RADIO · TELEVISION · ELECTRONIC

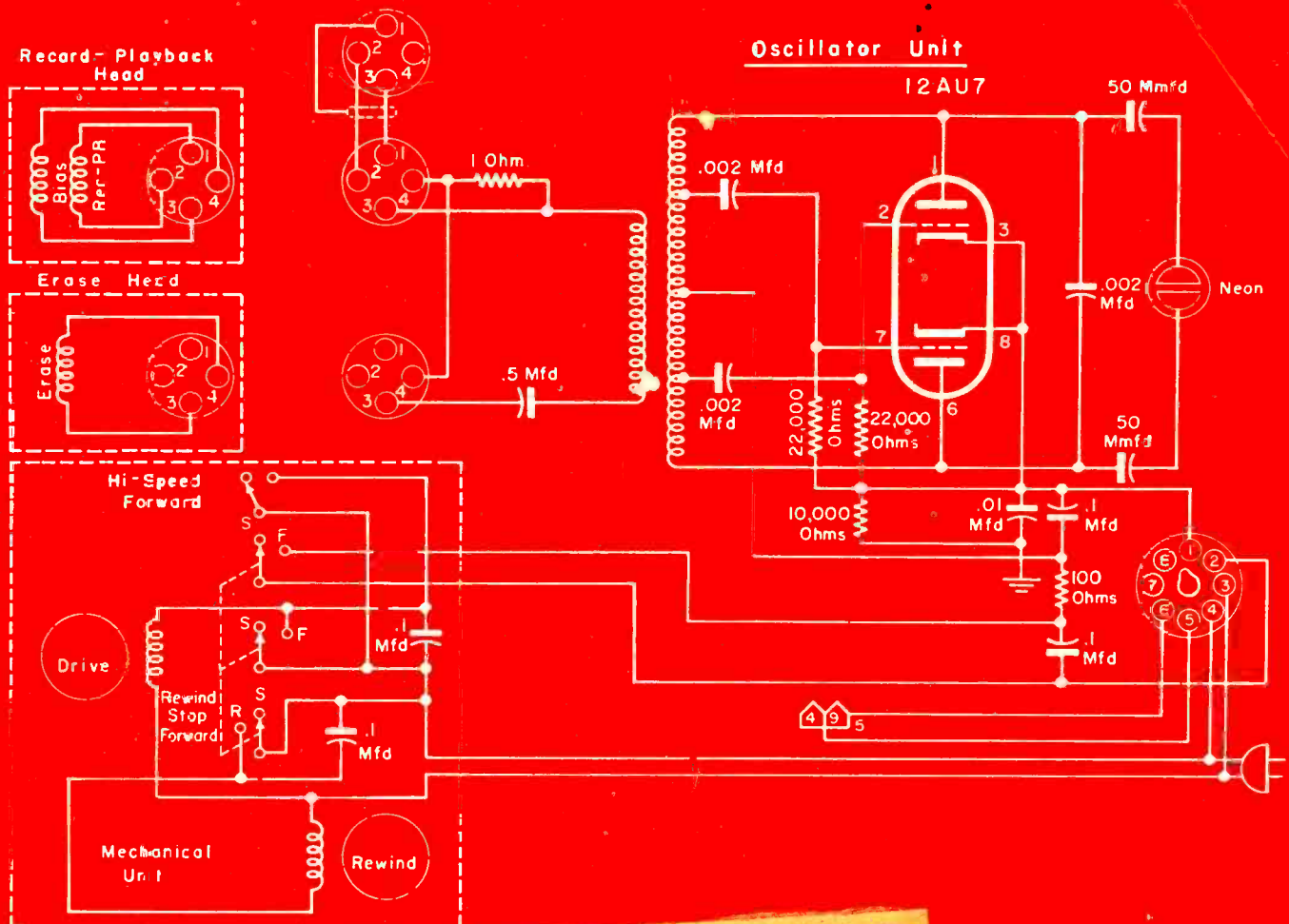
SERVICE

VOL. 24

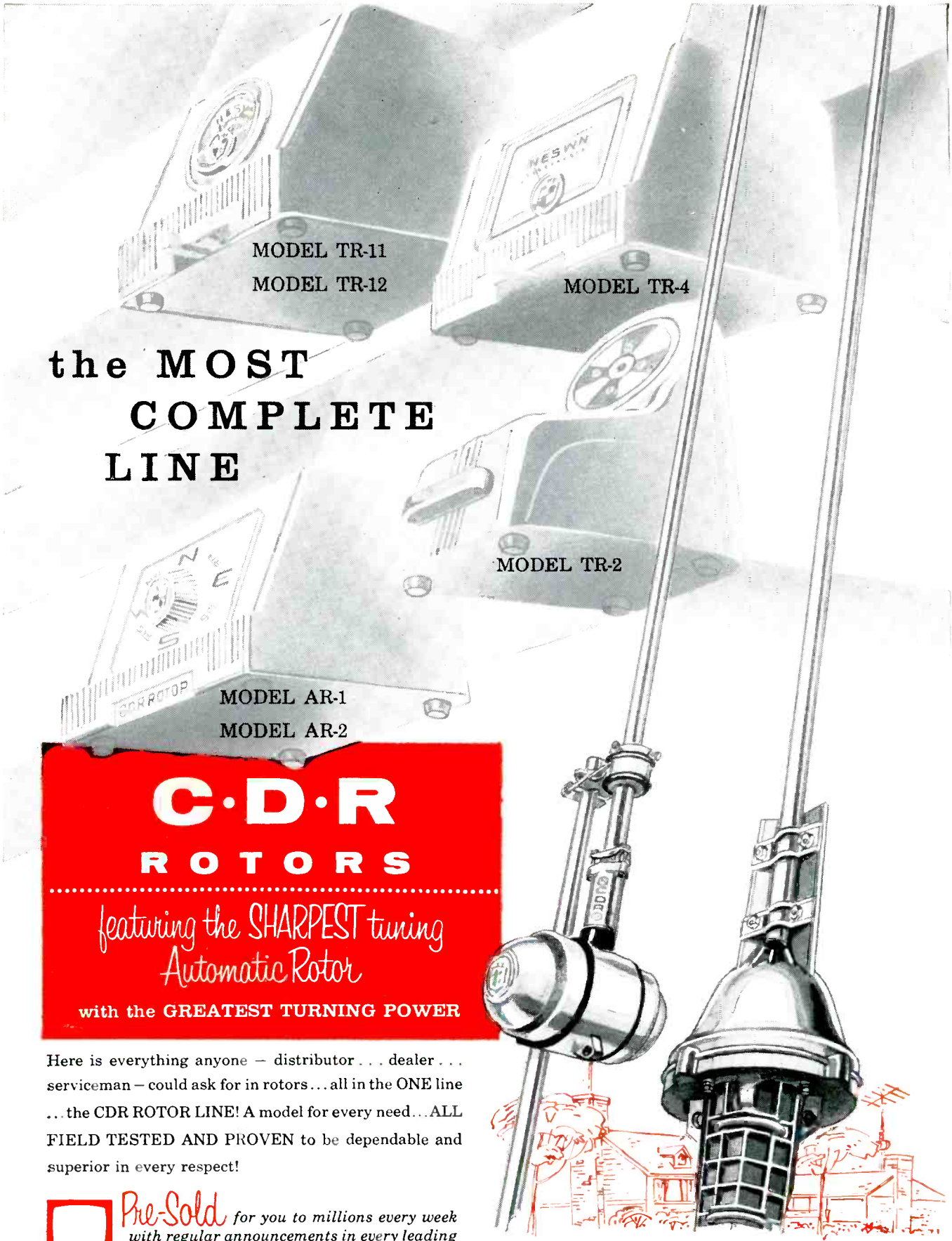
THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE

MAY 1955

In This Issue: AUDIO FORUM



Oscillator section of two-speed tape recorder-playback unit. [See circuit analysis, this issue]



the MOST COMPLETE LINE

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featuring the SHARPEST tuning Automatic Rotor

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Here is everything anyone – distributor . . . dealer . . . serviceman – could ask for in rotors . . . all in the ONE line . . . the CDR ROTOR LINE! A model for every need . . . ALL FIELD TESTED AND PROVEN to be dependable and superior in every respect!

