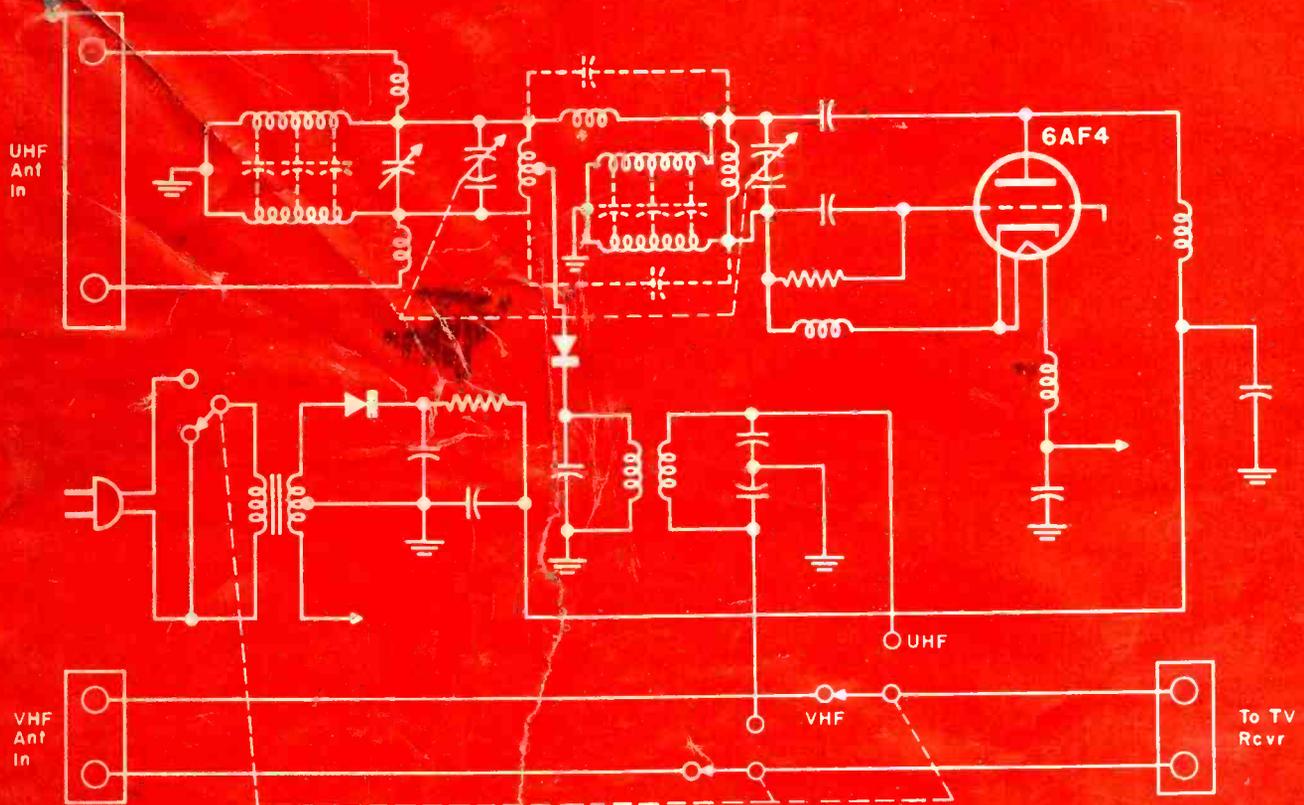


SERVICE

VOL. 23

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE

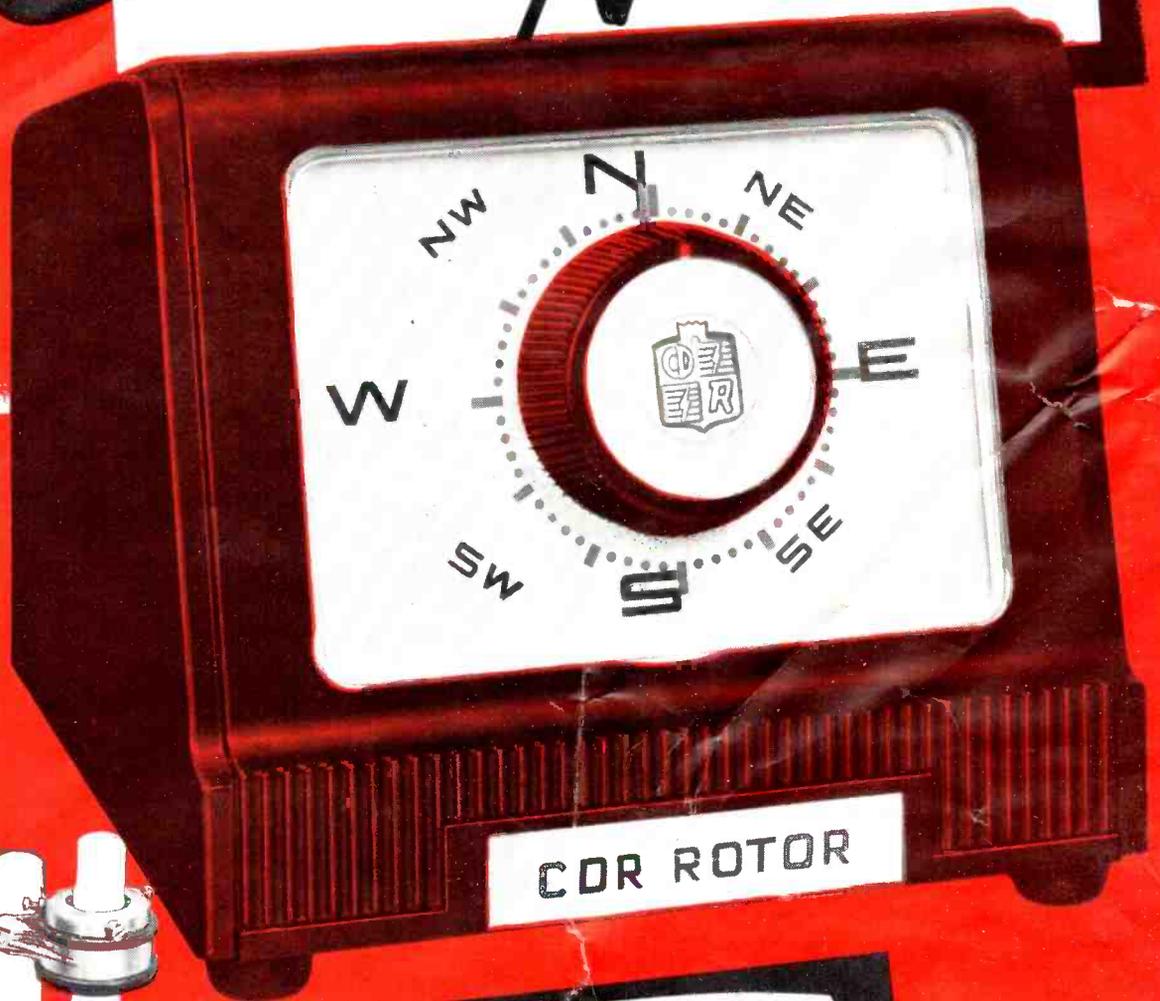
AUGUST
1954



Conversion tuner with thermal compensation and channelack coax-tuned circuitry.
[See circuit analysis, this issue]

AL BROWDY
1962 S STEARNS DR
LOS ANGELES 34, CALIF
2-55
SO SR 2-24-50 C

*Sensationally
New!*



Pre-Sold to consumers in every leading TV market area with saturation TV spot announcements as well as newspaper advertisements. These further helps — animated point-of-sale display... newspaper mats ... envelope enclosures... window streamers.

Models AR-1 and AR-2

CDR AUTOMATIC ROTOR

40% sharper tuning
than any other
AUTOMATIC ROTOR

They said it couldn't be done – never thought it possible – but HERE IT IS! The AR-1 and AR-2... the sharpest tuning AUTOMATIC ROTORS in the world. Superior construction and quality manufacture are featured in these as in the other CDR ROTORS, plus a handsome NEW MODERN DESIGN CABINET styled along lines for gracious, contemporary living. An added feature is a MECHANICAL BRAKE THAT IS RELEASED MAGNETICALLY! Here, truly, is the ultimate in rotors – handsome design, accurate, pinpoint, automatic performance easier to set and adjust – and CDR dependability!

Model AR-2

... complete, AUTOMATIC rotor with THRUST BEARING... and handsome modern design plastic cabinet, uses 4 wire cable.....

Model AR-1

.... same as AR-2, without thrust bearing.....

Model TR-2

The heavy-duty rotor with plastic cabinet featuring "Compass Control", illuminated "perfect pattern" dial, uses 8 wire cable....

Model TR-4

The heavy-duty rotor complete with handsome, modern design cabinet with meter control dial, uses 4 wire cable....

Model TR-11

The same as the TR-12 without thrust bearing, complete with meter control dial cabinet, uses 4 wire cable

Model TR-12

A special combination value consisting of complete rotor including thrust bearing. Handsome modern cabinet with meter control dial, uses 4 wire cable



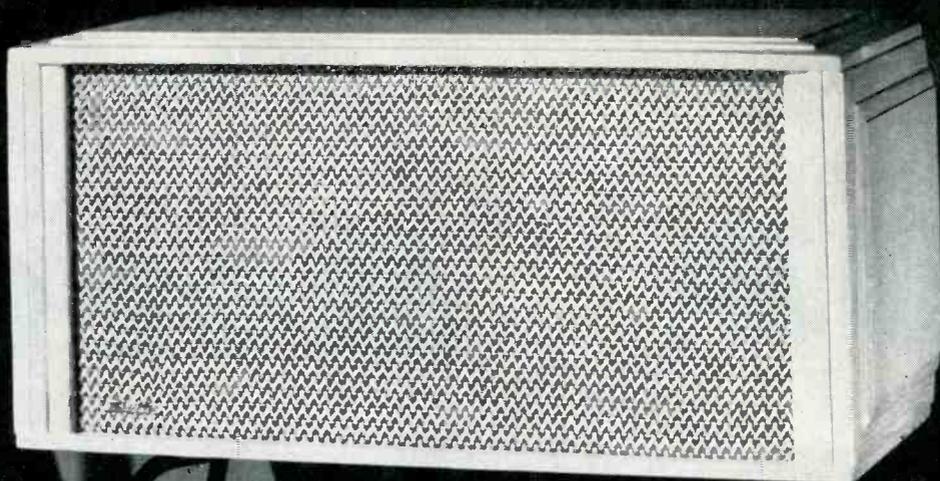
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SOUTH PLAINFIELD, N. J.



THE **RADIART** CORPORATION

CLEVELAND 13, OHIO



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Treasure Chest

FIRST to give you the real high fidelity of a two-way speaker system in a small package—the Jensen "Duette" won your acclaim.

Now the Jensen Duette "Treasure Chest" model is an elegant compliment to your decor whether traditional or modern. The handsome versatile chest design is available in either selected mahogany or blonde oak veneer with genuine matching hardwood trim.

The "Treasure Chest" Duette fits on your book shelf or in a small table area. Measures only 11" by 23¼" by 10". The "Treasure Chest" may be made into a graceful free-standing piece by the addition of modern wrought iron legs—available separately.

Duette "Treasure Chest" gives the full performance of the true two-way system with its special 8-inch woofer and compression driver tweeter in an unusually compact scientifically designed acoustic enclosure. Ideal for

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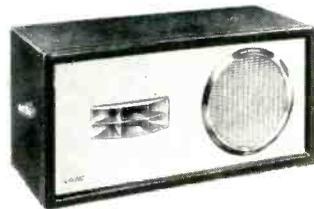
The Jensen "Treasure Chest" Duette in either blonde oak or mahogany is an extraordinary value at **\$76⁵⁰ net.**

ST-862 Wrought iron leg set, \$4.25

Also see the "Duette DU-201" in Dupont Fabrikoid finish at a new low price **\$62⁵⁰ net.**

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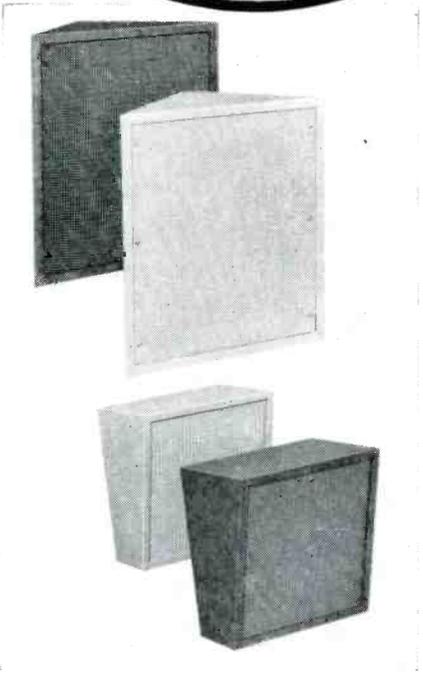
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Argos proudly presents a new look—more modern, more pleasing—with the same "Craftsmanship in Cabinets."

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Craftsmanship in Cabinets

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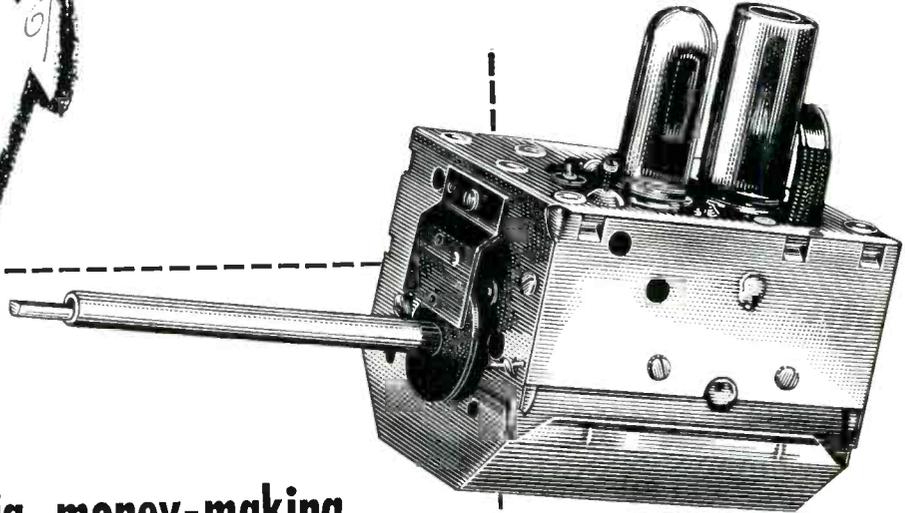
Bryan S. Davis, Pres. F. Walen, Sec. John Iraci, Adv. Mgr. A. Goebel, Cir. Mgr.

Mid-West Mgr.: Stuart J. Osten, 333 N. Michigan Ave., Chicago 1, Ill. Tel.: DEarborn 2-3507
East-Central Rep.: James C. Munn, 2253 Delaware Dr., Cleveland 6, O. Tel.: ERview 1-1726
Pacific Coast Rep.: Brand & Brand, 1052 W. 6th St., Los Angeles 17, Cal. Tel.: MADison 6-1371

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 U. S. A. and Canada; 25 cents per copy. \$3.00 per year in foreign countries; 35 cents per copy.



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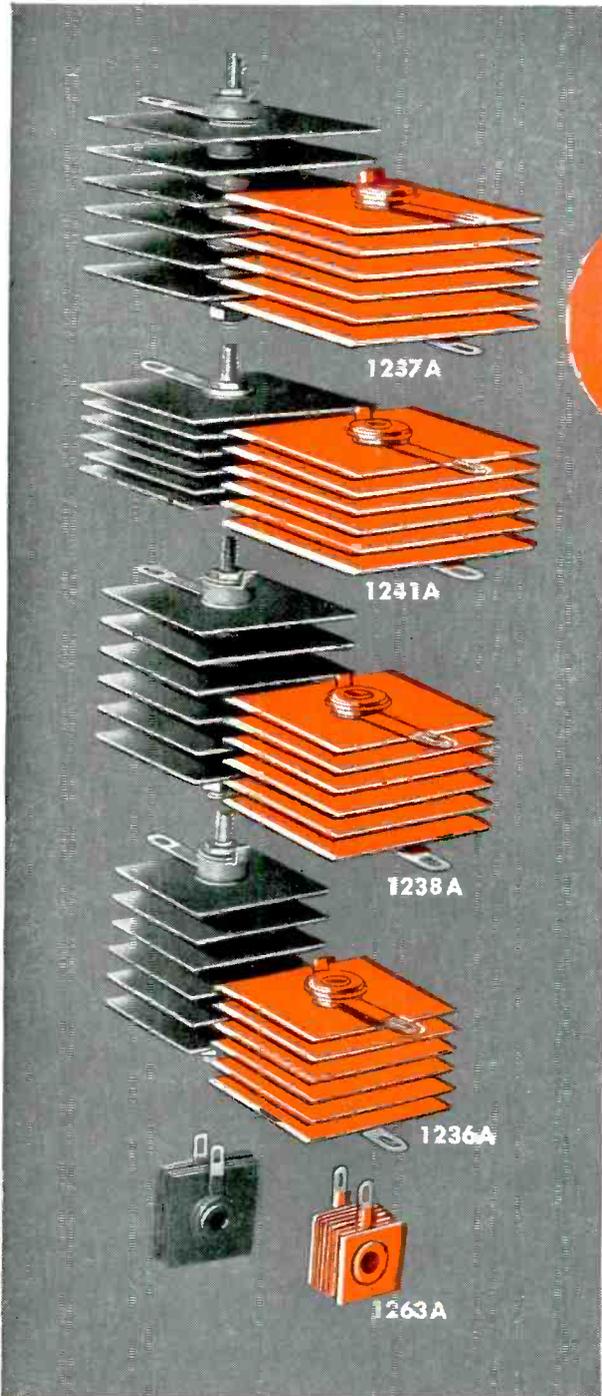
The Universal Line's smaller "H" dimension does the
job where space is a factor. The five types are listed below.
All are eyelet construction, with 6/32" mounting screw
enclosed. They are designed to handle approximately 70%
of all replacements.

Make *your* servicing job easier... more profitable... by
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pendability and performance—plus *long, long life*—by re-
placing with Federal's *Universal* and *Regular Lines*... in
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UNIVERSAL LINE RATINGS AND DIMENSIONS:

Type	Max. DC Ma.	"H" Dim. Max.	Plate Size
1263A	65	21/32" ± 1/32"	11/16" Sq.
1236A	300	1-3/8" ± 1/32"	1-5/8" Sq.
1238A	350	1-3/8" ± 1/32"	1-3/4" Sq.
1241A	400	1-1/4" ± 1/32"	2" Sq.
1237A	500	1-3/8" ± 1/32"	2" Sq.

Federal has available a new type bolt and nut for mounting rectifiers
in tandem. Order bolts by Part No. IDR-6131; nuts by Part No. IDR-6015.



Federal Selenium Rectifiers are listed in
Howard W. Sam's Counter-Facts and Photo Facts

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A Division of INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

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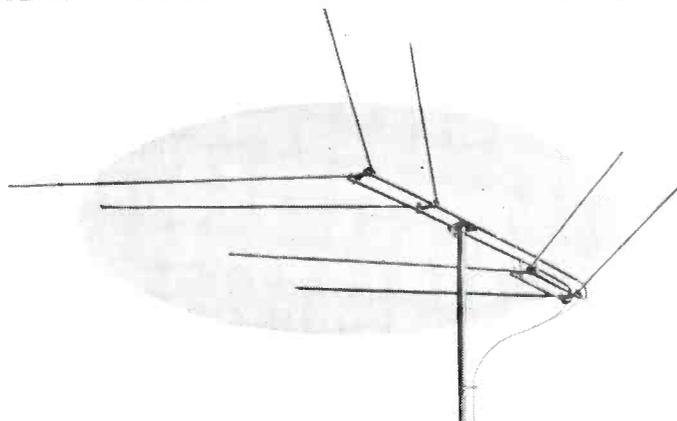
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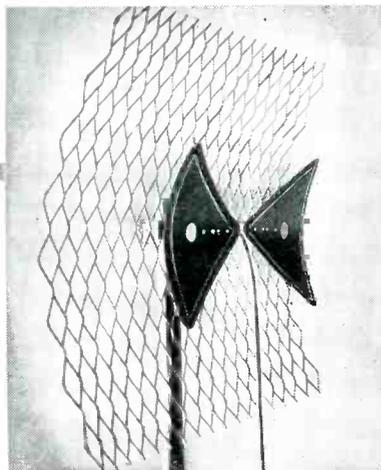
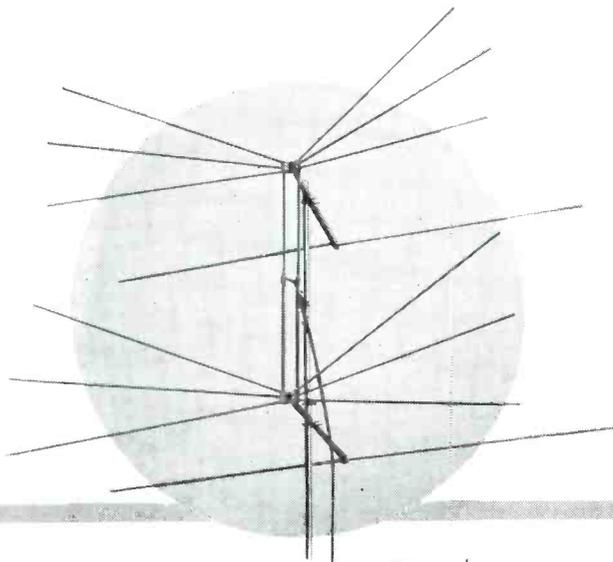
Scientifically designed to give top performance, Philco television antennas are products of extensive research into receiver requirements in all types of locations. Field tested electrical and mechanical designs provide

proper gain, directivity, bandwidth and impedance... long life and ease of installation. Now a wide choice of Philco television antennas give you better picture quality... build complete customer satisfaction... more sales for you!

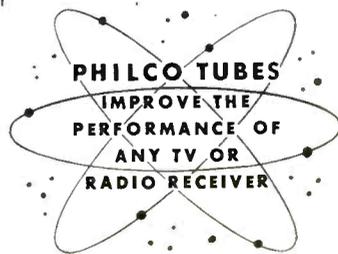


PHILCO ALL-CHANNEL UHF-VHF TROMBONE ANTENNA: The ideal antenna for areas having both UHF and VHF stations. The Philco Trombone can be stacked for VHF fringe area use. Completely pre-assembled at the factory... all-aluminum construction with dowelled elements: Part No. 45-1880.

PHILCO TWO-BAY SUPER CONICAL ALL-CHANNEL ANTENNA: Strong signal pickup on VHF channels 2 through 13, UHF channels 14 through 83... ideal reception in fringe areas... all-aluminum: Part No. 45-3096-2. Fringe area single bay design: Part No. 45-3096.



