



RADIO AND TELEVISION

# Service News

A PUBLICATION OF RCA ELECTRONIC COMPONENTS AND DEVICES

*In this issue*

## *Perma-Chrome*



*... What it is  
... How it works  
... What it does  
for you*

SUMMER  
1966

Vol. 31, No. 1

See Special Color Supplement Facing Page 12

# NATESA Award Honors RCA for 'Outstanding' Action In Promoting Status of Independent Service-Dealer

Repeating last year's notable achievement, the RCA Sales Corporation and the Distributor Products organization of RCA Electronic Components and Devices again have been honored with special awards from the National Alliance of Television & Electronic Service Associations (NATESA).

For RCA Electronic Components and Devices, this year's presentation marks the fourth award in a row. Designated the "Friends of Service Management Award," this testimonial is conferred in recognition of outstanding

activities to improve public relations and acceptance of the contributions of independent dealers and technicians toward better service and performance of home electronic devices.

Awards were presented during the NATESA Spring Directors Conference in St. Louis.

Jack K. Sauter, Vice President in Charge of Product Planning and Development, RCA Sales Corporation, received the handsome, bronze-and-wood plaque from Arthur Nelson, Jr., Secretary of NATESA's East Central Region. Representing RCA Electronic Components and Devices at the Conference was Joseph A. Haimes, Manager, Distributor Sales, who received the plaque from O. L. Dell, Vice President of NATESA's West Central Region.

The National Alliance of Television & Electronic Service Associations is composed of service-dealers and technicians primarily engaged in the maintenance of home-entertainment electronic devices. "Friends of Service" awards are presented annually to those manufacturers who, during the course of the year, make noteworthy contributions towards promoting the status of the independent service technician.



Presentation of NATESA's "Friends of Service" award to RCA Electronic Components and Devices was made by O. L. Dell, left, Vice President of the Association's West Central Region. Holding plaque is Joseph A. Haimes, Manager, Distributor Sales, RCA Electronic Components and Devices. Award marks fourth straight testimonial received by the RCA Distributor Sales organization.



## WR-50B(K) Includes Latest Sweep Features

# RCA's Popular RF Signal Generator Now Available in Kit Form

Do you enjoy the fun, challenge, economy, and personal fulfillment of assembling your own electronic test instruments?

If so, you'll be happy to learn that RCA's widely renowned WR-50B RF Signal Generator is now being offered in kit version.

Including all the advantages of the WR-50B factory-wired-and-calibrated instrument, the WR-50B(K) similarly features a sweep output at 10.7 megahertz with return trace blanking for sweep alignment of FM receivers; and a sweep output at 455 kilohertz with return trace blanking for sweep align-

ment of AM receivers. Among its numerous other outstanding features are a wide frequency range — continuous coverage 85 kHz to 40 MHz in six overlapping ranges; a built-in crystal calibrating oscillator circuit with front-panel crystal socket; and an internal 400-Hz audio oscillator.

Highly versatile and readily portable, the multi-purpose WR-50B(K) RF Signal Generator is designed primarily for use in the shop or in the field for general television and radio servicing as well as other applications which require a continuous-wave or modulated RF sine-wave signal from 85 kHz

**RCA** RADIO AND TELEVISION  
*Service News*  
A PUBLICATION OF RCA ELECTRONIC COMPONENTS AND DEVICES

RCA RADIO & TELEVISION SERVICE NEWS is published in the interest of dealers and service technicians. It is written to assist them in providing better service, and to foster the growth of their business by supplying them with information on the latest troubleshooting and sales promotion techniques, sales and service aids, together with invaluable data on RCA tubes, transistors, batteries, and electronic instruments.

SUMMER 1966

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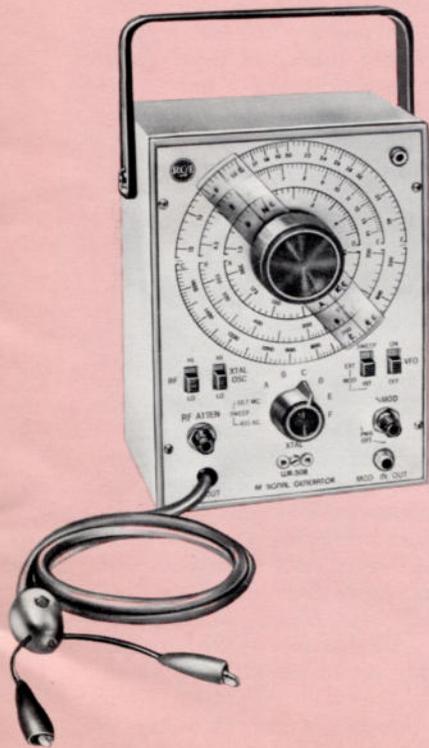
to 40 MHz. The unit is particularly well suited for such applications as alignment and signal tracing of AM, FM, High-Fidelity and Citizens'-Band receivers; alignment of low-frequency IF amplifiers in television receivers; and signal tracing and troubleshooting in nearly all sections of television receivers.

The 455 kHz and 10.7 MHz sweep positions make the WR-50B particularly useful for sweep alignment of both AM and FM receivers, especially since the introduction of several new AM-FM transistor radios in which sweep alignment of both circuits is a recommended service procedure.

As mentioned above, the variable oscillator covers the fundamental frequencies from 85 kHz to 40 MHz in six ranges. For higher frequencies, harmonics of the high range can be used. A tuning control permits precise setting of the output frequency. The RF output can be modulated with the internal 400-Hz oscillator, or with an external audio signal. The modulation level is adjustable.

The range switch and the tuned-circuit coils and trimmers are completely pre-assembled, pre-wired, and pre-tuned.

*Assembled WR-50B(K) RF Signal Generator measures only 4 $\frac{3}{4}$  inches by 5 $\frac{3}{8}$  inches by 7 $\frac{3}{4}$  inches. Generator includes a shielded RF output cable to minimize radiation and hum pick-up. A phono-type panel jack is provided for AF input/output.*



## A Cool H.O.T.\* Means Longer Life



### \*Horizontal Output Tube

The horizontal output tube as employed in color television sets requires very high efficiency from this tube. In this type of high-efficiency circuit, the plate dissipation of the tube rises to 8-to-10 times normal if drive is removed from the horizontal

output tube. Under a "no-drive" condition, the horizontal output tube may become permanently damaged in 10 or 20 seconds.

In view of the above, the service technician is urged to pay special heed to the following "Don'ts":

**DON'T** remove the horizontal oscillator tube with power applied to the color-TV receiver.

**DON'T** turn the set back on immediately after replacing the horizontal oscillator tube. The oscillator tube is cold and, in the time required for it to heat up, the output tube can be damaged. (The oscillator tube can also be heated up in a tube checker.)

**DON'T** reapply power until the horizontal output tube has cooled.

**DON'T** short out any overload devices or fuses. Quick-acting protective devices are the best protection for the horizontal output tube.

**DON'T** remove the horizontal output tube plate-cap to protect the tube or to kill the high voltage. Screen-grid and/or screen-grid circuit component damage may result.

**DON'T** forget to adjust the efficiency coil according to the manufacturer's instructions whenever the horizontal output tube is replaced (see manufacturer's service data and adjust to recommended cathode current).

## Practical Items From RCA Geared to Lighten TV Servicing

In the fast-moving television servicing business — where minutes often prove vital — having “the right tool for the right job” can sometimes spell the difference between realizing a fair profit or a meager profit. Included in the over-all equipment requirement, of course, are the less sophisticated but all-important labor-and-time savers commonly referred to as service aids.

Continual awareness of the technician's customer and workbench needs — plus a ceaseless flow of timely, practical devices — have made RCA a recognized leader in the field of service aids. In recent months, RCA has introduced several new items designed to help ease the technician's color-TV service jobs and thus contribute to a solid working foundation in color TV.

Here are some RCA service aids currently enjoying wide popularity among the nation's television specialists. You may find many of these items of tremendous value in your own operations.

### Color-TV “Quik-Measure” Kit

Think of the convenience of being able to measure both, voltage and current, at any tube pin in a color set without pulling the chassis from the cabinet.

You can do this, quickly and easily, with RCA's Color-TV “Quik-Measure” Kit (1A1569), which adds a new measure of efficiency to your routine service calls.

In the past, for example, you no doubt found it difficult to get at the two measurement points required for



“Cycolac” Tube Caddy (1A1560)

servicing the horizontal-output and high-voltage sections. The handy “Quik-Measure” kit enables you to make these measurements in rapid order — without unsoldering leads or removing the chassis.

Packaged in a soft, red-plastic, zip-

pered container, items in the kit consist of 7-pin and 9-pin socket adaptors for miniature tubes; an 8-pin socket adaptor for octal tubes; a top cap extension lead; and a current-measuring probe.

### “Cycolac” Tube Caddy Features Color-TV Service

Most recent addition to RCA's selection of widely used tube caddies is the “Cycolac” Tube Caddy (1A1560), which can hold up to 362 receiving tubes.

Made of “Cycolac” — a tough, hard plastic produced by Borg-Warner Corp., this extremely durable caddy is in full keeping with the modern trend towards lighter, stronger materials in carrying cases of all kinds.

Its superior impact strength defies shock and withstands rugged use and abuse. It resists scuffs, mars, staining, mildew, and rot. Damp cloth and mild soap are all that are needed to help this caddy retain its gleaming condition.

Base dimensions are 4½ inches by 20½ inches by 8 inches. One “wing”



Color TV “Quik-Measure” Kit (1A1569)

# Chores and Help Technicians Perform Jobs Neater, Faster

measures  $3\frac{5}{16}$  inches by  $10\frac{1}{2}$  inches, and the second wing  $4\frac{5}{16}$  inches by  $10\frac{1}{2}$  inches. Each time you carry this handsome tube caddy on a house call, the business-building service message boldly printed on its side is in plain view of the customer.

Two additional tube caddies that you may wish to consider for your supplementary needs are the widely popular "Treasure Chest" models featuring Superweld vinyl construction.

The RCA Superweld Treasure Chest Tube Caddy (1A1001A) represents a significant advance over the older-line, earlier-version tube caddies. It is longer-wearing than its predecessor types; has stronger hardware and increased space; and has been "slimmed down" for easier portability. It can carry up to 362 receiving tubes.

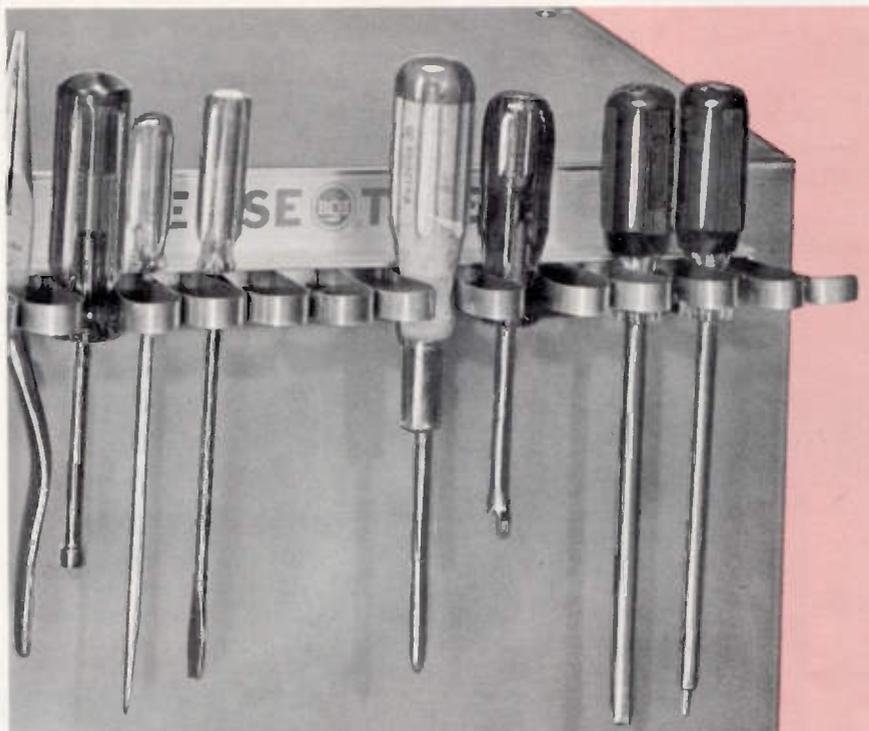
The RCA Superweld Jr. Treasure Chest Tube Caddy (1A1002A), a smaller-sized version, can hold up to 234 receiving tubes.

## "Swingline" #101 Staple Gun Useful in Shop or Home

A handy work assistant for numerous chores in your service shop, on service calls, or in your own home is



"Swingline" #101 Staple Gun (1A1570)



RCA Tool Holder (1A1561)

made available to you in the solidly constructed, heavy-duty "Swingline" #101 Staple Gun (1A1570).

This staple gun, for example, can be used for attaching TV antenna wire both indoors and outdoors. It also can be used for weatherstripping, insulating, valances, and screening. Of sturdy, all-steel construction — case-hardened for lifetime wear — this high-compression staple gun drives  $\frac{1}{4}$ -inch or  $\frac{5}{16}$ -inch staples.

## RCA Tool Holder

Screwdriver, adjusting wrench, or pliers can be neatly stored and handily spotted for immediate use when clipped into the convenient RCA Tool Holder (1A1561).

Consisting of a spring-steel holder solidly affixed to an extruded-aluminum bar, this practical device holds up to 13 tools. It measures a space-saving  $12\frac{1}{2}$  inches in length and  $3\frac{1}{2}$  inches in depth, and can be easily fastened to wall, pegboard, or counter. Tools are merely slipped out and then snapped back in position when no longer needed. The spring-steel holder grips each tool lightly but firmly and keeps it handy for the next job. You'll find this service aid highly useful for keeping tools at your fingertips.

## Earlier RCA Favorites Still Showing Wide Gains In Popularity

Inherent serviceability and appeal of RCA service aids among the nation's television technicians are reflected in the continued gains in demand for items which have been available for two or three years and even longer.

Covering a broad range of practical working needs, these items include such favorites as the RCA TV Toter Table, RCA Drop Cloth, RCA 6-Way Pin Straightener, RCA Receiving Tube Puller, the RCA Heavy Duty Multiple Outlet Box, and the RCA TV Tool Kit. While each of these service aids has been designed to occupy a minimum of space in your store, workbench, or tube caddy, each can represent a cumulative gain of immense proportions in either increased efficiency, effortless labor, additional time saving, or customer good will.

## RCA TV Toter Table

With RCA's TV Toter Table (1A1043), you can roll a chassis instead of lifting it. This two-shelf unit will also increase your working area and storage facilities. Two toter tables

(Continued on next page)

# Aids From RCA Lighten TV Servicing Chores

(Continued from preceding page)

— with a board between — provides you with an additional bench. Three such tables can make up a three-section bench with a roll-out center. Constructed of 20-gauge reinforced steel, each caster-mounted table measures 24 inches square and 33 inches high — ideal dimensions for supporting a TV chassis at convenient bench height. A useful rubber mat is included with each table.



TV Toter Table (1A1043)



RCA Drop Cloth (1A1044A)

## RCA Drop Cloth

Here's a handy item that can help "sell" your neatness and operating efficiency and make a hit with every customer you visit. The RCA Drop Cloth (1A1044A) protects your customers' carpets, floors, and furniture. Trimmed to a compact three-foot-square size and reduced in bulk and weight, this drop cloth sports a cushiony lining that makes it skid-resistant and a "natural" for preventing mars or scratches. It packs easily and sheds permanent wrinkles. You'll discover that this is an item you automatically include in your kit on every service call.

## RCA Receiving Tube Puller And RCA 6-Way Pin Straightener

For fast removal of tubes from sockets, RCA's Receiving Tube Puller (1A1348) makes an ideal service aid.



Receiving Tube Puller (1A1348)



RCA 6-Way Pin Straightener (1A1369)

This flexible rubber device grips each tube firmly, enabling you to pull it from the socket without fuss or bother. Its small size offers easy access to any TV cabinet, and a simple-to-carry accessory for tube caddy or jacket pocket.

The RCA 6-Way Pin Straightener (1A1369) can save you valuable time by quickly realigning bent pins on novars, nuvistors, 12-pin tubes, and 7-, 9-, and 10-pin miniatures. Bolt one on your workbench and attach one to your tube caddy to have handy on all service calls. Offered complete with screws for bolting, the 6-Way Pin Straightener features trim, free-form design that takes up little space.

