative. When working on transistorized equipment, keep the red test lead in the positive meter terminal and the black lead in the negative terminal. This will help you to determine immediately the polarity applied to any circuit under test.

Resistance measurements in any circuit containing a transistor will often result in misleading indications. Unlike a vacuum tube, a transistor will conduct with only a small voltage applied to its elements. Therefore, if a transistor is in parallel with a component under test, the measured resistance may be much lower than anticipated. Resistance readings in a transistor circuit will also depend on the value and polarity of the applied test voltage. Reversing ohmmeter leads may result in a reading that is 10 to 20 times higher or lower than the original reading.

At this point, the technician might wonder exactly how these various limitations will affect him and his particular ohmmeter. The average multimeter or VOM usually makes use of a 1.5- to 3-volt battery on resistance scales of

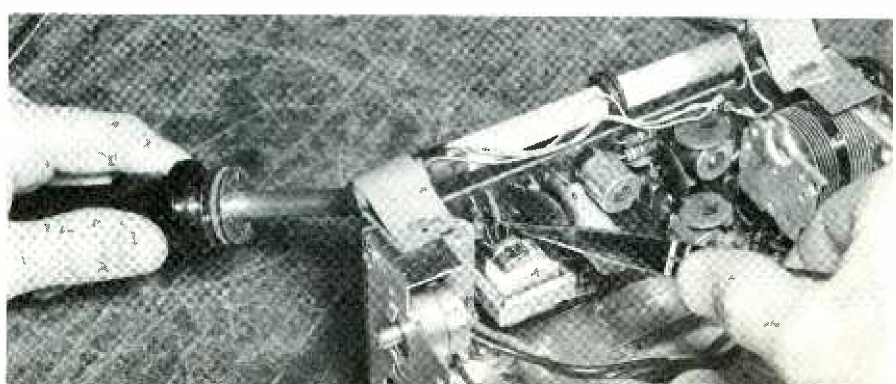

Fig. 8. Use of a heat sink is very important when soldering transistor leads.

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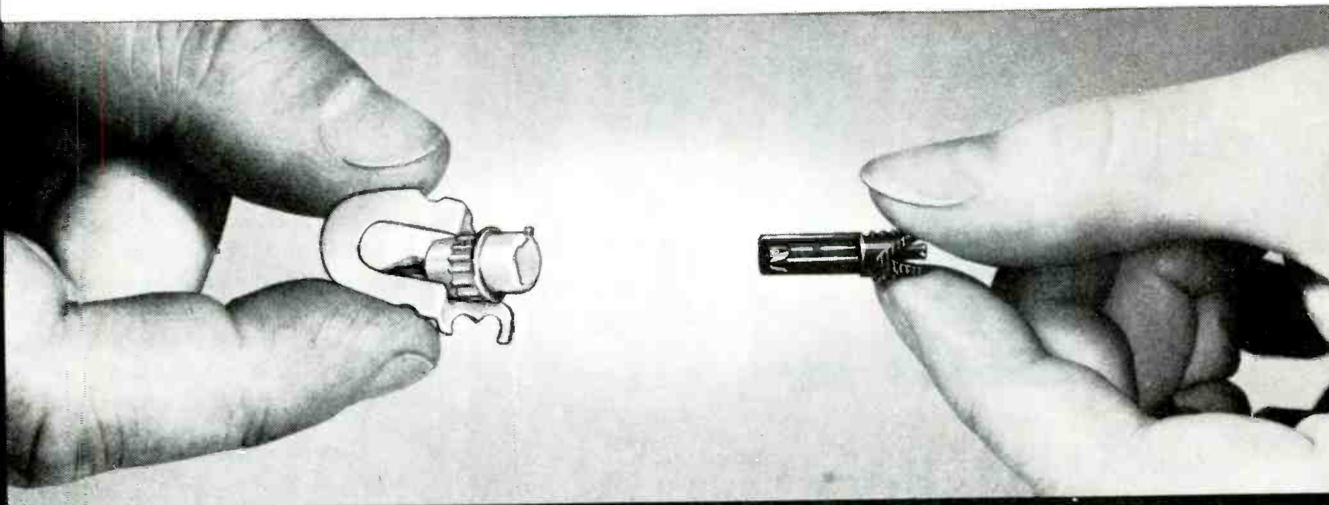

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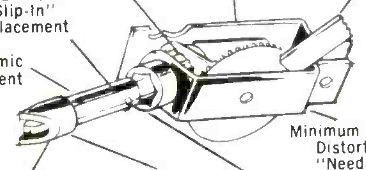

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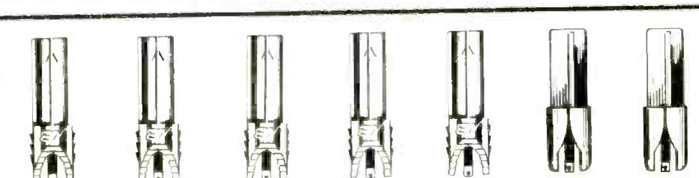

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R × 10,000 or less. However, when these same meters are placed on a high-ohms range such as R × 100,000, they may use a supply as high as 30 volts. Applying potentials of this value to transistors or low-voltage electrolytics is asking for trouble.

Many commercial VTVM's have provisions for resistive measurements, and the internal battery supply very seldom exceeds 3 volts for any range. Taking advantage of the internal vacuum-tube amplifier, these meters are highly recommended for both voltage and resistance measurements in transistor circuitry. Regardless of the type of meter employed, however, the technician should always be aware of its voltage values and polarities.

Component Replacement

After one locates a defective component in a transistor portable, a difficult task still remains. Replacing certain components will usually require special tools, a different soldering technique and a good deal of patience. This is especially true for parts having several lugs or contacts soldered to a small wiring board. Component leads or mounting lugs are often bent or twisted, and the removal of these parts requires a procedure similar to that used on can-type electrolytics, only on a smaller and more delicate scale.

As the technician may know from working with any printed wiring assembly, resistors and capacitors with short wire leads may be cut so that the replacement can be soldered to part of the remaining leads. In some cases, it may be necessary to crush the body of the component so that the old leads will be long enough.

"I see where these things weren't built to last-- you're the third man I've had to call in."

Transistors, like conventional germanium diodes, are extremely sensitive to heat. If they are the plug-in variety, always remove them before soldering associated socket connections. Should they be soldered into the circuit, it's a good idea to protect them in some manner before applying heat. One of the easiest ways to dissipate some of the heat is to grasp the lead with a pair of conventional long-nose pliers as demonstrated in Fig. 8. If space is limited, one might use needle-nose pliers or a heavy piece of copper wire.

Never remove or install a component in a transistor radio while the set is on, as surge currents may permanently damage a transistor. When replacing a relatively large component, the technician may have trouble melting the solder at some of the larger mount-lugs with a small, low-wattage iron. It is often more advantageous to use a larger iron to heat the joint for only an instant rather than to apply a small iron for any length of time.

Although the experienced technician may be extremely careful when working on these small wiring boards, at some time or another he will probably use too much solder or perhaps slip with a probe or iron and cause one of the printed conductors to blow. If this occurs, however, the break can usually be repaired by bridging it with a piece of hookup wire. After completing this type of repair, always check to see that all shorts have been removed before restoring power to the circuit.

Troubleshooting Check List

1. Make a complete visual inspection first.
2. Use an accurate VTVM for all voltage measurements.
3. Remember, transistors can be damaged by applying to much heat or subjecting them to improper voltages.
4. Know your ohmmeter and the supply voltage it utilizes.
5. Avoid resistance measurements around low-voltage electrolytic capacitors.
6. When replacing components, solder quickly and use some form of heat sink to protect transistors. ▲

QUICKER SERVICING

by Calvin C. Young, Jr.

This procedure works very well until you're called upon to adjust the local oscillator for channels 6 or 13, and find that the adjustments are not accessible from the front of the tuner (see Fig. 1). If you are in the customer's home and have the receiver repaired except for the oscillator adjustments, you may be torn between two desires—wanting to get the receiver operating the way it should and not wanting to take the set to the shop for what is seemingly a minor adjustment procedure.

Fortunately, there are adjustments for these channels and they are located in almost identical positions on different models. Channel 6 (Fig. 2) is located on the left side of the tuner and is a variable inductor which is reached through the hole nearest the front of the tuner. The channel 13 adjustment is on top of the tuner (Fig. 3) and is located immediately to the rear of the fine tuning capacitor.

The only trick is knowing where the adjustments are located; the adjustment procedure is identical to the one outlined above.

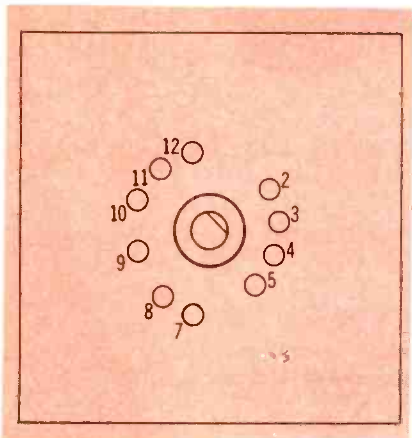

Fig. 1. Front of RCA tuner showing local oscillator adjustments.

Oscillator Adjustments for Switch Type Tuners

The local oscillator in turret tuners may be expediently adjusted by simply switching to the active channels and turning the oscillator slugs in the corresponding strips. This procedure will not produce consistent results on the switch type tuner. Best results in this case are obtained by following the alignment procedure recommended by the manufacturer.

Naturally, this can be done only in the shop where a signal generator capable of producing a swept RF signal at each channel frequency and accurate marker signals at the video and sound carrier frequencies of each channel, plus an oscilloscope, are available.

It is generally acknowledged that suitable results can be obtained in adjusting the local oscillator without using any test equipment, provided the proper procedure is followed. In step-by-step form, this procedure is as follows:

1. Set the fine tuning control to the center of its range.
2. Turn the channel selector to the highest channel received in the area. If a rotator is employed in the antenna system, be sure that the antenna is pointing toward the station being adjusted.
3. Adjust the local oscillator screw for best picture and sound reception.
4. Turn the channel selector successively to the next highest channels and adjust as in step 3 until all stations have been correctly tuned.

Fine Tuning Belt

In RCA tuners with this type of local oscillator adjustment setup, a belt arrangement is employed in the fine tuning assembly. It is not always possible to obtain replacement belts on short notice; however, a pair of shoe strings serves as a good makeshift substitute, provided a bottle of dial cord dressing is also available. You simply make two belts

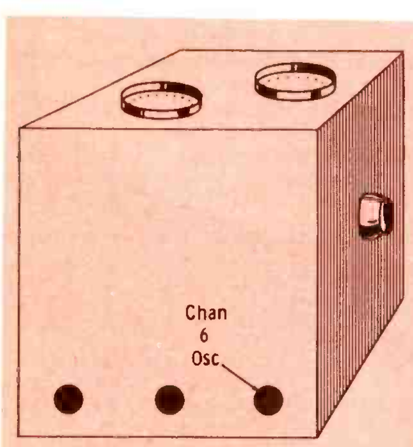

Fig. 2. Left side of RCA Tuner showing location of channel 6 adjustment.

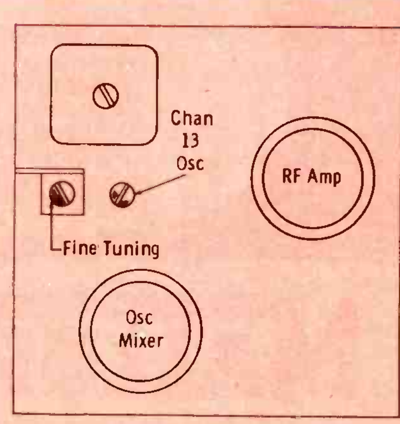

Fig. 3. Channel 13 oscillator adjustment on top of tuner.