PHILCO PARAFLECTOR ALL-CHANNEL UHF ANTENNA: Pre-assembled, all-aluminum... 8 db to 10 db gain... outstanding fringe area performance... immediate mounting on existing masts: Part No. 45-3071. Bow Tie, Part No. 45-3069 and Bow Tie with reflector, Part No. 45-3070 provide top quality pictures in many UHF areas.



PHILCO CORPORATION

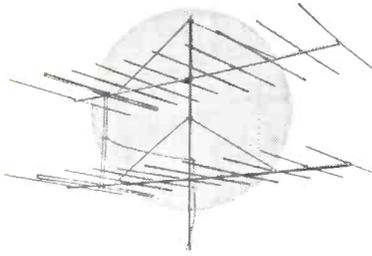
PHILCO

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TV

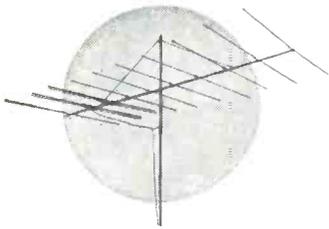
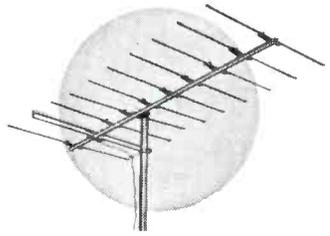
ANTENNAS

PHILCO VHF "V" ANTENNA: Adequate reception on all VHF channels in most localities . . . heavy chrome plated three-section brass tubing . . . weighted plastic base holds antenna fully extended in any direction: Part No. AD-2643. Also available with aluminum tubing "V": Part No. AD-2643-1.



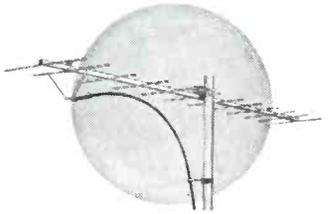
PHILCO TWO-BAY VHF LOW BAND YAGI ANTENNA: 10 elements . . . all-aluminum . . . factory pre-assembled. Top performance on channels 2 through 6 . . . 13 db to 15 db gain on various channels. Single bay Part No. 45-3112-2 through 6. Stacked version uses stack-harness Part No. 45-3267.

PHILCO HIGH BAND VHF YAGI ANTENNA: Pre-assembled, all-aluminum, 10 elements . . . high gain in fringe areas on channels 7, 8, 9, 10, 11, 12, or 13 . . . 10 db to 12 db gain on various channels . . . eliminates co-channel station interference: Part No. 45-3112-7 through 13.



PHILCO BROAD BAND VHF YAGI ANTENNAS: All-aluminum, factory assembled for quick installation . . . high gain plus adequate band width. Three broad band models cover channels 2 to 6 . . . 4, 5, 6 . . . or 7 through 13: Basic Part No. 45-3112.

PHILCO GOLDEN YAGI UHF ANTENNA: Designed for 300 ohm operation . . . all steel construction . . . 11 db to 12 db gain on various channels . . . "Cronak" coated components resist salt air . . . humidity . . . six models cover entire UHF spectrum: Basic Part No. 45-1996.

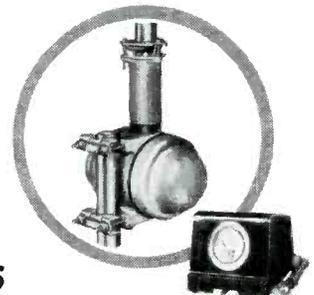


← PHILCO HEAVY DUTY ANTENNA ROTORS: →



PHILCO MODEL P-4: Supports antenna installations weighing up to 150 pounds . . . completely weather sealed . . . factory lubricated for life . . . uses 4-wire rotor cable . . . modern direction meter control cabinet: Part No. 45-1974.

PHILCO MODEL P-11: Easily handles two-bay arrays . . . mounts on masts up to 1 5/8" in diameter . . . accurate direction control . . . heavy duty motor . . . streamlined design . . . uses 4-wire rotor cable . . . modern direction meter control cabinet: Part No. 45-1994.



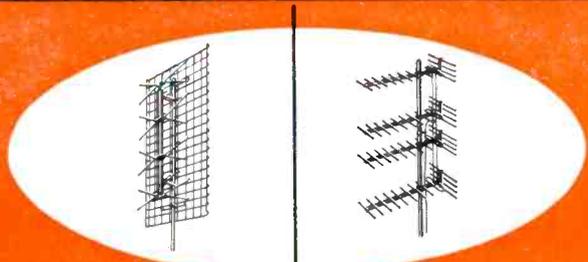
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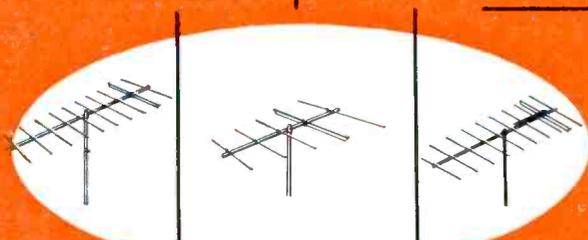
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CAT. NO. 3006C Four-stacked bow-tie—Receives all UHF channels. Exceptional gain. Fine directivity. Available in many models from single bow-tie to array of 12.

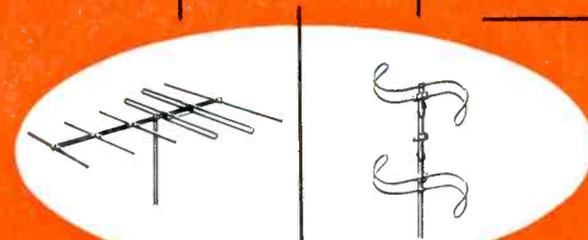
CAT. NO. 3015 Grid yagi—Finest UHF antenna made. Available as single, double or four-stacked array. Excellent front-to-back ratio.



CAT. NO. 1850 Silver Streak high-band—Optimum gain and signal-to-noise ratio on any single high-band VHF channel. Recommended for weakest signal areas.

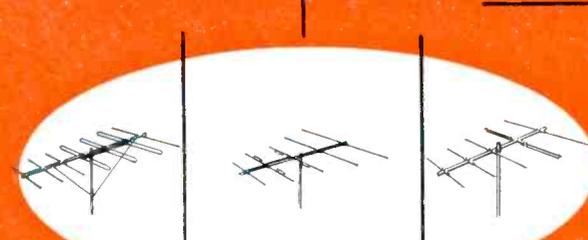
CAT. NO. 1350 5-element yagi high-band—The best buy among medium price antennas. Provides excellent gain and directivity on any single high band channel.

CAT. NO. 1860 Bazooka-Tuned high-band—Provides yagi gain and directivity throughout entire VHF high band. Bazooka element assures perfect impedance match on all channels.



CAT. NO. 644 Twin-driven FM—Ideal for fringe areas. Receives entire FM band with highest signal-to-noise ratio. Sharp directivity. Single or stacked.

CAT. NO. 6245T Omni-directional—Perfect circular gain pattern. Receives FM from all directions without mechanical rotating. Single or stacked.



CAT. NO. 1840 Triple-driven yagi—Single channel yagi characteristics throughout the low-band. Provides maximum signal pickup and gain.

CAT. NO. 1880 Broad band Trapper—The most revolutionary TV antenna ever offered. Peak performance on channels 2 through 13. Also UHF in prime service areas.

CAT. NO. 1325 5-element yagi—For those installations where price is a "must." Yagi gain and characteristics in a medium priced antenna.

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On Book Row

POWER REQUIREMENTS FOR TRANSISTOR CIRCUITS . . . By J. DALFONSO: A revealing report on power sources which can be used in transistorized equipment designed for audio, communication and allied equipment. Useful service plots are offered.—8 pages, no charge; P. R. Mallory and Co., Battery Division, North Tarrytown, N. Y.

RC/RL TIME CONSTANT . . . By ALEXANDER SHURE: First of a series of specialized texts intended for the student studying electronics. Special emphasis has been placed on the applications of time constant in equipment of all kinds. The points found generally mystifying are clarified by illustrations and examples.—48 pages, 5½" x 8½", paper bound, priced at \$.90; John F. Rider, Publisher, Inc.

PRACTICAL COLOR TELEVISION: Second edition, with text, drawings and photographic explanations of the operation of color TV. Included in the new manual are detailed descriptions of a commercial color receiver as well as latest model test equipment for the servicing of color sets. Featured are forty full-color photos taken directly from the face of a tri-color tube. Whenever possible, basic color principles are presented in non-technical terms.—80 pages, priced at \$2.00; Commercial Service Section, RCA Service Company, Inc., Camden 2, N. J.

COLOR TV DICTIONARY. By J. RICHARD JOHNSON: A compact dictionary aimed to serve all who read color-TV articles and texts. Basis of the book are the terms which originated in the NTSC and which formed the basis of present color TV. Defined are more than 263 names and terms; contains 45 illustrations.—70 pages, 5½" x 8½", priced at \$1.25; John F. Rider, Publisher, Inc.

TV COMPONENTS SERVICE MANUAL: A handy reference work, containing over 150,000 cross-reference listings of TV sweep components for every TV set manufactured to date, plus servicing data in *pix-a-faults, trouble facts and circuits*. A section devoted to theory and service of sweep circuits is also included. Manual discloses types of TV sweep components to use as *exact replacements* per the set manufacturers' own specifications.—62 pages, no charge; Ram Electronics Sales Co., Irvington, N. Y.

RETMA ADVANCED TV SERVICING TECHNIQUES COURSE: A 3-volume study prepared by RETMA pilot training school teaching staff. The main text, a 176-page volume, is divided into 13 chapters. Contents are based on actual experiences gathered through the use of the book in the classes conducted by RETMA in the New York Trade School. The second book is a *laboratory workbook*; this is a 32-page manual. The third volume is the *instructor's guide* with details for the implementation of a course of this type in any school. It describes sets necessary in setting up a school service lab; specific equipment required; organization of test benches; materials required for each student, etc. *First two volumes are priced at \$3.60 and \$95, respectively . . . third book is available free to all educational institutions and instructors*; John F. Publisher, Inc.

Catalogs - Bulletins

REON TUBE CORP., 58-15 57th Dr., Maspeth, L. I., N. Y., has published a picture tube replacement guide chart, that lists all types of TV picture tubes, their function, Reon replacements and direct substitutions, as well as characteristics and changes required for the substitutes.

* * *

PERMO, INC., 6401 Ravenswood Ave., Chicago 26, Ill., has introduced its '54-55 catalog, 104, covering metal, jewel or diamond needles, and replacement types by shape, or cartridge name and number. A cross reference and needle guide is also included, as well as an inventory stock control system. Also detailed are products made for tape and wire.

* * *

ELECTRONIC INSTRUMENT CO., INC., 84 Withers St., Brooklyn, N. Y., has released a 6-page brochure, DMC-554, with specifications of a line of 38 kits and 42 factory-wired instruments. Brochure folds to 6½" x 4" for mailing purposes.

* * *

JAVEX, P. O. Box 646, Redlands, Calif., has released catalog 254, covering TV installation practices, types of accessories available for a multiplicity of installations, as well as ad and promotional materials available.

* * *

SNYDER MANUFACTURING CO., Philadelphia 40, Pa., has published a catalog describing their line of auto-radio antennas. Included are descriptions of cowl and fender mount antennas, plus rear and deck mount types, as well as an antenna which raises or lowers three sections by means of a finger tip dash control.

* * *

INTERNATIONAL RECTIFIER CORP., 1521 E. Grand Ave., El Segundo, Calif., has issued a 4-page bulletin, GD-1A, listing ratings and specifications of germanium diodes. Included is a diode replacement guide.

* * *

CLEAR BEAM ANTENNA CORP., 100 Prospect Ave., Burbank, Calif., has released a catalog describing a line of TV antennas, telescoping steel masts and accessories.

* * *

CHICAGO STANDARD TRANSFORMER CORP., ADDISON AND ELSTON, Chicago 18, Ill., has published its '54 catalog of stock transformers for radio, TV, amateur, communications and other electronic applications.

* * *

ASTRON CORP., 255 Grant Ave., East Newark, N. J., has prepared a folder, AB-19A, with technical data and operating characteristics of high temperature metalite metallized paper capacitors. Folder contains information on the types available, their high capacitance stability, voltage rating and derating, insulation resistance, sizes and other characteristics. Capacitors (Hy-Met) are designed for operation over a temperature range of -55°C to +125°C.

* * *

SIMPSON ELECTRIC CO., 5200 W. Kinzie St., Chicago 44, Ill., has released issue No. 4 of *The Technician's Timesaver*, a special color edition describing how to use the Genescope and model 479 in the alignment of a color-TV chassis, with the aid of a color adapter cable and booster amplifier. Report, prepared by Bob Middleton, features a number of schematics, block diagrams and frequency plots.



INTRODUCES

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- DRIVER-TYPE COIL CONSTRUCTION
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the U.S. Rubber Company...”***

HARRY E. HUMPHREYS, Jr.

*President,
United States Rubber Company*



“For over twelve years the United States Rubber Company has offered its employees the Payroll Savings Plan, whereby they can systematically and regularly save in United States Savings Bonds. Over those years, tens of thousands of our employees have joined the Payroll Savings Plan with direct benefits to themselves and their families. Such employees are better employees because with more personal security and freedom from economic worry, there is less absenteeism and personnel turnover, fewer accidents and greater employee responsibility. Such regular investment in Bonds contributes also to the economic strength of the nation. By thus promoting a sounder dollar, business also directly benefits itself. That’s why we at United States Rubber endorse the Payroll Savings Plan for Savings Bonds.”

Mr. Humphreys cites three important benefits of the Payroll Savings Plan: Payroll Savers build personal security . . . production curves reflect serious-minded workers and reduced absenteeism . . . the national economy is strengthened by a growing reservoir of future purchasing power—more than 49 billion dollars in U. S. Savings Bonds, *cash value*, held by individuals.

There is still another big advantage in the Payroll Savings Plan: it is easy to install and maintain.

If you do not have the Payroll Savings Plan, or if you have the Plan and your employee participation is less than 60%, here’s all you have to do to help your employees, your company and the country:

Write today to Savings Bond Division, U. S. Treasury

Department, Washington, D. C. Tell them you want to join the United States Rubber Company and the 45,000 other companies that are making an important contribution to national security and a sounder dollar.

Your State Director, U. S. Savings Bond Division, will contact you promptly. He will explain the simple procedure of installing the Plan and will show you how to conduct a simple, person-to-person canvass that will put a Payroll Savings Application Blank in the hands of every man and woman in your plant and offices.

That’s all you have to do. Your employees will do the rest. They are as interested in their own future as you are in yours. Give them an opportunity to build personal security for themselves and a better America for their children.

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

SERVICE





Superior's new Model 670-A **SUPER METER**

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

SPECIFICATIONS:

D.C. Volts: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. Volts: 0 to 15/30/150/300/1,500/3,000 Volts
Output Volts: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. Current: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
Resistance: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
Capacity: .001 to 1 Mfd. 1 to 50 Mfd. (Quality test for electrolytics)
Reactance: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms
Inductance: .15 to 7 Henries 7 to 7,000 Henries
Decibels: -6 to +18 +14 to +38 +34 to +58

ADDED FEATURE:

The Model 670-A includes a special **GOOD-BAD** scale for checking the quality of electrolytic condensers at a test potential of 150 Volts.

The Model 670-A comes housed in a rugged crackle-finished steel cabinet complete with test leads and operating instructions.

\$28⁴⁰
NET



Superior's new Model TV-11 **TUBE TESTER**

SPECIFICATIONS:

- ★ Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyatron, Miniatures, Sub-Miniatures, Novals, Sub-minars, Proximity fuse types, etc.
- ★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.
- ★ The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.
- ★ Free-moving built-in roll chart provides complete data for all tubes.
- ★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.
- ★ **NOISE TEST:** Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

The Model TV-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

\$47⁵⁰
NET

EXTRA SERVICE—The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

SUPERIOR'S NEW MODEL TV-40

C.R.T. TUBE TESTER

A complete picture tube tester for little more than the price of a "make-shift" adapter!!

The Model TV-40 is absolutely complete! Self-contained, including built-in power supply, it tests picture tubes in the only practical way to efficiently test such tubes; that is by the use of a separate instrument which is designed exclusively to test the ever increasing number of picture tubes!

EASY TO USE:

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

Tests all magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton!!

SPECIFICATIONS:

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

Model TV-40 C.R.T. Tube Tester comes absolutely complete—nothing else to buy. Housed in round cornered, molded bakelite case. Only . . .

\$15⁸⁵
NET



**SHIPPED ON APPROVAL
NO MONEY WITH ORDER — NO C.O.D.**

Try any of the above instruments for 10 days before you buy. If completely satisfied then send down payment and pay balance as indicated on coupon. **No Interest or Carrying Charges Added!** If not completely satisfied return unit to us, no explanation necessary.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-57, 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no carrying, interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

Model 670-A . . . Total Price \$28.40
\$7.40 in ten days. Balance \$3.50
monthly for 6 months.

Model TV-11 . . . Total Price \$47.50
\$11.50 in ten days. Balance \$6.00
monthly for 6 months.

Model TV-40 . . . Total Price \$15.85
\$3.85 in ten days. Balance \$4.00
monthly for 3 months.

Name
Address
City Zone State

Mr. Service Dealer:

THIS **RAYTHEON** AD IS YOUR AD

LIFE

LIFE

NICE GUY

"DOCTOR"
(of Sound and Sight)

Your **RADIO AND TELEVISION SERVICE DEALERS** might be called *eye and ear specialists*, because theirs is the exacting job of curing the ills of the instruments that supply you with looking and listening pleasure. To accomplish the tremendous task of keeping America's millions upon millions of television and radio sets in top condition, requires many trained technicians, expensive up-to-the-minute equipment, and a wealth of experience and know-how.

America is fortunate indeed to have tens-of-thousands of competent TV-Radio technicians from coast to coast, doing the miraculous job of keeping up with this complex and fast growing industry. Raytheon salutes them all and is especially proud of those who are **RAYTHEON Bonded Electronic Technicians**. During the past ten years more than 35,000 Registered Bond Certificates have been issued by Raytheon to qualified service dealers all over the country. In spite of the fact that these dealers have handled many millions of jobs *less than fifty complaints* have been received.

Facts such as these justify confidence in your TV and Radio Service Dealer. Make doubly sure of satisfaction by taking a moment to look up the *Raytheon Bonded Electronic Technician* near you. Find him through his shop identification or in the yellow pages of your telephone directory.

RAYTHEON
Bonded
ELECTRONIC TECHNICIAN

Look for this seal. Here's what it stands for:

1. GUARANTEE ALL RADIO AND TELEVISION REPAIR WORK 90 DAYS.
2. Use only parts of recognized quality.
3. Charge not more than list price for parts.
4. Test customers' tubes as accurately as possible.
5. Keep labor charges at a reasonable level.
6. Perform only such work as is necessary.
7. Maintain proper equipment for good repair work.

RAYTHEON
Bonded
ELECTRONIC TECHNICIAN

RAYTHEON MANUFACTURING COMPANY, Receiving and Cathode Ray Tube Operations
NEWTON • CHICAGO • ATLANTA • LOS ANGELES

RECEIVING TELEVISION AND RADIO TUBES, INDUSTRIAL AND POWER TUBES, TELEVISION SETS, ROOM AIR CLEANERS, SEMICONDUCTOR PRODUCTS, DIATHERMY EQUIPMENT, ELECTRONIC COOKERS, ELECTRONIC EQUIPMENT, ELECTRONIC DUPLICATORS, INDUSTRIAL EQUIPMENT, ULTRASONIC MACHINE TOOLS, AND ELECTRONIC TUBES, SONAR, RADAR AND COMMUNICATIONS EQUIPMENT FOR THE UNITED STATES GOVERNMENT

SEPT. 13, 1954

More than twenty-six million people will read about you and the good work *you* are doing, in the September 13th issue of LIFE Magazine. We at Raytheon are publishing this advertisement because we believe you deserve a public pat on the back for the successful way you have met every challenge of the Radio and Television Service industry. We

are telling you about it in advance so that you can take full advantage of its appearance to help increase your volume and profit. It's our way of saying thank you for using and recommending *Raytheon Quality Radio and Television Tubes*.

RAYTHEON MANUFACTURING COMPANY

Receiving and Cathode Ray Tube Operations
Newton, Mass., Chicago, Ill., Atlanta, Ga., Los Angeles, Calif.

RAYTHEON MAKES ALL THESE:

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



Excellence in Electronics

RADIO · TELEVISION · ELECTRONIC
SERVICE

Completely Indispensable

THE ORGANIZED CONTROL of operating costs has always been found to pave the way for a sturdy business. In the Service Shop such control is a rugged job; it involves more than a routine watch over elementary expenses. Here one must also know how to police bench and field time wisely and obtain a just reward for knowledge and skill. One might say that here is a tall order; it is, but certainly not beyond the ability of any Service Man alert to the requirements of modern servicing.

Today, the Service Man knows that no longer need he fear those embarrassing moments in the home or shop, fussing and fumbling, and wasting valuable moments searching for those trouble areas with crude makeshift screwdriver-flashlight combos. For today, with the aid of precision test equipment, he knows that a defect can be spot-checked quickly, and in a professional manner of which he can be proud. Today, the Service Man knows that he has the finest array of instruments available to serve him in every field, be it radio, TV, auto radio, audio or industrial electronics.

The wide assortment of equipment now being produced could pose a problem; what should be used and how can it be used most effectively? Once again, knowledge and skill become academic issues. For armed with basic design and constructional know-how obtained through experience, religious attendance at clinics and serious study of texts and articles in technical journals such as *SERVICE*, it does not become difficult to decide what tool should be used to perform the task at hand.

To illustrate, it has been found that 20,000 ohms-per-volt meters are notoriously inaccurate for measurements in high-impedance circuits, or tuned or high-frequency circuits. Thus, to measure *dc* voltages in TV receivers, one must use a vacuum-tube voltmeter.

Seasoned Service Men have learned too that one can't service a TV chassis with just a tube checker. There's quite a family of apparatus required to troubleshoot thoroughly those TV models. Among the essentials are a sweep-signal generator, 'scope, the *vtrm*, marker generator, *vom*, *hv* probe, capacity tester and the tube tester.

When one becomes aware of the multiplicity of uncanny checks these instruments can provide, any skepticism about their need in the shop just vanishes. To illustrate, some markers can be used to check alignment and bandpass of the *rf* and *if* circuits, as well as the scanning linearity of both horizontal and vertical circuits. They can also be used as rebroadcast transmitters, modulating the *rf* output by a video signal from an operating set to provide *rf* carriers complete with video and sync information. The output signals can be used to check picture performance of other sets on any channel.

