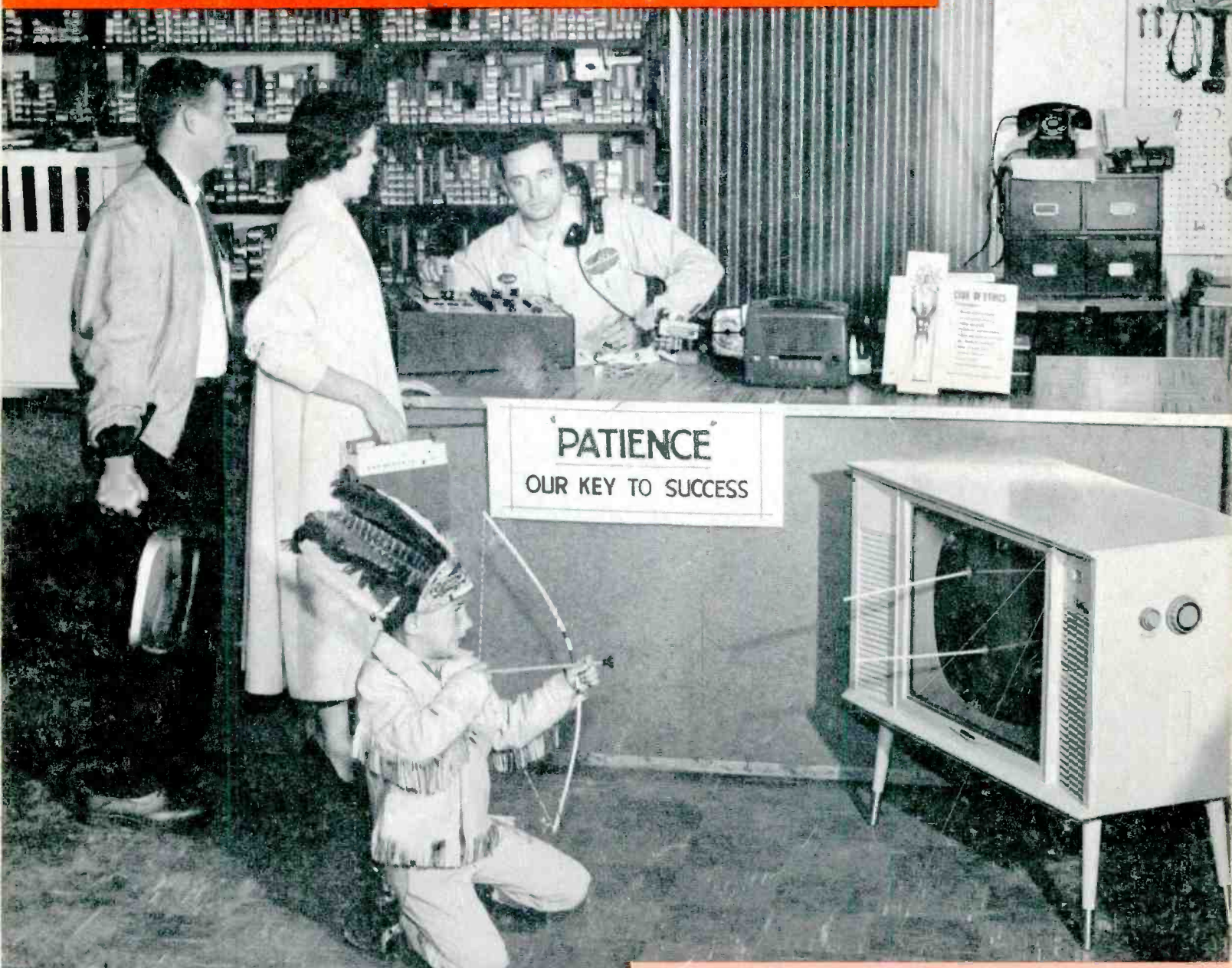
OCTOBER · 1957 25 CENTS

PF REPORTER

PHOTOFACT

FOR THE ELECTRONIC SERVICE INDUSTRY



Capacitor Color Codes

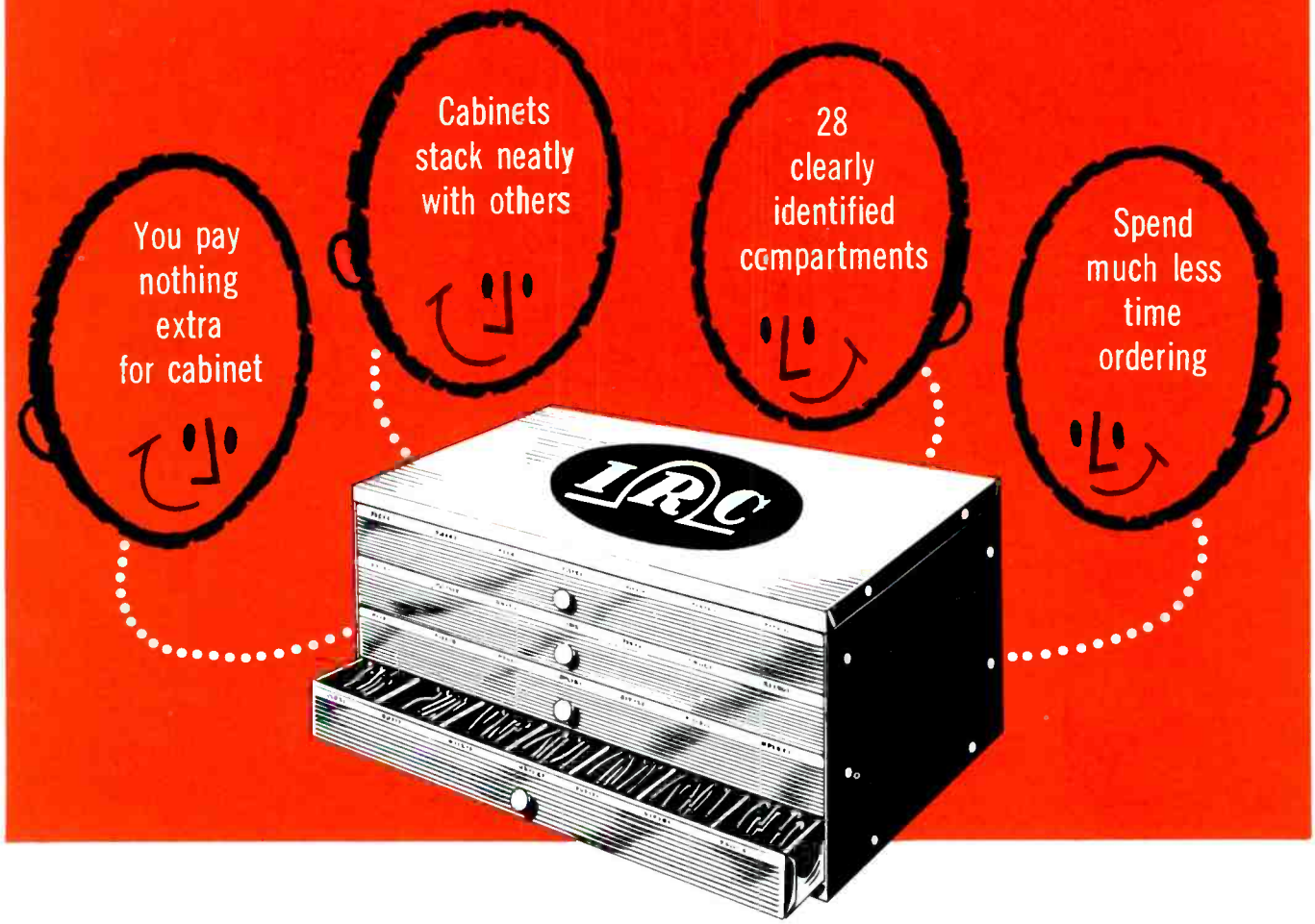
AUXILIARY SYNC CIRCUITS

Servicing Transistor Radios

INDUSTRIAL ELECTRONICS—PART 2

. . . PLUS OCTOBER SUPPLEMENT TO SAMS MASTER INDEX

SAVE MANY WAYS



with IRC® Resist-O-Cabinets

Four "Savingest" Assortments

IRC Resist-O-Cabinets come complete with a colorful all-metal cabinet and any one of four resistor assortments. All resistors are guaranteed fresh and packed in the cabinet at the factory. Cabinets are yours at no extra charge. They have 4 "non-spill" drawers with 28 clearly identified compartments. Design permits neat stacking.

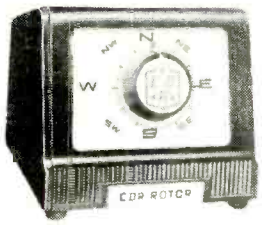
Assortment	No. 3A 2 Watt	No. 4A ½ Watt	No. 5A 1 Watt	No. 6A Combination
Contents	120 BTB 2 Watt Fixed Composition and BW-2 Insulated Wire Wound Resistors. 33 different values from 4.7 ohms to 1 megohm.	150 BTS Fixed Composition and BW-½ Insulated Wire Wound Resistors. 47 ohms to 10.0 megohms.	125 BTA Fixed Composition and BW-1 Insulated Wire Wound Resistors. 28 different values from 47 ohms to 4.7 megohms.	Combination of 139 ½, 1, and 2 Watt Resistors and Type DCF Precistors. 63 different values from 47 ohms to 5 megohms.
List Price	$39.60	$25.50	$31.25	$31.65
Your Price	**$24.00**	**$15.00**	**$18.75**	**$18.85**

ORDER FROM YOUR IRC DISTRIBUTOR

Radio and TV technicians who use IRC Resist-O-Cabinets call them the "savingest" resistor deal they know of. Here's why. You save time and trouble in ordering—all of the resistors most used in TV repair work are pre-selected for you. You save money—you not only get resistors at regular dealer price, but also a handsome all-metal cabinet at no extra charge. And you save time on the job—you know what you have—and you have what you want when you want it. To trim costs and fatten profits, buy resistors in IRC Resist-O-Cabinet assortments.

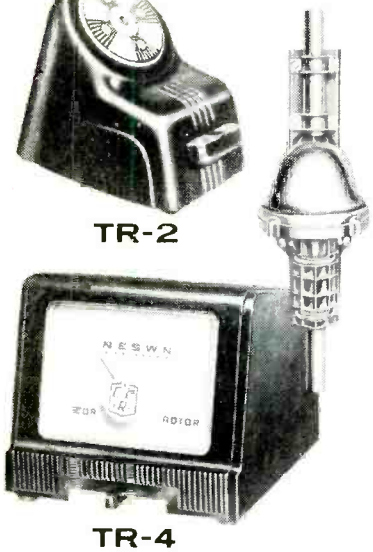
Wherever the Circuit Says IRC

INTERNATIONAL RESISTANCE CO. Dept. 363 401 N. Broad St., Phila. 8, Pa. **In Canada:** International Resistance Co., Ltd., Toronto, Licensee



AR-22

TR-2



TR-4

5-star feature...

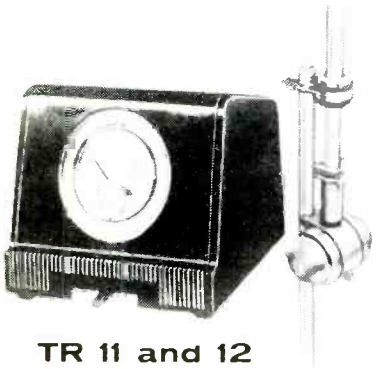
1 **the best color TV picture**

the growth of color TV means an even greater demand for CDR Rotors for pin-point accuracy of antenna direction.

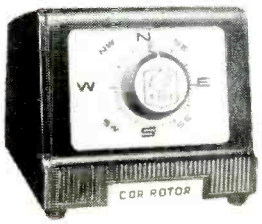
2 **a better picture on more stations**

CDR Rotors add to the pleasure of TV viewing because they line up the antenna perfectly with the transmitted TV signal giving a BETTER picture . . . and making it possible to bring in MORE stations.

CDR ROTORS



TR 11 and 12



AR 1 and 2

3 **tested and proven dependable**

thousands and thousands of CDR Rotors have proven their dependability over years of unfailing performance in installations everywhere in the nation. Quality and engineering you know you can count on.

4 **pre-sold to your customers**

the greatest coverage and concentration of full minute spot announcements on leading TV stations is working for YOU . . . pre-selling your customers.

5 **the complete line**

a model for every need . . . for every application. CDR Rotors make it possible for you to give your customer exactly what is needed . . . the right CDR Rotor for the right job.

CORNELL-DUBILIER SOUTH PLAINFIELD, N. J.

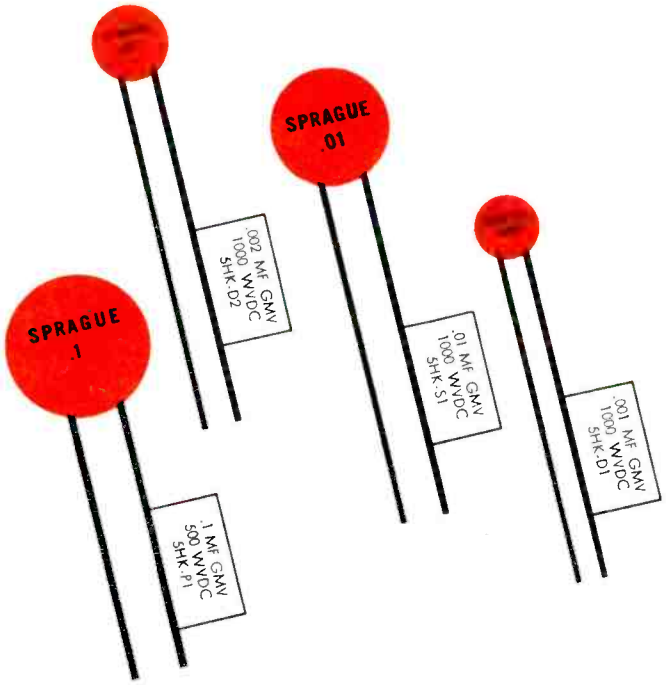
THE RADIART CORP. CLEVELAND 13, OHIO

Reputation Builder #4: it pays to wear a smile

• "Not so courteous servicemen" get less than 20% repeat business

• BUT . . . "pleasant and courteous servicemen" get a healthy 85% repeat business

it pays to replace with Sprague Cera-mite* Ceramic Capacitors



• Another way to build and hold a reputation is to insist on top quality replacement parts. Callbacks due to replacement failures not only cost you money . . . they also cost you customers! Replace with less than the best and you place your reputation at stake. In capacitors, the best is Sprague.

• Take Cera-mite Ceramic Capacitors, for example. Their silvered flat-plate design gives Cera-mites low self-inductance . . . means very high by-pass efficiency in all TV circuits . . . permits higher self-resonant frequency than tubular ceramic or molded mica capacitors. And they often can replace paper capacitors, too! These capacitors are tough, tiny, and dependable in every application . . . even under severe humidity and vibration conditions. They fit easily into tight spaces. Designed for continuous operation at 85°C (185°F).

• For the complete list of ratings for all types of Sprague ceramics, get your copy of Sprague's latest radio and TV service catalog, C-456. Write Sprague Products Co., Distributors' Division of Sprague Electric Company, 105 Marshall Street, North Adams, Mass.

*Trademark

don't be vague . . . insist on

SPRAGUE®

world's largest capacitor manufacturer

SPRAGUE RESEARCH IS CONSTANTLY PRODUCING NEW AND BETTER CAPACITORS FOR YOU

PUBLISHER
Howard W. Sams

GENERAL MANAGER
Mal Parks, Jr.

EDITOR
Verne M. Ray

ASSOCIATE EDITORS
Leslie D. Deane
Thomas A. Lesh
Calvin C. Young, Jr.

CONSULTING EDITORS
William E. Burke C. P. Oliphant
Robert B. Dunham George B. Mann
Paul C. Smith

ART DIRECTOR
Glenn R. Smith

EDITORIAL ASSISTANT
Gwen Bigham

PHOTOGRAPHY
Robert W. Reed

CIRCULATION
Pat Tidd

ADVERTISING SALES OFFICES

MIDWESTERN
PF REPORTER,
2201 East 46th Street, Indianapolis 5, Ind.
Clifford 1-4531

EASTERN
Paul S. Weil and Donald C. Weil,
39-01 Main Street, Flushing 54, New York.
Independence 3-9098.

WESTERN
The Maurice A. Kimball Co., Inc.,
2550 Beverly Blvd., Los Angeles 57, Calif.
Dunkirk 8-6178; and 681 Market Street,
San Francisco 5, Calif. EXbrook 2-3365.

Published monthly by Howard W. Sams & Co., Inc., at Indianapolis 5, Indiana.
Entered as second class matter October 11, 1954, at the Post Office at Indianapolis, Indiana, under the Act of March 3, 1879.
Copyright 1957 by Howard W. Sams & Co., Inc. No part of the PF REPORTER may be reproduced without written permission. No patent liability is assumed with respect to the use of information contained herein.
A limited quantity of back issues are available at 35c per copy.

Subscription prices in U.S.A. and possessions: 1 yr., $3.00; 2 yrs., $5.00; 3 yrs., $7.00. In Canada and Pan America: 1 yr., $3.60; 2 yrs., $6.00; 3 yrs., $8.50. Foreign subscriptions: 1 yr., $6.00; 2 yrs., $11.00; 3 yrs., $15.00.

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

This Month's Cover 65

Letters to the Editor 6

Shop Talk ..... *Milton S. Kiver* 10
Transistorized TV Sync Circuits

Troubled by Color Codes? 14
Latest capacitor color coding data.

Servicing Industrial Electronics—Part 2 ..... *Melvin Whitmer* 16
All about industrial heat-sensing and temperature-controlling devices.

Theory of Auxiliary Sync Circuits 20
Theory and servicing hints on special sync-handling circuits.

Removing Radio from 1955 Chevrolet 22

Servicing New Designs ..... *Thomas A. Lesh* 24
Space-saving TV tuner in 1958 set; the Motorola "Tube Sentry."

Notes on Test Equipment ..... *Leslie D. Deane* 30
Reports on intermittent analyzer, meter probes, transistor tester and millivoltmeter.

Dollar & Sense Servicing ..... *John Markus* 40

More Facts on Servicing Transistor Radios 42
How to replace components and make voltage and resistance measurements.

Quicker Servicing ..... *Calvin C. Young, Jr.* 56

Inside TV Tuners—Part 3 60
Design and operation of oscillator-mixer circuits.