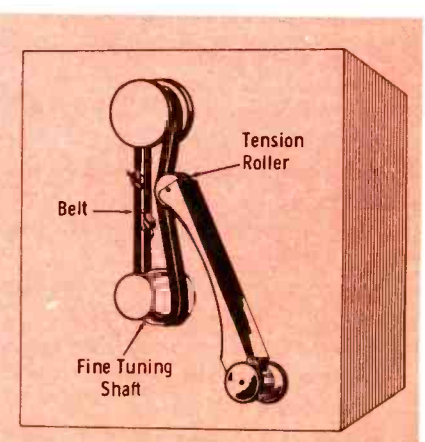

Fig. 4. Belt drive for fine tuning replaced with "treated" shoe strings.

of the shoe strings (Fig. 4) and then apply a liberal coating of the dressing to the entire "shoe-string belt." This arrangement has been known to give many months of trouble-free service and should also work out for emergency repairs on other receivers which use belt drives in tuning applications.

Replacement Yokes and Brass Width Sleeves

By now most technicians have encountered a TV receiver that employs a brass width sleeve. This sleeve is slid into the yoke core to reduce width and out to increase the width. A special lining is used around the inside of the original yoke (Fig. 5) to prevent this width sleeve from coming in contact with the yoke windings and causing a short. This lining is not furnished with standard replacement yokes, but a lining which will serve the purpose can be made out of fish paper. A piece about 2" wide and 4.7" long should work satisfactorily for most replacement yokes.

Fig. 5. Lining in yoke to prevent shorts through contact with width sleeve.

Shielded Scope Probe

The oscilloscope probe shown in Fig. 6 is one of three variations being produced by Scope-Probe

Fig. 6. Scope-Probe Model 10 type LC.

Co. of San Fernando, Calif. These probes (low-capacity, crystal-diode and isolation-direct) all feature completely shielded coaxial construction and have a plunger-type hook-on tip. This means that a very minimum of extraneous signal pickup will be experienced, permitting the examination of even very low-amplitude waveforms.

The hook-on tip features an insulated sleeve which permits the probe to be connected into a circuit without the danger of introducing a short. The low-capacity Model 10 features a variable capacitor which can be adjusted for an impedance match between the probe and the oscilloscope, thus insuring minimum distortion of the signals passed through the probe. No adjustments are required with either the crystal-diode or isolation-direct types. ▲

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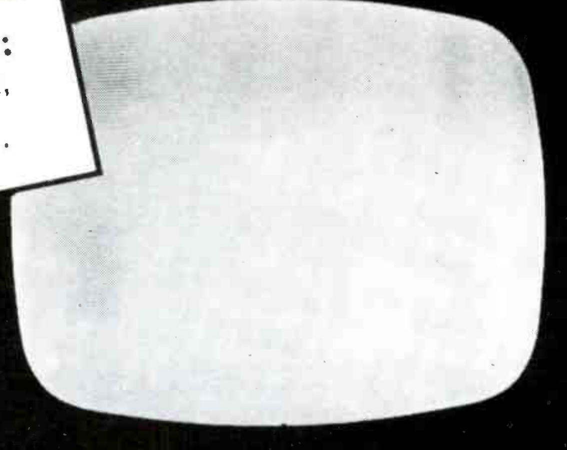

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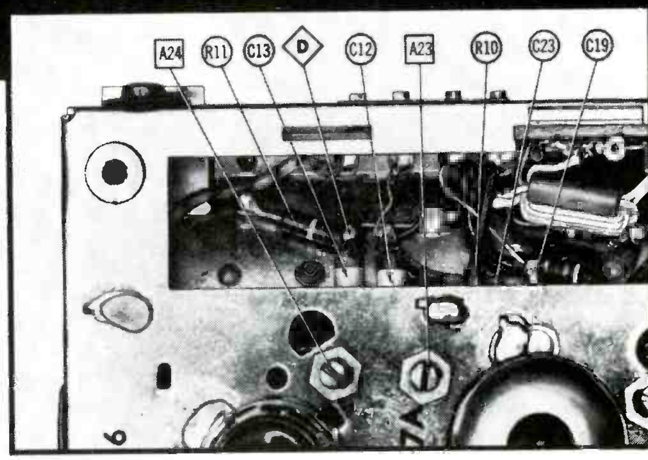

(Based on an actual case history taken from the Howard W. Sams book "TV Servicing Guide")

Let's take a look at this problem: A condition such as this can exist only when there is no signal reaching the picture tube or the audio output stage. Using the Tuner Service data (found in every PHOTOFACT TV Folder), first isolate the trouble by connecting an amplitude-modulated signal to the mixer-grid test point "D." The appearance of one or more black bars on the face of the tube would indicate that the trouble is probably in the tuner. So look for the following possible causes:

1. Defective oscillator-mixer tube
2. Defective RF amplifier tube
3. Open plate-load resistor in the oscillator stage
4. Failure of the feedback capacitor in the oscillator stage
5. Open decoupling resistor
6. Dirty or faulty contacts
7. Cold solder joint

Using the applicable PHOTOFACT Folder you can troubleshoot and solve this problem in minutes. Here's how:

Check the oscillator-mixer and RF amplifier tubes. Tubes okay?—then: Check voltages on the tube pins (they're right on the schematic) for open oscillator plate-load resistor, open RF decoupling resistor, faulty feedback capacitor, dirty switch contacts or cold solder joints.

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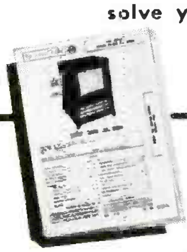

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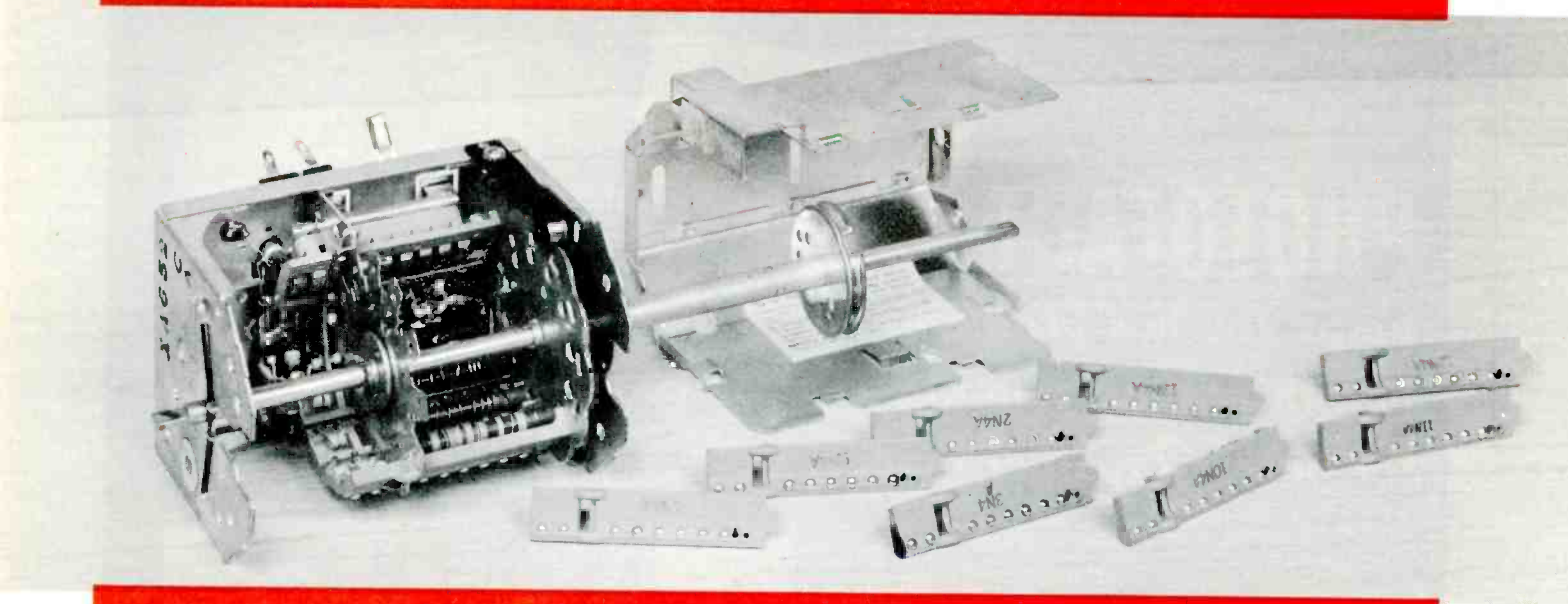
inside TV tuners



part 3 Mixer and Oscillator Circuits

by Calvin C. Young, Jr.

Having previously covered the RF amplifier and input circuits of VHF tuners, we now come to the point where a detailed analysis of the two most common types of oscillator-mixer circuits is in order. Since VHF tuners are divided into two general categories, switch and turret, let's examine a pentode mixer used in a popular switch-type tuner (Fig. 1) and a triode mixer employed in a popular turret tuner (Fig. 2). Thus, we will be dealing with the circuits and the associated problems you are most likely to encounter in service work. Before going into the characteristics of the individual circuits, however, let us first examine the purpose and general functions of the mixer and oscillator sections.

In order to utilize a single string of amplifiers to amplify each station signal to the level required by the video detector, some means must be provided for the conversion of each incoming carrier to a common (IF) intermediate frequency. By utilizing the heterodyne principle, a tunable CW signal can be mixed with incoming station carriers and an interme-

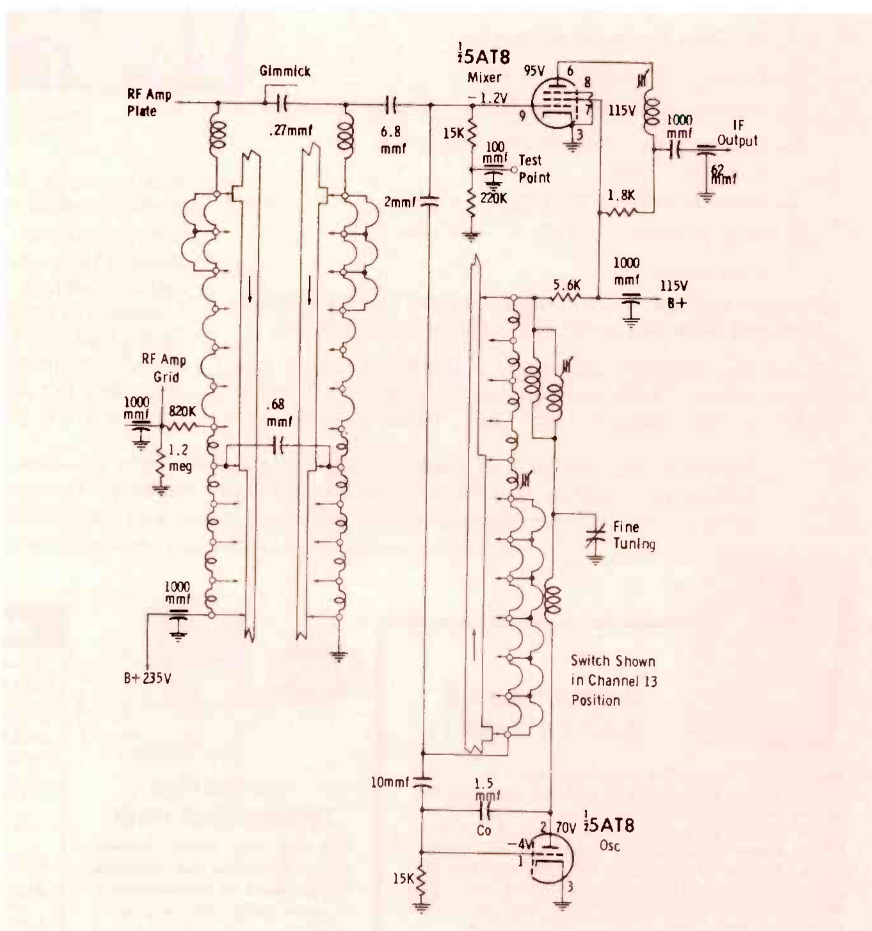


Fig. 1. Mixer and oscillator section of switch-type tuner.