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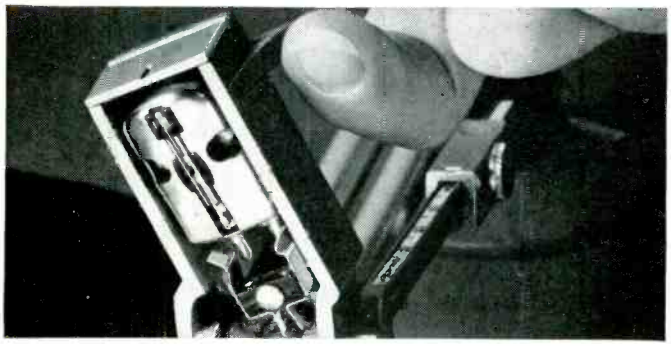
G-E CARTRIDGE
with exclusive
CLIP-IN TIP
stylus . . .

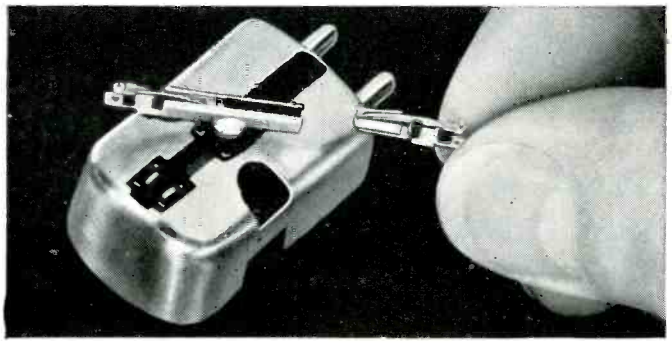
builds new and repeat sales!

Only G.E. gives you this profit opportunity . . . because only G.E. makes it as easy to change a stylus as it is to change a record. Without solder . . . tools . . . without experience! Now every record fan can replace worn styli at home, in seconds . . . *just as soon as a new stylus is needed.* Capitalize on this new design *plus* G.E.'s outstanding performance reputation. Stock the CLIP-IN TIP and you're sure of immediate and continuing sales volume.

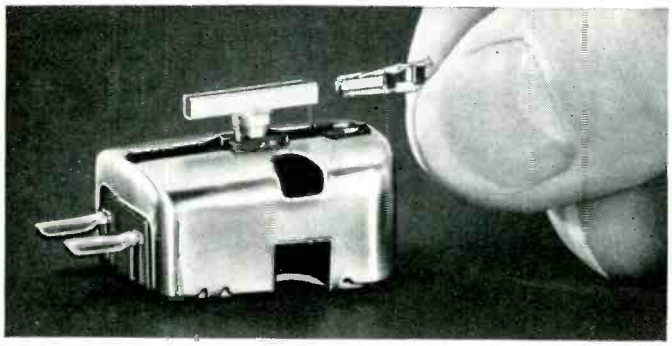
General Electric Company, Radio & TV Department, Section R355, Electronics Park, Syracuse, N. Y.



Simply raise the tone arm sufficiently to permit free rotation of the CLIP-IN TIP stylus. No more effort than is required when changing from 78 to LP playing position.



The worn stylus insert slides out easily and you insert a new one in its place. That's all with a G-E CLIP-IN TIP. Needs no diagram . . . requires little effort . . . little time.



New single styli have this feature, too. Just raise the stylus shaft . . . replace the insert. A CLIP-IN TIP can be used in existing G-E dual cartridges or new single and dual types.

GENERAL ELECTRIC

FIRST V-O-M with ALL in ONL

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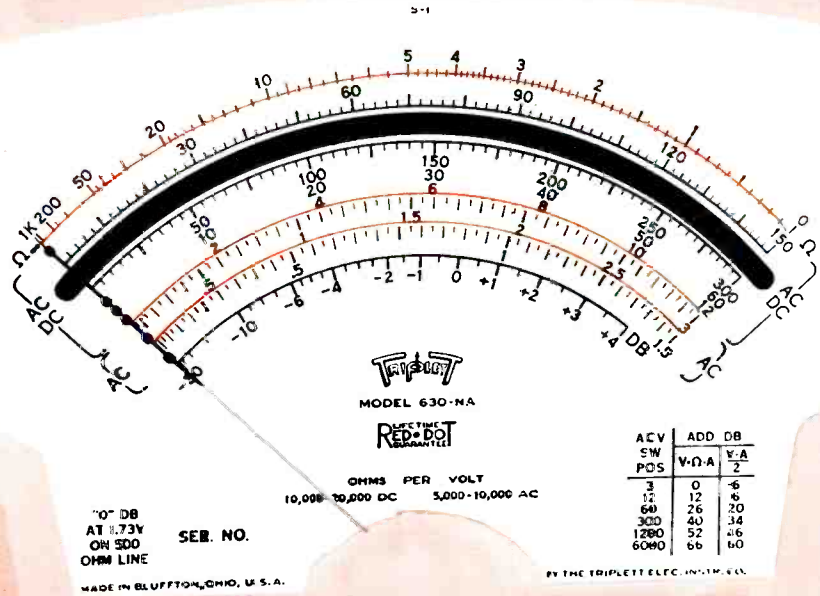

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The above are examples of the complete Triplett V-O-M line in which 10,000 ohms per volt AC sensitivity has been featured for 10 years.

TRIPLETT

TRIPLETT ELECTRICAL INSTRUMENT CO.
Bluffton, Ohio

Vol. 24, No. 5 — May, 1955

RADIO · TELEVISION · ELECTRONIC
SERVICE

LEWIS WINNER
Editor

D. E. PEARSALL II
Assistant Editor

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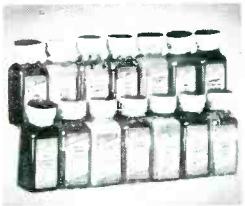

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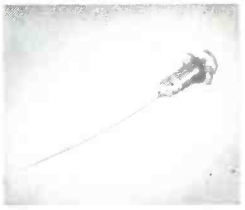

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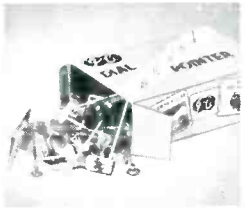

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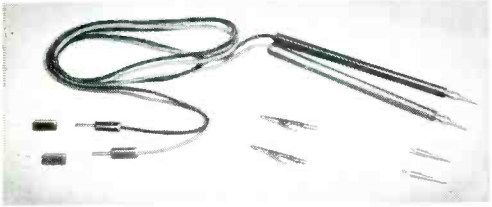

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Heavy duty 6000 V. leads 50" long, 6" handles, solderless tips.
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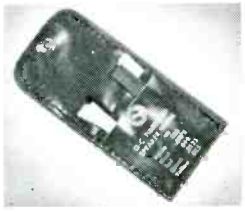

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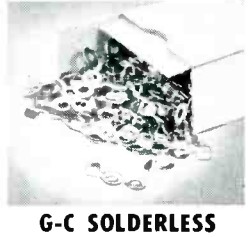

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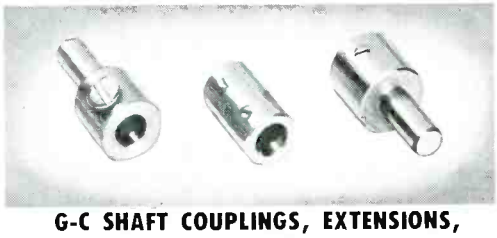

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"SUPERIOR DESIGN" towers and accessories

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3 added towers to solve ALL your needs

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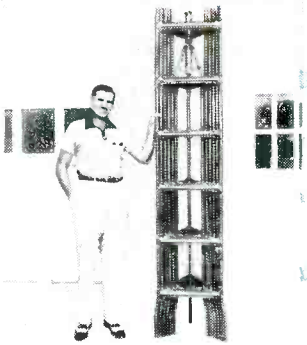
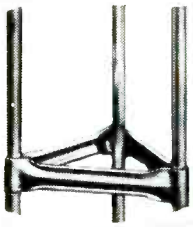
Fulfills 75% of your general tower needs—is structurally as sturdy—yet *costs less* than the well-known Rohn No. 10 Tower. Ideal for home and industrial installations, communication requirements . . . eliminates stocking many different tower models. *Self-supporting to 50 ft. or guyed to 120 ft.!* Easy to climb for fast, efficient servicing. Utilizes "*Magic Triangle*" which insures *far* greater strength and stability. Permanent hot-dipped galvanized coating. Dependability — a feature customers demand — is assured with the Rohn No. 6 Tower . . designed to "stand up" for years to the rigors of weather and climatic conditions.



Package Tower

"Space Saver"— cuts storage space 300% or more!

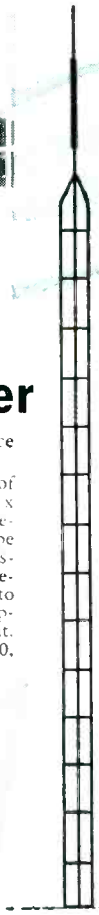
Popular PT-48 has almost 50' of sturdy tower within a compact 8' x 20" package! "Magic Triangle" design is adapted to a pyramid shape using a wide 19" base with progressively decreasing size upward. Decreases your overhead . . easy to transport and assemble — cuts shipping costs. Galvanized throughout. Available in heights of 24, 32, 40, 48, 50 and 64 feet!



