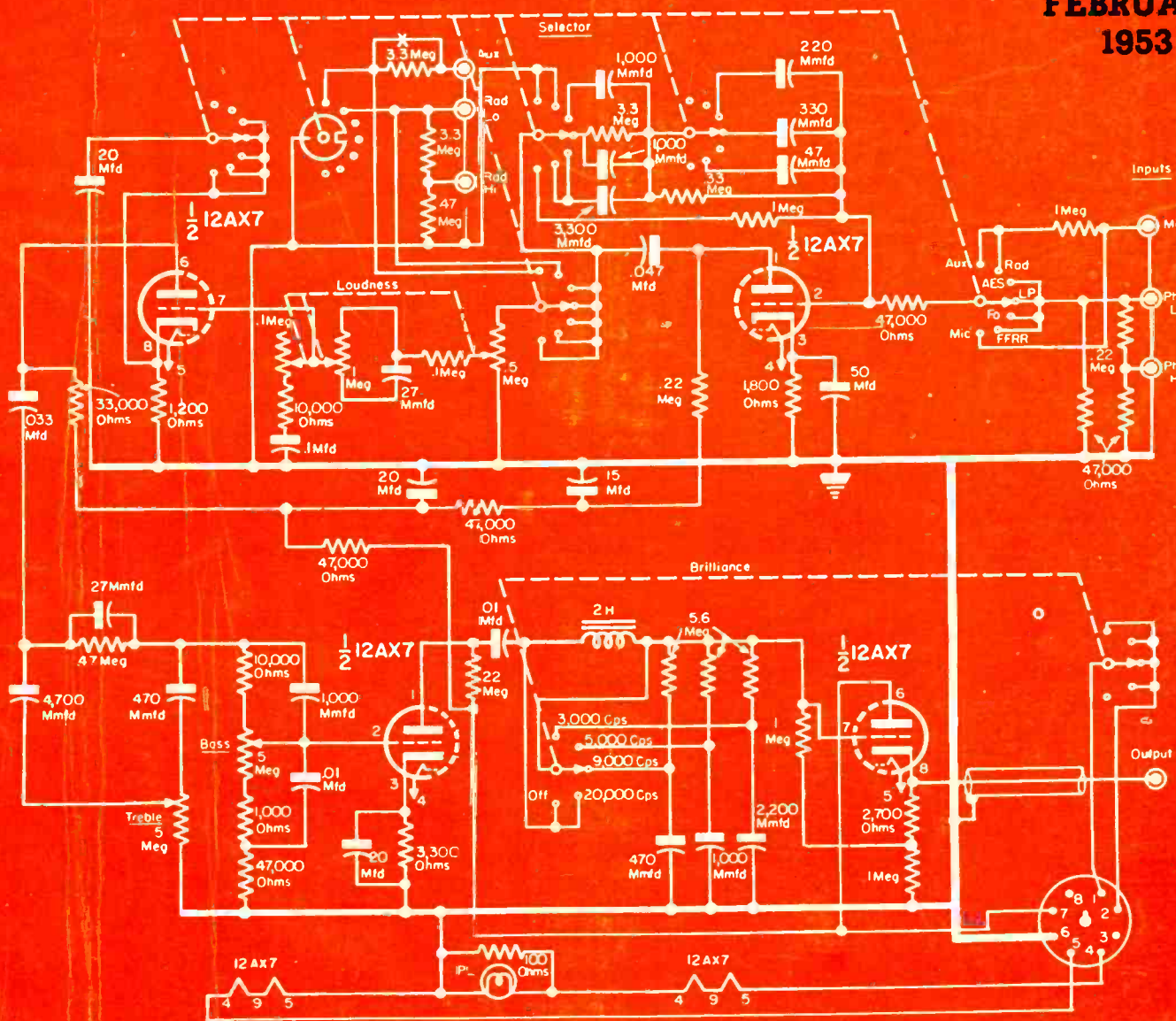
RADIO · TELEVISION · ELECTRONIC

SERVICE

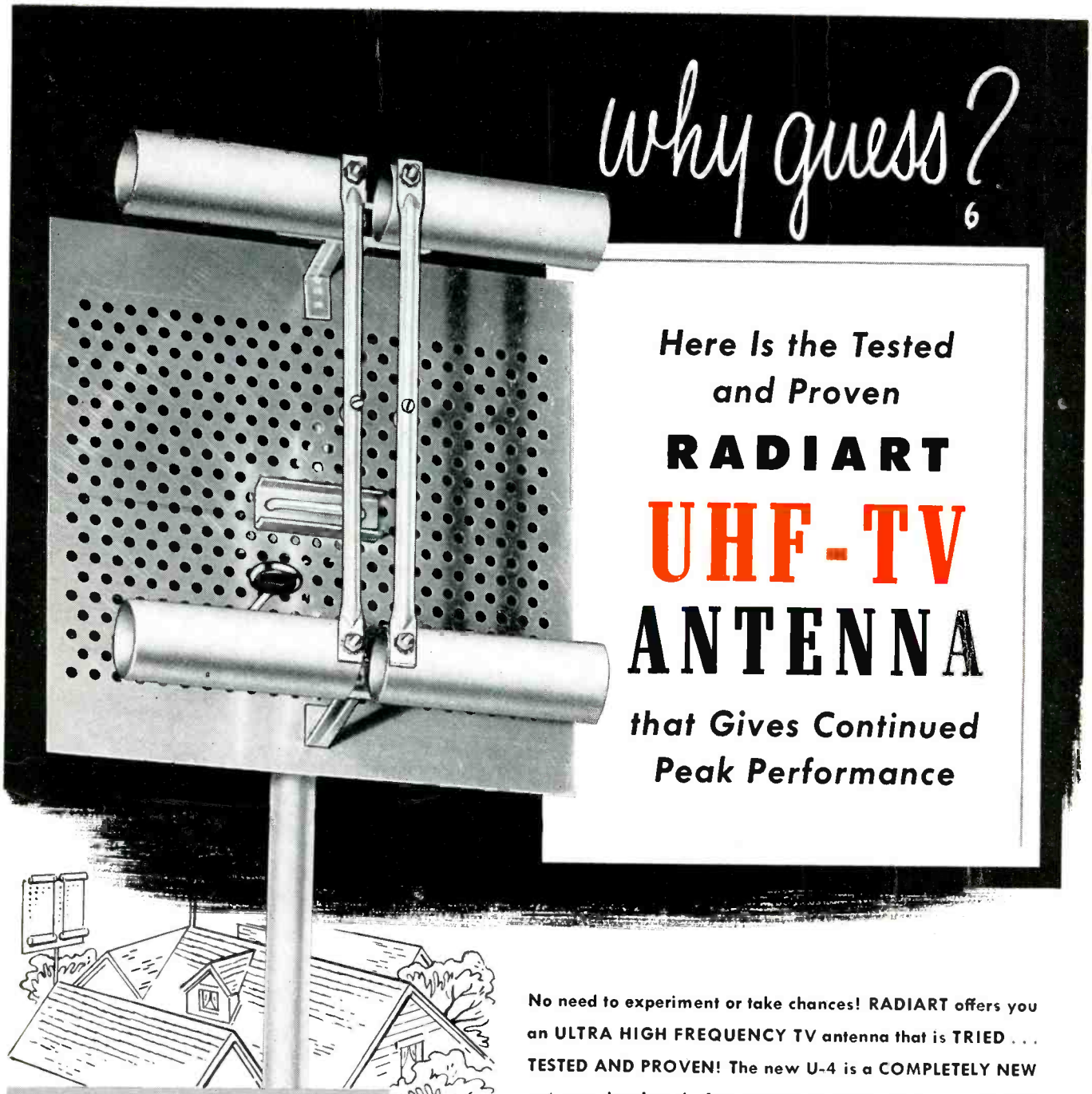
FEBRUARY 1953



Preamp-remote control with mike, radio, domestic and foreign records inputs, and treble and bass, volume and brilliance controls.

[see page 3]

THE TECHNICAL JOURNAL OF THE RADIO TRADE



why guess?

Here Is the Tested and Proven

RADIART

UHF-TV ANTENNA

that Gives Continued Peak Performance

UHF ADAPTER

for TV Antennas

Here's a speedy conversion unit for present TV antennas that brings in UHF signals. Easy to install . . . . fits most present TV antennas.

No need to experiment or take chances! RADIART offers you an ULTRA HIGH FREQUENCY TV antenna that is TRIED . . . TESTED AND PROVEN! The new U-4 is a COMPLETELY NEW antenna developed after months of research and testing! It is a stable operating, broad band antenna of uniform gain covering the entire UHF spectrum, with a very low standing wave ratio. COMPLETELY FACTORY PRE-ASSEMBLED for speeding installation!

- ★ *Uniform Gain with Low Vertical Radiation Angle (No Ghosts)*
- ★ *Uniform Gain . . . Low Standing Wave Ratio*
- ★ *300 Ohm Terminal Impedance*
- ★ *May Be Stacked . . . Measures 12 x 12 x 5 inches*

SUBSIDIARY OF ® CORNELL-DUBILIER ELECTRIC CORP

THE *RADIART* CORPORATION CLEVELAND 13, OHIO

VIBRATORS • AUTO AERIALS • TV ANTENNAS • ROTORS • POWER SUPPLIES

Vol. 22, No. 2

RADIO · TELEVISION · ELECTRONIC
SERVICE

February, 1953

LEWIS WINNER
Editor

B. BLOCK
F. WALEN
Assistant Editors

Including *Radio Merchandising* and *Television Merchandising*
Registered U. S. Patent Office

AUDIO INSTALLATION AND SERVICE

CIRCUITS

COVER

SERVICING HELPS

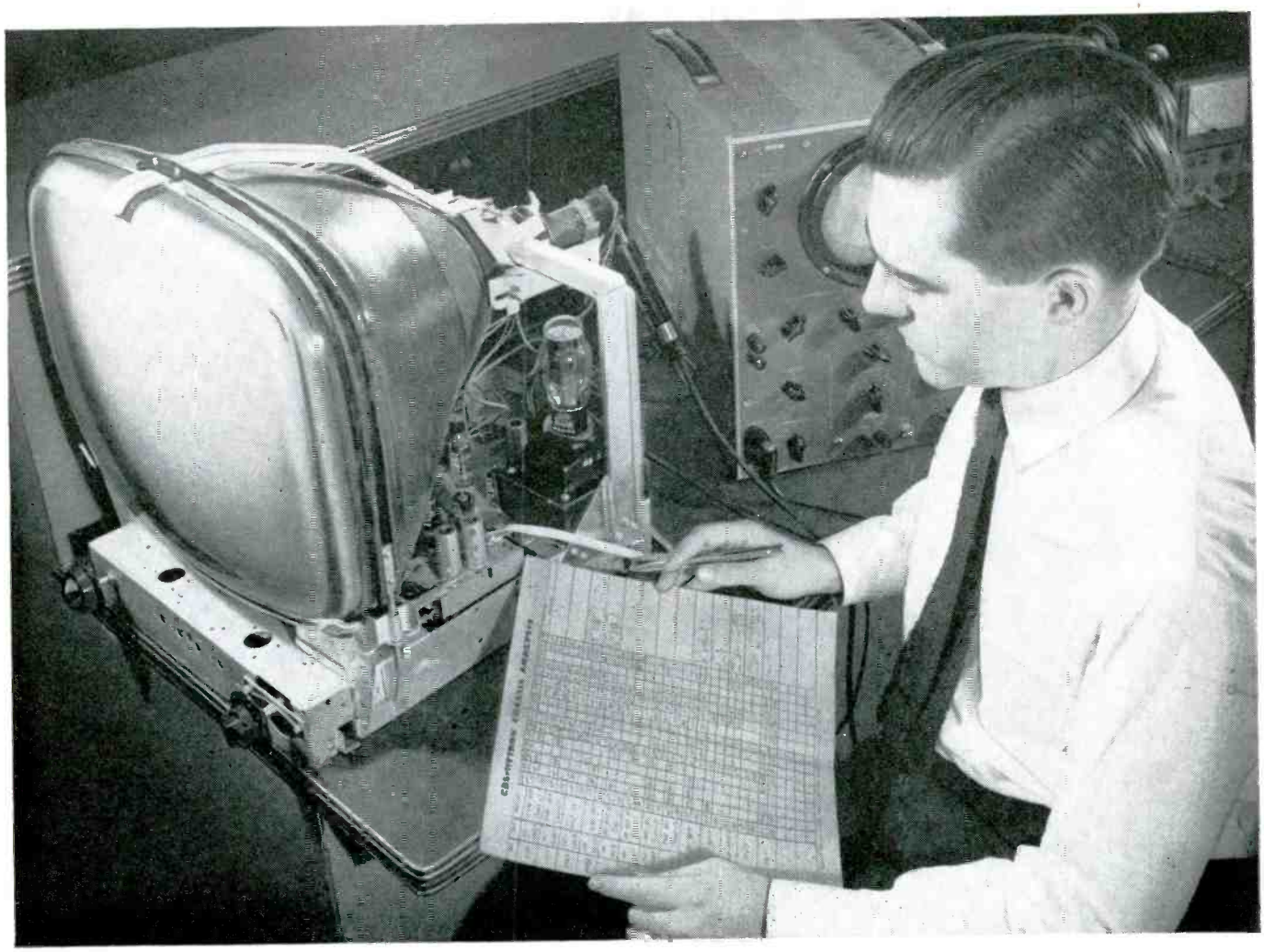
Manufacturers

Published monthly by Bryan Davis Publishing Co., Inc.

52 Vanderbilt Avenue, New York 17, N. Y. **Telephone MUrray Hill 4-0170**

Bryan S. Davis, Pres. Paul S. Weil, Vice-President F. Walen, Sec. A. Goebel, Cir. Prom. Mgr.
Mid-West Representative: Stuart J. Osten, 333 N. Michigan Ave., Chicago 1, Ill. Telephone: DEarborn 2-3507
East-Central Representative: James C. Munn, 2253 Delaware Dr., Cleveland 6, Ohio. Telephone: Erleview 1-1726
Pacific Coast Representative: Brand & Brand, 1052 W. Sixth St., Los Angeles 14, Calif. Telephone: Michigan 1732
Metropolitan District Manager: Donald C. Weil, 52 Vanderbilt Ave., New York 17, N. Y.

Entered as second-class matter June 14, 1932 at the Post Office at New York, N. Y., under the Act of March 3, 1879. Subscription price: $2.00 per year in the United States of America and Canada; 25 cents per copy. $3.00 per year in foreign countries; 35 cents per copy.



Bring back that New-Set Sparkle with Performance-Tested Tubes

Meet John Cunningham, a CBS-Hytron Commercial Engineer. John is beginning at the beginning for you. Socket by socket, he is analyzing the tube requirements of a brand-new TV set design.

John knows the superior performance demanded. He concentrates his know-how on insuring top tube operation within standard specification limits. He tests sample tubes . . . checks analysis data. Working hand-in-glove with the set designer . . . and with CBS-Hytron engineers . . . he assures control of the characteristics of all tubes for this new chassis. Finally he achieves . . . from rectifiers to picture tube . . . the perfect performance all of this engineering team (and you) seek.

Constantly CBS-Hytron carries on teamwork like this. Socket by socket analysis. Day in, day out — with 9 out of 10 leading TV set makers. Both tube and set engineers pool their specialized skills. Scores of the nation's foremost TV set engineers help make endless CBS-Hytron improvements. Help assure you of unsurpassed performance in virtually *all* leading TV sets.

Small wonder that your CBS-Hytron replacement tubes recapture that new-set sparkle. Please *your* customers. Cut *your* call-backs. Profit more. Take advantage of CBS-Hytron engineering. Demand CBS-Hytron . . . your logical replacement tube, because it is performance-tested all the way . . . from original to replacement.

CBS HYTRON RADIO TUBES

MANUFACTURERS OF RECEIVING TUBES SINCE 1921

HYTRON RADIO AND ELECTRONICS CO.

A Division of Columbia Broadcasting System, Inc.

Main Office: Danvers, Massachusetts

NEW . . . BIGGER . . . BETTER

FREE!

6th Edition

CBS-HYTRON Reference Guide for Miniature Electron Tubes

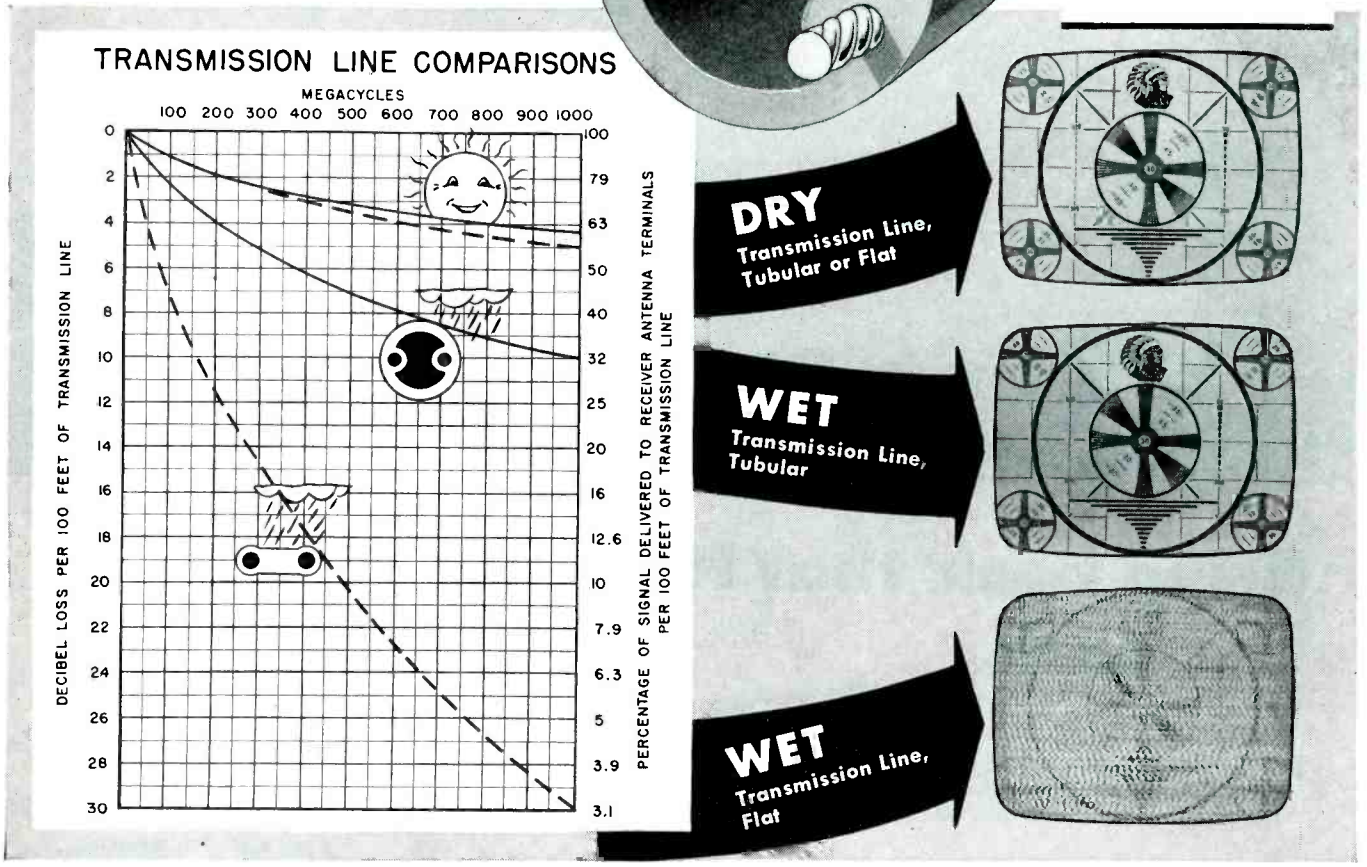
- A CBS-Hytron original . . . it's unique.
- *All* miniatures, regardless of make.
- 250 miniature types . . . 87 new.
- 111 basing diagrams . . . 34 new.
- Similar larger prototypes indicated.
- 8 packed pages of data you need daily.
- And it's FREE!

Get your copy of this old friend brought up to date now. Ask your CBS-Hytron jabber or write direct . . . today!

TUBULAR TWIN TRANSMISSION LINE for UHF

Saves the picture when it RAINS

Now available from your Admiral distributor



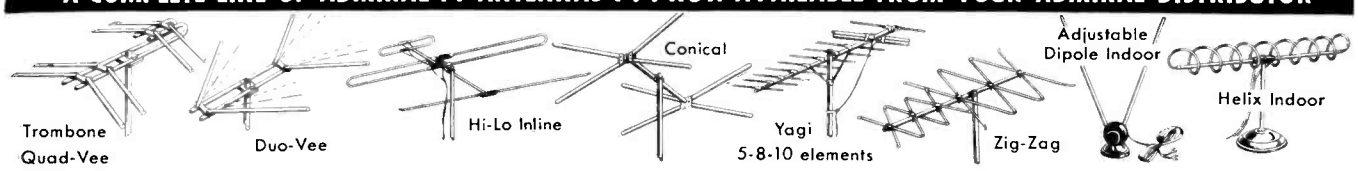
Many dealers are in doubt about the type of transmission line to use in the new UHF areas. The graph and test patterns tell the story. When rain, fog, dew, etc., accumulate on flat transmission line, the electrical field is short-circuited, causing loss of signal strength. The higher the frequency, the greater the loss. *Only a tubular line provides a weather-free air space for constant impedance.*

Admiral tubular transmission line is made of virgin polyethylene, free from impurities that reduce impedance. Aluminum oxide is added to reflect light and prevent deterioration due to sunshine. It is kink-proof and long-lasting . . . impervious to rain, sleet, snow, wind or salt spray. Furnished in 600 ft. spools. Order from your Admiral distributor by part number—95A22-32.

Admiral Corporation

Accessories and Equipment Division • Chicago 47, Illinois

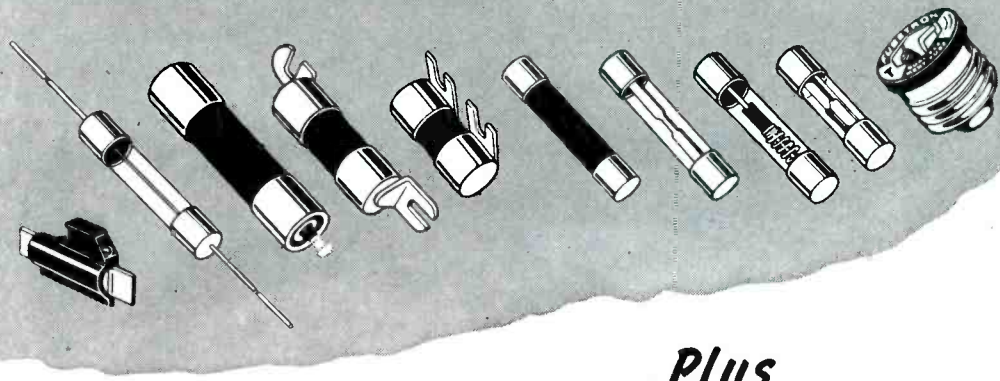
A COMPLETE LINE OF ADMIRAL TV ANTENNAS . . . NOW AVAILABLE FROM YOUR ADMIRAL DISTRIBUTOR



WHATEVER YOUR FUSE NEEDS THIS ONE SOURCE SAVES TIME AND TROUBLE

BUSS FUSES

for TELEVISION...RADIO...RADAR INSTRUMENTS...CONTROLS...AVIONICS



From fractional amperage types to huge industrial fuses, BUSS has specialized in a complete fuse line for the past 39 years. Whatever your circuit protection problem, you can choose from this complete line not only with convenience but with confidence in the unequalled BUSS reputation for quality and dependability.

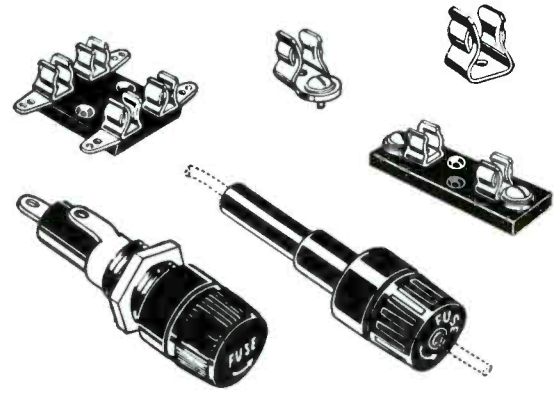
Evidence of BUSS dependability is the rigid electronic testing every fuse must undergo before leaving the factory. Ultra-sensitive electronic devices check it to exacting standards of construction, calibration and physical dimension.

BUSS Fuses Are Best For Your Business.

When you install BUSS Fuses, you can forget about troublesome "callbacks" caused by unnecessary blowing... and yet you can be certain of positive protection. In addition, your customers will appreciate the BUSS name... famous in home, farm and industry for 39 years. They'll know you've used the best.

...Plus

A COMPLETE LINE OF FUSE CLIPS, BLOCKS AND HOLDERS



USE THE HANDY COUPON—*It's just good business to rely on BUSS FUSES*

BUSSMANN Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me bulletin SFB containing facts on BUSS small dimension fuses and fuse holders.

*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City & Zone*_____ *State*_____ S-253

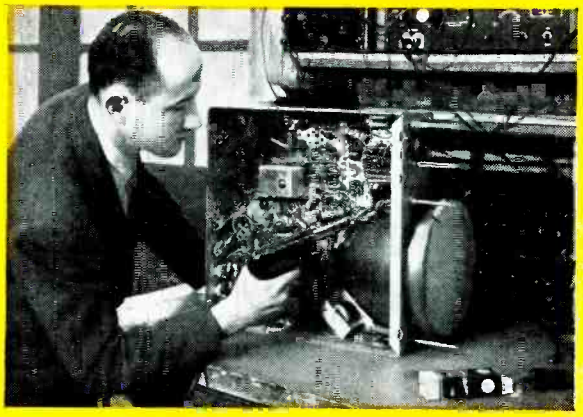
THEY INCREASED SERVICE

These service dealers weren't content to sit still and wait for repair jobs to come to them. Like hundreds of others who took part in G. E.'s big 1952 summer promotion, they went looking for business . . . and found it! Here are facts and figures that prove service promotion pays off!

"Every month showed bigger sales!"

"Because of our summer promotion, June service sales were 194 percent of May; July sales 223 percent. August service will equal or exceed July. Newspaper ads, mailing cards, TV spots, radio announcements—we used them all successfully."

LAURENCE T. SAMPLE
Electronic Television of Florida, Inc.
1003 S. W. 27th Ave., Miami, Fla.



"1952 business was far ahead!"

"Our promotion campaign consisted of three parts: (1) a special TV-check-up mailing, (2) general service mailings, (3) newspaper advertising that featured a prize contest. G-E-tube direct-mail cards were employed. . . . A comparison of our C. O. D. business during the two months shows a 72% increase, 1952 over 1951."

WILLIAM S. WEIL, JR.
Interstate Television Service Co.
1300 N. Third St., Philadelphia, Pa.

"We more than doubled service income."

"We spent half our 1952 advertising budget in an intensive service promotion, using direct-mail, newspaper space, and ads in local-events programs. As a result, our gross income was up 112% from the same months in 1951 when we had put no special emphasis on promotion."

E. J. HORSTMAN
Suburban Television Company
605 W. Hillgrove Ave., La Grange, Ill.

You can put your confidence in—

BUSINESS UP TO 123%!

Now you can do it!

1953's here. It's time to plan ahead for a bigger, better year—for more business through aggressive promotion. The G-E Tube Department can help you with sure-fire aids that work hard beginning the first day you use them. They're described in this brand-new 12-page catalog. You've seen how aids like these paid off for Sample, Weil, and Horstman. Make G. E.'s new catalog *your* blueprint for profits in '53!

Look what you can get!

- **Identification aids,** such as decals, clock, signs, and tube display cartons.
- **Advertising aids,** such as mailing pieces, newspaper ad mats, doorhangers, and streamers.
- **Business aids,** such as job tickets, calling cards, letterheads, and tube-test stickers.
- **Service aids,** such as tube puller, jumper cord, drop cloth, and shop garments.
- **Technical manuals and publications.**

SEE YOUR G-E TUBE DISTRIBUTOR TODAY!

He will be glad to help you get started! ***Or write direct to Tube Department, General Electric Company, Schenectady 5, N. Y.***

1878 75 1953 YEARS OF ELECTRICAL PROGRESS
Diamond Anniversary

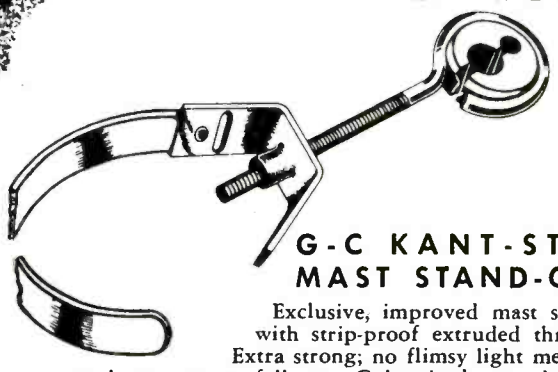
GENERAL ELECTRIC

161-1A1

G-C HAS MADE... 125 MILLION STAND-OFFS FOR THE TELEVISION INDUSTRY

All G-C Stand-Offs are supplied with genuine Polyethylene insulators like this . . . featuring the exclusive G-C reinforcing rib that keeps the insulator from collapsing.

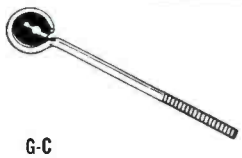
125 MILLION STAND-OFFS! Yes, G-C recently completed the manufacture of its 125,000,000th Stand-Off . . . made possible by the fact that the entire radio-TV service industry recognizes the value, the top quality built into every G-C Stand-Off—available from your jobber in 24 popular styles.



G-C KANT-STRIP MAST STAND-OFFS

Exclusive, improved mast stand-offs with strip-proof extruded threads. Extra strong; no flimsy light metal used; no loose nuts to fall out. Galvanized strap has round end for easier threading. Genuine Polyethylene insulator, unique G-C design.

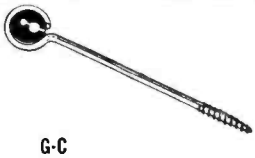
No.	Size
8253	3½" Single
8257	7½" Single



G-C UNIVERSAL STAND-OFFS

(Machine Screw Type)

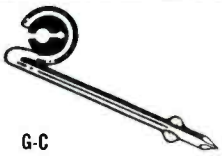
No.	Length
8031	3½"
8032	5½"
8035	7½"



G-C UNIVERSAL STAND-OFFS

(Wood Screw Type)

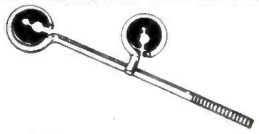
No.	Length
8027	3½"
8028	5½"
8029	7½"
8030	12"



G-C NAIL-IN STAND-OFFS

New, speed-type nail-in stand-offs save installation time, labor and cost on each job. Easy to use, Genuine Polyethylene insulators.

No.	Length
8343	3½"



G-C DUPLEX IN-LINE STAND-OFFS

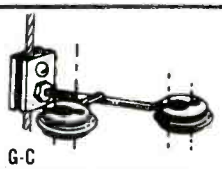
Two styles, wood screw and machine screw types. Heavily zinc plated to prevent rust.

No.	Size and Type
8225	7½" Wood Screw
8226	7½" Machine Screw

G-C SNAP-ON STAND-OFFS

NEW, improved snap-on that is easier to install, then stays on. Snap . . . and it's on; that's all there is to it! Two standard sizes. Feature exclusive G-C reinforced insulators.

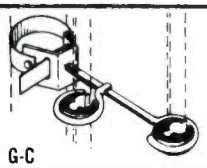
No.	Size
8797	For 1" Masts
8798	For 1¼" Masts



G-C "WIRE-GRIP" GUY WIRE STAND-OFFS

TV lead-ins and rotatot wires can be brought down long guy wires. Fasten permanently; easy to use. Genuine Polyethylene insulators.

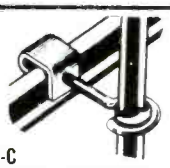
No.	Size and Type
8255	3½" Single
8256	Double Type



G-C DUPLEX KANT-STRIP MAST STAND-OFFS

Heavy steel stand-off with strip-proof extruded threads. A deluxe stand-off at a really low price. Galvanized strapping. For both 300-ohm and coaxial lines.

No.	Type
8258	Double



G-C EAVE TYPE CLAMP-ON STAND-OFFS

New type, clamp-type stand-off that quickly fastens to eaves. Easy to install. Genuine Polyethylene insulators.

No.	Type
8811	Single
8812	Double

G-C TEE-TYPE STAND-OFFS

Heavy zinc plated for permanent installation. Two types, wood screw and machine screw. For both 300-ohm and coaxial lines.

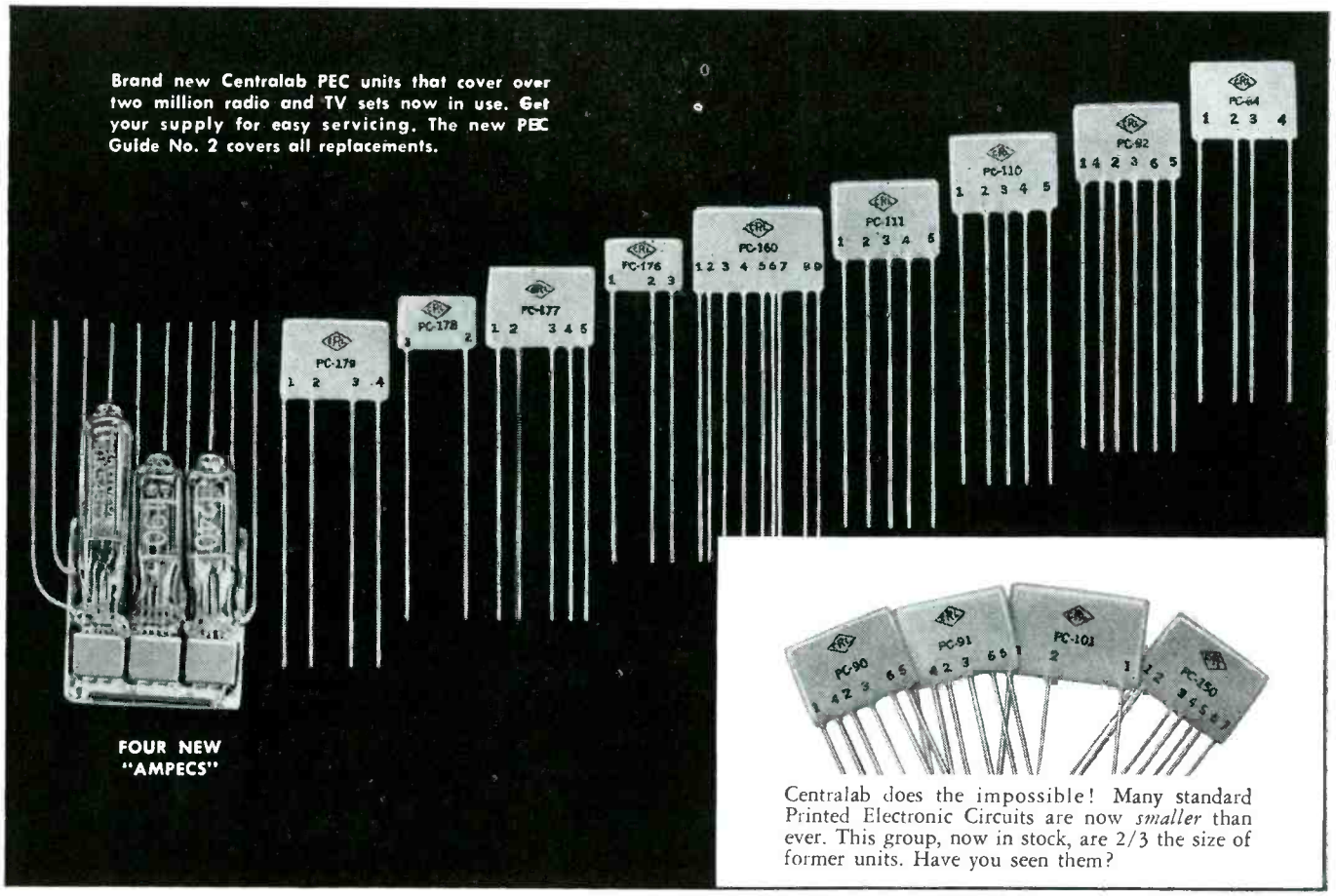
No.	Size and Type
8809	7½" Wood Screw
8810	7½" Machine Screw

FREE G-C's big, illustrated Catalog, chock-full of hundreds and hundreds of radio-TV service aids. Send a postcard for your copy today!

GENERAL CEMENT MANUFACTURING CO.

901 TAYLOR AVENUE ROCKFORD, ILLINOIS

Thirteen NEW CRL Printed Electronic Circuits for replacement service!



Now Available from your Centralab Distributor

THESE thirteen new Printed Electronic Circuits are now in use in thousands of radio and TV sets. You should have a complete stock on hand for shop work and service calls. Centralab Circuits are safest and easiest for servicing. In most cases, the replacement PC number is the same as shown on the original part.

These new PEC units replace whole Pentode Coupling, TV I. F., Triode Coupling, or Pentode Detector networks. Four new plates, too, to replace *special* manufacturer's parts. Together with the other CRL stock Printed Electronic Circuits, these parts will cover 95% of all PEC replacements. Over 15 million circuits are now in use . . . are you ready to service them?

Don't overlook the new smaller sizes in older PEC units. Small size is not enough . . . Centralab makes Printed Electronic Circuits even smaller! For complete information on parts, replacements, and test data, see the *new* Printed Electronic Circuit Guide No. 2. Ask your distributor for a copy, or use the coupon.

Make your Centralab distributor headquarters for exact electronic replacements

Centralab

A Division of Globe-Union Inc.
Milwaukee 1, Wisconsin
In Canada, 635 Queen Street East, Toronto, Ontario

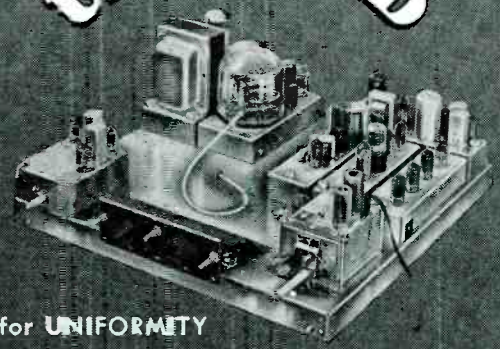
Centralab Printed Electronic Circuits are among the more than 470 *new* items listed in Centralab's new Catalog 28. Get your copy of this 32-page index to the latest developments in the fast-changing electronic field, plus the 20 page Printed Electronic Circuit Guide No. 2. See your distributor or use coupon.