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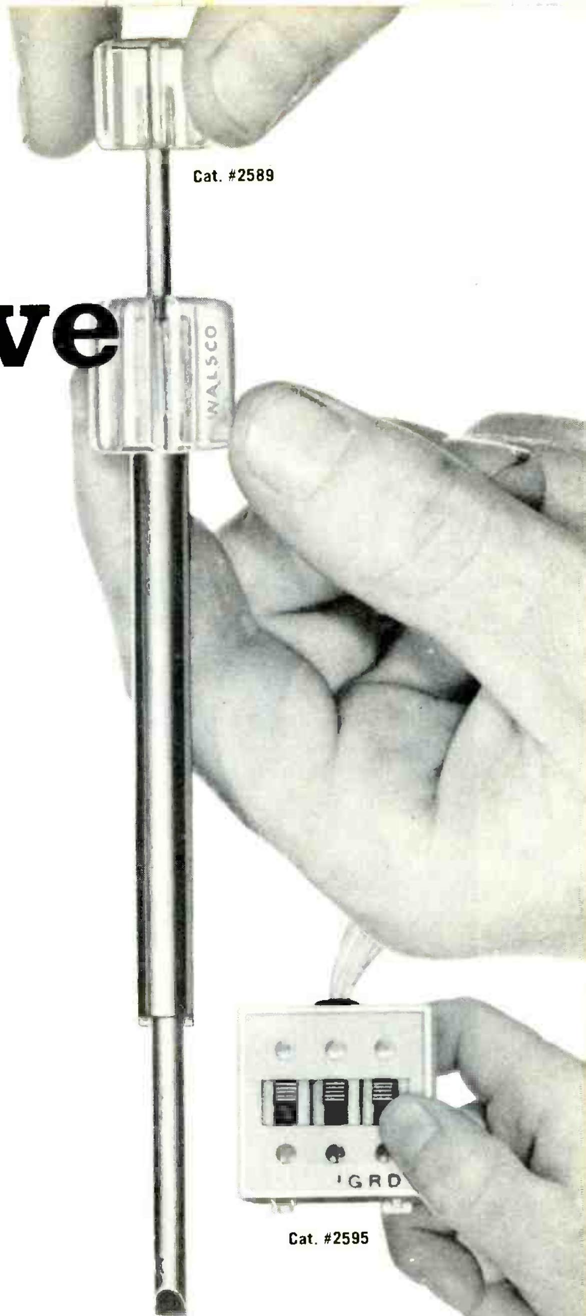

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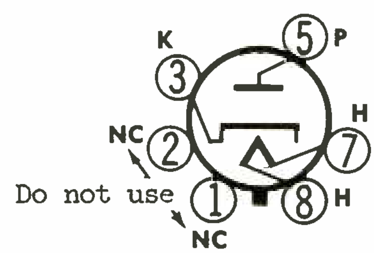
diate carrier having all of the modulation characteristics of the original carrier will be developed. Station selection then becomes a matter of changing the CW signal frequency to provide a beat frequency difference which corresponds to the IF carrier frequency.

It is the job of the local oscillator to generate the CW signal, and of the mixer to simultaneously receive the incoming modulated carrier and oscillator signals so that the heterodyne action will take place. Since it is possible to re-

Arcing Damper Tubes in RCA Victor KCS-47A Chassis

When replacing the 6W4GT horizontal damper in an RCA Victor Chassis KCS-47A, make sure the replacement tube does *not* have a pin 1 in the base. Terminal 1 on the socket in this set—and possibly in other types and models of TV sets as well—is used as a ground connection, and therefore an internal ground will be present in the damper tube if it has a pin 1 in its base. Since damper circuits



operate at a high potential above ground (in some cases, thousands of volts), extreme arcing may occur within the tube and overload the circuit to the extent that the horizontal output tube can be ruined in a very short time. Some 6W4GT tubes are supplied with pin 1 on the base. When installing such a tube, cut the extra pin off with side cutters rather than risk a recall.

—*George D. Philpott*

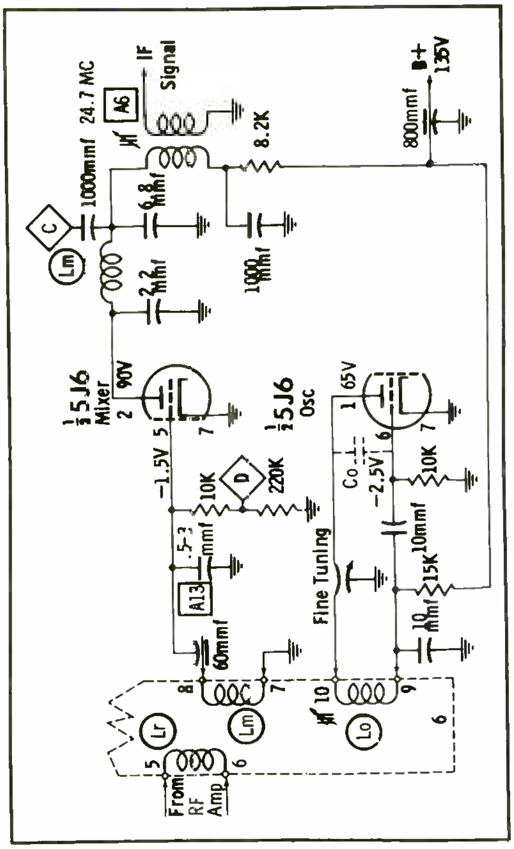


Fig. 2. Mixer and oscillator section of turret-type tuner.

ceive two carriers at about the same distance above and below the oscillator frequency, common practice has been to operate the oscillator above the desired frequency and to choose an IF range into which no image frequencies will fall. (The 40-mc range best fulfills this requirement because there are no station carriers 40 mc below the oscillator frequency when tuned to receive a desired TV channel.)

Switch Tuner With Pentode Mixer

The pentode-mixer, triode-oscillator combination is the most popular of the designs appearing in newer receivers. There are twelve different triode-pentode tubes used in this application (including both 5 and 6 volt versions) which have been designed and placed on the market for mixer-oscillator use in VHF tuners, while there are only three dual triode types. In the triode-pentode combination are the 5AT8, 6AT8, 5BE8, 5BR8, 6BR8, 5CG8, 6CG8, 5U8, 6U8, 5X8 and 6X8. This wide variety of similar tubes has evolved from the original 6U8 and 6X8 types because of the trend toward the use of printed boards and circuitry having a minimum of local oscillator radiation. (Refer to "A Gallery of Triode Pentodes" in the June PF REPORTER for a thorough analysis of these tube types.)

The popularity of the pentode as a mixer, even though it has a higher noise figure than a triode, is due to two factors: (1) The development of high-gain, low-noise RF tubes and (2) the added IF signal gain which a pentode mixer affords.

Now for the actual circuits. In Fig. 1, notice that RF signal energy is coupled into the tuned mixer grid circuit at two points, (across the entire coil assembly and also across the lower five coils). The .68-mmf capacitor across the lower coils provides additional coupling at the lower channel frequencies (7 and below) so that a linear response over the entire tuning range will be achieved. The .27-mmf coupling capacitor is effectively increased in value by the gimmick which is set for optimum performance when the tuner is aligned at the factory; so when you see what is apparently the free end of an extra long pigtail alongside the body of a capacitor, don't cut it off—it's probably a gimmick.

The oscillator signal in this circuit is coupled to the mixer from the oscillator grid through the 10-mmf and 2-mmf capacitors. The negative 1.2 volts at the mixer grid is the result of the oscillator signal developed across the grid load resistors. The amount of signal injection is adjusted for optimum conversion transconductance over the entire VHF band. Any material increase or decrease in

"Maybe now you'll call a serviceman."

THIS MONTH'S COVER

This month's cover pretty well sums up what the average serviceman faces during the month of October—work, work, work!

As with most PF REPORTER covers, we pose a choice of scenes; for those of our readers who are avid science-fictionists, we present above one of the "other" cover shots we took, but didn't use.

Incidentally, our young "Indian" (Associate Editor Les Deane's son) really worked himself up to the spirit of the cover; he scored a brilliant coup over 2 table model TV sets and a transistor portable.

Our sincere thanks to Lane TV Sales & Service, Indianapolis, for the use of their modern store.

the oscillator injection voltage can cause a decrease in the signal-to-noise ratio. A change in the capacity of the 2-mmf coupling capacitor from the oscillator, for example will result in a change of the oscillator injection voltage. This voltage may be measured at the test point provided between the 15K and 220K resistors. Only a VTVM or an equally high-impedance instrument should be used to measure this voltage; a low-impedance meter will load the circuit and provide erroneous readings.

Turret Tuner With Triode Mixer

There are only three dual-triodes that have seen widespread use as mixer-oscillators in TV tuners—the 6J6, 5J6 and the 12AT7. Even though the triode generates less noise than a pentode, it has less gain and must be neutralized to prevent it from breaking into oscillation. Neutralization in the mixer stage of Fig. 2 is accomplished by the inclusion of a small RF choke (L_N) in the plate circuit.

Note that this figure illustrates a triode-mixer, triode-oscillator circuit employed in a turret tuner. If a triode mixer is employed in a switch-type tuner, its operation does not differ; however, the problems associated with incremental inductance tuning must be considered. By the same token, a pentode mixer could be used in a turret tuner, and the special considerations associated with the turret tuner would then apply to the pentode mixer.

One of the first differences that you will notice between the circuits in Fig. 1 and Fig. 2 is that the latter seems to be less complicated. This is due to the fact that only a single set of channel coils is shown. You will further notice that there is no coupling capacitor between the oscillator and mixer sections. None is employed because of the mutual coupling between L_O and L_M. Mutual coupling is also employed between L_R and L_M in feeding RF signal energy to the mixer grid circuit. The multiple coupling arrangement used in the switch tuner is not necessary in the turret tuner, since the fixed mutual coupling of each channel strip is such that relatively constant bandwidth is achieved for all channels.

Oscillators

We have already discussed the purpose of the local oscillator signal. Now let's look at the circuit that generates this signal. The local oscillator in TV tuners almost invariably uses a triode tube. When using a triode as an RF amplifier or a mixer, neutralization is necessary for the prevention of oscillations which would otherwise occur due to the feedback capacity between the plate and control grid. In an oscillator application, this capacity comes in handy for use as a portion of the feedback network; thus, instead of being a hindrance, it now is quite a desirable characteristic.

In Fig. 1, a 1.5-mmf capacitor (C_0) has been connected between the plate and grid of the oscillator tube. This adds to the internal capacity of 1.5 mmf to produce a total capacity of 3 mmf, permitting the passage of a sufficient amount of feedback signal to sustain oscillations at the desired level in the switch-type tuner.

In Fig. 2, the internal capacity (C_0) of the tube alone is sufficient for the feedback application. The 10-mmf capacitor between the turret strip and the oscillator control grid is a grid-leak and DC blocking capacitor. Its value is critical in determining the oscillator frequency, as is that of the 10-mmf capacitor from terminal 9 of the strip to ground.

In both the switch-type and turret tuners, fine tuning is accomplished by varying the capacity of the oscillator tank circuit. However, the turret tuner circuit shown incorporates the so-called "book" fine tuning system in which the distributed capacity between the small inductor and a grounded plate or leaf is varied. In a turret tuner, the oscillator frequency may be adjusted on each channel by turning the associated oscillator adjustment slug, and an adjustment on one channel has absolutely no affect on the oscillator frequency of any other channel.

On the switch-type tuner, where a small amount of inductance tunes with the oscillator capacity on channel 13 and additional increments of inductance are added in series for each lower channel selected, the oscillator must be adjusted in a different manner. First, the fine tuning is preset to the center of its range and then the oscillator slug on the highest receivable channel is adjusted. Following this, the next highest receivable channels are adjusted in succession, taking care not to disturb the setting of the fine tuning.

When the tuner has been set-up in this manner, aging of the oscillator tube or minor changes in component values won't result in detuning of the oscillator on only one channel. Setting the oscillator to produce the best picture and sound at the center of the fine tuning makes it unnecessary for the set operator to readjust the frequency vernier each time the channel is changed—a feature the customer is sure to like.

