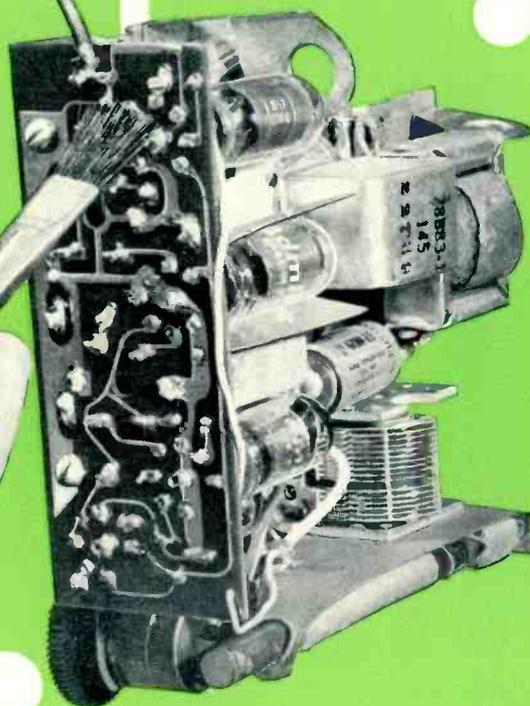


# TECHNICIAN

& *Circuit Digests*

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"Etched"  
Circuits



March • 1954

# NO. 1

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MARCH, 1954

TECHNICIAN'S COVER illustrates soldering operation on an etched-metal radio. A glue brush and a low-wattage soldering iron are being used. For further details, consult Jack Bayha's article, *Servicing Printed Chassis*, on page 29 of this issue.

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# REVOLUTIONARY NEW

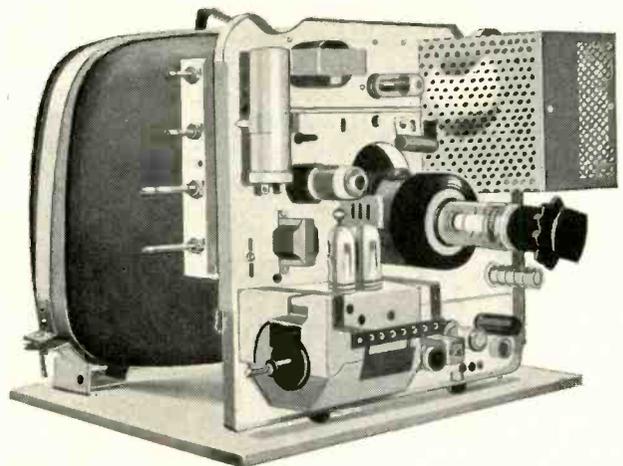
(Most compact TV set ever designed) **IS A**

## Crosley Super-V is dramatically different inside!

Here's one set that is designed with the TV service man in mind. Removing the back of the Super-V plainly exposes all secondary controls and every tube in the set. And as you know, 9 out of 10 service calls merely require the change of a tube.

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The Super-V is a cinch to install. It's compact, weighs only 53 pounds. And

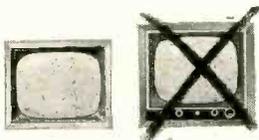


in many places, you'll find its built-in antenna is all you need for perfect reception. Service men who've seen the Super-V call it the greatest forward step ever taken in TV chassis design.

## Crosley Super-V is dramatically different outside!

**How?** The Super-V is the most compact TV set ever designed . . . takes up  $\frac{1}{3}$  less space than other 17" sets. It'll fit in places you couldn't *think* of putting other sets, actually make it possible for your customer to have TV in any room in his house!

The front of the Super-V is *all screen*—for added convenience and extra good looks, the controls are on the side.



Be ready when Super-V Day hits your town.  
Call your Crosley distributor now.

Your customers will hear about the revolutionary Crosley Super-V on their favorite musical show—"Your Hit Parade." They'll come in and buy one faster when they see your name alongside Crosley's big newspaper ads. They'll stop and look when your window flies the colorful Super-V banners.

Your Crosley distributor has hard-working co-op advertisements, counter cards, specification sheets—and ideas to help you make a bonanza on the Crosley Super-V. Get in touch with him . . . TODAY!

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# CROSLEY SUPER-V SERVICE MAN'S DREAM !



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*A triumph of Crosley's 33 years' electronic research*

- TAKES UP TO  $\frac{1}{3}$  LESS SPACE THAN OTHER 17" TVs—FITS WHERE OTHER SETS WON'T
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- CHOICE OF THREE FINISHES (MAHOGANY, WALNUT, BLOND)
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*Super-V*

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Coast to coast.

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## TELEVISION PATTERN GENERATOR

**DEVELOPS BOTH RF  
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### A Must for Areas Where Continuous Station Broadcasts are Not Available

Now use the dot and line patterns from the new PHILCO Model G-8005 to check linearity, focus, astigmatism, blooming and high voltage regulation. Trouble shoot receivers on any channel, 2 through 6, or with video output. The PHILCO G-8005 Television Pattern Generator is an instrument especially adapted for service work . . . designed to save you time.

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4. A custom type instrument with new and novel circuits designed to reduce service time in both laboratories and service shops.

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### PHILCO MODEL S-8200 3" OSCILLOSCOPE

A sensitive, portable unit adaptable to either bench or field service. **VERTICAL AMPLIFIER:** DC coupled, Sensitivity—0.05V rms/inch. Frequency Response—0.1 mc/s within 6DB. DC coupled Vert. Amplifier circuits and low capacity probes facilitate video circuit trouble shooting. Built-in voltage calibrator permits use as high sensitivity vacuum tube voltmeter. **HORIZONTAL AMPLIFIER:** Sensitivity—0.5V rms/inch. Frequency Response—10 cps to 125 KC/s within 6DB. Sweep Circuit Frequency—Variable 15 to 30,000 cps . . . preset frequencies at vertical and horizontal sweep rates.



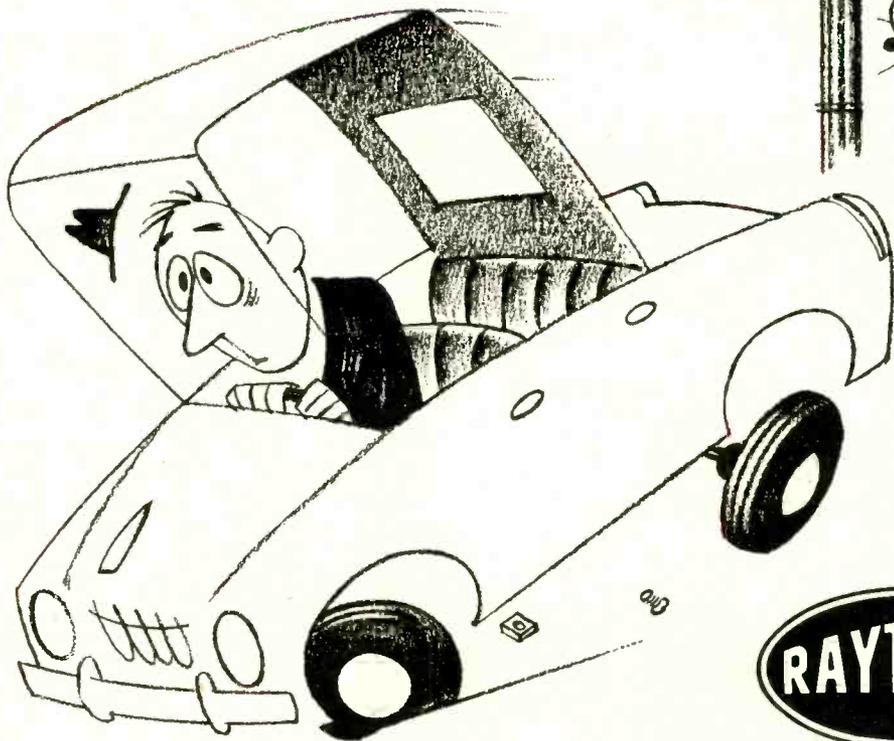
Take advantage of the great  
**SHARE and PROFIT Program**  
on Philco Receiving Tubes  
Parts and Accessories  
**NOW AT YOUR PHILCO DISTRIBUTOR**



See **PHILCO** Exhibit at IRE Show, March 22-25, Kingsbridge Armory, New York City



# CALL BACKS COST MONEY...



**AVOID  
THEM  
WITH  
THE**



## SERVICE SAVER PLAN

available through your **RAYTHEON TUBE DISTRIBUTOR**

The Raytheon Service Saver Plan, which permits customers to identify about 85% of all the troubles that may occur on the screen of a defective TV receiver — *and accurately transmit this information to the Service Dealer via telephone* — is helping to minimize costly call-backs two ways.

First, when a Service Dealer goes on a call knowing in advance what ails a TV receiver (thanks to Raytheon's Service Saver Plan), he goes completely equipped to do

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Ask your Raytheon Tube Distributor to tell you how to put the Raytheon Service Saver Plan to work for you.

**RAYTHEON RADIO AND TELEVISION TUBES** cut call-backs, too! Their outstanding quality reduces early tube failures to a minimum. Use them. You'll find them Right... for Sound and Sight... and you!



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Receiving Tube Division  
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already installed!



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**CHAMPION\***

the world's most powerful  
all-channel VHF antenna  
—OUT-PERFORMS AND OUT-SELLS THEM ALL!

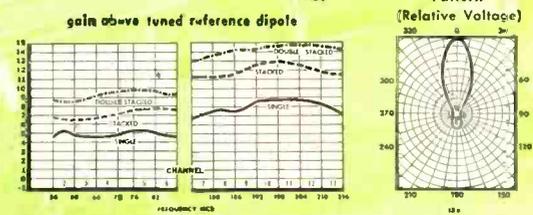
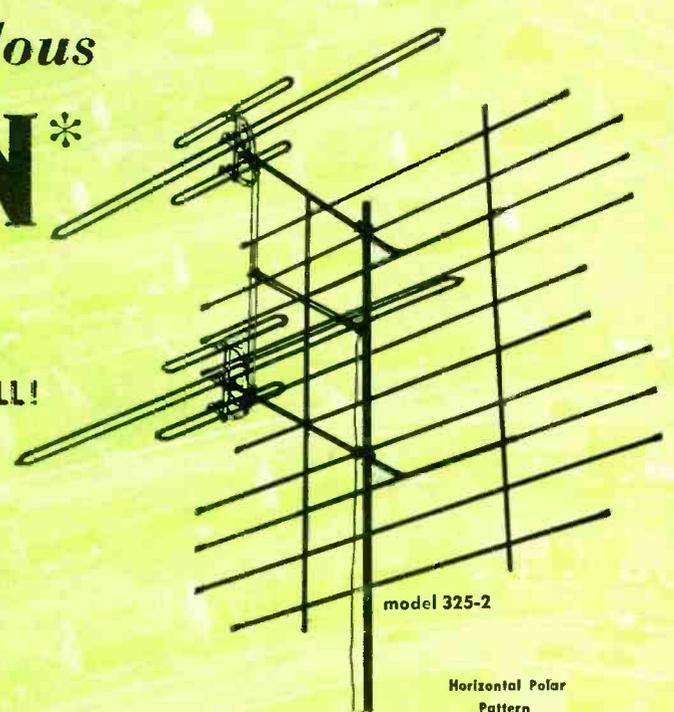
Never before in the history of television has an antenna received such an overwhelming reception. Channel Master's CHAMPION — in a few short months — has rocketed to the top as the nation's most-wanted, best-selling, best-performing VHF antenna!

**CHAMPIONSHIP Performance:** Only the CHAMPION has the unique new "Tri-Pole", a triple-powered dipole system in which the Low Band dipole also functions as three dipoles tied together, in phase, on the High Band.

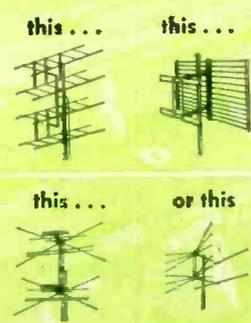
All-aluminum. Assembles faster than a 5-element Yagi! The CHAMPION is another great contribution of the Channel Master Antenna Development Laboratories.

**CHAMPIONSHIP Promotion:** The CHAMPION is the antenna America knows best!

- Publicized in leading magazines!
- Outstanding dealer Cooperative Advertising Program!
- Free newspaper mats, window streamers and TV film commercials!



**THE STACKED CHAMPION**  
**OUT-PERFORMS**



**THE STACKED CHAMPION PROVIDES:**  
**11-13 DB High Band gain**  
**6 1/2-7 1/2 DB Low Band gain**

Model No.		List Price
325	Single Bay	\$20.83
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<b>Separate Stacking Harness</b>		
325-3	2-Bay Harness	\$ 2.08
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**CHANNEL MASTER CORP.**

ELLENVILLE, N. Y. WORLD'S LARGEST MANUFACTURER OF TELEVISION ANTENNAS

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- No switching
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VHF only  
**TENNA-TIE**

model  
no.  
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Use with leads of any length! New, specially designed High and Low Pass filters entirely eliminate the need for critical lead lengths! This new, extremely effective circuit makes the TENNA-TIE the most effective filter of its type now available.  
— only \$3.50

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new low price — \$3.75

VHF-UHF  
**TRIPLE-TIE**

model  
no.  
9035



Ties together all three TV reception bands:  
1. Low Band VHF  
2. High Band VHF  
3. All UHF  
High and Low Pass filters enable the Triple-Tie to adapt all Hi-Lo VHF installations to UHF — quickly and effectively. "Free-Space" terminals for perfect all-weather UHF reception.  
new low price — \$4.86

## THE ANTENNA IN COLOR TELEVISION

by Harold Harris, Vice President, Sales and Engineering

Now that color telecasting is a reality, we will see an ever-increasing flow of color sets to the consumer. Although much is being said and written on the subject of color sets, many unanswered questions remain about the role of the television receiving antenna in color television.

*Will present antennas work on color?*

*Will a special antenna be needed?*

The results of thorough laboratory and field tests made by engineers of the Channel Master Antenna Development Laboratories show that practically all present TV antenna types will perform satisfactorily on color. Gain variations as high as 3 DB across one channel can be tolerated. When this figure is exceeded blurring or smearing of the picture may occur. Although there are certain antennas on the market which do have excessive gain variation, this is not the case of the vast majority of present installations.

There are also indications that fringe area color reception may be more critical. This may necessitate the use of fringe area antennas in areas closer to the TV station.

In the nation's most advanced television research laboratory, Channel Master antennas have always been designed for full band width and minimum variation in gain on any one channel.

For this reason, every Channel Master antenna which you have installed in the past, as well as the ones you install today, will provide reception of outstanding quality when color TV comes to your area.

**Channel Master antennas were the antennas selected for the tests which led to the F.C.C.'s approval of the National Television Standards Committee color system.**



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more ways  
than one!



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ANTENNA  
DEVELOPMENT  
IN YEARS...

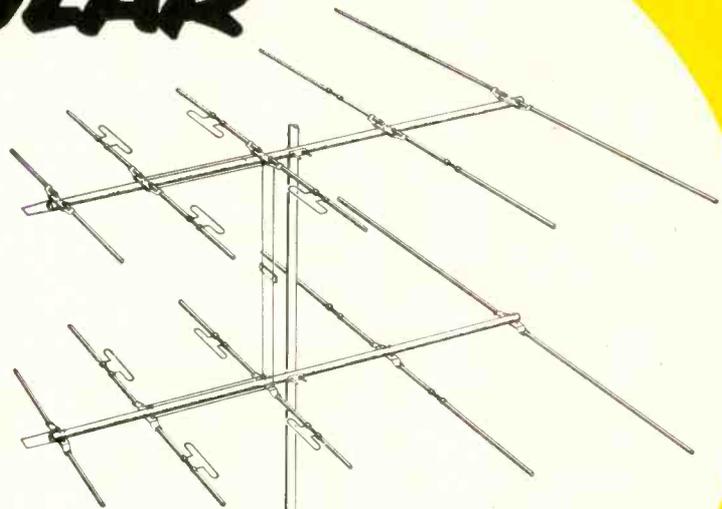
THE

**TACO**

**TRAPPER**

FOR CHANNELS

**2**  
*thru*  
**13**



**GAIN:**

Up to 10 DB single and  
13 DB two bay stacked

**DIRECTIVITY:**

Excellent pattern and  
high front-to back ratio  
for ghost-free performance

**SIZE:**

No larger than a single  
channel five element  
low band Yagi

**DURABILITY:**

High tensile strength  
aluminum and Fiber-  
glas insulation assures  
stability

**APPEARANCE:**

Streamlined and sym-  
metrical. Provides  
neat installation

**COLOR TV:**

Sharply directional, a  
color TV requirement

**PACKAGING:**

No KING SIZE cartons  
—easily transported &  
stored

**PRICE:**

Cat. No. 1880 Trapper.  
List: \$19.75 ea.  
Cat. No. 1882 Stacking  
lines. List: \$1.75 pr.

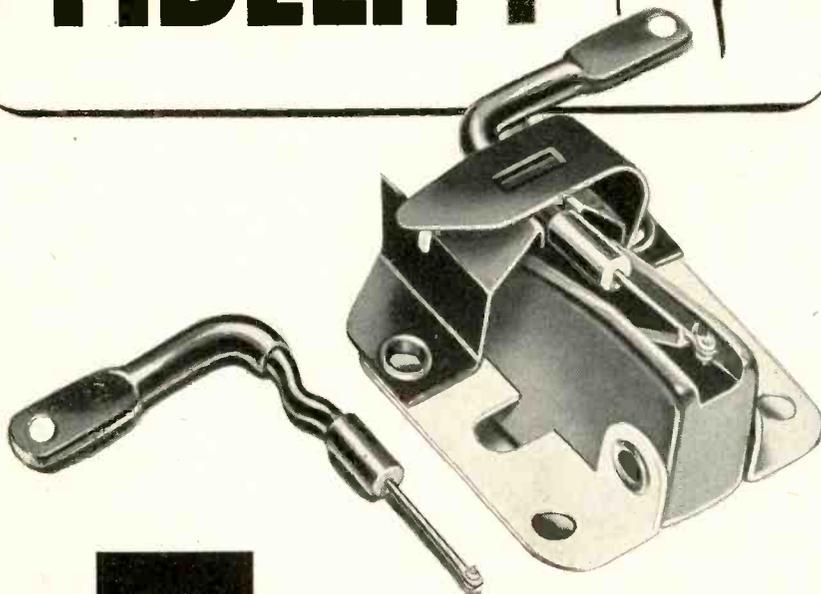
**All around, your BEST antenna buy!**

AT LAST, A SINGLE MODEL PACKAGED TWO PER CARTON, TO FILL  
EVERY VHF INSTALLATION NEED. REDUCES INVENTORY.

TECHNICAL APPLIANCE CORPORATION, SHERBURNE, N. Y. In Canada: Hackbusch Electronics, Ltd., Toronto 4, Ontario

The *FIRST STEP* in

**HIGH  
FIDELITY**



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( Used by America's foremost manufacturers of high-fidelity phonographs, TITONE is an original discovery and development of the Sonotone laboratories. Literature available. )

ELECTRONIC APPLICATIONS DIVISION

**SONOTONE CORPORATION**

Elmsford, New York

## LETTERS To the Editors

### Author Answers Critic

EDITORS, TECHNICIAN:

With respect to Mr. Green's comments regarding the "misinformation" in my article, *VHF Antenna Installation Problems* (December '53 *TECHNICIAN*), I would like to make the following comments.

1—In my use of the term *oscillating lines* (to which Mr. Green objects), I was not using standard nomenclature. I was trying to get across the idea that a transmission line in which standing waves are present will radiate energy in much the same way that an oscillator will, even though no amplification exists in the transmission line system. The existence of such radiations can be verified with a field strength meter.

2—With regard to my recommending an open-ended quarter-wave stub across the antenna: this was an oversight on my part. The manuscript should have said *closed-end* quarter-wave stub.

3—Mr. Green objects to my recommending a pad to eliminate "ghosts." He says:

"When 'ghosts' are due to reflections in the transmission line, due to mismatch at its ends, the use of a pad will help. However, in the case of 'ghosts' due to multipath reception, the ratio of the direct signal to the reflected signal is not changed by a pad. Therefore a pad will not help at all to reduce 'ghosts' due to multipath reception. Furthermore, the formula given in this paragraph will not give the straight line distance to the reflecting obstacle; it will give the difference in total path lengths of the direct and reflected signals."

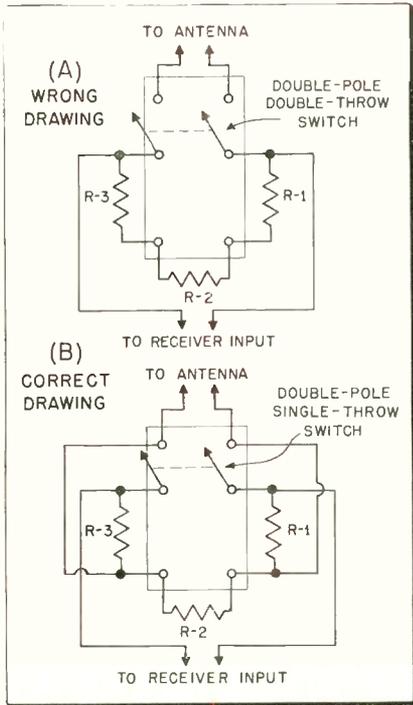
In the case of multipath signals, the attenuating pad is not supposed to change any ratio. Consider the fact that the "ghost" signal is usually much weaker than the direct, or desired, signal. Therefore, if the pad cuts down the signal strength of both signals, it is possible to reduce the "ghost" to an unobjectionable level while still retaining enough "direct" signal to permit a viewable picture. A judicious choice of attenuating pad will, in most cases, accomplish the desired result.

Incidentally, Mr. Green claims a pad will help eliminate "ghosts" due to line reflections when mismatch is present. In such a case, however, the unit used is no longer called a pad—it is, rather, referred to as a *matching device*. The word *pad* connotes attenuation.

With respect to Mr. Green's remarks on my formula for determining the approximate straight line distance between the receiving antenna and a reflecting surface responsible for a ghost: For many (but not all) practical cases, the formula present will give the desired distance to be set off as a radius from the receiving antenna loca-

tion. On a map of the area in question, use this radius to draw a circle with the receiving antenna as the center. The enclosed area will often include just one, or a very few, logical locations for the reflecting object.

While not accurate in all cases, the formula is, in practice, helpful.



Incidentally, an error is present in one of the drawings for which I must disclaim responsibility. Fig. 2 was drawn as shown in sketch A. It should actually have been drawn as in sketch B (Our fault—Ed.).

PHILIP THIER

East Meadow  
Long Island, N.Y.

### Another Valentine

EDITORS, TECHNICIAN:

Keep up the good work. Your magazine is the only one that tells how and why a fault occurs as well as how to correct it.

P. E. CAUBLE

Cauble's TV & Radio Service  
114-44 226th Street  
Cambria Heights, N. Y.

### Wants More Theory

EDITORS, TECHNICIAN:

I enjoy your publication very much. I have found it to be interesting, informative, richly filled with new manufacturers' products and a definite aid to better business.

I hope that you will come out with more deeply technical articles on the . . . synchroguide horizontal oscillator. Most articles just explain a few of the basic principles of all oscillators and give a few service hints. What I would like to read is a good text-book approach with a few derived formulas illustrating the time constants and reasons for the values of the components

(Continued on page 20)

# B-T LABS Ultravert

THE ALL CHANNEL UHF CONVERTER  
THAT OFFERS YOU *Everything*



PRICE  
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EXCLUSIVE FEATURES  
and GREATER  
PROFIT MARGIN

✓ LIST PRICE IS ONLY \$39<sup>95</sup>

✓ High Gain with Lowest Noise Factor

✓ Makes ANY TV Set a Modern 82 Channel Receiver

✓ Rapid Dual-Speed Tuning Controls

✓ Has No Power-Switch—'On-Off' Automatically Controlled by TV Set

✓ Rugged Construction, Attractive Styling, and Rubber Protective Feet

✓ Exclusively Designed 3-Section B-T Ultratuner

✓ Better Discounts for Greater Profits.

Make Your Own  
Point By Point  
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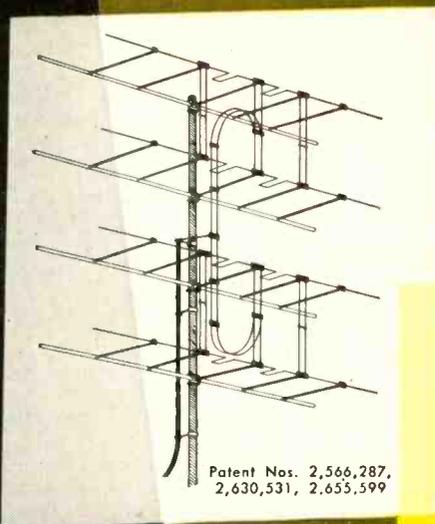
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Manufacturers of TELEVISION AMPLIFIERS, UHF CONVERTERS,  
MIXERS, DISTRIBUTION UNITS and TV ACCESSORIES

# Great Antennas by **FINCO**<sup>®</sup>

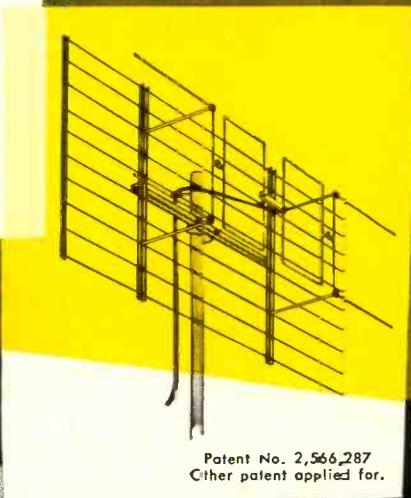
**DESIGNERS AND PATENT HOLDERS OF THE WORLD'S  
MOST ADVANCED ANTENNA PRINCIPLES . . . . .**



Patent Nos. 2,566,287,  
2,630,531, 2,655,599

## **FINCO 400-A UHF-VHF**

The acknowledged leader in the fringe area market — Perfect pictures, all channels 2 to 83, up to 150 miles and MORE from station. Protected by exclusive electronic and mechanical patents.



Patent No. 2,566,287  
Other patent applied for.

## **FINCO 500 Series UHF**

Consistently out-performs all others an entire UHF band — in close-to the station and in the super-fringe. Very high gain and narrow pattern for complete elimination of ghosts.

**The FINNEY COMPANY**

**THE FINNEY COMPANY**  
Dept. T-34 • 4612 St. Clair Avenue • Cleveland 3, Ohio

WRITE FOR COMPLETE INFORMATION  
ON THESE VERY PROFITABLE ANTENNAS

- information on the 400-A
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CITY ..... ZONE ..... STATE .....

**LIFE  
RADIO • TV**

**NEWSPAPER • FARM PAPERS**

OFFERING YOU THE MOST POWERFUL NATIONAL ADVERTISING PROGRAM IN THE INDUSTRY... a program in which you can participate at no cost! A program that has been so very successful with jobbers and dealers and servicemen all over the nation!

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# Another Outstanding Service Success Story...

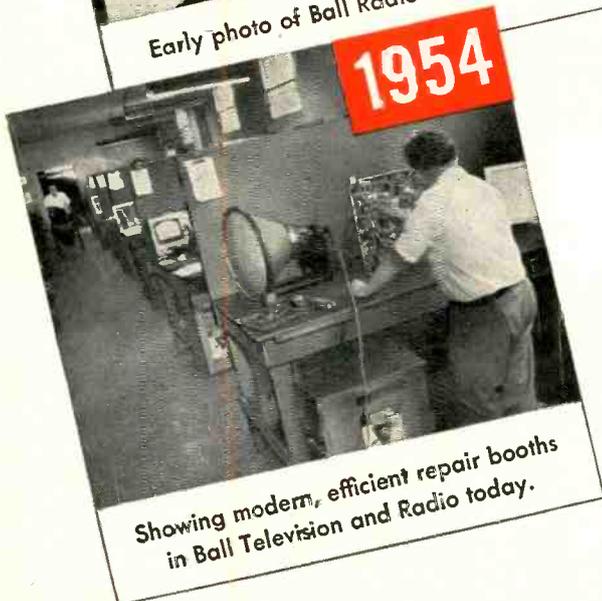
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From Basement Repair Shop  
to prosperous Service Business...  
featuring Sylvania Tubes, Parts  
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The steady and substantial growth of the Ball Television and Radio Service, from basement shop to the large handsome brick building, shown below, is a tribute to the fair practices and alert policies of the owner, Mr. Ted Ball.



Early photo of Ball Radio Service Shop.



Showing modern, efficient repair booths  
in Ball Television and Radio today.

Says Mr. Ball: "My men are as skilled and experienced as any you'll find anywhere, and each is instructed to do the best job possible with the best of parts... and that, of course, includes Sylvania Tubes."

Ted Ball is another important Radio-TV Service Manager that appreciates the quality performance, dependability, and the nation-wide high reputation of Sylvania products.

Mr. Ball also knows about the business-boosting power of Sylvania's promotion and display offers. Find out how Sylvania can step up *your* business. Your friendly Sylvania Distributor is ready and anxious to give you full cooperation. Call him today.

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In Canada: Sylvania Electric (Canada) Ltd., University  
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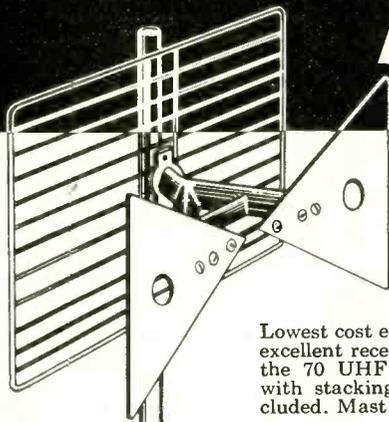
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# Admiral

**ALL-CHANNEL**

**UHF ANTENNAS**

**HIGH GAIN  
LOW COST**

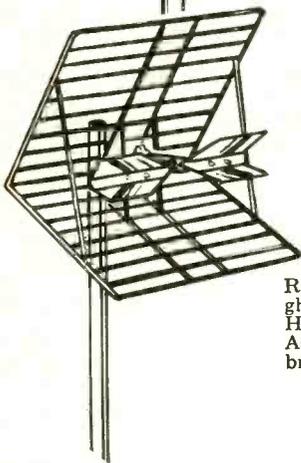


## Admiral BOW TIE

Lowest cost ever for a quality UHF antenna. Gets excellent reception in good signal areas on any of the 70 UHF channels. Each antenna furnished with stacking bar. Mast mounting brackets included. Mast not included.

**No. AN65A**—Deluxe—Shipped completely assembled. Suggested list price . . . . . **\$5.95**

**No. AN65B**—Standard—Similar to above, smaller reflector screen. Shipped knocked-down. Sug. list price . . . **\$3.95**



## Admiral CORNER REFLECTOR

Recommended for troublesome locations where ghosts, reflections and interference are encountered. High gain, 14db. Front to back ratio 15 to 1. Assembled, ready to put up. Mast mounting bracket included. Mast not included.

**No. AN56A**—One bracket mounting. Suggested list price . . . . . **\$11.25**

**No. AN56B**—Same as above, front mounting. Suggested list price . . . . . **\$11.25**

### INDOOR UHF ANTENNAS



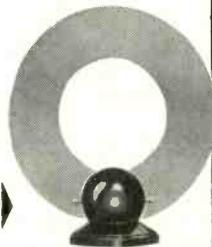
#### Admiral Super

Recommended for troublesome locations. Exceptionally high gain . . . over 7 db . . . excellent ghost suppression. Only 12 inches wide. Weighted and felt padded base.

**No. 94A10-6**—Complete with lead-in. Suggested list price . . . **\$12.95**

#### Admiral Target

Smartly styled in rose-gold colored anodized aluminum with mahogany phenolic base. Stands only 10 inches high. Base is weighted and felt padded . . . can be placed on top of receiver . . . picks up all UHF channels.



**No. 94A10-7**—Complete with lead-in. Suggested list price . . . **\$4.95**

You'll make an *extra profit* on every installation using these high gain UHF antennas. Ask your Admiral distributor about the *extra large discounts* from the list prices quoted here.

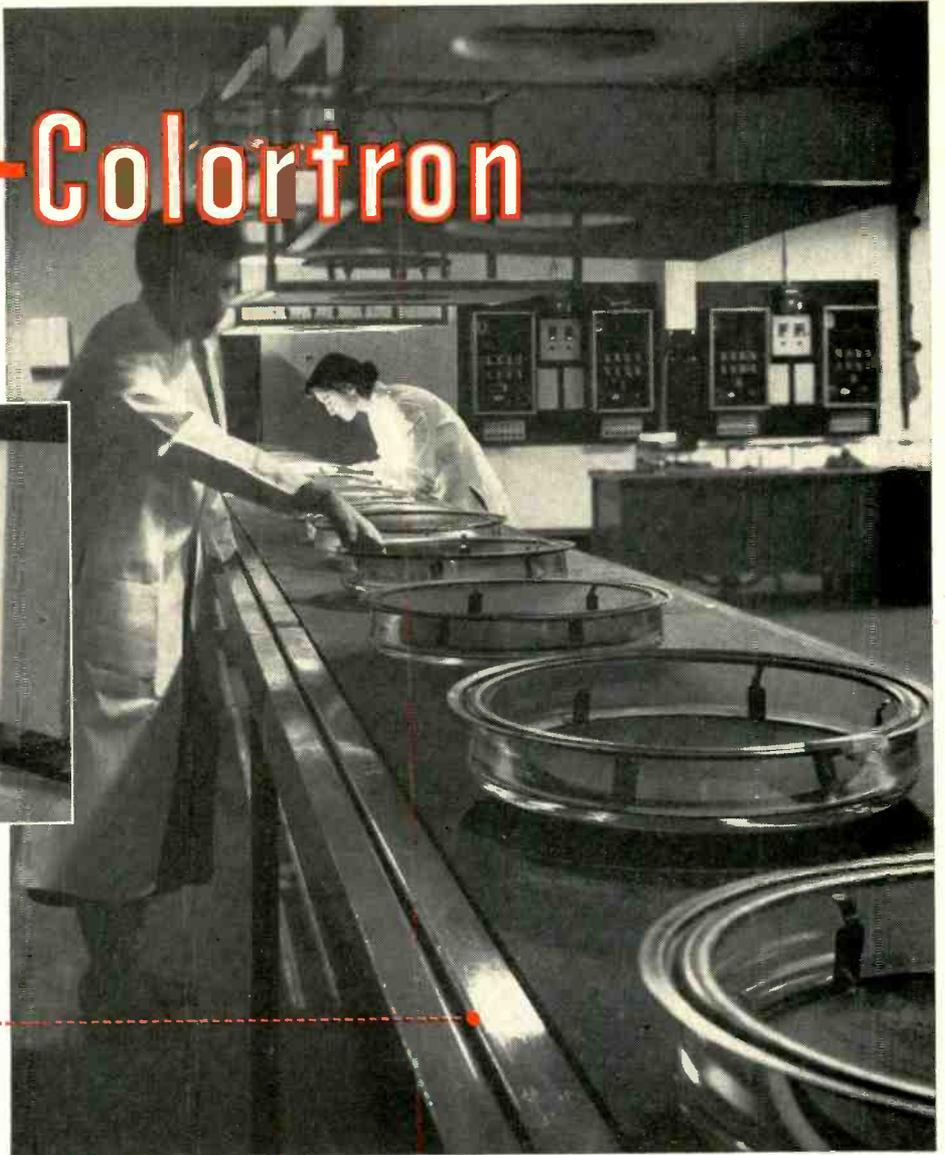
You'll be giving your customer extra value, too! All these antennas are finest quality . . . made with aircraft aluminum antenna elements and vibration-proof reflectors. "A-frame" insulators provide plenty of free air space around elements. The units have high mechanical strength and low resistance. They are *double plated* for extra resistance to weathering . . . first zinc plated, then dipped in zinc dichromate which gives them a beautiful gold finish. These antennas can be easily fastened to existing masts and towers. Order by part number from your Admiral distributor.

Ask your **Admiral** distributor for  
**FREE CATALOG**  
with complete line of **Admiral**  
TV antennas and accessories

**Admiral Corporation**  
Accessories and Equipment Division,  
Chicago 47, Illinois

# New CBS-Colortron

**NOW IN MASS PRODUCTION**



Unique photographic process, like photoengraving, uses aperture masks as negatives to print consecutively the red, green, and blue phosphor dots (250,000 of each) on CBS-Colortron screens.