#### RCA TV Tool Kit

Ever find yourself on a service call without that *one* particular alignment tool you need for a TV adjustment?

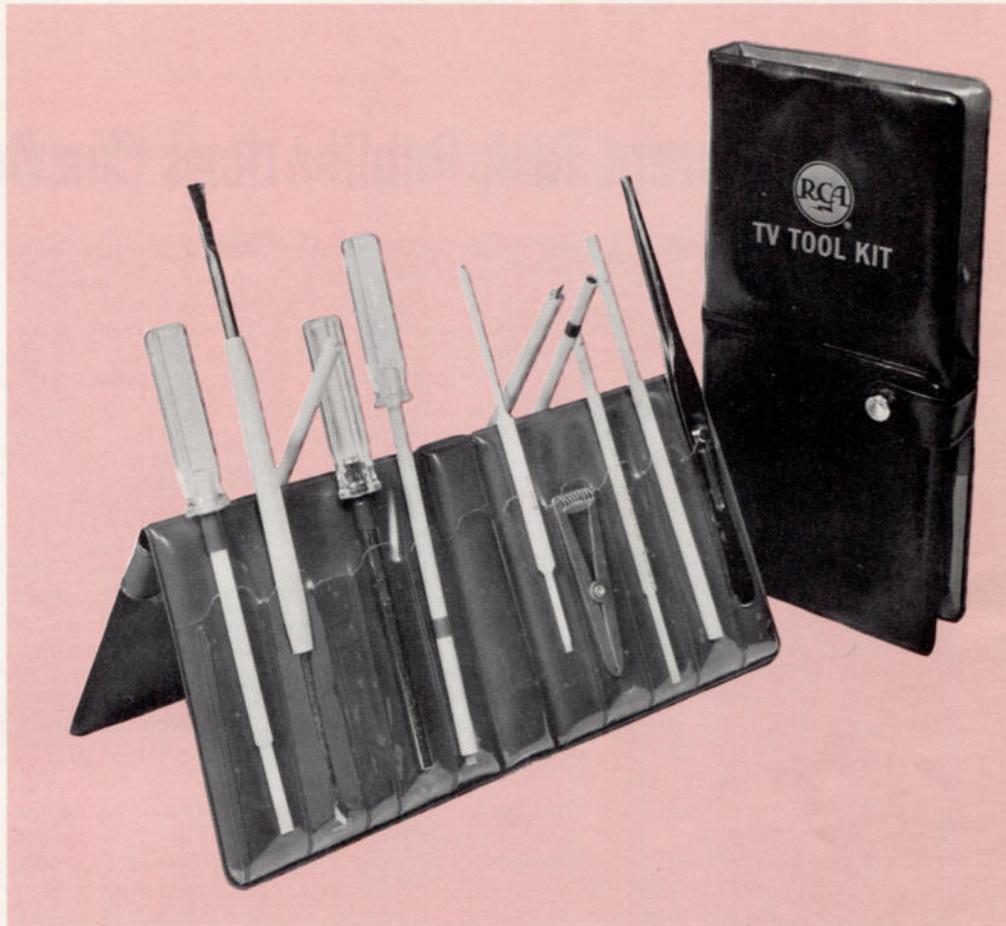
RCA helps you eliminate this problem with the RCA TV Tool Kit (1A1509) — containing 12 of the most frequently needed alignment and service tools in a handsome, red-plastic kit. Carried as a compact, pocket-sized packet, this kit opens up into a self-standing, fold-back unit affording easy access to each of the 12 tools encased in individual pockets. “Wrapping up” just about everything you need in the line of service-call instruments, the kit contains an Aligner; K-Tran TV Aligner; Tuning Wand; TV Aligning Wrench; Universal Aligner; three Adjusting Trimmer Tools; Clamping-Type Tweezers; Solder-Aid Tool; Heat Sink; and a Two-in-One Screwdriver, one end recessed.

#### Heavy Duty Multiple Outlet Box

Here's a convenient, master-control center that provides you with six sockets for your test equipment and other power requirements. The Heavy Duty Multiple Outlet Box (1A1414) is capable of handling up to 1,800 watts simultaneously, and is rated for 15 amperes, 115 volts. Solidly encased in a rugged, drawn-metal container, this outlet unit features a long-life fused plug, on-off switch, neon indicator, individually replaceable sockets, 10 feet of UL-approved heavy-duty cord, and facilities for easy mounting.

• • •

If you haven't already had the opportunity to personally examine each of these practical service aids and its possibilities in your own operations, now's the time to do so. With servicing requirements in color television and all television in general reaching new heights of professionalism, RCA attempts to provide you with every available means for helping you to perform



RCA TV Tool Kit (1A1509)



Heavy Duty Multiple Outlet Box (1A1414)

your work in the fastest, neatest, and most effective manner.

For a complete summary of the service aids, business aids, technical literature, and advertising and promotional items now available to you through your RCA Tube Distributor,

you might wish to refer to RCA's 1966 Sales Promotion Material Catalog (1A1350C). Your distributor will be happy to furnish you with all the important details concerning this catalog and how you can get any of the items described in its pages.

# NEW

Product Guides . . .  
Technical Manuals . . .  
Color-TV Service Handbook . . .  
Interchangeability Directories . . .

## Current RCA Publications Cue Dealers and Technicians

Ready to capitalize on today's ever-widening opportunities in electronics servicing?

You can take advantage of these new opportunities—speedily, effectively—by keeping abreast of latest developments in products and servicing techniques. One of the surest ways to accomplish this is with a well-organized library of current and reliable technical literature.

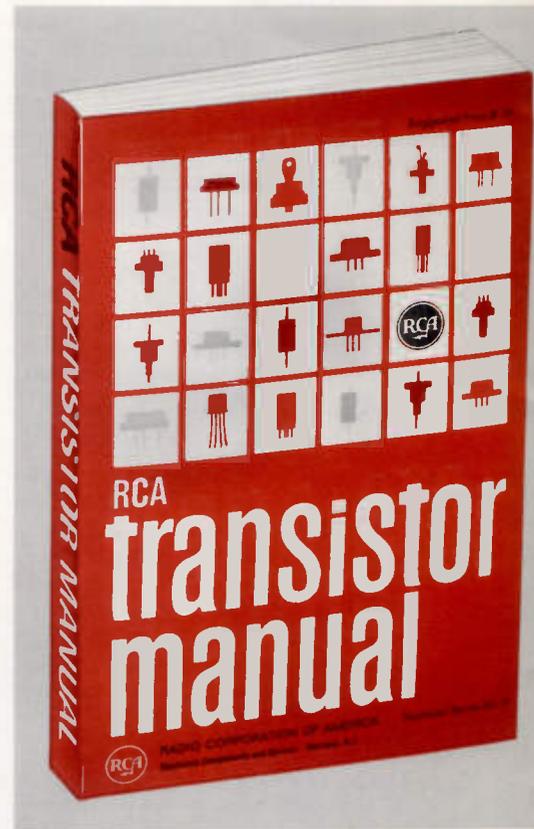
Technical literature from RCA—an industry pioneer and leader in the instructional guidance of the service technician—is completely current and completely reliable. Whether you're seeking the solution of a complex circuit problem or a simple tube replacement, there's an RCA publication to meet your need. All these publications are made easily available to you through your local RCA distributor. All are designed to make your work easier and save you time and money. Here are some recently published reference aids you may wish to add to your files:

- **RCA Receiving Tube Manual (RC-24)**. 576 pages. Technical design and applications data on more than 1,200 receiving tube types. Features of the RC-24 not contained in previous editions include: additional data on 100 new tube types; revised circuits section with new, simple format; updated picture tube characteristics chart; revised and updated Applications Guide; new tube index section for ready reference; separate data sec-

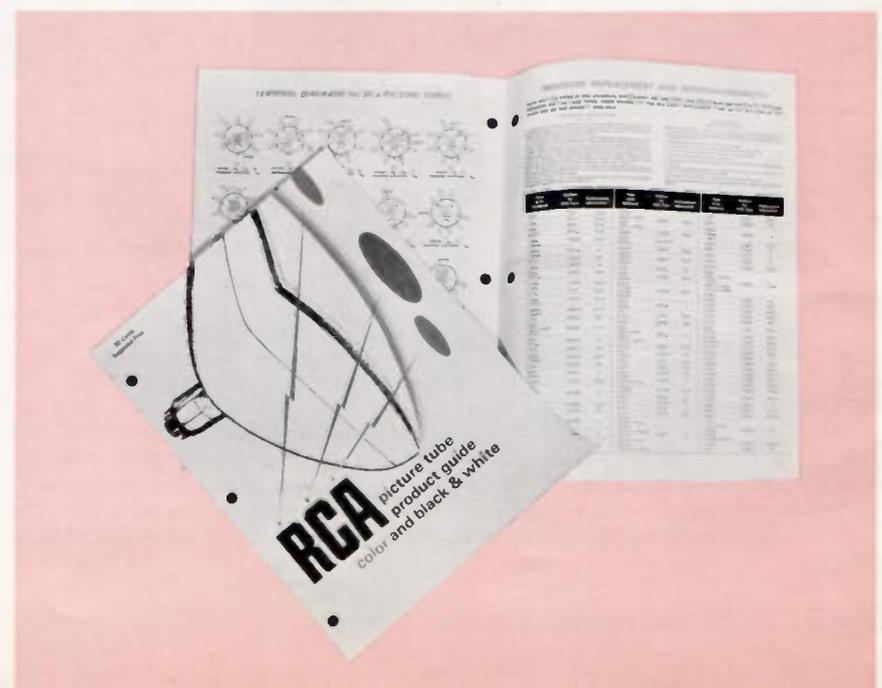
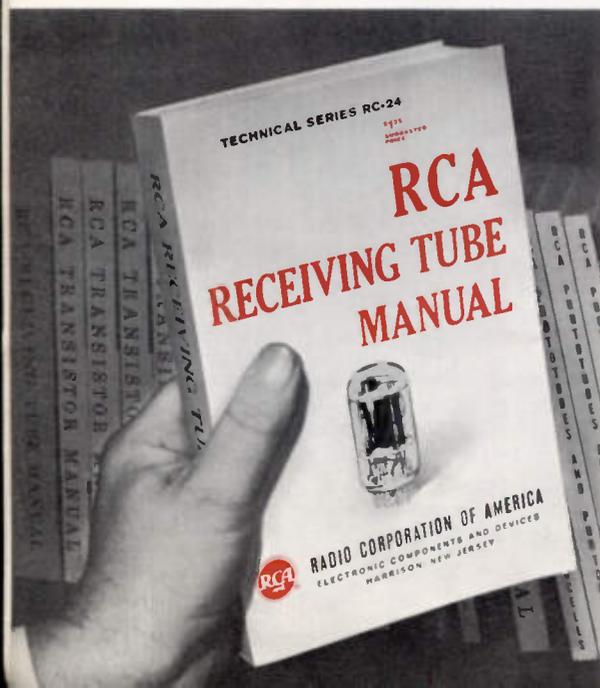
tions on active types and discontinued and replacement types; and additional text material on TV in the tube applications section. Suggested Price: \$1.25.

- **RCA Transistor Manual (SC-12)**. 480 pages. Brand-new 1966 edition features information on the latest semiconductor-device technology and applications. Included with the technical presentation is definitive data on more than 630 different semiconductor devices. A special circuits section provides descriptions of more than 40 circuits, including AM/FM radio receivers, AC/DC radio receivers, FM tuners and FM stereo multiplex adapters. Special introductory chapters on transistors include basic information on materials, junctions, types of devices, design, fabrication, basic circuits, characteristics, and applications. Separate chapters are devoted to MOS field-effect transistors, silicon rectifiers, silicon controlled rectifiers, tunnel diodes and other semiconductor diodes. Also treated separately are transistor mounting, testing, and reliability; interpretation of transistor data; transistor symbols; and RCA military-specification transistors. Other information in the 1966 edition includes transistor selection charts; technical data for RCA transistors; symbols for RCA rectifiers, SCR's, and diodes; and outlines and mounting hardware. Suggested Price: \$1.50.

- **RCA Picture Tube Product Guide (PIX-300)**. 12 pages. A handy 8½-by-11-inch booklet offering useful background information on both black-



and-white and color-TV picture tubes. Featured in the Guide are a three-page characteristics chart; a three-page "Industry Replacement and Interchangeability" chart; and a special section illustrating terminal diagrams for RCA picture tubes. On the back cover is a



# To New Areas of Opportunity in Products and Services

capsule chronology of events pointing out RCA leadership in color television. Suggested Price: 30 cents.

• **RCA Battery Manual (BDG-111A)**. 68 pages. The 1966 edition of the RCA Battery Manual is an invaluable aid for anyone designing or working with battery-operated circuits. It includes data and characteristics, construction, recommended current ranges, test procedures, and terminal and socket connectors. Of special value to the technician making his initial entry into the field of battery-operated circuits are Manual sections dealing with the historical background of batteries and explanations of basic cell and battery types; battery terminology and characteristics; and battery testing and recharging. Data on single-voltage types, multiple-voltage types, and A-B battery packs are presented in separate classification charts outlining terminal voltages and suggested current ranges for the various available types of mercury, alkaline, and carbon-zinc batteries. An RCA Battery Applications Guide presents RCA battery types for transistor applications, photoflash use, industrial and special-purpose applications, flashlight and lantern use, and portable "A," "B," "A-B," and Farm "A-B" packs. A 43-page data section for RCA batteries includes dimensional outlines and average service hours for each type at various current drains. Also in the new RCA Battery Manual are supplementary data consisting of a complete index for RCA batteries, snap-fastener dimensions, and instructions on how to use the Manual. A "must" for anyone working with batteries. Suggested Price: 50 cents.

• **RCA Battery Catalog (BAT-134H)**. 36 pages. This handy, quick-reference source covers all 138 battery types in the RCA line, and includes a comprehensive radio battery replacement guide covering radio models from 1948 through 1966. Like the RCA Battery Manual, the RCA Battery Catalog features individual classification charts for single-voltage types, multiple-voltage types, and A-B battery packs, and a complete Data Section offering vital characteristics and operating information on battery types for transistor applications, industrial and special-purpose battery types, portable "A" types, portable "B" types, photoflash types, portable "A-B" packs, farm "A-B"



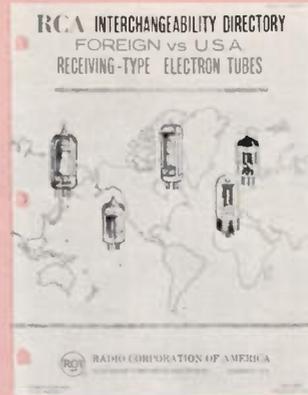
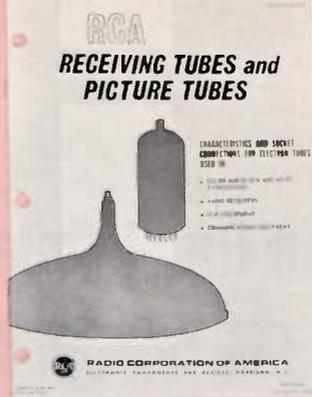
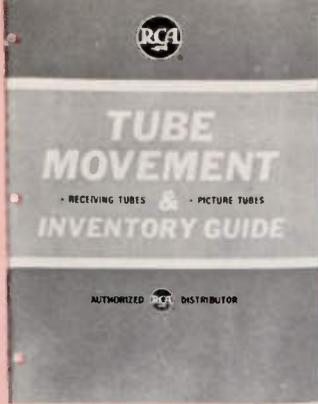
packs, and types for flashlight, lantern, and emergency lighting. For added user convenience, the catalog provides a cross reference of NEDA numbers versus RCA battery types. A four-page Battery Interchangeability Directory gives a listing of types by various manufacturers and the specific RCA types which can be used as replacements. Suggested Price: 35 cents.

• **Dealer Tube Movement & Inventory Guide (1A1079B)**. 82 pages. Maintenance of accurate, up-to-date records in this convenient form-guide enables the service-dealer or technician to have a balanced stock inventory at all times. Current information about each tube is available at a glance, allowing more time for other business matters. High-volume tube types are printed in bold-face type, and a separate "U. S. Ratio" column based on a thorough study of national movement by tube type provides the dealer with a means for comparing his own sales with national results. Properly used, the Dealer Tube Movement & Inventory Guide serves as an invaluable aid

for spotting opening inventories, unfilled orders, completed orders, and sales by type.