Let's Talk Business 81

Product Report 85

Free Catalog & Literature Service 88

Supplement to SAMS Master Index 89

SUBJECT REFERENCE INDEX

BUSINESS
- Estimates, hints for making accurate 81
- Personnel, considerations in managing 40
- Sales as a sideline 40

CIRCUITS
- Auxiliary sync 20
- Filament, in new Motorola 28
- Oscillator-mixer 60
- Temperature-controlling 16
- Transistorized sync 10

COMPONENTS
- Capacitors, color codes for 14
- Thermistors 17
- Thermocouples 75
- Transistors for video-frequency applications 10

SERVICING
- Auto radio removal 22
- Fine-tuning belt replacement 56
- Oscillator adjustments, tuner 56
- Oscillator-mixer circuits 60
- Transistor radios 42
- Yokes with width sleeves 58

TEST EQUIPMENT
- Eby Trans-Tester 36
- Futuramic meter probes 32
- Bolometer 17
- Portable potentiometer 76
- Scope-Probe 58
- Simpson millivoltmeter 38
- Wintronix Intermittent Analyzer 30

THEORY
- Bolometer 17
- Oscillator-mixer circuits 60
- Sync circuits, special type 20
- Thermistor 16
- Thermocouple 75
- Transistor circuits, TV sync 10

TRANSISTOR CIRCUITS
- Portable radio 42
- TV Sync stages 10

USE HANDY CARD AT BACK TO ENTER YOUR SUBSCRIPTION

Sylvania TV Damper Tubes

...New design plus

New heater-cathode design helps Sylvania damper types pass this dynamic arc test with flying colors. Dynamic tests such as this have now been instituted by Sylvania on all important types in every critical TV function. It's Sylvania's way of helping you overcome problems which often make the difference between profit and loss and a happy or unhappy customer.

new dynamic tests produce high E.L.A.*

Sylvania damper tubes scored an **Earned Life Average* of 99.54% in a recent test of types in the 6AX4GT family. This means greater service reliability for you with an absolute minimum of trouble resulting from arcing, heater-cathode shorts and heater burnouts. It's the result of a new heater-cathode design introduced by Sylvania to meet your service needs.

Earned Life Average is an established method for evaluating tube life performance; for the service industry it serves as an index of protection against call-backs. These tests were performed in TV sets which simulated field service conditions where high line voltages are encountered.

109 Sylvania damper tubes performed for a total of 132,890 hours out of a possible 133,500 hours for an *Earned Life Average* of 99.54%.

To Sylvania this is satisfying evidence that the service industry has been provided with extra protection against the most common damper tube troubles. We think you'll agree too, that in the long run you'll profit more with Sylvania.

SYLVANIA

SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway, New York 19, N. Y.
In Canada: Sylvania Electric (Canada) Ltd.
University Tower Bldg., Montreal

LIGHTING • RADIO • ELECTRONICS • TELEVISION • METALS & CHEMICALS

STOCK and SELL

RAYTHEON

TRANSISTORS

Transistor receivers are now big business and before you know it, servicing these sets will be big business, too.

With Raytheon Transistors in stock, you'll be way ahead of your competitor in the race for this profitable business because the majority of these sets use Raytheon Transistors.

What's more, Raytheon Transistors are (1) low priced (2) available for every application (3) stocked by Raytheon Suppliers from coast to coast. With Raytheon on your shelves you have an excellent opportunity to cash in on the rapidly growing market for Transistors among experimenters, hobbyists and engineers.

Ask your Raytheon Tube Supplier about the profits to be earned with Raytheon Transistors.

Raytheon Transistor Applications Books Vol. I and Vol. II

Musts for Service Dealers . . . Full of practical circuit design information, transistor theory and shop practice . . . Many circuit applications including circuits for making useful transistorized shop equipment. Buy from your Raytheon Tube Supplier or send 50¢ for each book to Department PF2.

RAYTHEON

Excellence in Electronics

RAYTHEON MFG. CO.

Receiving and Cathode Ray Tube Operations
Newton 58, Massachusetts

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

ASTRON *"Staminized"* CAPACITORS HAVE . .

long life

NO CALL-BACK CONSTRUCTION ASSURED BY 10 INDIVIDUAL PRODUCTION TESTS *plus* 100% FINAL INSPECTION

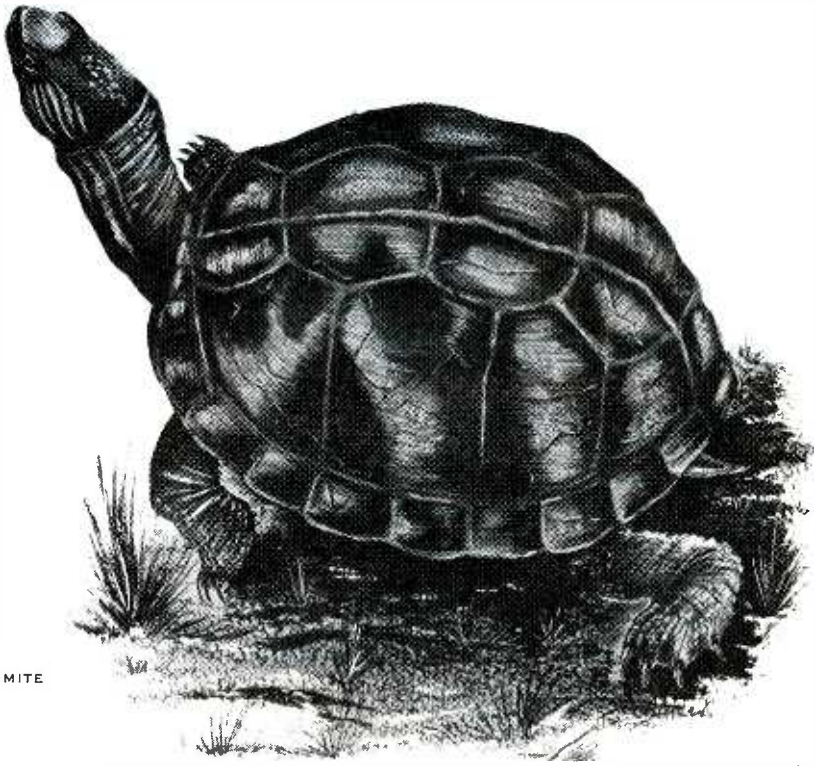
Long life in capacitors is important to you as a serviceman. Complete confidence in the components you use is a necessity, because your business is built on reputation.

Astron considers the serviceman's reputation to be prime importance. That is why each capacitor is manufactured under Astron's "Staminized" system. Astron's "Selected Purchasing" guarantees that only the very finest of raw materials are chosen. Astron's special production techniques are supplemented by continuous inspection under strict quality controls. Production tests are made right on the production line . . . 10 separate tests in all. **A 100% final inspection is made before any capacitor can be shipped.**

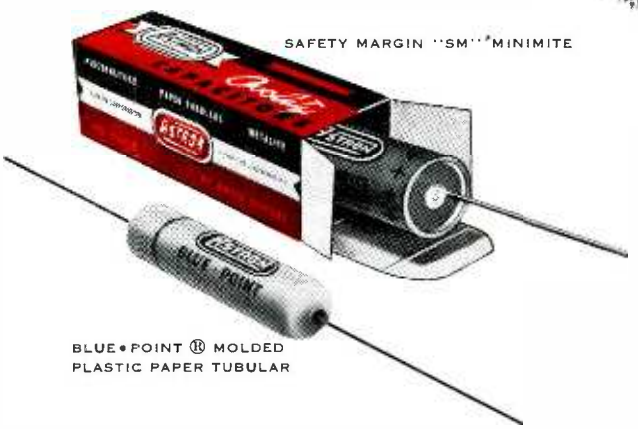
You can put your trust in Astron . . . your assurance of top performance . . . **every time.**

There is an Astron "Staminized" Capacitor built especially to fill the specific, exacting replacement requirements of any job you tackle.

Remember, your reputation is our business, too. Build it, guard it, protect it . . . Buy Astron!



*Trade-Mark



BLUE•POINT ® MOLDED PLASTIC PAPER TUBULAR

Free Servicing Aid . .
Save time, use handy Astron pocket-sized Replacement Catalog and Pricing Guide (AC-4D) . . Write today!

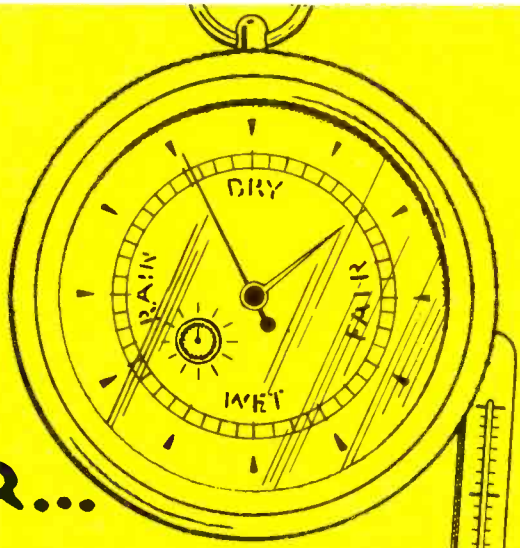
ASTRON
CORPORATION
255 GRANT AVENUE EAST NEWARK, N. J.

ASTRON

CATALOGED IN MASTER

Export Division: Rocke International Corp., 13 East 40th St., N. Y., N. Y. In Canada: Charles W. Pointon, 6 Alcina Ave., Toronto 10, Ontario

NO MATTER WHAT THE WEATHER...



Hot-and-humid or cold-and-damp . . . Aerovox "DURAMIC" Capacitors give you "trouble-free" operation even under the most adverse weather conditions. You avoid costly call-backs when you specify-and-buy "DURAMIC" capacitors because the severe-service characteristics are built into each capacitor.

AEROVOX "DURAMICS"
. . . utilize a dense steatite case to provide exceptional protection against humidity. All terminal lead wires are firmly imbedded into the end seals so that they will not pull out or work loose even under the most severe operating conditions.

AEROVOX "DURAMICS"
. . . have that **exclusive Aerovox** end-fill which will not soften or flow nor separate from the case at any rated temperature.

AEROVOX "DURAMICS"
. . . have excellent power-factor, insulation resistance and temperature characteristics. Operating temperatures from —55°C. to +85°C. Available in 10 standard voltage ratings from 200 to 15,000 VDC.

Your local Aerovox Distributor always carries a stock of Aerovox "DURAMIC" Capacitors in a wide range of capacitance values and voltage ratings. While you're there ask for your free copy of the latest Aerovox Catalog with complete listings of all Aerovox components.

AEROVOX CORPORATION

AEROVOX capacitors

DISTRIBUTOR SALES DIVISION, NEW BEDFORD, MASS.

In Canada: AEROVOX CANADA LTD., Hamilton, Ont.
Export: Ad Auriema, 89 Broad St., New York, N. Y., Cable: Auriema, N. Y.

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

You can do more than ever before with this new portable B&K

AUTOMATIC MONEY-MAKER

TESTS TUBES AND TRANSISTORS *Automatically*

WITH LABORATORY ACCURACY

- Saves Servicing Time
- Sells More Tubes
- Satisfies More Customers

B&K MODEL 675

AUTOMATIC

DYNA-QUIK

DYNAMIC MUTUAL CONDUCTANCE TUBE & TRANSISTOR TESTER

Again, B&K helps servicemen give *faster, better service at less cost and make more money*. The new *automatic* Model 675 makes tube checking quick and easy in the home or shop. (Tests transistors, too.) *Measures true dynamic mutual conductance*. Makes complete tube test in seconds, under actual operating conditions of the set. Checks average set in a few minutes. Simple to operate. *No multiple switching. No roll chart*. Shows customer the true condition and life expectancy of tubes in the set, *sells more tubes on-the-spot, saves call-backs*. Quickly pays for itself.

MORE ACCURATE TEST

Tests Each Section of Multiple Tubes Separately for Gm, Shorts, Grid Emission and Life

Tests each tube for Gas Content and Grid Emission simultaneously with Short check.. Instantaneous Heater Continuity test.

SIMPLIFIED AUTOMATIC DYNA-CARD SYSTEM

With only 60 heavy-duty, phenolic Dyna-Cards you can test over 500 tube types. Dyna-Card automatically sets socket connections for quick, accurate test. Each Dyna-Card is identified and indexed, ready to use. Always kept up-to-date simply by adding new Dyna-Cards. Minimizes obsolescence.

CHECKS OVER 99%

of the tubes most widely used in television receivers plus popular home and portable radio tubes.

ONE EXTRA TUBE SALE

on each of 5 calls a day pays for the Dyna-Quik in a few weeks.

TESTS TRANSISTORS, TOO

Transistor Section checks junction, point contact and barrier transistors, germanium and silicon diodes, selenium and silicon rectifiers.

Shows tube condition on "Good-Bad" scale and in micromhos. Large 4½" meter has two highly accurate ranges calibrated 0-6000 and 0-18,000 micromhos. 7-pin and 9-pin straighteners are mounted on panel. Automatic line compensation. Special bridge monitors line voltage continuously. Light weight, easily portable in handsome leatherette-covered carrying case. Operates on 105-125 volts 60 cycle a.c. Size: 15¼" x 12¼" x 6". Net wt: 10½ lb. Net, **$169.95**

Also makers of famous CRT, DYNA-SCAN, CALIBRATOR

See your B&K Distributor, or write for Bulletin 675-R

B&K MANUFACTURING CO.
3726 N. Southport Ave. · Chicago 13, Illinois

Canada: Atlas Radio Corp., 50 Wingold, Toronto 10, Ont. Export: Empire Exporters, 439 Broadway, New York 13, N.Y.

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 cut off 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.

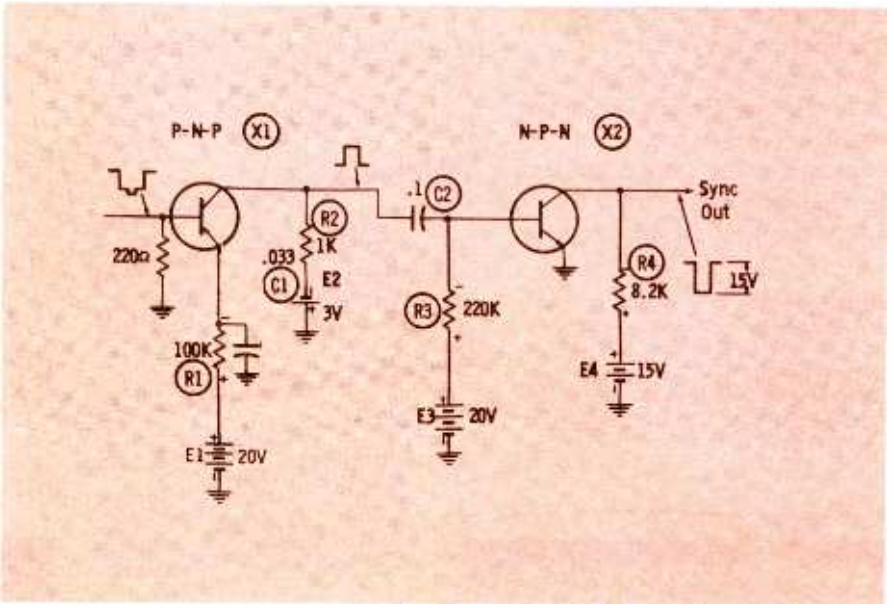
The second stage, containing transistor X2, is used to amplify and limit the amplitude of the pulses appearing across R2. X2 is biased so that it is driven to saturation by the sync pulse tips of any usable signal. This not only establishes the sync pulse amplitude at a relatively fixed value, but it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

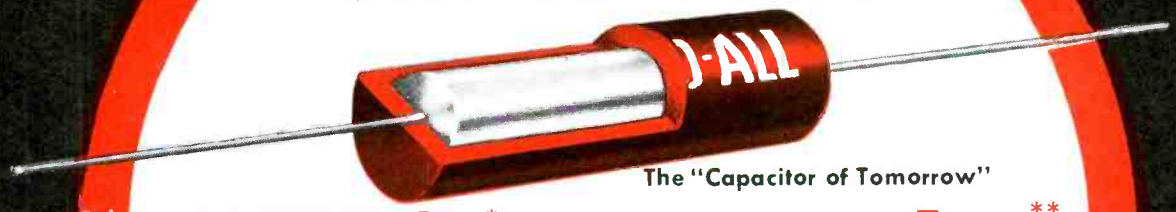
* "Transistorized Sync Separator Circuits For TV Receivers" by H. C. Goodrich, RCA Review, December, 1955.



(Courtesy RCA Review)

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

GOOD-ALL
CAPACITORS



The "Capacitor of Tomorrow"

600-UE Mylar* Dielectric • Molded in Epoxy**

NEW to the replacement market! Widely used by leading equipment manufacturers.

The 600-UE is created by the skillful combination of new "wonder materials," and Good-All's advanced design, exclusive production technique and tight quality control. It is ideal for replacement use in today's modern circuitry.