After tri-color screens are printed, aperture masks are temporarily removed and face plates move on to critical inspection for screen imperfections.

**COLOR TV IS COMING . . .** faster than you think. The revolutionary new CBS-Colortron . . . a practical color picture tube . . . hastens the day. Already it is in lower-cost, mass production . . . made possible by its simplified, advanced design.

As in black-and-white tubes, the CBS-Colortron's screen is deposited directly onto the inside of its face plate. A unique photographic technique makes this possible. Because each aperture mask serves as a negative to print its tri-color screen, perfect register of mask and screen is automatically achieved

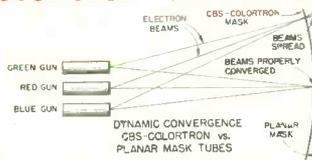
and maintained. The rugged, simple, light-weight mask sharply reduces assembly and exhaust problems. And the spherical design of mask and screen simplifies convergence circuitry and adjustment.

The CBS-Colortron is now a 15-inch, round tube. But, as soon as tooling is completed, it will be made in larger sizes. Watch for the new CBS-Colortrons. You'll see plenty of them soon. And you'll be sold on sight by their logical simplicity . . . their superior performance . . . their many advantages.

## CBS-Colortron OFFERS MANY ADVANTAGES



Cross-section (face plate, aperture mask, funnel, tri-color electron gun) shows simplicity of CBS-Colortron and its adaptability to low-cost, mass production.



Spherical screen and aperture mask of CBS-Colortron simplify convergence and focus. Electron beams remain in focus over entire surface of screen.



Light-weight (6 oz.), rugged, simple aperture mask of CBS-Colortron minimizes problems of exhaust, handling, and assembly.

### COMPLETE CBS-Colortron DATA FREE!

Take a look into the future. Write today for complete information on CBS-Colortron 15HP22: Construction . . . operation . . . application . . . installation and adjustment . . . electrical and mechanical data. Four packed pages . . . free!



**CBS-HYTRON**, Main Office: Danvers, Massachusetts

Manufacturers of Receiving Tubes Since 1921

A Division of Columbia Broadcasting System, Inc.

A member of the CBS family: CBS Radio • CBS Television • Columbia Records, Inc. • CBS Laboratories • CBS-Columbia • and CBS-Hytron

RECEIVING • TRANSMITTING • SPECIAL-PURPOSE • TV PICTURE TUBES • GERMANIUM DIODES AND TRANSISTORS

it's new  
it's new  
it's new

**It's What You've Been Asking For!**

**it's new**

it's new  
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it's new  
it's new

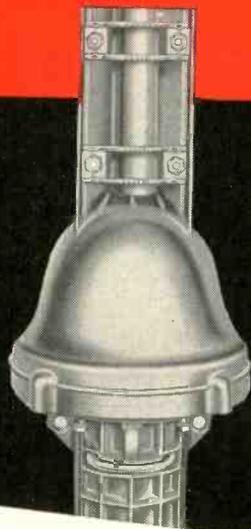
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it's new  
it's new

**the TR-4 C★D★R Rotor**

still the most powerful TV rotor, enough power to turn any array.

**NOW... With Meter Cabinet Using 4-Wire Cable**



**Model TR-4**

the de-luxe HEAVY DUTY ROTOR complete with modern design meter control dial cabinet, using 4 wire cable.

**\$53.95**

also these models **TR-2 • TR-11 • TR-12**

**CORNELL-DUBILIER**  
SOUTH PLAINFIELD, N. J.



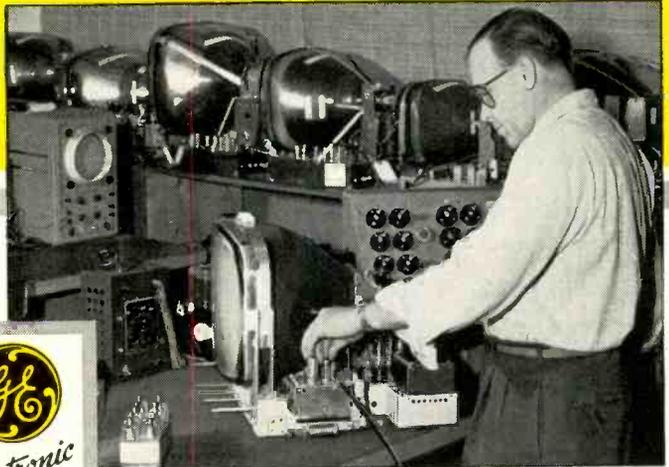
**THE RADIART CORP.**  
CLEVELAND 13, OHIO

Now

# G-E TUBES ARE SERVICE-TESTED FOR TV-SET INTERCHANGEABILITY!

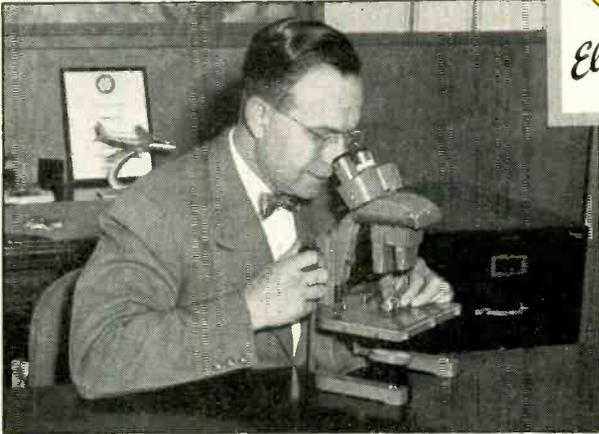
## IN INDIANAPOLIS:

Howard W. Sams & Co., Inc., regularly checks the performance of current-production G-E tubes in all popular TV chassis, at various line voltages.



## AT GENERAL ELECTRIC:

the Howard Sams reports are studied, and any case of unsatisfactory tube performance receives detailed investigation. Corrective steps in manufacture or testing follow at once.



● A General Electric executive micro-inspects a tube structure for proper assembly.



● A General Electric plant employee, using a comparator, checks a greatly magnified tube grid.

**Simplify your tube requirements, reduce call-backs, with G-E interchangeable tubes!**

SINCE September, 1953, the Howard Sams TV-radio technical organization has checked G-E receiving tubes for servicing interchangeability. A number of tubes of each type—fully representative of normal production—are tested periodically in TV chassis of different makes. Accurate instrumentation is employed.

Any unsatisfactory tube performance in any chassis is reported to General Electric. There, further tests are held to confirm the Howard Sams finding, and establish the cause of the difficulty. With the aid of laboratory study, corrective steps are decided on by G-E tube management and applied immediately. These may take the form of an improvement in manufacture or inspection, or revised test specifications.

*Result:* you are always installing tubes that are more fully interchangeable and high-quality! Your General Electric tube distributor is your source for a product that is constantly being improved! *Tube Department, General Electric Company, Schenectady 5, New York.*

# GENERAL ELECTRIC

161-1A2

# 7 Out of 8 Times

## THE ORIGINAL CRYSTAL CARTRIDGE IS ASTATIC

SCIENTIFICALLY SELECTED  
BY MANUFACTURERS AND  
THEIR ENGINEERS

Player and changer manufacturers have made Astatic Crystal Cartridges their overwhelming choice . . . because of Astatic's ability to match exactly the performance characteristics called for . . . because of Astatic's ability to turn out hundreds of thousands of uniform duplicates of each cartridge from its unparalleled precision production lines. These same factors work to assure perfect matching of requirements . . . perfect results . . . when you REPLACE THE ORIGINAL WITH ANOTHER ASTATIC CRYSTAL CARTRIDGE!

KNOWN THE WORLD OVER  
. . . FOR HIGHEST QUALITY  
AT LOWEST POSSIBLE COST



Ask for details on the new, FREE steel storage cabinet and dispenser for Astatic Crystal Cartridges.

**EXPORT REPRESENTATIVE** . . . 401 Broadway, New York 13, N. Y.  
Cable Address . . . ASTATIC, N. Y.

(Continued from page 13)

used in the circuit . . .

You may now say, "Wait; we publish the magazine for service personnel who . . . do not have time to take for a complete analysis . . ." Print only one such article . . . This feeler article, I am sure, will be acclaimed by the more serious technicians, which I am also sure portray the bulk of your subscribers.

ELLERY EARLE CADIZ

Electronic Service Laboratory  
166 Lakota Avenue  
Akron, Ohio

### Price Cuts vs. Salesmanship

EDITORS, TECHNICIAN:

I want to bring to your attention the enclosed newspaper article that was clipped from the Miami Herald this week.

(Reference is to a report on a speech by Robert S. Armacost, pres. of the National Automobile Dealers Association. Armacost asked auto dealers to halt the type of "cut-throat competition that has had a serious effect on television and radio markets." Condemning price-cutting on "products worth every cent of their legitimate list price," Armacost said, "We must find a way to correct the situation in which one partner—the factory—realizes its full profit . . . while the other partner—the dealer—is called upon to make all the sacrifice.")

Mr. Armacost brings out some very important points and also reveals that people outside our industry know that there are no such things as salesmen in our midst. If this article doesn't read off TV salesmen as they are, I don't know what does. During our recent run on UHF converters and antenna installations, these zanies in Miami were cutting prices when the merchandise could have been sold just as fast at the fair and reasonable retail price it was designed to sell for. But we are not the only town with that fault, I understand.

HARRY C. KELLER

Keller TV Radio Service  
750 East 10 Street  
Hialeah, Florida

• We're in your corner!—Ed.

### McRoberts' Fan

EDITORS, TECHNICIAN:

I should like to take this opportunity to commend you for the series of articles by James A. McRoberts dealing with TVI problems. These articles are not only exceptionally well written, but are most informative. When so many writers deal largely in generalities, it is a pleasure to read something that is specific, informative, and clearly stated. I hope you will give us many more articles on other subjects by the same writer.

G. WARREN HEATH

182 East 19 Street  
Brooklyn, New York

• No sooner said than done. See McRoberts piece on ringing circuits in this issue.—Ed.

Now a

# COLOR

## TELEVISION

### HOME STUDY COURSE

by RCA Institutes



"Color Television is here—not around the corner, or in the developmental labs, but here! The big question now is . . . Are You ready for Color TV?"

"You may now have a successful TV servicing business. When color sets come to your bench for servicing, will you be able to handle them?"

"Color Television is a vast new field, embodying entirely new concepts . . . principles of light and vision, radically new circuitry."

#### First Home Study Course in Color TV

Now is the time to prepare. Now, for the first time, you can train yourself for the

opportunities in this brand-new field. The just-announced RCA Institutes Home Study Course is the *first* home study course covering all phases of color television. Offered only to those already experienced in radio-television servicing, it explains the "why" of basic theory, as well as the "how-to-do-it" of servicing techniques.

Planned and written by RCA instructors, the entire course is based on the practical experience of RCA engineers—the men who have pioneered in the research and development of color television since the very first color experiments, many years ago.

Remember when black-and-white television first became a reality? Overnight, the demand for men who knew television grew. Even now, a shortage of qualified servicemen exists. Think, then—of the even greater demand for servicemen who will understand the many additional problems of color reception!

#### Costs so little to gain so much

RCA Institutes makes it easy for you to prepare yourself now for color television. Not only is the cost of the home study course for qualified servicemen extremely low, but you pay for the course on a pay-as-you-learn basis.

RCA Institutes conducts a resident school in New York City offering day and evening courses in Radio and TV Servicing, Radio Code and Radio Operating, Radio Broadcasting, Advanced Technology. Write for free catalog on resident courses.

Send for FREE Booklet—Mail the coupon, today. Get complete information on the RCA INSTITUTES Home Study Course in Color Television. Booklet gives you a general outline of the course lesson by lesson. See how thoroughly you can learn Color TV. Mail coupon in envelope or paste on postal card.



#### MAIL COUPON NOW!

RCA INSTITUTES, INC., Home Study Dept. T354  
350 West Fourth Street, New York 14, N. Y.

Without obligation on my part, please send me copy of booklet "RCA INSTITUTES Home Study Course in COLOR TELEVISION." (No salesman will call.)

Name \_\_\_\_\_ (please print)  
Address \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

**RCA INSTITUTES, INC.**  
A SERVICE OF RADIO CORPORATION of AMERICA  
350 WEST FOURTH STREET, NEW YORK 14, N.Y.



*Only One . . .  
of its kind!*

**NEW!**

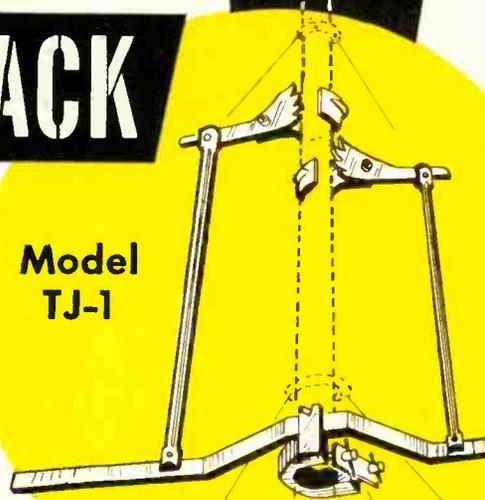
**UNIQUE!**

**DIFFERENT!**

**WARD'S**  
*Exclusive* **TOWER-JACK**

• Now, WARD'S TOWER-JACK makes erecting Telescopic Masts a one man job. Just mount the antenna on the top section — and then raise it away. Each section is held firmly until secured with pin and guy-wires. WARD'S TOWER-JACK is then attached to the next succeeding sections until the mast is fully extended. Completely pre-assembled, the TOWER-JACK is easy to use . . . easy to carry from job to job. Handles any two-to-five section mast from 1¼" to 2¼" in diameter. Greatest time and money saver for telescopic mast erecting ever devised . . . Order your WARD TOWER-JACK today. Model TJ-1.

**Model  
TJ-1**



Shipping  
Wt. 11 lbs.

**WARD PRODUCTS CORP.**

DIVISION OF THE GABRIEL COMPANY  
1148 EUCLID AVE. CLEVELAND 15, OHIO

In Canada: Atlas Radio Co., Ltd., Toronto, Ont.



# TECHNICIAN

## & Circuit Digests

CALDWELL-CLEMENTS, INC., 480 LEXINGTON AVENUE, NEW YORK 17, N. Y.

# So MUCH for So Little!

## A Tribute to the TV-Radio Technician

There are wonderful TV-radio programs ahead for John Q. Public. Competition between TV and radio on the one hand, and TV and movies on the other, has greatly improved the quality of the shows being broadcast. Quantitatively as well, broadcasts have shot up. You, Mr. Public, are currently getting more than one billion dollars worth of entertainment per year.

And the man who makes possible this continuous flow of programming is the TV-radio technician. He is the key man in this great amusement structure, and nights would be much longer indeed if he suddenly ceased to exist. Mr. TV-Radio Technician is also one of the least appreciated persons in the technical and business world. Let's detail this comment a bit.

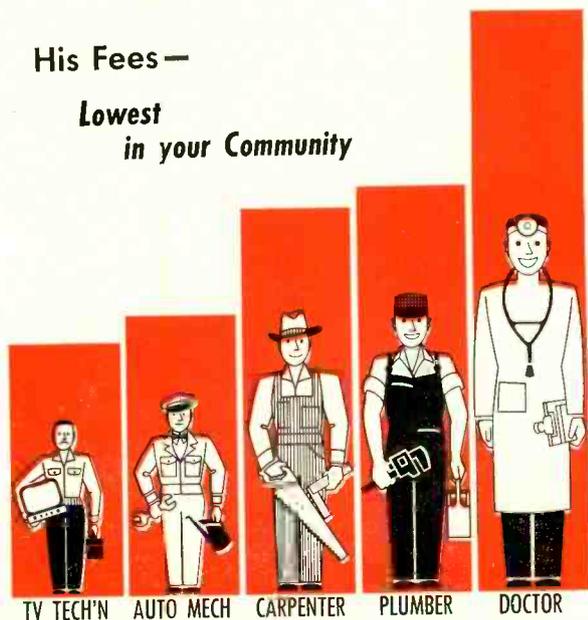
Your TV-radio serviceman spends many years acquiring the intricate know-how necessary for servicing the many makes of radio and TV chassis. Even when he has mastered his field he must still spend many hours per week reading technical journals and books, to keep up with the changes and developments that are constantly taking place. These hours of study must, of course, come after a long work day.

The coming of color TV will put additional pressure on the serviceman, and require still further after-hour



### His Fees —

Lowest  
in your Community



study. A large investment in expensive test equipment, tools and parts is necessary, before the technician-dealer can open his service establishment.

And with these burdensome investments of time and money, what does the TV-radio technician earn? *Less per hour than technical people in four other comparable fields of activity (see chart).* Furthermore, this overworked and underpaid serviceman is regularly made the butt of sensational slanders, whipped up by those who have not yet ferreted out the black sheep in their own industry.

This little guy doesn't have a loud enough voice to answer the slanders. Besides, he'd be too busy to answer back, even if he had the power to make himself heard. We, the editors and publishers of TECHNICIAN, can speak up for him, however, and we welcome the opportunity to do so.

The American public is spending more time in front of its radios and TV sets than it is riding in automobiles, eating or, in fact, any other activity except sleeping. The healthy man as well as the sick one gets enormous pleasure from his TV-radio set.

Let's salute the man who makes all this possible.

(Giant blow-ups of this page for store display, 15¢ cash or stamps.)

# Tuning In the

**SPACE CADETS** have nothing on Atlantic City police, who are walking their beats with tiny aerials protruding up from behind the badges on their caps. Tiny 4-tube receivers, slightly larger than cigarette lighters and weighing less than 5 oz. with batteries, make no bulges in the patrolmen's hats, keep them in constant touch with headquarters.

**RADIO HELMETS** for firemen, also in Atlantic City, will be in use soon. These two-way affairs will have 20-mi. range and will even operate in steel buildings or below sea level.

**AMAZING HOW SOME TV TECHNICIANS** can see and hear TV programs without responding to anything but the presence of sound and black and white images, while others who work on sets know just about every program and performer on the air. Servicemen who can readily identify a program often find this knowledge helpful, particularly when front-end misalignment is being cleared up.

**MAKE SURE YOUR OUTSIDE SERVICER** presents a good appearance to the customer. One technician we know commented wryly on the fact that income (which was based on a percentage of the total home-call take) dropped sharply on days when he wore a lumberjacket, or unpressed pants, or a none-too-spotless shirt. "It would pay me to clean my suit daily, and put on a clean, starched white shirt on every service call," the man remarked thoughtfully. Many other sources confirm the importance of dressing carefully, especially when a house on the "better side of the tracks" is to be visited.



"Hello . . . is this Bob's TV Service? I'm having a little trouble with my set . . ."

**SERVICING, SELLING AND RENTING SOUND EQUIPMENT** is sound business for the progressive shop. Activities in the PA and intercom field pay off handsomely for numbers of technician-dealers, and keep service volume up during periods when TV-radio set repairs are slow. Sources of business: Schools, offices, factories, amusement parks, restaurants, arenas and the many prospects for mobile equipment in political, advertising and similar fields.

**THE SERVICER IS THE VICTIM** of another instance of unfair publicity. A daily in a suburban area near New York City concluded a recent series based on its survey of honesty amongst TV repairmen. Basis of the test was a receiver that was in operating condition except for one bad tube, which had been deliberately inserted. Most technicians called in on the complaint replaced the tube, charged the correct list price for same, and added their normal fee for house calls. Some tried to sell additional tubes to replace those they said were getting weak. Their argument was that this procedure would save service charges on future calls, since the tubes would soon need replacement anyhow. This is bad? The daily in question thought so.

**VERY FEW TECHNICIANS** tried to pull the set or build up a phoney charge. One such instance seemed to be the result of an honest mistake, although the paper wouldn't yield on this point. How was the series presented to readers? With daily scare headlines about TV gyps, video victims and the service "racket," although careful reading of the articles showed the truth to be the opposite of the headline slant. The series concluded with a plea for stringent legislation to regulate the activities of TV technicians, along with stiff penalties for violations. A conclusion more in line with the data presented would have been: "TV servicers honest; rates fair; slanders without foundation."

**SERVICE ASSOCIATIONS** are entitled to pats on the back for the showing their members made on the daily's survey. All technicians called in on the check-up who were members of these associations did no more than replace the tube at list price plus service fee. One member-technician went this far: On discovering that the defective receiver was still under first-year warranty, he offered to withdraw without a fee. He told the set owner that it would be cheaper to call the dealer from whom the receiver was purchased and pay for the call, saving money on the guaranteed tube. Naturally, this incident was not played up in the newspaper.

**AN EASTERN TECHNICIAN** advised a customer to buy a new set, rather than keep on spending money in trying to keep a "dog" percolating. "I'm going to make it do until I size up the color television situation," the owner said. And plenty of others are doing that very thing right now. Under the circumstances, service problems may, in many cases, become considerably tougher.

**FOR A SOURCE OF NEW SERVICE REVENUE**, consider tape recorders. Market experts estimate that this year will see an increase in sales of almost 50 per cent over '53. Forecast for this year made by **TECHNICIAN** editors: 400,000 recorders will be sold to non-commercial users.

# Picture .....



**COLOR-TV SERVICE**, which will be needed more frequently and will cost a lot more than b & w service, will increase the squawks over high service charges—unless YOU do something about it. One of the reasons that people who pay high fees for other services scream about TV charges is ignorance. Let them know WHY they have to pay. Color sets will have many more components; there will therefore be many more things that can go wrong. Also, replacement cost for color components will be higher. These are facts. You can help illustrate them with the following chart, which compares the number of parts used in present-day monochrome sets with those expected in color units:

Type of Component	Amt. in B & W Set	Amt. in Color Set
Tubes	21	34-46
Fixed circuit components (resistors, condensers, coils, interstage transformers)	230	500-600
Controls (external and internal)	13	40
Large components (iron-core transformers, electrolytic condensers)	17	40

**CUSTOMERS ARE NOT PAYING THEIR BILLS** as promptly as they did a year ago, report a number of service managers in several large cities. One of the reasons, according to certain technician-dealers, is growing unemployment in some industrial centers. These dealers also point out that they've lost varying sums of money in cases where families have moved away to seek employment in other localities.

**HOW MANY MODELS?** Ever wonder how many radio, television or phonograph models are manufactured each year? Here are some interesting 1954 figures made available by our research department. Television receivers: 52 companies report 753 models. Radios: 37 companies make 363 models. Phonographs: 45 companies, 383 models. These figures represent returns from about 85% of all manufacturers in the industry.

**MORE RADIO SERVICING BIZ** is a possibility not to be overlooked, especially if you have been concentrating on TV only or TV mainly. Despite TV tail-off, AM set sales are going up sharply. About 40% more radio receivers were purchased in TV areas in 1953 than in the preceding year.

**ANTENNA SALES, SERVICE, INSTALLATION** due for big upswing in 1954 both in dollar and unit volume, informed sources believe. There are several reasons for the anticipated increase. One big factor, important on several counts, is the increase in new stations. Old TV areas, as well as new ones, will be affected. In old areas, there will be replacements of single-channel antennas by broad-band designs. Even broad-band VHF designs will give way, in many cases, to combined UHF-VHF units. Physical obsolescence is another factor, one whose impact is just being felt. A steady annual replacement rate extending into the millions is expected in future years.

**A SPRING CAMPAIGN TO REPLACE** or repair outdoor antennas which have gone through a tough winter is now in order. Ways to get business: 1. Advertise in newspapers. 2. Send out direct-mail pieces. 3. Solicit regular customers via phone. Point out that replacement or "revamping" of customer's antenna can often result in a 50 per cent improvement in reception—and that's a conservative estimate.



"Ya mind holdin' off the enemy until this program ends?"

# Serviceman's Analysis

## Operation of Chrominance Sections of the Receiver;

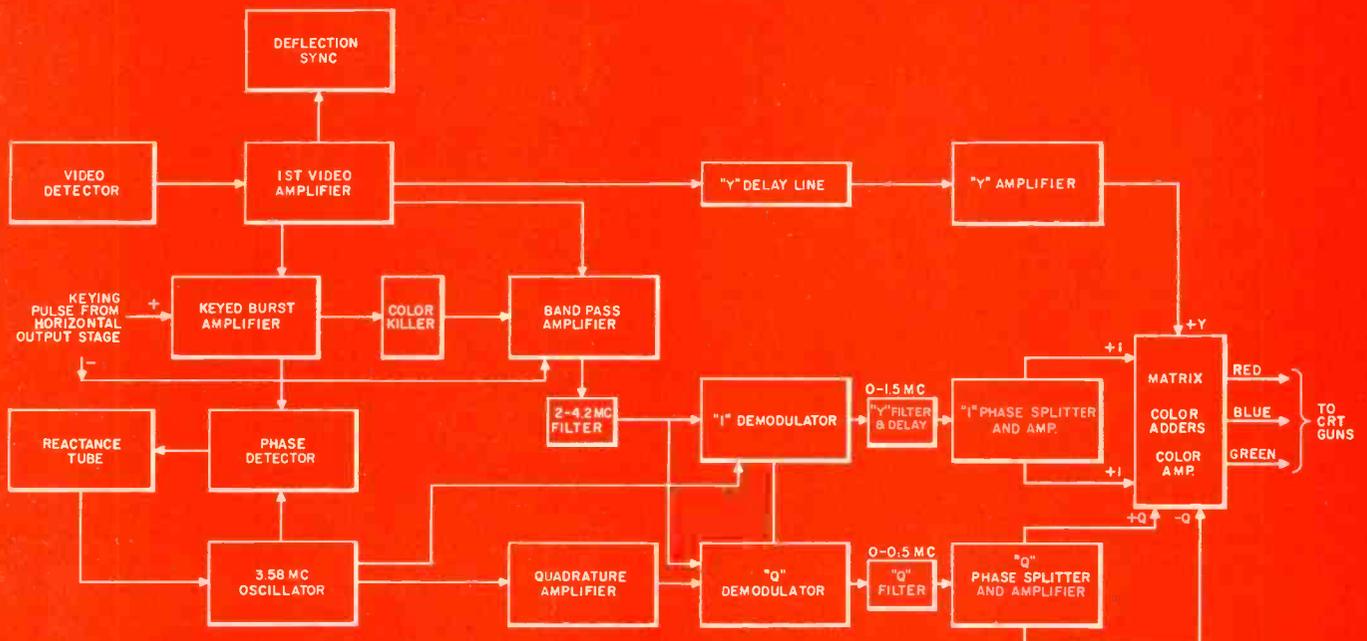


Fig. 1—Block diagram of color stages in color TV receiver. Output of matrix-adder-amplifier block goes to the red, blue and green guns of the crt.

BY PETER ORNE  
AND  
SOL HELLER  
Managing Editor, *TECHNICIAN*

• In an article published some months ago (Nov. '53 *TECHNICIAN*), we discussed sections in the color TV set similar to corresponding portions of the black and white receiver. In our most recent pieces, we analyzed color television standards, so that we might better understand the make-up of the color signal. We are now prepared to talk in some detail about the block diagram of the color section of the receiver. In this discussion, we will concentrate on the function of each section, and the effect of trouble in it on the picture, leaving a closer circuitry analysis for future articles.

Let's start with the first stage in the block diagram of Fig. 1, and examine the video signal after detection. The sync portion of the signal contains the horizontal, vertical, and equalizing pulses and in addition, a burst of about 8 cycles of

color subcarrier that appears after each horizontal sync pulse. The video portion contains the "Y" signal, ready for application to the picture tube after proper amplification; also present is the color information, in the form of sidebands of the subcarrier (the subcarrier itself is suppressed in the transmitter, to minimize interference).

We can now consider what is done to this detected information, in order to obtain the color signal needed for each of the three guns in the crt. The first video amplifier supplies the take-off point for the different signals that must be processed. First, there are the deflection sync signals, which are supplied to the deflection sync section to provide vertical and horizontal synchronization (described in a previous article).

At another video amplifier take-off point, signal is supplied for the keyed burst amplifier. The keyed burst, the reader will remember, is needed to keep the receiver's 3.58 mc oscillator in step, in respect to frequency and phase, with the trans-

mitter subcarrier oscillator. This burst, incidentally, constitutes one of the major differences between the signals sent out during a black-and-white transmission on the one hand, and a color telecast, on the other.

The keyed burst amplifier separates the burst from the rest of the signal, amplifies it, and applies it to the phase detector. The burst cannot be removed in the same way that the deflection sync pulses are stripped from the composite video signal in a black-and-white (or color) receiver—i.e., by permitting only the top of the composite signal (the sync pulse) to get through, while the rest of it is cut off. This method of *amplitude discrimination* would be ineffective (see Fig. 2) because the burst and the sync pulses fall into the same amplitude region, and *both* would, therefore, be passed, instead of the burst signal only, if the kind of clipper we are familiar with was employed.

The burst is separated by a different method, one which involves keying the amplifier (the keyed burst amplifier). This amplifier is

# of Color Stages

## Theory and Service Data; Trouble Symptoms.

designed to operate only when a pulse from the horizontal sweep section arrives; the pulse is so timed that the amplifier functions only when the burst is present at its input (see Fig. 3).

The output of the keyed burst amplifier operates the *color killer*. This stage, you may remember, cuts off the color receiver sections when the burst is absent. (If the color stages were permitted to operate when a black-and-white transmission was being received, colored snow would be seen at the edges of all objects or persons.) If the burst amplifier is defective, no color will be visible in a color transmission, since the color killer will not allow the color stages to operate.

### APC System

The burst from the burst amplifier is fed to the phase detector, where it is compared to the output of the local 3.58 mc oscillator. If there is any phase difference between the two signals, the phase detector will develop a (corrective) output voltage; if no phase difference is present, on the other hand (indicating that the local 3.58 mc oscillator is locked in step with the transmitter sub-carrier generator), the output voltage of the phase detector is zero.

The phase detector output is applied to the grid of a reactance tube; as the reader no doubt knows, the effective reactance of this tube changes with a change in grid voltage. The reactance tube is in parallel with the oscillator tank circuit, and thus controls the frequency and phase of the receiver's 3.58 mc oscillator. This whole system—phase detector, local 3.58 mc oscillator and reactance tube—are referred to as the apc (automatic phase control) system.

Before we consider what symptoms may be expected when trouble is present in this section, we should remind ourselves of the function of the local 3.58 mc oscillator. This oscillator is needed to produce a signal which, when it beats with the color sideband signals, will reproduce the

original chrominance signals generated at the transmitter. The action is similar to that taking place in a broadcast receiver's 2nd detector, which reproduces the audio signals by beating the i-f carrier and its sidebands together.

If the 3.58 mc oscillator becomes completely inoperative, all pictures will appear black and white, since the color sideband signals are not detected in this case. Let's consider how the oscillator may be checked, to determine if it is the source of trouble when no color pix is coming through.

In the RCA receiver on which we are basing all our discussions, the noise between stations will be sufficient to cause the color killer to leave the color stages operative at between-station settings, *when circuit operation is normal*; colored snow (also known as "confetti") will be seen in consequence, when the set is tuned to a between-station point. This fact permits a quick check for the operation of the color oscillator to be made as follows: Tune to a point between channels, and note whether "confetti" becomes visible. If "confetti" is seen, the 3.58 mc oscillator must be in working order; if black and white snow alone is noted, the oscillator may be defective.

When trouble in the reactance tube or phase detector is present,

the 3.58 mc oscillator will be off frequency. If the frequency is close to the correct one, slanted bars of intense colors will appear superimposed on normal black-and-white information; that is, the color information is torn out (the condition is comparable to horizontal loss of sync in a b & w set), while the monochrome information remains ok.

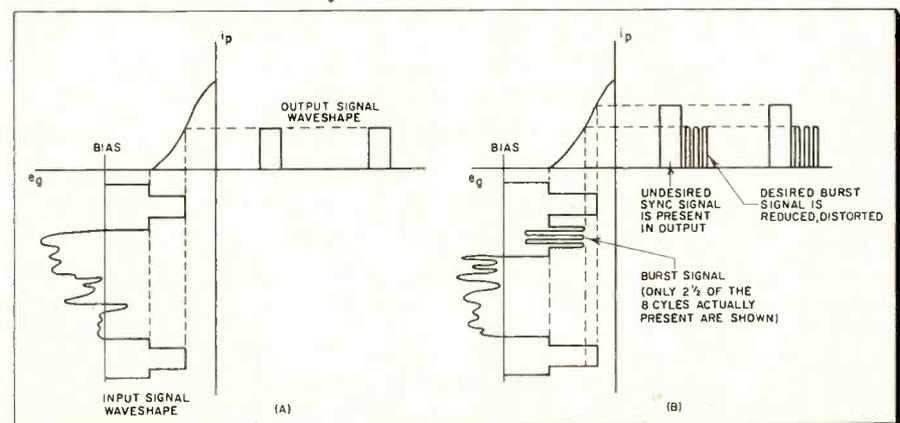
### APC Trouble

If the frequency is *very far off*, an unmarred black and white picture will be seen, since the uniformly mixed color information present will blend together and become white (effectively invisible). Thus a set in which confetti can be seen, that reproduces a color transmission only in black and white, may have a defective or completely misadjusted apc system.

The same symptoms may be produced when the keyed burst signal has insufficient amplitude. The color killer will keep the color section of the receiver inoperative under the circumstances.

To distinguish between the two troubles (insufficient burst amplitude, and improperly-operating apc system), remove the color killer tube. If the color stages now become operative, causing a normal color picture to be seen, the source of

Fig. 2A—Input and output of conventional sync separator when a black-and-white composite video signal is applied to it. Only sync pulse appears at output. B—What the input and output of the same separator would look like if a color composite video signal was applied. The (undesired) sync pulse would be passed; the (desired) burst signal would be clipped, distorted.



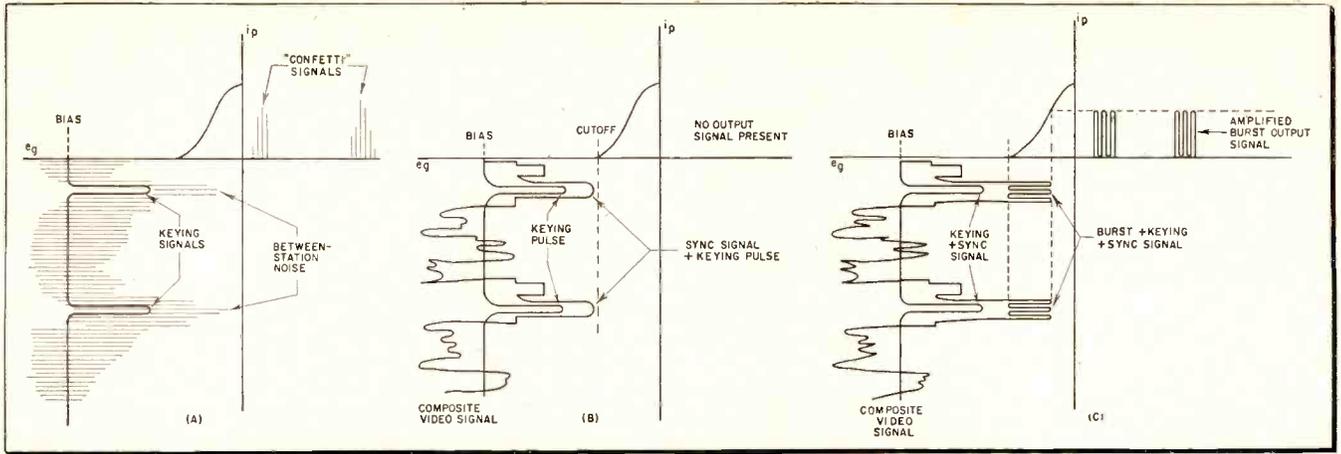


Fig. 3—How the keyed burst separator operates. Dotted line represents the d-c bias; note that this bias extends well beyond cutoff. The solid-line waveform is the keying pulse; it combines with the d-c bias. Note that the sum of the d-c bias voltage and the keying pulse does not extend beyond cutoff. Between-station noise is amplified during keying time, causing "confetti" to be produced (A). When

a black-and-white transmission is being received, the sum of the bias, keying and sync pulse voltages still does not extend above cutoff, and the burst amplifier therefore has no output (B). When a color transmission is coming in, the sum of the burst and keying signals extends well above cutoff, causing the burst amplifier to conduct and develop an amplified burst output signal (C).

trouble is either insufficient burst signal amplitude, or a defect in the color killer. If, on the other hand, removing the killer has no effect on the picture, a defect in the apc system is indicated.