• **Receiving Tube and Picture Tube Substitution Directory (ERT-198)**. 36 pages. A handy, 3½-by-8½-inch reference booklet that the technician can easily carry in his pocket. Intended specifically for making tube substitutions in home-entertainment electronic equipment, the guide is divided into two sections. The section on receiving tubes lists 283 RCA tube types which may be used as replacements for more than 680 domestic and foreign types. One chart covers the RCA direct-replacement types and the domestic and foreign types each RCA type can replace. A second chart gives an alphabetical/numerical listing of the domestic and foreign types and the corresponding RCA direct-replacement type. A similar format is followed in the picture tubes section of the booklet, which lists 120 RCA types which can be used as substitutes for 451 industry picture tube types. Color picture tubes are

(Continued on next page)



## Current RCA Publications

(Continued from preceding page)

listed separately. Suggested Price: 25 cents.

• **RCA Receiving Tubes and Picture Tubes Booklet (ERT-1275M)**. 44 pages. A comprehensive source of information on characteristics and socket connections for electron tubes used in color and black-and-white TV receivers; radio receivers; hi-fi equipment; and communications equipment. Among data featured in the separate sections are tube dimensions; receiving-tube and picture-tube characteristics charts; terminal diagrams, and a listing of discontinued RCA receiving-tube types. Included in the booklet are 125 recently announced receiving-tube types and 15 new picture-tube types.

Suggested Price: 40 cents.

• **RCA Interchangeability Directory of Foreign Vs. U.S.A. Receiving-Type Electron Tubes (ERT-197E)**. 8 pages. Prepared to assist dealers, technicians, and others in selecting the proper tube type as a replacement for a foreign tube type, this directory covers more than 800 foreign tube types used principally in entertainment equipment such as AM and FM radios, television receivers, and audio amplifiers. Types in RCA's current line of tubes are printed in bold-face type. Suggested Price: 10 cents.

• **RCA Color-TV Receiving Tube Guide (ERT-199)**. 4 pages. This guide is arranged by basic functional circuits of a color receiver, beginning with the

tuner and ending with the power supply. RCA tube types used in each circuit are shown in alphabetical-numerical sequence for quick and easy reference. In the listing are 215 RCA receiving-tube types used in 1,700 models of color-TV receivers made by 35 different manufacturers from 1955 through early 1966.

The time and effort you save in quickly locating some important information when you need it can more than compensate for any relatively small investment in technical literature. Why not decide today to include these current RCA reference aids in your work library? Your local RCA distributor can supply you with any or all of the previously described publications in the quantities required for your individual operations.

## Handy, 'One-Package' Reference Source Is Big Time Saver In Routine Service Adjustments and Basic Troubleshooting

Here is something you've been waiting for! A "package" of accurate, "right-on-the-nail" information for routine service adjustments and preliminary troubleshooting of popular-make color television receivers — *all in one easy-to-consult spot!*

You'll find this wealth of useful data in the **Color TV Service Handbook (1A1553)**, RCA's current on-the-job instructional aid for technicians establishing a solid future in color television. If you haven't already obtained a copy from your RCA Tube Distributor, ask how you can receive one today.

In this 5½-inch-by-6-inch, 140-page handbook — just the right size for your pocket or tube caddy — is key data on numerous makes and models of color-TV sets from 1960 to 1966. It includes information on such brands as Admiral,

Airline, Curtis Mathes, Emerson, General Electric, Magnavox, Motorola, Olympic, Philco, RCA, Silvertone, and Zenith — *all based on the manufacturer's own service notes!*

Containing practically all the data you usually need on a service call, the **RCA Color Service Handbook** features individual sections on chassis layouts, purity adjustments, convergence adjustments (both static and dynamic), black-and-white set adjustments, phase and matrix adjustments, color AFPC field adjustments, miscellaneous adjustments, fuses and circuit breakers, test equipment for color-TV servicing, and receiving tubes for color television.

All this information is organized for your easy reference. You merely refer to the "Chassis Index;" look up the

chassis number of the set you are working on; and are immediately guided to the appropriate sections of the Handbook. Say, for example, that you are working on an RCA CTC-15 Series color receiver and are interested in dynamic convergence procedures. In the alphabetical Chassis Index, you quickly spot RCA and the CTC-15 Series. Moving across the page to the column headed, "Dynamic Convergence Adjustments," you find that Procedure "A" applies to CTC-15 Series receivers. Turning to Handbook Section-3, titled "Static-Convergence Adjustments," you immediately locate "Procedure A" and its accompanying illustrative diagrams.

In the **RCA Color TV Service Handbook** is the information you want, and *need*, for every color-TV assignment.

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 CHASSIS INDEX

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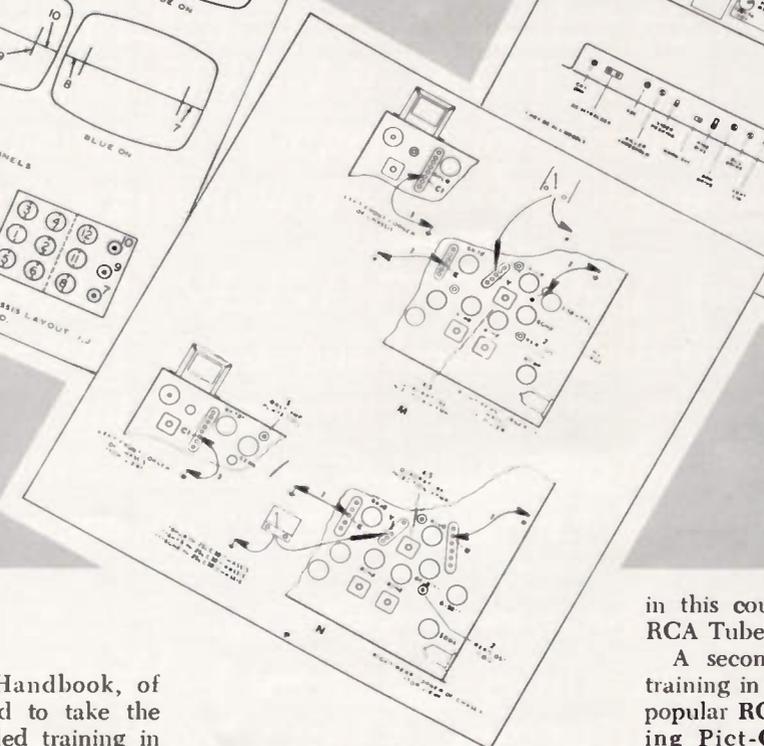
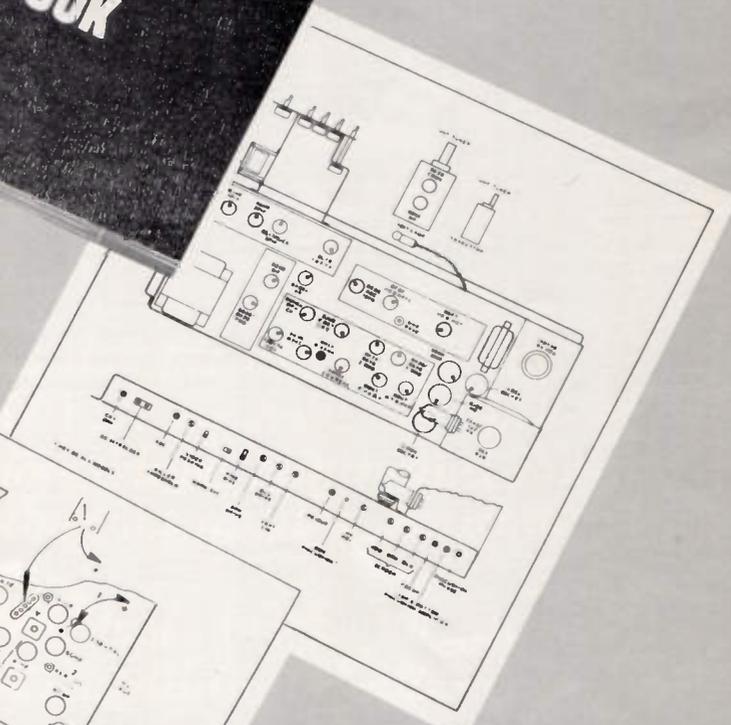
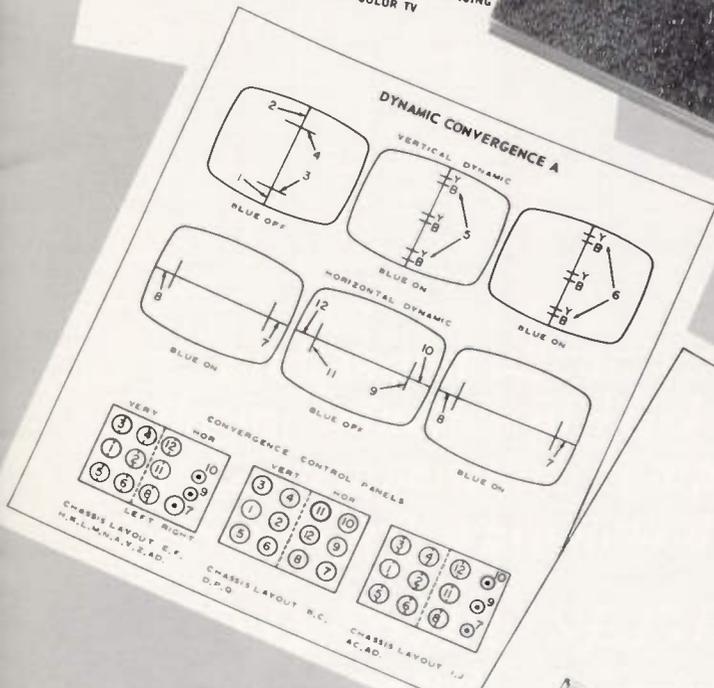
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This outstanding Handbook, of course, is not intended to take the place of a well-grounded training in color television, but to supplement such training. In order to use the Handbook properly, it is necessary that you have an understanding of the principles of color television receivers, and the basic techniques involved in adjusting and troubleshooting such receivers.

An excellent source of this necessary background is the famed RCA Insti-

tutes Home Study Course in Color Television (1A1325), which offers the technician the most comprehensive, basic course in color television sponsored by RCA, universally acknowledged as the pioneer of the color-TV industry. RCA makes easy enrollment

in this course possible through your RCA Tube Distributor.

A second source of well-rounded training in color television is the ever-popular RCA Color TV Troubleshooting Pict-O-Guide (1A1389), also prepared by RCA Institutes and available through your RCA Tube Distributor.

Together, these three comprehensive instructional aids can represent your wisest move in color television and three vital steps towards a profitable future. Contact your RCA Tube Distributor today for the important details.



Protected by a rugged, cast-aluminum case equipped with leather carrying-handle, the RCA WV-98C Senior VoltOhmyst® measures 6½ inches high, 7 inches wide, and 3¾ inches deep. Among the instrument's numerous features is a special 0.5 DC-volt scale for transistor-circuit tests.

### Sure-Fire Guide to Accurate Instrument Readings

## WV-98C Senior VoltOhmyst Now Has Mirrored Scale

The latest versions of RCA's universally acclaimed WV-98C Senior VoltOhmyst® and WV-98C(K) Senior VoltOhmyst Kit incorporate a mirrored scale which reduces the possibility of error while taking instrument readings.

Designed into the face of the VoltOhmyst, midway between the DC/RMS and P-P scales, the new mirrored device voids parallax effect through the simple expedient of reflection. An accurate reading is provided at the point where the meter pointer coincides with its reflection.

This newest aid to VoltOhmyst users further broadens the general appeal and numerous features which have made the WV-98C one of the most popular instruments of its kind. Notable among the latter is a special 0.5 DC-volt scale for transistor-circuit tests.

All measurements are made with the WG-299D DC/AC-OHMS Single-Unit

Probe and Cable. This probe is quickly adapted to either DC measurements or AC and resistance measurements by means of a built-in switch. The fixed ground lead of the WV-98C insures good connection to the circuit under test.

Seven overlapping resistance ranges of the WV-98C Senior VoltOhmyst cover measurement needs from 0.2 ohm to 1,000 megohms.

Seven voltage ranges permit measurements from 0.05 to 1,500 RMS volts on RMS AC operation, while eight ranges are provided for DC-voltage measurements from 0.01 to 1,500 volts. RMS AC and DC voltages up to 1,500 volts and P-to-P voltages up to 4,200 volts may be measured with an accuracy of  $\pm 3\%$  of full scale.

Accurate, dependable, and versatile, the WV-98C Senior VoltOhmyst has countless uses in audio, radio, TV, and industrial servicing.

*And Now — Some Very Special News . . .*

*Another Innovation from the Leader in Color Television*

## *Perma-Chrome*



*First major advancement in color picture tubes since the introduction of Hi-Lite, RCA's **Perma-Chrome** provides temperature compensation which eliminates the beam register problem due to shadow-mask expansion.*

***NO MORE SET-UP TIME LAG...** No more "guesstimated" yoke positions...within minutes you can set an optimum color picture on a rectangular Hi-Lite tube and be sure of customer satisfaction whether his set operates for half an hour or half a day.*

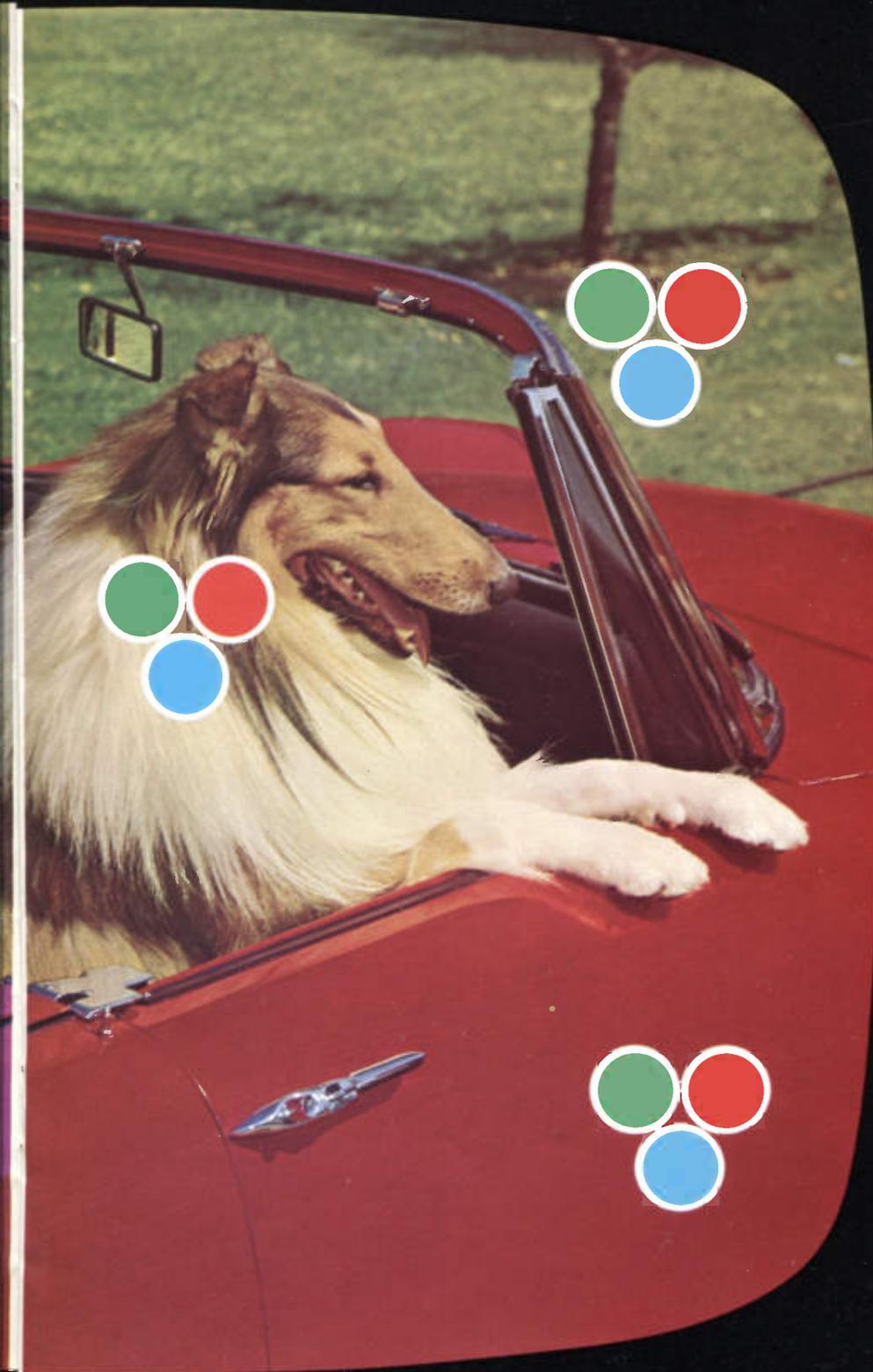
***Perma-Chrome** lets you quickly, positively, and accurately adjust Hi-Lite rectangular color-TV picture tubes to the full potential of their rare-earth phosphor screen...from picture-on throughout normal operation at temperature equilibrium. Easier for you...much more satisfactory for your customer. Tube set-up errors due to shadow-mask expansion are a thing of the past...and your customer gets the full benefit from the set's "auto-degauss" feature.*

# *without Perma-Chrome...*

rectangular color picture tubes chance misregister, color impurity, and white non-uniformity. As indicated by the enlarged insets of phosphor-dot trios and photographically simulated television picture (illustrated on this page, immediate right), expansion of shadow mask during warmup of rectangular Brand-X tube can destroy original alignment between electron-beam trios and phosphor-dot trios.



with *Perma-Chrome* . . .