Both Towers Feature

HOT-DIPPED GALVANIZING!

Famous First for Rohn Towers . . . to add more profits in your cash register. Yes, you can have these two famous towers in hot-dipped galvanized finish—the most durable and permanent coating of all! What a sales feature for you!



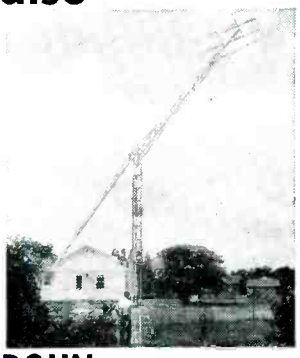
no. 30 tower

Heights up to 200' or more when guyed

Self-supporting up to 60'

Sturdy communication or TV tower that "stands up" to *all* the stresses of weather and climatic conditions . . will withstand heavy wind and ice loading. Heavy gauge tubular steel, electrically welded throughout. Weather resistant, non-corrosive *double* coating provides durable finish. All sections in 10' lengths. Only 2-4 manhours required for installing 50' tower!

also



ROHN Fold-over tower

For experimenters, TV service departments and retailers. Use this kit with regular Rohn tower sections. Simple and easy to use.

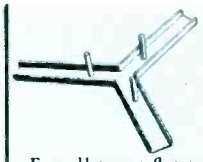
ROHN Telescoping Masts

Heavy-duty hot-dipped galvanized steel tubing and rigid joints give extraordinary strength. *Quick installation* . . . mast attached to base—antenna fixed, then mast hoisted quickly to desired height. Utilizes special clamp and guy ring arrangement. Flanged interior section; crimped exterior section gives mast stability that can't be beat. Complete with guy rings and necessary erection parts. In 20, 30, 40 and 50 ft. sizes. Bases and ground mounts available.

and a complete line of ROHN accessories —*all galvanized*

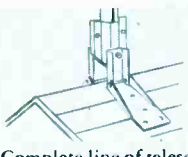
PEAK ROOF MOUNT

Heavy duty for quick, secure mounting of tower to top of peak roof. Flanges hinged, fastened to roof with 2 lag screws in each flange.



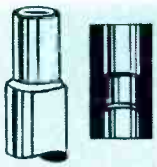
FLAT ROOF MOUNT

For all types flat surfaces. 3–1" solid steel projections permit first section of tower to be mounted directly on roof mount by inserting usual ⅜" bolts.



MAST BASES

Complete line of telescoping mast bases for every requirement, accommodating masts from 1"–2¼" diameter. Also available—drive-in mast bases.



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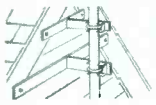
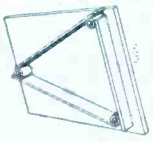


PEAK and WALL MOUNTS

For mounting of mast or pole to roof or wall. Heavy-duty steel. Variable sizes. Models for most every need.



DRIVE-IN BASE

Set on top of ground . . . 3–4' drive rods driven through base into ground. First tower section secured to rods with single bolt in each leg. Instant erection.

SERVICE TABLE

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ROHN *Manufacturing Company*

116 Limestone, Bellevue Peoria, Illinois

A must for after-dark TV servicing

G-E SERVI-SPOT

Electronic TUBES

- FIND HOUSE NUMBERS!
- READ STREET SIGNS!
- CHECK OUTDOOR ANTENNAS!

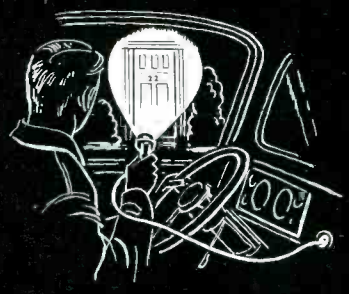
* * *

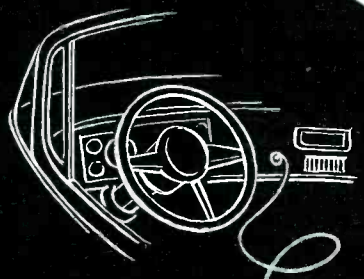
Plugs into the lighter socket on your dash.

Pre-focussed beam carries ¼ mile.

Compact, weighs only 6 oz., 12-ft. cord.

Manufactured by General Electric, world leader in lamps.





Get your SERVI-SPOT from your G-E tube distributor! *General Electric Company, Tube Department, Schenectady 5, N. Y.*

* * *

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161-1A3

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Every thing you need in one package!

- A 3¼x5x1¼" clear plastic box— reusable as a small-parts container
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- Handy crystal cartridge replacement chart

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full vision...full sound ...where Fidelity speaks for itself!

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AN ELGIN NATIONAL WATCH COMPANY AFFILIATE

"6,000 employees . . ."

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Sherwin-Williams Company

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The personal interest of executives like Mr. Steudel, and the systematic bond purchases of more than 8,000,000 enrolled Payroll Savers are reflected in the following figures:

- In March, 1954, purchases of U.S. Savings Bonds, Series E and H, by *individuals* reached $474 million, highest March figure in 9 years—a gain of 20% over March, 1953.
- Purchases of E and H Bonds, by *individuals* during the first quarter of 1954, totaled $1,380 million—the highest for any quarter since 1945.
- The *cash value* of Series E and H Bonds held by *individuals* at the end of March, 1954, was $37 billion, 175 million—the highest in the thirteen year history of the Savings Bond program.
- Payroll Savers are serious savers: over 75% of the amount of Series E Bonds that matured since May, 1951—almost $9 billion—is still being held by individuals under the Treasury's 10 year optional automatic extension plan.
- For the third straight month of 1954, sales of E and H Bonds exceeded maturities and redemptions. The sales excess amounted to $242 million on March 31—the highest first quarter net since 1950.

If employee participation in your Payroll Savings Plan is less than 50%—or if your company does not have a Payroll Savings Plan, get in touch with Savings Bonds Division, U.S. Treasury Department, Washington, D.C. Your State Director, U.S. Treasury Department, will be glad to help you install a Plan and build employee participation.

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MODEL 88

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VACUUM TUBE VOLTMETER and ELECTRONIC OHMMETER

Complete with 3-way Universal Test Probe.

Peak to Peak Voltage Ranges to 3200 volts

The Model 88 is a compact, wide range VTVM-Ohmmeter, for modern electronic circuit checking in the laboratory, on the production line and for general service-maintenance.

Its many advanced features include specially engineered Peak-to-Peak voltage ranges which afford a new high in P-P reading accuracy of pulsed wave-forms encountered in Color or Monochrome TV and similar applications.

THE MODEL 88 PROVIDES
7 DISTINCTLY SEPARATE FUNCTIONS
40 SELECTED, WIDE-SPREAD RANGES

- **6 TRUE-ZERO-CENTER DC VOLTAGE RANGES.** Eliminates need for test lead reversal or polarity switching: Constant 26⅔ Megohms input resistance. 0 ±1.2 ±6 ±12 ±60 ±300 ±1200 volts.
- **5 ELECTRONIC OHMMETER RANGES.** Covers wide range of resistance values encountered in modern electronic circuits, AM-FM-TV: 0—1000—10,000 ohms. 0—1—100—1000 Megohms.
- **6 (—) MINUS DC VOLTAGE RANGES:** (Left-Hand-Zero) constant 13⅓ Megs. input resistance. 0—1.2—6—12—60—300—1200 volts.
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  300V Range: — 1 Megohm, 70 mmfd.
  1200V Range: — 4 Megohms, 67 mmfd.
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  Engineered for more accurate measurement of symmetrical and pulsed voltages: 0—3.2—16—32—160—800—3200 volts.
  Input Characteristics: Up to 160V Range: — 6 Megohms, 90 mmfd.
  800V Range: — 1 Megohm, 70 mmfd.
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- **5 SPECIAL HIGH FREQUENCY PROBE RANGES:** Extends AC RMS reading facility to 300 Mc. with minimized circuit loading: 0—1.2—6—12—60—300 volts RMS. (Requires optional PRECISION RF-10A HF Probe). Probe input capacity: — approximately 5 mmfd.
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- **PEAK-TO-PEAK "RE-SET" PUSH-BUTTON** for rapid "zero" return of special, electronically damped test circuit.
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MODEL 88: complete with detachable AC line cord, internal ohmmeter battery, 3-way coaxial VTVM probe and detailed operating manual. Over-all case dimensions 5⅜ x 7 x 3⅛". Net Price **$69.75**