FEATURES: • Low leakage • High stability • Long, trouble-free life • Rugged construction • Extremely reliable service in humid climates

SUPERIOR QUALITY • COMPETITIVE PRICE

DU PONT

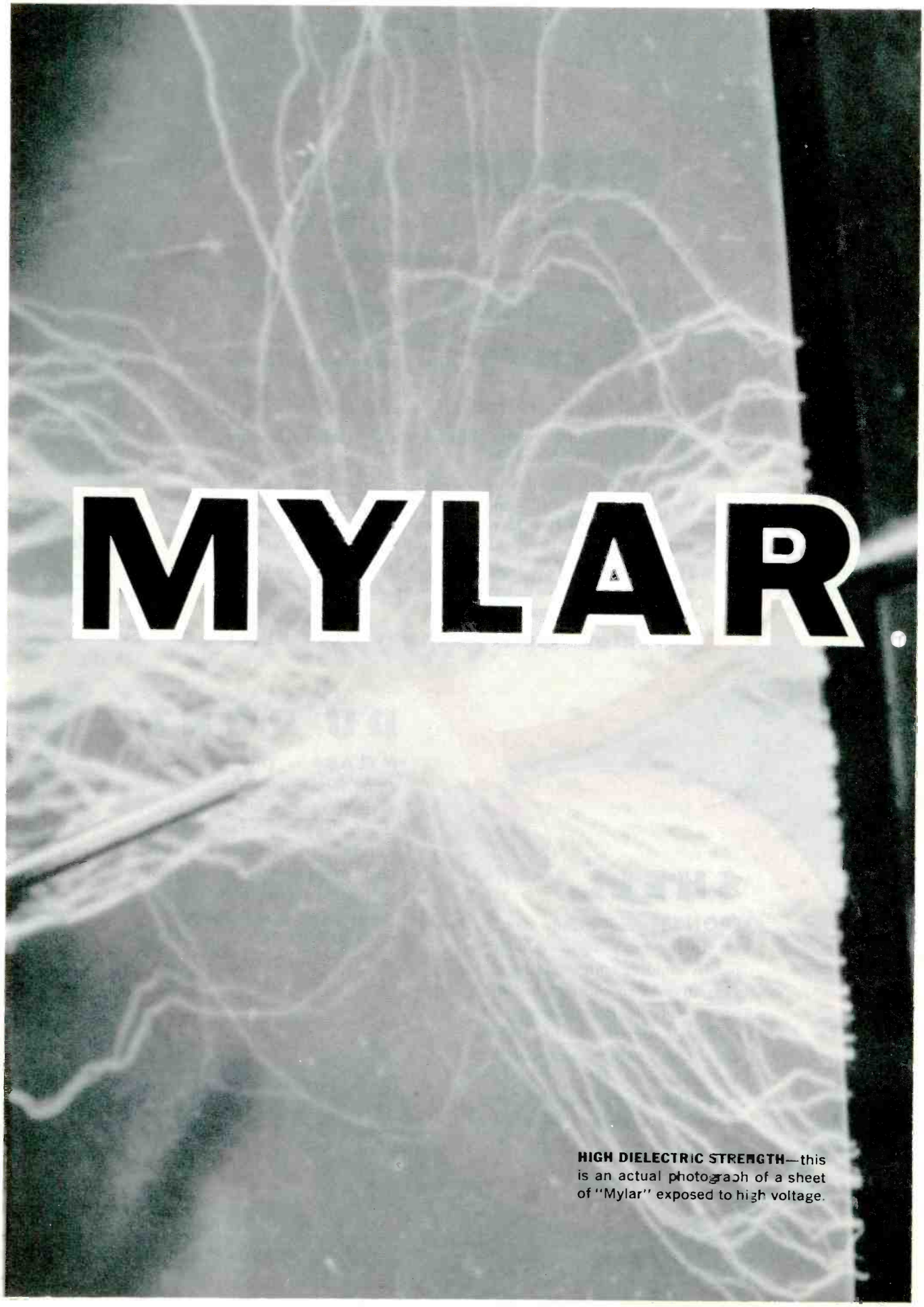
***MYLAR®** is DuPont's trade name for their amazing space-saving polyester film. This thin, tough film makes an ideal capacitor dielectric. Its inherent electrical stability and exceptional dielectric strength contribute greatly to the trouble-free service of the 600-UE.

SHELL

****EPON®** is Shell's trade name for their epoxy resin wonder plastic molding compound base. Far superior to common molding materials, Epon forms an extremely rugged moisture-tight case. Leads adhere securely to the compound. High dielectric strength is also an attractive feature of this tough, dense material.

GOOD-ALL ELECTRIC MFG. CO.

Distributor's Division • 26 RITTENHOUSE PLACE • ARDMORE, PENNSYLVANIA



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

Report from Du Pont for electronic service dealers

• • THE MOST TALKED ABOUT NEW DIELECTRIC FOR CAPACITORS!

Here are 5 important reasons you should use capacitors made with Du Pont "Mylar"

1. MYLAR* has high dielectric strength . . . average of 4,000 volts per mil . . . average power factor of 0.003 at 60 cycles . . . dielectric constant above 3.0 at 72°F., 1,000 cycles.

2. MYLAR is tough and durable . . . permits capacitor manufacturers to save space because the film is extra-strong even in the thinnest gauges.

3. MYLAR has long life . . . will not deteriorate with age or voltage stresses within normal operating ranges of most electronic equipment.

4. MYLAR is moisture-resistant . . . this polyester film performs equally well in hot, humid climates or cold, crisp air . . . it won't dry out and become brittle with age.

5. MYLAR has proved its value . . . capacitors made with "Mylar" as the dielectric are being used in guided missiles and sensitive electronic computers.

Yes, where high reliability and long life are concerned, capacitors made with "Mylar" assure the finest in performance. Think of it! No more wasted call-backs for failure of newly installed capacitors . . . capacitors with "Mylar" assure longer shelf life, no storage problems.

So next time you order, ask your distributor for highly reliable, long-life capacitors made with Du Pont "Mylar". For detailed information on the basic properties of "Mylar", write: Film Department, Room EP-10, The Du Pont Co., Wilmington 98, Delaware.

**"MYLAR" is Du Pont's registered trademark for its polyester film. Du Pont manufactures "Mylar"—not finished capacitors.*

DU PONT
REG. U.S. PAT. OFF.

DU PONT MYLAR® POLYESTER FILM

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Troubled By Color Codes ?

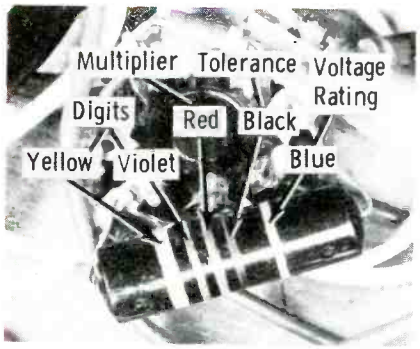
The "age-old" problem of deciphering color codes is still to a great extent unsolved by neophyte and old timer alike. For the most part, this is due to the fact that the code has been expanded to provide additional information for a greater variety of units.

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.

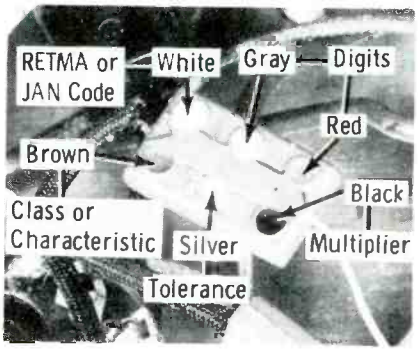


The Mica

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.

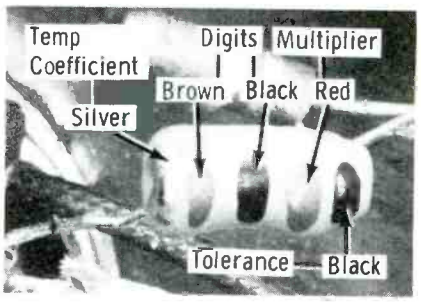
The JAN or Joint-Army-Navy 6-dot system is also employed for mica capacitors and differs from the RETMA system only in that the first dot is black instead of white.



The Insulated Ceramic Tubular

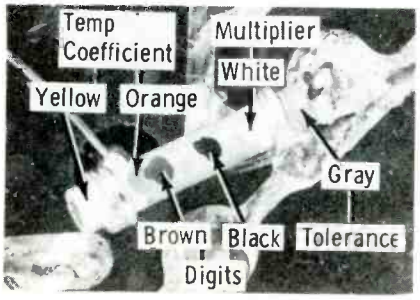
Constructed with radial leads, this style of capacitor generally uses a 5-dot system as shown and is oriented by placing the color dot closest to one end of the unit on the left. Referring to the chart and reading from left to right, we find that the capacitor is a bypass or coupling, 1,000-mmf unit,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



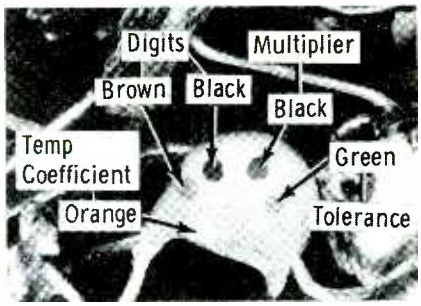
The Insulated Ceramic Disc

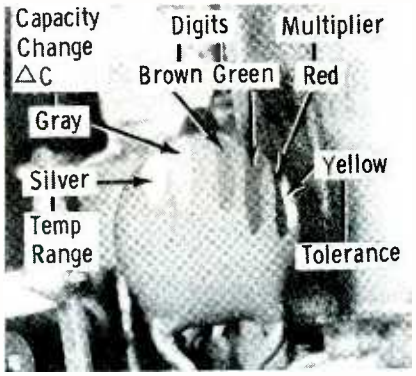
Although this type of capacitor is usually typographically marked, it may be color-coded with 5 dots or stripes. Using the chart, and reading from left to right with the unit oriented as shown, we find that this unit is an N150, 10-mmf capacitor, having a tolerance of ±0.5 mmf.

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%).



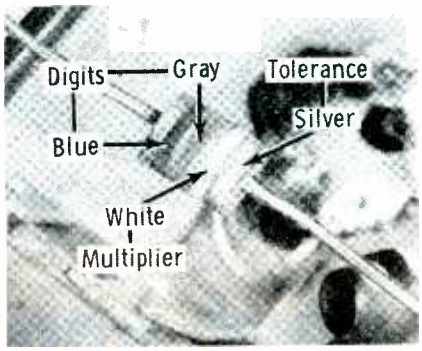


The Miniature-Molded Ceramic

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.

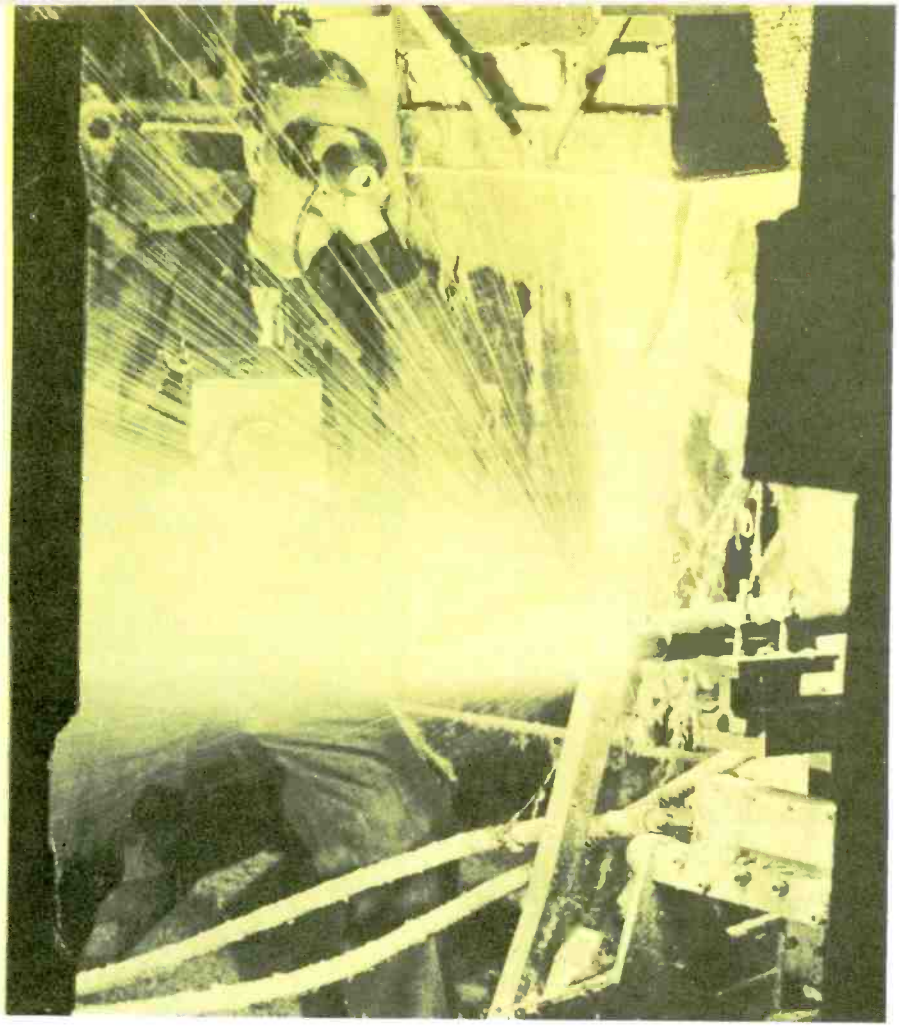
Reading the bands and referring to the chart, we find that this capacitor is a 6.8-mmf unit with a tolerance of ±10%.

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%.



CERAMIC TYPES ONLY

Color Marking	Digit	Multi	Value Tolerance	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	—



SERVICING INDUSTRIAL ELECTRONICS

PART-2

heat-sensing and temperature-controlling devices

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.

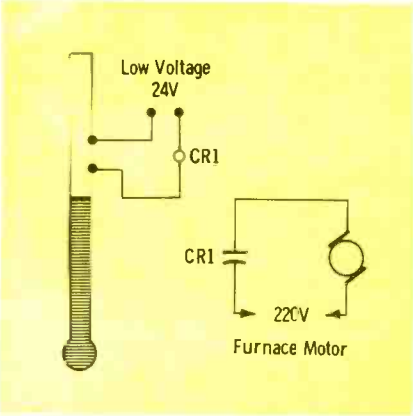


Fig. 1. Basic construction of a mercury temperature switch used to actuate a furnace control relay.

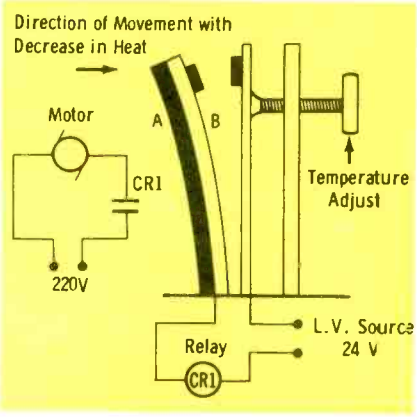


Fig. 2. The contacts of a bi-metal thermostat will open and close over a predetermined temperature range of 2° to 3°F.

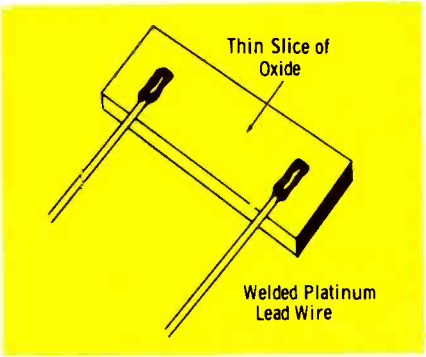


Fig. 3. Simple sketch of a thermistor.

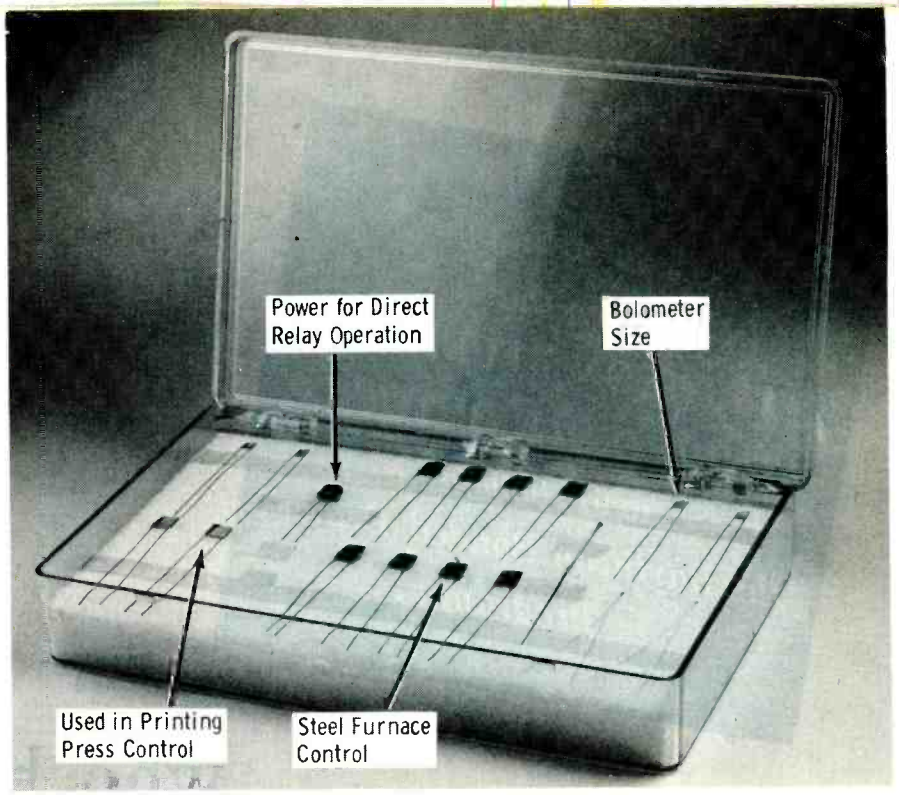
As industrial processes required better control of heat, sometimes within only a few degrees, the ingenuity of man was called upon to devise electro-mechanical and electronic sensing units. Early devices could indicate the temperature on a calibrated dial, but could not actuate a control. The thermometer 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-

· *Please turn to page 75*



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.

Courtesy Servo Corporation of America

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.

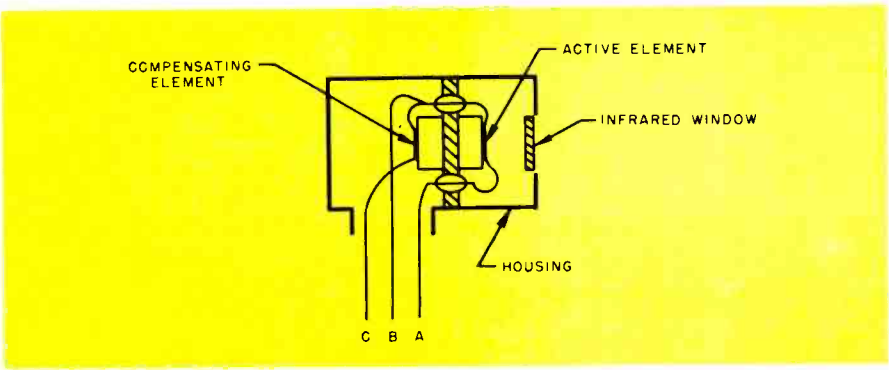


Fig. 4. Internal makeup of a bolometer.

A wonderful offer from the RAYTHEON RECEIVING TUBE DISTRIBUTORS who sponsor the Raytheon Bonded Dealer Program . . .

at no added cost . . .

GROUP

for Raytheon

who by preference

Now, Registered Bonded Dealers can gain personal security for themselves and their families — automatically increase their life insurance coverage, through their regular purchases of Raytheon Receiving Tubes. The amount of coverage is determined by the quantity of Receiving Tubes the dealer buys.