Some of the oscillator output is applied directly to the "I" demodulator; the rest of this output is sent through a *quadrature amplifier* that shifts the phase of the oscillator signal 90 degrees, then passes it on to the "Q" demodulator.

#### "I" and "Q" Demodulators

The purpose of the two demodulators is to convert the subcarrier sidebands back to the original color signals. This demodulation is accomplished by beating the subcarrier sideband signals against the properly-phased local subcarrier oscillator signal. The sideband signals must get to the demodulators, of course; they travel from the video detector to this rendezvous, through the bandpass amplifier. The sideband signals must be properly prepared for application to the demodulators; the bandpass amplifier "does the honors" in this respect. Let's consider just what the bandpass amplifier is called upon to do.

In order to get best results from the "I" and "Q" color demodulators, it is necessary to strip away the unnecessary information associated with the color subcarrier sidebands. The unwanted information in this case consists, in part, of the low video frequencies. These are removed by a filter which allows only frequencies from 2 to 5 mc to get through the bandpass amplifier. The other unwanted signal is the burst. It is removed by keying; a negative keying pulse is applied to the band-

pass amplifier causing the latter to become inoperative during the time of the burst.

The bandpass amplifier forms the signal path for the color information between the 1st video amplifier and the demodulators. The bandpass amplifier is cut off by the color killer when a black-and-white signal is received.

A defective bandpass amplifier will result in a black-and-white picture alone being seen; snow but no confetti will be visible in such a case. The symptoms are the same as when the 3.58 mc oscillator is defective. When substitution of bandpass amplifier and oscillator tubes does not remove the symptoms, appropriate scope and/or voltage tests should reveal which of the two stages is the source of the trouble.

The output of the bandpass amplifier is fed to both demodulators. Each demodulator receives two signals: the subcarrier sidebands containing the color information, and the properly-phased 3.58 mc local oscillator signal.

The output of the "Q" demodulator consists of the "Q" color signal (which extends from 0 to 0.5 mc) and many other frequencies, such as the original input signals and their sums. A low-pass filter allows the "Q" signal to go on to the phase-splitter and removes all the unwanted higher frequencies. This filter, like any other filter, causes a time delay; that is, the signal comes out of the filter later than it came in. The delay is the longest for the filter with the lowest cutoff frequency—i.e., the "Q" filter.

In the case of black-and-white receivers, such time delays are not important, since only one video signal is processed in these sets. In

the color receiver, however, *three* separate signals must be combined to obtain the proper color. These signals must reach their final destination at the same time, if the color they produce is to be correct. If one signal is delayed, the others must be delayed the same amount. Since the filter acting on the "Q" signal delays the latter, a comparable delay must be provided in the "Y" and "I" signal channels as well. Fig. 1 shows the relative location of these delay networks.

A defective "Q" channel will be evidenced by the absence in the picture of the colors that make up the "Q" information—i.e., green and magenta (purple).

The "I" demodulator output is made up of the "I" signal, which extends in frequency from 0 to 1.5 mc,

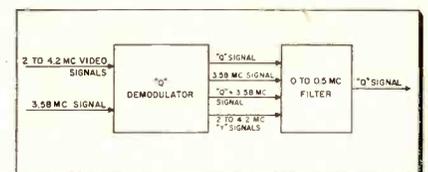


Fig. 4—Input and output of "Q" demodulator and its associated filter. Similar input and output signals appear in the demodulator and filter circuits of the "I" channel.

and unwanted signals above this frequency range. A combination filter and delay system rejects the unwanted signals and permits the "I" signal to arrive at the crt at the same time as the "Q" signal. A defective "I" channel will result in the absence of the "I" colors; that is, no cyan or orange will appear in the picture.

Going back to the first video amplifier, we note that the last (last to be discussed) take-off point goes  
(Continued on page 56)

# Servicing Printed Chassis

## Recommended Soldering Technique for "Etched-Metal" Radios

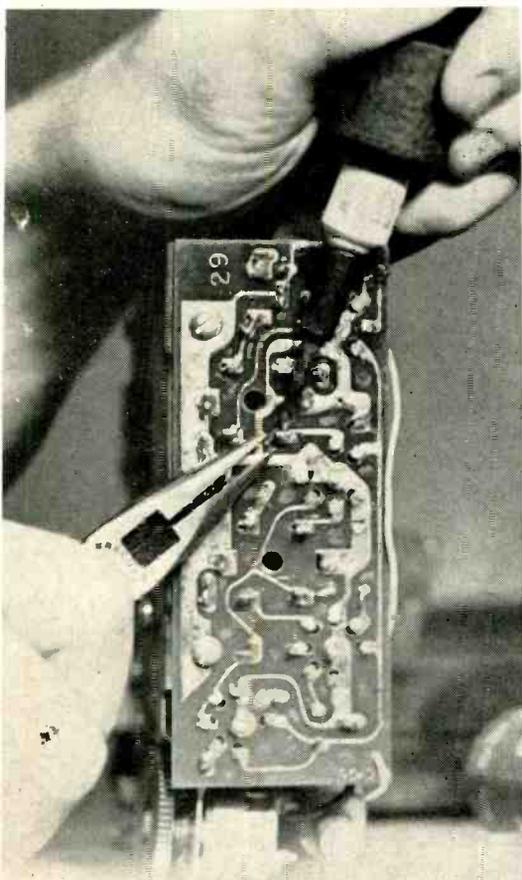
By JACK BAYHA

CHIEF ENGINEER, PHEN-O-TRON, INC.,  
NEW ROCHELLE, N. Y.

• The rash of etched-metal radio sets appearing on the market, and the millions to come soon, have placed many servicemen in somewhat of a dilemma. Actually a blessing in disguise, the printed chassis seems like a Frankenstein monster to many technicians. Some of them, in fact, are even refusing to service sets of this type.

The etched-metal, or as some call it, *printed-circuit* radio, is actually easier to service than a conventional set, once you know the tricks of the trade, and can put them into practice. There is no great secret to successful etched-metal service work. Follow the simple methods outlined here, and you will find servicing a pleasure.

Photo of unsoldering job in progress on a late-model Admiral printed-chassis radio.



Several types of etched-metal, embossed-circuit and printed-circuit sets exist. In the true printed-circuit receiver, the wiring is electroplated on a layer of conductive (metallized) ink, printed on a sheet of phenolic plastic material, and deposited by a printing or silk-screening process. The bond between the chassis and wiring is very delicate, and special care is therefore necessary during servicing.

The embossed circuit is made by stamping metal or metallic powder into the surface of the plastic; the bond to the base material is quite strong.

The most popular form, the etched-metal panel, is made by etching away from a solid sheet of copper, which is bonded to the plastic, those areas where wiring is not wanted, leaving solid copper wiring. Bond strength is excellent.

The following tools and accessories are needed to service any of the three receiver types just mentioned:

1. A good pair of long-nose pliers.
2. 60-40 low-temperature solder with rosin core.
3. A glue brush (app. cost, five cents) purchasable at the local hardware store.
4. A 25-watt soldering iron. A higher-wattage will *not* do.
5. Tinned wire, such as resistor or capacitor pigtail clippings.
6. Carbon tetrachloride.

### Solder Removal

As you probably know, etched-metal sets are assembled by either automatic or dip soldering in a matter of seconds; getting them apart, however, is not as speedily achieved, as you may well have found out. Maybe you are one of the servicemen who have turned the air blue in your immediate area with words not meant for tender ears, as you smashed tubes and speaker, and broke chassis boards, trying to extract a particularly stubborn i-f can from the death grip in which the chassis held it. The answer to the problem lies in getting the solder away from the joint between the etched conductor and the component.

Removing the solder from a joint

is readily accomplished with the glue brush and the low-wattage iron. Heat the joint cautiously; if the set manufacturer has bent the prongs of some unit in forty directions, as sometimes happens, straighten them with your long-nose pliers. By heating the joint again and rapidly brushing it, you can brush off the still molten solder. Since the solder present in the set has a very low melting point, and a low-wattage soldering iron is being used, the conductor will not generally be lifted from the base plate during this operation.

### Component Installation

After eliminating all the solder by brushing, remove the component carefully, using your iron to smooth out the solder left on the pattern. Be sure to leave the component holes open for insertion of a replacement. Clean the chassis area around the repair zone with carbon tetrachloride, before installing the replacement part.

Install the new component with care, so as to not lift the pattern; then solder it in place with the special low-temperature solder. Leave coating of rosin in place, to act as a protective layer.

Successful removal and replacement of a component without damage to the conductors is not always possible, and occasionally a conductor section will break off. Repairs are readily made in such a case by soldering a short piece of tinned wire to the damaged conductor. Resistor or condenser pigtailed are ideal for this purpose.

At all times use only a low-wattage soldering iron, always brush all joints free from solder, use only 60-40 solder, and be just a little careful—and etched-metal radio servicing will be a cinch. You will soon find the excellent accessibility, and absence of conventional wires, more than makes up for the extra care needed to service these sets.

By all means learn to service these units—you'll be getting plenty of this type of work soon, as almost every major manufacturer is currently putting such sets on the market, or will do so in the near future.

# Ringling Problems in TV Sets

By JAMES McROBERTS

• Ringing circuits embrace all networks which oscillate or ring due to shock excitation. Television receivers employ the ringing circuits in some horizontal oscillator circuits (multivibrators and blocking oscillators) under several aliases: oscillator coil, stabilizer, phasing coil, etc.

Signal excitation usually causes rings in the peaking coils of video amplifiers. The resonant circuit of the peaking coils includes parasitic circuit capacitance (not shown on schematic) and interelectrode tube capacitances; hence, peaking coil circuits might also be classified as parasitic oscillatory circuits. Other television circuits, such as those in which the horizontal deflection coils lie, may also be placed in this category, due to their ability to resonate with their self-capacitance and produce excessive amounts of ringing.

The technician is concerned with how such circuits oscillate, practical means for increasing or decreasing the intensity of the ring or oscillation, and ways of suppressing the ring completely.

**Simple Ringing Circuit.** The simple series-resistance ringing circuit of Fig. 2 is derived from the multivibrator circuit shown in Fig. 1. The reader will recall that multivibrator and blocking oscillator tubes act like switches, that is, these tubes change

very rapidly from no conduction (open-circuit condition resembling an open switch) to full conduction (closed switch condition). The tube's plate-to-cathode resistance is in series with the switch (Fig. 2B). The plate load resistor is in series with the plate resistance and the switch, and we are therefore justified in adding these together to form resistance  $R_x$  in Fig. 2A.

We may liken the incoming sync pulses shown in Fig. 1 to a mechanical arm attached to switch SW of Fig. 2A. The analogy may also be thought of with respect to Fig. 2B. The internal resistance of coil L in Fig. 1 becomes series resistance R in Fig. 2A. Capacitance C in Fig. 2A comprises shunting capacitor C-1 shown in Fig. 1, plus the self-capacitance (not shown) of coil L.

**Analysis of Series Ringing Circuit.** Having simplified the circuit of Fig. 1 to the one shown in Fig. 2A, we may proceed to analyze its operation. For the benefit of those readers who are not familiar with the subject of ringing, we will further simplify Fig. 2A by considering that R is absent (R can never be eliminated in actual practice, it should be noted). We assume at the outset that switch SW is closed, permitting battery B to send a current through the coil L, and to charge condenser C.

Opening the switch causes this passage of current through coil L to cease. The current that previously

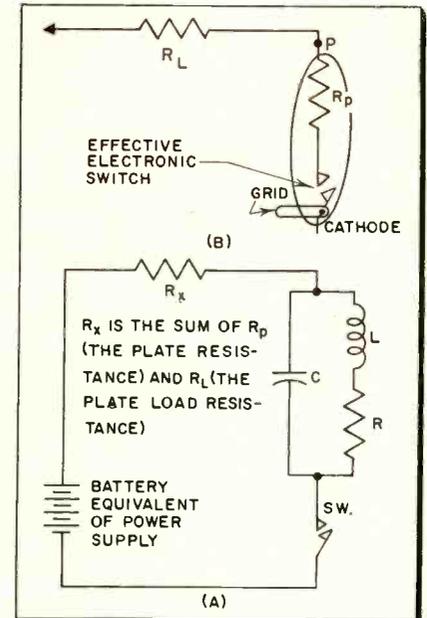


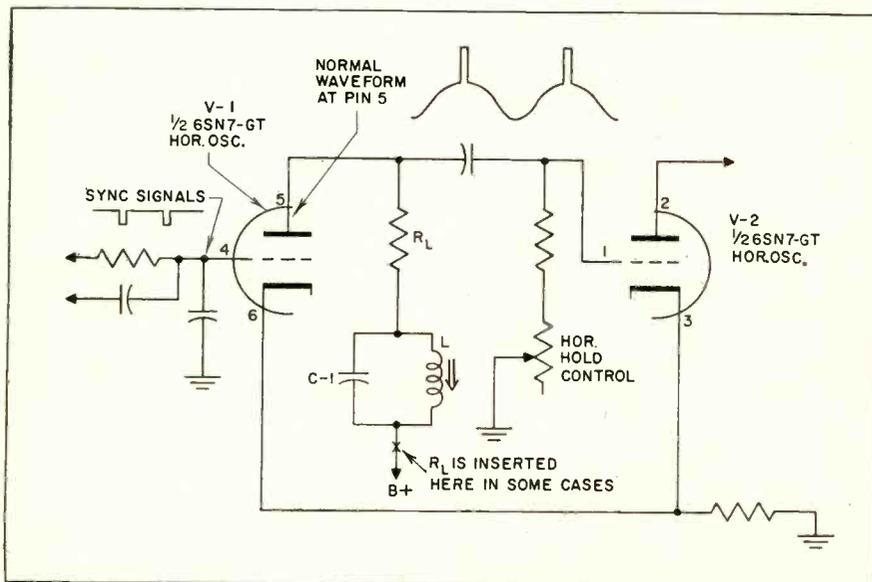
Fig. 2A—Simple ringing network (L, C, R) and associated circuit. R is made up chiefly of the resistance of the coil winding. B—Equivalent circuit of triode-switch tube. Grid-cathode voltage acts like a mechanical switching arm that opens or closes the switch.

passed through coil L stored up energy in the coil in the form of a magnetic field around it. This magnetic field now tries to dissipate itself, or collapse. In so doing, it sends a current through the circuit in a direction *opposite* to the one which originally flowed there. This new current charges C in the opposite direction.

When the coil has transferred its energy to C (storing a charge on C), the condenser will discharge, sending a current through L in the same direction as that of the original current. This recreates the field that originally appeared around coil L, and causes C to acquire a charge whose polarity is the same as the initial charge developed across it. One cycle of oscillation is thus completed. This cycle repeats itself (see Fig. 3A).

Since R (Fig. 2A) is assumed to be absent, and no energy is dissipated in the coil or condenser in this hypothetical case, each succeeding cycle is an exact duplicate of the first one. We call this the undamped case, due to the fact that no resistance is present to damp out the oscillatory energy. This theoretical case is approached in practice only in some extremely high "Q" circuits

Fig. 1—Section of horizontal multivibrator circuit. L and C-1 make up the ringing circuit.



(such as the lightly-damped networks associated with quartz crystals that are used to "ring" in some radar applications).

We now proceed to the case where series resistance  $R$  (Fig. 2A) is relatively small. The passage of current through the resistor causes a dissipation of energy ( $I^2R$  loss) that manifests itself as heat in the resistor. Not all of the energy is now transferred from the inductance (coil  $L$ ) to the capacitance (condenser  $C$ ) or vice versa. In each succeeding cycle the oscillatory peak amplitude consequently becomes progressively smaller (Fig. 3B).

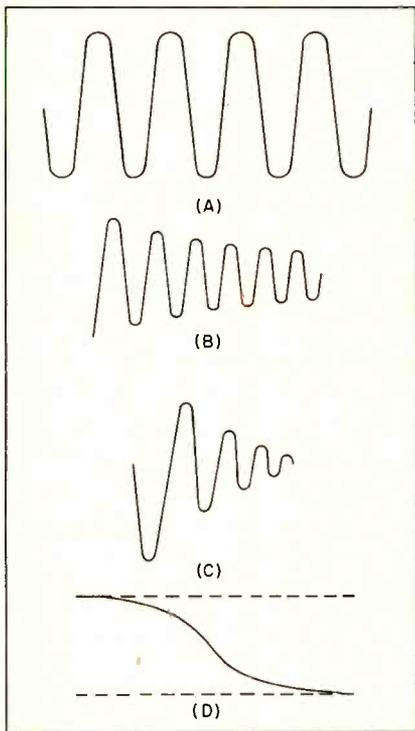


Fig. 3—Waveform of a ringing circuit when the latter is (A) undamped, (B) slightly damped, (C) heavily damped, (D) over-damped.

If series resistance  $R$  is increased further in value, more energy will be dissipated per cycle, or every half cycle, and the waveform now produced will resemble the one shown in Fig. 3C. Note the rapid decay of the oscillation in this case.

Increasing series resistance  $R$  beyond a certain critical value will cause the waveform shown in Fig. 3D to be produced. In this case, no oscillation whatsoever is present, and the current simply decays to zero without reversing. This "over-damping," as it is called, serves as a means for eliminating parasitic oscillation, such as the ring sometimes encountered when the horizontal output tube is overdriven. (To permit greater drive without ringing, antiparasitic damping resistors are

## What the Technician Should Know about the Theory and Servicing of Ringing Circuits

inserted in horizontal output stages.)

We turn now to the parallel resistance case shown in Fig. 4, typical of video peaking coils and their shunting resistors. We are considering a simple instance here. When resistance is in *parallel* with an "excited" coil, the ringing that takes place will vary in *direct proportion* with the value of the parallel resistance (whereas ringing varies *inversely* with the resistance present, when the latter is in *series* with the coil). The absence of shunting resistance (we assume the absence of series resistance as well) produces the undamped wave of Fig. 3A; when parallel resistance is inserted in decreasing amounts, damping increases, and the ringing present goes through the changes shown in Figs. 3B, C and D.

Let's now apply the information we have developed to practical problems.

**The Stabilized Multivibrator.** The purpose of a ringing coil (regardless of its alias) in the plate circuit of the stabilized multivibrator, is to provide a means for triggering the retrace tube (2nd half of multivibrator) when incoming sync pulses have been lost, or are weak. Its further purpose is to prevent such retrace tube triggering at times other than at the end of exactly one horizontal line.

The circuit is appropriately resonated by adjusting the slug of coil  $L$  (Fig. 1) to produce one cycle of oscillation for every horizontal line. This one-cycle ring is very lightly damped, as indicated by the waveform (see Fig. 1) at pin 5 (plate) of V-1, carried over, also, to the grid of V-2, the 2nd tube section. We note further that the retrace spike occurs on or near the crest of the sine-wave ring; this spike, incidentally, starts the ring.

If the circuit is heavily damped for any reason, the waveform will resemble the one shown in Fig. 5. Note that the peak amplitude of the composite waveform is now considerably smaller. The stabilizing action becomes as ineffective under such conditions as if the stabilizer were not tuned, or could not be tuned (due to change or improper values of  $L$  or  $C$ ) to produce a single-cycle ring. When any of the troubles just mentioned are present, symptoms of

instability and exceedingly critical horizontal hold will be produced.

The source of the trouble may be identified in each case with the aid of scope waveform checks. Too much damping will produce the waveform of Fig. 5, in which the spike starts from the sine wave valley; the absence of the sine wave or similar waveform, on the other hand, indicates either improper coil adjustment or improper component values (you can distinguish between these causes of trouble by trying to tune the slug). When a component's value is improper, its replacement is obviously indicated.

The author ran into a case where overdamping was due to water absorption by the stabilizing coil. A cold solder joint, which increased the resistance in series with this coil, was responsible for another overdamping condition.

**Pulse Width Stabilizer Coil.** The stabilizing coil used in a blocking oscillator pulse-width controlled circuit is similar in function to the stabilizing unit employed in the multivibrator. Only the waveform is different (see Fig. 6). The same troubles and symptoms occur in this as in the preceding case, and we will therefore not treat it further.

**Parasitic Oscillation Providing Horizontal Retrace.** The self-capacitance of the horizontal deflection coils resonates with their inductance

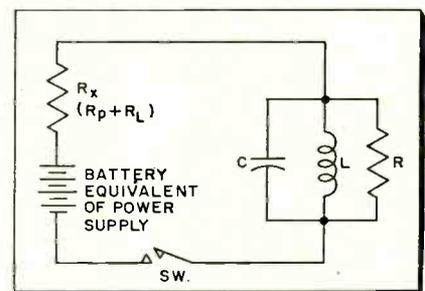
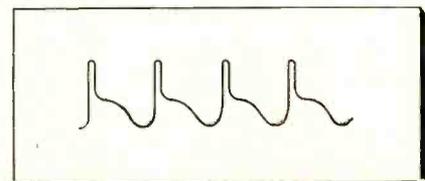


Fig. 4—Ringing circuit with shunt resistance.

Fig. 5—Waveform at first plate of multivibrator with excessive resistance in ringing circuit (compare with pin 5 waveform, Fig. 1).



to form an oscillatory circuit whose frequency is about 95 kc; the frequency is such that one half-cycle of oscillation occupies an interval approximately 5-6 microseconds long (retrace time duration). The energy stored in these coils tends to dissipate itself as an oscillation when the horizontal amplifier plate current stops flowing at the end of the trace interval. The absence of (excessive) damping allows the oscillation to start and go through one half-cycle; the oscillation is normally stopped at this time by the conduction of the damper tube, which acts as a parallel damping resistance.

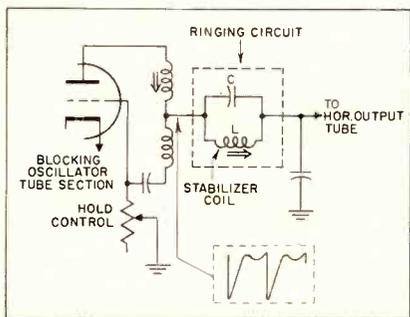
The waveform produced in the absence of damping is shown at Fig. 7B. With proper damping, the waveform will resemble the one shown in Fig. 7C (a very slight amount of oscillation is present in this case). The essential damper circuit is illustrated in Fig. 7A. Note the two (parasitic) self-capacitances.

One group of troubles in this circuit develops because of an increase in self-capacitance; the resonant frequency is lowered as a result of this increase, thereby increasing retrace time. If the retrace time becomes excessive, foldover will result. Troubleshooting is simple: try another yoke.

Tubes are frequent sources of trouble. Old or even new damper tubes may have a high plate resistance, causing damping to be insufficient. The capacitor from damper cathode to ground may develop a high resistance, increasing the effective impedance in shunt with the horizontal coils during retrace, and thus producing insufficient damping. Try replacing the capacitor, to check for this condition.

The rings produced by the troubles just cited (vertical lines at left of screen, most intense line at extreme left, with each successive line progressively weaker) may arise from other causes, such as parasitic oscillation in the screen or plate circuit of the horizontal output tube(s).

Fig. 6—Section of blocking-oscillator pulse-width circuit showing ringing network used.



Localization of, and remedies for, this type of fault have been considered in a previous article. Barkhausen-Kurtz oscillations may also produce similar symptoms. A magnet moved about the horizontal output tube will eliminate, and thus serve as a check for, this source of trouble.

Pronounced changes in the series resistance of the deflection circuit (including the flyback secondary) will result in too rapid a decay of the half-cycle oscillation or ring. Since the oscillation is rectified by the damper and converted into a dc boost voltage, the reduction in amplitude produced by its too-rapid decay will lower the B boost voltage

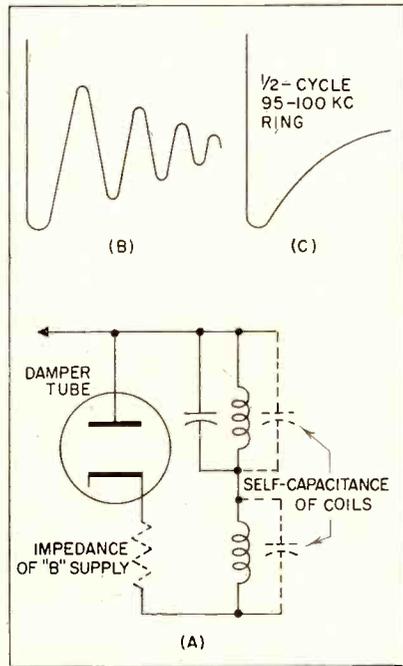


Fig. 7A—Section of damper circuit. B—Ringing waveform if damper tube were not used. C—Ringing waveform with damper present.

and decrease the width and high voltage; the need for increased drive in such a case may also cause the parasitic previously mentioned to be produced.

**Ringing in Vertical Deflection Coil.** Fig. 8 illustrates part of a conventional vertical coil circuit. Parallel damping is provided by the shunt resistors, whose customary value is 560 ohms each. From our previous discussion, we know that an appreciable increase in the value of these resistors will result in increased ring intensity; this often happens in practice.

The ring appears as a bar, similar to a sound bar but stationary, at the upper edge of the picture screen; it is followed by lower bars of successively-diminishing intensity. These symptoms give the appear-

ance of a wrinkle to a picture or test pattern; the condition is often referred to as a wrinkle in consequence. (Wrinkles are distortions of lines that are normally straight; the lines assume a sine-wave shape.) The remedy is, of course, replacement of the resistor at fault with one of the correct (lower) value, to decrease the ringing intensity.

Trouble may develop due to excessive capacitance across the vertical coils; this is, however, apt to be less pronounced than in the case of the horizontal circuit. Extreme cases of excessive capacitance will cause foldover, due to integration of the sweep signal; milder cases will produce (vertical) non-linearity.

Substitution of a new yoke is the proper test procedure, although this is not recommended until other circuit tests have been tried without success.

Trouble in the 56 mmfd (anti-wrinkle) condenser shunting half of the horizontal winding may cause wrinkle symptoms similar to those resulting from an increase in the value of the resistors shunting the vertical deflection coils. Check for such a defect by condenser substitution, making sure to connect the replacement across the same half winding.

#### Peaking Coils as Ringing Circuits.

Another ring that frequently manifests itself is the one following an abrupt change in picture content—i.e., when a predominantly dark scene becomes very light, or vice-versa. Ringing in this case may be caused by the peaking coils of the video amplifier (see Fig. 9A). Symptoms include ghosts of lines in the picture.

A ghost due to a ringing peaking coil is very similar to a reflection caused by an improperly-oriented antenna, except that the spacing of the direct and ghost signals remains the same at all channel settings, when a peaking coil is the source of the trouble; this spacing generally varies, on the other hand, when improper antenna orientation is causing the symptoms.

Several ghosts may be seen following an object in the picture, when a peaking coil ring is present, with each ghost less intense than the one immediately preceding it.

Some ringing is usually permitted in video peaking circuits. Certain customers may, however, object to the ringing intensity. The technician can alter the damping provided by the shunting (parallel) damping resistor in such cases.

The serviceman should check all

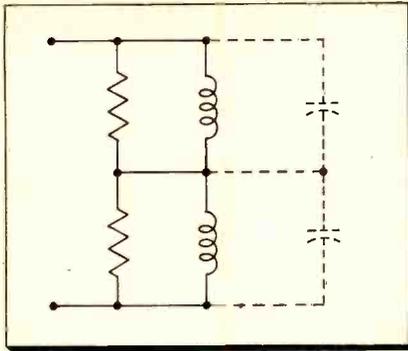


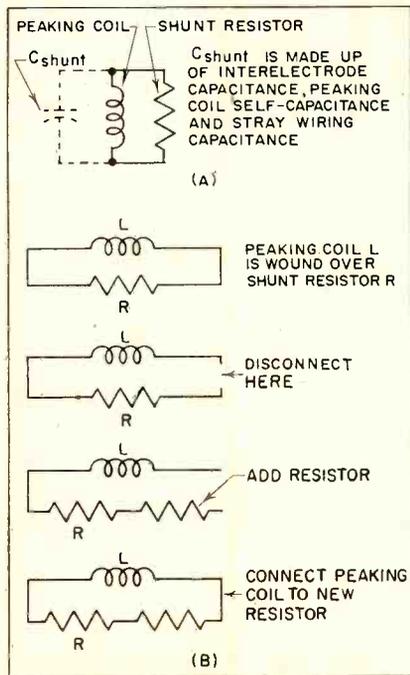
Fig. 8—Sketch showing resistance and capacitance associated with deflection coil circuit.

the individual peaking coils, using a bridging resistor in a manner similar to the bridging condenser used in checking for open condensers. This bridging resistor should have a value about eight times as great as the resistance in shunt with the peaking coil; a resistor ten times as large may not always produce enough of a change. Note that conventional resistors have a tolerance of about 20 per cent.

The bridging check just described will determine whether or not some coil circuit is not sufficiently damped, and is primarily responsible for the ringing. In cases where bridging any coil produces about the same decrease of ringing intensity as when the others are so tested, it is advisable to reduce all the damping resistors by about the same value—do not excessively over-damp one coil circuit alone, in order to get by with only one resistor.

Conversely, in some areas of low

Fig. 9A—Sketch showing resistance and capacitance associated with peaking coil circuit. B—Increasing resistance in shunt with coil.



signal strength, an increase in ring intensity may be desired, to improve the picture contrast; the procedure in such a case would be to increase the value of the parallel damping resistors, preferably raising all of them the same amount. A practical way of doing this is to disconnect the peaking coil lead from the pigtail of the resistor around which it is wound; attach the resistor to be added to the freed resistor pigtail; then connect the free end of the peaking coil lead to the pigtail of the new resistor (see Fig. 9B).

It should be noted that ringing may arise in the video i-f amplifier; this receiver section should be checked for proper alignment, if resistor bridging tests similar to the ones just described yield negative results.

**Summary.** Some important points relative to ringing circuits are enumerated below for the convenience of the reader:

1. A circuit must possess inductance and capacitance in order to be able to ring, regardless of whether or not such parameters are shown on the schematic.
2. The frequency of the ring is determined by the inductance and capacitance of the (resonant) circuit.
3. Ringing circuits are excited by a change in the current flowing through them; a change of voltage across such a circuit will obviously cause such a change in current.
4. Proper frequency adjustment of a ringing circuit permits it to ring in phase with the shock producing the ring.
5. Since ringing circuits do not amplify, the initial half cycle is the maximum half cycle or alternation. Succeeding alternations must decay relative to this first alternation, due to voltage dissipation across the resistive element present.
6. The rate of decay of a ringing circuit—i.e., its damping effectiveness—is determined by the ratio of resistance to the inductance and capacitance present in the circuit.
7. Damping—decay rate—is increased by increasing the series resistance, or by decreasing the parallel resistance. Both shunt and series resistance, when present in the same circuit, may be altered to produce the desired damping rate.
8. A circuit which possesses resistance, inductance and capacity cannot ring or oscillate if the damping exceeds a certain critical value; a condition known as *overdamping* is present in this case,

An acre of performance is worth the whole world of promise.—Howell

## Printed-Circuit Confusion

In recent months it has become more and more evident that there is considerable confusion in the industry on the subject of printed circuits. In technical literature for example, we find general technical statements on "printed circuits"; the statement involved, however, is frequently not applicable to all types of printed circuits. The book "Printed Circuit Techniques" (1947), available through the Superintendent of Documents in Washington, D. C., defines "printed circuits" as circuits produced on an insulated surface by any means. Painting, spraying, chemical deposition, vacuum processing, die stamping and dusting are listed as the methods now in use. Obviously, it is difficult to make any general statement on printed circuits because characteristics differ so from type to type.

### Case in Point

As a case in point, in the article titled "Servicing Printed Circuits and Chassis" appearing in the December 1953 issue of *TECHNICIAN*, under the sub-heading "Replacement Techniques" the author, in discussing the replacement of printed circuit networks and/or components thereof, has laid down general principles for soldering which are not applicable in all cases. Low-heat soldering is, of course, desirable when working on etched circuits because a high temperature iron might tend to loosen the binder between the circuit material and the backing insulation. This in turn could cause possible tearing of the circuit material in the event the latter lifts off on the iron. Obviously this is not a restriction in the case of ceramic networks such as Centralab's "Couplates," "Filpacks" and "Filplates." These units are designed to be handled in the same way that conventional paper capacitors or composition resistors might be handled.

While it may not be practical to eliminate the term printed circuits in general discussions, the editors of *TECHNICIAN* will also refer, in the future, to the type of circuit under discussion, such as etched, sprayed, stamped circuits, etc., and unless otherwise indicated, the technical data presented will be concerned with only that type circuit. It is hoped that standardization in this relatively new industry will occur soon, to clarify the uncertain definitions both for the reader and for the editor.

# First Printed TV Chassis

*Kaye-Halbert "Etched-Circuit" Television Set Has Been Scheduled for Mass Production*

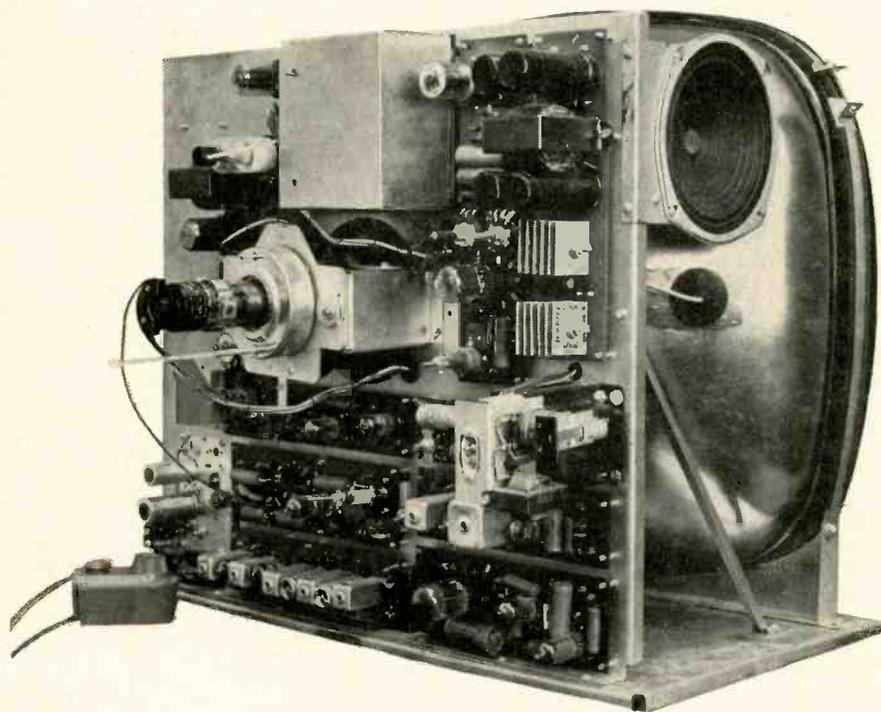


Fig. 1—Camera view of the new Kaye-Halbert all "printed-circuit" television receiver chassis. Note concealment of high-voltage circuit and the "Robot" remote control (extreme bottom, left). The remote control unit turns the receiver on and off, adjusts volume and changes channels.

• The first mass-produced all-printed-circuit chassis for television receivers will soon be manufactured by the Kaye-Halbert Corporation of Culver City, California. Production on this newly-designed chassis is scheduled to begin sometime within the next 90 days. The chassis (Fig. 1) was recently previewed in Chicago during Market Week and retail prices for the new set are now being worked out by company officials.

The printed-circuit chassis is the culmination of a year's development work, and utilizes the silk screen-etched method. The chassis, instead of being constructed as one complete printed circuit, has been divided into nine major sections. One such section is illustrated in Fig. 2.

Each of the major sections is separately silk screened and etched on copper phenolic plates. These plates are then punched and proper components and tubes are placed in them. The entire plate is then dip-soldered. When all nine printed circuit sections have been sub-assembled and dip-soldered, they are

snapped into a large phenolic frame which acts as the chassis holder. The sections are then connected with each other through a few conventional wire attachments.

The printed circuit chassis is mounted vertically back of the picture tube. The backs of Kaye-Halbert cabinets will be hinged, so that servicemen will merely have to drop the back of the cabinet, to look directly into the vertical chassis.