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TV-8	60 Kilovolt safety probe	14.75 net
ST-1	Snap-on foldaway tilt-stand	1.00 net

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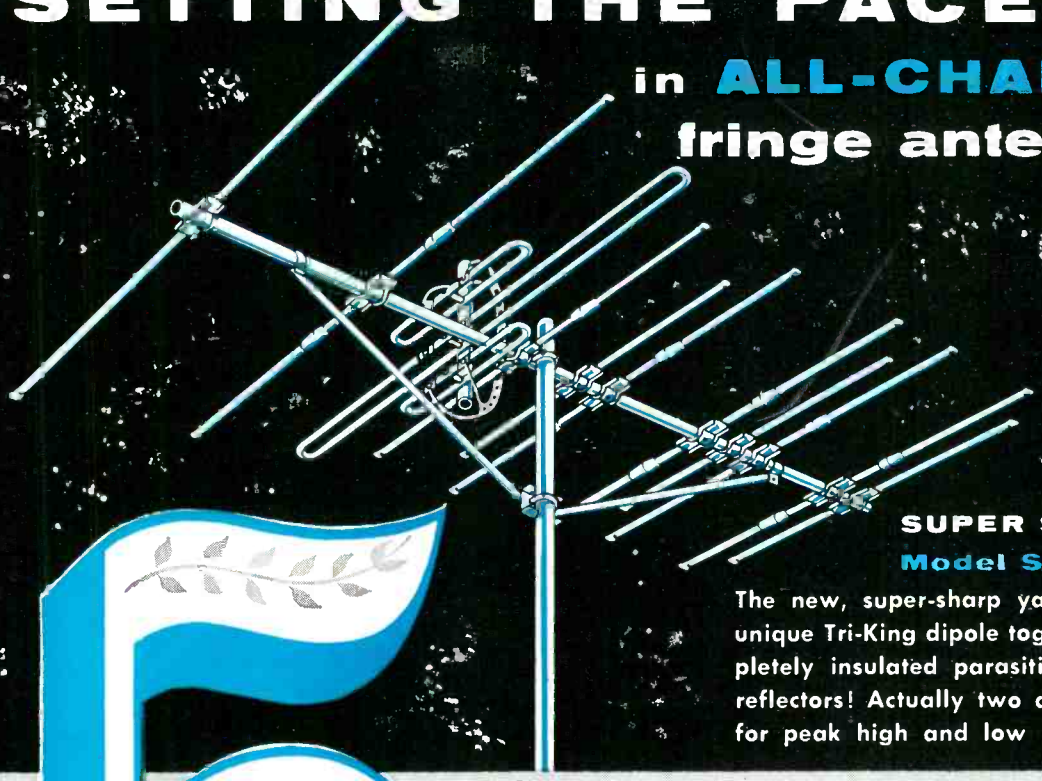

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Model SB662

The new, super-sharp yagi utilizing the unique Tri-King dipole together with completely insulated parasitic directors and reflectors! Actually two antennas in one for peak high and low band reception.

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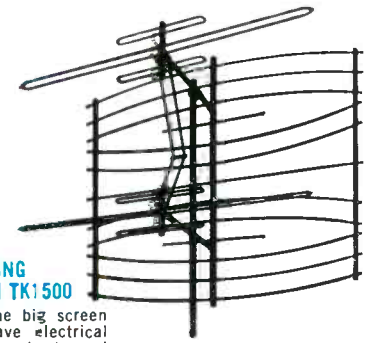
Clear Beam's 5 peak performers solve all fringe problems. . .*



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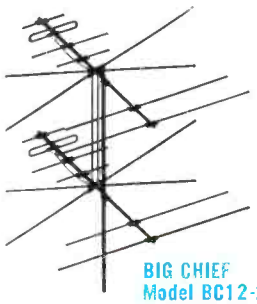
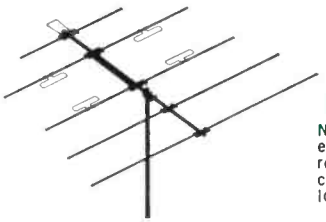


BIG CHIEF
Model BC12-2

An advanced conical-Yagi with element diameters varied for precision tuning, matched sensitivity and peak performance on high and low band!

SKY SWEEP
Model MYS80

A deep fringe yagi incorporating the new magnetic "Focal-Sharp" design for concentrating signal strength!



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New wave trap principle gives extremely high gain, sharp directivity, in-phase tuning on all channels. New, flat design for low wind resistance!

*Spectrum-tested for balanced color reception!

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Warehouses in Seattle, Portland, San Francisco, Honolulu, Dallas, Kansas City, Chicago, Detroit, Baltimore

Catalogs-Bulletins

MANGER ELECTRIC CO., Miller St., Stamford, Conn., has issued a 4-page brochure, describing custom wire leads. Included are stripped, center stripped, counterstripped, shielded counterstripped, multiple conductor, coded, and solder dipped leads.

* * *

AUDIO-MASTER CORP., 17 E. 45th St., New York 17, N. Y., has released a catalog detailing audio-visual equipment. Listed are a portable 3-speed phono, hi-fi transcription playback machine, automatic record changer, varispeed units, combination slide film projectors, record players and *pa* combination unit.

* * *

NEWARK ELECTRIC CO., 223 W. Madison St., Chicago 6, Ill., has published a 48-page illustrated catalog supplement, *60,* listing amateur gear, audio equipment, components, test equipment and tools.

* * *

KEYSTONE ELECTRONICS CORP., 423 Broome St., New York 13, N. Y., has issued a 17-page catalog, *53A,* describing custom built and standard terminal boards, turret terminals, miniature terminals, shaft and dial locks, diode mounts, banana plugs and jacks, extruded terminal lugs, brackets and bushings, test leads, hi-frequency probe handles, phone tips, alignment tools and visulite testers.

* * *

INTERNATIONAL RESISTANCE CO., 401 N. Broad St., Philadelphia 8, Pa., has published two technical data bulletins, *B-9* and *D-2. B-9,* a 2-page unit, contains data on ½-watt molded deposited carbon resistors. *D-2* has data on voltmeter multipliers.

* * *

RECOTON CORP., 52-35 Barnett Ave., Long Island City, N. Y., has issued a 6-page brochure describing a replacement needle promotion plan.

* * *

ROHN MANUFACTURING CO., 116 Limestone, Bellevue, Peoria, Ill., has released a folder entitled *Superior Design Towers and Accessories,* describing TV tubing, towers, masts and accessories.

* * *

PYRAMID ELECTRIC CO., 1445 Hudson Blvd., North Bergen, N. J., has published a 21-page flip chart (16" x 24" or pocket size), describing *Kool-Sel* selenium rectifiers. Features explanation of selenium rectifier functions.

* * *

DENSON TELEVISION CORP., 38 Park Pl., Rockville, Conn., has issued four technical data sheets covering an *rf*-mixer-crystal oscillator head assembly; a 10.7-mc *if* amplifier; tone plates for removing or boosting commercials, multiplex operation or restoration of normal operation; and an audio amplifier and FM receiver for functional or background music service.

* * *

RADIO MERCHANDISE SALES, INC., 2016 Bronxdale Ave., New York 62, N. Y., has released a 6-page illustrated brochure describing TV antenna brackets, *vhf* yagi and conical antennas.

* * *

WARD PRODUCTS CORP., 4710 State St., Ashtabula, Ohio, has announced a promotion kit for the *Duraramic* auto antenna. Includes a 4-page catalog, window streamer, identity pennant and a *replace your old aerial* tag.