The New England Mutual Life Insurance Company has created a Group Life Insurance Plan for Raytheon Bonded Electronic Technicians — a plan offered exclusively by Raytheon Distributors who sponsor the Bonded Dealer Program. Any such Distributor who meets the necessary requirements for setting up a Group Life Insurance Plan for Bonded Dealers may give them this valuable protection without the necessity of a physical examination. Check with your Raytheon Sponsoring Distributor and see if he has it available to you.

If you're not at present a Raytheon Bonded Dealer, better see your Sponsoring Distributor as to whether you can qualify. You'll find being a Raytheon Bonded Dealer a real asset to you. You'll find using Raytheon quality receiving tubes is a big help, too.

**Administered and underwritten by New England Mutual Life Insurance Company*

RAYTHEON MANUFACTURING COMPANY

Receiving and Cathode Ray Tube Operations

NEWTON 58, MASS. 55 Chapel Street | CHICAGO, ILL. 9501 Grand Ave. (Franklin Park) | ATLANTA 6, GA. 1150 Zonolite Rd. N.E. | LOS ANGELES 7, CALIF. 2419 So. Grand Ave.

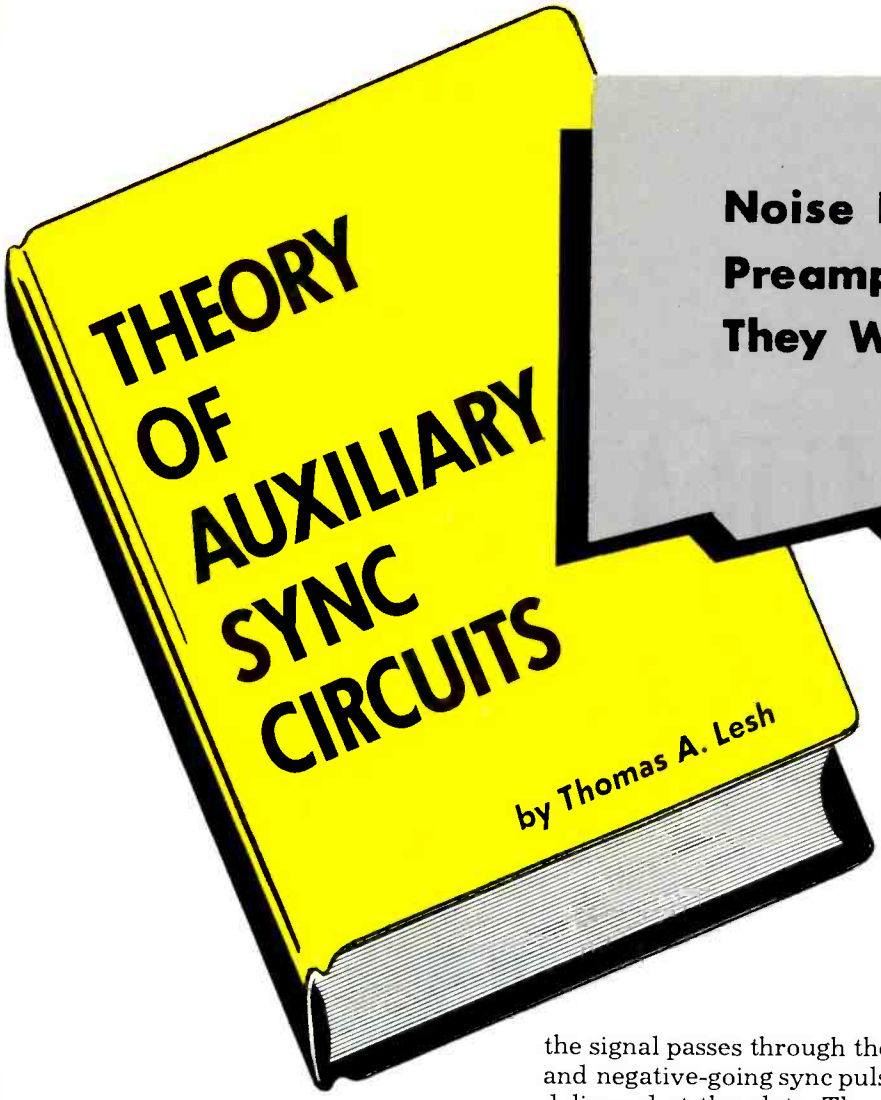
Raytheon makes all these { Receiving and Picture Tubes, Reliable Subminiature and Miniature Tubes, Semiconductor Diodes and Transistors, Nucleonic Tubes, Microwave Tubes.

RAYTHEON®

Excellence in Electronics

LIFE INSURANCE*

Bonded Electronic Technicians use RAYTHEON RECEIVING TUBES



Noise Limiters and Sync Preamps and How They Work

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-

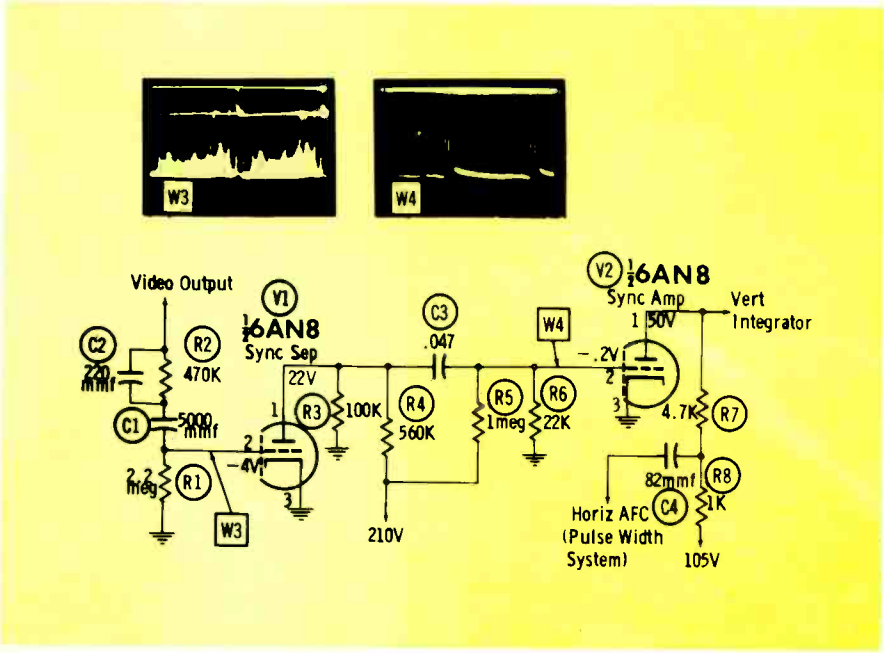


Fig. 1. Typical dual-triode sync section—Truetone Model 2D2423A.

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

· *Please turn to page 77*

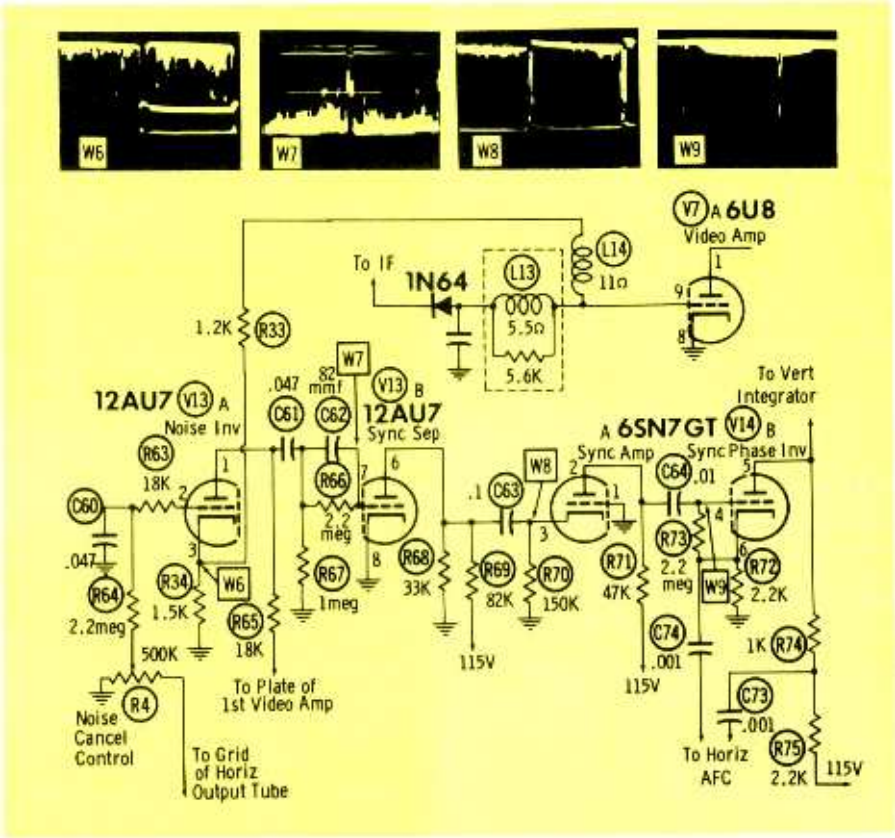


Fig. 2. Sync section plus triode noise inverter—Stromberg-Carlson Model 621.

Removing Radio from 1955 Chevrolet

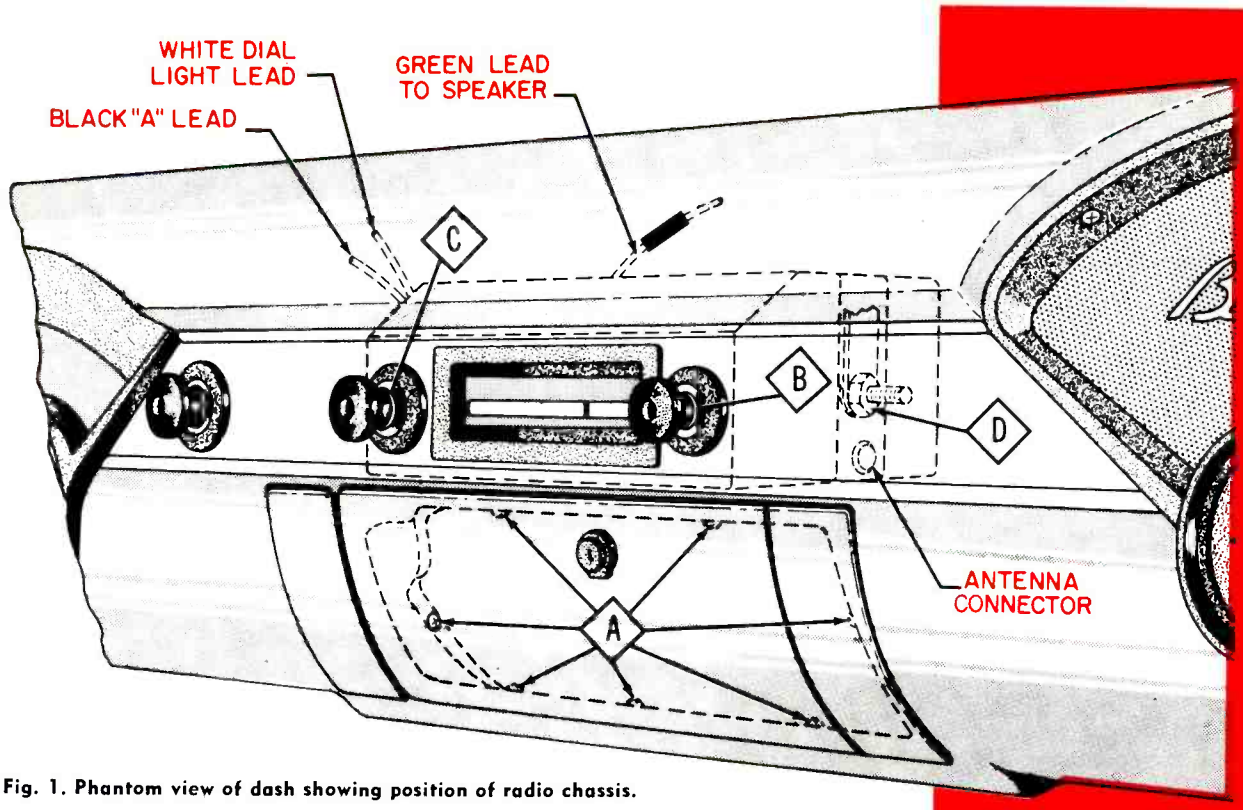


Fig. 1. Phantom view of dash showing position of radio chassis.

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.

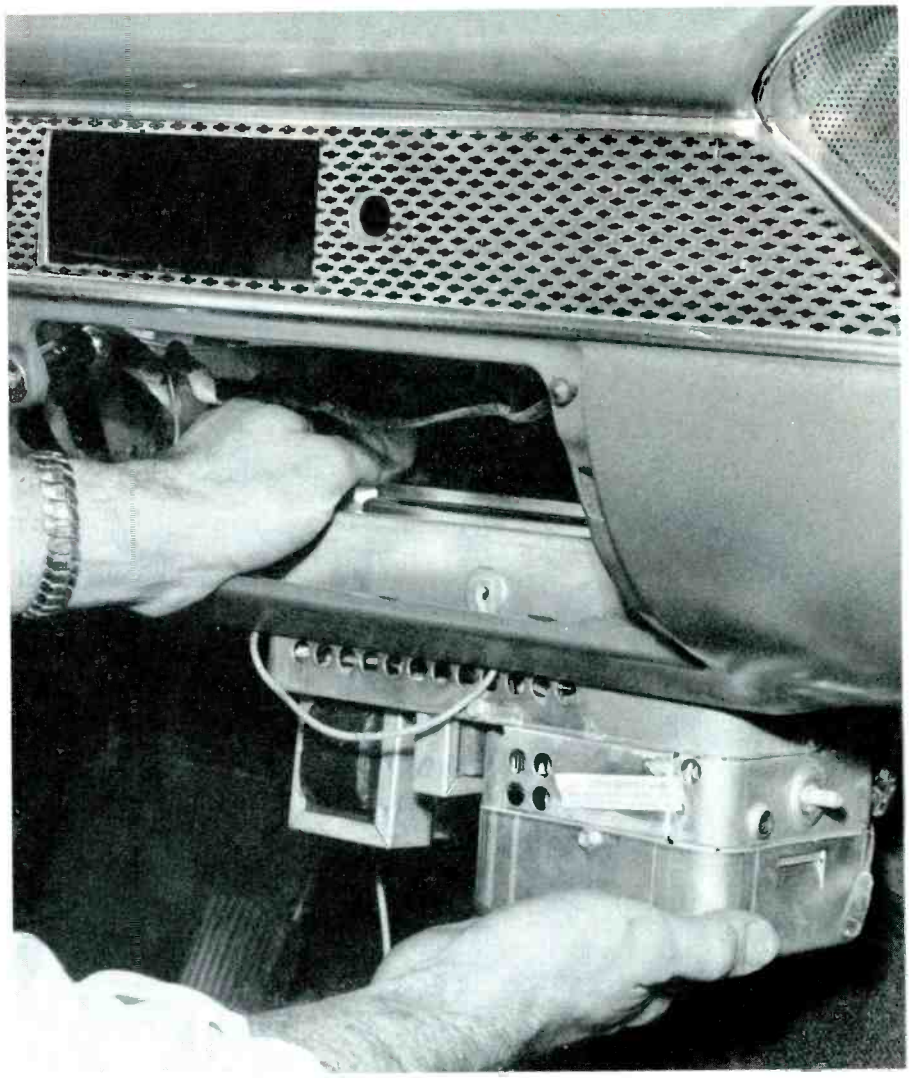


Fig. 2. Removing chassis.

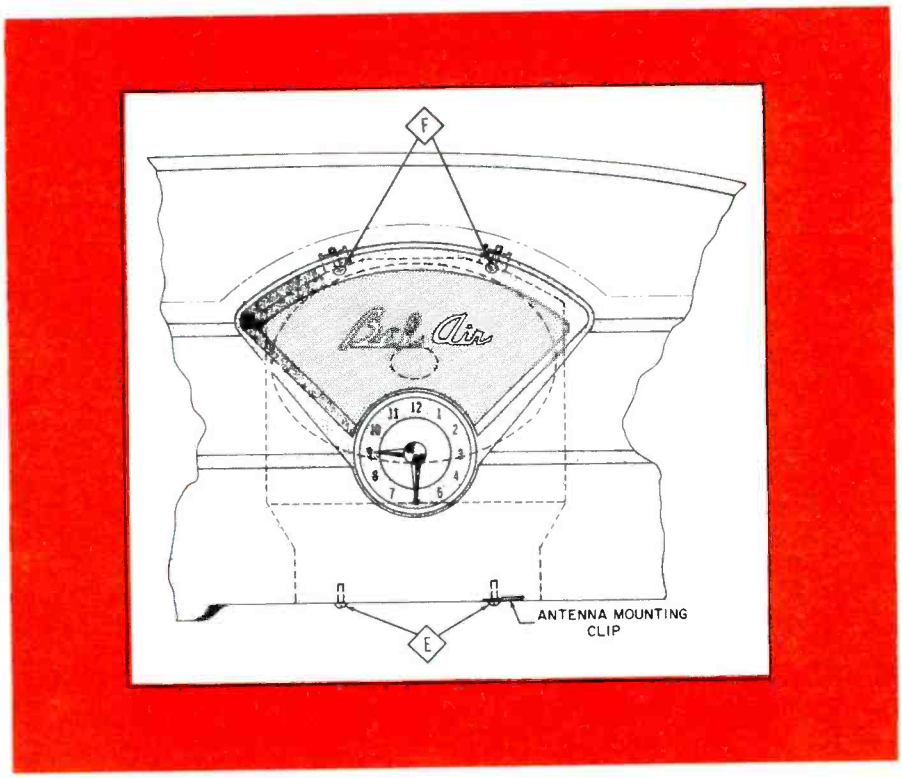


Fig. 3. Phantom view showing position of speaker unit.

servicing new designs

by Thomas A. Lesh

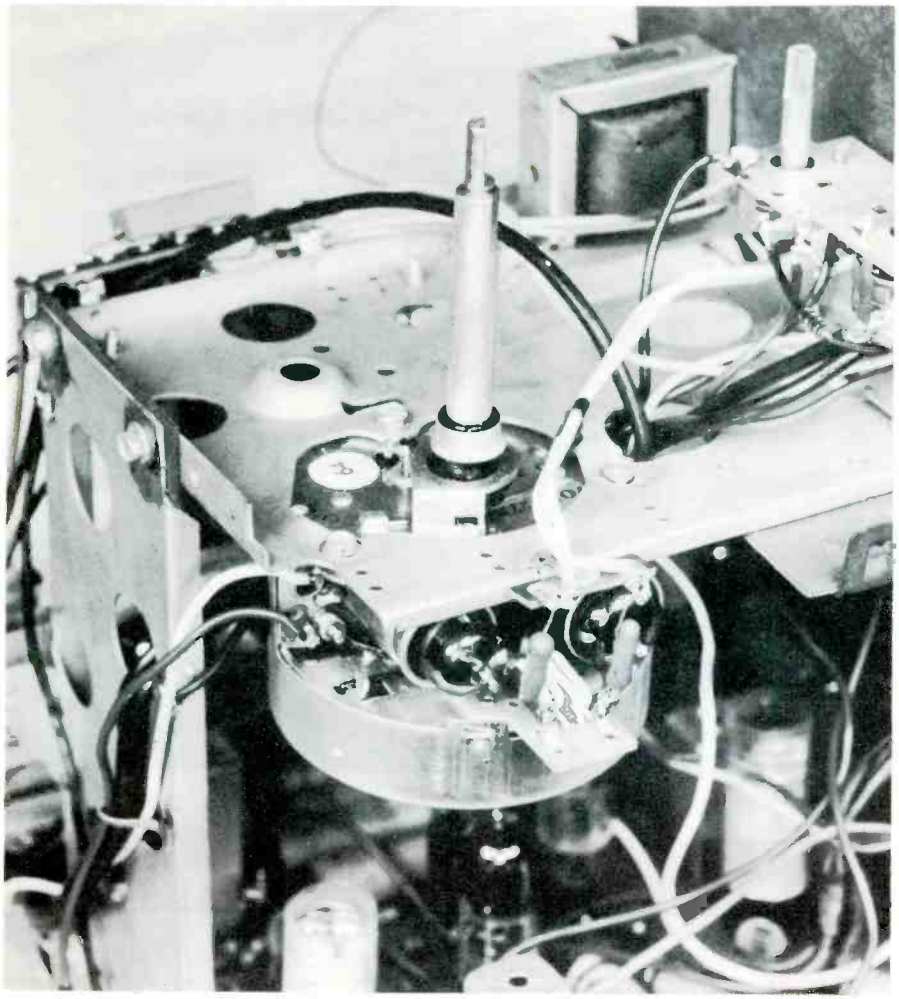


Fig. 1. New compact version of Standard Coil tuner in Airline Model GTM4031A.