For those who have become expert with the basic equipment and wish to expand their facilities, complete generator sets are available. Not only can these instruments be used to check audio, sync, *agc*, damper, vertical

and horizontal-deflection circuits, as well as the video amplifier, but they can be used to conduct noise rejection tests, sensitivity measurements and even drive a TV camera or a monoscope.

A number of the basic tools described can also be used effectively in the repair of other than TV equipment. The 'scope, for instance, has been found to serve as an excellent trouble tracer in audio gear, and auto and home radios. 'Scopes are now used widely to check vibrators. Of course, there are many special types of instruments that are particularly adapted to certain problems in servicing. In this category we find grid dip oscillators, voltage calibrators, intermodulation analyzers, square-wave generators, audio oscillators, and bridges. All can contribute substantially to the needs of a complete servicing bench, serving to reduce the time required to find solutions to varied problems during the busy days, and thus adding more dollars to those payrolls.

In color, too, all implements will be found very useful. The basic group described earlier will be found particularly effective. For all color chassis will contain the standard circuitry employed in b-w sets, plus the color portion, and thus it will be necessary to use these basic instruments to align and adjust all of the preliminary monochrome circuits, just as carefully as if the set were designed for black and white pickup only.

To service the color section of the new models, additional test items will be required. At present, for the three-gun sets now being made, two basic types of gear have been established as essential; the dot-bar or color bar generator, and a wide-band 'scope cited as necessary for observation and measurement of the 3.58mc burst signal. One dot-bar generator provides a pattern of rectangular dots to make convergence adjustments; it also provides a choice of horizontal or vertical bars, or cross-hatch patterns for linearity adjustments in both color and b-w models. The color bar unit produces ten bars of different colors, including red, magenta, blue, cyan and green. Another dot generator has been designed to produce small white dots on the screen; nominally 16 horizontally and 12 vertically. The exact number of dots can be changed somewhat by a synchronizing signal control. Each dot, actually rectangular in shape, is about a quarter of an inch long and two or three vertical scan lines high. The sensitivity of one wide-band model 'scope has been described as flat within 3 db from 3 cycles to 4.5 mc, with a direct sensitivity of .1 volt peak-to-peak per inch.

Some manufacturers also have developed accessories extending the usefulness of their b-w equipment for certain phases of color service, such as conversion and 'scope measurement.

Regardless of the type of servicing one is engaged in today, an adequate set of quality instruments must be used to insure a solid success. Such tools are truly invaluable, completely indispensable partners in every shop's operation.—L. W.

For "Trouble-Free" Electrical Protection



You can rely on BUSS FUSES!

Accuracy and dependability are built in every BUSS fuse at the factory and will be there no matter when the fuse is called upon to operate.

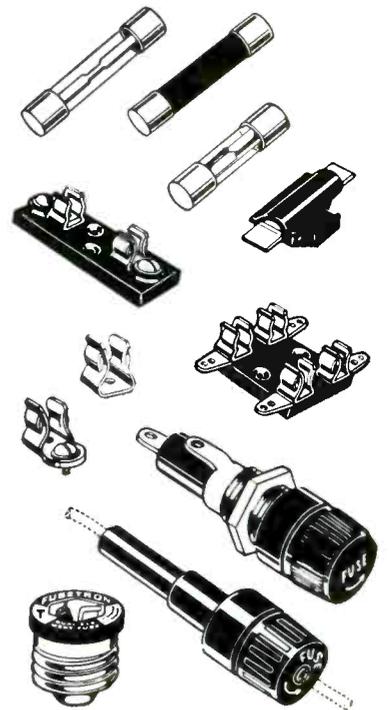
For every BUSS fuse normally used by the Electronic Industries is tested in a sensitive electronic device that rejects any fuse that is not properly constructed, correctly calibrated and right in all physical dimensions.

Proper construction prevents poor contact heating, correct calibration makes certain that the fuse will carry its rated current.

This insistence on perfection results in quality, 'trouble-free' fuses. That's why manufacturers and service organizations rely on BUSS fuses for dependable electrical protection under all service conditions.

And to your customer too, the BUSS trademark stands for fuses of unquestioned dependability and high quality. For the BUSS reputation has been built on millions and millions of installations for home, farm and industry over the past 39 years. So be doubly safe, protect the product and your reputation . . . furnish only genuine BUSS fuses.

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Please send me bulletin SFB containing facts on
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SERVICE... *The National Scene*

AUDIO ACTIVITY TO SIZZLE IN FALL AND WINTER¹--Industry is now selling audio components and systems, alone, at a \$50-million a year rate, it has been reported. And during the next few months many have estimated that rising sales will jump this figure considerably. Last year, one expert said recently, folks who bought custom built as well as packaged hi-fi units, spent nearly \$500-million for equipment that would insure better tone; this year the interest in quality reproduction is even greater. . . . Commenting on these optimistic views, another specialist declared that the enjoyment of realistic, undistorted music is now within the reach of everyone, and industry is being called on not only to supply equipment for millions of new music enthusiasts, but to replace older instruments no longer found satisfactory. . . . Service Men will find tape, now quite a factor on the audio scene, sharing more and more of the limelight. Not only will pre-recorded tape stir up interest, as previously reported, but kits, plug-in accessories, attractive consoles and improved recorder-playbacks will add sparkle to the market, too. . . . One tape kit includes a 7½ ips recording head that, it is said, will provide a frequency response of 16-20,000 cps. In addition to the head, the kit also contains an erase head and a mounting bracket for any of six types of recorders. . . . Phono owners also will be able to convert their players over to tape by using a plug-in transport mechanism driven by the turntable. . . . Tape recorders are also being built into hi-fi consoles, with provision for record playing, too. . . . The growing enthusiasm for tape has prompted one manufacturer to include a mechanism in a special console featuring extended-range dynamic speakers being fed by a 10-watt amp.

THE SPEAKER-ENCLOSURE FRONT will be brimming with new developments, too. High-frequency speakers, based on the electrostatic principle, will be available for the first time in packaged hi-fi, and possibly as a separate component. One such speaker, recently demonstrated, consisted of 16 slender units disposed as facets on a half cylinder. Each unit consisted of two electrodes, a fixed backplate made of ribbed aluminum, and a movable electrode composed of an extremely thin sheet of polyester plastic, on which had been deposited a film of metal. In operation, a steady polarizing voltage is applied between the two electrodes, causing the membrane to be attracted toward the backplate. The membrane is held permanently under uniform tension by the action of two springs and a supporting bar. AF voltage, also applied between the electrodes, causes the membrane to move back and forth in accordance with the audio signal. This particular unit is claimed to have a frequency range of from 7-20 kc, and will be used in conjunction with 8" and 10" em speakers.

ANOTHER REPRODUCER DEVELOPMENT recently announced features a handsome housing for a 3-way system, with an lf unit loaded by a new design reactance-annulling trilaterial-mouth horn for bass, selected compression-driver horn-loaded mid-channel with intra-range equalizer, and a space blended tweeter.

EXTENSION SPEAKER INTEREST will also be brisk. These remotes can be adapted for radio and TV use, and used independently of the set, or with the receiver speaker. . . . Some models have been designed for hi-fi installations and include such features as wide-range speakers, and tuned acoustical-slot baffles to provide effective bass response and eliminate boominess.

THE MUSHROOMING DRIVE-IN THEATRES have been a boon to the audio world in sales, installation, maintenance and servicing. The need for amps, preamps, cables, and individual car-stand speakers has sparked replacement potentials. The Fall will see a continuing demand for these items.

AUDIO will also continue to be the headline feature at Fall shows in Boston, Chicago, New York and on the Pacific Coast. . . . In the Northeast, a New England Hi-Fi Festival will be held on October 22-23-24, at the Hotel Touraine in Boston. Equipment on demonstration will include record changers, amps, tuners, loudspeakers, enclosures, tape recorders, cabinets and assorted components. It is reported that a host of celebrities in the musical world have agreed to serve on the show committee advisory board.

¹The first of an exclusive series of industry progress reports on audio appears in this issue on page 22, as part of the *AAC Audio Forum*.

SERVICE... *The National Scene*

COLOR TUBE VIEWING AREAS NOW EQUAL TO LARGE B-W SCREENS--The predicted large-size picture tubes for color have become a reality. During the past few weeks, 3-gun models providing up to 250 square inches have been announced. One type, a 19" 205 square-inch version is already in production². . . . Another, described as a 250-square-inch model, will be demonstrated this Fall. The tube, a 21" round metal-envelope type, features a frosted faceplate said to eliminate glare from reflections caused by roomlight and windows. According to company spokesmen, the new tube incorporates an improved curved mask, with phosphor dots on the faceplate of the color tube. . . . Another manufacturer has announced that they've developed a rectangular 250-square inch picture tube using, however, a single gun. These tubes are still in the experimental stage, and will probably not be available for receivers until sometime in '55.

STREAM OF COLOR SCHOOLS ANNOUNCED BY SET MANUFACTURERS--Recognizing that an ever-increasing number of color TV sets will soon be going into homes, receiver manufacturers have begun to concentrate on education and conduct special clinics for independent Service Men and the service crews of distributors. . . . One manufacturer recently notified all service associations that they would welcome one member from their group for a one-week free color-training course; groups were asked to recommend on the basis of technical competence, and the ability to pass on what has been learned to others in the association. In this way it was felt the training program could spread more rapidly across the country. Because a heavy enrollment is expected, associations were asked to route the application for training to the company distributor in their territory. The school will be kept running as long as there is enough interest to fill classes, it was said. . . . Spokesmen stressed that the course was not one for beginners or tube changers, but for those already highly qualified in b-w service. . . . Another manufacturer has announced the opening of a school for distributor Service Men, and the inauguration of service clinics to be held throughout the country in each distributor's territory.

CRTSA EDUCATIONAL TV PROGRAM SCHEDULED FOR EARLY DEBUT--A series of TV programs, designed to acquaint viewers with some of the difficulties which must be overcome by Service Men to keep sets in good working order, will soon be a weekly feature in Philadelphia, under the sponsorship of the Council of Radio-TV Servicemen's Associations. . . . The script, being prepared by a local ad agency, will reveal the Service Man's side of the repair picture, and point up the fact that TV servicing is no simple task. TV circuitry will be explained in a graphic manner, so that viewers will come to realize that the Service Man is not a charlatan who charges prices for work he doesn't do. . . . Members of the association will serve as actors. Guest experts will be invited to discuss some aspect of TV in layman's language; typical questions that viewers would ask will be answered during the show. . . . The Council seal will be displayed at appropriate times during the presentation, and announcements will emphasize the fact that through the Council's efforts TV set owners can get better and more honest service. . . . Programs are expected to be 15-minute affairs, and run for a 13-week period.

FEDERAL LEGISLATION SUGGESTED BY NETSDA--The possibility of acquiring a Federal license for radio and TV Service Men was suggested recently during a meeting of the National Electronic Technicians Service Dealers Association. Noting that it is the duty of the FCC to supervise the use and maintenance of devices which can cause interference with communication equipment employed in interstate service, the association boys felt that a license should be issued by the Commission to all qualified Service Men to help enforce regulations. It was their feeling, too, that there are many other types of electronic interference which could be corrected by qualified licensed Service Men, directly resulting in benefits to broadcasters and the public.

BASIC ASSOCIATION-FORMATION GUIDE ISSUED--An encyclopaedic report, describing in detail how to organize a local service association, has been prepared by the National Alliance of TV and Electronic Service Associations in Chicago. Every step is expertly detailed: requirements and responsibilities; aims and purposes; legal procedures; duties of officers and board members; meeting places; frequency of meetings; parliamentary procedure; basic dues; programming, and committee activities. . . . Membership questionnaires, regulation forms, and typical ads that can be used to promote associations are all attractively illustrated and carefully described. . . . Those who prepared this guide can well be proud of their work. Congratulations.--L.W.

²See *Tube News* section, this issue, page 24.

The BACKSTOP

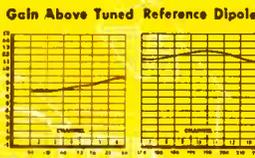
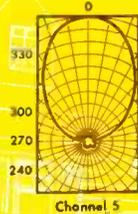
STOPS co-channel and adjacent-channel interference caused by rear signal pick-up!

- Highest front-to-back ratio ever built into an antenna!
- No rear pick-up; eliminates "venetian blinds"!
- Largest screen area: 70 square feet!
- Very high all-channel gain. Incorporates basic Champion design, including Tri-Pole, with additional elements!
- Completely preassembled!

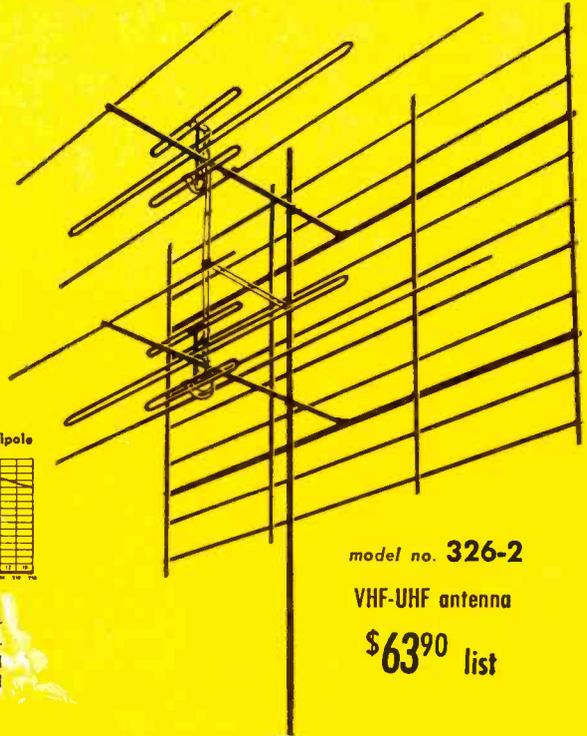
Table of Front-to-Back Ratios (Relative Voltage)

Channels	Front-to-Back Ratios
2	9:1
3	10:1
4	11:1
5	20:1
6	18:1

Only Low Band channels shown, since co-channel interference is not encountered on High Band channels.



IMPORTANT . . . don't be misled by polar patterns representing relative POWER. Remember, power is the square of voltage. All Channel Master polar patterns are presented in relative VOLTAGE.



model no. 326-2

VHF-UHF antenna

\$63⁹⁰ list

2 radical new antennas by CHANNEL MASTER

The most beautiful antenna ever made! The only indoor antenna featuring powerful outdoor design principles — Bow-Tie and Screen.

Wonder Bow * VHF-UHF

indoor antenna

DESIGNED FOR POWER!

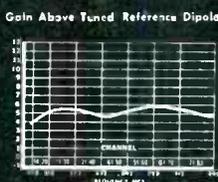
On UHF: For primary and secondary areas. In many cases, performance is equal to actual outdoor installations. Good directivity on all channels.

On VHF: Ideal in areas of strong V-F signals.

STYLED FOR BEAUTY!

Designed by a well-known industrial designer, the WONDER BOW is proof that indoor antennas can be beautiful as well as powerful. Wins customer approval on beauty alone!

The first gain figures ever to be published for an indoor antenna!



Gold and black
model no. 416

Silver and black
model no. 417



\$835 list



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The World's Largest Manufacturer of TV Antennas

Write for complete technical literature.

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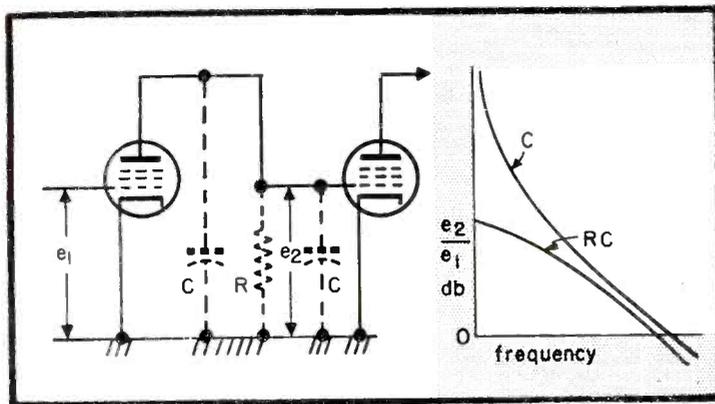
*Pat. No. D-171560

CHAIN AMPLIFIERS

by LESTER C. SMITH

Chief Engineer

Spencer-Kennedy Laboratories, Inc.



(Left)

Fig. 1. Uncompensated stage and plot of gain versus frequency.

CHAIN OR DISTRIBUTED amplifiers, when properly designed and utilized, have been found to provide smooth, effective amplification over the 54 to 216-mc spectrum, and capable of handling a large number of signals, even though the signals might be close together or wide apart in frequency. No other method for providing this coverage over this range of frequencies appears to have been devised, and, in fact, no other method seems theoretically possible with currently available tubes.

Some twenty years ago experts in the field of network analysis, notably Hansen, Wheeler, and Bode, showed that the maximum gain which one could achieve with a particular type tube over a specific band is inversely proportional to the width of the band. The gain cannot be increased beyond a certain theoretical limit, no matter how complicated or refined the network might be with a given tube. The maximum gain which one could achieve with tubes, then available for a bandwidth of 4 mc, was embarrassingly close to one; in fact, at that time several qualified theoretical men concluded that coast-to-coast relaying of TV was impossible. One can see that, if a stage has a gain of one or less, adding additional stages will give

an output no greater than the input and nothing good is accomplished.

Better tubes were, of course, developed, and the future was by no means as grim in that respect as it seemed, but real progress in very wide band amplification was very slow until the principal of the chain amplifier was invented.

The fundamental reason why the bandwidth of an amplifying stage is limited is because each tube has associated with its input and output leads an appreciable amount of capacitance, and this capacitance must be charged and discharged during every cycle. The higher the frequency, the more rapid is this discharging, and the greater the current which flows through these undesired capacitances. If a signal of a certain size is applied to the grid of a tube, the total available plate current is determined by the characteristics of the tube. If this current is wasted in the distributed capacitance, it is not available to produce a useful voltage on the grid of the next tube. Since the amount of current which is wasted increases directly with frequency, the voltage available would ordinarily decrease with frequency as in Fig. 1.

A somewhat flatter frequency response can be achieved if a resistor

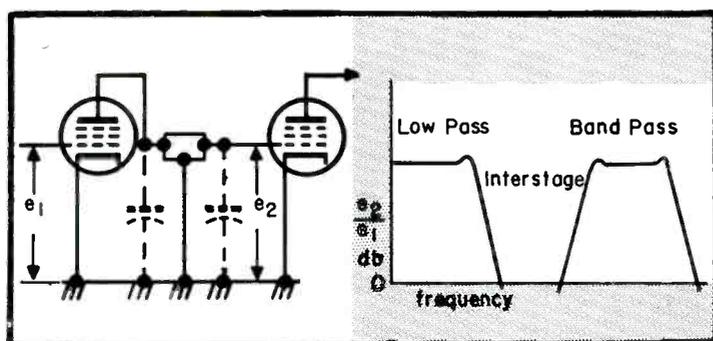
is shunted across the circuit, but the high-frequency response will still be determined chiefly by the distributed capacitance.

By using very complex networks, it is possible to compensate for the capacitance over a certain band of frequencies, and an amplifier which approaches quite closely the theoretical gain-bandwidth product may be achieved; see Fig. 2.

If we wish to produce a band-pass amplifier, a coil can be placed in parallel with each capacitance to cancel out the capacitance current at some point within the pass band, but, strange as it may seem, the gain-bandwidth product which we achieve is still precisely the same as if a low-pass amplifier were being made.

One might think that it would be possible to achieve greater gain by operating two or more tubes in parallel, but a little thought will show that while the output current is doubled, we at the same time double the capacitance; the gain-bandwidth product remains the same.

Some sixteen years ago the stagger-tuned amplifier, in which each stage is tuned to a different frequency, was developed. While this, in some cases, permits a useful amplifier to be built at lower cost, its gain-bandwidth is



(Left)

*From a report presented at the third annual National Community Television Association convention in New York City.

Fig. 2. Compensated low-pass and band-pass stages, and plot of gain versus frequency.

For TV Master-Antenna Systems*

still restricted to the same value as is achieved in conventional amplifiers; its performance is, in reality, not superior to the conventional amplifiers in any way.

The Chain Amplifier

If we could only devise a method by which the currents of the tubes could be added, without adding their capacitances, we would, as a first approximation, secure as much gain per stage as we wished. It has been found that this objective can be approximated by utilizing the chain-amplifier principle.

As an introduction, let us consider the behavior of a long length of coax cable. We are all familiar with the fact that this cable has a capacitance distributed all along its length, but this cable does have quite excellent frequency response, and if it were not for the resistance in the conductors, it would have absolutely flat response up to many thousands of megacycles. This good frequency response, in spite of distributed capacitance, results from the fact that there is within the cable a distributed inductance which overcomes the bad effect of the distributed capacitance.

A similar situation exists in low-pass delay networks, which use a large number of sections in cascade, each section consisting of a shunt capacitance and a series inductance. The fact that both C and L are lumped and not truly distributed results in a finite cut-off frequency. Even so, a delay network such as this (Fig. 3), with suitable small refinements, can be made which has very flat frequency response and quite constant impedance over a very wide band. If one examines the voltage appearing at the various nodes, one finds that the signal arrives at node B somewhat later than node A , at node C somewhat later than node B , and so forth. The most interesting characteristics of such a network is that, if the coils and capacitors are of high quality, its length can be doubled or tripled without appreciably changing the input impedance, the bandwidth, or the magnitude of the output voltage. We have here then a way of adding on additional capacitances, in theory as many as we desire, without increasing the apparent input capacitance, or suffering loss

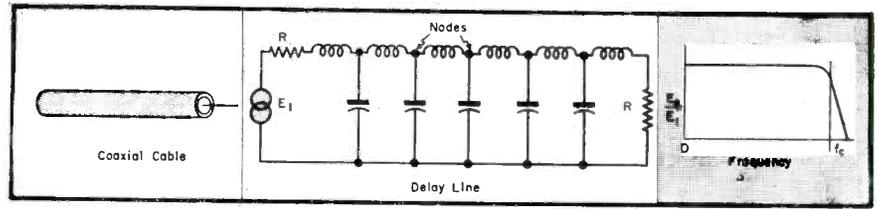


Fig. 3. Delay networks and response plot.

through attenuation, but of course only up to the cutoff frequency of the network.

If now the grids of pentode tubes are connected at the various nodes taking the place of the capacitances in the delay line, we have a method of supplying voltage to as many tubes as we wish without lowering the input impedance. In fact, the input impedance is at least as good as if only one tube were being used.