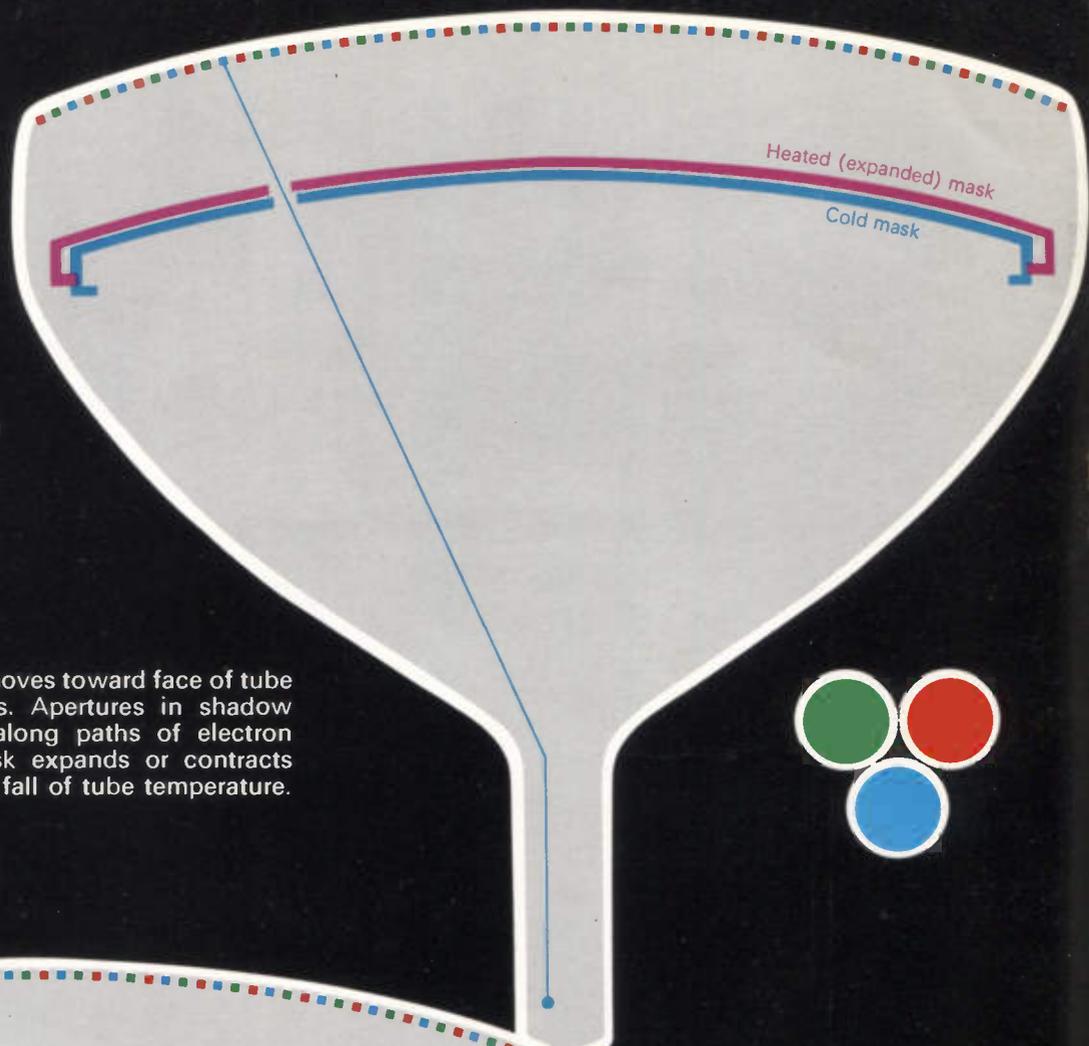


RCA's Hi-Lite rectangular tubes make it possible to obtain television pictures with locked-in register, optimum color purity, and white uniformity. As illustrated by enlarged insets of phosphor-dot trios and photographically simulated television picture (immediate left, this page), *Perma-Chrome* construction locks electron beams and phosphor-dot trios in stable alignment throughout tube-usage period.

## RCA Hi-Lite Tube With *Perma-Chrome*

Exaggerated drawing of cross-section of RCA's Hi-Lite rectangular tube with temperature-compensated shadow-mask assembly shows locked-in register of beam with phosphor dot as shadow mask is heated.

Note: Mask moves toward face of tube as it expands. Apertures in shadow mask move along paths of electron beam as mask expands or contracts with rise and fall of tube temperature.



## Brand-X Tube Without *Perma-Chrome*

Exaggerated drawing of cross-section of rectangular Brand-X tube shows shadow-mask expansion and change in beam-landing register.



*RCA's new temperature-compensated shadow-mask assembly eliminates the problems of shadow-mask expansion which have limited the attainment of the full potential of rectangular color picture tubes. The new **Perma-Chrome** method of mounting the shadow mask provides the answer to a twofold tube-adjustment predicament:*

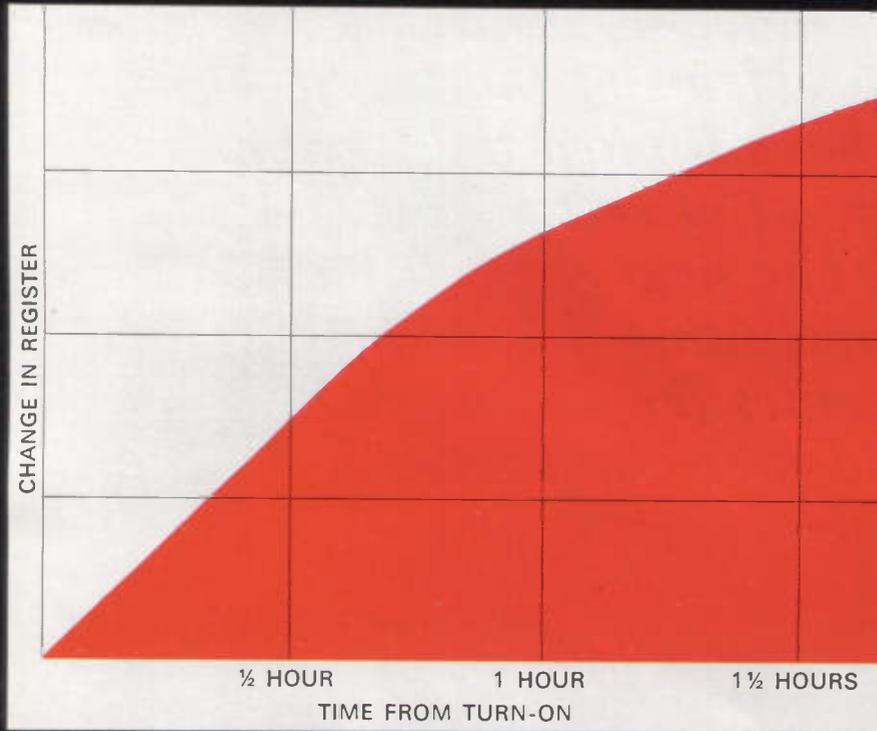
- no longer need you wait an appreciable length of time for rectangular picture-tube warmup so that you can adjust to a "guesstimated" yoke position which, upon tube temperature stability, may develop an acceptable color picture. (Such tube temperature stability normally is not reached until one-and-a-half hours after turn-on.)
- no longer need you risk customer displeasure should your "guesstimate" lead to distorted color values . . . before or after temperature stability is attained.

*RCA Hi-Lite Color Picture Tubes with **Perma-Chrome** offer immediate multifold benefits:*

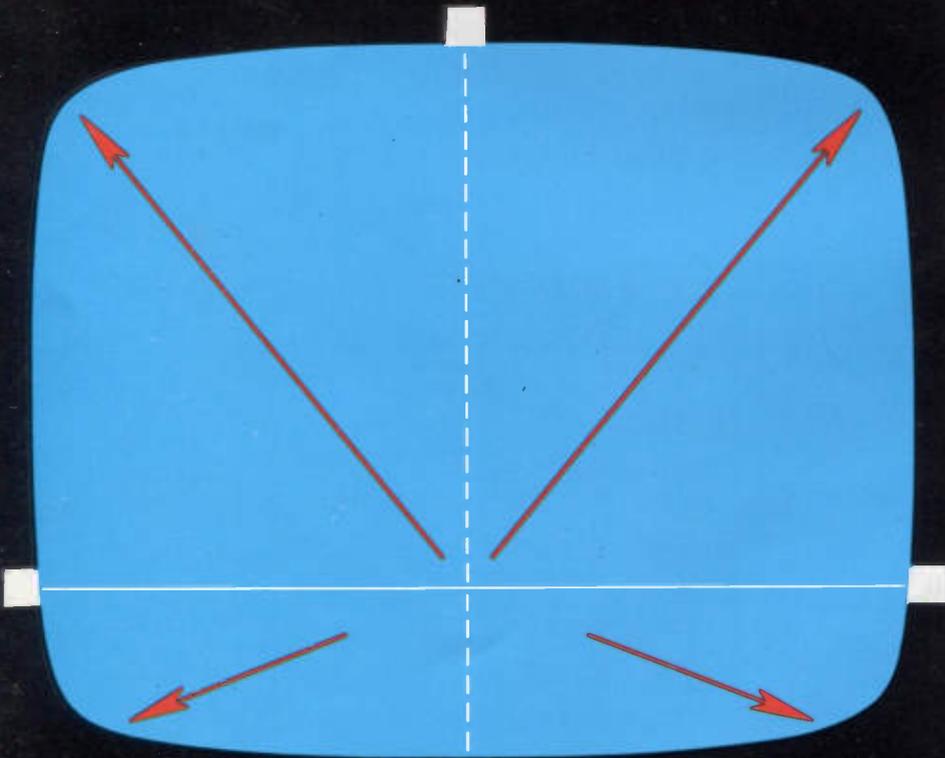
- appreciable savings in tube-setup time, since you can completely and reliably adjust a Hi-Lite rectangular color picture tube to optimum performance within minutes of turn-on.
- elimination of tube-setup errors due to shadow-mask expansion.
- assurance of full benefit from color-set "auto-degauss" feature.
- virtual elimination of need for tube-setup adjustment upon set delivery to buyer.
- customer satisfaction because **Perma-Chrome** performance will continue to entertain television viewers with all the true colors of life . . . whatever their set turn-on/off practices, and whether their sets operate for half an hour or half a day.

# Performance Data

Brand-X Tube Without *Perma-Chrome*



Change in register of electron beam and phosphor dot versus time for rectangular Brand-X tube using three-position shadow-mask mounting.



Three-position shadow-mask mounting in Brand-X tube. Arrows indicate non-uniformity of temperature expansion of mask.

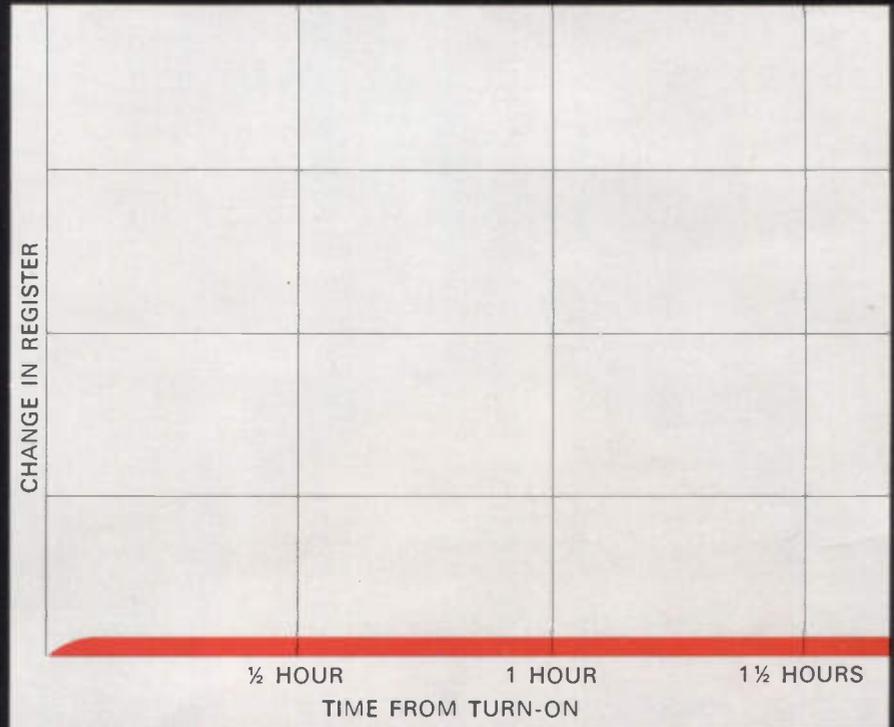
The successful achievement of a temperature-compensated shadow-mask assembly, resulting in *Perma-Chrome* performance, was made possible with RCA's four-position, symmetrical mounting of the shadow mask in rectangular-shaped tubes.

This symmetrical shadow-mask mounting leads to uniform temperature expansion from the geometrical center of the mask. Uniform temperature expansion, inherent in the symmetrical 21-inch round color tubes, is now accurately tracked in rectangular tubes with RCA's new shadow-mask assembly...the apertures of the mask locked "on target" with their respective phosphor-dot trios.

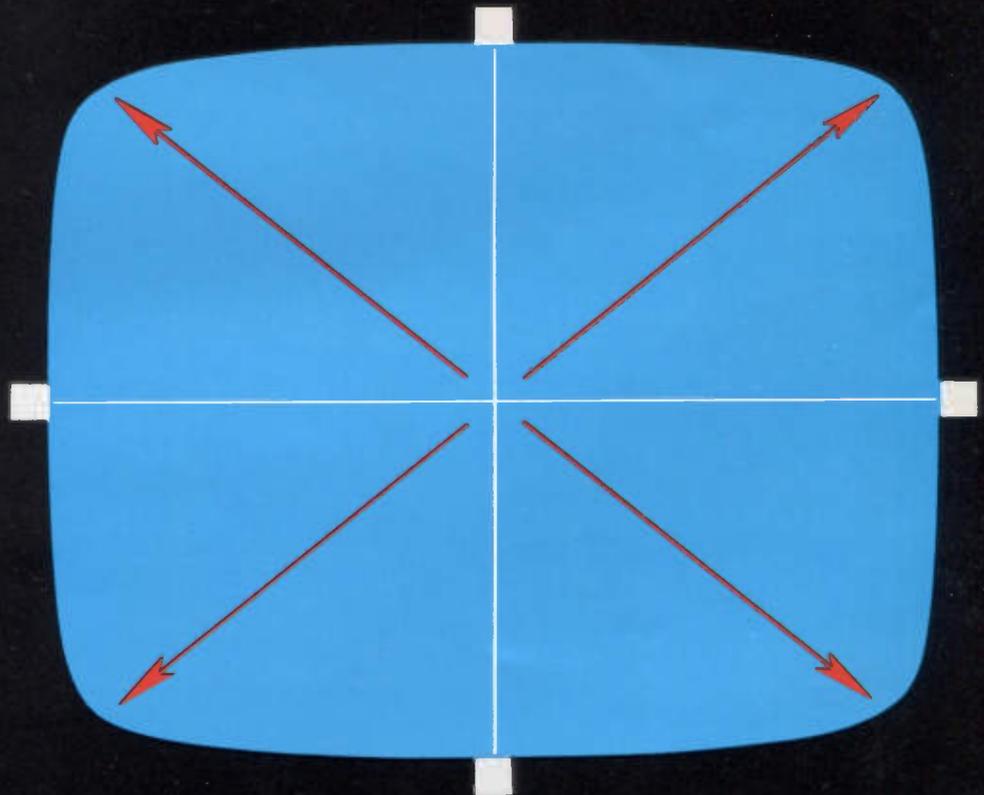
RCA's Hi-Lite Color Picture Tube with *Perma-Chrome* is a distinct advancement over other rectangular color picture tubes which employ a three-position non-symmetrical mounting of the shadow mask. (By the design limitation of the three-position mounting in a rectangular tube, shadow-mask expansion develops from a point other than the geometrical center of the mask.)