Because the printed circuit arrangement is in nine sections, the servicing problem becomes much simpler. A service manual is being prepared that will advise technicians to remove such-and-such a section, when certain listed symptoms of trouble appear. All sections will be coded in the manual.

By breaking down the chassis into nine major sections and designing a snap-in arrangement for these sections, it will be possible, according to estimates, to perform about 95 percent of all future servicing on Kaye-Halbert sets in the home.

The new chassis will contain 27 tubes, instead of the 23 now operating in current K-H chassis. In addition, the printed-circuit set will contain two selenium rectifiers and two germanium crystals. The new chassis will have four stages of i-f; it is designed to provide better interlace, and will have a better video response.

Since the human error in production will have been almost entirely eliminated, mechanical failure in the new Kaye-Halbert printed-circuit television set will, it is expected, be limited to component breakdowns. One of the major improvements introduced by the p-c TV receiver, thus, will be the standardization of high-quality chassis assembly.

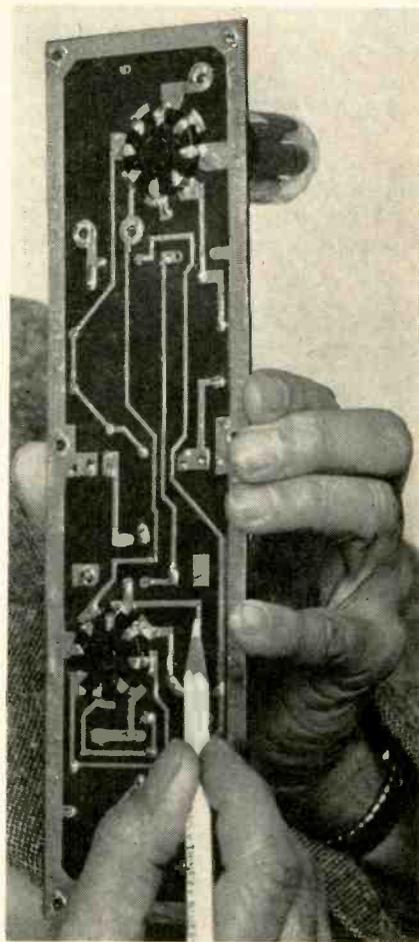


Fig. 2—Above photo is a sample of one of the printed-circuit sections. Section is etched to one of the copper phenolic plates. Glimpse is offered of component parts on reverse side.

# Eliminating Sound TVI

## Data From WASHINGTON TELEVISION INTERFERENCE COMMITTEE on Keeping R-F Out of Audio Stages.

• The grid circuit of the first audio stage of a television receiver usually requires from a fraction of a volt to a few volts of bias. Any r-f signal from a nearby radio station (taxi, police, military, amateur or other), strong enough to overcome this small bias, or large enough in amplitude to cause grid-current flow will, as a consequence of non-linear grid voltage-plate current relationship, be rectified, and, if amplitude-modulated, will appear as an audio signal passing through the audio amplifier, together with the audio signal of the station actually tuned to. An FM or

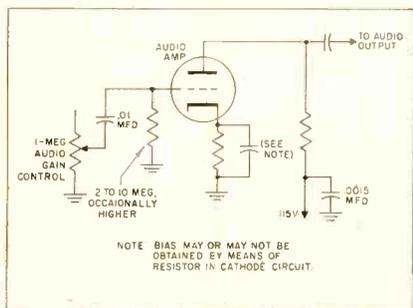


Fig. 1—Conventional first audio amplifier.

unmodulated carrier of moderate intensity may produce hum or distortion. A strong FM or unmodulated carrier will reduce the audio output level of the station to which the receiver is tuned. If the interfering signal is keyed, program reception with breaks in volume will be noted. This type of interference will be evident on all television channels, regardless of receiver tuning adjustments.

### Identifying Rectification Effects.

To identify the interference described, momentarily short the output of the last i-f amplifier through a condenser to ground. If the interfering signal *persists*, it is most probably due to pickup in the first audio amplifier; the procedures outlined in the paragraphs following will be found effective in such a case. If the interference *stops*, it is not due to pickup in the audio stages, but is probably being caused by inter-modulation in the r-f or i-f stages.

These same effects can also occur in AM and FM receivers, phono and

public-address amplifiers, hearing aids, and other high-gain audio devices.

**Receiver Modifications.** Effectively eliminating this type of interference depends entirely on preventing the r-f from being rectified; once rectification occurs, it is impossible to separate or filter the interference from the desired signal.

Fig. 1 is a simplified schematic of a conventional first audio amplifier, and indicates typical values of associated components.

In Figs. 2A, B, changes made in the circuit of Fig. 1 to eliminate the undesired signals are indicated. When the original grid resistor is large, it may be necessary to reduce its value to as little as 1 megohm. This will not appreciably affect the gain of the desired audio. However, care should be taken in choice of values for bypass condenser and series resistor or inductance to maintain the grid circuit pre-eminently resistive to audio frequencies (i.e., use a relatively large capacitance, and a small inductance).

Choke or resistor and condenser should be mounted directly at the grid pin of the tube socket, with the shortest possible lead length between grid and cathode. For grid-cap type tubes, the grid lead should be shielded, and the bypass condenser connected as close to the grid-cap as practicable.

The bypass condenser added as a shunt across the tube input provides such a low impedance at r-f that it

practically shorts out any such signals at this point; the series choke, or resistor, helps prevent r-f from reaching the grid. The choke gives the best results, but the carbon resistor is almost as effective.

**Bypassing and Filtering Suggestions.** As in ac-dc standard broadcast receivers, bypassing the heater of a combined detector-first-audio stage to ground with a 0.01 mfd condenser, will often prove helpful. Be certain screen and suppressor grid bypassing is adequate.

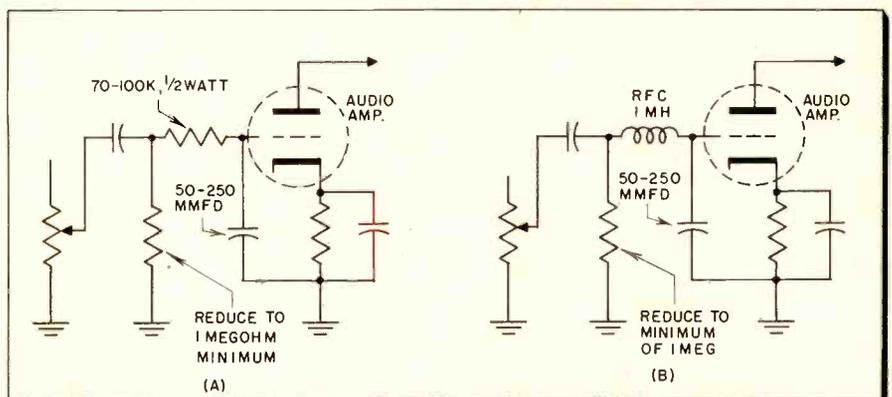
In extremely strong signal fields, it may be necessary to filter the second audio amplifier, or output amplifier, in the same manner. Where the interference is strong enough to be feeding into stages after the first audio amplifier, care should be taken that no phase inverter stage is affected by any filter installation.

Series heater strings should be well bypassed to prevent the undesired signal from entering the tube through the heater leads. Both sides of the ac line may be bypassed to chassis (in transformer-powered sets) with 0.01 to 0.1 mfd (value non-critical), 600-volt condensers.

Tube shields, if used, should be checked for positive ground connection. If an audio tube is unshielded, it may be necessary to install a shield. Lead dress should be carefully checked. R-f pickup may occur on long volume control leads running to the front of the chassis. Receiver wiring may represent an

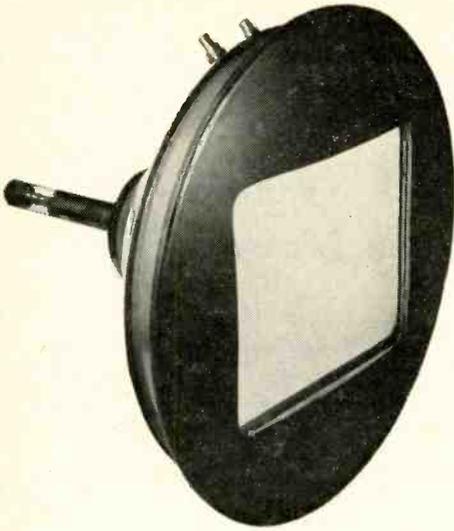
(Continued on page 52)

Fig. 2—Circuit changes for keeping r-f out of the audio stages. Observe cautions described in text.



# The Chromatron:

## How This CRT Works. Comparison



By SIDNEY C. SILVER  
Associate Editor, TECHNICIAN

The existence of a single-gun structure, the Lawrence gun, has been known for some time. Use of this structure in the *Chromatron*, designed by Chromatic Television Laboratories, is not a development of the last few weeks or months; recent events, however, make it worth while to call attention to this tube and to its possible impact on set design. In the first place, two or more important manufacturers of black-and-white crt's have been licensed to produce the tube. In addition, at least two manufacturers of nationally-sold name-brand receivers are making plans to use the *Chromatron*, and are working on associated circuit design.

As discussed in earlier articles, color phosphors in three-gun shadow-mask tubes are deposited in dots on the inside surface of the tube's viewing screen. The dots are arranged in triangles of three each, one for each of the primary colors. The electron beams from the tube's cathodes are so directed that, in passing through apertures in the mask, the beam from each gun can only strike dots of the correct color phosphor—or strike no dots at all. Electrons that are not propelled directly onto the desired dots are blocked by the mask altogether. As a result, such tubes are highly inefficient devices; it is estimated that only 15 per cent of the electrons that leave the three cathodes actually strike the picture-tube screen. With an aperture mask, then, three guns are needed to insure enough total electron emission, if for no other reason. Also, because of the low efficiency, higher second-anode voltages are required than are common

in black-and-white receivers, and overall brightness of the picture is reduced.

The *Chromatron*, which uses no aperture mask, is said to permit 85 per cent of all electrons beamed from the single gun to strike the phosphor-coated screen. Elimination of the mask is made possible by a dynamic *lensing* or *beam-bending* system. When information of any particular color is to be displayed in the picture, a varying voltage applied to elements inside the crt bends the beam coming from the single cathode so that it strikes phosphors of that color only.

To see how this is done, a look inside the tube is necessary. The manner in which the color phosphors are placed on the inside surface of the tube's viewing screen differs from the triad-dot arrangement common to three-gun types. The ar-

range in the latter is shown on one segment of the tube's inner surface in Fig. 1A. In Fig. 1B, which is a comparable segment of the surface in the *Chromatron*, these phosphors are deposited in adjacent horizontal strips extending across the faceplate.

It will be noted that there are twice as many strips of green phosphor (G) as there are of blue (B) or red (R). Such an arrangement is used because most of the luminance information is associated with the green signal. This design feature does not upset color balance. See explanation in caption for Fig. 3.

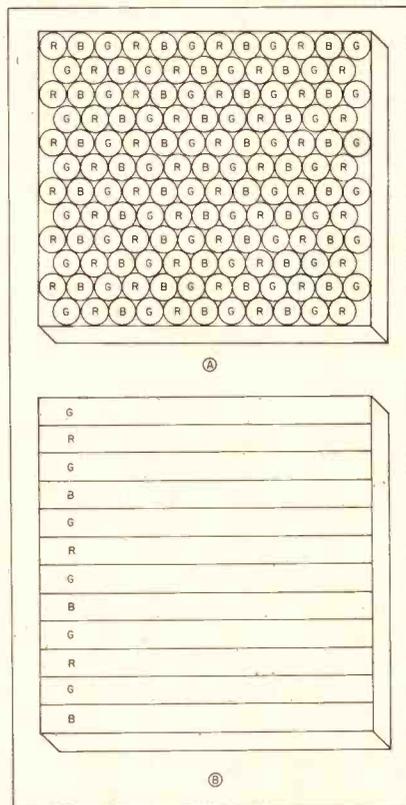
### Grid Wires Act As Lenses

Between the gun assembly and the phosphor-coated screen, but closer to the screen, is an assembly of horizontal grid wires, as shown in Fig. 2. Alternate horizontal wires are connected together and brought out as two fundamental connections, marked red and blue.

In Fig. 3A, a cross section view shows the electron beam passing between one red and one blue wire when there is no potential difference between them; that is, when the voltages applied to the connections marked red and blue in Fig. 2 are equal. The like positive charges on the grid wires have only one effect, in this instance: they tend to focus the beam sharply onto the green phosphor strip. When the structure of red grid wires is made *positive* with respect to the blue assembly, the electron beam is deflected *upward*, as shown in Fig. 3B, and the beam strikes the red phosphor strip. In like manner, when the potential between adjacent wires is reversed, only the blue strip is struck (Fig. 3C). Note that, even when there is no voltage difference between the red and green wires, the potential on both sets of wires still has a lensing effect on electrons propelled toward the screen.

A keying or switching arrangement is used inside the receiver to develop the varying potential that is applied to the grid wires. In this

Fig. 1A—Phosphors for three primary colors are deposited in dot-triangle arrangement in 3-gun tubes. B—Horizontal phosphor strips are used in *Chromatron*.



# A Single-Gun Color Tube

with 3-Gun Types. Associated Receiver Considerations

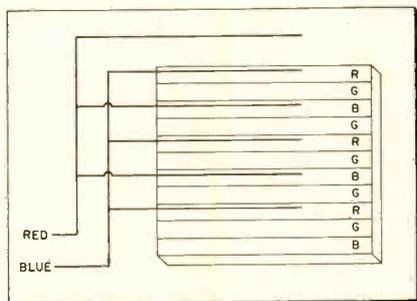


Fig. 2—Instead of an aperture mask, a screen of horizontal wires is placed behind the phosphor-coated faceplate. This lensing structure directs electrons to the proper color strips.

way, beam lensing is constantly switched from one color to another. Obviously some means must exist, controlled by color information, for varying the emission from the gun's cathode as the beam is being lensed or bent to the various color strips.

More than one circuit has been devised to accomplish this. The most elaborate one makes use of a color section in the receiver that is comparable in size to the specialized color sections already developed for receivers using three-gun tubes, although it operates in an entirely different fashion. On the other hand, one laboratory talks of incorporating the entire color-processing section into a single stage. This single-tube section will work in conjunction with the color tube; actual decoding of color information will take place in the latter. Such circuits will be discussed in future issues of *TECHNICIAN*, as and when they become available. Evaluation of the possibilities introduced by Lawrence-gun tubes, however, need not wait for such information.

Since many of the tube's possibilities depend on its physical characteristics and some electrical characteristics not yet mentioned, this data is presented here. Maximum diameter of the tube in its present form is about 22 in. The diagonal of the rectangular viewing screen is about 18 in. Overall tube length is about 22 in. Length is comparable to that of 19-in. black-and-white crt's; the Chromatron is considerably shorter than a three-gun color tube providing a comparable picture size would

be (in the present state of design).

The 22-in. overall length is made possible by the use of a 72-degree deflection angle. Still wider deflection angles are said to be possible. Magnetic deflection and magnetic focus are accomplished with standard yoke and focus assemblies. The larger and more expensive yokes required for three-gun tubes are thus eliminated.

The Chromatron requires 18 kv of second-anode voltage in its present size. This is only slightly higher than the value required for black-and-white tubes that produce pictures of the same dimensions. The three-gun tube, on the other hand, needs 20,000 v to produce a picture with a diameter of app. 12 in.

Regulation of the hv section in a receiver using a Chromatron is not highly critical. The same statement may be applied to the normal B+ supply, for that matter. In three-gun tubes, we are dealing, in one sense, with three tubes that happen to use a common shell and phosphor screen. For proper functioning (particularly with respect to convergence), the three guns and their associated external circuits must be critically adjusted with respect to each other. Voltage changes beyond certain narrow limits upset this delicate balance.

## Non-critical Tolerances

In the Chromatron, the relationship between the voltages on the single cathode, the wire-grid structure, the second anode, and other tube elements remains essentially unchanged over a fairly wide range of overall increase or decrease in the low and high dc supplies. Receiver tolerances in general are comparable to existing tolerances in b & w sets. This means that conventional fly-back transformers may be used in familiar horizontal-output circuits. Low-voltage supplies will also tend to resemble those now in use.

With the use of a single electron beam, the problem of convergence is eliminated as it exists in shadow-mask tubes. There will simply be no convergence controls. There will

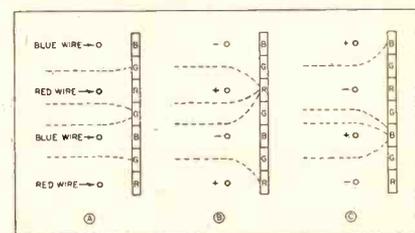
also be no need for critical balancing adjustments to match the outputs of three guns. These factors are particularly important when the receiver is required to reproduce a black-and-white picture, free of color fringing (color "ghosts") on the one hand, and of overall color tinting on the other.

## Limitations of Chromatron

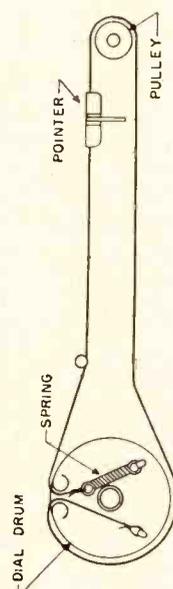
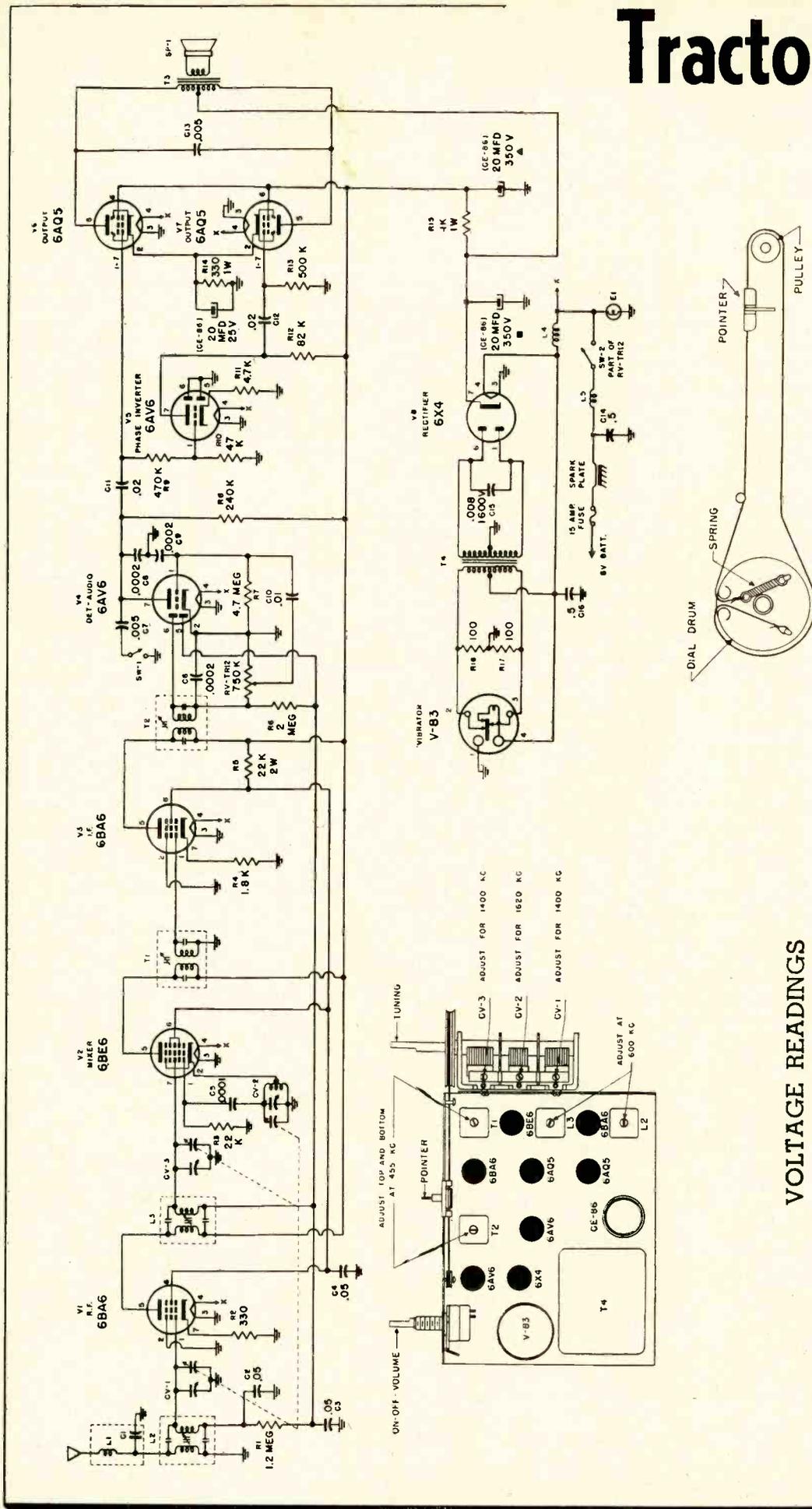
A sober estimate of this color tube's potential indicates some disadvantages. In the current version of its associated receiver, a 25-watt oscillator is used at the frequency of the color subcarrier (3.58 mc). Interference radiation from this stage is a possibility. Measurements with a field-strength meter at 100 ft. indicate radiation of 5 microvolts per meter in the present state of circuit design. In addition, the limited number of phosphor strips now used (450 for green, half that number for red or for blue) make for coarse definition of blue or red detail, although subjective reaction to this phenomenon varies.

It is impossible to say at this time that the Chromatron, or any other color crt, enjoys a clear advantage over its rivals. Changes in all tube types, as well as in the design of associated circuits, will determine whether one tube will obsolete the others, or whether more than one type will come into general use for an indefinite period.

Fig. 3—The potential difference between adjacent grid wires bends the electron beam. The paths of four electrons in the beam are shown when (A) green, (B) red and (C) blue phosphor strips are being activated. Despite the fact that fewer strips are struck in the last two cases than in the first, note that the same number of electrons are activating phosphors in all three cases. Uniform saturation is thereby maintained for the three primary colors.



# Tractor Radio



VARIABLE CAPACITOR  
FULLY-OPEN

DIAL DRIVE

## VOLTAGE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
V 1	6BA6	0	0	0	± 6.3	195	80	1.2
V 2	6BE6	-4.2	0	0	± 6.3	195	80	0
V 3	6BA6	0	0	0	± 6.3	195	80	1.9
V 4	6AV6	0	0	0	± 6.3	0	0	40
V 5	6AV6	0	1.6	0	± 6.3	0	0	165
V 6	6AQ5	0	12	0	± 6.3	220	195	0
V 7	6AQ5	0	12	0	± 6.3	220	195	0
V 8	6X4	250AC	195	0	± 6.3	0	250AC	215

# to Lighten Farmer's Chores

*Technicians Located Near Farm Areas Will Be Interested in the Profit Possibilities Provided by This New Receiver*

This new Tractor Radio is an 8-tube (including rectifier) superheterodyne, designed to operate from the 6-volt storage battery of a tractor. It is equipped with a self-contained telescopic antenna, and features single unit weatherproof construction and shock-proof mounting. The radio covers the frequency range 538 to 1620 KC. Three operating controls are provided.

The receiver has been designed with a tuned RF stage and a 3-gang tuning condenser. The unit is easily installed and requires no electrical adjustment after installation.

This Tractor Radio is enclosed in a rugged weatherproof case. Open the front cover by raising the thumb catches at the sides of the case, swing the cover all the way back so

that it lies flat, and rotate the catches to lock over the sides of the case. Extend the antenna to the lowest position necessary for good reception. The cover should be closed and locked when the radio is not in use. Collapse the antenna and turn the radio off before closing the cover.

The Tractor Radio has been designed so that it may be easily installed in any convenient location. The specially designed shock-proof mounting base is made to accommodate a standard one-inch pipe. *Never* attempt to mount your Tractor Radio without its shock-proof base. A one foot length of pipe and a floor flange are supplied with the radio. Some installations require additional lengths of pipe, lumber and hardware which are readily obtainable

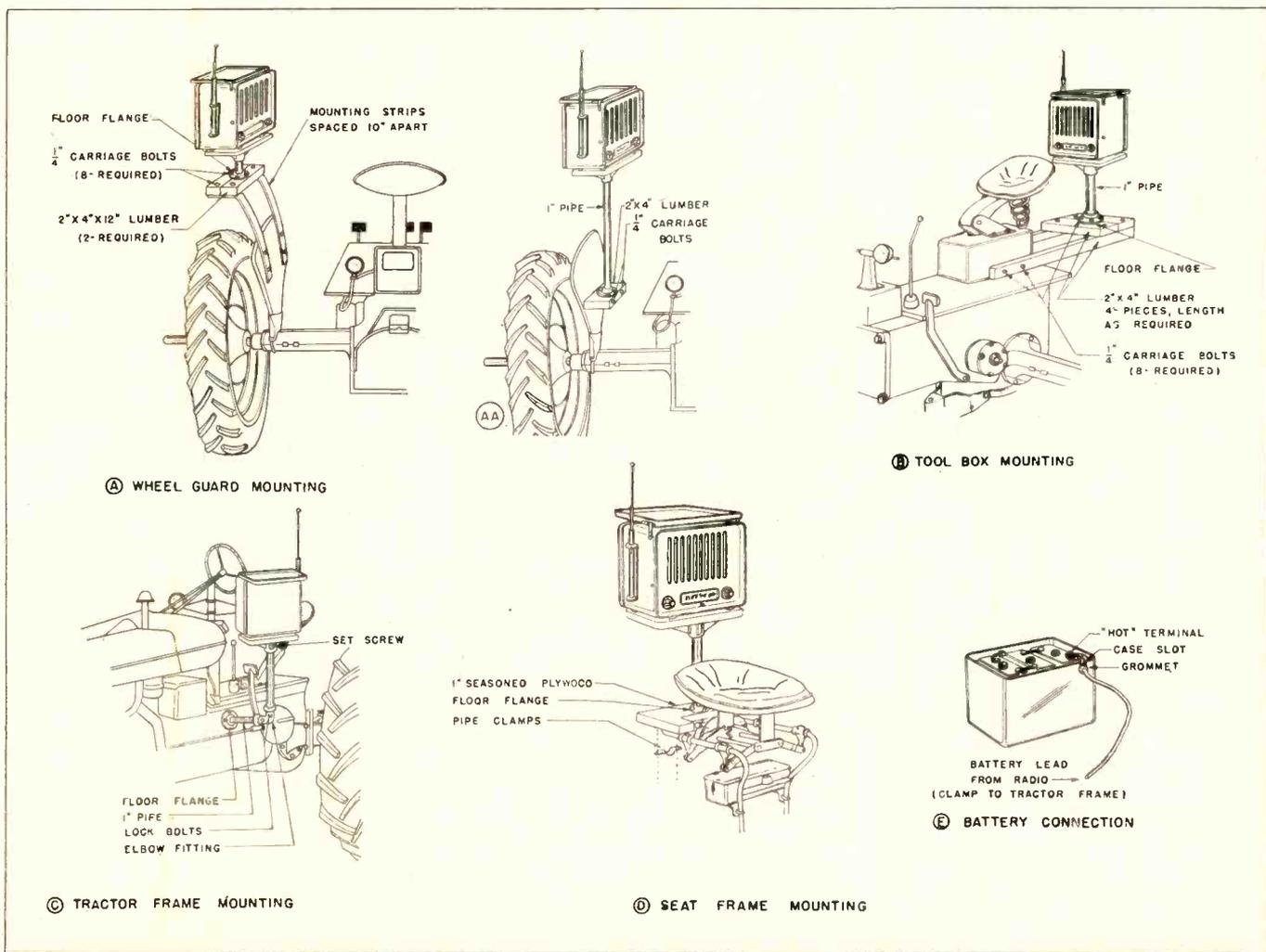
locally. The best method of mounting will depend upon the tractor on which the radio is to be installed. Four suggested methods are shown in the sketch below.

### Electrical Specifications

Power Supply ..... 6.3 Volts DC  
 Current ..... 5.5 Amp. Avg.  
 Frequency Range ..... 538-1620 KC  
 Speaker ..... 6" x 9" PM  
 Power Output ..... 5 w., undistorted  
   6 w., maximum

Sensitivity ..... 2-3 microvolts avg. for 1 watt output  
 Selectivity ..... 40 KC broad at 1000 times signal, at 1000 KC

This receiver contains the following:  
 1 - 6BA6 - RF Amplifier, 1 - 6BE6 - Converter, 1 - 6BA6 - I.F. Amplifier, 1 - 6AV6 - Detector - AVC - 1st Audio, 1 - 6AV6 - Phase Inverter, 2 - 6AQ5 - Power Output, 1 - 6X4 - Rectifier.

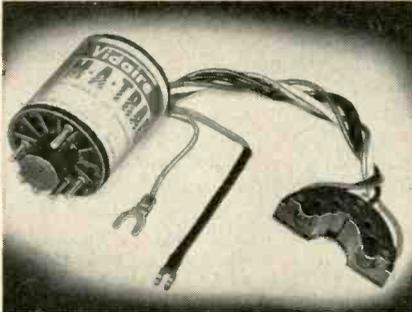


# Products and Parts

## TV Receiver Accessories, Replacement Components,

### Vidaire RETRACE KILLER

Elim-A-Trace, a vertical retrace line eliminator, may be installed without removing chassis or crt from cabinet. No cutting or splicing of leads required. Installation is said



to take a few minutes. Permits high setting of brightness control without bringing up annoying vertical retrace lines. Vidaire Electronics Corp., Lynbrook, N. Y.—TECHNICIAN

### Stancor FLYBACKS

Exact replacement flybacks, A-8227, A-8228, A-8229, are said to cover almost 90% of all Sylvania production up to 1953. They are supplied as coil and core only, because mounting bracket for these Sylvania flybacks is a permanent part of the chassis. New filament leads are packed with each transformer.

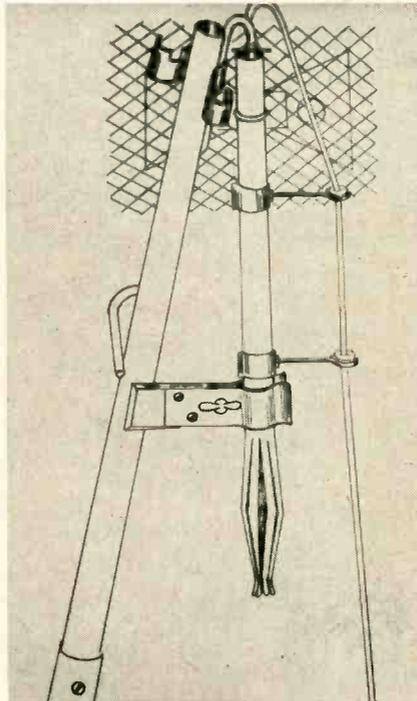
Three flyback transformers—A-8230, A-8231, A-8232—are exact physical and electrical replacements covering 88 chassis and 194 models in the following brands: Air King, CBS-Columbia, Emerson, Firestone, Silvertone. List of applicable models and chassis available from the manufacturer: Standard Transformer Corp., Standard Div., Addison and Elston, Chicago 18, Ill.—TECHNICIAN

### IRC PRECISION RESISTORS

Molded boron-carbon precision  $\frac{1}{2}$ -watt resistors, type MBC, are available in values from 100 ohms to .51 megohms, in tolerances from  $\pm 1\%$  to  $\pm 5\%$ . These small-size components are stable under changes in humidity, temperature and voltage. Bulletin available from International Resistance Co., 401 N. Broad St., Philadelphia 8, Penna.—TECHNICIAN

### Broth ANTENNA INSTALLER

Tenna-Tool is designed to permit the addition of a UHF or other antenna to an existing installation without the need of climbing. From a point at the base of the existing mast, the installer can raise the additional unit and attach it at any height up to 28 ft. The new antenna can be installed in either of 2 ways: with a slotted extension mast (as shown) for top mounting, or with



a clamp for side mounting. For further information, contact Broth Television Co., 602 Penn Ave., West Reading, Penna.—TECHNICIAN

### North Hills VARIABLE COILS

Series 120 variable-inductance coils cover the range from 2 microhenries to 2 millihenries in 11 coils, 120-A through 120-K. Useful for replacing video peaking chokes or coils in r-f and i-f circuits, where various units in the 120 series may be adjusted to the exact values required. Made with low-loss adjustable cores, the units are moisture- and fungus-proof. Minimum order of 10 units, 95 cents each. North Hills Electric Co., P. O. Box 427, Great Neck, N. Y.—TECHNICIAN

### Sandor TV SCREEN CLEANER

Skreen Kleen, a silicone treated cleaning cloth, cleans and protects the surface of TV picture tubes or safety glass. Continued use is said to create surface resistance to dust and fingerprints. List price, \$1.00. Sandor Products, Inc., 21333 Woodward Ave., Ferndale 20, Mich.—TECHNICIAN

### Controla-Tone REMOTE UNIT

This auxiliary volume control rheostat provides remote sound adjustment of sound level on any conventional radio or TV receiver. Connecting wire from remote unit attaches to one of speaker leads. Installation is said to be a matter of a few minutes. Directions with each unit. Retail price, \$5.95. Controla-Tone Co., Tacoma, Washington.—TECHNICIAN

### Airserco TV VENTILATOR

The T-Ventilator, easily attached to the back of a TV receiver, discharges hot air inside the cabinet and draws in cool air, thus reducing operating temperatures. With overheating thus prevented, deterioration of set performance due to change in component values or breakdown is said to be reduced



substantially. The unit operates only when receiver is on, and is designed for quiet performance. Price, \$14.75. Airserco Mfg. Co., 435 Melwood St., Pittsburgh 13, Penna.—TECHNICIAN

# for Sales and Service

## Servicing Aids, Audio Units

### Fenton GUY WIRE

Tuf-Guy Ten Spot guy wire, available in a flat pack, is spot-marked every 10 ft. for easy measuring. Wire is unwound from the center, through a 7-in. perforated



circle in the top of the box. Pack is designed for more convenient use than reel-wound wire. Fenton Co., 15 Moore St., New York 4, N. Y.—TECHNICIAN

### C-D MIDGET ELECTROLYTICS

Type TAN sub-miniature tantalum electrolytic capacitors are  $\frac{1}{16}$  in. long and  $\frac{3}{16}$  in. in diameter. Thirty-five units available from 0.01 mfd to 8 mfd, 3 v-dc to 150 v-dc. Said to have the following special features: wide range of operating temperatures, low leakage current, long shelf life, long service life, superior frequency characteristics. Cornell-Dubilier Electric Corp., South Plainfield, N. J.—TECHNICIAN

### MASCO 2-WAY INTERCOM

The "Small Talk" is a complete 2-way intercom system designed for use in home, office or other applications requiring a low-cost system. The system includes 50 feet of cable. Master unit features an on-off switch with volume control, pilot light and press-to-talk switch. Remote unit can originate or answer calls with separate press-to-talk switch. List price, \$29.95. Mark Simpson Mfg. Co., Long Island City 3, N.Y.—TECHNICIAN

### AMCO BATTERY TAPE RECORDERS

The series of Magnemite portable tape recorders, battery-powered and with regulated spring-wind motors, make field recording possible at points far from regular external and with regulated spring-wind motor power sources. Models in the 610 lbs., provide tape speeds from 15/16 to 15 in. per sec.; response on best model is 50-15,000 cps. Series 310 recorders (8 lbs.) use electric motors. Net price ranges from \$195 to \$435. Amplifier Corporation of America, 398 Broadway, New York 13, N.Y.—TECHNICIAN

### Telectrosonic TAPE RECORDER

Portable recorder model 880 is designed to fill the demand for a low-priced, simple-to-operate tape machine for home use. Features: dual-track recording, fast forward and rewind, built-in amplifier and speaker, level indicator and high impedance input for mike, radio, record player and other devices. May be operated with the cover closed. One hour recording at  $3\frac{3}{4}$  in. per sec. Telectrosonic Corp., 35-18 37th St., Long Island City 1, New York.—TECHNICIAN

### Sylvania FLASHLIGHT-TOOL

The See-Well is a 3-way tool with a built-in flashlight. Bulb and batteries, contained in handle, light up work area. Three heads that fit into handle are: philips screw driver, alignment tool and flat-head screw driver. Unit comes in plastic carrying case. Available for 16 Sylvania premium tokens up to March 31. Sylvania Electric Products, 1100 Main St., Buffalo 9, N. Y.—TECHNICIAN

### Merit REPLACEMENT FLYBACK

Flyback unit HVO-13 is an exact replacement for 4 units used in Sylvania receivers; the HVO-13 covers 39 chassis and over 160 models, almost 90% of Sylvania's production up to 1953. Since the original transformer's mounting bracket, which is an integral part of the chassis, must be used, the unit is supplied as core and coil only. List price, \$8.25. Also available, horizontal scan choke C-2980, to replace Sylvania

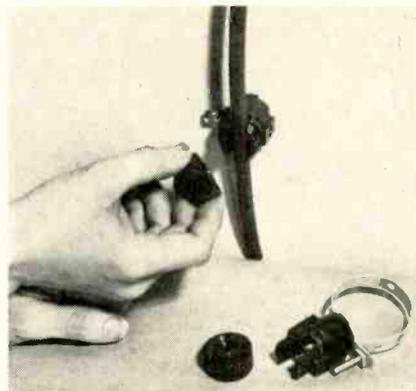
part 241-0002. List price, \$3.50. Merit Coil & Transformer Corp., 4427 N. Clark St., Chicago 40, Ill.—TECHNICIAN

### Imperial TRANSMISSION LINE

Spongee, a low-loss sponge polyethylene twin-lead antenna wire, is suitable for UHF and VHF applications. Each lead is made of 7 strands of pure 28 copper (20 gauge wire). Suitable for all climates and weather conditions, this wire is available on 1,000-ft. reels. Sample on request. Heavy steel ground rods,  $\frac{3}{8}$ -in. in diameter, are also being produced. Available in 4- or 6-ft. lengths, the rods are double-plated and finished with hand-rubbed oil coating. Turned-down point is used to facilitate driving into any type soil. Imperial Radar & Wire Corp., 820 E. 233 St., New York 66, N. Y.—TECHNICIAN

### RCA LIGHTNING ARRESTORS

Two quick-service UHF lightning arrestors are designed for installation without the need of splicing wires, stripping insulation or soldering. May be used with most types of 300-ohm transmission line without affecting electrical properties. During installation, a screw cap forces antenna line against staple contacts which pierce the insulation and make contact with conduc-

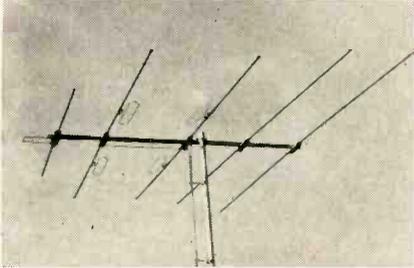


tors. Arrestors available in screw-in type (234A1) for direct mounting to baseboards or windowsills; also in strap type (235A1) for mounting to masts and water pipes. Both listed by Underwriters Labs. Radio Corp. of American, RCA Victor Division, Harrison, N. J.—TECHNICIAN

# New Antennas and UHF and VHF Types Designed for Outdoor and

## TACO VHF ANTENNA

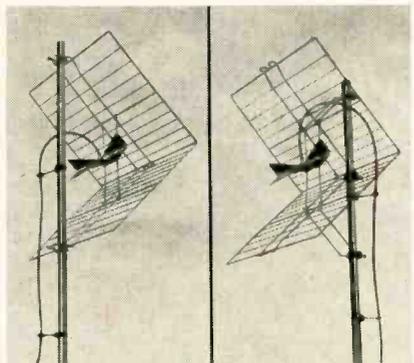
Designed for high-gain all-channel VHF use, the Trapper, cat. no. 1880, is similar to a broadband twin-driven yagi on the low band. Phase-reversing radiators, in the



form of folded dipoles, are spaced along two of the antenna elements to provide full in-phase pickup with minimum loss on the high band. Gain up to 7 db for a single-bay model on the low band, up to 11 db on the high band. Other features: high front-to-back ratio, sharp directivity, 300-ohm impedance, easy assembly. Designed for ultra-fringe use. List price, \$19.75 for each bay, \$1.75 for 2-bay stacking line. Technical Appliance Corp., Sherburne, N. Y.—TECHNICIAN

## Channel Master UHF ANTENNAS

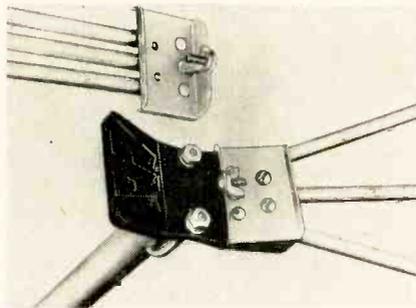
Model 409 UHF corner reflector can be mounted either in front of or behind the antenna mast, depending on installation conditions, with no difference in performance. For quick assembly, screen swings open and dipole snaps into place. For all-channel UHF use, with gain up to 12½ db and sharp directivity.