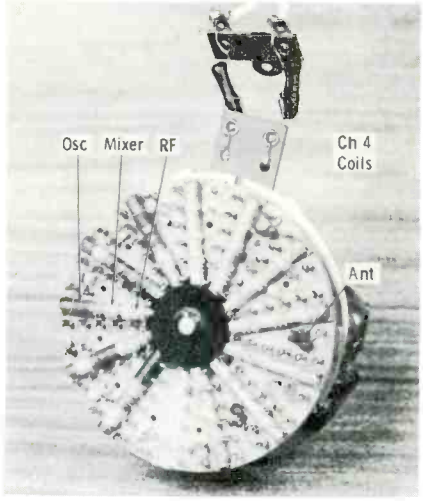


Fig. 2. Bottom view of new tuner showing tuner coils mounted on wheel.

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

40% FEWER CALLBACKS*

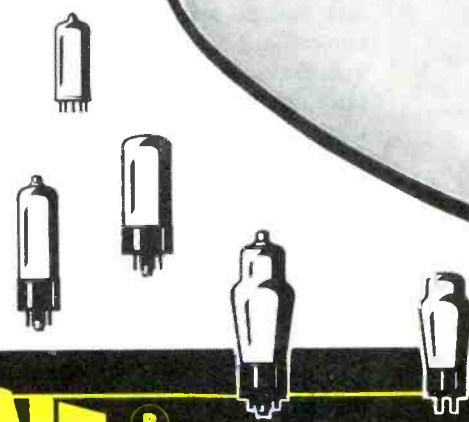
DUMONT POSITIVE QUALITY

A positive fact about
Du Mont Positive Quality . . .

Du Mont Picture Tubes cut callbacks due to tube failure by 40%. Consider what this means to you — fewer callbacks, greater profits.

Ask your distributor about
Du Mont Positive Quality Picture Tubes and Electronic Tubes.

● *Send name and address for your free copy of the Du Mont Replacement Tube Chart.*



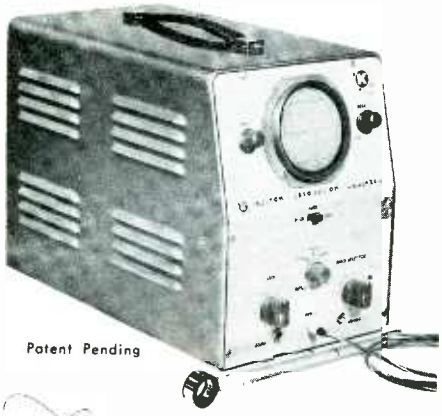
*Based on actual engineering figures.

DUMONT®

Television Tube Division
Allen B. Du Mont Laboratories, Inc., Clifton, N. J.

AMAZING

NEW



KINGSTON
ABSORPTION ANALYZER

SIMPLIFIES
WAVE FORM ANALYSIS
SPEEDS
TV TROUBLE SHOOTING

- This revolutionary test equipment so simplifies wave form analysis that every TV service man can use it to save time and make more money.
- Follows composite video from antenna to CRT. Traces sound from sound IFs to speaker without any physical connection.
- Displays sweep and sync information through progressive stages . . . every tube becomes a test point for top-side servicing.
- Isolates defective circuit by displaying wave forms as they appear in each stage. Electrostatic pick-up minimizes loading.
- Light-weight and portable, may be taken on every call, to speed servicing, reduce call-backs and build customer confidence.

For complete information and the name of your nearest distributor, write today.

KINGSTON
ELECTRONIC CORPORATION
MEDFIELD, MASSACHUSETTS

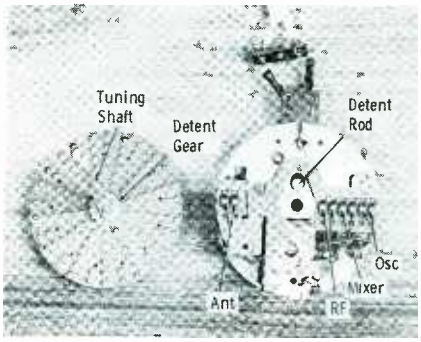


Fig. 3. Wheel removed to show contacts.

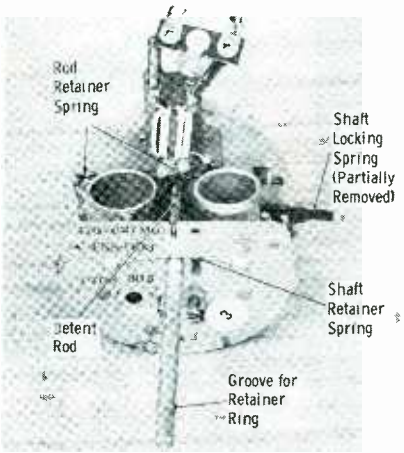


Fig. 4. Components which must be loosened or removed to free the coil wheel.

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-

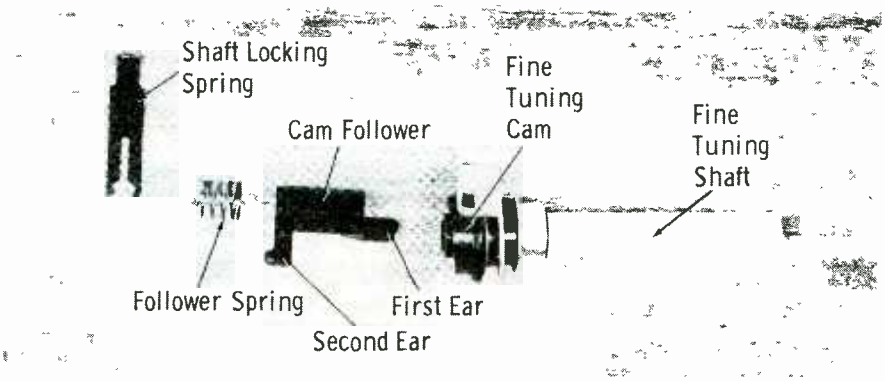


Fig. 5. These components fit around the tuning shaft. (C-ring not shown.)

...stock and sell

RCA BATTERIES!

Modern Americans play outdoors, day and night, twelve months a year. And, wherever they go, hayrides, football games, weenie roasts, ski lodges—they take their portable radios along!

Make sure your supply of RCA Batteries is adequate to meet public demand this fall!

RADIO CORPORATION of AMERICA

® COMPONENTS DIVISION CAMDEN, N.J.

RCA BATTERIES...THE BRAND THAT COMMANDS PUBLIC DEMAND!

it's **new**

The **TRC**
triple-duty microphone
by
American

Actual size of new TRC microphone

it's versatile . . .
lightweight . . .
low cost, too!

Elgin's new TRC dynamic microphone offers faithful audio reproduction in the 80-8500 cps range, yet lists from $11.50. It is designed for use with tape recorders . . . yet has the versatility to perform ideally at meetings and assemblies, wherever p.a. systems are used. The TRC is less than five inches long, weighs only nine ounces, has a polished, chromeplated case. It is omnidirectional and picks up voices within a radius of ten feet under average conditions.

The TRC is also available in crystal and ceramic types.

Get the facts on this new addition to Elgin's complete line of "American" microphones. Write today for specifications and complete descriptive literature.

ELECTRONICS DIVISION
ELGIN NATIONAL WATCH COMPANY
107 National Street, Elgin, Illinois

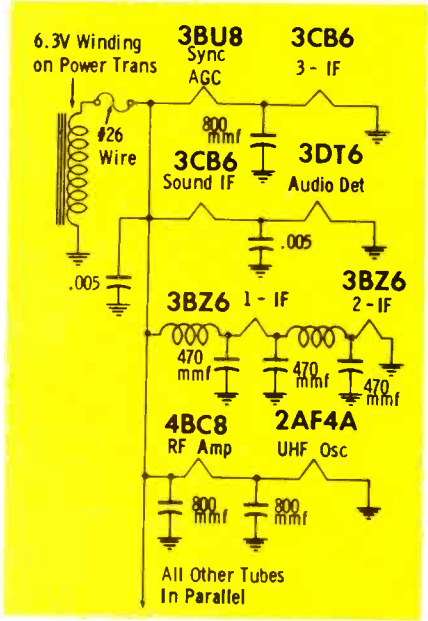


Fig. 6. Series-parallel hookup across 6.3-volt filament supply in Motorola TS-544.

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.

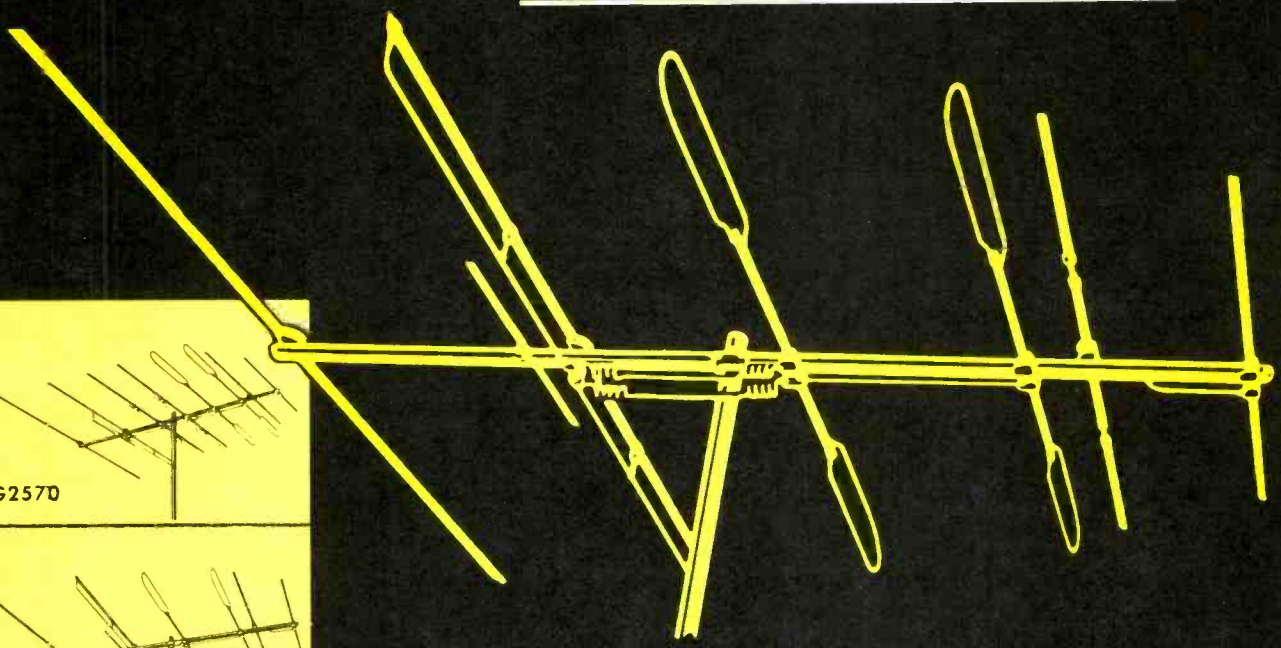
Since the TS-544 chassis has a power transformer, it is surprising to find several 600-ma series-string tubes such as the 3CB6 in this set. Several pairs of these tubes are wired across the 6.3-volt filament winding of the power transformer in the manner shown in Fig. 6. This type of hookup is used in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

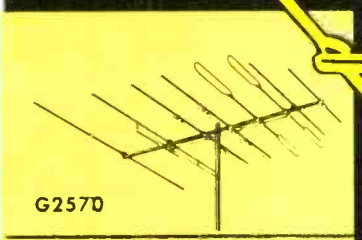
Series-string tubes were used in this unconventional way for one good reason: Field experience has revealed a noticeably lower failure rate for the reduced-voltage, 600-ma tubes than for the 6.3-volt versions of the same types.

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. ▲

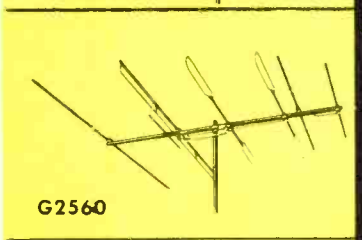
ANODIZED

...it lasts forever

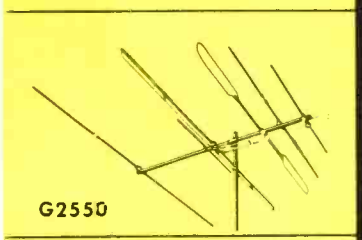




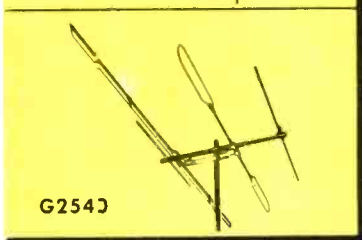
G2570



G2560



G2550



G2540

The new magnificent

GOLDEN

Topliner

Trade-mark

Completely anodized to lock out corrosive fumes and weather elements . . .

. . . . . .

Designed to outperform any antenna, dollar-for-dollar, or size-for-size . . .

. . . . . .

Designed to make your installation look better . . .

This is the new Taco Golden Topliner, the antenna you've been waiting for . . .

. . . . . .

Install a Golden Topliner. You'll marvel at its performance.

TACO

TECHNICAL APPLIANCE CORPORATION
SHERBURNE, N. Y.
In Canada: Hackbusch Electronics, Ltd., Toronto 4, Ont.
U.S. PAT. 2799018

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.*

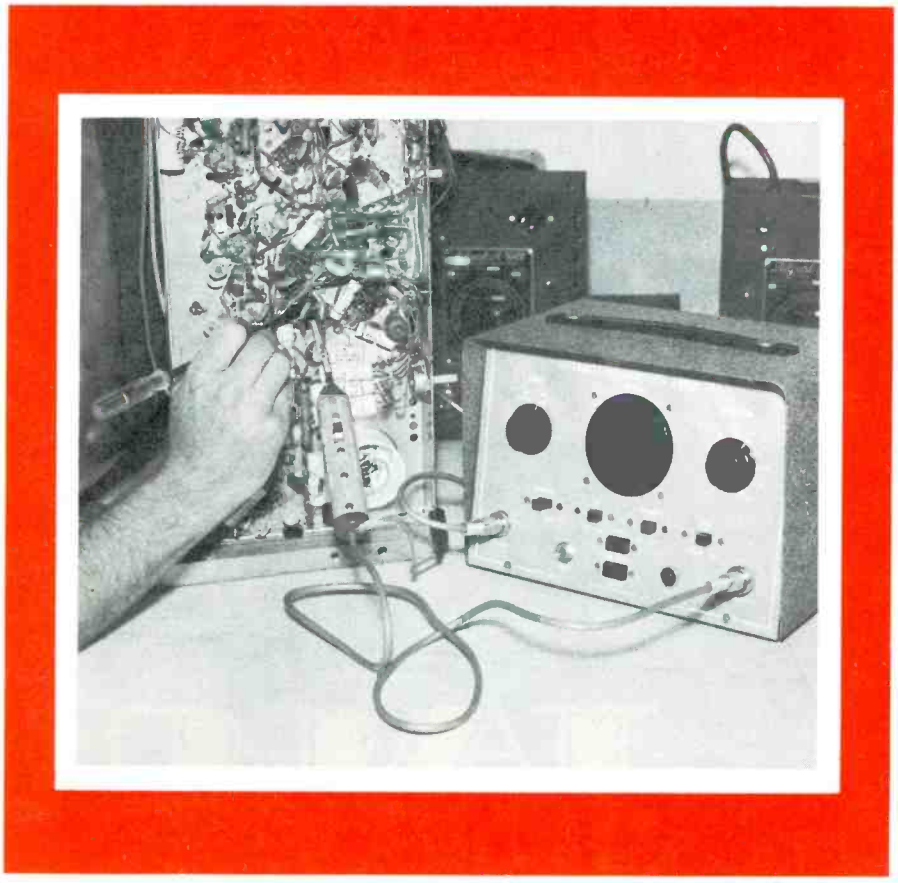


Fig. 1. New Win-Tronix Analyzer aids in quickly isolating intermittents.