## Performance Data

RCA Hi-Lite Tube With *Perma-Chrome*



Change in register of electron beam and phosphor dot versus time for RCA Hi-Lite Color Picture Tube with *Perma-Chrome*



Four-position shadow-mask mounting of RCA's Hi-Lite Tube. Arrows indicate uniform temperature expansion from geometrical center of mask.

*Rectangular Hi-Lite  
Color Picture Tubes with  
Perma-Chrome*



*Look to RCA...*

- pioneer of color TV
- developer of the 21-inch round color picture tube, which created the overwhelming demand for color
- manufacturer of the finest rectangular color-TV picture tubes

*Perma-Chrome* —  
an added attribute of Hi-Lite  
Color Picture Tubes—logically  
comes from RCA, the leading  
manufacturer of color-TV  
picture tubes.

*You owe it to yourself to check with your authorized  
RCA Distributor about the full advantages of this  
exclusive innovation from the acknowledged leader  
in color television. Call him today and ask about  
Perma-Chrome... currently in the 25-inch and soon  
to be available in the 19-inch!*

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.



The Most Trusted Name in Electronics

# Troubleshooting 'Kit' Instruments

by Rhys Samuel

Electronic Instruments Operations  
RCA Electronic Components and Devices

You have just completed the last step in assembling your kit instrument and you happily apply power. Then, to your dismay, you discover something is wrong. Your newly built 'scope does not display any trace. Or — if your instrument is a VOM or a VTVM — it may refuse to "read" on any range or function.

If you're one of the vast majority of experienced kit builders, chances are that this will never happen to you. If it *does*, however, don't pack up the instrument and send it back to the manufacturer in disgust. Except in extremely rare cases, the manufacturer's assembly instructions are correct, and the trouble turns out to be a simple assembly error or an oversight in following instructions.

Over the years, RCA repair centers have learned that nearly every difficulty could have been corrected by the kit builder if he had rechecked his work. Here are the most common sources of trouble:

- **Faulty Solder Connections.** Cold solder joints and unsoldered connections are the greatest single cause of operating failures. Use of a dirty or insufficiently heated soldering iron often results in a connection in which a connecting lead rests in a hole in the solder. The joint then has high resistance or is intermittent. Connections to printed boards, especially, must be secure; the solder should form a bright, firm bond to the component lead and the board copper. Connections to lugs and terminals are more stable if a lead

is made mechanically secure by bending and pinching it with pliers prior to soldering.

- **Wrong Terminations.** Second only to faulty soldering is the connection of leads to the wrong lug or terminal. Tube sockets and switches offer the greatest possibilities for mistakes because of their many terminals and close proximity, and the way in which pins and terminals are identified. A single wrong connection can cause serious trouble.

- **Transposed Parts.** It's easy to misread color codes of resistors and capacitors. Unfortunately, many kit builders fail to catch these common errors in checking their work. Transposition of a 100-ohm cathode resistor and a 1-megohm grid resistor, for example, can render an amplifier stage completely inoperative. Such mistakes are not infrequent, although they can be detected in a few minutes of routine checking.

- **Shorted Wiring.** Printed boards and switches offer the kit builder who's in a hurry ready opportunities to go wrong. Wafer-switch contacts often become shorted because they have been twisted or because protruding leads touch other metal points. Close-spaced printed wiring is easily shorted if too much solder is used. These trouble sources, like those previously described, are easily discovered by visual inspection.

- **Omitted Parts.** It's easy to overlook a resistor or capacitor if it has been lost in the packing material or

has found its way into other non-kit parts around the work area. Manufacturers will often supply extra washers and other small hardware to replace items that are easily lost during the kit-building process. *But beware of the electrical component that is left over.* There's a strong possibility that it belongs somewhere in the instrument.

While it would seem reasonable to assume that mislaid or missing parts would be identified by the end of the assembly work, many kits are "completed" with one or more parts omitted. Here, again, a few minutes spent in checking all hardware — *both before and after assembly* — would save time and shipping expense.

Infrequently, the manufacturer will err and omit a part. Over the course of a single year, RCA, for example, may package more than a million parts in its many kits. Despite careful quality control and inspection, a kit may lack that one item needed for completion. Fortunately, such cases are rare, and the needed part is mailed directly from RCA as fast as possible.

If you have trouble with a newly completed kit instrument, follow this simple check-out procedure. It will enable you to correct the trouble in the shortest time.

1. **Examine all solder joints.** Resolder every joint that looks even remotely suspicious. Use a clean, hot iron or gun. Give special attention to printed-board connections and tube-socket terminals. Look for unsoldered connections.

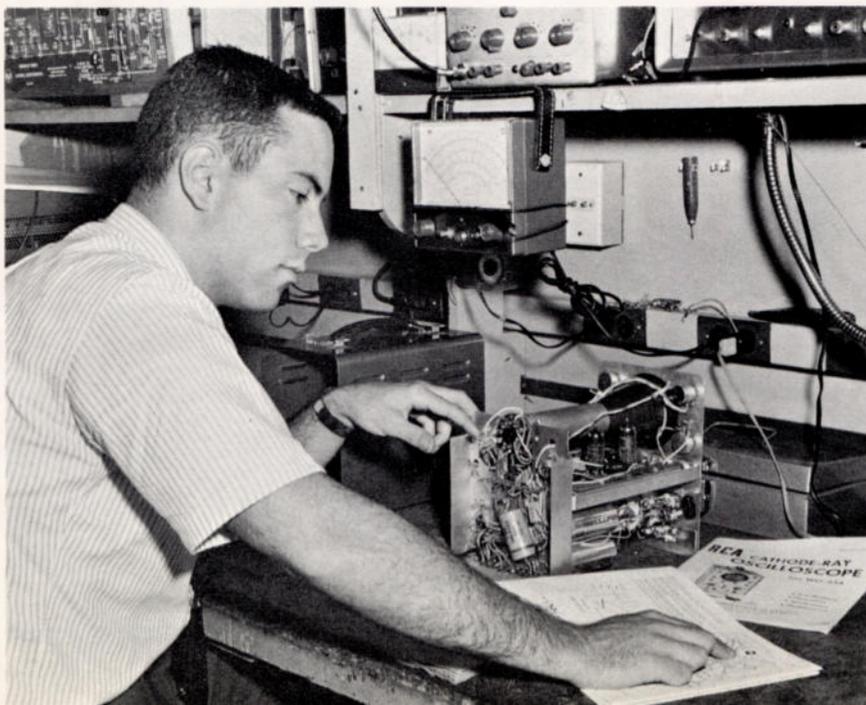
2. **Recheck placement and terminations of all leads and parts.** Refer to the wiring and assembly drawings as you go along. If your instrument has wafer switches, start with these. Place the instrument so the switch is oriented exactly as shown in the assembly drawing, and check connections to every terminal. Look for bent or twisted contacts, and for any terminal which is unused.

3. **Check values of all electrical components.** Make sure that resistors and capacitors of the right values are installed where they should be. Check color coding and connections of transformers and other inductors.

4. **Look for shorts.** Inspect printed-board leads for solder bridges between closed-spaced leads. Examine, especially, tube-socket terminals and all switch connections, particularly those adjacent to the support rods of wafer switches. Switch frames are often grounded. Make sure diodes and transistors are connected in their right polarity and to their correct tie points.

5. **Check power-on indicators.** Tubes

(Continued on next page)



# Troubleshooting 'Kit' Instruments

(Continued from preceding page)

should light, of course, and the pilot-lamp will indicate if line power is applied. Internal batteries in meters and other instruments are a frequent source of trouble. Make sure batteries are installed with correct polarity, and that their terminal contacts are good. A soldered battery connection is most reliable.

By this time, you should have discovered the trouble. If it persists, however, resort to traditional troubleshooting methods. A VOM or VTVM is indispensable for pinning down an elusive flaw. The following steps are suggested as a possible procedure:

1. *Measure voltages.* Start with the power source (AC line or batteries) and proceed through the power supply and distribution leads. Check voltages at all tube sockets and transistor connections.

2. *Wiggle parts and leads.* Move resistors and capacitors to detect broken leads and connections; tap or wiggle tubes and plug-in connectors. Above all, don't overlook the possibility of broken or intermittent test leads and cables.

3. *Make resistance measurements.* Check continuity between various circuit points; look for shorts or low-resistance paths between ground and key leads.

4. *Check for defective parts.* Check continuity of transformers; substitute capacitors in critical circuits; look for missing or misplaced terminals on wafer switches; and substitute new tubes or diodes in suspicious areas. Make sure that precision resistors have not changed value because of excessive soldering heat. Damaged meter movements usually are sluggish or sticky; do not measure their resistance with conventional ohmmeters — you may burn out the meter coil.

Checking and troubleshooting the inoperative kit instrument should be especially simple for the person who has just completed its assembly. Detailed assembly and wiring drawings make the job easy, and even the most complicated instruments can be thoroughly checked in less than an hour.

So, if you have any difficulty with the next kit instrument you build, check it carefully. You'll probably get it working in less time than it would take you to mail it or carry it to the repair center.

## Don't Forget to Ask 'Em...

# What else needs fixing?



**National Business-Building  
Program Sponsored by EIA  
Offers Wide Possibilities**

"What else needs fixing?" A mere four words in a simple, direct question — but service technicians in the Indianapolis area considered this question sufficiently important to ask of all their customers during a four-week test period recently concluded in that city.

Result? A whopping 7½ per cent increase in business!

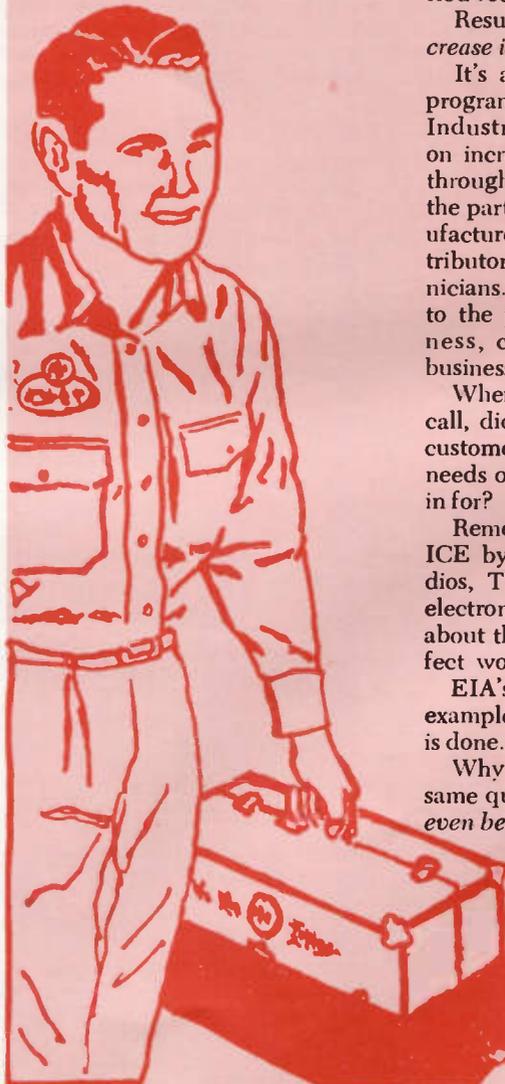
It's all part of a new, nation-wide program — originated by the Electronic Industries Association — which sights on increasing over-all industry results through a vast cooperative effort on the part of electronic components manufacturers, electronic components distributors, and electronic service technicians. The idea behind it is plain and to the point: when you *ask* for business, chances are you'll get more business.

When you've been out on a service call, did you ever stop to think that a customer might have *additional* repair needs other than the job he called you in for?

Remember, you can **SELL SERVICE** by *reminding* customers that radios, TV sets, phonographs, or other electronic equipment lying unused about the home can be restored to perfect working order through servicing.

EIA's "Indianapolis Test" is just one example of what can happen when this is done.

Why not ask your customers the same question? *Your results may prove even better!*



# Across the Bench

By 'Doc'



I don't know how you feel about your competitors, but I don't have any hard feelings toward mine — most of them, anyway. But I don't believe in helping them too much, either. Last night, though, I couldn't resist temptation.

I'd finished a call on the other side of town and passed Shorty's one-man shop on the way home. I could see he was still at it, so I stopped in to give him a little friendly needling. He was sweating over a dog with sync trouble.

"This is the fourth or fifth model of this !°-#-!/:°!! set I've gotten in here with the same trouble," Shorty complained. "There oughta be a law against it!"

"Against it, Shorty? Why, I'd think you'd specialize in them if you've got that many coming in. What's the trouble?"

Shorty swore softly as he snipped a handful of resistors and capacitors from the circuit.

"I don't know," he growled. "I just cut out all the sync-circuit parts and put in new ones. That usually cures it."

"That's one way of doing it," I agreed. "But suppose that doesn't fix it? Do you strip it down to the chassis?"

"*Ve-ry funny.* You just watch. I'll show you how it fixes."

Shorty resumed his muttering as he soldered in new parts. I lit my pipe and looked around. The shelf over the bench held a VOM, a VTVM, an RF signal generator, and a capacitor checker. I almost didn't see the 'scope because it was shoved into a corner on the floor.

"What's the matter with your 'scope, Shorty?" I asked. "Why don't you use that?"

"I'll tell you why. It takes me an hour to get what I want on it. Clipping parts out is a lot faster."

"If there's something wrong with that 'scope, why don't you fix it?" I asked. I then hoisted the 'scope onto the bench and plugged in the line cord. When I blew the dust off the case, I could see it was a new RCA WO-91B.

"Now, Doc, I'll show you how I've cured this trouble," Shorty announced. "Wait til I get this set plugged in."

Shorty clipped on an antenna lead and turned on the set. The sound came

up and a picture with good contrast filled the screen. But it was out of sync.

Shorty then turned the front V and H sync controls. The picture flipped in all directions but wouldn't lock in. He pulled the chassis around and worked on the back-apron adjustments. Still no sync.

I felt a little embarrassed for him and averted his gaze.

"Now, that's a dog for you," I said. "Tell you what, Shorty — let's try that 'scope. I'll handle the probe and you twist the knobs. Okay?"

"Right, Doc," he said half-heartedly, "but I don't think it's going to save any time on this lousy set."

Shorty is very stubborn. That's why he works late so many nights.

"Now," I said, "I've set the probe switch to 'Direct' and hooked it into the sync take-off point."

"I can see it in the picture, Doc. That sync looks nice and black."

"I know that, Shorty. I just want to see how well the sync circuit works in this 'scope."

Shorty didn't know it, but I have a 91 'scope in my shop. I just wanted to prove to him that you don't have to be a genius to use it.

"Set that sweep switch to 'V' or 'H' and see what you get."

Shorty fumbled for a moment, then found the switch. I knew he hadn't even read the operating instructions.

"You've got too much gain, Shorty. Turn down the vertical range switch and center the trace."

"How does that look?"

"It would be better if you expanded the trace so you can see the corners on that sync pulse. Turn up your horizontal gain."

Shorty was obviously surprised at what he saw. A large, clean-looking pulse sat rock-solid in the middle of the 'scope screen. I could see that I would have to play school teacher.

"You shouldn't have any trouble if you use those pre-set V and H positions," I went on. "They give you automatic lock-in on V, H, and composite signals. That covers about 90 per cent of the forms you look at in this business."

Shorty flipped the sweep switch from H to V. The 60-cps vertical pulse snapped in.

"Bet you didn't know your 91 had a built-in, two-stage sync separator, did you?" I asked. "It's just like the integrating and differentiating networks in a TV set. They automatically sort out the sync pulse you want and feed it into the 'scope sync circuits. Neat, eh?"

Shorty grunted in modest acknowledgment.

"All right, Doc," he said, "Where do we go from here?"

"Let's measure the peak-to-peak voltage of that pulse, Shorty. Then you can look for the place where you're losing sync amplitude."