CENTRALAB, A Division of Globe-Union Inc.
908 E. Keefe Avenue, Milwaukee 1, Wisconsin

Please send me my copy of:
☐ P.E.C. Guide No. 2 ☐ Centralab Catalog 28

Name..... Position.....
Company.....
Address.....
City..... State.....

UNIT-IZED
TRADE MARK



• for UNIFORMITY
• for MODERNIZATION
• for MAINTENANCE

SETCHELL CARLSON TELEVISION

.. an engineering masterpiece
... a coveted dealership

B. T. SETCHELL
President and
Chief Electronic Engineer

SETCHELL CARLSON "UNIT-IZED" TELEVISION, the receiver that is electrifying the industry . . . bringing order and simplicity to a host of production and service problems.

The compact chassis consists of a base and 8 plug-in units, each performing its separate and distinct yet perfectly synchronized function, producing picture and tonal quality that defies comparison.

This new and exclusive type of chassis construction provides maintenance of peak quality by individually testing each unit, provides the possibility of modernizing at the lowest possible expense and provides an ease of service unequalled in the television industry.

In addition to the features that have proven to be valuable, such as, models with radio and phono, 4 stages of I. F. amplification, simplified adaptation to U. H. F., variable tone control, front panel adjustment, removable safety glass, luminous dials, and distinctive cabinet designs, SETCHELL CARLSON television contains many more basic *exclusive* features that make it television's best buy.

—Herm-A-Dome; (patent applied for) a hi-voltage unit hermetically sealed against humidity and dust, preventing arcing and corona thus prolonging its life.

—A unique circuit (patent No. 2,589,299) that protects major parts in case of oscillator drive failure.

It is truly the dream set of the customer, the dealer and his serviceman.

SETCHELL CARLSON television is custom designed in a limited production schedule and equipped with powerful sales tools that make every dealership a valuable and coveted one.

Interested dealers are requested to write:

one of the several models . . . Blonde 5301 with Radio and Phono compartment

SETCHELL CARLSON, INC.

"Leaders in Electronics for a Better Life"

NEW BRIGHTON, MINNESOTA

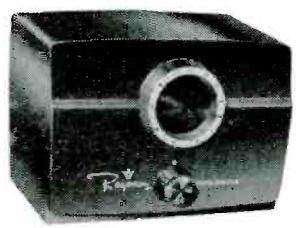
Thomas A. White

president: Jensen Manufacturing Company, Chicago, Illinois

says: "In every field there's one leader

---- in boosters it's Regency"

the largest selling booster at any price



Burton browne advertising

Sylvania's New 1954 Calendar for Service Dealers . . . . sells all through the Year!

They'll read your super-service story every month!

Filled with ideas and recipes your prospects will want to keep

It's your personal Christmas greeting, too

Don't miss this Dramatically Different Business Builder!

Here's the hardest-selling, custom-made Home Calendar ever offered to Radio-TV Service Dealers! It's tailor-made just for you! Features an appealing illustration painted exclusively for Sylvania by a famous cover artist. Reproduced in full color and imprinted with your name and address.

Your prospects simply can't overlook this calendar. It's filled with timely hints and valuable household suggestions they'll want to keep handy. And, every time they turn the page they'll be reminded of your dependable service, skill, and experience.

Order now . . . supply limited! At only 1½¢ per customer per month (in lots of one hundred or more), this calendar is truly the smartest advertising buy ever offered. But don't delay, the supply is limited! Order a couple of hundred from your regular Sylvania distributor . . . TODAY! If he is out of stock, write to: Sylvania Electric Products Inc., Dept. 3R-2402, 1740 Broadway, N. Y. 19, N. Y.

SYLVANIA

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

MERCHANDISE YOUR IDEAS FOR EXTRA PROFITS

Did you know that 5 out of every 6 TV sets are sold in metropolitan areas . . . well within the reception area of the Radion Metropolitan antenna? That's your BEST target area for extra profits. Here are some ideas to get them now! . . .

Big Replacement Market

It's rapidly becoming a big factor in antenna sales. There'll be 20 million sets in use this year. Even by the most conservative estimates, replacements are a huge market you can't afford to pass up! Keep a Metropolitan on display. Radion sells best over the counter because it's the one antenna folks recognize. That $6.95 list gives you a fine spread and remember, sell just TEN antennas and you've earned as much profit as you'd make on a table model TV set.

Let Deliverymen Install

Save time and money . . . keep your TV technicians free for service calls and shop work. With Radion, the man who delivers the set installs the antenna. Radion saves on antenna complaints too because the customer adjusts his own antenna.

Sell on Service Calls

Frank Moch of NATESA estimates that there'll be 26 MILLION service calls in 1953. Each call is an opportunity to sell an accessory. Have your technicians carry a Radion Metropolitan as a replacement antenna or, if it's an outside installation, sell a Radion lightning arrester. Remember, the initial sale is an invitation to further selling. Check your customer list . . . it's a constant source of business for you.

RADION Sells TV Trade-ins

Those traded-in sets may seem like a headache to you but there's a big market for used and small-screen sets. Add a Radion Metropolitan in a flat-price package deal . . ."complete with antenna!" You'll find it a natural for extra sales.

Fans Buy Radions for FM

The Radion Metropolitan with its adjustable dipoles makes a fine FM antenna. Remember the sound on TV is FM too. Sell Radions right out of your TV antenna inventory for extra profits.

New Lightning Arrester a Natural

Radion's new *all-purpose* arrester is proving a terrific source of extra profits. Cuts your inventory problems because it fits all twin leads, mounts anywhere, comes complete with hardware. Sell an arrester with every outdoor installation. See Radion's handsome new display package. It's a top "silent salesman" for your counter.

FREE PRIZES FOR YOUR IDEAS

Selling more TV helps you — helps us. Let's exchange our proven ideas for extra profits. Send ideas you've tried successfully to Radion. If we print them, we'll send you your choice of a case of 12 antennas or 24 lightning arresters. Send as many ideas as you like. In case of duplication, first letter received wins, so write now!

Get On The Profit Bandwagon—Send This Coupon Today

Radion

The Radion Corp., 1130 W. Wisconsin Ave.
Dept. S-2, Chicago 14, Illinois
Send me free Radion profit plan folder

Name_____

Firm_____

Address_____

EXPORT SALES DIVISION: Scheel International, Inc., 4237 N. Lincoln Ave., Chicago 18, Illinois, U. S. A.

NOW—a dynamic new campaign to help you

Share in the Magic of the

Dealer Identification Program spotlights your service . . . builds prestige and profits

Now—you can make the most of the magic selling power in the famous RCA trademark. Here is a complete business-building program that includes everything from window displays to local and national advertising. Don't miss this great opportunity . . . see your *RCA Tube Distributor* today for full details.

1. "REGISTERED DEALER" DISPLAY SET. For your window, a three-dimensional display in full, rich colors . . . plus a set of 10 RCA dummy cartons . . . plus two companion easeled display cards.

Dynamic Promotions to help you sell your service to your prospects:—

3. DIRECT MAIL PROGRAM. Seven brand-new and unique mailing pieces that will stimulate your service business. Also, a Basic Mailing Kit to help you get started with your campaign.

4. ILLUMINATED "SPINNING MOTION" SIGN. Action-packed 15" sign that sells your service. Spinning wheel creates dancing shadows and colors. Nothing like it offered before.

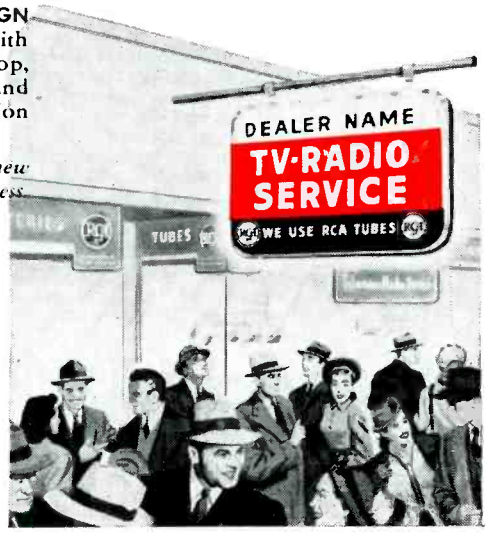
RCA

WE USE RCA TUBES

2. RCA TRADEMARK DECAL. For your door, window, or service truck.

5. OUTDOOR ILLUMINATED SIGN FOR DEALERS. Personalized with your own store name at the top, this brilliantly glowing plastic and steel sign will command attention up and down the street.

. . . and many other dynamic new plans to help you build your business.



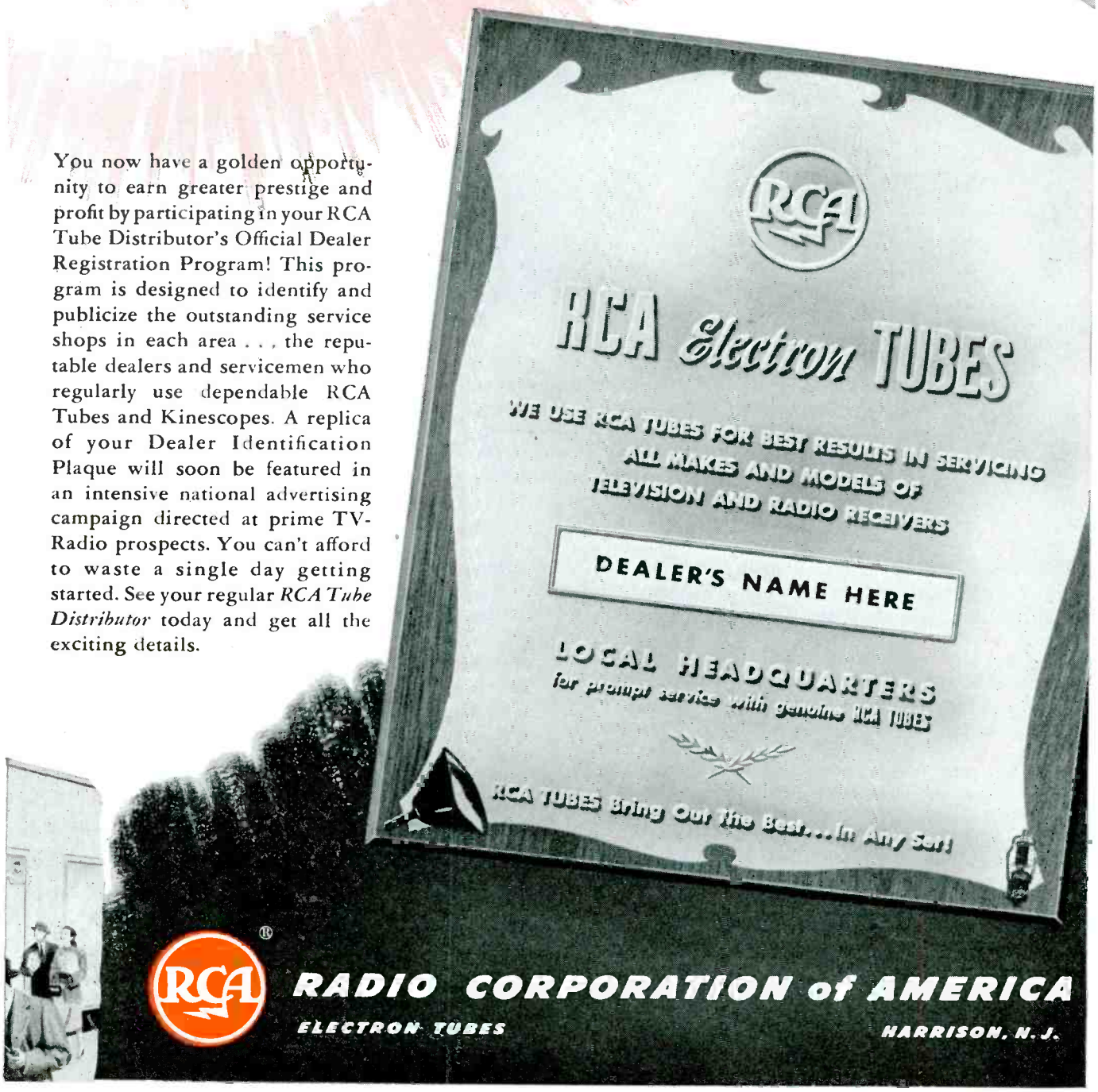
GET THE STORY TODAY!

Ask your RCA Tube Distributor for your copy of the colorful 16-page booklet "A Magic Pass-Key to Customer Confidence." The complete campaign is outlined, illustrated, described in full detail. Be sure to get your copy as soon as possible. It's free!

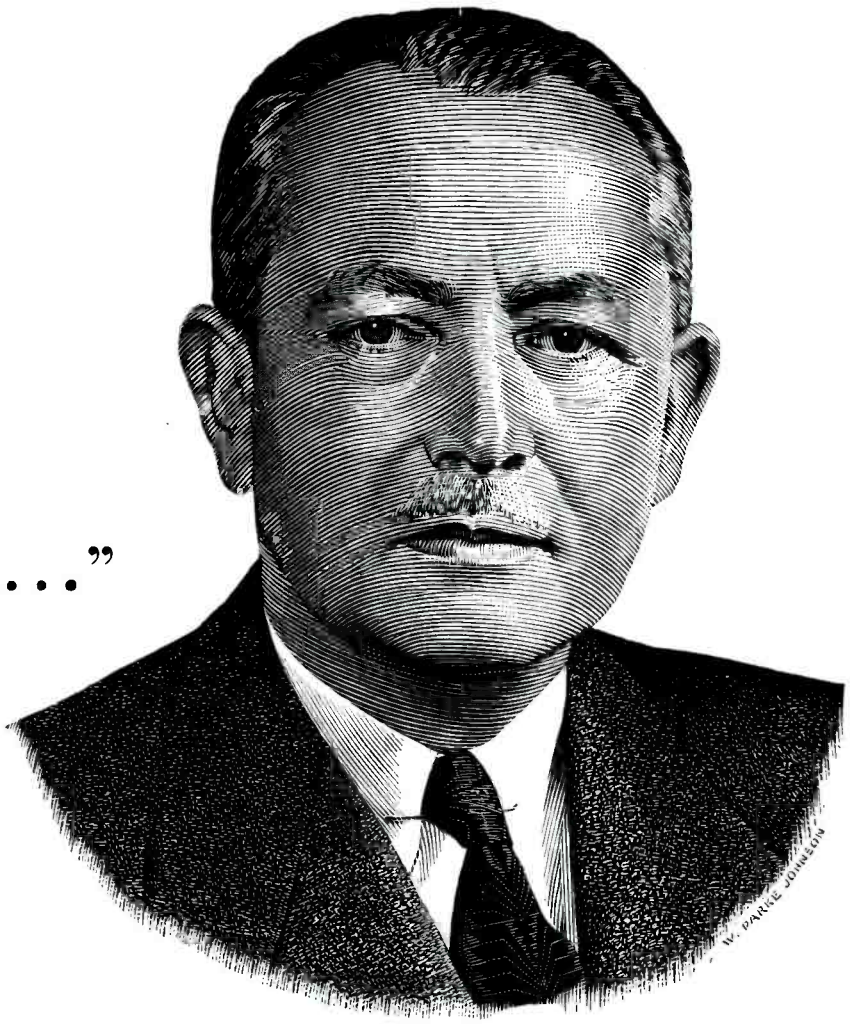
RCA Trademark

Your *RCA Tube Distributor* presents the greatest *prestige-building, profit-packed* program ever offered to service dealers! . . . an Official Dealer Registration Program, featuring a *personalized Dealer Identification Plaque*, and backed by a hard-hitting local and national advertising campaign.

You now have a golden opportunity to earn greater prestige and profit by participating in your RCA Tube Distributor's Official Dealer Registration Program! This program is designed to identify and publicize the outstanding service shops in each area . . . the reputable dealers and servicemen who regularly use dependable RCA Tubes and Kinescopes. A replica of your Dealer Identification Plaque will soon be featured in an intensive national advertising campaign directed at prime TV-Radio prospects. You can't afford to waste a single day getting started. See your regular *RCA Tube Distributor* today and get all the exciting details.



"... opportunity is freely given..."



PAUL M. HAHN
President, The American Tobacco Co.

"Our nation has grown great largely because opportunity is freely given. Only very few people actually make their own 'breaks.' Today, millions of Americans are providing for their personal financial security and at the same time helping in the building of our national defenses. The opportunity to do so is given by business management which affords employees the means of practicing systematic thrift through the Payroll Savings Plan for the purchase of U. S. Defense Bonds."

Nearly seven million employees of industry are "providing for their personal security and at the same time helping in the building of our national defenses."

- they are the men and women who availed themselves of the opportunity referred to by Mr. Hahn—the opportunity to enroll in the Payroll Savings Plan for the systematic purchase of U.S. Defense Bonds.
- they represent a high percentage of their companies' employees—in plant after plant, the averages are climbing to 60%, 70%, 80%—even higher.
- their investment in Defense Bonds—and America—add up to $140 million per month.
- they constitute a large block of the men and women who on December 31, 1951, held Series E Bonds amounting to $34,727,000,000—$4.8 billions more than the cash value of Series E's outstanding in August, 1945.

Not far from you is a State Director of the Savings Bond Division. He will be glad to tell you how easy it is to give your employees a Payroll Savings Plan. Or, if you already offer the Plan to your people, he will show you how to conduct a simple person-to-person canvass of your plant—a canvass intended to do only one thing—to put a Payroll Savings Application Blank in the hands of every man and woman on your payroll. Your employees will do the rest.

Phone or write to Savings Bond Division, U.S. Treasury Department, Suite 700, Washington Building, Washington, D. C.

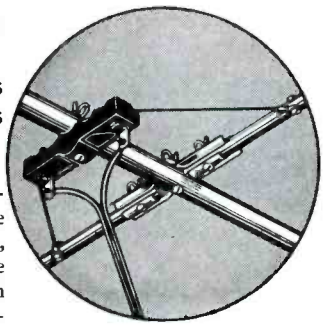
The U. S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

SERVICE

NEW LOW PRICES ON WORLD'S MOST POWERFUL YAGIS

New Delta Match

Perfected by Vee-D-X Engineers Makes Possible the New Low Prices on These Powerful Yagis



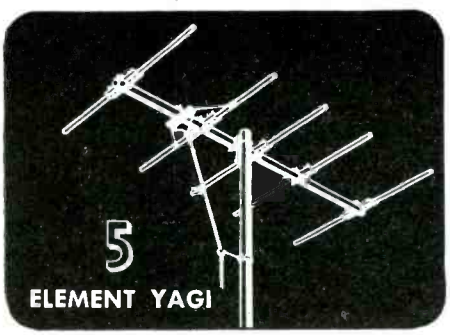
The new Vee-D-X Delta Match is an ingenious method of selecting the exact impedance point of the di-pole with any frequency, made possible by the unique tapered line principle. The Delta Match accomplishes an exact transformer action over an entire channel without loss of picture highlights or cutting of the audio portion of the TV signal. What's more, it permits *lower cost* with no sacrifice of either quality of performance or quality of the antenna. Except for the Delta Match section, the new Vee-D-X Delta Series have the same pre-assembled construction and powerful performance that have made Vee-D-X Yagis the Number One line of single channel antennas.

SAVINGS OF MORE THAN 30%

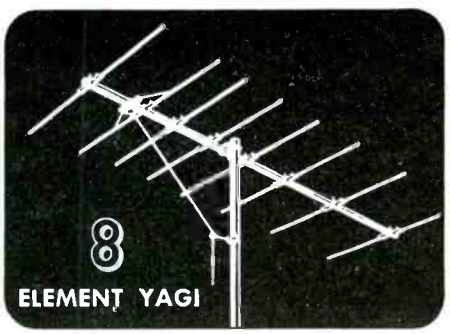
No Sacrifice of Quality or Performance

Here's good news to all Yagi users where low price is as important as the high gain that these powerful single channel antennas deliver. They are not cheaply made. In fact, they differ only from the famous standard Vee-D-X Yagis in their Delta Match section.

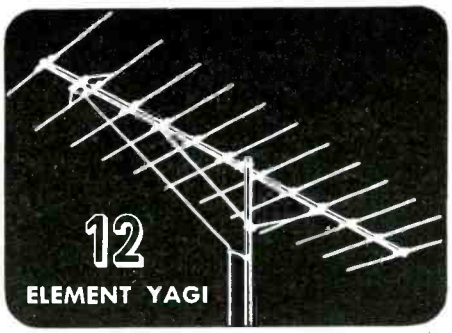
THREE MODELS FOR POWERFUL RECEPTION IN ANY SINGLE CHANNEL AREA



THE DC—Here is truly outstanding value in a quality five-element Yagi. The new DC delivers the power of the famous JC at lower cost. Its features include rugged pre-assembled all-aluminum construction; high gain on every channel; 6 megacycle band width; excellent front-to-back ratio. When ordering, be sure to specify channel. For example, for Channel 6, order DC-6. The DC may be stacked for extra gain. Special VEE-D-X phasing harnesses are available for double-stacking. When ordering for Channel 6, order DH-6. For complete prices on the DC see below. Channels 7-13 lists at only **$5.55**



THE DELTA LONG JOHN—Here is the Delta Match version of the famous eight-element Long John that provides 41% more gain than a five-element Yagi, and gives equal gain to a double-stacked five-element Yagi array. High front-to-back ratio eliminates co-channel interference. Has rugged pre-assembled all-aluminum construction. When ordering, be sure to specify channel. For example, on Channel 6 order DLJ-6. The Delta Long John may also be stacked for additional gain. For complete prices, see below. Channels 7-13 lists at only **$9.75**



THE DELTA LONG LONG JOHN—Where super high gain is required, you can't beat the Delta Long Long John either in performance or low price. It is the highest gain, single channel antenna ever developed and guaranteed to outperform any other Yagi except the standard Long Long John. Has rigidized boom bracing with pre-assembled, all-aluminum construction. High front-to-back ratio, full six megacycle band width. When ordering, be sure to specify channel. For example, when ordering Channel 6, order DLLJ-6. The DLLJ may be stacked for additional gain. See below for complete prices. Channels 7-13 lists at only **$16.00**

COMPARE THESE LOW PRICES!

Channel	DC list	DLJ list	DLLJ list
7-13	5.55	9.75	16.00
6	9.75	18.05	26.40
4-5	11.15	21.55	31.95
3	11.85	23.65	34.75
2	12.50	23.65	34.75

The LaPointe-Plascomold Corporation
Rockville, Connecticut

Gentlemen:

Please send me information, at once, on your low cost Delta Series Yagis.

NAME .....

ADDRESS .....

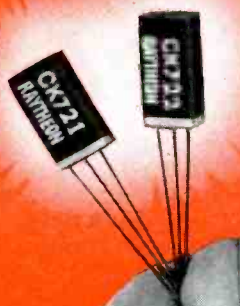
CITY ..... ZONE ....

STATE .....

NOW AVAILABLE!

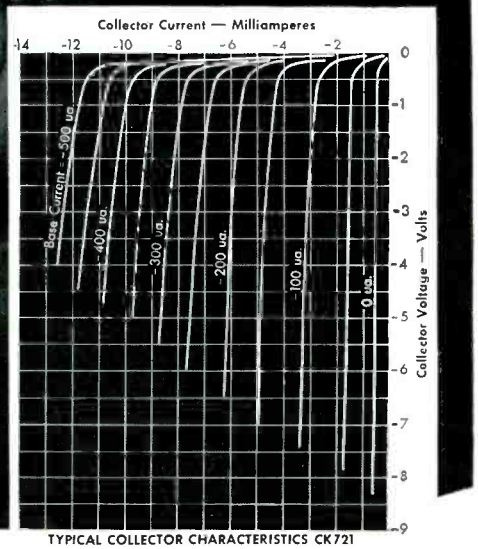
PNP GERMANIUM JUNCTION

RAYTHEON TRANSISTORS



AVERAGE CHARACTERISTICS AT 30° C	CK721	CK722
Collector Voltage (volts)	−1.5	−1.5
Collector Current (ma.)	−0.5	−0.5
Base Current* (ua.)	−6	−20
Current Amplification Factor*	40	12
Power Gain* (db)	38	30
Noise Factor* (1,000 cycles) (db)	22	22

*Grounded Emitter connection

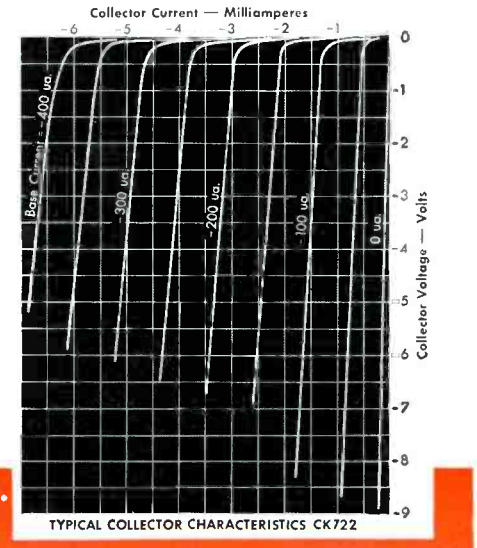


TYPICAL COLLECTOR CHARACTERISTICS CK721

For the first time in history, Germanium Junction Transistors are commercially available. Raytheon Junction Transistors, types CK721 and CK722 can now be obtained for your experimental and developmental use.

Here's another first for Raytheon! Leaders in the development and production of Electron Tubes and Germanium Products, Raytheon now leads the way in production of this important new electronic development.

For price and delivery information of Raytheon Germanium Junction Transistors, write, phone or wire your Raytheon Tube distributor.



TYPICAL COLLECTOR CHARACTERISTICS CK722

RAYTHEON®

Excellence in Electronics

RAYTHEON MANUFACTURING CO.

Receiving Tube Division

Newton, Massachusetts • Chicago, Illinois • Atlanta, Georgia • Los Angeles, California

RAYTHEON MAKES ALL THESE:

RECEIVING AND PICTURE TUBES • RELIABLE SUBMINIATURE AND MINIATURE TUBES • GERMANIUM DIODES AND TRANSISTORS • NUCLEONIC TUBES • MICROWAVE TUBES

RADIO · TELEVISION · ELECTRONIC
SERVICE

Tempest Over Atlantic City

OVER A QUARTER CENTURY ago, when broadcasting made its exciting debut, zealous opportunists stormed the scene, blasted away with rash promises on performance, which they knew were completely dishonest, and created havoc. It is true that equipment was simpler then and not too expensive, but the art was changing rapidly, and the repeated bursts of false claims sickened everyone. A barrage of pleas, and eventually court action in some instances, were of little help, *until* industry itself became mature enough to take a vigorous hand and clean house. For a span of years the efforts were fruitful. Claims still appeared, but in a comparatively subdued tone.

It was truly heartening to see the change, and it was felt that the millenium had at last arrived. But, the pleasant calm apparently was not destined to hold on and on, and some years ago it was shattered on the arrival of commercial TV. Once more truculent promises poured forth, and violent trouble really hit everywhere. For now, all sets were expensive, accessories were costly, and installation and servicing charges were quite an item, too. Disappointments were rife.

Trouble on the Ultrahighs

Industry action was promised, but was tardy in coming. Finally, industry found those brooms and began to sweep, not too briskly, but sweep nevertheless. Again, it was believed that we would now see a golden era. Then, the ultrahighs swept across the nation, and the gilt began to tarnish, once again. The tarnish was slight at first. In Atlantic City a few weeks ago, it turned black, a deep black, because of foolhardy promises on performance.

Months before the *uhf* station opened up there, a sensational publicity and promotion program was instituted, proclaiming that conversion to *uhf* was easy and a very inexpensive matter, and absolutely no outdoor antenna installations would be required. Many announcements bannered the fact that built-in or indoor antennas would function perfectly in 90% of the installations.

When the ultrahigh station came on the air, snow was the featured attraction on most screens. The built-in antennas failed completely, in most cases, and those who had relied on their standard *vhf* antenna systems were disappointed, too, with picture results. Even in locations within a few miles from the transmitter, the indoor rods did not perform satisfactorily. Of course, a well-installed, properly-oriented outdoor *uhf* antenna would have eliminated the difficulty immediately. Much of the trouble was due to a complete lack of respect for the odd weather conditions which prevail in Atlantic City, and which obtain, too, in countless cities and towns across the country. Facing the Atlantic Ocean, the resort town is subjected to healthy ocean winds (southeast, in this instance), seriously reducing signal strength; thus only a highly-efficient outdoor setup can normally really be depended on here.

The receiving problem was further complicated by the use of flat twin-lead whose losses rose as clinging sea sprays swept in with the wind swamping the leads with moisture. In the roaring campaign, the public had been reassured that they would not have to change their leadin at all.

Miracle Claims Continue

Unfortunately, the seriousness of the situation has not impressed everyone, for the past few weeks have witnessed another outpouring of advertisements and bulletins in other new *uhf* areas, describing built-in *uhf* antenna chassis, and proclaiming that in most installations outdoor antennas were a thing of the past, and built-in antenna were worthy successors. One does not deny that there are *some* locations in which a built-in antenna model will work, but such locations are far too few. And, even in good zones, heavy rains, snow, and the appearance of foliage, can cancel out reception. Moving the receiver about might improve matters, but often it will be found necessary to shift constantly the position of the cabinet to insure best results; certainly not a very practical procedure, nor one that could possibly please Mrs. Consumer very much.

Not only are some setmakers inviting trouble, but some who claim to have miracle replacements for the outdoor antenna are bidding for this ill-fame, too. In one announcement of such a sensational development, set owners were told that now they can not only have ghost-free reception, but no longer will they suffer from static, smear, rope, crazy quilts, whirlpools, tears, jitters, zag, flips, fuzziness, fadeout, frying noises and any other conditions that cause eye bleariness. Fortunately, this promotion appeared in a *vhf* high-powered station area, and the damage might not be too severe. But, one shudders if the product should be promoted in weak-signal areas or *uhf* communities.

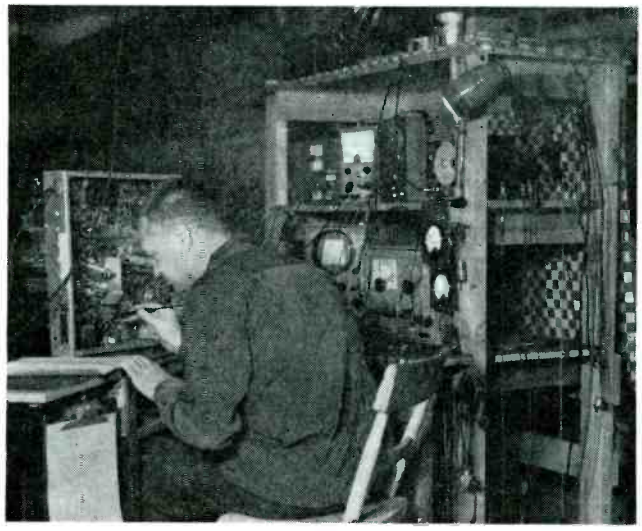
Needless Heartaches

There is no doubt that the rancor will disappear in Atlantic City, and eventually the residents will welcome *uhf*. But, a damaging blow has been struck, and so needlessly. Actually, there was no lack of information here on the basic receiving conditions that could be expected practically everywhere. Earlier experiences with the veryhighs revealed many of the receiving perils that obtained here; experience having been gained through many, many *vhf* fringe installations where the utmost in care had to be exercised to insure best results. Countless experts had warned that *uhf* pick-up would not be a simple matter. But, their advice went unheeded, and instead there appeared fanatical promises, causing commotion, embarrassment, and particularly, stinging headaches for Mr. Service Man.

Let's hope that this misstep has served as a lesson, and that there'll be no repetition of this tempest over Atlantic City.—L.W.

by J. C. GEIST

ONE-MAN TV



Fixed-Mobile Bench-Rack Design Provides Convenient Method of Handling Large TV Chassis, With Minimum Amount of Lifting; Allows Operator to Do Most Work in Comfortable Sitting Position; Affords Orderly Arrangement and Convenient Access to Hand Tools, Test Leads and Instruments, and Permits Checks on Audio Systems

ONE OF THE MOST EFFECTIVE means of increasing the efficiency of a TV service activity is through the application of integrated, functional test positions.

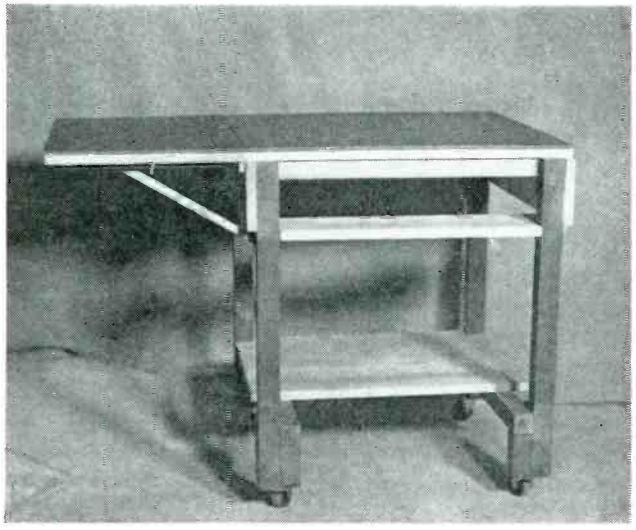
In designing a system which will provide such a setup, it is necessary to evaluate the difference between TV and broadcast receiver servicing. More test equipment is required for TV servicing, and TV chassis are larger and heavier and therefore more difficult to handle than broadcast receiver chassis.

With these two differences in mind it is apparent that it is necessary to have something significantly better than the usual radio workbench, with test equipment, tools and space for the chassis being repaired.

To take care of the more difficult chassis handling problem a special dolly, shown in Fig. 2 was designed. This dolly can be used to move the chassis around in the shop and also as a repair bench. Although it is a simple device, it has a number of features to increase its utility for its intended application. The general design and main dimensions are shown in Fig. 4. A drop leaf (*A*) was included to provide space on which to spread service notes and diagrams during actual servicing work; it can be dropped to save space when the dolly is not in actual use. For larger objects such as separate speakers or power supplies, another shelf (*B*) was included, and for hand tools in immediate use, test capacitors and other small articles, a small shelf (*C*) was provided. To keep notes and necessary papers on the set being repaired, the dolly has a hook for a clipboard (*D*). For immediate access to a soldering gun, there's another hook (*E*) on which the gun can be hung. The dolly, mounted on ball-bearing rubber casters, swivels easily permitting the placement of the chassis under test in any desired position, without having to scrape the bench top, so often necessary in most shop setups.

To permit grouping of all the necessary test equipment for convenient access, the test equipment bench was designed with a minimum of unused space. On the top shelf is a multimeter required only for current measurements or to be used in conjunction with a *vtvm* to monitor two test points simultaneously. Provision for a small fan has been made, to be used in locating temperature induced faults,[1] and, of course, for general cooling, too. To house oscillator/mixer tubes, with pins removed for use in receiver alignment, a box has been provided. There are also several containers including an electrical contact cleaner, contact lubricant (vasoline), coil dope, and a plastic insulating spray. In addition, the setup has a 7½-volt battery to provide bias during receiver alignment. Various sized blocks of wood and lucite have also been included, to be used for supporting chassis in the desired posi-

(*Continued on page 68*)



(*Above*)

Fig. 1. TV chassis under inspection and repair with integrated tool-bench-instrument setup.

(*Left*)

Fig. 2. Dolly assembled from 2 x 2s and standard 1" shelving, and used to move chassis around in the shop, as well as a fixed repair bench.

[1]Geist, J. C., *Location of Temperature-Induced Faults in Television Receivers*, SERVICE; June, 1952.

(*Right*)

Fig. 3. Dimensional sketch of test-equipment bench. *A* = multimeter; *B* = fan; *C* = box for alignment tubes; *D* = bias battery, contact cleaner, contact lubricant, coil dope and plastic spray; *E* = assorted wooden and insulating blocks; *F* = power supply for 'scope; *G* = square-wave generator; *H* = *vtvm*; *I* = fixed-frequency signal generator; *J* = signal generator specifically for TV *i/s*; *K* = 'scope; *L* = sweep generator; *M* = hand tools; *N* = knobs for channel selector shaft; *O* = wire bracket; *P* = adjustable spotlight; *Q* = hand tools; *R* = power outlet for soldering gun; *S* = power outlet for receiver under test; *T* = isolation transformer; *U* = primary switch pilot lamp and voltage control; *V* = voltmeter; *W* = ammeter and shunting switch; *X* = speaker; *Y* = hooks for long clip leads, oscillator probes, and *hv* probe; *Z* = wire bracket for medium-length clip leads and *AA* = wire bracket for short clip leads.