If now the plates of these tubes are connected to the corresponding nodes of another delay line, we have a means of adding the plate currents of the tubes without adding the plate capacitances of the tubes; Fig. 4.

For the amplifier to work properly the time delay from the input to the output through path A must be the same as through path B or C or D . This can be accomplished with suitable care. An amplifier can be made which performs in accordance with the basic assumptions.

Inspection of Fig. 4 will disclose that the plate current of each tube can flow toward the right and also toward the left. The amount which flows toward the left cannot be usefully employed and must be absorbed in a terminating resistor, R_p , which incidentally serves as a convenient means

of supply plate voltage to the tubes.

In a practical amplifier for TV the circuit elements are adjusted to give flat frequency response to approximately 220 mc. In this case the circuit values are such that any one tube would give a gain of less than one, but because the total current is the sum of the currents of several tubes in a single chain, the overall gain may be 10 db or more for each stage.

This then is the principle of the chain or distributed amplifier. If the vacuum tubes did not have imperfections other than their stray capacitance, one could achieve by this method as great a gain as one wished over as wide a band as one needed. In practice, the circuit elements are lossy, and, in particular, the tube grid absorbs appreciable power at the higher frequencies. In addition, tube lead resonances may occur. These effects put limitations on gain-bandwidth products realizable in practice.

If suitable care and skill is employed in the design of the chain amplifier, its frequency response, both with respect to magnitude and phase, can be made to be very good. For example, with one type,¹ it has been found that even with its input and output matching transformers, it is flat within 1 db from 54 to 108 mc and from 74 to 216 mc.

¹SKL212C TV.

[Next Month: Practical Applications]

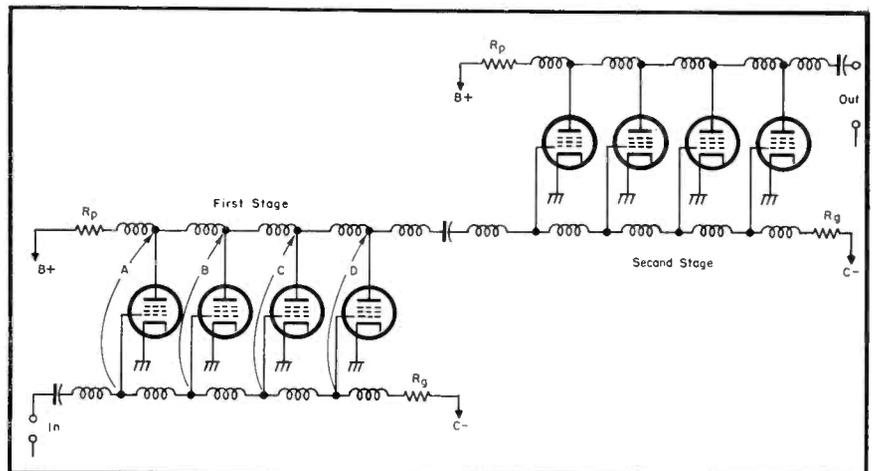
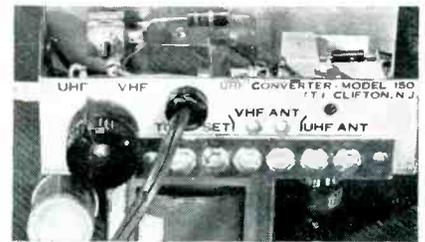
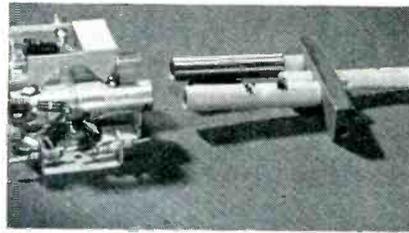
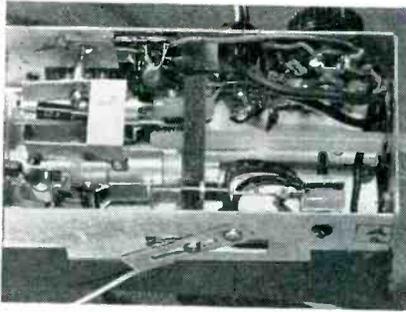


Fig. 4. Two stage distributed or chain amplifier.



Figs. 2, 3 and 4. Bottom view of chassis showing pointer drive is shown at left. In center is oscillator and pre-selector assembly with tuning slugs. Back view showing connections and switch is at right.

Coax-Tuned UHF Converter‡

by WYN MARTIN

[See Front Cover]

PRIOR TO JUNE '52 all TV stations operated in the *vhf* range. In preparing the revised allocation table the Commission felt that the ultrahighs had now become practical and could readily be used to expand the early 12-channel plan and on a national scale. Accordingly, they allocated seventy *uhf* channels to supplement the existing *vhf* assignments.

The research and development engineering staffs of the TV receiver and accessory manufacturers cooperated fully by solving innumerable technical problems involved in the reception of ultrahigh signals.

However, in many areas, an economic problem has appeared, because of intermixture of *vhf* and *uhf* stations.

In competing with *vhf*, some *uhf* stations have been at a disadvantage. Although many veryhigh stations are operating at their maximum legal power output, ultrahigh transmitters are still operating at relatively low power because high power *uhf* transmitters are still unavailable. And where *vhf* and *uhf* stations are in the same market, national or regional advertisers can reach more people by buying time on *vhf* rather than the low-powered *uhf* station.

To build an audience *uhf* stations must actively promote the sale of ultrahigh converters and *uhf*-equipped receivers. Since *vhf* programs are al-

ready available at no additional cost, *uhf* operators must make their service particularly attractive so that listeners will incur the expense of converting to *uhf*. Such campaigns are now underway in several parts of the country.*

To aid the telecaster and encourage conversions engineers have designed compact converters especially for primary areas with their large population centers. The circuit of such a converter¹ appears on the cover and in Fig. 1.

If cost were the only consideration in converter design, models could be built using only a tuned oscillator with some provision for coupling the antenna to the mixer input, and the receiver to the mixer output. But good electrical performance plus protection against obsolescence has been found to dictate the inclusion of preselection.

In a superhet system a receiver will respond to signals below and above the oscillator by the first *if*. Without a preselector it has been found that two

signals can be received at every tuning position with equal strength. The purpose of preselection is to pass the desired signal with minimum loss, while attenuating all other AM, FM and TV signals in the spectrum.²

The Preselector

The design of preselector and oscillator tuned circuits involves both mechanical and electrical considerations. In general, the methods can be reduced to tuners using sliding contacts, and non-sliding contact capacity arrangements. The capacity-tuned circuit has been found to be preferable because sliding contacts sometime cause erratic tuning, noise, and there is the necessity for periodic lubrication.

In the converter illustrated the conventional radio type of capacitor with the limitation of 180° tuning rotation has been replaced by a unique capacitor using coax tuning with direct

(Continued on page 44)

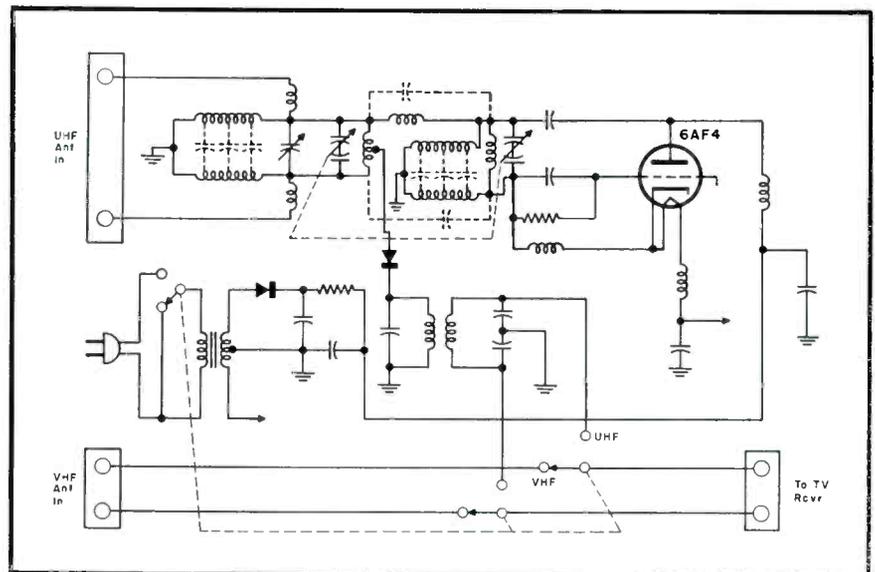
‡Based on notes supplied by the engineering department of Industrial Television, Inc.

*National Scene, SERVICE; July, 1954.

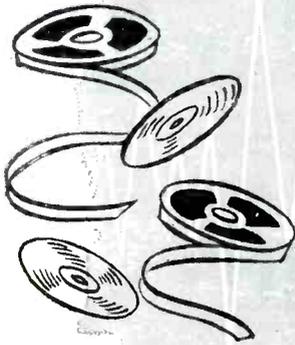
¹ITI Model 150.

²Although converters will work satisfactorily in many areas at present, there is the possibility that a future channel assignment, or a power increase of an existing transmitter might destroy the usefulness of such converters in the area. The problem deserves consideration since there is no protection in the allocations plan for such situations.

Fig. 1. Schematic of the ITI model 150 converter.



The AAC Audio Forum †



AUDIO INSTALLATION AND SERVICE Hi-Fi - Phono - Tape - P A Amplifiers - Speakers

Part I of a Special Series of Progress Reports*: Initial Study Covers Basics of Sound, Purity Factors, Musical Tone Composition and Relationship to Reproducers

by **KEN STEWART and PAUL EDWARDS**

SOUND is vibration. It may be a vibration of the air, or of a string in an instrument, or of the head of a drum being hit by a drumstick. Without that vibration, we would hear nothing. But there are many kinds of vibration.

We are familiar with the term *harmonic*, but many are less familiar with the term *partial* as used in musical studies. A partial to the musician is the same as a harmonic to the engineer. Harmonics are simply octave relationships to a fundamental tone; this is illustrated in Fig. 1, where we see such structures of fundamentals and their relative harmonics. The top portion of the microphoto shows the fundamental of a string vibrating as a unit. If this were the vibration of the string of a violin, it would be possible to change this vibration pattern into the one shown immediately below it, by simply touching the middle of the string lightly with the finger. By making this contact, the vibration of the string would be divided into two parts. This represents the second harmonic of the fundamental. Vibration of the string in this fashion, will sound almost the same when being played as does the vibration indicated above it, but will sound one octave higher. In like manner, the bottom section of the photo shows the string vibrating in its third harmonic mode. This means that the string is vibrating in three sections rather than in one section. This is a physical picture of the fundamental and harmonic structure of sound waves.

Now it might be assumed that the best musical tones are the purest tones. This is not necessarily so. Although we do hear people talking about the purity of singers voices and the purity of the musical tones coming from an

† Presented as a service to industry, in cooperation with the Audio Activities Committee (through its Promotion and Public Relations Subcommittee) of the Sales Managers' Club, Eastern Division, who have arranged for members of the audio industry to contribute authoritative data on all phases of audio in which they are most expert. Comprehensive articles will contain technical and merchandising information on amplifiers, pre-amps, speaker enclosures, speakers, turntables, record changers, cartridges, needles, arms and accessories, recording discs and tapes and accessories, tape recorders, special output transformer kits and tuners.

instrument, that word purity does not indicate what we, in the electronic or acoustic field, commonly call a pure tone. Fig. 2 (top) shows a pure tone; pure in the sense that it is mathematically perfect. It is a pure sine wave. When we see a wave such as this, we know that we have perfect reproduction. Yes, it is perfect electrical reproduction, but this does not make that particular tone a musical tone. The fact is, that musical tones are seldom pure sine waves. They are combinations of sine waves. They are combinations of fundamentals and harmonics, or musically speaking, fundamentals and partials; this is illustrated in Fig. 2. At top a perfect sine wave, while the wave below it is also a perfect sine wave, but a second harmonic of the fundamental. If the second harmonic is added to the fundamental, the waveform shown at the bottom of the illustration will appear. Now, this wave-

form does not look anything like the fundamental; it doesn't look as *pure*, but it is more musical in tone than is either of the pure sine waves making up the tone.

Perhaps one of the greatest problems that a manufacturer of electronic organs has to face is to take the pure sine wave from the master oscillators, add the harmonics in proper number and phase to make the musical tone that he wishes his organ to reproduce. They vie with one another to produce more voices, as they call it, by the addition of more tones and overtones, and still more overtones to the fundamentals to produce the voices of the violin, flute, clarinet, the bassoon, and even the human voice, through a system of stops. Good musical tones are not pure tones in the sense that we know them to be; they are mixtures of fundamentals and harmonics. Actually, they are the electronic synthesis or rather acoustic synthesis of fundamentals and harmonics which go up to make a good musical tone.

Now how does one musical tone differ from another musical tone? Is it in the number of harmonics that are introduced? Is it the phase in which the harmonics are introduced? Just what is it that enables us to recognize the difference between a violin and a flute or a cello, or an oboe and a bassoon? It is these harmonics, the number of harmonics, the strength of the harmonics and the way the harmonics are integrated to produce the complex tone characteristic of that particular instrument which gives it its particular tone; its timbre, as we call it. Fig. 3 shows two such musical instrument waveforms; the middle curve is that of a flute, and the bottom is typical of a violin tone. It will be noticed that

*Based on paper entitled *Putting Color in Sound* presented by Abraham B. Cohen of University Loudspeakers, Inc., at recent CRTSA color TV symposium in Philadelphia.

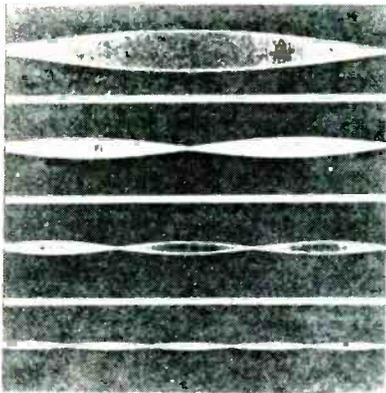


Fig. 1. Microphoto of fundamental vibration of a string plus relative harmonics.

neither of these are pure sine waves. They are combinations of waves far different from sine waves, yet they are pleasant musical tones. However, even though they may sound different, they may have the same pitch. One will note that there are three recurrent waveforms in each of the two lower sections when checked against the upper sine wave. The clarinet and the violin do not produce pure sound waves; they produce musical tones full of harmonics which give them their color, their timbre.

Harmonics and combinations of harmonics must be reproduced exactly as they were produced in order for us to get the true color of the musical tone. Our acoustic reproducers, or loudspeakers, must be able to reproduce in true faithfulness the complexity and the patterns of the individual tones if we are to get the true musical picture. We have been speaking only of the second and third harmonics; but this has been done only for purposes of clarification. The fact is, that the harmonics that form the musical tones go up much higher than the second and third; they go into the ninth, tenth, the eleventh and the twelfth and the thirteenth harmonics. And even though these harmonics may stretch way up into the areas beyond hearing, they form a very important part of the complex waveform that produces the tonal picture or timbre of the individ-

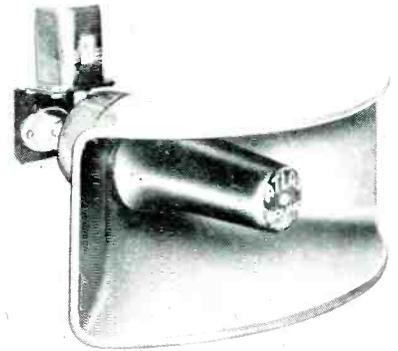
ual instruments. To reproduce properly those true tonal musical values, the reproducers must be able to reproduce in full faithfulness all the harmonics of the music involved. They must be able to go up into that range and reproduce what the instruments produced in the original tone.

Now what are the actual range of frequencies involved in good musical reproduction? A wide range of frequencies are produced by a modern orchestra. The bass violin is perhaps the lowest frequency generator and the piccolo is the highest frequency producer. Between both of them, they encompass the entire range from 30 cycles way up into 15,000 cycles, and higher. In the early days of FM broadcasting, the fidelity of which FM was capable was judged by a *key jingle* test; a set of keys were jingled in front of the microphone. The frequency components produced extended well out beyond 15,000 cps. FM was supposed to reproduce this, but since there were few full-frequency range producers and loudspeakers in use, the broad effect of the jingle test was lost. This may be one reason among the many, why FM did not take hold; there were not adequate reproducers in distribution to do justice to FM.

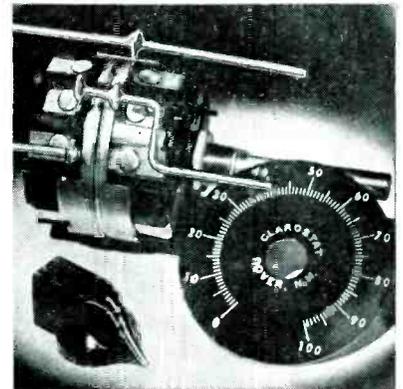
However, being able to reproduce a wide range of frequencies itself, is not necessarily a criterion of good musical reproduction. We might have here a full stage of violinists, and nothing but violinists. This would definitely not make up an orchestra. We would soon tire of the single restricted range of the violins. And then again, we might have a stage full of bass violins, and we would, likewise, tire of this group of bass violins. Neither of these would constitute a *balanced orchestra*. We might, on the other hand, take our bass violins, with their low frequencies, and the violins, and their highs and combine them. Now we would have some balance between the bass and the normal-range fiddles. If, in turn, we put in a few middle frequency instruments,

(Continued on page 36)

New Audio Products



Wide-angle, all-purpose projector, designed for penetrating coverage of wide areas and under adverse sound conditions. Features polyester fiber-glass projector, Almico-V magnetic assembly, phenolic diaphragm and voice coil assembly, all-weather sealed non-resonant construction, tropicalized and polarized finish on all metal parts, and universal mounting bracket. Input power (continuous) . . . 15 watts; input impedance . . . 8 ohms; response . . . 250 to 9,000 cps. (Model CJ-30; Atlas Sound Corp., 1449 39th St., Brooklyn 18, N. Y.)



Constant-impedance attenuator (10-watt) control available with wiring instructions, dial plate and bar knob. Wiring data includes not only schematic for control circuitry, but also actual connections to and bussing of terminals. Circular dial plate is marked in even divisions from 0 to 100, and used in conjunction with pointer of bar knob. (ClaroStat Mig. Co., Inc., Dover, N. H.)

Tri-plex reproducer system. Power rating, 35 watts maximum speech and music signal input. Components include an ultra-high frequency unit, mid-channel high-frequency unit; low channel low-frequency unit, crossover networks for 4000 and 600 cycles, and balance controls. (TP-200 Series; Jensen Manufacturing Co., 6601 S. Laramie Ave., Chicago 38, Ill.)



SERVICE, AUGUST, 1954 • 23

Fig. 2. At top, a perfect sine wave; below, second harmonic of the fundamental and combination of harmonic plus fundamental.

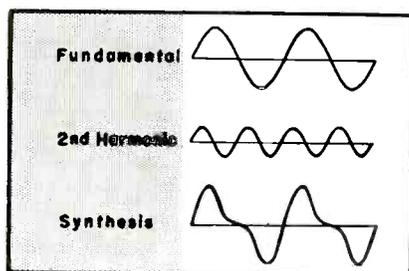
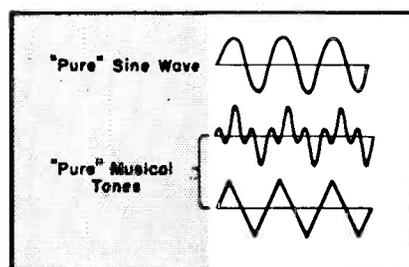


Fig. 3. Waveforms of musical instruments. Middle represents that of a flute, while at the bottom a violin tone is represented.



The 19-Inch Aluminized, Curved Masked-Screen

Color-TV Picture Tube

by E. A. TEVERSON

COLOR TV Tube News

WHEN THE 15-inch tricolor picture tube was introduced in '53, it was generally felt that this small-screen version would be replaced soon by larger models whose screen size would be comparable to those found on the present runs of b-w types.

A few weeks ago, this belief became an actuality in the announcement of a 19-inch color tube¹ featuring an aluminized glass-envelope and a useful screen area of 205 square inches.² In addition, the tube, with 62° deflection, incorporates an electromagnetic convergence system that, it was said, eliminates the high-voltage problems associated with electrostatic convergence. Electrostatic focusing is used.

Electron-Gun Assembly

The electron-gun assembly of the tube contains three matched electron beam sources arranged in a triangular configuration. Each of the three beam sources is tilted toward the common tube axis. This tilted structure provides proper convergence of the beams at the center of the screen. The elec-

tron-gun assembly of this new model contains three pairs of pole pieces mounted 120° apart above the anode.

Phosphor Screen and Shadow Mask

By a method of screen processing, described earlier³, the tri-color phosphor-dot screen is placed directly on the inside surface of the spherical face plate.

The phosphor screen contains some 300,000 phosphor dots of each primary color, a total of 900,000 phosphor dots. These dots are arranged in 300,000 triangular groups, or triads. Each triad contains one red, one blue, and one green phosphor dot.

Another component of the tube is the shadow mask; a thin, arched mask located between the phosphor screen and the electron-gun assembly. It contains approximately 300,000 uniform-size, round holes, one for each triad on the screen. Since the position of these holes relative to the

triads is of paramount importance for proper tube operation, the mask is accurately positioned with relation to the triads and is approximately 0.4" behind the phosphor screen.

The entire mask assembly consists of the curved mask with spring clips to hold it in place. This assembly is mounted on three hemispheres, which are raised points of glass molded around the edge of the face plate, beyond the picture area.

The mask contains three V-shaped surfaces which rest over the hemispheres and make use of the kinematic principal of precise location. Since the mask is unstressed, it is free to expand and contract. This combination of a curved face plate and a curved unstressed mask is claimed to permit expansion and contraction automatically without misregistration.

High-Voltage Requirements

The high-voltage requirements of the 19-inch model are: anode, 25,000 volts with a maximum peak current of

(Continued on page 45)

¹CBS-Hytron Model 19VP22

²See *National Scene*, this issue, p. 16.

³*Color TV Tube News, SERVICE*; Nov. 1953.