I guided Shorty through the three simple steps of voltage calibration. I explained how the graph-screen scales were just like the voltage scales of his VTVM, and showed him how the 'scope range and bandwidth switches resembled the range and function switches of his VTVM. After he had calibrated the 91, I reached over and changed the setting on all the controls.

"Why'd you do that, Doc! Now I have to go through the whole thing again."

"Why don't you?" I asked challengingly.

Shorty was learning. In 20 seconds, he was again ready for voltage measurements.

"You should be able to do that in five seconds flat, Shorty. But practice some other time. What does that pulse measure?"

Shorty moved the waveform over to the right-hand side of the graph screen and lined it up with the 50-volt scale.

"About 40 volts, Doc. That seems right for a pulse coming off this video stage."

"Now you're in business! I'll just sit back and criticize. Let me know when you find the trouble."

Shorty had found a new toy. After locking in and measuring several waveforms, including a couple that had nothing to do with the problem, he hit pay dirt.

"I knew it! I knew it!" he shouted. "I was going to clip out that bunch of parts next!"

I doubled up laughing. It was a good way for both of us to end the day.

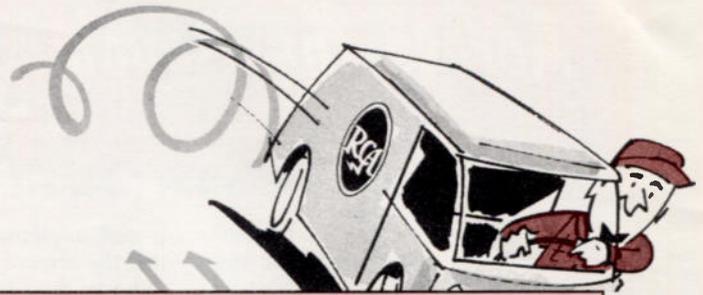
"Doc, let's go home," he grinned. "I'll fix that set first thing in the morning."

"Good, Shorty. But first — let me put that 'scope back where I found it."

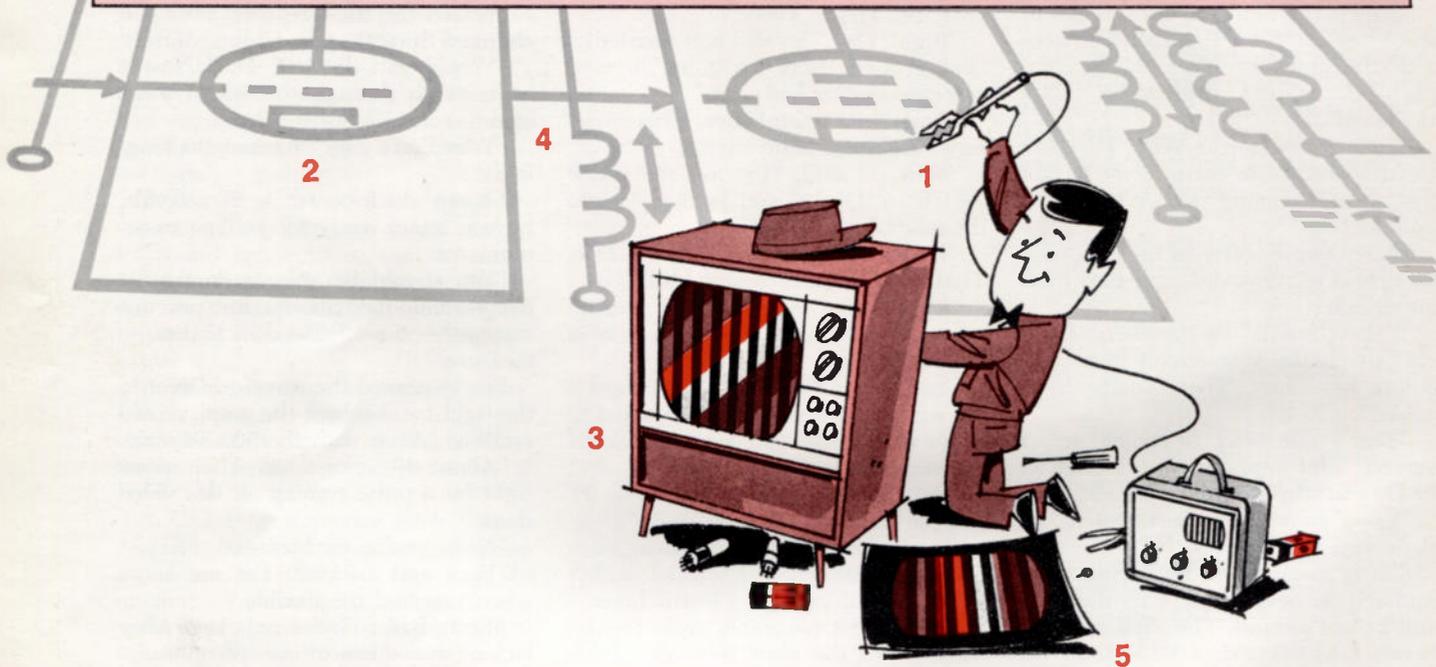
"Don't bother," he cut in. "I'll take care of it."

He did. He cleared away an area on the bench and tenderly set the 91 in the middle of it.

I felt that Shorty had found a silent partner.



**RCA HAS YOU IN MIND!** As the pioneer in compatible color television and a leading manufacturer of receiving tubes and picture tubes for color TV, RCA has a big stake in "Color." As a businessman and technician who serves the needs of the television public, *YOU* have a big stake in Color. Now – RCA provides a constant stream of helpful information specially designed to make your color-TV servicing work easier. On this two-page spread of *RADIO AND TELEVISION SERVICE NEWS* are the first in a series of ads now being featured in national trade publications. Prepared in the interest of the service-dealer and technician by RCA's foremost specialists in color television, these "Color TV Fastchecks" offer valuable tips and shortcuts to the heart of specific, everyday servicing problems encountered on the workbench or on house calls. If followed, these preliminary steps can avoid much unnecessary troubleshooting effort and save important minutes of your busy workday schedule for other important assignments.



## Loss of color sync? TRY ADJUSTING THE PLATE COIL...

Loss of color sync is often caused by a defective 3.58-Mc/s oscillator. In some receivers, it may also be caused by misadjustment of the plate coil in the reactance tube control circuit. Next time you run into this trouble, follow this simple procedure and it may save you a time-wasting callback.

1. Connect a color-bar generator such as the RCA WR-64B to the receiver and get the ten-color bar pattern on the picture tube.
2. Short the control grid of the reactance tube to ground.
3. The bars may have bands or blocks of color across them. These bands are "beats" resulting from difference between the local oscillator and transmitted signal frequencies. These colors may drift diagonally across the bar giving a "barber pole" effect, or they may be locked into the bars in blocks of different hues.
4. Slowly adjust the reactance tube plate coil with an alignment tool. Turn the slug in the direction which reduces the number of color bands or blocks across the bars.

5. Adjust for a zero-beat condition. At zero beat, the bars will display individual solid colors from top to bottom. These colors may be locked in or they may drift slowly from bar to bar. Remove the short from the reactance tube grid and re-adjust the plate coil for solid lock-in of the color bars.

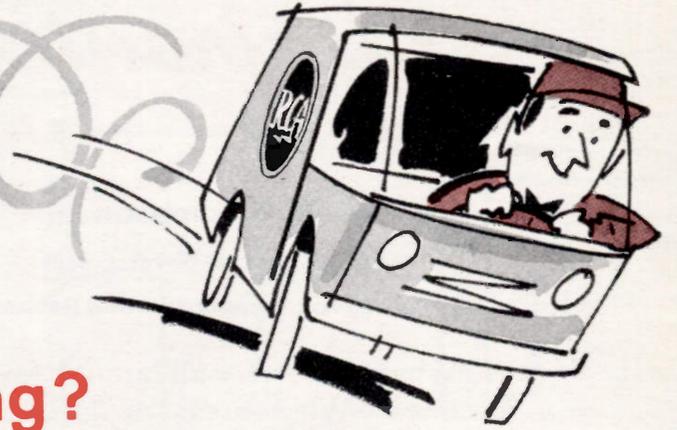
If you can get an exact zero-beat condition, it is an indication that the oscillator tube is good. If it is necessary to replace the oscillator tube, be sure to adjust the circuit for zero-beat as shown in step 5.

This color TV service hint is the first of a series of service hints from RCA. For satisfied customers and fewer callbacks, always replace with ultra-reliable RCA receiving tubes.

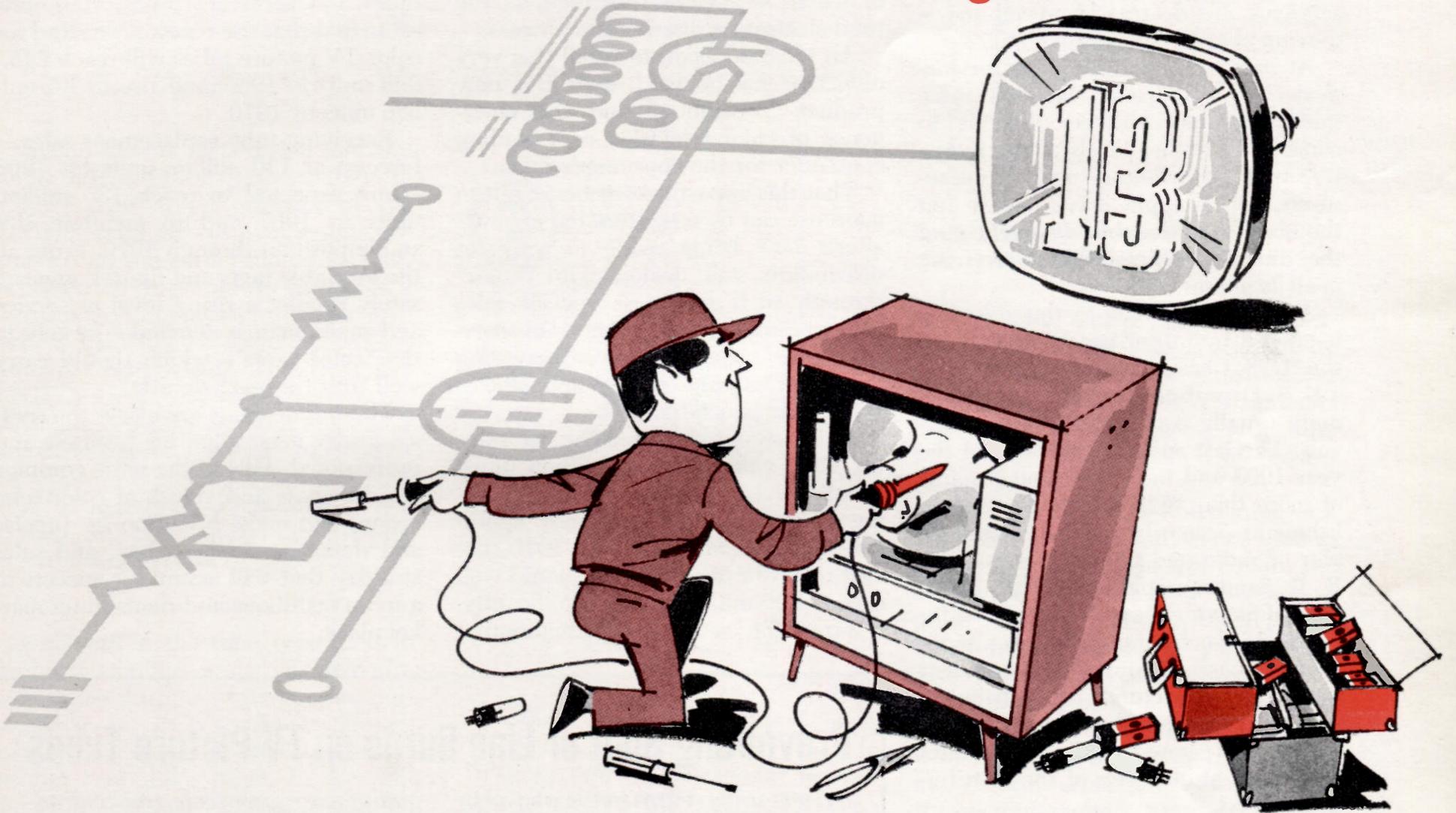
RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.



The Most Trusted Name in Electronics



**Blooming?**



## ...Varying picture size? Misconvergence?

### Check the high voltage regulator section

Poor high-voltage regulation in color sets can be the cause of many needless callbacks, and in some cases, the outright loss of a valued customer. Merely replacing tubes in the horizontal and high voltage sections could result in a premature tube failure brought about by improper high voltage regulator action. Follow these simple FAST-CHECKS and make your color set servicing life a little easier.

1. Determine the proper value for the high voltage by checking the service notes of the receiver. Measure the high voltage at the picture tube anode connection and adjust the high voltage control for the specified value.
2. Turn the brightness control back and forth. If during this adjustment you get blooming, varying picture size and misconvergence, measure the cathode current of the high voltage regulator tube with the brightness turned down. If the regulator tube cathode current is below the specified minimum when the correct high-voltage is attained, the high-voltage input to the regulator system is probably low.
3. To correct small errors in the high-voltage input to the regulator tube, measure cathode current in the horizontal deflection output tube and adjust the horizontal efficiency coil for the specified current.
4. If this adjustment does not increase the regulator tube cathode current to the specified value, check the horizontal output tube, the damper tube and the drive to the horizontal output tube.
5. After making any adjustments or changes required in step 4, rotate the brightness control. If the shunt regulator tube is in good operating condition and you have made the proper adjustments, the blooming, varying picture size, and misconvergence will disappear.

Before replacing a shunt regulator tube, always follow the procedure above. You'll save time and money and have a satisfied customer.

This color TV service hint is another in a series of service hints from RCA. When you order receiving tubes, always specify "RCA". You'll find your customers better satisfied and you'll have fewer callbacks.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.



**The Most Trusted Name in Electronics**

# Electronics Servicing is Big Business

by R. B. Sampson

Manager, Market Development

RCA Electronic Components and Devices

"What is the over-all outlook for my business? What areas of electronics servicing are decreasing in volume — moving ahead — or standing still?"

At best — the independent service-dealer or technician who asks these questions finds answers difficult to come by. At other levels of the industry, both, distributors and manufacturers, for example, have keenly felt the absence of reliable data reflecting the direction of electronics servicing in all its phases.

A partial approach to this dilemma is offered by information contained in the "U. S. Census of Business Reports," a U. S. Department of Commerce summary usually issued at five-year intervals. The last such report covered the year 1963 and indicated total receipts of more than \$628 million for "establishments primarily engaged in the repair of radio and television sets" (see R. B. Sampson column in Fall, 1965, issue of SERVICE NEWS).

Lack of such information on a more frequent basis, of course, is inexpedient for the manufacturer or distributor, who would like to know the "where, when, and how-much" of product movement at all levels of the distribution process.

But the dealer, too, has an important stake in knowing all the answers. He might, for instance, wish to know what aspects of electronics servicing are showing growth on a national or regional basis. With this information, he could plan to drop "unprofitable" areas of servicing and concentrate his equipment build-up and know-how on those sectors showing promise. To cite another example, a dealer experiencing a sustained increase in servicing demand might wish to know whether he should invest money to expand his facilities. Here — again — reliable data reflecting the presence or absence of a "trend" would help him reach a decision. When such data are not available, he must rely solely on his experience, business judgement, and "trade talk."

Fortunately, the recent tremendous upsurge of the home-electronics market and the growing importance of "in-depth" planning have fostered notable improvements. Today, numerous manufacturers, associations, and agencies

are grinding out a continuous flow of marketing information, "forecasts," and "projections." It is only reasonable to assume that the benefits of all this new information should be extended to the distributor and service-dealer, each of whom is a vital constituent in the total electronics distribution process.

An ideal occasion to fulfill this very objective has arrived with the new product "revolution" and the emergence of color television as a leading contender for the consumer's dollar.

That this opportunity is being put to good use can be seen from the gigantic efforts now being made to acquaint distributors and dealers with "color" through such media as special sales presentations, technical and business "seminars," and the ever-increasing current of valuable reports and articles from trade associations.

It is estimated that color set sales for 1966 will reach 5.5 million units. Total television receiver sales, including black-and-white sets, may aggregate 13.5 million units. By 1970, the vast reservoir of sets-in-use should well exceed 100 million units. Significantly, it is from the "sets-in-use" category that

the service-dealer derives the bulk of his revenue.