Oscillator radiation is a problem that the tuner manufacturers have made a successful effort in curbing. Keeping this radiation at a minimum is your responsibility, and there are a few points to remember in this respect. Always replace the oscillator tube shield and see that, when necessary, all bypass capacitors and RF chokes

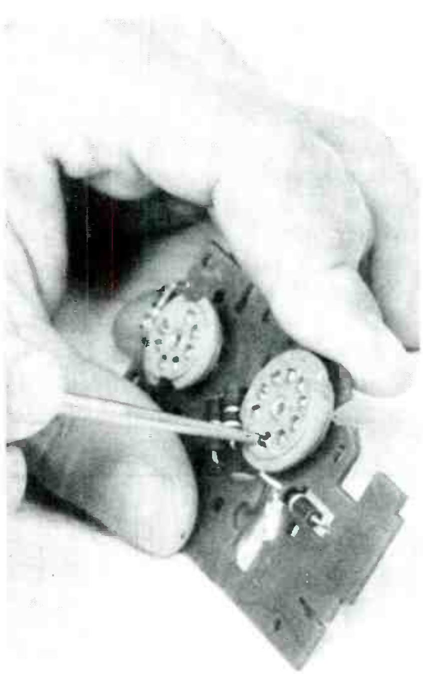


Fig. 3. Using a soldering aid to tighten tube socket contacts.

Fig. 4. Putting a thin film of conductive lubricant on tube pins.

in the oscillator stage are replaced with suitable (identical) units. One more thing—the filter and trap circuits in the input sections of the tuner must be in good working order and correctly adjusted.

Servicing

Oscillator and mixer stages are relatively free from trouble, but when it does develop, it can be very difficult to locate. Probably the two most-often-encountered problems will be a failure to oscillate on high channels (usually a defective oscillator-mixer tube) and intermittent flashing (often caused by dirty contacts or tube socket pins). Contact trouble that can be traced to the tube socket is probably the most difficult to remedy because even some amount of conductive film on the socket itself can be the cause. Since some cleaners will leave a slight film on the surfaces to which they are applied, such liquids should be applied with caution if an apparently "unreasonable" trouble is to be avoided.

Probably the best way to clean a tube socket is to squirt a little carbon-tet into each pin contact, and then, using air pressure, clean

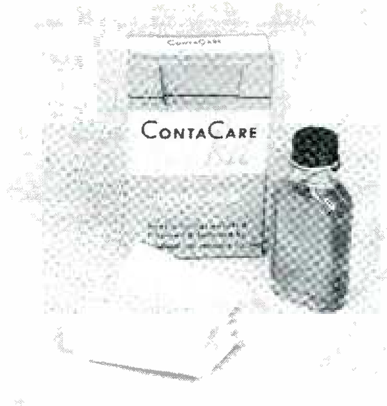


Fig. 5. Standard Coil "ContaCare Kit."

the socket and expel the carbon-tet.

If the socket pins are loose, they can be tightened up with the use of a solder tool or other sharp pointed instrument (Fig. 3). To avoid causing damage in this operation, care should be taken not to exert too much pressure. After applying a thin film of conductive lubricant (such as Walsco's *Lubriplate* or General Cement's *Lube-Rex*) on each pin (Fig. 4), the tube should then be worked in and out of the socket a few times to coat the socket contacts and protect them against possible corrosion. Should a socket contact become damaged, an attempt should be made to install one taken from a new socket rather than face the tedious job of replacing the entire socket.

The contacts on switch-type tuners and the drum and slider contacts on turret types can be cleaned with any of the commercially-available cleaners. If compressed air is available, it should be used to evaporate excess fluid and to blow away the dirt which might cling to the dampened surfaces. If no compressed air source is available, be sure to wipe the excess fluid away and allow time for the remainder to evaporate.

A tuner contact care kit has been recently introduced by Standard Coil Products Co. under the name of "ContaCare Kit" (Fig. 5) which is especially designed for use with turret tuners. This kit consists of a specially-treated cleaning cloth and a special oil. The proper use of this kit duplicates original factory treatment of contact surfaces, affording lubrication and protection against corrosion for about one year. ▲

Shop Talk

(Continued from page 10)

It is possible, by driving a transistor to saturation, to utilize the sharp cutoff and saturation characteristics of a junction transistor in a one-stage sync separator. Such a circuit is shown in Fig. 2. The incoming signal must be strong enough to drive the transistor into saturation so that the full output of 15 volts peak-to-peak is obtained; thus, for a one-stage separator, an input amplitude greater than that used in the two-stage system is required. As before, fixed and variable bias is employed to provide automatic adjustments for varying signal conditions.

The choice of values for R1 and C1 will greatly influence the noise immunity characteristics of the circuit. If their values are made relatively low, (i.e., R1 = 100,000 ohms, C1 = .022 mfd), the circuit will enjoy good horizontal impulse noise immunity because it will be able to respond quickly to sharp spike voltages.

On the other hand, a long time constant is necessary for the best separation of vertical sync pulses. If this design is followed, the ability of the circuit to cope with short noise pulses will be impaired. A compromise could be worked out, but a more desirable solution is shown in the circuit of Fig. 3 where two separate time constant circuits are employed. R1, R2, and C2 form a short time constant combination while R3, R4, and C3 provide the long time constant network. When a sync pulse is active in this circuit, the X1 emitter current biases D1 in the forward direction, thereby causing both time constant networks to be effective. By having R3, R4 and C3 active, the emitter

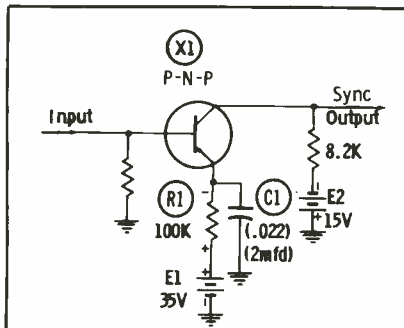


Fig. 2. A single-stage sync separator.

bias is maintained for the duration of a vertical sync pulse, permitting its proper separation.

Now, let us suppose that a noise pulse appears, and further, that it possesses a greater amplitude than any of the sync pulses. It too, will cause D1 to conduct but because of its amplitude, will charge C3 to a higher voltage than a normal sync pulse. This higher potential on C3 will reverse the bias on D1 and keep it cut off until the excess voltage has discharged through the parallel combination of R3 and R4. This may take some time. In the meantime, horizontal sync separation can resume as soon as the excess charge across C2 (due to the same noise pulse) discharges through R1 and R2. The latter action will occur much faster because of the far smaller value of C2 as compared to C3.

The foregoing circuit will give a performance comparable to vacuum-tube sync separators in standard commercial receivers. Furthermore, transistor interchangeability has been found to be good.

Beyond the sync separators, the pulses are fed to the vertical and horizontal deflection sections. Because transistorized vertical sweep circuitry is simpler and has progressed farther, let us examine it first, starting with the oscillator. In vacuum-tube circuits, either multivibrators or blocking oscillators have been utilized. In transistorized systems, at least to the present time, only blocking oscillators have been used because transistorized multivibrators have thus far exhibited frequency changes due to temperature variations, whereas the blocking oscillator is considerably more stable in this respect.

In many respects the blocking oscillator in Fig. 4* is similar to its vacuum-tube counterpart. For example, the blocking transformer T1 serves to provide feedback from the collector output circuit to the base input circuit. Also, sync pulses are fed to the base while a sawtooth deflection wave is developed across the 8-mfd capacitor from collector to ground. Furthermore, the charge capacitor receives its voltage build-up

* "Transistorized Vertical Deflection For Television Receivers," by M. B. Finkelstein, Transistors I, published by RCA.

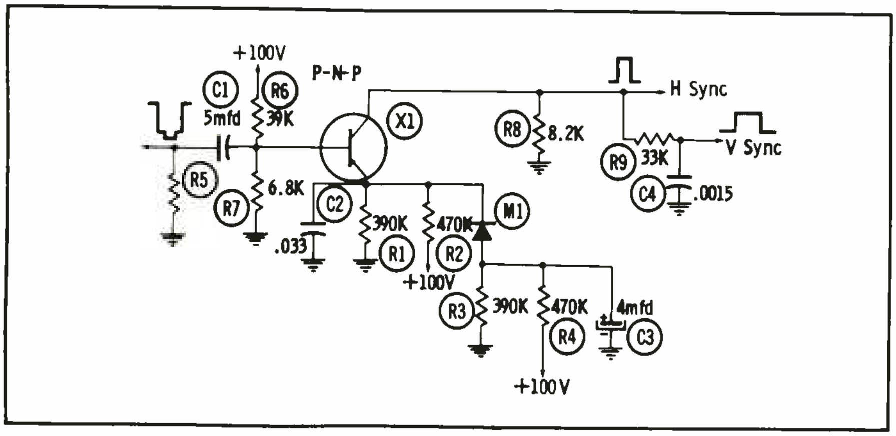


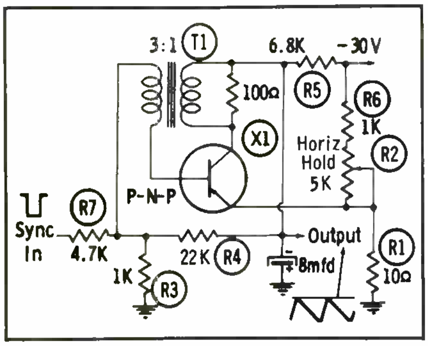
Fig. 3. A one-stage sync separator using a diode-controlled time constant.

while the transistor is cut off and then discharges when the transistor is pulsed into conduction. There are, however, some significant differences between the two circuits, and these stem from the dissimilarity in operational characteristics of tubes and transistors. This will be evident from the following analysis of circuit operation.

The transistor is biased beyond cutoff by the negative voltage present across R1. The value of this cutoff voltage is determined by the resistance setting of R2; hence R2 is equivalent to the conventional hold control. At the same time, capacitor C1 charges through R5 until the voltage across R3 becomes more negative than the voltage at the emitter. When this occurs, current will flow through the transistor and the conductive part of the cycle will begin. The current flowing through the collector circuit causes a voltage to be induced in the base side of T1, increasing the forward bias and the transistor current. This, in turn, couples a greater voltage into the base winding and increases the collector current even more. As a result, the transistor very rapidly becomes a virtual short circuit, permitting capacitor C1 to discharge quickly through T1 and R1. The discharge is practically complete and the voltage across C1 essentially drops to zero.

At this point the voltage across R3 and R4 is also zero, and the transistor is driven into cutoff by the difference between the emitter voltage at the arm of R2 and the voltage induced at the base by the collapsing field around T1. The sequence of events now repeats itself at a frequency determined by the various resistance and capacitance values in the circuit.

The major frequency determining components are C1, R5 and R2; C1 and R5 also develop the output wave. Here is a major difference between transistor and vacuum-tube blocking oscillators. In the latter circuits, the frequency determining parts are separate and distinct from the wave-forming circuit; in the transistor circuit, one set of components performs both functions.



(Courtesy RCA Review)

Fig. 4. A transistor blocking oscillator.

The sawtooth output waveform produced by the circuit of Fig. 4 is negative; if a positive-going signal is desired, an n-p-n transistor would be employed in conjunction with a positive voltage source. Obtaining reversal in this way is another unique feature of transistors and cannot be duplicated by tubes.

Another sawtooth blocking oscillator, in which the output wave is developed in the emitter leg, is shown in Fig. 5. This circuit is similar to the previous arrangement in that one RC combination (here, R3 and C2) provide both the timing and the output deflection waveform. It differs, however, in the way in which the sawtooth wave is produced. It has become customary in vacuum-tube circuits to have the charge time of the deflection capacitor correspond with beam trace and the discharge period with beam retrace. In the arrangement of Fig. 5, C2 charges through the transistor during the retrace period and discharges through R3 during trace time. Just how this is accomplished can be seen from the following discussion.

