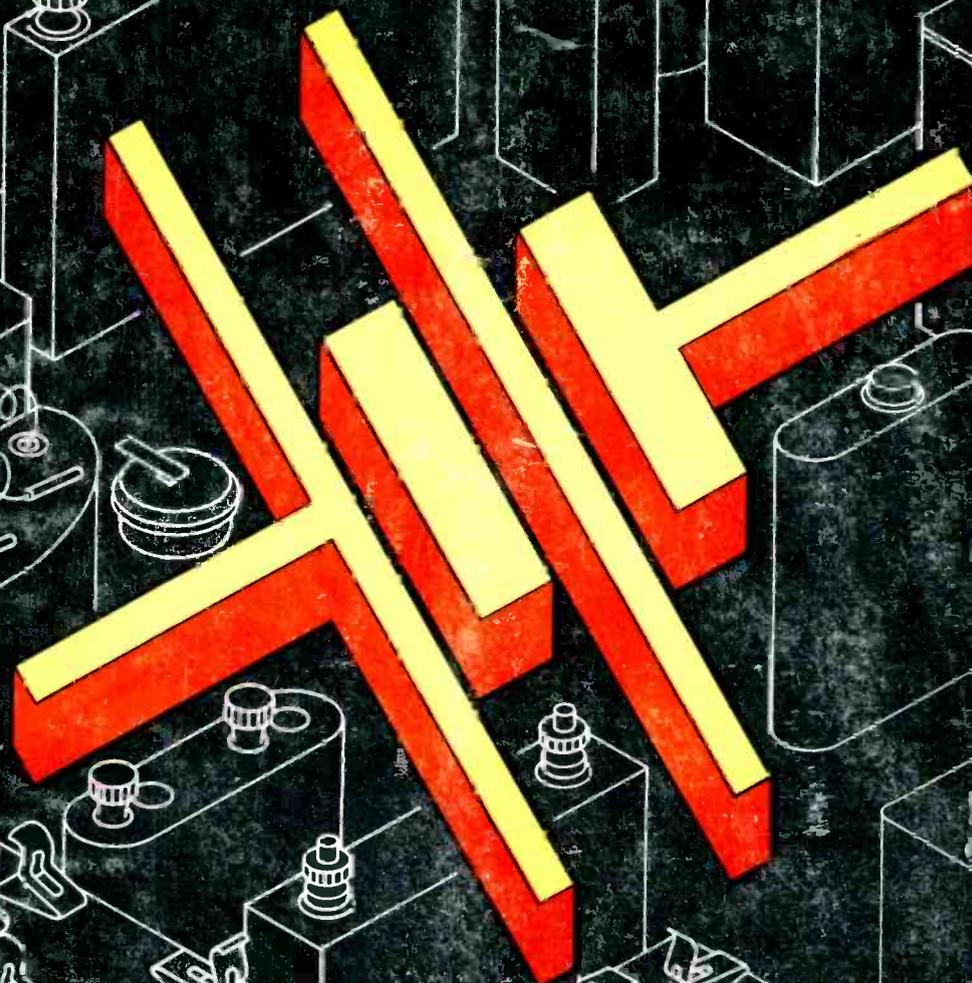


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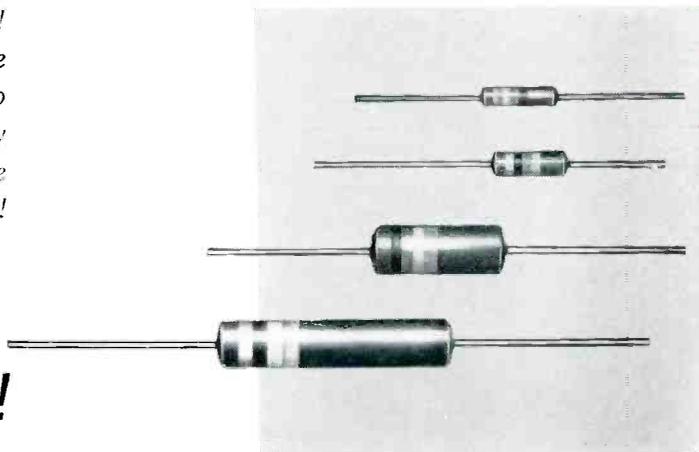
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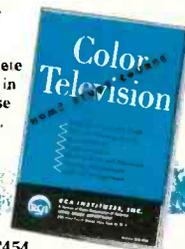
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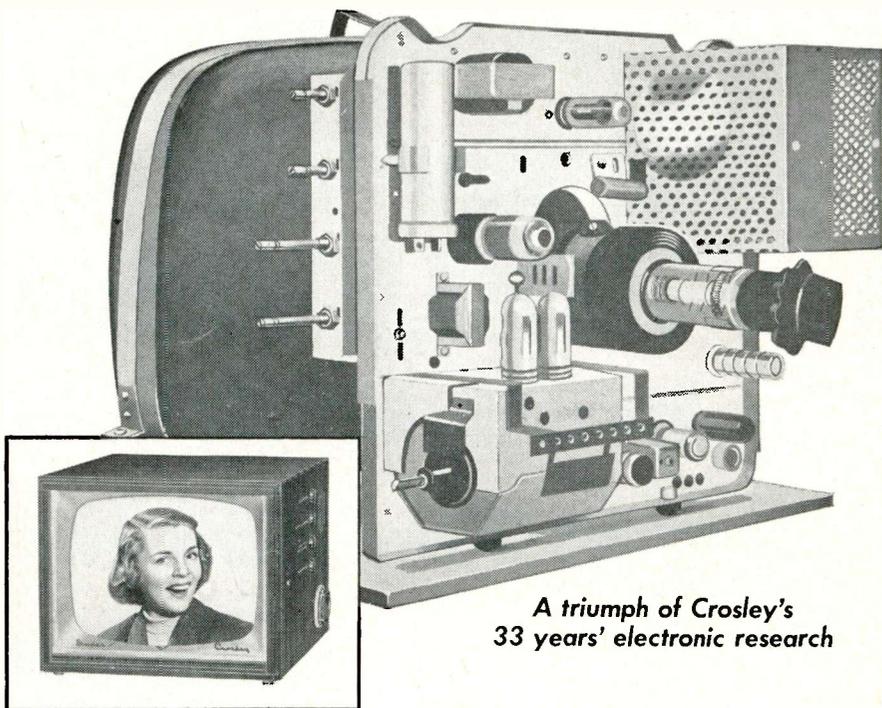
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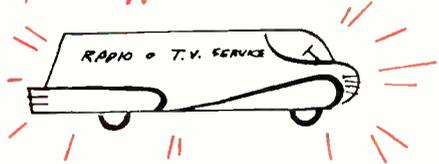
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- 100 Ninth Prizes of \$15 Each in Merchandise

FILL IN THIS ENTRY BLANK TODAY!

1. League Leaders on August 1st, 1953, were:

AMERICAN LEAGUE

NATIONAL LEAGUE

2. Here is what I would say to the lady in the Cartoon:

.....

.....

.....

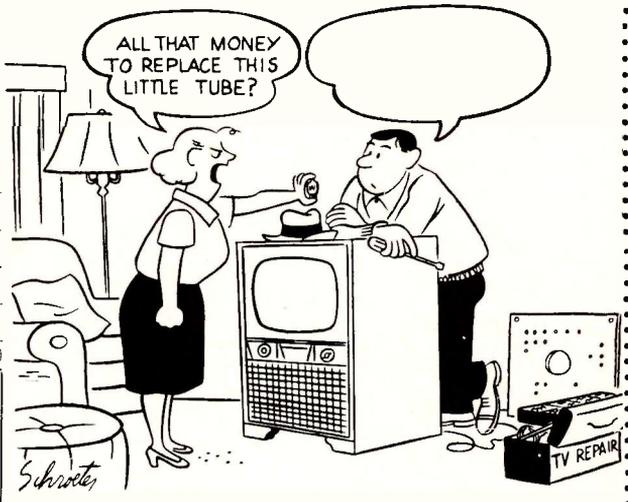
(ATTACH AN ADDITIONAL SHEET OF PAPER IF NECESSARY—100 WORDS MAXIMUM)

MY NAME

SHOP NAME

STREET

CITY.....STATE.....



THIS SPACE FOR DISTRIBUTOR SALESMAN'S CERTIFICATION

I certify this Entry Blank has been qualified by the purchase of (25 Westinghouse Receiving Tubes) (1 Westinghouse Picture Tube)

SALESMAN'S SIGNATURE

COMPANY NAME

CITY.....STATE.....

SEND ALL ENTRIES TO:

WESTINGHOUSE TUBE CONTEST

Box 610, Grand Central Station, New York 17, New York

Now... SOLDERING MADE TWICE AS EASY!

FIRST, the Soldering Aid.
Now, the **NEW CBS-HYTRON
SOLDER DISPENSER**
makes soldering *twice as easy.*

No more tangling with haywire coils of solder. Your thumb on knurled control wheel of unique Solder Dispenser feeds solder . . . retracts it neatly when job is done . . . without waste. A one-hand tool, Dispenser eliminates time out to unroll and straighten solder. Holds 72 inches of solder . . . a month's supply. It's compact . . . light . . . convenient . . . pencil-like . . . with handy pocket clip. Soldering becomes a pleasure with this time-and-money saver. Servicemen say, "Wouldn't be without it."



FREE . . . APRIL 15
THROUGH MAY 31

You can get this complete package free from April 15 through May 31. Your CBS-Hytron distributor will give you a free Solder Dispenser (loaded with 20 Refills) . . . and a plastic tube of 80 additional Refills. Enough to last 5 months.



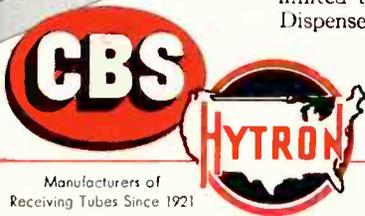
HOW TO USE. Your CBS-Hytron Solder Dispenser comes ready to use . . . with 20 lengths of 0.050-inch, 40/60 activated rosin core solder.

To start: Point Dispenser vertically downward. Shake a length of solder into position . . . at the same time rotating the knurled wheel toward you to begin the feed. Roll out an inch of solder and go ahead with the job. Need more solder? Just rotate the wheel with your thumb. When through, turn wheel away from you to draw unused solder back into Dispenser.

Knurled cap of Dispenser unscrews for refilling. Your package of 80 specially cut and sealed Refills gives you four months' supply. Plus the month's supply already loaded in the Dispenser.

Your new Solder Dispenser is fun to use . . . a natural companion to your Soldering Aid. And your Dispenser saves you time and money, too. Get yours today!

WITH YOUR ORDER FOR CBS-HYTRON TUBES . . . ONLY 75 RECEIVING OR 3 PICTURE TUBES
Just order 75 CBS-Hytron receiving tubes . . . or 3 CBS-Hytron picture tubes. Your CBS-Hytron distributor will give you this valuable, time-and-money saver . . . free. Remember, offer is limited to April 15 through May 31. And the unique Solder Dispenser and Refills are available *only* on this special offer.
ACT NOW!



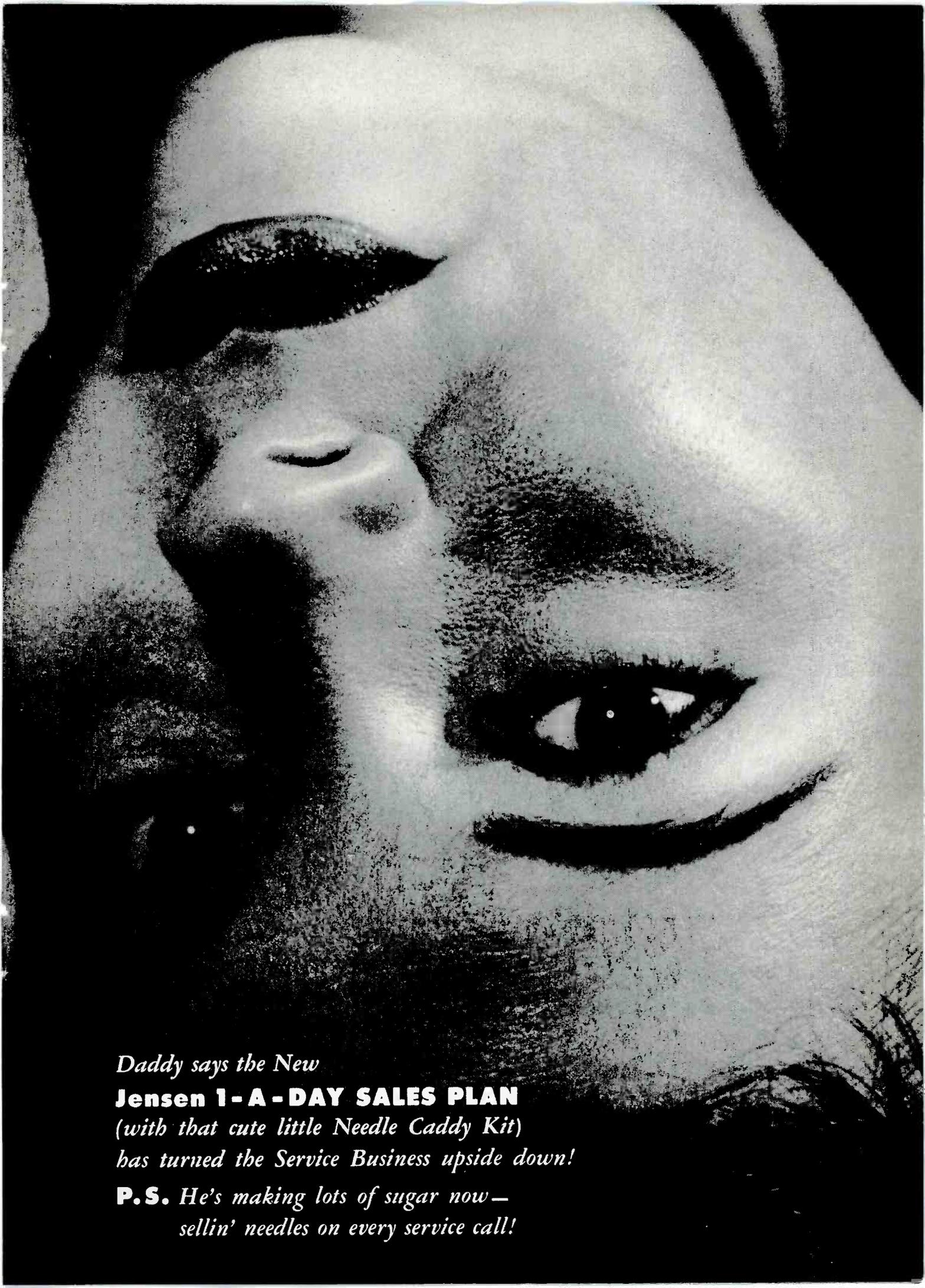
Manufacturers of
Receiving Tubes Since 1921

CBS-HYTRON Main Office: Danvers, Mass.

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 • CRYSTAL DIODES AND TRANSISTORS



Daddy says the New

Jensen 1-A-DAY SALES PLAN

(with that cute little Needle Caddy Kit)

has turned the Service Business upside down!

P.S. *He's making lots of sugar now—
sellin' needles on every service call!*

everything needed . . .

FOR THE QUALITY INSTALLATION

antennas

A complete line of VHF and UHF antennas, designed for high gain and top performance, is made by the antenna-wise craftsmen of AMPHENOL. The color-tested INLINE* and its new partner the Conical are superior VHF antennas. The Corner Reflector, Yagi, Rhombic and re-designed Bo-Ty are the sturdiest, most efficient UHF antennas offered today. For VHF, UHF or combined VHF/UHF installations the AMPHENOL Stacked-V is the first choice of distributors, dealers and the public.

*Reissue U.S. Patent 23,273

accessories

AMPHENOL accessories for the quality tv installation include Stand-off Insulators, mast sections and hardware, the UHF/VHF ISONET, new UHF/VHF Lightning Arrestor with *lowest measurable loss*, and the new TELE-COUPLEERS for effective coupling of two to four television sets to one antenna. The TRISONET couples high and low band VHF antennas and UHF antenna to one TV set.

lead-in

Unique AIR-CORE Tubular Twin-Lead (U.S. Pat. No. 2,543,696) is a truly efficient transmission line with lowest signal loss of any lead-in. AIR-CORE is a must for UHF television. AMPHENOL Flat Twin-Lead has been proved through years of effective transmission as a superior VHF lead-in.

the famous trade mark

AMPHENOL

AMERICAN PHENOLIC CORPORATION

LETTERS

To the Editors

UHF Conversion Charges

EDITORS, TECHNICIAN:

On Page 22 of your February magazine appeared an item titled "High UHF Conversion Fees." We are in a newly-developed UHF area and everyone is, as you say, grumbling. If you listen closely, you can tell that the tune has not changed a bit. They all still want something for nothing. Please tell us, someone, how you can convert and install an antenna for less than \$75.00, when the converter alone lists at \$55.00, \$60.00 and even \$75.00.

FLOYD A. YOUNG

Member, Board of Directors
Texas Electronic Technicians Assn.
Houston, Texas

Liked Color Article

EDITORS, TECHNICIAN:

Peter Orne and Sol Heller are to be congratulated on doing such a good job in explaining color interleaving (p. 26, Jan. '54 TECHNICIAN). This is the first time I saw any mention made in any magazine that the field frequency for color was NOT 60, and the horizontal frequency NOT 15750, even though some figuring with the color carrier as a basis would have shown this to be the case. It's the sort of thing that wouldn't ordinarily occur to the average serviceman, being strictly a technical problem.

MAURY GOLDBERG

St. Paul 1
Minnesota

Exaggerated Antenna Claims

EDITORS, TECHNICIAN:

Enjoy your publication very much and find it invaluable. Doubtless, you receive complaints and gripes from servicemen all over the country. Please add mine under "Exaggerated Antenna Claims." I am enclosing a copy of a letter to a manufacturer of a nationally advertised antenna.

Gentlemen:

Last month we received one of your antennas, providing all-channel coverage.

Your exact installation procedure was followed, using four-conductor polymethylacetylene transmission line. The antenna was mounted on a 20-foot mast for a total height of 45 feet above average terrain. 90-inch spacing between bays was used to give maximum gain on Channel 3. Results were as follows:

(The writer describes antenna performance on three VHF and one UHF channels, all WELL WITHIN the range claimed for the unit by the manufacturer. A satisfactory picture was received only on the one UHF channel; unacceptable pictures were received from two VHF stations, while the sig-

nal from a third was marred by snow and noise.—Ed.)

In order to give your product what we considered a fair trial, another installation was made approximately two miles from the original site, with the same results, except for weaker picture on Channel 3.

The customer for whom the installation was made was very unhappy with the results obtained; (to please him we installed) a rotomotor and conventional all-channel antenna, with satisfactory results.

We firmly believe your product has been given a fair trial and in this area does not meet with expected advertised results. Upon approval from _____ distributors, we are returning the unit to them for credit.

Naturally, the expense of transmission line, time and shipment charges two ways will be recorded in our books as experience.

JAMES T. SELF
Asheville Engineers for Television
Asheville, North Carolina

Comments from NRI Director

EDITORS, TECHNICIAN:

I would like to go on record with the multitude of other readers who must have written in to congratulate you on the quality of your new magazine—TECHNICIAN. It seems to me to combine all the best qualities of the old and very popular "Radio and Television Retailing," the technical magazine and the general interest group. More power to you!

JOHN H. BATTISON
Director of Education
National Radio Institute
16th and U Streets, N. W.
Washington, D. C.

Mash Note of the Month

EDITORS, TECHNICIAN:

Did you ask me how I liked TECHNICIAN? It most nearly approaches the Ideal. I open my latest copy with the same pleasure and satisfaction I experience when I have a receiver chassis bottom side up, probe in hand, and an obscure intermittent (at last) decides to intermit.

JAMES D. MOORE
12519 Dace Street
Norwalk, California

Favors Shop Hints

EDITORS, TECHNICIAN:

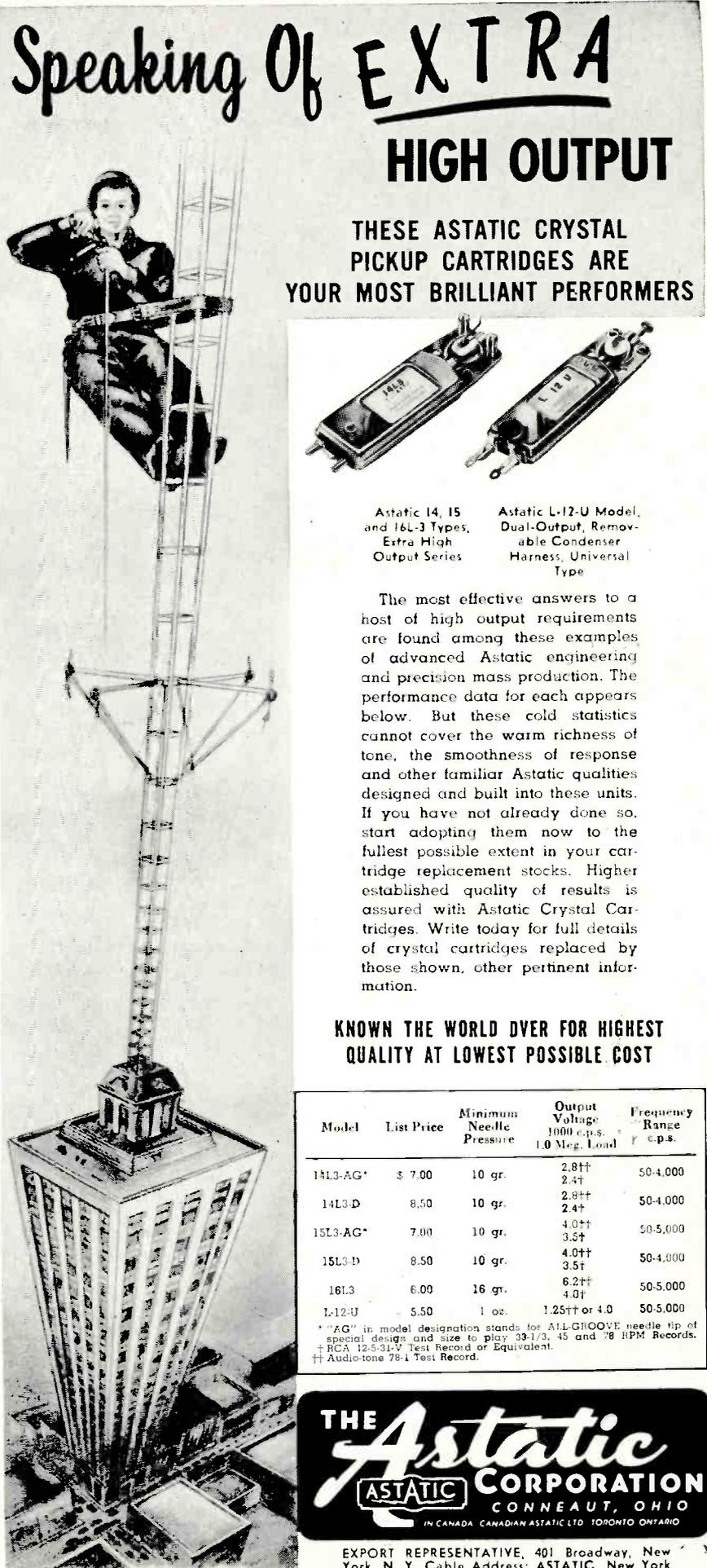
There is very intense interest among servicemen in ways of doing repair tasks quickly as shown in your "Shop Hints" and I would like to see you print a little booklet containing all the many shortcut ideas you have printed and have at your disposal. Such a booklet of "kinks" would find a wide sale among the radio fraternity. Do you think your office could get around to putting out such a publication? I'd give the matter serious thought.

JOSEPH AMOROSE
Amorose Radio
Route 4, Hungary Road
Richmond, Virginia

Speaking Of EXTRA

HIGH OUTPUT

THESE ASTATIC CRYSTAL PICKUP CARTRIDGES ARE YOUR MOST BRILLIANT PERFORMERS



Astatic 14, 15 and 16L-3 Types, Extra High Output Series

Astatic L-12-U Model, Dual-Output, Removable Condenser Harness, Universal Type

The most effective answers to a host of high output requirements are found among these examples of advanced Astatic engineering and precision mass production. The performance data for each appears below. But these cold statistics cannot cover the warm richness of tone, the smoothness of response and other familiar Astatic qualities designed and built into these units. If you have not already done so, start adopting them now to the fullest possible extent in your cartridge replacement stocks. Higher established quality of results is assured with Astatic Crystal Cartridges. Write today for full details of crystal cartridges replaced by those shown, other pertinent information.

KNOWN THE WORLD OVER FOR HIGHEST QUALITY AT LOWEST POSSIBLE COST

Model	List Price	Minimum Needle Pressure	Output Voltage 1000 c.p.s. 1.0 Meg. Load	Frequency Range c.p.s.
14L3-AG*	\$ 7.00	10 gr.	2.8†† 2.4†	50-4,000
14L3-D	8.50	10 gr.	2.8†† 2.4†	50-4,000
15L3-AG*	7.00	10 gr.	4.0†† 3.5†	50-5,000
15L3-D	8.50	10 gr.	4.0†† 3.5†	50-4,000
16L3	6.00	16 gr.	6.2†† 4.0†	50-5,000
L-12-U	5.50	1 oz.	1.25†† or 4.0	50-5,000

* "AG" in model designation stands for ALL-GROOVE needle tip of special design and size to play 33-1/3, 45 and 78 RPM Records.
† RCA 12-531-V Test Record or Equivalent.
†† Audio-tone 78-1 Test Record.

THE Astatic CORPORATION
CONNEAUT, OHIO
IN CANADA: CANADIAN ASTATIC LTD. TORONTO, ONTARIO

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

over **150,000**
already installed!



CHANNEL MASTER'S fabulous
CHAMPION*

the world's most powerful
all-channel VHF-UHF antenna

—OUT-PERFORMS AND OUT-SELLS THEM ALL!

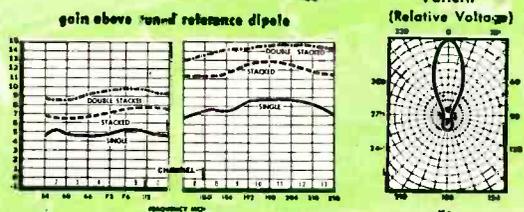
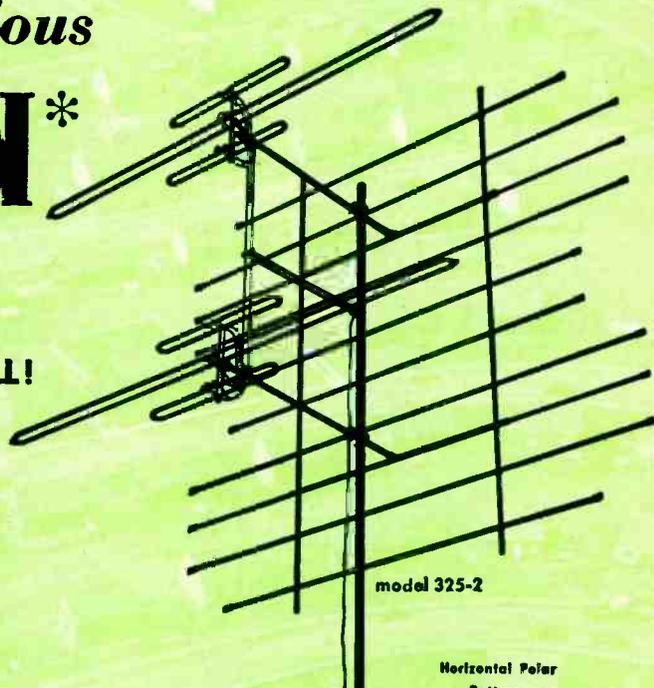
Never before in the history of television has an antenna received such an overwhelming reception. Channel Master's CHAMPION — in a few short months — has rocketed to the top as the nation's most-wanted, best-selling, best-performing TV antenna!

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!



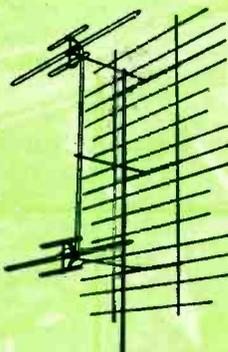
THE STACKED CHAMPION PROVIDES:

- 11-13 DB High Band gain
- 6½-7½ DB Low Band gain
- All-channel UHF performance

the new **SUPER CHAMP**

VHF-UHF antenna *model no. 325-6*
Actually out-performs the stacked CHAMPION . . . gives from 1½ to 3 DB more Low Band gain and 1 DB more High Band gain! **\$54.17 list.**

Conversion Kit:
For converting standard 2-Bay *model no. 325-7* CHAMPIONS into Super Champs. **\$14.58 list.**



Model No.		List Price
325	Single Bay	\$20.83
325-2	2-Bay	\$42.36
325-4	4-Bay	\$88.89
Separate Stacking Harness		
325-3	2-Bay Harness	\$ 2.08
325-5	4-Bay Harness	\$ 4.17



CHANNEL MASTER CORP.

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

*pat. pending

TECHNICIAN

& Circuit Digests

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

Antenna Manufacturers: Clean House!

First of a Series on Industry Problems

Technicians have for some time been trapped in the middle of certain industry problems that they are not responsible for, and can do very little about.

One of these problems—and we are not going to mince words—is occasioned by the exaggerated claims of some antenna manufacturers.

The feeling is common in the trade that something should be done about this misrepresentation. Antenna manufacturers themselves have expressed the hope that TECHNICIAN will assist in plucking this thorn from the side of the industry.

Your editor recently heard of a case where a sales engineer admitted “doctoring up” response curves and performance specs.

“Other companies do it, so we’re forced to do likewise,” the man said, according to the report. “Why should we let liars take away our business?”

Here is one phase of the problem, then. The companies who resort to misrepresentation feel that they must do so to meet the competition. Secondly, they believe it helps them sell more antennas.

Another phase of the problem lies in the reaction of the technician-dealer. This man buys an antenna on the basis of an ad, installs it, finds its performance inadequate. So then—he either returns it for a refund—if he can get one—and suffers a loss of the time spent in installing the unit; or else he leaves the unit up (if it isn’t too bad) and risks the loss of a customer (to say nothing of the business lost by the unfavorable publicity given to him by this dissatisfied customer). Other courses of action open to him are equally unpleasant.

Serviceman, Set Owner & Manufacturer Suffer . . . Nobody Benefits

The reputable and square-shooting antenna manufacturer gets hot under the collar because misrepresentation is unfair competition. The product of a rival company may be far inferior to his, but if it “dresses up” its specs and response curves, how can the serviceman reading the ads tell the true from the false?

The set owner, as we previously indicated, is also “miffed,” of course, but vents his wrath on the serviceman, knowing nothing of the real source of his trouble.

The serviceman thus becomes the goat in this case—as he has in so many others.

Manufacturers who misrepresent their products should realize that it is economically unwise to do so. Word eventually spreads regarding which company’s products are over-rated, and the company inevitably suffers.

It’s time the industry itself solved this problem of misrepresentation.

Publishers cannot police the industry, especially under circumstances where there is a wide difference of opinion on engineering designs, methods of testing, etc. An antenna that is perfect in one location may perform in a considerably less satisfactory way at some other site—a fact that helps complicate matters.

If the industry doesn’t find a solution to the problem and find one quickly, the government is very apt to step in, and put another undesired tentacle into our business—something few of us desire.

Our word to the offending antenna makers is—put your house in order and do it right away.

Childish behavior is definitely not good business.

Tuning In the

RENT-A-SET PLAN FOR COLOR: Emerson prexy, Benjamin Abrams, doesn't believe public will shell out for high-priced color set and steep service charges, just to get 2 color shows a week on a small-size screen. With larger pix tubes now on their way, Emerson would lease its current small-picture line of color sets on a monthly basis, rather than sell them (\$200 for first month, \$75 for each additional month).

RADIO GROWTH: Six years after the start of widespread commercial TV, radio is stronger than ever. The average TV set owner listens to the radio at least three hours a day—in the car, while doing housework, at the seashore, in the dentist's office and in bed. In 1953, more than 13 million radios were made and distributed as compared to about 7 million TV sets. One-third of the nation's families own 2 or more radios. One-fifth owns between 3 and 7 sets.

REASONS WHY SERVICE DEPARTMENTS FOLD UP: 1. Too much overhead. 2. Not enough volume. 3. Inadequate charges. 4. Inefficient or lazy employes. 5. Too high a rate of free call-backs. 6. Loss of too many customers because of unwise practices.