On Book Row

ELEMENTS OF TELEVISION SERVICING . . . By ABRAHAM MARCUS AND SAMUEL E. GENDLER: An extremely well-written book providing a lucid review of TV-set theory, plus practical bench-field information, based on actual experiences in black-white and color-TV. Contains 17 chapters, divided into four sections: *Introduction, Field Servicing, Bench Servicing* and *Color Television*. Chapters cover TV transmission and reception, selecting TV antennas, setups for bench servicing, theory of color television, practical color TV receivers and servicing of color TV receivers. Has 290 illustrations, including 12 color photographs showing color TV defects; also contains 91 test patterns and circuit diagrams of many current b-w and color models. Has an excellent glossary of general TV and color TV terms.—*587 pages, priced at $7.35; Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y.*

* * *

28 USES FOR JUNCTION TRANSISTORS . . . By SYLVANIA STAFF: An excellent application manual complete with circuitry for all types of junction-transistorized equipment. Theory has been held to a minimum; only essential transistor data are included. Booklet is divided into five chapters: *Elementary Transistor Theory; Transistorized Amplifiers; Transistorized Oscillators; Transistorized Control Devices* and *Transistorized Instruments*. Features a number of valuable charts.—*48 pages, priced at $.25; Sylvania Electric Products, Inc., 1100 Main St., Buffalo 9, N. Y.*

* * *

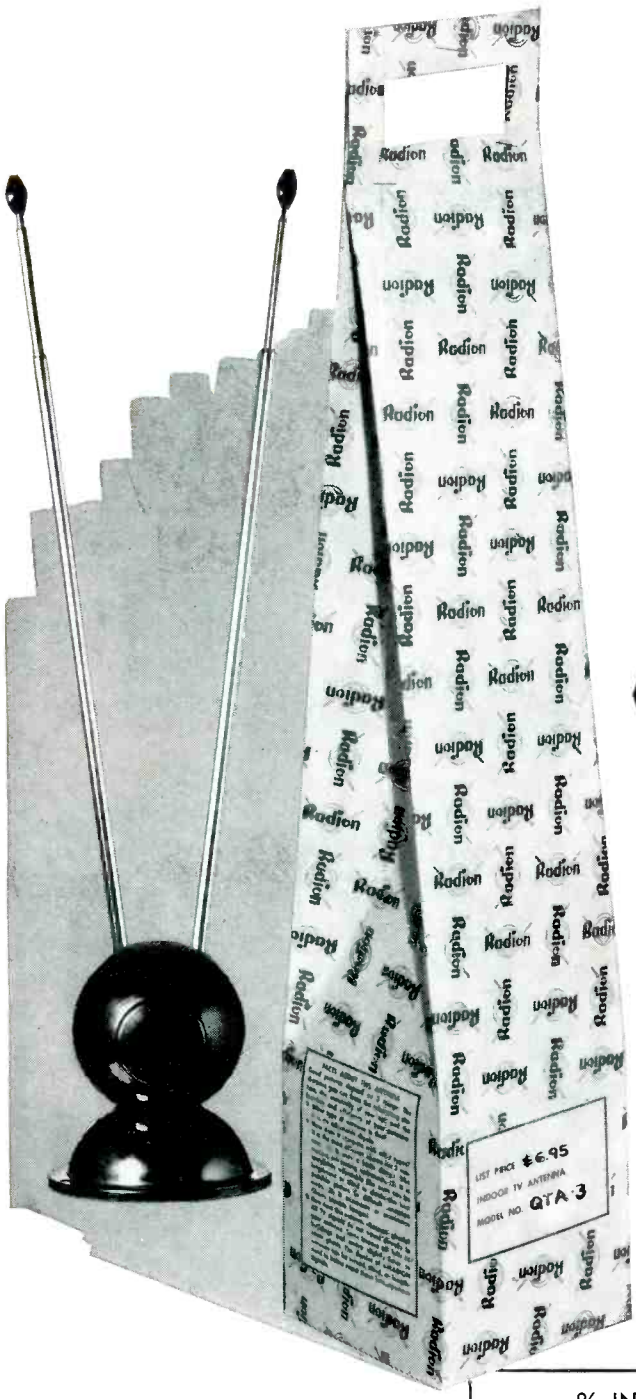
TELEVISION TUBE LOCATION GUIDE (VOL. 5) . . . By HOWARD W. SAMS STAFF: A tube identification manual covering '53 and '54 TV receivers; 197 drawings show top view of chassis and include every tube, its function and alternate types. Socket orientation of tube is indicated and fuses are shown in proper location with a description of protected circuits. A failure check chart is included with each drawing. Also includes a section devoted to stocking tube kits, with information on tube types and quantities needed by the Service Man. Cumulative index for all five volumes is included.—*232 pages, 5½" x 8½"; priced at $2.00; Howard W. Sams and Co., Inc., 2201 E. 46th St., Indianapolis 5, Ind.*

* * *

PICTURE BOOK OF TV TROUBLES (VOL. 2) . . . By JOHN F. RIDER STAFF: A 5-chapter volume offering a diagnosis of troubles in vertical and horizontal sweep and deflection circuits of TV receivers. Schematics of every type sweep and deflection circuit are shown. Results of defects in components are illustrated by picture tube patterns and resultant incorrect waveforms, as well as correct waveforms. Chapters cover troubles in blocking oscillator and multivibrator type vertical sweep generators; vertical output transformer replacement; vertical retrace blanking circuits; vertical deflection yokes and systems, and rapid troubleshooting.—*96 pages, 5½" x 8½", priced at $1.80; John F. Rider, Publisher, Inc., 480 Canal St., N. Y. 13, N. Y.*

* * *

PAY AS YOU SEE TV . . . By IRA KAMEN: A comprehensive report on subscription TV problems and possible solutions. Describes proposed systems, with an analysis of their features. Included are sections on the *whys* of subscription TV, who needs it and how it may benefit the entire industry.—*96 pages, 5½" x 8½", priced at $1.50; Howard W. Sams and Co., Inc.*



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*National average

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DISTRIBUTOR IN:	%	DISTRIBUTOR IN:	%	DISTRIBUTOR IN:	%
Atlanta, Ga.	31	Detroit, Mich.	26	Pittsburgh, Pa.	41
Austin, Tex.	100	Kansas City, Mo.	48	St. Louis, Mo.	110
Buffalo, N.Y.	8	Los Angeles, Cal.	48	St. Paul-Mpls., Minn.	92
Chicago, Ill.	11	Memphis, Tenn.	20	San Antonio, Tex.	230
Cincinnati, Ohio	21	Milwaukee, Wis.	9	San Francisco, Cal.	23
Cleveland, Ohio	8	Oklahoma City, Okla.	11	Seattle, Wash.	300
Columbus, Ohio	26	Omaha, Nebr.	16	Spokane, Wash.	42
Dallas, Tex.	4	Rochester, N.Y.	20	Syracuse, N.Y.	18

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for Home and Auto Radios, Phonographs and Television

Product of combined Delco Radio and General Motors engineering skills, manufactured in plants devoted exclusively to electronic parts, the Delco speaker line embraces 14 standard models for home and auto radios, phonographs, and television—plus the model 8007, a superior Hi-Fi dual-purpose speaker for replacement in AM, FM, TV and phonograph sets, and for use with custom-built high-fidelity audio systems. It's plain to see that here's the speaker line to fill your needs...products of uniformly fine design and construction, *all* of them competitively priced!

Standard Speaker Features: Designed and built to R.E.T.M.A. standards; cones uniform in response over operating frequency range; fully dustproofed with drawn brass magnet covers and felted cones; Alnico-V magnets; heavily plated metal parts.

Model 8007 Hi-Fi Speaker Features: Size 8″; 50 to 12,500 CPS frequency range; Alnico-V magnet; 10-watt power rating; 4.1 input impedance; 13/16″ voice coil.