The base-emitter circuit is biased in the forward direction by

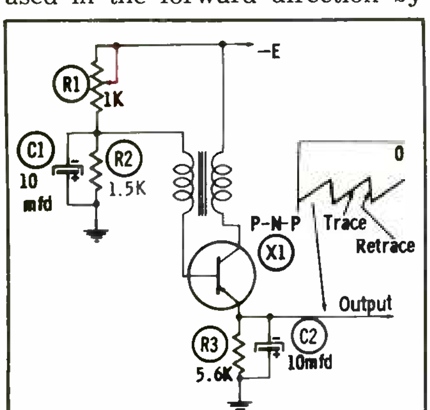
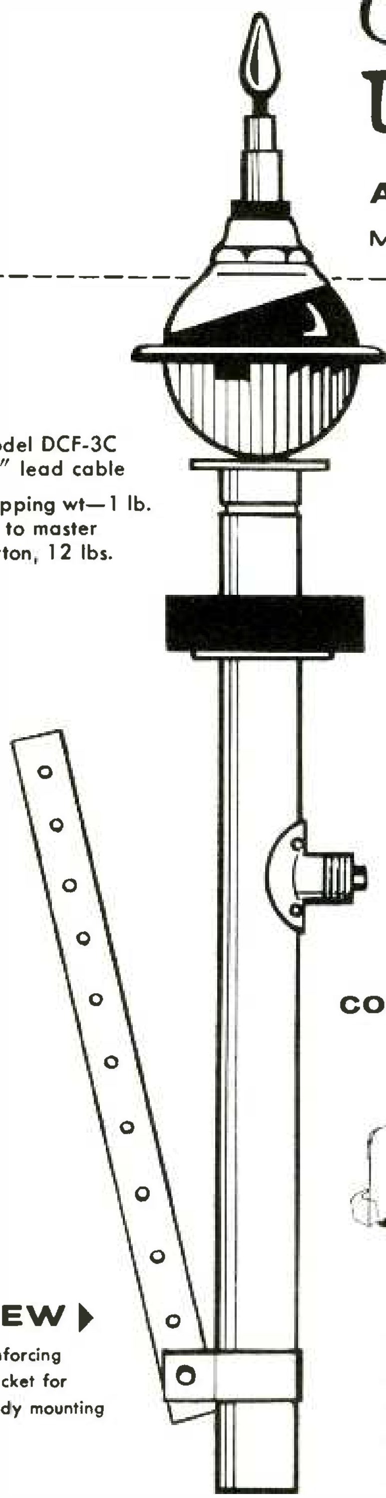
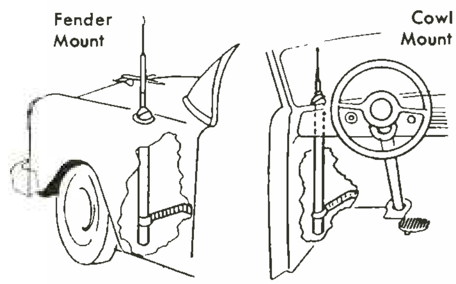


Fig. 5. Development of the sawtooth wave in this circuit differs from Fig. 4.





R1 and R2. This produces a current flow through the transistor which starts charging capacitor C2. The collector current flowing through the primary of T1 induces a voltage in the base winding which acts to increase the base current. This serves to further raise the collector current and thus the induced base voltage until the transistor is conducting to its fullest extent. This current buildup through the transistor is exceedingly rapid, and during this interval capacitor C2 is charging through the resistance of the transformer primary and the transistor. The ultimate value of the charge is determined by the fixed base bias and the induced voltage in the transformer secondary winding.

When this point is reached, the base current ceases and the transistor is driven into cutoff because the voltage across C2 is sufficient to bias the base-emitter circuit in the reverse direction. While the transistor is cut off, C2 discharges slowly through R3, thereby developing the trace portion of the deflection wave. Note that this wave gradually rises toward zero from its initial high negative value.

When C2 has discharged to the point where its voltage is equal to the fixed bias voltage, current again starts flowing in the base-emitter circuit and the same sequence of events recurs. Since R1 determines the value of fixed base bias, it determines the frequency of operation (together with the time constant of R3 and C2) and hence would function as a hold control.

A negative sync pulse could be introduced to the base circuit either through the use of capacitive coupling or a third winding on the blocking transformer. Both methods have been employed and both are satisfactory.

A positive-going sawtooth wave is produced by the above circuit. If a negative-going sawtooth is desired, an n-p-n transistor could be used with a positive power supply.

All of the circuits discussed above are practical designs which have been employed for the purposes indicated, and each has performed in an entirely satisfactory manner. ▲

Industrial Electronics

(Continued from page 17)

pensations must be made in order to obtain the proper reading from the sensed body.

A device for correcting the error caused by ambient temperature, as the temperature around a body is called, is the bolometer. It is composed of two thermistors, one of which measures the ambient temperature, and one that is trained on the body or sensed heat. Its internal construction is shown in Figure 4. Two oxide flakes are placed within a heavy shield to keep out external noise pulses, with the compensating flake facing the inside of the wall. The sensitive flake faces an infrared window which admits the low frequency radiations but excludes all others. Connection to a typical amplifier circuit is usually made by the use of a bridge with the thermistors in opposite legs. Figure 5 shows the DC source used in conjunction with R1 and R2 to provide linear operation about some specified temperature. The signals from the two thermistors will oppose each other and the resultant signal will pass on to the grid of the amplifier. Capacitors C1 and C2 filter out the noise and 60-cycle signals picked up by the batteries and leads.

Minneapolis - Honeywell uses thermistors to great advantage in their residential heat controls. The requirements of home heating are quite different from the industrial heat controls previously described. When the outside temperature falls, the "Moduflow System" increases the inside temperature at the rate of 1°F for each 38°F fall in outside temperature; thus, the goal of home heating is to provide comfort for the individual, rather than constant temperature control.

If two different metals are joined together, a difference of potential will be created. The voltage developed is a function of the temperature and the work function of the metals. Work function is an energy level which is just great enough to cause one electron to escape the force exerted on it by the nucleus of an atom. Each metal has its own characteristic work function, and the addition of energy will cause more electrons to escape. When metals with different work functions are joined at both ends as shown in Figure 6, a current can be generated simply by heating one end. The heated end is called the "hot junction" and the other end the "cold junction." A device of this type is referred to as a "thermocouple."

The current through the leads is proportional to the difference in temperature between the hot and cold junctions. Both junctions develop a voltage with polarities which oppose the other; therefore, the current is a measure of the difference in voltage, and it will vary just as much with a change in cold junction temperature as with a change in the temperature of the hot junction. To obtain a true reading, the cold junction must be maintained at an even temperature. When very accurate readings are required, the cold junction can be held at the melting point of ice or placed in a controlled oven, and the temperature can be calculated from a chart supplied by the thermocouple manufacturer. The range of a thermocouple extends from about

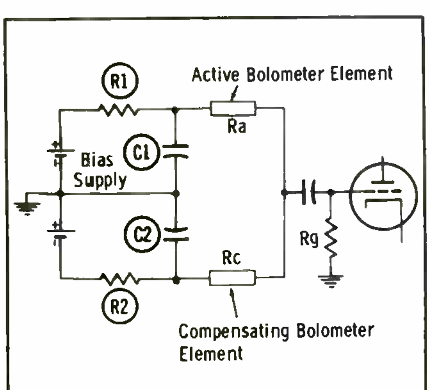


Fig. 5. Typical bolometer bridge circuit.

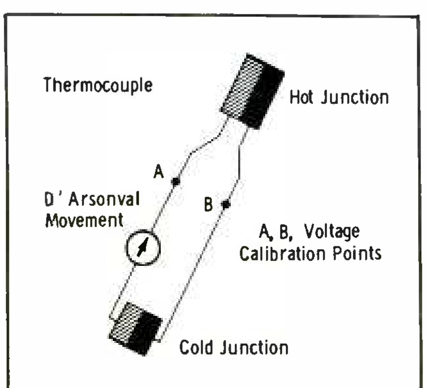
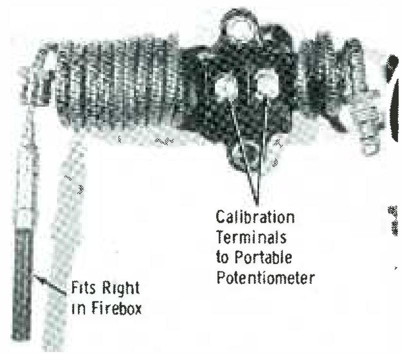


Fig. 6. Structure of a thermocouple.



Courtesy Minneapolis-Honeywell Regulator Co.

The thermocouple hot junction is housed within the protective cover at left. Special alloy wire completes the circuit to the indicator connector at the right, with the cold junction contained in the temperature indicator.

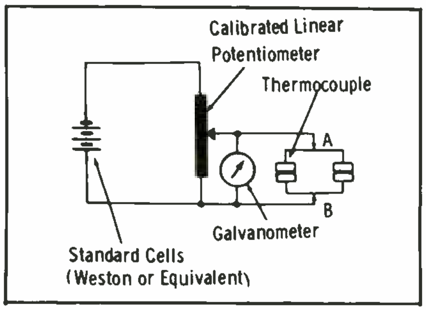


Fig. 7. A portable potentiometer connected across a thermocouple unit can be used in conjunction with a chart to determine temperature of the hot junction.

—100°F to 1,000°F, the exact limits being determined by the materials used and the method of construction.

The output voltage is measured in millivolts, requiring the use of a very sensitive voltage measuring device called a "Portable Potentiometer." As shown in Figure 7, the potentiometer is placed across a standard voltage cell such as the Weston unit. The voltage of the thermocouple is placed between the slider and one side of the potentiometer. When the voltages at points A and B are equal, there will be no current through the galvanometer, and the voltage of the thermocouple can be read directly from a calibrated dial on the potentiometer shaft. The voltage measured in this manner is then located on a chart from which the temperature is calculated. Most charts assume a cold junction of 32°F, and when the cold junction is other than this, a correction voltage must be determined from the chart and added to the dial reading. For example, suppose the voltage

CHART I—Temperature correction figures used in conjunction with portable potentiometer.

0°	—.922	1.96	4.92
5°	—.778	2.11	5.07
10°	—.634	2.26	5.22
15°	—.490	2.40	5.37
20°	—.346	2.55	5.53
25°	—.202	2.70	5.68
30°	—.058	2.85	5.83
35°	.088	3.00	5.98
40°	.228	3.14	6.13
45°	.378	3.29	6.28
50°	.518	3.44	6.44
55°	.658	3.59	6.58
60°	.808	3.74	6.74
65°	.948	3.88	6.89
70°	1.10	4.03	7.04
75°	1.24	4.18	7.19
80°	1.38	4.33	7.34
85°	1.53	4.48	7.50
90°	1.67	4.62	7.65
95°	1.82	4.77	7.80
100°	1.96	4.92	7.95

Figures are in millivolts

reading were 3.5 millivolts, but the cold junction is at a room temperature of 75°F and Chart 1 assumes a cold junction temperature of 32°F. To determine the correct voltage, locate 75°F on the chart; directly opposite you will find the correction voltage of 1.24 millivolts. This must be added to the 3.5-mv reading to get the proper voltage. The cold junction is developing a voltage which is 1.24 mv greater than that at which the chart is calibrated; thus the hot junction is 3.5 mv above the cold junction and the cold junction is 1.24 mv above the reference of the chart. The sum of the two voltages is 4.74 milivolts and, according to the chart, the actual temperature of the hot junction is 194°F.