YEAR OF THE COLOR TV BOOM will be 1956, predicts Henry F. Argento, Raytheon vice-prexy. Large-screen color sets priced at around \$500 should be available by that time. Color today is still strictly experimental, he opines. A receiver using only four more tubes than a b & w set, plus a single-gun color crt, will pave the way to the predicted boom, Argento feels.

TELEVISION GROWTH: Last year, 225 TV stations went into operation, bringing the national total to 354. Look for 200 more stations in 1954. In all, 230 U. S. cities have one TV station or more; 152 of these cities offer live network shows. More than 27 million TV receivers are in use in this country so far, but there are still 16 million homes without TV facilities.

SAFETY GLASS OFFERED LITTLE PROTECTION when a 21-in. crt imploded in his shop, reports Richard Doyle, of Mount Kisco, N. Y. Pieces of the tube came through the "safety" glass, scattering as far as ten feet from the set.



What an implosion can do to safety glass. Controls on front panel have been masked off, in order to prevent identification of the set.

GERMANIUM DIODE production up sharply. In 1951, 5,600,000 units were made. The production for '54 is estimated at 18,300,000.

TOO MANY SHOPS KEEP SETS awaiting repairs on the floor. A few weeks ago, a Southern technician, running through a dark repair department, stepped into a TV chassis, smashed 5 tubes and nearly broke his neck as well. In addition to being dangerous, an accumulation of dusty chassis on floors is not a pleasing sight for customers, in instances where the latter are permitted to enter repair departments.



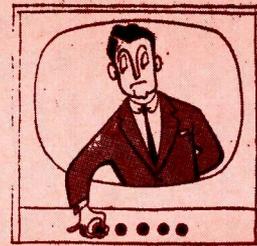
"The man who put it up said I'd have no trouble finding it. He said it was the one with the arms sticking out like this."

FROM HERE ON LOOK FOR: An increasing number of shops to be air conditioned . . . A slew of portables to come in for repairs and batteries . . . More interest in juke-boxes, and therefore, more service on such units . . . Money to be a bit tighter . . . Increasing work on those new "stripped"-chassis, low-priced TV sets . . . Also, diminishing interest in efforts to get licensing for technicians, and an upped number of service outlets. . .

DEALERS CAN GET AS MUCH AS 50 BUCKS for a product small enough to hide in the palm of one's hand—and we're referring to a phono needle. Smart owners and service managers always make certain that their outside men take needles with them on calls, and suggest stylus replacement to customers. This high-profit item, the phonograph needle, can bring in extra revenue to the wide-awake shop operator.

A FIRM COLLECTION POLICY is a must for any service department. Answers to the following questions should be available to men on outside calls: 1. Is the job C.O.D., or is it to be billed? If C.O.D. and customer says he'll drop in at the shop and pay later, what should the servicer do? Leave the set? Phone the office for instructions? 2. Is the technician to accept a check? 3. If customer on C.O.D. basis refuses to pay, on the grounds that the bill is too high or the work is unsatisfactory, is the technician authorized to make an adjustment? Should he, under such circumstances, leave the set without being paid? Numerous other money situations arise from time to time, and much grief can be eliminated by careful briefing of outside men.

Picture



ROLLING STOCK MUST ROLL. Dealers who don't think it essential to keep trucks in good condition should think twice about this matter. We know of a case where a truck, loaded with 7 repaired TV sets, broke down in a storm 8 miles from the shop. Repair cost on vehicle: \$70.00, and that doesn't count loss of the technician's time, and the grief accumulated through the beefing of 7 irate customers. When trucks are in bad condition, and need frequent repairs, it's usually cheaper to buy a new vehicle than to put up with the old heap.

AIN'T-LOVE-GRAND DEP'T. Male customer kicked to shop owner about what he considered to be too many calls on the home TV set. Owner dug into the matter and found that the daughter of the set owner and one of his technicians were "that way" about each other, and that the girl called, not for needed repairs to the receiver, but to be alone with the TV servicer.

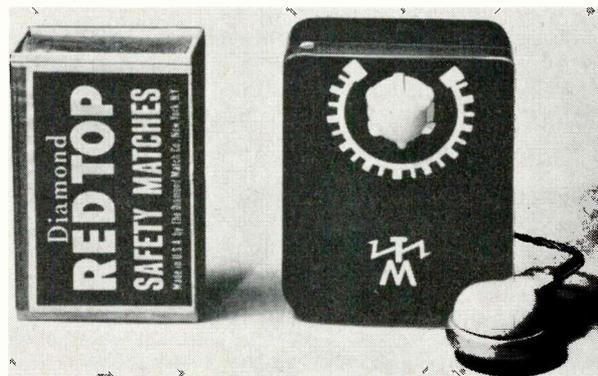
TO SAVE TIME AND MONEY, a New England service manager insists that employees who receive phone calls for repairs get as much information as possible regarding nature of complaint. Armed with all the info the customer is able to provide, the manager is often able to figure out what the trouble is; this helps him decide what tubes and components should be taken along on each service call. "Impossible to carry everything in the truck," the service manager comments, "but my method helps prevent returns to shop for parts, and is saving plenty of time—and time is money."

MORE SERVICING REVENUE ON THE WAY in record players and equipment. Phono record sales are likely to run more than 30% ahead of last year, and phonographs will sell to the tune of 3,800,000 units, it is estimated—an increase of 6%.

TRENDS OF THE TIMES: Increasing number of complaints of distributors "taking" service work away from dealers and selling same service at cut prices . . . Interest in Hi-Fi causing plenty of consumers to be more "sound-conscious," with result that many TV and radio set owners are spending money to improve sound of sets . . . In spite of belt-tightening in many areas, service charge rates on TV sets haven't dropped to any appreciable degree . . . TV set sales lively in spite of dire predictions of crepe-hangers. Total volume is likely to exceed 6 million receivers, considerably higher than even the optimists forecast just before the new year was ushered in . . . Before long look for a number of tiny radios, smaller than ever, to hit market.

HIGH PRICES ON SMALL-SCREEN COLOR SETS are helping push monochrome set sales back to normal. Price slashes on b & w models have also served to stimulate their sale. Public seems resigned to doing without color for a while.

TRANSISTOR RECEIVER HERE. First commercial set for public sale is match-box size, uses small earset, operates 500 hours on a tiny 3-volt cell, and is priced at \$16.95. This peanut personal portable, called the TRANSI-MITE, is made by Transi-Mite Radio Laboratory, Manteo, North Carolina.



Transistor set is shown beside match box to illustrate its size.

MANY A DEALER FLIPS HIS WIG when the customer demands that the new TV set for delivery and installation be sent to the home in the original factory carton. Reason is that the dealer would much prefer to test the set and make minor necessary adjustments in the shop rather than in the home, because in the latter place the customer feels that something's radically wrong with a brand-new receiver which won't operate perfectly first crack out of the box. A recent survey shows that the nation's retailers in TV and appliances spend an average of 4% of gross on servicing products under guarantee.

LOUDSPEAKERS, traditional bottlenecks in home Hi-Fi systems because of the space required by their enclosures for good bass reproduction, may take on a new look. Engineer Paul A. de Mars has come up with a thin plastic panel, 20-in. square, to replace the speaker cone as the vibrating member of the bass reproducer. Better bass is obtainable with this construction, it is claimed, than with current 12-in. cone-type designs.

CALENDAR OF COMING EVENTS

- May 17-20: Electronic Parts Show, sponsored by Association of Electronic Parts and 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.
- Aug. 25-27: Western Electronic Show & Convention, Pan-Pacific Auditorium, Los Angeles (show) Ambassador Hotel, Los Angeles (convention hq.)
- Sept. 24-26: Fifth Annual TV-Radio Service Industry Convention and Exhibitions, Morrison Hotel, 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.

Understanding the Matrix-Adder

Conversion of Color Information into Y, Q and I Signals;

• In preceding articles, we outlined the functions of the various sections of the color TV receiver. In this piece, we will consider in some detail how the detected video signal is processed and applied to the 3-gun color tube.

As we pointed out in previous discussions, red, blue and green information is not transmitted *directly*, but is, instead, changed into Y, Q and I signals. If direct transmission of the three colors just mentioned was made, each color would have

BY PETER ORNE
AND
SOL HELLER
Managing Editor, TECHNICIAN

to be transmitted for a band-width of app. 4 mc, and too much spectrum space would thus be needed. Changing the color signals into Y, Q and I components permits an efficient use of the spectrum space actually available; Y video information occupies 4 mc, but I signals only cover 1.5 ms, and Q signals a mere 0.5 mc.

This signal conversion at the transmitter necessitates a reconversion job at the receiver—i.e., the demodulated Y, Q and I signals must be changed back into red, blue and green color information. The adders perform this function. How they do so will be described in this article.

The primary requirement the adders must satisfy is that they perform a *pure addition* to produce the red, blue and green signals—that is, no non-linearity must be present in the operation of these stages, since such a defect can cause an undesired heterodyning between the three color signals. Careful design of the stages where addition is performed is therefore necessary. Degenerative amplifiers are used, to better guard against non-linear operation.

An additional adder function is *isolation*; each adder stage prevents interaction between the original detected signals present at its input, and the added signals at the output.

How Adders Work

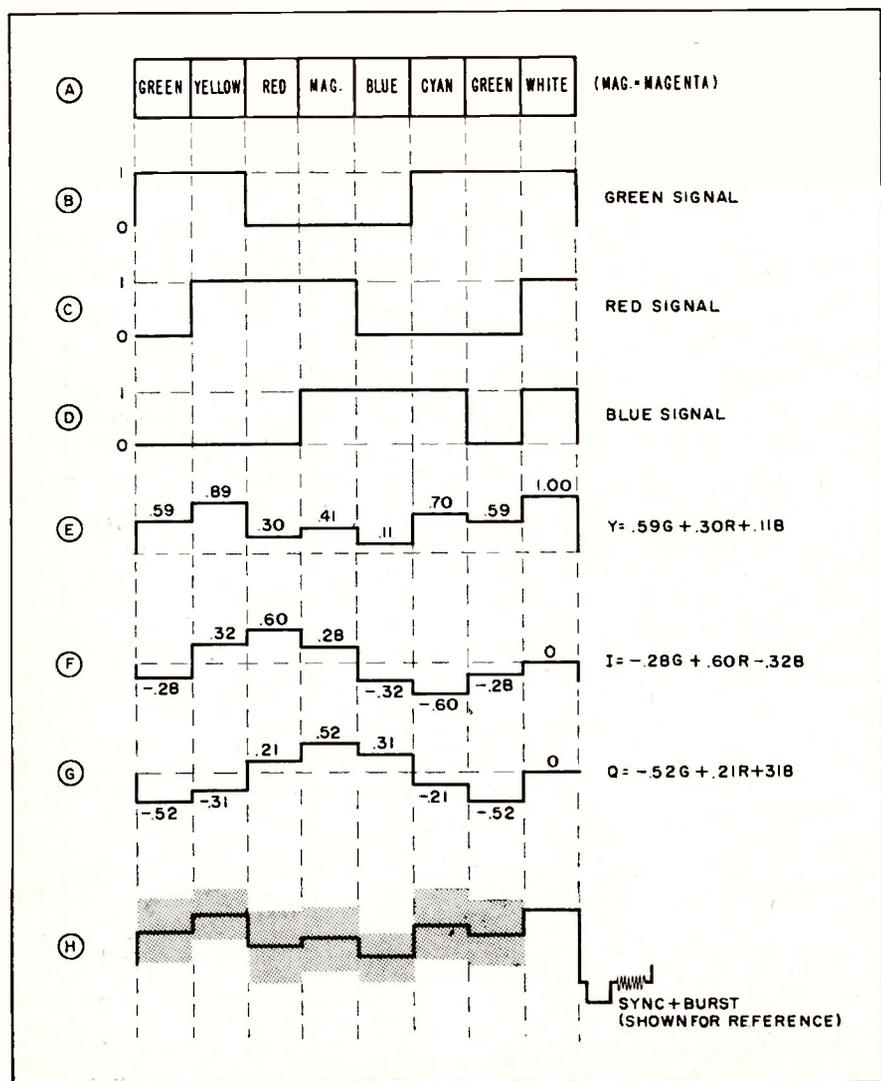
To further analyze the operation of the adder stages, we must consider the incoming signal. It will perhaps be easiest for us if we assume that a bar pattern generator is the source of the color signals. We can follow the bar pattern signal from its starting point at the transmitter pickup tubes, to its final destination at the guns of the receiver crt.

The makeup of the pattern, as it looks to the transmitter, is indicated in section A of Fig. 1. The color bars produce (in the transmitter cameras) the green, red and blue signals shown in B, C and D of Fig. 1.

To understand the discussion that follows, the reader should remember that the color yellow can be made by mixing red and green.

(Readers who have worked with paints may feel that this is erroneous, but it isn't. We are talking here of mixing colored lights, or *adding* colors in the truest sense of the term. When pigments are combined, on the other hand, a *subtraction* from white light occurs;

Fig. 1A—Bar pattern scanned by color TV cameras. B, C, D—Voltage outputs of green, red and blue cameras during scanning of bar pattern. E, F, G—Y, Q and I signals developed in transmitter matrix from green, red and blue output signals of color TV cameras. H—Composite color video signal after I and Q signals have been modulated onto the subcarrier and combined with the Y signal. Reverse of process shown in this sketch is illustrated in Fig. 4.



Section of the Color TV Receiver

Reconversion of Y, Q and I into Red, Green and Blue

the rules for the two processes are different.)

The transmitter cameras analyze the bar pattern. Since yellow is made up of green and red, full output is obtained from the green and red camera when the yellow bar is being scanned, as indicated by the maximum level of green and red signal under the yellow bar. No output is obtained at this time from the blue camera; note that the blue signal has zero amplitude at the section which falls below the yellow bar. The other bars present can be similarly analyzed with respect to the signals they generate in the transmitter cameras.

Transmitter Matrix Action

The transmitter must convert the color signals shown in B, C and D of Fig. 1 into Q, Y and I information. Considering the signals produced by the yellow bar only: Some circuit must change the full green, full red and zero blue information present into Y, Q and I signals. The transmitter matrix does this. The amounts of red, blue and green that go into the Y, Q and I signals are indicated in the formulas shown in E, F and G of Fig. 1. These formulas are in accordance with NTSC signal specifications. In accordance with the formulas, the yellow bar produces a Y signal 89% (.89) of the maximum or 100% level; the I signal produced is 32%; and the Q signal is -31% (the minus sign indicates it is negative-going).

As an illustration of how these percentages are obtained, let's consider the 89% level of Y signal that the yellow bar produces. This percentage comes from adding up the $.59G + .30R + .11B$ given by the equation in E. Inasmuch as no blue signal output is produced by the yellow bar, the $.11B$ disappears—11% of zero is zero. The sum of $.59G + .30R$ equals .89—i.e., 89% of the total amplitude of the red and green signals. The conversion of primary color signals into Y, Q and I information can be worked out in a similar way for the other bars present.

The I and Q signals must be

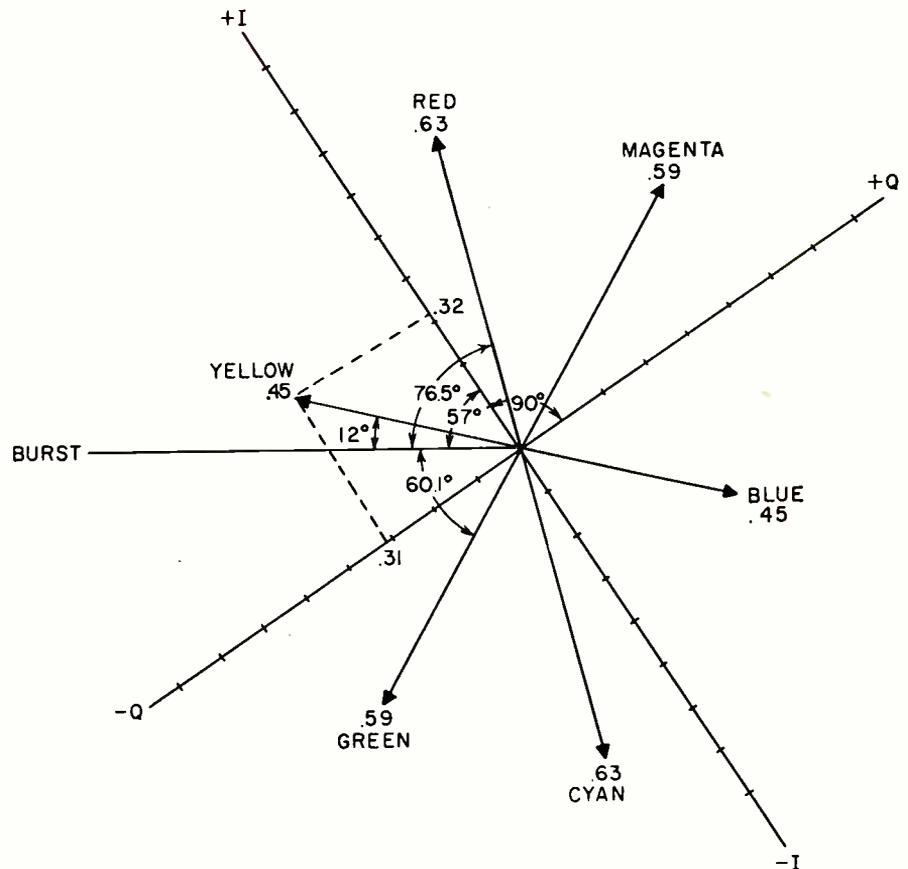


Fig. 2—Color vector diagram showing the amplitude and phase of the colors most important to the serviceman. Hues not shown fall between the colors of which they are compounded—for example, orange would (if shown) lie between yellow and red. Amplitudes of the various vectors indicate fully-saturated colors. Phase of burst is given for reference.

modulated onto the color subcarrier in quadrature (as explained in the Feb. '54 issue of *TECHNICIAN*), to produce the higher-frequency sideband signals needed for transmission. These sidebands combine at the transmitter, and form a resultant signal which contains the transmitted color information. The process may be represented by the addition of vectors. If the sidebands produced by the Q signal is one vector, and the sidebands created by the I signal another, the resultant (produced by adding the two, (1) will indicate the color by its *direction*, or *phase angle*; the *amplitude* of the resultant will represent the amount of saturation.

The vector diagram of Fig. 2 shows the phase angle of the various colors, compared to the burst signal.

Yellow lags the burst signal by 12 degrees (signals are considered to rotate counter-clockwise); red lags the burst signal by 76.5 degrees, etc.

When the amplitude of the yellow signal is .45 or 45%, as shown in Fig. 2 (approximating 45% sub-carrier modulation) fully saturated yellow is being transmitted; when the amplitude of the yellow vector is smaller, the saturation is proportionately lower.

The fractions shown beside each color vector indicate the amplitude (of modulation) needed to produce a fully saturated color.

Some readers may wonder why 100% amplitude is not used for full saturation. Such maximum modulation is avoided because the Y signal must still be added to the color information. Reducing the Q and I

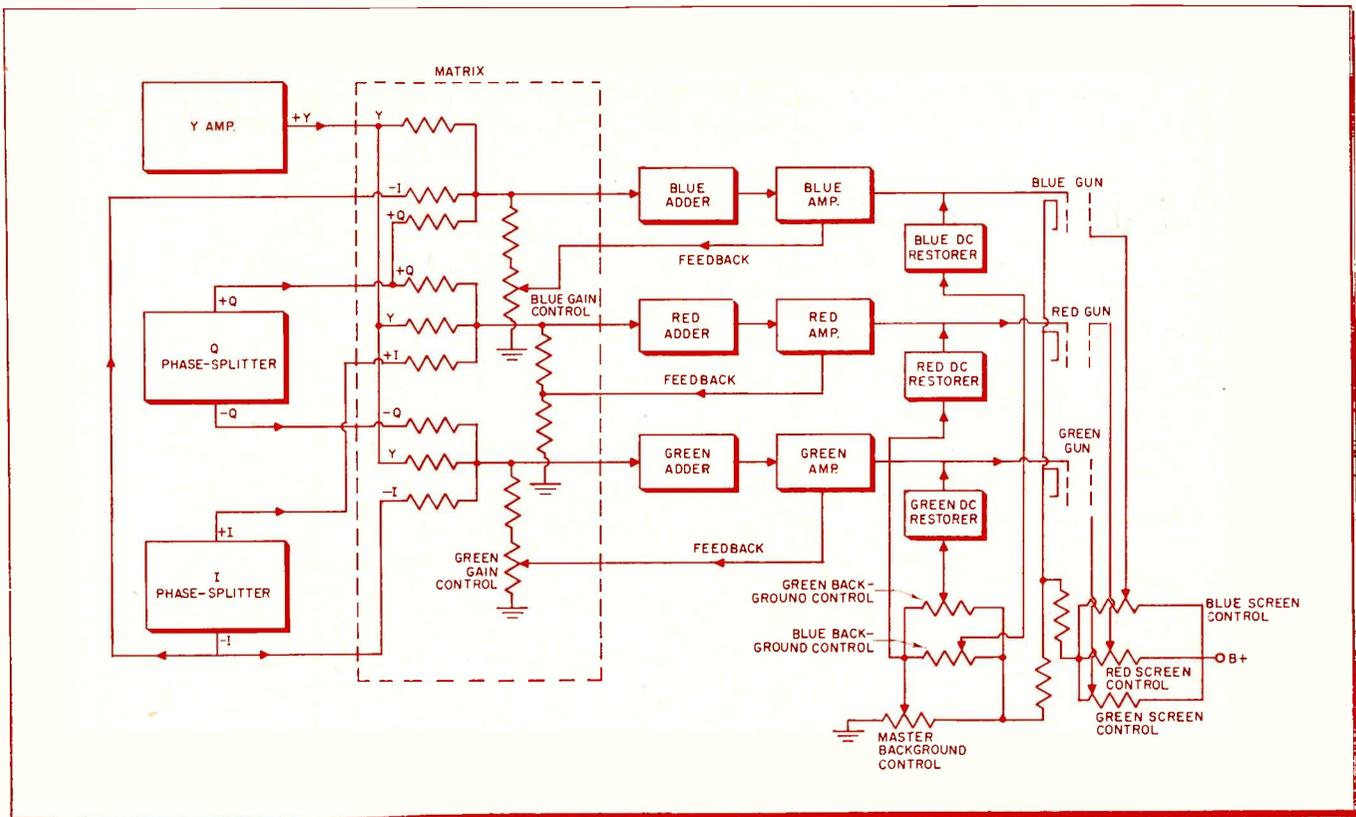


Fig. 3—Block diagram of matrix-adder section of color receiver. The matrixes are purely resistive networks in grid circuits of the adder stages.

signals to the maximum levels shown in Fig. 1 will prevent the transmitter from being overloaded when handling highly saturated colors that contain a high brightness component.

The *I* and *Q* axis in Fig. 2 represent the phase angle of the subcarrier, when *I* or *Q* signals alone are being transmitted. This vector diagram can be used to determine the correct amount of *I* and *Q* signal needed to represent any of the colors shown.

Suppose, for instance, it was desired to find out how much *I* and *Q* signal was necessary to represent yellow. Dotted lines would be drawn as shown, to complete the parallelogram for which the yellow vector forms the diagonal. The *Q* signal level, it is now readily apparent, is -31%; the *I* signal is 32%. These amplitudes and polarities are identical with the ones indicated for the yellow-produced *I* and *Q* signals in *E* and *F* of Fig. 1.

Subcarrier Amplitude

One final comment on the vector diagram of Fig. 2. As the saturation of a color decreases—that is, as the color is mixed with white—the amount of color information decreases. For instance, a half-saturated yellow will produce a subcarrier amplitude in the yellow

direction of .225. This amplitude keeps decreasing as more and more white is added. When a pure white is finally reached, the color subcarrier amplitude becomes zero.

Fig. 1H illustrates the composite video signal (produced by the bar pattern of 1A). This waveform represents the sum of the *Y* signal and the *Q* and *I* color sideband signals. This is how the signal looks just before it modulates the carrier at the transmitter; this is also how it will look at the output of the video detector, provided no defect is present at any point in between (either at the transmitter or the receiver). The receiver must reconvert this composite signal into the original colors of which it was formed. These color signals are then applied to the three guns of the receiver's crt, and cause the transmitted scene to be correctly reproduced.

With regard to the recovery of the *Y* signal: the composite color signal can be, and is, used as the *Y* signal. This is so because the *Q* and *I* components that are also present will not interfere with *Y* signal reproduction; the interleaving effect (discussed in previous articles) makes these *Q* and *I* signals invisible.

The color subcarrier component of the composite video signal (a portion of subcarrier remains in

spite of its suppression at the transmitter) can cause a noticeable, crawling black-and-white dot pattern to become visible; a trap tuned to 3.58 mc is inserted to eliminate this subcarrier component.

The matrix (Fig. 3) applies the *Y*, *Q* and *I* signals to the adders, in the amount and polarity needed for recovering the red, blue and green color information.

Adders Need *Y* Signal

The full *Y* signal must be applied to each of the three adders. This is necessary because the color receiver has been so adjusted that a black-and-white picture will be reproduced *only* when equal amounts of input are supplied to each adder (red, blue and green). Putting it a little differently: all the crt guns must be activated. Since *Y* is the only signal present in the case of a black-and-white transmission, *Y* information must be applied to each gun. If it was *not* applied to every gun, the resulting inactivation of one or more guns would not permit the formation of a black-and-white picture.

The chrominance information must be added to the *Y* signal in such a fashion that it will cancel this *Y* signal on any gun that should not be in operation at some particular instant; in addition, the chro-

minance signal must cause the guns that should be active, to be so. To explain: Suppose a yellow signal is coming in. There is no blue in yellow. Therefore the blue gun must be cut off when yellow is to be reproduced. Since the blue gun tends to be activated in this case by the Y information applied to it (89% during saturated yellow), a signal opposite in polarity is added to the Y signal present at the blue gun, causing the Y information to be completely canceled. In this way, the blue gun is completely inactivated, as it should be.

Analyzing Formulas

Fig. 4 shows the proportions and polarities of Q and I signals that must be added to the individual guns in the color receiver's crt, to obtain the color output desired from each.

Let's consider what the formulas in Fig. 4 mean. Suppose we investigate what happens at the three guns in the receiver's crt when a fully-saturated yellow bar is being scanned at the transmitter. We'll begin with the green gun.

The formula for obtaining green (given in Fig. 4A) is as follows:
 $-.271I - .647Q + Y = \text{Green}$

Since the amplitudes of I, Q and Y when the yellow bar is being scanned are 32%, -31% and 89% respectively (as indicated in Fig. 1E, F and G), these values are substituted in the preceding equation, causing this equation to become:
 $-.271(.32) - .647(-.31) + .89 =$
 $-.09 + .20 + .89 = 100\%$

Full output from the green gun is thus obtained when the yellow bar is being scanned.

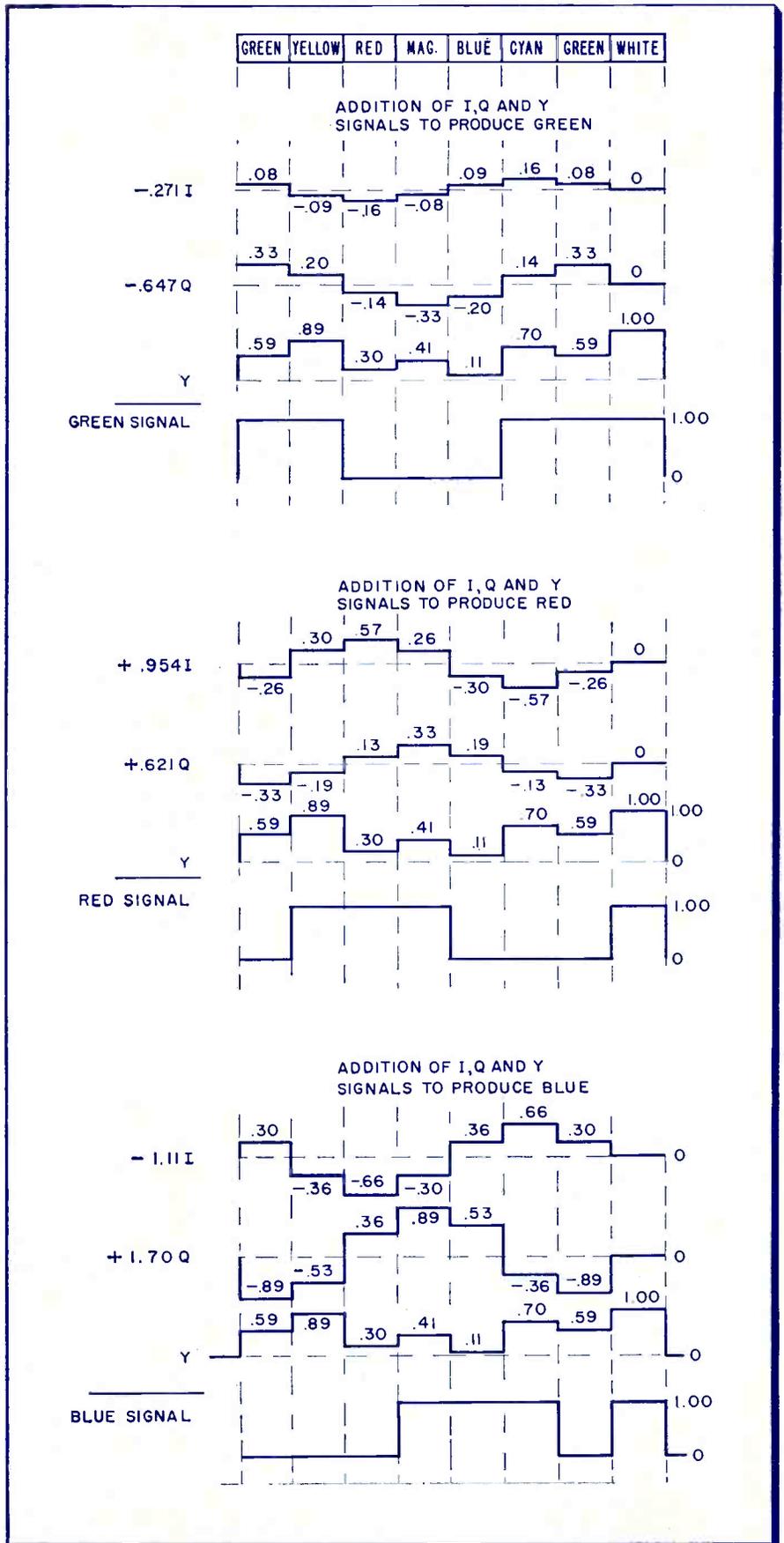
In a similar manner it can also be shown that there is full output from the red gun at this time, but zero output from the blue gun.

The multiplications in the equations just cited are achieved in the receiver matrix circuit by use of the proper resistance values in this network.

Why have we discussed the waveforms of Figs. 1 and 4 in detail? Just as an understanding of the working of the different sections in the black and white receiver helps in servicing b & w sets, so a thorough understanding of the way that colors are matrixed is valuable in color set repair. As a matter of fact, it is often possible to pinpoint the trouble present to the stage at fault, by proper interpretation of the bar pattern seen on the crt screen.

Next month: Service approach to problems involving incorrect coloring.

Fig. 4—How receiver matrix operates. The detected Y, Q and I signals are combined in the amounts shown to produce the desired green, red and blue signals. After amplification, these signals are applied to their respective guns in the crt of the color receiver. The process indicated is the reverse of the one illustrated in Fig. 1. A bar pattern is assumed as the incoming signal. The colors in the pattern are shown at top for reference purposes.



Focus Circuit Problems in TV Sets

EM and PM Units; Defects, Tests, Adjustments. Electrostatic and Electromagnetic Focus. Yoke-Caused Defects

BY M. G. GOLDBERG

• The focus circuitry of a TV receiver doesn't cause the average TV serviceman many headaches. When troubles do occur, however, lack of familiarity with symptoms and cures may lead to much wasted time and effort in tracking down the cause of the difficulty. Troubles in the focus circuit, for instance, can cause the picture to be so dim and lacking in definition that the technician may in

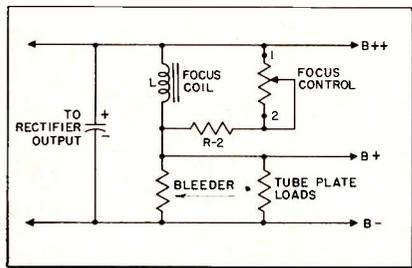


Fig. 1—Circuit section showing shunt focus control and series load. (Tubes are the load.)

some cases wrongly assume that the picture tube is at fault. Another trouble that may produce misleading symptoms is an unusually weak PM focus unit. The effect on the picture is very much the same as that caused by a gassy crt, everything on the screen presenting a dull gray or muddy appearance.