SHOP Tool-Test Setup

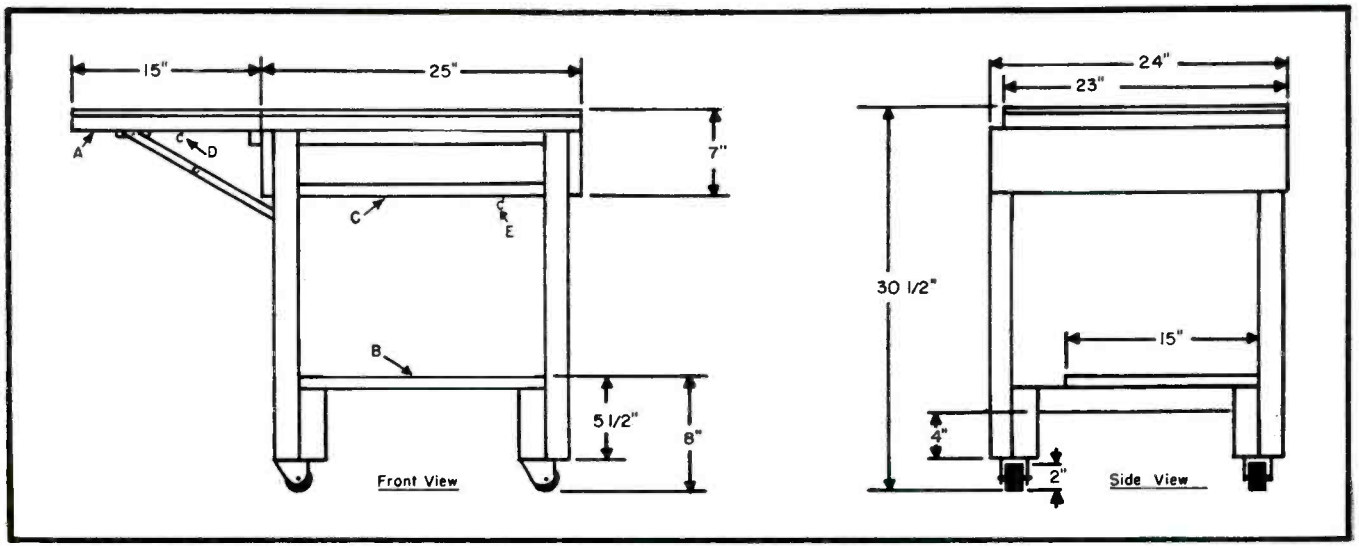
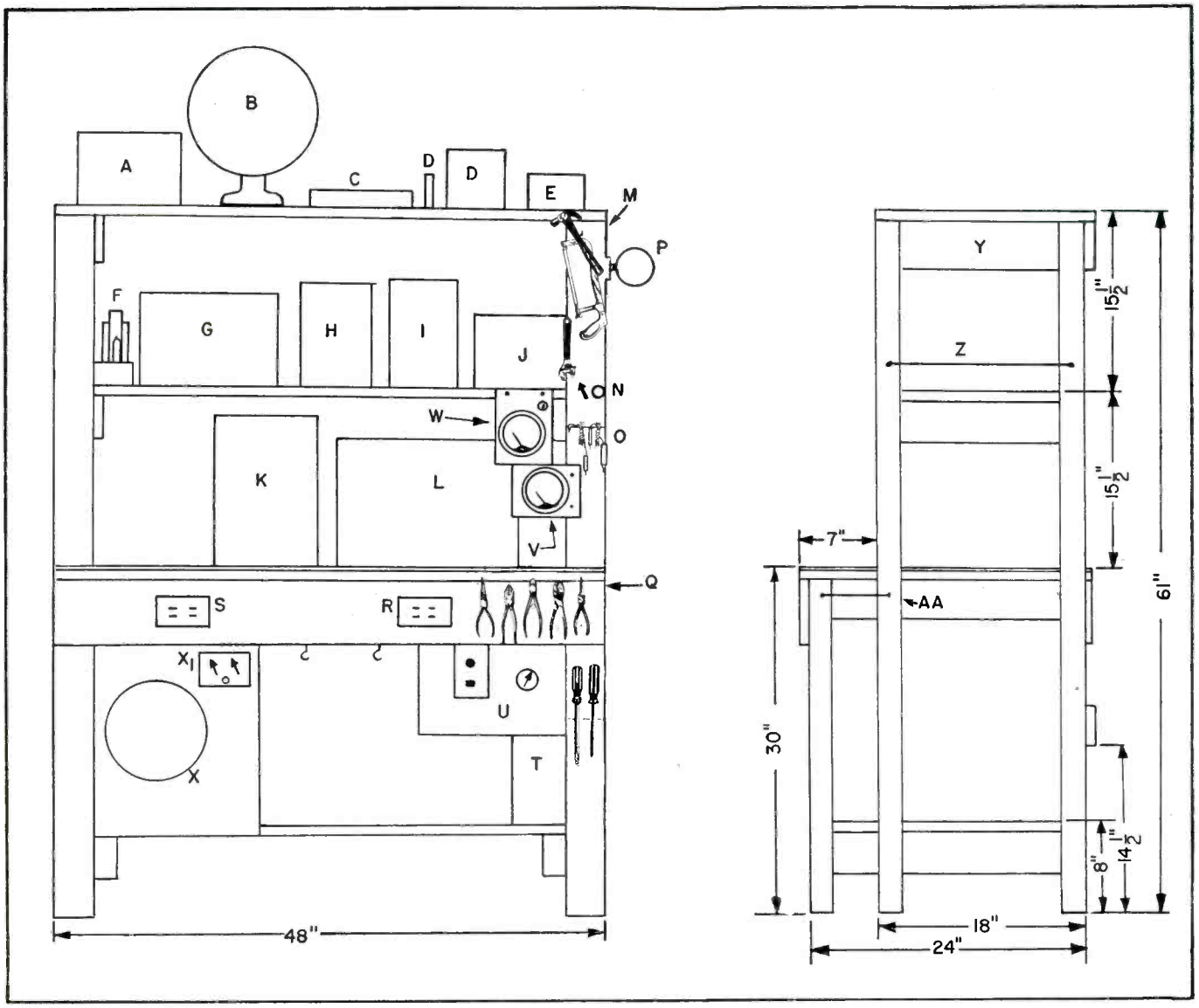
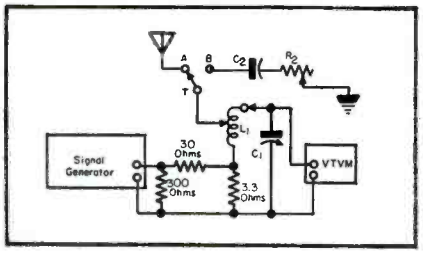


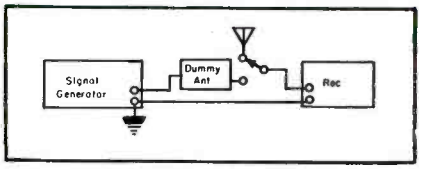
Fig. 4. Two-view dimensional drawing of dolly. *A* = drop leaf; *B* = shelf, *C* = shelf, 6" deep; *D* = hook for clipboard; *E* = hook for soldering gun. Top and the drop leaf are covered with masonite fastened with countersunk wood screws to provide a smooth hard working surface. Working surface can be improved by several applications of paste wax, polished and buffed to a high polish.



Designing and Testing

Fig. 1*a*. Arrangement used when measuring the apparent capacity and *rf* resistance of auto antennas.

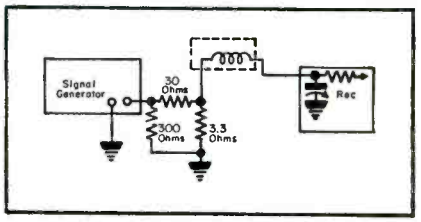




(*Above*)

Fig. 2*a*. Connections used in measuring effective height of antenna.

Fig. 3*a*. Simplified setup used to measure field strength of signals being picked up on auto antenna.



Electrical/Mechanical Considerations Involved in the Evolution of Top-Mounting Antennas and Measurement Techniques Required to Check Performance on the Road

SERVICE MEN have on occasion found the installation of auto antennas far from a pleasant experience, not only because of certain mechanical/electrical antenna peculiarities, but because of the car itself. In some vehicles, for instance, obstructions under the fender or cowl caused by reinforcing plates or supports make it very difficult to install antennas from beneath the fender or cowl.

In searching for a solution at our labs, it was found that an antenna could be designed to mount completely from the top of the fender or cowl, making it unnecessary to crawl under the car, or to strain one's self reaching under the fender.

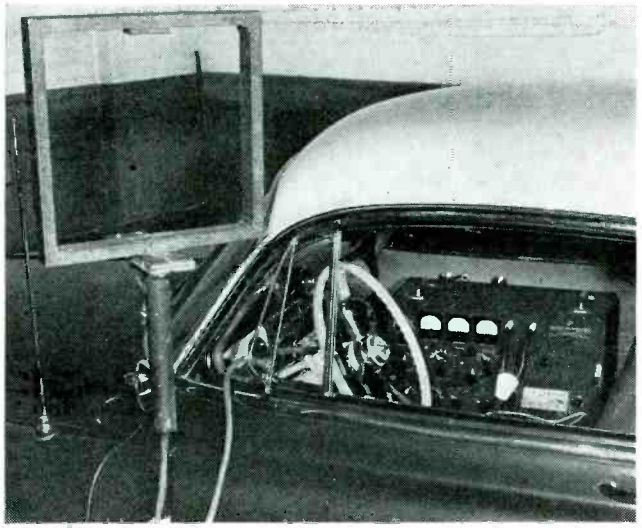
Continuing our study of other problems, it was noted that on several antenna types[1] some difficulty was experienced in achieving vertical alignment of the antenna, and holding the rod as the hex nut was being tightened. Unless care was used in aligning the split insulators before tightening the hex nut, it was possible to fracture the top section of the split insulator.

In addition, in earlier models[2], it was found impossible to service all the parts of the antenna separately, due to the type of construction. The mast assembly was permanently affixed to the base assembly and the coax lead was also permanently connected to the base; thus if any of the three parts (mast, the base, or coax lead) needed replacement, it was necessary to replace all three sections. To solve the foregoing difficulties and retain the top-mounting feature, several mechanical approaches were surveyed. A solution appeared in the adoption of separate assemblies for the mast, base and coax, so that they could each be replaced. In addition, it was decided to use a short base assembly facilitating mounting on trucks and vehicles where available mounting space is quite restricted. The shorter base assembly was also found to provide less capacity to ground.

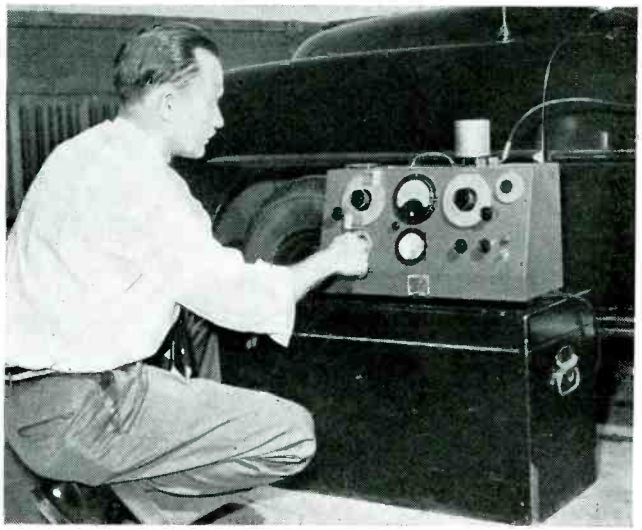
Tests on several antennas revealed that road film and moisture can create a short between prongs and the plug shell which is the grounded side of the antenna circuit, greatly reducing efficiency. This could be avoided, it was

[1]Such as the Delco 4281. [2]Delco.

Setup of measuring set used to determine auto antenna's effective height, apparent capacity and *rf* resistance. It is shown in use with a shielded loop antenna, by means of which small capacity and field strengths in the broadcast band may be determined. In making test car door must be closed.



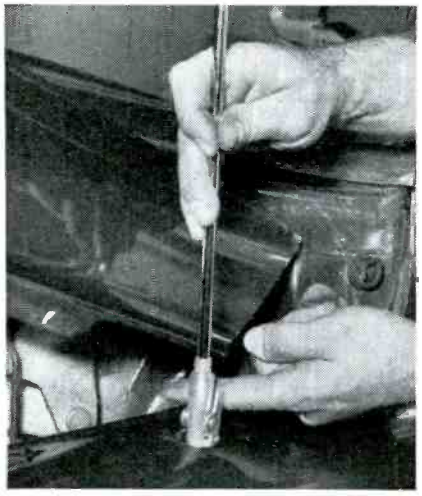
Laboratory *Q* meter also used in antenna tests. This instrument serves to measure small inductances, the *Q* of capacitors, *rf* resistance and distributed capacity of coils. *While the photos show these instruments being used indoors, antenna tests are made in large open areas away from all interference.*



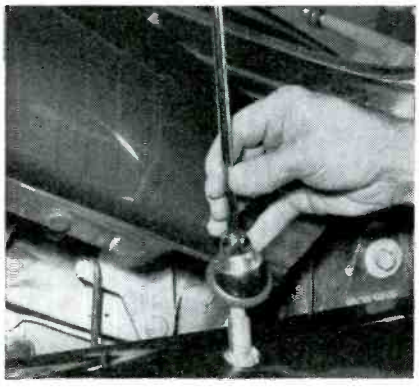
AUTO-RADIO Antennas

by C. D. WYMER
United Motors Service

How antenna assembly can be mounted from the top of the fender or cowl.



A 1" hole accommodates the antenna assembly, but the components are so constructed that larger holes of original antennas can also be used. Self-adjusting mounting arms assume the angle of the surface on which the antenna is mounted to provide rigidity.



found, by using a shaped prong insulator to afford an unusually long path in a normally small space and thus minimize the possibility of leakage. The entrance of moisture into the coax cable could be avoided, too, it was noted, through the use of a long, tight-fitting skirt hugging polyethelene insulation.

Antenna Measuring

To evaluate the electrical efficiency of antennas* incorporating the foregoing features, models were installed in cars and linked to a test setup which included a standard signal generator**, modified automobile receiver, a built-in dummy antenna with variable capacity and resistance values, and a tuned circuit for resonating either the external or internal dummy antenna.

Three separate meters were employed for indicating, respectively, the output of the signal generator, the output of the radio receiver, and resonance in the tuned circuit. A shielded loop was included, together with cable, for connecting to the antenna under observation.

In Fig. 1*a* appears the arrangement used when measuring the apparent capacity and *rf* resistance of the antenna. In testing, the signal generator is set for the frequency desired and the tuned circuit, consisting of L_2 and C_2, is tuned to resonance with the switch T in the A position. Resonance is indicated by the *vtvm* which is actually a crystal diode meter.

Then, *without changing* the adjustments of the tuned circuit or signal generator, the switch T is thrown to position B connecting a dummy antenna, consisting of C_2 and R_2, to the tuned circuit. C_2 is adjusted for resonance as indicated by the tuned circuit meter and then R_2 is adjusted so that the magnitude of the meter reading is the same as before.

It will be apparent that the dummy antenna is now equivalent to the external antenna including leadin, as far as capacity and resistance are concerned, and the values may be read directly from the calibrated dials associated with C_2 and R_2.

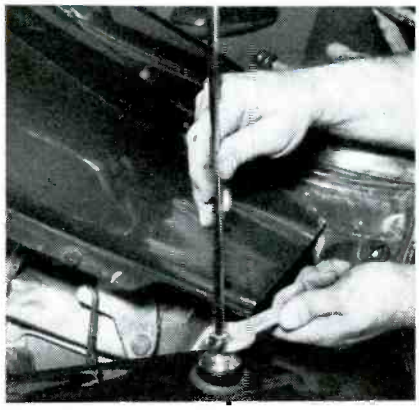
Resistance and capacity of an antenna may be expected to vary with

(*Continued on page 70*)

*Delco 4283. **Ferris model 21-B.

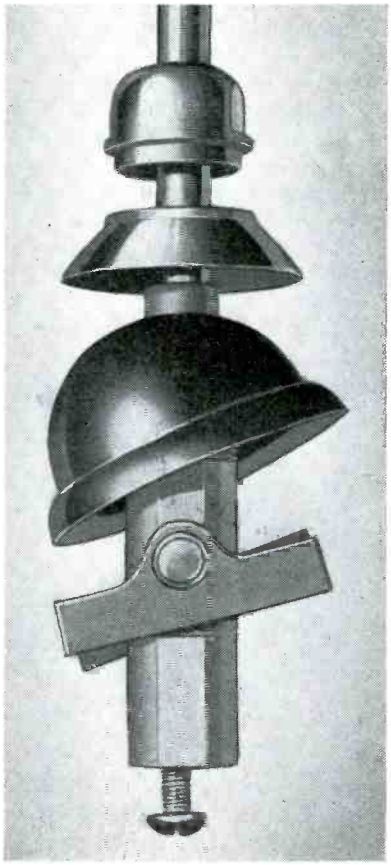
(*Left*)

Another step in auto-antenna installation; mounting components dropped down over the top of the mast and placed in position. Rubber pad, weather resistant, interlocks on the contour insulator, which is adjustable up to 35°.



When the cap nut is tightened to a point where the trim cap cannot be rotated by hand, a sharp leading edge cuts a permanent groove in the insulator of the antenna. This was found to provide added rigidity and hold the mast assembly in vertical alignment. At the same time, the arms ground themselves, eliminating any need for scraping.

The universal auto radio antenna, consisting of three sections which extend from 25" to 60", for mounting atop fender or cowl. External insulator is high strength tenite, adjustable to angles up to 35°, while internal insulator is high impact polystyrene. Coax polyethylene lead assembly is 48" long.



UHF TUBES and

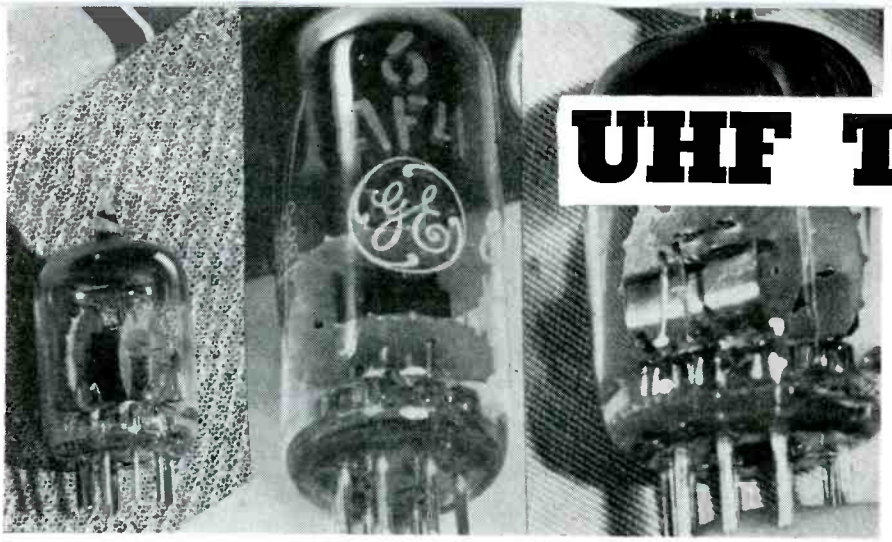


Fig. 1. Three tubes specially designed for *uhf* applications, left to right: 6AJ4, 6AF4 and 6AM4. (*Courtesy G.E.*)

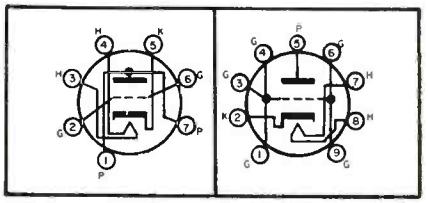


Fig. 2. RTMA basing diagrams for 6AF4 and 6AN4 (*7DK*, left) and 6AJ4 and 6AM4 (*9BX*, right).

THE VACUUM TUBES available, at the opening of the *uhf* band to experimental TV in '49, were of the lighthouse and other coplanar type. They were primarily intended for radar applications and not really suitable for *uhf* TV, because they were expensive to make, delicate to handle, larger than the usual miniature tubes, and required special sockets.

For this reason a tube development program was inaugurated to fill the need for *uhf* tubes suitable for use as oscillators, amplifiers and mixers. To date four *uhf* types have been produced. Their designations, socket connections and service applications are detailed on table 1.

While *uhf* tubes apparently look the same as any other miniature tube, they are actually quite different in construction and performance. Upon close inspection it will be noticed that *uhf* tube elements are much smaller, being only about ¼" long. The elements are also very closely spaced, being .001" between grid and cathode, and approximately .004" between grid and plate.

This close spacing increases the mutual conductance and decreases the transit-time loading effects. The *uhf* tubes also feature multiple tube pin connections. On the 6AF4s and 6AN4s, for instance, two pin connections are used for the plate and grid, respectively. And on the 6AJ4 and the 6AM4 types there are five pin connections to the grid of the tubes. The use of these multiple-pin connections reduces the lead inductance and resistance to the tube elements. In the case of the 6AJ4s and 6AM4s the five grid pins spaced around the base also serve as shields between the plate and cathode. When using any of these *uhf* tubes all the multiple socket connections must be utilized.

The most urgently needed *uhf* tube is the oscillator since it is required as a local oscillator; that is why the 6AF4 was the first to be released in the *uhf* series. On *uhf* the Colpitts circuit is used as the local oscillator. The great advantage of this circuit in *vhf* and *uhf* is that the tube interelectrode capacitances can be used to provide the required feedback for oscillation; Fig. 3. It will be noticed that a number of inductors and capacitors are shown within the tube envelope; these inductors are the lead inductances from the tube elements to the pin connections shown as L_p, L_g, L_k, and the interelectrode capacitances C_{pg}, C_{pk} and C_{gk} associated with the tube. These inductances and capacitances are an important part of the circuit operation. An amplifier can be made to oscillate if the amplified output is fed back to the input in the correct phase so as to increase the signal further. The correct phase in the case of a single tube amplifier is 180°. This means that the polarity of the voltage on the grid and plate are reversed at every instant. In the case of the Colpitts oscillator the interelectrode capacitances are part of the tuned circuit, and the grid-to-cathode capacitance, C_{gk}, is in series with the plate-to-cathode capacitance, C_{pk}; thus the voltages across these two capacitances result in voltages of opposite polarity appearing on the grid and plate of the tube, with the cathode of the tube at a voltage between the plate and grid voltages. The conditions nec-

Table 1. UHF tubes now available.

Type	*Socket Connection (RTMA Designation)*	*Service Application*
6AF4	7DK	Oscillator
6AJ4	9BX	Grounded grid amplifier
6AM4	9BX	Grounded grid mixer
6AN4	7DK	Grounded grid amplifier or mixer

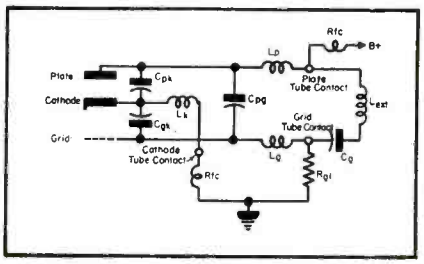
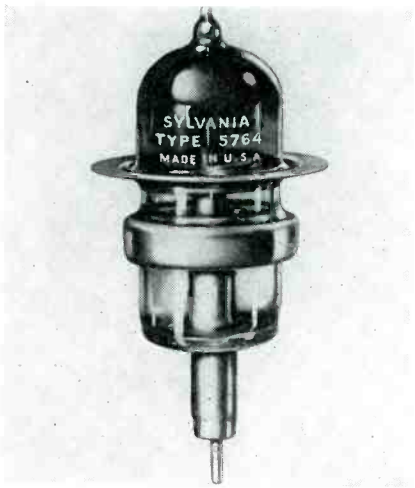


Fig. 3. Colpitts oscillator circuit with tube interelectrode capacitances and tube pin connections indicated.



(*Left and right*)

Fig. 4. Radar-application tubes used for *uhf* in the early days of ultrahigh experimentation.

TUBE CIRCUITRY

by HENRY R. HESSE

Senior Engineer, TV Receiver Division
Allen B. DuMont Labs

Types of Tubes Now Available for the Ultrahighs; Their Construction and Performance . . . Servicing UHF Oscillators . . . Use of Transit Time Load Effect . . . Properties of Grounded Grid Amplifiers

essary for oscillation are that the negative resistance developed by the oscillator tube be greater than the positive resistance due to all circuit losses. The tube develops a higher negative resistance when the mutual conductance is higher. The circuit will oscillate at a frequency where the net capacitive reactance of the tube plus any stray capacitance equals all of the inductive reactance of the circuit and leads. If another circuit tuned to the oscillator frequency is coupled to the oscillator, the grid bias developed by the oscillator will decrease. This happens because the decrease of grid bias allows a greater flow of plate current which increases the mutual conductance and thus increases the negative resistance. This represents the normal operation of the conventional grid-dip oscillator. Of course, if we couple too closely, oscillation will cease when the bias reaches zero since there can no longer be any increase of mutual conductance or negative resistance under this condiion. At this point, we have a lower positive circuit resistance than the negative resistance the tube can develop, and thus no oscillation is possible. At *uhf* the circuit losses are quite high and accordingly a high mutual conductance tube is required. Some oscillators at these frequencies will not oscillate unless they are fully shielded to reduce the radiation losses.

The best single criterion for judging oscillator performance is the amount of grid bias developed at a given plate voltage. The greater the grid bias voltage developed, the more efficient the oscillator is operating.

UHF Oscillator Servicing

Servicing of the *uhf* oscillators will most frequently consist of the replacement of the oscillator tube to restore oscillation or to restore normal current to the crystal mixer. When changing oscillator tubes the exact same type should be used as replacement. This will reduce the necessity for major realignment due to lead inductance and capacitance variations; these characteristics are not, as yet, as well standardized as other conventional characteristics. It is very important when replacing a tube that it be pushed down in the socket and seated properly; oscillators can change frequency by up to 10 mc if the tube is within $\frac{1}{32}$" of being properly seated in its socket. Oscillators may refuse to oscillate only over a small band of frequencies or operate poorly over a small band of frequencies. This trouble will frequently be due to a spurious absorption resonant circuit coupled to the oscillator, commonly referred to as a *suckout*. This condition can frequently be caused by poor shield fastening all around, or a bent shield not making good contact at all points.

Transit Time

In a class *A* amplifier we ordinarily think of the grid as being an open circuit requiring only a voltage applied to it for operation. At higher frequencies this is no longer true. Even at channel *2* the grid of a tube represents a resistance of between 6,000 and 20,000 ohms and as the frequency increases the grid resistance rapidly decreases as illustrated in Fig. 5. This is called the transit-time loading effect; transit time is the time required for an electron to go from the cathode to the grid of a tube. At *vhf* the transit time is an appreciable part of an *rf* cycle

(*Continued on page* 63)

Fig. 5 (*right*). Plot of input resistance of 5AK5 (left) and 2C4O (right) versus frequency.

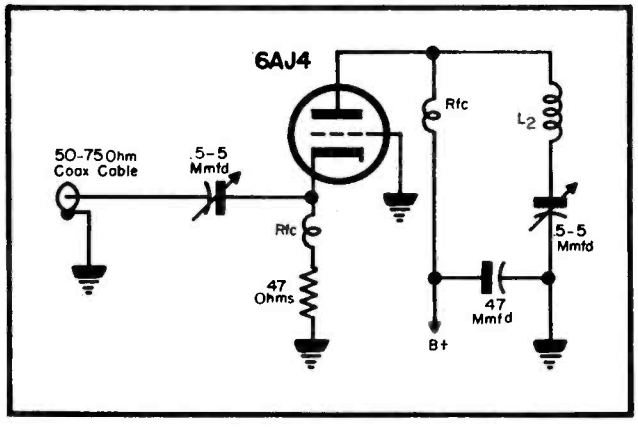
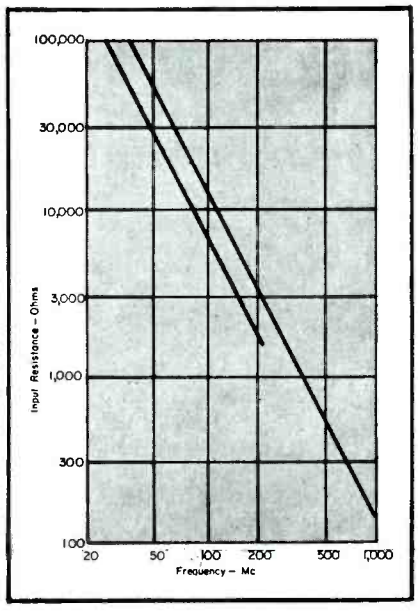
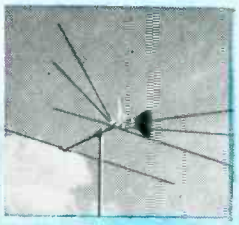


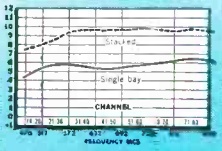
Fig. 6 (*left*). A grounded-grid amplifier using a 6AJ4 *uhf* tube.



ULTRA FAN series — Complete VHF-UHF coverage



single bay — model no. 413

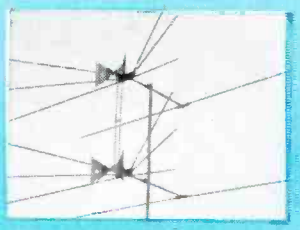


Today's most sensitive All-VU* antennas! The Ultra Fans actually operate on *three* separate electronic principles — automatically:

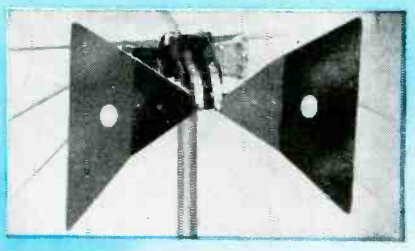
1. Low Band VHF (Channels 2-6) . . . *Conical antenna with parasitic reflector*
2. High Band VHF (Channels 7-13) . . . *Large diameter V antenna*
3. UHF (Channels 14-83) . . . *Triangular dipole with sheet reflector*

One set of All-VU* stacking rods provides highest VHF and UHF gain. Each Ultra Fan has its own 2-stage inter-action filter, so that only one transmission line to the set is required.

*All VHF, all UHF



stacked — model no. 4132



ULTRA DAPTER
model no. 414

Instantly converts all Channel Master Super Fans into high gain, all-channel, VHF-UHF antennas. *Features a built-in inter-action filter.*

Your best bet for UHF!

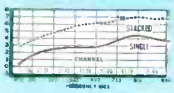
CHANNEL MASTER Ultra-Tennas

America's most complete — most effective — UHF antenna line.

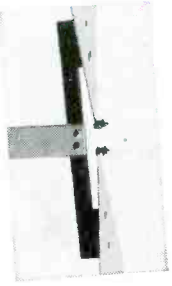
Channel Master's advanced engineering pays off again. While rain caused hundreds of UHF antennas to FAIL recently in Portland, *not one Channel Master antenna dimmed or shorted out a picture!* The facts speak for themselves: Rain or shine, Channel Master antennas outperform all others.

ULTRA BOW
model no. 401

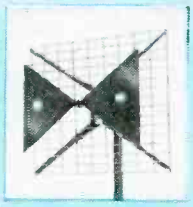
The basic UHF antenna for primary signal areas, and the outstanding member of the bow-type antenna family.

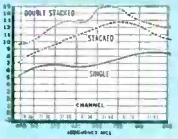


Only Channel Master Antennas are designed to eliminate the "TWIN TERRORS" OF UHF RECEPTION:



- **Vibration, which causes picture flicker.**
  Eliminated by Channel Master's Ultra-Rigid construction and advanced mechanical design.
- **The accumulation of dirt or moisture around the antenna terminals, which dims and eventually shorts out the TV picture.**
  Eliminated by Channel Master's sensational "free-space" terminals which prevent the accumulation of foreign deposits at the feed points.



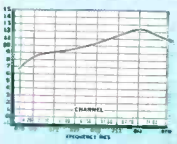


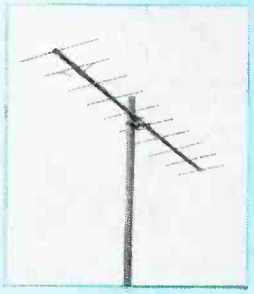
ULTRA BOW
with
SCREEN
REFLECTOR
model no. 403

Can be stacked in 1, 2, and 4 bays. High, all-channel UHF gain, excellent front-to-back ratio.

ULTRA VEE
model no. 404

- Good UHF gain
- Low VHF gain
- The most rigid UHF antenna of its type and size.

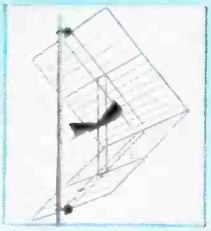


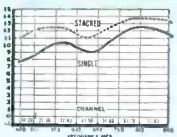


Gain: 11 DB, single
14 DB, stacked

DELTA WELD
Wide Band 10 Element UHF Yagi

Custom-designed for full coverage of your specific area! Brilliant high gain performance across as many as 23 *different channels.*





CORNER REFLECTOR
model no. 405

The outstanding all-channel UHF FRINGE antenna. Now — can be stacked for even greater gain.

MEMBER
ANTENNA MANUFACTURERS ASSOCIATION

MOST PREASSEMBLED ANTENNAS

Sold through the nation's leading distributors

CHANNEL MASTER CORP.
ELLENVILLE, N. Y.

Write for complete technical literature

ULTRA-TIE model no. 9034
Electronic Inter-Action Filter

JOINS separate antennas into a single VHF-UHF antenna system, for use with a single transmission line.

SEPARATES VHF and UHF signals at the set or converter where separate inputs are provided.

The only filter with "free-space" terminals.

NOW—read this true story of

UHF ANTENNA FAILURE IN PORTLAND!

GARRETSON RADIO SUPPLY, INC.
INDUSTRIAL DIVISION
2416 SECOND AVENUE
SEATTLE 1, WASHINGTON
SE. 0340 • MU. 0422

January 22, 1953

Channel Master Corporation
Napanoch Road
Ellenville, New York

Attn: Harold Harris

Dear Harold:

Now that the UHF station, KPTV in Portland, Oregon has been on the air for a few months, it may interest you to know some of the results of antenna performance.

Antennas of all descriptions, both multi-channel and single channel UHF have been installed in the Portland area. The results in most cases were fair, however in some instances certain types of antennas specifically for the UHF channels failed completely to perform. Several of the so called 'all channel" antennas performed in strong signal areas, but failed completely where gain was needed, or ghost problems were encountered. These results were obtained while the weather in Portland was good.

For the past few weeks it has been raining consistently in the Portland area and the antenna failures have been numerous, due to the shorting out of the terminal connection at the antenna. The result -- antenna crew men have been out drilling small holes in the terminal blocks trying to provide as much air insulation as possible. Certain types of antennas, which used an isolation filter at the antenna also had their troubles. In many cases this filter broke down and moisture leaked into the filter, causing it to short out at the terminal.

Many of the Channel Master UHF antennas have been sold and installed by our dealers in Portland, with no complaints whatsoever. In all cases, the antennas have given excellent performance and provided clean pictures, regardless of weather conditions. This, we feel, is the result of research and engineering, and the foresight to foresee the many problems which would confront the UHF antenna.

The use of your free-space terminals has forestalled any problems of signal loss due to moisture conditions and in all cases, our dealers tell us that the Channel Master antennas live up to the published catalog information.

May we offer our congratulations on an excellent unit - and let's keep them rolling!

Very truly yours,

GARRETSON RADIO SUPPLY, INC.

Paige C. Lundberg

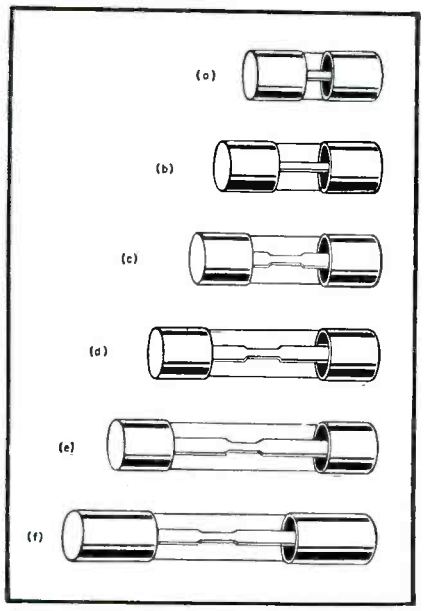
By: Paige C. Lundberg

VMH/pl

Look to Channel Master for UHF— IT PAYS OFF!

A Report on the Design Features, and Operational and Application Characteristics of Fuses Used in Auto, Radio and TV Chassis Today

TV and RADIO

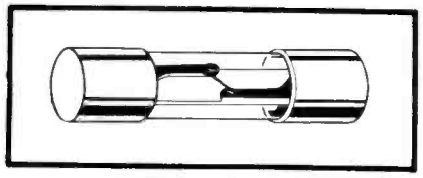


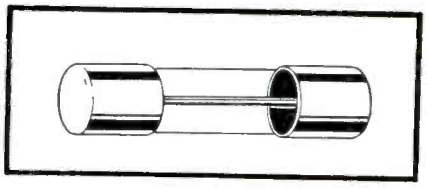
(*Above*)

Fig. 1. SFE standard glass tube fuses. At *a* is an SFE 4, which is ⅝" long; at *b* appears an SFE 6, ¾" long; at *c* SFE 9, ⅞" long; at *d*, SFE 14, 1 1/16" long; at *e*, SFE 20, 1¼" long; and at *f*, SFE 30, 1 7/16" long.

(*Below*)

Fig. 2. Glass tube fuse with steatite support for delicate fuse link.



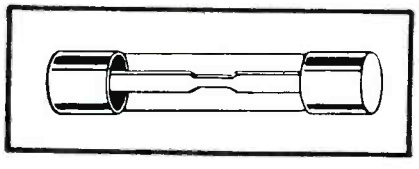


(*Above*)

Fig. 3. Glass tube fuse with wire type fuse link.

(*Below*)

Fig. 4. Larger size glass tube fuse with die-cut zinc link.



TELEVISION AND RADIO sets usually are protected by glass tube fuses. There are many types, sizes, and kinds available today, each designed for a specific application. In some cases the fuses may be interchanged without destroying the electrical protection or creating a hazard, but, if substitution is made without appreciating the characteristics and performance, a serious condition can be created unknowingly.

Glass tube fuses are rated at 32 volts or less, 125 volts or less, and 250 volts or less. The use of glass tube fuses rated at 32 volts or less is restricted to battery operated and auto radios. The most common fuse of this type is the *SFE* fuse especially designed for automotive application. As shown in Figure 1 these fuses are of different lengths for different amperages. All are ¼" in diameter, designed to carry 100% load indefinitely, and open at 125% load in one-half hour.

The SFE series of fuses were designed to meet the requirements of the automobile electrical load and the different sizes were selected for the different amperages to make it impossible to insert a larger fuse, thereby preventing over-fusing. The ampere ratings were selected so as to form a geometric progression, each size being 50% greater than the preceding one. In other words, the 6-ampere rating of the SFE 6 fuse is 50% greater than the 4-ampere rating of the SFE 4. The sizes so selected were considered adequate to cover the range required in the automobile.

The requirements of the glass tube fuses rated at 125 and 250 volts are much more stringent than those of the 32-volt fuses. If rigid controls are not maintained in the manufacture and test of these fuses, the fuse not only may fail to give the required electrical protection but, in itself, may create a serious fire hazard. The fuses of the more reputable manufactures are tested and listed by the Underwriters' Laboratories, Inc.*

The Underwriters' Laboratories and its standard for fuses establish the meaning of the voltage rating. In the blowing of the fuse it is the current and current alone which causes it to melt, but once it melts and starts to open the circuit the entire line voltage appears across the fuse and, before the circuit is cleared, the fuse must extinguish the arc established by this voltage. Obviously, the higher the voltage the greater the arc and the more difficult it is to clear the circuit. It is for this reason that the voltage rating of fuses always is given as *250 volts or less* or *125 volts or less,* meaning that the maximum voltage is established and the fuse will perform satisfactorily at any voltage up to and including this maximum.

10,000-Ampere Check

The Underwriters' Laboratories, Inc., establishes the voltage rating of low-voltage fuses on a *dc* circuit capable of delivering 10,000 amperes at the voltage for which the fuse is rated. When a fuse is blown on such a system the fuse must remain intact and open the circuit without emitting sufficient flame or molten metal to ignite surgical cotton entirely surrounding it. Hence, this test establishes that the fuse will perform satisfactorily without creating a fire hazard at rated voltage under the most severe conditions.