This formidable build-up in the number of television sets in operation bears a direct relationship to sales of renewal, or "replacement," picture tubes and receiving tubes. It is now estimated that the renewal demand for color-TV picture tubes will reach 245,000 units in 1966, and rise to 1.5 million units by 1970.

Receiving-tube replacement sales — forecast at 130 million units for 1966 — are expected to reach 135 million units in 1967 and to maintain this stable position through 1970. From all the available facts and figures, one can safely predict a rising level of service and maintenance demand — largely in the "color" area — which should carry well into the next decade.

The implications are clear: the service-dealer must align his business and professional skills to the more complex requirements and values of color television; and make provision for precise and definitive "approaches" and sales strategy that will assure his success in a more fastidious and demanding market place.

## Preventing Spot or Line Burns on TV Picture Tubes

Spot or line burns in the phosphor of a television picture tube result from a scanning failure in the TV receiver, and show up as permanent dark areas on the face of the tube.

In many instances, scanning failure can be avoided by following correct servicing procedures. Spot burns, for example, are caused by loss of both vertical and horizontal deflection. Under the latter condition, the electron beam appears as a stationary, high-intensity point near the center of the screen. Line burns, on the other hand, are caused by a vertical-deflection failure in which the electron beam is concentrated in a single, horizontal line across the picture tube.

Under the aforementioned conditions, burns can result even when the brightness control is set below a normal level. (Note: While the "service" switch on the rear apron of color-TV chassis is used to collapse the vertical deflection during

*preliminary gray-scale tracking adjustments, this control simultaneously biases the tube so that electron-beam intensity is reduced below the damage point.*)

A typical cause of burns is neglect to reinstall the yoke on the picture tube. Scanning failure and subsequent burns also result if B+ voltage to the vertical oscillator or output circuits is removed.

Once a spot or line has been burned into the tube phosphor, it cannot be eliminated. Such burns are not covered by picture-tube warranty.

In all TV servicing, therefore, it is important to remember these two simple rules:

- Never operate the receiver unless both vertical and horizontal scanning are functioning.
- Never operate the receiver unless the deflecting yoke is correctly positioned on the neck of the picture tube.

# PLAIN TALK

AND

## Technical Tips

### General Pointers on the RCA-CTC17X 25-Inch Color Chassis

Several circuit refinements and the use of different tube types combine to improve over-all performance of the CTC17X color chassis over results obtained from the earlier-model CTC17. Incorporated in the newer chassis is a transistorized circuit to insure positive vertical blanking of the color picture tube. All instruments employing the CTC17X are equipped with the RCA-25AP22A "Hi-Lite" picture tube. This rare-earth phosphor picture tube, offering improved picture brightness and more natural color reproduction, is a 25-inch, 90° rectangular, integral-protective window type.

#### Tube Applications

A change in the tube type used in the burst amplifier and color demodulator stages further improves the performance of RCA's newer 25-inch chassis. A frame-grid 6JC6 is used in the burst amplifier stage. In the previous "17" chassis, a 6EW6 performed this function. Use of the frame-grid tube in the burst amplifier stage improves the performance of color lock-in during fringe reception.

Functioning in the demodulator stages are type 6HZ6's. Other tube type changes include the 6JE6A horizontal output; 2AV2 focus rectifier; 6DW4B damper; and 6BK4B high-voltage rectifier.

#### Circuit Variations

Refinement of the side pincushioning circuit now makes the use of a side pincushioning control unnecessary. This circuit now uses fixed value components. A closer control of the tolerance in the side pincushioning transformer made the change feasible. The top-bottom pincushion circuit is basically the same as in the CTC17. Adjustment of the top and bottom pin and amplitude controls — to obtain straight horizontal sweep at the top and bottom of the screen — is the same as that in the previous 25-inch chassis.

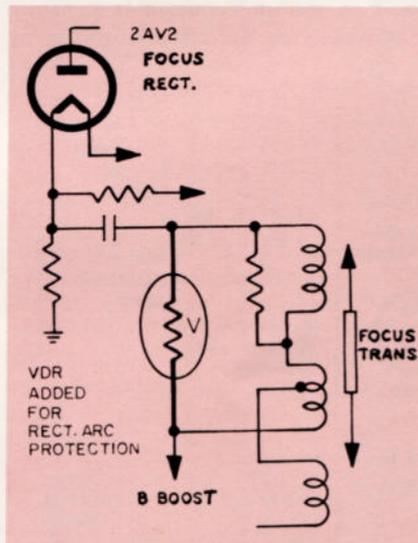


Figure 1: Simplified focus circuit.

The CTC17X focus circuit is basically that used in the CTC17, however, the tube has been changed (2AV2), and the circuit is slightly revised to provide arc protection. A VDR now shunts the majority of the focus transformer windings. This device will protect the focus transformer from damage in the event arcing occurs in the focus rectifier.

The 25AP22A used with the CTC17X chassis has a very efficient red phosphor. To permit gray-scale tracking, the video drive to the cathode of the red gun is reduced by adding a shunt resistor (15K) as shown in Figure 2.

#### Solid-State Vertical Blanking in the CTC17X Chassis

In modern television design, it is common practice to supply — from within the receiver circuits — blanking pulses in addition to those transmitted by the station. Most receivers supplement vertical blanking; some also include horizontal blanking. Usually, pulses obtained via fixed-value components perform this function. In

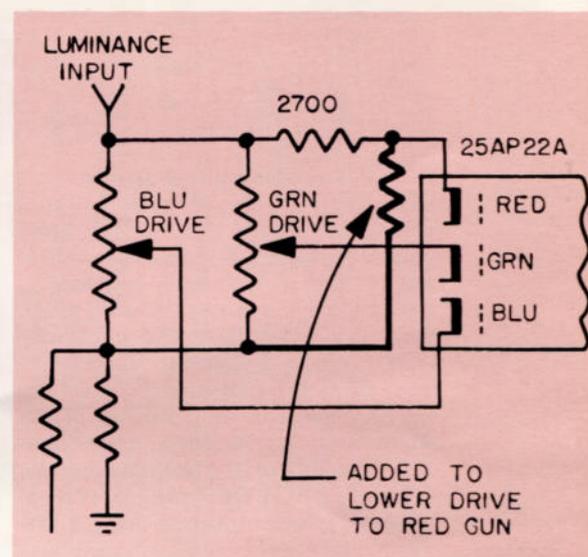


Figure 2: Simplified schematic showing CTC17X chassis picture-tube drive circuit.

RCA's CTC17X color chassis, however, active vertical blanking is realized by inclusion of a separate transistorized stage. The solid-state circuit permits precise timing and shaping of a pulse to be used for elimination of vertical retrace lines.

An n-p-n transistor functioning in a grounded base configuration is used as shown in Figure 3. In this circuit, the emitter is the signal input element (a pulse obtained from the vertical output transformer is coupled to the emitter). The transistor is biased so that it conducts during active scanning time. During the time that the positive vertical pulse is applied to the emitter, i.e., vertical retrace time, the transistor is forced into cutoff. Now — recall that in a common base circuit, with the signal takeoff in the collector circuit, the input signal to the emitter has no phase reversal. Consequently, a selected portion of the positive input pulse is developed in the collector output circuit. The positive signal, shaped by the transistor circuit, is coupled via the diode to the grid of the second video tube; this added positive signal increase at the grid causes more tube conduction during the time indicated by the shaded portion of the waveform. The waveform illustrated at the input to the video stage in Figure 3 indicates the vertical blanking interval and the vertical sync pulse. R333 (27 K) is a bias resistor to limit the positive excursion on the grid, thus protecting the tube. The output signal available at the plate is, of course, a negative going signal, modified to include the additional blanking level. The transistor actually acts as a switch. During scanning time, the transistor is conducting; during ver-

(Continued on next page)

# Plain Talk and Technical Tips

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tical retrace time, the transistor is driven into cutoff. The block diagram portion of Figure 3 shows the end result on the picture tube cathodes — after inversion and amplification in the third video amplifier. The *additional* level appears during the vertical retrace time; the increased positive signal impressed on the cathodes of the picture tube is sufficient to insure complete blanking of vertical retrace lines.

In other RCA color chassis, vertical blanking is accomplished using a dif-

ferent arrangement. A positive pulse, usually obtained via a dividing network from the vertical output transformer, is coupled to the plate circuit of the final video amplifier and thus to cathodes of the color picture tube. The new transistorized vertical blanking stage used in the CTC17X color chassis results in more efficient elimination of vertical retrace lines. The transistor used in the vertical blanking stage is a soldered-in, epoxy type which is located on the underside of the chassis in proximity to the 3.58-Mc crystal.

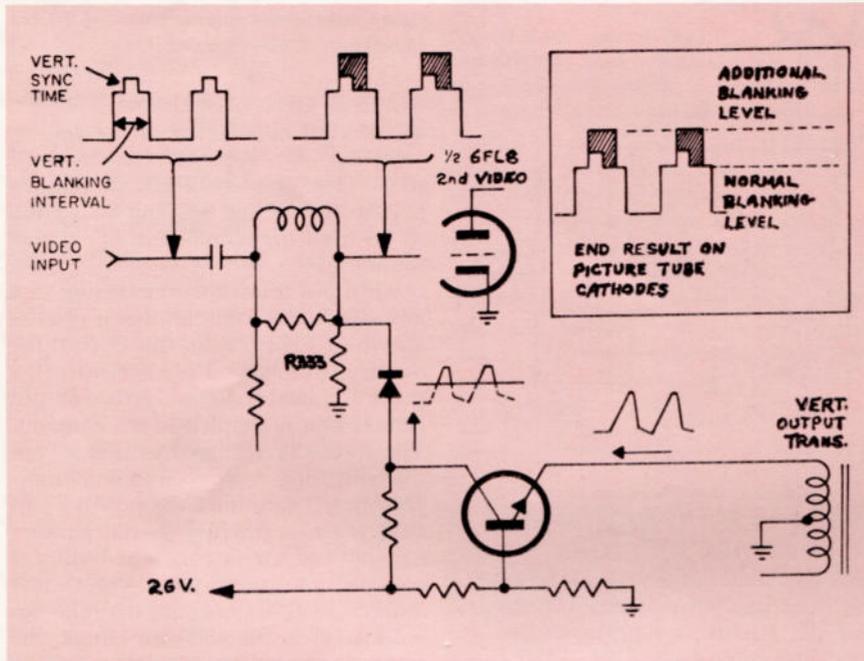


Figure 3: Transistor vertical blanking circuit and block diagram showing end result on the CTC17X picture tube cathodes.

## Some Salient Features of the RCA-CTC19 Color Chassis

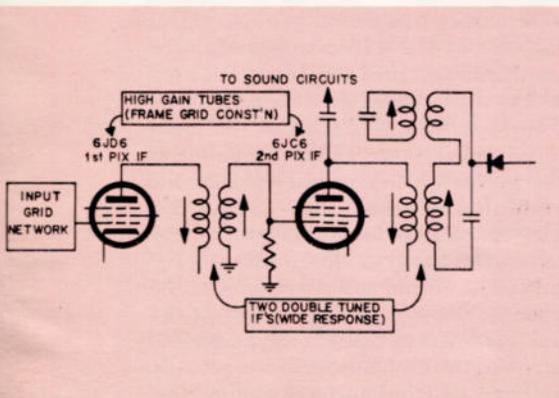


Figure 4: Simplified schematic showing CTC19 two-stage IF.

The RCA-CTC19 color chassis is designed to operate the RCA "Hi-Lite" 19EYP22, a 19-inch rectangular 90° picture tube type announced in 1965.

General operation of the receiver follows that of the current RCA color sets. Two "solid-copper circuit" boards are used in the main chassis. One board contains the chroma, audio output, and the video output stage. The second board contains the picture IF's, first video amplifier, sync, AGC, vertical oscillator-output, sound IF and demodulator, and the horizontal oscillator.

Instruments employing the CTC19 chassis use the KRK128 VHF tuner. This tuner has four tuned stages, using

a 6DS4 nuvistor RF amplifier and a frame-grid 6KE8 as a mixer-oscillator.

All receivers are factory-equipped for UHF operation, using the transistorized KRK120 UHF tuner. Remote control is included in some models. The three-function, all-transistor KRS28 used in present black-and-white receivers is utilized.

The picture IF signal circuits in the CTC19 chassis consist of two high-gain IF stages using the 6JD6 and the 6JC6 frame-grid tubes. Gain and response performance equal to a three-stage IF is obtained with the use of a high-gain tuner (nuvistor and frame-grid mixer), high-gain IF tubes, and double-tuned inter-stage transformers.

Video detection is accomplished by a diode circuit and the detected signal is applied to a two-stage mixer video circuit. The first video amplifier uses the triode section of 6GH8A. This stage has a "frequency-selective" coupling circuit; the grid and cathode are driven independently. The detector output is impressed between the grid-cathode of the triode for high frequencies. For low-frequency luminance signals, the triode acts as a cathode follower and provides a low-impedance match for the delay line. The luminance signal passes through the delay line to a second video stage that uses a 12HG7 high-gain video amplifier tube. The brightness signal is DC-coupled from the plate circuit of the second video amplifier to the cathodes of the picture tube by way of the green and blue drive circuits. As in RCA's previous color receivers, a convenient switch is included for set-up adjustments. When in the service position, a fixed voltage is applied to the cathodes of the picture tube and vertical sweep is removed for set-up on a single horizontal line.

In the CTC19 chassis, color and sync signals (obtained from the grid-cathode circuit of the first video amplifier) are fed to a sync, AGC, and chroma amplifier stage (the pentode section of a 6GH8A).

Color information receives special attention in the first video and chroma amplifier stages. The chroma signals are obtained from the cathode circuit of the first video amplifier via networks *selective* to high frequencies. Additional peaking to recover *maximum* chroma is obtained by a series resonant network in the input grid of the AGC, sync, chroma amplifier tube. The sync, AGC, and *high-level* chroma are available at the plate circuit of the sync/AGC/chroma stage.

The sound circuit has a separate diode detector and, as in previous chassis, the signal is taken from the plate of the last picture IF. The sound

signal is handled by a three-stage sound circuit, using a *frame-grid* 6JC6 as the sound IF amplifier, a 6HZ6 demodulator, and a 6AQ5 in the output stage.

The CTC19 uses one stage of chroma amplification, "X" and "Z" demodulators, and color-difference amplifiers to recover R-Y, B-Y, and G-Y signals. The progress of chroma signals through these stages closely follows the signal flow in previous RCA color receivers. Tube type 6GH8A is used exclusively for all functions in the color circuits, as illustrated in the Figure-6 block diagram.

One of the most interesting circuits in the CTC19 is found in the color sync stages. The output of the burst amplifier stage (pentode of 6GH8A), injects the color burst signal directly to an *Injection-Locked* oscillator. Burst is coupled into the crystal oscillator grid circuit, which — in turn — locks the 3.58-Mc oscillator in step with the incoming burst signal. Temperature drift in the burst transformer has a minimum effect on the frequency and phase of the oscillator. The oscillator can be adjusted for the correct frequency, and the burst transformer can be peaked for maximum burst signal, independently of each other. A capaci-

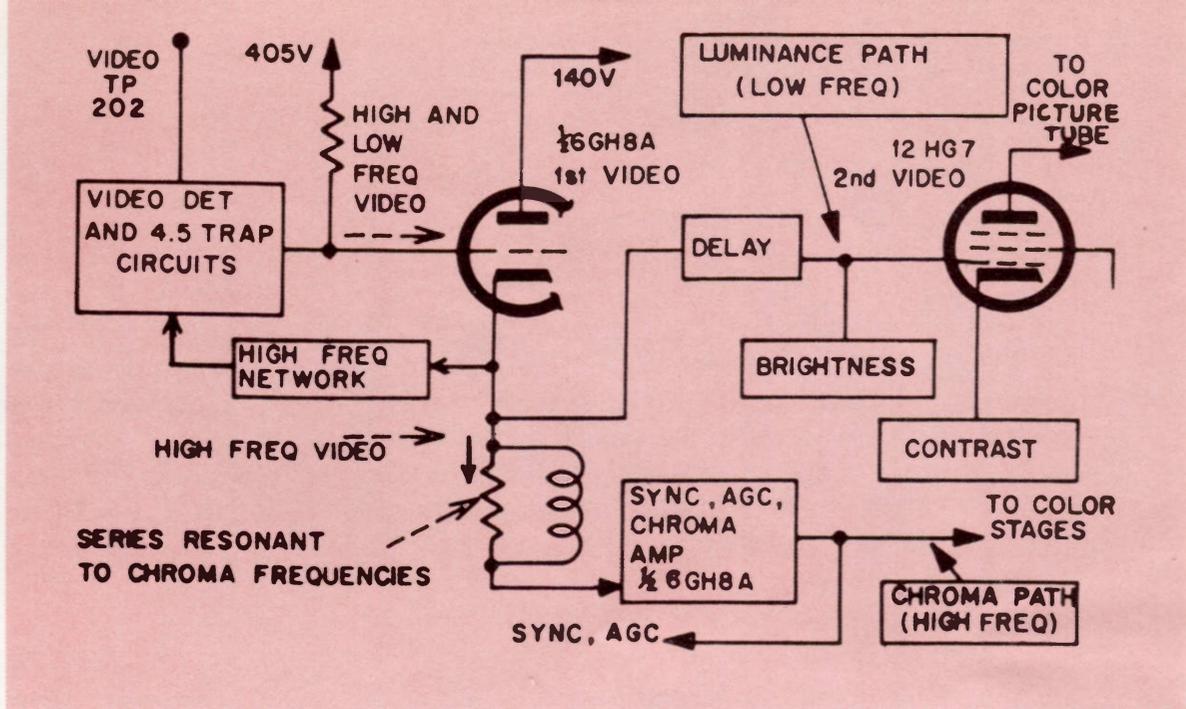


Figure 5: Block diagram of CTC19 frequency-selective video.

tor trimmer located in the grid circuit of the 3.58-Mc oscillator is used to adjust the oscillator on frequency; the burst transformer is adjusted for maximum transfer of the burst signal to control the oscillator. The frequency of the oscillator is determined mainly by the crystal circuitry. Any variation in loading on the output plate has little effect on the oscillator frequency. The TINT control is part of a phase-shifting network in the plate circuit. Rotating the control alters the phase fed to the color demodulators.