The first recommended focus circuit test is to turn the focus control from one extreme to the other, and note whether or not a "best" point may be found, with poorer focus present at either side of this point. If the results just described are obtainable, it may safely be assumed that the focus circuit is functioning properly; note, however, that a slight movement of the focus magnet or coil forward or backward may increase the area of good focus on the screen.

With the EM types, it may be found that the focus control must be set at one extreme or the other for best definition. If, at this optimum setting, maximum current flows through the coil (refer to Fig. 1), the trouble may be due to shorted coil turns, or insufficient focus coil

current due to low "B" voltage, or low emission in one or more tubes which draw their plate currents through the focus coil.

If current through the focus coil is normal, the setting of the control will be at some point between 1 and 2 in Fig 1. Shorted turns will reduce the inductance of the coil; more current must be sent through the winding to compensate for such a condition, because the product of I (amperes) and N (turns) must be the same as before the defect occurred. This calls for an adjustment of the control closer to point 2. The same applies when the bleeder resistor (if present) increases in value with age, or the tube plate load currents decrease for some reason, causing less current to flow through the bleeder resistor and focus coil.

The last-named condition (decrease in tube plate load currents) may be due to 1—Aging of the tubes that draw plate current through the focus coil; 2—Increase in the value of fixed bias resistors; 3—Drying out of input filter capacitors, which will reduce the "B" voltage, and consequently the current supplied to the various circuits; 4—Falling off of the output of selenium rectifiers, due to age.

When current focus is approached

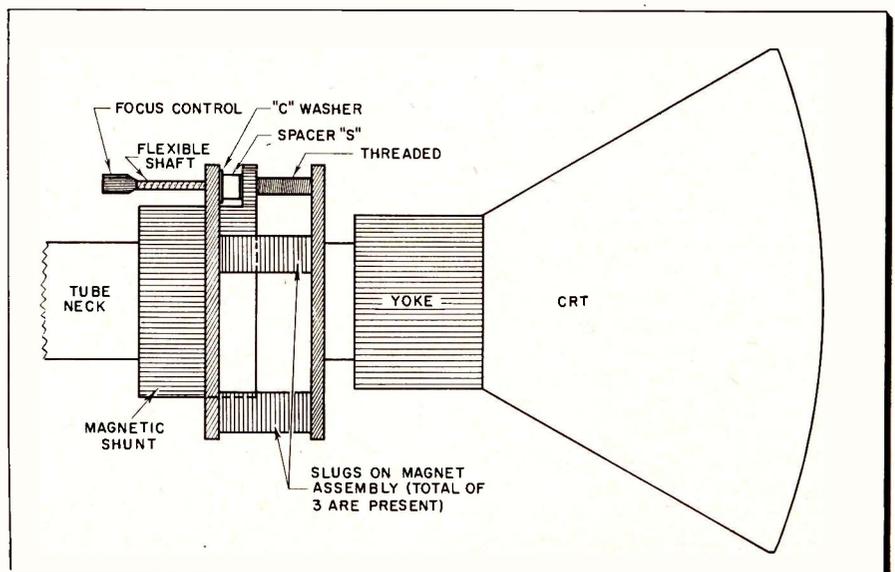
(but not reached) with the control up against the stop at point 1, the control's effect on focusing will not be improved appreciably if R-2, the limiter resistor, is shorted out by the serviceman, since R-2's value is only 10 or 15 ohms; also, the control may burn out near point 1, if such a procedure is resorted to. Replacing a poor audio output tube (such as a 6K6 or 6V6) may allow sufficient additional current to flow through L (Fig. 1) for the proper range of adjustment to be once more obtained.

Replacement of PM Unit

If moving the magnetic shunt on a PM unit outward as far from the PM slugs as it will go does not provide an optimum focus setting, the assembly must be replaced. (I have never run across a case where some trouble other than a defective focus unit was responsible for such a condition).

Presence of a poor crt will usually make it necessary for the ion magnet to be moved away from its normally correct setting toward the crt base—I have two such ion magnets in customers' homes sitting on the base itself, to keep their associated crt's operating as long as possible—

Fig. 2—Pictorial sketch of focus assembly, showing location of units referred to in text.



but regardless of the age of the crt, the focus magnet strength doesn't have to be adjusted very much. Just this past week I had a case where the crt took 10 minutes to warm up to the point where it would provide a reasonably good picture, after which it performed fairly well. Because the picture was so good after warm-up, I thought maybe the ion trap or focus were badly out of adjustment, but while the ion trap gave a slightly better picture when reset for "hot" position than for the "cold" one, the focus magnet adjustment stayed very much the same for both conditions.

Increasing Adjustment Range

Never disassemble a good PM unit for any reason since doing so will almost certainly weaken the unit. On the type shown in Fig. 2, a wide spacer *S* limits the maximum range of travel of the magnetic shunt. By removing and discarding this spacer, further adjustment in the desired direction may be obtained. If the adjustment is still insufficient, a replacement of the assembly is called for. The spacer just mentioned can be removed by taking out the "C" washer and threading out the control shaft, after which the shaft and the "C" washer can be replaced without the spacer. Another type of PM focus assembly (to which the procedure outlined does not apply) is illustrated in Fig. 3.

Lack of proper focus adjustment in some Motorola receivers, especially those using smaller screens up to 14 inches, usually turned out to be due to a low-emission 6BQ6-GT, even though the receiver seemed to be putting out a fairly good picture. Before attempting ion magnet, centering and focusing adjustments on these receivers, it is a good practice to try a new horizontal output tube first.

Shortly after the Korean War started in 1950, magnet material became scarce; electrostatic focusing was introduced in consequence in large picture tubes. The electrostatic-focus circuits used a high-voltage supply up to 4000 volts which was obtained in a manner similar to the one schematically shown in Fig. 4. Advantage was taken of the fact that a high-voltage pulse was available at the output tube plate; this pulse was rectified and filtered, then applied to a high-resistance potentiometer for adjustment purposes.

The electrostatic focus crt's used two extra grids in the electron gun. The adjustable dc voltage put out by

the special hv supply was applied to one of these grids, to provide focusing. Five grids in all were present in the electrostatic-focus crt, compared to three grids (grid, anode no. 1 and anode no. 2) in the EM-focus type of tube. Later the self-focusing crt was introduced, eliminating the need for the 2nd rectifier tube, with its associated socket, bleeder resistor, potentiometer and filter capacitor.

In the adjustable-focus electrostatic crt, a rare case of trouble may occur where correct focusing cannot be obtained even though everything in the circuit seems to be all right. A number of these cases have been corrected by rotating the tube 180 degrees. Still another problem that may arise with electrostatic tubes which did not occur with the EM types is this: leakage in a crt from the additional elements may bring about the condition where, even with the focus control set right up to the stop, the picture is not brought into maximum focus.

If the voltage from cathode of the focus hv rectifier (1V3 in Fig. 4) to ground is normal with the control set at point A, but drops rapidly when the control is advanced to point B, either the focus rectifier, or the crt, or both, are at fault. Let's consider why this is so.

Assume the presence of 1000 v between point B (Fig. 4) and ground. Also assume a partial or complete short-circuit between the focus element in the crt and some other electrode or lead.

CRT Effect on Focus

With the focus control at point A (Fig. 4), the shunting effect of the leak or short would be such as to parallel the 10-meg resistor with another one, anywhere from a few ohms to several megohms in value. Since 25 megohms is still present between this point and the 1V3 cathode, the loading effect on the 1V3 is relatively slight.

As the control is moved to point B, however, the shunting effect becomes severe, and may even produce an effective dead short between the 1V3 cathode and ground. Therefore, if the 1V3 cathode-to-ground voltage decreases when the focus pot is moved toward B, a defective crt may be present.

If the 1V3 tube is poor, reduced voltage output will be available; the control will have to be moved further towards B in consequence, to obtain sufficient voltage for correct focus. With a leak in the crt present, the increased drain on the

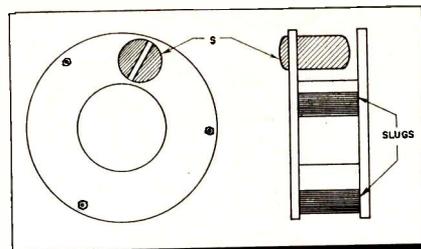


Fig. 3—One type of PM focus adjustment (another variety is illustrated in Fig. 2). Turning iron screw "S" inward decreases the strength of the focus unit's magnetic field.

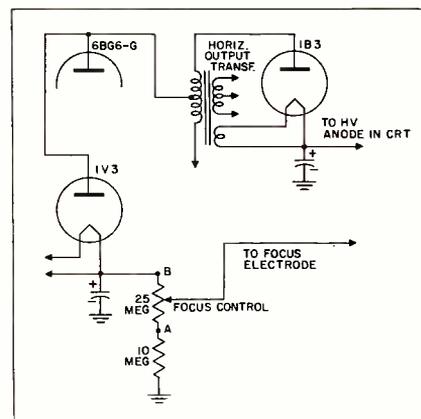


Fig. 4—Separate hv supply (1V3 circuit) used in electrostatically-focused crt's to provide proper voltage to focus electrode.

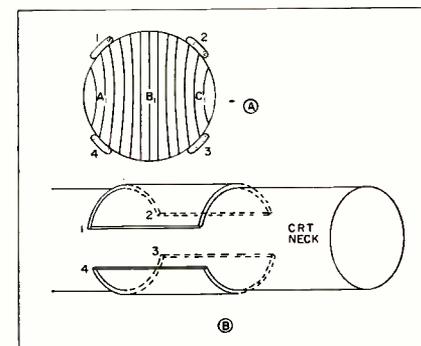
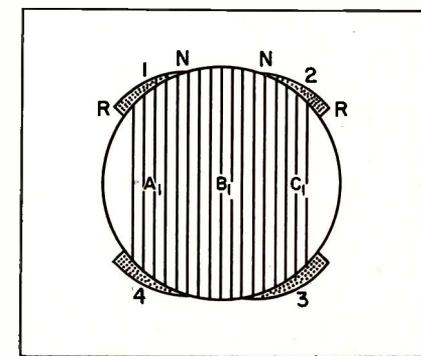


Fig. 5—Sketch A illustrates placement of horizontal coils of early-type yoke around neck of crt. A different view of the coils is illustrated in (B). The vertical lines in (A) indicate the (non-uniform) magnetic field of the yoke. Corresponding points in both sketches have the same numbers.

Fig. 6—Cosine yoke. Note uniform field. Coils are thick at R, thin at N. Nos. 1-4 indicate points located at same positions as correspondingly-numbered ones in Fig. 5.



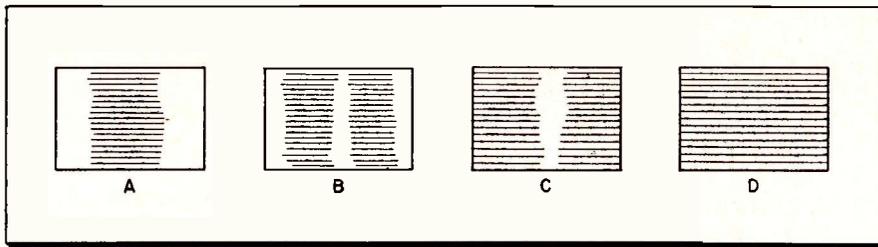


Fig. 7A, B, C—Rasters produced by old-style yoke at three different focus control settings. The horizontal lines indicate the focused portions of the raster. D—Normally-focused raster.

1V3 produced by such a setting will cause a still greater reduction in focus voltage. Even a crt inter-electrode leak as minor as 35 meg will double the 1V3 current in the circuit of Fig. 4 (with the focus pot at B). Thus a weak 1V3 will, when a slight inter-element leak in the crt is present, also produce the symptoms previously described (marked reduction of focus voltage when focus pot is moved toward B).

Alignment vs. Focus

A TV technician may spend hours doing a perfect alignment job on the r-f and i-f circuits of a receiver, to obtain the best detail possible; most of his labor will go for naught, however, if the receiver design is such as to make good focus difficult to obtain, and the scanning lines are not sharp and distinct.

The ideal scanning system produces a raster on which all lines are distinct across the entire face of the tube. All early-model TV receivers used deflection yokes which did not produce a uniform magnetic field (see Fig. 5).

Because of the non-uniform field of the old-style yoke—the field was weaker at the center than at any of the four sides, and not all of the

magnetic lines were straight—greater deflection occurred at the four sides, than at the corners, giving rise to a condition known as a *barrel-shaped raster* (Fig. 8A).

An adjustment of the focus control which would be correct for the beam when it was at position B_1 would be incorrect at A_1 and C_1 (Fig. 5A). This was not too serious when small screens were in use; as tubes increased in size, however, the area of poor focus became too large to be ignored, and something had to be done to correct the condition. The remedy provided was the now universally-used cosine yoke (Fig. 6). Note that the distribution of the windings around the neck of the tube was changed, with the coils thick (more wires) at R, and thin (fewer wires) at N.

With the earlier yokes, because of the limited area over which true focus was achieved, conditions such as those shown in Figs. 7A, B, and C were the rule. If the focus control was adjusted with the raster in focus at the center, it would be out of focus at the edges. As the control was turned, starting with the center in focus as at 7A, the area in focus would split up into two parts, as shown in 7B; further rotation of the control would produce definition that

was good both sides of the raster, but poor in the center (7C). The cosine yoke eliminated this undesirable condition, providing scanning lines that were sharp and clear from one edge of the screen to the other (7D).

While correcting one serious problem of focus, the cosine yoke introduced another one. We pointed out a little while ago that, because of the non-uniform field of the old-style yoke, greater deflection occurred at the sides and top of the raster and less at the corners, giving rise to a condition known as a barrel-shaped raster (Fig. 8A). Now, the beam had a longer way to travel at the edges (because the face plate of the tube is *not* shaped like a sphere, with equal radii to all points); this characteristic of the scanning process would, by itself, bring about what is called "pin-cushioning" (see Figs. 8B, C).

The two effects just described cancelled each other out fairly well when the old style yoke was used, and little or no correction was needed. This was really a case of two wrongs making a right! The result was a reasonably good, rectangular raster. With the coming of the cosine yoke, however, while the tendency toward barrel shape because of non-uniform field was eliminated, the pin-cushion effect (Fig. 8E) remained to be dealt with.

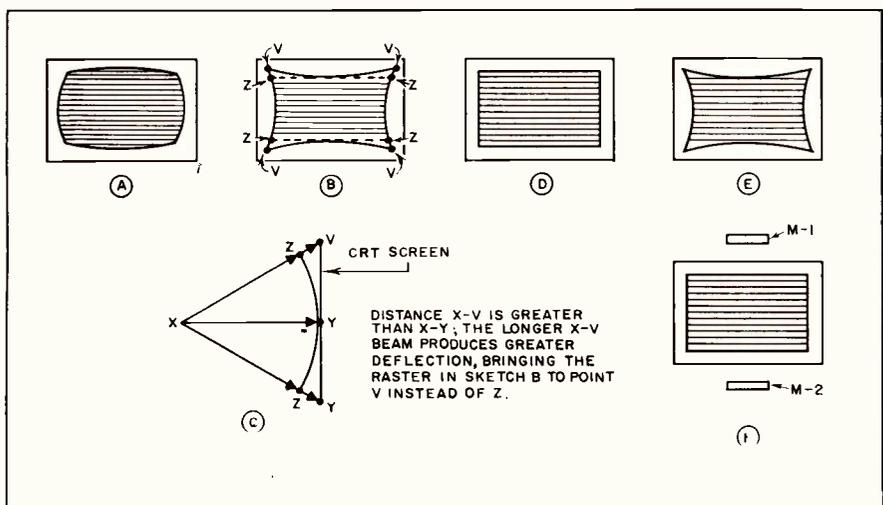
Removing Pincushion Effect

This pincushion effect was not due to the deflection system but to the tube geometry, as previously explained; it was compensated for by the use of two small PM correction magnets (Fig. 8F). (Under ordinary conditions of operation, these magnets should not be disturbed. If an adjustment is required, however—say when replacing a crt—such adjustment should be attempted only after the receiver is thoroughly warmed up. Anyone who has noticed the strange curves at the raster edges when the receiver is first turned on will appreciate the reason for this caution.) The PM correction magnets have a slight effect on focusing.

Before making any changes in the focus circuit, make certain that the deflection yoke is tight up against the the bell of the crt, to minimize beam neck shadow; and that the focus magnet or coil (on EM types) is centered around the neck of the tube. On electrostatic types, adjust the yoke and centering magnets so that the raster is not tilted; then

(Continued on page 63)

Fig. 8A—Barrel-shaped raster would have been produced by old-style yoke, due to its non-uniform field, if no opposing factors were present. B, C—Pincushion raster tends to be produced by all yokes, due to longer beam travel at raster edges. D—Effects shown in (A) and (B) counteract each other, producing normal raster. E—With effect (A) absent, pincushion raster is produced. F—Addition of correction magnets eliminates effect (reversing polarity of magnets accentuates it).



Of Cabinets and Chassis

Repairing Plastic Cases; Other Problems, Solutions

Plastic Cabinet Repair

Cracked or broken plastic cabinets, like those used on portables and other small receivers, are hard to replace. We mend them for our customers in a way that we find very satisfactory. Apply ordinary glue to the edges of the broken sections, then put these pieces together. After the glue has set, use a warm soldering iron on the inside of the plastic cabinet. The iron is run along the cracks. This procedure, which molds the glue and the plastic together, will not distort the cabinet or show on the outside. The cabinet may then be sprayed with any color desired.—*Russell's Radio Repair, Waterbury, Vt.*

Reader Phil Smith, who is with the Phil-Rad Electronics Co., NYC, offers an additional suggestion on plastic cabinet repair. If necessary (says Phil) I melt pieces of plastic (from any old scrap catalin or plastic cabinet) into the break to strengthen and reinforce a weak spot. I have successfully repaired broken plastic hinges on camera-type portables, as well as back covers of large and small portables; once I even inserted a scrap piece of catalin to fill in a large hole in the back cover of a camera portable. Grind, file and buff down the section in which the joint has been made, and the case looks almost as good as new. Advantages not to be overlooked in making such repairs are that the customer does not have to wait a long time for a factory replacement; second, the profit margin is generally higher than it is when the case is replaced.

Broken Screw Threads

I have serviced several small radios and TV boosters, mounted in plastic cases, in nearly all of which one or more mounting screws could not be tightly inserted. The trouble was probably due to the screws being forced in, causing the plastic to break away from the hole. These mishaps can be prevented by putting a drop of light oil in the hole and on the screw, before insertion of the screw. The latter will now enter without danger of cracking or breaking the plastic while being inserted.

When a new case is used as a replacement, the holes are not threaded. However, if self-tapping screws are used with the oil, no difficulty will be encountered. This method also works very well for starting stud screws in selenium rectifiers.—*Robert J. La Belle, Southbridge, Mass.*

"Creeppers" for TV Sets

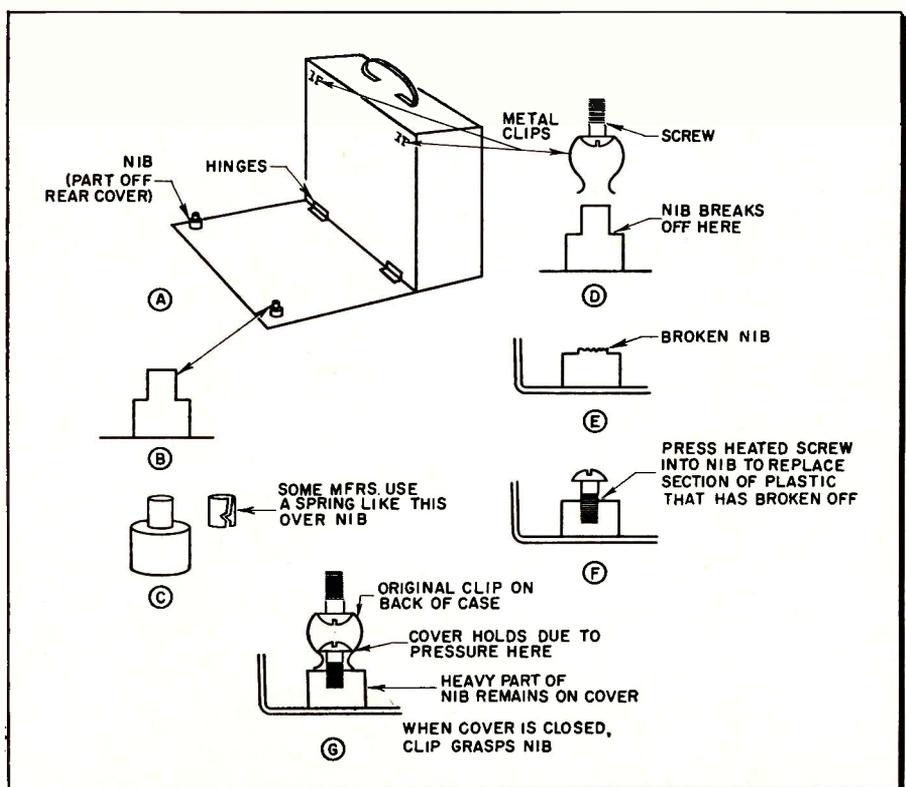
Moving heavy TV sets from the loading dock to the service department and back can be made an easy task by constructing "creeppers" on which to keep each set while it is in the shop. A piece of five-ply veneer, about 20 x 20 inches is used for most 21-inch sets. Attach a good ball-bearing caster to each corner, and you have a little helper that will enable one man to move sets wherever he wants. Several of these should be made and kept near the unloading door; each console that

comes in to be serviced may remain on the creeper the entire time that it is in the shop.—*Bruce C. Vaughan, Jr., Springdale, Ark.*

Cover Repair On Portables

The small plastic studs on the rear covers of some portables, which normally snap into the back of the receiver, often break off readily, allowing the cover to flop open. The normal snap-in arrangement is shown in sketch A; sketch E shows part of the cover with the stud broken off. The broken stud may be replaced by heating a round-head screw of the right size ($\frac{1}{8}$ or $\frac{3}{16}$, as required) and pushing it down the required depth into the plastic stud base with a hot soldering iron (see sketch F). This will effect a permanent repair. Having a small wet rag handy to cool off the metal will allow the plastic to set in less than 10 seconds.—*M. G. Goldberg, St. Paul, Minn.*

A—Rough sketch showing relative positions of nibs and clips used at the backs of some portables. B—How the nib looks. C—Another type of nib. D—Clip slides over nib, normally. E—Appearance of nib when its upper portion has broken off. F—Screw substitutes for missing nib section. G—Clip fastens on screw. Drawings shown above are not drawn to scale.



UHF Service Notes

Premature 6AF4 Failure; Re-Designing Antenna Switch; Improving Strip Performance; Microphonic UHF Tuner; Removing Snivets

Premature 6AF4 Failure in UHF Converters

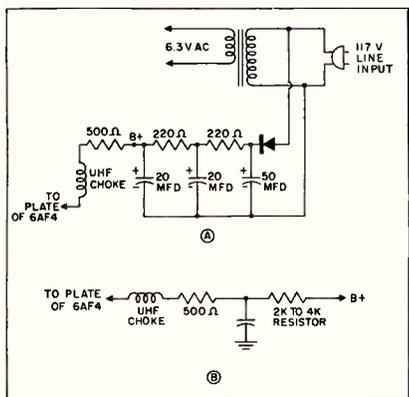
It is common knowledge that a certain percentage of 6AF4 tube failures are due to manufacturing difficulties; other 6AF4 failures, however, can be traced to a different source of trouble.

I have found some UHF converters continually burning out 6AF4's in two to four month periods, while other converters do not burn out any. Careful checks to locate the source of trouble revealed this interesting fact: some UHF oscillator circuits require more power to oscillate than others.

For example, I have taken two converters from the same manufacturer, placed a 6AF4 in one, and checked the plate current. Next I removed this 6AF4 and placed it in the other converter of the same make. A marked difference in oscillator plate current was noted.

Consider the power supply of these converters (sketch A). Note that the only resistance in series with B+ feeding the plate of the 6AF4 is a 500 (in some cases 1,000) ohm resistor. Now it can be seen that a power supply of this design would have very poor regulation under varying power line voltages. Under high line voltage conditions, the power supply voltage would rise considerably. Add to this the fact that a high plate current is present in some of these oscillator circuits even with the line voltage normal,

A—UHF converter power supply. B—Where 2k to 4k dropping resistor is inserted.



and we can see that the 6AF4 may be often operated very close to its maximum plate dissipation, thus promoting frequent tube failure.

In most cases, we have successfully solved the problem by reducing the plate voltage on the 6AF4. This may be accomplished simply by adding a resistor of two to four thousand ohms (exact value depends on amount of line voltage present) in series with the plate to B+ return of the 6AF4. The resistor is bypassed to ground with a .004 mfd or similar value condenser (capacitance not critical), as indicated in sketch B.

We have not, unfortunately, had the opportunity to try these slightly revamped converters in fringe areas. Since converters whose oscillator circuits require a certain amount of power to oscillate will not have the same output or stability when the oscillator plate voltage is reduced, the change described is not recommended for such weak-signal locations.

The fact that a 6AF4 lists at \$4.15 points up the value of the suggestion offered.

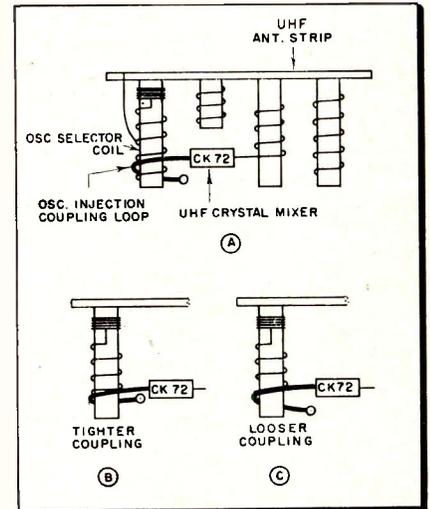
Removing Snivets

"Snivets" are black lines or blotches appearing on the right-hand side of the raster in a television picture tube. While quite prevalent in the UHF band in most receivers, they can be ignored unless they occur on a channel where the signal is not strong enough to override them. In such severe cases, they can be eliminated or moved to a different part of the spectrum by changing the horizontal output tube (6BQ6 or 6CD6).

Improving Strip Performance

Improvement in the performance of UHF strips on any series of Standard Coil tuners (F, G, Q, etc.) may often be obtained by varying the oscillator injection voltage. The reason for this is that some UHF crystals work better with higher oscillator injection voltages than others.

To adjust this voltage for any given Standard Coil UHF strip, tune



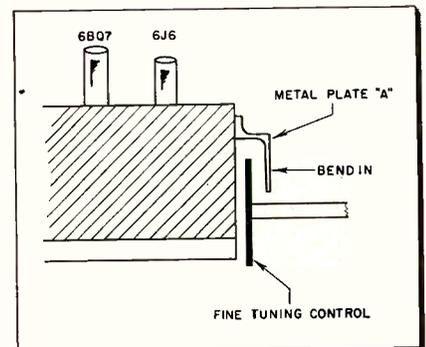
UHF antenna strip on Standard Coil tuner, showing the location of the coupling loop.

the front end to the UHF channel on which improvement is desired, with the strips in place. Remove the inserts adjacent to the UHF antenna strip, allowing access to the UHF crystal and coils while the set is on. Next increase or decrease the coupling on the oscillator injection coupling loop, as shown. To increase the injection voltage, tighten the coupling loop; to decrease, loosen the loop. This may be done by pushing in or out lightly on the CK72.

Microphonic UHF Tuner

The following symptom occurred on a Standard Coil Q series tuner. Walking across the floor would cause the picture to flicker, but only on
(Continued on page 58)

Mechanical vibration of plate "A" may cause the picture to flicker on UHF reception only.



COLOR SHORTS

THIRTY ADMIRAL FIELD AND SERVICE engineers attended the school's training program, which ended recently after running for a month. Eight days of the course were devoted to color theory and fundamentals; the remainder of the month was devoted to practical work (installation and service) on receivers. Students were chosen from areas now able to receive network color broadcasts. Eligibility of future students will also depend on availability of color programs in their localities. Text for the course was *Introduction to Color Television*, prepared by Admiral staff engineers.

DETROIT WAS THE KICK-OFF POINT for a nationwide program of color TV service training meetings launched by G.E. in March. The 4-hour Detroit session, held at the Edison Auditorium, was attended by about 800 G.E. service employees and service personnel of the company's dealers. Open invitations are being extended to all service technicians to come to other meetings.

ANDREA RADIO CORPORATION recently demonstrated a color set to some of its distributors. Production models, expected during second or third quarter of this year, will be available in limited quantities. This openface consolette provides a 12½-in. pumpkin-face picture on the 15-in. 3-gun tube. Price has not yet been set.

Preview of Andrea's first color TV receiver.



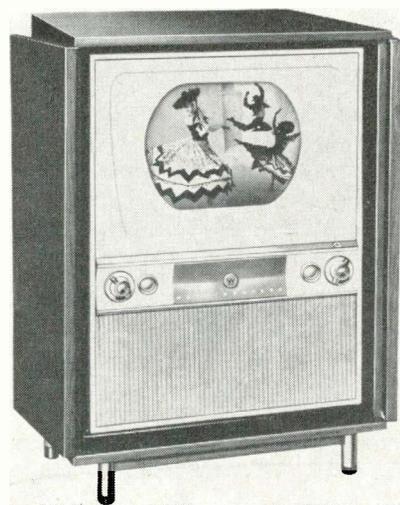
COLOR-BLIND TECHNICIANS were weeded out of the candidates applying for admission to Admiral's color TV training school. These technicians, who were discovered through tests, were not permitted to take the course; their future service activities will be confined to b & w TV. Tests were administered because more than 10 million Americans (about 7 percent of our population) are said to be color blind to some degree.

HARTFORD AND BRIDGEPORT, Conn., were the scenes of G.E. 8-hour training sessions. Three-day meets were being scheduled for Philadelphia, Cleveland, Boston and Los Angeles. The shorter sessions cover theory and fundamentals. In the longer meetings, instruction in the alignment and service of G.E. color receivers is being offered.

MASTER ANTENNA SYSTEMS suitable for use with color receivers are now a reality. It has been known for some time that existing distribution systems used with b & w sets may not be sufficiently linear, or have enough shielding against interference, to feed a good signal to color sets. The large collection of color receivers displayed at the recent Sixth Annual Music & TV Festival at Macy's in New York were fed from a master system built by Jerrold. Macy executives were pleased with the operation of the set-up.

DU MONT'S FIRST TRAINING EFFORTS in color have taken the form of a series of articles in that company's monthly, *Du Mont Service News*. The first installment presents a theoretical discussion of light and color, color properties, color vision and color reproduction. This initial article fills most of the *Service News* issue in which it appears.

IMMEDIATE DELIVERY on Westinghouse color sets—production models—is being offered in some parts of the country. After advertising these receivers for more than a week, Wanamaker's in New York reports the sale of one set. Price is \$1250 for an open-face consolette that produces a picture 12½ inches in diameter. Contract service, han-



Now on sale—Westinghouse color console.

dled by Westinghouse, is offered at \$60 for 90 days. Charges for one year come to \$240. Not a bad fee, if you can get it.

PHILCO DISTRIBUTOR SERVICE MANAGERS are finishing a course of color studies in Philadelphia. Through service clinics and meetings, they plan to pass on this knowledge to technician members of the company's factory-supervised service plan. In addition to the 2-week 80-hour course just referred to, Philco is preparing another of the same duration, to be offered to independent service technicians and dealers through local distributors. Lectures will be given for 40 hours; the remaining 40 will be devoted to actual shop practice.

GRADUAL TRANSITION will be the keynote of the change from monochrome to color, opines William R. Feingold, Emerson's senior TV engineer. Feingold says that Emerson has shifted from a 47-tube multiple-chassis design to a 34-tube single-chassis receiver. Many more such alterations will be necessary, Feingold believes, before color sets can be considered to have received a final "shakedown."

REPLACEMENT COMPONENTS for color sets are now available for sale to the service industry in New York City. At least one distributor-jobber, Harvey Radio Co., now carries a complete line of RCA color TV components.

Sell *More* Service to

Now's the Time to Suggest Tune-Up, Tube-Up, Check-Up Work to Boost

Spring is here and with it comes new ambitions and new ideas.

And such new ideas and ambitions are always slanted dollar-wise for the man who is in business to make money—not just for his health.