UHF 16-element yagis (Sweet Sixteen, model 420) are also available, with coverage up to 21 different channels available on some sizes, for use in fringe areas. Elements are

welded in place on these pre-assembled yagis. Channel Master Corp., Ellenville, N. Y.—TECHNICIAN.

## Trio VHF ANTENNA



The Colorite is a VHF conical whose elements cannot weaken and fall out because they are riveted to the head. The use of non-hygroscopic head material provides good weather resistance as well as mechanical strength. Assembly is accomplished by tightening 4 wing nuts. List price for single-bay model: \$7.85. Also available in two-bay model with stacking harness. Trio Manufacturing Co., Griggsville, Ill.—TECHNICIAN.

## Vee-D-X YAGI

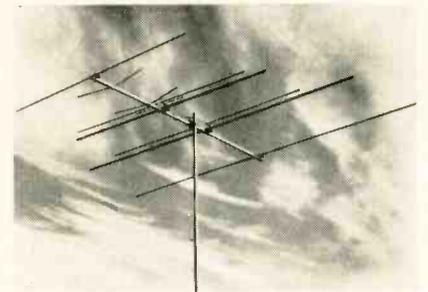
The Vee-D-Xtra Special, model SP-II, is a broadband VHF yagi that incorporates basic yagi performance in an all-channel VHF design. The forward high-channel section is matched to the rear low-



channel section, both being coupled for 300-ohm termination. A sharp horizontal pattern with superior front-to-back ratio minimize ghosts and interference. Reinforced con-

struction uses drawn aluminum elements with crimped ends. LaPointe Electronics Inc., Rockville, Conn.—TECHNICIAN.

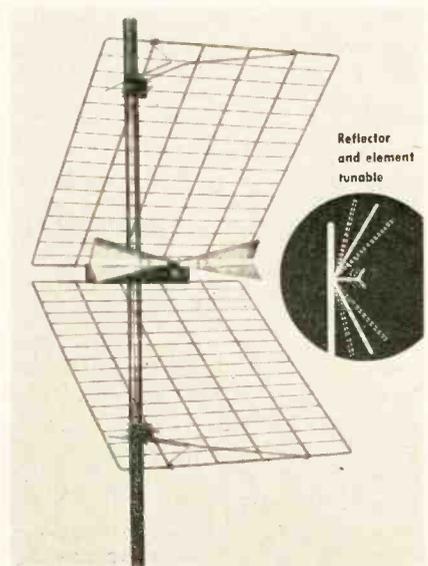
## Welco VHF ANTENNA



The Challenger, a high-gain antenna for all-channel VHF use, features sharp directivity, high signal-to-noise ratio and 300-ohm impedance match. It is light, rigid and quickly assembled. Welco Mfg. Co., Burlington, Iowa.—TECHNICIAN

## Tele-Matic UHF ANTENNA

The Tuner Tenna, model 715, is an adjustable corner reflector for UHF that may be tuned for optimum reception on any channel. It is also said to be adjustable for optimum lobe pattern and for impedance match to any type of transmission line. Completely pre-assembled. Also available as a one-piece side-



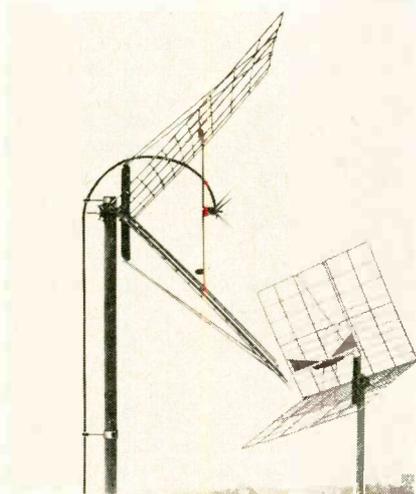
by-side version for greater gain (model 715-2X). Tele-Matic Industries, 1 Joralemon St., Brooklyn, N. Y.—TECHNICIAN

# Related Products

*Indoor use. Self-Supporting and Telescoping Towers*

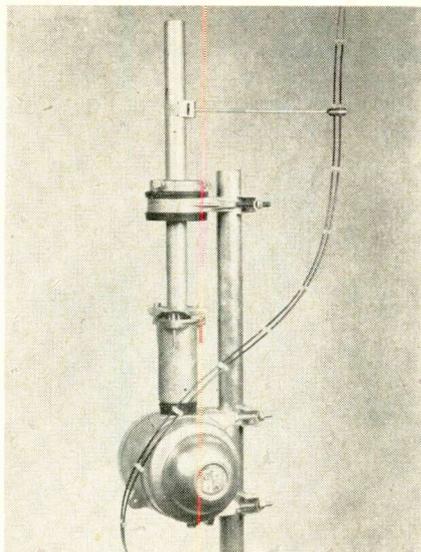
## JFD UHF ANTENNA

The Golden Rig bowtie with corner reflector, model UHF415, is designed for fringe reception on Channels 14 to 83. Four-way bracing



eliminates ghost-producing vibration. Pre-assembled construction is said to make installation possible in less than one minute. Gold color is due to anti-corrosion plating. List price, \$9.05. JFD Manufacturing Co., Inc., 6101 Sixteenth Ave., Brooklyn 4, N.Y.—TECHNICIAN

## Buchan ROTOR LINK

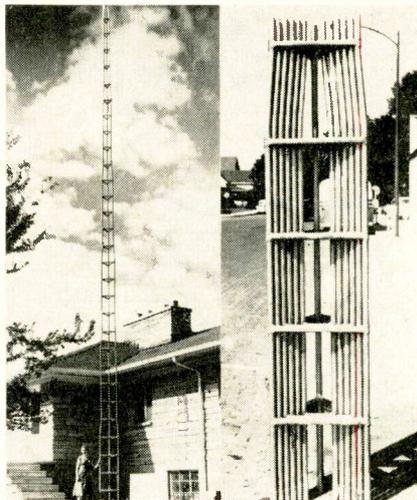


The problem of connecting open-wire or other rigid transmission lines to antenna rotators is solved by LL300, a 6-ft. length of open-wire 300-ohm line. Each conductor is in-

sulated with fiberglass tubing and fitted with solderless connectors. LL300 can be used in rotor installations without danger of shorting, while maintaining the low-loss long-life features of open-wire line. R. J. Buchan Co., P. O. Box 9, Bricelyn, Minn.—TECHNICIAN

## Spaulding ANTENNA TOWER

One hundred feet of Strato-Tower steel tower sections nest together compactly to occupy a space less than 2½ ft. square. A complete tower can be hauled to an installa-



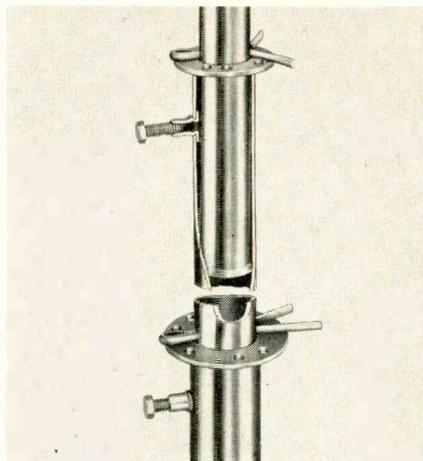
tion in a station wagon or on top of a car, in a package only 8 ft. long. The self-supporting tower features heavily coated galvanized steel, all-riveted bracing with no welds to rust, installation of rotators without additional accessories, assembly without wrenches and low cost. Spaulding Products Co., Tipton, Ind.—TECHNICIAN

## Wamco ANTENNA TOWER

One person, who has to climb 27 ft. at the highest point, can erect this 60-ft. self-supporting steel antenna tower. No guy wires or house supports are needed; tower is balanced so that it can be lowered to ground with minimum exertion. A hinge near the middle enables antenna to be swung down for repair and swung back up for use. Walnut Machine Co., 1525 S. Walnut St., South Bend, Ind.—TECHNICIAN

## iE TELESCOPING TOWER

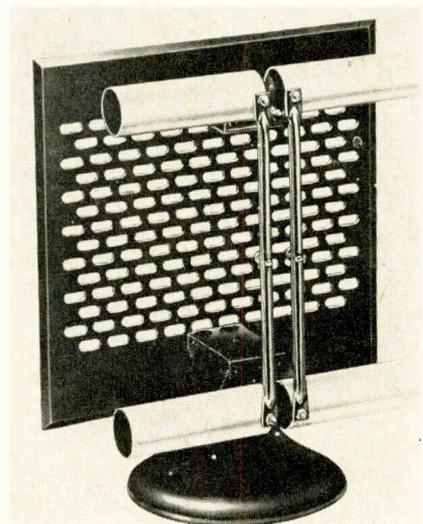
Nine-thread rivnut and hex bolt lock the tubes of this telescoping mast in any position to prevent swaying. A cotter pin resting se-



curely on the guy ring locks tubing into assembled position. Flared tube bottoms permit easy sliding, minimize scratching. Corrosion resistant construction is used throughout. iE Mfg., 325 N. Hoyne, Chicago 12, Ill.—TECHNICIAN

## Ward INDOOR UHF ANTENNA

The indoor Can-Can, model TV-215, is designed for high gain on the UHF band. Finished in simulated wrought iron and bronze, it is said to be decorative as well as func-



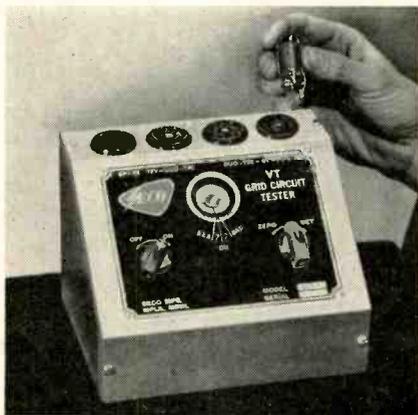
tional. List price, \$10.95. Ward Products Corp., Div. of the Gabriel Co., 1148 Euclid Ave., Cleveland 15, Ohio.—TECHNICIAN.

# Electronic-TV Technician

## Test Instruments and Shop Accessories

### Seco GRID CIRCUIT TESTER

Positive isolation of age tube malfunctions is one of the features claimed for model GCT-1, a grid circuit tester. Designed to supplement the average tube checker, this



tester uses an electronic eye to reveal control-grid emission, also to indicate high resistance grid-cathode or cathode-heater shorts. Maker recommends it for checking tubes in the audio, i-f, and sync sections, where trial-and-error, wait-and-see substitutions are normally used. List price, \$24.95. Available in kit form as model GCT-2, \$19.95. Seco Mfg. Co., 5015 Penn Ave. S., Minneapolis, Minn.—TECHNICIAN

### EPL 12-VOLT ADAPTER KIT

To prevent obsolescence of models B and BJ 6-volt dc power supply units for servicing auto radios, a 12-volt modification kit has been developed. Change-over requires drilling 3 holes and installing 2 selenium rectifiers, 1 switch and 1 new dc meter (0-20 v). Kit is supplied complete with parts, instructions and diagrams. Net price, \$10.50. Electro Products Laboratories, 4501 Ravenswood Ave., Chicago 40, Ill.—TECHNICIAN

### EMC INSTRUMENT STAND

Model IS, a safety instrument stand, will hold a vtvm or other meter at a convenient angle for reading with no danger of tipping over. The stand is rubber-covered to protect the instrument. Electronic Measurements Corp., 280 Lafayette St., New York 12, N. Y.—TECHNICIAN

### EICO CRT CHECKER

Model 630 crt checker indicates shorted or open elements in electron guns with a neon lamp. Also provides bridge measurement of peak beam current (proportional to screen brightness). Calibrated in terms of tube condition. Test sockets are provided for pix tubes with duodecal or diheptal bases to cover practically all modern types. Octal socket is provided on panel so that adapters for tubes with other bases may be plugged in. Picture tubes may be tested without removal from set or carton. Oscilloscope tubes may also be checked. Model 630, factory wired, \$24.95. Model 630-K, kit form, \$17.95. Electronic Instrument Co., 84 Withers St., Brooklyn 11, N. Y.—TECHNICIAN

### ITI UHF GENERATOR

The IT-130R UHF generator is useful as a demonstrator device as well as a laboratory instrument. It can take the signal from any VHF station and translate it to any UHF signal. Useful in new UHF areas for making adjustments and installations before the local transmitter is ready to operate on a full-time basis, it also can be used with existing VHF instruments (signal and sweep generators) to adapt them for UHF use. Service technician's price, \$149.50. Industrial Television, Inc., Clifton, N.J.—TECHNICIAN

### Louchheim RESIST. DECADE

This decade resistance box has a range from 0 to 11 meg in 1000-ohm steps, 4 decades, with an accuracy of  $\pm 1\%$ . Stable deposited carbon resistors are used throughout. The compact unit is 10 in. long and is shielded. Useful for trial substitutions of resistance values during trouble-shooting or to determine the value of resistance needed for best circuit operation. List price, \$49.95. Stuart F. Lochheim Co., 1229 N. Broad St., Philadelphia 22, Penna.—TECHNICIAN

### Hickok VHF-UHF MARKER

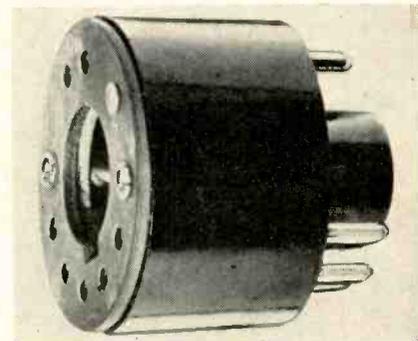
Model 690 TV marker generator covers frequencies from 4.25 to over 225 mc on fundamentals with 0.25 v r-f output, and provides dual markers for use with TV sweep generators. Output up to 900 mc, for UHF coverage, is available on harmonics. Accuracy of marker setting within .05% is said to be possible with the illuminated shadow-type non-parallax dial, which may be viewed from any angle without introducing error. Uses a self-contained crystal calibrator supplied with crystal. Hickok Electrical Instr. Co., 10523 Dupont Ave., Cleveland 8, Ohio.—TECHNICIAN

### Raytheon SERVICE LAMP

Worn on the head, the Brow-Lite is designed so that the service technician can have both hands free for work at the same time that he is directing light to the desired area. An adjustable socket enables light to be directed at any angle. The pocket-size unit is constructed of durable plastic and uses standard parts. Raytheon Mfg. Co., Receiving Tube Div., 55 Chapel St., Newton 58, Mass.—TECHNICIAN

### P-P BAR GENERATOR

The HBG horizontal bar generator is plugged on the picture tube to provide a sequence of equally-spaced horizontal lines. Lines are developed by a neon-tube relaxation



oscillator. Useful for adjusting vertical linearity, height and vertical centering; also for positioning yoke and focus coil or magnet. Small in size and self-contained. Perma-Power Co., 4727 N. Damen Ave., Chicago 25, Ill.—TECHNICIAN

Be Sure to See Page 73  
CIRCUIT DIGESTS

# COLOR

## SHORTS

**MORE TRAINING NEWS:** Last month, CBS began 5-day, 35-hour seminars at its plant in Long Island City, N. Y., which are still continuing. Discussions and demonstrations cover color principles, the CBS Colortron, circuitry, components, installation and maintenance. RCA color service clinics also teed off during February in 15 major cities—New York, New Haven, Newark, Philadelphia, Pittsburgh, Washington, Cleveland, Cincinnati, Detroit, Chicago, St. Louis, Des Moines, Denver, San Francisco, and Los Angeles. Other major cities will be covered during the rest of the year.

**RCA'S 19-INCH TRICOLOR TUBE**, now in the development stage, is expected to be commercially available in limited quantities in the latter half of this year. Its pumpkin-faced viewing screen will reproduce pictures in about the size available from 16-in. round tubes. Directly below you see the 19-incher com-



pared with the company's 15-in. tube, which is now in production. Based on the earlier tube, the 19 incorporates some design changes: new gun assembly, improved phosphors, modification of the shadow mask and a wider deflection angle. The latter makes possible an overall length no greater than that of the 15-in. crt.

A **21-INCH TUBE** is also in the works at RCA. This rectangular color crt will incorporate fundamental design changes. The shadow mask will be replaced by a focus mask. Tube brightness will be stepped up. Commercial production is expected next year.

**CONVERGENCE, FOCUS** and high-voltage transformers, as well as deflection yokes, are color receiver components that are scheduled to be

available to manufacturers in mass production quantities at just about the time you read this item.

**DU MONT TRAINING PLANS** for color TV, now being developed, will include lectures, actual bench work, personal assistance in handling color receiver problems and a booklet on the subject similar to the one issued by this organization on UHF. Emphasis is being placed on developing a complete program rather than on getting it into operation immediately. Du Mont promises the program will be in effect in time for technicians to handle its color sets.

**LUCKY OWNER** of a color set tried this experiment during a color telecast: He placed his old b & w receiver beside the new one and tuned it to the same program. Except to make quick comparisons, none of the viewers present paid attention to the b & w version. This despite the fact that faulty transmission was throwing color balance way off. His conclusion: even bad color TV is better than none at all.

**ANTENNA DESIGN** has already felt the influence of color. While many antennas now in use will continue to be entirely satisfactory, sharply-tuned single-channel arrays, like yagis, may need replacement. This opinion was voiced by Ira Kamen, vice-president of Brach Manufacturing Co., in an engineer-

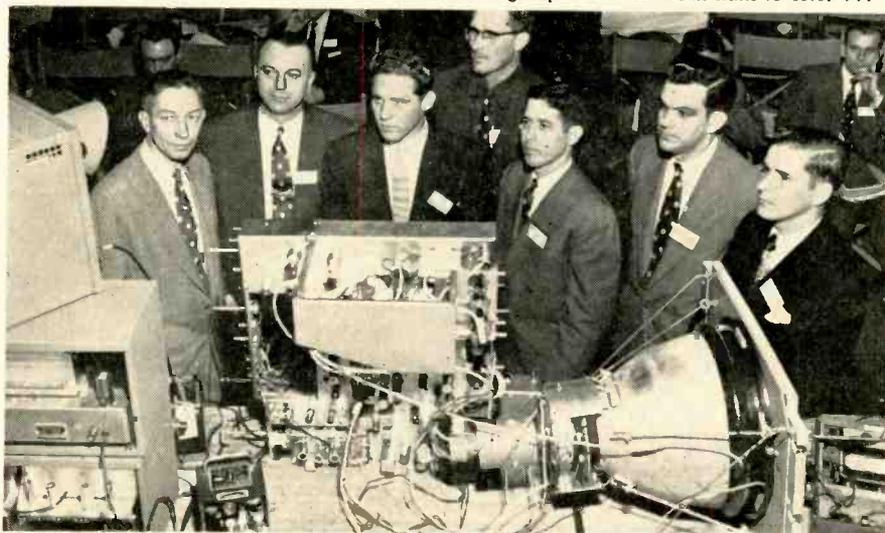
ing report. All antennas in the new Brach line are being designed with color in mind. Single-channel yagis are being broadbanded sufficiently to preclude dips and valleys; normal broadband designs are being engineered to reject FM signals and side-lobe pick-up on all types is being minimized.

**THE COLOR SERVICE BONANZA** will not be free of headaches even for the technician who gets to know his color receiver inside-out. Present high resistance to b & w service charges is expected to be much greater in the case of color TV maintenance, since the number of calls needed, as well as the charge per call, is bound to go up. Advance estimates for average number of service calls per year go as high as 11 per color set. Let your customers know about this NOW—save headaches later.

**CHEERFUL NOTE** on service: despite the increased complexity of the color set, picture symptoms will provide more clues to the actual trouble than is the case with b & w receivers.

**GE'S RECENT SEMINAR** on color TV, held at the GE Syracuse plant, was attended by 200 distributor and dealer service technicians. The week-long seminar (35 hours) covered all phases of color TV alignment and service.

W. L. Parkinson of G.E. (extreme left) introduces a group of service technicians to color TV.



# Prevent Paperwork Losses

## Profits Pour Down Drain When Record-Keeping is Sketchy

• Poor record-keeping is a sieve through which huge sums of money are lost forever to TV-radio service departments throughout the country.

Such losses are caused by failure to charge out *all time* spent on jobs, both in repairing and delivering, as well as in neglecting to charge *all* tubes and components to respective repair jobs.

There are various reasons why dealers fall into slipshod habits which permit good money to go down the drain. The Number One reason is that they do not have an air-tight record-keeping system. Number Two, they are lax in policing what may otherwise be an efficient system. In cases where an intrinsically satisfactory system is in use, yet fails to work, no one person may be responsible for seeing that forms are filled out completely and without "rigging."

In addition to losing dough as a result of not charging out all time,

and all tubes and parts, sketchy record-keeping methods present the possibility that still more money may take wings and fly away due to inability of bookkeepers to interpret such records accurately. Under such conditions, customers are likely to be under-charged or over-charged.

To provide all relevant data for charging, billing and keeping track of time and parts, it isn't necessary to use a large or complicated form. Everybody knows that the typical technician hates to fill out forms, anyway, and the harder the boss makes it for him to do the paper work, the more likely that errors will creep in and corners will be cut.

On this page is a form especially designed by TECHNICIAN editors. Local printers can provide supplies on cheap paper, similar to that used on shipping tags. In ordering, make certain that the forms are numbered and perforated. Don't start with no. 1, because the customer receiving

this low number may think that you've just gone into business. Instead, make your first set of figures read 5500 or something similar.

In using the form when picking up a set, or in the over-counter transactions, it is only necessary to fill in the customer's name and address, the date, make of set, complaint, date promised, and the estimate (if it is your practice to make estimates). The form then stays with the receiver until the job is finished. Upon completion of the repair, the form is turned over to the bookkeeper, who transfers the information on it to the ledger or sales slip for billing. In addition to the foregoing routine, it is very desirable to transfer profit and loss data to a day book or journal, so that the owner can make an analysis of his service operation at any time.

The reader will notice that provision is made for repairs stretching  
(Continued on page 67)

Below is a simplified repair form, designed by TECHNICIAN editors to provide all necessary information to keep repairs rolling out on time, control parts and tubes used, keep track of technicians' time and to furnish speedy means for billing. Additionally, the form will enable the service manager to see how he made out financially on each job. In cases where it is not shop policy to give estimates,

the estimated charge line on the customer's coupon can be left out. "Don't-Write-In-This-Space" section is for bookkeeper, who can make a complete billing from a single form. It is recommended that forms be filed alphabetically under customers' names, so that they can be consulted without delay in case of call-backs. Make form larger than this sample, to allow more fill-in space.

8467 Date _____ Customer's Receipt Name _____ Address _____ Set Make _____ Chassis No. _____ Approx. del. date _____ Estimated Charge \$ _____ XYZ Television Co., 426 No. Main St., Dover. Tel: DO-76544-2	8467 Date taken in _____ Date promised _____ Completed _____ Delivered _____ Customer _____ Address _____ Tel. _____ Set Make and Chassis No. _____ Approx. Age of Set _____ Complaint _____ Date Started _____ Time: from _____ to _____ Tot. Hrs. _____ Completed? _____ Date Resumed _____ Time: from _____ to _____ Tot. Hrs. _____ Completed? _____ Date Resumed _____ Time: from _____ to _____ Tot. Hrs. _____ Completed? _____ Nature of Repairs Made _____ <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 25%;">Tubes Used</th> <th style="width: 25%;">Parts Used</th> <th style="width: 25%;">Date</th> <th style="width: 25%;">Servicer's Initials</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table> Date of pickup _____ Time consumed in pickup: _____ Hrs., _____ Min. Date of return _____ Time consumed in return: _____ Hrs., _____ Min. Was Job Estimated? _____ Am't. Estimated \$ _____ Who Estimated? _____ DON'T WRITE IN THIS SPACE Charges to Customer: Time \$ _____ Parts \$ _____ Tubes \$ _____ Total \$ _____ Cost to Shop: Time \$ _____ Parts \$ _____ Tubes \$ _____ Total \$ _____	Tubes Used	Parts Used	Date	Servicer's Initials												
Tubes Used	Parts Used	Date	Servicer's Initials														

# \$5000

## IN PRIZES

*... easy to win*

# 503

## PRIZES!

### \$2000 - 1st prize

\$500 - 2nd prize,

\$100 - 3rd prize

100 - \$10 prizes,

400 - \$5 prizes

### HOW TO WIN

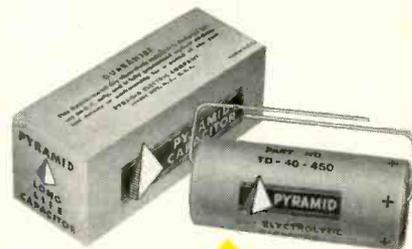
To win one of these 503 prizes all you have to do is complete in 25 words or less "I like Pyramid capacitors because \_\_\_\_\_" You fill in this statement on a Pyramid contest entry blank which can be obtained from any electronic parts jobber selling Pyramid capacitors. You have this entry blank countersigned by your jobber or one of his salesmen and forward it to us attached to a Pyramid Dry Electrolytic Capacitor box top—the top being the part which carries the description of the item. There is no limit to the number of entries which you may make in this contest but each entry must be accompanied by a box top. Full rules for the contest appear on the entry blank.

It's so easy. Here is the kind of statement that might win:

*"I like Pyramid capacitors because they always check out perfectly and don't deteriorate and so I know I won't have to call back at my expense."*

*"I like Pyramid capacitors because the line is so complete that I can always get what I need and don't have to worry about an off-brand capacitor."*

## PYRAMID



### PYRAMID FEATURES:

- 1 Only one quality—the best at no premium. All Pyramid capacitors are made of materials commanded by rigid military specifications.
- 2 All Pyramid capacitors are non-hygroscopic.
- 3 Highest quality insulator material used in all production results in low leakage factor.
- 4 Exclusive non-contamination technique guarantees close tolerances and no deterioration. Peak performances for life.
- 5 Pyramid capacitors operate unchanged at ambient temperature of 85° centigrade.
- 6 Designed by service technicians across the country for their requirements.
- 7 Individually packaged for protection.
- 8 Permanently legible, high visibility ratings on each item.
- 9 100% absolute electronic inspection before shipment.

Pyramid is in its 10th year as a leading manufacturer of high-quality capacitors.

**PYRAMID ELECTRIC COMPANY**  
1445 HUDSON BOULEVARD  
NORTH BERGEN, N. J.

# Shop Hints to Speed Servicing

Tips for Home and Bench Service Contributed by Readers

## New Flyback Upsets Sync

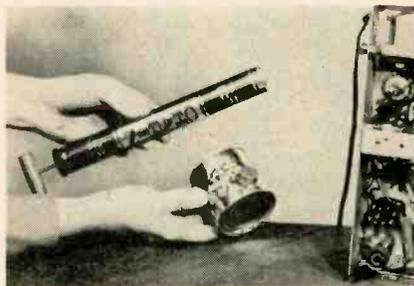
In two instances after horizontal output transformers had been replaced in sets using a 6AL5 horizontal sync discriminator with only one horizontal circuit control (horizontal frequency slug), the following symptom resulted: The slug would lock the picture only at a position that placed the entire horizontal blanking bar at one side of the picture. This caused critical horizontal hold and made horizontal retrace lines visible at the opposite side of the raster.

Good horizontal hold was obtained by changing the components in the circuit that feeds back pulses from the horizontal output transformer to the sync discriminator. One effective procedure for making this change is to temporarily replace the series resistor in the feedback loop with a potentiometer. The potentiometer and the frequency adjustment slug are then both varied for the best hold, with approximately equal blanking on both sides of the picture. That part of the potentiometer's resistance which is in the circuit is then measured. Finally, a fixed resistor of this measured value is then used in the feedback network.—R. R. Ondrovic, San Diego, California.

## Chassis Blower-Cleaner

An inexpensive garden plant duster may be changed easily to provide a source of air for blowing dust from radio, TV and other chassis. It is only necessary to re-

move that section of the duster which ordinarily holds some form of insecticide. It may also be necessary to solder up the small hole to which



Garden sprayer altered to air-clean chassis.

this container section was attached; the full force of the expelled air will now be directed from the front opening.—H. Leeper, Canton, Ohio.

## 6BY5 Substitution

We have often found it difficult to purchase a 6BY5-GT tube, used mostly in Philco receivers. We have therefore been rewiring the damper circuit that uses this type to accommodate a 6W4-GT. The simple changes necessary can be made in a few minutes. There are six steps:

1. Leave plate connections as is on pins 5 and 4.
2. Disconnect wires tying pins 1, 7 and 8 together.
3. Remove horizontal linearity lead from pin 8 and connect it to pin 3.
4. Disconnect filament lead from pin 2 and connect it to pin 8.
5. Connect pin 1 to pin 3.

6. Disconnect the horizontal amplifier's screen resistor (about 18 k) from pin 7 and connect it to pin 3.

There is another advantage to be gained from this procedure. The 6W4-GT costs less than the 6BY5-GT.—Joseph F. Valenti, Bronx, N. Y.

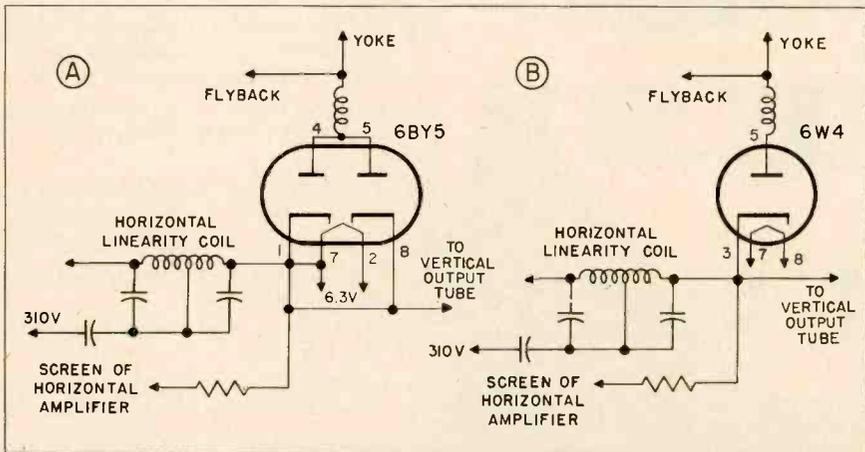
## HV Condenser Check

To find leaking condensers of the 500-mmfd, 20kv type rapidly and easily in the high-voltage power supplies of some TV sets, I use the following procedure: Take a wooden stick, rod or rule about 20 or 30 in. long and fasten a small square of cardboard at one end. This end is used as an earphone. Then apply the other end near the suspected condensers. The clearest noisy clicks will be heard when the stick is closest to the bad condenser. The trouble appears as black pips or streaks on one side of the screen at the same time that the clicks are heard. The wooden rod used must be very dry, to act as a good insulator and also to pick up the sounds better.—J. G. C. Hernandez, El Paso, Texas.

## Dial Stringing Shortcut

To replace hard-to-get-at dial strings, tie the new cable to one broken end of the old string; then pull the other end of the old cable through and out of the assembly. The new string will thread through, following the old one. This time saver can be used on many sets.—J. V. Cicero, Carson City, Nevada.

A—Damper tube wiring for 6BY5. B—Wiring changes to permit 6W4-GT to be substituted.