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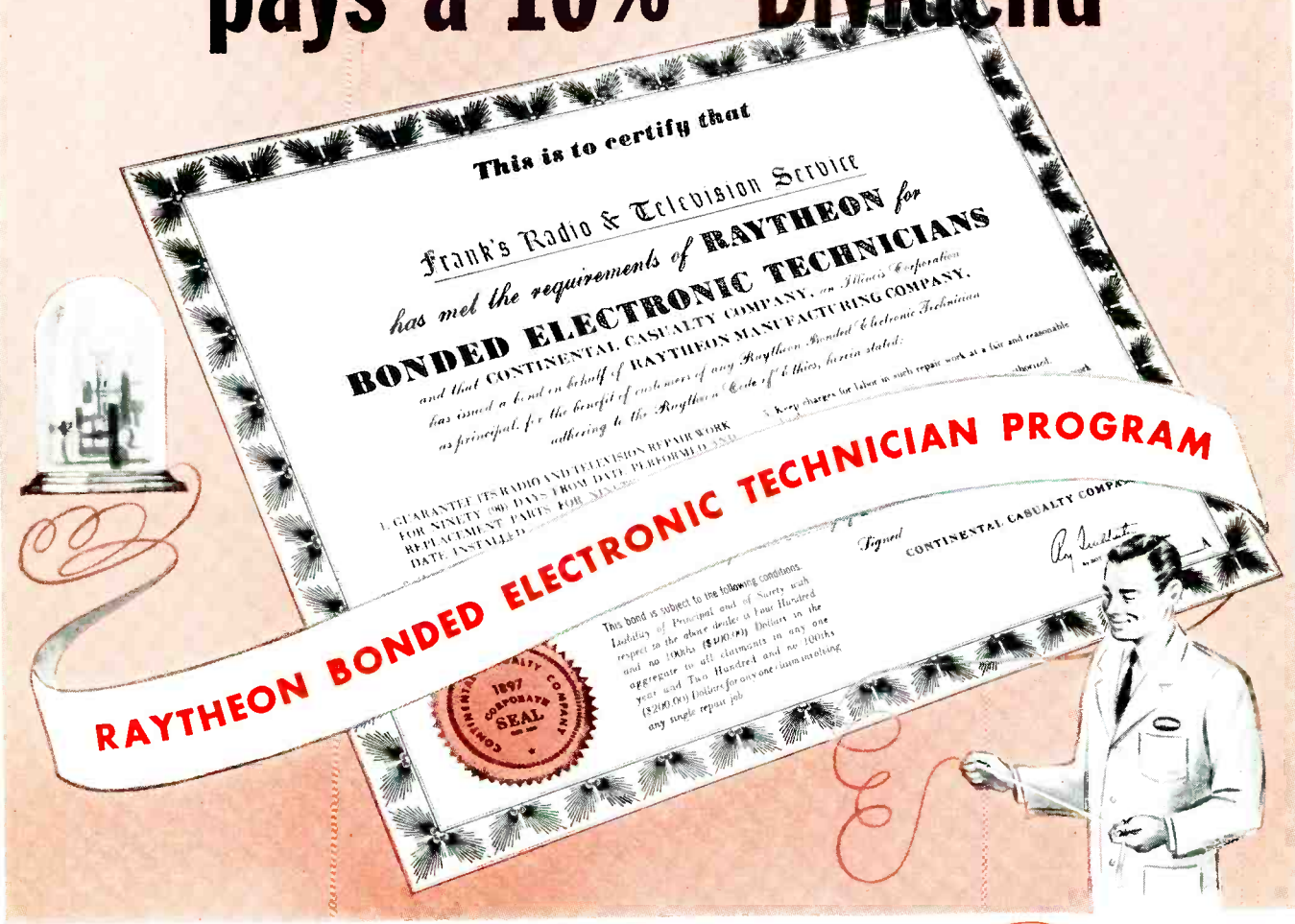

If you are interested in increasing your Radio & TV Service business and profits 10% or more call the Raytheon Tube Distributor in your area right now.

Ask him to tell you how the Raytheon Bond gives you a national backing of your 90 day guarantee, increases customer confidence in you and your shop.

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Ask him about the Raytheon national advertising that makes it easy for you to get more business and then ask him if you can qualify for this exclusive Raytheon business builder. If you can, it costs you nothing — it's Raytheon's investment in your future.

*Recent surveys prove the Raytheon Bonded Program improves business by at least 10 per cent.

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Spring Is Here

IT'S OUTDOOR installation time!

You can now get at those antenna systems that have been roughed up by bad weather: Now you can replace not only those antennas whose elements, connections and feed points have been ripped up and broken by gales, ice and freezing temperature, but the complete rooftop-to-receiver link (insulators, arrester, rotator, leadin and pole supports) that also has been battered about by winter.

And, of course, the time is ripe, too, for new installations in the fringe and super-fringe areas.

For replacements and new-installations, there's an excellent array of antenna models on hand to fit every need. To illustrate, for the rural and suburban areas, where a large number of low-gain antennas were installed years ago when only a few stations were on the air, there are now available high-gain antennas capable of picking up those additional stations that have begun to telecast. And also efficient broadband models have been designed to replace the single-channel yagis, in those zones where additional channels have appeared on the scene. For those homes with second sets, either of these improved antenna types will be found ideal, providing that extra input so necessary for successful multi-receiver reception.

Elsewhere, for those areas where powers are being increased, channel shifts are being made and transmitting towers are being moved, a number of special types of antennas have been engineered. These have been developed to provide not only maximum signal, but eliminate interference caused by co-channel or adjacent-channel problems that usually occur when stations move, up their output or change their frequency.

On occasion, in local areas, some will question the need for a new antenna, pointing out that they've heard that all that's necessary now, since TV has reached the radio stage, are those small miracle attachments, like the suction-cap wire-bobbin wonders. Repeated tests have proved that these gimmicks are worthless. Even for reception of nearby stations, built-in antennas, such as makes radio acceptable, have been found unsatisfactory.

The springtime new-antenna installation opportunities do not stop in home assignments. There are tremendous possibilities elsewhere. As an example, resorts and motels have become lively TV customers. Today over 60 per cent of the nation's sport and rest hotels, and drive-ins, have video installations. Before the year is out, at least ten to fifteen per cent more will join the viewing parade. And they'll all require antenna installations, and extensive ones at that, with husky multi-bay pickups.

Another bright antenna-installation prospect appears in community TV. In the remote areas and those centers completely blacked out by hills, hundreds of thousands are now able to look in, thanks to this novel master-antenna system. In the months to come, a vast new audience will be added, and they'll come from small villages. The original idea that the community system was only practical for the larger cities has been scuttled. Since last year, enterprising Service Men* have installed successfully over 500 mountain-top-to-village systems serving from as few as a dozen to around a hundred subscribers.

According to a spokesman for the National Community TV Association,** community-TV activities in small towns will boom and set a merry pace during the coming months. And it will be the independent Service Man who will be running the show.

Another dynamic member of the outdoor-installation family is sound. The old-reliable *pa* still represents a golden opportunity at this time of the year for fairs, carnivals, outdoor restaurants and playgrounds, to mention a few. And the expanding outdoor sound movies also present a bristling field for audio work. Here, resourceful Service Men will find a lucrative market place for their talents, and the assortment of audio gear, such as amplifiers, speakers, phono players, and records, too, they'll be called on to supply, and install, maintain and service.

Be it in TV antenna systems or sound, there's a robust program on tap for the Service Man — in that bustling outdoor season ahead.—L. W.

As exemplified by* ***T. C. Masters,* *who has been reporting on his extensive community-TV experiences in* SERVICE.

***See page 35, this issue, for a preview report on the association's fourth annual conference.*

by LEO G. SANDS

Troubleshooting

Locating Sources of Stop-Go Troubles in Tubes, Components and Contacts

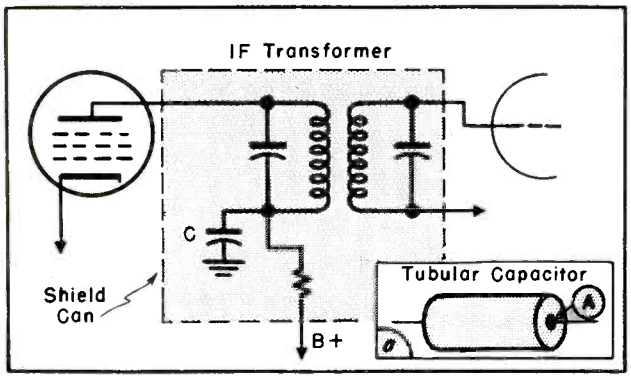


Fig. 1. Opening or shorting of capacitor C inside of an if transformer shield can is a common cause of intermittent operation. Poor connection at point A in capacitor can cause intermittent operation.

THE BANE of the Service Man's life is the intermittent, in the radio, TV receiver, amplifier and other electronic gear.

Intermittent troubles are hard to find because the period of failure may be so short, although recurring, as to make it quite a project to locate the source of the trouble. The mere act of touching a test prod to a circuit might restore normal operation and failure might not occur again for a considerable time.

Intermittent operation and malfunctioning of electronic equipment can be caused by any one of a great many electrical changes in the circuitry. A radio receiver, for example, may cut out or fade for short or extended periods. The period of malfunction may be short or very long, and normal operation may resume with or without external cause depending upon the nature of the fault.

Tubes are often the cause of intermittent operation. Slow fades may be due to the opening of tube heaters or filaments. Abrupt discontinuities in performance may appear because of tube-element shorts or opening of welds within the tube.

Capacitors are probably the most common cause of abrupt loss of gain, distortion or cutting out. Time takes its toll on capacitors and it is often cheaper to replace all suspicious capacitors than to spend hours trying to identify a defective one. Capacitors may short, open or develop high resistance to electrical leaks.

Resistors, particularly in critical circuits as in oscillators, may be the cause of intermittent operation. Wire-wound resistors may open up completely, whereas carbon resistors may change greatly in value due to temperature changes or aging.

Power transformers seldom cause intermittent operation. When insulation breaks down, they generally burn out or give off an offensive odor. Audio transformers and reactors in live signal circuits can cause intermittent operation when insulation breaks down or windings open intermittently.

Improperly soldered connections are probably the major cause of intermittent operation, particularly in fairly new equipment. Resin joints, cold-soldered joints and use of acid core solder have and do contribute to intermittent operation.