Make no mistake about it, the hot breath of opportunity is breathing down the neck of every dealer, so far as his service department is concerned.

It's a simple thing to grab this opportunity now in order to make more money. All the technician-dealer has to do is launch a drive for more business by doing two simple things:

1. Teach his technicians how to "sell" more service on more units in the home.

2. Teach his technicians to sell *complete* jobs, and shy away from "make-do" work which merely "patches up" receivers, phonos or what-have-you.

All the technician-dealer has to do advertising-wise is to step up the tempo of his promotion work, whether he uses newspaper ads, direct-mail or radio time.

Sincere and intelligent effort along the lines indicated is bound to pay off handsomely.

And now is the time to make such an effort.

Presuming that *you* want to sell more service—and that you'd like to expand your business, let's take a look at ways and means for increasing service revenue.

Two Approaches Compared

The other day the writer took his car to a service station to ask about replacing a defective directional light switch of rather unique design. The mechanic took one look at the dashboard-mounted switch and said, "Nope, I can't help you out. We ain't got anything like that in the place." When the writer asked if he could repair the device, he shrugged his shoulders and said "nope" again. At another service station, however, the mechanic said, "Say, why don't you let me install a large-handled switch on the

steering wheel post? The whole job will run to only \$15, and you'll be tickled to death with it."

Well, to make a long story short, we "bought" the guy's suggestion. He made a couple of bucks and a friend out of the deal.

Plenty of similar cases exist in all fields of service today. A jeweler installs a new mainspring in your wrist watch and lets you go out with a crummy old watch-band, when he's got a whole case-full of 'em for sale in his store. Another sends you out happy with a "working" watch and a snappy new band. And we could go on and on but—

Snatching at Opportunity

Let's look into the TV-radio-phonos service situation.

Every time the technician rings a doorbell, *opportunity* stands beside him.

And *opportunity* in each instance is easy to grasp. It's as simple as ABC, and all it means is that he should not be satisfied with doing a "token" servicing job on a specific complaint, and letting it go at that.

The technician should, instead, endeavor to "sell" more service on other products owned by the customer. On a TV service call, for example, he loses nothing by finding out whether there is one portable receiver or more in the house that may need a new set of batteries. Especially at this time of year, before the movement to the outdoors gets under way, customers might appreciate being reminded that last year's batteries aren't likely to be much good now. In cases like these, battery sales would be strictly gravy.

The technician should suggest that *all* necessary work be done on the specific job, rather than use a mere "get-it-in-operation" technique. When he gets through, for example, the TV receiver may be working fine, but the picture on some channels may still look a little pathetic if the set is getting signal from a four-year old antenna installation. Why not suggest a new high-gain job to replace the cus-

tomers' old, early-design or battered antenna, particularly when this unit has gone through a rough winter?

The foregoing practice is not a "hungry" approach by any means, and we say this in spite of the fact that a few ultra-conservative technician-dealers may allege that it is. It's good business from the service department's viewpoint, and it provides *real service* to the customer.

Let's look at it this way: Suppose the technician goes out to answer a "no-picture" complaint. Let us assume that he restores the picture pronto, and then leaves. What does the customer think if that particular receiver has a picture, all right, but same is not properly framed, or the sound continues to be "off," or other pre-service-call objectionable characteristics still remain? Chances are that the set owner will magnify such conditions in his own mind. He's very apt to be less tolerant of the minor troubles he put up with before.

Keep Customer in Mind

Don't take it for granted that he will be happy just because the picture's back. People aren't built that way. They'll think, well, the technician *should* have fixed the whole set up. They don't know what's going on service-wise.

How much better it would have been in the foregoing case to suggest a *complete* job. Give the customer an opportunity to get the very best in reception.

"Selling" in the home is the function of every service department. It is the function of every technician. *Service is "sold," make no mistake about that. It's sold just like any other commodity, and the more service you sell at a profit, the more money you make.*

This Spring is the right time to launch a real campaign to increase service revenue, as well as revenue from the sale of products carried by the shop.

And this campaign can pay real dividends to those who are willing to make a forthright effort.

Every Customer This Spring!

Volume. "Complete" Jobs Bring Repeat Business, Build Following

Do it this way:

Let the service manager give the technicians some "basic" sales training. Don't feed the technicians a lot of blue-sky stuff, and don't give 'em any of the same kind of pep talks the product sales manager indulges in. But go at it in a realistic manner. Tell your man that the firm is making a drive for more business. Give him a copy of the checklist accompanying this article. Urge the man to do two things: Offer a *complete* job on the specific complaint, and ask about other sets and products in the home which may need service after an "inspection," which he, the technician, offers to make. Any dealer will be surprised at the results such efforts are bound to bring.

And here are some hints:

When suggesting work that is *additional* to the basic complaint on, say, a TV set, don't let the serviceman say "the vertical's off," or "there's trouble in the sync circuit," using technical terms. Rather, let him say that certain work needs to be done to bring the user *improved reception*—more specifically, *brighter picture, better sound, etc.*

When suggesting a phono conversion job, it's simple for any intelligent technician to point out the many advantages of being able to

play all speeds in records, and to suggest that the customer's handsome but obsolete machine is worth modernizing.

When offering to look at the various radio sets in the home, the technician is always able to stress the advantage to the customer in getting peak reception on these sets, or in putting into use receivers now lying around dead.

Customers Appreciate Suggestions

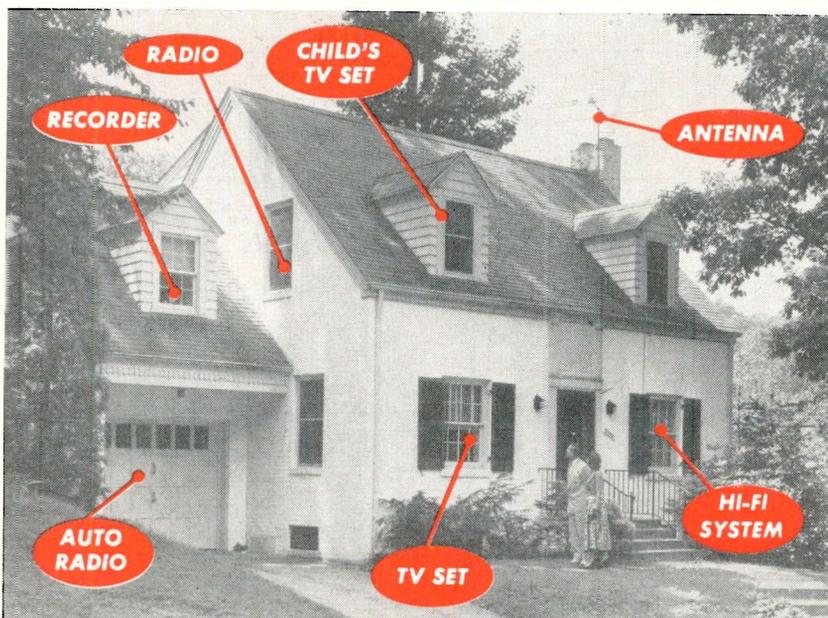
The thing to remember is that the average customer appreciates such suggestions from the technician, whom he usually trusts. A technician in this field, or a mechanic in some other business, always enjoys more customer confidence than the salesman. In the first place, the customer considers the technician (or mechanic) an "unbiased" expert who *hasn't anything to sell*. Here then, is a golden opportunity—an opportunity to build more volume, without taking unfair advantage of the customer attitude just mentioned. The usual set owner is not inclined to be skeptical of service suggestions made by the technician—though he might be leery of the natty, glib salesman who approaches him at the front door and tries to sell him on similar service jobs.

A Massachusetts dealer has trained men so that, in addition, to performing top-flight work, they sell plenty of needed extras to a large following of satisfied customers. When defective receivers are brought into the shop in this firm, the service manager always makes a follow-up call, suggesting complete overhaul where necessary, and quoting the price at the same time. If the repair is a minor one, on the other hand, the customer is thanked for the work, and a delivery date is arranged. Plenty of good-will is generated in this way.

A Chicago firm has grown tremendously, not only through doing excellent work at fair prices but by refusing to perform any make-do work. Everything must be perfect; all jobs must be thorough. This practice minimizes call-backs, and keeps customers happy. Word-of-mouth advertising has it that "so-and-so charges quite a lot, but does wonderful work." And that's not a bad reputation for any dealer to have.

Now is the time to go after *more* work. If you have more business volume you can expand, and that's just what every ambitious man wants to do.

The way to get more service business is to *go after it*.



CHECK-LIST for SERVICE CALLS in HOME

Suggest these things:

- 1 Roof-to-set antenna inspection
- 2 Test TV set or sets
- 3 Check of all radio receivers
- 4 Replacement of batteries in portables
- 5 Phonograph test
- 6 Purchase of 3-speed phono, or "conversion," to replace 1-speed or 2-speed job
- 7 Test of recorders or other electronic equipment customer owns
- 8 Auto-radio check-up
- 9 Thorough test of Hi-Fi gear

Servicing Automatic Record-

Theory and Troubleshooting of Hard-to-Repair Mechanism.

BY HARRY MILEAF*

• Probably the most difficult section of the automatic record changer to repair is the automatic trip mechanism. The basic necessities of an automatic trip are shown in Fig. 1.

When an automatic record changer has gone through its cycle of changing a record, the cycle drive control, (or actuating cam, as it is also called) is automatically detached and then kept at bay by the automatic trip mechanism (refer to Fig. 1). The trip mechanism is a precision-balanced device that automatically releases the cycle drive control when the record being played is completed.

The names of the individual parts usually vary with different manufacturers. The names used in this article follow the parts' functions as closely as possible.

The basic functions of the trip's component parts are as follows:

Trip Finger. The trip finger must in some way follow the movement of the pickup arm on the record; the finger must also interpret the position of the arm, so that it can determine when the record play has been completed. The trip finger can be easily located as follows:

- (a) Turn off power.
- (b) Mount the automatic record

changer on a service stand.

(c) Move the pickup arm slowly across the turntable, and then back again.

(d) Observe the underside of the changer as this is being done.

(e) *The lever device that closely follows the movement of the pickup arm is the trip finger.*

Trip Link. The trip link is used to transfer the movement of the trip finger to the trip lever. In some automatic changers the trip link is unnecessary because, due to design, the trip finger is directly coupled to the trip lever. In changers where the trip finger and the trip lever are relatively far apart, a trip link is used to couple them. The trip link can be easily located as follows:

(a) Locate and move the trip finger.

(b) The lever device the trip finger contacts during its movement is the trip link.

Trip Lever. The purpose of the trip lever is to couple the movement of the trip link (or trip finger, as the case may be) to the trip pawl. Due to the leverage design of the trip lever, the minute movement of the trip finger and the trip link is considerably amplified, as indicated in Fig. 2. The trip lever can easily be located

by using a procedure similar to the one employed for trip link identification.

Trip Pawl. The purpose of the trip pawl is to couple the drive gear to the cycle drive control, and thus start a change cycle. When the trip finger moves sufficiently, it pushes against the trip link, which in turn transfers this movement to the trip lever. The trip lever now causes the trip pawl to rotate. The trip pawl continues to rotate until it contacts the pawl stop; at this point, one end of the pawl (the end to the left of the pivot in Fig. 1) functions as a gear tooth on the cycle drive control, and engages the drive gear. The drive gear, which is always rotating (it is usually connected to the turntable), then rotates the cycle drive control, and a record change cycle starts.

Pawl Stop. The purpose of the pawl stop is to lock the trip pawl in

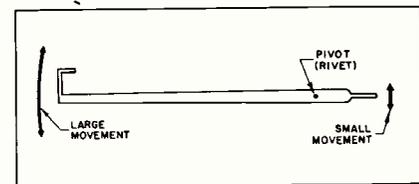


Fig. 2—Movement amplification of trip lever.

position when it couples the drive gear. The pawl stop is, actually, just an obstruction that prevents the trip pawl from further rotation.

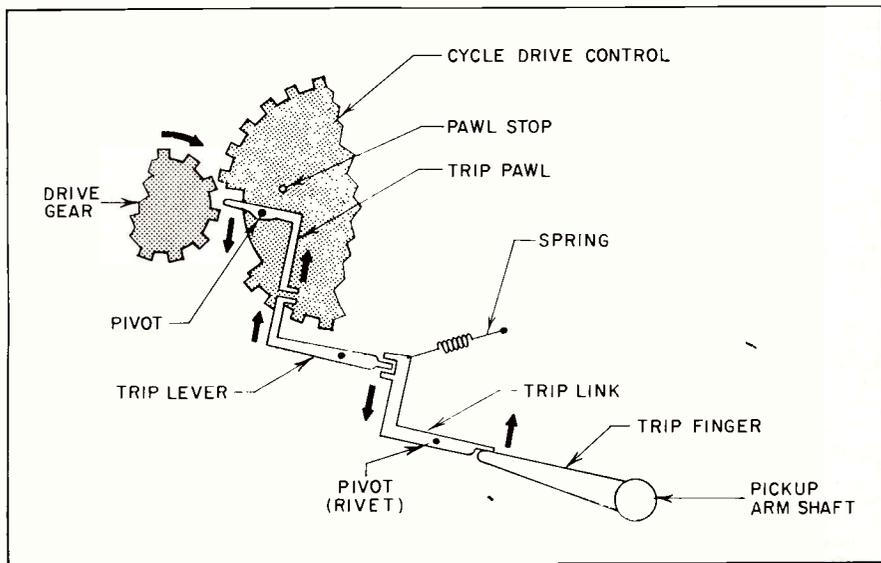
Trip Devices. There are three basic types of trip devices. Each works on a different principle, and is designed to operate on all types of records. The basic trip types are as follows:

1. Positive-action (position) trip.
2. Oscillating (reverse-direction) trip.
3. Velocity trip.

Positive Action Trip. This method of tripping was the first type used on

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Fig. 1—Drawing of basic trip device. Heavy arrows indicate directions in which parts move.



Changer Trip Mechanisms

Positive-Action, Oscillating and Velocity-Type Units.

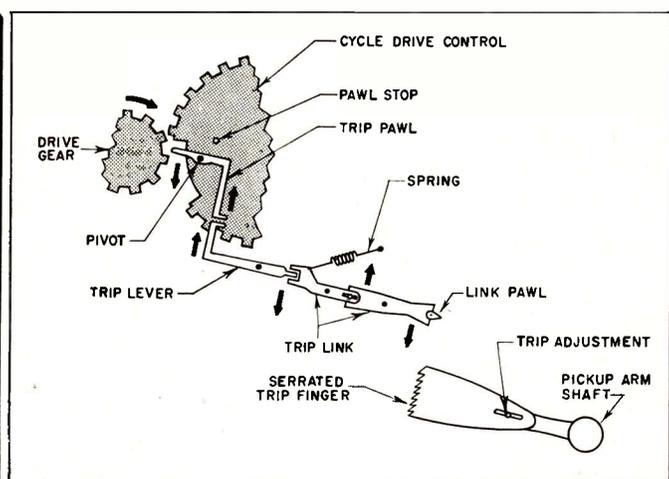
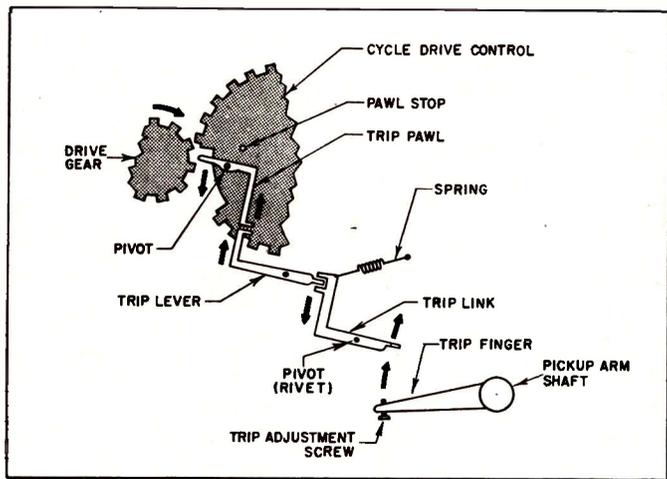


Fig. 3—Positive-action trip. Device was earliest one used in changers.

Fig. 4—Oscillating trip. Finger hits link pawl at record's half-way point.

automatic record-changers. The basic feature of this mechanism is that the trip finger moves with the pickup arm to a certain position to start the change cycle (see Fig. 3). The trip finger is attached permanently to the pickup arm shaft.

During the playing of the record, the trip finger does not come in contact with the trip link at all. At the end of the record, however, as the pickup arm runs into the run-off grooves, the screw in the trip finger strikes the trip link. The movement of the trip link is transferred by the trip lever to the trip pawl; the trip pawl rotates to connect the drive gear to the cycle drive control, and a change cycle starts.

The screw in the trip finger is the trip start adjustment. By adjusting it inwards, the trip operates sooner. Adjusting it outwards causes the trip to operate later. Outlined below are some of the trouble symptoms associated with this type of trip, and their causes.

Changer Does Not Change Records

1. Trip adjustment screw is improperly adjusted.
2. Trip finger is bent or broken, causing the trip screw to lose contact with the trip link.
3. Trip finger is loosely attached to the pickup arm shaft and slips.
4. Trip link is bent or broken; or it is too tight and resists movement. The trip link may need lubrication or

cleaning; or the trip link rivet may be loose, causing the trip link to slip out of contact.

5. Spring attached to the trip link may be too tight.

6. Trip lever operation may be faulty (same troubles as trip link.)

7. Trip pawl operation may be faulty (same troubles as the trip link).

8. Broken pawl stop.

9. Drive gear or cycle drive control has stripped teeth.

Changer Continues to Cycle

1. Trip link jammed; it may need lubrication; it may need cleaning.
2. Spring on trip link too loose.
3. Trip lever jammed: it may need lubrication; it may need cleaning.
4. Trip pawl jammed; it may need lubrication; it may need cleaning.

Changer Starts Cycle too Early

1. Trip adjustment screw is improperly adjusted.

It is important to note that with this type of trip mechanism, certain records may cause the trip to trigger prematurely. If the record used has been made in such a way that it modulates the grooves closer to the center hole than is usual, the trip will trigger prematurely, although it will operate normally on other records.

Oscillating Trip. This method of tripping was devised to prevent the

position of the pickup arm from determining the point at which the trip triggers. Operation is based on the manner in which standard records are cut. The recorded portion of the disc, often called the music grooves, provides a continuous spiral which slowly carries the tracking arm toward the center hole of the record. At the end of the music portion, the close groove spacing broadens, causing the pickup arm to swing rapidly toward the center hole.

The widely-spaced grooves are known as the *run-off* or *run-out grooves*. They terminate in a final *return groove*, which is a continuously circular one; the pickup arm will track indefinitely in this groove—if permitted—when the record is played on a manual phonograph.

In accordance with industry standards, the final circular groove is not centered around the record hole. It is cut *off-center*; because of this fact, the return groove is usually referred to as the *eccentric*. The pickup arm does not remain stationary when tracking in the eccentric—it swings back and forth instead, as may be observed on a manual player. It is the *reverse* motion of the pickup arm, away from the center hole of the record, that operates the oscillating trip mechanism (refer to Fig. 4).

The serrated trip finger has saw teeth at the contacting end, and is permanently attached to the pickup arm shaft. Approximately half-way

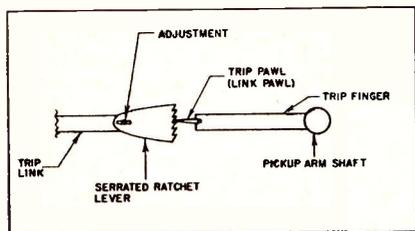


Fig. 5—Sketch of RCA RP-177 oscillating trip.

across the record, the serrated trip finger comes in contact with the link pawl. As long as the trip finger moves in a forward direction, the link pawl just rotates and slips along the sloping edges of the teeth on the trip finger.

The trip link will not move appreciably under these conditions. At the end of the record however, when the pickup arm is pulled down the run-off grooves and then back along the return groove, the link pawl is caught in the notch of the teeth in the serrated trip finger, and is unable to rotate. The link pawl is now pushed back, along with the trip link. The trip link moves the trip lever, which in turn rotates the trip pawl. The trip pawl contacts the revolving drive gear and couples it to the cycle drive control, and a change cycle starts.

The serrated trip finger is adjustable back and forth, and from side to side, permitting it to be placed in the proper position to interpret the backward pressure and start a change cycle.

The Belmont C-9 employs an oscillating trip mechanism. The RCA RP-177 uses a similar unit, except that the serrated section is attached to the trip link, and the link pawl (RCA calls it the trip pawl) is mounted on the trip finger (see Fig. 5). The operation of this trip is exactly the same as that of the Belmont's.

Outlined below are some of the troubles associated with the oscillating trip, and their causes.

Changer Does Not Change Records

1. Trip adjustment screw is improperly adjusted.
2. Trip finger is bent or broken, causing the link pawl to lose contact with the serrated edge.
3. Trip finger is attached to the pickup arm shaft too loosely, and slips.
4. Link pawl is chipped or broken.
5. Saw teeth are stripped.
6. Trip link is bent or broken or resists movement. It may need lubrication or cleaning. The rivet may be loose, causing the trip link to slip out of contact.
7. Spring attached to trip link may be too tight.

8. Trip lever and trip pawl can have the same troubles as the trip link.

9. Pawl stop may be broken.

10. Drive gear or cycle drive control has stripped teeth.

Changer Continues to Cycle

1. Trip link is jammed; it may need lubrication or cleaning.
2. Spring on trip link is too loose.
3. Trip lever is jammed; it may need lubrication or cleaning.
4. Trip pawl is jammed; it may need lubrication or cleaning.

Changer Starts Cycle too Early

1. Trip adjustment screw is improperly adjusted.
2. Link pawl is jammed; it may need lubrication or cleaning.
3. Hole in record is too large; record wobbles.

It is important to note that in the oscillating trip there is a little pressure applied to the trip finger. This pressure is also applied to the pickup arm. If the pressure is too great, it may pull the pickup arm back a groove at various intervals. An improperly adjusted trip finger can cause this. A worn pickup needle can also cause it. The automatic changer is so designed that the pickup arm weighs just enough to counteract this trip pressure. If the pickup cartridge is replaced with a cartridge that is too light, the trip pressure will cause the pickup arm to pull back.

Velocity Trip. The velocity trip was the last trip mechanism to be introduced. Its development was the result of a search for a trip device that would be sensitive and rapid, and yet would not apply much pressure to the pickup arm. The determining factor in the velocity trip's operation is the speed at which the pickup arm moves across the record. The pickup arm must move more than $\frac{1}{4}$ in. in one full revolution of the turntable to operate the trip. The pickup arm moves more slowly than this while the record is playing, but moves faster at the run-off grooves.

(Since trip action begins almost as soon as the stylus leaves the recorded grooves, the velocity trip provides the shortest change cycle. There is no waiting period during which the pickup arm must reach a fixed position, or during which it must traverse the run-off grooves and begin to oscillate in the eccentric. This reduces the period of silence between the end of sound on one record and the beginning of sound on the next.—Ed.)

The velocity trip mechanism is set up in a manner similar to the one

shown in Fig. 1. The only point of difference is that the trip finger is not permanently attached to the pickup arm shaft. It is, instead, loosely attached by a friction clutch arrangement. A friction clutch unit similar to the one used in Webcor changers is illustrated in Fig. 6.

The movement of the trip finger in changers of this general type closely follows the movement of the pickup arm until the trip finger contacts the trip link. While the pickup arm is on the modulated grooves of the record, it moves slowly, and very little pressure is supplied to the trip finger. The trip link holds the trip finger back, causing it to slip in the friction clutch assembly. When the pickup arm rides in the run-off grooves, however, the arm moves much faster, providing enough pressure to the trip finger for it to move the trip link. The trip link then moves the trip lever, which rotates

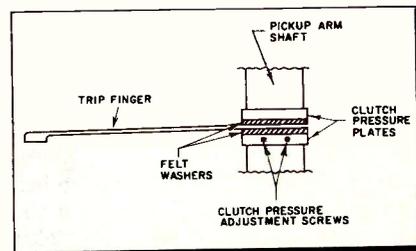


Fig. 6—Friction clutch, in velocity-trip unit.

the trip pawl. The trip pawl contacts the drive gear and couples it to the cycle drive control, thus starting a change cycle.

As we can readily see, the clutch pressure is the most determining factor in the proper operation of the velocity trip. If the clutch plates are moved closer together, the pressure increases. If the plates are separated, the pressure decreases.

Webcor and VM automatic changers made in recent years employ the velocity-type trip.

Outlined below are some of the troubles associated with the velocity trip, and their causes.

Changer Does not Change Records

1. Clutch adjustment is set too loose; trip finger slips.
2. Trip finger is bent or broken and does not contact the trip link.
3. Trip link is bent or broken, or it is too tight and resists movement. It may need lubrication or cleaning. The trip link rivet may be loose, causing the trip link to slip out of contact.
4. Spring attached to the trip link may be too tight.
5. The trip lever and the trip pawl

(Continued on page 58)

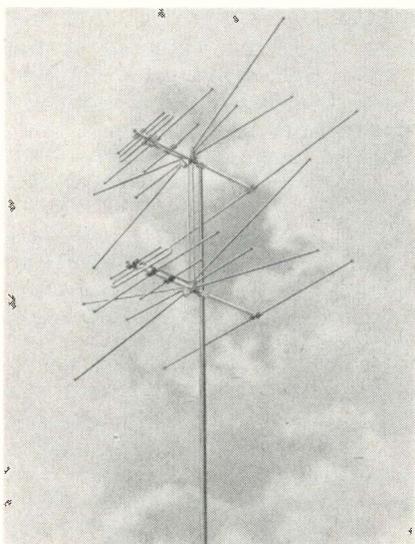
New TV Antennas

Indoor and Outdoor Types; VHF and UHF Assemblies

JFD ANTENNAS, MAST TUBE

The 6-position selector switch in the base of the Tune-O-Matic, indoor UHF-VHF antenna, model TA145, matches the UHF phasing element for optimum reception on different channels. A rabbit-ear arrangement is used for VHF. List price, \$7.95.

JFD all-channel conical-yagi combinations for fringe use are now available in 3 price ranges. List price ranges for single-stack models:



Superjet, model JET213, \$18.70; Pip-Jet, model JET513, \$12.65; Big Gun, model P213, \$11.75.

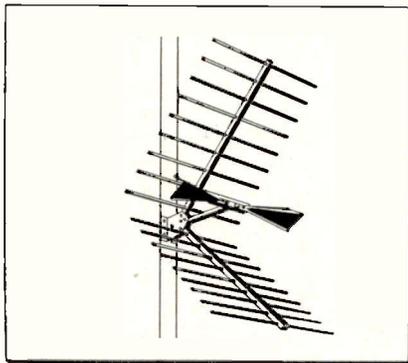
Also available: Sky-Lok telescopic mast tubing, in units varying from 2 sections (20 ft.) to 5 sections (50 ft.). Tubing is of 16-gauge steel, hot-dipped in molten zinc. JFD Mfg. Co., Inc., 6101 16th Ave., Brooklyn, N.Y.—TECHNICIAN

RMS INDOOR ANTENNA

Model K-38 is a UHF-VHF indoor antenna with a 6-position selector switch to permit choice of antenna elements. This feature allows optimum tuning from Channels 2 through 83. Weighted base prevents tipping. Five feet of twin lead supplied. Also available as model KN-38, with nickel-plated brass elements. RMS, 2016 Bronxdale Ave., New York 62, N. Y.—TECHNICIAN

Acme UHF ANTENNA

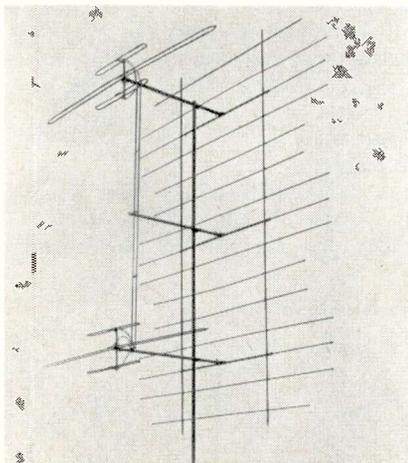
Molded glass fibre construction and a reverse "V" dipole design are features of Acto-tenna UHF all-channel corner reflector. The antenna's 2 reflector screens are produced by molding a series of U-shaped aluminum reflectors into



a glass fibre spine. This construction assures critical spacing in a weather-proof, vibration-proof mounting. Recommended for ghost-ridden areas because of its high horizontal and vertical directivity, and minimum back and side response characteristics. Comes completely assembled. Acme Tool & Specialties Co., 224 N. Loomis Street, Chicago 7, Ill.—TECHNICIAN

Channel Master ANTENNAS

Model 325-6 Super Champ is a UHF-VHF combination, similar in design to the VHF-only Champion



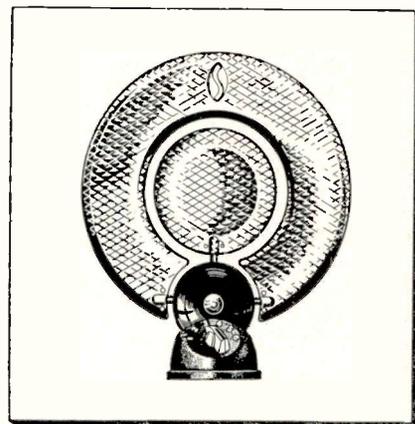
tripoles. This 2-bay model is said to provide up to 3 db more gain on VHF than the original 2-bay Cham-

pion, in addition to delivering up to 12 db on UHF. List price, \$54.17. Conversion kit for adapting 2-bay Champion to operate as Super Champ lists at \$11.81.

Also available: Globe Trotter, model 321, which uses a conical-yagi combination design. Intended for all-channel VHF coverage in fringe areas and UHF coverage in primary areas. List prices: single-bay, \$12.64; 2-bay, \$25.97. Channel Master Corp., Ellenville, N.Y.—TECHNICIAN

Snyder INDOOR ANTENNA

The "4D" is a compact VHF-UHF indoor antenna for metropolitan areas, designed with an independ-



ently operating halo element and center phasing disc, both affording maximum orientation. Constructed in the base is the Snyder 6-position electronic beam selector switch. Heavy-duty base includes 5 ft. of transmission line. Snyder Mfg. Co., Philadelphia 40, Pa.—TECHNICIAN

Brach ALL-PURPOSE ANTENNA

The 555 Delta V Beam antenna eliminates the need for mixers, couplers, networks and switches when UHF and VHF signals are to be received via a common transmission line. Field-tested in color areas, this antenna is said to be effective in discriminating against reflections which tend to turn color television pictures into scotch-plaid nightmares, and in minimizing interference. List price, \$10.56; stacked version, \$22.62. Brach Mfg. Corp., 200 Central Ave., Newark, N.J.—TECHNICIAN

Troubleshooting Data

Servicing Information on a Much-Used TV-Radio Component.

Selenium rectifiers are found in home radios, portable radios, television receivers, record players, relay power supplies, business machines, electric razors, and many other applications requiring direct current from a 117 volt line. The service data provided below should prove a valuable aid in the servicing of these units.

Testing the Selenium Rectifier

While the selenium rectifier has been found to be a long-lived and trouble-free component, instances do occur when it is important to know how to install one properly and test it when a radio or television set is in trouble. Faulty operation may result from the rectifier becoming open-circuited, short-circuited, high in forward resistance, or low in reverse resistance. If trouble occurs, a visual inspection of the rectifiers and other components of the power supply may show whether replacement is necessary. As failure is not always accompanied by physical changes, an electrical test may be necessary to determine whether the rectifier is damaged.

Removal and Replacement

In soldering or unsoldering leads to a selenium rectifier, the heated soldering iron should not be brought in contact with the cells making up the rectifier. The heat may melt the alloy on the cells or damage the protective coating.

The rectifier should be replaced in its original position, or in a position which provides better cooling. Best cooling is obtained when the rectifier is mounted with the cells vertical and when the passage of air through the cells is not restricted at

the top or bottom.

When replacing a rectifier, be sure that it is firmly fixed in place so that it cannot turn and come in contact with the chassis, other components, or wiring of the set. Any barriers provided by the set manufacturer for this purpose which have become damaged should be replaced.

The rectifier has been given a moisture-resistant coating before leaving the factory. Additional coatings should not be applied unless it is first determined from the manufacturer that the coating to be used will not affect the rectifier.

Mercury vapor is very harmful to selenium rectifiers and will destroy the rectifying action even though they have been coated. Any mercury remaining due to a broken mercury vapor tube should be carefully removed.