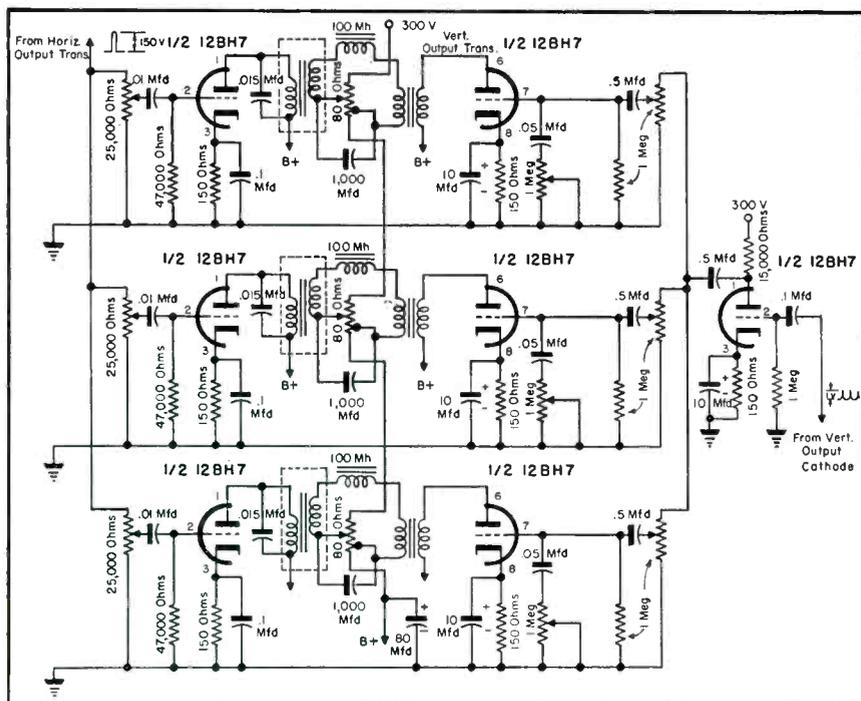
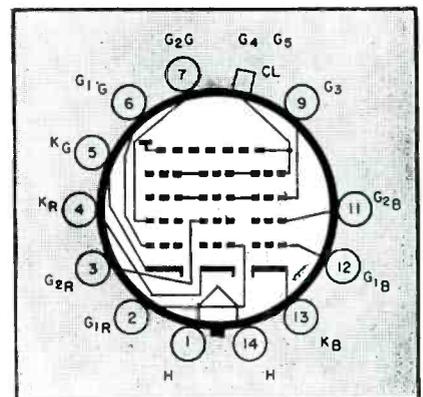


Fig. 1 (left). Suggested circuit for the derivation of convergence currents. Plate winding of 12BH7 transformer (in dashed box) = red, green and blue (horizontal) convergence coils; output winding = red, green and blue (vertical) convergence coils.

Fig. 2. Basing of the 19VP22. Pin 1 = heater; 2 = grid 1 of red beam source; 3 = grid 2 of red beam source; 4 = cathode of red beam source; 5 = cathode of green beam source; 6 = grid 1 of green beam source; 7 = grid 2 of green beam source; 8 = grid 3; 9 = grid 2 of blue beam source; 10 = grid 1 of blue beam source; 11 = cathode of blue beam source; 12 = grid 1 of blue beam source; 13 = cathode of blue beam source.



COLOR TV developments

by **L. A. BASSETT** and **JACK HAWTHORNE**

Radio and TV Department, General Electric Company

SINCE ONLY 3.58-mc chroma sidebands are transmitted to convey color information, a means must be provided at the receiver to generate two quadrature related subcarriers which will be used in the *R-Y* and *B-Y* detectors. This is the function of the subcarrier generator, which consists of a 6U8 used as a burst gate, a subcarrier amplifier and limiter (6AU6 and 6U8) and an accessory device called the *color killer* (6U8).

The purpose of the burst gate is to extract the transmitted 8 or 9 cycle burst of 3.579545 mc from the composite signal and then pass this burst on to the subcarrier generator as a phase and frequency reference. Since the burst is transmitted right after the horizontal sync pulse on the pedestal *back porch*, it is a relatively simple matter to separate it from the remainder of the signal. The 6U8 burst gate grid is driven with a properly shaped horizontal flyback pulse obtained from a winding on the horizontal output transformer. This pulse is rectified by the diode clamp found in the 6T8 and

develops a bias which cuts off the 6U8. Hence, only the most positive portions of the flyback gating pulse permit this tube to conduct. Since the grid of the tube is also fed a composite chroma signal from the chroma channel, only the transmitted 8 or 9-cycle burst will be found on the burst gate plate.

The plate circuit consists of a balanced output tuned transformer. In normal alignment practice, only the primary core is tuned for maximum burst amplitude. The secondary core is preset to a specific core thread dimension, since its position also determines the degree of coupling between windings. Instead, an inductance is varied to tune the transformer output circuits to resonance.

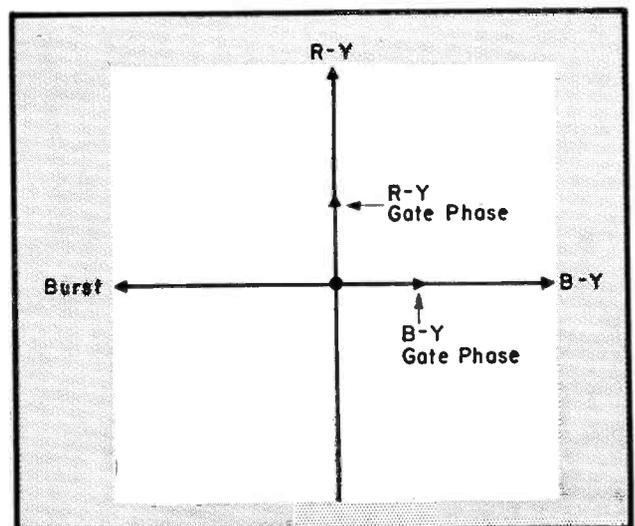
The crystal in the plate circuit of the burst gate amp effectively is a high *Q* tank circuit, which continues to ring after the exciting voltage ceases. Since it would be possible for low-frequency transients, noise, etc., to excite also the crystal, neutralization of these effects must be provided. A 1 to 15-mmfd capacitor shunted across

the crystal must be adjusted to equal approximately the internal and wiring capacity of the crystal. Since the aforementioned transients of opposite polarity appear at the output tuned transformer terminals, proper adjustment of this trimmer will cause opposite polarity, equal-voltage transients to appear on both plates of the crystal internal capacity, thereby nullifying transient voltage effects upon the crystal.

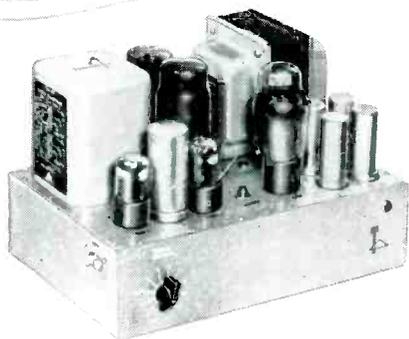
Maladjustment of the trimmer can be easily observed while viewing a monochrome program with chroma control turned up. The effect will be seen as a most irregular band or bar of nondescript information at the left edge of the screen. In extreme cases of maladjustment these effects may extend over a major portion of the raster area. This is caused by horizontal sync transients which tend to excite the crystal. In actual practice, this effect may be used to an advantage in adjusting the trimmer. The proper setting is easily determined,
(Continued on page 45)

Part IV of Philadelphia CRTSA Color Symposium Report: Subcarrier Generator and the Synchronous Detector in the G. E. R-Y/B-Y Color Chassis

Fig. 1. Phase of subcarrier output voltages, with respect to the transmitted burst.



**FOR THE FINEST
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HF-18 Kit: "Williamson" type all-triode amplifier. Full power output of 16.2 watts for triode operation or 20 watts for pentode operation from 12 to 60,000 cycles. Frequency response within 0.2 db from 7 to 80 kc. Output impedances 4-8-16 ohms or 125-250-500 ohms. List prices from — \$63.65.

HF-40 Kit: Features a full 40-watt amplifier from 20 to 40,000 cycles, using regulated screen voltage and fixed bias on two 6146 output tubes. Output impedances 4-8-16 ohms or 125-250-500 ohms. List from — \$78.35.



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Associations

TRT, Kansas City, Mo.

A CODE OF ETHICS to govern the business conduct of the individual Service Man was adopted recently by the executive committee of the Television and Radio Technician Association in Kansas City, Mo. The code was designed by the committee as one step in their continuing program to improve the television service industry in the Kansas City area.

All present and future TRT members will be asked to sign this code and file it with the office of the Electrical Association of Kansas City.

The code, a 10-point guide, stipulates that association members will do their part in improving the industry, and that the code shall be a set of standards that will govern their future business conduct.

Specifically the code requires all TRT members to keep themselves qualified for the job by studying the latest developments and by attending training classes; be aware of appearance at all times and keep clean and neat; always try to give customers an honest job worthy of the amount he is being charged; avoid knocking competitive products; sell only parts and accessories that are needed and can be used, but recommend things that will help get better results; leave all old out-of-warranty parts (except picture tube) with the customer unless asked to take them away; and be honest with his employer's time and material.

In addition, the code states that TRT members will not promise to do some-

thing and then not follow through; will not oversell the performance of his products; and will not compete with his employer by soliciting work on his own time.

* * *

RETA, Fraser Valley, B. C.

DALTON NEWBERRY has been elected president of the Radio Electronic Technicians Association, Fraser Valley chapter British Columbia. Others now serving are: James Fraser, vice president; Thomas D. Grant, secretary; and Jack Unrich, treasurer.

James Fraser and Frank Freemanth have been named to the examination committee, and Dalton Newberry, Frank Freemanth and Thomas Grant were named provincial council directors.

P. Benson, of Vancouver, discussed equipment and engineering principles for multiple-TV installations at the election-meeting.

* * *

TSG, Dayton

A REPORT from Marshall Rankin, secretary of the Television Service Guild, Dayton, Ohio, noted that the names of a number of customers who have been lax in payment have been included on a credit list and submitted to all members of the association. Marshall also disclosed that there are now seventeen memberships, with a total employee enrollment of about 65, on the TSG rolls.



At recent annual clambake-meeting of Radio Servicemen's Association of Luzerne, during which ye ed offered a field report on audio and TV developments, based on a series of lab, bench and on-location tests now being conducted by ye ed and members of industry. Left to right: Fred Schmidt, FRASAP treasurer; Bert Brezenger, FRASAP publicity and program chairman; Leon J. Helk, FRASAP secretary; Milan Krupa, FRASAP prexy; ye editor; Maurice Rader, president—Luzerne chapter, Wilkes-Barre; Alex Chappel, vice prexy—Luzerne chapter; and Joseph Czapracki, treasurer—Luzerne chapter.

At first annual all-industry banquet of the Radio and Television Servicemen's Association of Pittsburgh, Inc., held in the Elks Club, Pittsburgh, which featured talks by Dan Creato, vice prexy of RCA Service Company and ye ed. Left to right: Dan Creato; Bert Brezenger, association program chairman; John Cochran, RTSA prexy; and ye editor. (Views and News, SERVICE; July, 1954)



ARTSD, Columbus

THE 9th annual picnic of the Associated Radio-Television Service Dealers of Columbus, Ohio, was held recently at Buchsieb Park. Program featured awards of over thirty prizes.

Recent issue of *ARTSD News* revealed that another *hi-fi* salon has been opened by an association member; there are now three such operations in Columbus. This growing Service Shop interest in *hi-fi* has prompted one distributor in Columbus to announce that he would discontinue retail selling of *hi-fi* equipment.

At a recent meeting members approved a motion to obtain rubber stamps of the *ARTSD* emblem, for use on letterheads and statements.

John Graham, chairman of the price stabilization committee, is compiling the results of a new price stabilization survey. *George Dykes* is lending a hand.

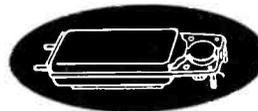
TEN YEARS AGO

NAB spokesmen estimated that at least 100 and possibly 200 per cent more tubes year than in the first half. . . . Frequency control in phono circuits and electronic production testing devices were subjects of feature articles. . . . An *ac vtvm* (Hewlett-Packard 400A) with a frequency range of 10 cps to 1 mc, providing nine ranges from .03 to 300 *v* in 10 db steps, was diagramed on the front cover. . . . *Harry Kalker*, Sprague Products sales manager, reviewing the shortage difficulties created by World War II, described how a number of the problems were solved through the *trading-post* ad campaign which served to route critical materials, test instruments and parts to Service Men throughout the country. . . . *Charley Golenpaul* served as chairman of the reservation committee of the first Electronic Parts and Equipment Industry Conference. . . . *John I. Crockett, Jr.*, was named sales manager of Merit Coil and Transformer Corp. . . . *William H. Kelley* was appointed general sales manager of the Galvin Manufacturing Corp. . . . *H. A. Pope*, National Union Radio Corp., was reelected vice chairman of the RMA eastern credit committee. . . . *E. Bruce McEvoy, Jr.*, was appointed assistant to *L. S. Rannon*, radio tube equipment sales manager for the eastern divisions of Sylvania Electric. . . . *Leslie G. Thomas* joined Solar Manufacturing Corp., as works manager. . . . *Charles R. Wexler*, formerly with Magnavox, and *Homer R. Dennis*, formerly with Crosley, were appointed chief engineer and plant manager, respectively, of the electronic division of John Meck Industries. . . . *Frank J. Hajek* was elected president of Taylor Tubes, Inc. . . . *Rex Munger* rejoined Taylor as sales and advertising manager, after 2½ years as technical advisor for Douglas Aircraft in Africa and Mid-East. . . . *Charles A. Powell*, manager of headquarters engineering for Westinghouse, was elected president of AIEE. . . . *W. E. Kress* was named middlewest sales manager of Philco. . . . *R. J. Keogh* joined the engineering staff of Webster Products.

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crystal pickup cartridges replace 210!

AT A TOTAL COST OF ONLY \$18.00 LIST



The MODEL W68 replaces 41 Crystal Cartridges made by the five leading manufacturers.

The W68 is a "Muted Stylus" type, Dual-Weight Cartridge. The dual weight makes it possible to replace either aluminum or steel case cartridges—without adjusting tone-arm balance. With weight slug net weight is 25 grams; without weight slug net weight is 12 grams. The W68 is equipped with the famous A62A silent-tracking, "Muted Stylus" needle.

STANDARD CARTRIDGE FOR 78 RPM RECORDS

MODEL NO.	TYPE	LIST PRICE	OUTPUT LEVEL	MIN. NEEDLE FORCE	RESPONSE TO	NET WT.	SHURE NEEDLE NO.
W68	Crystal	7.50	1.6V	1 DE.	4,000 c.p.s.	Dual Weight 25 grams or 12 grams	A62A



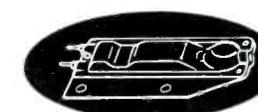
The MODEL W78 replaces 149 Cartridges made by the five leading manufacturers.

Model W78 is a Dual-Volt, Dual-Weight Cartridge—so versatile it replaces 149 other cartridges! This cartridge alone will become a sensation overnight—because it replaces steel or aluminum case cartridges, of either high or low output! The W78 provides the broadest coverage at the lowest investment—only \$5.55 list.

General Information: With weight slug, net weight is 25 grams; without weight slug, net weight is 12 grams. In addition, Model W78 has a capacitor, furnished as an accessory. Without capacitor, output is 4.0 volts; with capacitor, output is 2.0 volts.

STANDARD CARTRIDGE FOR 78 RPM RECORDS

MODEL NO.	TYPE	LIST PRICE	OUTPUT LEVEL	MIN. NEEDLE FORCE	RESPONSE TO	NET WT.	SHURE NEEDLE NO.
W78	Crystal	5.55	4.0V or 2.0V	1 DE.	8,000 c.p.s.	Dual Weight 25 grams or 12 grams	None



The MODEL W70 replaces 20 "Special" Cartridges.

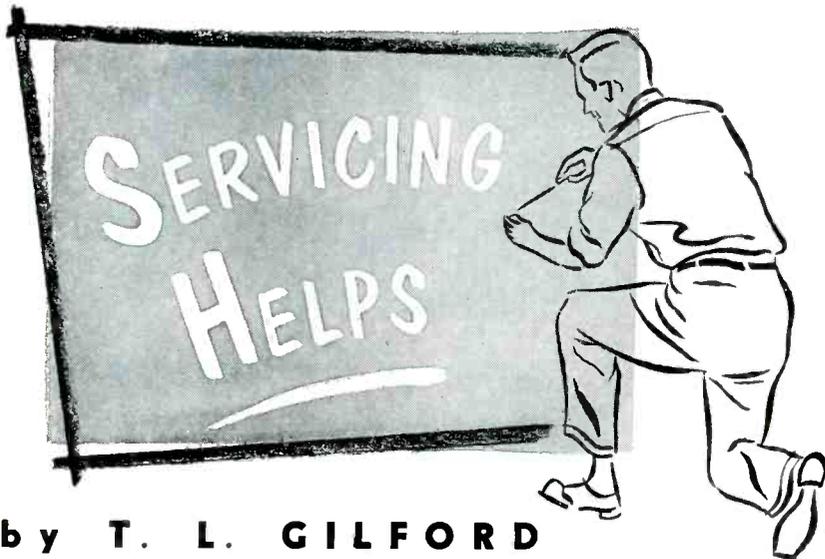
Model W70 is a completely new cartridge in the Shure line. It replaces all the Webster "CX" and "C" Series Cartridges, comes equipped with all the necessary accessories. The W70 is more than an adequate replacement; it is an improvement, because it uses pin jacks—doing away with laborious "threading" of leads through the tone-arm.

ALL PURPOSE SINGLE NEEDLE CARTRIDGE FOR 33½, 45, 78 RPM RECORDS

MODEL NO.	TYPE	LIST PRICE	OUTPUT LEVEL	MIN. NEEDLE FORCE	RESPONSE TO	NET WT.	SHURE NEEDLE NO.
W70	Crystal	4.95	3.0V 3.8V	10-15 grams	8,000 c.p.s.	16 grams	None

SHURE *The Mark of Quality*

A Report on Line-Voltage Control for TV Receivers †



by T. L. GILFORD

ONE OF THE TV Service Man's greatest headaches is bad line voltage. Some Service Men know it, others don't. But know it or not, poor line voltage means poor reception for the TV receiver owner, and he loads his problem on the Service Man.

Just what is poor line voltage? It's much more than merely low voltage, although that is most common. Let's look briefly at the three basic forms of poor line voltage and then let's see how widespread the condition is, what it does to TV reception, and how it can be corrected.

Low line voltage results in all-around bad reception; poor contrast, low brilliance, bad sync, tinny sound, shrunken picture, bad focus and poor sensitivity.

High line voltage is the other extreme. The voltage level of signals are raised to the point where blanking pulses may not override the signals they are intended to blank out. Focus is bad, and picture size is usually much too great since deflection voltages are much too high. Contrast is usually good, brilliance is very good, but tube

life is shortened from breakdown of overheated filaments.

The third condition of poor line voltage is *fluctuating voltage*. Fluctuations may be slow or rapid, but they affect the performance of the television set, and in some cases even modulate the signal.

Rapid fluctuations are caused by individual motors or appliances; loads that change because equipment is turned on or off. One need only plug an *ac* meter into the average home service outlet and watch the needle fluctuate. Sometimes the fluctuations may be very rapid in the order of six cycles per second, which often actually modulates the line voltage and any voltage sensitive device connected across the line. The variations may be as little as one volt, and still cause TV interference. The most typical result of rapid line fluctuations is a constant change in the picture size.

†Based on notes prepared by Sidney Clayton in cooperation with the engineering department of the Sola Electric Company.

*Study was made by Sola Electric Company.

This will cause the picture to *jitter*. In severe cases the picture will constantly lose sync.

Slow fluctuations are caused by changes of load on the various circuits of the power distribution system, rather than any individual devices loading one circuit. The voltage can fluctuate over a period of minutes or hours.

These slow fluctuations can often be as much as 20 volts in a given period. The most common effects are, variation in picture size, change in contrast and brightness, local oscillator frequency drift which means constant retuning.

Now, how bad are voltage conditions, and why? The utilities do a magnificent job of supplying good voltage into the pole transformers. What happens from there? Well, practically anything.

Today many homes are hopelessly underwired for modern electrical living. Motors, stokers, refrigerators, ventilating equipment, electrical appliances and equipment of all kinds are already operating on badly overloaded, inadequate wiring. The TV set is added to the whole load, and used mostly during early evening when heavy load conditions prevail. It often is the straw that breaks the camel's back.

The result is inevitable; poor TV performance. The set manufacturer designed the set to operate at a nominal of 117 volts; that voltage is rarely available at the wall outlet.

Recently a survey* was made to test typical line voltage conditions throughout the country. The curves shown in Fig. 1 represent the findings. The generally poor voltage condition has not caused any acute awareness of voltage problems by laymen, since the average condition is satisfactory for

(Continued on page 46)

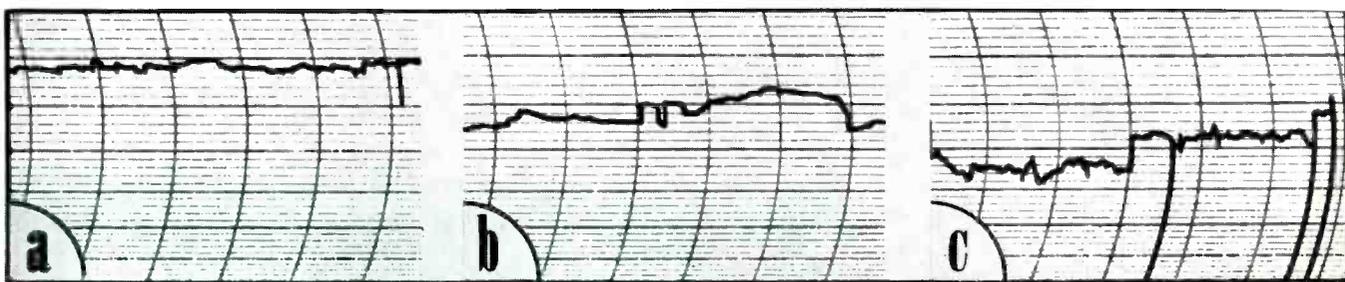


Fig. 1. Line-voltage waveforms obtained during survey of typical conditions. In center (b), the tracing is more nearly representative of the average condition of line voltage which is used to operate electrical and electronic devices. It emphasizes that voltage-sensitive devices require voltage regulation within the unit itself. At right (c) is illustrated an extreme condition of line voltage fluctuation. Severe line voltage variations, such as this, are not unusual. A tracing made at another time may have shown entirely different conditions, since periods of stable voltage are often followed by violent fluctuations. At left (a) we have a line voltage recording typical of best line voltage conditions. Here the equipment under test was supplied by a special line, from an otherwise load-free distribution transformer.