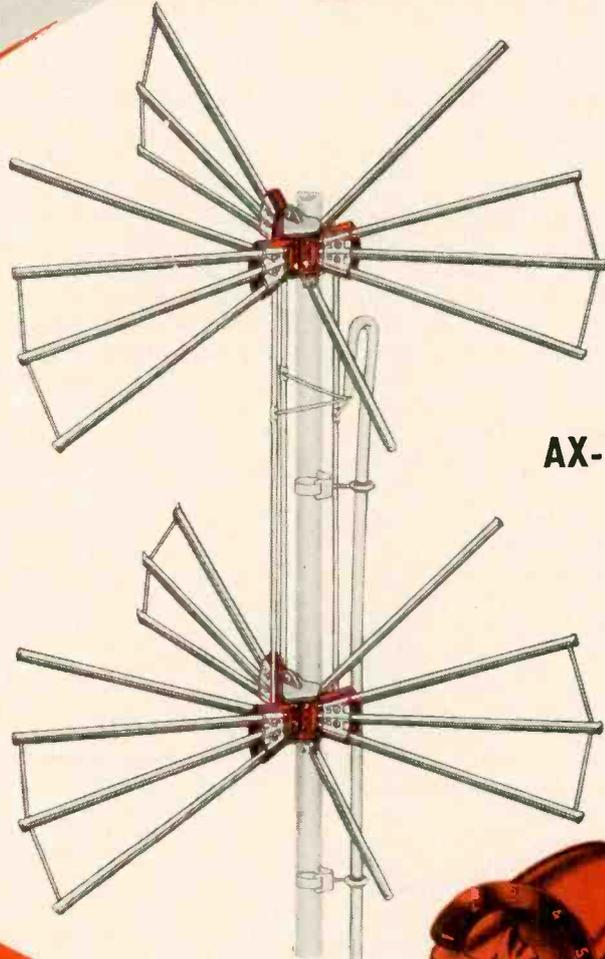
## SHOP HINTS WANTED

TECHNICIAN will pay \$5 for acceptable shop hints. We are particularly interested in hints that tell how a technician located a hard-to-find trouble in a TV set, radio, record-changer or similar unit; or how he traced a conventional defect to its source more rapidly than usual by using a short-cut. Unacceptable items will be returned to the contributor. Send your ideas to "Shop Hints Editor, TECHNICIAN, Caldwell-Clements, Inc., 480 Lexington Ave., New York 17, New York."

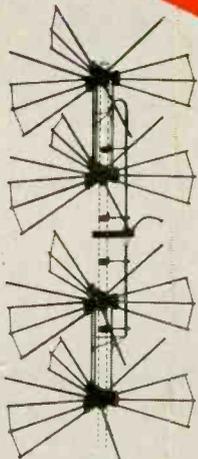
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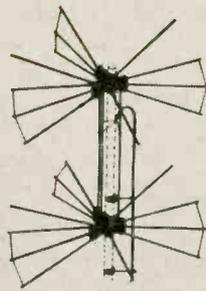
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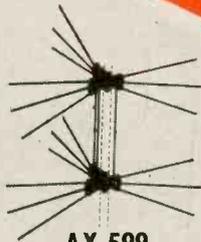
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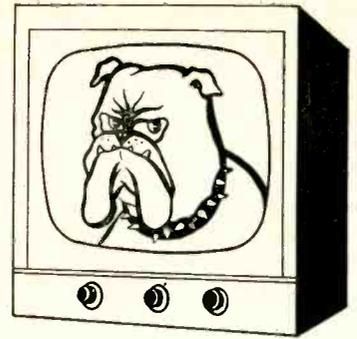
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# "Tough Dog" Corner

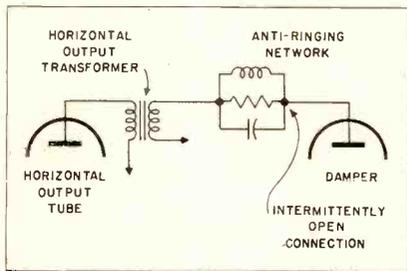
Difficult Service Jobs Described by Readers



## Width, Focus Intermittent

This was a toughie for me; in fact it took a couple of months to lay this dog low. The trouble occurred in a '51 model Philco. It happened to be a 14 in. job, but it could have been any one of their '51 models. These were the symptoms: The picture narrowed in, mostly from the right side, and was out of focus. The sound was not affected. The trouble occurred about a year from the purchase date, and was of an intermittent nature. The set would perform normally for four or five hours then go into its act, or maybe go intermittent two or three times in the first five minutes of operation. Several times I thought I had it fixed only to see the same trouble pop up after a couple of weeks. The thing would not stay busted long enough to work on it. As soon as I got the thing on the bench it would work fine.

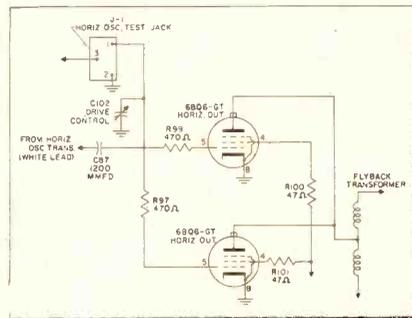
All joints were inspected in the horizontal section and found to be ok. The trouble finally turned out to be the anti-ringing coil in the horizontal output transformer circuit.



Apparently the ends of the coil's wire are wrapped around the wire terminals, then soldered. Next the whole assembly is dipped in wax. Somebody forgot to solder one end on this one. If I had my hands on him, he would never forget another one. I had checked that particular coil at least three times previously, but it always seemed ok. How can you inspect a solder joint under a heavy coating of wax?—W. H. Callan, Altoona, Pa.

## Intermittent Raster

I had the bad luck to run into the following "tough dog" recently. When the set (Philco 50T1632, Code 122) was first turned on, the pix tube screen sometimes lit up, sometimes didn't. There was no telling what to expect. At times the receiver would operate satisfactorily for an hour; yet it might go on and off a dozen times during that same period.



Schematic of the horizontal output stage in which a defective trimmer killed the raster.

I thought I might narrow the fault down somewhat by monitoring somewhere before the horizontal output transformer, but after the horizontal oscillator; so I connected a vtvm between pin 5 (grid) of the 6BQ6-GT and ground, and turned the set on. The normal negative voltage was present when the crt lit up; when the screen became dark, however, the voltage went to zero with respect to chassis.

My next step was to adjust the horizontal drive trimmer capacitor. Lo and behold—the raster appeared when this control was turned counter-clockwise! Turning the trimmer clockwise again caused the screen lighting to disappear as before. Now we were getting somewhere. When the trimmer was removed and taken apart, the following was disclosed: The mica dielectric was falling apart, with the result that the two capacitor plates made contact at random intervals during adjustment. The resultant short-circuit killed the sweep and high voltage.

Many times these variable capacitors are severely abused by amateur tube jockeys who, in last-minute desperation (when they can't find a bad tube), will tighten various trimmers very forcibly.—J. L. Mancini, Winthrop, Mass.

## Obscure Radio Hum

Excessive hum occurred on this AC-DC receiver—it happened to be a Zenith G615—that could not be localized by conventional techniques. The power supply filter system was not the source of the trouble; and the 35W4 rectifier showed no leakage in the tube checker. The fault was finally traced to a 60-cycle AC leak to pin 1 of the 35W4. This pin, which has no internal connection to the tube, connects to a lug at the socket used as a tie point for the set's bass-boost circuit. Anyone of three remedies will cure the fault: 1—Change the tube. 2—Clip pin 1 off the tube. 3—Move the wiring from the lug for pin 1 to another tie point.—Alpert Radio and Appliance Co., West Allis 14, Wis.

## Intermittent Vertical Sync

This defective receiver would play for half an hour, or as much as four hours, and then suddenly roll vertically. The rolling would last about five to twenty seconds, then normal operation would resume. I changed the vertical integrating network along with the sync and vertical circuit tubes. The trouble continued. I checked the vertical and sync circuits, but found nothing wrong. Then I noticed that, when the picture rolled, light 60-cycle hum bars could be seen very faintly on the screen. A check of the tubes showed the trouble was caused by leakage in the oscillator-mixer (6J6).—F. S. Mattioli, Racine, Wisconsin.

Have you tangled with a difficult service problem recently? Write it up, and send it to "Tough Dog" Editor, TECHNICIAN, 480 Lexington Ave., New York 17, New York. \$10 will be paid for usable material.

# NEW

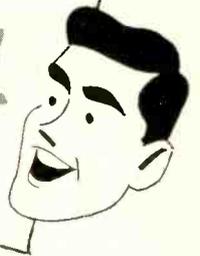


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Patent Pending

<sup>†</sup>Trade Mark

\* Safety Margin

# Eliminating Sound TVI

(Continued from page 35)

appreciable portion of a wavelength at the higher frequencies and therefore pick up considerable r-f energy.

In isolated instances, a volume control with an ungrounded shaft may be found. Pickup on the shaft, especially when the hand is placed on the gain control, as in adjusting volume, is considerable. The cure in this case is to install a control having a shaft insulated from the terminals, so that

the shaft may be grounded to the chassis.

Dual and triple-purpose tubes, when performing several functions, such as detector, first audio and avc, present a special problem because of inter-electrode capacitance, and a common cathode which feeds from one circuit to another.

Where the usual remedies for preventing r-f rectification on the grid of a triple-purpose tube do not cure the condition, the audio section of the multiple circuitry may be removed and incorporated with a separate tube, preferably mounted on a small sub-assembly bracket under the

chassis. The resistor or choke, bypass condenser and lower-value grid leak may then be added as modifications in circuitry to the (standard) first audio circuit in the new sub-assembly.

**"An Ounce of Prevention".** An unwanted r-f signal may get into the receiver as a result of direct pickup, because of inadequate tube or tube input shielding; more commonly, however, the undesired signal will be introduced through power line coupling, or through the antenna and transmission line. Any measures taken to prevent or attenuate r-f energy, other than the desired signal, from entering the set at the antenna or other paths are helpful.

Much can be accomplished in stubborn cases when the interfering signal is introduced through the power source, by installing the necessary

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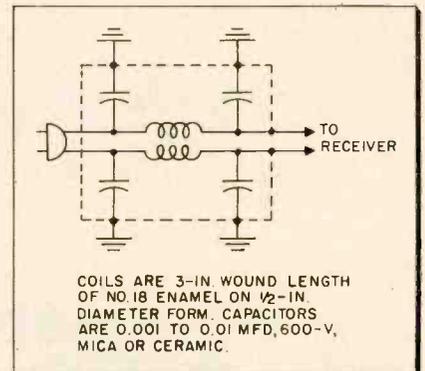


Fig. 3—Elements of typical power line filter.

power line filter. Commercial plug-in line filters are available for this purpose, and are particularly suitable in cases where space is limited, as in compact ac-dc receivers. Bypass condensers for r-f installed across the line may also be effective.

Fig. 3 shows the basic elements of a filter. An appropriate filter may be installed as close as possible to the receiver antenna input transformer, if the interference is entering by that path.

It is important that these filters be enclosed in a metallic shield to prevent direct pickup of signal. The entire equipment should be carefully constructed electrically, with wire size appropriate to the load. The unit should be effectively grounded either directly, or through a 0.01 mfd, 600-volt condenser in the case of ac-dc sets. A water-pipe or similar plumbing fixture is usually an effective ground.

Essentially the same cures outlined here also apply to audio systems other than those associated with standard broadcast and television receivers.

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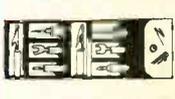
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### Inline Gutter Stand-Offs

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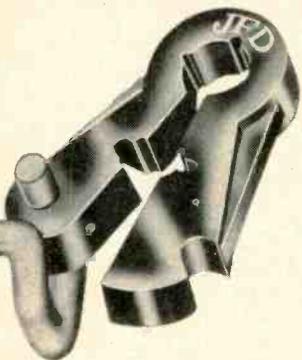
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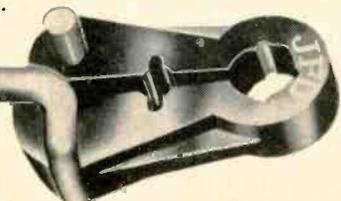
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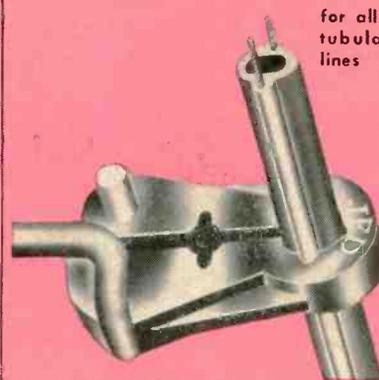


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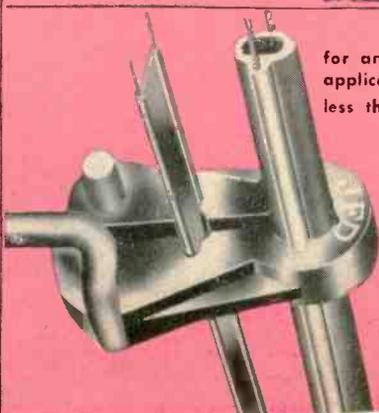
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## SARATA Elects Officers

New officers elected at the annual meeting of the San Antonio Radio and Television Association are: Albert R. Niehaus, pres., 1131 Nolan St.; Elmo Bohmann, vice pres.; Ora G. Fretz, secretary; Thomas F. Boyd, treasurer; H. M. Willmann, director; Esteban Z. Viera, director. This organization is affiliated with the Texas Electronics Association. After operating expenses and contribution to the state association, SARATA's funds are used for cooperative advertising.

## LIETA Planning Co-op Ads

Members of the Long Island Electronic Technicians Association, Inc., 88 Fourth Street, Oceanside, N. Y., have approved a plan for cooperative advertising, in which the organization guarantees all repairs made by its members. LIETA urges all members to use this information in their individual advertising. Affiliated technicians are also urged to use their membership cards when buying from distributors, to identify themselves as LIETA technicians.

## ETSC Annual Conference

The Eastern Television Service Conference, composed of service associations on the eastern seaboard, will hold its annual session in the Bellevue-Stratford Hotel, Philadelphia, April 2-4, in connection with the color symposium to be held at

# SERVICE ASS'N REPORTS

the same time in the same place. All persons connected with the service industry, whether affiliated with associations or not, are welcome to attend. Business sessions will cover the problems of managing a service business, public relations, methods of increasing business, reduction of expenses and operations of service associations. The conference chairman is Harold B. Rhodes, of Paterson, N. J., president of the Radio and TV Servicemen of New Jersey and eastern secretary of NATESA. In addition to the two just mentioned, participating groups are NETSDA, ARTSNY, Philadelphia Radio Servicemen's Assoc., Federation of Radio Service Associations of Penna., Council of Radio and TV Service of Phila., Mid-State Radio Servicemen's Assoc., of Harrisburg (Penna.), Allied TV Technicians of N. J., Long Island TRT Guild, Empire State Federation of Electronic Technicians, Radio Technicians Guild of New England, TV Service Dealers of Phila., TV Service Dealers Assoc. of Delaware County (Penna.), and Radio and TV Servicemen's Assoc. of Pittsburgh.

## CRTSA Color Symposium

The Council of Radio and Television Service Associations, in cooperation with local parts distributors, will sponsor a color symposium featuring technical papers and demonstrations. The program is scheduled at the Bellevue-Stratford Hotel, Philadelphia, April 2-4. Subjects to be covered besides color include: VHF-UHF TV, hi-fi, tape recorders, record-changers, transistors, and business management. Eight member associations are participating: Allied TV Technicians' Service Assoc. of South Jersey, Northeast TV Service Dealers Assoc., Phila. Radio Service Men's Assoc., TV Service Dealers Assoc. of Delaware County, TV Contractors' Assoc., and TV Service Dealers Assoc. of Phila. For further infor-

mation on the symposium, contact show committee chairman Dave Krantz, 1917 W. 74th Avenue, Phila. 38, Penna.

## NATESA Annual Award

First annual award of the President's Cup of the National Alliance of Television-Electronics Service Associations went to Fred Colton, chairman of the board of the Associated Radio & Television Service Dealers of Columbus, Ohio. The cup



Fred Colton (left) receives NATESA annual cup from organization's president, Frank J. Moch.

was presented by Frank J. Moch, NATESA, at a luncheon in Colton's honor. Colton, who is eastern central v. p. of NATESA, received the award for his work in behalf of the organization.

## LITRTG Color Lecture

The Long Island Television and Radio Technicians Guild, P. O. Box 87, Bethpage, N. Y., recently held a color-TV forum that was attended by approximately 250 persons. Henry Wawryck, president, discussed the traditional independence of the service technician. He noted the emergence of a new type of technician, better educated, more interested in his work and his customers, and more interested in the exchange of ideas with his fellow technicians through service organizations.

## Calendar of Coming Events

- Mar. 22-25: Institute of Radio Engineers National Convention, Waldorf-Astoria Hotel, New York. Exhibits, Kingsbridge Armory, Bronx, New York.
- May 17-20: Electronic Parts Show, sponsored by Association of Electronic Parts & Equipment Manufacturers; West Coast Electronic Manufacturers Association; Radio-Electronic-Television Manufacturers Association and National Electronic Distributors Association and Sales Managers Club (Eastern Group), Conrad Hilton Hotel, Chicago, Ill.
- June 15-17: Radio-Electronic-Television Manufacturers Association Convention, Palmer House, Chicago, Ill.
- July 12-15: National Association of Music Merchants Trade Show, Palmer House, Chicago, Ill.
- Sept. 30-Oct. 2: High Fidelity Show, International Sight and Sound Exposition, Palmer House, Chicago, Ill.
- Oct. 13-16: The Audio Fair, Hotel New Yorker, New York.

## WILL YOU HELP US?

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Mail to: Associations Editor, TECHNICIAN, 480 Lexington Avenue, N.Y.C. 17, N.Y.

## Serviceman's Analysis of Color Stages

(Continued from page 28)

through a delay line to the "Y" or luminance amplifier. The purpose of the delay line is to assure the arrival of the "Y" signal at the picture tube at the same time as the "Q" and "I" signals. The "Y" amplifier is similar to a video amplifier in a black-and-white set except that a trap, tuned to the color subcarrier frequency, is usually present, to reduce interference.

A defective "Y" section will, first of all, cause a complete loss of detail. This is so because picture detail information is all contained in the "Y" signal. Secondly, there will be no brightness information. The brightest colors—yellow, cyan, and green—will appear too dark, whereas the dark colors—blue, red and magenta—will appear bright by comparison.

The outputs of the color demodulators are amplified (in the phase-splitter blocks) and fed to the matrix section. The matrix determines the proportion and polarity the "Y," "Q" and "I" information should have, when combined in the adder stage, to produce red, blue and green color signals. These signals are separately amplified in individual amplifiers, before being applied to the crt guns. Since both positive and negative "I" and "Q" signals are required in the matrix, phase splitters or inverters are necessary.

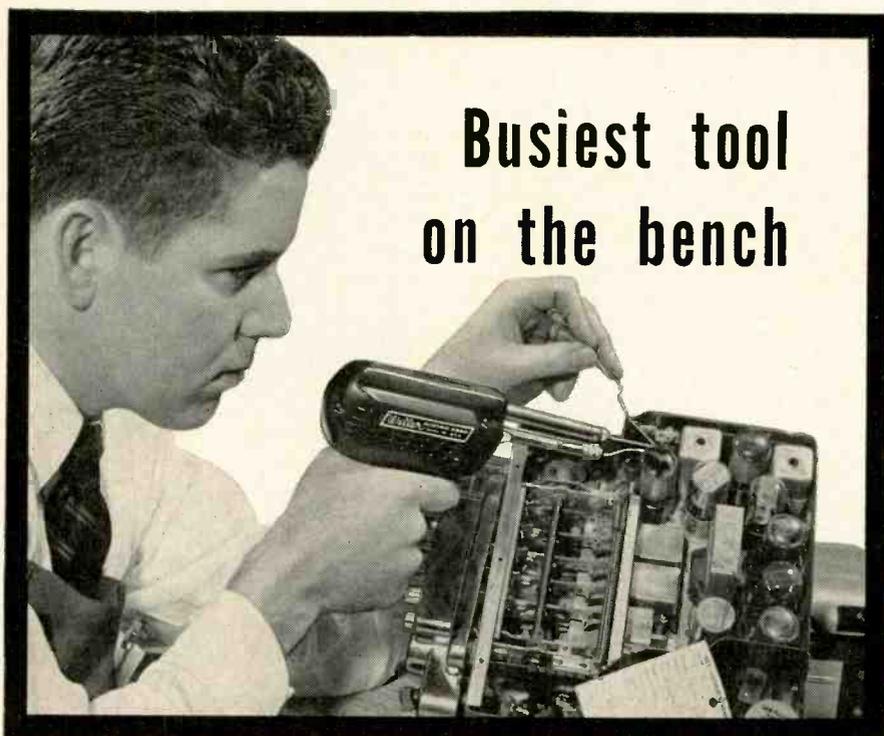
There are two controls in the color section that the set owner will operate. One of these is the *chroma control*. This adjustment regulates the amount of signal fed to the band-pass amplifier, and thus determines the amount of "I" and "Q" signal that will be available. When it is set fully *counter-clockwise*, there will be no color at all in the picture. As the control is turned *clockwise*, the saturation of the colors will be increased—that is, the colors will go from pastel to more and more vivid shades. With the control fully up, the picture will usually have an excessively vivid, supersaturated appearance.

### Hue Control Adjustment

The other control the set owner will manipulate is the *hue control*, also called the *color phase control*. This adjustment regulates the phase of the 3.58 mc oscillator, with respect to the incoming burst signal. In an ideal system, such a control would not be necessary, since this phase relation should be fixed. In practice, however, it is found that some phase shift may be introduced anywhere in the system—antenna, the lead-in wire, video i-f section, etc. Incorrect shading tends to be produced in consequence; the hue control is used to counteract this tendency.

On a live program, the best way to adjust the hue control is to set it to the position where the most pleasing flesh tones are produced. As the hue control is rotated, flesh color will be seen to vary from green or greenish yellow to orange, then to normal flesh color and finally to red. If a color bar pattern is on (this consists of a series of vertical bars in the following order: green, yellow, red, magenta, blue, cyan, green), optimum adjustment can usually be obtained by setting the hue control for the best yellow.

Service (rather than customer) adjustments will be discussed when individual circuits are described in detail.



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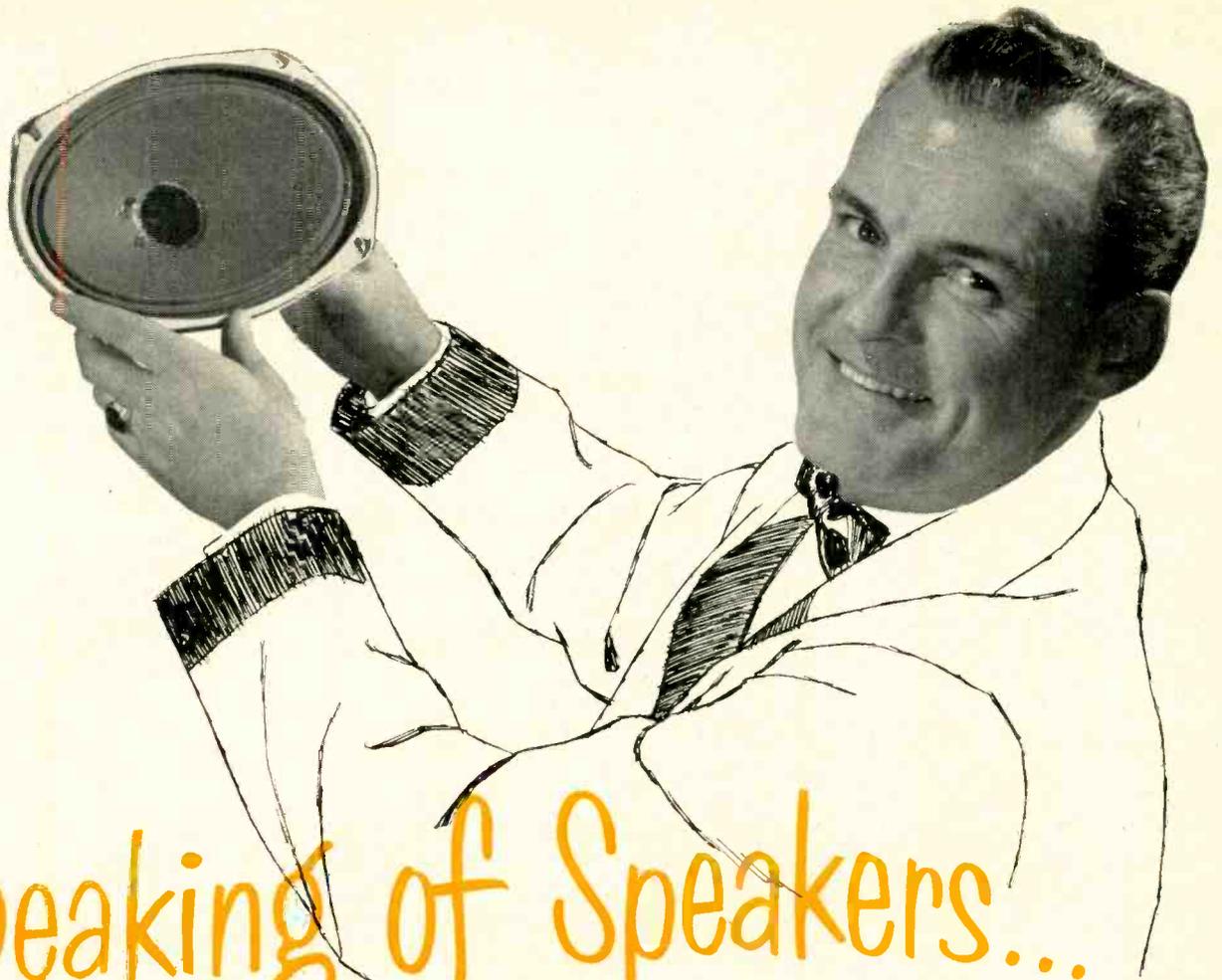
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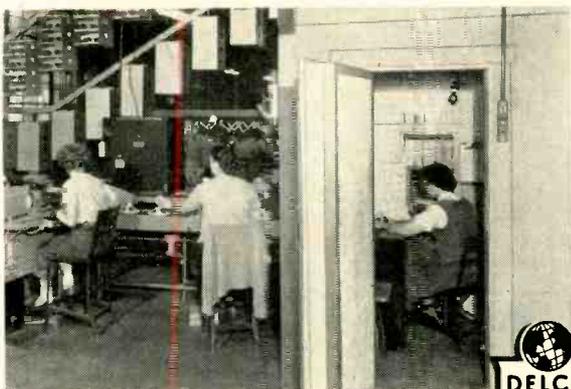
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## NEWS of the TRADE

### Stewart-Warner Transceiver

The model 73 Portafone is said to be the only FCC-approved Class B telephone transmitter-receiver. Any citizen of the United States over 18 years of age can easily obtain an operational license from the FCC. The units are sold and operated in pairs or multiples.

Using a case only about 10½ in. long (17 in. with antenna), the unit



weighs less than 2 pounds. With carrying case and battery, weight is about 5½ pounds. Set to transmit on 465 mc, the Portafone is said to have unusual stability in the face of wide changes in temperature, humidity and operating voltages.

For listening, the device functions as a 2-tube super-regenerative receiver, which may be accurately adjusted with a tuning knob. A press-to-talk switch reconnects the circuit to act as a 2-tube transmitter. The circuit uses standard parts, easily replaced, which are operated well below their ratings. Despite compact size, the layout of the transmitter-receiver permits accessibility to components for servicing.

Receiver sensitivity is about 12 microvolts for a readable signal. Audio output is about 15 mw, with unit working into a 600-ohm earphone. The unit meets FCC and RETMA standards of good engineering practice.

### Tung-Sol Appoints Rep.

J. D. Van der Veer, of Tung-Sol

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- Provides horizontal sweep signal to check H.V. section of fly-back and pulse operating power supplies.



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Electric, Inc., has announced the appointment of John J. Corcoran as sales representative and commercial engineer on the west coast. Corcoran has been associated with the Tung-Sol sales force since 1950. His new headquarters will be in Culver City, California.

#### Raytheon Caravan Hits N. Y.

Manhattan Center in New York City was the scene of a recent Raytheon Service Saver meeting, one of many that have been held all over the country. Bill Ashby, Raytheon service engineer, explained operation of the plan at the well-attended lecture.

Under the system, the purchaser of a TV set gets a Service Saver booklet containing 40 numbered pictures illustrating common troubles that show up on a TV screen. The serviceman has a related version of the Service Saver booklet, which permits him to identify, via telephone, the faulty tube or circuit in the Raytheon receiver; he may even be able to pinpoint the defective component. Servicing time is thus reduced; the need for removing the set from the home is said to be eliminated frequently.

Bill Ashby was introduced by John F. Rider, publisher. At a press conference preceding the lecture, Raytheon's Carroll Hoshour said the plan would be even more significant with the advent of color TV.

The meeting was co-sponsored by local distributors H. L. Dalis, Inc., and Dorfman Distributing Co., also by the N. Y. C. Service Managers Group. Similar meetings were held in Reading and Wilkes-Barre (Penna.); also in Hagerstown (Md.).

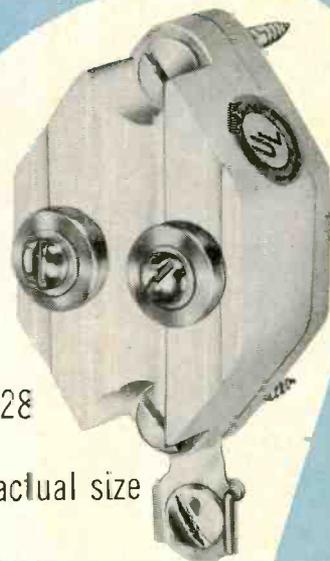
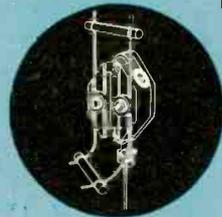
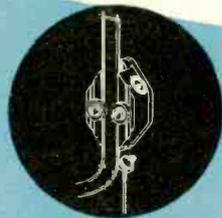
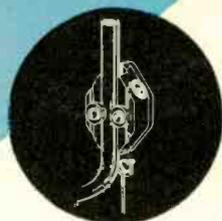
#### Crosley Pushes B & W Sets

Remember the pre-TV days when many homes had the big console radio in the living room, with one or more additional table-model receivers in other rooms? A new design approach by Crosley foreshadows a similar situation in TV, in which the b & w receiver may continue in use long after the large color set in the living room is a common fixture in the American home.

New Crosley receivers using 17-in. pix tubes are scarcely larger than the crt. Space is saved by mounting the chassis vertically, rather than horizontally, and placing it behind the pix tube. Controls are mounted on one side rather than in front. The streamlined circuit uses only 15 tubes and light-weight components. This is said to make the receiver portable. Suggested list price for the set (Super V) is \$139.95.

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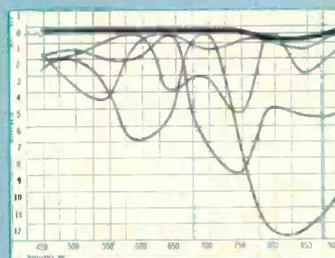


model 114-328

actual size

## universal LOW-LOSS LIGHTNING ARRESTOR

Insertion  
Characteristics  
Chart



AMPHENOL  
Competitor A  
Competitor B  
Competitor C  
Competitor D

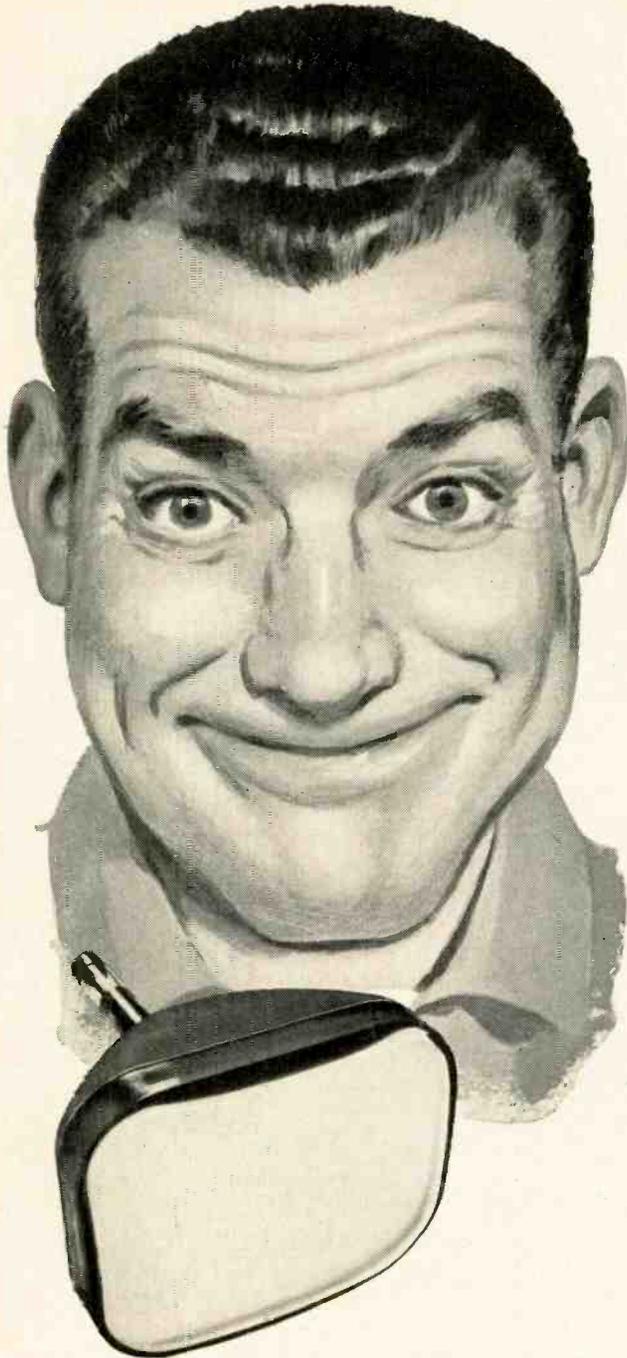
**LOWEST LOSS**—The chart above gives the characteristics of the AMPHENOL model 114-328 and four competitive lightning arrestors. The superiority of the AMPHENOL arrestor is obvious—negligible losses over UHF frequencies. The same standard measurement procedures applied to four competitive lightning arrestors illustrate the high loss on UHF resulting in poor pictures at the receiver.

FROM THE LABORATORIES OF AMPHENOL comes a new concept in lightning arrestors, designed not only to protect the television receiver from the hazards of lightning but to give full protection to the signal strength as well. This is the new model 114-328 AMPHENOL Lightning Arrestor, the result of long months of research by skilled engineers. This Arrestor's low-loss performance means better picture quality—VHF or UHF. Its unique design assures easy installation—a sure-grip of flat, tubular or open-wire lead-in.

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# DB Measurement

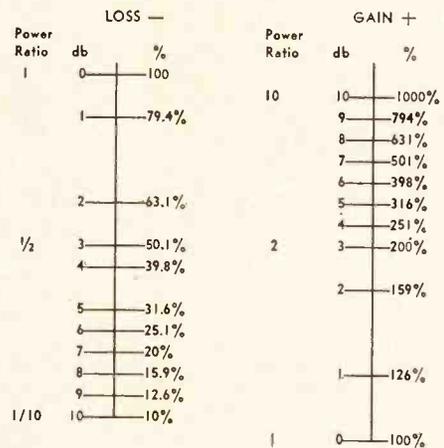
BY GEORGE P. KEARSE

Widespread contacts with numerous TV service engineers have revealed that many of these highly qualified and vitally important members of our family are greatly confused by the decibel values used to evaluate the performance data of antennas and transmission lines. Therefore, we believe that a short discussion of the use of the decibel as a measuring unit would help to clear up some of this confusion.

**ORIGIN.** The decibel is one tenth of a bel, named after Alexander Graham Bell, and was originally developed by telephone companies to measure power levels in communication circuits. It has been "borrowed" by other branches of electronics and today it is almost universally used in any application where it is necessary to compare two power levels, even when these levels are measured in different terms, such as voltage or current.

**LOGICAL CHOICE FOR ANTENNA MEASUREMENTS.** It is a natural choice, therefore, to select the decibel as a measuring unit when comparing the power sensitivity (signal pickup) of an antenna with that of a folded dipole, where pickup differences must be stated in relative units independent of the power level at which the measurements are made.