Line Resistor Considerations

A line resistor is connected in series with the rectifier in radio and television sets. While omission of this resistor will increase the voltage of the B+ supply, it serves an important purpose in protecting the rectifier and condenser from heavy surge currents. These currents may damage or shorten the life of the rectifier and/or electrolytic condenser. In some sets the resistor rating has been selected so that it will burn out on overload, thus protecting more expensive components against burnout. Replacement of a defective line resistor should be made with another of the same type and rating.

A damaged rectifier may be due to failure of the rectifier itself, or faulty operation of the components

of the set. When a selenium rectifier must be replaced, the current draw of the B+ circuit should be checked to be sure it is within the rating of the rectifier. The cabinet and chassis should be checked to make sure that ventilating openings have not been blocked off, or restricted, preventing proper cooling.

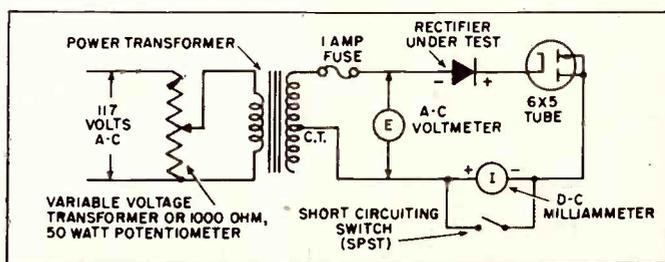
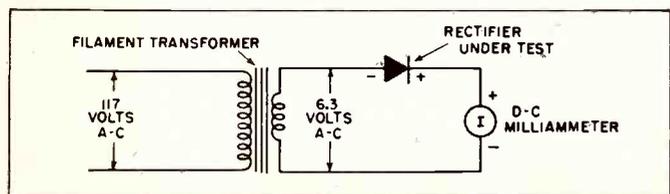
Visual Inspection

Trouble may be indicated by melting of the alloy which covers most of one side of each cell and which forms the cathodes of the rectifier. Such melting may be due to excessive heating of the rectifier caused by current overload, or by restricted ventilation causing the temperature of the rectifier to rise above the melting point of the alloy. The melting may be indicated by a thickening of the alloy at the bottom edge of the cells, or by the presence of drops of solder-like metal below the rectifier.

Inspection of the alloy area at the center of the cells around the contact washer may show burning or discoloration. A burning all around the contact washer may result in an open circuit; the rectifier should be replaced when such a condition is evident. Discolored or burned spots may be observed on the alloy away from the contact washer. These spots have been caused by sparking on the cells resulting from application of higher than rated voltage to the rectifier. They may also occur when voltage is first applied after a long period of idleness. These spots are self-healing and will not affect the operation of the rectifier unless an area equal to about 20 percent of a cell has been burned, or unless sparking is persistent. In

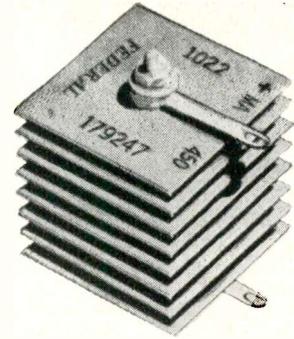
Fig. 1—(Below) Set-up for testing forward current in a selenium rectifier.

Fig. 2—(Right) Set-up for testing reverse current in selenium unit.



on Selenium Rectifiers

Defects, Tests, Color-TV Units



either case, the rectifier should be replaced.

Troubles in Selenium Rectifiers

The troubles found in selenium rectifiers will generally fall under one of the following classifications:

- (a) Open-circuited rectifier resulting in no B+ voltage.
- (b) High forward resistance in rectifier, resulting in low B+ voltage.
- (c) Short-circuited rectifier, resulting in burned-out line resistor or opening of circuit-protecting device.
- (d) Low reverse resistance of rectifier, resulting in low B+ voltage and/or hum in loudspeaker of set.

(e) Overheated selenium rectifier, resulting in melted alloy on the rectifier cells and any of the troubles listed above.

Technicians sometimes inquire about aging effects. Under operating conditions, and, to a lesser extent, when idle, the selenium rectifier will age. During the aging period the forward and reverse resistances will increase gradually, and, after approximately one year, stabilize. This aging will result in approximately a 7% decrease in outut voltage.

Ohmmeter Test

An ohmmeter of the conventional type, employing a battery and meter for measuring resistance, may be used for a rough check of a selenium rectifier.

Place the leads from the ohmmeter on the terminals of the rectifier in one direction and then reverse them, reading the resistance each time. Two high-resistance readings indicate an open-circuited rectifier. Two low-resistance readings indicate a short-circuited rectifier. One low and one high resistance reading show that the rectifier is functioning as a rectifier. These indications do not, however, reveal whether the forward resistance is sufficiently low, or the reverse resistance sufficiently high, for satisfactory performance.

Forward Current Test

Fig. 1 shows a simple circuit which can be made for testing the forward resistance of a selenium rectifier. The limits of forward current for each type of rectifier are

shown in Table 1. These figures are approximate, and give a good indication as to whether the rectifier is near the end of its useful life. There will be cases where rectifiers that test within these limits will not give

TROUBLE SHOOTING CHART

Trouble	Possible Condition	Procedure
No B+ voltage.	Open line resistor. Open rectifier.	Test for AC voltage between switch and B-. If o.k.: Test for AC voltage between rectifier + and B-. If o.k., check stack for open circuit.
Low B+ voltage.	High forward resistance rectifier. Leaky or low capacity condenser. Excessive B+ current.	Test rectifier for forward resistance. If o.k.: Test condenser for capacitance and leakage. Test B+ circuit for excessive tube current or partial short-circuit due to defective components.
Hum in Loudspeaker.	Leaky or low capacitance condenser. Low reverse resistance rectifier.	Test condenser. If o.k.: test rectifier.
Sparking or dark spots on plates of rectifier.	Deformed rectifier.	If sparking occurs after set has been inoperative for a long time, leave it on as rectifier will probably reform. If sparking continues, test rectifier reverse resistance. If reverse current is high or sparking persists, replace rectifier.
Burned-out line resistor.	Defective condenser. Defective rectifier. Shorted load.	Test for shorted rectifier or condenser. Check load for excessive current or intermittent shorts.

TEST LIMITS for FEDERAL & RADIO RECEPTOR SELENIUM RECTIFIERS

Federal Unit Number	Radio Receptor Unit Number	Forward Current Test Min. Milliamperes at 6.3 Volts A-C (See Fig. 1)	Reverse Current Test Max. Milliamperes at E=240 Volts A-C (See Fig. 2)
1002	8J1	20	13
1003	5M4	20	13
1004	—	33	19
1005	5P1,6P2	33	19
1006	5R1	80	23
1007	—	11*	6*
1008	—	19*	8*
1009	—	43*	10*
1010	5Q1,6Q1,6Q2	80	23
1014	—	19	8
1021	—	135	31
1022	6S2	65	13
1023	5QS1,6QS2	120	27
1028	5Q1,6Q1,6Q2	80	23
1090	6Q4	80	23
1101	5M1	20	13
1159	8Y1	6	4
1200	—	210	48
1214	—	12	8
1223	—	210	48

* Test Limits Apply to a Single Section.

high enough B+ voltage. Judgment must be used in marginal cases by testing the rectifier in the set and measuring the B+ voltage under actual working conditions. A rectifier which produces B+ voltage near the operating minimum may cause trouble in the near future.

Reverse Current Test

Fig. 2 shows a simple circuit which can be made for testing the reverse current of a selenium rectifier. When voltage is first applied to a good rectifier, the reverse current will be high; this current will rapidly decrease while the voltage is applied. The short-circuiting switch is used to protect the meter during the high current or forming period. Allow 1½ to 2 minutes for forming. It would be desirable to use a variable voltage transformer or a potentiometer (as shown) to increase the voltage gradually, protecting the tube in the event the rectifier has a low reverse resistance.

Selenium Rectifier Checker

An easily-built test gadget for checking selenium rectifiers is illustrated in Fig. 3. Data on building and operating this unit is presented below. Models referred to under *Operating Instructions* are Sarkes Tarzian selenium rectifier units.

Parts List

- F₁—Fuse—2 ampere
- J—Jack, to accept rectifier lugs
- S₁—Switch—Toggle—On-Off
- S₂—Switch—2 wafer, non shorting
- E₂—Voltmeter—0-150 Volts D.C.
- C₁—Capacitor—50 mfd.—150 volt
- C₂—Capacitor—125 mfd.—150 Volt
- C₃—Capacitor—350 mfd.—150 Volt
- R₁—Resistor—Adjustable—2000 ohms—25 watt—Tapped at 2000; 1750 and 1300 ohms
- R₂—Resistor—Adjustable—1000 ohms—50 watt—Tapped at 850; 650 and 520 ohms.
- R₃—Resistor—Adjustable—500 ohms—100 watt—Tapped at 430; 375 and 290 ohms

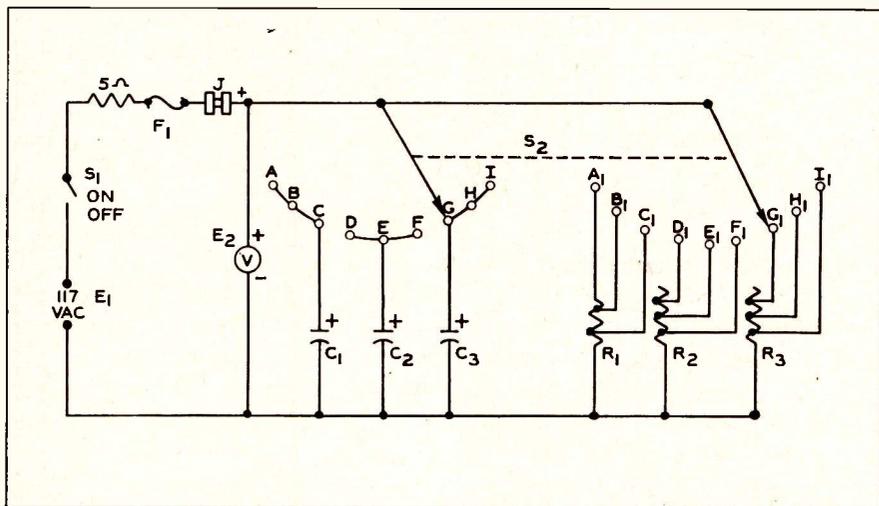


Fig. 3—Selenium rectifier tester. Construction details are presented in text. Switch present is a 2-wafer unit. Jack labeled J accepts the selenium unit to be tested.

Service data on the line of selenium rectifiers for color TV currently being manufactured by IRC Corp. A is the length, B is the width, of each cell plate. Y is the distance the connector terminal protrudes above the cells. MD is the distance between mounting nuts at front and back of unit.

Type	Maximum Current Rating MA	Maximum Input Volts RMS	Maximum Peak Inv. V.	Minimum Series Resistor Ohms	A (Inches)	B (Inches)	MD Maximum (Inches)	Y (Inches)	Stud Size
RS-600S	600	130	380	5	2	3	1-5/16	13/32	8-32
RS-608S	600	174	505	5	2	3	1-3/4	13/32	8-32
RS-609S	600	195	570	5	2	3	1-7/8	13/32	8-32
RS-700S	700	130	380	5	2	3	1-7/8	13/32	8-32
RS-708S	700	174	505	5	2	3	2-5/8	13/32	8-32
RS-709S	700	195	570	5	2	3	3	13/32	8-32
RS-750S	750	130	380	5	2	3	1-7/8	13/32	8-32
RS-758S	750	174	505	5	2	3	2-5/8	13/32	8-32
RS-759S	750	195	570	5	2	3	3	13/32	8-32

Selector Switch Positions

- A-A₁ Model 65—2000 ohms on R₁
- B-B₁ Model 75—1750 ohms on R₁
- C-C₁ Model 100—1300 ohms on R₁
- D-D₁ Model 150—850 ohms on R₂
- E-E₁ Model 200—650 ohms on R₂
- F-F₁ Model 250—520 ohms on R₂
- G-G₁ Model 300—430 ohms on R₃
- H-H₁ Model 350—375 ohms on R₃
- I-I₁ Model 450—290 ohms on R₃

Operating Instructions

1. With switch S₁ in the off position, plug rectifier to be tested into the socket. Observe polarity very carefully.
2. Rotate Selector Switch S₂ to proper position for rectifier type being tested.
3. Apply voltage by pushing switch S₁ to the on position.
4. Within 5 minutes from the time the voltage is applied the readings should be as follows:

MODEL	APPROX. DC VOLTAGE READING
65	130 volts
75	130 volts
100	125 volts
150	130 volts
200	130 volts
250	130 volts
300	125 volts
350	125 volts
450	120 volts

5. Reject all units that do not approximate these voltages

CAUTION: It is important that rectifier polarity is closely observed.

Color TV Rectifiers

Color TV production, presently under way on a small scale, has initiated demand for larger current capacity selenium rectifiers due to the increased number of vacuum tubes required. After many months of development, International Rectifier Corporation has started production on a series of color TV selenium rectifiers. Considerable design effort was expended in establishing the electrical and mechanical specifications. For example, to efficiently handle the increased current rating, the units are assembled with a bellows type spring contactor identical to the type used in quality industrial selenium rectifier stacks. This type of contact permits lower forward voltage drop, lower temperature rise and positive large area contact all resulting in efficient long life operation.

In regard to size, this series of rectifiers is assembled using 2-in. x 3-in. rectifier plates. This size plate allows the electronic design engineer wider latitude in chassis layout. It was found in consideration of various size plates that the 2-in. x 3-in. plate is the most practical size. (Continued on page 63)



NOW FROM P. R. MALLORY & CO. Inc. **MALLORY...**

the **1**st... All-Channel
UHF Converter
Designed to fit
Inside ANY VHF Set

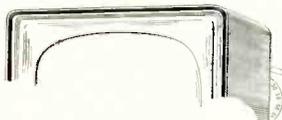
Here's another first from Mallory . . . The Mallory Model '188' Concealed UHF Converter. It fits inside any VHF set to make it an all-channel receiver. And it's a sure-fire salesbuilder for you.

Look at these features of the Mallory '188'.

OUT OF SIGHT . . . The entire unit is mounted inside the cabinet. All that shows is a clear plastic selector dial and switch lever.

EASY TO INSTALL . . . No alteration in the set chassis is required and the '188' has its own power supply. Can be mounted inside the cabinet on either side or at the top. A bracket and four screws do the job on wood cabinets. On plastic or metal cabinets, the converter may be mounted on the fiber-board rear enclosure.

PROVED PERFORMANCE . . . The '188' offers you the same proved performance . . . the same high quality reception . . . as the Mallory '38' Cabinet Converter which has given outstanding performance in UHF areas across the Nation.



*Mallory Concealed Converter
—first on the market*



*Mallory Cabinet Converter
—first on the market*

*Give Yourself Greater Converter Sales . . .
By Giving Your Customers Their Choice
of Mallory Converter Styles.*

.....
NO RADIATION PROBLEM!

Both Mallory Converters contain specially designed components to prevent troublesome interference from radiation—a problem common to low quality converters which ruin TV reception over a wide area.

P. R. MALLORY & CO. Inc.
MALLORY

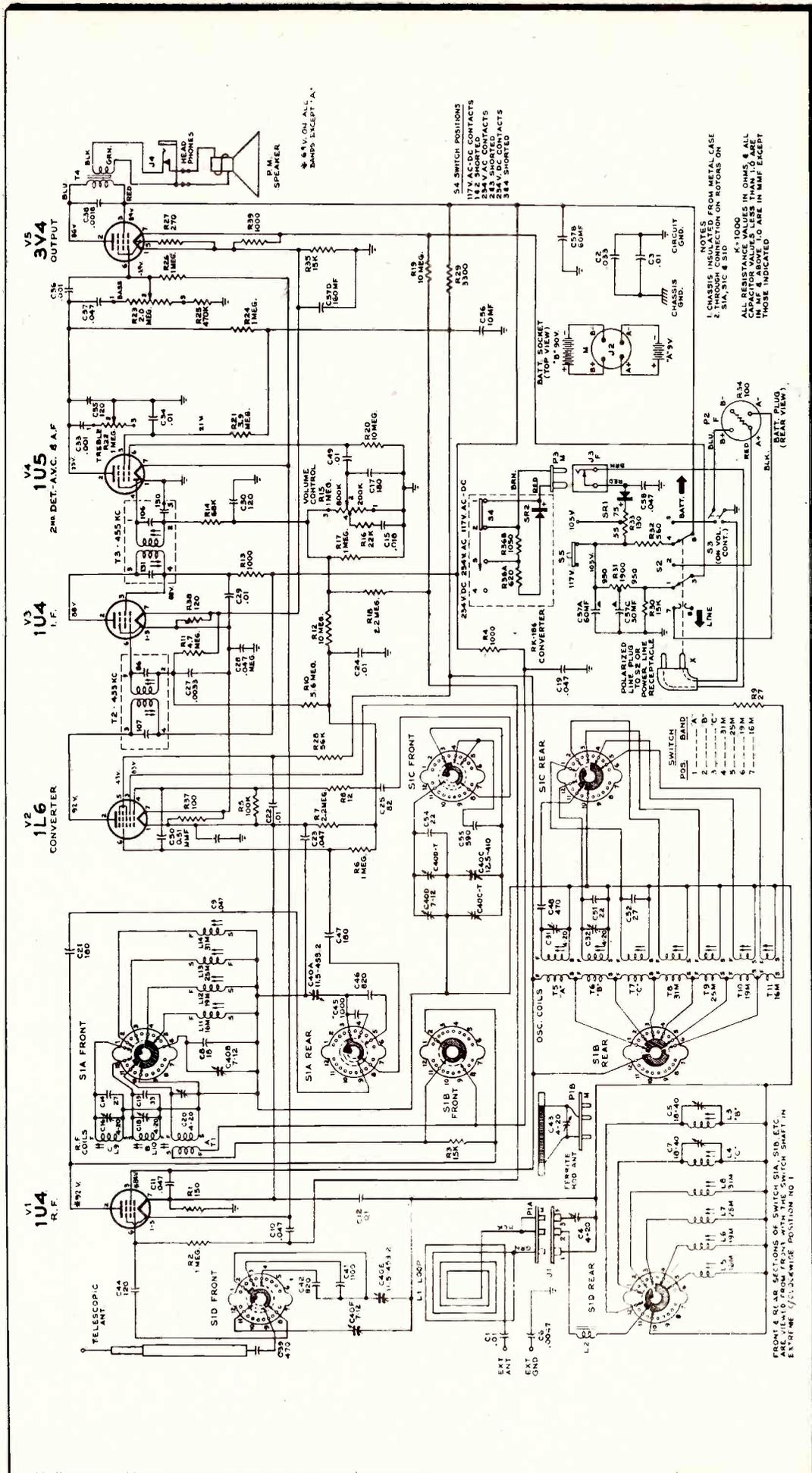
CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS
RECTIFIERS • POWER SUPPLIES • CONVERTERS • MERCURY BATTERIES

APPROVED PRECISION PRODUCTS

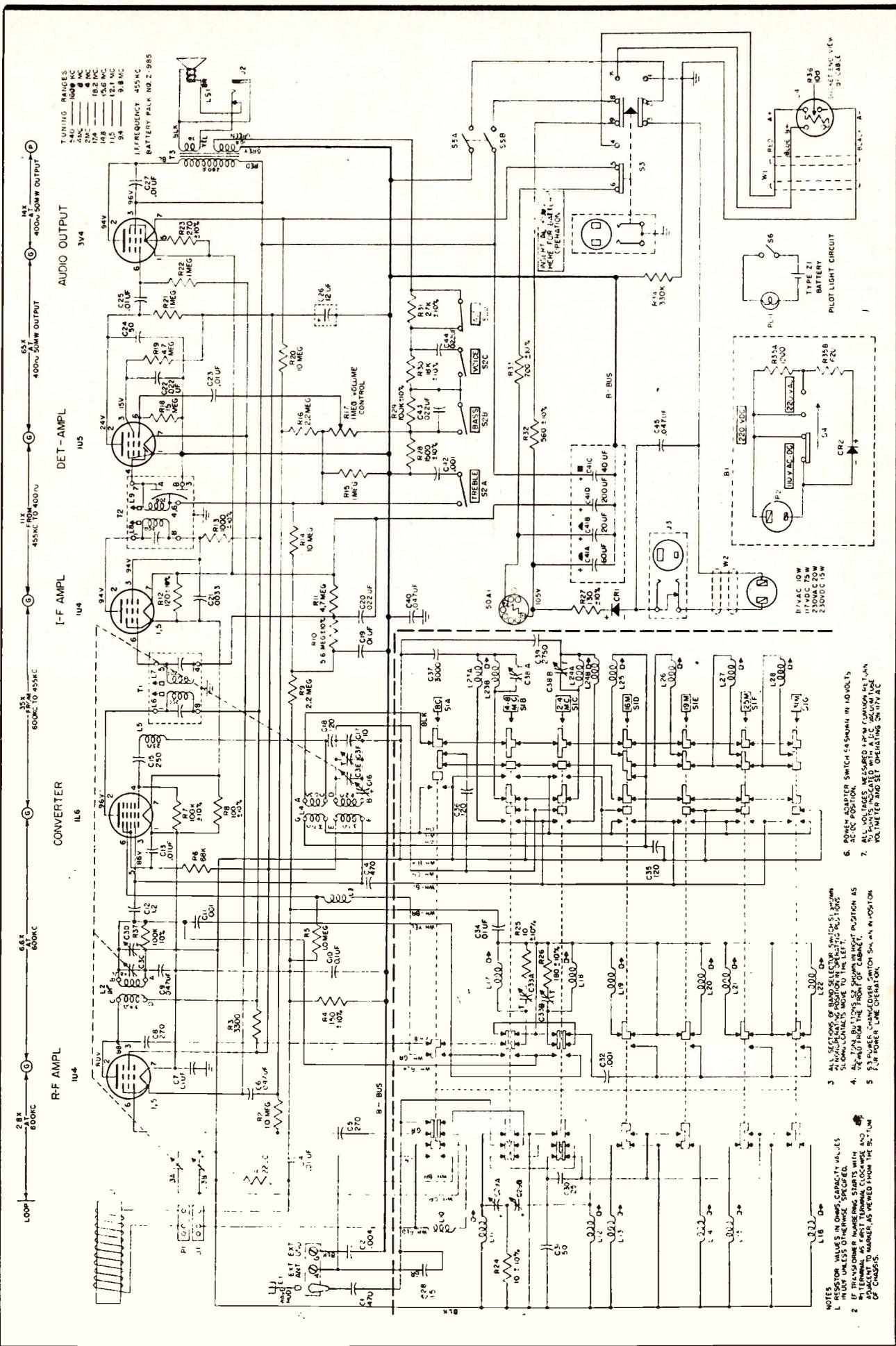
P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

Late-Model 3-Way Portable Radios

Schematics of New RCA and Zenith Sets Will Help You Service These Receivers



RCA Victor AC-DC-Battery 7-Band Portable Receiver—The Strato-World. Models 3-BX-671, 3-BX-672. Chassis No. RC-1125



ZENITH Portable Model L600, Chassis 6L40. New circuit note: Thermal Regulator Tube 50A1 is an automatic rheostat designed to counteract supply voltage changes.

Battery Data for Technicians

Testing, Storage; Most-Popular Types; Replacement Considerations

• By the time you read these words, the first signs of an annual trend will be evident. With warmer weather and more hours of sunlight, the nation's citizens will turn away from their fireplaces and once more begin to investigate the outdoors. Lawns, beaches and parks will be dotted by growing numbers of people. Many of them will have portable radios beside them. These radios mean more sales and service for you. Are you ready *now*?

Portables that have spent the winter in the attic or storage closet are getting dusted off. Many of them need servicing that was neglected over the cold months. How's your stock of 1.4v tubes, as well as other types used in these receivers?

A great many portables will need new batteries.

Are you ready to cash in on this seasonal swing? Can you give your customer the right replacement if he threw out last year's batteries and doesn't know which type he needs? Do you know which type in the brands you carry are replacements for units used in any set, even when the batteries originally present were made by another company and coded differently? Can you give batteries an adequate test, convincing to the customer, to see whether they need replacement? Do you know how to store batteries in order to keep them at peak potential? Do you know which types to stock, on the basis of probable demand? If you want answers to any of these questions, read on:

Identification of Types: Every battery manufacturer uses his own coding system to identify the types in his line. Since no two adhere to the same system, you sometimes run into this problem: A customer walks into your shop with a set of old "A" and "B" packs made by company X. You carry a full stock of replacements in brands Y and Z. Between them, you're bound to have the set the customer needs, but how do you ferret them out? The National Electronics Distributors Association has gone a long way to clear up this confusion by assigning standard code numbers to all battery cells and packs in current use. Many manu-

facturers are cooperating with this organization to the extent of printing the NEDA numbers in a prominent place on their batteries, along with the manufacturer's own code numbers.

"A" BATTERIES	
(NEDA Code Numbers)	
3	13
7	19
20	
"B" BATTERIES	
(NEDA Code Numbers)	
200	203
201	204
202	211
"A-B" PACKS	
(NEDA Code Numbers)	
401	404

13 most popular battery types for portables.

Where manufacturers do not adhere to this practice, identification is still possible. NEDA annually prepares a battery interchangeability chart, available on request, listing NEDA numbers and corresponding manufacturers' identification for all types. The heart of this chart, showing listings for 11 leading brands of batteries, is reproduced on the following page. A twelfth brand, Bond, while not listed, can be tied up with the listing easily. For the most part, Bond numbers correspond with those used by Olin and Winchester. In those cases where they do not, the following rule usually applies: Where the third digit of a 4-digit Olin number is 1, the 3rd of the 4 digits on the corresponding Bond pack will be 2. For example, Olin battery 4816 is equivalent to Bond 4826.

Sometimes your potential battery customer has thrown away his worn-out batteries, and there is no marking in the receiver itself to help you determine the replacement types needed. Inspecting the battery-connector plugs in the portable is the first step in determining the proper replacements. The socket terminal guide on the following page

can help you in this bit of detective work. To the right of each socket type is a list of batteries (NEDA code) using the terminal arrangement shown.

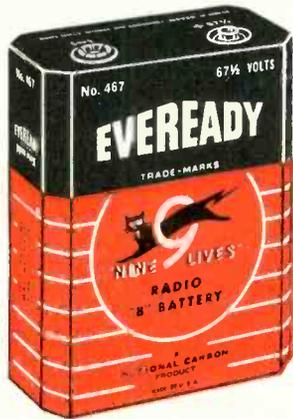
The surest way to identify a doubtful type is to consult a *receiver listing*. These lists, which are prepared by most battery makers and are available through jobbers and distributors, cover hundreds of portable receivers by brand name and model number, and describe the battery complement used in each. A novel device that does this job and also acts as an attention-getting sales aid is the *RCA Select-O-Meter*. Pictures of 72 popular portable sets of various makes are laid out in squares. A wire terminating in a male contact tip is plugged by the customer into a corresponding female outlet on the square where his receiver is listed. This causes a bulb to light up beside the RCA code numbers for the appropriate battery replacements. Of course, the device is battery-operated! It works from a 1.5v flashlight cell.

Popular packs: Since batteries don't last forever, even under the best storage conditions, knowing which ones are likely to be most in demand is a great help toward judging your stock requirements. The "baker's dozen" shown elsewhere on this page lists the 13 most popular "A," "B" and "A-B" packs. Depending on your anticipated turnover, you may want to order these types only, or you may want to order more of the 13 than of other numbers.

Testing: It is no secret that putting your voltmeter leads across the terminals of a battery, with no load, will tell you very little about its true condition. The best load with which to check a battery is the receiver in which the unit will be used, or one like it. Often the customer doesn't bring the portable in. He just drops his "A" and "B" cells on the counter, asking: "Think these'll hold out another month or two?" If you don't happen to have a portable handy at the time, a fast, adequate battery check is not likely to be made.

(Continued on page 54)

Everything in this ad **FREE** With Orders For "Eveready" Portable Radio Batteries!

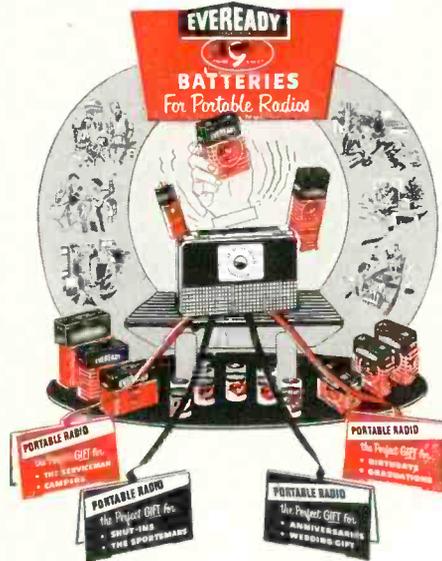


FREE BATTERIES!

Bonus batteries to sell
at 100% profit!

FREE MOTION-DISPLAY!

Powered by a single "EVEREADY" flashlight battery, the moving hand catches your customer's eye . . . gets big impulse sales! Displays your featured portable. Has special provision for promoting radio service. Measures 25" x 20" x 8".



FREE DEALER-HELPS!

Banners . . . streamers . . . replacement guide . . . dummy batteries. *All* to help you sell more "EVEREADY" batteries!



DON'T MISS THIS OFFER!

Place your pre-season orders now for "EVEREADY" radio batteries on the special order blank available through distributors. Start making extra profits on year-'round sales of portable sets and service, and "EVEREADY" batteries. Order today! Quantity of displays is limited — act quickly.

The terms "Eveready", "Mini-Max", "Nine Lives" and the Cat Symbol are registered trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY

A Division of Union Carbide and Carbon Corporation • 30 East 42nd Street, New York 17, N. Y.

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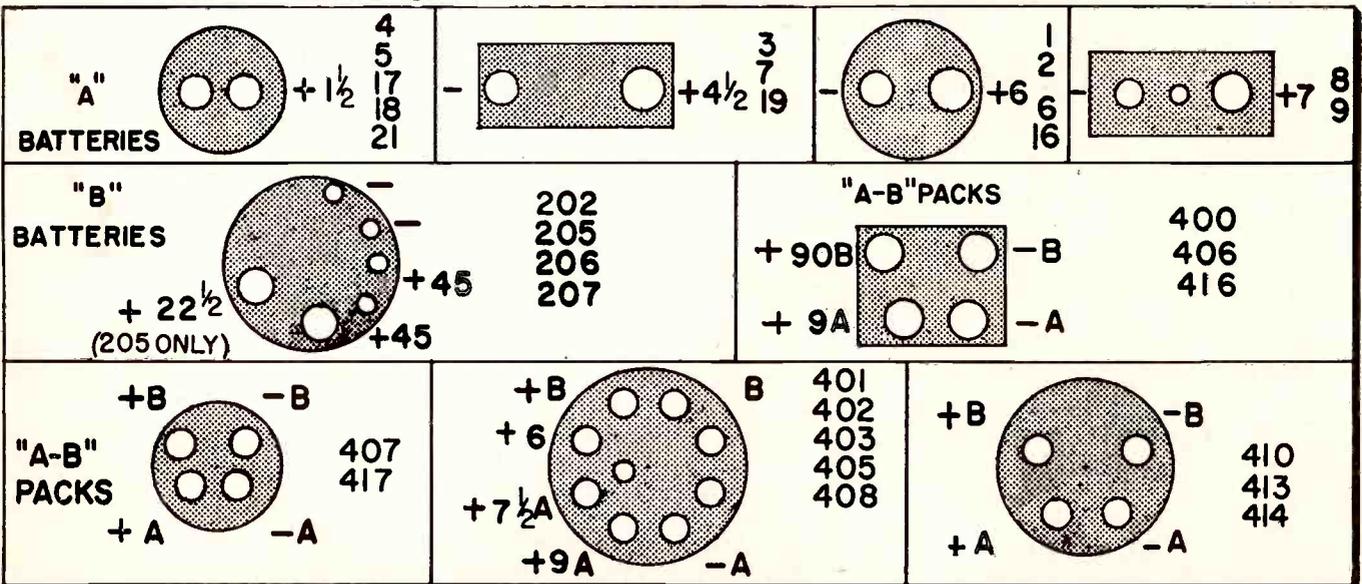
Battery Replacement Chart

*Most numbers for Bond batteries correspond to those for Olin (see text). Chart adapted from NEDA listings.