Actually, when the fuse is installed in the radio or TV receiver it will not be subjected to short-circuit currents as great as 10,000 amperes. This current will be reduced materially by the impedance introduced by the attachment cord and branch circuit to which it is connected. On the other hand, the fuse may be installed in a circuit where voltages in excess of its rated voltage are present. It is up to the circuit designer to select and test the fuse for his application before approving its use and so specifying. It is for this reason that care must be exercised in the replacement of fuses so that the proper voltage rating be maintained and, even more important, care must be exercised so that an Underwriters'

*The Underwriters' Laboratories, Inc., is an organization sponsored by the National Board of Fire Underwriters, which tests and determines the compliance of material with the National Electrical Code. Its principal interest and sole reason for existence is safety. Any product that does not create a fire or health hazard and meets its standard is acceptable to the Underwriters' Laboratories even though it may have little value to industry because of other shortcomings. Hence, its test determines only the safety of the fuses.

by J. C. LEBENS, Chief Engineer, Bussmann Manufacturing Company

CHASSIS PROTECTION

Laboratories approved fuse is not replaced by an unapproved one. Even though both fuses may be marked with the same voltage rating, one is inspected and tested by an unbiased laboratory, whereas the other is based upon the integrity of the manufacturer.

In addition to establishing the voltage rating, the Underwriters' Laboratories also establishes the current rating of glass tube fuses. Fuses other than the SFE fuses already mentioned must carry 110% of their rated current continuously when installed in a single pole fuse holder mounted horizontally and so arranged that each fuse under test is held in a horizontal position above the fuse holder. Usually two or more fuses are tested in series and when so tested the fuses must be spaced at least 6" apart. The fuse holders must be connected with No. 8 *AWG* wire at least 2' long.

During this test the temperature of the glass tube and the ferrules is determined by means of a glass-mercury thermometer, the bulb of which is placed on the surface whose temperature is being measured and covered with a small amount of fresh glaziers putty. With the test conducted in an ambient of 18° to 32° *C*, the temperature rise when the fuse is carrying 110% load cannot exceed 50°*C*.

This purely arbitrary test, requiring the fuse to carry 110% load when tested in the open, connected by a large wire with the temperature rise held to an established value, assures that the fuse will carry its rated current when installed under normal operating conditions. The purpose of the requirement is to eliminate any variables which might effect the test and the performance of the fuse so that the fuse must open at 135% load within

Under these same conditions the fuse must open at 135% load within 60 minutes and at 200% load within 2 minutes. Hence, the Underwriters' Laboratories tests establish the rating of the fuse. On this basis a 1-ampere fuse listed by the Underwriters' Laboratories will carry 1.1 amperes indefinitely, will open at 1.35 amperes within 60 minutes, and will open at 2 amperes within 2 minutes. The Underwriters' Laboratories has established that this is a safe performance, and any fuse meeting these requirements will not create a fire hazard if applied properly.

Starting from this common point of current and voltage rating as established by the Underwriters' Laboratories, the various types of fuses as furnished by the fuse manufacturers have special electrical and mechanical characteristics which make them desirable for the protection of radio and television receivers. From an electrical consideration the most important criterion is the opening time at the higher loads. For some applications fast operation at these loads is required to protect the circuit, whereas in other applications where harmless transient currents may flow, the ability of the fuse to carry these loads for several seconds is very desirable. Hence, on this basis, glass tube fuses can be divided into two general classes of fast acting or instrument fuses and fuses with long time-lag.

Fuses without time-lag are made in ratings from 1/500 ampere to 30 amperes in glass tube fuses ¼" in diameter, either 1" or 1¼" long. As shown in Figure 2, the extremely delicate platinum fuse wire on the small ampere rating is supported mechanically on a steatite bridge to produce a rugged construction. This is necessary because, on the 1/500-ampere fuse, the diameter of the fuse wire is only .000017". When it is remembered that the diameter of the human hair is approximately .003" it is realized that it would be impossible to handle or assemble such a wire without proper support.

Actually, in the assembly operation, the platinum wire is covered with a silver jacket which is dissolved off the wire after it has been soldered in place.

The $\frac{1}{16}$ and the ⅛ ampere fast-acting fuses are the first sizes having the wire extending from ferrule to ferrule without the use of a supporting bridge, as shown in Fig. 3. To reduce the resistance of the fuse and increase its mechanical strength, the wire is coated, except in one section, with a silver jacket. This, in effect, reduces the length of the fuse link thereby decreasing its resistance and increasing its mechanical strength.

Fuses from ⅛ ampere to 3 amperes use a wire fuse link, the composition

(*Continued on page 72*)

Fig. 5. Glass tube dual-element slow-blow type fuses[1] with long time lag. At *a* is a 1/100 and 1/32-amp type; at *b* a 1/16 to 2-amp type, and at *c*, a 2½ to 30-amp type.

[1]Fusetron.

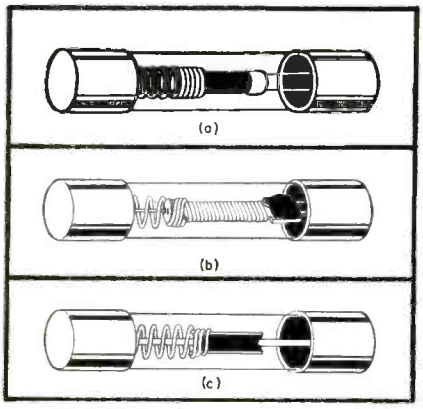


Fig. 7. Glass tube fuses with pigtails for soldering in the circuit, thereby eliminating fuse clips.

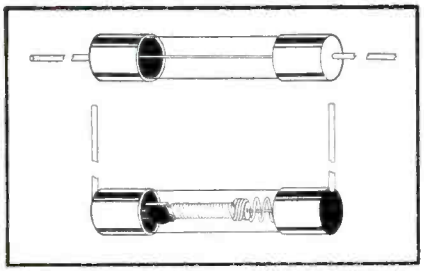
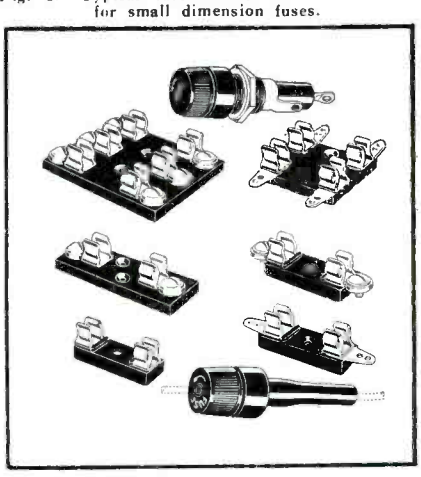
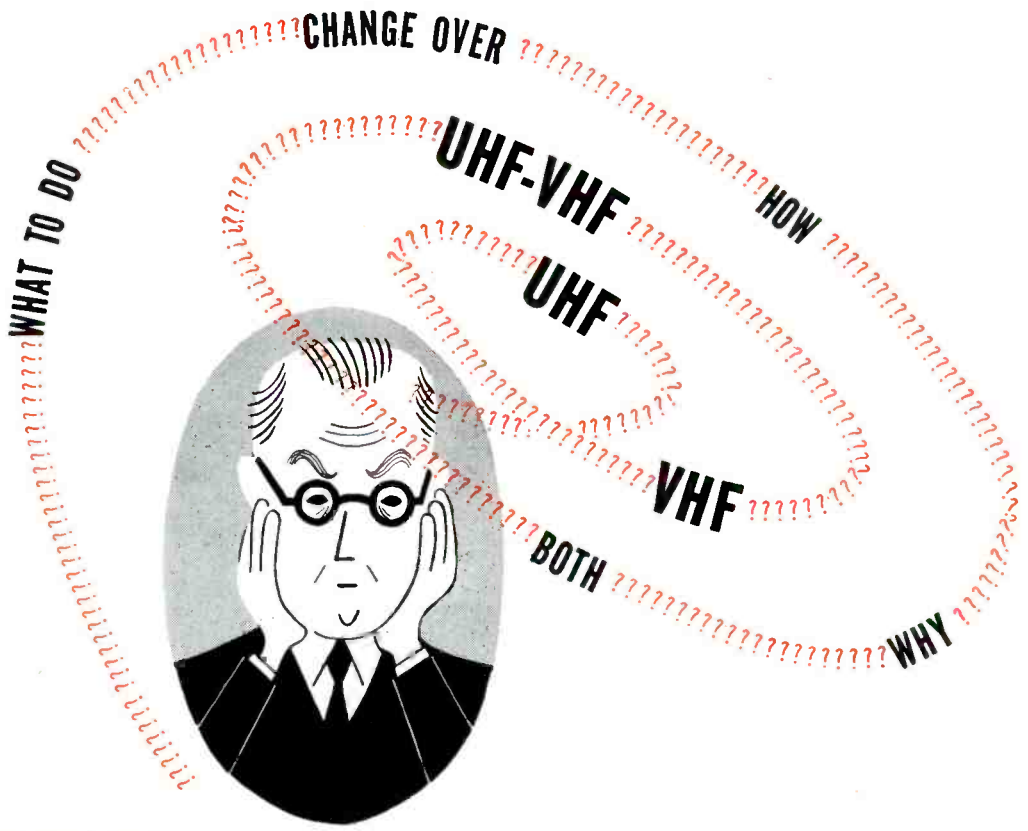


Fig. 6. Typical fuse blocks and fuse holders for small dimension fuses.





WARD antennas have all the UHF-VHF answers!

UHF only for old installations

Add it to present VHF installations and you have a complete UHF-VHF Antenna . . . covers all UHF channels with high gain . . . small, neat and pre-assembled. JAZZ TROMBONE is the first new UHF only antenna . . . an exclusive WARD development.

UHF-VHF for new installations

Here is the sensational, new WARD Antenna that brings in all-channels, all-frequencies—both VHF and UHF—with one single Antenna . . . the completely universal WARD TROMBONE. For new installations nothing compares with WARD TROMBONE.

THE DIPLEXER

This brand new WARD item completely solves the problem of lead-in lines, where separate UHF and VHF Antennas are employed. Simply attach the two lines to THE DIPLEXER and extend one single line from the DIPLEXER to the TV receiving set.

THE WARD PRODUCTS CORP.

DIVISION OF THE GABRIEL COMPANY

1148 Euclid Avenue • Cleveland 15, Ohio *In Canada: Atlas Radio Corp., Ltd., Toronto, Ont.*

SERVICE...The National Scene

INDUSTRY TOLD TO CURB ALL SPURIOUS TV OSCILLATOR RADIATIONS--In response to urgent pleas from Washington, and consumers, too, calling for the immediate control of oscillator radiation from TV sets, particularly the uhf type, RTMA has formulated an interference-elimination plan, and asked industry to take prompt action and cooperate. Commenting on the import of the program, the association's director of engineering pointed out that even though it may be necessary to include circuit and component modifications which might increase manufacturing costs, industry has this job to do and must do it to the best of their ability. . . . A letter to the chairman of JTAC (Joint Technical Advisory Committee, serving as industrial liaison for the FCC) from the Commission's head man, sparked the new move to eliminate once and for all radiation trouble, it being felt that this problem could seriously disturb the new allocations. . . . In many communities, uhf receiver interference has already irked viewers. In Wilkes Barre, Pa., for instance, radiating adapters picking up channel 28 and converting to channels 4 and 5 for feeding to standard TV sets, have disturbed receivers tuned to channel 12. In some cases, audio has been effected, and in other cases, picture distortion has prevailed. . . . In the new plan, efforts will be made to find solutions to not only oscillater radiation from uhf tuner strips and converters, but sweep-circuit radiation and receiver spurious responses. A committee on radio interference has recommended to industry that before July, '54, all TV receivers placed in production should have a radiation limit for the ultrahighs of less than 500 microvolts per meter at 100', and 50-150 mv/m for channels 6 and 7, with 150 and 500 mv/m set as the limit for channels 13 and 14. It was also suggested that the standard if of 41.25 mc be adopted by by all TV setmakers. Currently, around 35% of the sets being made are still using other frequencies. . . . A table exhibited at a radio-interference meeting revealed that radiation from some converters ranged from 5000-9500 mv/m at 100', and many were in the 2-4000-mv/m range. Fortunately, there were a few which met the 500-mv/m standard now under consideration.

HAM CITED FOR TVI WORK--Philip S. Rand, W1DBM, who developed methods and techniques for eliminating interference in TV receivers caused by amateur transmitters,[1] received a special Edison Radio Amateur Award citation recently for his outstanding work. Congratulations, Phil Rand, on a job well done.

INCREASED SPEAKER PRODUCTION TO CONTINUE IN '53--The manufacture of loudspeakers is expected to continue at a high level during the year, in view of the expansion of TV facilities, an upswing in public demand for phonos, and a growing need for speakers as replacement parts. Although magnet manufacturers will face no drastic reduction in their allocations of cobalt and nickel used in processing speaker pms, there might not be an official increase in the base supply. To provide an additional source, a four-point program has been suggested: Reduction in the size of magnets (already under way), reclamation of tubes containing magnets, standardization of magnets, and salvaging of metal content in discarded magnets.

PRELIMINARY COMPATIBLE COLOR-TV SPECS APPROVED--With the paper specifications for compatible color TV approved by NTSC, field testing now under way, and drafting of final specs for submission to the FCC to follow soon, the industry-approved color system may soon bloom into a commercial reality. According to one manufacturer, limited color-TV chassis production may be expected some time next year. Others have not been so optimistic, and established '55 as the target date for production. . . . In field testing color, 22 features will be considered. They include continuity of motion, color break-up freedom, fidelity, fringing, resolution, picture texture, susceptibility to all types of interference (noise, adjacent channel, sync and non-sync hum), fringe-area operation, and the effects of ghosts, multipath due to airplanes, and other signal propagation peculiarities. An anlysis of these tests will appear soon in SERVICE.

[1]TVI Report, SERVICE; July, August, 1952.

SERVICE...The National Scene

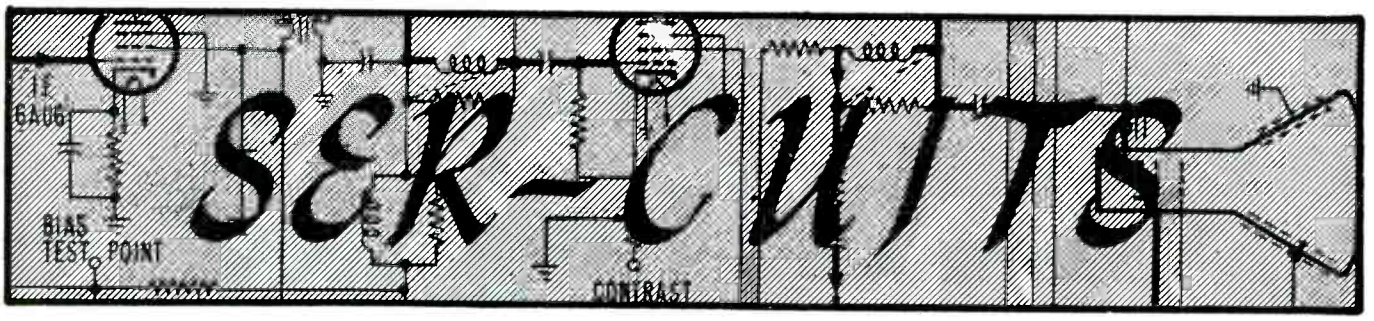
TV STATION GRANTS CLIMB TO 220--Applicants in all but two states (N. H. and Vt.) have now received permission to build TV stations, and at this writing, 220 have received such approvals. Among those on the new construction timetable are: WCHV, Charlottesville, Va. (channel 64); KSWS, Roswell, N. M. (8); KTEM, Temple, Texas (6); KFBC, Cheyenne, Wyo. (5); WKNY, Kingston, N. Y. (66); and KFBB, Great Falls, Mont. (5). . . . The next few weeks are expected to witness the arrival of several new uhf telecasters: WICC-TV, Bridgeport, Conn. (43); WFTV, Duluth Minn. (38); WETV, Raleigh, N. C. (28); WILK-TV, Wilkes-Barre, Pa. (34); and WATR-TV, Waterbury, Conn. (53).

KNOXVILLE, LONGVIEW AND FRESNO TO ADOPT TV LEGISLATION--Even though no TV is expected in Knoxville, Tenn., before '54, the TV servicing association in this area has asked for an ordinance to license and bond TV Service Men. . . . In Longview, Wash., the city fathers have adopted an ordinance governing the installation and servicing of TV antennas. The measure decrees that outdoor antennas shall not have a height of more than 50' above the roof, or 70' above the ground. And, in addition, the antenna must be a substantial distance from the sidewalk (height of the antenna plus 10'). The bill also indicates that antenna towers must withstand a wind pressure of 25 pounds per square foot. . . . A rigid antenna bill has also been passed in Fresno, Calif. Here, it will be necessary for antenna installers to post bonds of $1000. Hams will not be obliged to comply with the ordinance, as long as their activities are restricted to amateur work.

RHODE ISLAND AND NEW YORK LEGISLATURES RECEIVE TV LICENSING MEASURES--Once again an effort is being made to secure passage of a licensing bill in New York state. In the current attempt, an assemblyman has offered a bill which would authorize the Secretary of the state to issue rules and regulations on minimum standards of service, number of employees a shop must have, predicated on the number of sets serviced, and rates and contracts to be issued, if any. Licenses would cost $25 a year and all those who have been in business for a year within a 5-year period, until Oct. 1, would be recognized as applicants for licensing. . . . The judiciary committee of the general assembly in Providence, R. I., has also received a bill not only to license TV Service Men, but appliance repairmen. This measure stipulates posting of a $2000 bond, and a license fee of $2. . . . During the past few years, an assortment of measures have been introduced in both of these states, and all have been shelved.

VALLEY TOWNS WELCOMING COMMUNITY TV--Notwithstanding power increases and new-station installations, many communities surrounded by hills have found themselves still blacked out, and in need of community TV. In Fairmont, W. Va., a second installation has been proposed, for pick up of channels 2 from Pittsburgh and 6 from Johnstown, with coax carrying the signals to tap-off points. A charge of $125 is planned for installation of service, with a monthly fee of $3.50 to prevail thereafter. Over 8000 are noted as prospects for this service. . . . In San Bernardino, Calif., a community antenna has been placed high on Little Mountain, and TV service will be offered to the 2500 residents of this community. . . . In Palm Springs, Calif., community TV has become a very active operation, with service not only offered to homes and residential apartments, but trailer parks, restaurants and retail stores. Installation fees have ranged from $500 for the retail stores, $250 for trailer parks and restaurants, to $150 for homes and apartments. . . . In Steelton, Pa., a unique uhf/vhf community system is now in service providing signals from York, Lancaster and Baltimore. Complete details on this unusual installation will appear next month in SERVICE. Watch for this article.

$10-MILLION WORTH OF GEAR AT '53 IRE SHOW--Over 400 manufacturers will display the greatest assortment of TV, radio and electronic equipment ever assembled, worth more than $10-million, at the annual IRE Radio Engineering Show, in the Grand Central Palace, on March 23, 24, 25, and 26. The year's outstanding developments will be on view: transistorized equipment; uhf antennas, converters, boosters, strips, leadin and components; test instruments, and all types of picture tubes. There'll also be a host of unusual demonstrations. . . . We'll be at the show, at our usual post on the second floor: Booth 2-201. Hope we'll be seeing you.--L. W.



by M. W. PERCY

Instrument Circuitry: TV 'Scope Using Direct-Coupled Push-Pull Vertical and Horizontal Deflection Amplifiers... Resistance Checkers. Cascode RF Tuner Design Features . . . Phono-TV Switch Operation

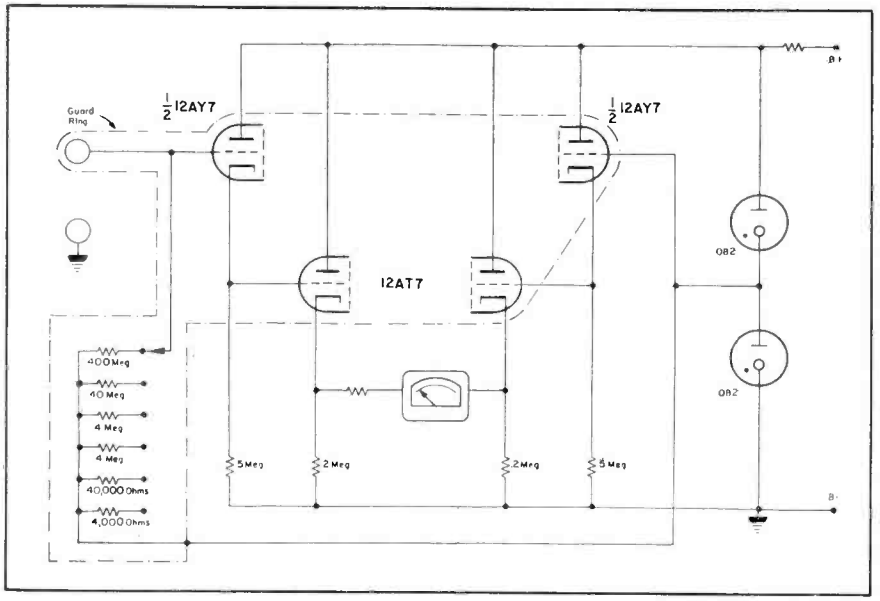


Fig. 2. Schematic of resistance meter used for checking both leakage and continuity.

To TROUBLESHOOT rapidly and accurately, it has always been considered best to use special types of test gear capable of pinpointing problem areas and revealing the difficulty. With the advent of multi-element and multi-purpose tubes, assorted special components and complex TV circuitry, the need for the special types of instruments has increased. The demand has resulted in the development of many unusual test devices with unique circuits.

An interesting example of such circuitry appears in Fig. 1, where we have the schematic of the vertical-amplifier section of a 7-inch 'scope[1] developed for TV servicing.*

The 'scope employs direct-coupled, push-pull vertical and horizontal de-

[1]RCA WO-56A.

*Based on an analysis prepared by M. J. Ackerman and R. D. Scheldorf of the RCA test and measuring equipment development group, for RCA *Radio and Television News*.

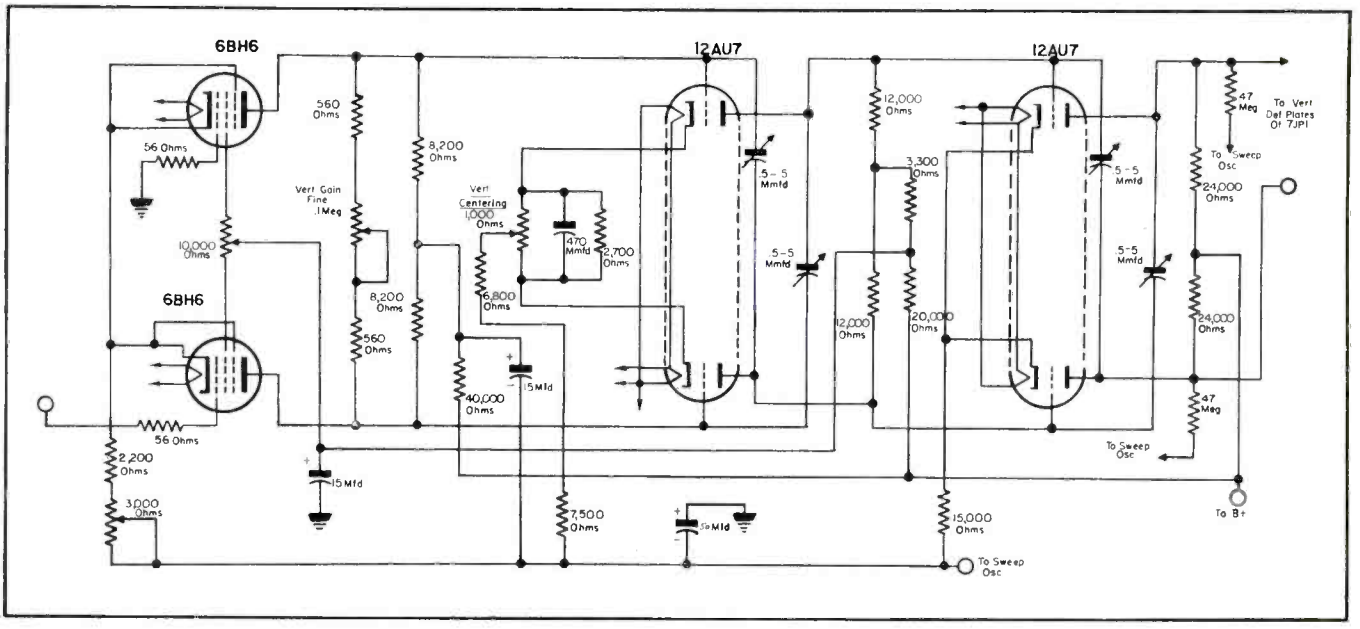


Fig. 1. Vertical-amplifier section of RCA WO-56A 7-inch 'scope.

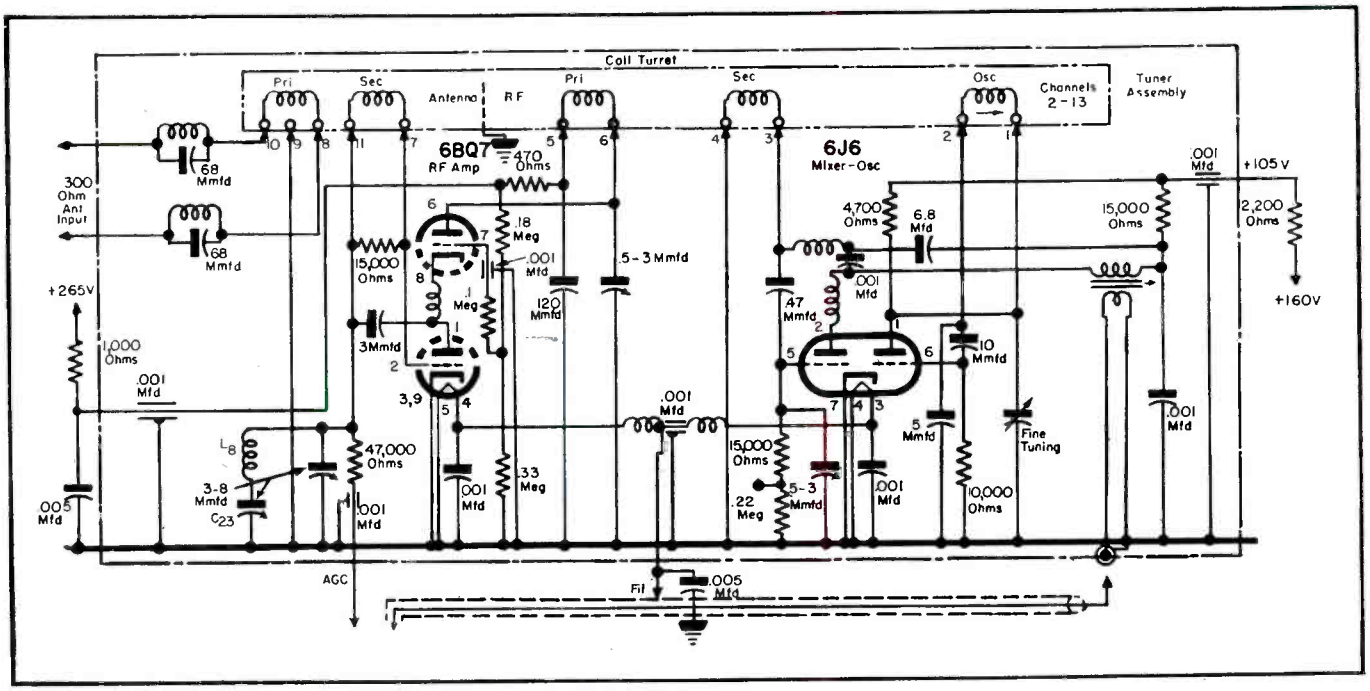


Fig. 3. Circuit of Hoffman tuner which features cascode and 41-mc output design. C_{23} and L_8 serve as a trap which can be tuned to eliminate interference in the 40 to 47-mc region.

flection amplifiers, which it is said aids in obtaining electrical symmetry which facilitates neutralizing and balancing of the circuits. It has also been found that push-pull amplifiers reduce astigmatic distortion, thereby providing a sharper image over the entire useful area of the picture tube screen. In addition, residual hum, which may plague high-gain amplifiers, is claimed to be reduced in push-pull stages because the hum has the same phase in both amplifier sections, and is cancelled in the output circuit.

Each amplifier section employs three stages, with two 6BH6 pentodes in the inputs. These tubes are provided with a variable screen-voltage supply to permit balancing of the amplifiers.

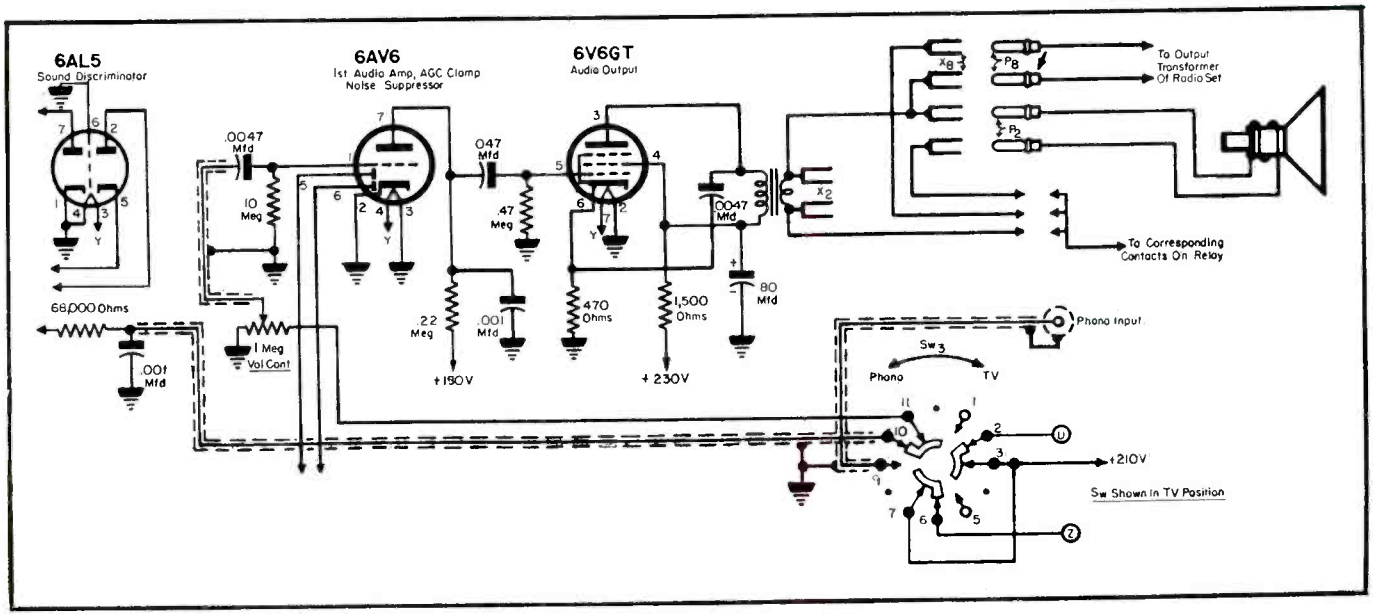
The total plate-to-load of the vertical-input stage includes a 100,000-ohm vernier control and a pair of 560-ohm resistors. Each of the two following amplifier stages uses a 12AU7 twin triode, which has a relatively low plate resistance, permitting the use of a high plate-load resistance with practically no loss of frequency response. The combination of the pair of 12AU7s has been found to provide high gain because the 12,000-ohm plate resistors in the second amplifier stage and the 24,000-ohm plate resistors in the third amplifier stage permit the development of considerable voltage changes. The 12AU7 output stage produces enough voltage to drive the 7JP1 picture tube to three times full deflection.

Sweep Oscillator Circuit

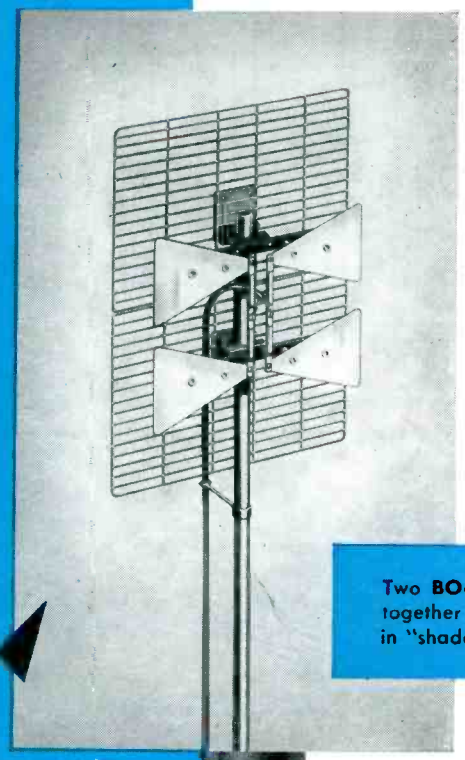
A Potter-type sweep oscillator (time-base generator) is used in the 'scope. It employs a 12AU7 twin-triode multivibrator to provide a linear sawtooth voltage having a frequency

(*Continued on page 59*)

Fig. 4. Phono-TV switch circuitry in Emerson 731D receivers. When the switch is in the phono position, it removes the B+ voltages from the screen of the horizontal output tube, plate of the damper tube, and removes screen and plate voltage from the video *if* tube. This renders the TV sweep, *hv* and signal circuits inoperative. At the same time, the input to the volume control is disconnected from the discriminator output and connected to the output of the phono crystal cartridge.



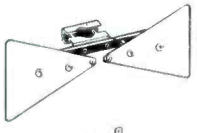
...and now UHF antennas by AMPHENOL

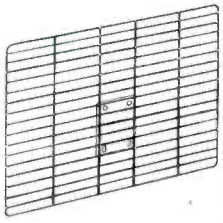


The magic words in television these days are Ultra High Frequency. That UHF television is a practical reality has been proved, not only by laboratory tests, but also by the success of the first commercial UHF station now operating in Portland, Oregon. Because of the high signal losses common to UHF, it is extremely important that the entire antenna system be of the finest quality and of a proved design. The choice of antenna and the availability of the proper accessories to adapt that antenna to the particular locale are factors that determine the success of any UHF installation. The entire Amphenol line of UHF antennas and accessories has been designed and approved by the Amphenol team of engineers that achieved industry-wide renown for the origination of the Inline VHF Antenna.

The BO-TY UHF Antenna is the first of a complete line of Amphenol UHF antennas. It is designed as a general purpose UHF antenna for all major signal areas. The Amphenol UHF Antennas previewed for you at the left have been designed to answer the varied installation requirements in major, fringe or "shadow" areas.

Two **BO-TY 114-053** Antennas with Reflectors, **114-560**, stacked together with Stacking Rods, **114-558**, for increased signal strength in "shadow" areas or nearby fringe.





Model 114-053 *BO-TY Antenna is a bi-directional, all-channel UHF antenna. It is fastened to the mast with an integral universal clamp that accommodates masts from ¾" to 1½" O.D.*

Model 114-558 *Stacking Rods are designed for stacking BO-TY antennas one above the other. Stacking BO-TY antennas provides additional gain and the Stacking Rods maintain perfect impedance match.*

Model 114-560 *Reflector is designed for the BO-TY Antenna when a uni-directional pattern is desired. Addition of the 114-560 also helps somewhat in increasing the gain of the BO-TY.*

* Model 114-054 Yagi UHF Antenna for high gain on specific channels

* Model 114-057 "V" combination UHF and VHF Antenna

* Model 114-058 All-Channel UHF Corner Reflector Antenna

* Model 114-060 UHF Rhombic Antenna for high gain and rejection of reflected signals.

* These UHF antennas are currently in final laboratory tests and will shortly be released to production. When available they will meet the mechanical and electrical efficiency characteristic of all Amphenol antennas.

AMPHENOL Tubular TWIN-LEAD

Amphenol Tubular Twin-Lead has proved itself to be the best answer to the need for an economical lead-in for UHF television. Actual installations in Portland, Oregon have established the superiority of Tubular over all other existing types of twin-lead.

The tubular construction provides a constant impedance that is virtually unaffected by age, weather conditions, salt or dirt deposits on the line. The extremely low-loss of the Tubular Twin-Lead is one of the characteristics that is essential to a UHF lead-in.

The illustration at extreme left reveals the lack of protection that the dielectric of flat lead-in affords to the essential field of energy between the conductors in twin-lead. The illustration to the right demonstrates how this field of energy is protected within the tubular twin-lead and therefore is unaffected by external weather conditions or deposits on the line.

AMPHENOL

Opportunity Unlimited*

by

CHARLES GOLENPAUL

Vice-President
Distributor Sales
Aerovox Corporation

OPPORTUNITY, said a very wise man, is a favorable occasion for *grasping a disappointment.* In similar vein, another noted that: *Opportunity* always looks bigger *going* than coming. Yes, *opportunities* lie on every hand, and so do a lot of people. If *opportunity* is seized when it comes, it will not have to be chased when it goes. The person who doesn't grasp *opportunity* when it knocks, usually winds up by *knocking* opportunity. The difference between *opportunity* and the knocker, is that *opportunity* knocks but once.

There's a lot of horse sense in those definitions. However, the quotation that is truly a gem is the following one which refers to those who grab *opportunities:*

An *optimist* is a person who *meets the wolf at the door,* and *appears the next day in a fur coat.*

Every Service Man has an *outstanding opportunity,* for he is *indispensable.* For the radio-TV manufacturer depends on every Service Man, once the set leaves the factory, the dealer depends on the Service Man to install the set and show the folks how to run it, the set-owner counts on the Service Man to keep his pride-and-joy perking, and the engineers pay close attention to the Service Man's bouquets and brickbats in designing next year's models.

The finest TV set ever built can be no better than the local servicing available. Once that set has left the factory, passed through distributor and retailer, and reaches the home, it is entirely at the mercy of Mr. Service Man, whether the work is done in the manufacturer's own service setup, or for a dealer, or for himself. The Service Man is truly *indispensable.*

Now any *indispensable* man, whether the title be phoney or genuine, is subject to a lot of attention. On the one hand he may be looked up to and respected and properly compensated for his *indispensable* contribution to American home life. But more likely he is the target for much suspicion, downright hard feelings, and meagre and begrudgingly granted remuneration.

From time to time those writers and editors using sensationalism as a means of building up their readership, run articles or series of articles on radio-TV racketeers. One of the foremost popular magazines has on several occasions taken a round-house wallop at radio-TV Service Men as a group, as well as at auto mechanics. A leading New York newspaper has run a series on TV service contracts and how the public has been cheated out of millions of dollars of maintenance. Several metropolitan areas have seriously considered licensing radio-TV Service Men and organizations so as to stop the

(*Continued on page 74*)

*From a talk delivered before the Philadelphia Radio Service Men's Association recently.