**PECULIARITIES OF THE DECIBEL SCALE.** Decibel values, being logarithmic quantities, can often become confusing and misleading unless one has been using these units regularly. For example, values of 10 db or 20 db correspond to a power ratio of 10 to 1 and 100 to 1, respectively, and values of 30 db, 50 db, and 100 db, while being relatively small numbers themselves, represent tremendous changes in power levels. Less confusion will result



if one will remember that a 2 to 1 (or 1 to 2) power ratio represents approximately a 3 db change, and that a 10 to 1 (or 1 to 10) power ratio represents a 10 db change. Points in between these two values may be "guesstimated" within a few per cent without too much trouble. The following table showing power ratios as db values compared to percentage changes vividly illustrates the difference between the two. It is based on a 1 to 1 ratio, or 0 db, as representing a 100% level.

## EXAMPLES OF THE USE OF THE CHART

1. An antenna with a gain of 3 db over a folded dipole would collect 200% or 2 times the power collected by a folded dipole.
2. A lightning arrester with an insertion loss of 1 db would permit 79.4% of the signal power to remain in the transmission line for reception purposes—20.6% being consumed by the unit itself.

The chart may be extended as needed, remembering that as the percentage values are multiplied or divided by 10, the decibel values add. For example:

A serviceman has the problem of determining how much gain a booster should have, to overcome the loss in a 1000-ft. run of coaxial line from a hilltop antenna to an installation in the valley below. At the operating frequency, the loss per hundred feet is 1.5 db. The total loss will be ten times 1.5 db. or 15 db. Therefore, the booster must raise the power level at the input to the cable 31.6 times or 3160%, to compensate for the long cable run. (Courtesy American Phenolic Corp.)

## Mfrs. Service Tips

### Excessive Heat in HV Cage

This symptom in the Packard-Bell 2040 chassis, along with the cure recommended by the manufacturer, suggests an approach that may be useful in handling the same problems in other sets. The condition may result in a drop in high voltage and loss of picture width. In this case the Q of the horizontal output transformer decreases due to heat. Therefore it has been found necessary to add a heat baffle in the high-voltage cage between the horizontal output tube, 6BQ6, and the horizontal output transformer. The baffle is easily installed and is held in place by the 6BQ6 plate-cap lead. The lead must be removed in order to install baffle, which is placed at right angles to cage. Baffle part number is 78113 and it is available through the nearest Packard-Bell service department.

### Fuse Failure in Horizontal Circuit

The fuse now used in many RCA TV sets is a 0.3 ampere, 250 v type with wire leads, Stock No. 78214. The fuse has been found to be satisfactory in this application for all operating conditions normally encountered. Replacement should be made only with a fuse of the same rating.

In cases where an unexplained fuse failure occurs, examine the glass body interior to determine the mode of failure.

1. Failures where a small segment of the fuse has been melted are generally due to a malfunction of the horizontal scanning circuit. Horizontal output and damper tubes should be checked. An intermittent component, such as a capacitor in this circuit, may result in fuse blowing.

2. Failures where the fuse link has been vaporized against the fuse glass body can be due to an intermittently shorting 6AQ5 vertical output tube. In some cases, a momentary flashover occurs which clears itself. During flashover time, the B+ to the scanning circuit is shorted through the tube, resulting in a vaporized fuse link. In such cases, it is advisable to replace the tube. Where the same tube type is used in other positions, such as the audio output circuit, it may be possible to exchange tubes and obtain satisfactory operation.

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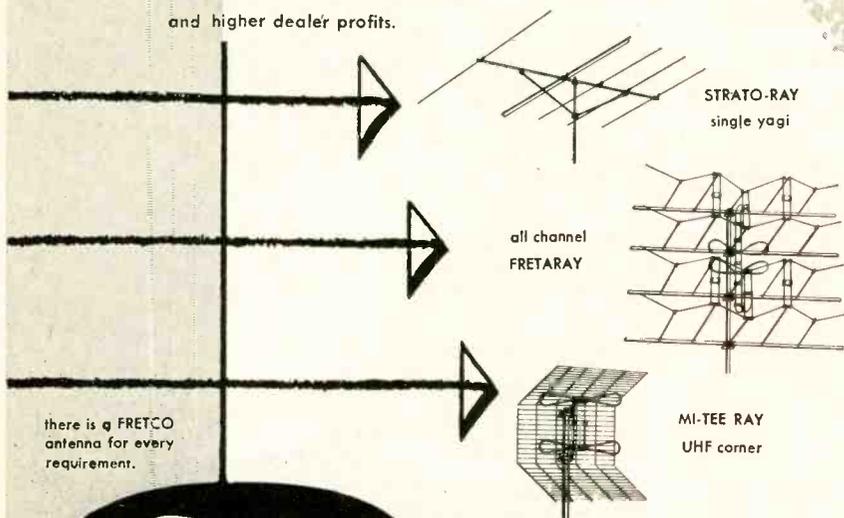


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## NEW BOOKS

UHF TELEVISION ANTENNAS AND CONVERTERS. By Allan Lytel. Published by John F. Rider Publisher, Inc., 480 Canal Street, New York 13, New York. 118 pages; \$1.80, paper bound.

It is the purpose of this book to explain in simple terms the function and operation of the UHF conversion systems that are appearing on the market in ever increasing numbers. It is also meant to prepare the service shop owner and serviceman for the installation and maintenance of these units. Emphasis is placed not only on the converter systems but also on the antenna structures and transmission line systems. The level is meant to be direct and practical; every effort has been made to use circuits and descriptions that are useful. No involved mathematics have been included, although there are a few instances where simple formulas have been used.

PROTECTION AGAINST BURGLARY. By Richard L. Holcomb. Published by the Institute of Public Affairs of the State University of Iowa, Iowa City, Iowa. 54 pages; \$1.00, paper bound.

Professor Holcomb is Chief of the Bureau of Police Science of the State University of Iowa's Institute of Public Affairs. His first book in this series, *Armed Robbery*, was designed to point out to potential victims the things they might do to thwart hold-up men and to reduce their losses in the event they should be held up. The present volume attempts to achieve the same purposes regarding burglary.

Both of these books were prepared with two objectives in view: 1. to help individual citizens and business firms protect themselves against criminals and 2. to help law enforcement officers enlist public support and cooperation in their efforts to prevent crime and to apprehend and convict criminals.

After a brief introduction, this book is divided into two sections: preventing burglaries of business places, and preventing burglaries of homes. At the back of the book are two check lists; by surveying your place of business and your home with these check lists you can find out what burglary protection devices and practices you need to adopt and follow in order to make your property more secure.

Many humorous cartoons illustrate points made by the author.

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## MFRS' Catalogs & Bulletins

**THORDARSON REPLACEMENT GUIDE:** Fly-backs, peaking coils, yokes, inductive controls, i-f assemblies and other types are covered in *TV Replacement Guide*, 32 pp. Available free from Thordarson-Meissner, Dept. C, Mt. Carmel, Ill.

**JFD ANTENNA BROCHURE:** Describes antenna package merchandising, antenna accessory kits. Discusses cutting installation time. Available to part jobbers and service dealers. Write for form no. 245. JFD Manufacturing Co., 6101 16 Ave., Brooklyn 4, N. Y.

**SIMPSON TROUBLESHOOTING MONTHLY:** Technician's *Timesaver* covers test equipment and troubleshooting technique, servicing shortcuts, in 4 pp. Illustrated. Available to service personnel. Simpson Electric Co., 5200 West Kinzie St., Chicago 44, Ill.

**ALLIED CATALOG SUPPLEMENT:** Supplement no. 137, 56 pp., to be used with 1954 catalog no. 135. Lists parts, equipment, chassis, and other units added to line since main catalog. Available free. Allied Radio, 100 N. Western Ave., Chicago 80, Ill.

**HEATH SERVICE BUSINESS GUIDE:** *Planning Your Service Business*, by John T. Frye, 8 pp. Illustrated data on selecting location, choosing equipment, bench layout, record keeping, advertising, and charging. Price, \$1.00. Heath Company, Benton Harbor, Michigan.

**BLONDER-TONGUE SERVICE MANUAL:** Complete service data, schematics and replacement lists for all B-T home and master TV units, 16 pp. Boosters and converters covered. Price, 25 cents. Blonder-Tongue Laboratories Inc., 526-536 North Ave., Westfield, N. J.

**GEE-LAR KNOB CATALOG:** *Catalog no. 56* lists complete line of plastic knobs for radio, TV, other equipment; 16 pp. List prices and descriptions included. Available free. Gee-Lar Mfg. Co., 1330 10th Ave., Rockford, Ill.

**STANCOR HI-FI AMPLIFIER BULLETIN:** *Bulletin 479*, 4 pp., describes Stancor-Williamson ultra-linear amplifier. Chassis drawings, schematics, parts list included. Available free from distributors or from Chicago Standard Transformer Co., Standard Div., Addison & Elston, Chicago 18, Ill.

**MALLORY AUTO-RADIO REPLACEMENT CONTROLS:** *The Auto Radio Replacement Control Manual* lists replacement controls for nearly 600 models made by 39 mfrs. of auto radios. 11 pp. Fully indexed. Available free from distributors or write to P. R. Mallory & Co., P. O. Box 1558, Indianapolis, Ind.

**WESTINGHOUSE SERVICE MANUAL:** All Westinghouse TV receivers from 1947 through 1954 are covered by schematics and service data in 127 oversize pages. Manual designed to lie flat on service bench while in use. Price, \$1.75. Westinghouse Electric Corp., 401 Liberty Ave., Box 2278, Pittsburgh 30, Penna.

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Get this new book FREE—150 Radio-Television Picture Patterns and Diagrams Explained! Gives complete 11 x 22" Schematic Diagrams on leading Radio and TV sets. Explains how to trouble-shoot with picture tube patterns.

**GET MONEY-MAKING "KNOW-HOW"**

FREE book your gift for examining Coyne's new 6-volume set, Applied Practical Radio-Television. Complete reference set covers everything on Radio and TV including Color TV, UHF, Transistors, Convertors, Adaptors... helps you get ahead. Over 2500 easy pages; 1200 illustrations; "breakdown" photos. Tells how to install, service, trouble-shoot, align all sets. Extra! New 762-page quick-reference TV Servicing Cyclo-pedia included.



**FREE ON 7 DAYS TRIAL**

**MAIL COUPON—SEND NO MONEY!** Get this 6-volume set and FREE Book. Use the set 7 days. If you want to keep it, pay \$2 after 7 days and \$2 a month until \$22.50 plus postage is paid. (Cash price \$20.95.) If not 100% satisfied with set, send it back and owe us nothing. EITHER WAY TV-RADIO DIAGRAMS BOOK IS YOURS FREE. Coupon is just a request to see set and get FREE Book. Send it today!

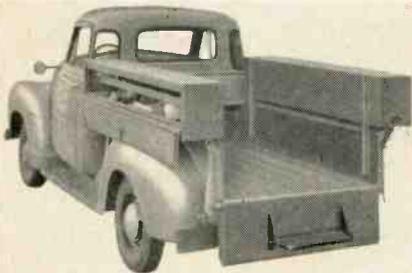
**MAIL COUPON NOW!**

COYNE ELECTRICAL & TELEVISION-RADIO SCHOOL  
 500 S. Paulina St., Dept. 34-A1, Chicago 12, Ill.  
 Rush 6-Volume "APPLIED PRACTICAL RADIO-TELEVISION" on 7 days' FREE TRIAL, per offer above. Include FREE Book.

Name ..... Age .....  
 Address .....  
 City ..... Zone ..... State .....  
 Where Employed .....

Check here if you want set sent C.O.D. You pay postman \$20.95 plus C.O.D. postage. Same money-back guarantee of satisfaction.

**You'll earn more profits with KARYALL COMPARTMENTS**



**KEEP YOUR TOOLS ORGANIZED AND SAVE TIME ON YOUR SERVICE CALLS**

- Karyall Compartments convert any 1/2, 3/4 or 1 ton pick-up truck into a handy mobile service unit.
- Made in sizes to fit full length of truck bed: 78"—88"—96"—108"
- Complete with brackets for easy installation.
- Immediate delivery from our complete stock.

Mail this coupon today for specifications and prices

Name .....  
 Company .....  
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**KARYALL BODY, INC.**

8221 Clinton Road Cleveland 9, Ohio  
 Department T

**Du Mont Fix-Faster**

A Du Mont troubleshooting chart, the *Fix-Faster*, is designed to assist non-technical set dealers and salesmen in outlying TV areas where qualified technicians are miles away. Consisting of a series of faulty picture tube patterns, the guide indicates only external adjustments that may need re-setting, and possible defective tubes.

The user is cautioned not to attempt such other repairs as require technical knowledge. *Fix-Faster* may also be useful to service technicians in narrowing down more serious circuit faults.

**RCA Atomic Battery**

The combination of a radioactive source with semi-conductor techniques, similar to those used in transistor operation, has resulted in an experimental atomic battery. The thimble-sized unit, which converts atomic energy directly into usable electricity, is seen as a major breakthrough toward the eventual RCA goal: a tiny battery capable of operating for at least 20 years.

**RETMA Training Course**

Graduation exercises for TV technicians who completed the RETMA study course at the N. Y. Trade School were held on the evening of Feb. 1. The pilot course, designed to upgrade the experienced technician both in the business and technical sense, had an enrollment of 60 selected servicers in the N.Y. area.

The course was the first in a series intended to provide basic information for developing an industry-recommended training program. The final program will be offered to trade and vocational schools throughout the country. RETMA member companies donated over \$80,000 in money, test equipment, sets, and parts to make this one of the best-equipped courses of its kind in the entire country.

On another front, the RETMA Service Committee announced approval of a standardized parts tag for use on all components returned to the set manufacturer under warranty. Use of this standard form will simplify procedure for technician-dealers and servicemen. Many RETMA member-companies are now distributing the return tags to their distributors throughout the country.

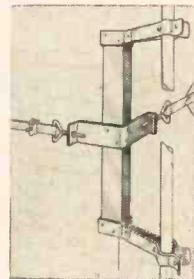
Editors, **TECHNICIAN**:

You have a wonderful journal for the serviceman. I like it better all the time.

E. F. HARMON

Strand Electric Co.,  
 Strand, Okla.

*South River*  
 ★★ NEWS ★★



**Chimney Uni-Mount Model UM-1**

Riveted, heavy-gauge, galv. steel with wide, flared-lip, snap-in mast holders. 18" spacing between mast holders for firm support. Available with one heavy-gauge stainless steel strap, Kwik-Klip banding closure and Chimney Corner Guards. Model UM-2 . . . same as UM-1 with 2 heavy-gauge stainless steel straps.

Write for catalog.

In Canada—A.T.R. Armstrong Ltd., Toronto

**SOUTH RIVER METAL PRODUCTS CO., INC.**  
 SOUTH RIVER, N. J.

PIONEER AND OUTSTANDING PRODUCER OF FINEST LINE OF ANTENNA MOUNTS

**LOCALIZE YOUR SELLING**

—by supplementing your free editorial listing in the Manufacturers' Alphabetical Index in the **TECHNICIAN BUYERS DIRECTORY** to be published in the May issue of **TECHNICIAN**.

Space may be purchased by the inch, immediately under your firm name, for the listing of:

- Local representatives
- Branch or regional offices
- Territories covered
- Types of products
- Brand names
- Executive and sales personnel

Localizer Listings result in quicker evaluation of inquiries; save time and money; cut red tape and get you to the buyer faster.

Write for details

**TECHNICIAN**

480 Lexington Ave., New York 17



## C-D's new Cub

outlasts other  
molded tubulars  
in humidity tests!



- Government humidity tests show C-D's to be 3 to 6 times better!
- A better all-around tubular designed specifically for radio and TV service replacement needs!
- Compare its new sleek looks!
- -- and be sure to ask about the new "Cub-Kit".

This time try C-D's NEW CUB! For your nearest C-D distributor see the Yellow Pages of your Telephone Directory. Write for catalog to Dept. RT34 Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

CONSISTENTLY DEPENDABLE

# CORNELL-DUBILIER CAPACITORS



There are more  
C-D capacitors in  
use today than any  
other make.

PLANTS IN: SO. PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD AND FUGUY SPRINGS, N. C. SUBSIDIARY: RADIART CORP., CLEVELAND, OHIO

### Silicon Transistors

The use of silicon in place of germanium for the manufacture of transistors may open up transistor applications not possible until now. Raytheon engineers have announced experimental silicon transistors that operate at temperatures of 350 degrees and higher. Since germanium cannot withstand much heat, transistors have not heretofore been practical in high-wattage or high-heat applications.

### Pyramid Contest Continues

Closing date for entries in the cash-prize contest for servicemen conducted by Pyramid Electric Co. is April 30. More than 500 cash prizes totalling \$5,600 are being offered to service technicians who write the best 25-word statements beginning "I like Pyramid capacitors because . . ." Entries must be accompanied by capacitor box-tops. Contest details were reported in *TECHNICIAN* last month (February.)

### Transvision Coin-Box TV

Model C-1 Coin-TV Set, designed for use in hotels, motels, hospitals and other points of assembly, provide half an hour of TV viewing for 25 cents. A "free viewer" device permits a teaser view of the program for a few minutes, shutting off unless a quarter is deposited.

Transvision, Inc. of New Rochelle, N. Y., manufacturer of the sets, claims these tamper-proof receivers are not simply regular sets with attachments. They are ruggedly designed for operation under more demanding conditions of use than those to which conventional home receivers are subjected.

### Freed Appoints Sales Mgr.

Freed Electronics & Controls Corp., 200 Hudson St., New York 13, N. Y., announces appointment of W. Walter Jablon as sales manager of the Home Instruments Division. Associated with the industry since the early days of broadcasting, Jablon will promote the manufacturer's complete line of "Higher Fidelity" equipment for home use.

An old name in radio and audio, Freed produced FM receivers and wide-range sets before World War II, preceding the present hi-fi boom.

### Correction

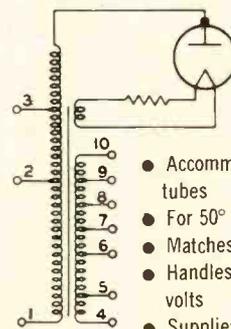
On page 29 of the December '53 issue of *TECHNICIAN*, two sketches closely based on Centralab drawings were published without a courtesy line. We wish to apologize for this omission.

Built for **SERVICE**

# No Redesign Problems

with RCA

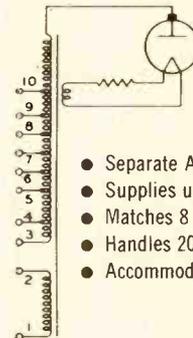
## "Universal" HV Transformers 231T1 and 232T1



231T1

For replacement  
use in isolated-  
secondary type  
circuits

- Accommodates all popular driver tubes
- For 50° to 70° kinescopes
- Matches 8 to 30 mh yokes
- Handles "B" supplies; 250 to 375 volts
- Supplies up to 15 kv



232T1

For replacement  
use in auto-  
transformer type  
circuits

- Separate AGC/AFC winding
- Supplies up to 16 kv
- Matches 8 to 30 mh yokes
- Handles 200 to 375 volt "B" supplies.
- Accommodates all popular driver tubes

Why redesign, when mechanically and electrically, these two RCA "universal" horizontal-output and high-voltage transformers meet practically every mounting and circuit requirement.

Excellent for conversions. Comprehensive instruction booklet packed with each transformer.

Available through your local RCA Distributor.



**RADIO CORPORATION of AMERICA**  
ELECTRONIC COMPONENTS CAMDEN, N. J.

# "Greatest Show on Earth"

Yes, the industry's greatest TV-electronic parts show will be held in two places simultaneously.

—In CHICAGO, May 17-20, when parts, accessories and test equipment will have the spotlight at the Conrad Hilton.

—In **TECHNICIAN**, May issue, destined to be the Greatest TV-Electronic Show on Paper.

Why the Greatest Show on Paper? Because the many exclusive features planned for May will surpass anything done by O. H. Caldwell and M. Clements in 30 years.

## Is **TECHNICIAN** THE GREATEST SERVICE PUBLICATION IN TV? ... *Yes!*

Substantiating the jet-like progress of **TECHNICIAN**, manufacturers are now polling 14 cities—asking servicemen what publication they prefer. First was an independent survey of 750 servicemen listed in Chicago's Classified Telephone Directory, made by a prominent agency with this result:

### % OF TOTAL VOTES

Technician	32.0%
Radio TV News	17.0
Radio Electronics	13.0
Radio TV Service Dealer	12.5
Service	12.0
Sams Index	4.0
Electronics	3.0
Service Management	2.0
Miscellaneous	4.5

Note—**TECHNICIAN** led in 1st choice votes—and also in 2nd choice votes. In percentage of total votes, **TECHNICIAN** received more votes than the next two publications combined.

**TECHNICIAN'S** 50,000 circulation includes more professional servicemen and service managers (no consumers or experimenters) than any other radio-TV service publication—actually more than 45,000. And . . . **TECHNICIAN'S** PAID CIRCULATION NOW EXCEEDS 40,000!

Thus, media ratings of last Fall are already obsolete. It's time to again review your advertising schedule, and . . .

**MAKE SURE YOU ADVERTISE IN THE TOP SERVICE PUBLICATION.**



Caldwell-Clements, Inc., 480 Lexington Avenue, New York 17, N.Y.

Complete manufacturers' directory of products used by distributors and service men

Alphabetical listing of all manufacturers of radio-TV-electronic products

Exclusive annual distributors' directory

Complete Representatives directory

Complete list of service associations

**Yes, **TECHNICIAN'S** May Issue will be the GREATEST SHOW ON PAPER**

# 6 NEW TRIAD FLYBACKS



As evidence of Triad's continuing efforts to meet your TV replacement needs — exactly and completely — 6 new flybacks have been added to the line. A total of 19 are now available, with more being added all the time. These flybacks are precisely engineered for specific replacements and carefully constructed of the finest materials. Their resulting high performance and long life insures satisfied customers and helps you build and hold your service business.

Type No.	List Price	Description
D-31	\$11.00	Universal type. Universal mounting. Replaces RCA 231-T1
D-32	11.00	Has AGC tapped winding. Matches all yokes.
D-33	11.00	Universal type. Universal mounting. Has AGC tapped winding similar to D-32, but low impedance secondaries.
D-35	11.00	Universal type. Universal mounting. Replaces RCA 223-T1, 224-T1, 230-T1 and 232-T1.
DA-36	5.50	Coil only. Replaces coil in Zenith Part No. S-18567.
DA-37	5.50	Coil only. Replaces coil in Zenith Part No. S-19032.

Available from stock. See your jobber for these — and all of your TV replacements.

Write for Catalogs TR-54K and TV-54K



4055 Redwood Ave., Venice, Calif.



## Prevent Paperwork Losses

(Continued from page 46)

over a period of three days. (Additional days may be added.) This multi-day set-up is preferred because it can help plug up a very real source of losses. To illustrate:

Technician Joe starts work on Mrs. Smith's TV set on Monday, March 15th. Half-way through the job, he's sent on an outside call. It's a hurry-up affair; this home call, so he rushes out, planning to charge out the tubes and parts he's used on the Smith job, as well as his time, the next day. But things don't work out that way. The next morning Joe is asked to pick up a couple of sets on his way to work, and Fred takes over the Smith job.

Right off the bat, Fred loses time because he doesn't know how much or what kind of work Joe has done. Furthermore, Fred doesn't concern himself with the time Joe has spent on the job, or the parts he used. Fred, then, makes a fresh start, completes the job, and it goes through billed for only the time and parts used by the second man.

The foregoing is a typical example of how losses arise. There are many similar instances, too numerous to cite. Obviously, the first thing the owner should do after he's satisfied that the forms he uses are foolproof and complete is to insist that whenever a man leaves a repair job unfinished, he put down all time and all components used on the repair. Nothing should be left to memory.

TECHNICIAN editors hope that the accompanying form will be of help to shop owners and service managers; we will be pleased to receive samples of forms readers are successfully using in their own operations.

Bob Middleton, formerly with RCA and Precision Apparatus, has joined the sales-engineering division of Simpson Electric Company, Chicago. In his new position, Bob Middleton will conduct lectures for servicemen throughout the country. A novel twist will be his open invitation to all servicemen who attend the meetings to bring their "can't-fix-it" repair problems to the sponsoring jobber the following morning. Bob will personally tackle each repair.

Simpson's five plants manufacture electronic test equipment and panel instruments.

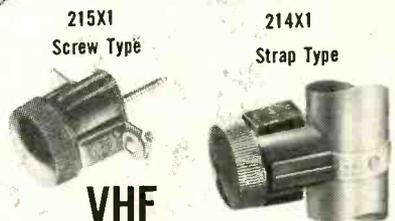
## Built for SERVICE

### Easy to Install



#### UHF LIGHTNING ARRESTERS

Accommodate Tubular, Oval, Foam and Jacketed UHF Lines. Low-capacitance design. Standing-wave ratio approximately 2:1 at 800 Mc. Low loss—approximately 1 db at 800 Mc. Listed by Underwriter Laboratories, Inc.



#### VHF LIGHTNING ARRESTERS

Weather-resistant . . . continually dissipate static charges . . . do not unbalance line . . . easy to install. Listed by Underwriter Laboratories, Inc.



#### TV SET COUPLERS

Permit operation of two or more TV sets from single antenna. Easy to install . . . no need to cut or splice twin lead.

Individually packaged RCA UHF and VHF Arresters, and TV Set Couplers are available in handy display cartons containing 10 units. Get yours from your local RCA Distributor today.



**RCA** RADIO CORPORATION of AMERICA

ELECTRONIC COMPONENTS

CAMDEN, N. J.

Burton Browne advertising



# THINGS ARE NOT AS THEY SEEM...

Things are not as they seem  
These two fuses alike . . .  
Until you look inside.



*This is not a spiral. It is a series of concentric circles that do not join.*

This fuse has a straight element—cannot be made more delicate than 1/16 amp. with normal blowing characteristics.



This fuse has a bridge construction (note short filament between electrodes). This type fuse may be rated as low as 1/500 amp. with precision blowing characteristics required for protection of extremely fine instruments. Without this construction pioneered by Littelfuse—the microscopically fine filament would break in shipment, in normal operating vibration or even from nearby footsteps.



## LITTELFUSE

DES PLAINES, ILLINOIS

*Littelfuse leads all other fuse manufacturers in design patents on fuses.*

# ALL "CIRCUIT DIGESTS" TO DATE

Including Current Issue. CIRCUIT DIGEST NOS. 116 to 120 will be found in this issue of TECHNICIAN

All Units Are TV Receivers  
Unless Otherwise Noted

<b>ADMIRAL</b>	Circuit Digest No.
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25-30	Dec. 1952
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37-43	Feb. 1953
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89-94	Oct. 1953
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Note: Months prior to September, 1953, refer to issues of Television Retailing (predecessor of TECHNICIAN)

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Electro-Voice

# CARTRIDGES

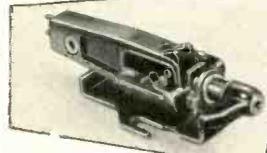
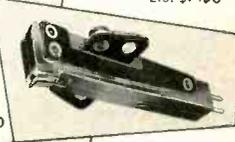
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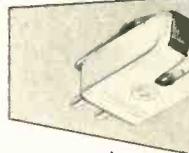
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Ceramic Cartridge. Plays 78, 45, 33 1/2 rpm with single 2.3-mil all-purpose needle-tip. Output .7 to 1.0 volt. 43. Osmium. List \$6.50. 43-S. Sapphire. List \$7.50.

**MODEL 44**  
Ceramic Cartridge. Plays 45 and 33 1/2 rpm. with 1-mil needle. Impervious to heat and humidity. Output .7 volt. 44. Osmium. List \$6.50. 44-S. Sapphire. List \$7.50.



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**MODEL 16-TT**  
Crystal Twin Tilt. Uses one piece twin tip needle for 78, 45, 33 1/2 rpm. Merely turn selector handle for 1-mil Sapphire or 3-mil Osmium tip. Output 1 volt. 16-TT. List \$10.00. 16. Same without tilt mechanism. List \$9.00.



**MODEL 12**  
Crystal Cartridge. Plays 78 rpm with 3-mil needle. Light weight. High compliance. Tracks perfectly. Output 2 volts. With snap-in holder. 12. Osmium. List \$7.50. 12-S. Sapphire. List \$8.50.

**MODEL 60**  
Crystal Duo Volt. Permits selection of high or medium output (2 or 4 volts on 33 1/2-45, and 3 or 6 volts on 78). No soldering. Uses any standard 3-mil, 1-mil or all-purpose needle. 1/2" mounting hole centers. 60. Less needle. List \$4.95.



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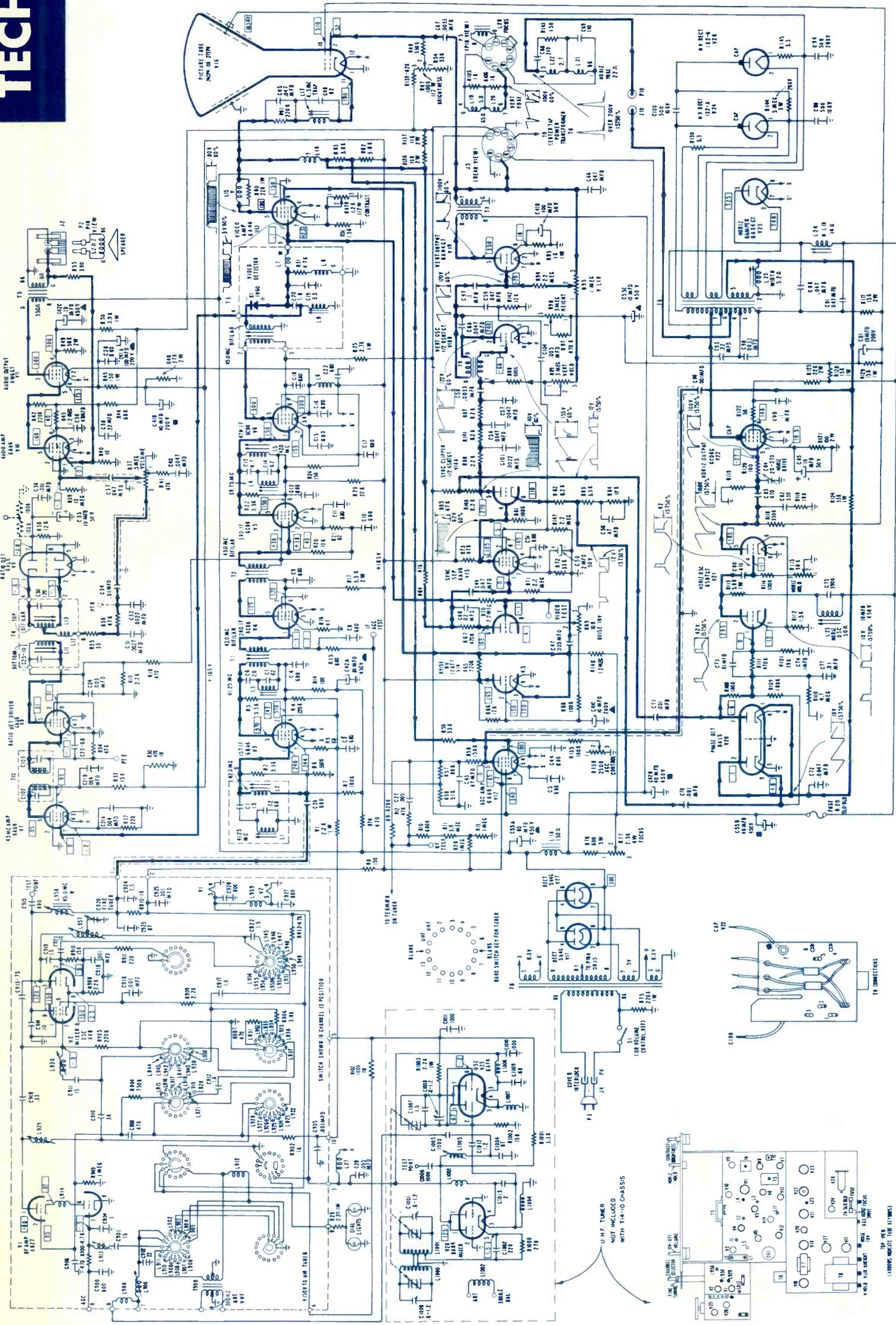
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- NOTES:
1. ALL RESISTORS ARE 1/2W WITH VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
  2. RESISTORS ARE IN OHMS UNLESS OTHERWISE NOTED.
  3. MEASUREMENTS ARE IN OHMS UNLESS OTHERWISE NOTED.
  4. MEASUREMENTS ARE IN OHMS UNLESS OTHERWISE NOTED.
  5. MEASUREMENTS ARE IN OHMS UNLESS OTHERWISE NOTED.
  6. MEASUREMENTS ARE IN OHMS UNLESS OTHERWISE NOTED.



**NOISE INVERTER ADJUSTMENT**

NOTE: The noise inverter control is adjusted at the factory to give optimum performance under varied conditions. Therefore, adjustments should only be made when necessary. If the receiver has a high noise level, or this control becomes adjusted by one means or another it can be satisfactorily set by the following procedure:

Select and properly tune in the strongest station in the area. With the noise inverter control set at minimum, slowly turn it in the clockwise direction until a slight shifting of the picture in the horizontal plane is observed, then back off (counter clockwise) 1/8 of a turn.

CAUTION: If this control is set too far in the clockwise direction, an erratic jumping of the picture will be encountered when switching channels.

**FOCUS COIL ADJUSTMENT**

The focus coil is held to the yoke mounting assembly by 3 slotted "L" brackets. By loosening the 11/32 nuts holding these brackets, the focus coil can be moved either forward or backward to obtain the optimum focus position, or tilted to any position which might be required for proper centering of the picture. The focus control should be set at mid-range before the optimum focus position is determined. Still further adjustment can be made by loosening the self-tapping screws that hold the coil to the "L" brackets. This allows the coil to be moved in a vertical to horizontal plane about the neck of the tube removing any shadows which may have appeared during the previous adjustment.

Chassis T11-3: Models  
FM27C, HB27C  
Chassis T11-10: Models  
TM24DS, TB24DS  
Chassis T11-11: Models  
TM24DU, TB24DU

## BENDIX Chassis T11-3, T11-10, T11-11 Technician CIRCUIT DIGEST T116

**I. F. ALIGNMENT**  
Remove the AGC Amplifier (V12) from its socket. Connect the negative terminal of a 3 volt dry cell supply to the I.F. AGC test point and the positive terminal to chassis ground.

Generator Freq.	VTVM Connections	Adjustment	Remarks
45 MC	To Test Point (C) and Ground	T3-T2-L958*	Adjust for Max.
42 MC	To Test Point (C) and Ground	L5-T1-L2*	Adjust for Max.
41.25 MC	To Test Point (C) and Ground	L1-L3	Adjust for Min. with output of Signal Gen. at Max.
39.75 MC	To Test Point (C) and Ground	L4	Adjust for Min. with output of Signal Gen. at Max.

NOTE: It will be necessary to repeat the steps outlined above for optimum performance of the IF system. \* The designated frequencies for L958 and L2 are to be used for preliminary alignment only. Since these two coils comprise a band pass circuit, final alignment should be made with a sweep generator.

**SOUND ALIGNMENT**  
Connect the Negative Terminal of a 9 Volt dry cell supply to the I.F. AGC test point and the Positive Terminal to Chassis ground.

Signal Generator Coupling	Frequency	Connect	Adjust	Remarks
High side to Pin 1 of V13 (Video Amp)	4.5 MC	DC probe of VTVM to "PT. E." Common lead to chassis.	L9 (top & bottom)	Adjust for Max reading keeping height of picture about 4V on "PT. E."
SAME	4.5 MC	Parallel R38 with two 100K resistors which are within 1% of each other. DC probe of VTVM to "PT. A." Common lead to Chassis.	L11	Adjust for Max reading
SAME	4.5 MC	DC probe of VTVM to "PT. B." Common lead to "PT. A."	L13	Adjust for Zero reading at cross over.