NEDA NUMBER	VOLTAGE	ACME	BRIGHT STAR	BURGESS	EVEREADY NATIONAL CARBON	GENERAL	OLIN * WINCHESTER	PHILCO	RAY-O-VAC	R C A	USALITE
RADIO A BATTERIES											
1	6			866	2F4	718	4817		P698A	VS010	638
2	6				Z4	724	4919		87R4	VS068	
3	4 1/2			360	F3	736	3816	D-100	P93A	VS067	688
4	1 1/2	114		462	4F	742	4816	P 94	P94A	VS004	634
5	1 1/2	116		660	6F	743	4814	P-96	P96A	VS007	637
6	6			646	F4P1	744	4914	P 4F4R	P694A	VS009	639
7	4 1/2	123		361	G-3	746	4918	P-100	P83A	VS002	683
8	7 1/2				B-5	713	5219		P551	VS129	
9	7 1/2				C-5	717	5316		P751	VS065	
10	7 1/2				T-5				P7CD1		
11	1 1/2				2F				P 24A		
12	1 1/2			465	4FL		13		P941	VS005	642
13	1 1/2			10A	2R	950	906	D	2LP	VS036	
14	1 1/2	112		11M	1	935	914	C	1LP	VS035	944
15	1 1/2	115		59-1	Z	915	900	AA	7R	VS034	908
16	6	118SL		868	2F4L	747	4815	P205	P698L	VS011	646
17	1 1/2	118		860	8F	741	4919	P8 F1	P98A	VS011	635
18	1 1/2				2D	720	2516		123P	VS069	
19	3			360	D-3	726	4518		423PX	VS072	
20	1 1/2				21R	954	77		8R	VS236	
21	1 1/2			865	8FL	745	13	4813	P98L	VS008	645
22	7 1/2			561	G5	687			P85A	VS003	
23	1 1/2			60A	TE				PF1	VS070	
24	1 1/2				T	912			400		
25	6				F4L				P694L		643
RADIO B BATTERIES											
200	67 1/2	545	45N	XK45	487	108	1710	P-67	4367	VS016	767
201	45			XK30	455	105	6211	P-105		VS055	
202	45		30-33	M-30	482	109	6210	P-45	P7830	VS013	640
203	67 1/2			K-45	457		1712			VS082	
204	90		60N	N-60	490	132	1713	P-132	4390	VS090	769
205	45		30-59	Z-30	738	104	6718		P7R30	VS015	620
206	45		30-55	A-30		110	6118	P-210	P430	VS014	621
207	45		30-03	B-30	484	111	6218	P-305	P5303	VS012	624
208	15			U10	411		1914		510		
209	22 1/2			U15	412		1915		215	VS084	
210	30			U20	413		1916		520	VS085	
211	67 1/2			P45	477	144	1709	P144	946	VS216	
RADIO A AND B PACKS											
400	9-90		66-03	G6B60	752	343	616	P60B6 F6	AB995	VS047	AB677
401	7 1/2-9-90		66-50	F6A60	753	271	614	P841-A	AB994	VS019	60AD5
402	7 1/2-9-90			G6M60	754	291	615		AB978	VS018	
403	6-7 1/2-75			T5Z50	755	350	618		AB775	VS050	
404	7 1/2-90			T5Z60	756			P-361-P363		VS057	
405	7 1/2-9-90			T6Z60	758	362	619	P-363	AB601	VS057W	
406	9-90			F6A60P	757	273	620		AB909	VS058	
407	1 1/2-63			4GA42		258	624	P41A4FL	AB944	VS053	AB669
408	7 1/2-63			G5A42		263	623	P87	AB794	VS038	AB676
409	1 1/2-90			5DA60		278			AB24	VS043	AB665
410	1 1/2-90			6TA60			622		AB64	VS054	
411	6-75			F4A50							
412	1 1/2-60			2TXK40		254		P-89			
413	1 1/2-80	782	61-05	17GD60	759	328	0518	P60D11L	AB82	VS022	AB666
414	1 1/2-90			4SD60	758	299	0513	P60B6 L	AB85	VS021	
415	7 1/2-9-90			S6D60		326		P326	AB982	VS119	
416	1 1/2-9-90				752W	343(plus EF-728)	0616W				
417	1 1/2-90			6FA60		279	611	P80A4L	AB84	VS037	AB667
418	6-90			F4B60					AB695	VS048	
419	67 1/2								AB484	VS041	
420	6-7 1/2-90			F5M45					AB767		
421	6-90			C4B50					AB688A		
422	6-75			C4B50					AB685	VS046	
423	1 1/2-61 1/2			4GA41				P41A4G	AB1944	VS052	
424	1 1/2-90			4T260					AB82) Metal cap		
425	1 1/2-90				729	364		P364		VS064	
426	1 1/2-90						0511			VS045	
427	6-67 1/2			18GD60					AB6145N		

Socket Terminal Guide

Numbers to right of sockets are NEDA battery types. Chart adapted from Olin guide.



\$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

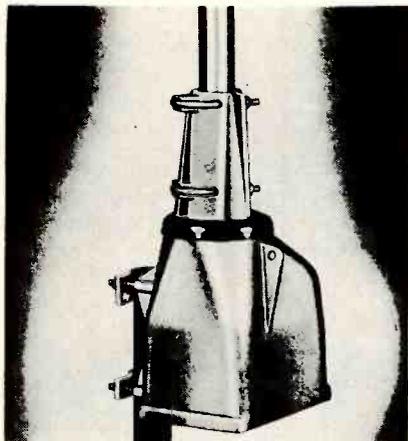
1445 HUDSON BOULEVARD
NORTH BERGEN, N. J.

Installation Accessories

Mounts, Masts, Rotators; Boosters, Converters, Couplers

Crown ANTENNA ROTATOR

Designed with a preassembled mast support, this antenna rotator simplifies installation. Other features: wide mast support base,



weather-proof design, automatic braking to prevent coasting and wind-milling, lifetime lubrication of capacitor motor, and 365-degree rotation in 60 seconds. Crown Controls Co., Inc., New Bremen, Ohio.—TECHNICIAN

CDR ANTENNA ROTOR

Model TR-4 CDR Rotor offers the following features: ability to handle as much as a 150-pound load; weather-proof design; reinforced die-cast housing; precision gears; positive stop at end of rotation; reversible clamps that handle 7/8-in. to 2-in. masts; heavy-duty motor that reverses instantly; and adaptability to mast, tower or platform mounting. Unit is weather sealed and lubricated for life. Cornell-Dubilier Electric Corp., South Plainfield, N.J.—TECHNICIAN

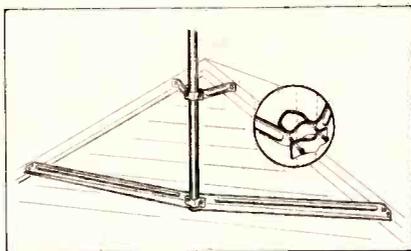
ITI ANTENNA COUPLERS

The IT-131A and IT-132A VHF Autocouplers use individual r-f transformers to feed up to eight receivers. Units have low insertion loss and provide good receiver isolation. The recently developed IT-135A UHF Autocoupler uses wide-band hybrid ring principles to feed two UHF receivers or converters from a single antenna. All couplers are housed in plastic shallow surface wiring boxes with phenolic covers.

A full line is available for VHF, UHF and VHF/UHF applications. Industrial Television, Inc., 369 Lexington Avenue, Clifton, N.J.—TECHNICIAN

South River ANTENNA MOUNT

This eave mounting for antenna installations, EM-48, is made of heavily-embossed steel to provide strength and rigidity; it is also galvanized to prevent rust. The lower member (one-piece construction) has a 48-in. spread. Embossed steel upper bracket provides clearance from roof overhang to permit vertical installation. A mounting feature enables the installation man to use a spintite nut driver to tighten the mast clamp securely and easily. Also



available with 60-in. spread to permit eave mounting on gently-pitched roofs (EM-60). South River Metal Products Co., 377-379 Turnpike, South River, N.J.—TECHNICIAN

Waldom BOOSTER-COUPLER

A distribution amplifier permits the use of two TV receivers from a single antenna and simultaneously boosts signal strength for both. The broad-band Duo-Tenna operates directly from the antenna on VHF, and can convert two receivers to UHF from a single converter. Isolation design prevents radiation interference between the two sets. List price, \$39.50. Waldom Electronics, Inc., 911 N. Larrabee, Chicago 10, Ill.—TECHNICIAN

PRICE CORRECTION

A New Product report on Webcor Tape Recorder model 2030, in February TECHNICIAN, page 47, was in error as to the price. Suggested list price for model 2030 is \$239.50 east of the Rockies.

Cayo TELESCOPING MASTS

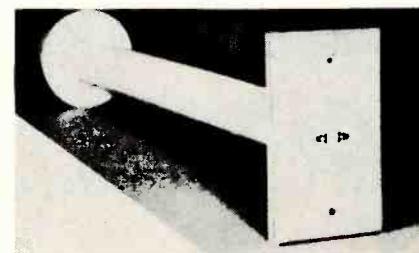
Teles-KO-Ping antenna masts, available as 2- or 3-section towers in sizes from 15 to 35 ft., are said to require only one man for complete installation. List prices, depending on size, range from \$9.95 to \$24.95. Tall-KO-Kits, using the special Tall-KO-lock feature, include all attachments and instructions for assembly and erection of 3-section telescoping masts except the tubing. List price, \$4.95. Cayo-TV Engineering, 1014½ Michigan Ave., St. Joseph, Mich.—TECHNICIAN

Granco UHF CONVERTERS

Hide-Away UHF converters, available in 3 models, may be installed out of sight behind the TV receiver, attached to the rear protective cover. An inconspicuous tuning knob protrudes at one side of the receiver's cabinet. A miniature slide-rule dial can be read by looking at the rear edge of the cabinet. Converts to Channel 5 or 6; shielded to avoid interference problems; incorporates UHF-VHF switch; requires less than 1¾ in. clearance at back of TV set. One model operates from TV receiver's power supply; another model is self-powered. Granco Prods., Inc., 32-17 20th Ave., L.I. City 5, N. Y.—TECHNICIAN

Javex LEAD-IN FEED-THRU

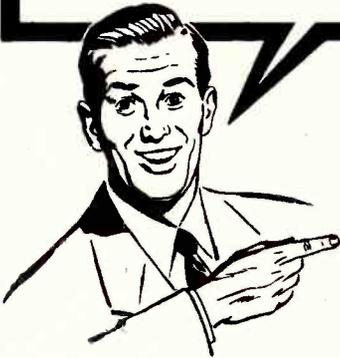
Constructed of polystyrene, the Thru-the-Wall Tenna-Tube handles any antenna line, including co-ax.



ladder, round or flat, and is installed in wall by drilling a 1¾-in. hole. Solderless in design, it comes complete with plug and screws for mounting, and features a miniature wall plate. Available in choice of colors. Javex, P.O. Box 646, Redlands, California.—TECHNICIAN.

Push the tube that PROTECTS YOU TWO WAYS!

**SYLVANIA
PICTURE TUBES
GUARD YOUR
REPUTATION
AND PROFITS!**



Be sure to show your customers the name SYLVANIA now etched on the lower left face of every Sylvania Picture Tube.

These letters are small in size (imperceptible when the tube is lighted), but they're mighty big in importance! For, they identify a genuine Sylvania Picture Tube... the tube found best in exhaustive tests conducted by an independent laboratory on tubes of 9 different makes.

Naturally, this high performance record helps maintain your reputation. It

also helps protect your profits... eliminates customer complaints and costly call-backs.

Remember, most customers regard a picture tube as an important investment. So, you're doing them a valuable service when you sell them the best their money can buy... a SYLVANIA! For new characteristics booklet covering all the latest Sylvania Picture Tubes, call your regular Sylvania Distributor or write direct to Dept. 4R-4204 Sylvania today!

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Most of your customers have seen and heard about Sylvania's high quality during the big popular show "Beat the Clock" on CBS-TV. Week after week, from coast to coast, the facts about Sylvania quality are being demonstrated to millions.



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Sylvania Electric Products Inc.  1740 Broadway, New York 19, N. Y.

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LIGHTING • RADIO • ELECTRONICS • TELEVISION

Audio and Hi-Fi Products

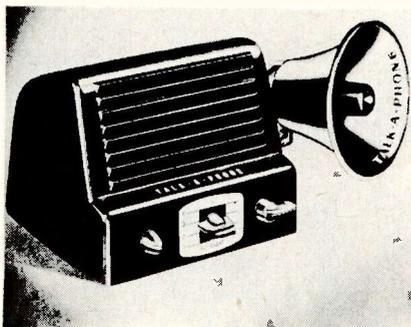
FM-AM Tuners, Intercom, Preamplifier, Tape Units, Speaker

Altec AM-FM TUNER

The model 303C AM-FM tuner provides increased sensitivity, optional afc, inputs for phonograph and other accessories, and controls for use as preamplifier. Controls include 3-position record crossover, on-off-volume, tuning, 5-position selector (FM, FM with afc, AM, phono, spare), and separate boost-and-cut bass and treble controls. Altec-Lansing Corp., 161 Sixth Ave., New York 13, N. Y.—TECHNICIAN.

Talk-A-Phone INTERCOM

The AC-5406 master station, with 5-substation capacity, and the AC-5411 master station, with 10-substation capacity, are designed to provide ample volume for paging on all positions in the intercom system.



Both models are master selective systems. Person using the master can talk and listen to any one substation, or all simultaneously. Only the master unit plugs into an electrical outlet. Talk-O-Phone, 1512 So. Pulaski, Chicago 23, Ill.—TECHNICIAN

Reeves MAGNETIC TAPE

"Lifetime" magnetic recording tape, guaranteed not to break or curl under normal uses, employs a base of polyester film instead of standard cellulose acetate. Unaffected by abnormal conditions of humidity or temperature, the tape is not susceptible to shrinkage or stretching, it is said. Available in splice-free reels of 600, 1200 and 2400 ft., priced respectively at \$5.25, \$9.75 and \$19.80. Available on hub only (2400 ft.) at \$16.95. Reeves Soundcraft Corp., 10 E. 52 St., New York 22, N. Y.—TECHNICIAN

Heath HI-FI PREAMP

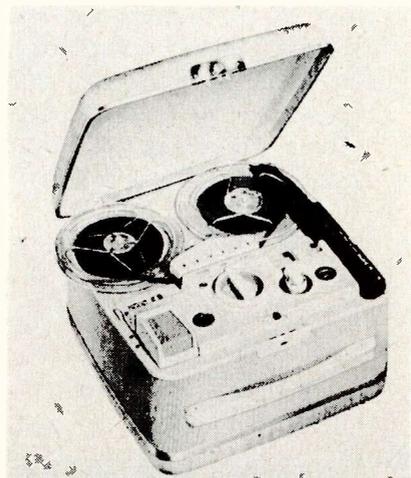
The re-designed separate-chassis preamplifier and control unit, model WA-P2, features 5 inputs, separate turnover and roll-off switches for record equalization (4 positions



each), 3 twin triodes, separate bass and treble tone controls, volume control and cathode-follower output. Requires external power supply. Available in kit form, \$19.75. Heath Co., Benton Harbor, Mich.—TECHNICIAN

Revere TAPE RECORDERS

The T-900 portable recorder uses 2 speakers mounted in a perforated case to achieve wide-angle sound dispersion. Frequency response is 85 to 7500 cps, ± 3 db; tape speed is 3- $\frac{3}{4}$ in. per sec.; wow and distortion are low. Also available with

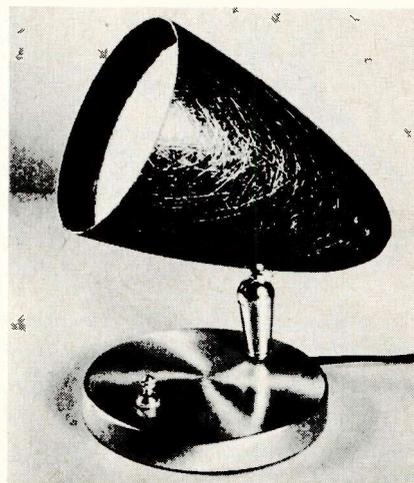


radio as model TR-1000. Hi-fi model T-10 provides response from 60 to 15,000 cps with a tape speed of 7- $\frac{1}{2}$ in. per sec., ± 3 db. Unit features keyboard operation and dual re-

ording-level indicators. Revere Camera Co., 320 E. 21st St., Chicago 16, Ill.—TECHNICIAN

Floritone EXTENSION SPEAKER

Model 100 portable auxiliary speaker comes with 15 ft. of cord and with instructions for easy connection to any radio or TV speaker. Switch in base allows use of both speakers at once, either speaker separately or simultaneous cutting out of both speakers when sound portion of program is not desired. Speaker angle is adjustable. List price, \$14.95. Other models, higher-priced, provide choice of colors, flex-



ible goose-neck mounting of speaker, and speaker-lamp combinations. Sootin's, Inc., 321 N.W. Third Ave., Miami, Florida.—TECHNICIAN

Newcomb AM-FM TUNER

The Classic 200, a hi-fi tuner, is designed for use with amplifiers having their own complete controls. FM features: adjustable afc, cascode front end with 1 microvolt sensitivity for 20 db quieting, dual limiters with Foster-Seeley discriminator, Armstrong circuit, response from 20 to 20,000 cycles within 1 db, distortion below 0.5 percent. AM features: adjustable bandwidth and sensitivity, low-noise circuit, low-distortion detector, 10 kc whistle filter. Tuning eye works on AM and FM. Newcomb Audio Products, 6824 Lexington Ave., Hollywood, Calif.—TECHNICIAN.

NATION WIDE!

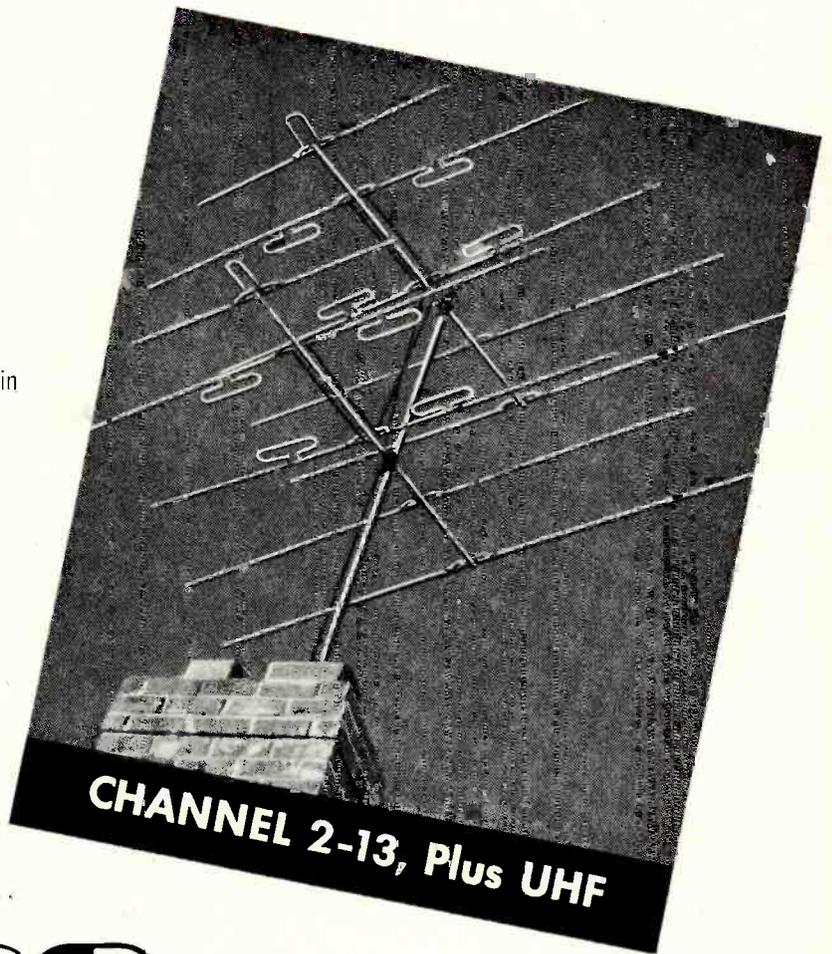
THE FIRST CHOICE OF SERVICEMEN

Here's the antenna beyond all comparisons — the antenna that gives you exactly what you want in packaging, ease of assembly, appearance, and above all, customer satisfaction through outstanding performance.

The Taco Trapper is the only high-gain, broad band antenna that retains the appearance, mechanical balance, and low wind resistance of the accepted medium-gain, streamlined yagi design.

- Cat. No. 1880 Taco Trapper \$19.75 ea.
- Cat. No. 1882 Stacking Kit 1.75 ea.
- Cat. No. 1884 4-Stack Kit 5.90 ea.

COMPLETE DETAILS FROM YOUR DISTRIBUTOR . . .



the TACO TRAPPER . . .



Packed two antennas per carton . . . No king-size cartons — fits in average auto!



Completely factory-assembled — no loose parts!



Opens as easily as an umbrella. Elements automatically lock in position!



Exclusive Taco design permanently locks elements — WITHOUT USE OF TOOLS.

TECHNICAL APPLIANCE CORPORATION • Sherburne, N. Y.

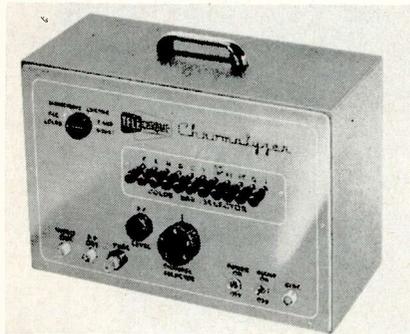
In Canada: Hackbusch Electronics, Ltd., Toronto 4, Ontario

New Test Equipment

Sweep and Signal Generators, Wide-Band Scope, Continuity Tester

Telechrome COLOR GENERATOR

Model 636-B, the Chromalyzer, provides eleven bars of blue, red, magenta, green, cyan, yellow, G-Y, R-Y, B-Y, Q and I signals, in addition to black, white, sync and color burst. Crystal-controlled for accu-



racy and push-button operated, this color generator produces video or r-f signals on any channel from 2 to 6, with both picture and sound carriers. Lightweight portable design. Telechrome, Inc., 88 Merricks Rd., Amityville, N.Y.—TECHNICIAN

Telonic UHF MARKER OSC.

This new UHF marker oscillator is said to tune from 400-930 mc with an accuracy of $\pm 0.25\%$. The 4-in. dial is individually calibrated, and engraved to maintain accuracy. A smooth-action, 5-to-1 vernier facilitates tuning. The 50-ohm output is attenuated by 0, 20 and 40 db. For use as a marker or signal source. Price, \$100.00. Telonic Industries, 444 South Rural Street, Indianapolis, Indiana.—TECHNICIAN

Hickok GENERATORS

UHF sweep alignment generator, model 697 provides fundamental output on all UHF channels, together with linear sweep, for accuracy in alignment. Other features: internal blanking to provide baseline, triple shielding to minimize leakage, continuous tuning, built-in phasing control, variable sweep width.

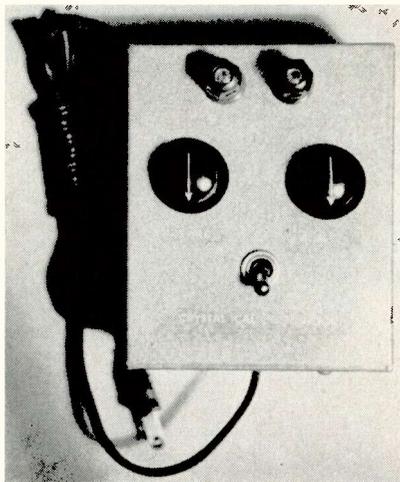
VHF sweep generator, model 695 offers fundamental output on all VHF channels. Other features: built-in adjustable bias voltage (0-12 v) for alignment purposes, variable heterodyned output on i-f

band (0-50 mc), internal blanking to provide reference baseline, phasing control.

White dot generator, model 650 C is a universal video generator based on earlier model 650. Unit provides a modulated r-f carrier for injection at the receiver's antenna input. It is useful in checking linearity, as well as operation of video stages in monochrome receivers. In addition, white-dot pattern facilitates checks of convergence and other factors in color sets. Conversion assembly to adapt earlier-model 650 for color is available for \$5.00. Hickok Electrical Instrument Co., 10523 Dupont Ave., Cleveland 8, Ohio.—TECHNICIAN

Noll MARKER GENERATOR

The One-Meg marker generator is said to develop one-megacycle markers over entire i-f, FM and



VHF ranges with a single-tube circuit. Key calibration markers are also developed for identification purposes. Several methods are possible for injecting markers into circuit under test. Generator presently available in kit form. Edward M. Noll, Box 94, Hatboro, Penna.—TECHNICIAN

Precision SIGNAL GEN.

Model E-200C provides frequency coverage from 88 kc to 60 mc on fundamentals, up to 240 mc on harmonics. Coverage is on 9 direct-reading bands; instruments are individually calibrated for accuracy.

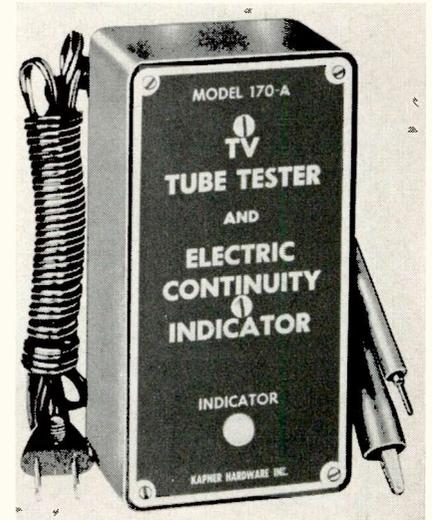
Useful as marker generator or in signal substitution technique. Available outputs; unmodulated r-f, modulated r-f (400 cps), 400 cps audio, or externally modulated r-f. Net price, \$78.50, with cable and booklet. Precision Apparatus Co., 92-27 Horace Harding Blvd., Elmhurst, L.I., N.Y.—TECHNICIAN

Du Mont WIDE-BAND SCOPE

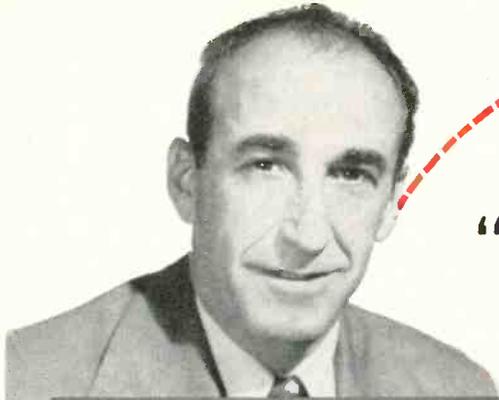
Type 323 precision oscilloscope provides response to 10 mc (3 db down) without impairment of low-frequency signals. Sweep frequency may be adjusted by a calibrated control. Eleven ranges permit full-scale deflection from 0.2 to 400 v. Internal voltage standard facilitates waveform measurements. Type 5AMP crt minimizes beam distortions that normally limit accuracy of measurements. Regulated power supply. Technical Sales Dept., Allen B. Du Mont Laboratories, Inc., 760 Bloomfield Ave., Clifton, N.J.—TECHNICIAN

Kapner CONTINUITY CHECKER

Model 170-A continuity tester plugs into wall outlet to operate without batteries in bench or portable service. Indicator light works over range from less than one ohm to 5 meg. Low current prevents



damage to low-voltage tube filaments. Price, \$4.95. Kapner Hardware, Inc., 2248 Second Avenue, New York 29, N.Y.—TECHNICIAN



Mr. Ed. Lombard, *of Dealer's Wholesale Supply, Ventura, Calif. states:*

“We have tested almost every all-channel antenna, to find the best antenna for our Dealers!”



A Tough Reception Area...

but the DAVIS SUPER-VISION antenna in the Ventura test received all these channels: nos. 2, 4, 5, 7, 9, 11 and 13 from Los Angeles, 75 miles away, over mountainous terrain... nos. 6, 8 and 10 from San Diego, 160 miles away... no. 3 from 24-miles-distant Santa Barbara, despite terrific co-channel interference ...no. 10 from Bakersfield, 90 miles away.

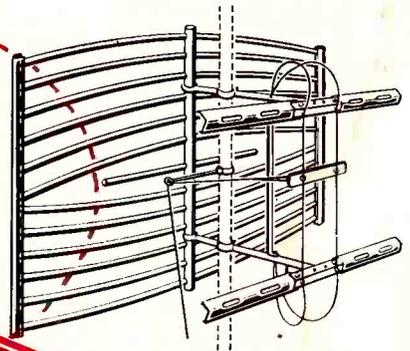
“We are in a fringe area,” says Mr. Lombard, “and since our dealers cannot and will not stock many different brands, we have tried to supply the antenna that will give the best all-around performance.”

“With many manufacturers claiming top superiority in their antennas, we were not sure which one to choose. We therefore tested antenna after antenna right on our own roof, and had our dealers try and test antennas to see which brought in clearer, sharper pictures and the least interference on all channels.”

“Dealers in our area have chosen Davis Super-Vision antennas, because our test and their test have proven outstanding results in every area.”

“There are many similar antennas, but our Dealers demand Davis from the results it gives.”

Every dealer has heard antenna manufacturers claim top performance. Davis alone backs its claim with a money-back offer. The Davis Super-Vision antenna is factory-guaranteed to give the maximum reception obtainable. Try one...judge it...and you too will standardize on the Davis.



DAVIS ELECTRONICS

DAVIS ELECTRONICS • P. O. BOX 1247 • BURBANK • CALIFORNIA

Factories in; BURBANK, CALIF., CHICAGO, ILL., SILVER SPRING, MD.

You Can't Buy a Better Antenna

TV-Electronic Technician

Service Aids, Replacement Parts, Products for Sales & Service

Du Mont CRT SELECTOR

The Picture Tube Selector, a pocket-size slide-rule device, solves picture tube replacement problems. The selector gives electrical values, basing, and physical features for 36



major crt types. Over 100 other tube type listings are indexed according to interchangeability with the basic types. Allen B. DuMont Labs, Inc., Cathode-Ray Tube Division, Clifton, N.J.—TECHNICIAN

Controlmaster TV REMOTE

The Controlmaster, designed for use with TV sets using the Standard Coil tuner, is said to install easily and is small enough to hold in the hand. Provides these features: on-off switch, contrast control, volume control, channel selector. Permits simultaneous use of existing controls on set. Included are 25 ft. of connecting cable. List, \$39.50. Mercury Marine Electric Co., 2905 Jones St., San Francisco, Calif.—TECHNICIAN.

Microtran P-C XFORMERS

Miniature transformers for use in printed-circuit designs range in power-handling capacity from 8 milliwatts to 2 watts. They are designed with special soldering tabs for insertion in printed-circuit terminal boards. Microtran Co. Div., Crest Laboratories, Inc., 2117 Mott Ave., Far Rockaway, New York.—TECHNICIAN

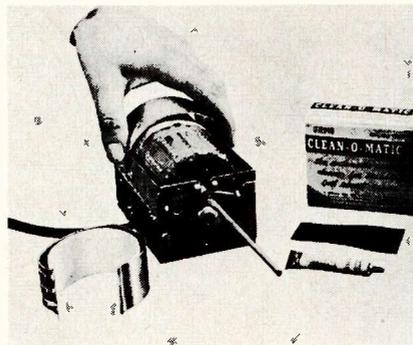
Alpha SOLDER

Cen-Tri-Core rosin-filled solder consists of a solder wire surrounded with a coat of rosin over which, in turn, an outer sleeve of solder is formed. This construction is said to eliminate the possibility of rosin voids, thereby assuring continuity

of flux and reduction of cold joints. Since the flux flows ahead of the molten solder, less time and material are said to be consumed in soldering. Available in all alloys, diameters and percentages. Alpha Metals, Inc., 56 Waters St., Jersey City 4, N. J.—TECHNICIAN

Walsco TUNER CLEANER

The Clean-O-Matic, which may be fitted on any standard coil tuner, cleans and protects all tuner contacts except, of course, the ones being used. A brass cover encircles the tuner subchassis to prevent radiation. Clean-O-Matic comes individually boxed with a crocus cloth



and tube of lubricant for cleaning oxidized contacts. Walsco Electronics Corp., Los Angeles, Calif.—TECHNICIAN

Superex ANTENNA COILS

The Vari-Tenna antenna coil is said to increase sensitivity up to 25 times when used to replace antenna coil and hank of wire on older type broadcast receivers. The Energized Ferri-Loopstick is intended to supplement existing loop antennas where increased sensitivity is desired, as in portable receivers. List prices: Vari-Tenna, \$1.25; Energized Ferri-Loopstick, \$1.50. Superex Electronics Corp., 23 Atherton St., Yonkers, N.Y.—TECHNICIAN

UTC VOLTAGE REGULATOR

Type R-49 regulating transformer adapts electrical appliances to poor line voltage conditions. This unit will handle any load up to 350 watts and is suited for TV receiver applications where high line voltage can

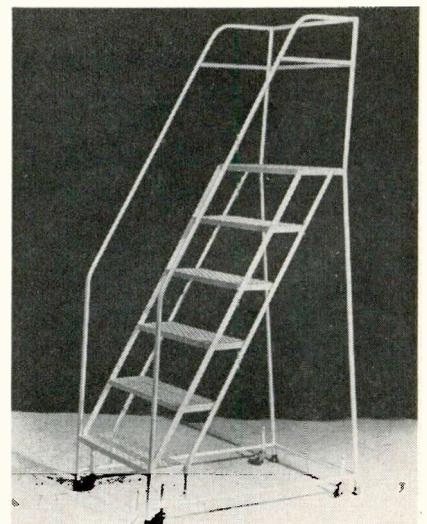
burn out parts, or where low line voltage will cause poor receiver performance. Unit comes with line cord and plug input, provides settings for 115-volt output with input line voltages of 85 to 125 v. United Transformer Co., 150 Varick Street, New York City.—TECHNICIAN

Trimm SPEAKER SHUT-OFF

Stop-It is the name of a commercial trimmer, type 639, which permits the TV viewer to suppress unwanted sound without leaving his armchair. Unit connects to voice coil leads of loudspeaker. Trimm, Inc., P.O. Box 489, Libertyville, Ill.—TECHNICIAN

Precision SAFETY LADDERS

These all-steel step ladders may be rolled to desired position on casters. When user steps on ladder, casters are automatically disengaged and the rubber-tipped legs lock in place. Stepping off ladder re-engages the casters. Useful in stock rooms, and warehouses. The two taller models are equipped with hand-rails. A wire-mesh basket is an optional feature for transporting stock. Available in 4 models comprising 2, 3, 4 and six steps, priced



respectively at \$26, \$37, \$53.50 and \$93.50. Basket is \$2.50 extra. Precision Equipment Co., 3714 N. Milwaukee Ave., Chicago 41, Ill.—TECHNICIAN

FINE TYPE . . . Does it escape reading by service technicians?