The heat sensing devices described in this article deal with units which change in their physical characteristics for each change in temperature. The thermometer and the bi-metal strip respond to temperature variations by expansion or contraction of the sensitive parts; the thermistor changes its resistance, while thermocouples develop a voltage difference. In addition to the physical changes, there are heat sensers which detect a change in the characteristics of heat itself. These are the radiation-sensitive devices which will be described in the next part of this series. ▲

Auxiliary Sync

(Continued from page 21)

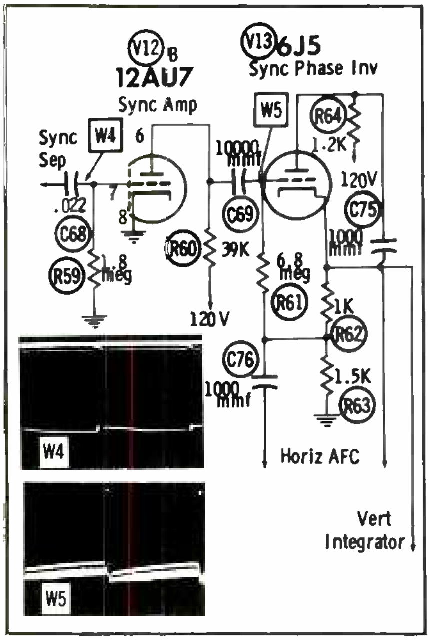


Fig. 3. Intermediate sync amplifier with grid input—Fada Model H274T.

separator and sync output. In this particular case, the extra stage V14A is a grounded-grid triode which amplifies the rather low-level output of the separator and applies it to a phase splitter. Any video information which might get through the separator tends to be eliminated by the amplifier, since video is the most positive portion of the signal at the cathode, and biases V14A beyond cutoff. The main job of this stage, however, is to provide sync pulses of fairly constant amplitude to the phase inverter. In order to do this, the sync tips must drive the tube into saturation, which they do during the reception of all usable signals. The grounded-grid stage does not invert the sync signal, but passes it on to the phase inverter in the same polarity as in Fig. 1.

Another intermediate amplifier is presented in Fig. 3. V12B is a conventional grid-fed stage which takes over the "sync-clipping" function normally handled "as a sideline" by the output stage of an ordinary two-triode circuit. Since V12B inverts the sync signal, the output from the phase splitter to the vertical sweep circuits must be taken from the cathode of the splitter, rather than from the plate as in Fig. 2.

Sync Preamplifier

Quite a few receivers have a

"What say we organize a safari and hunt up a JENSEN NEEDLE."

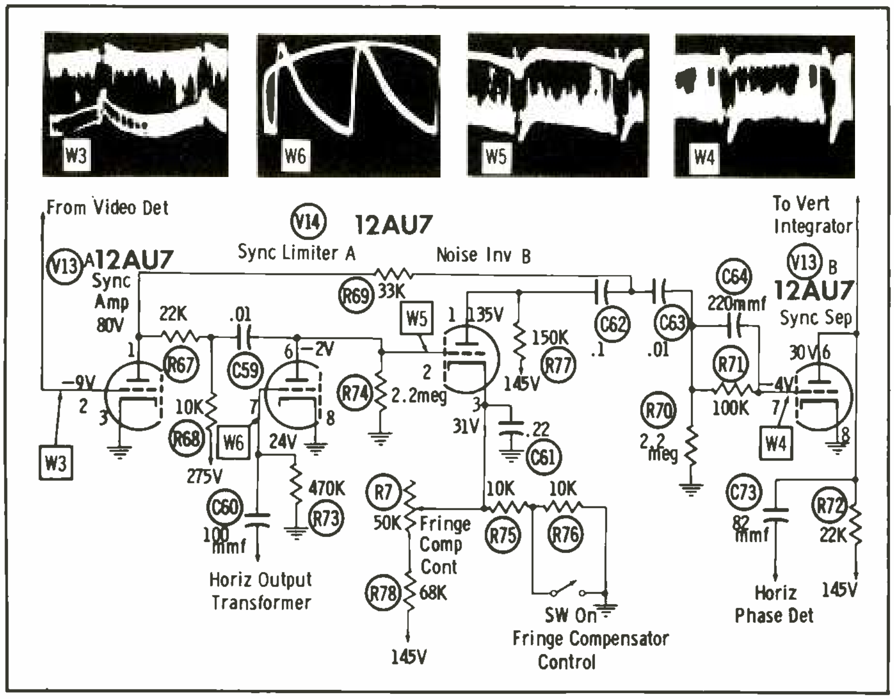


Fig. 4. Sync preamplifier and keyed noise inverter—Emerson Model 748B.

stage labeled "Sync Amp" which, on examination, actually precedes the sync separator. This type circuit will be classified as a "sync preamplifier" for discussion purposes. Its name is a bit misleading, since it is basically a video amplifier in which both the input and output are composite video signals. A sync preamplifier differs from a typical video output stage, however, in that the former requires no peaking coils or other components to boost the high-frequency response. A stage such as V13A in Fig. 4 needs only a wide enough bandpass to maintain reasonably steep-sided sync pulses.

Note that the input for V13A is taken from the video detector load circuit, and that the output is fed to the sync separator. This means that the preamp stage takes the place of the regular video amplifier in the path of the sync signal through the receiver.

Keyed Noise Inverter

Included in Fig. 4 is an unusual noise inverter circuit of a type found in several Sylvania and Emerson chassis. The sync-positive, composite video output of the sync amplifier V13A is fed through C59 to the grid of the noise inverter V14B, and the inverter is driven into conduction only by the peaks of strong noise pulses in this signal. Each time V14B conducts, it applies a negative pulse to the grid circuit of the sync separator via C62.

The inverter cannot properly set its own grid-leak bias because it is triggered only by random noise pulses and thus conducts irregularly. To provide a means of adjusting the inverter grid voltage to compensate for changes in the strength of the incoming signal, a sync limiter (V14A) is included in the circuit. This tube conducts only during horizontal retrace time, when it is keyed at the grid by a positive pulse obtained from the horizontal output transformer. The level of the sync pulse tips in the incoming signal determines the amount of conduction through V14A, which in turn determines the charge on C59. The RC circuit composed of C59 and R74 then establishes the grid voltage of V14B.

The bias on the limiter tube is also partly determined by the cathode voltage, which can be varied by a "Fringe Compensator" control. Adjustment of the control allows the technician to set the bias on V14B so that the entire input signal (including sync tips) will remain below the cutoff level; yet the bias must be such that noise pulses above the sync tip level will drive the tube into conduction.

In practice, the control is adjusted for the most stable picture obtainable on all weak channels.

In strong-signal areas, the control can be turned until it clicks "Off," placing extra resistance between the cathode of V14B and ground and increasing the bias on the tube to prevent it from conducting excessively.

Note that V14 is not absolutely essential for operation of the receiver. In low-noise areas, no difference in performance would be observed if this tube were entirely removed from the circuit.

Twin Separators

The conventional sync separator is really a compromise design, required to handle two pulses of widely different durations. Under some conditions, the horizontal and vertical sync pulses can interact and reduce sync stability. For example, consider what happens to the grid-leak bias of the separator tube each time a vertical pulse arrives. Being broad, this pulse draws grid current for a longer time than the horizontal pulses, and so it temporarily increases the bias on the separator. Then the first several horizontal pulses of each field are reduced in height. This effect is not normally severe enough to interfere with synchronization, but some conditions, such as an abnormally high contrast setting, may cause the shifts in pulse amplitude to affect horizontal AFC operation. Bending or twitching then occurs at the top of the picture.

If the vertical and horizontal pulses could be separated from the video signal by two different circuits, each designed to provide optimum conditions for one type of pulse, a highly stable sync system should be the result. Several such arrangements have actually been employed. In the circuit shown in Fig. 5, two triode separators are connected in parallel. Both are supplied with identical composite video signals, and both feed their output signals into a common sync amplifier. Notice the difference between the grid circuits of the two separators; while the vertical circuit has a conventional grid-bias network, the horizontal circuit derives its DC grid voltage from a divider across B+ so that it will be relatively unaffected by the vertical pulses.

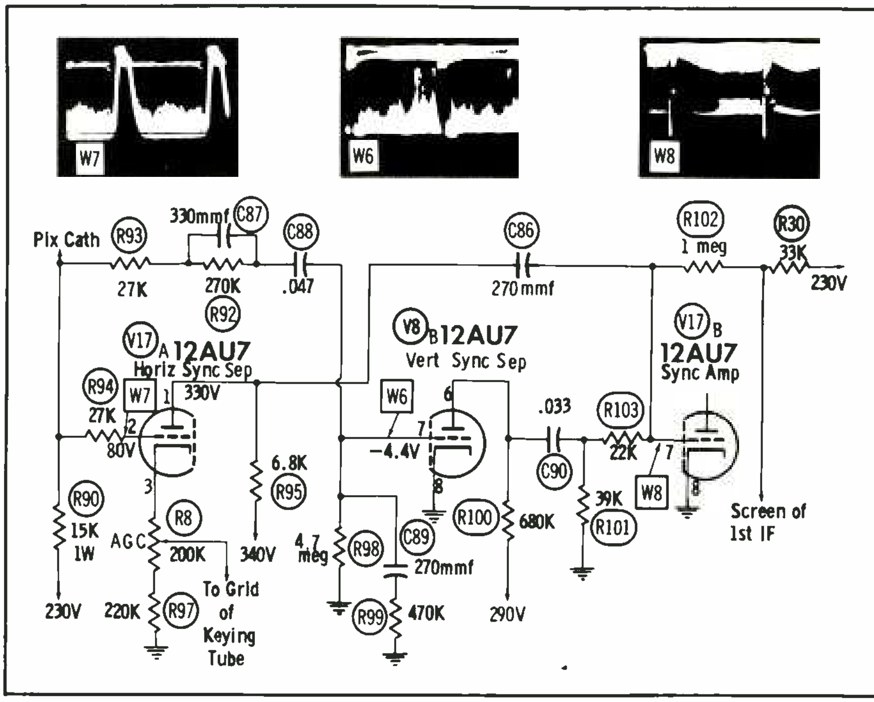


Fig. 5. Separate horizontal and vertical sync separators—ATR Model 26001.

In some other receivers, individually separated signals are not recombined at the sync amplifier grid, but pass through completely separate horizontal and vertical sync amplifiers.

Bias Setters

A constant problem in designing sync circuits is the need to allow for wide variations in input signal strength. Noise inverters are especially critical, since the bias on the inverter must be just great enough to cause cancellation of noise spikes, but not great enough to cause degeneration of the sync pulses themselves. Most pentagrid-type separators include a control in the inverter-grid circuit which allows the DC bias on this grid to be varied to accomplish the desired results.

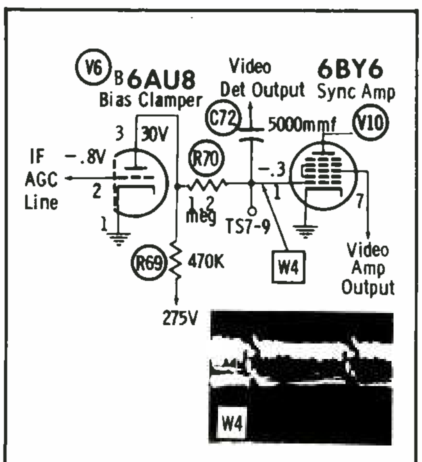


Fig. 6. Bias clamper for pentagrid separator—General Electric "ST" Line chassis.

The use of a manual control offers a certain disadvantage in some areas where the available signals differ widely in strength. This factor is growing more important as the practical limits of "fringe areas" are being extended. An automatic bias clamper which takes care of this problem (Fig. 6) has been used in many General Electric sets. Inverter-grid voltage on the 6BY6 pentagrid separator is varied according to the conduction of bias clamper V6B, and conduction is controlled by the same AGC voltage which is applied to the IF strip. When input signal strength increases, the grid voltage goes in a negative direction and the clamper plate voltage accordingly rises. This positive swing of voltage is passed along to the inverter grid of the pentagrid tube. As a result, this grid has less bias and requires a greater input signal to effect tube cutoff on noise peaks. The composite sync signal coming into the circuit actually is somewhat larger, and so the balance of the circuit is maintained. Remember that the inverter-grid circuit is quite critical, so that a variation of less than a volt in signal amplitude at this point will have considerable effect. ▲

Let's Talk Business

by H.M.Layden

HOW MUCH WILL IT COST TO FIX IT?

Selling TV service today is like selling groceries, drugs, or any of a thousand and one other commodities clamoring for the consumer's dollar!