TUBE News

Circuit for a Precision Junction Transistor Oscillator . . . 12-Volt Beam-Power Amplifiers for Auto Sets . . . Miniature Medium-Mu Twin Triodes and FM/TV Amplifiers

by L. M. ALLEN

AS PART OF A PROGRAM devoted to the improvement of measuring and calibrating standards, the Bureau of Standards has developed a unique crystal oscillator[1] that utilizes for the first time a junction transistor as a source of driving power for a high-stability quartz crystal unit. All components of the circuit, including the power supply, fit into a metal tube less than 2″ in diameter and about 7″ long. At an operating frequency of 100 kc, the long-period drift in the first model was found to be about 3 parts in 10^9 per day.

The major components of the transistor oscillator are a junction transistor,[2] a high-precision 100-kc GT-cut quartz crystal unit,[3] and a long-life mercury cell. The dry cell supplies power to the whole unit (1.35 volts at 100 microamperes), and has an active life, under these conditions, of five or more years.

Two of the requirements that must be met in developing a high-stability crystal oscillator are constancy of phase shift in the feedback loop associated with the crystal and constancy of the amplitude of oscillation. A constant phase shift has been obtained by using large, stable *swamping* capacitors at both crystal connections and by using highly stable components in the remainder of the circuit.

The transistor is used in the oscillator in the grounded-emitter connection. It produces an output of .8 volt across a tuned circuit connected to the collector electrode. The tank circuit, composed of a 350-mmfd capacitor and a 6-mh coil, was designed to oscillate at 100 kc; however, the magnitude of the voltage is too high to be applied directly to the crystal unit. Consequently, the voltage is reduced by means of an attenuator, which consists of a 40-mmfd and a .01-mfd capacitor in series from the collector electrode to ground. The driving current (less than 100 microamperes) for the crystal is taken from the junction between these capacitors. Crystal voltage is coupled to the output through a 100-mmfd capacitor.

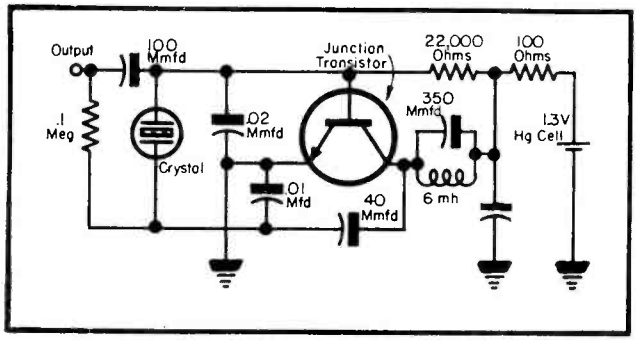
Over half of the space in the 1¼″ diameter by 7″ metal tube is consumed by the crystal, which is mounted in an evacuated glass envelope. The transistor, coil, capacitors, and resistors are supported on a bakelite frame that may be *potted* in casting resin to add to the rigidity of the section. The mercury cell, only about one-half inch deep, is at the base of the assembly and is insulated from the metal *can* by a bakelite shield.

Determinations of the frequency stability with changes in temperature and supply voltage have indicated that the frequency varies approximately 1 part in 10^8 per degree *C*, and 1 part in 10^8 per .10 volt. The transistor oscillator was also compared with standard oscillators controlling the transmissions of WWV. Short time variations were about ±3 parts in 10^{10} and long inter-

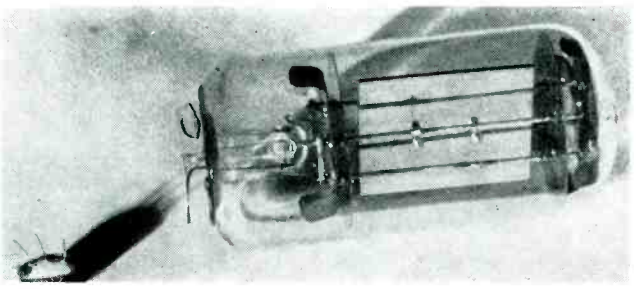
(*Continued on page 67*)

[1]Developed by Peter G. Sulzer. [2]Type 2517.

Circuit diagram of the transistor oscillator developed by the Bureau of Standards. Mercury cell (right), with a life of about five years, supplies the power to the unit; 1.35 volts at 100 microamperes.



Basic components of the transistor oscillator. The driving power for the unit is obtained from a type 2517 junction transistor (left). This power is applied to a precise GT-cut quartz crystal unit, which is enclosed in an evacuated glass envelope (right).



PREAMP-REMOTE 25-Watt Amplifier CONTROL

by WYN MARTIN

[*See Front Cover*]

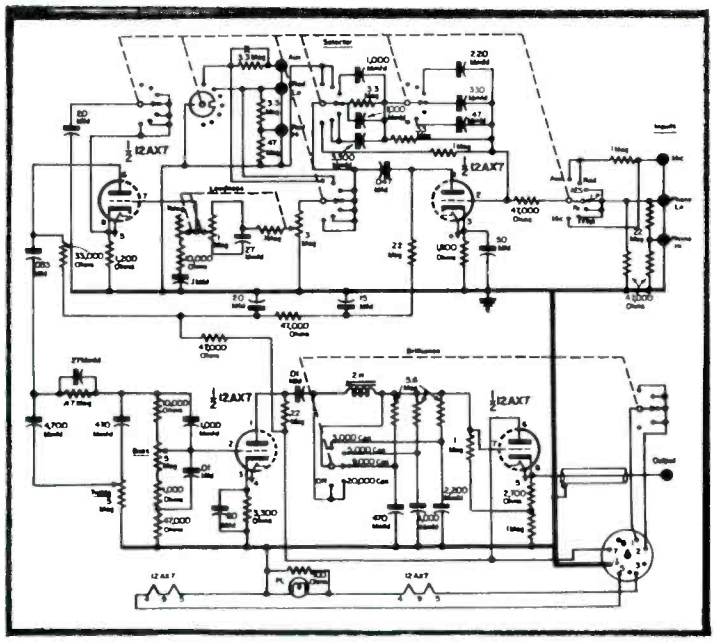


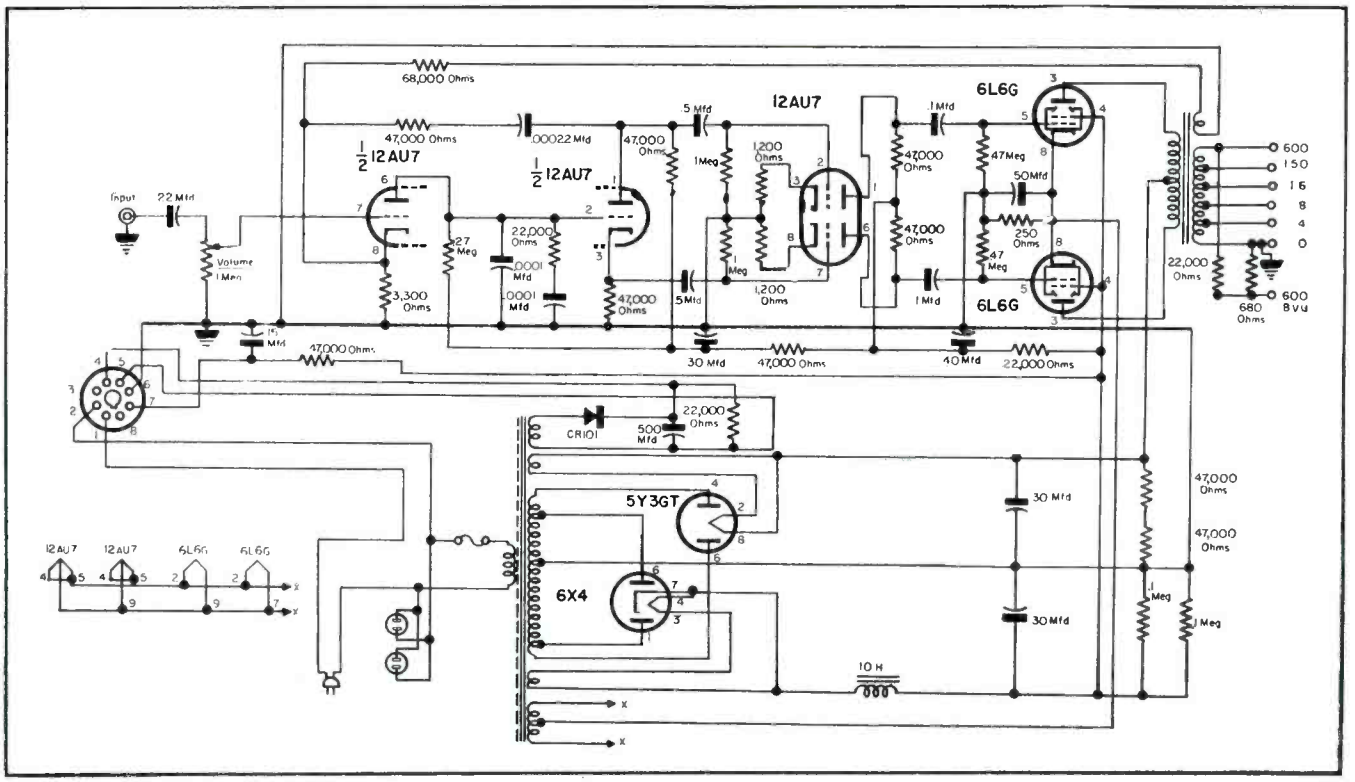
Fig. 1. Stromberg-Carlson AR-425 remote control[1] unit; see cover.

IN COMPLETE WIDE-RANGE audio-system installations, remote controls with preamps are becoming quite a factor.

Several novel and effective types are now available. On the cover and in Fig. 1 appears the circuit of one type[1] which includes input connections for a high-impedance microphone; a high or low-level output magnetic (variable reluctance) phono pickup; a high or low-level output radio tuner; high or low-level output auxiliary signal source such as a TV tuner, wire or tape recorder. To operate, the input sensitivity must be .003 volt for the microphone input; .006 volt for the low-level phono input; .040 volt for high-level phono input; .1 volt for low-level radio and auxiliary input; and 2 volts for a high-level radio input. The preamp incorporates a treble control providing 12-db boost and 20-db droop at 10,000 cps; a bass control providing 15-db boost and 20-db droop at 30 cps; a brilliance control providing sharp cut-off (10-db down) steps at 3,000 cps,

(*Continued on page 78*)

Fig. 2. Stromberg-Carlson AR-425 power amplifier and power supply. Unit is equipped with an output terminal strip which provides direct connections for 4, 8 and 16-ohm speakers, as well as 150 and 600-ohm units. An additional 600-ohm 8-*vu* connection provides an output level to feed a telephone line, tape or disc recording equipment. Amplifier is said to be stable under all output load conditions through the use of a separate interleaved feedback winding in the output transformer.



PATENT APPLIED FOR

THE NEW Synkote® "OVALTUBE"

Low-loss tubular twin-lead for better reception on VHF and UHF

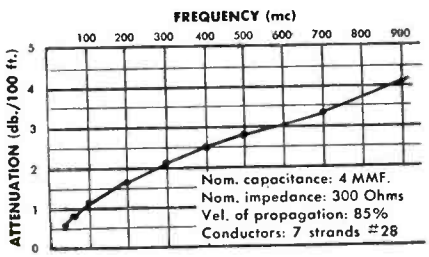
Here is a unique, *practical* down-lead that minimizes the effects of dirt, salt air and moisture on TV picture quality. Smooth, rounded exterior — no place for dirt to accumulate. Fits the same hardware and handles as easily as ordinary twin-lead, but gives excellent, trouble-free reception under *all* weather conditions!

SEAL THE ENDS IN 60 SECONDS

Simply heat with match or cigarette lighter, then squeeze ends together with pliers or knife blade.

USE YOUR REGULAR HARDWARE

Synkote OVALTUBE fits into the usual slotted stand-off insulator quickly and easily. No special threading, no special hardware required.



Synkote OVALTUBE twin-lead is available now. Ask your Plastoid representative . . . or mail coupon today.

PLASTOID Corporation

plant: HAMBURG, N. J. | offices: 42-61 24th St., Long Island City, N.Y.

PLASTOID CORP.
42-61 24th St., Long Island City 1, N. Y.

☐ We are interested in Synkote OVALTUBE.
☐ We are also interested in ☐ hook-up wire; ☐ twin-lead;
☐ coaxial cable; ☐ microphone cable; ☐ multi-conductor cable.

Name: .....
Company: .....
Address: .....
City: ..... State: .....

LOUDSPEAKERS for HI-FI

by MARK VINO

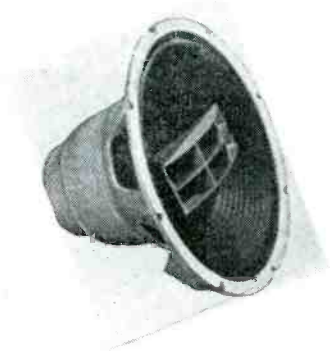


Fig. 1. Modern high-fidelity speaker. The *tweeter* (which works into the multi-cellular horn) is mounted on the same axis as the *woofer*, resulting in a unit identified as *coaxial*. (*Courtesy Jensen.*)

THE SELECTION OF A LOUDSPEAKER is one of the most critical tasks in constructing a *hi-fi* audio system. It is also one of the most difficult, because of its mechanico-acoustical nature, and related design and structural characteristics. The loudspeaker is a machine, and science has not yet devised the means for controlling a mechanical system with the same precision that can be expected of electronic circuits. The success which speaker engineers *have* achieved, in the face of the difficulties, is indeed remarkable.

Frequency Response

It has previously been pointed out that there are two aspects of frequency response, range and uniformity, and that *uniform* response over the reproduced range is of prime importance. This is especially true of loudspeaker performance. Conditions of acoustical coupling, various modes of mechanical resonance, and the imperfect rigidity of parts when transmitting high-frequency vibrations tend to create violent dips and peaks in the response curve. If the frequency response of a high-fidelity speaker system is uniform within ± 5 db from 60 to 12,000 cycles or so, it may be considered unusually excellent in this characteristic.

Frequency-response curves for speakers, no matter how honestly made, cannot be taken as literally as the corresponding curves for pickups or amplifiers, because of the differences between acoustical conditions at the test and in actual use. Assuming proper baffling, however, they do represent frequency performance in general, and when available they should be examined for the characteristics listed below, which appear in the order of their importance:

(*1*)—Minimum variation over the frequency range.

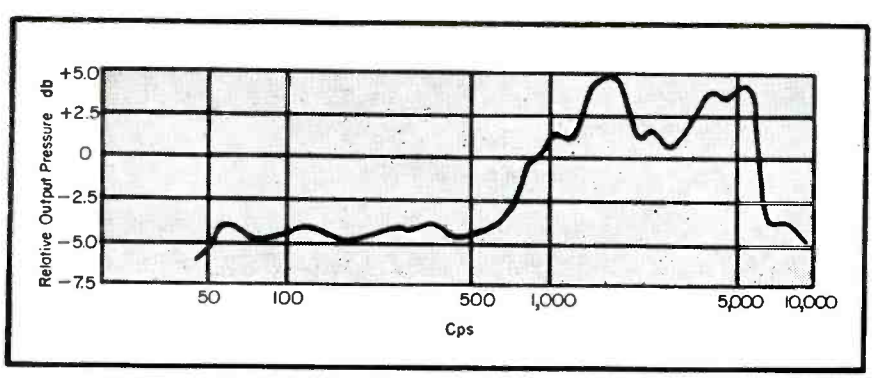
(*2*)—Approximately balanced response of treble against bass. This does not refer to the bass and treble frequency extremes, but to the relative handling of signals over the *entire* spectrum of lower frequencies (from about 800 cycles down) and over the entire treble spectrum (from about 800 cycles and up). To take an extreme example, a loudspeaker whose response is uniform within ± 5 db will still sound somewhat shrill if frequencies below 500 cycles are generally attenuated 5 db, and frequencies above 1,000 cycles are generally accentuated by 5 db; see Fig. 2.

(*3*)—Adequate range of response, at least 65 to 10,000 cycles for high-fidelity applications.

The final test for loudspeaker frequency response is usually in the listening. There are many audio listening rooms in which such tests can be conducted; here it is possible to switch instantaneously from one speaker to another (all other components of the assembly remaining the same) to help comparison. Using fairly loud orchestral music, the prospective buyer may check the characteristics listed by noting whether the treble is unnaturally muffled or shrill, or if the bass is boomy or weak, and whether the natural metallic timbre of triangles and cymbals, and the deep fundamentals of double bass strings or organ pedal notes, are evident.

The bass performance of any cone-type loudspeaker is completely dependent upon the type of mounting employed, and the finest *woofer* on the market will be poor in bass response unless it is properly mounted.

Fig. 2. Frequency response of a speaker (imaginary) with poor balance. Although the numerical rating may be correctly given as 60—10,000 cps, ±5 db, the output will tend to be shrill.



Directional Characteristics

Loudspeakers tend to beam the higher frequencies directly ahead, so that the on-axis frequency response is quite different from the response at an angle of, say, 45° to the axis. The larger the speaker used for the treble the greater is this effect. Various methods for dispersing the high-frequency signals include the use of small diameter tweeters, the use of acoustic *lenses*, the arrangement of several tweeters in an array following the line of an arc, and the use of multi-cellular horns, also arranged in an arc. To check the directional properties of a loudspeaker, one should walk across the room while the music is playing, in a path perpendicular to the direction in which the speaker faces, noting the relative changes of quality of the reproduced music.

Speaker Distortion

A professional quality loudspeaker will have a maximum harmonic distortion of about 5% at full output and at certain regions of the frequency spectrum (usually in the bass, and particularly at the bass resonant frequency of the speaker's mass-elasticity system), with a considerably lower figure for most of the range. Speaker systems which employ separate units for low and high frequencies, and which have an inductance-capacitance dividing network to keep the high frequencies from the *woofer* and the low frequencies from the *tweeter* (Fig. 3 *a*), have a certain design advantage with respect to distortion.. Although

Comprehensive Study of Speaker Frequency Response, Directional Characteristics...Distortion Problems . . . Woofer-Tweeter Networks . . . Power Capabilities . . . Construction Requirements . . . Multiple Speaker Uses

the spurious harmonic content in such a system may be not less than in a single unit, the separation of the high-frequency signals from the bass, so that both are not passed simultaneously through the same non-linear system, reduces the intermodulation which inevitably results from harmonic distortion. This separation helps *clean up* the sound. The advantage does not, however, apply to dual systems using simpler dividing networks, such as the type shown in Fig. 3*b*. The resistance-capacitance circuit keeps the bass signals out of the tweeter, to prevent damage to its delicate high-frequency mechanism, but allows the treble to feed into the woofer simultaneously with the bass. Thus, intermodulation created in the woofer is not discriminated against.

Whatever methods are used by the loudspeaker designer to reduce distortion, with few exceptions, the purchaser must judge the results wholly by a listening test. Again the *naturalness* of musical sound is the standard (familiarity with the live instruments, especially from a recent performance, helps considerably). One index to speaker distortion is the absence of a *muddy* quality in low pitched but powerful tones, such as are produced by the plucked strings of the double bass or by the kettle drums. These notes should have clearly identifiable pitch, so that one can pick them out on the piano, and should not sound like the diffuse rumbling of thunder or other non-musical noises.

Power Capability

Speakers for home systems require a minimum power capability of about ten watts. Using a speaker with a large reserve of power capability makes considerably more sense in the case of speakers than in the case of amplifiers. Operations at a small per cent of rated power ordinarily means lower values of distortion, and while ampifier distortion at rated power is usually negligible, this is not so for speakers. When multiple speakers of equal power capacity are connected together, either in series or in parallel, the power capability of the total system is equal to the sum of the capabilities of each speaker.

Transient Response

Transient response refers to the accuracy with which momentary effects associated with the starting and stopping of sound are reproduced. Although loudspeakers contain a certain amount of internal damping, the extent to which the speaker exhibits *hangover* (continues to oscillate after the signal has stopped) depends more on the type of mounting than on the speaker itself. (Proper baffling also affects distortion and power capability.) Good reproduction of transients is directly related to a smooth and extended frequency response.

Speaker Construction

As in the case of amplifiers there is more than one method of designing a successful loudspeaker. Some of the desirable physical characteristics are:

(*1*) As low a resonant frequency of the speaker mechanical system as possible. This helps achieve bass reproduction which is full, does not suffer from hangover, and is relatively undistorted.

(*2*) Strong, solid frame.

(*3*) High intensity magnetic field in the voice coil gap. This makes for speaker efficiency and good electrical damping from the power amplifier stage. The intensity of the magnetic field cannot be judged from the size or weight of the magnet, unless the magnet material and design of the speaker's magnetic system is known. Other factors being equal, however, the larger the magnet the stronger the field. Older magnetic speaker structures which do not use Alnico V may have several times the magnet weight of an Alnico V structure without achieving the same field strength.

(*4*) Seamless molded cone of soft material (does not apply to cone-type tweeters). This helps prevent sharp resonances in the frequency region of a few thousand cycles, which create an apparent loudness but are not conducive to natural reproduction. A soft cone has, in addition, a wide pattern

(*Continued on page 77*)

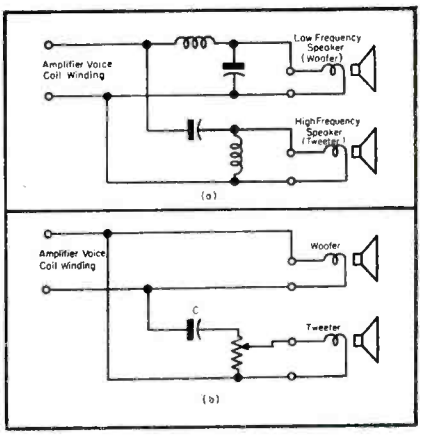
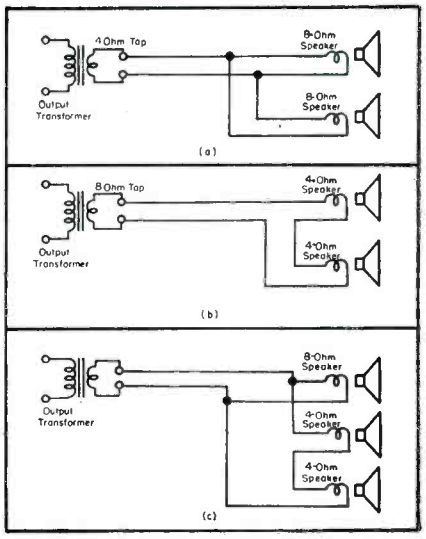


Fig. 3. In *a* (top) appears an inductance-capacitance dividing network, and in *b* (bottom) a resistance-capacitance dividing network. The latter circuit has the disadvantage of allowing greater intermodulation, but it is much simpler and more economical. The value of C, which determines the frequency at which the tweeter circuit begins to discriminate against lower tones, is ordinarily several microfarads. *C* must be non-polarized.

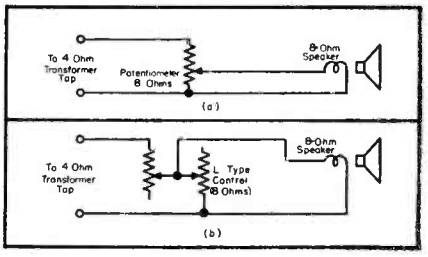
(*Below*)

Fig. 4. Methods of conecting multiple speakers to a single amplifier. Method used in *a* is for parallel hookup; *b* is for series connection, and *d* for series-parallel.



(*Below*)

Fig. 5. Two circuits for controlling volume at the speaker. In both cases the controls must have the full power rating of the amplifier, and half of the amplifier output power is wasted in the resistances at full volume. Higher values of resistance will dissipate less power, but will create an impedance mismatch.



COMPLETE information products

Brand new *Clarostat TV Manual!* Over 275 pages of TV control replacement listings — by brand names, model, chassis; with manufacturer's part number, catalog number, function, description, list price, etc., etc. Simply indispensable! Ask your Clarostat distributor for a copy.

Then, to keep your Clarostat TV Manual up-to-date, there are the *TV Supplementary Sheets* published in each issue of *PF Index* and *Successful Servicing*. Just tear out the pages and place them in your Manual. You're always up-to-date with Clarostat!

Many TV controls not available from other manufacturers, are stock items in the RTV line. Clarostat has the largest choice of exact-duplicate replacements that match the initial-equipment controls. *Don't improvise—RTV-ize!* Catalog on request.

Where standard controls can do, Clarostat has a wide selection of carbon 15/16" and 1-1/8" dia. controls; and in wire-wound 2, 3 and 4 watt controls. "Pick-A-Shaft" provides a choice of 12 field-attached shafts. "Ad-A-Switch" provides field-attached switches.

CLAROSTAT CAN FILL YOUR AND ONLY CLAROSTAT TV CONTROL NEEDS

STAND PAT WITH CLAROSTAT Controls & Resistors

CLAROSTAT MFG. CO., INC., DOVER, NEW HAMPSHIRE

In Canada: Canadian Marconi Co., Ltd., Toronto, Ontario

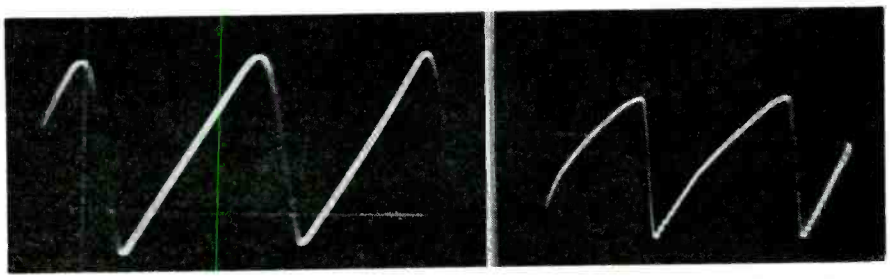
In The Field‡

Eliminating Ringing in Rasters . . . Troubleshooting Keyed AGC Circuits . . . Determining the Characteristics of Vertical Sync and Buzz Pulses

WHEN RINGING in the raster, or the so-called *curtain effect,* is caused by ripple in the sawtooth of current deflection what can be done to eliminate this defect?

In most cases, the defect can be eliminated by use of good tubes, correction of improper component values, and the proper adjustment of the operating controls. There are instances, however, when ringing may persist because of the use of simple retrace-blanking networks in the horizontal sweep circuit. Sawtooth current waves with and without ringing are illustrated in Fig. 1. In difficult cases, cures can be effected by connecting a ringing trap, of the type shown in Fig. 2, in series with the deflection circuit.

(*Below*)
Fig. 1. At left appears a sawtooth current wave without any ringing in evidence, while at right is a sawtooth current wave with a small amount of ringing, sufficient to be seen on the raster. This waveform also exhibits sweep non-linearity.



HOW CAN I TELL whether the pulse on a 'scope screen is a vertical-sync or a buzz pulse?

It is true that 60-cycle buzz pulses which are frequently audible in the sound output of an intercarrier receiver, may look quite a bit like vertical sync pulses. The similarity is especially great when the buzz is being generated in the *if* or in the video amplifiers. When the buzz pulse is traced in these amplifiers, a tuned signal-tracing probe is necessary, because the tuned probe rejects the picture signal and accepts the sound signal. It is necessary, therefore, to adjust the tuned probe to the correct frequency. This can be done with a signal generator having modulated *rf* output. A tuned signal-tracing probe designed for this purpose appears in Fig. 4. Often it may be necessary to use an audio amplifier as a preamp to obtain satisfactory deflection on the 'scope screen.

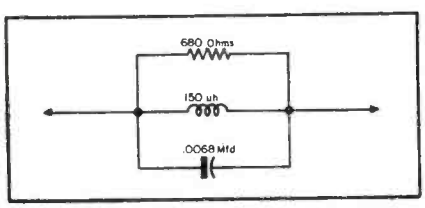


Fig. 2. Ringing frequencies can be *filtered out* of the sweep by use of the ringing filter shown above. Such a filter will eliminate only the ripple in the deflection-current sawtooth; if the vertical shadow bars in the raster are developed by a ringing ripple in the high-voltage supply, for example, the filter will not improve the situation. Neither can the filter improve *picture ringing* such as is caused by excessive high video peaking. The resonant frequency of this circuit is .5 mc. (*Courtesy Admiral Corp.*)

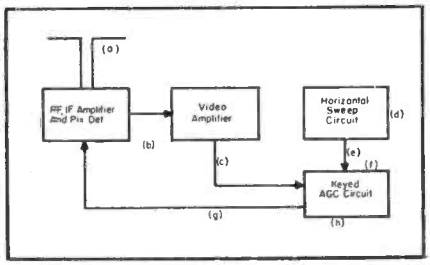
IS THERE A quick and simple way to troubleshoot a keyed *agc* circuit?

Yes. It is not difficult to troubleshoot any TV circuit, including a keyed *agc* circuit, if an honest-to-goodness understanding of how the circuit operates obtains. Insofar as keyed *agc* circuits are concerned, the basic tests indicated in Fig. 3 will be found to be very helpful. These tests require a *vtvm* and a 'scope with a low-capacitance probe.

WHAT CAN BE DONE to trace the cause of alternate light and dark gray bars on the screen of the picture tube, even when no picture is present?

There are several possible causes of this type of ringing in the raster. To check, the height control should be advanced as far as possible, to separate the individual scanning lines; if the lines are not straight through the bars, but are wavy, you will know that at least one of the troubles is cross-talk between the vertical coils and the horizontal coils in the yoke. If the chassis employs a yoke with a satisfactory low cross-talk specification, careful adjustment of the value of the balancing capacitor across the hot half of the horizontal coils will clear up the waviness of the horizontal lines. Then, if bars are still observed, it will be necessary to test for high-voltage ripple, horizontal velocity modulation, and for cross-talk of the grid circuit of the picture tube. To test for grid cross-talk, a 0.1-mfd capacitor should be shunted from the picture-tube grid to ground; this will eliminate the bars if the grid circuit is picking up ripple. Next, it is necessary to inspect the *current* sawtooth through the horizontal deflection coils with a 'scope; a damped sine wave superimposed upon the sawtooth will disclose the presence of velocity modulation due to sweep ringing; see Figs. 1-2. Finally, the ripple on the *hv* supply to the second anode of the picture tube should be checked with the aid of a *hv* capacitance-divider probe.

Fig. 3. Block diagram of keyed *agc* system test setup. Changing signal strength from antenna should produce a corresponding change in *agc* bias voltage (*a*). Direct connection to the second detector (or a *dc* restorer) must be present (*b*) as well as a *dc* connection between the video amplifier and the *agc* tube (*c*). The keyed *agc* system will not operate unless the horizontal sweep is synchronized by a picture signal (*d*) and a positive sync pulse with a frequency of 15,750 cps must appear at the grid of the *agc* tube (*e*). The grid of the *agc* tube must be —4 volts (approximately) with respect to cathode (*f*). Only *dc* voltage should be present on the *agc* bias voltage bus, and should vary from —2 to —5 *v* (*g*). 'Scope should show a positive pulse on the plate of the *agc* tube, with a peak voltage of about 35 *v* higher than the cathode potential (*h*).



‡*Based on questions posed during meetings conducted by* **R. G. Middleton,** *senior engineer at Precision Apparatus Co., Inc., and author of TV Trouble-shooting and Repair Guide Book, published by John F. Rider.*

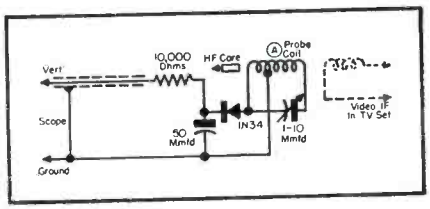


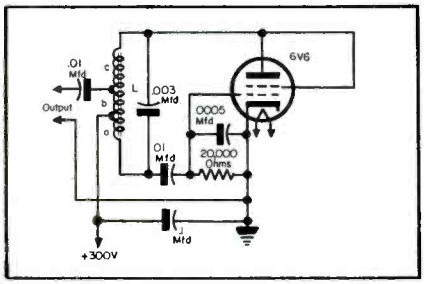
Fig. 4. Tunable signal-tracing probe suitable for use in 20-mc *if* amplifier strips. Generally, the *hf* core must be readjusted for each receiver, since the sound *if* frequency is seldom identical from one receiver to another. Probe coil, which is coupled to video *if* coil, is shown at *A*. The coil is wound on a ½" form, with 9 turns total, and a tap at 3 turns.
(*Courtesy Precision Apparatus Co.*)

AUDIO installation and service

Phono-Tape-Wire-PA-Amplifiers-Speakers

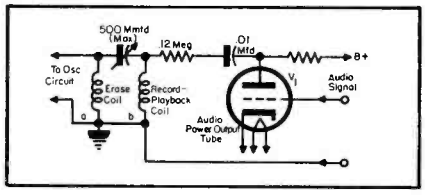
by KENNETH STEWART

Characteristics of Magnetic Tape Recording Equipment: Tape Pulling Mechanisms, HF Biasing, Hum-Reducing Provisions . . . Tape Recorder Servicing Procedures

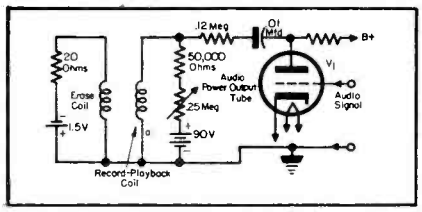


(Above)‡
Oscillator circuit designed to operate at 25 kc as a source of *hf ac* erasing and biasing. *L* is a 750-turn (*c*; No. 25 Formex or enameled wire) ¼" diameter by 1 1/16" long, powdered iron-core coil, with taps at 150 (*a*) and 300 (*b*) turns. Frequency of bias used is usually about five times highest audio frequency to be recorded. Oscillator frequency can be varied by increasing or decreasing .003-mfd capacitor.

(Below)‡
Recording circuit using *ac* bias and erase voltage. The 500-mmfd trimmer serves to adjust bias current and 120,000-ohm resistor provides constant current audio signal.



(Below)
Recording circuit using *dc* bias and erase voltage.



‡From report on *Engineering Considerations in the Use of Magnetic Recording Heads* by Lee Gunter, Jr., of Shure Bros., appearing in IRE Professional Group on Audio Transactions.

[1]Based on a discussion of the comparison of recording processes by John G. Frayne of the Westrex Corp. appearing in The Transactions of the IRE Professional Group on Audio.

[2]*Audio Installation and Service* and *Wire-Tape Servicing*. SERVICE; August, 1952.

THE USE OF MAGNETIC RECORDING on tape, which has been adopted as a basic pickup media in most disc plants because of its wide range and simplified editing possibilities, has become an equally popular member of the home *hi-fi* audio family. Today, large numbers are using tape to record off-the-air, home recitals, and other musical functions, which on occasion are transferred to disc. This growing interest in tape has developed into a robust activity for Service Men.

Tape Properties

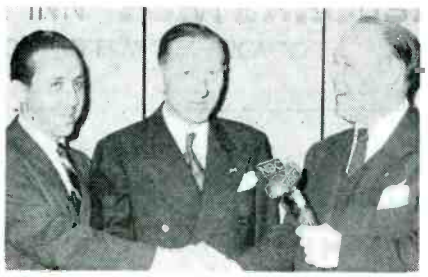
The properties of tape are unique. In analyses of these characteristics[1, 2], it has been noted that the extreme flexibility of standard ¼" tapes have been found to simplify tape pulling mechanism design and thus it is possible to obtain considerable freedom from very low flutter rates with relatively inexpensive drives. The capstan type drives do normally introduce low-frequency flutter rates. However, these flutters are considerably higher than those encountered in disc recording and are, therefore, not so objectionable. The irregular motion of tape or film over the magnetic head does introduce a considerable amount of high frequency flutter of a somewhat random nature. Fortunately, these rates are sufficiently high, so that their effect on the ear is negligible except at the higher audio frequencies, such as some of the higher overtones from string instruments. This irregular tape motion has also been found to introduce substantial amplitude distortion which produces an effect almost indistinguishable from that of the high-frequency flutters. Accordingly, at the usual speed of 15" per second, both of the effects can produce a harsh quality if the range is stepped up to a 15-kc limit.

H F Bias

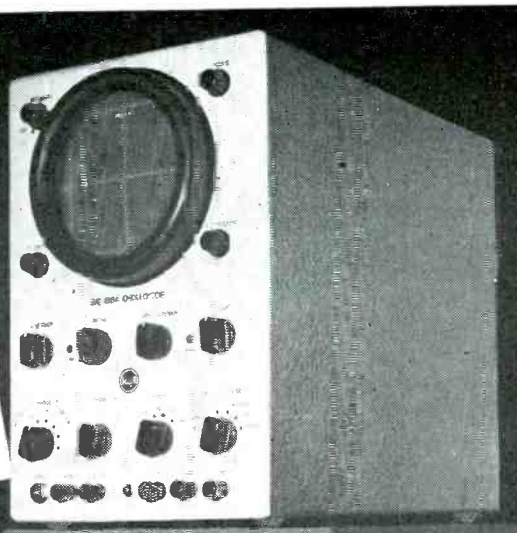
The use of high-frequency bias in magnetic-tape operation provides a

(Continued on page 80)

Peter L. Jensen (center), president of Jensen Industries, receiving congratulations on his 50th anniversary in the business of *sound* on *Welcome Travelers*, an NBC network television show, from producer Les Lear (right) and publicist Max Cooper (left). Jensen was honored on both the TV and radio versions of the show.

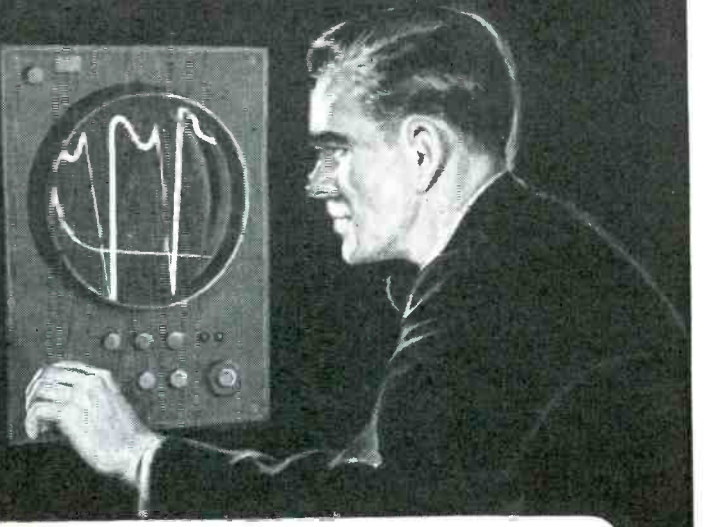


Speakers now available with 2.15 ounce magnet and 1" voice coils, and 1-ounce magnets with 1" voice coils, said to supply substantial flux in the air gap. *(Gold Cup speakers; Carbonneau Industries, Grand Rapids, Mich.)*



5"
RCA WO-88A
$169.50
Suggested User Price

You can believe what you see with an RCA oscilloscope



7"
RCA WO-56A
$217.50
Suggested User Price

The RCA WO-88A 5-inch and WO-56A 7-inch oscilloscopes have the facilities you need for precise *qualitative analysis* and accurate *quantitative measurements* . . . thanks to advanced engineering design.