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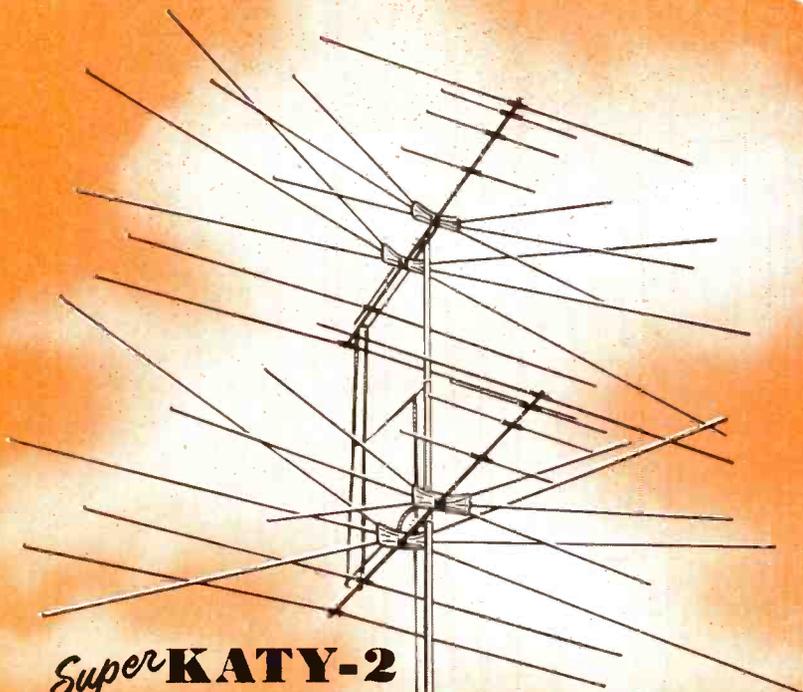
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The long reach, long profit antenna

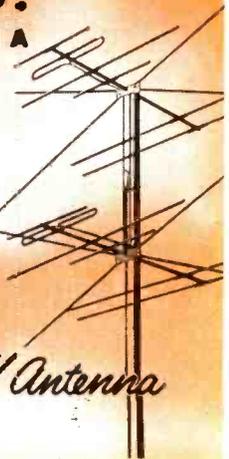
"Fringe area" dealer-servicemen in every part of the country are reporting outstanding sales and service stories . . . and, mounting TV consumer demand! The new, revolutionary Super "KATYS" have now convincingly proved every quality and performance claim attributed to them.

Kay-Townes' original SUPER KATY design . . . now amazingly improved . . . will out-perform any other competitive antenna on the market today, regardless of type or design principle!

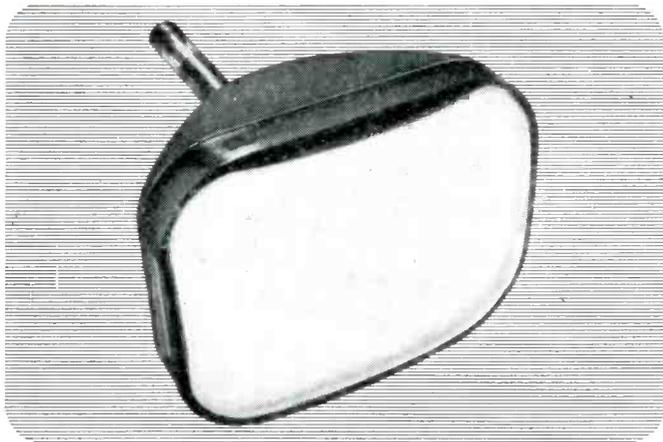
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DELHI METAL PRODUCTS, LTD., DELHI, ONTARIO

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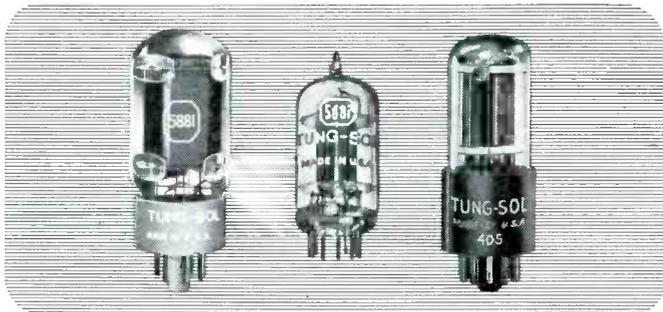
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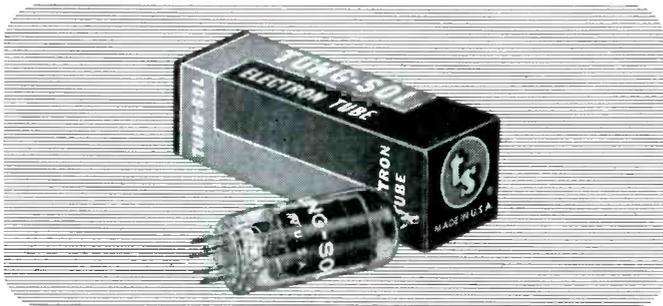
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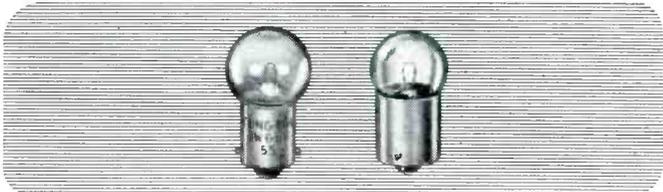
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ELECTRON TUBES

HI-FI AUDIO

by MARK VINO

Symptom

Possible Sources of Trouble

Insufficient volume, no obvious distortion; all signal sources.

Weak voltage amplifier tube.
Insufficient B+ voltage:
(1) Defective rectifier.
(2) Leaky filters.
(3) Other short from B+ to ground.
(4) Rise in value of series filter resistor.

Open cathode bypass capacitors, creating negative current feedback. (Reduction in volume will not be too great.)

Insufficient volume, no obvious distortion; phono only.

Weak preamp tube.

Defective preamp circuit; details above.

Defective cartridge.

Distortion, particularly at high volume; *mushy* sound from all signal sources.

Defective tube in amplifier; one must pay special attention to output tubes. Defect may not show up in tube checker. If replacement tube also goes bad shortly, bias trouble is indicated.

Improper bias in voltage amplifier or power output stages. May be caused by leaky coupling capacitor.

Imbalance of push-pull output stage. Distortion from this will not be very great.

Distortion; program sounds as though playing through water, all signal sources. Probably accompanied by hum.

Open filter capacitors.
Heater-cathode leakage in amplifier tube.

Distortion as above, but phono only.

Improper shock mounting of record player.

Hardening of rubber washers on which record player motor is mounted.

Defective player motor.

Heater-cathode leakage in preamp tube.

Distortion in form of rattle, especially on signal peaks; all signal sources.

Rubbing voice-coil in speaker.

Supersonic oscillation in amplifier; check with scope.¹

¹The Maintenance of Hi-Fi Audio Systems, SERVICE; October, 1953.

SERVICING Chart

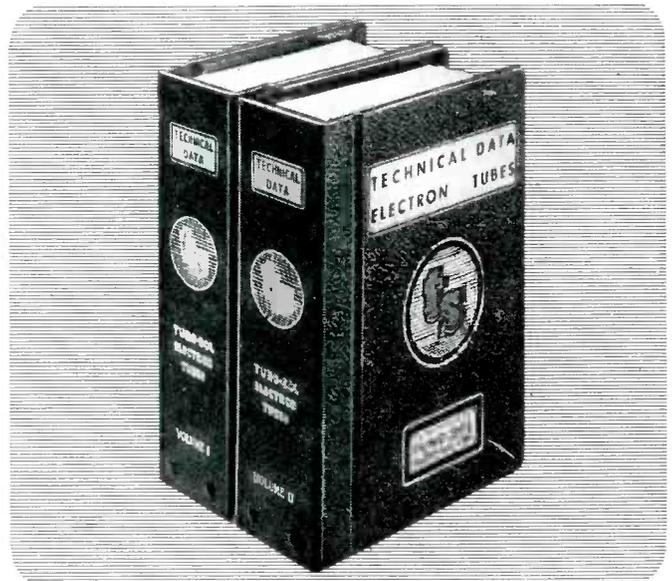
A Simplified Circuit/Component Symptom, Trouble-Source Table

Symptom	Possible Sources of Trouble
Distortion as noted, but phono only. May be accompanied by groove skipping on loud passages.	Worn needle. Defective cartridge. Insufficient vertical force on cartridge.
Distortion in FM receiver only.	Insufficient receiver sensitivity. Frequency drift of heterodyne oscillator. Improper alignment of discriminator or ratio detector circuit. ²
Distortion in AM receiver only.	Defective detector circuit.
Hum, all signal sources.	Open filter capacitors. Heater-cathode leakage in tubes, especially in low-level stages. Improper adjustment of hum-balancing potentiometer in heater circuit. Improper connection of ground returns; corroded or loose contacts, etc. Broken connection between signal cable shield and plug. Reversal of signal cable polarity. Failure to connect cathode and grid ground returns at same point after a repair operation.
	Proximity of signal and power cables, or of signal cable and transformer. Reversed polarity of power plug. Lack of earth ground; ac amplifiers only. Polarity of power plug should be checked after grounding.

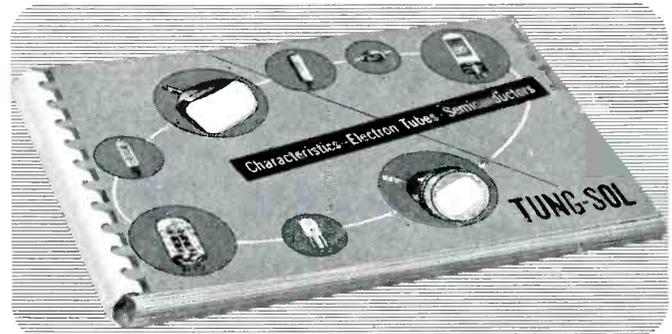
²Audio System Maintenance: Hi-Fi Tuners, SERVICE, November, 1953.

[To Be Continued]

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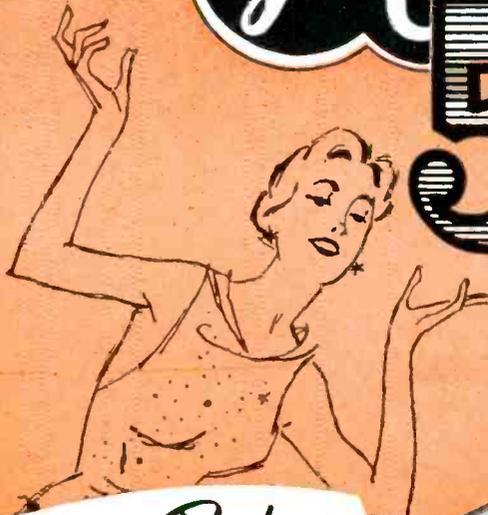
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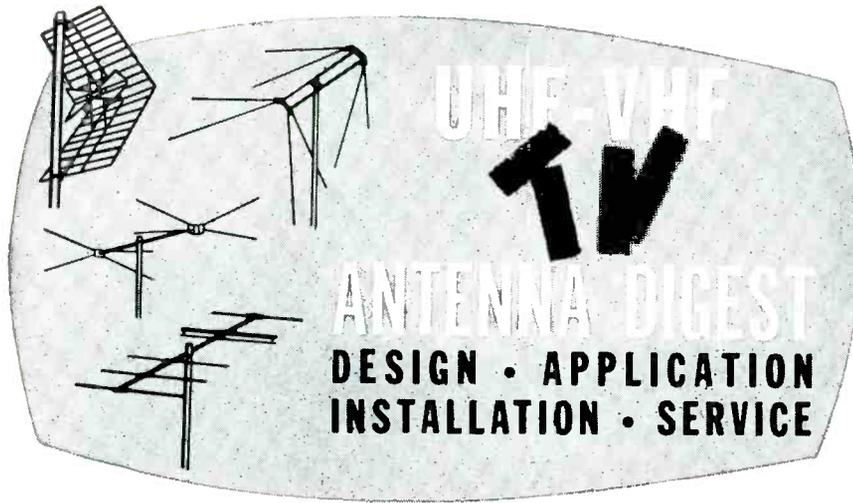
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The Co-Channel (Venetian Blind) Problem*



by **RALPH G. PETERS**

A NATIONWIDE survey† has revealed that there are at least 100 areas in which serious co-channel and adjacent-channel interference problems obtain. In many instances, satisfactory reception has become impossible.

Three factors have contributed to this situation:

(1) According to FCC rules stations, as close as 170 miles apart, can operate on the same channels.

(2) There has been a continuing increase in the number of stations employing maximum power for transmission.

(3) TV sets and antennas have become increasingly sensitive and have pushed out the boundaries of the fringe areas.

The problem has been particularly frustrating to many because reception

had been fine in these trouble areas until stations began increasing power, or new stations came on the air. As a result, the public, Service Men, and engineers, too, have been searching for a way to lift the annoying *venetian blinds*, characteristic of co-channel interference.

The problem of adjacent-channel interference is primarily a set problem. The circuitry of the receiver must be selective enough to discriminate between the stations operating on adjacent channels. Most receivers now available have adjacent channel traps in their *if* circuits to eliminate effectively this interference. This,

†The results of a series of antenna field tests, now being conducted in co-channel zones, will appear soon in SERVICE.

however, is an extremely critical adjustment even in the best receivers.

An antenna with extremely sharp directivity will help eliminate adjacent-channel interference considerably in cases where these interfering channels lie in different directions. It is important, though, that the Service Man become thoroughly acquainted with the location and proper adjustment of the adjacent-channel traps.

Co-Channel Interference

The problem of co-channel interference can only be solved by the antenna.

Until now, the antenna that has been most widely used to combat co-channel interference has been the 10-element yagi. This type antenna, however, has been found to have two serious drawbacks. In many cases, the front-to-back ratio of the yagi has not been sufficient to eliminate completely interference. Moreover, the yagi, a narrow band antenna, cannot receive all the stations available in most areas. The importance of this problem has been realized for some time and become a top-priority project among engineers.‡

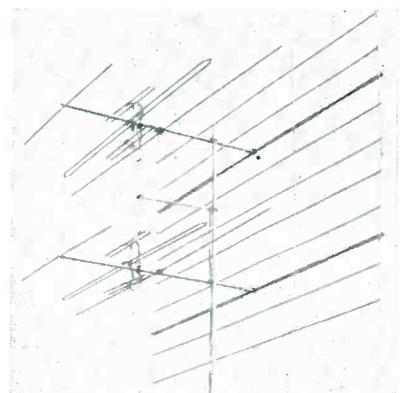
The problem of rear interference is encountered chiefly in those areas located midway between stations operating on the same channel; the fringe
(Continued on page 34)

‡At Channel Master, the problem was assigned to Julius Green, a member of antenna development lab, by Harry Greenberg, chief engineer of the lab.

Fig. 1. The St. Louis and Kansas City, Mo., areas where channel-5 stations, now on the air, have created a co-channel problem for Jefferson City viewers, approximately 100 miles from these cities.



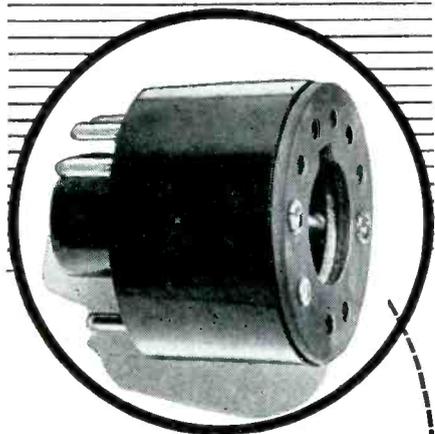
All-channel antenna designed to eliminate venetian blind effects experienced in areas which lie within the field of two different transmitters broadcasting on the same or adjacent channels.



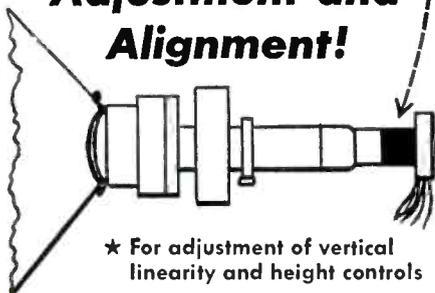
*From an exclusive report prepared for SERVICE by Sam Schussel, Channel Master Corp.

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areas, at least 75 to 100 miles from the closest station.

To cite a typical example, St. Louis and Kansas City, Missouri, both have stations operating on channel 5 (Fig. 1). Those living in the Jefferson City area are approximately 100 miles from each of these cities. In order that they might obtain acceptable channel-5 reception, it is necessary to use an antenna that will have sufficiently high gain on this channel, and at the same time screen out the signal from the rear station. A single-channel antenna that would do the job on channel 5 would still not be the answer to the reception problem in this location, since there are many other channels that can be received in the Jefferson City area. Some of these are Sedalia, channel 6; Springfield, channels 3 and 10; St. Joseph, channel 2; Kansas City, channels 4 and 9; and Columbia, channel 8.

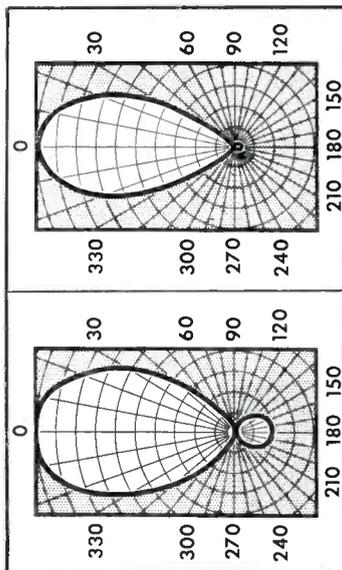
It can be seen, therefore, that the situation requires an all-channel antenna having not only high front-to-back ratios, but also very high gain.

Front-To-Back Ratios

The directivity of a receiving antenna is its ability to receive or reject signals from different directions. These data are generally presented on a horizontal polar diagram which can be expressed either as a *voltage* or a *power ratio*.

Power is determined by the following formula: $P = E^2/R$, where P = power, E = voltage, and R = resistance.

Since R is constant, the power is equivalent to the square of the voltage. This means that if we have an antenna with a front-to-back ratio of 5:1 *relative voltage* (Fig. 2), such data could also be shown with a front-to-back

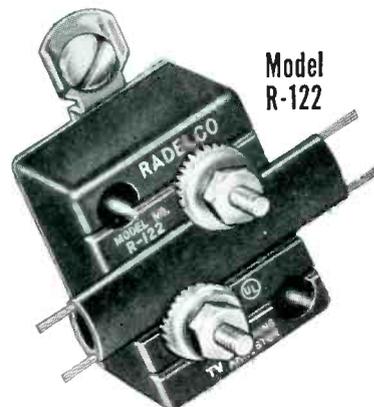


Figs. 2 and 3. At left, a 5:1 relative-voltage polar pattern. At right, a 25:1 relative power polar pattern.

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ratio of 25:1 *relative power* (Fig. 3).

When evaluating a horizontal polar diagram one must determine if the pattern is presented in terms of *relative voltage* or *relative power*. While both of these terms are technically correct, horizontal polar-pattern presentations in relative power can be misleading.

Expressing the front-to-back ratio in relative voltage serves to explain the relationship between the relative amount of signal being picked up from the front and from the rear of the antenna. This is so because the signal picked up by the antenna is a voltage signal. Converting these data to relative power exaggerates the results. For example, the antenna discussed earlier, having a front-to-back ratio of 5:1 *relative voltage* (or 25:1 *relative power*) will pick up five times as much signal from the front as from the rear, *not* 25 times. Thus the presentation of front-to-back figures in *relative voltage* presents a precise picture of the antenna's ability to reject rear signals.

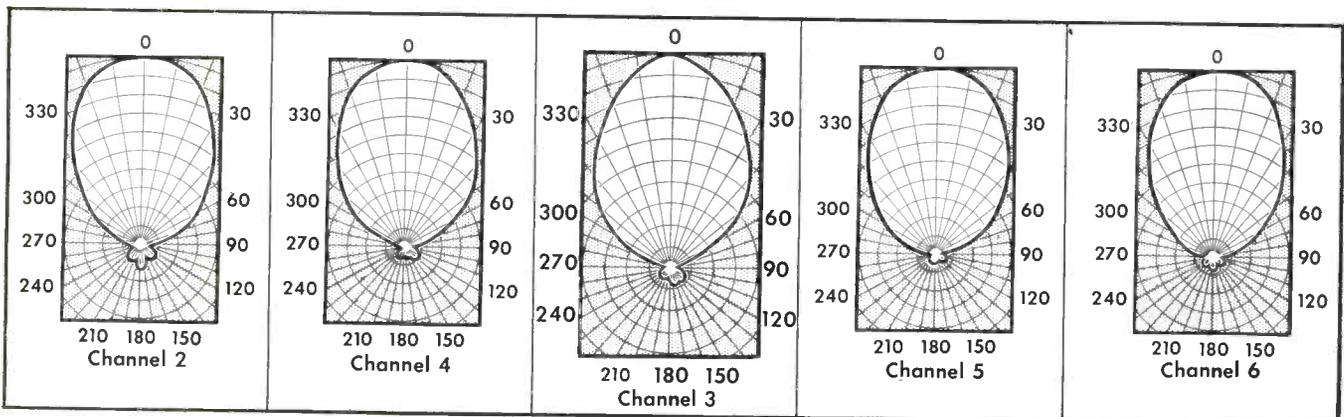
Screen Reflectors

The front-to-back ratio of any antenna can be improved simply by the use of a screen reflector. In fact, many throughout the country have added chicken-wire screens to existing installations. It is not an uncommon sight in many interference areas to see yagis, conicals, colinears, or other antennas with homemade chicken-wire screen additions. By doing this, it has been possible to improve the front-to-back ratio in many cases, but it has been found that the gain of the antenna suffers, and often seriously.

A well-designed antenna has electrical and physical dimensions that produce a 300-ohm impedance. Adding a screen reflector reduces the antenna's impedance. This is especially true where the screen is placed very close to a driven element; it is this

(Continued on page 36)

Fig. 4. Horizontal polar patterns (relative voltage).



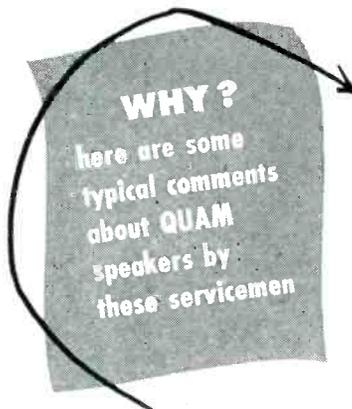
THANK YOU, Mr. Serviceman

for naming



your preferred brand!

In a recent nationwide survey*, radio and TV servicemen were asked this question: "What brand of replacement speakers do you prefer? Why?" QUAM was first in number on mentions—almost 30% more than the next most preferred brand.



* Conducted by Brand Name Surveys of Chicago, Illinois, May 1954.