Finding the cause of intermittent operation may require considerable ingenuity. One way to effect a cure, without necessarily identifying the cause, is to replace all suspicious parts and tubes. Sometimes this won't work either. When equipment operates normally most of the time, but is reported to fail intermittently, it is often possible to hasten the complete failure of the part causing the trouble.

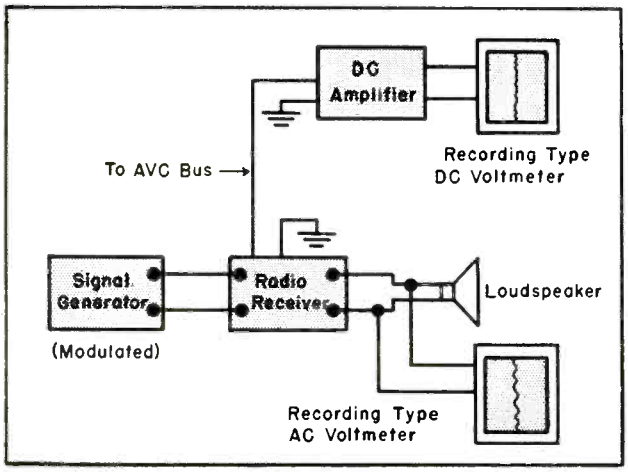
Heat Tests

Since heat may be the factor causing a part to fail, the temperature of the equipment being checked can be increased rapidly by placing a cardboard box over it, while it is on the bench and turned on. This may hasten intermittent operation and permit one to find the trouble in a shorter time.

Defective capacitors can often be caused to break down quickly so they can be located by removing all of the tubes except the rectifiers from the equipment. This reduces the load on the power supply and allows the plate voltage to rise to an abnormal level. By observing the plate-voltage level, with the tubes in and out, and noting if any change occurs a short while after the tubes have been taken out, it is possible to determine if bypass or filter capacitors are the possible causes of intermittent operation. A sudden drop in voltage could indicate that one or more capacitors has shorted partially or completely.

Boost Transformer Use

By inserting a line-voltage boosting transformer of the tapped or continuously variable type, the plate voltage

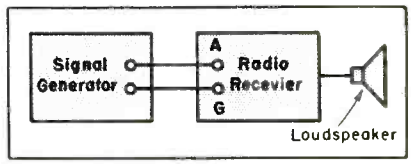


(Right; below)

Fig. 2. Strong unmodulated signal fed to receiver will cause set to become microphonic if defective parts and loose connections are in radio.

(Left)

Fig. 3. Setup for visual monitoring of a radio set with intermittent problems.



Radio Intermittents

Through Heat Tests, Strong Signal Feeds and Monitor-Fault Alarm Device

may be raised to a higher than normal level to hasten the failure of partially defective capacitors. This can be done with the tubes in the set over short periods without damaging the tubes.

One of the easiest ways to find poorly-soldered joints and defective tubes and components in a radio receiver is to feed a very strong signal to the set; the entire receiver will become microphonic if there are defects. Tapping tubes with the eraser end of a pencil will reveal noisy tubes; tapping the tuning capacitor will show up loose plates and prodding tubular capacitors, resistors and other components with a tuning wand or similar tool will reveal bad connections and frail parts. For example, a poor connection at the point where the leads come out of the capacitor, when prodded in this type of test, will cause quite a noise in the loudspeaker of the receiver being checked. This test will reveal many defects hard to detect any other way.

Often a set owner will complain that his set cuts out or fades, but fails to do so when the Service Man calls or when the set is checked on the bench. The usual procedure in such a case is to hook up the receiver on the bench and let it play hoping it will fail so it can be repaired and returned to its owner. When several such sets are being monitored simultaneously, it becomes difficult to keep an accurate check of what set faded or cutout, when, and for how long.

Monitoring of suspected intermittent radio receivers can be done semi-automatically by feeding a constant level signal to the receivers being monitored and by observing the receiver outputs with recording meters or special fault alarm devices. Recording meters of the type using a paper tape will note the meter reading continuously so that a graphical presentation of receiver performance can be had. To indicate overall performance, the audio output of the receiver can be metered. For observance of the stability of the *rf* and *if* portions of the receiver the *avc* bus can be metered. Naturally, when an audio amplifier is to be monitored in this manner, an audio signal generator is used as the signal source.

Fault Alarm

A fault alarm device can be constructed. The purpose of such a device is to set off an alarm whenever the receiver or amplifier output drops off from its present level. A thyratron or vacuum-tube circuit can be used; it can be set so that it is tripped off when the signal output voltage of the receiver or amplifier drops to half or less of its normal or present value.

A more sensitive device which could detect smaller changes in signal voltage is not considered necessary, since a 50% voltage drop is only 6 db, which is not a large change in level to the ear. An intermittent receiver or amplifier would have a much greater change in signal output.

Signal Piping

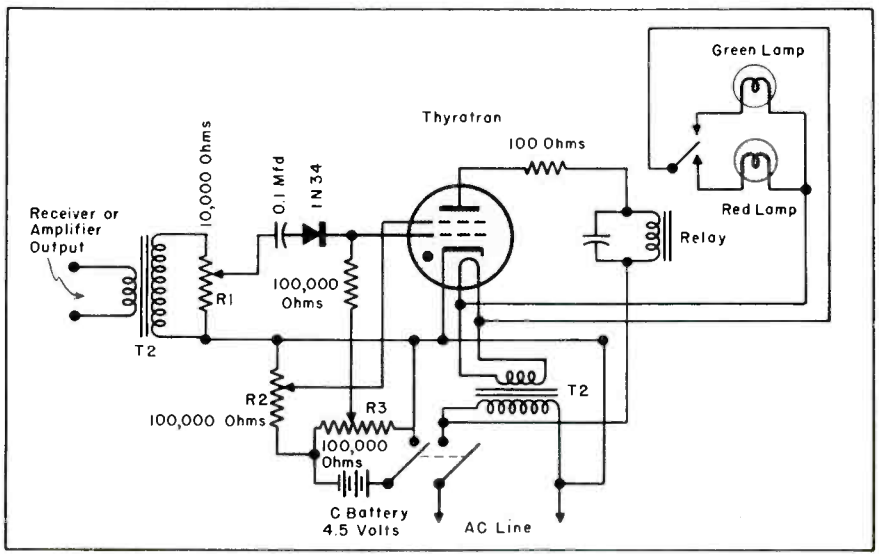
Where a large number of suspected intermittent receivers or amplifiers are to be checked, a signal may be piped to several receivers or amplifiers, each equipped with a fault alarm. When one of the units being monitored fades or cuts out, a bell can be used to release a warning signal and a lamp can identify the unit which failed.

External Condition Problems

Intermittent operation of radio receivers can be caused by external conditions which might be present in the owner's home, but not in the service shop. For example, a set may play better when the lights in the room are turned on than when they are off. The house wiring may affect the receiver antenna system. The solution in such cases is to add an external antenna, if the receiver uses a built-in loop antenna, or to reorient the loop so it will pick up more signal. If the receiver uses an external antenna, it may be too short or need repair. Another cure in such cases is to provide the receiver with a good external ground or to install a capacitor between the *ac* line and the receiver chassis.

Defective House Wiring

Defective house wiring, too, can cause intermittent radio reception; a condition to suspect if a receiver cuts out in the owner's home but fails to do so in the shop. Once verified, this becomes a problem for a qualified electrician.



(Right)
Fig. 4. Fault alarm circuit. With no signal R_2 and R_3 must be adjusted so that relay closes, and with signal applied it should open and green lamp will operate. Sensitivity can be adjusted by setting R_1 to the desired level. Failure of the signal or a drop in the signal level will allow relay to close and red lamp will glow. For filament and relay powering a 6.3-v filament transformer is used. T_2 is an output transformer with voice-coil side as input.

Resistance-Capacitance Substitution

by ROBERT G. MIDDLETON

Chief Field Engineer, Simpson Electric Company

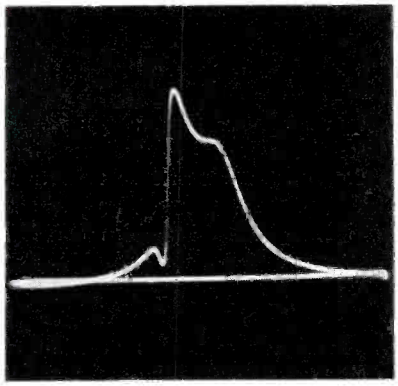


Fig. 1. A typical TV receiver response curve. This curve is most closely related to a 60-cycle square wave. If the vertical amplifier in the 'scope will reproduce a 60-cycle square wave without distortion, it will reproduce a visual-response curve without distortion. But to do this, the 'scope must respond to frequencies far below 60 cycles.