For instance, one of the outstanding features of these instruments is their *remarkably true square wave* response . . . obtained by adequate band width, negligible phase shift, fast rise time, frequency-compensated attenuators, and a complete absence of peaking circuits.

Equally important are the peak-to-peak *voltage-measurement features*—obtained through the use of voltage-calibrated attenuators, front-panel calibrating-voltage terminals, calibrated graph screens, and good amplifier linearity.

Other quality features common to both designs include . . . push-pull direct-coupled amplifiers . . . extra fast retrace . . . shielded CRT gun . . . plus and minus sync . . . line-frequency sweep with phasing . . . and a set of matched probes and cables including a high impedance probe having an input resistance of 10 megohms and an input capacitance of less than 10 uuf.

Before selecting a 'scope for your special needs, be sure to get the full details on the WO-88A and WO-56A from your *RCA Test Equipment Distributor* . . . or write RCA, Commercial Engineering, Section 56BX, Harrison, New Jersey.

RCA®
RADIO CORPORATION of AMERICA
TEST EQUIPMENT **HARRISON, N. J.**

Dealers find the *NEPCO* line

Reduces Stocks

Reduces Call Backs

Increases Goodwill

Increases Profits

MASTER OF THE ELEMENTS

THE **NEPCO** LINE INCLUDES:

- YAGI ANTENNAS • CONICAL ANTENNAS
- UHF ANTENNAS • MASTING • EAVE MOUNTS
- WALL BRACKETS • VENT MOUNTS • ROOF MOUNTS
- CHIMNEY BANDING • CHIMNEY MOUNTS • GUY RINGS
- BANDING & MAST CLAMPS • ADD-A-TOWER PLATES • TV WIRE

National Electric Products

RADIO AND TELEVISION DEPARTMENT, PITTSBURGH, PA.

TV set owners want a better picture, longer

Here is the answer

Today, TV set owners are demanding better reception. Often the *trouble is in the antenna installation, not the set.* A corroded antenna (and most antennas are corroded if they have been up a while) or cracked and crazed down-leads (and most polyethylene leads *are* faulty after 10-12 months) can cause a deteriorated picture. *Nothing* you do to the set can correct this condition. A *new* and *better* antenna installation is the answer.

The NEPCO Line of antennas and TV installation materials eliminates this condition.

It was designed to meet the pressing demand for *better* electronic equipment—with more built-in ruggedness and corrosion-resistance than any line now known.

The NEPCO line was designed with YOU in mind:

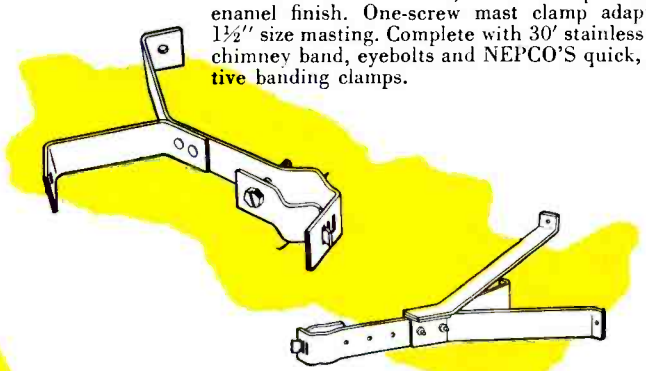
- Provides *maximum* number of installations with a *minimum* number of parts from jobbers. Your stocks are kept at a minimum.
- Its high quality eliminates costly call backs . . . saves you time, trouble and tempers . . . improves customer goodwill.
- Eliminates rust streaks—a common customer complaint.
- Provides *quicker* installations . . . goes up fast . . . easy to handle . . . easy to carry.

Remember, a better installation using better materials will insure more satisfied customers.

ORDER A BALANCED STOCK FROM YOUR JOBBER TODAY

CHIMNEY MOUNTS

Made of ⅛" x 1¾" steel, zinc-coated plus baked-enamel finish. One-screw mast clamp adapts to 1½" size masting. Complete with 30' stainless steel chimney band, eyebolts and NEPCO'S quick, positive banding clamps.

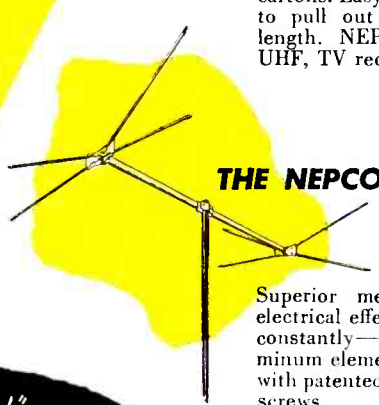


WALL BRACKETS

Fabricated of ⅛" x 1¾" steel, heavily zinc-coated with baked-enamel finish. One-screw mast clamp adjustable to 1½" masting. Hex head slotted bolts to speed erection time.

SPACE SAVER— BIG, FLAT BOXES FOR TV WIRE

NEPCO "Zee" Line comes in strong, flat cartons. Easy to stack, easy to handle, easy to pull out for cutting to any desired length. NEPCO "Zee" Line is low-loss UHF, TV receiving wire.

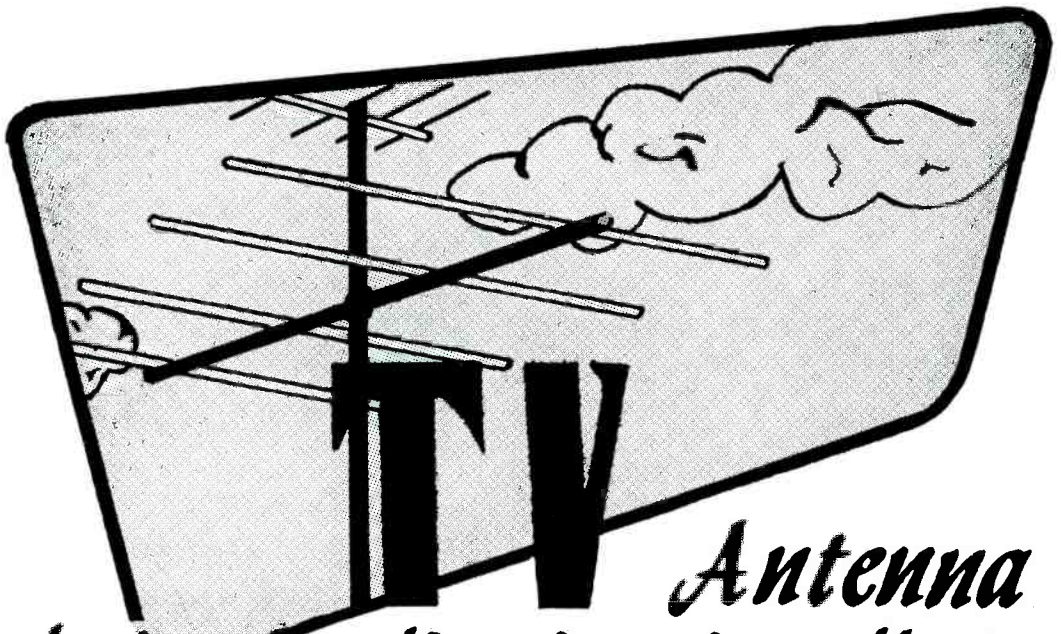


THE NEPCO CONICAL ANTENNA IMMEDIATE DELIVERY

Superior mechanical features maintain electrical effectiveness and performance—constantly—regardless of conditions. Aluminum elements are permanently secured with patented "vibration-proof" imbedding screws.

These other features will "spark" your TV sales:

- All parts heavily zinc-coated plus baked-enamel finish.
- All mounts made of rigid, heavy gauge steel.
- Unique adjustable mast clamp with one-bolt mounting.
- Two 15' stainless steel chimney bands with each chimney mount.
- Over 100 installation combinations possible with minimum inventory.
- Slotted, hex-head bolts standard equipment . . . all zinc-coated plus baked-enamel finish.
- Exclusive antenna mast clamp with positive alignment in all planes.
- Patented imbedding type screw for positive electrical and mechanical locking.



Antenna Digest

design..application..installation..service

by RALPH G. PETERS

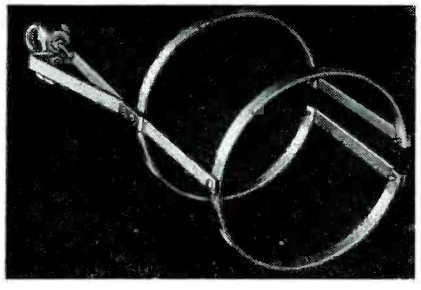
Recent Developments in Antennas for the Ultrahighs and VHF/UHF Pickup

ON THE HIGH OR low bands in TV, *position, height* and *orientation* are important factors. But on the ultrahighs, they are extremely critical and demand the closest consideration.

As reported on several occasions, it is entirely possible that an increase in the height of an antenna several feet can cause a decrease in signal strength, due to a difference in phasing between the direct signal and the grounded reflected signal. Yet, in many installations, it has been found that antennas must be mounted on poles from 10′ to 25′ above the rooftops.

On *uhf* it has also been noted that there are points of maximum and minimum signal strength to consider. In view of this peculiarity, it is possible to move away from the transmitter and still secure an increase in signal strength. This oddity coupled with such obstacles as hills, buildings and trees causes wide variations in signal level. Many have also found that ghosts are more common on *uhf*. Because, however, of the smaller dimensions of *uhf* antennas, it is not difficult to build high-gain directive antennas to compensate for these problems.

Circular construction antenna for the ultrahighs. (*Rytel*)

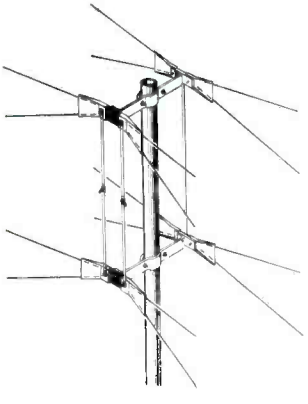


New Antenna Designs

Many antenna designers have concentrated on the ghost and gain problems and come up with quite an array of systems. On the Pacific Coast, one manufacturer* has developed a circularly constructed unit** which it is said will provide greater directivity along a horizontal plane, a low pickup response in vertical directions and a reduction of *ghosts,* because they say, noise, multipath and other signals which arrive at an angle other than perpendicular to the plane of the circle, cancel out at the terminals. With the two circle antennas fed 90° out of phase, it is noted that an additional gain of 3.8 db for each circle of antenna is obtained. The dielectric of the antenna is air and the unit is supported at a current node or ground potential.

*Rytel. **Double-O.

Ultra conical-V-beam designed for the ultrahighs. (*Telrex*)

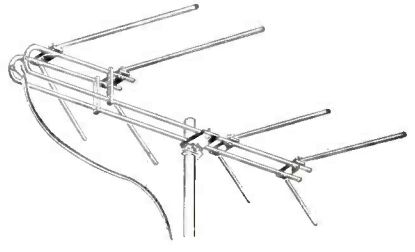


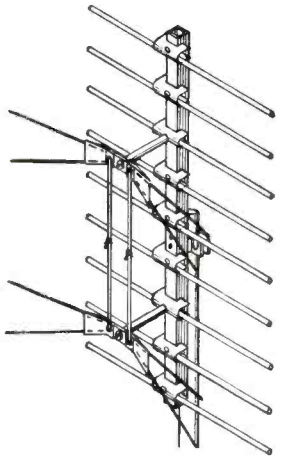
Trombone Design

In another effort to reduce ghosts, an antenna maker[1] has fashioned a modified trombone[2] (2′ x 2′) which is said to have a uniform gain of 8 db across the band, low *vswr,* 300-ohm impedance and sharp directional

[1]Ward. [2]Model TV-180; Jazz Trombone.

Trombone type *uhf* antenna, which is claimed to have a sharp directional pattern to cut down down ghosts. (*Ward*)





Screen-reflector array/stacked-conical dipole assembly for *uhf* which features reactance transformer bars. (*Telrex*)

pattern to cut down the critical *uhf* ghost problem.

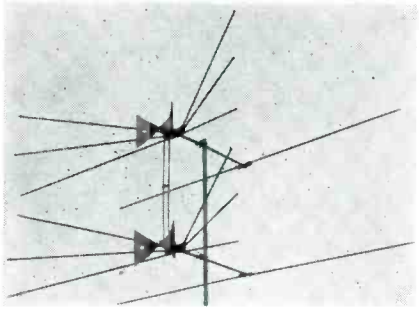
Also on the *uhf* production line are broadband stacked *conical-V-beam* dipoles[3] that are claimed to insure flat hi-gain response.

Another version of the *uhf* conical appears in a screen reflector array[4] employing patented *conical-V-beam* dipoles.

The antenna utilizes two, full-wave, stacked conical dipoles and reactance compensated transformer bars that, it is said, develop gain up to 18 db at an average front-to-back ratio of 20 db. Another unique feature of the unit is a provision for converting to a

(*Continued on page 52*)

[3]Telrex Ultra Model 200. [4]Telrex model 800-2X.



Stacked antennas for standard and *uhf* pickup with interaction filters at each antenna. (*Channel Master*)

Closeup of *free-space* terminals used in antenna illustrated above.

TV Antennas

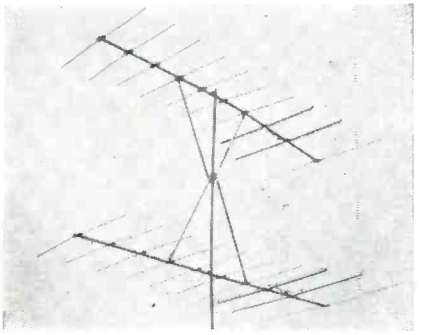
(*Continued from page* 51)

parabolic array to increase gain and vertical directivity.

Other Antenna Developments

Now also available for application is a *vhf-uhf* stacked *ultra fan*[5] which utilizes two interaction filters, one at each antenna, which electronically separate the *vhf* and *uhf* bands. This

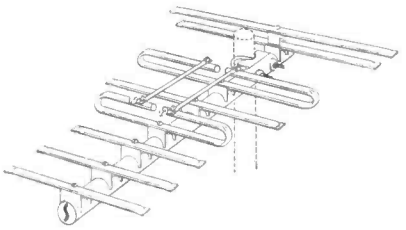
[5]Channel Master 4132.



All-aluminum broad-band yagis available for channels 7 to 13, 2 to 5, 3 to 6, and 4 to 6. Features a balanced-line matching transformer system. (*Cascode models* 10*B*713, 10*B*2345, 10*B*3456 *and* 10*B*456; *JFD.*)

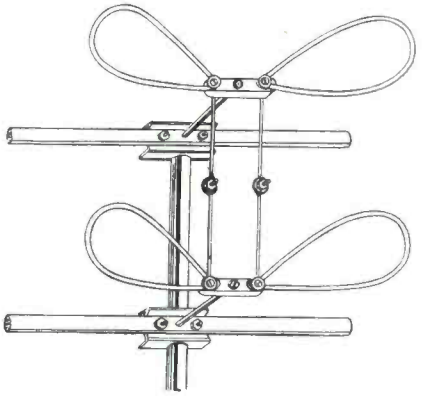
(*Below*)

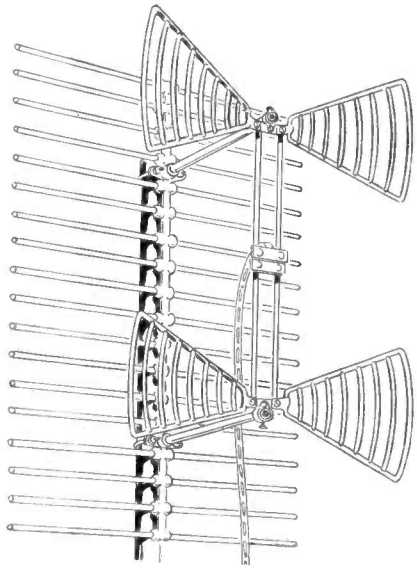
Broad-band *uhf* yagi produced in 3 models to cover channels 14 to 48, 27 to 62 and 47-83, respectively. Factory preassembled. Features eight ⅛" aluminum elements and a universal mast clamp. (*Models UHF-3A, UHF-3B and UHF-3C; Snyder Manufacturing Co., Philadelphia* 40, *Pa.*)



(*Below*)

All aluminum *uhf* antenna which measures 9½" x 10½" x 16½". (*Mi-Tee Ray; Fretco, Inc.*)





Fan type *uhf* antenna constructed from Dural and cast aluminum, with non-corrosive hardware. Available in single, dual and four-bay arrays. (*Universal; Tel-A-Ray Enterprises, Inc.*)

is said to permit the antennas to be used with only one transmission line.

Free-Space Terminals

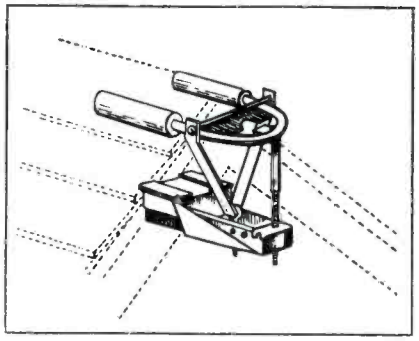
The terminals of this antenna are isolated in free space, which it is claimed serves to prevent accumulation of dirt and moisture. The filters also have *free space* terminals.

The stacked fan automatically operates on three separate principles for three different TV bands: On low-band *vhf* it is a conical antenna with parasitic reflector; on high band *vhf* it is a large diameter *V* antenna; and on *uhf* it is a triangular dipole, with the *vhf* elements functioning as a sheet reflector.

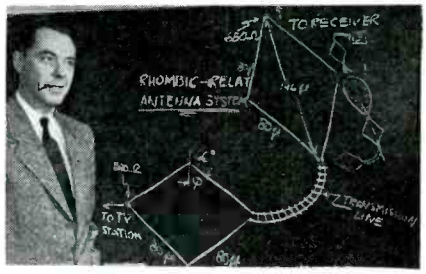
The *uhf* triangular dipole has stamped holes to reduce wind resistance and is vee'd forward at its extremities so that its entire length

(*Continued on page* 54)

AutoCoupler which permits operation of two or four *TV* receivers from a single antenna. Features interaction suppressing distribution, and is suitable for twin lead or open-wire line. May be used in conjunction with ITI AutoBoosters for multiple installations in secondary signal areas. (*IT-117A and 118A; Industrial Television, Inc., 369 Lexington Ave., Clifton, N. J.*)



Antenna clamp which does not require screws, or nails to mount. Can be applied to flat or peak edge of roof. Contact with roof cushioned in rubber. Clamp permits running of leadin under the overhang. (*Ed's Radio Service Station, 90 Lewis St., Lynn, Mass.*)



Dr. Richard C. Webb, senior research engineer with the DU Denver Research Institute, describing a double-rhombic TV antenna which he designed for valley areas. In a test an experimental model of the antenna, shaped like two giant rhombi more than 200′ long, was placed atop a high peak overlooking a TV receiving site far below. Antenna was found not only to provide a substantial signal feed to the plateau receiver, but reradiate signals to other antennas in the valley below. In constructing antenna about 1,000′ of No. 14 copper wire, 25 insulators and three resistors were used.

TV Antennas

(*Continued from page* 53)

is parallel at all times to the fan elements which function as a reflector.

UHF Open Wire Line

A closer-spaced open-wire transmission line[6] that is noted as being more suited for use at *uhf* than the more or less standard 1″ spaced line has also become available.

The line, using No. 18 solid copper wire, spaced ½″, utilizes polystyrene spacers. The closer spacing is claimed to restrict the field and minimize the dissipation losses and reflection *bumps* that occur at *uhf* when open-wire line is brought close to most any physical object.

UHF Distribution System

A line of *uhf* 2- and 4-set couplers, and matching transformers[7] has also been developed for home and commercial applications.

The 4-set couplers are designed to divide the *uhf* signal equally for distribution to four television sets or converters. Two 4-set couplers are being offered: one is designed to accept 300-ohm down lead and a second is for 72-ohm coax input.

The units are said to isolate the input signal of the television receivers or converters from each other and to preclude interaction.

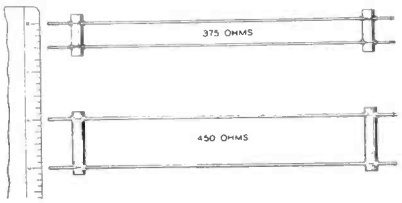
Bandwidth and Conicals

In a recent issue‡ it was noted that . . . "during field tests . . . ¼″ diameter solid elements in conical antennas reduced the bandwidth to such a point as to make it difficult to synchronize video and audio in some receivers."

According to *M. D. Ercolino* of *Telrex,* theoretical estimates that smaller diameter rods in conicals have absolutely no effect on bandwidth have been borne out in actual lab and field investigations, as well as in actual installations. Because the effective diameter of the conical dipole is related to the cross-section of the cone generated by the individual *splines,* or elements, the diameters of the *splines* themselves play no part in obtaining the over-all dimensions and hence, in determining bandwidth. Actually, in production, 7/32″ diameter rods have been used (which are the smallest that are still self-supporting), and experimentally, light gauge wires have been supported to form a cone section, without detecting any restricted bandwidth.

[6]Gonset. [7]Brach.
‡ Peters, Ralph G., *TV Antenna Digest,* SERVICE; November, 1952.

Indoor antenna which is said to feature a counterbalancing principle in the base; utilizes a lower center of gravity and a gradual increase in the weight of the base from the center to the sides. (*Neva Tip; Radio Merchandise Sales, Inc.,* 2016 *Bronxdale Ave., New York* 60, *N. Y.*)



Narrow-spaced open transmission lines for *uhf/vhf* applications (*above*) which it is said will supplant wider-spaced lines originally designed for the veryhigh bands only. (*Gonset*)

Rep Talk

HAROLD A. MOYER, formerly assistant sales manager of The Astatic Corp., has established a manufacturers rep office, P.O. Box 14, Haddonfield, N. J. Moyer has received appointments to represent most of the firms with which the late Ray Schottenberg was associated. . . . *William J. Doyle,* formerly vice president in charge of sales for Astatic, has established rep offices at 333 N. Michigan Blvd., Chicago, Ill. . . . *K. C. Burcaw and Co.* has moved to Suite 207, 22128 Grand River Ave., Detroit 19, Mich. William S. Lee has joined the organization. . . . New York chapter of the Reps held its Neda-Rep dinner dance recently at the Commodore Hotel. *Sidney S. Fleischman, Edward E. Kleeman* and *Lee Holtz* were elected associate members into the chapter. . . . Chicagoland chapter of the Reps recently installed its new officers: *Perc Ridley,* president; *Roy J. Magnuson,* vice president; *Karl Engle,* secretary; and *Robert Clark,* treasurer. . . . *Edwin A. Schulz Co.,* 721 Sherwood Dr., Indianapolis 30, Ind., has been named rep for Halldorson Transformer Co. in Indiana and Kentucky. . . . *John B. Skewis,* 2618 Oahu Ave., Hawaii, has been appointed Hawaiian rep for the Quietrole Co., 395 St. John St., Spartanburg, N. C. . . . *Frank A. Emmet Co.* are now reps in southern California and Arizona for Rea Magnet Wire Co., Lenz Electrical Manufacturing Co., Central Electronics and American TV and Radio Corp. . . . The *Gerald B. Miller Co.,* Hollywood, Calif., has been named rep for Kron-Hite Instrument Co. in California, Arizona, New Mexico and Nevada. . . . *Dan J. Connor Co.* has moved to larger quarters at 1346 Suburban Station Building, Philadelphia 3, Pa. . . . *Ralph Sellas* has been appointed direct factory sales rep for Alprodco, Inc. Sellas was formerly with Allied Radio and Hallicrafters. . . . *D. R. Bittan Co., Henry P. Segal Co., Inc., Frank W. Taylor Co.* and *Bittan-Boenecke Co.* (***east***); *Murphy and Cota* (***southeast***); *Arthur H. Baier and Co., Wright Engineering, KaDell Sales Associates, Gerald Wilson Sales, Bill Bartleson Co., Schryver Sales Co., Campion Sales Co.* and *Earl K. Moore Co.* (***midwest***), and *James J. Backer Co.* (***northwest***), have been appointed reps for the wire and cable division of Copperweld Steel Co. . . . *Wilson H. Zimmerman, Inc. has been* named upstate New York rep for Merit Coil and Transformer Corp. . . . *Stan Cluphf and Associates,* 4265 Sante Fe Drive, Littleton, Colo., has been appointed rep for Ram Electronics in Colorado, Utah, Wyoming, Montana and New Mexico. . . . *Mike Roth Sales Co.,* 4397 Groveland Rd., Cleveland 18, Ohio, has been named rep for Mark Simpson Manufacturing Co., in Ohio, West Virginia and western Maryland.

W. J. Doyle

W. H. Zimmerman

TV Parts . . . Accessories

C-B-C PICTURE TUBE BRIGHTENERS

Picture-tube brighteners, *Picboost Pacemaker,* that are said to restore brilliance to any size or type picture tube for long periods, have been announced by C-B-C Electronics Co. Inc., 1310 Callowhill St., Philadelphia, Pa. Models are claimed to relieve permanently heater - to - cathode shorts. Units are installed by plugging in.

Four models are available: models *1F* and *2F* restore tube brightness to dim picture tubes in parallel and series circuits respectively; models *3F* and *4F* relieve heater to cathode shorts only, in parallel and series circuits, respectively.

* * *

HALLDORSON DIRECT-DRIVE YOKES

Two 6000-volt direct-drive deflection yokes, *DF603* and *DF604,* with 30-mh horizontal inductance, have been announced by the Halldorson Transformer Co., 4500 North Ravenswood Ave., Chicago 40, Ill.

Vertical inductance of DF603 is 3.5 mh, while DF604 is 50 mh. Both yokes are supplied with 20" color-coded leads and networks.

* * *

EICO 4.5-MC CRYSTAL

A 4.5-mc crystal, model *C4.5,* to facilitate the alignment and servicing of TV sets having the new *if frequencies,* has been introduced by Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y.

Model is designed for use with most FM and TV oscillators and accommodates standard sockets and circuits.

DUMONT MOVABLE TABLE FOR PICTURE-TUBE MOUNTING

A movable table, *2602,* for mounting picture tubes in a tilted position, has been announced by the Instrument Division, Allen B. Du Mont Laboratories, Inc., 1500 Main Ave., Clifton, N. J.

Top of table can be tilted from the horizontal plane to angles up to 20°. Provision is also made to allow a picture tube to be placed at varying depths on the tilted top by means of an adjustable bar which supports the instrument. Table. which also contains a lower shelf and a large drawer in which tools, auxiliary instruments and components may be stored, rides on large, rubber-tired swivel casters, and is 19" wide, 31" deep and 36⅝" in height.

C-E TV TUNER CLEANER

A TV tuner cleaner, *Hush*, which, it is said, does not leave a powder residue when sprayed on, but rather a protective film, has been introduced by Chemical Electronic Engineering, Inc., 283 Main St., Matawan, N. J.

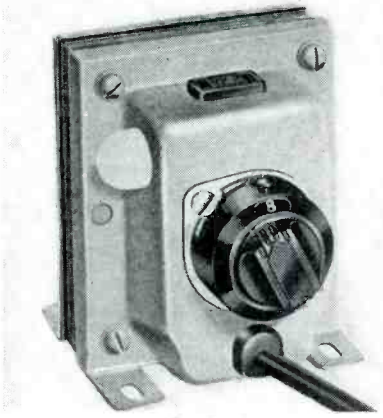
Cleaner is sprayed on by atomizer. Available in 8-ounce bottle and with spray atomizer.

* * *

CREST LINE VOLTAGE BOOSTER

A line voltage booster, *LVB-117*, that can be plugged in between the wall outlet and set, has been announced by Crest Laboratories Inc., 84-11 Rockaway Beach Blvd., Rockaway Beach, N. Y.

Booster features an overload cutout to protect against unsafe line voltage increases, and utilizes a multi-tap selector switch for exact selection of required boost, plus a visual indicator for precise determination of necessary boost.



* * *

INDUSTRIAL MAGNESIUM LADDERS

Magnesium ladders, that are said to be 33⅓% lighter than aluminum, have been introduced by Industrial Mail Order Corp., 131 W. 53rd St., New York 19, N. Y.

Available in straight ladders from 8′ to 20′, and in extension ladders from 20′ to 40′. Equipped with non-slip steps. Brochure sent on request.

* * *

INTERNATIONAL RECTIFIER HV SELENIUM RECTIFIERS

Two high-voltage selenium rectifiers, *V-75HF* and *V100HF*, designed to deliver 5 ma into a capacitive load at a *dc* output voltage of 1500 and 2000 volts respectively, have been developed by International Rectifier Corp., 152 E. Grand Ave., El Segundo, Calif.

STANCOR DEFLECTION YOKES

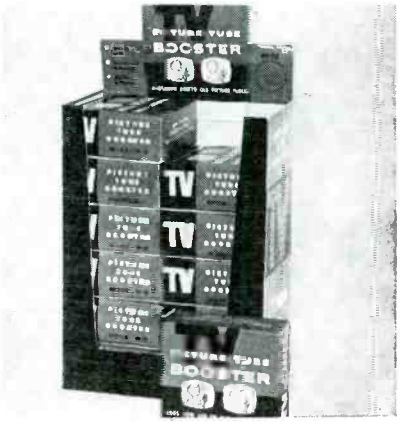
Four deflection yokes, *DY-1-8-9-10*, with or without leads and networks, have been introduced by the Standard Transformer Corp., 3580 Elston Ave., Chicago 18, Ill.

Deflection yokes provide maximum scanning of 53° (model DY-1) and 70° (DY-8-9-10).

* * *

WORKMAN TV COUNTER DISPLAY

Distribution of a counter display which contains 12 individualy boxed tube boosters has been announced by Workman TV, Inc., Teaneck, N. J.



CATALOGS, BULLETINS ETC.

United Catalog Publishers, 110 Lafayette St., New York 13, N. Y., has published a 76-page book, *Handi-Guide,* that catalogs radio and TV antenna systems, antennas and accessories, of 32 manufacturers.

A cross-indexed 1,220-page buying guide, *Radio's Master,* describing 80,000 items of electronic products, is also available on request.

* * *

David Bogen Co., Inc., 29 Ninth Ave., New York 14, N. Y., has prepared a catalog, *HC-1152,* describing a home intercom system that can employ six control stations and any number of remotes. Power supply features *standby* condition, which is said to minimize cost of operation and extend life of tubes and components.

* * *

Workshop Associates, The Gabriel Co., Endicott St., Norwood, Mass., has released a catalog sheet listing over 100 different types of parabolic reflectors.

* * *

Electro-Voice, Inc., Buchanan, Mich., has issued two 8-page bulletins, *185* and *189,* describing Klipsch-Licensed folded horn corner enclosures, 12-inch and 15-inch 2-way loudspeaker systems and sound equipment consoles. Detailed are coax speakers, high and low-frequency drivers, diffraction horns and crossovers, and a table showing changer, amplifier and tuner combinations.

* * *

Heath Co., Benton Harbor, Mich,. has published a 32-page catalog, detailing 49 kits of test-equipment, receivers, amplifiers and tuners. Featured are circuits of most of the items described, such as, push-pull 'scopes, *vtvm,* Q meter, etc.

* * *

Gee-Lar Manufacturing Co., 1330 10th Ave., Rockford, Ill., has prepared a 16-page catalog, *54,* covering radio and TV knobs, and noting replacements said to be available for all popular name-brand sets.

* * *

Hudson Radio and TV Corp., 48 W 48th St., New York 36, N. Y., has published a catalog of high-fidelity sound reproducing equipment. Described are standard makes of equipment available for a complete *hi-fi* system.

* * *

Microtran Co., an affiliate of Crest Labs, 84-11 Rockaway Beach Blvd., Rockaway Beach, N. Y., has released a transistor and standard-type transformer catalog.

* * *

Equipto, Division of Aurora Equipment Co., Aurora, Ill., has issued an 8-page catalog, *2020,* detailing work benches, racks, chassis stands, sales counters, heat-run racks, steel shelving and bins, truck and warm-up racks.

* * *

Penn Boiler and Burner Manufacturing Corp., Lancaster, Pa., has released a folder describing telescopic and standard towers.

* * *

Davis Electronics, 4313 West Magnolia Blvd., Burbank, Calif., has issued a catalog page with information on the Davis *vhf* all-channel antenna.

"Mrs. O'Toole, may I have that kit of JENSEN NEEDLES on the chair, please."

Clarostat Mfg. Co., Inc., Dover, N. H., has prepared catalog, *No. 52,* with expanded listings of carbon and wire-wound controls, including *Pick-A-Shaft* or field-inserted-shaft controls taking any one of 12 different shaft types, plus the non-metallic shaft and the high-voltage coupler. Offered also are data on miniaturized carbon and wire-wound controls, and outdoor-theatre L-pads.

* * *

Cornell-Dubilier Electric Corp., Plainfield, N. J., has published a six-page bulletin, *NB-147,* describing the *Demicon* line; a series of miniaturized, tubular metal-cased paper capacitors, hermetically sealed in metal cases, with glass-to-metal seal terminals, and available in seven mounting and container styles. Impregnants, tolerances and internal constructions are provided to meet the most popular applications encountered in present-day engineering practice.

* * *

Insuline Corp. of America, 36-02 35th Ave., Long Island City 1, N. Y., has prepared an 8-page publication, *Metal Goods Stock Calendar,* that indicates the availability status of racks, panels, chassis, etc. Calendar will be a monthly supplement to regular catalog.

* * *

Sarkes Tarzian, Inc., 415 N. College Ave., Bloomington, Ind., has released a 4-page folder, *B-1,* covering *embedded selenium rectifiers,* which are designed for use, where because of environmental conditions or extreme altitudes, standard convection cooled-painted rectifiers are not suitable.

* * *

Terminal Radio Corp., 85 Cortland St., New York 7, N. Y., has published a 132-page audio equipment catalog.

Ser-Cuits

(*Continued from page* 35)

range of 3 cycles to 30 kc. This type of oscillator has been found to have good stability at high frequencies, and extremely fast retrace; the latter serves to reduce distortion of the leading edges of waveforms, particularly on those having steep fronts. The 12AU7 generates a sawtooth voltage by regenerative amplifier action, with a 1,200-ohm common cathode resistor providing a feedback path.

An important feature of the sync system is a *phase* control, a 100,000-ohm pot, and a 0.1-mfd capacitor, connected to a 12.6-volt, center-tapped winding in the power transformer. When this voltage is fed to the input of the horizontal amplifier, it provides a sinusoidal sweep for the alignment of receiver circuits.

Resistance Meter

In Fig. 2 (p. 34) appears the circuit of another interesting type of instrument[2] developed for checking both leakage and continuity of components. It can be used to determine the insulation resistance of transformer windings, capacitors, electrical windings, and also measure the ohmic value of resistor and windings.

The circuit consists of two dual-triode tubes, 12AY7 and 12AT7. One-half of the 12AY7 is the input circuit, and the other half is used for *dc* balancing of an infinity setting. The 12AY7 feeds the 12AT7, which powers a 100-microampere meter. The 12AY7 is operated with 20 microamps of plate current to minimize grid current in the input circuit. With a maximum range resistance of 400 megohms in the grid of the 12AY7,, the effect of grid current is negligible, and resetting of the infinity control is not necessary when switching to a 100,000 range.

Hoffman RF Tuners

Two types of tuners are used in Hoffman chassis; RF-9, 10, 11, 13. One (RF-9) is a pentode-type tuner wired for series filaments, whereas another (RF-10) is a cascode type.

RF-13 is also a cascode-type tuner similar to RF-10 in electrical aspects, whereas, RF-11 (Fig. 3, p. 35) also a cascode type, but of 41-mc design, is similar to RF-8.

The tuner also features a trap, C_{23} and L_8, which can be tuned for interference occurring between 40 and 47 mc.

[2]Model C-3, Southwestern Industrial Electronic Co.

Servicing Helps

by M. A. MARWELL

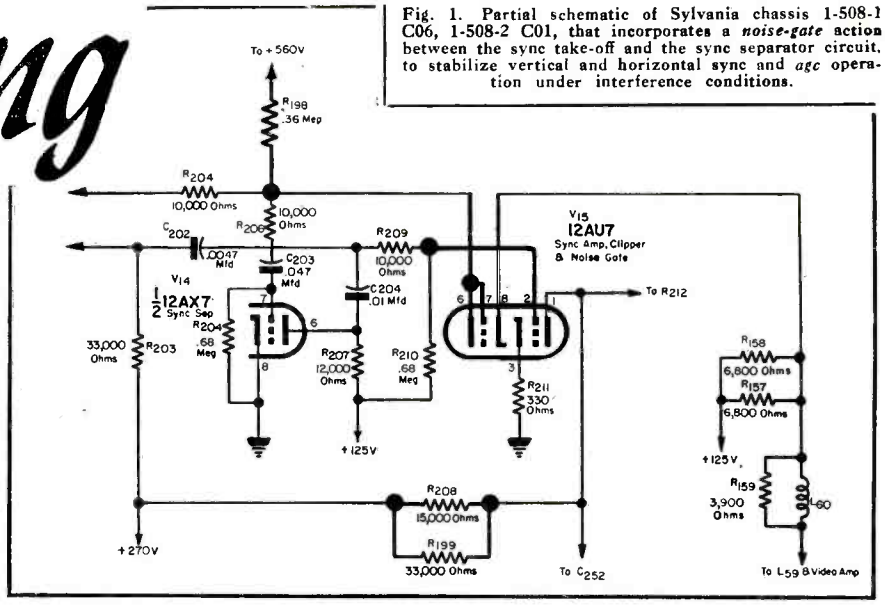


Fig. 1. Partial schematic of Sylvania chassis 1-508-1 C06, 1-508-2 C01, that incorporates a *noise-gate* action between the sync take-off and the sync separator circuit, to stabilize vertical and horizontal sync and *agc* operation under interference conditions.

Solutions to Corona Problems in HV Sections of Large Picture-Tube Chassis ...Vertical-Horizontal Sync Stabilization...Germanium Crystal Servicing Notes

LARGER PICTURE TUBES usually operate on high voltages, which increase the corona problem; bad corona can cause a fire in the *hv section* of the TV set.

Therefore, precautions should be taken, when servicing a big-picture tube chassis.*

Lead Dress

If it becomes necessary to make repairs or replacements around the *hv* compartment, all lead dressing must be checked carefully. Any low voltage lead or any lead near ground potential dressed too close to a *hv* point can cause corona spray, or even an arc to be drawn from the high voltage point; this can eventually start insulation burning.