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 underchassis 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-

BURTON BROWNE ADVERTISING

1,000,000,000 proofs a day...

that a VOM is electronics' most basic Test Instrument
Yes, over 1,000,000,000 measurements are made every day with Volt-Ohm-Milliammeters

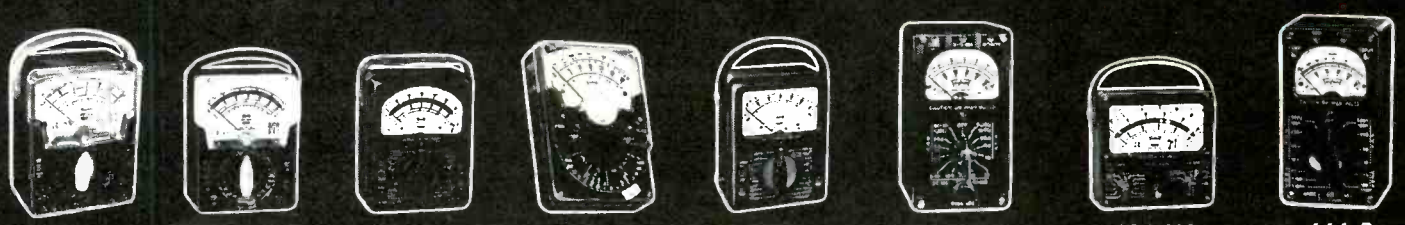
and triplett model 630 leads all vom's

in design, quality, performance, operating simplicity, and value per dollar. The leader at only $44.50
At leading electronic parts distributors everywhere.

TRIPLETT Model 630 VOM—the proof of 53 years' experience in test instruments.

TRIPLETT

Triplett Electrical Instrument Company
Bluffton, Ohio



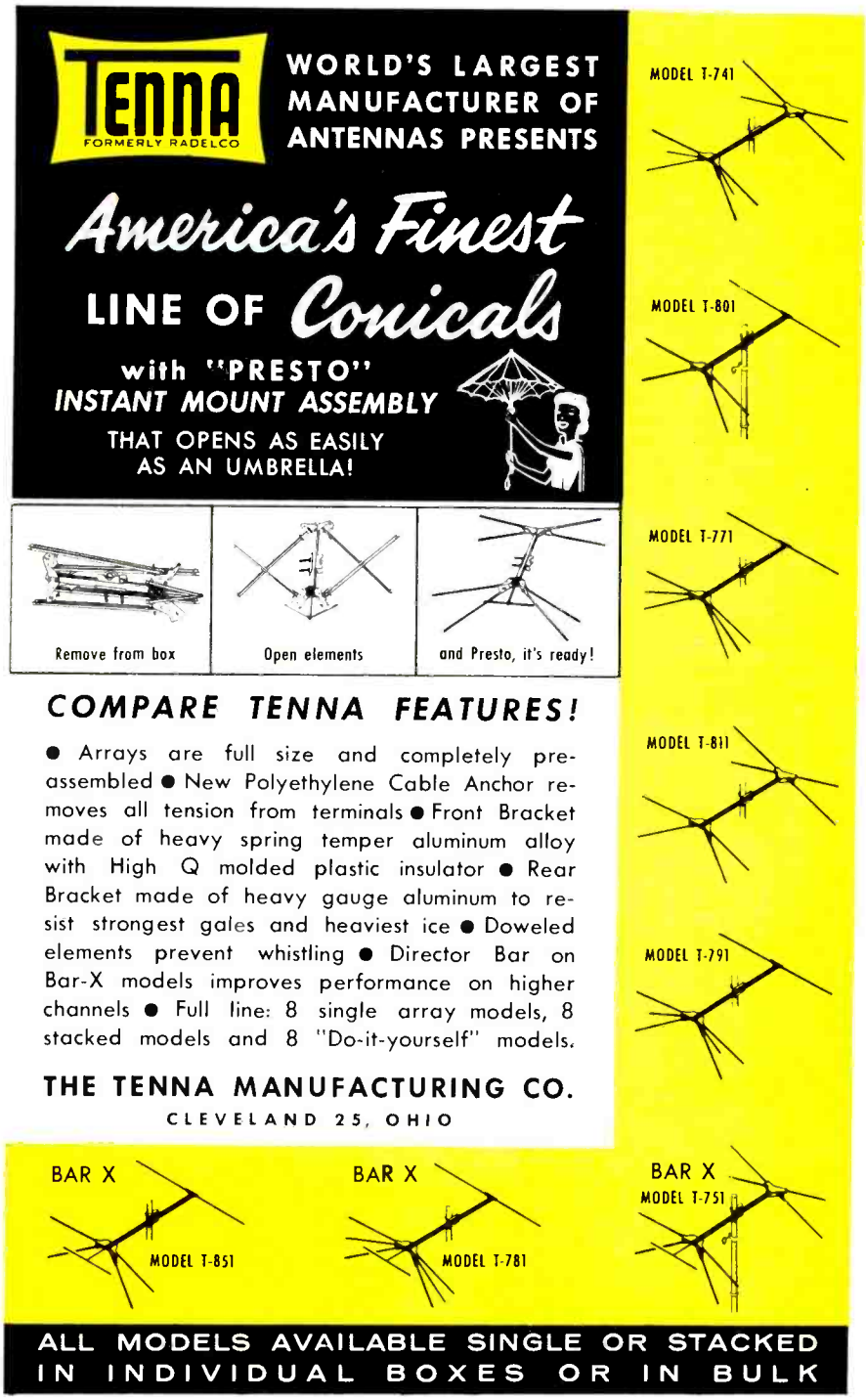
631 630-NA 630-A 310 630-T 666-HH 625-NA 666-R

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.



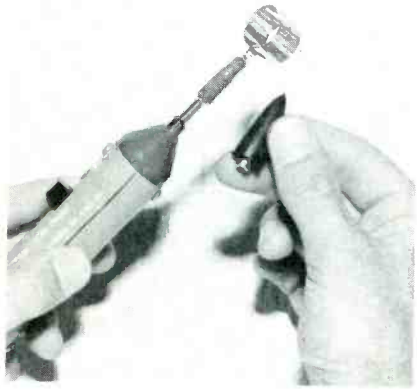


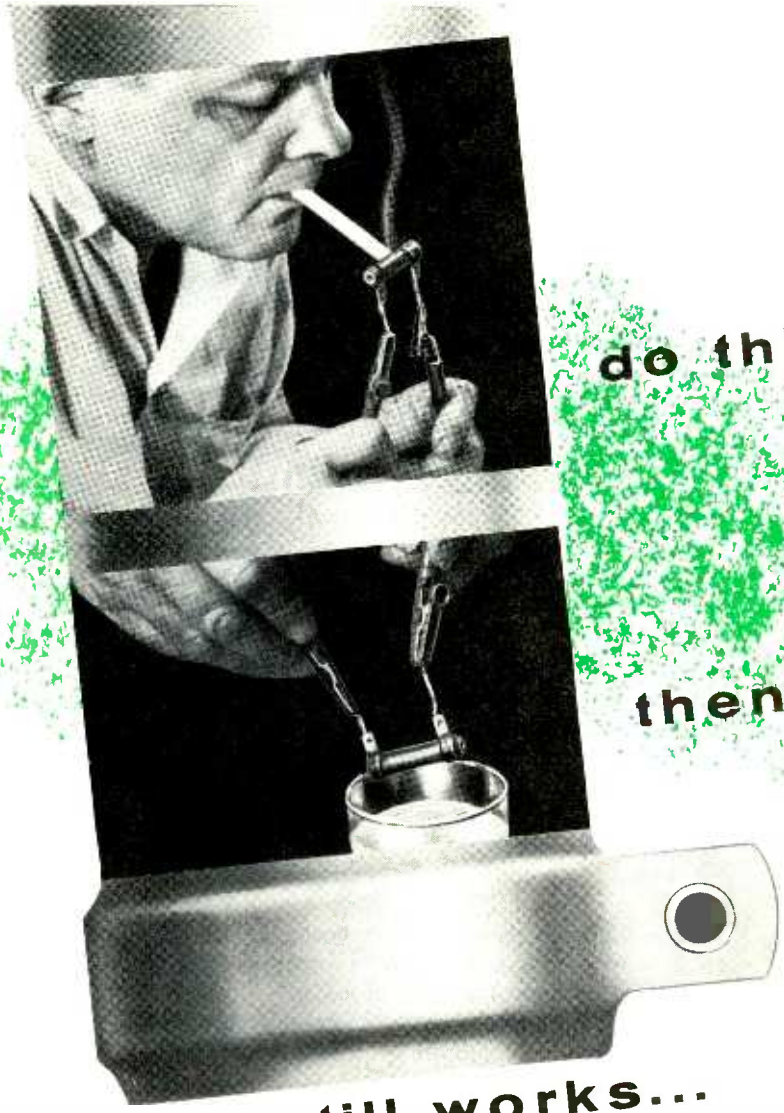
Fig. 2. Attachments for Win-Tronix intermittent probe pemit signal sampling without direct circuit contact.

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-



do this...

then this...

if it still works...

it's a **Greenohm***

WIRE-WOUND • CEMENT-COATED

POWER RESISTOR

Here's proof of the **BUILT-IN** dependability of every Clarostat **"Greenohm"** Power Resistor. Take a 200-ohm 10-watt **"Greenohm"** Resistor. Connect it across 110 v. line. Resistor will become hot enough to light a cigarette. Disconnect and plunge in water. Resistor will remain as good as new—no blisters, no cracks. You can count on **"Greenohm"** Cement-Coated Power Resistors for every application.

Your CLAROSTAT Distributor carries a Complete Stock (5- to 200-watt sizes) of "GREENOHM" Power Resistors!

*Reg. U.S. Pat. Off.

CLAROSTAT®

CONTROLS AND RESISTORS

CLAROSTAT MFG. CO., INC. • DOVER, NEW HAMPSHIRE, U. S. A.

In Canada: Canadian Marconi Co., Ltd., Toronto 17, Ont.

DO NOT BE ELECTROCUTED...

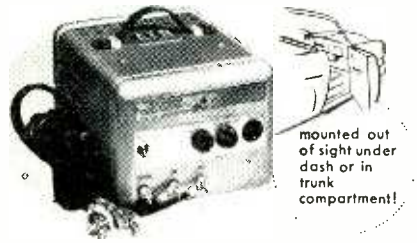
USE SAFE* A.C. POWER!

WITH ATR

UNIVERSAL (ATR 6U-RHG for 6 volts and 12U-RHG for 12 volts)

INVERTERS

for changing your storage battery current to A.C. HOUSEHOLD ELECTRICITY Anywhere . . . *in your own car!*

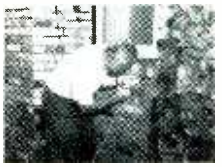


Especially designed for operating standard 110-volt A.C. ¼" Electric Drill,

also

- Electric Soldering Iron
- Electronic Test Equipment
- Electric Polisher
- Hand Vacuum Cleaner
- Portable TV Sets
- Tape Recorder
- PA Systems
- Electric Razors

ATR Inverter mounted in Car


Using Electric Drill

Soldering ground lead

Splicing antenna lead-in

Tape Recording details of call

*In many Cities, the use of commercial AC power for outside electric hand tools use is prohibited by law since AC line is grounded. ATR INVERTERS provide SAFE AC Power with no possible danger of being electrocuted.

SEE YOUR JOBBER OR WRITE FACTORY

√NEW MODELS "A" Battery Eliminators. √NEW DESIGNS DC-AC Inverters, √NEW LITERATURE Auto Radio Vibrators

ATR AMERICAN TELEVISION & RADIO CO.
Quality Products Since 1931
SAINT PAUL 1, MINNESOTA, U. S. A.

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

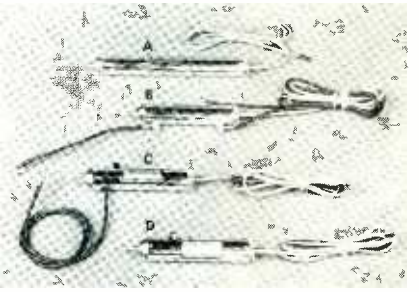


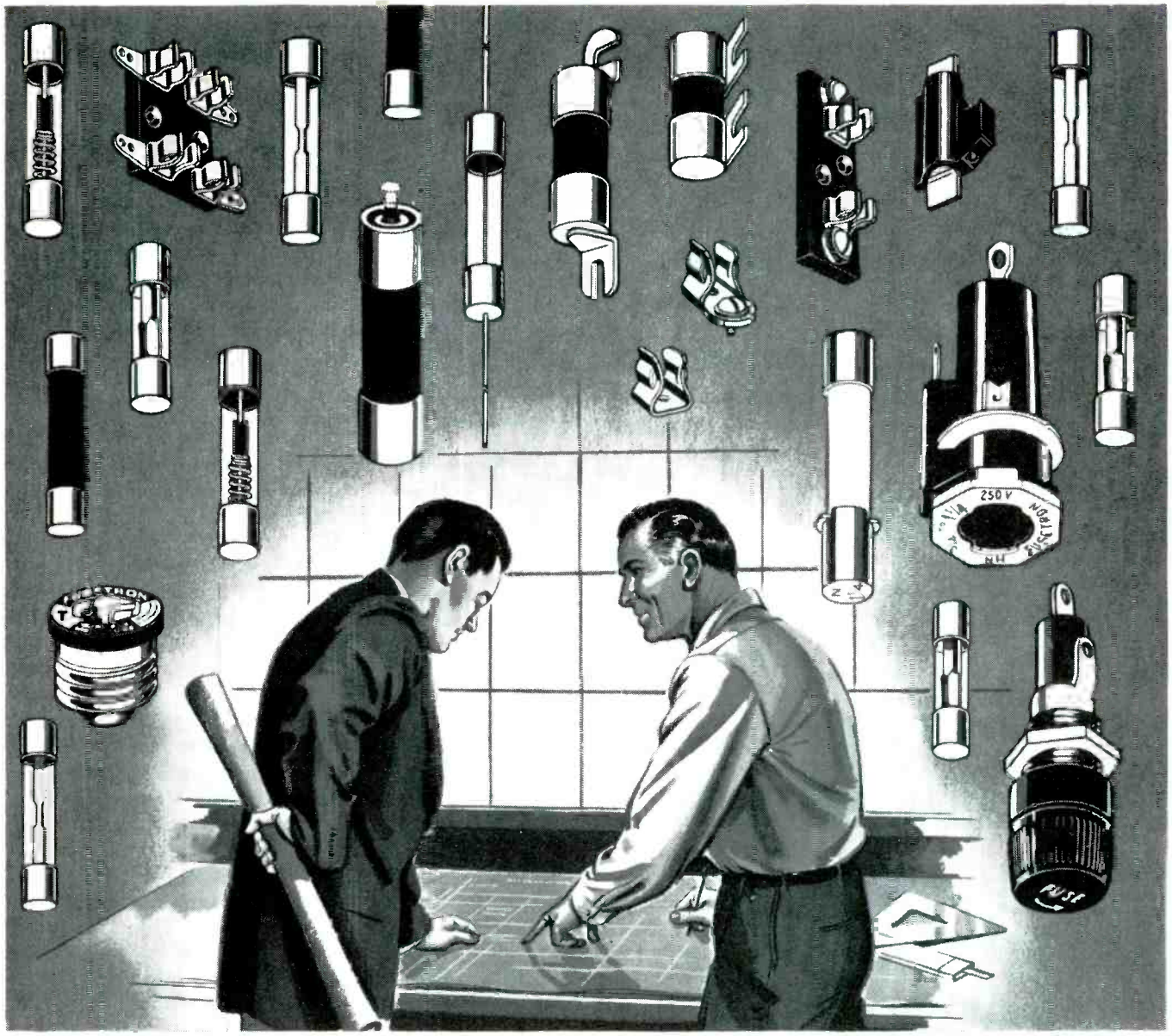
Fig. 3. Futuramic multimeter probes. (A) type 261, high-ohms probe; (B) type 262, signal-tracing probe; (C) type 263, polarity-reversing probe; and (D) type 264, range-splitter probe.

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-



Whenever You Want Dependable Electrical Protection

. . . BUSS FUSES ARE YOUR ANSWER!

Here's why . . With BUSS fuses, dependable electrical protection isn't left to chance. Every BUSS fuse is tested in a sensitive electronic device that automatically rejects any fuse not correctly calibrated, properly constructed and right in all physical dimensions.

The result — when an electrical fault occurs, BUSS fuses quickly clear the circuit and the danger of damage to equipment is held to a minimum. Yet, BUSS fuses won't cause needless shutdowns by blowing when trouble does not exist.

In sales, the dependability of BUSS fuses helps you avoid 'kicks' and complaints that the fuses you sold failed to protect or blew needlessly.

In service, by installing BUSS fuses you help prevent costly, unnecessary 'call-backs' because BUSS fuses operate properly under all service conditions.

With a complete line of fuses available to meet all your service needs, it is just good business to standardize on BUSS. They help protect both your good name and your profits.

For more information on BUSS and FUSETRON Small Dimension fuses and fuseholders . . . Write for bulletin SFB. Bussmann Mfg. Division (McGraw-Edison Co.) University at Jefferson, St. Louis 7, Mo.

BUSS fuses are made to protect – not to blow, needlessly

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

Makers of a complete line of fuses for home, farm, commercial, electronic, automotive and industrial use.

anchor

SANDY SAYS!
Tests and Repairs ALL CRT Tube Elements for Opens and Shorts.

New and Improved
REACTO-TESTER

Model T-401
Tests and repairs ALL picture tubes.

Only $39.95
with Case and Cover

FACTORY TESTED AND FULLY WARRANTED

TESTS FOR:
- Open Connections
- Open Elements
- Useful Life
- Shorted Elements
- Cathode Emission
- Gaseous Tube

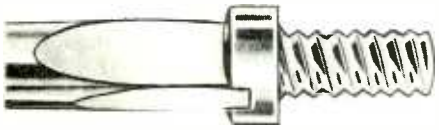
REPAIRS:
- Open Elements
- Corrects Shorts
- Reactivates Low Emission Tubes
- Restores Brightness

AT YOUR DISTRIBUTOR

anchor products co.
ELECTRONIC COMPONENTS
2712 W. Montrose • Chicago 18, Ill.

Grips the screw!
Drives it too!