Take the situation where the technician finds a set with no raster but good sound. From these symptoms, what can he really tell about the over-all condition of the set? Let us suppose he accounts for the absent raster by testing for high voltage, which he finds missing. For all he knows, the CRT may be on its last legs or there may be trouble in the video section or in the sweep system. But all these would be hidden, as a consequence of the dark screen. Yet, when the technician tells the lady her set must go to the shop, invariably she wants to know, "How much will it cost to fix it?"

Fig. 1. Neon test lamp being used to check for the presence of oscillator energy at the horizontal output tube.

At this point the technician can do one of two things. He can gamble that the only malfunction is in the high voltage system, and base his cost-of-repair estimate on what he has learned from past experience. Or, if he is a fellow who has read this article, he can make a few simple tests to satisfy himself that his estimate won't put him out on a limb.

Customers have been known to live with a set in need of repair for months. It is only when the picture or sound goes completely out that they phone for service. All too often, you restore the set to proper operation and the customer hits the ceiling in indignation because you charged for "extras." Naturally, additional repairs were necessary to cure deficiencies of long standing, which the customer "swears" were not evident before you took the set to the shop! The only way to avoid a hassle of this sort is to know, at least approximately, the over-all condition of the set before you quote any repair charges.

Of course, if the technician is still mentally lingering in the past, when TV was a luxury, he might answer the question of cost with: "I won't know how much it will cost until I get the set on the bench." While such an answer may be honest, it is not altogether satisfactory today from the customer's standpoint. All she knows is that her viewing pleasure has been interrupted, and she wants the set back as soon as possible and at a price within her budget. Obviously, if the technician is to avoid a rupture in public relations, he must do something to get over the hurdle of hit-or-miss estimates.

With the limited equipment the average technician carries on a house call, it is unlikely that he will be in a position to give a comprehensive estimate when the screen is without a raster. If his equipment is augmented by a few small aids, however, the situation can become tolerable. These aids consist of: a neon test lamp, a CRT emission indicator (which will operate from voltages available in the set), a set of tube-socket adapters (for octal and 7- and 9-pin miniatures) and a fused cheater cord. These items add little to the weight or bulk of a caddy, but in usefulness they are priceless.

Neon Test Lamp

A neon test lamp (Fig. 1) when immersed in a high potential AC field will glow without being directly connected to the potential. This feature makes such a lamp very useful when tracing high voltage around the flyback transformer and the horizontal output circuit. If the neon glows when the lamp is held close to the envelope of the output tube, it indicates that the horizontal oscillator is working. Furthermore, if the lamp glows when it is held five inches from the high voltage rectifier tube, the chances are that the lack of high voltage at the second anode is due to a bad rectifier. This is a lot simpler and far safer than drawing an arc from the horizontal output plate.

A further use for the neon test lamp is in checking fuses. If the fuse is open, the lamp will glow when it is bridged across the fuse. If the fuse is in the primary circuit of the flyback transformer, it can be checked from the top of the chassis by touching one lead of the neon lamp to the plate of the output tube and the other to the chassis. The lamp will glow if the fuse is good.

CRT Emission Indicator

There is also much need for a small, easily-carried CRT emission indicator. A technician is not long in this game before he realizes, only too well, that you can't believe everything the customer says about his set. The picture tube may be on its death bed, but some customers never mention the dim screen they have been viewing for months. It is exasperating to cart a set to the shop for replacement of an open flyback, only to discover a dead or weak CRT. This is something the technician usually has not bargained for and naturally he dislikes calling the customer to alter his estimate. How much better it would be if he had some means by which he could check the picture tube before giving an estimate.

The most accurate method would be to use a commercially available CRT checker, but this is not always convenient on home calls. The schematic of a simple CRT checker which the technician can construct and carry in his case is shown in Fig. 2. The checker is inserted between the socket and the base of the CRT like a booster.

The second-anode connection should be removed from the picture tube and the set turned on. If there is any useful emission left in the tube, the lamp will glow. A switch in the grid lead permits the tube to be tested with the grid either floating or connected in the circuit. With the grid connected, manipulation of the set's brightness control should

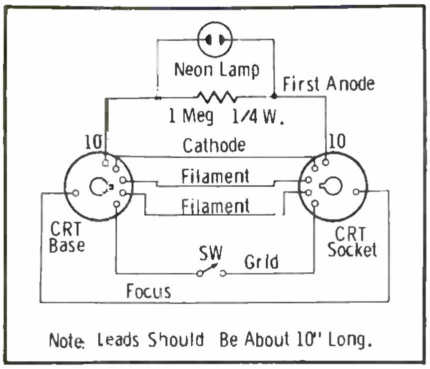


Fig. 2. CRT emission indicator which utilizes a neon lamp shunted by a 1-meg resistor in the first-anode lead.

vary the brightness of the lamp. At one extreme, the control should extinguish the lamp entirely, thus indicating beam cutoff.

Variation of the contrast control will indicate the presence or absence of picture information reaching the CRT. Flickering in the lamp indicates the signal is reaching the grid or cathode, depending on which is the driven element of the tube. This gadget is useful in those cases where the sound seems normal but the screen is dark. It is assumed, of course, that pin 10 is receiving first anode voltage and the heater is intact.

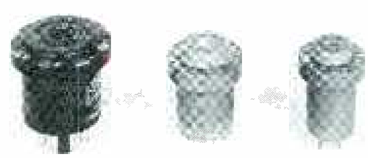


Fig. 3. Tube-socket adapters make it possible to measure pin voltages from the tube side of the chassis.

To test for first anode voltage, insert one leg of the neon test lamp in pin 10 of the CRT socket and touch the other to the chassis. The busy technician may find the neon test lamp more convenient than his meter in checking for the presence of voltages throughout the receiver. It is only a rough test, to be sure; but there are many occasions when a rough indication is all that is necessary.

Socket Adapters

The set of tube-socket adapters in Fig. 3 will often enable the technician to avoid the embarrassment of a wrong diagnosis. A typical example of this occurred recently with a late-model Zenith where snow was the problem. A new 6BQ7 RF amplifier, right out of the carton, failed to cure the trouble. The technician, knowing that trouble which involves dismantling of the tuner can be expensive, decided to check some voltages before breaking the news to the customer. To check voltages on a 6BQ7 requires, however, that the tube be in its socket since it is a dual-triode with direct coupling between sections. A 9-pin adapter was inserted in the socket, and the tube was placed in the adapter.The technician found that the plate of the first triode section was not receiving DC voltage, possibly indicating an open element in the new tube! When another tube was used, the trouble was licked. This case poses an interesting question. Would the customer have given the technician the job if it had involved carting to set to the shop? Possibly yes, but then again, possibly not. "A bird in the hand, etc., etc.!"

Cheater With a Fuse

Now we come to the fused cheater, which also has a tale attached.

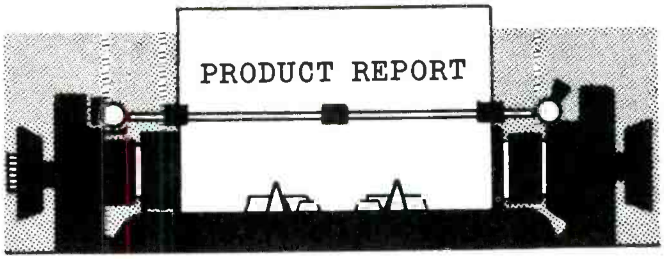
Fig. 4. Cheater cord fitted with Elmenco plug and a pair of 5-amp fuses.

A call came in on a set which was blowing the house fuse. The owner had located the fuse box in the basement, replaced the fuse, and then witnessed the lights fail again in a few moments. He summoned an electrician, who quickly traced the short to the TV set.

When the TV technician arrived and examined the clues, he suspected a DC short, since the lights had come on and had remained on briefly. He wasn't sure however. It might be an AC short in the transformer; in which case, if he tried the power, he would have to stumble around in the basement to replace the fuse. To avoid this, he used a fused cheater cord (Fig. 4) carried just for such cases. With this arrangement, he was able to watch for the cherry-red glow in the 5U4's commonly associated with a DC short and at the same time prevent the house fuse from blowing if it was an AC short. It paid off—the trouble proved to be a DC short in the primary of the audio output transformer.

Selling TV service today is a highly competitive business. TV has long since left the lap of luxury for the more mundane ranks of an everyday necessity. Homo Sapiens Americanus would sooner go without a meal than be deprived of his "window on the world." But this does not mean he will not shop around when his set needs service.

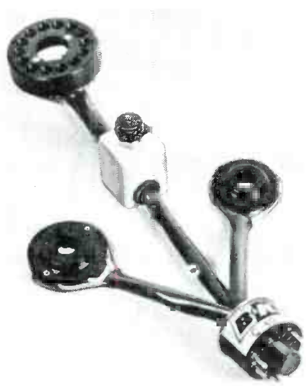
He is on a budget, like everyone else. His pay check is often spent in advance paying for things he thinks he needs. He will watch any cash outlay, such as TV repairs, like a hawk. This puts the TV technician in an unenviable position. He must see to it that his customers, pressed as they are with bills and not above seeking something for nothing, do not find it at his expense! ▲



Cartridge-Needle Combination

Astatic Corp., Conneaut, Ohio, has announced the "Soundflo," a plug-in combination ceramic cartridge and needle with frequency response from 30–15,000 cps. The unit includes both 1- and 3-mil synthetic sapphire tips, or an optional 1-mil diamond tip. A complete kit, used to install the "Soundflo" in place of another cartridge, consists of a cartridge-needle assembly plus a holder that fits any standard manual or changer arm. Two basic versions are available—Model 81TB with 1-volt output and compliance greater than 1, and Model 89TB with 1.3-volt output and compliance greater than 2.

Adapter for CRT Tester



B & K Mfg. Co., 3731 N. Southport Ave., Chicago, Ill., is offering a new Model C40 Adapter that equips B & K Cathode Rejuvenator Testers (Models 400 and 350) for checking 110° and color picture tubes. Both types of new 110° tube bases are included so that all testing and rejuvenating operations can be performed on these tubes. In addition, all three guns of a color tube can be checked, one at a time. User's net price of the accessory is $9.95.

Multiple-Branded Picture Tubes

To help simplify the service industry's picture tube stock requirements, Sylvania Electric Products, Inc., has introduced 26 new multiple-branded types, specifications of which are controlled so that these tubes will serve as exact replacements for a total of 60 regular types. Examples of the multiple types are: 17ATP4A/17AVP4A, 17HP4/17RP4, 20CP4B/20DP4B, 21ALP4A/21ALP4B, 21ATP4/21ATP4A, 21XP4/21AYP4, and 24CP4A/24VP4A/24ADP4/24TP4.

Marker and Sweep Generators

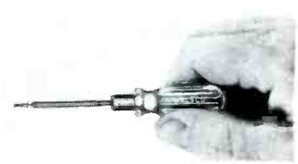
A new crystal-calibrated marker generator, WR-99A, is being produced by RCA Components Division, Camden, N.J. This instrument covers a frequency range of 19 to 260 mc in eight bands, with crystal calibration points at 1-mc intervals. Its slide-rule dial scale is linked to the band switch so that the portion of the dial corresponding to the band in use is automatically displayed. User price is $242.50.

Also new from RCA is the WR-69A TV-FM Sweep Generator ($295), which includes two built-in variable bias supplies and a video sweep for alignment of color TV sets.

Hi-Fi Console Cabinets

The "Viscount" console cabinet manufactured by Electro-Voice, Inc., Buchanan, Mich., is designed to accommodate a hi-fi amplifier, tuner, and record changer of the user's choice, and is styled to match the "Empire," "Centurion," and other E-V speaker enclosures. The lid can be lifted and the cabinet front tilted to give access to components. A differently styled "Sovereign" console is also offered as a companion to the E-V "Suzerain" enclosure. Both consoles are available in mahogany, limed oak, and walnut finishes.