Solder Points

Any soldering completed on any part of the *hv* circuit must be done with great care. No sharp points of solder should be left protruding, but the joint should be smoothly rounded off. In addition, if the area was previously covered with *hv* insulating cement or wax, this coating should be restored upon completion of repairs.[1]

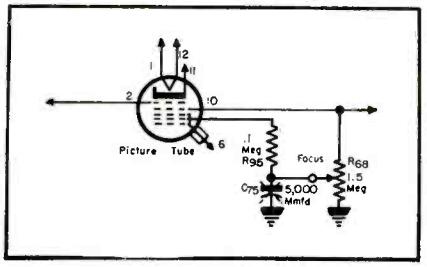
In attaching wires to socket terminals, transformer terminals, etc., the wires must not be left sticking up in a sharp point, but be buried completely in the solder, which seals the connection.

In general, no attempt should be made to repair *hv* transformers by splicing breaks in windings, etc., because this cannot be done successfully in the field without serious hazard of arcing and corona later on. It is better to replace a defective transformer with a new one.

When repairs are completed, a careful inspection of the *hv* compartment and leads in a darkened room, with the set in operation, is well worthwhile because corona, which might not be visible in bright light, will show up in a darkened room. The smell of ozone should always be investigated and a set which gives off this characteristic indication of corona should not be released until the source of corona has been found and eliminated.

When a set gives an audible indication of intermittent arcing, which is not sustained enough to cause either the ozone smell or burning of insulation, an investigation should also be made immediately. The source should be found and eliminated because the condition may get worse and cause a fire when the set is reinstalled in the customer's home.

Fig. 2. Change in picture tube circuit of Motorola TS-501B-02 to add protection to focus-control potentiometer: The 5000-mmfd capacitor has been deleted and a 100,000-ohm resistor added between the focus control arm and the blue lead to the picture tube focusing anode.



*Based on a report in Motorola service notes.
[1]Motorola 11M490397 wax, and (red) *hv* insulating coating; Motorola 11M490423.

Vertical-Horizontal Sync Stabilization

Noise-gate action between the sync take-off and sync separator circuit, that serves to stabilize vertical and horizontal sync and *agc* operation under interference conditions, has been added to Sylvania chassis 1-508-1 CO6 and 1-508-2 CO1.

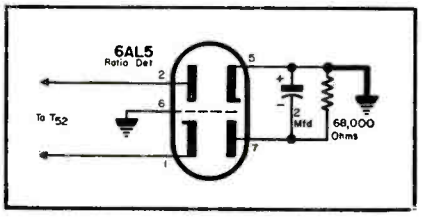
To accomplish this improvement, the following component changes have been made (Fig. 1): The .047-mfd capacitor, C_{203}, has been changed from a 200 to a 400-volt capacitor. The 10,000-ohm resistor, R_{208}, has been replaced by a 15,000-ohm resistor, and a 33,000-ohm resistor, R_{199}, added and connected in parallel. Finally, a 360,000-ohm resistor, R_{198}, has been added and connected between +560 volts and the 12AX7 sync separator and 12AU7 sync amp clipper and noise gate.

Sync-Stability Improvement

An improvement in over-all sync stability under the presence of impulse-

(*Continued on page 62*)

Fig. 3. Ratio-detector circuit of Sylvania 1-508-1 featuring connection of 2-mfd capacitor and 68,000-ohm resistor in cathode-plate of 6AL5 to eliminate 4.5-mc harmonic interference in picture.



Servicing Helps

(*Continued from page* 60)

type noise interference in *fringe* areas can be accomplished in Arvin chassis[1] by lowering the screen voltage on the 6AC7 video amplifier, V_{10}, from 110 to 60 volts. Although this change may introduce a slight decrease in picture contrast, it is reported that this should not prove to be detrimental on a comparison basis.

Additional parts needed include a 4-mfd, 300 *v* electrolytic and a 91,000-ohm resistor.

To make the change, the orange wire from pin *6* of the 6AC7, now going to the 110-*v* terminal strip lug is removed and the lead rerouted to blank lug of adjacent terminal strip, one inch away. Then the 91,000-ohm resistor is added between old lug (110-*v* supply lug) and new lug. The 4-mfd capacitor is now connected between new lug and chassis ground lug connected to pin 7 of the 12AU7 sync amp.

Germanium Crystal Detectors

Several different types and makes of crystals are used in RCA-TV chassis, such as IN60, IN64 and CK706. These crystals have slightly different characteristics and may not be directly interchangeable. In production, these differences are taken care of by varying the value of R_{154} which is located in *T109*. This resistor normally has a 10,000-ohm value. However, to take care of different crystals, this resistor may vary from 5,600 to 10,000 ohms.

[1]TE 319, 319-1, 330, 330-1, 2, and 3, 331-3, 332, 332-1.

If the crystal is to be replaced, the same make and type should be used. However, if desired, the entire *T109* transformer and matching resistor may be installed. In any event, if *T109* or the crystal detector (*CR101*) is replaced, the overall response should be checked.

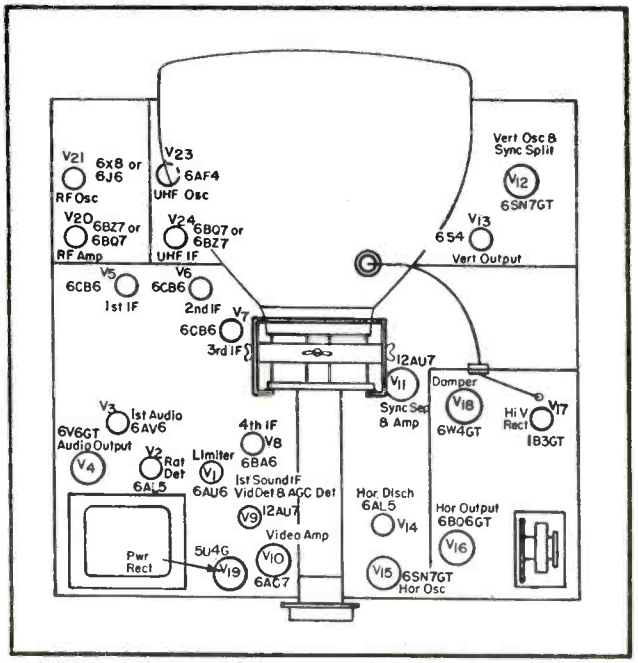


Fig. 4. Chassis layout of Arvin 6000 series; TE 319, 330, 331, 332. In checking this chassis for possible defective tubes, the following *symptom-change* procedure can be followed: No sound or pix, and screen lighted; change V_5, V_6, V_7, V_8, V_9, V_{20}, V_{21}, and V_{23} and 24 . . . in *uhf*, no sound, pix okeh; change V_1, V_2, V_3, V_4 . . . no sound, no light and tube filament lights; change V_{19} . . . no pix, sound okeh, screen lighted; change V_{10} . . . no picture, sound okeh, no light; change V_{15}, V_{16}, V_{17}, V_{18} . . . no picture, sound okeh and one horizontal line on screen; change V_{12}, V_{13} . . . no horizontal sync and sound okeh; change V_{14} . . . no horizontal or vertical sync and sound okeh; change V_{11}.

In replacing a crystal, care should be taken to see that it is connected in the proper polarity. Since germanium crystals are marked differently than selenium rectifiers, confusion may result. Selenium rectifiers are marked + and − to show the polarity of the *dc* output voltage. Germanium crystals are marked to show the polarity of voltage that must be applied to obtain maximum current flow. The cathode end of a germanium crystal may be coded with green paint or marked −. The anode end may not be coded or may be coded +. In schematic symbols, the anode is shown as an arrow and the cathode as a flat bar. In *T109*, the anode (+) end is connected to terminal *A* and the cathode (−) end to terminal *D*.

As a protection against damage to the crystal detector, a 220-ohm, ½-watt resistor has been added in series with the screen of the 6AG7 video amplifier. This resistor is designated as R_{174} in both 17 and 21-inch receivers, and is carried under stock number *503122*.

UHF Tubes

(*Continued from page 25*)

and causes a current to flow in the grid in phase with the applied signal voltage. This in-phase current represents a resistive loading of the tube-input circuit. At *uhf* the tube-input loading becomes quite low and it is important to match this load carefully to obtain maximum gain.

At *uhf* it is not possible to use multigrid tubes because of the small spacings required and thus we must depend on the old reliable triode. There is only one difficulty in using triodes at high frequencies; it is extremely difficult to neutralize and prevent oscillation. To avoid such oscillation, the grounded-grid amplifier has been developed; this circuit requires no neutralization. As its name implies, the grid is grounded and acts as a shield between the cathode and plate circuits. This circuit has been found to be quite stable when the plate and cathode circuits are adequately shielded. A typical 6AJ4 grounded grid-amplifier appears in Fig. 6, p. 25. It will be noted that the input is directly connected to a 50 to 75-ohm coax cable from the antenna, the cathode being fed through an *rf* choke and a bias resistor. The grid is directly grounded to the chassis and the plate circuit is series tuned to the desired frequency by means of inductor L_2 and a .5 to 5-mmfd output capacitor. The output is usually coupled to a mixer crystal for conversion to *if*.

ASSOCIATIONS

FRSAP

AT ITS ANNUAL PRESENTATION-LUNCHEON in Harrisburg, Pa., the Federation of Radio Servicemen's Associations of Pennsylvania met with over 65 delegates representing 20 technicians' and service dealers' associations from surrounding states to honor General Electric, recipient of the '53 Federation award . . . "for their initiative in providing a public relations program in behalf of the independent TV technician."

The award, tendered by Bert Bregenzer, head delegate of the Pittsburgh Radio Servicemen's Association to FRSAP, was received by *John T. Thompson,* sales manager of the company's replacement tube department, who outlined the results of the '52 public relations program and the forthcoming '53 program designed to help the servicing industry in both public acceptance and merchandising of their commodity, *service.*

Gordon E. Burns, G. E. field sales manager, presented on behalf of *J. M. Lang,* general manager of the G. E. tube department, a review of the future in servicing.

Noting the enviable record set by TV Service Men over the past seven years, he said that the mastering of service problems and demands of an entirely new industry, which has grown to encompass 20-million customers, represents a feat to which each Service Man can point with pride.

Surveying the future then, the tube specialist declared that TV Service Men face a battle, a battle to keep abreast of a host of new technological developments. For, he said, this TV industry is still an infant when it is judged by its potential. The new bands, upstairs, for instance, will demand the mastering of special installation problems, new tubes, new circuits, new tuner units, new antennas. For the service industry, it was noted, it will mean the training of still more Service Men to do the vital work of servicing in cities and towns which will have television for the first time because of *uhf.*

In cities which already have television, customers will be calling for advice as to how best to add *uhf* reception to their old sets. Service Men will have to be ready with this information, it was emphasized.

To gauge the importance of these new expanded frequencies on the nation's television scene, some striking figures were cited: "At the present time there are about 120 TV stations on the air. During the next five years, about 700 new stations are expected to go on the air, of which 350 will operate on the ultrahighs. In other words, in a shorter time than it has taken us to build and master our present TV system there will be nearly six times as many new stations in operation. There will be nearly three times as many *uhf* stations as there are vhf stations on the air today."

Describing the portrait of the future as a picture of hard work, perseverance, and initiative, the G. E. rep said that it must be evident that this hard work will have very real and valuable compensations. "For with each new step forward in television development, whether it be *uhf,* color television, transistors, or whatever, the service industry will prosper. Each step forward means an additional incentive for the public to buy TV and everyone will agree that the service industry must consider each new set as a potential customer, and each customer represents an added measure of responsibility for the service industry. These new responsibilities, posed by technological advances already under way, offer the greatest challenge for tomorrow."

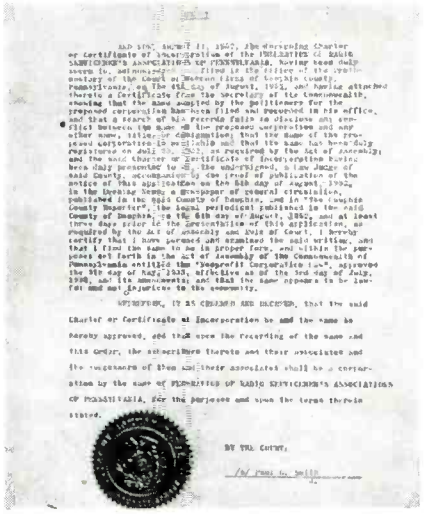
PRSMA

SAMUEL BRENNER has been elected president of the Philadelphia Radio Service Men's Association.

Others elected and installed recently were: *William Poole,* vice president; *Stan Myers,* treasurer; *Charles McMeen,*

(*Continued on page* 66)

View of plaque awarded by FRSAP.



Charter certifying incorporation (non-profit) of FRSAP awarded by the Commonwealth of Pennsylvania, and officially presented to association at award-luncheon.

J. M. Lang, general manager of G.E. tube department, whose talk on the future of servicing was featured at the FRSAP meeting.

John T. Thompson, sales manager of the G.E. replacement tube department (second from right), receiving congratulations, on receipt of FRSAP award, from *Al Coumont,* RTMA service coordinator. Looking on, left to right: *Bert Bregenzer* of the Pittsburgh RSA who made the official presentation during the luncheon; *ye editor* who offered an analysis of *uhf,* color and transistor servicing problems and solutions; *Dave Krantz,* FRSAP chairman who moderated the luncheon-meeting and announced his retirement from the chairmanship; and *Gordon E. Burns* of G.E., who presented, on behalf of J. M. Lang, an address on the future of servicing.

Among those at the luncheon-meeting. In foreground, from left to right: *Mark L. Houtz,* Mid-State RSMA; *Art Rhine,* ARTSNY, TRSD and TCA; *John Hubbard; Max Liebowitz,* ARTSNY and NETSDA; *Hank Govan,* LRTA; *Ray Rogers,* LRTA; *Jack Ornstein,* ARTSNY; and *Vance Beachley,* Mid-State RSMA. In rear, from left to right: *Fred H. Miller,* G.E. field service engineer; *R. C. Spangle* and *H. Darlington,* Raub Supply Co.; *H. B. Rhodes, G. Palmer Murphy, Saul Smith* and *Aaron Edelman,* R-TSM, N. J.; and *John G. Rader.*

FAR BETTER RECEPTION

IN EVERY LOCATION

with Sensational New

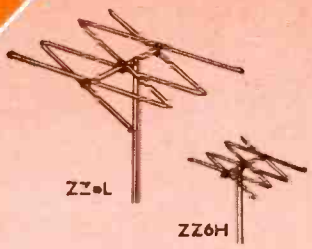
TRIO ZIG-ZAG

Patent Pending

TV ANTENNAS

SUBURBAN MODELS

Models ZZ4A and ZZ6A give you all-channel (2 thru 13) reception in ONE SINGLE BAY ANTENNA. The Model ZZ4A has excellent gain and is designed for suburban areas. Model ZZ6A has even greater gain and provides excellent all-channel reception in near fringe areas.



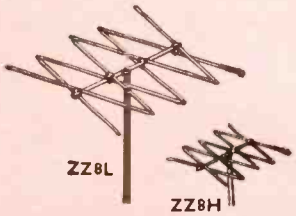
NEAR FRINGE MODELS

For near fringe area reception, the Models ZZ6L and ZZ6H are recommended. Model ZZ6L covers Channels 2 thru 6. Model ZZ6H is for Channels 7 thru 13. Both antennas offer high gain with patterns and front-to-back ratios similar to out-of-channel yagis.

From ultra-ultra fringe to metropolitan areas, the sensational new TRIO ZIG-ZAG TV Antennas are providing clear, enjoyable TV pictures.

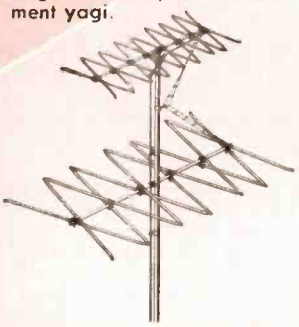
Enthusiastic reports are pouring in from across the nation, testifying to the high efficiency of the new, exclusive TRIO ZIG-ZAG TV Antenna design.

Yes, results — not mere claims — have made the TRIO ZIG-ZAG America's most wanted TV antenna!

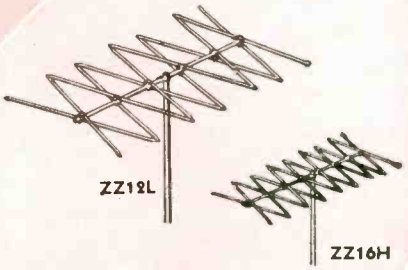


FRINGE MODELS

Models ZZ3L and ZZ8H were designed for normal fringe area reception and provide clear, snow-free pictures. Forward lobe patterns and front-to-back ratios are similar to a good single channel, multi-element yagi.



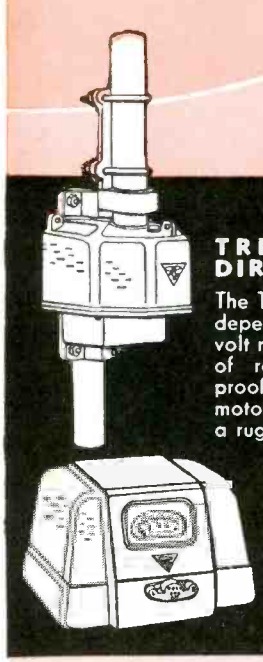
ZZ12L and ZZ16H are stacked for all VHF Channel Reception



ULTRA FRINGE MODELS

The extremely high gains of the ZZ12L and the ZZ16H models provide unequalled reception in ultra-fringe areas. Model ZZ12L covers Channels 2 thru 6 and Model ZZ16H, Channels 7 thru 13. These two models when stacked, are fed with only one 300 ohm line and provide ALL VHF CHANNEL RECEPTION. Line match is excellent and front-to-back ratios are unusually high.

* *To provide even greater strength, TRIO Antennas now have stamped steel element clamps.*



TRIO ROTATOR AND DIRECTION INDICATOR

The TRIO Rotator is America's most dependable — has two powerful 24-volt motors — one for each direction of rotation. Absolutely weatherproof, permanently lubricated. All motors, shafts and gears mounted on a rugged, one-piece casting for true alignment, strength and longer life. Every TRIO Rotator fully guaranteed for two years! Beautiful Direction Indicator has "finger tip" control — no need to hold knob for rotation. A touch of the finger starts it — a touch stops it.

TRIO

TRIO MANUFACTURING COMPANY • GRIGGSVILLE, ILLINOIS

Association News

(*Continued from page 64*)

recording secretary; and *Fred Cohen*, corresponding secretary.

Martin Long, Samuel Smiley, Wade Lockey, James Daly and *William Humes* were elected directors.

RTA, San Antonio, Texas

AL NIEHAUS has been elected prexy of the San Antonio Radio and TV Association, Inc. Others elected were: *A. B. O'Keefe*, vice prexy; *Forrest L. Baker*, secretary, and *Tom Boyd*, treasurer.

According to a memo from Forrest Baker, the association, formed in '49, received its state charter in June, '51. Shortly after, an emblem was designed and adopted. It is now displayed on shop windows, on a code of ethics, on cars and trucks of members and on all advertising of the association, as well as on membership cards and certificates and identification cards of members and their employees.

In the beginning most of the group's meetings were purely of a business nature, but the need for technical sessions was soon realized, and it was decided to have regular technical meetings twice each month. Technical sessions were so successful that currently a TV course, developed by Philco, is being given.

For the benefit of members many ad aids are available: Posters bearing the emblem of the association and featuring the code of ethics; cuts of the emblem in several sizes suitable for cards, envelopes, letterhead and newspaper advertisements; two color cuts; decals of the emblem in color approximately the size of a ten and twenty-one-inch picture tube, respectively, and folders entitled *"Interesting facts about your TV set,"* for customer distribution.

The group was instrumental in organizing a state organization in '51 under the name of Texas Electronics Association. Regular meetings are held four times a year at Austin, Texas. Baker of Radio Service Company is now TEA president. Present members are Dallas, Ft. Worth, Austin, Houston and San Antonio associations.

TEN YEARS AGO

BANDSWITCH SERVICING was analyzed by *Alfred A. Ghirardi*, detailing constructional features of the multielement, switches, cleansing of contacts and section replacements. . . . Industrial sound-system installations for use in paging, transmitting fire and time signals, and broadcasting music in war plants, were reviewed. . . . Formation of the RCA Service Co. was announced. *E. C. Cahill* was named president of the company, and *W. L. Jones*, vice president. . . . *Charles Golenpaul*, Aerovox sales manager, reported on the parts—jobber wartime service to the radio industry. . . . *Ed DeNike* was named National Union public relations director. . . . *Lt. Dahl Mack*, former NU distributor in Scranton, Pa., was reported to be studying at the Naval Training School. . . . *Art Akeroyd* was assigned to special work in the Raytheon special equipment division. . . . *Russ Lund* succeeded Akeroyd as replacement sales manager. . . . *Henry Johnson* became an ensign in the U. S. Navy.

Tube News

(*Continued from page* 38)

val drift (in days) indicated changes of about 3 parts in 10^9 per 24 hours. These figures were found to be comparable to those obtained from vacuum tube standard oscillators, particularly at the time of their initial installation. Fortunately, frequency drift in the quartz-crystal unit of a conventional type standard oscillator normally decreases with age. Because the transistor oscillator has just been developed, no data exist in regard to long-time stability in terms of years.

Tests were conducted on the new transistor oscillator with the complete unit operating at 0° *C*. Reasonable temperature stability was achieved by merely placing the oscillator in a flask containing crushed clear ice. Among the results was an indication that the reduced temperatures were responsible for reducing drift and increasing the *Q* of the quartz crystal unit. Thus, it now becomes possible to make available a readily-portable continuously-oscillating frequency standard that may be carried to all parts of the world.[3]

FM/TV Triode-Pentode

A miniature nine-pin, triode-pentode (6U8), designed primarily for service in FM and TV receivers as an oscillator mixer, has been announced.[4]

Both sections of the tube are electrically independent and shielded.

The pentode section is said to provide substantial gain with a low local oscillator voltage which minimizes oscillator radiation. The pentode section may also be used as an *if* amplifier, video amplifier, sound limiter or sync separator. The triode can be used, too, as a horizontal or vertical oscillator, or sync clipper.

12-Volt Auto Tube

The advent of 12-v auto power system has prompted the development of the 12V6GT[5], a beam power tube of the heater-cathode type intended primarily for use in the output amplifier of auto receivers.

The application of directed electron beam principles in the design of this tube was said to make it capable of producing relatively high power output with high power sensitivity. For example, a single tube operated with a plate and grid-2 voltage of 250 can deliver a maximum-signal power output of 4.5 watts with a driving voltage of about 12 volts.

[3]Griffin, J. P., *High stability quartz crystal unit for frequency standards*, Bell Lab Record *30*; No. 11, 1952. [4]Sylvania Electric. [5]RCA.

One-Man TV Shop

(*Continued from page* 20)

tion on test dolly, and for use as unsulating spacers, etc.

On another shelf, provision has been made for a power supply for a 'scope, which normally might be included within a 'scope. Other instruments mounted on this shelf are a square-wave generator, *vtvm*, a fixed-frequency signal generator, and a second signal generator specifically for TV *if*'s. The main deck has the 'scope and a high-impedance 'scope probe, hung on a hook. A sweep-signal generator also sits here. Various useful hand tools were hung on a corner post: two small wrenches, two long channel-selector frequency-adjusting tools, a small rubber mallet (for tapping tubes, etc.), and also knobs for channel selector shafts. Below these tools a small wire bracket (like a midget towel rack) was placed to accommodate a number of useful servicing auxiliaries including a shortened tube shield for coupling signals into the mixer stage, capacitors and resistors on clips, a short test lead with clips at both ends, and a crystal diode. An adjustable spotlight has also been mounted on the corner post. The most used hand tools, such as ¼" spintite pliers and screwdrivers were hung on the front of the bench, where they would be most readily available to an operator when seated. A 6" strip along the front of the bench also includes a convenience outlet for soldering gun, hung on a hook just below its outlet from a wire loop fastened under both ends of the rear assembly bolt. Another convenience outlet for the receiver under test was also included; this is isolated from the power wiring system by an isolation transformer on the lower shelf. A switch and variac were connected so as to control only this isolated outlet and thus provide the Service Man with a convenient means of controlling the primary power voltage to the receiver under test. The voltage at this outlet can be read on a 0-150 voltmeter and the primary current drawn by the set under test read on a 0-5 ammeter, both meters being mounted on small bakelite panels fastened to the bench. The ammeter panel includes a shunting switch to short the meter except when a measurement is desired. At the left front of the test bench a test speaker was mounted on a plywood panel. In the upper right-hand corner of this panel, have been included terminals and controls used with the test speaker and audio amplifier behind the speaker on the lower shelf. The assembly at this point includes an input connection, gain control and primary power switch for the audio amplifier, speaker input terminals and a three-position switch to allow the speaker to be connected to either the amplifier, receiver voice coil, or through a plate transformer to an audio output tube. On the top right-hand side of the bench, another wire bracket was placed, on which can be hung longer clip leads, a high-voltage probe, and a crystal-detector 'scope probe. Lower down toward the front, still another wire basket was placed for shorter test leads and test pots with clip-lead corrections.

The chassis of each piece of test equipment, except the *vtvm*, can be connected together at a single point, and in turn connected to a water-pipe ground. A heavy clip lead from this common point serves to ground the chassis under test. At the rear of the test bench it was decided to install a heavy-duty multiple outlet power box into which each piece of test equipment can be plugged and which can also be connected by heavy line cord to the shop power circuit. The circuit, feeding the test bench, was wired through a power switch box into which a 110-volt, 7.5-watt red pilot lamp was thus connected, so that the lamp serves an

indication of power on the test bench, and thus all power to the test bench can be controlled by a single switch. The antenna transmission line, which drops from the ceiling, can be kept completely out of the way when not in use by looping it over a hook fastened to a ceiling beam. The test bench has been equipped with dust covers to reduce the collection of dust during periods of disuse. These covers are simply pieces of light plastic cloth fastened under small wood strips on top of the front, back, and each side of the bench, and with a small strip of wood fastened along the bottom edge. When the bench is in use the dust covers can be rolled up on the bottom wooden strips and allowed to rest on top of the bench.

In actual servicing work, the setup has been found to be ideal. The absence of haywire during servicing work has been a source of real satisfaction. To summarize, the bench-dolly arrangement has been found to provide a convenient method of handling relatively cumbersome TV chassis with a minimum amount of lifting, allowing the operator to do most work in a comfortable sitting position; a compact grouping of test equipment in a permanent setup—since test equipment does not have to be moved around on the test bench; an orderly arrangement and convenient access to hand tools, test leads, probes, etc.; built-in power wiring for test equipment and soldering gun, and accurately controlled voltage and power circuit isolation for the receiver under test; permanent test equipment grounding with convenient means for grounding the chassis under test; an accessible, yet out-of-the-way antenna transmission line connection, and an accessible test speaker and audio amplifier.

It will be noted that limited incandescent lighting was used. This has not been completely satisfactory; a flashlight must often be used for close work within a chassis. However, such lighting was selected, in lieu of fluorescent lights, because it was noise free. It was felt that the somewhat inferior, incandescent lighting would eliminate the need for shielding and isolation required by fluorescent fixtures. Further shortcomings are evident in the makeshift dust covers which might be tedious to roll up, and also in the lack of a signal source with a low-level calibrated output, a device which would be particularly advantageous in weak-signal areas. In a shop with a higher ceiling, a somewhat different arrangement would be required for the antenna transmission-line connection. Inciden-

(*Continued on page 70*)

(Continued from page 69)

tally, it has been found convenient to maintain a small stock of commonly used parts in a small cabinet immediately adjacent to the operator's position, but out of the line of movement of the dolly.

The equipment setup was developed for a one-man shop and has proved well suited to this operation. However, the development of appropriate procedures in conjunction with the setup, would make it directly applicable to a larger operation. One possible method of operation would be to have several of the test equipment benches each manned by experienced Service Men with 5 or 6 dollies provided for each test position. Apprentice-type Service Men could then put chassis for repair on the dollies and take them off when repaired, obtain proper service notes and previous service information, put chassis in cabinets and make final adjustments as required, keep repair parts available and act as assistants to test-bench operators.

In this way the test equipment would be utilized to its maximum capabilities and the veteran Service Men would be kept busy doing the tough repair jobs instead of spending much time on the less technical aspects of a service operation, as is so often done in the smaller service shops. Indeed, a shop built around two test equipment benches and a dozen or so dollies with adequate back-up assistance for the test bench operators could make an important place for itself in any TV community.

Auto Antennas

(Continued from page 23)

frequency; consequently, these measurements must be made at several frequencies in the range.

Fig. 2*a* shows the connections used in measuring the effective height of the antenna. In this instance, the receiver is first connected to the antenna, a suitable station tuned in, and the receiver sensitivity control adjusted to obtain a substantial reading on the receiver output meter. The receiver is then switched from the antenna and connected to the signal generator through the dummy antenna which has been adjusted to the *same apparent capacity* and *rf resistance* by the procedure outlined for Fig. 1. The signal generator is then set to the same frequency as the station and its output adjusted until the receiver indicating meter provides the same deflection as before. The voltage which the

signal generator is introduciing into the circuit is read directly from its output dials and, multiplied by ten, is the same as the voltage which the antenna introduced, since it produced the same meter reading.

It should be noted that this method depends on the dummy antenna having the same constants as the actual antenna, so that the voltage stepup occurring in the input circuit will be the same for the station as for the signal generator. The effective height of the antenna can then be found by the following formula:

Effective height (meters) = Microvolts introduced in antenna/Field strength of station (microvolts per meter)

A slightly simplified arrangement used for measuring the field strength of a station is shown in Fig. 3*a*. Here, the output terminals of the signal generator are connected through a voltage divider to a 3.3-ohm resistor in series with the loop. Actually, the loop is tuned by an intermediate circuit, but this detail has been omitted and the loop shown connected directly to the first grid of the receiver.

With the signal generator output set at zero, the desired station is tuned in on the receiver and the loop rotated for maximum signal. The receiver sensitivity control is then adjusted to give a suitable indication on the receiver output meter, following which the loop is rotated for minimum signal.

The signal generator is then set to the same frequency as the station and its output adjusted to give the same meter reading as the station gave when the loop was in its maximum position.

Since the signal generator and the station introduce voltage into the same circuit, the voltage stepup, due to the *Q* of the loop circuit, is the same for both, and the reading of the signal generator output is equivalent to the signal voltage. The field strength of the station can then be found from:

Field strength (microvolts per meter) = Microvolts introduced in loop circuit/ Effective height of loop (in meters)

The effective height of the loop can be calculated from its physical construction and varies with frequency. A calibration curve supplies the effective height over the frequency range covered by this instrument.

Therefore, with a knowledge of the microvolts introduced into the loop circuit, as read by equivalent signal generator microvolts to produce the same output, and the figure for effective height at the frequency of the signal as obtained from the calibration curve, the field-strength of the station can readily be obtained from the foregoing formula.

TV/Radio Protection

(*Continued from page 29*)

of which is varied with the rating to obtain required mechanical strength with the desired electrical characteristics. As shown in Figure 4 (p. 28), fuses larger than 3 amperes use a zinc alloy fuse link, die cut to the required dimensions.

Time Lag

These fast acting fuses have little time-lag at the higher overloads. To illustrate, a one-ampere fast-acting fuse will blow at 300% load, or 3 amperes, in approximately .1 second. Any harmless transient load would cause the fuse to operate if it is continued for this length of time. However, if the long time-lag fuse were used this would hold the 3-ampere load for 8 seconds which would be ample for any harmless transient. If the overload were caused by some faulty condition, the fuse would blow to clear the circuit after the 8 seconds had elapsed.

Such long time-lag fuses have a fuse link which operates only on the high overloads or short-circuits and have a thermal cutout which operates at the lower overloads to give the required time-lag. These fuses are furnished in the ¼ x 1¼" dimensions. As shown in Figure 5 (p. 29) three types of construction are employed depending upon the ampere rating.

The extremely small sizes use a carbon resistor, soldered to the short-circuiting wire with a low melting fusible alloy. The other end of the carbon resister is attached to the ferrule by means of a spring. Current passing through the carbon resistor generates heat in it. Under normal loads the heat generated is not sufficient to raise the fusible alloy's temperature to its softening point. However, if an overload is continued long enough, the heat generated in the resistor elevates the temperature of the fusible alloy to its softening point, allowing the spring to pull the resistor away from the short-circuiting wire, so opening the circuit.

On the larger sizes a heat coil is wound on a copper support to which the short-circuiting wire is soldered with the low melting fusible alloy. The copper support is attached to the other ferrule by means of a spring. Again the operation is the same. Current flowing through the heat coil generates heat in it which on overloads causes the fusible alloy to soften, permitting the spring to pull the assembly away from the short-circuiting wire, opening the circuit. On the high overloads

the short-circuiting wire blows instantly.

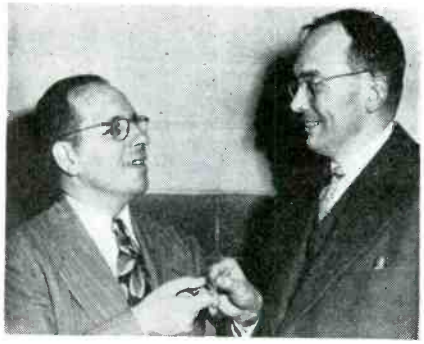
On the largest glass tube dual-element slow-blowing fuses[1] the heat coil is replaced by a flat heater which again generates heat when current flows through it melting the fusible alloy on overloads, opening the circuit. In every case the time-lag is obtained at the lower overloads because it takes an appreciable time to heat up the assembly to the softening point of the fusible alloy before the circuit is broken. However, instantaneous action is obtained on the high overloads and short-circuits where the fusible alloy is not softened before the circuit is opened.

Until the advent of TV the glass tube fuses always were installed in either open clips or post type fuse holders for ready replacement without the use of tools. Typical fuse blocks and fuse holders are shown in Fig. 6 (p. 29). However, the TV manufacturers took the position that the fuses in these devices always are replaced by qualified Service Men who could solder a fuse into the circuit as rapidly as they could replace the fuse in open clips. At their request fuses were furnished with pigtails and have been used quite extensively. These are furnished with pigtails in line with the fuse or at right angles to them as shown in Figure 7 (p. 29). Both fast-acting fuses and fuses with long time-lag are furnished with the pigtails.

Hence, the radio and TV Service Man has available a multitude of fuses suitable for the protection of his equipment. Many of these fuses are tested and approved by the Underwriters' Laboratories, Inc. It is strongly recommended that Service Men use only fuses so listed or made by a reputable manufacturer.

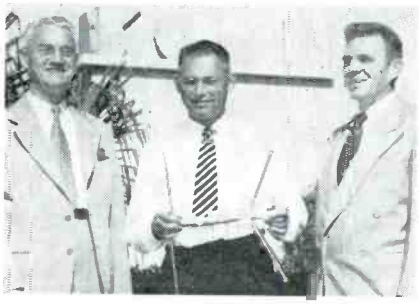
[1]Fusetron.

AT PLANT EXPANSION



George Greer, vice president in charge of manufacturing of the Hickok Electrical Instrument Co., handing key to new Hickok assembly plant at 10626 Leuer Avenue, Cleveland, to R. D. Hickok, Jr., prexy of Hickok. New factory is designed as a single floor, continuous flow assembly operation. Over-all equipment design, engineering and meter manufacturing work will continue in the main Hickok plant at 10514 Dupont Ave.

HONOLULU STATION OPENING



Walter L. Schott, discussing Walsco Signal King antenna with J. Howard Worrall, president of the Hawaiian Broadcasting System (left) and Richard Evans, vice president and general manager of KGMB, at opening of Honolulu's first TV stations.

FLYBACK TRANSFORMER CAMPAIGN

Bill Barron, sales manager of Merit Coil and Transformer Corp., with the donkey used in the *Taking the Kick Out of TV* campaign to introduce HVO-X7 flyback transformer which features a non-hygroscopic insulation enclosing the high voltage winding, said to be impervious to moisture and high humidity, and forming a watertight seal for the high-voltage lead.

Opportunity Unlimited

(*Continued from page 37*)

TV service contract swindle; and with due cause, to be sure, since several large TV service organizations, not to mention many small ones, have welched on their insurance commitments and even gone broke.

However, we all know that the vast majority of radio-TV Service Men and service organizations are on the level. There are a number of individuals and outfits in TV areas throughout the country that consider service contracts as sacred stewardships. Many of them put the collected monies in escrow, only to be drawn upon as contract periods expire, or when replacements or repairs are made. Frankly, most Service Men never saw the kind of money that poured in on them when the earlier TV sets were being installed. Many of them went on a financial binge, using up the monies as fast as they came in, without thought of the replacements and repairs that might be coming up during the contract period. And mind you, *just one good windstorm* could and did wipe out many of those improvident Service Men and organizations.

It is good to report that the service-policy racketeers have largely disappeared.

Now it stood to reason that the *high cost* of TV service contracts and the *low performance* of the contractors would bring about a severe reaction. And sure enough, we have of late witnessed that flood of *Fix-it-yourself* books which are enjoying a colossal sale. Large advertisements are running in metropolitan newspapers, proclaiming how simple it is to fix a TV set and thus bypass the modern version of Jesse James who would hold you up even in your own living-room. At almost any gathering of Service Men these days, the main subject of conversation soon gets around to the *Fix-it-yourself* threat to legitimate servicing.

To be sure, the ads sound mighty convincing so far as the average housewife is concerned; particularly the free advice given as the *come-on*. The *trouble-spotter guide* indicates what to do if the screen picture is wobbly or blurred or broken up or rolling or what-have-you. It's all so easy. This symptom means that simple adjustment; at worst, a new tube which the set owner can buy for a buck or two, and for which you, the modern Jesse James, would charge a ten spot.

Service Men know far too much about the intricacies of TV sets to fall for that kind of threat. We all know that the average TV set has some 1600 components; that there are over 2,000 soldered connections; that any one of 24 to 32 tubes can require replacement after testing; that realignment of circuits calls for elaborate test equipment. How's the usual handyman going to track down the more involved troubles. How is he going to safeguard himself against the hazards of *live* wires and components, and charged capacitors? How's the ever-critical housewife going to react to her husband actually going to work on that precious TV set on which there are further instalments to be met?

No, there is no need to worry too much about Service Men being put out of business by these *first aid* books and charts. For decades past, there have been books and articles on how to repair

your automobile, and yet auto repairmen are doing more business today than ever before; likewise, with all the books and articles on how to do your own plumbing or wiring, roofing or siding, masonry work or painting. The building trades are still doing pretty well by themselves, even at today's high prices. Again, the home medical books haven't done the doctors out of their practices; rather, I believe, the books have served to send still more patients to the doctors. These *fix it yourself* TV books may well do the same thing, as Mr. Handyman gets into difficulties with the intricacies of his TV set.