- "Adjust-a-Cone feature-ruggedness"
- "Complete range of sizes and types"
- "Stand up best in service"
- "Include hardware for easier installation"
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- "Heavier magnets"
- "Good quality at a reasonable price"
- "Always satisfactory"

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- 1** Included with Photofact Folder Set No. 252—out Sept. 1st. You get it in *addition* to over 100 pages of regular Photofact TV-Radio coverage. Get the Color TV Folder at the regular price of the complete Set... Only \$1.75!
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reduced impedance that can lower its gain.

With high gain established as a basic feature of the antenna that would solve the co-channel difficulty, the engineers at one lab¹ decided to attack the problem by redesigning an antenna featuring Dr. Yuen T. Lo's *tripole* design; a screen-type, high-gain, fringe-area antenna.²

Because co-channel interference problems are most common on the low band, and since the *tripole* model had good directivity on the high band, it was decided to concentrate on obtaining particularly high front-to-back ratios on the low band.³

In looking at the antenna's horizontal polar patterns (Fig. 4; p. 35) it will be noted that there are, in some cases, several very small rear lobes. The front-to-back ratios shown in Fig. 5 (p. 35) were based on the largest of these lobes.

In the field, in a number of co-channel problem areas, it has been reported, the antenna has proved itself, serving to eliminate the *venetian blind* bugaboo.

¹Channel Master. ²Champion. ³In recognition of antenna's ability to reject rear signals, model was tagged *Backstop* (type 326).

Channel	Front-to-Back Ratio (Relative Voltage)
2	9:1
3	10:1
4	11:1
5	20:1
6	18:1

Fig. 5. Front-to-back ratios based on largest of rear lobes shown in horizontal polar patterns of Fig. 4.

Audio

(Continued from page 23)

we would really have a balanced orchestra. And so one cannot simply say that if high-frequency reproduction obtains, we have a good orchestra, or a good reproducer; nor if we have a good low-frequency instrument, do we have a good orchestra, or a good reproducer. We must be able to cover the whole range of frequencies. We must have bass violins, and we must have low-frequency loudspeakers (woofers); we must have middle range instruments, and we must have middle-range loudspeakers; we must have high-frequency instruments (such as the piccolo's and the flutes), and we must have high-frequency reproducers (tweeters) to do these instruments justice.

What can one expect from the *re-producing* instrument, now that we know the capabilities of the *producing* instrument.

The basic principle of a reproducer

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UNCONDITIONALLY
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is that it does just that: reproduce, and that it does not produce anything of its own. It must take what is given to it and reproduce it. It must not add anything that does not exist. One must realize that actually reproduction can be affected by a chain of events from the transmitting station through to the home loudspeaker; the turntable, amplifier, detector stage in the receiver, or the horn in which a loudspeaker is used. Wherever the reproducer element is inserted, it must do nothing but reproduce and add nothing of its own.

TV Parts... Accessories

VIDAIRE SOCKET EXTENSIONS

A tube-socket extension, *Adap-Test* which has dual sockets with 20" of lead extensions that brings all sockets' voltages out into the open, has been introduced by the Vidaire Electronics Manufacturing Co., 576 West Merrick Rd., Lynbrook, N. Y.

Accessory enables Service Man to reach remote and inaccessible tube sockets in chassis. Test points are numbered for identification. Available in three models: *AT-1* for octal tubes; *AT-2*, for 7-pin miniatures; and *AT-3*, for 9-pin miniatures.



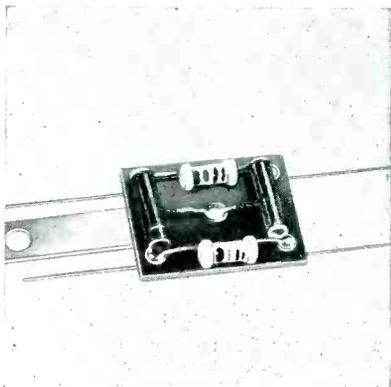
Vidaire Socket Extension

* * *

REGENCY HIGH-PASS FILTER

A high-pass filter, *HP-45*, said to reduce TV interference caused by interfering transmitters, is now available from the Regency division of Industrial Development Engineering Associates, Inc. (I.D.E.A.), 7900 Pendleton Pike, Indianapolis 26, Ind.

Unit is a constant *K* type filter with a cut-off frequency of approximately 45 mc in a 300-ohm balanced line. Attenuation at 29 mc is approximately 20 db. At frequencies of 14 mc and below, attenuation is 40 db or more. Signals above 55 mc are passed through the filter without loss.



Regency High-Pass Filter

more servicemen prefer

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REPLACEMENT TRANSFORMERS

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- ease of installation
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Stancor transformers
are listed in Photofact Folders and Counterfacts



* Brand Name Surveys, Chicago, Illinois; brand preference survey of electronic replacement components, May, 1954. Answered by servicemen from all over the U. S.

FREE NEW STANCOR GENERAL CATALOG listing over 500 transformers for TV, radio, high fidelity, communications and other electronic applications. Available from your local Stancor distributor or by writing Standard Division, Chicago Standard Transformer Corporation.



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SHELDON ALUMINIZED PICTURE TUBES

Production of 10", 12" and 20" aluminized picture tubes, *Hi-Po*, has been announced by the Sheldon Electric Co., 69 Cort St., Irvington 11, N. J.

Sizes, which have been initiated and registered with RETMA, include: *10BP4C* 10" round glass, clear face; *10BP4D* 10" round glass, dark face; *12ZP4*, 12" round glass, clear face; *12ZP4A* 12" round glass, dark face; *20CP4B*, 20" glass rectangular, no external conductive coating; and *20CP4D*, 20" glass rectangular, with external conductive coating (all with aluminized magnetic focus).

Picture tubes are listed in '54-55 edition of Sheldon's *Interchangeability and Exchange Plan* guides, which show how to convert from a non-aluminized to an aluminized TV picture tube.



Sheldon Aluminized Picture Tube

KESTER

Since the most important single step in Radio-Television Servicing is soldering . . . it's just plain good sense to use the best — KESTER SOLDER . . . Key Name in Solder for More Than 50 Years.

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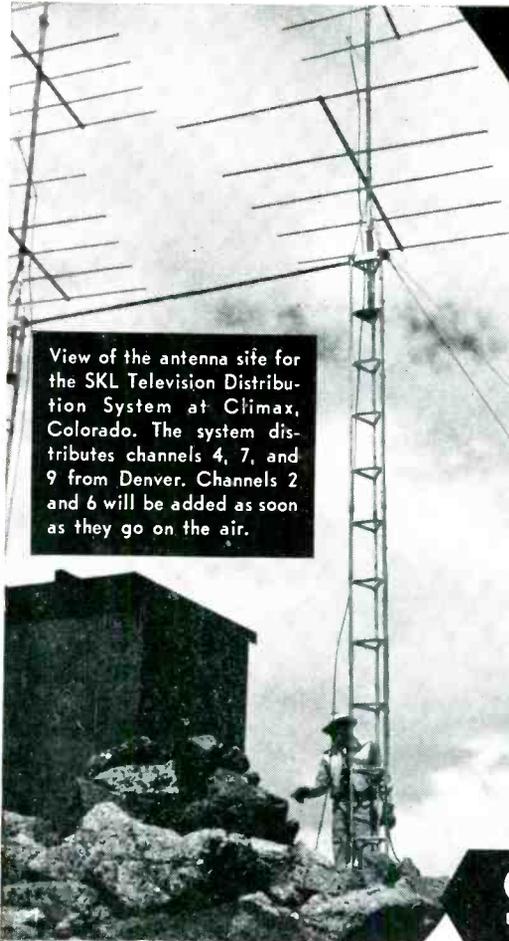
Rep Talk

PUBLICATION of the '54 national membership roster of The Reps has been announced. In addition to names, addresses and telephone numbers of all national members by chapters, roster includes names and addresses of all '54 national officers, board of governors, national committee members, and local chapter officers. Available from national headquarters at 600 S. Michigan Ave., Chicago 5, Ill. . . . With the addition of 30 new senior members during the past three months, together with 20 associate members, total membership in the organization is now 649. . . . *Angey Natalino* is now on the sales staff of *Karl D. Engle*, 4724 N. Sheridan Rd., Chicago. . . . *Jules J. Bressler*, Union City, N. J., is now rep for Regency in metropolitan New York, Long Island, Westchester county and northern New Jersey, including Trenton. . . . *H. F. Koether Co.*, 120 W. 13th Ave., Denver, Colo., will cover Colorado, Wyoming, Utah, eastern Montana and southeastern Idaho for Regency. . . . *George Pettit Co.*, 349 N. Ashland Ave., River Forest, Ill., has been appointed rep for United Catalog Publishers, Inc., in Illinois, Indiana and Wisconsin. . . . *Herb Erickson Co.*, 1429 Peachtree St., N.E., Atlanta, Ga. (Virginia, North and South Carolina, Tennessee, Mississippi, Alabama, Georgia and Florida), and *The Jack Goss Co.*, Cambridge, Mass. (New England), have been named reps for the Allen D. Cardwell Electronics Productions Corp. . . . *M. F. Klicpera Co.* (Oklahoma, Arkansas, Louisiana and Texas), and *Hyde Sales Co.* (Montana, Idaho, Wyoming, Utah, western Nebraska, Colorado and New Mexico) are now reps for Thordarson-Meissner. . . . *George Baird*, 133 Third Ave., Gallipolis, Ohio, has been appointed rep for Trio Manufacturing Co., in Ohio, West Virginia and western Pennsylvania. . . . *Richard H. Legg Co.* has been appointed rep for Clear Beam Antenna Corp., in Washington, Oregon and Montana. . . . Appointed rep for the Quam-Nichols Co., in upper New York State, is *Electro Sales Agency* (Harry Paston), 609 Demong Dr., Syracuse 3, N. Y. . . . *Paul Kurts Co.*, Detroit, Mich., has been named rep for the Insuline Corp. of America, in Michigan.

Ceremony in commemoration of Triplett's 50th anniversary as a manufacturer of electrical indicating instruments, at chapter meeting in Argonne Hotel, Lima, O., where Buckeye chapter of The Reps presented Ray L. Triplett with plaque. Neal Bear (left), chapter president, is shown congratulating Triplett, whose half century of service, as the plaque states, has been distinguished by vision, high standards, and a cooperative spirit in the best tradition of the electronics industry.



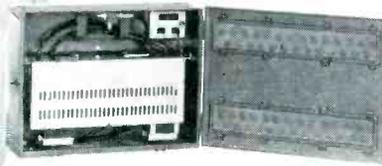
RELIABILITY + WIDE-BAND TELEVISION DISTRIBUTION SYSTEM



View of the antenna site for the SKL Television Distribution System at Climax, Colorado. The system distributes channels 4, 7, and 9 from Denver. Channels 2 and 6 will be added as soon as they go on the air.

Snows up to twenty feet deep make the antenna site equipment for Climax, Colorado, on top of 14,000-foot McNamee Peak inaccessible during five months of the year. To insure uninterrupted service, SKL Wide-Band Television Distribution equipment was selected because of its designed-in reliability.

An unusual feature of the SKL System is the Model 212-TV Chain Amplifier which is able to provide simultaneous distribution of up to thirteen television channels, as well as FM signals. These broadband amplifiers continue to operate even though a tube fails because of their unique design. In addition, the SKL System requires no tuning or adjustment. Vacuum tubes have also been eliminated in all parts of the system except in the amplifiers to provide high reliability and low maintenance expense.



View of the SKL Model 212-TV Wide-Band Chain Amplifier mounted in a weatherproof Model 420 Cabinet.

Write today for further information to:

SKL SPENCER-KENNEDY LABORATORIES, INC.
186 MASSACHUSETTS AVE., CAMBRIDGE 39, MASS.

ROBERT N. VENDELAND has been appointed promotion manager of Jerrold Electronics Corp., Philadelphia, Pa. His duties will include advertising, public relations and sales promotion.

* * *

JERRY KIRSHBAUM, sales manager of Precision Apparatus Co., Inc., Elmhurst, L. I., N. Y., has been reelected president of the eastern division of the Sales Managers' Club. . . ROBERT FEREE, International Resistance Co., Philadelphia, Pa., has been reelected vice president, and WALTER JABLON, Freed Electronics and Controls Corp., has been elected to the board of directors of the Show Corp. for two years.

PERSONNEL



JOHN HODER is now art director of the Ward Products Corp., 1148 Euclid Ave., Cleveland, Ohio.

* * *

G. LEONARD WERNER, formerly sales manager of the Mark Simpson Manufacturing Co., Inc., has been appointed general sales manager of the Astatic Corp., Conneaut, Ohio.

JOHN S. LEAROYD, secretary and assistant treasurer of Sylvania Electric Products, Inc., has retired after 38 years of service with the company. . . . CARROLL L. HASLER has been named supervisor of sales administration. . . . J. P. DRISCOLL, formerly sales rep for the central district in Chicago, has been transferred to the midwestern district, covering the Buffalo-Rochester areas.

* * *

LESLIE A. JOHNSON has been elected vice president of the Cornell-Dubilier Electric Corp., South Plainfield, N. J., and has been appointed manager of the new Sanford, N. C., plant.



Jerry Kirshbaum



Ed Straw



G. Leonard Werner



Dr. Rodolfo M. Soria



Leslie A. Johnson



Albert Brand

ED STRAW has been named national sales and advertising manager for Collaro products, distributed by Rockbar Corp., 215 E. 37th St., New York, N. Y.

* * *

STANLEY W. HORROCKS has been named general manager of the special products division of Aerovox Corp., New Bedford, Mass. Before joining Aerovox, Horrocks was with RCA in various managerial, supervisory and engineering positions.



Stanley W. Horrocks



S. John La Puma

ALBERT BRAND, secretary-treasurer, has assumed the duties of sales manager of Radio Merchandise Sales, New York, N. Y.

* * *

S. JOHN LA PUMA is now publicity director of the JFD Manufacturing Co., Inc., Brooklyn, N. Y., succeeding DAVID B. TOLINS, JR., who has joined the staff of Cowan and Dengler, New York ad agency.

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DO MORE, COST LESS
POWER RESISTORS

No better power resistors made. Yet Greenohm power resistors cost less. Try them on heavy overloads—they won't flinch. Try them for life—they'll outlast most others. Try them on heat-shock or frequent on-off operation—the unique inorganic cement coating won't flake, peel or crack. Fixed types (5 to 200 watt ratings) and Adjustable types (10 to 200 watt ratings). Also handy Greenohm Jr.* midget power resistors in 5 and 10 watt ratings, with pigtail leads, for use in tight spots.

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CANADIAN MARCONI CO., LTD., Toronto, Ont.

DU MONT PIX TUBE COAST DEPOT

A west coast sales and service depot to serve both initial equipment and replacement tube users in eleven western states and Hawaii, has been announced by the cathode-ray tube division of Allen B. Du Mont Laboratories, Inc., 760 Bloomfield Ave., Clifton, N. J.

Permanent headquarters for the depot will be established on September 1, at 2545 South Yates Ave., Los Angeles. During construction, interim headquarters will be located at 1235 East Olympic Boulevard, Los Angeles.

* * *

TELREX ISSUES V-BEAM CANADIAN LICENSE

Delhi Metal Products, Ltd., Delhi, Ontario, Canada, has been granted an exclusive license for the manufacture in Canada of *Conical-V-Beams*, now protected under Canadian patent 500,436 issued to Telrex, Inc., Asbury Park, N. J.

Delhi Metal Products, Ltd., have also been appointed Telrex sales reps in Canada for their antennas, for both amateur and commercial, as well as governmental services.

* * *

SIMPSON TUBE CHART

A tube chart for the model 1000 plate conductance tube tester, that shows all of the new tubes produced since the last tube chart was introduced May 1, 1953, is now available from Simpson Electric Co., 5200 W. Kinzie St., Chicago 44, Ill.

In November '54, company will issue a free supplement including all added tubes shown in new chart over previous one issued in May, '54. Space is provided on all roll charts for addition of new tube data. Tube chart is priced at \$2.00.

* * *

SPRAGUE REPRINTS FLYER

Reprints of the direct-mail flyer, *Beware The Service Bargain*, are now available from the Sprague Products Co., 61 Marshall St., North Adams, Mass.

Designed to promote a better understanding between TV set owners and Service Men, reprint is a follow-up to *Why Doesn't My Set Stay Fixed?* and *Are Servicemen Gyps?* messages. Article explains why the Service Man—on the basis of receiver complexity, years of training, and capital equipment required—is entitled to receive a fair price for his services.

Reprints have space for dealer imprint. They may be acquired directly from Sprague at cost: \$3.00 for 1,000, \$25.00 for 10,000.

* * *

C-D OPENS SANFORD, N. C. PLANT

A formal opening of the new Sanford, N. C., plant, of the Cornell-Dubilier Electric Corp., was held recently.

In attendance were *Ben Douglas*, Director of the State Department of Conservation and Development, representing *Gov. Umstead*, and *Edwin Gill*, State Treasurer, and *Frank Crane*, Commissioner of Labor. *Oclave Blake*, president of Cornell-Dubilier, and *Leslie A. Johnson*, vice-president and plant manager, acted as hosts.

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BUILD YOUR OWN — INCREASE KNOWLEDGE — SAVE MONEY — BUY DIRECT FROM MANUFACTURER . . . Top quality instruments in kit form featuring latest design and circuit developments. Completely detailed step-by-step construction manual—clear pictorials—complete schematics. All sheet metal work punched, formed and finished. Low kit prices include tubes, chassis, cabinet and all necessary constructional components.

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\$19.50

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Inst r u m e n t s

AUTHORIZED PICTURE TUBE TESTER

A picture tube tester, model 101, designed for continuity and emission tests, is now available from the Authorized Manufacturers Service Co., 919 Wyckoff Ave., Brooklyn, N. Y.

Indication results appear on neon indicators or meter. Facilities are available for the testing of open connections, shorted elements, leakage, cathode emission and indication of gaseous tubes. Tests can be made with tube in carton, TV set, or on the bench, for electromagnet and electrostatic duo-decal socket based tubes (except 12VP4A triode).



Authorized 101

PRECISION VOM

A 20,000 ohms-per-volt *dc*, 5,000 ohms-per-volt *ac*, multi-range test set, model 120, has been introduced by Precision Apparatus Co., Inc., 92-27 Horace Harding Blvd., Elmhurst, N. Y.

Instrument features 44 self-contained ranges; a low resistance range affording a 2-ohm center scale; low voltage range offering 1.2 volts full scale, both *ac* and *dc*; an extended low *dc* current range starting at 0-60 microamperes; 1% wire-wound deposited-film type multipliers and shunts; and all standard ranges served by 2 plug-jacks.

Ranges include: *ac* and *dc* voltages... 0-1.2-3-12-60-300-600-1200-6000 *v*; *ac* outputs... same as *ac* volt ranges (with built-in 600 *v* blocking capacitor); *dc* current... 0-60-300 microamperes, 0-1.2-12-120-600 ma, 0-12 *a*; resistance... 0-200-2000-200,000 ohms, 0-2-20-meg-ohms; and *db* from -20 to +77 (0 *db* = 1 *mW*, 600 ohms).

Accessories include a snap-on, fold-away tilt-stand, (model ST-1) which permits 45° table mount; a 30-*kV* safety probe (TV-2B); and leather instrument case (LC-3).



Precision 120
* * *

EBY SUBMINIATURE POCKET TESTER

A subminiature pocket tester, A1000, has been introduced by the Eby Sales Co. of N. Y., 130 Lafayette St., New York 13, N. Y.

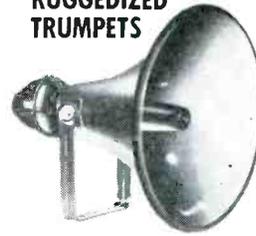
Instrument is said to serve as a low-voltage tester (0-1000 *v*) *ac/dc*; high-voltage tester (50 *kV*); signal tracer, audio oscillator, capacitor tester; *agc* substitution voltage supply; visual output meter; and continuity checker.



SAVE 2-WAYS WITH University DRIVER UNITS & TRUMPETS

1. Higher Conversion Efficiency Lowers Amplifier Costs
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RUGGEDIZED TRUMPETS



UNIVERSITY trumpets are built to the highest standards in the industry—by the pioneers of the reflex trumpet. They are completely weather-proof, super conditioned for any locale or climate. Achievement of highest attainable conversion efficiencies reduce amplifier requirements. Get the facts.

* Less Driver Unit

MODEL	GH	LH	PH	SMH
Low Frequency Cutoff	85 cps.	120 cps.	150 cps.	200 cps.
Sound Distribution	65°	75°	85°	95°
Air Column Length	6 1/2 ft.	4 1/2 ft.	3 1/2 ft.	2 1/2 ft.
Bell Diameter	30 1/8"	25 3/8"	20 1/4"	16 1/4"
*Horn Length	27 7/8"	19"	15 1/4"	12"
*Shipping Weight	25 lbs.	20 lbs.	11 lbs.	9 lbs.

HIGH EFFICIENCY DRIVER UNITS



MODEL SA-HF — Workhorse of the sound industry for general PA and industrial use. Very high efficiency delivers extra punch to cut through heavy noise. Response to 10,000 cps. — ideal for both speech and music. Tropically and hermetically sealed for trouble-free service anywhere.

MODEL MA-25 — A low cost unit for use where response to 6000 cps. meets requirements. No compromise in quality — incorporates all the famous UNIVERSITY quality features — high efficiency magnet structure, trapezoidal full size 2" voice coil, rim-centered break-down proof bakelite diaphragm, etc.



MODEL PA-30 — A "de-luxe" unit incorporating every advance design feature including famous University W Alnico 5 Magnet and built-in transformer with terminals available thru housing base. For all amplifiers including 70 volt systems. Response 80-10,000 cps. with 30 watt cont. power.

MODEL SA-30 — Similar to the SA-HF in response and efficiency but includes a multi-impedance line matching transformer with taps accessible through water-tight cover. Taps designated in impedance values and watts for "constant voltage" lines. Die-cast aluminum housing affords lasting protection.



Write for catalog describing the complete line of University Hi-Fi and PA reproducer equipment, including Radial Type Projectors. Address Desk 17-H

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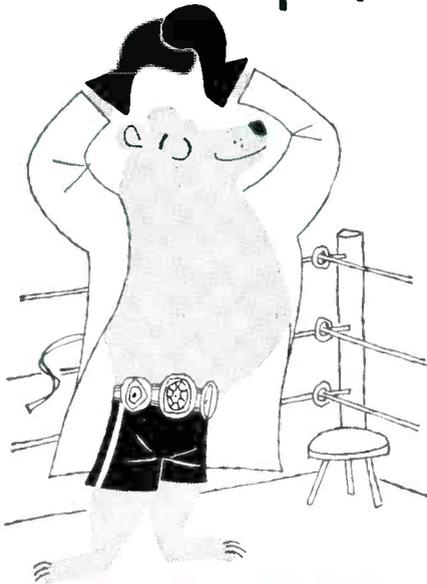
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- ★ Ask your C-D jobber about the special "Cub-Kit"!