Screw-Holding Screwdriver

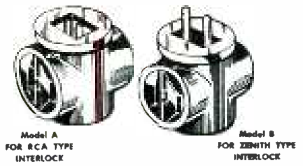


Walsco Electronics Mfg. Co., 100 W. Green St., Rockford, Ill., has introduced a new "Mini-hold" screwdriver (Catalog No. 2568) which can grip a tiny #1 to #4 screw with a wedge action, thus providing greater convenience in working with miniature screws such as those found in phono cartridges. Over-all length of the tool is 2⅞"; dealer net price is $1.98.

Multi-Purpose Tool

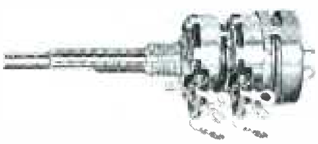
The "Crimcut" combination tool designed by Vaco Products Co., 317 E. Ontario St., Chicago, Ill., features jaws for crimping wire, five holes for shearing common sizes of bolts and screws, wire-cutting edges ½" long, and a row of six slots for stripping insulation off various sizes of wire from #10 to #22. The tool is 8" long and is chrome-plated with plastic-covered handles.

Handy AC Plug



The "Cheater Cube" developed by R-Columbia Products Co., Inc., Highwood, Ill., is a three-way AC outlet which plugs into the back cover of a TV set after the cover has been taken off, enabling the technician to utilize the receiver's line cord as a convenient source of AC power for soldering irons, lamps and other accessories during repair work in the home. The cube is available in two models, Type A to fit RCA-style interlocks and Type B to fit Zenith interlocks.

Snap-Together Dual Controls



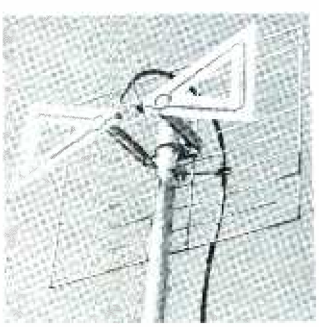
P. R. Mallory & Co., Inc., Indianapolis, Ind., has introduced a new line of controls which can be custom-assembled by the distributor into almost any desired dual-concentric combination. Assembly takes under a minute, since it consists of only three operations as follows: A shaft (selected from a wide assortment of precut parts) is attached to each of two preassembled controls, and then these two subassemblies are fastened together with a built-in snap-action coupling.

Replacement Capacitors

Good-All Electric Mfg. Co., Ogallala, Nebr., is now supplying its Type 600-UE "Mylar" dielectric capacitors to the replacement market. These units, molded in epoxy resin, have previously been used by original equipment manufacturers. Competitively priced, the line features long life and excellent resistance to humidity.

Capacitors of 43 often-used values, mounted on cards wrapped in plastic film, are being featured on a display "tree" made from a cedar log. Each card includes either two, three, or four identical pieces.

Air-Dielectric Bowtie



Technical Appliance Corp. (TACO), Sherburne, N. Y., has announced a new weather-resistant UHF bowtie antenna for strong-signal areas, the Model 3011 "Golden Grid." The dipole elements are supported on brackets designed so that the lead-in terminals are separated by an air gap instead of a solid dielectric. This arrangement helps prevent signal losses in wet weather and, incidentally, reduces vibration of the elements in strong winds. Stacking lines are available for making two-bay installations.

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CATALOG and LITERATURE SERVICE

1J. AMPHENOL
New Dealer Catalog with part numbers and prices of antennas, twin lead, accessories, connectors, cables, sockets and plugs. *See ad page 46.*

2J. ANCHOR
Literature on connecting cables, replacement parts, service aids, (CRT ext. cables adapters, pilot light). *See ad page* 36

3J. ARGOS
New 6-page catalog lists data on the new Super Tube Caddy (3,300 cu. in.). *See ad page 79.*

4J. B & K
Bulletin 1050 tells how you can transmit video and audio to any TV set with new Model 1050 Dyna-Scan. Bulletin 650 describes the new Model 650 Dyna-Quik portable dynamic mutual conductance tube and transistor tester. Bulletin 400-C40 describes CRT Cathode Rejuvenator Tester. *See ad page 9.*

5J. BELDEN
New electronic wire and cable catalog.

6J. BUSSMANN
Television fuse chart Form TVC. Shows components protected and proper fuse for all TV and auto radio sets. *See ad page 35.*

7J. CBS-HYTRON
Catalog sheet describing "Engineer's Handbook and Technician's Handbook." *See ad page 37.*

8J. CHICAGO STANDARD
Stancor TV Transformer Replacement Guide and supplemental sheets. *See ad page 43.*

9J. CLAROSTAT
TV & radio line voltage regulators —Form No. 751772. *See ad page 33.*

10J. CORNELL-DUBILIER
Reference guide 200D-4E on electrolytic capacitors. *See ad page 72.*

11J. DYNAMIC
Booklet entitled "Accessories and Service Aids to Help Solve Most Hi-Fi and TV Problems." *See ad page 80.*

12J. 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 44.*

13J. ELECTRO-VOICE
Power Point Interchangeability Guide, a complete cross-reference of hundreds of phono-cartridges and their correct Power Point replacements. Also, "ABC's of Microphones," a primer on microphone application. *See ad page 53.*

14J. 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 81.*

15J. HICKOK
New 8-page technical brochure describing functions of circuits used in latest methods of tube testing. *See ad page 41.*

16J. IRC
DLR-57 (form S035A) dealer replacement parts catalog. *See ad 2nd cover.*

17J. JACKSON
Condensed catalog sheet listing all products. *See ad page 65.*

18J. JENSEN INDUSTRIES
Jensen needle sales aids. *See ad page 78.*

19J. JERROLD
"Aids to Better Televiewing"—new jobber product line catalog. Gives complete details on equipment for improving TV reception in the home; TV distribution systems; accessories and test equipment. *See ads pages 66, 67.*

20J. KEDMAN
Catalog sheet describing 4 screwdriver displays and specifications of 14 kinds of screwdrivers in the company's line. *See ad page* 36

21J. 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 26.*

22J. LITTELFUSE
Handy cross-reference card showing LC fuses and list prices. *See ad 4th cover.*

23J. MERIT
Merit exact replacement wall chart—No. 700. *See ad page 50.*

24J. PERMA-POWER
Illustrated brochure to be used as an envelope stuffer describes the new line of Picture Tube Restorers. Also, brochure describing color service aids, featuring the new Color Gun Killer and Color Kinescope Adapter. Technical catalog sheet describing the A-400 Transistor Power Supply. *See ad page 78.*

25J. QUAM-NICHOLS
Catalog sheet (S757) on full line of all PA, intercom and outdoor speakers. *See ad page 58.*

26J. RCA ELECTRON TUBE DIV.
Folder describing new RCA color "Pict-O-Guide." *See ad* 3rd cover.

27J. SECO
Complete information on the features and operation of the new Seco Model 107 Tube Tester plus a folder on other instruments. *See ad page* 75

28J. SENCORE
Two-color line folder of all Sencore products (Form #106). *See ad page 80.*

29J. SOUTH RIVER
New 1957 catalog on antenna mountings and accessories, magnesium extension and stepladders. *See ad page 81.*

30J. TELETEST
Literature on the new "Dynamatic" Automatic Tube Tester—Model DM456. *See ad page 79.*

31J. TACO
Promotional Kit on the "Golden Topliners." *See ad page 29.*

32J. TRIAD
Triad Replacement Guide, TV-57.

33J. TOBE DEUTSCHMANN
New 26-page catalog on Quality Service Capacitors. *See ad page 57.*

34J. TRIPLETT
New catalog No. 35-T on test equipment. *See ad page 31.*

35J. V-M CORP.
C-13-FO line folder.

36J. WARD
Mailing folder "The Shape of Things to Come." *See ad page 74.*

37J. WINSTON
One-page flyer on full line of equipment. *See ad page 49.*

38J. XCELITE
New catalog of company's products. *See ad page 70.*

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Supplement to Sams August, 1957 Master Index

This Supplement is your handy index to the new models covered by PHOTOFACT since August, 1957. For prior model coverage see the Sams Master Index dated August, 1957. To stay up-to-date, always use the latest issue of this supplement *with* the Sams Master Index—together, they are your complete index to PHOTOFACT coverage of over 28,000 receiver models.

IMPORTANT: DISCARD ALL PRIOR SUPPLEMENTS

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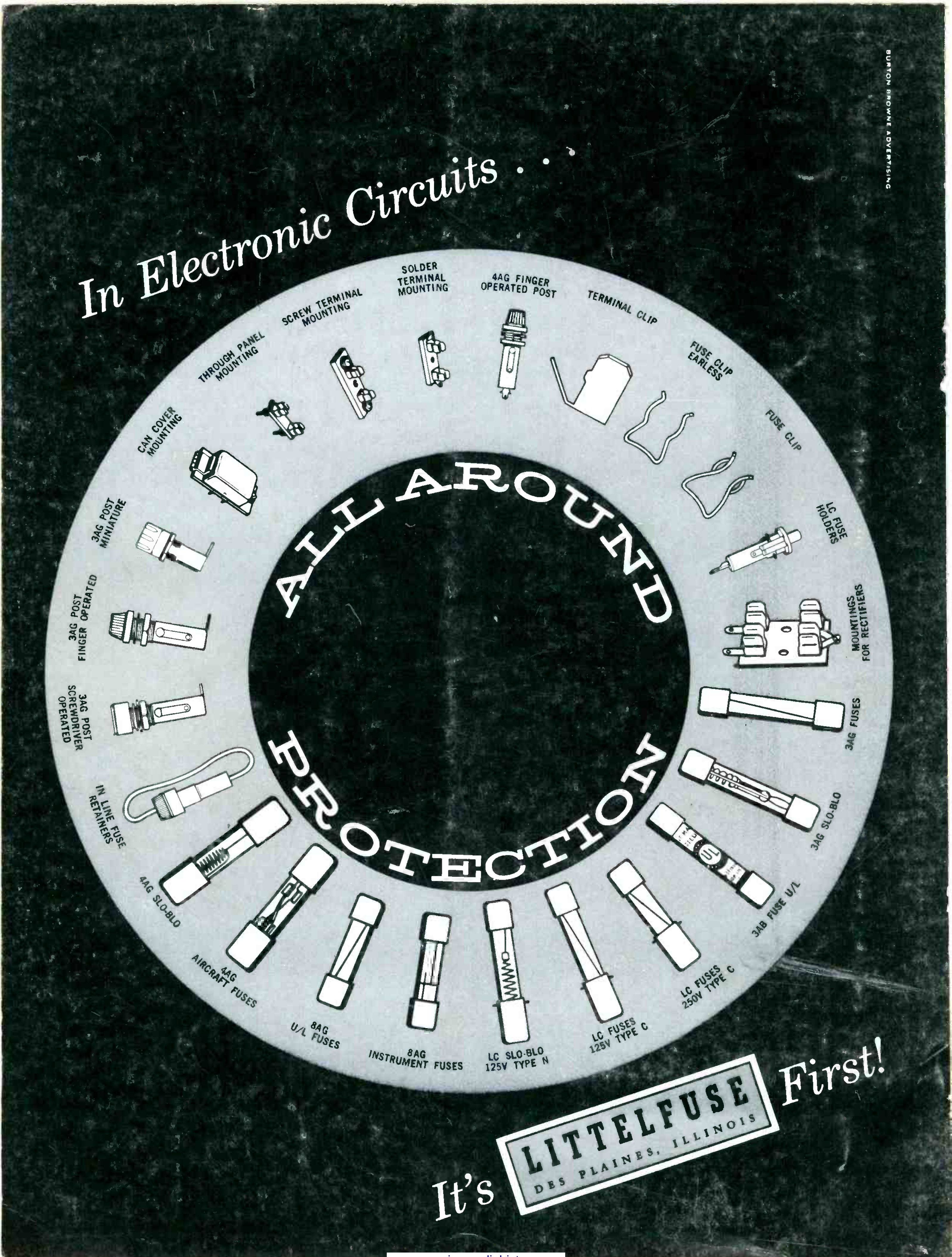
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