So MUCH for So Little!

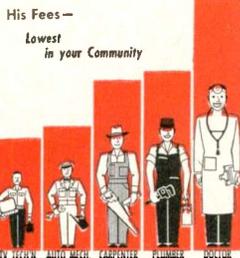
A Tribute to the TV-Radio Technician

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 might as well 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 shiny 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



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 TECHNICALIAN, 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 radio 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

TECHNICIAN March 1954

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What Technicians Say About "So Much for So Little"

"We enjoy this publication immensely and hope you keep up the good work." —Bronson, Michigan

"Although we have never expressed our approval of your magazine, we most certainly do agree with the favorable comments expressed by other service organizations." —Libertyville, Illinois

"Thanks for a nice tribute to the TV and Radio Technician in your March issue of TECHNICALIAN." —Bronx, New York

"'So Much for So Little', from the March TECHNICALIAN and CIRCUIT DIGEST is very good and I want some other folks to see it." —Conrad, Iowa

"Articles like this should appear in magazines read by the layman. We in the Trade realize this." —Franklin, Ohio

"I would like to express my fondest appreciation for the job you fellows do for us TV servicemen. Keep up the good work." —Cleveland 8, Ohio

"Keep up the good work on your TECHNICALIAN. Don't clutter it with a bunch of junk like other magazines. Yours I read from end to end, others I lose interest due to too much junk in them." —McKeesport, Pennsylvania

The answer is "No!"

Small type or big type . . . top of page or bottom . . . front of book or back . . . it's all the same to these men who MUST keep uptodate and are constantly striving to improve their professional ability.

But, you be the judge.

Last month's editorial page, titled "So Much for So Little", carried a tribute to the TV-radio technician, presenting his case as it should be understood by fair-minded set owners.

In fine type at the bottom of the page, we ran this inconspicuous notice:

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

Did the technicians discover it? They did. Orders poured in. Within a few days the demand had snowballed into a young avalanche. Our advance printing was exhausted and a new edition was ordered.

Still they come. Those technicians don't miss a thing. And, in future, we'd better not try to "bury" anything in fine type, anywhere.

BLOW-UPS STILL AVAILABLE

This attractive 2-color blow-up, four times the size of this page, sets the record straight on the role of the service technician. It blasts the phoney charges made by irresponsible individuals and publications who talk about service "gyms" and "swindles" . . . gives, graphically, the real story of his low rates . . . calls attention to the skill, training and investment his job requires . . . points out his key role in the billion dollar field of TV entertainment.

Display the blow-up prominently inside your shop or in your window where customers can't miss it. Use this handy coupon:

Reader Service Dept. TECHNICALIAN
480 Lexington Avenue, New York 17, N. Y.

I want giant blow-ups of "So Much for So Little!" at 15¢ each. My payment of is inclosed.

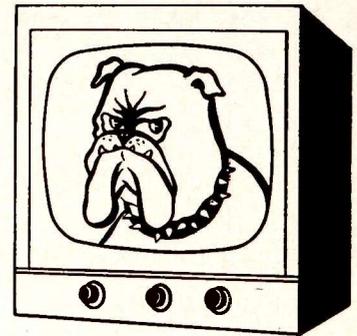
Name

No. & St.

City Zone State

"Tough Dog" Corner

Difficult Service Jobs Described by Readers



Piecrust Trouble

Although a good deal of time and effort was needed to find this "dog" its cure was very simply effected by reversing two leads on the flyback afc coil. I can't help thinking, in these cases, of the customer who knows that some very small part, which costs only a few cents is defective in his set, and ought to be no trouble at all to find—you have, perhaps, heard this story before?

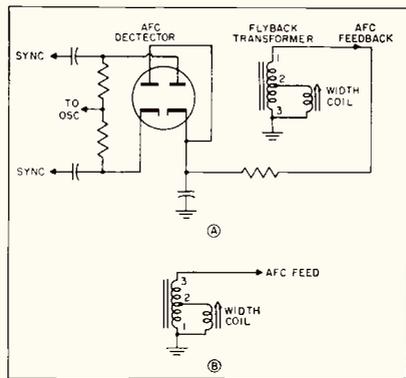
It was noticed that the adjustment of the width control caused a slight change in the number of piecrust indentations on the circles of a test pattern. On lifting a lead from the width coil, the frequency of the piecrust was changed considerably,



"Pie-crust" in test patterns. Symptom is also described as a "cog-wheel." (courtesy G.E.)

and the amplitude of the indentations or waves was reduced from about 2 in. peak to 1 in. peak or less. Tests of the disconnected width coil and flyback revealed no departure from normal. To check the possibility of parasitic oscillation, the width coil and the flyback were reconnected with the width coil across the other half of the afc winding (see illustration). If a parasite was causing the trouble, the change in wiring should change the frequency of oscillation, it seemed to me. The parasite changed frequency all right—it became zero in frequency and amplitude!

The explanation is probably that the parasitic circuit comprised the self-capacitance of the width coil, the inductance of the leads and the



A—Wiring of width coil prior to change. B—Coil wiring after change referred to in text.

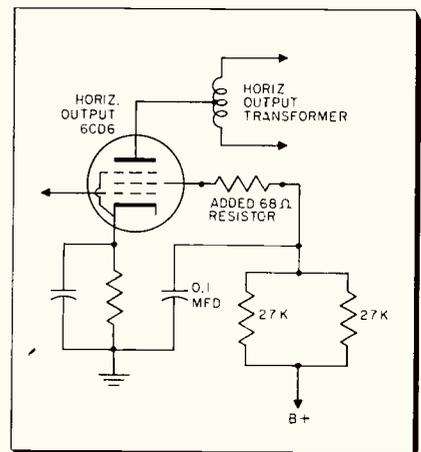
capacitance to ground of the afc winding—ground being the core of the flyback. This parasitic circuit was changed by reversal of the leads. The illustration shows the original connection of the afc feeder to terminal "1" as well as its subsequent connection to terminal "3"; corresponding changes in width coil connections were, of course, made. The trouble was aggravated because the drive had been increased to compensate for aging of various tubes. Actually, occasional complaints had been made earlier, when the drive was originally adjusted. The trouble appeared only now and then at that time; when the increased drive was needed a year later, the parasite became more persistent.—*J. A. McRoberts, Brooklyn, N.Y.*

Hor. Circuit Parasitic

While working on a 1954 RCA model 24T420 (chassis KCS84C), I came across an unusual trouble of intermittent nature. When in the "out" condition, the horizontal sync would vary as the brightness control was varied; not only would it go into "lines," but it would also, at certain settings, go into a jagged "arcing" condition, or what appeared to be a violent hunting. All of these symptoms could be alleviated or aggravated by adjustment of the horizontal drive, linearity, or

locking range controls. A thorough rundown with a vtvm showed all voltages to be normal; no abnormal variations in voltage occurred when the brightness control was varied.

I tested filters, bypass condensers, etc., and checked values of other components, but to no avail. It was while holding a condenser across another unit that I discovered that, by merely touching one end of the condenser, or even my finger, to the screen grid pin on the 6CD6 socket,



Section of horizontal amplifier circuit in which parasitic oscillation was present.

I could stop the trouble. This led me to believe that parasitic oscillation might be present. I inserted a 68-ohm 1/2-w. resistor between the screen socket contact, and the junction of the screen resistors and bypass condenser, as illustrated. This completely cured the "tough dog." —*Donald E. Tucker, Washington, D.C.*

\$ For Your "Tough Dog Story"

Have you tangled with a difficult or obscure service problem recently? Write it up, telling us how you licked it, and send it to "Tough Dog" Editor, TECHNICIAN, Caldwell-Clements, Inc., 480 Lexington Ave., New York 17, N.Y. \$10 will be paid for usable material. Unacceptable items will be returned to the contributor.

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PRECISION E-200

in Every Other Service Lab in the Country!

THIS FAMOUS SIGNAL GENERATOR provides — at a practical, sensible price — the accuracy, stability, range, functions and long-lived reliability that are so necessary to the efficient Service-Lab.

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The Modern Multi-band
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- ★ Frequency Coverage: 88 KC to 240 MC (To 60 MC on fundamentals)
- ★ Direct Reading in 9 bands on easy-reading 6½" dial.
- ★ 1% Accuracy and exceptional stability on all bands assured through use of the famous PRECISION "Unit-Oscillator" construction.
- ★ 0-100% Modulation controlled at front of panel.
- ★ AGC-AVC Substitution voltage, continuously variable on expanded scale from 0-50 volts D.C.
- ★ Hand Calibrated: each instrument is individually calibrated against 'PRECISION' standards.



NET PRICE: \$78.50 complete with tubes, RG type coaxial output cable and 96 page operating text 'Servicing by Signal Substitution'. Black ripple-finished, portable, steel case, 10½" x 12" x 5".



PRECISION Apparatus Company, Inc.

92-27 HORACE HARDING BLVD., ELMHURST 6, N. Y.

Export Division: 458 Broadway, New York 13, U.S.A. Cables: Morhane
Canada: Atlas Radio Corp., Ltd., 560 King Street W., Toronto 28

Battery Data for Technicians

(Continued from page 40)

Some test-equipment manufacturers market battery testers for use in cases like these. The testers usually use a meter and a choice of resistive loads for different types of batteries. While the simple arrangement used in these testers can easily be duplicated in the service shop with a voltmeter and a similar selection of resistors, the commercial testers do have an important value:

the customer sees an impressive, commercial device presenting an objective judgment; he isn't just taking the technician's word on the condition of his batteries.

You can do a pretty fair job of duplicating the set-up in a battery tester by calculating the required values for a set of substitute load resistors. One example is enough to illustrate the procedure. Let's sup-

pose you want to check an "A" or filament pack rated at 9 v, to see whether it's still usable in a portable employing miniature tubes of the 1.4 v kind (1R5, 1T4, 1U4, etc). According to the tube manual, these draw 0.05 amperes each. If the heaters are in series, 0.05 amps will be drawn under load at 9 v. A minor skirmish with one of the Ohm's-law formulas ($R = E/I$) shows that the resistance of the filament string is 180 ohms. A resistor of this value, then, will properly load the battery under test.

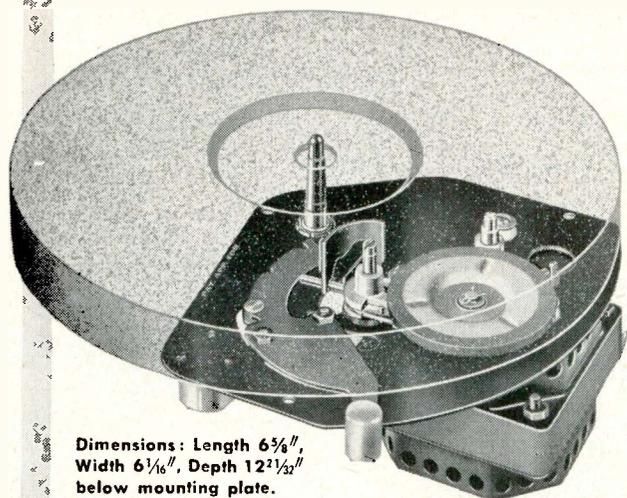
The drain on the "B" packs can be worked out from the number of tubes in the set, the normal cathode current for each (the tube manual, again) and the nominal voltage for the battery. Approximate figures will be good enough for test purposes. The dummy load for most "B" cells should be between 2500 and 5000 ohms. If battery output voltage falls to 75 percent of rated value or less under load, you're (ethically) safe in selling a replacement, even though the battery may be working at the time.

It is a good idea, during a load test, to leave the meter and load connected to the battery for a minute or so. If the battery is weakening, there often will be a slow but definite falling off in output during this time. This can also be a good sales argument to use on a doubtful customer. A receiver using such a pack is likely to operate with reduced output for a while, and then cut out altogether.

Storage: Since battery life, even on the shelf, tends to be shortened by high temperatures, these units should be stored in a cool part of the shop or storage room. The storage temperature should be 70 degrees or lower during the battery season. For long-term storage, as from one season to the next, batteries will last well if they are kept at a temperature no higher than 45 degrees. While refrigeration is advisable, it is not always practical. Keeping the batteries in an unheated area over the winter is a good idea. Even freezing will not affect them if they are allowed to return to room temperature before being put to use. Techniques that help to prolong life are: storing close to the floor, storing in an unheated attic or cool dry basement, and storing against an outside wall.

(In addition to the data provided by NEDA, material from the following manufacturers was used in preparing this article: Burgess, Eveready-National Carbon, Olin-Winchester, Philco, Ray-O-Vac and RCA.)

first requisite FOR HIGH FIDELITY



Dimensions: Length 6 $\frac{5}{16}$ "
Width 6 $\frac{1}{16}$ " Depth 12 $\frac{1}{2}$ "
below mounting plate.

GENERAL INDUSTRIES Model DSS (4-pole) Phonomotor

Typical of General Industries' leadership in phonomotor design and engineering is this three-speed phonomotor, produced expressly to meet the rigid requirements of true, high-fidelity reproduction.

Model DSS is ideally suited for use with magnetic pickups. Its heavy-duty 4-pole, 4-coil motor holds stray field radiation to an absolute minimum. Moving speed shift lever to "OFF" position automatically disengages idler wheel from motor shaft and cuts off the current to the motor.

The Model SS, 3-speed phonomotor is well adapted to hi-fi systems where crystal or ceramic pickups are used. Idler wheel is disengaged from motor shaft during non-operating periods. Power by a 2-pole, shaded-pole type motor.

General Industries also offers a complete line of single and dual-speed models powered for either 2 or 4-pole motors. Write for complete information, including specifications and quantity price quotations.

THE GENERAL INDUSTRIES CO.
DEPARTMENT MD • ELYRIA, OHIO



To build a healthy, growing service business...

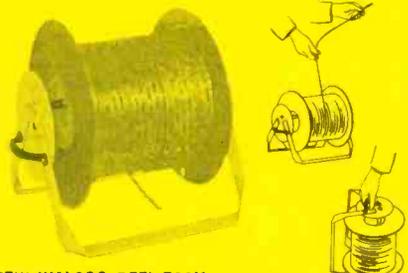
YOU NEED THESE 6 NEW

WALSCO

SERVICE ITEMS



NEW WALSCO CLEAN-O-MATIC...
Covers contacts on "Standard Coil" tuners and keeps them clean, silent, oxidation-free. Very easy to install. Tube of "Tunerlub" and crocus cloth included.
Cat. No. 1200 \$1.50 net



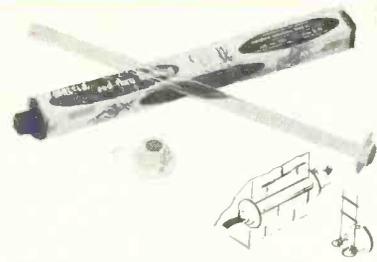
NEW WALSCO REEL-EASY
Portable wire reel holder. Light, durable, compact—weighs only 1½ lbs. Handy to carry, easy to dispense lead-in wires. Eliminates tangled cables.
Cat. No. 503 \$3.60 net



NEW WALSCO VIEW BINS
Keeps small parts handy, sorted, visible and dust-free. Sturdy, tilt-type, spill-proof drawers reveal contents. No hidden corners. Silver hammer-tone finish. Welded steel.
Cat. No. 1010-6 bin \$4.95 net
Cat. No. 1010-12 bin 9.50 net
Cat. No. 1010-24 bin 16.95 net



NEW WALSCO TOOLS
New I.F. alignment tool for all UHF RCA, Zenith and other sets.
Cat. No. 2527 \$0.42 net
"Slug Saver" front end alignment tool for all "Standard Coil" tuners. Impossible to lose slugs with this patented tool.
Cat. No. 2528 \$0.63 net
Solder-ease tool. Bristles of brush and prongs of stainless steel. Solder will not stick.
Cat. No. 2529 \$0.99 net



NEW WALSCO FEED-THRU BUSHING
Bring antenna cables into the house the professional way. This bushing fits all lead-in and rotocables. Terminate "open line" outside... bring flat line through bushing to set. Fits walls up to 16". Requires ¾" hole.
Cat. No. 1551 \$1.17 net



NEW WALSCO GUY-TITE
Tighten guy wires faster and better with this new Walasco tool. Does the job of a turnbuckle at a fraction of its cost.
Cat. No. 1558 Box of 100 \$3.60 net
Cat. No. 1566 Tool and 18 tites 4.95 net

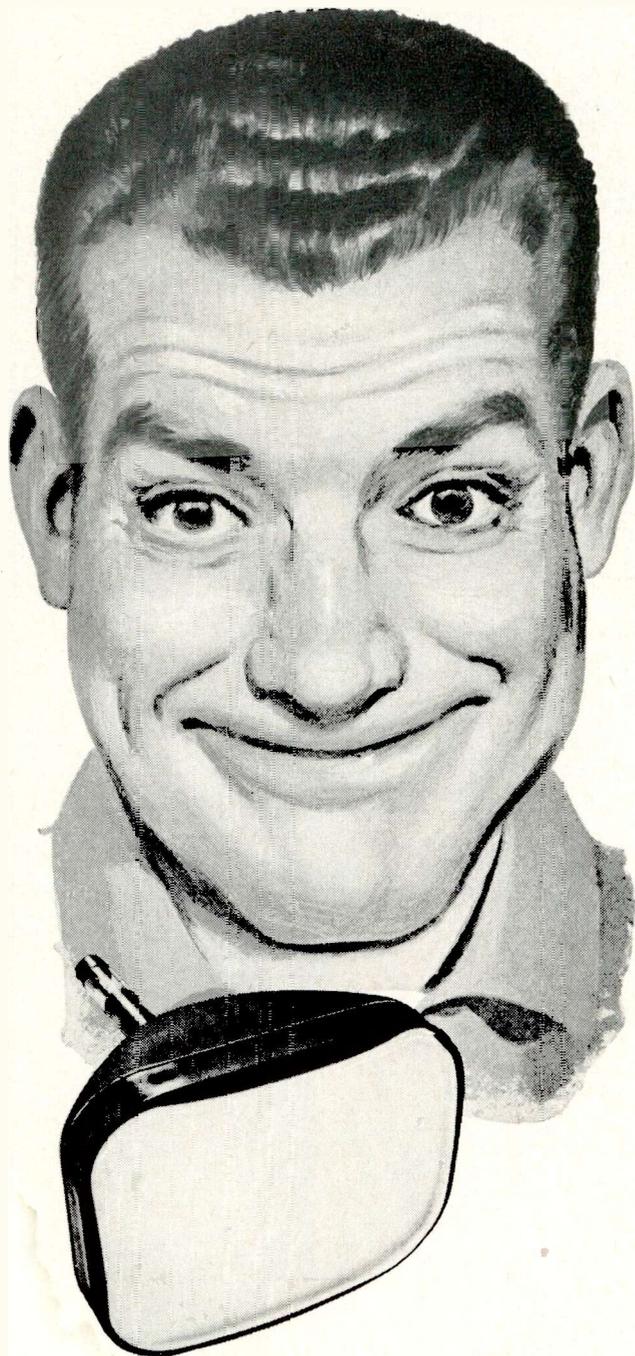


WALSCO ELECTRONICS CORPORATION

3602 Crenshaw Blvd. • Los Angeles 16, Calif.

Canadian Factory Distributor: Atlas Radio Corp., Ltd., 560 King St. West, Toronto 28.
Overseas Distributor: Ad Auriema, Inc., 89 Broad St., New York 4, N.Y.

SERVICE MEN LIKE TO USE TUNG-SOL TUBES



Tung-Sol business practices are on the same high level with Tung-Sol Tube quality—and service men have always profited from both. It pays to use Tung-Sol Tubes.

TUNG-SOL[®]

dependable

PICTURE TUBES



TUNG-SOL ELECTRIC INC., Newark 4, N. J.
Sales Offices: Atlanta, Chicago, Columbus,
Culver City (Los Angeles), Dallas, Denver,
Detroit, Newark, Seattle.

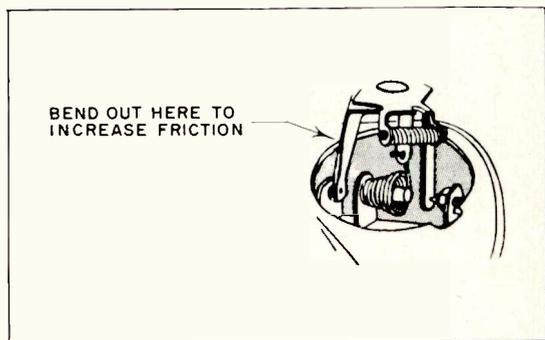
Service Tips

Most of the following service hints, while intended to refer to specific chassis made by the manufacturer, have a broad general application as well.

"Flutter" Correction in Magnavox Phonos

If certain frequencies have a tremolo or fluttering sound while records are played on our current record-changer, you can probably correct this by increasing the vertical friction of the pickup arm.

Lift the pickup arm to a 45-degree angle and with a pair of long-nosed pliers bend the left side of the hinge assembly as shown in the accompanying sketch. Bend outward or in the direction that will increase the friction between the pickup arm hinge and its mounting assembly.



Don't bend too far, or the pickup will not track properly—in other words, the needle will not move up and down as necessary to ride the full area of the record grooves. If you increase this vertical friction beyond the required amount, bend back slightly and check your adjustment with a record to determine if the flutter is eliminated.

If in some cases, the flutter cannot be eliminated by the adjustment described, the record-changer motor may be at fault and should be replaced.

Packard-Bell: Elimination of Fuse Failure

Some complaints have arisen (with respect to chassis 2040) due to fuse failure caused by flash-over or arcing in the 6AX4 damper tube. No damage to the 6AX4 occurs during this flash-over but the fast-blow $\frac{1}{4}$ ampere fuse will fail, causing unwanted service calls.

Effective February 1, 1954 all 2040 chassis will incorporate a $\frac{3}{16}$ ampere slow-blow fuse. This fuse will not fail unless subjected to a prolonged arc or short. Warning: Do not use any fuse larger than $\frac{3}{16}$ ampere slow-blow or damage to other components will result should a short occur.

Service Information from Stromberg-Carlson

High-Voltage Fuse Failures in Models 624, 625, 624RP TV Receivers. Some cases of excessive high-voltage fuse failure have been traced to pulse current surge. It is recommended when failure occurs that the $\frac{1}{4}$ -amp fuse be replaced with a .2 amp slow-blow type (Stromberg-Carlson part no. 128010).

Streaking of Picture Due to Ignition Noise Interference in Models 621A, 622, 624, 625. Due to resistor tolerances in the agc delay network, some receivers have a tendency to produce a long streak of ignition noise, instead of small dots. This effect can be corrected either by adjusting the agc potentiometer slightly, or in extreme cases, by connecting an r-f choke between the

from Mfrs.

input terminal and the agc terminal on the printed i-f strip. A 2.2 microhenry choke (Stromberg-Carlson part no. 114693) should be used.

Low UHF Tuner Sensitivity in Models 622 and 625. In many cases, low sensitivity in UHF tuners can be traced to loose or dirty contacts in the crystal holder. It is suggested that the contacts be cleaned and tightened, in addition to replacement of the 6AF4 or 6T4 oscillator tube.

Cautions from DuMont

In recent months an increasing number of TV receiver attachments have been placed on the market (crt brighteners, voltage-boosters, etc.). Several of these attachments have been found to cause excessive component breakdown in the receiver with which they are used.

Unauthorized use of such devices constitutes improper operation of a receiver and automatically voids DuMont's Teleset Warranty.

Service organizations are cautioned against recommending or installing attachments which may cause premature failure of receiver components.

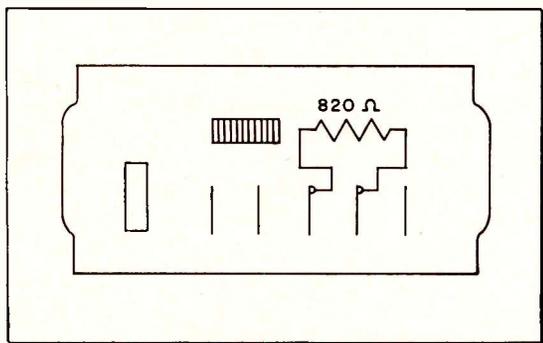
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When troubleshooting a receiver exhibiting insufficient horizontal and/or vertical size, measure the high voltage.

This is particularly important if a universal crt bench set-up is being used. The additional capacitance introduced in the yoke circuit due to the test cable can cause a reduction of as much as 2 to 3 kv. As a result the picture will increase in size, failing to exhibit the symptoms observed in the customer's home.

Zenith Service Data on "L" Models

Picture Smeared on Channel 2. Some all-channel antennas are too short electrically to offer a good impedance match on Channel 2. If the resulting mismatch is too great, a smeary picture usually results. To correct this condition, remove the Channel 2 antenna strip and connect a 820-ohm $\frac{1}{2}$ -watt carbon resistor across the antenna coil (see sketch).



Fuse Failure, 22L20 Chassis. In some of these models the fuse blows for no apparent reason. To correct this condition, replace with a 300 ma SloBlo fuse, Zenith part No. 136-30.

Improving Picture Register Control Action. The action of the picture register control can be improved by shunting the control with a 68-ohm $\frac{1}{2}$ -watt resistor. In the 21L21 chassis, the resistor can be conveniently connected to the picture register control plug-in terminals on top of the chassis.

CUSTOMERS LIKE SERVICE MEN WHO USE TUNG-SOL TUBES



Tung-Sol hi-performance tube quality is a dependable safeguard against call-backs that cut into service work profits. Keep that in mind and remember—it pays to use Tung-Sol Tubes.

TUNG-SOL® dependable TUBES-DIAL LAMPS

TUNG-SOL makes All-Glass Sealed Beam Lamps, Miniature Lamps, Signal Flashers, Picture Tubes, Radio, TV and Special Purpose Electron Tubes and Semiconductor Products.



STOP TV TUNER NOISE...

QUICKLY—SAFELY! with

SPRA-KLEEN

Pressure-Applied CLEANER-LUBRICANT



WRITE TODAY for your free copy of the big new G-C Catalog 156.



GENERAL CEMENT MANUFACTURING CO.

902 Taylor Avenue Rockford, Illinois

DEALER'S NET \$1.00
LIST \$1.67 (6 full ounces)

A NEW MUST FOR EVERY SERVICEMAN

- No Harmful Ingredients
- Exclusive X-79 Formula
- Reaches Everywhere — No Need To Pull a TV Chassis!

G-C's new SPRA-KLEEN Electrical Contact Cleaner and Lubricant is just what you need for fast, easy, safe servicing of TV tuners and other parts like relays, switches and controls. No need to pull that chassis; just "poof" and SPRA-KLEEN's directional nozzle reaches any remote corner. See your favorite jobber today!

Automatic Record-Changer

(Continued from page 32)

can have the same troubles as the trip link.

6. Broken trip pawl stop.
7. Drive gear or cycle drive control has stripped teeth.

Changer Continues to Cycle

1. Trip link is jammed; it may need lubrication or cleaning.
2. Spring on trip link is too loose.
3. Trip lever is jammed; it may need lubrication or cleaning.
4. Trip pawl is jammed; it may need lubrication or cleaning.

Changer Starts Cycle too Early

1. Clutch adjustment is set too tight; trip finger jams.
2. Trip finger is jammed; it may need lubrication or cleaning.
3. Hole in record is too large; record wobbles.

It is worth noting that the pressure applied to the trip finger brings about the same problems as in the case of the oscillating trip: the velocity trip mechanism is, however, not quite as critical.

UHF Service Notes

(Continued from page 26)

UHF. Replacing the UHF strips did not help. The trouble was finally traced to vibration between the metal plate "A" and the fine tuning control (see sketch). This vibration caused considerable oscillator shift on UHF, resulting in picture flicker. Bending the metal plate in corrected the trouble.

Re-designing Antenna Switch

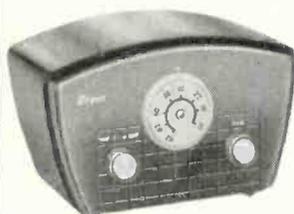
Some current-production UHF-VHF receivers have the two tuners mounted side by side. The manufacturers of these sets suggest that both the VHF and UHF lead-in pairs be connected to the single antenna board provided; antenna switching is accomplished by a compact switch ganged to the tuners, as shown at (A) in the accompanying drawing.

Because of the compactness of the switch, fairly high (signal-shunting) capacitances are present. UHF reception was quite poor in one such unit I was working on until the lead from the UHF tuner was disconnected and run to a separate antenna terminal strip, to which the

(Continued on page 60)

new Bogen UHF Design
traditional Bogen efficiency

NEW 'UCT-1' UHF CONVERTER

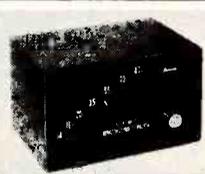


- better than competitive converters by a 6 db signal-to-noise ratio
- 6 db reduction in noise level means corresponding 6 db increase in signal level from antenna—clearer viewing
- maximum performance in *all* signal areas—often permits simpler antenna
- connects to any VHF set
- single-knob tuning runs entire UHF range, channels 14 to 83 inclusive
- complete with tubes, 4' of 300-ohm twin lead, instruction sheet... list \$42.50



"G-Line," UHF Transmission line, list \$43.75 (kit includes: 2 launchers, 150 feet of special insulated wire, 2 stand-off brackets)

"UHB,"
UHF
Booster,
list \$41.00



Bogen

See your distributor or write
DAVID BOGEN CO., INC.
29 Ninth Avenue, New York 14, N. Y.