For the name of your C-D distributor, see the yellow pages of your phone book. Write for Catalog to: Dept. S854, Cornell-Dubilier Electric Corp., South Plainfield, N. J.

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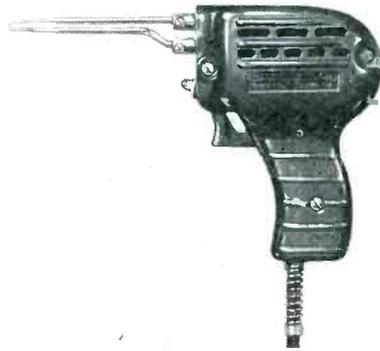
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Tools . Parts

WEN QUICK-HOT SOLDERING GUN

A gun-type soldering iron, 199, that weighs 1½ pounds, and is said to become working-hot in 2½ seconds, is now available from Wen Products, Inc., 5808 Northwest Highway, Chicago 31, Ill.

Iron features long reach, long-life tips, and balance.



Wen 199

* * *

ALLIANCE GARAGE DOOR OPENER

An electronic garage door opener *Lift-A-Door*, that opens and closes overhead type garage doors by pushing a button on auto dash, has been announced by the Alliance Manufacturing Co., Inc., Alliance, Ohio.

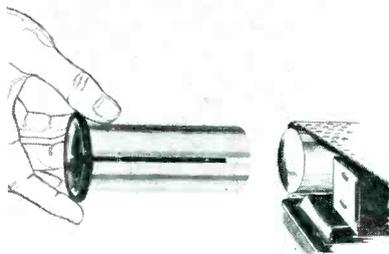
A radio impulse transmitter installed under the hood of auto is tuned to receiver installed inside garage. Receiver activates a motor mechanism to raise or lower the door. It also locks and unlocks door, and turns light on or off automatically.

Works on overhead doors up to 8' height and 16' width. Has preset frequency to eliminate any detuning. Also features a built-in thermal circuit breaker to protect motor against overload.

* * *

JAMES VIBRAPOWR VIBRATOR PULLER

A vibrator puller, C-905, designed to automatically release the vibrator ground clamp, grip can firmly and permit easy removal from the most confined auto radio chassis, is now available from the James Vibrapowr Co., 4036 North Rockwell St., Chicago 18, Ill.



James Vibrapowr Vibrator Puller



No. 9132

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- ★ Easy To Install ★ Builds Good Will
- ★ Improves Reception—Stops Noise

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GENERAL CEMENT MFG. CO.

901 TAYLOR AVENUE
ROCKFORD, ILLINIOS

XCELITE ELECTRICIAN'S KNIFE

A do-all knife for cutting, stripping insulation, scraping wire and light screw-driving, has been introduced by Xcelite, Inc., Orchard Park, N. Y.

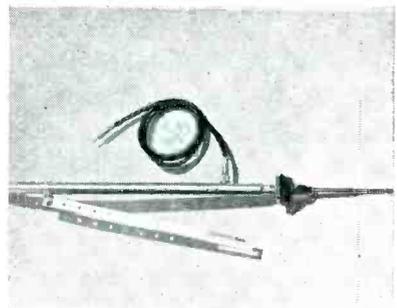
Knife features a plastic jet-black handle, blades of steel, chrome plated, while the frame is steel with brass inserts. One blade is a general purpose spear type, while screwdriver blade has scraper and cutting edges and is self-locking when open, and can be closed by depressing a spring-loaded stop.

* * *

BRACH AUTO ANTENNAS

Two universal auto antennas, 473 *Speedmount*, and 501 *Fendermount*, are now available from the Brach Manufacturing Corp., Division of General Bronze Corp., 200 Central Ave., Newark 4, N. J.

Both models feature patented design to speed and simplify installation. Each unit has a three section triple chrome-plated mast, automatic ground connection, and adjustable (0-32°) insulator.



Brach Fendermount

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Assortment of summer sports equipment, designed to help distributors promote Raytheon tubes during summer months. Featured in the program are items ranging from golf to tennis to hunting to barbecue cook-outs; for traveling, luggage in two-suiters, week-end cases, plaid travel-pacs, fitted dressing cases and travel alarm clocks. Other popular items included are beverage coolers, Winchester carbines and rifles, Boontonware dinner sets, cocktail mixer sets, complete fishing kits, movie cameras, beach balls and horseshoe pitching sets.

CAPACITOR CONTEST WINNERS



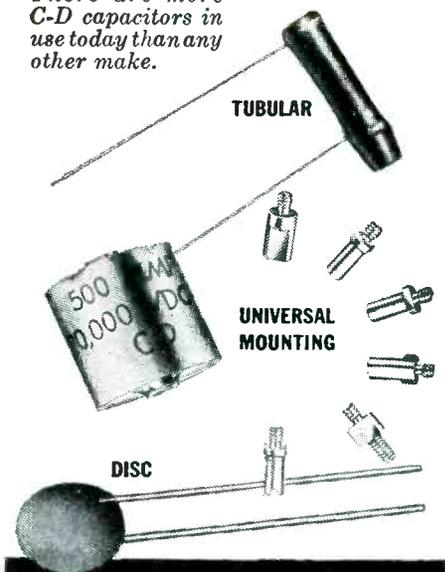
J. K. Poff (second from left), jobber sales manager of Pyramid Electric, sponsors of the recent \$11,200 cash-award contest, awarding \$2,000 first prize to Stanley A. Mol, 808 Walker Street, Dickson City, Pa. (extreme right), and a second duplicate check to the Service Man's distributor, Fred P. Pursell, Scranton. Looking on: Ken Watson, general manager of Pursell Radio, and Pete Papura, counter salesman at the store.

ANIMATED ROTOR SALES AID



An animated CDR rotor display that is illuminated and turns to show the rotating action of rotors. Available upon request to jobbers. CDR rotors are manufactured by Cornell-Dubilier, South Plainfield, N. J., and their subsidiary, Radiart, Cleveland, O.

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"UHB,"
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Bogen

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NATESA 5th Annual Convention

Morrison Hotel, Chicago, Ill.
Sept 24, 25 and 26, 1954

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Ser-Cuits

(Continued from page 20)

make it more dependable with longer life.

The filament circuit has all tubes in series which accounts for the $7\frac{1}{2}$ volt *A* battery. This plan was found to simplify *ac-dc* switching, making it possible to use a smaller switch.

For another Admiral model, the 4Z series, rod antennas are $21\frac{1}{64}$ " x 8", and wound with 90 turns of No. 28 double celanese wire, resulting in a factor of merit of .6 at 1400 kc and .3 at 600 kc. The factor of merit of the loop or rod antenna is the ratio of the *rf* voltage, fed in this case into the converter tube, for a given output, to the *rf* voltage radiated into the antenna for the same output. As an example, if the *rf* sensitivity at the converter grid was 60 microvolts for 50 milliwatts output at the voice coil and the *rf* voltage radiated from a calibrated antenna a given distance from the chassis antenna, for the same output was 100 microvolts per meter, then the ratio of the two (60/100) would be 16; or the antenna's factor of merit would be .6.

The 5K32 chassis employ an output transformer $\frac{1}{2}$ " x $\frac{1}{2}$ " in size which was found to pass the desired frequency range with high efficiency.

UHF Converter

(Continued from page 21)

micrometric drive from a double threaded anti-back lash tuning rod.

Since the slug travel of approximately one inch does not provide a suitable dial-scale presentation, a mechanical amplification has been obtained by an off-center dial drive. This system has been found to provide approximately three inches of dial scale for ease of channel identification.

Electrically the input circuit consists of a tuning capacitor, in parallel with a padder, and a fixed shunt inductor terminating a transmission line. A balanced line is used to provide a balanced input, and a degree of high pass filter action is provided by the low shunt inductance to ground. The antenna is fed into the transmission line through suitable inductors to provide a good input impedance match for maximum power transfer from the antenna.

A very important design consideration is that oscillator drift should be reduced to an absolute minimum. The need for frequent retuning can discourage listeners, regardless of program material. Since converter owners have had experience with *vhf* reception, they can judge any difference in drift during *uhf* operation.

This problem was studied during the development stages, and a rigid mechanical assembly was evolved, with precision tuned elements held to tolerances of $\pm .0003$ ". The materials constituting the tuned circuit were so chosen as to provide temperature compensation over a wide range.

The balanced oscillator uses a tuned circuit similar to that used on the input, with the oscillator tube capacity effectively in parallel with the tuning capacitor. The total capacitance is shunted by a fixed inductor and this tuned circuit terminates a balanced transmission line in an arrangement similar to the input circuit.

Approximately seven turns of tuning are provided to cover the complete frequency range.

Diode conversion was selected over other methods because smaller injection voltages can be used, and oscillator radiation is considerably reduced. In addition the loose coupling between the oscillator and mixer was found to permit more stable oscillator performance.

Inductive coupling is used to couple the oscillator energy into the mixer circuit. The crystal is tapped down on the input tuned circuit to provide correct impedance match and maximum signal transfer.

Tube News

(Continued from page 24)

3,000 microamperes; focus electrode, 8,000 volts with a maximum current drain of 300 microamperes.

The regulated voltage for the anode can be derived from a fly-back-type deflection system that employs a tapped autotransformer. This voltage is obtained by using a pulse doubler rectifier system from the tertiary winding of the autotransformer. A separate tap of the same autotransformer supplies the voltage to the focus rectifier tube.

Shunt-Regulator Tube

Since 2% regulation is desirable for the anode voltage supply, a shunt regulator tube must be used.²

Adjustment of the focus potential can be achieved by the use of a potentiometer in the high-voltage divider network.

Permanent damage may be done to the screen-and-mask assembly if scanning should cease during the tube operation. For this reason, an electronic switch activated by the horizontal and vertical deflection voltages is required; the circuit being arranged so that, in case of scanning failure, all beam current will be cut off.

²Such as CBS-Hytron 6BD4A.

Color TV

(Continued from page 25)

since at this point the raster becomes clean.

Despite the fact the crystal is, in effect, a high Q device (approximately 8000), the output sine wave of 3.579545 mc tends to decay between excitation periods. Therefore, the signal is amplified and passed through a conventional limiter before it is fed to the synchronous detectors.

Since the phase of the transmitted burst may be slightly incorrect, a hue control is provided to allow minor correction of the generated subcarrier phase. Errors of this type would cause, for example, orange or purple stripes in the American flag instead of red, depending upon the direction of the burst phase error.

The limiter plate circuit contains a quadrature phase shifter; actually this is not a transformer, since little magnetic coupling exists between its windings. When this transformer is properly tuned, the sine-wave output voltages of the two windings will be 90° out of phase. By proper choice of the number of tuned circuits ahead of the limiter and the polarity of the balanced output transformer, the voltage found on the plate of the limiter will be of $B-Y$ phase. The other output voltage

is of $R-Y$ phase; Fig. 1 (p. 28). These voltages are fed to the sync detectors.

Limiter grid voltage is also fed to the chroma amplifier grid and provides, in effect, a simple chroma *agc* system.

It is desirable to shut off the color circuitry during periods of monochrome reception. This is accomplished by the *color-killer* circuit. Subcarrier limiter grid voltage is fed to the grid of the killer. This voltage keeps the tube cut off during color programs. When viewing monochrome programs and no burst signal is transmitted, this bias disappears. The plate of the tube is supplied with horizontal flyback pulses from the sweep system. The tube now conducts and rectifies the flyback pulses and thus develops a large negative voltage on its plate. This voltage is used to bias off certain amplifiers which follow the synchronous detectors.

The purpose of the sync detectors is to recover the *color video* or chroma information, which is conveyed by sideband components of the 3.58-mc transmitted subcarrier. These sidebands are amplitude modulated in accordance with the degree of color saturation of the various picture components; and also phase modulated to convey specific colors or *hue*.

[To Be Continued]

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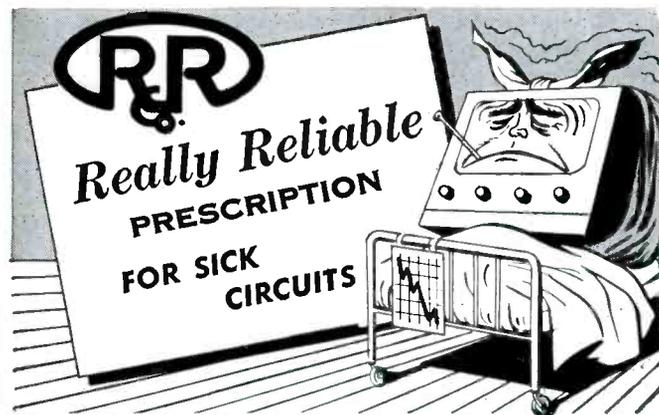
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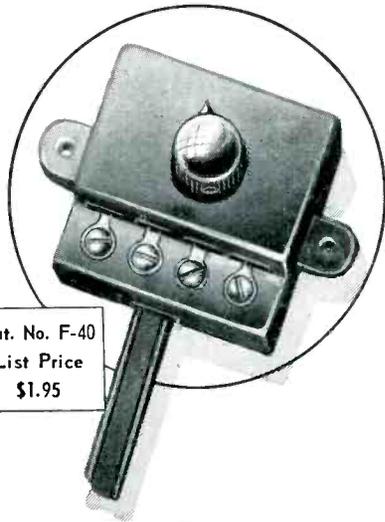
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Servicing Helps

(Continued from page 28)

devices which are not voltage-sensitive. Unfortunately TV is a voltage-sensitive device, and to operate well, it requires the proper level of stable voltage for which it was designed.

What's the solution? Well, it's not so simple as it may seem. Step-up and step-down devices have been offered to cure line voltage troubles. In the main, these devices are tapped autotransformers; tap selection is made by a rotary switch which can be adjusted to boost or drop the line voltage.

These devices work well when the voltage trouble is always the same; always high or always low. However, loads shift from day to night, resulting in frequent shifting of line voltage levels in relation to the load shifts. Almost every distribution system is subject to some slow voltage fluctuation; if the total fluctuation within a level is small, a tapped autotransformer provides a relatively inexpensive solution.

However, manually set autotransformers have a limitation. They cannot automatically adjust for rapid fluctuations, which can occur.

In some cases manually-set autotransformers might feed damaging high voltages into the set; if the tap position was set for a boost when the line voltage was low, and afterward not continuously readjusted to correct for any rising line voltage level, the set would be operating from abnormally high voltages.

On the other hand, if the autotransformer tap was set for a drop when the line voltage was high, it would not operate the set properly under the lower voltage conditions which could occur later, unless the tap switch was readjusted for larger boost.

A solution has appeared in automatic voltage stabilization through the use of static-magnetic voltage stabilizers,¹ which operate on a patented constant-voltage principle. These units have no moving parts except a relay. The relay acts as an automatic switch to put the unit in and out of the circuit when the TV receiver is turned on or off. It has been found that the device can automatically stabilize high, low and fluctuating voltages.

The primary of this stabilizer is connected across the normal 115 v line through a normally open relay. However, the inrush current of the set causes the relay to become energized, closing its contacts and thereby placing the primary of the stabilizer across the 115 v line, and its secondary across the input to the television receiver.

[To Be Continued]

¹Sola TeleVolt.



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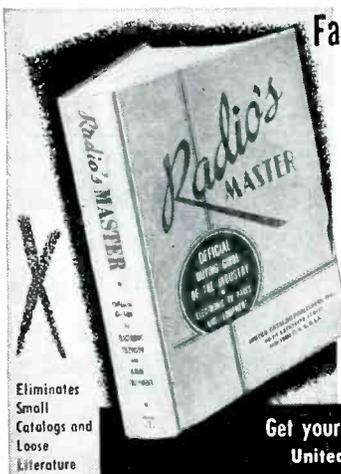
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JOTS AND FLASHES

A TREMENDOUS UPSWING in the electronic business, due to color TV, is on its way. So forecast *John T. Thompson*, manager of distributor sales for the G. E. tube department, recently during a talk in Seattle, Wash., before distributors from nine Western states at an electronic parts distributors' seminar. Ten years hence, he said, the replacement market will stand at \$476 million in color picture tubes, \$69 million in monochrome picture tubes, and \$321 million in receiving types. In '57, Thompson predicted a color picture tube re-

placement volume of \$55 million, monochrome picture tube volume of \$180 million, and a radio and TV receiving tube volume of \$312 million. In '60, comparable figures will have color picture-tube replacements at \$262 million, monochrome picture tubes at \$102 million, and receiving tubes at \$321 million, for total tube sales of almost \$700 million. . . . Audio sales during the remainder of '54 will top even last year's record figures, according to *H. R. Letzler*, general sales manager of Webster-Chicago Corp. Not only do more and more people want their own music, but they are learning to be more selective in their choice of recordings and to demand the greatly improved sound reproduction that is made possible by the new phonos and tape recorders, he said. . . . More than 1,800 radio-TV service shop operators have qualified for a color TV training course offered by the tube division of RCA with purchases of RCA receiving tubes, *Harold F. Bersche*, manager of distributor sales, revealed recently. The current promotion, announced late in May, will continue until November 15, '54; it provides Service Men with a nine-lesson color TV receiver home study course, obtainable on the basis of their purchases of RCA receiving tubes from RCA distributors. . . . *Dr. Irvine Levine*, professor of chemical engineering at University of New Hampshire, and *Roy B. Ireland*, who has served for the past five years as president and director of Merchants National Bank in Dover, have been elected to serve one-year terms on the board of directors of Clarostat Manufacturing Co., Inc. In addition to these two new directors, stockholders reelected the following executives as directors for one year: *Victor Mucher*, president and treasurer; *George Mucher*, executive vice president; and *Arthur Richenthal*, general counsel and secretary. . . . Transamerica Electronics Corp. have moved into their own building at 115 Liberty St., New York City. *Benjamin H. Rice* is president of the firm. . . . A special booth commemorating Passaic, N. J., as the Birthplace of Television, featured a display of DuMont TV receivers at the recent convention of the Junior Chambers of Commerce of the U. S., held at the Broadmoor Hotel, Colorado Springs. . . . *Wayne F. Wales*, an honor student in the Sherburne Central School district, has been awarded the '54 TACO scholarship having a value of \$2,500.

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¹See *National Scene*, this issue, p. 15.

TV Voltage Trouble?

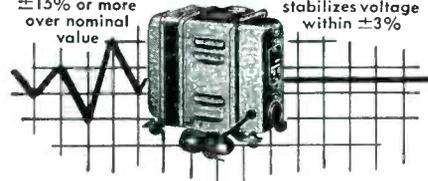
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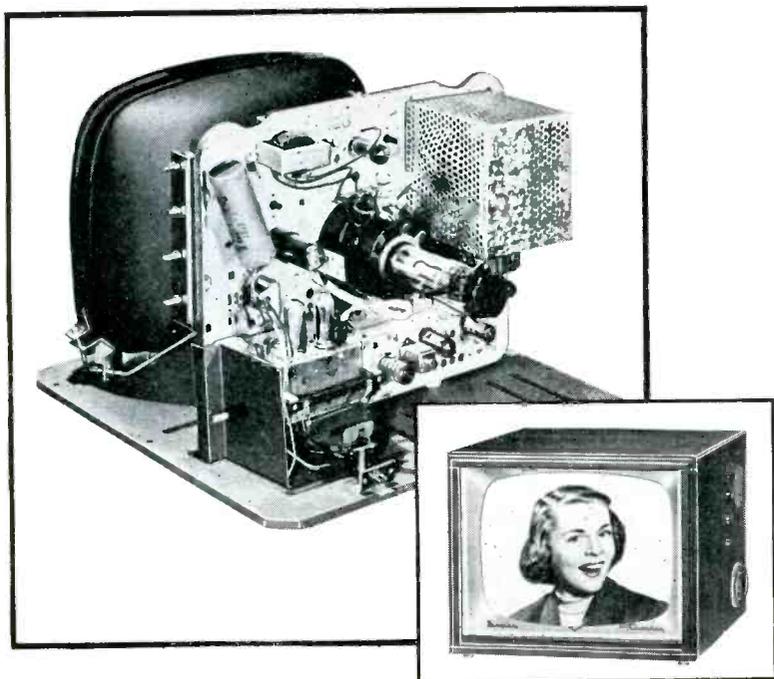
—read these letters

"The Super-V is not only a low-priced set, but a set that can be maintained at a low price, which is equally important. I only wish that someone had thought of the vertical-chassis arrangement for a TV set before. To me, there is nothing more annoying than fishing around blindly trying to get a miniature tube back into its socket on a conventional chassis."

Charles W. Rhodes, Electronic Service Mgr.
Robert L. Rice & Co., Portland, Oregon

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Roy R. Thompson, General Service Manager
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- Genuine fabricated plate anode
- Corrosive impurities held to less than
7 parts in 10 million
- Long shelf life
- Long service life
- Fast, twist prong mounting
- Standardized can size

P.R. MALLORY & CO. Inc.
MALLORY

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

APPROVED PRECISION PRODUCTS

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

**"A little attention
on my part increased
my Battery Sales**

62% "



says—

**FRED WHEELER of
Wheeler Radio Service,
117 East Main Street,
Monroe, Washington**



**"BY KEEPING a fresh stock
of RCA Batteries clearly
priced in neat arrangement
and by reordering promptly,
my sales of RCA Batteries
have increased 62%. This,
of course, has meant a great
deal in increasing my dollar
profits."**

Yes, a little more attention to the battery business by radio dealers and service technicians pays handsome dividends. Enterprising battery dealers don't just order . . . they *sell* RCA Batteries.

Step by step you can build the foundations of a profitable radio battery business such as Mr. Wheeler enjoys in Monroe, Washington. Your RCA Battery Distributor Salesman will help you to analyze your current neighborhood potential and to prepare an order for batteries which will produce top profit results.

As your initial stock starts to move, he'll remind you to place the new stock at the rear of your shelves, thereby assuring every customer of fresh new RCA Batteries and eliminating your spoilage problems.

If your store is not already equipped with a useful RCA Battery Tester (WV-37A), ask about its remarkable selling power. Thousands of dealers all over the country have found that it's good to do business with an RCA Battery Distributor.

Be sure to ask for copy of: "The 1954 RCA Battery Sales Planner."

Here's how RCA helps you sell more Radio Batteries



● NATIONAL TV and RADIO ADVERTISING



● POWERFUL SALES PROMOTION



● COMPLETE LINE



● GREATEST NAME IN RADIO



● RADIO TRADE DISTRIBUTION



RADIO CORPORATION of AMERICA

RADIO BATTERIES

HARRISON, N. J.