Quick-Wedge
SCREW-HOLDING
SCREWDRIVER



2" to 14" blades, 4 bit sizes
Available with shockproof plastic covered tubing
Unconditionally guaranteed

ASK FOR IT AT YOUR DEALER
Kedman Co., 233 So. 5th W., Salt Lake City

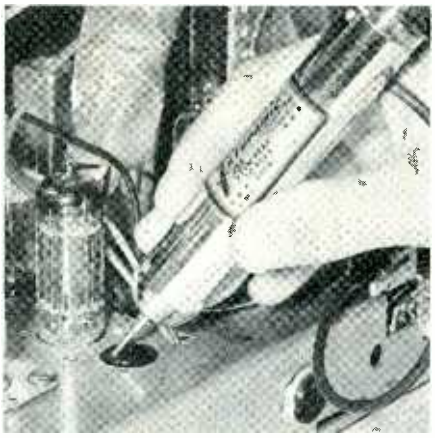


Fig. 4. Futuramic's type 268 is used with VTVM to measure peak-to-peak signals.

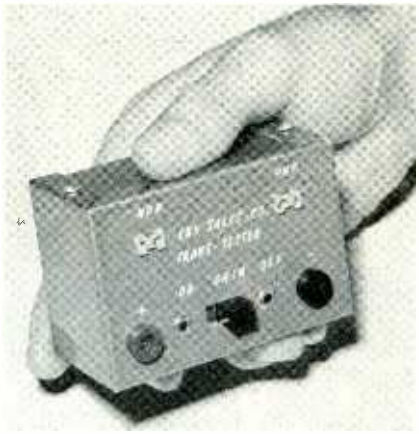


Fig. 5. Eby's new Trans-Tester converts milliammeter to transistor checker.

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-

Your Independent Service Advertising Program expands with your purchases of CBS tubes

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

This family cook is your independent service-dealer. He's that busy neighbor who somehow finds time to be scoutmaster of his son's troop. He has his radio and TV service business in your town . . . and he knows he'll stay in business there only as long as he does superior work. In fact, when he works for you, he bets his family's bread and butter he'll do a better job . . . and he will.

for your radio and TV repairs, call the man who cares... your INDEPENDENT SERVICE-DEALER

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

He is a highly skilled technician, trained and equipped to service promptly *all makes* of radio and TV sets at a fair price. So next time your radio or TV needs repairs, call the man who cares. Call your *independent* service-dealer.

Look for this emblem . . .

Whenever your set needs a new tube, ask to have it replaced with a CBS tube. There are no better tubes made.

For the best in entertainment tune to CBS.

©CBS-HYTRON, Danvers, Mass.
A Division of Columbia Broadcasting System, Inc.

We know you like your Independent Service Program and want it expanded. We know it from a nation-wide survey . . . and from your increasing purchases of CBS tubes. May we remind you: each time you buy CBS tubes, you support your own independent service-dealer campaign. Keep it going . . . keep it growing . . . always specify CBS tubes.

SUPPORTING MATERIAL ALSO EXPANDS

- "The Independent Service Business and Your Future" booklet
- Independent Service decal
- 10 new postal cards
- 16 new advertising mats
- Radio and television scripts
- Consumer booklet "On the Care of a Television Set"

Ask your CBS Tube distributor for this tie-in material . . . or write for illustrated broadside PA-181.

CBS-HYTRON—Danvers, Massachusetts
A Division of
Columbia Broadcasting System, Inc.

FOR THE BEST IN ENTERTAINMENT TUNE TO CBS

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. ▲

SPECIALLY PRICED DURING OCTOBER

TIMED RIGHT FOR YOUR BIG TV SERVICE SEASON!

NEW ACTIVATED FORMULA

No. 8666X

G-C SPRA-KLEEN

2 CANS FOR $1.89 DEALER NET

VALUE $2.40

special this month

2 CANS $1.89

SEE YOUR G-C JOBBER NOW!

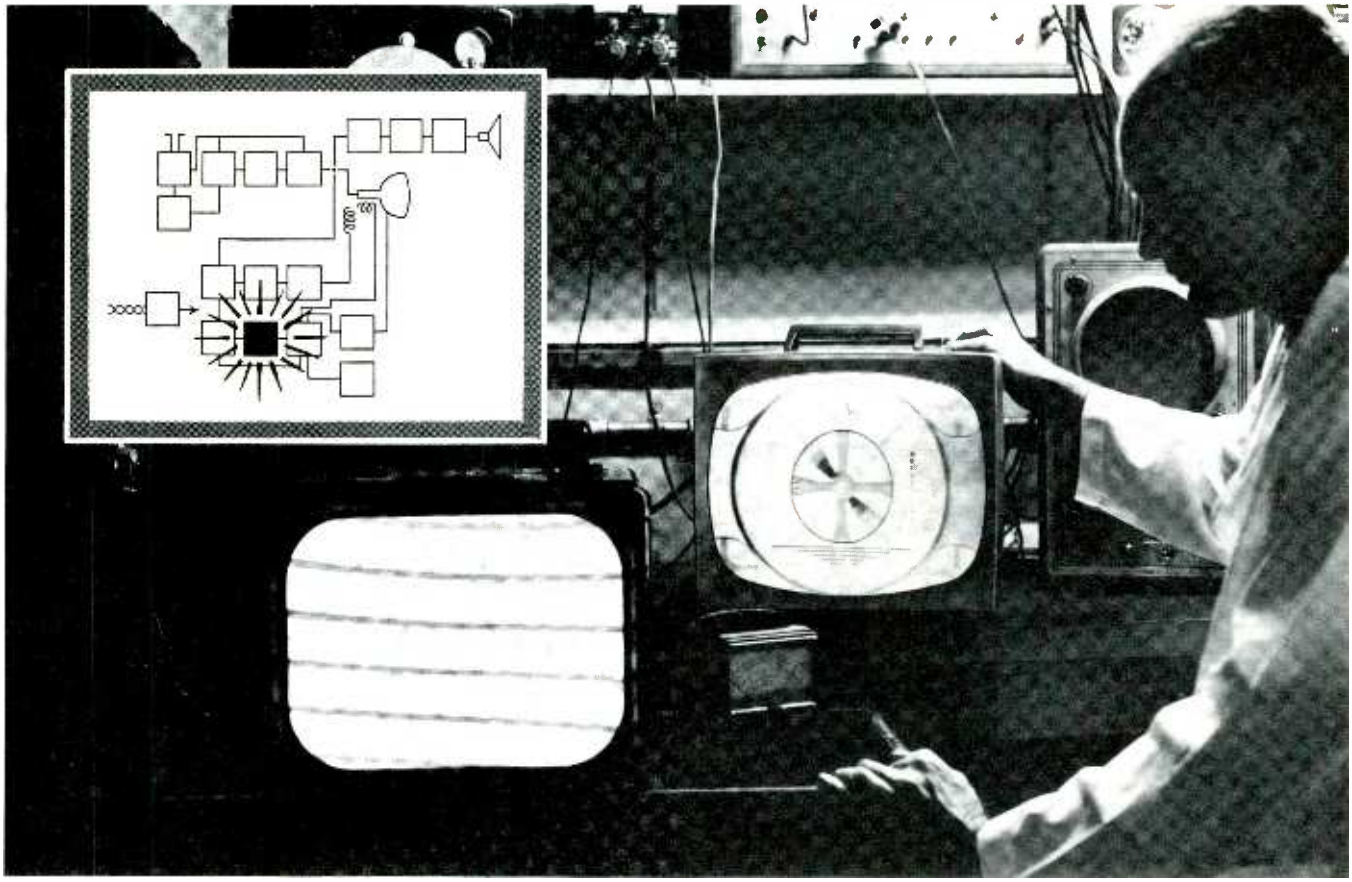
NOW, WHEN YOU NEED IT, is the time to stock up on G-C SPRA-KLEEN . . . the easy-to-use electrical contact cleaner and lubricant in the power spray can. Brushless, clean, convenient . . . SPRA-KLEEN makes servicing easier. Buy now and save during this special sale!

FREE G-C CATALOG... send postcard today!

GENERAL CEMENT MFG. CO.

Division of Textron Inc.

400 SOUTH WYMAN STREET ROCKFORD, ILLINOIS



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.*

Progress Is Our Most Important Product

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.

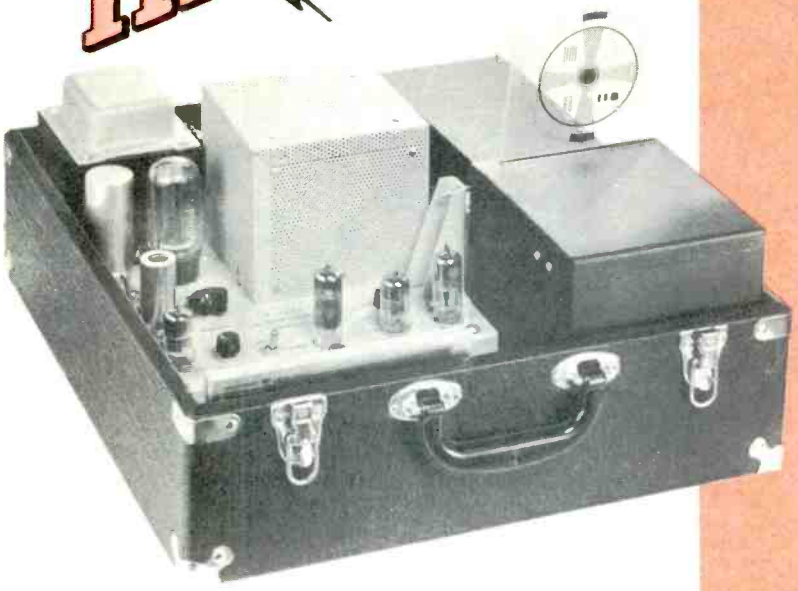
$ & ¢

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

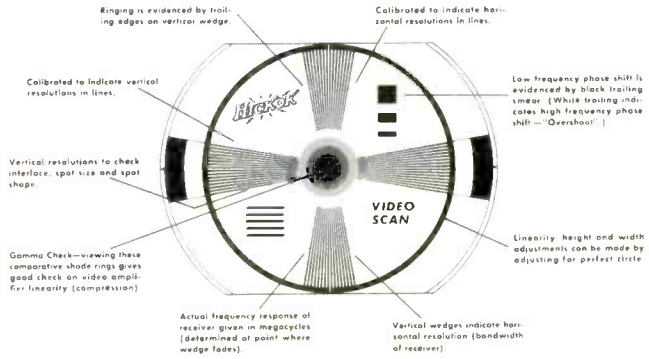
This extremely stable and versatile TV trouble shooter has many uses in TV service. It features innumerable signals and displays normally not available to the TV technician. The 760 will instantly scan and produce a video or RF signal for any slide that is inserted into the unit.

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.

* 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:



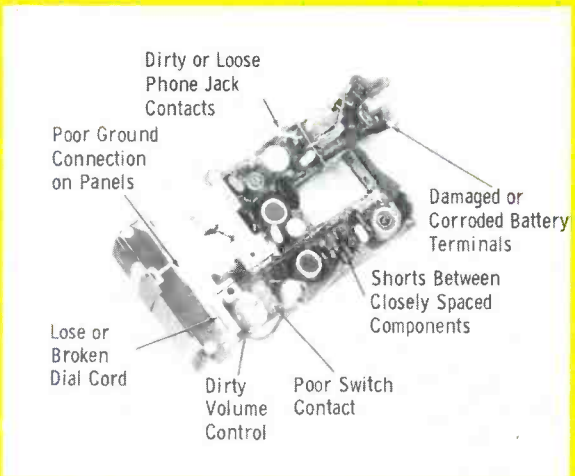
THE HICKOK ELECTRICAL INSTRUMENT COMPANY

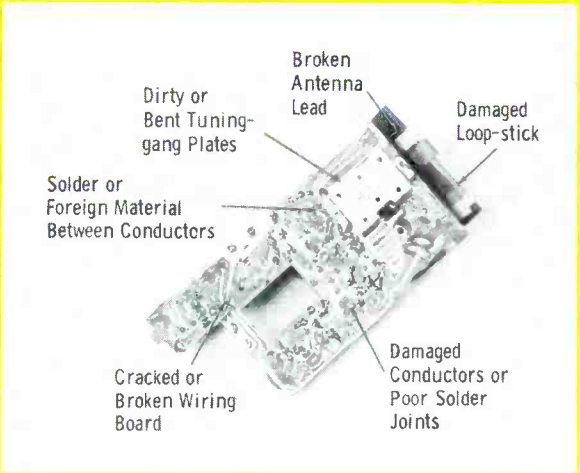
10566 Dupont Avenue • Cleveland 8, Ohio

Stark Electronic Sales Co., P.O. Box 2407, Ajax, Ontario, Canada

Export Department, 431 Fifth Avenue, New York 16, N. Y.

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.

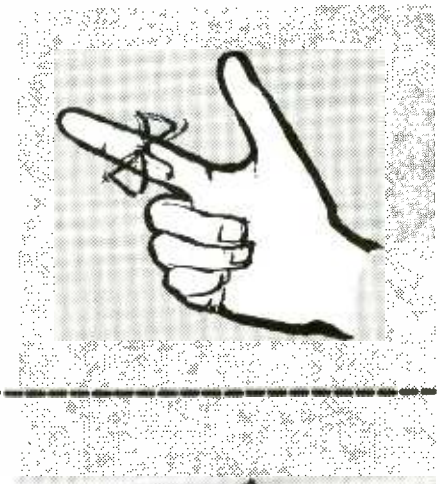
Visual Inspection

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.

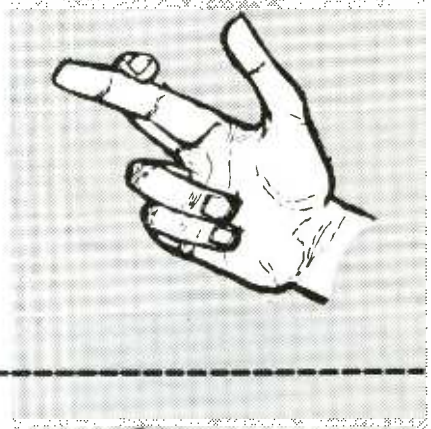
Fig. 2. A needle-point probe is ideal for transistor-radio testing.

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

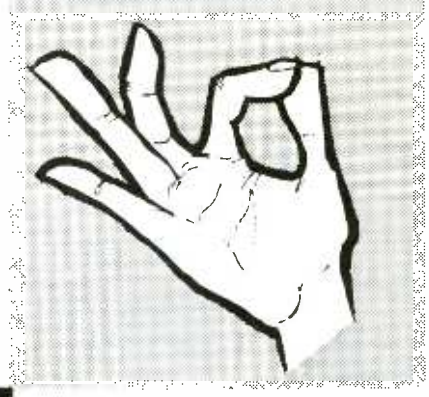
REMEMBER...
when you
SPECIFY STANCOR



YOU WON'T HAVE
TO DO THIS...



because
YOUR CUSTOMERS
WILL DO THIS



STANCOR
TRANSFORMERS
are available at better distributors everywhere

free!

The latest up-to-date Stancor TV Transformer Replacement Guide and Catalog—from your distributor or write us for your copy.

CHICAGO STANDARD TRANSFORMER CORPORATION
3503 ADDISON STREET • CHICAGO 18, ILLINOIS
Export Sales: Roburn Agencies, Inc., 431 Greenwich St., New York 13, N.Y.

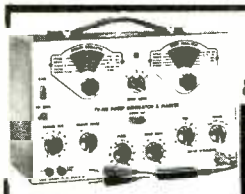
the specs are the proof . . .
the BEST BUYS are EICO
for COLOR & Monochrome TV servicing

NEW COLOR and Monochrome DC to 5 MC LAB & TV 5" OSCILLOSCOPE

#460 Factory-wired and tested $129.50
Also available as kit $79.95

• Features DC Amplifiers!

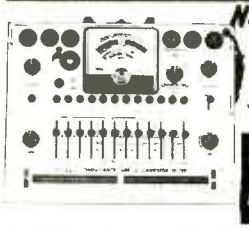
Flat from DC-4.5 mc, usable to 10 mc. VERT. AMPL.: sens. 25 rms mv/in; input Z 3 megs; direct-coupled & push-pull thruout; K-follower coupling bet. stages; 4-step freq-compensated attenuator up to 1000:1. SWEEP: perfectly linear 10 cps-100 kc (ext. cap. for range to 1 cps); pre-set TV V & H positions (30 & 7875 cps); auto. sync. ampl. & lim. PLUS: direct or cap. coupling; bal. or unbal. inputs; edge-lit engraved lucite graph screen; dimmer; filter; bezel fits std photo equipt. High intensity trace CRT. 0.06 usec rise time. Push-pull hor. ampl., flat to 400 kc, sens. 0.6 rms mv/in. Built-in volt. calib. Z-axis mod. Sawtooth & 60 cps outputs. Astig. control. Retrace blanking. Phasing control.



NEW TV-FM SWEEP GENERATOR & MARKER

#368 Factory-wired and tested $119.95
Also available as kit $69.95

Entirely electronic sweep circuit (no mechanical devices) with accurately-biased increductor for excellent linearity. Extremely flat RF output: new AGC circuit automatically adjusts osc. for max. output on each band with min. ampl. variations. Exceptional accuracy: edge-lit hairlines elim. parallax. Swept Osc. Range 3-216 mc in 5 fund. bands. Variable Marker Range 2-75 mc in 3 fund. bands; 60-225 mc on harmonic band. 4.5 mc Xtal Marker Osc., xtal supplied. Ext. Marker provision. Sweep Width 0-3 mc lowest max. deviation to 0-30 mc highest max. dev. 2-way blanking. Narrow range phasing. Attenuators: Marker Size, RF Fine, RF Coarse (4-step decade). Cables: output, 'scope horiz., 'scope vertical.



NEW DYNAMIC CONDUCTANCE Tube & Transistor Tester

#666 Factory-wired and tested $109.95
Also available as kit $69.95

COMPLETE with steel cover and handle.

SPEED, ease, unexcelled accuracy and thoroughness. Tests all receiving tubes (and picture tubes with adapter). Composite indication of Gm, Gp & peak emission. Simultaneous sel of any 1 of 4 combinations of 3 plate voltages, 3 screen voltages, 3 ranges of continuously variable grid voltage (with 5% accurate pot). New series-string voltages: for 600, 450, 300 ma types. Sensitive 200 ua meter. 5 ranges meter sensitivity (1% shunts & 5% pot). 10 SIX-position lever switches: free-point connection of each tube pin. 10 pushbuttons: rapid insert of any tube element in leakage test circuit & speedy sel. of individual sections of multi-section tubes in merit tests. Direct-reading of inter-element leakage in ohms. New gear-driven rollchart. Checks n-p-n & p-n-p transistors: separate meter readings of collector leakage current & Beta using internal dc power supply. CRA Adapter $4.50

See the 50 EICO models IN STOCK at your neighborhood distributor. Write for FREE Catalog PF-10

Prices 5% higher on West Coast

EICO® 33-00 Northern Blvd. Long Island City 1, N.Y.