As though the *fix it yourself* angle weren't enough bother to radio-TV Service Men, there is the current plague of *$1.00 Service Calls*. Here and there, there have appeared advertisements offering to call at any home for a fee of $1.00 to $3.00 to cover labor, with parts extra. Such low prices are startling enough during the day, but when such proffered service extends into the night, it becomes a miracle.

Many serious Service Men have become quite upset by such competition. They know that one cannot make a service call for much under $5.00, plus extra for transportation if at any considerable distance. It should be obvious to TV set owners that, in these days of 25c per pack cigarettes, lipsticks at a dollar, magazines at from 35 to 50c per copy, butter at 79c per pound, the nickel carfare at 10 to 15c, that a dollar service call, and even a three-dollar deal, just can't be on the level. Folks simply invite highway robbery when they fall for that stuff!

Whatever Service Men may be losing by way of new or latter-day TV service contracts, one can more than make up through the number of TV sets in daily use, many of which will be requiring more and more servicing from here on, as they grow old. Of the 16-million TV sets already installed, at least one-third of that number are three years old. That spells *opportunity*. Many of those aging sets are of the 10" size, and that also spells *opportunity*.

No matter how well designed and built and used, a three-year-old TV set is a good prospect for service. Even if some components are not wearing out as yet, there are weak tubes with which to contend. The picture tube, after two or three-thousand hours of operation, begins to lose a lot of its brilliancy. A new picture tube can give the aging set a terrific *lift*. The alignment of a set usually does shift over the years; therefore, the realignment of circuits can mean a lot better performance. It seems that there is real *opportunity* here if Service Men will only do a bit of selling; selling new tubes and selling a complete tune-up job.

When it comes to those 10" TV sets, it does not take too much selling to *up* the owners to larger tube sizes. If the Service Man works for a dealer or has a sales deal with a dealer, then the thing to do is to *sell a new set*. Where a Service Man is positively a Service Man and nothing else, then the *opportunity* is in the form of TV set conversions and custom-built installations.

Today, more than ever, there is a *real opportunity* in extra-curricular activities for the Service Man.

What does one mean by extra-curricular activities? Simply, the cultivation of brand new fields. Supposing you've already done all you could, which is doubtful, to take care of aging sets, to service and even install new and more efficient antennas, to step up old 10" and 12" sizes to large rectangulars, to revamp existing sets for fine cabinet jobs or for built-in wall installations; nevertheless, there are still new fields to be cultivated.

Until recently the trade worked the immediate and easier market, which means primary service areas of existing TV stations. Beyond, in the fringe areas or even in the poor localities where signals were weak, most did little or nothing because there was too much lush business to be grabbed. But now, with primary areas pretty much worked except for such replacement and repair trade which grows all the while, we can find time and effort to look into the fringe areas and the poor-reception localities.

Actually, the poor-reception localities offer the biggest TV *opportunity* today, at least until such time as many more TV stations open up more primary service areas. Recently, a group of individuals and organizations specializing in *community antennas* met for a pow-wow. They reported over 80 community antenna systems already in use, serving per-

(*Continued on page 76*)

(*Continued from page 75*)

haps 15,000 TV sets. Some have paid off 80 to 100% of investment the first year. A substantial installation fee is charged; generally $125 to $175, followed by a monthly subscriber fee of $3 to $5. As a result of this community antenna enterprise, those folks at considerable distance from TV stations, or down in deep valleys, have been permitted to join the TV audience of the nation.

Similar to the community antenna system is the apartment antenna deal, whereby one or more master antennas with suitable distribution lines can serve all the TV sets in the building. Many apartment house owners have found such an installation indispensable in reconciling local fire and other ordinances covering the clearance of roofs and walls, with the TV-mindedness of today's tenants. Here again, it's a job for the big-league Service Man or organization, rather than for the electrical contractor unless the wiring is of the concealed category calling for electricians. Now is the time to get the dope on community antenna and apartment antenna systems, and to see whether or not you can fit into those profitable pictures.

Another tremendous field is that of utilizing existing TV station signals and reception localities to the best advantage. Look around your territory and see how many ancient antennas are still in use. It doesn't require much salesmanship to sell an up-to-date, new efficient antenna to enthusiastic TV fans. Also the accessories such as rotators, boosters and especially the antenna-located boosters can mean vastly improved reception in areas heretofore considered poor.

Then what about the *opportunity* opening up with the early advent of *uhf*? It's not a bit too early to be looking into converters that can be connected on to existing sets, to *uhf* antennas, to special tuning strips or other means of adapting the present TV sets to *uhf*.

Then, in the far background, there is *color*. While color TV may not be a commercial reality for another few years, yet nevertheless it must be included in our business calculations. Complicated as color TV will be, it will spell a lot more business for the Service Man who can master it. It's later than you think, gentlemen, in getting ready for color TV.

While TV gets most of our attention, one should not overlook what goes on in FM and phono progress. It would seem that those sixteen-million TV sets had soaked up most of the people's home entertainment funds, and yet the *hi-fi* fad is at an unbelievable peak. And there's big money here. The music lover thinks nothing of spending from $500 to $1,000 for a beginning in *hi-fi* equipment. Only the best disc records are bought. Lately the tape recorders are gaining. All kinds of amplifiers, loudspeakers and tone chambers are tried out as ears become more and more critical; likewise, FM tuners and amplifiers, phono turntables and pickups. Every time one of those topflight music lovers can be exposed to even a slight gain in fidelity, another sale is in the making.

Here is an unlimited field for the ambitious Service Man willing to make a critical study of audio equipment. You will find that the installation of these costly setups, whether it be in a fancy custom-built cabinet or as a built-in job,

spells many extra dollars for the chap who raises his sights and aims high.

Still bothered by those $1.00 service calls? Or the *Fix-it-yourself* threat? Or by the racketeers who may give our profession a temporary black eye?

Come, come, fellows, there are bigger jobs waiting for you than bargain-hunting set owners. Know your TV stuff. Establish a reputation for handling service jobs promptly, thoroughly, and reasonably but not cheaply. Stand behind your work. Give sound advice when asked about the relative merits of different sets, particularly if you are strictly without retail affiliations.

And then, with your service business thus sewn up, look for new targets, raise your sights, and go after the extra dollars which are there to be plucked. Exploit the newer TV opportunities to the limit; *uhf* reception, apartment-house antenna systems, community TV networks, TV conversion and custom-built jobs, and so on.

By all means look into the *hi-fi* vogue, for here is a lush market where nickels and dimes are not even thought of.

Finally, it is wise to look into the business end of your service business, for first, last and always it is a *business* if you wish to make money out of it. For too many Service Men are too interested in the technical aspects of their work to give any thought and effort to such essential matters as advertising for future clientele, establishing charges based on known costs, maintaining a bookkeeping system which indicates whether they are coming or going, collecting sour accounts, drawing a weekly or monthly salary first and then counting anything beyond as true profit.

Hi-Fi Speakers

(*Continued from page* 43)

of wide frequency spatial distribution than one of hard material. Spatial distribution is also improved by the use of a shallow cone.

Multiple-speaker installations, designed to service a remote room or merely to avoid the single source effect of one speaker, are occasionally desired. If all the speakers have the same voice-coil impedance the simplest method is to connect them in parallel. The output transformer tap whose value corresponds to the combined impedance of the parallel speaker circuit is used: i.e., if there are two 8-ohm speakers the total impedance presented to the transformer secondary is 4 ohms. Series or series-parallel circuits may also be used, with appropriate transformer connections for the total impedance. These circuits are illustrated in Fig. 4, p. 43.

A remote-speaker installation may have a separate volume control for adjusting the sound level at that point; this is especially desirable when the speaker is not in the same room as the set, or when the efficiency of different speakers in the multiple installation are not the same. Fig. 5 (p. 43) shows two methods of installing a speaker volume control. The single potentiometer circuit should only be used for a limited amount of control, because when it is turned down too far the series resistance of the upper arm creates a mismatch between the amplifier and its load. The *L*-type level control is tapered in such a way that the input impedance to the control-speaker network remains approximately constant.

Loudspeaker Developments

Loudspeaker design has made very great advances in recent years. One suggested design involves the use of a second coil in the speaker from which to tap negative feedback voltages for the amplifier. This is an old idea, but has never been brought successfully to practical application. A completely new type of speaker is also in the developmental stage in France. It is called the *ionic* speaker, or *ionophone,* and works without any mechanical moving parts by directly agitating ionized molecules of air in an acoustical chamber. Engineers are busy, and the most revolutionary changes in audio design will probably take place in the loudspeaker field.

Preamp-Remote

(*Continued from page* 40)

5,000 cps, 9,000 cps and a position to provide flat response beyond 20,000 cps; loudness control to boost automatically treble and bass response at low volume levels to compensate for normal hearing deficiencies at low volume levels; selector switch to provide selection of the inputs listed and in addition provide selection of four equalization networks for record playback.

Output Matching

In Fig. 2 (p. 40) appears the circuit of a power amp and power supply designed to work with the preamp remote. This setup has an output strip which provides direct connections for 4, 8 and 16-ohm speakers, as well as 150 and 600-ohm speaker lines. An additional 600-ohm 8-*vu* connection provides the correct output level to feed a telephone line, tape or disc recording equipment.

Negative Feedback

The amplifier employs 24 db of controlled negative feedback, providing a damping factor of *10*. This is equivalent to saying that looking back from any one of the output windings, the internal impedance of the amplifier is one-tenth the impedance of that winding. For example, a speaker connected to the 8-ohm output is working out of the equivalent of an .8-ohm generator. This low internal output-impedance is claimed to reduce the influence of the speaker impedance on the amplifier output to a negligible degree, and the high damping factor reduces the *hang-over* effect often experienced in some loudspeakers connected to an amplifier having higher internal output impedance.

Use of Multiple Speakers‡

This amplifier has been designed so that it could be used with systems employing more than one loudspeaker. The total power available can be divided equally or unequally among the speakers, as desired. Speakers can be switched on or off without the necessity of providing dummy output loads, and as the speakers are connected or disconnected, there is said to be no increase in distortion or apparent change in volume level. It is only necessary to be sure that when all speakers are connected to the amplifier, the total power drawn by all speakers does not exceed the rated power output of the amplifier (25 watts). To determine the power into any speaker, the impedance of the am-

‡See p. 42 this issue; *Loudspeakers for Hi-Fi.*

plifier output tap is divided by the rated impedance of that speaker (or the tap on the speaker transformer when one is used). This is the fraction of the total power output of the amplifier delivered to the speaker. For example, if an 8-ohm speaker is connected across the 4-ohm output of the amplifier, the speaker will draw one-half of the power delivered by the amplifier or 12½ watts. At the same time, two more speakers using line-matching transformers and the 625-ohm tap can be connected across the 150-ohm tap and each would draw 6 watts. Combining these two setups, a total of 24½ watts would be drawn by the speakers, and would provide a satisfactory method of connecting three speakers to this 25-watt amplifier.

Output and Rectifier Tubes

This hi-fi amplifier uses three beam-power tubes in the output stage, 6L6s, KT66s, or 5881s. It also employs a 5Y3GT rectifier to supply the output tubes' plate voltage and a separate rectifier, 6X4, for the screen-grid voltage for the output tubes and the plate voltage for all other tubes. A 5V4G can be used in place of the 5Y3GT; this will raise the plate voltage to the output tubes and increase the maximum audio power output approximately 20 per cent. When a 5V4G is substituted for the 5Y3GT, KT66s or 5881s should be used in place of the 6L6s.

Fig. 3. Audio power table (*top*) providing the correction connection to make in order that each speaker will draw the desired amount of power from the amplifier (25 watts). Bottom chart shows the maximum speaker line distance that can be used with various speakers and still hold the line loss to less than 1 db.

AUDIO POWER

Impedance of Speaker or Transformer	Amplifier Taps—Impedance in Ohms 4	8	16	150	600
	(*Watts*)				
4 ohms	25	—	—	—	—
8 ohms	12.5	25	—	—	—
16 ohms	6.2	12.5	25	—	—
625 ohms	—	—	.6	6	—
1,250 ohms	—	—	.3	3	—
5,000 ohms	—	—	—	.75	3

SPEAKER LINE LOSS

Wire Gauge	4	Speaker or Line Impedance in Ohms 8	16	150	600
		(*Feet*)			
22	20	40	80	800	3,200
20	30	60	120	1,000	4,000
18	50	100	200	1,600	—
16	80	160	320	2,400	—

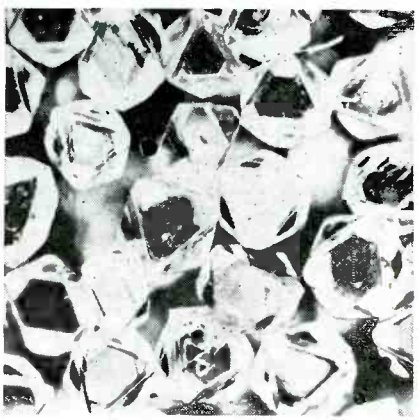
Audio

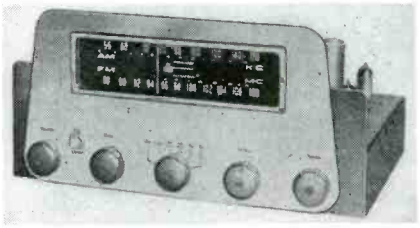
(*Continued from page* 46)

minimum of distortion, generally lower than that in either disc or photographic recording, and provides, too, a signal-to-noise ratio of 50-60 db. To obtain these results, the high-frequency bias oscillator must have a second harmonic content about 60 db lower than the fundamental, and the ratio of the high-frequency current to the maximum audio current must be of the order of *10* to *20*. To achieve low noise levels and relative freedom from distortion, the magnetic head and associated shield must not acquire any permanent magnetism; it has been found that the *dc* magnetic field thus produced acts in a manner analogous to the presence of second order harmonic components in the high-frequency bias oscillator. A common result of these *dc* fields is pronounced rumble. This effect has also been traced to improperly erased tape. When a proper value of high-frequency bias is used, the distortion above the so-called overload of the medium will be mostly third order harmonic components, the second order being almost entirely absent. It has been found that considerable overload can be tolerated, which is generally attributed to the absence of the more unpleasant even order harmonic components. One disturbing factor in ¼" tape is the presence of *print-through* from layer to layer, which results in *echo* effects. It has been reported that it is possible to prevent this by reducing the peak amplitudes in the recording, and can be prevented from becoming too serious by avoiding storage of recorded tape in excessive high temperature locations or in the proximity of high magnetic or electrostatic fields.

In magnetic recording care must be taken to avoid excessive 60-cycle hum pickup in the reproducer. Since the

Group of high quality diamond crystals (300 to carat) used in manufacture of diamond needles. In selecting grades, they are measured tridimensionally.





High fidelity 14-tube FM-AM tuner, featuring push button selection of *afc* action, with a cascode *rf* amplifier and a triode mixer said to provide five to fifteen db. Chassis is claimed to require a 3-microvolt input for 30-db quieting. For AM operation, tuner features a variable bandwidth *if* channel. A 10-kc whistle filter is also included to eliminate interstation whistle. Has continuously variable treble and bass controls, a volume control, tuning control and a six-position function selector switch. Other features of the tuner include a dual impedance-coupled FM limiter; built-in phono preamplifier, providing correct compensation for G.E., Pickering or Audax pickups; detector output at rear of chassis to simplify use with tape recorders; and a cathode-follower output circuit. Tuner's audio output is 3 volts at 6,000 ohms, with, it is said, .2% distortion. Frequency response is noted as ± .5 db, from 20 to 20,000 cycles on FM, .5 db from 20 to 4,000 cycles on normal AM and .5 db from 20 to 7,500 cycles on high-fidelity AM. *(R701; David Bogen Co., 29 Ninth Ave., N. Y. 14, N. Y.)*

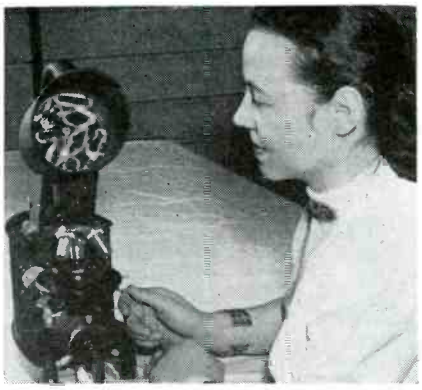
common power line 60-cps frequency can have a gain which is 20-30 db higher than, for instance, 1,000 cycles, to correct for non-linear frequency response, the pickup head and the input circuit, especially the input transformer of the preamplifier, must be well shielded to avoid pickup from ambient 60-cycle fields. Fortunately, it has been found that the ear characteristic, for medium sound reproducing levels, aids in reducing the effect of such a disturbing frequency. Since the ear is at least 20 db less sensitive at this frequency than at a 1,000-cycle tone, an effective signal-to-noise ratio of 40 db at 60 cycles is equivalent to a 60-db signal-to-noise ratio at the higher frequency.

Recorder Servicing

Servicing of tape equipment, on a continuing basis is very important, particularly if all problems of noise are to be minimized. For instance, cleaning the capstan and recording head is important after reasonable use. Dirt and slight gum deposit from the tape gradually accumulate on the recording head and rubber capstan. In one line,[3, 4] the recording head and and capstan may be reached for cleaning by removing two Phillips-head screws from the *record and erase-head* housing and lifting off the housing cover. Cleaning is accomplished by means of a cloth dipped in carbon tetrachloride. Incidentally, for maximum efficiency tape should be rewound once before using when it has been stored 6 months or longer. It is recommended that a new reel of tape be rewound once before recording, too.

[3]Masco. [4]SERVICE, Audio Installation and Service; June, 1952.

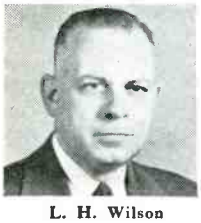
Finishing setup in diamond styli processing line. Special mountings for small unfinished stones are made and parts assembled here. *(All photos courtesy E. J. Marcus of Tetrad)*



Measurement of length and examination of contours of diamonds on a shadowgraph.

WILSON NAMED ARGOS GENERAL MANAGER

Lynal H. Wilson, formerly consulting and industrial relations engineer, has been named general manager of the Argos Products Co., Inc., Genoa, Ill.



L. H. Wilson

W. W. Jablon

NEWS

JABLON NOW BOGEN VP-SALES

W. Walter Jablon has been appointed vice president in charge of sales of the David Bogen Co., 29 Ninth Ave., New York 14, N. Y.

Jablon formerly held the same post at Espey Manufacturing Co., prior to which he was associated with Hammarlund Manufacturing Co. for approximately 20 years.

RAY ROBINSON BECOMES JERROLD GENERAL MANAGER

Ray Robinson, formerly eastern regional sales engineer for Philco, has been named general manager of Jerrold Electronics Corp., N.E. Corner 26th and Dickinson Sts., Philadelphia 46, Pa.

* * *

SARKES TARZIAN EXPANDING RECTIFIER DIVISION

A two-story, 20,000-square foot structure is now being added to present facilities of the rectifier division of Sarkes-Tarzian, Inc., Bloomington, Ind.

Additional space, it is said, will enable the division to double its production.

NICHOLSON WINS G.E. PROMOTION

Thomas J. Nicholson has been appointed parts sales manager of the receiver department of G.E.

Raymond V. Buivid has been named radio sales manager.

Roger F. Long has been appointed sales manager for equipment tube sales in the central region, with headquarters in Chicago.

* * *

WALTER E. PEEK JOINS CENTRALAB

Walter E. Peek has been named sales manager of the mechanical electronic products section, of Centralab, 900 East Keefe Ave., Milwaukee 1, Wis.

Peek formerly was sales manager of the resistor division of the P. R. Mallory Co.

ALL-CHANNEL ANTENNA GRANTED TWO PATENTS

Patents 2,585,670 and 2,609,503 covering TV and radar antennas have been granted to the All-Channel Antenna Corp., 70-07 Queens Blvd., Woodside, N. Y.

Antenna is a broad-band type and is said to develop gains up to 22 db over a tune dipole because of four design features: Correct angular spacing of the elements in the vertical plane; correct angular spacing of dipole sections in the horizontal plane; correct vertical stacking spacing between two single bays; and the use of exact mirror image reflectors of the driven dipole sections. It is a motorless unit and is claimed to receive signals from all directions, operating on *uhf*, *vhf* and FM frequencies. A nine-position switch selects any one of nine different antenna arrays.

Included with every antenna is a simplified multi-wired stacking harness which automatically allows for the proper connections and the proper vertical stacking spacing. Also included is an automatic impedance matching transformer coupler for use between switch and set, which it is said automatically provides the correct impedance matching regardless of the *uhf* or *vhf* frequencies and irrespective of whether the input is 72 or 300 ohms.

* * *

BURZYCKI APPOINTED CREST CHIEF TRANSFORMER ENGINEER

Lou Burzycki has been appointed chief transformer engineer of Crest Laboratories, Far Rockaway, N. Y. Burzycki was formerly with Berkshire Transformer Co. and N. Y. Transformer Co.

Company has relocated its factory and offices to 84-11 Rockaway Beach Blvd., Rockaway Beach, N. Y., and quadrupled its manufacturing space.


J. Summers


L. Burzycki

JIM SUMMERS NOW SIMPSON AD MANAGER

Jim Summers has been appointed advertising manager of the Simpson Electric Co., 5200 W. Kinzie, Chicago, Ill.

Summers was formerly advertising manager of Ampro Corp.

* * *

AUDEL TV SERVICE MANUAL

A 346-page book, *TV Service Manual*, covering the installation, troubleshooting and repair of TV receivers, has been published by Theo. Audel and Co., 49 W. 23rd St., New York 10, N. Y.

Text covers placement of TV receivers; receiver controls, test patterns and adjustments; TV interference and traps; antennas and transmission lines; master antenna systems; installation procedure; broadcasting; receiver fundamentals and circuit descriptions; picture tubes; projection-type receivers; TV test equipment; servicing and troubleshooting procedures, and color TV and conversion methods.

Glossary of TV terms is also included. Priced at $2.00.

WHEN YOU CHANGE YOUR ADDRESS

Be sure to notify the Subscription Department of SERVICE at 52 Vanderbilt Avenue, New York 17, N. Y., giving the old as well as the new address, and do this at least four weeks in advance. The Post Office Department does not forward magazines unless you pay additional postage, and we cannot duplicate copies mailed to the old address. We ask your cooperation.

HENRY FOGEL NOW GRANCO PREXY

Henry Fogel, formerly manager of commercial products division for the Radio Receptor Co., Inc., has been appointed president of Granco Products, Inc., 36-17 20th Ave., Long Island City 5, N. Y.

Company, organized recently for the design, manufacture and distribution of *uhf* converters for TV receivers and *uhf* measuring instruments will be located in a 10,000 square-foot plant.

Henry Fogel

D. H. CARPENTER FORMS ANTENNA COMPANY

Douglas H. Carpenter, formerly chief engineer of the LaPointe-Plascomold Corp., has established the Summit Engineering Company, 3324 Main St., Hartford, Conn.

Principal products will be TV antennas, particularly for *uhf,* and other electronic equipment.

D. H. Carpenter

HAUSER APPOINTED CBS-HYTRON RENEWAL TUBE S-M

John H. Hauser has been appointed renewal tube sales manager of Hytron Radio and Electronics Co., Danvers, Mass.

Hauser, formerly in distributor sales with Sylvania Electric, served as assistant sales manager of the distributor sales department, and more recently as midwest regional manager of distributor sales.

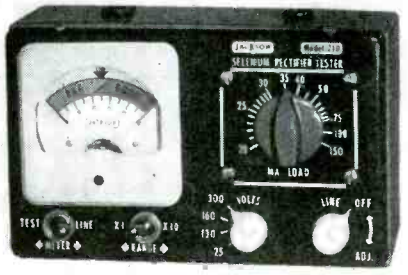
John H. Hauser

Tools . . . Instruments Parts . . .

JACKSON SELENIUM RECTIFIER TESTER

A tester, *710*, for testing selenium rectifiers rated from 20 to 650 ma, has been introduced by the Jackson Electrical Instrument Co., 18-54 S. Patterson Blvd., Dayton 2, Ohio.

Tester operates on 110 to 125 volts *ac* and has a variable indicated voltage range of 25 to 300 volts *ac*. *Good-Bad* dial shows condition of the rectifier and also indicates life expectancy.



* * *

ELCO CONNECTOR KIT

A miniature connector kit, which is said to make it possible to assemble connectors with any number of circuits, has been, introduced by the Elco Sales Co., 190 W. Glenwood Rd., Philadelphia, Pa.

Variations in arrangement of contacts at time of assembly also make possible construction of connectors with the same number of contacts, but with different polarity. Features include identical male and female components; four basic parts; high current and voltage rating; low resistance and low capacitance. Available in general purpose, black phenolic; low-loss mica phenolic; natural; alkyd, natural; or general purpose phenolic in colors.

RICE CONTACT CLEANER AND LUBRICANT

An electrical contact cleaner and lubricant, *Spray-Kleen*, in a pressurized aerosol-bomb type dispenser, has been announced by Ward E. Rice Industries, Box 1705, Glen Park Station, Gary, Ind.

Can contains six fluid ounces, and flexible nozzle, so that the spray may be directed into difficult locations. Product is said to eliminate the necessity for removing controls and other components from the radio or TV chassis, because of the pressure feature.

* * *

AEROVOX SELENIUM-RECTIFIER FILTER ELECTROLYTICS

Twist-prong base electrolytics, type *AFHS*, for filtering in selenium-rectifier circuits, have been announced by Aerovox Corp., New Bedford, Mass.

* * *

SUNRISE SOLDERING UNIT

A soldering unit, *GLO-Point* L-72, that features a metal ground plate on which jigs can be mounted, in addition to an adjustable heat control which is said to allow the electrodes to heat up instantly to 1250° *F*, has been introduced by Sunrise Products Co., P.O. Box 173, Hawthorne, N. J.

* * *

INSULINE RELAY RACK

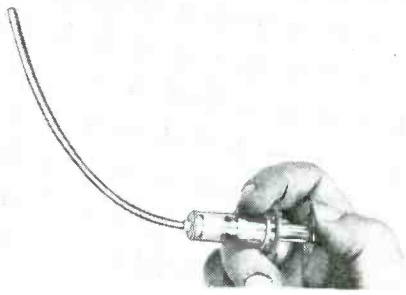
An open-face relay rack, *3913*, designed to take standard 19" panels, has been introduced by the Insuline Corporation of America, 2602-35th Ave., Long Island City 1, N. Y.

Made of ⅛" steel and finished in black ripple enamel, rack measures 38¼" high, 20" wide and 18⅜" deep.

G-C LUBRICATING DEVICE

A remote-control lubricating device, *Long Reach Lubricator, 8690,* has been introduced by General Cement Manufacturing Co., 919 Taylor Ave., Rockford, Ill.

Essentially an oil can with a flexible tube that is 4" long, item is said to permit a Service Man to oil or grease electronic controls and bearings from any position.



* * *

XCELITE FOCALIZER-COIL SCREWDRIVER

A screwdriver for adjusting focalizer coils has been developed by Xcelite, Inc., Orchard Park, N. Y.

Screwdriver has an extra-long shank, 10", to reach into the TV chassis, and ¼" blade flared at the tip and tapered to fit in the focus adjustment screw. Tool is said to be non-magnetic, fatigue-resistant and does not need frequent re-grinding.

* * *

SPRAGUE RESISTOR-CAPACITOR PRINTED CIRCUITS

Five R-C pc units, for TV and radio sets, have been added to the replacement parts stocks of the Sprague Products Co., 61 Marshall St., North Adams, Mass.

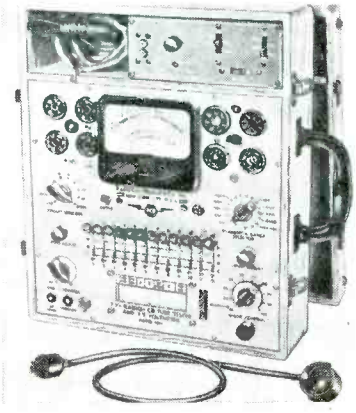
Resistor-capacitor networks are screen printed on high-dielectric constant ceramic bodies. Resistor elements are said to be highly stable, and have a moisture-resistant insulating resin to protect the completed plate assemblies.

* * *

RCP SERVISHOP

A combination test instrument, *Servishop* 8873, that features a tube tester, *vtvm* and signal generator, has been announced by Radio City Products Co., Inc., 152 W. 25th St., New York 1, N. Y.

Combination includes TV-radio-picture-tube tester and picture-tube reactivator, *vtvm* in 17 ranges with input impedance of 25 megohms and a zero center scale, *hv* probe to extend range to 30,000 volts, and frequency generator and audio oscillator for audio tracing and alignment, with signals supplied on *rf*, *if* and *af* frequencies for AM, FM and amplifier circuits.



CECO CONTROL RESTORER

A combination solvent, lubricator, restorer and silencer, *Ceco Restorer,* for controls and contacts, has been announced by Chemical Electronics Corp., Irvington, N. Y.

Restorer, in 2-ounce bottles, is a hydrocarbon colloidal suspension of a highly refined vegetable gum that it is said does not affect inductance, capacitance or resistance, and is wholly non-reactive to heat, cold, oil or corrosives. Hyper-capillary action forces it into inaccessible places where it cleans and forms a non-greasy, non-sticky *hard-bonded* lubricating surface.

RI IF TRANSFORMERS AND ALIGNMENT TOOL

Redesigned *if* transformers, series *A, RI-trans*, for use on standard chassis, with long terminal lugs for conventional wiring and soldering, and for use with printed-circuit chassis, employing short terminal lugs for pressure-fitting into the lug slot openings, have been announced by Radio Industries, Inc., 5225 N. Ravenswood Ave., Chicago 40, Ill.

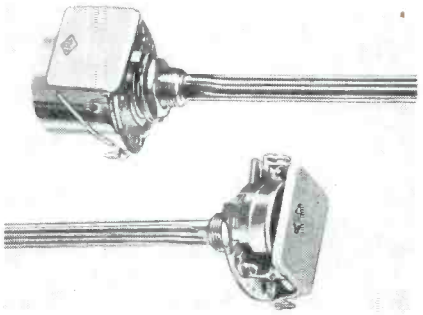
Features of the new series include *Torkrite* machine-cut internally-threaded coil forms, that are said to insure uniform torque of the adjusting core and freedom from stripping on production lines or in field servicing and molded *Plaskon* alkyd base, with high *Q* efficiency and high heat resistance. Transformers utilize silvered mica capacitors, having zero temperature coefficient; perm tuned, top and bottom, and bandwidth maintained throughout the required core adjustment; reinforced one-piece terminal lugs; interchangeable, universal snap clip mounting; and availability with one or two internal diode capacitors. Size of the encasing can is ¾" square; standard height is 2".

An alignment tool, *Peaker*, for use with the *if* transformer, or other coils requiring adjustment, has also been announced. Tool with a hollow, four-inch handle, has an aluminum-oxide-ceramic reversible tip. Storage handle may be used for extra tips and other small tools. Rubber bumper cap, on the end of the handle, may be used to tap tubes and parts to check for loose elements, as well as to test for microphonism.

CENTRALAB LOUDNESS CONTROL

A compensated loudness control, *Compentrol*, that is a combination dual-tapped control and *printed-electronic-circuit* plate combining the compensating network, has been developed by Centralab, 900 East Keefe Ave., Milwaukee 1, Wis.

All components in the network are in shunt, and there is said to be no insertion loss, and no additional amplification required. Unit is claimed to compensate for the Fletcher-Munson hearing characteristic curves, boosting the very-high and very-low audio frequencies of sound at low volume level. Available in ½ and 1-megohm values, in both switch and non-switch types.



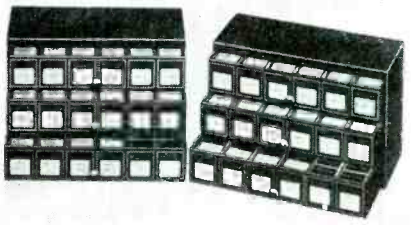
* * *

MALLORY CONTROL KITS

Three kits of radio and TV controls, *3735, 3755, 3810*, are now available from P. R. Mallory and Co., Inc., 3029 E. Washington St., Indianapolis, Ind.

Number and types of controls included in each kit were determined on the basis of recent figures disclosing which controls are most popular in different geographical areas. Included are six type *spst*, one type *dpst* and one type *spdt* switches with each kit.

Kit *3735* is recommended for western states; recommended for central States is kit *3755*, and kit *3810* is designed for Service Men in the eastern States.

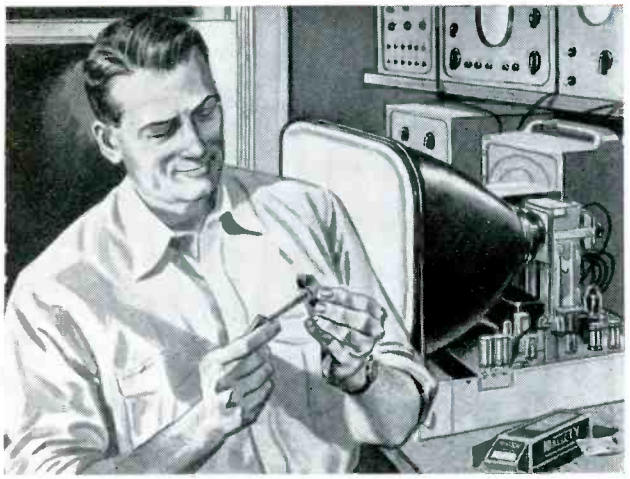


JOTS AND FLASHES

PICTURE-TUBE, SENSITIVITY and *afc* circuitry improvements highlighted '53 TV chassis, displayed for the first time in Chicago a few weeks ago. In one line, there appeared an automatic brightness control, featuring a photo-electric cell on the face of the receiver to measure room light and adjust picture contrast accordingly. . . . Another chassis offered a *precision-eye* type of tuning for *vhf* and *uhf* station selection. On these models, ultrahigh stations are read in a center lucite prism and the control is so geared as to provide rapid selection of station range. . . . Another series of models revealed an improved interlace to permit comfortable viewing of large picture tubes at close range. . . . In two lines, *hi-fi* audio power systems were accented items. . . . Another manufacturer announced the production of a *hi-fi* unit, containing a tuner, amplifier, tape recorder, record changer and speaker. . . . G.E. expects to increase its '53 radio and TV receiver sales about 35 per cent over those of last year. . . . *Raymond McClintock* has been appointed to the newly created post of manager of new product promotion of Sylvania. . . . *Sylvan Wolin*, formerly vice president-sales at Pyramid, has opened advertising, sales promotion and public relations offices at 15 W. Palisade Ave., Englewood, N. J. . . . *Bob Mueller*, Centralab distributor sales manager, delivered an address on printed electronic circuits recently at a clinic session sponsored by Marsh Radio Co., Milwaukee, Wis. . . . Admiral Corp. has a color TV research lab at Palo Alto, Calif. . . . Sound division of Stromberg-Carlson has opened sales and sales engineering offices in Room 112, Wilcox Bldg., 4607 Cole Ave., Dallas, Tex. *R. Edwin Gray* is in charge. . . . According to one picture-tube maker, present trends indicate that more than 70 per cent of new TV sets to be produced in '53 will use picture tubes that are over 19" in size. . . . *Aerovox Research Worker* recently celebrated its 25th anniversary of publication. . . . *International Resistance Co.* has opened a Chicago sales office at 4013 N. Milwaukee Ave., Chicago 41, Ill. . . . U.S. Wire and Cable Corp. has moved to a new plant at Progress Ave. and Monroe St., Union, N. J. *A. J. Sequeira* is prexy of U.S. Wire and Cable. . . . Merit Coil and Transformer Corp., Chicago, Ill., is now a participating manufacturer in the John R. Rider Publisher, Inc., replacement parts listing program. . . . Blonder-Tongue Labs, Inc., is now located in a new plant at 526-536 North Ave., Westfield, N. J.

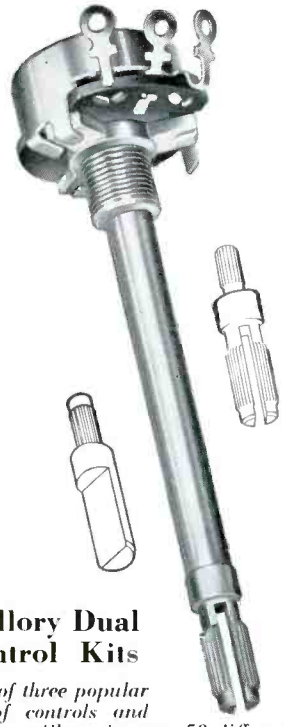
ADVERTISERS IN SERVICE FEBRUARY, 1953

Depend on Mallory
for
Approved Precision Quality



RIGHT

The First Time!



Mallory Dual Control Kits

Each of three popular kits of controls and switches will service over 50 different models of radio and TV sets. Housed in an attractive 3-drawer metal cabinet. You pay only for the controls and switches; the cabinet is yours at no additional charge. Details available from your Mallory distributor.

THE Mallory Midgetrol in his hand is the answer . . . the answer to long, dependable service for the set he is working on.

Mallory Midgetrols® are engineered to match the electrical characteristics of the original equipment in any TV or radio set. From the standpoint of performance and long life, they are equal to . . . and often better than . . . the original control. Midgetrols are designed to save you precious time.

Round tubular shafts are built for fast, accurate cutting . . . fit split-knurl and flatted-type knobs.

AC switches may be attached instantly without disassembling the control.

Their unique design simplifies inventory problems . . . always available from your Mallory distributor.

Be sure *every* job is right the first time . . . use Mallory Midgetrols for *all* your service work.

Here is another time saver. The Mallory Control Guide is a complete cross reference between set manufacturers' part numbers and the equivalent Mallory control. Ask your distributor for your copy.

P R MALLORY & CO Inc

MALLORY

CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS • RECTIFIERS • VIBRAPACK* POWER SUPPLIES • FILTERS

*Reg. U.S. Pat. Off.

APPROVED PRECISION PRODUCTS

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

AS A RESULT OF YOUR CALL

The show goes on...

YOU'VE just finished a routine call. Just a few adjustments . . . a couple of tubes . . . and the set works as good as new. Nice the way folks smile appreciatively when you bring that missing picture back to their screen.

Now you've got yourself another steady customer. You know they'll remember you . . . and recommend you to their friends . . . because they're enjoying the finest picture their set can produce. And the RCA Tubes you installed will continue to provide them with long, faithful service. The superior quality of RCA Tubes and Kinescopes is your best measure of protection against the costliness and inconvenience of premature tube failures. It's good to know you can service a receiver . . . and forget about call-backs.

Safeguarding your reputation is a vital, everyday service of RCA Tubes. And that service is yours at no extra charge.

RCA®

RADIO CORPORATION of AMERICA

ELECTRON TUBES — HARRISON, N.J.