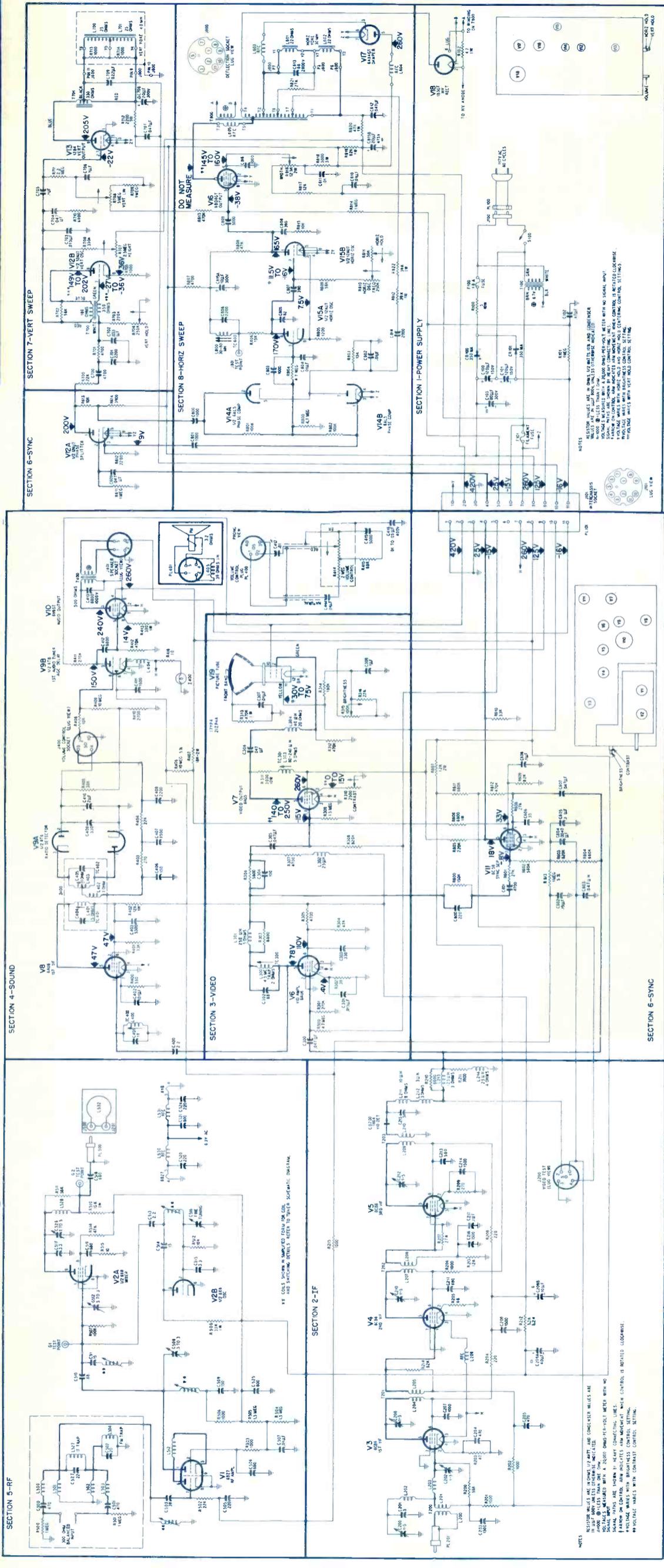


TRANSMISSION LINE ..... 300-ohm, twin-wire lead  
 POWER CONSUMPTION... without UHF, 175 watts;  
 with UHF, 180 watts

INTERMEDIATE FREQUENCIES  
 Video Carrier ..... 45.75 mc.  
 Sound (intercarrier) ..... 4.75 mc.  
 OPERATING VOLTAGE ..... 110 to 120 volts,  
 60 cycles, a. c.

UHF TUNING (if provided) ..... Continuous tun-  
 ing, covering UHF Television Channels 14 through  
 83; fine and coarse tuning

SPECIFICATIONS  
 VHF TUNING ..... Twelve channel, 12-position  
 incremental tuner, covering VHF Television Chan-  
 nels 2 through 13; fine tuning of local oscillator



## CIRCUIT DESCRIPTION

Philco "B" line, Code 140, Television Receivers use two chassis—the r-f chassis R-191, containing the r-f, video, audio, and sync circuits, and deflection chassis D-191, containing the power and deflection circuits. Since these chassis are not isolated from the 60-cycle power line, all protruding shafts and mounting feet are insulated from the chassis.

**R-F Chassis R-191, Deflected on Chassis D-191 Models 3002, 4002, 4004, 4102, 4106, 4109, 4150, 4302, 4304, 4306, 4307, 4005, 4007, 4107, 4112**

## IMPORTANT

**A-C LINE ISOLATION**  
**CAUTION:** The side of the a-c line is connected to the chassis through C101 and L403. The other side of the a-c line is connected to the chassis through F100, R100, CR101, and C103, in series. Grounding the chassis will result in a short circuit across one or the other of these two branches in the voltage-doubler circuit. During servicing and alignment it is desirable that an a-c line isolation transformer capable of handling at least 225 watts (Philco Part No. 45-9600) be used. Failure to use an isolation transformer will greatly increase the shock hazard, and may result in damage to the test equipment or receiver, or both.

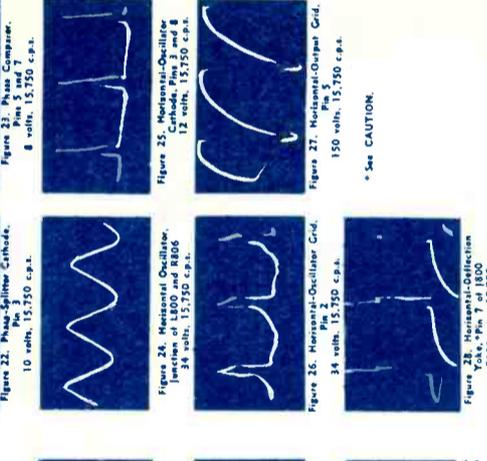
**B SUPPLY FUSE REPLACEMENT**  
 The B supply protective fuse, F100, is wired into the low-voltage section, and is in series with the selenium rectifiers. For replacement, use a 1.6-ampere delayed-action-type fuse, Philco Part No. 45-2656-23.

**CAUTION:** Discharge the circuit before replacing the fuse.

**HORIZONTAL-OSCILLATOR ADJUSTMENT**  
 To adjust the horizontal-oscillator circuit, tune in a station and proceed as follows:

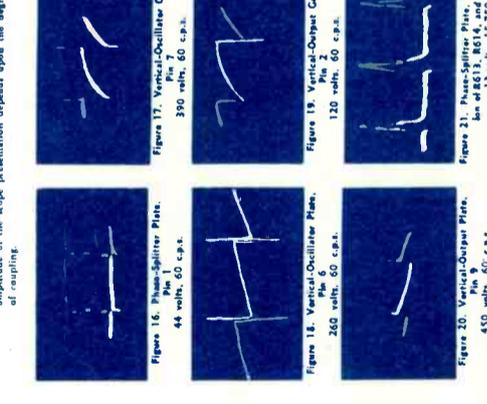
## OSCILLOSCOPE WAVEFORM PATTERNS

These waveforms were taken with the receiver adjusted for an approximate peak-to-peak output of 2 volts at the video detector. The voltages given with the waveforms are approximate peak-to-peak values. The frequencies shown are those of the waveforms—not the sweep rate of the oscilloscope. The waveforms were taken with an oscilloscope having good high-frequency response. With oscilloscopes having poor high-frequency response, the sharp peaks of the horizontal waveforms will be more rounded than those shown, and the peak-to-peak voltages will differ from those shown.



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**CAUTION:**

**PHILCO**  
**R-F Chassis R-191**  
**Deflection Chassis**  
**D-191**

Technician  
**CIRCUIT DIGEST**  
**118**

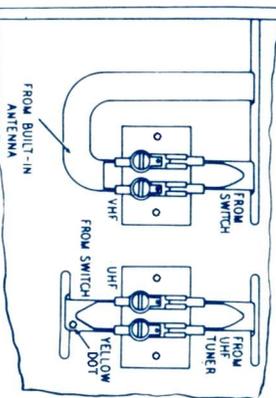


Figure 51. Antenna-Lead Connections, Common Built-In Antenna

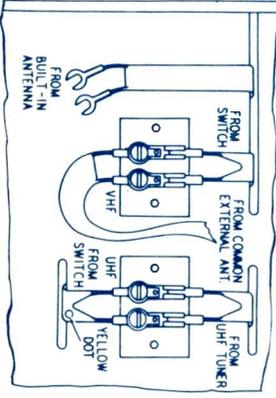


Figure 52. Antenna-Lead Connections, Common External Antenna

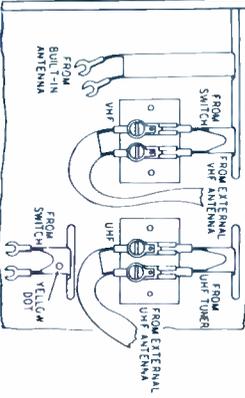


Figure 53. Antenna-Lead Connections, Separate External Antennas

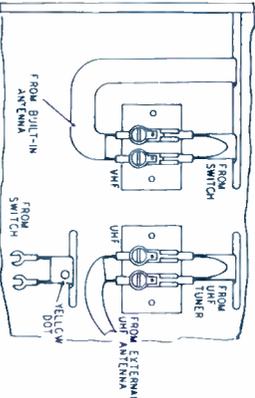


Figure 54. Antenna-Lead Connections, VHF Built-In and UHF External Antennas

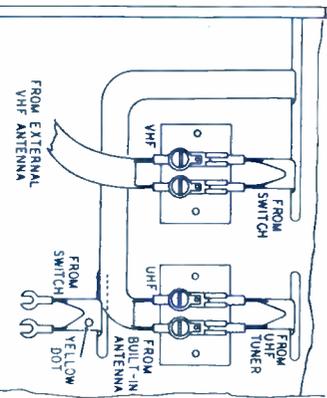


Figure 55. Antenna-Lead Connections, VHF External and UHF Built-In Antennas

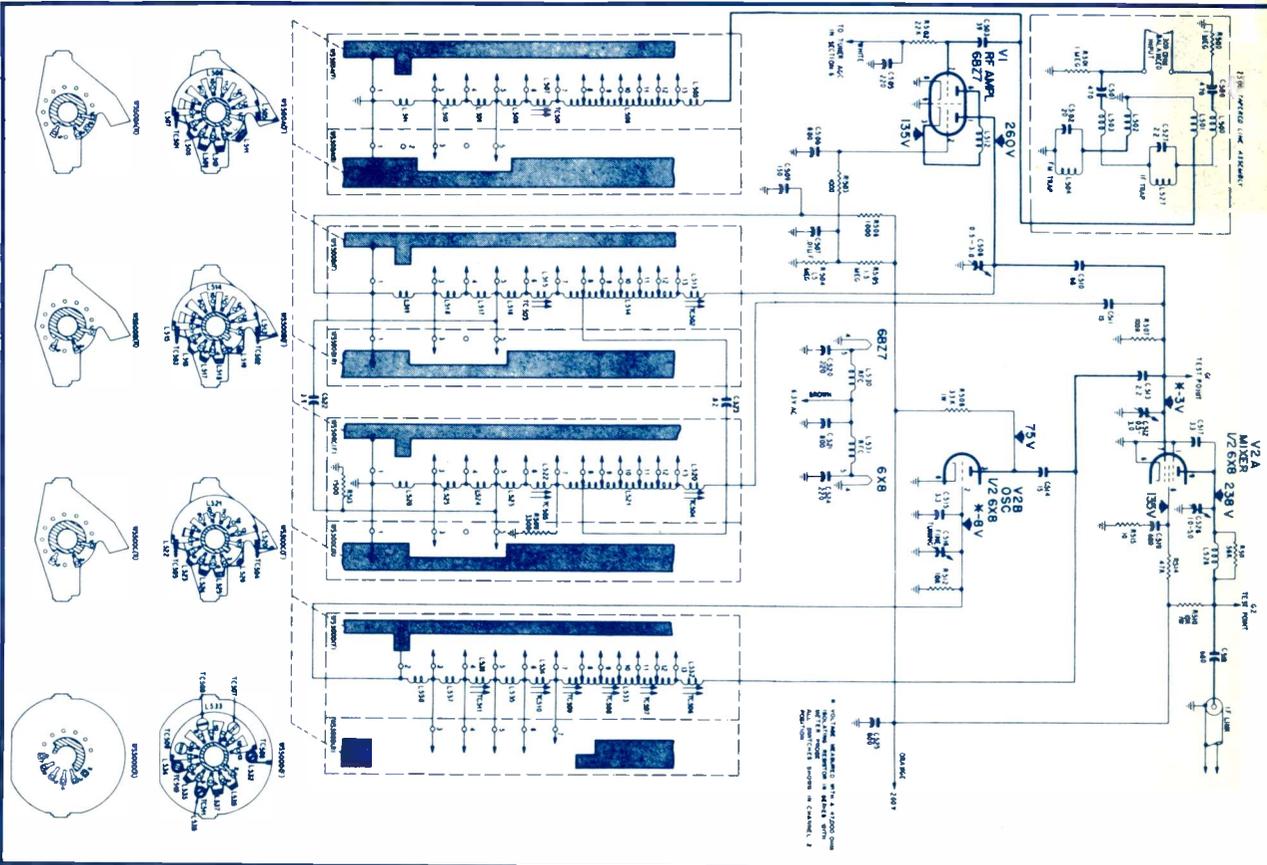


Figure 32. Television (VHF) Tuner, Part No. 76-8400, Schematic Diagram

**VIDEO PEAKING-COIL ADJUSTMENT**

The video peaking coil, L303, is adjusted at the factory for proper transient response of the video circuit. Ordinarily, this coil will require no further adjustment by the serviceman. On any station where excessive overshoot or excessive smear is present, a slight adjustment of L303 may improve the picture quality on that station; however, this adjustment may sacrifice the quality on other channels. If L303 is replaced in servicing, adjustment will be required.

Before adjusting L303, check the tuner alignment and if alignment is correct, check the tuner alignment of the receiver is correct. Then tune in a station and adjust L303 until there are no trailing whites or smear in the picture. Turning TC301 clockwise reduces trailing whites and overshoot; turning TC301 counterclockwise reduces picture smear and increases trailing whites. The proper position is the point where no smear or trailing whites appear in the picture.

The above procedure for adjustment of TC301 applies to a particular station exhibiting smear or overshoot. After TC301 is adjusted, reception on all the other stations should be checked, to make certain that the adjustment has not impaired the picture quality.

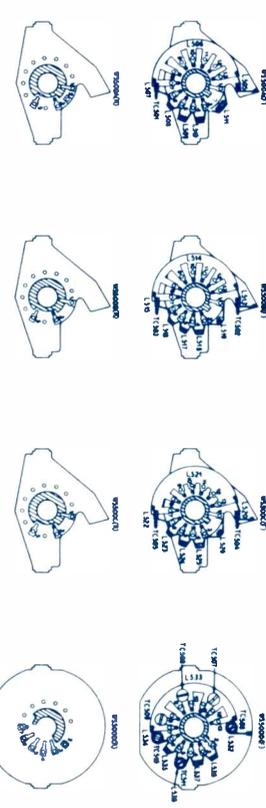


Figure 33. Oscillator Alignment Diagrams

**Oscillator Alignment**

**General**  
Tuning cores are provided in the oscillator coils at channels 13, 11, 9, 7, 6, and 4. By adjusting these tuning cores, all channels may be placed on frequency. This procedure should be carried out with the highest-frequency channel first, since the alignment of each channel affects the alignment of all the channels below it in frequency. The channel adjustments are so arranged that, with one exception, each adjustment corrects the tuning of more than one channel. The coverage of the various adjustments is as follows:

CHANNEL ADJUSTMENT	CHANNELS CORRECTED BY ADJUSTMENT
13	13 and 12
11	11 and 10
9	9 and 8
7	7 only
6	6 and 5
4	4, 3, and 2

Figure 37. Philco UHF Tuner-Adapter UT22, Part No. 43-6703, Schematic Diagram

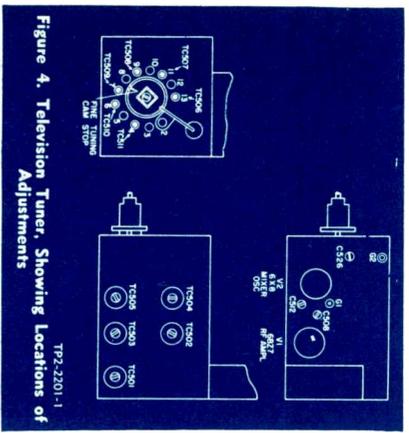
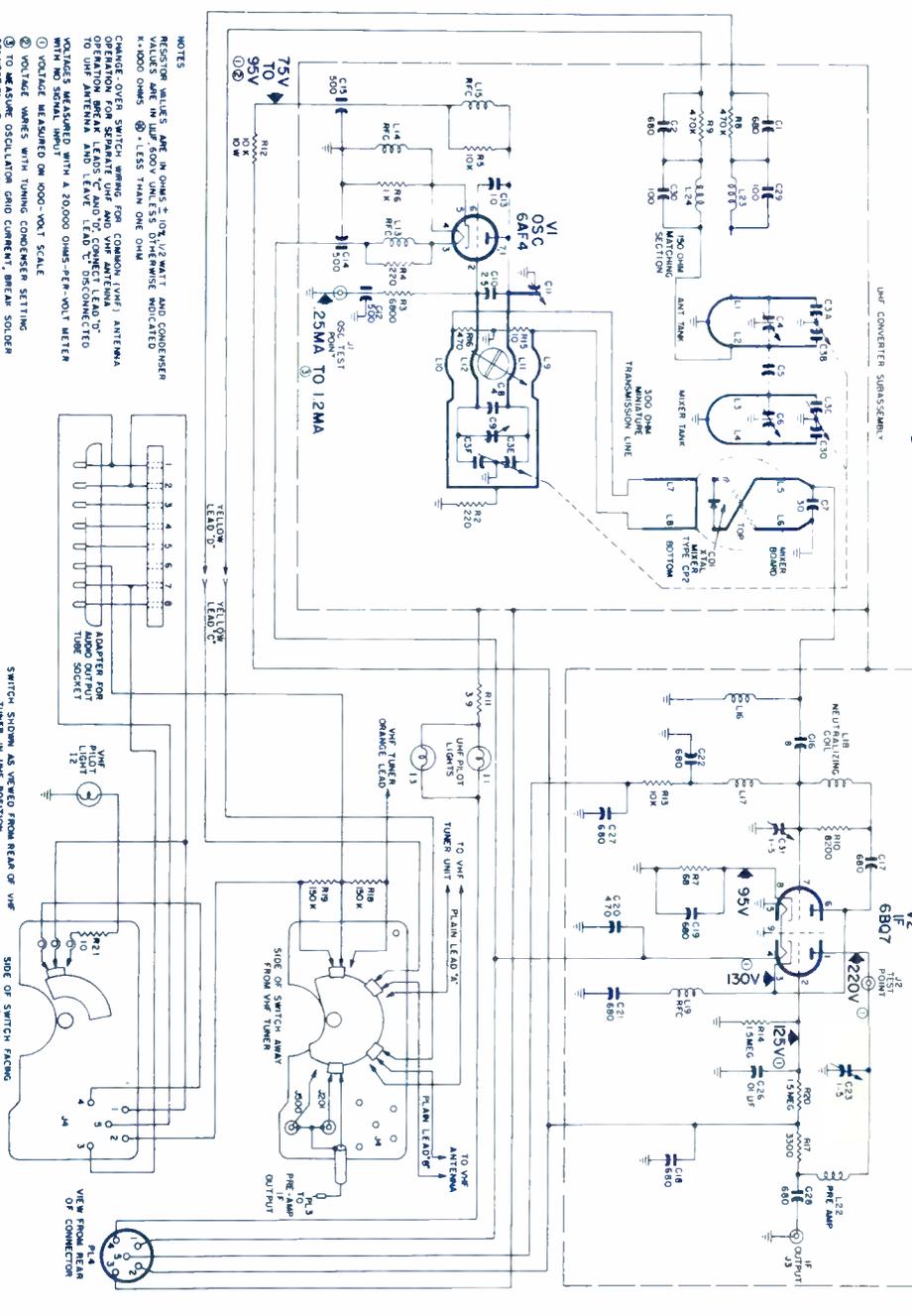


Figure 4. Television Tuner Showing Locations of Adjustments

The FINE TUNING gain should be preset for all adjustments by placing the stop on the FINE TUNING cam between the Channel 7 and 8 holes on the front plate of the tuner.

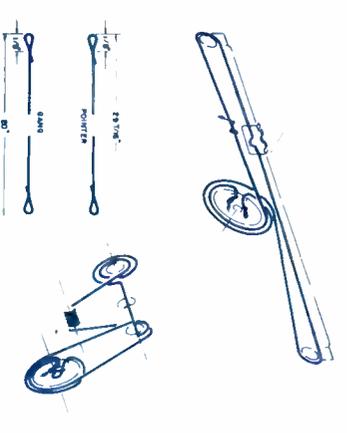


Figure 39. Drive-Cord Strapping Arrangement

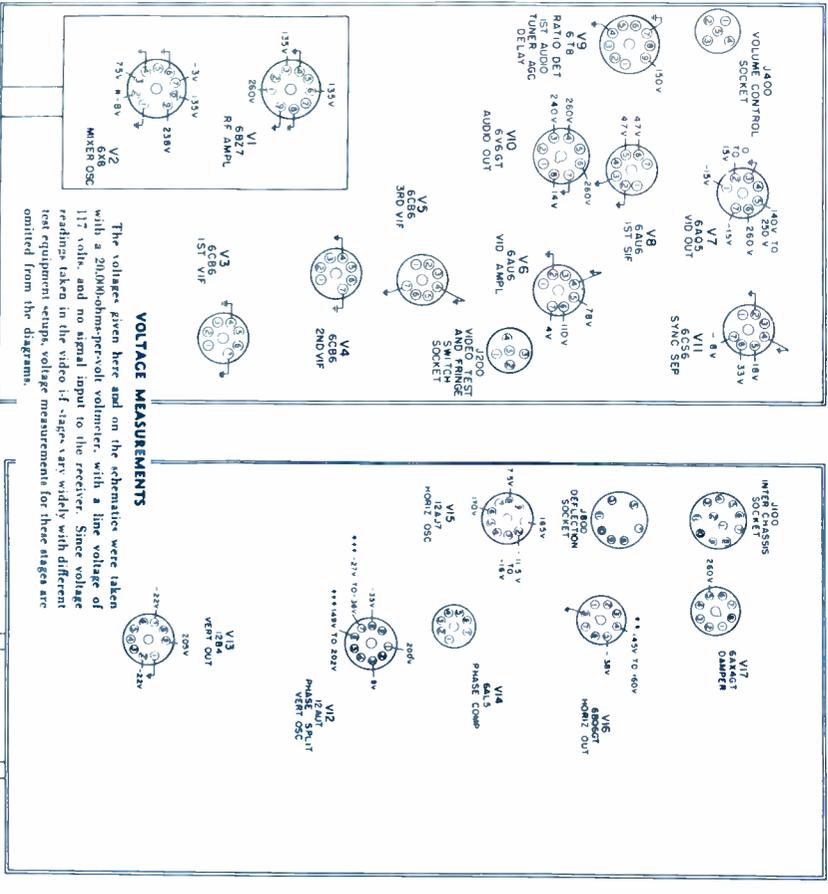


Figure 29. R-F Chassis R-191, Bottom View, Showing Voltages at Socket Pins

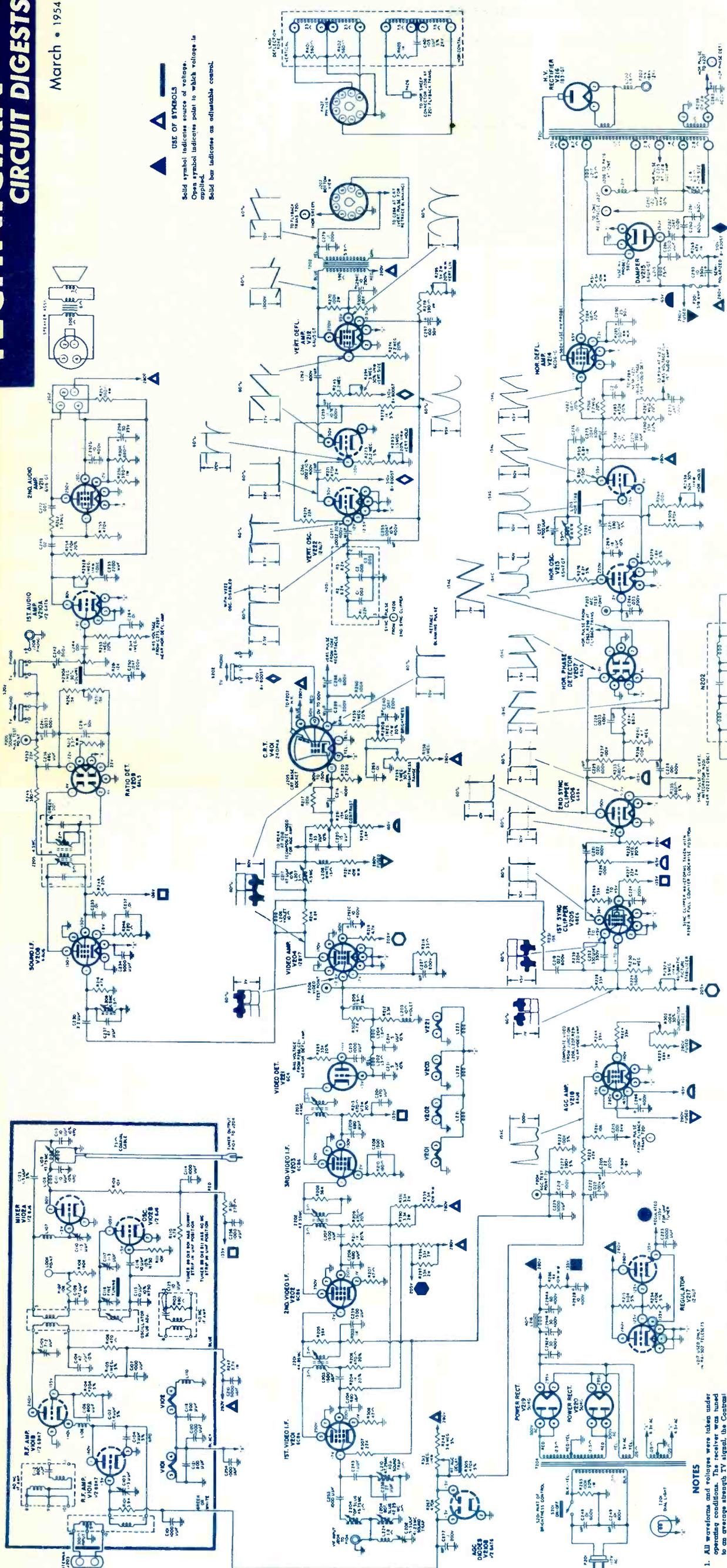
**VOLTAGE MEASUREMENTS**  
The voltages given here and on the schematics were taken with a 20,000-ohm-per-volt voltmeter, with a line voltage of 117 volts, and no signal input to the receiver. Since voltage readings taken in the video if stage vary widely with different test equipment setups, voltage measurements for these stages are omitted from the diagrams.

**VOLTAGE MEASUREMENTS**  
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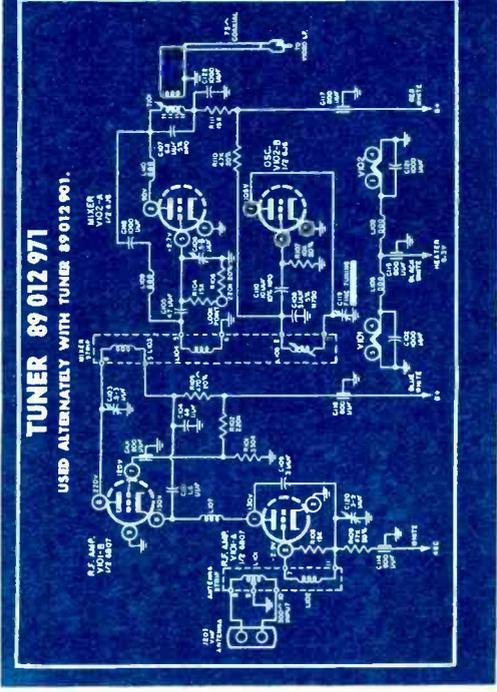
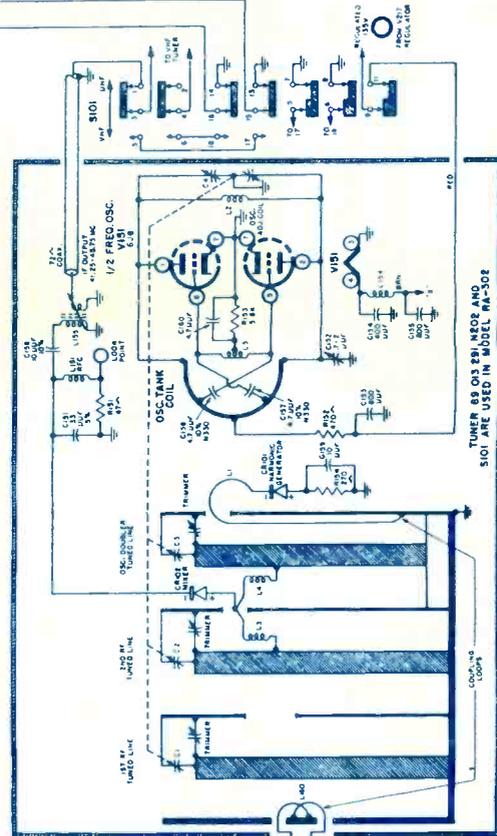


**▲ USE OF SYMBOLS**  
 Solid symbol indicates source of voltage.  
 Open symbol indicates point to which voltage is applied.  
 Solid bar indicates an adjustable control.



- NOTES**
- All waveforms and voltages were taken under operating conditions. The receiver was tuned to an average strength TV signal, the Contrast control rotated fully clockwise and the Du Mont monitor control (top) was adjusted for 100% voltage at 100% deflection.
  - All resistors are 10% unless otherwise indicated. W.W. indicates wire wound resistor.
  - All capacitors are 500V, unless otherwise indicated.
  - GI Tuner 89 012 971 is used in RA-301 chassis stamped G. GI Tuner 89 012 971 and 89 012 971 stamped G.
  - MI—Mica; P—Paper; E—electrolytic.
  - All capacitors are ceramic, unless indicated as follows:
    - MI—Mica; P—Paper; E—electrolytic.
  - GI Tuner 89 012 971 is used in RA-301 chassis stamped G. GI Tuner 89 012 971 and 89 012 971 stamped G.
  - MI—Mica; P—Paper; E—electrolytic.

### UHF TUNER 89 013 291



### RESISTANCE MEASUREMENTS

All Readings to Ground

	1	2	3	4	5	6	7	8	9	0
V111	12K	0	0	35K-45K	40K-50K	0	0	0	0	0
V112	100K	47	0	35K-45K	40K-50K	0	0	0	0	0
V113	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V114	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V115	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V116	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V117	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V118	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V119	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V120	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V121	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V122	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V123	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V124	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V125	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V126	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V127	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V128	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V129	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V130	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V131	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V132	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V133	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V134	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V135	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V136	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V137	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V138	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V139	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V140	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V141	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V142	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V143	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V144	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V145	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V146	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V147	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V148	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V149	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V150	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V151	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V152	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V153	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V154	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V155	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V156	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V157	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V158	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V159	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V160	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V161	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V162	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V163	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V164	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V165	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V166	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V167	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V168	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V169	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V170	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V171	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V172	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V173	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V174	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V175	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V176	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V177	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V178	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V179	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V180	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V181	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V182	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V183	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V184	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V185	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V186	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V187	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V188	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V189	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V190	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V191	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V192	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V193	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V194	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V195	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V196	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V197	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V198	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V199	100K	0	0	35K-45K	40K-50K	0	0	0	0	0
V200	100K	0	0	35K-45K	40K-50K	0	0	0	0	0

The above resistance readings were taken with an RCA Model WV97A VTVM. All readings are in ohms. K=1000, M=1,000,000. When the reading is affected by a control, two readings are given. These readings indicate the variation produced by the control.

**DUMONT**  
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 Technician  
**CIRCUIT DIGEST**  
**120**

Chassis RA-301, 302:  
 Model RA-301-A1,  
 RA-301-A2, RA-301-A3,  
 RA-302-A1, RA-302-A2,  
 RA-302-A3



# capacitor replacements

## BENDIX CHASSIS T14-3, T14-10, T14-11

Symbol No.	Rating MF @ WVDC	Bendix Part No.	Sprague Replacement
C35	10 @ 50	267024-16	TVA-1304
C41	100+40+10 @ 200/100 @ 50	267005-11	TVL-4516
C42	80+40+10 @ 450	267005-8	TVL-3792
C50	2 @ 50	267024-17	TVA-1301
C55	80+40+10 @ 450	267005-8	TVL-3792
C81	10 @ 200	267024-14	TVA-1504
C85	10 @ 50	267024-16	TVA-1304

## PACKARD-BELL CHASSIS 2740

Symbol No.	Rating MF @ WVDC	Packard-Bell Part No.	Sprague Replacement
C6	5+5 @ 75/25 @ 25/100 @ 15	24069	R-1316
C13	40+40 @ 450/100 @ 200	24055	TVL-3764
C16	40 @ 350	24063	TVA-1611
C66	40+40 @ 450/100 @ 200	24055	TVL-3764
C72	10 @ 600	24068	R-1222
C56	Integrator Plate	23951	101C1

## PHILCO R-F CHASSIS R-191, DEFLECTION CHASSIS D-191

Symbol No.	Rating MF @ WVDC	Philco Part No.	Sprague Replacement
C100	120 @ 150	30-2568-51	TVL-1428
C101	120 @ 150	30-2568-51	TVL-1428
*C103	20 @ 475/80+20+10 @ 300	30-2584-35	TVL-4801
C209	40+10 @ 300	30-2584-33	<sup>1</sup> TVL-3570
C410	2 @ 50	30-2417-7	TVA-1301

\* Includes C708, C815A, C815B  
Installation Notes: <sup>1</sup>Omit 20MF section

Sprague makes more capacitors . . . in more types . . . in more ratings . . . than any other capacitor manufacturer. Send 10c for 48-page TV Replacement Capacitor Manual to Sprague Products Co., 65 Marshall St., North Adams, Mass., or get it FREE from your Sprague distributor.

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## FOR SETS OF THE MONTH

## RCA CHASSIS KCS84C, KCS84E

Symbol No.	Rating MF @ WVDC	RCA Part No.	Sprague Replacement
C117	100 @ 400/20 @ 50	78212	<sup>1</sup> TVL-3672
C119	80+20 @ 400	77644	TVL-2673
C124	10+5 @ 350/30 @ 50	78213	TVL-3637

Installation Notes: <sup>1</sup>Omit 10MF section

## DUMONT CHASSIS RA-301, 302

Symbol No.	Rating MF @ WVDC	Dumont Part No.	Sprague Replacement
C290	25 @ 50	03138760	TVA-1306
C291	5 @ 50	03120960	TVA-1303
C292	30+10+10+10 @ 400	03130811	TVL-4766
C293	10 @ 350 S.P.	03250421	R-1468
C294	60+30 @ 400/10 @ 250	03138731	TVL-3790
C296	4 @ 400	03115080	TVA-1702
C297	100 @ 50	03138770	TVA-1310
C298	50 @ 25	03000020	TVA-1206
N201	Integrator Plate	88000631	101C1

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**1954 Dodge, Deluxe 1/2-Ton Panel Truck**  
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**1st prize**  
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**1954 DeSoto Automatic "Hard-Top"**—170-H.P. Fire Dome V8 engine, Power-Flite Transmission, Power Steering . . . completely equipped, including radio and heater.

**HURRY, HURRY, HURRY** . . . contest closes April 30, 1954. See your RCA Distributor Salesman right away, and get your copy of the "clue book" that includes complete contest rules, official entry blank, and clues that will help you win.

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The RCA "Tell and Sell" campaign was designed to help you sell your service on a local level. Everything you need, from giant illuminated signs and window displays, to a consumer booklet that will give your customers the facts of TV servicing—is available from your RCA Distributor. See him today!

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Tells the customer what is needed to bring him expert service. Points you out as "the man who keeps the show going."



1954 RCA BABY DISPLAY



NEW GIANT OUTDOOR SIGN



NEW RCA SERVICE DECAL



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DRAMATIC "EDGE LIT" SIGN



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