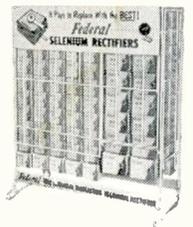
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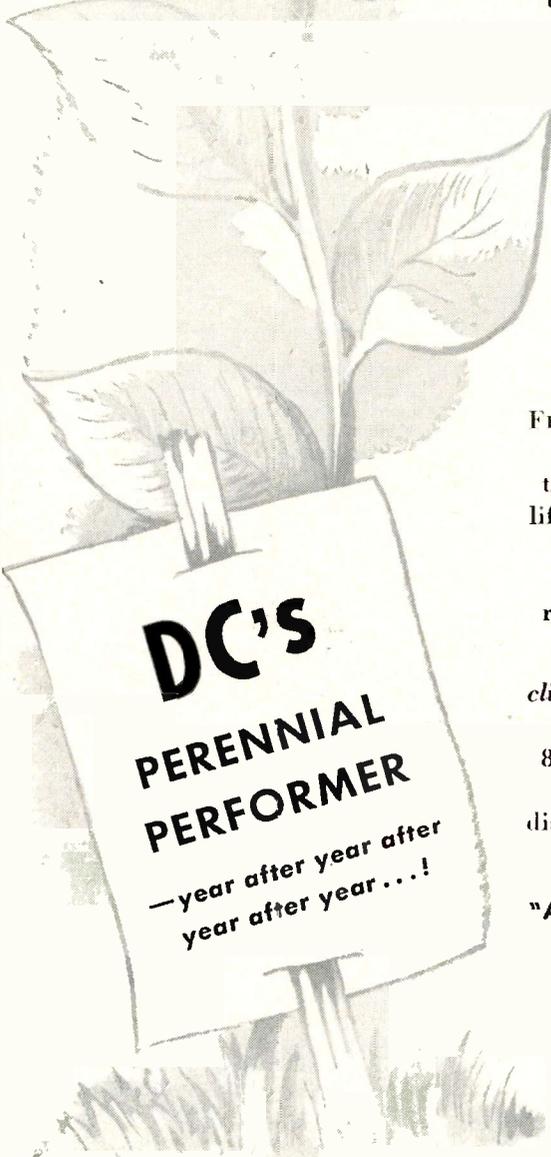
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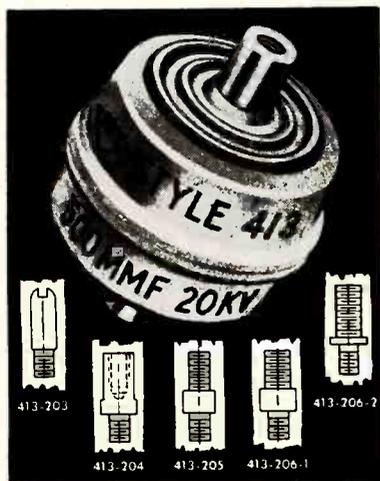
100 KINGSLAND ROAD, CLIFTON, N. J.

In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P. Q.
 Export Distributors: International Standard Electric Corp., 67 Broad St., N. Y.



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The ERIE 413 High Voltage Ceramicon is an innovation in capacitor design and has had wide acceptance by servicemen everywhere.

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ERIE components are stocked by leading electronic distributors everywhere.



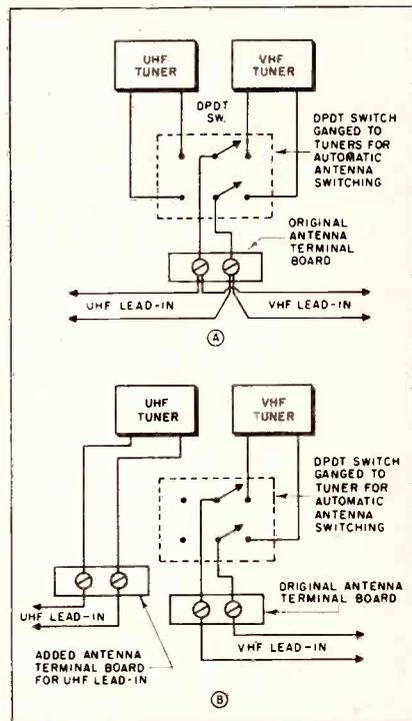
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Main Offices: ERIE, PA.
Factories: ERIE, PA. • LONDON, ENGLAND • TORONTO, CANADA

UHF Service Notes

(Continued from page 58)

UHF antenna lead was connected (see sketch). Reception then became satisfactory.



A—Original antenna feed on combination UHF-VHF receiver. Loading through dpdt switch capacitance reduces UHF gain. B—Change to prevent UHF losses. Capacitive loading through the dpdt switch is eliminated.

Credits: *Premature 6AF4 Failure, Improving Strip Performance and Microphonic UHF Tuner* were contributed by F. S. Mattioli, Madison, Wisconsin. *Re-designing Antenna Switch* was submitted by B. O. Riis, Miami, Florida. *Removing Snivets* is from a *Magnovox Service News Letter*.

WOW!

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Golden Wand
VHF UHF FM

Yes, you'll notice the difference the moment a Golden Wand antenna is attached to your set. Immediately, you receive a clear, distinct picture — eliminating the many annoying factors that appear on your television screen. This VHF and FM antenna has a heavyweight, felted, gold finish base. Admiralty brass dipoles finished in sparkling gold. 3-section, velvet smooth telescopic action. Solid Brass will not rust.

MODEL TG 84



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BEG PARDON

The make and model number of the "Tractor Radio" described in the March issue of *TECHNICIAN* was inadvertently omitted from this article. The receiver is an Airline Tractor Radio, model 61-12601 (Montgomery Ward).

In Fig. 1, p. 26, of the March *TECHNICIAN*, the signal output of the "I" Phase Splitter and Amplifier Block is indicated as +I and +I, instead of +I and -I. On p. 36 of the same issue, the eighth line from the bottom, last column, refers to red and green wires, instead of red and blue wires.

TRIPPLET 630 Volt-Ohm-Mil-Ammeter

"speaks" for itself in any company



ing to desired circuit thru a single 2½" knob flush with the face panel. The molded switch itself embodies the most advanced engineering practices. Fully enclosed, the silvered contacts are kept permanently clean. Its rugged construction means stronger performance and longer life.

These two factors are but samples of the many ways in which on-the-job needs have been anticipated and provided for in a beautiful streamlined tester. It provides A.D-D.C. Volts, D.C. Micro-amperes, Milli-amperes, Amperes, Ohms, Megohms, Decibel and Out Put readings in a no-short design embodying interior construction with all direct connections; no harness cabling. Its fool-proof unit switch construction houses precision resistors in insulated recesses in direct connection with switch contacts.

Study the following Ranges and descriptions and compare them point by point with any similar instrument for conclusive proof that Triplett 630 "speaks" for itself in any company.

Ranges

D.C. Volts: 0-3-12-60-300-1200—at 20,000 Ohms/Volt (For Greater Accuracy on TV and other High Resistance Circuits.)

A.C. Volts: 0-3-12-60-300-1200-6000—at 5,000 Ohms/Volt

(For Greater Accuracy in Audio and other High Impedance A.C. Circuits.)

Decibels: -30, +4, +16, +30, +44, +56, +70. (For Direct Reading of Output Levels.)

D.C. Microamperes: 0-60—at 250 Millivolts.

D.C. Milliamperes: 0-1-2-12-120—at 250 Millivolts.

D.C. Amperes: 0-12—at 250 Millivolts.

*Ohms: 0-1,000-10,000—(4,4-44 at center scale).

*Megohms: 0-1-100—(4,400-440,000 center scale).

Output: Condenser in series with A.C. Volt ranges.

*Resistance ranges are compensated for greatest accuracy over wide battery voltage variations. Series Ohmmeter circuits for all ranges to eliminate possibility of battery drain when leaving switch in Ohms position.

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BLUFFTON, OHIO

TRIPPLET

TRIPPLET 630 Volt - Ohm - Mil - Ammeter has many significant advantages and features that make it stand distinctly apart from similar instruments in its price class. Actually in components, in engineering, in minutely accurate performance, Triplett 630 closely approaches laboratory standards.

Since the scales of any VOM comprise the means by which it makes its multiple services most valuable, the legibility and easy-read-ability are of prime importance. Triplett engineers have created in Triplett 630 the longest scales available in this size tester. (The upper arc by actual measurement is four and three-eighths inches.)

This long-scale factor accounts for the ease with which precise readings are easily made. Further legibility is gained by use of black and red scale markings. D.C. and D.B. are black and white. A.C. and Ohm markings are red on white. Ohms from one hundred million to one-tenth ohm mark the range of this amazing scale. On low ohms, center scale reading is 4.5 ohms.

The Single Switch

Further indication of the practical skill and engineering "know-how" behind Triplett 630 is the Single Switch. Its simplicity of operation assures no burn-outs thru momentary memory lapses. There is instant switch-

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Bradley Wayne, Snyder Rep.

Dick Morris, sales manager of the Snyder Manufacturing Co. of Philadelphia, has announced the appointment of Bradley Wayne and Associates, of Dallas, Texas, to represent Snyder in the states of Texas, Louisiana, Arkansas and Oklahoma. Address of the Bradley Wayne organization is 4515 Prentice St., Dallas.

TACO Antenna Policy

Officials of Technical Appliance Corp. (TACO), Sherburne, N.Y. proclaim a policy that will be welcomed by technicians who have been "stung" by exaggerated antenna claims. Tore Lundahl, TACO sales manager, says, "Our policy of thoroughly field-testing every new antenna design before announcing it to the trade has paid dividends in a continuance of top sales volume . . . the service technician is the fellow we have to please. We must provide him with the product that will perform up to specifications and at the same time incorporate the dependability upon which he can stake his reputation."

Microwave Community TV

Microwave facilities, used in a closed-circuit community system, bring TV to Casper, Wyoming from Denver, Colorado, nearly 250 miles away. Citizens of Casper pay \$150, initial fee, plus \$7.50 monthly to get in on the community network. The set-up was engineered and installed by the Jerrold Electronics Corp.

ARRL Sponsors TVI Meets

Causes and cures for TVI will be demonstrated by the American Radio Relay League at meetings for service technicians and amateur operators in 14 western cities during April and May.

The League is undertaking the tour to correct the erroneous practice of identifying all interference with "probably some amateur." Local affiliates of the ARRL will sponsor the lectures in each city. The itinerary is as follows:

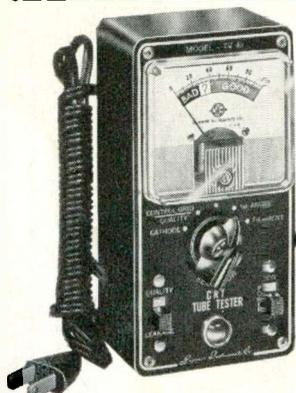
April 6, Salt Lake City, Utah; April 8, Denver, Colo.; April 12, Billings, Mont.; April 14, Spokane, Wash.; April 16, Seattle, Wash.

April 19, Portland, Ore.; April 22-23, San Francisco area; April 26-27, Los Angeles area; April 29, San Diego, Calif.

May 3, Albuquerque, N. M.; May 5, El Paso, Tex.; May 7, Dallas, Tex.

IF You have never ordered by mail because you did not want to buy anything "sight unseen" or— You have ordered by mail but with disappointing results or— You have never purchased anything on time payments because of excessive finance charges, then—

HERE is your opportunity to examine what you want under our "Seller not Buyer, takes all the risk" plan. We invite you to order this instrument and examine it in the privacy of your own home. If you decide to keep it, you can then pay the balance in easy monthly payments with no interest or finance charges added. Otherwise, you may return the merchandise for prompt refund of your down-payment.



THE NEW MODEL TV-40 C.R.T. TUBE TESTER

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SPECIFICATIONS:

- Tests all magnetically deflected picture tubes from 7 inch to 30 inch types • Tests for quality by the well established emission method. All readings on "Good-Bad" scale. • Tests for inter-element shorts and leakages up to 5 megohms • Tests for open elements.

EASY TO USE:

Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base (Ion trap need not be on tube). Throw switch up for quality test . . . read direct on Good-Bad scale. Throw switch down for all leakage tests.

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Please rush one Model TV-40. I am enclosing down payment of \$3.85 and agree to pay balance \$4.00 monthly for 3 months.

Name
Address
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Selenium Rectifiers

(Continued from page 36)

3-in. plate resulted in a better form factor in regard to chassis layout.

The rectifier stacks in this color TV series are designed to deliver 600, 700 and 750 milliamperes into a capacitive load. They are available for input voltage ratings of 130, 174 and 195 volts rms.

(Data for this article has been supplied by the Selenium-Intelin Dept., Federal Telephone and Radio Co.; Sarkes Tarzian, Inc.; Radio Receptor Co., Inc.; and International Rectifier Corp.)

Focus Circuit Problems

(Continued from page 24)

adjust the ion magnet for maximum brightness. There will be a small range of trap adjustment where the brightness stays the same, but the focus improves. Set it for optimum focus in this narrow range.

The ion magnet on electrostatic crt's, incidentally, is often weaker than it is in the case of a comparable EM type of crt because there is no focus magnet or coil with whose magnetic field it can interact.

Quite often a set will come in on which the focus magnet is off to one side, instead of being directly in line with the axis of the tube. In some cases, no amount of adjustment will permit maximum brightness, sharpness and lack of shadow to be obtained when the magnet is moved into (axial) line with the crt axis. In most cases, however, if the magnet is first lined up, and the other adjustments are then made *in the proper order*, the sharpness of focus will be improved, the neck shadow will be gone and the brightness will be increased. Since centering magnets (when present) are so close to the focus magnet, they have a slight effect on focus. Moving any focus magnet will change the centering, because of the change in magnetic field distribution. This will then require a slight repositioning of the centering units, after which the focus will have to be slightly reset again.

When adjusting focus with no test pattern on the air, set the control so that best definition occurs on narrow vertical objects near the center of the picture. Because the sharpness of the scanning lines does not de-

pend on the frequency response of the receiver, but mainly upon the size of the scanning spot, an optional method of adjusting focus consists of turning to an off-channel and setting the control for maximum sharpness of line structure. This method eliminates any error which might arise if the receiver is improperly aligned, and has an inadequate high-frequency response.

Improper alignment can promote an error in focus adjustment in this way: A deficiency of "highs" would cause lack of detail on small objects

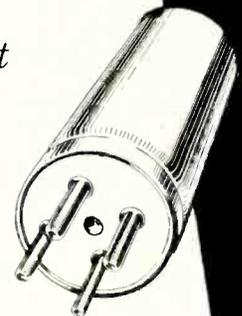
in the picture. It becomes a little more difficult to set the focus accurately if this condition exists, since the focus setting may be shifted around while the serviceman is trying to find the best-looking picture. The final setting may or may not be the correct one. Inasmuch as the loss of highs due to misalignment (or other troubles) does not affect the sharpness of the horizontal scanning lines, the correct focus setting can be obtained by adjusting these scanning lines for maximum clarity over the center area of the raster.

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SERVICE ASS'N REPORTS

RTA Elects Officers

In the recent election of the Long Beach Chapter of the Radio Technicians Association, P. O. Box 4085, Long Beach 4, Calif., the following officers were installed in their new posts: Lee Johnson, pres.; Merlyn Cochems, technical vice pres.; L. E. Peterson, dealer vice pres.; Harold Freeman, treas.; Clarence Spencer, asst. treas.; Bob Bergman, secretary; Joe Martin, technical advisor; Fred Abrams, asst. public relations; Elwyn Ley, trade consultant; Harry E. Ward, general chairman public relations. RTA now covers the greater portion of Southern California, with the largest technical group on the West Coast.

LIRTG Honors Former President

At the last general meeting of the Long Island Television and Radio Technicians Guild, P. O. Box 87, Bethpage, New York, a plaque for distinguished service was presented by Henry Wawryck, pres to former pres. Jack Wheaton.

The Guild has now established a permanent meeting place for the year—the Irish-American Hall, Willis Ave., Mineola, New York.

CRTSA Elects Officers

The Council of Radio & Television Service Associations, 1530 Lewis Tower Bldg., Philadelphia 2, Penna. elected Albert Haas, of the Television Contractors Association, as president.

Mr. Haas succeeds Samuel Brenner, president of the Philadelphia Radio Servicemen's Association, the group's temporary president.

Other officers elected to serve one year terms were: vice-president, Ray Cherrill, of the Northeast Television Service Dealers Association; secretary, William Wile, Jr., of the Television Service Dealers Association of Philadelphia; treasurer, Louis J. Smith, of the Television Service Dealers Association.

Report from Buffalo RTSA

EDITORS, TECHNICIAN:

In an Association letter dated November 14, 1953, addressed to all radio and television wholesale parts jobbers, we expressed concern over the increased number of retail customers receiving wholesale price courtesies usually reserved to members of our trade.

For many years this practice has prevailed, but since the introduction of UHF, the situation became worse. As independent service shop owners, we have suffered a loss of revenue because of the ability of retail consumers to purchase at the wholesale level, UHF converters and antenna equipment. In addition to the competition we were receiving from a few part jobbers, we were also concerned about what might happen to UHF as a result of conversion equipment being put into the hands of the unskilled.

Our association approached the problem in an objective manner. An invitation was extended to the independent parts jobbers to meet with our executive committee. At this meeting, we presented the problem to them and asked for suggestions as to methods that would bring about corrections.

A spirit of general co-operation between parts jobbers and service interests prevailed. We were asked by the wholesalers as to our suggestion. The majority of the members of our executive committee made the suggestion to offer wholesale discounts only to those individuals and organizations that have an Erie County sales tax exemption number. The exception were amateur radio operators.

At the writing of this letter, 23 parts wholesalers have signified their intention to co-operate. There has never been any doubt in my mind as to joint co-operation in this matter. The parts jobber is as important to us as we are to them. With so much at stake in the interest of good business relations, it is important to both groups to assist each other.

Your magazine has made a hit because of its technical coverage, plus business assistance. Keep up the good work and get the color rolling.

R.T.S.A.
F. J. LYNN
President

WILL YOU HELP US?

... By giving us the name of the technical association to which you belong? We'd like this information as part of an editorial survey which we're conducting.

Service Association:

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Manager or Recording Secretary's Name:

Phone:

Your Name:

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

MFRS' Catalogs & Bulletins

LANSING SPEAKER-HORN BROCHURE: Instruction folder, 4 pp., gives formula and construction data for rear-loaded folded corner speaker horn. Eight steps, from raw material to finished enclosure, are illustrated. *Booklet No. 34* is available free. James B. Lansing Sound, Inc., 2439 Fletcher Drive, Los Angeles 26, Calif.

SIMPSON METER BROCHURE: Descriptive data on Simpson meter, model 269, and 4 other Simpson meters is presented in *Form A-4 RCS*, 4 pp. Obtain through jobbers on request, or write: Simpson Electric Co., 5200 W. Kinzie St., Chicago 44, Ill.

AMPEREX TRANSISTOR BOOKLET: Operating theory, characteristics and basic circuits for type OC50 and OC51 point-contact transistors are provided. 30 pp. Write for free booklet to: Myron Smoller, Sales Engineering Div., Amperex Electronic Corp., 230 Duffy Ave., Hicksville, L. I., New York.

WESTINGHOUSE UHF CONVERSION BOOKLET: Written for the service technician, this illustrated booklet covers UHF reception problems in 34 pp. Some of the subjects dealt with include: transmission characteristics, interference, antennas, transmission lines, installation problems, and data from 25 set manufacturers re conversion of VHF receivers. *Booklet EB-108* is available through Westinghouse tube distributors, or send \$1.00 to Westinghouse Electronic Tube Division, Dept. T-567, Box 284, Elmira, N. Y.

NSL TRANSISTOR DATA: National Scientific Labs. publishes the bi-monthly *Transistor Research Bulletin*, covering new developments in transistors, crystal diodes and other solid-state devices. National Scientific Laboratories, 2010 Massachusetts Ave., N. W., Washington 6, D. C. \$5.00 per year.

TRIAD XFORMER CATALOGS: Complete line of Triad transformers, including TV replacements, is covered in *Catalog TR-54. TV Replacement Guide, Catalog TV-54*, is available separately. Triad Transformer Corp., 4055 Redwood Ave., Venice, Calif.

THORDARSON-MEISSNER CATALOG: Coils covering all service needs are listed with schematics and cross-references to coils of other manufacturers in *Catalog 54-A*. Also listed: complete line of Hi-Fi components and kits. Available free. Dept. C, Thordarson-Meissner, Mt. Carmel, Ill.

GE TUBE MANUAL SUPPLEMENT: *Receiving Tube Manual Supplement No. 24* consists of loose-leaf pages covering one new tube and revised data on 15 others, for insertion in large manual. Tube Division, Electronics Dept., General Electric, Schenectady, New York.

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Rohn Towers are built of heavy duty tubular steel electrically welded throughout by skilled workmen exactly to specifications. Proof of Rohn construction lies in the fact that thousands of towers have been sold in the past several years and have successfully withstood the rigors of time in all climates and under the severest of conditions!

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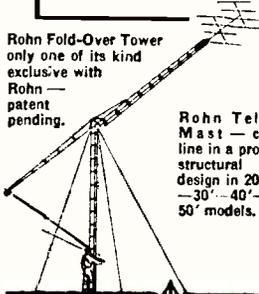
Rohn Towers assure you of trouble-free performance and once installed give unquestioned satisfaction year in and year out! You are free of complaints because over the years Rohn Towers have proved themselves from the serviceman, dealer and customer point of view!

IN SALES

Sales acceptance has been phenomenal — thousands have been sold coast-to-coast — and the design has been one which has withstood every test known! Why "experiment" with an unproved tower design when you can sell Rohn?

So we ask you, "Why take chances with an untried tower? Be sure — sell Rohn — the only tower of its kind to withstand every test!"

Rohn Fold-Over Tower
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M. H. NEWTON, TECHNICIAN
CALDWELL-CLEMENTS, INC.

MFRS' Catalogs & Bulletins

ROGERS TV REPLACEMENT INFO: TV deflection components, available as replacements, are described in this 16-page catalog. TV set models are listed, followed by data on replacement deflection yokes and flybacks, diagrams and other service information. Free on request. Rogers Electronic Corp., 43-49 Bleecker St., New York City.

ASTRON CAPACITOR BULLETIN: Technical data on Hy-Met metallized paper capacitors is available in *Bulletin No. AB-19*. Sizes, ratings, mountings and specifications are covered. Astron Corp., 255 Grant Ave., East Newark, N. J.

DU MONT SCOPE BULLETIN: Type 323 wide-band oscillograph is described in a bulletin, 12 pp., which gives specifications, illustrations and circuit diagrams. Technical Sales Dept., Allen B. Du Mont Laboratories, Inc., 760 Bloomfield Ave., Clifton, N. J.

ALPHA AUDIO WIRE CATALOG: Cutaway views illustrate the make-up of wires and cables listed in *Catalog 153-S*. 8 pp., devoted exclusively to wires used in audio and sound applications. Free copy on mail request: Alpha Wire Corp., 430 Broadway, New York 13, N. Y.

DIALCO SOCKET PAMPHLET: Sockets and mounting brackets for all types of small lamps are illustrated, with dimensions and other data, in *Catalog L-154*, 24 pp. Available on request at no charge. R. E. Greene, Dialight Corp., 58 Stewart Ave., Brooklyn 37, N. Y.

CLAROSTAT CONTROL & RESISTOR LISTING: Standard controls and resistors for radio, TV and other electronic applications are featured with illustrations, dimensional drawings and prices in *Catalog No. 54*. Available from distributors or by mail request. Clarostat Mfg. Co., Inc., Dover, New Hampshire.

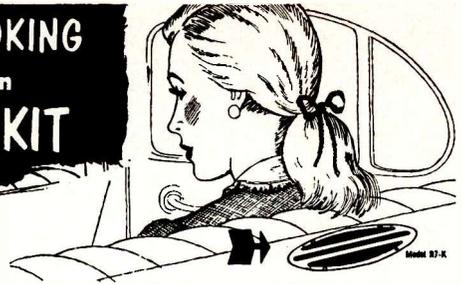
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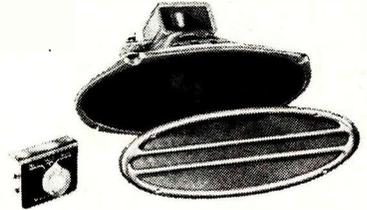
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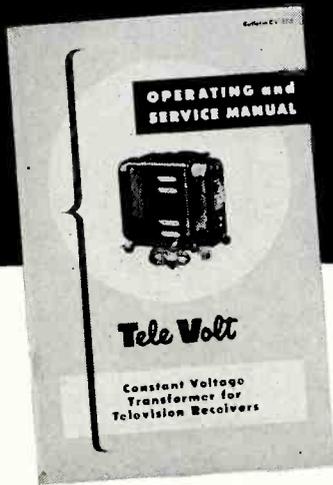
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The third in a series, this supplement describes tube substitutions and associated circuit changes involving many tube types that have become available since the appearance of the last supplement about 2 years ago. Most of the tubes considered are types used in TV circuits. A special section, devoted to picture-tube substitutions, is prefaced by a short article on general considerations for replacing one crt with another. This discussion covers external conductive coatings, tube dimensions, replacement or elimination of ion magnets, electrostatic and automatic-focus tubes vs. magnetic types, and other replacement considerations. A cumulative index lists all changes, by volume and page, appearing in the original guide and both supplements.

TELEVISION SERVICING, 2nd Edition. By Walter H. Buchsbaum. Published by Prentice-Hall, Inc., 70 Fifth Avenue, New York 11, N. Y. 367 pages; \$5.95, hard cover.

The first of three main sections covers general television theory. Alignment and installation are treated in the second part, while the final section, organized on the basis of symptoms of faulty operation, is devoted to troubleshooting. The new edition has been revised to include a consideration of color TV; treatment of late-model antenna types; coverage of UHF reception, together with a discussion of VHF-UHF receivers, tuners, converters and boosters; and discussion of the more recent large-screen picture tubes, together with crt design changes, such as automatic focus.

TV TROUBLESHOOTING AND REPAIR GUIDE BOOK, VOL. II. By Robert G. Middleton. Published by John F. Rider Publisher, Inc., 480 Canal Street, New York 13, N. Y. 160 pages; \$3.30, paper bound.

Practical techniques, hints, set-ups and other service information included in this book complement rather than duplicate the material presented in the first volume. Front-end troubleshooting, for example, which leads off the new volume, was not covered in the first book. Other topics covered: servicing the video i-f strip (alignment and component faults), video-amplifier defects, trouble analysis and practical pointers in TV sound circuits, and troubles in horizontal circuits. The more than 200 illustrations consist mostly of scope patterns, test set-ups and partial schematics. Each chapter concludes with a troubleshooting chart.

RADIO TROUBLESHOOTING GUIDEBOOK, VOL. I. By John F. Rider and J. Richard Johnson. Published by John F. Rider Publisher, Inc., 480 Canal Street, New York 13, N. Y. 150 pages; \$2.40, paper bound.

Planned as a reference text for radio repair technicians, the book begins (Part I) with a description of AM and FM receivers, their operation, section-by-section, and a description of common circuit variations. Part II considers the different methods of troubleshooting, when and where they are used, and the equipment needed. The concluding portion of the book (about 60 pages) is devoted to symptoms of faulty operation, probable causes and remedies.

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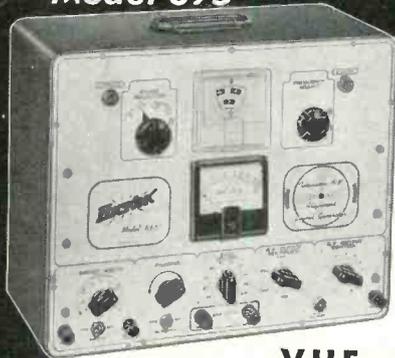
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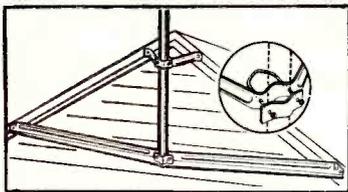
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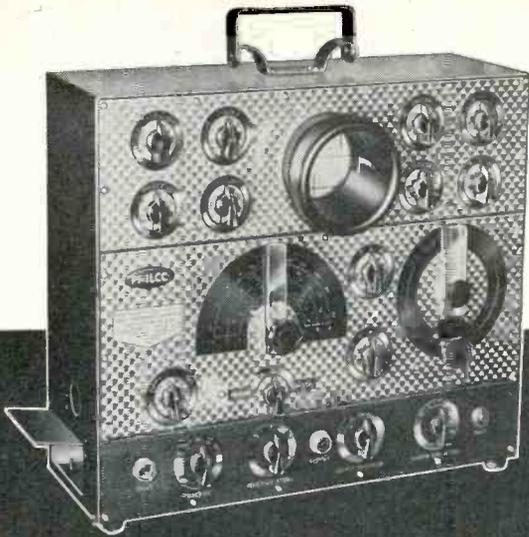
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C41	4 @ 100	45 x 361	TVA-1402
C51	5 @ 25	45 x 378	TVA-1203
C70	30 @ 400	45 x 393	TVA-1711
C71	5 @ 25	45 x 378	TVA-1203
C79	80+60 @ 400	45 x 390	R-1341
C80	30 @ 400	45 x 393	TVA-1711
C31, R46		76 x 7	V-1 (101C1)
C57, R75		76 x 5	T-1 (102C1)

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C38	1 @ 12	PMA-42027	TVA-1300
C40	40 @ 450/50 @ 350/50 @ 300	PMA-42001	R-1297
C52	100 @ 50	PMA-42005	TVA-1310
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C426	5 @ 50	8C-20557	TVA-1303
C436	20 @ 450	8C-22550	TVA-1709
C439	200+30 @ 150	8C-22730	¹ TVL-3448
C440	150 @ 150	8C-22463	TVL-1430
C441	150 @ 150	8C-22464	TVL-1430
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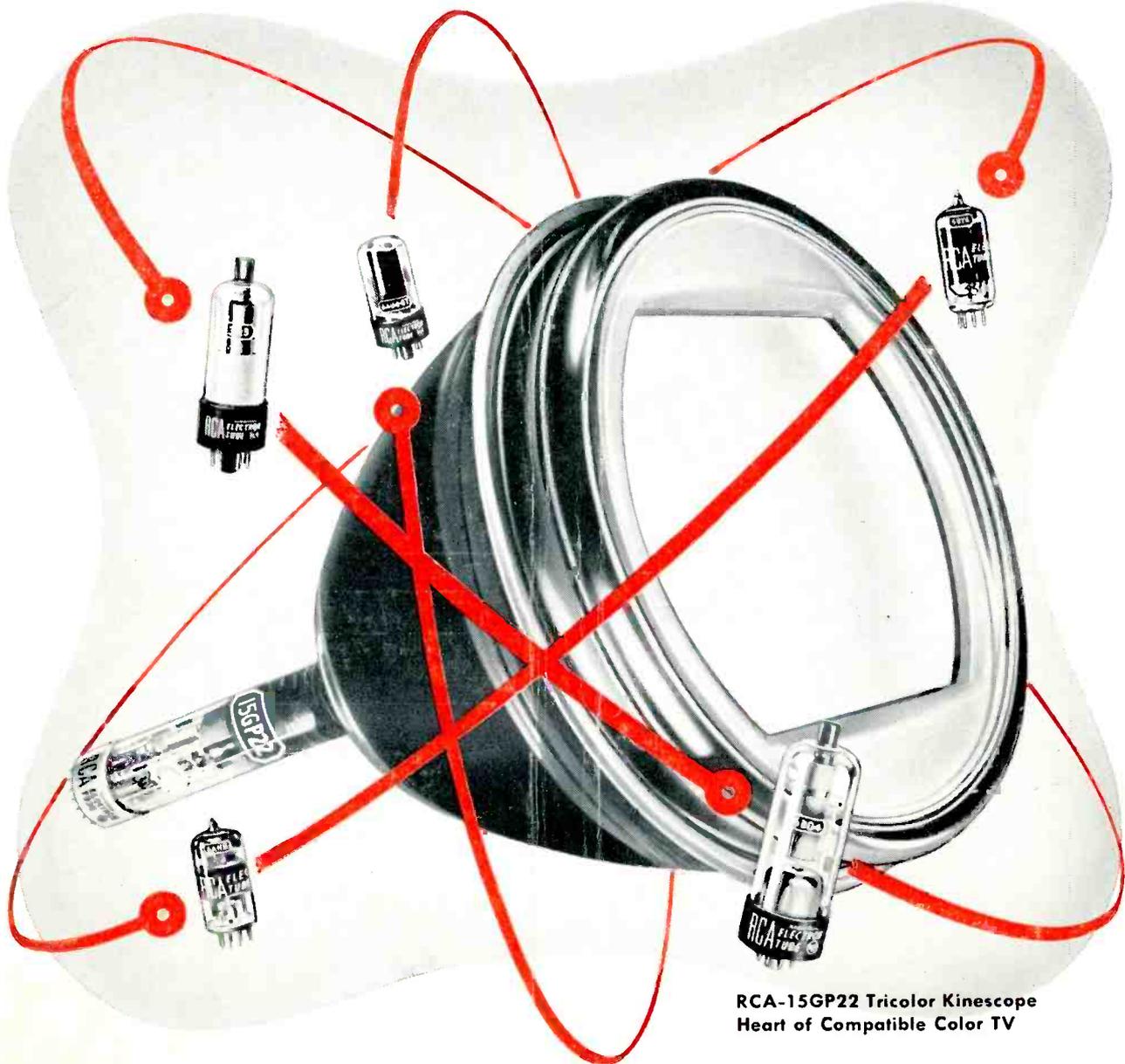
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