Control voltage for the killer stage (and thus the chromas bandpass stage) is derived directly from the grid of the oscillator circuit. During conditions of no color, negative voltage on the oscillator grid is approximately 4 volts; *with* color, negative 8 volts (actual voltage depends on the amplitude of the incoming burst signal). This voltage change in a more-negative direction is fed to the killer grid, and is sufficient to cut off the killer, allowing the bandpass stage to conduct. The circuit and

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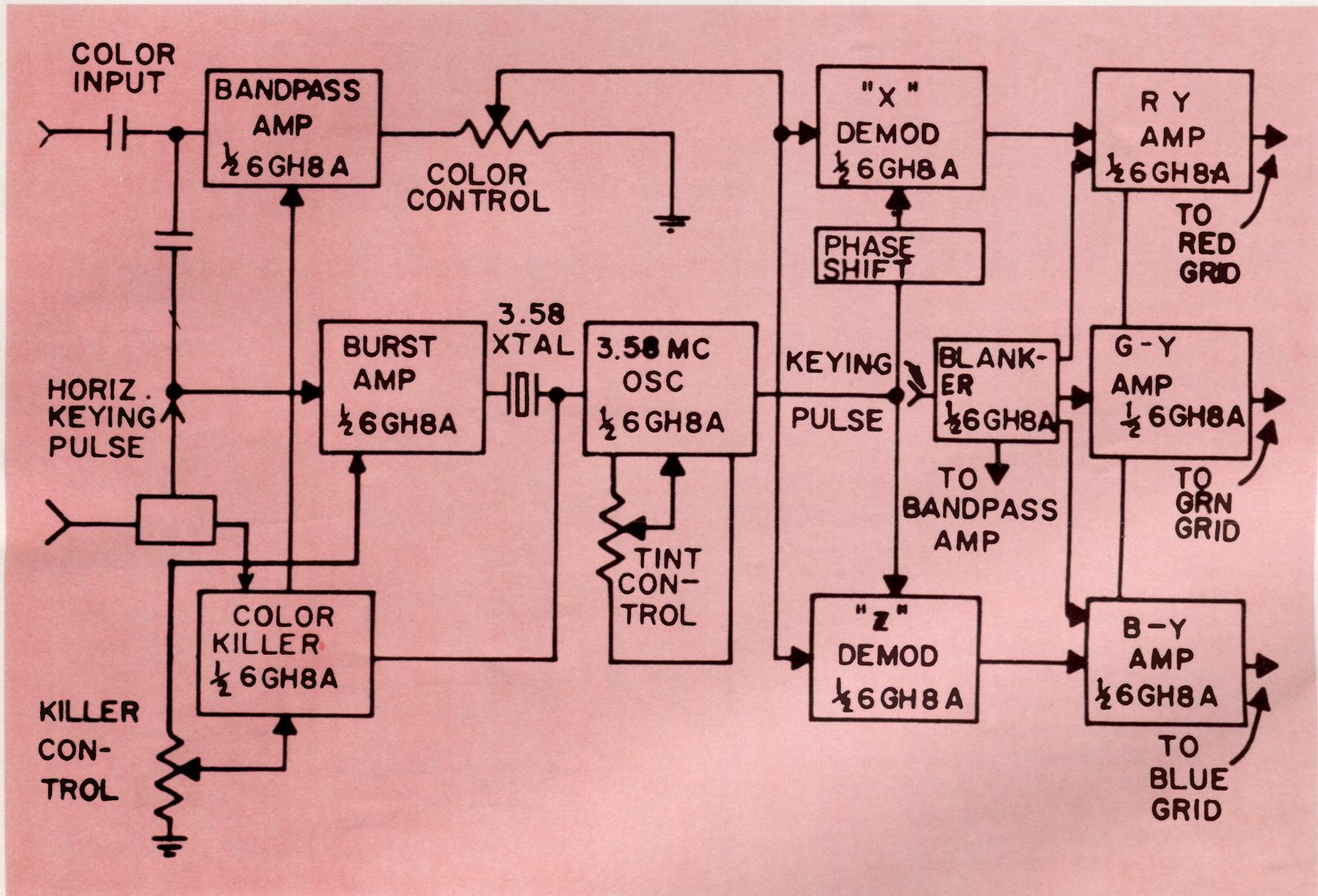


Figure 6: Block diagram of CTC19 color stages.

# Plain Talk and Technical Tips

(Continued from preceding page)

operation of the horizontal blanker and the three-position kine bias switch is very similar to that of previous RCA color receivers. Most of the circuits in the CTC19 are very closely related to the reliable circuits used in other RCA color chassis.

The vertical oscillator-output stage uses a 6GF7 and the basic circuit follows closely the vertical circuits in previous color chassis. Similarly, the horizontal oscillator-AFC circuit is related to previous circuits, with the commonly used 6FQ7 as the oscillator. The application of voltage-dependent resistors (VDR) in the vertical and horizontal circuits — to provide circuit stability — is continued in the CTC19. Several more recent tube types in the horizontal and high-voltage circuits were employed for the first time in RCA's 19-inch color chassis. Among these are the 2AV2 focus rectifier and the 6BS3 damper. In the horizontal-output role is the 6KM6, while use of a 6BK4B ensures higher reliability in the shunt regulator stage. The familiar 3A3 high-voltage rectifier tube furnishes the 24-kV second anode voltage for the 19-inch picture tube. Slightly modified versions of the focus and horizontal linearity circuits are used in the CTC19. Adjustments for high voltage, regulator current, and horizontal-output current are made using the same procedures as used in previous RCA color chassis.

The high-quality performance, reliability, and service features expected of RCA color engineering are continued in the CTC19. Here is a brief summary of CTC19 features:

There are 20 tubes in the CTC19 chassis. Seven 6GH8A's are used, and a 19EYP22 color picture tube is employed in instruments using this color chassis. The UHF tuner is transistorized. The power supply is a full-wave bridge circuit using four silicon rectifiers. Protection for the B+ line is a reset circuit breaker. A wire link fuse protects the main filament line. All receivers using the chassis are equipped with automatic degaussing. Vertical pincushion circuits are used. Adjustments for top and bottom pincushion are the same as in the CTC17. A side pincushion circuit is not needed with this 19-inch color picture tube. The CTC19 features RCA "solid copper circuit" construction; two main chassis boards are used. Receiver setup adjust-

ments (purity, convergence, etc.) are accomplished with the same procedures as used previously. Two video amplifiers are used: 6GH8A, first video; 12HG7, second video. The CTC19 demodulates on "X" and "Z" axes to recover R-Y, B-Y, and G-Y difference

signals. Color sync processing is by means of an injection-locked 3.58 crystal oscillator, directly controlled by the incoming burst signal, and color killer signal bias is obtained from the grid circuit of the 3.58-Mc oscillator.

The service technician will find that the CTC19 has many similarities to previous color receivers. The few circuit areas which are different are straightforward and servicing techniques in present usage can be easily applied to this color chassis.

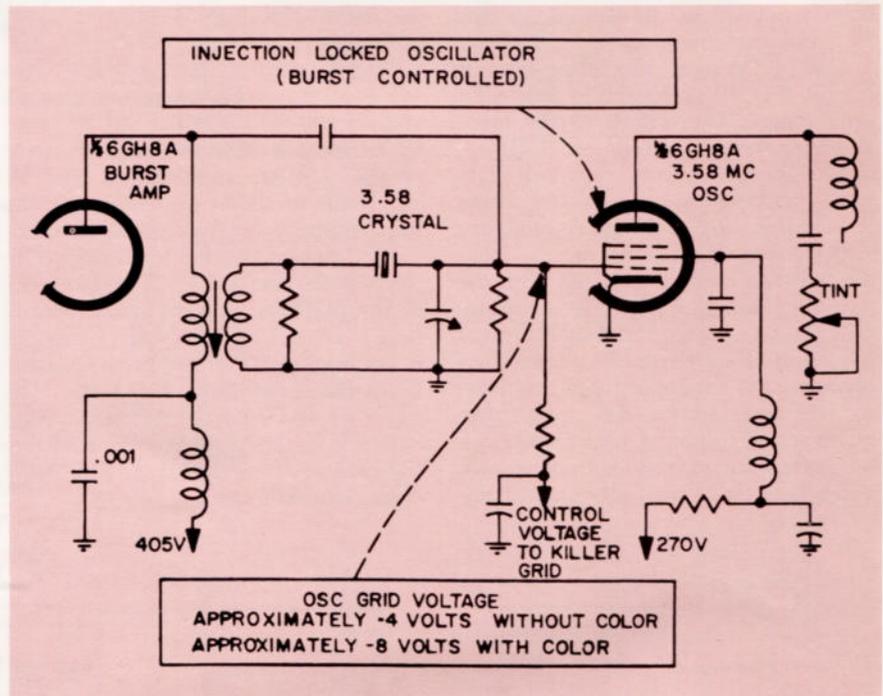


Figure 7: Simplified schematic of CTC19 3.58-Mc oscillator.

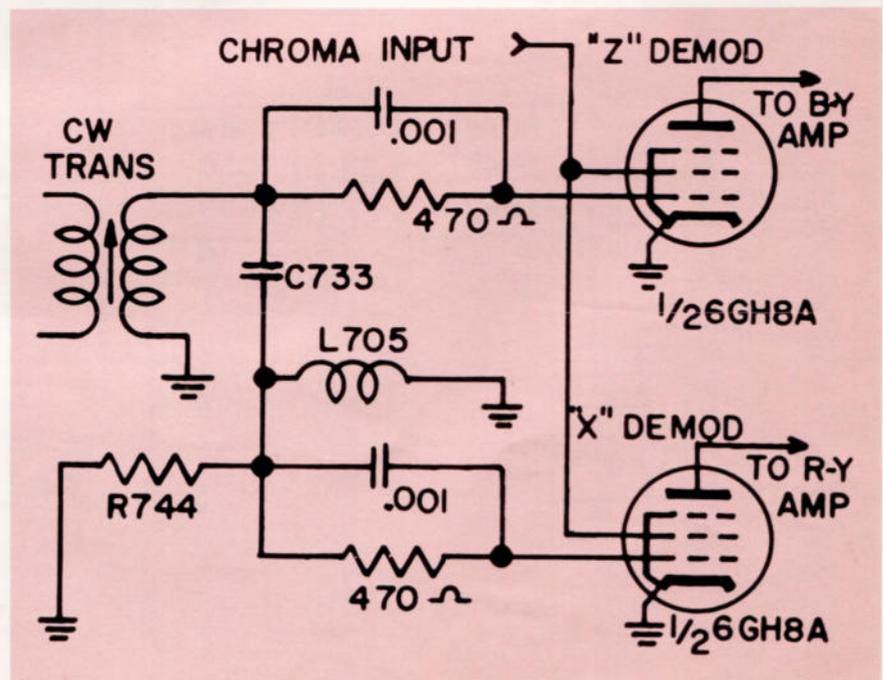
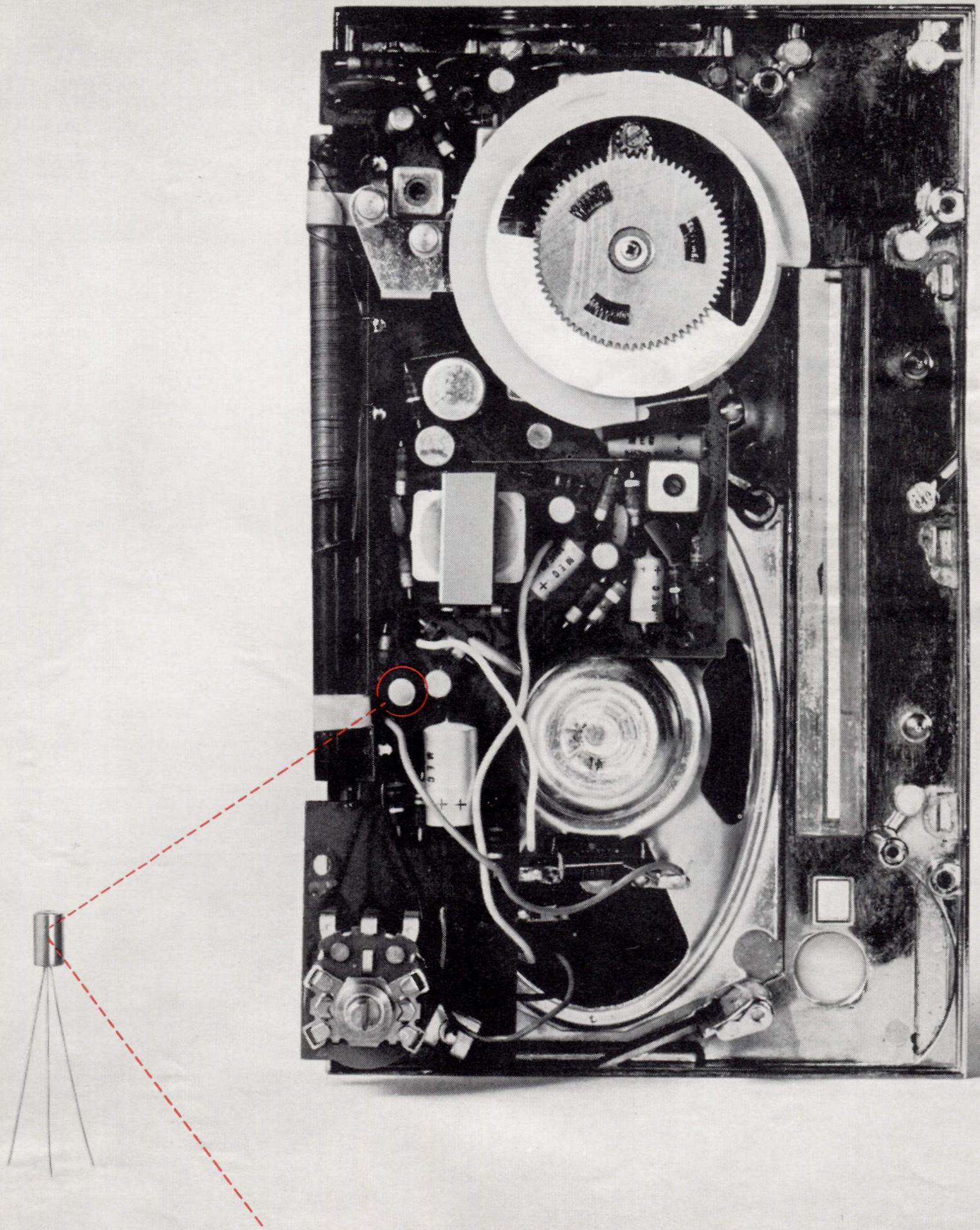


Figure 8: 3.58-Mc phase shift circuit.



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