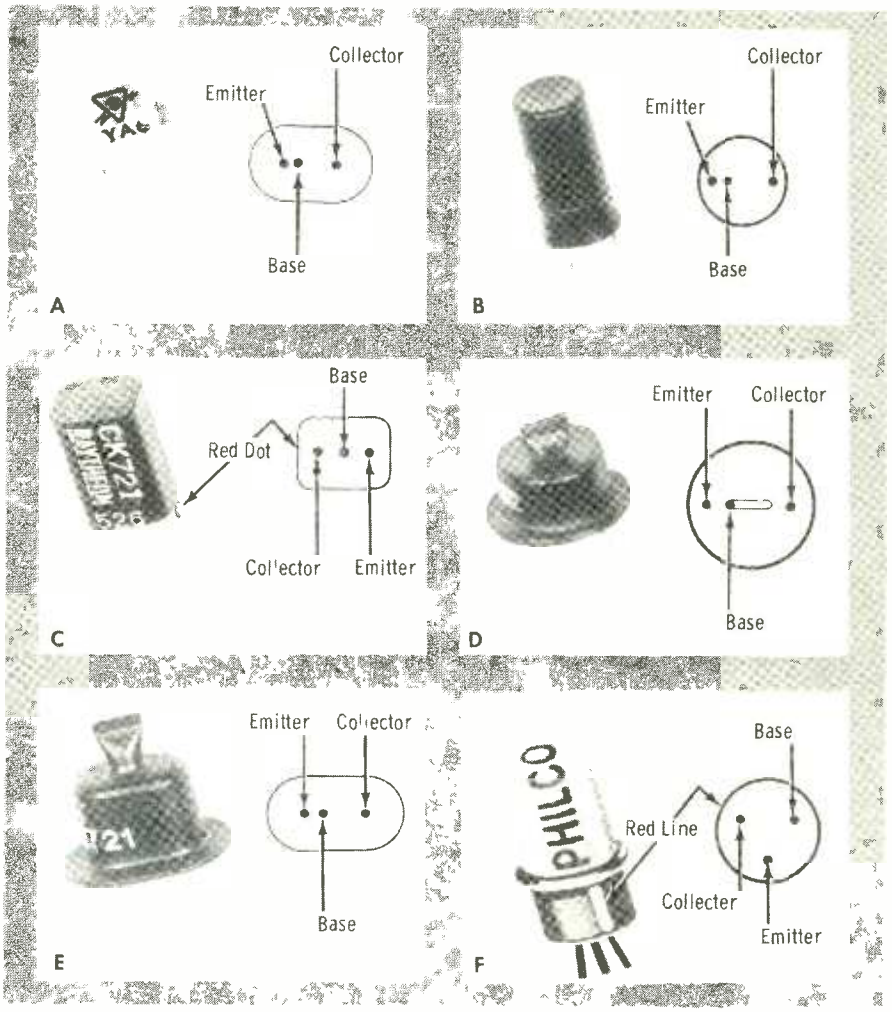


Fig. 3. Element connections for common portable-radio transistors.

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.

Although conventional multi-

SC57-9

BUILD STABILITY and LONG LIFE into your low voltage power supplies

with SANGAMO Type DCM Electrolytic Capacitors

These high quality electrolytic capacitors are especially designed for use as energy storage components in DC circuitry where peak power requirements exceed the maximum output of the associated power supply.

Sangamo Type DCM Capacitors provide exceptionally low equivalent series resistance . . . have extremely high capacity for case size in low voltage ranges . . . are designed to permit high ripple current without overheating. They minimize ripple voltage and insure steady, stable DC voltage. Use of the Sangamo DCM eliminates any need for heavy, bulky choke components.

Type DCM Capacitors can be supplied in maximum energy content rating of 80-watt seconds in voltage ratings from 15 to 450 VDC. Maximum capacity value of 33,000 mfds. can be supplied at 15 WVDC.

Write for Engineering Bulletin TSC-114C.

CAPACITY CHART

Rated Voltage	Surge Voltage	Max. Cap. 1⅜ x 4⅛	Max. Cap. 1¾ x 4⅛	Max. Cap. 2 x 4⅛	Max. Cap. 2½ x 4⅛	Max. Cap. 3 x 4⅛
5	7	8500	15000	20000	33000	45000
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
400	475	140	250	325	575	850
450	525	125	225	275	500	800

For additional capacity and voltage combinations, write us.

SANGAMO Electric Company

SPRINGFIELD, ILLINOIS

it's SELL SEASON!

with AMPHENOL Color COUPLERS!

Fall is the season for selling—and AMPHENOL'S new Color-Couplers are profitable selling items! Connecting two, three or four TV sets to one antenna system, Color-Couplers work with flawless efficiency – effective isolation, low loss and properly matched impedances for clear, bright pictures. Flat signal response makes them tops for color and equally good for Black & White TV—can be used with FM radio, too.

114-097	Two Set Color-Coupler	$2.95 List
114-098	Three Set Color-Coupler	3.95 List
114-099	Four Set Color-Coupler	4.95 List

FREE COUNTER-TOP DISPLAY

An attractive, 3 color display comes free with Color-Couplers at a special introductory price. On your counter, this display will not only catch the eye—it will catch the sale, too!

ADDITIONAL SELLING FEATURES

- Super-reliable Resistive Network
- Built in Strain Relief for Twin Lead
- Decorator Colors—Grey or Cocoa
- Two-way Mounting, Indoors or Out
- Modern Design; Tough, Weatherproof Case

see your AMPHENOL *Distributor—today!*

AMPHENOL ELECTRONICS CORPORATION *chicago 50, illinois*

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 trouble-shooting 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,

20,000 HOURS!

...and still going strong

103 Locked TV "Torture Tests" Prove Westinghouse Tubes Last Longer, Cut Call-Backs!

More than words, this picture proves the superior *quality* of Westinghouse RELIATRON® Tubes. "Torture tested" coast-to-coast in full view in distributor showrooms, 103 standard make TV sets with RELIATRON Tubes are making history! All sets are chained and padlocked. One of these sets has already run an incredible 20,000 hours . . . more than 13 years' average viewing time . . . and still going strong!

All sets tested are exactly like those owned by your customers—with one important difference. They're equipped with Westinghouse RELIATRON Tubes—the most reliable, most profitable tubes you can sell—bar none!

But see it to believe it! Stop by your Westinghouse Tube Distributor's today and watch famous "Locked TV" roll up even more hours—in the most strenuous TV performance test ever! Your best proof that you *profit much more* when you sell Westinghouse RELIATRON Tubes.

YOU CAN BE SURE...IF IT'S Westinghouse

Electronic Tube Division Elmira, New York

SAMS "BEST SELLER" BOOKS

FOR THE TECHNICIAN • STUDENT EXPERIMENTER • HOBBYIST

USE THIS HANDY ORDER FORM

☐ **Pinpoint TV Troubles in 10 Minutes.** Amazingly practical procedures for solving TV troubles. Includes over 50 time-saving check charts, dozens of diagrams and test Methods, circuit explanations, etc.—a real timesaver for TV repairs. 299 pages; 5½ x 8½"; fully illustrated. Only **$3.95**

☐ **TV Servicing Guide.** Quick reference guide for Technicians. Trouble symptoms are illustrated by picture tube screen photos and proper repair procedures are clearly described. Covers all sections of the TV circuit. 132 pages; 8½ x 11"; illust. Only **$2.00**

☐ **Tape Recorders.** Explains recorder theory, tape characteristics, how recorders work; covers motorboard mechanisms, drive motors, volume indicators, bias oscillators, amplifiers, magnetic heads, equalization circuits. 176 pages; 5½ x 8½"; illust. Only **$2.75**

☐ **Transistor Circuit Handbook.** The authoritative book on transistor types, construction, characteristics, applications, circuitry, techniques for wiring and testing. Covers every phase of the subject. 430 pages; 6 x 9"; illust. Only **$4.95**

☐ **Hi-Fi Handbook.** Invaluable data on Hi-Fi design, selection and installation, including fidelity, sound theory, analysis of all components (speakers, enclosures, amplifiers, tuners, etc.), systems design, proper selection and installation. 240 pages; 5½ x 8½"; illust. Only **$3.00**

☐ **Servicing AGC Systems.** Describes operation and circuit variations of AGC systems; explains applicable servicing techniques. Illustrated by actual case histories and photos of symptoms. 132 pages; 5½ x 8½"; illust. Only **$1.75**

☐ **Learning Electricity Fundamentals.** The complete, fascinating story of electricity: history, electron theory, static electricity, uses of switches and fuses, resistance, Ohm's Law, magnetism, electro-magnetism, transformers, generators and motors, circuits and controls, practical wiring, etc. 416 pages; 6 x 9"; illust. Only **$5.95**

☐ **Transistors.** A very practical, complete book on Transistors and their application in TV-Radio-Electronics. Explains theory, circuitry, installation, testing techniques and servicing. 100 pages; 5½ x 8½"; illust. Only **$1.50**

☐ **Color Television.** An outstanding training course for Technicians. Covers principles of the color TV system; color receiver circuits; installation and servicing of color receivers. Includes color blocks outlining use of color test equipment. 260 pages; 8½ x 11"; profusely illustrated. Only **$6.95**

☐ **Electronic Metal Locators.** Explains basic types and their operation; tells how to construct your own units; describes applications. Covers interesting uses in industry as well as in prospecting and mine location. 124 pages; 5½ x 8½"; illust. Only **$2.50**

HOWARD W. SAMS & CO., INC.

Order from your Parts Jobber, or mail to Howard W. Sams & Co., Dept. 3 K7 2201 E. 46th St., Indianapolis 5, Ind.

Send books checked above. My (check) (money order) for $..... is enclosed.

Name _____

Address _____

City _____ Zone _____ State _____

(outside U.S.A. priced slightly higher)

and the emitter lead is closest to the uncoded side of the transistor.

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.

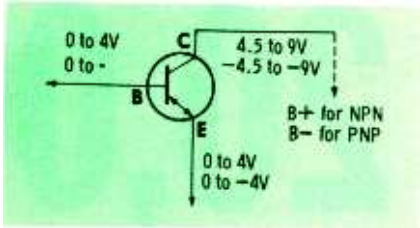


Fig. 4. Typical DC voltages for converter, IF, and some audio circuits.

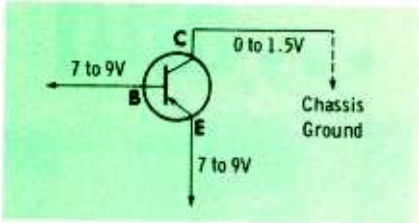


Fig. 5. Operating voltages for a conventional p-n-p audio stage.

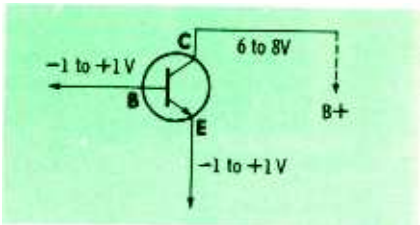


Fig. 6. Typical voltages for audio circuits employing n-p-n type transistors.

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

$169.95 Net

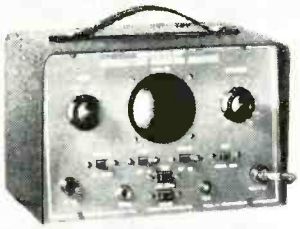
INDUCED WAVEFORM ANALYZER

MODEL 850

Top-O'-Chassis Troubleshooting . . . greatest servicing advance in years!

Perfect for Portable TV

Localizes defective stage in entire TV receiver in less than 5 minutes—*without* a direct circuit connection. Adapts any 'scope for spotting defects quickly by the modern, easy-to-use Induced Waveform Method. Unique, *Phantom Detector Probe* makes any tube a convenient test point. Just slip probe successively over each tube, then view and trace waveforms on scope from antenna thru RF, IF, audio, video & sync. Speeds servicing of TV, radios, amplifiers, instruments, industrial and laboratory equipment tool Compatible for color. Phone jack for audio monitoring.



$89.95 Net

INTERMITTENT CONDITION ANALYZER

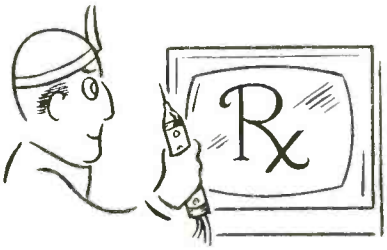
MODEL 828

Pinpoints Intermittents without waiting...cooking...or freezing.

Exclusive new principle makes any TV or radio super-sensitive to intermittents and noisy components . . . without waiting for breakdowns. Saves time and bench space. Cuts callbacks by detecting borderline components before they fail. Special Wintronix Probe and capacity pickup attachments let you *hear* intermittents thru built-in speaker.

Wintronix ANALYZERS

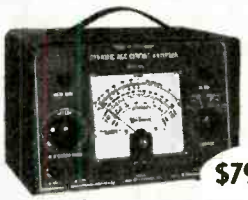
Electronic "Wonder Drugs" for Troubleshooting Pains



Here are the instruments you need to diagnose ailments fast and profitably in today's complicated–often inaccessible–TV, radio & hi-fi sets.

These four Wintronix *Analyzers* swiftly turn wasted trouble-shooting time into profitable parts replacement time on more and more jobs. Obscure radio and TV faults get tracked down fast by Winston's specialized reference signals and measurements. Like X-rays, they quickly give a complete picture of circuit operation—at far lower cost, with fewer circuit connections, and with less set-up time than with separate conventional instruments.

Today, issue a prescription to yourself for a healthier servicing business—see and try these new Wintronix *Analyzers* at your local parts distributor or write for detailed literature.



$79.95 Net

AGC CIRCUIT ANALYZER

MODEL 825

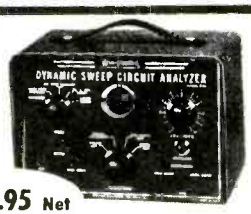
AGC Troubles Won't Fool You Any More!

Saves hours by detecting hard-to-find AGC faults that may look like sync trouble, etc. Furnishes standard, adjustable r-f signal to antenna; monitors AGC action; checks AGC buss for opens and shorts; measures action of gated pulse systems; supplies AGC bias to restore operation by substitution.

SWEEP CIRCUIT ANALYZER

MODEL 820

Rapid, Dynamic Sweep Testing



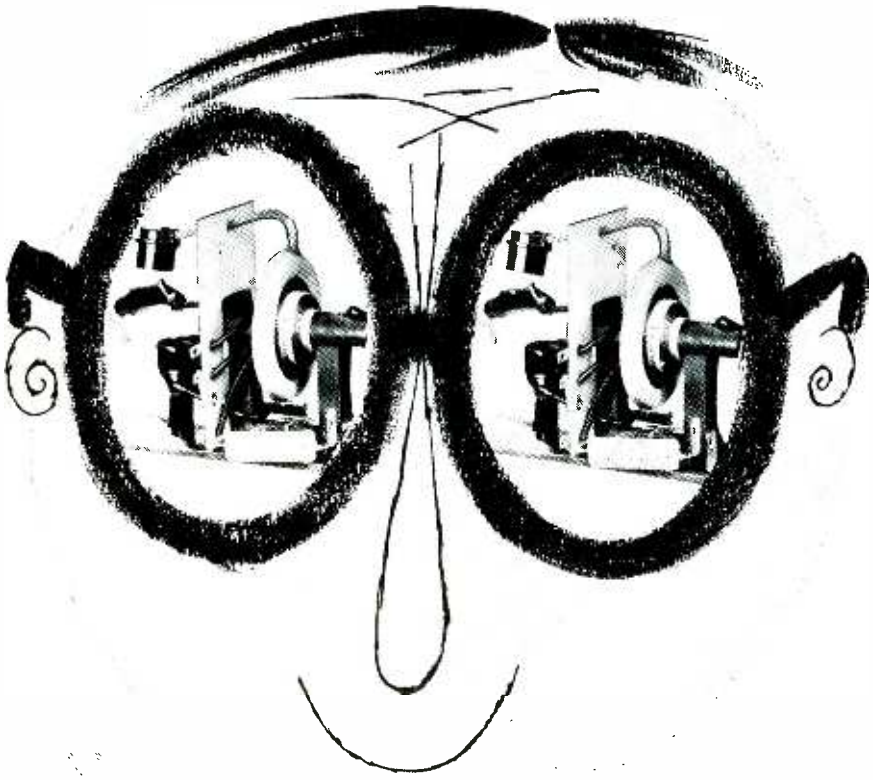
$69.95 Net

Completely troubleshoots entire sweep circuits and restores raster by substituting for defective stage. Tests all flybacks and yokes for continuity and shorts. Self-calibrating. Compatible for color.

Model 915/960 Adapter converts Model 820 to a Sync Circuit Analyzer for signal substitution of vertical and horizontal sync pulses. **$14.95 Net**

WINSTON ELECTRONICS INC.

4312 Main Street, Philadelphia 27, Pa.



Seeing Double?

SURE . . . THEY LOOK ALIKE BECAUSE THEY ARE EXACTLY ALIKE

Each Merit product of the same type is exactly the same as another—both in construction and appearance.

COMPARE IT WITH MERIT

Take a Merit product off the shelf. Compare it with any other similar product on the market. You'll find Merit *is* superior!

COMPARE IT WITH MERIT

Only Merit live tests its products to insure uniform quality.

Merit

MERIT

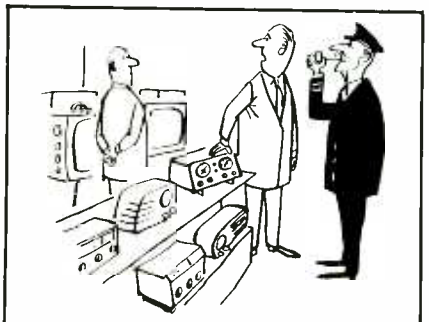
MERIT COIL AND TRANSFORMER CORP
4427 North Clark Street · Chicago 40, Illinois

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



"AL, WILL THIS CLOCK-RADIO OPERATE A LIGHTHOUSE BEACON?"