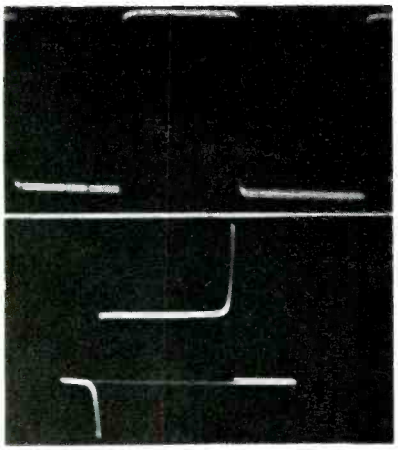


Fig. 2. Plot (top) illustrates satisfactory reproduction of a 60-cycle square wave by the vertical (video-frequency) amplifier in a service 'scope. Improper compensation of vertical amplifier causes overshoot distortion in reproduced 60-cycle square wave, as shown in bottom pattern.

WE ARE ALL familiar with resistance and capacitance substitution boxes, but too many are not acquainted with the variety of *applications* possible with these valuable tools.

To set the stage for this application survey, let us examine the 'scope, and consider first its low-frequency response. The vertical amplifier of the 'scope is a video-frequency amplifier. Video frequencies extend (often) from *dc* to about 4.5 mc. Hence, video frequencies include the audio and the ultrasonic range of frequencies.

One of the important jobs which the video-frequency 'scope amplifier is called upon to perform is the reproduction of visual-response curves, such as we see in Fig. 1. *What is necessary to obtain good reproduction of such curves?* Let's go back to essential fundamentals: This curve belongs to the general class of square waves; since the waveform is being displayed at a 60-cycle repetition rate, the 'scope must be capable of reproducing properly a *60-cycle square wave,* as shown in Fig. 2.

What will determine whether the 'scope has this capability? Looking at Fig. 3, we might say that since a 60-cycle square wave has a fundamental frequency of 60 cycles, plus various odd harmonics, the 'scope would be able to reproduce a 60-cycle square wave satisfactorily, if the vertical amplifier has flat frequency response down to 60 cycles. *But we would be wrong!*

As disclosed in Fig. 4, each of the harmonics in the square wave necessarily has a phase relation with the fundamental. Either the harmonic is *in step* (in phase) with the fundamental, or it is *out of step* (out of phase). Reproduction of an undistorted square wave requires that the 'scope amplifier maintain the in-phase relationship of all harmonics of the square wave, with respect to the fundamental. If the harmonics are shifted in phase, with respect to the fundamental, the reproduced 60-cycle square wave shows tilt, as illustrated in Fig. 5. Under these conditions, a reproduced response curve will exhibit *loop distortion,* as shown in Fig. 6.

To maintain a linear phase characteristic through 60 cycles, it has been found that the vertical amplifier of the 'scope *must have flat frequency response down to approximately 20 cycles.*

It is difficult to design a video amplifier with *ac* coupling having flat frequency response down to 20 cycles. This difficulty obtains because the

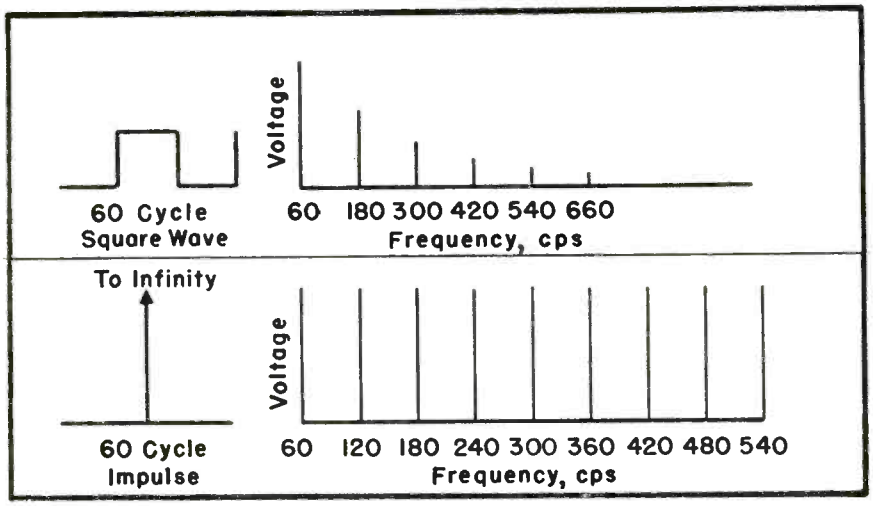


Fig. 3 (below). Harmonics of 60-cycle square wave drop off in voltage in inverse proportion to the order of the harmonic. A 60-cycle impulse (having infinitesimal width, and infinite height) has harmonic voltages of uniform value which extend out to infinitely high frequencies. In between these two extremes are various intermediate distributions of harmonics.

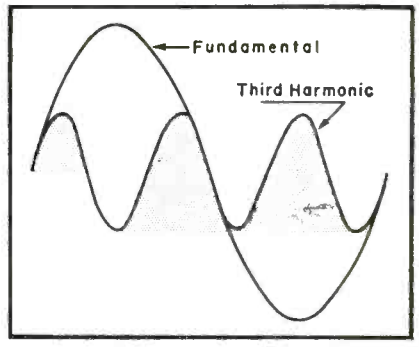


Fig. 4. In a square wave, phase relations are as important as the frequencies of the harmonics. An undistorted square wave displays harmonics going through zero at the same time as the fundamental goes through zero. If the 'scope amplifier shifts the phase of the harmonics, with respect to the fundamental, the reproduced square wave will show tilt.

Box Application In Video Work

Types of Resistor-Capacitor Networks That Can Be Used to Improve Efficiency of 'Scopes in TV Repair

reactance of the grid-coupling capacitors and of the decoupling and bypass capacitors tends to rise as the frequency is lowered, *thereby choking off the low-frequency response.* But there is a way out.

To maintain flat frequency response down to 20 cycles, the 'scope amplifier may utilize *low-frequency compensation,* as shown in Fig. 10 (p. 61). This is an arrangement which (when properly made) restores *both* the low *frequency* and *phase* response of the video amplifier. This compensation can be made by choosing *proper values* of *R* and *C,* the compensating resistance and capacitance, respectively. Here is where the *resistance* and *capacitance substitution boxes* prove to be so valuable. Now it might be supposed that if *R* was a little too small, that *C* could be changed a little in value to offset it. *This is not so.* You will find that your 'scope amplifier is properly compensated only for a certain value of *R,* and for a certain value of *C.*

The substitution boxes should be arranged as shown in Fig. 7. Here, a 60-cycle square-wave voltage is applied to the vertical-input terminals of the 'scope. The controls of the two substitution boxes then must be varied back and forth; the reproduced square wave will exhibit varying distortions, as shown in Fig. 8. By experimenting with various control settings of both boxes, however, a semi-critical value of *R* and of *C* will be found which will cause a distortionless reproduction of the 60-cycle square wave. It is apparent that *the substitution boxes can save an enormous amount of work* in soldering and unsoldering capacitors and resistors in the circuit.

Typical C and R Values

A typical value for *R* would be 18,000 ohms, and a typical value for *C* 2 mfd, but these values will vary over wide ranges, depending upon the particular video amplifier which is being serviced. However, these values provide a general idea of the requirements which must be met by the capacitor and resistor substitution boxes.

It is sometimes supposed that this operation requires the availability of a 60-cycle square-wave generator, but fortunately, adequate expedients are readily possible. For example, in case the sweep generator has a zero-volt reference-line blanking function, it can be easily converted to a 60-cycle square-wave generator by means of the arrangement shown in Fig. 9 (p. 60). The sweep-width control is set to nearly zero, and the *if* or *rf* output from the generator rectified by the 1N34 crystal; the resulting 60-cycle square-wave output can then be applied to the vertical-input terminals of the 'scope for purposes of the test de-

(*Continued on page* 60)

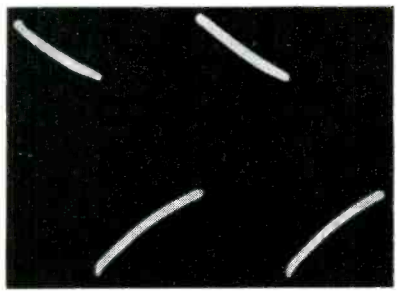


Fig. 5. Tilt in a reproduced 60-cycle square wave, due to shift in phase of the harmonics. A 'scope amplifier often shows this type of distortion, unless properly compensated. (From the Technician's Timesaver.)

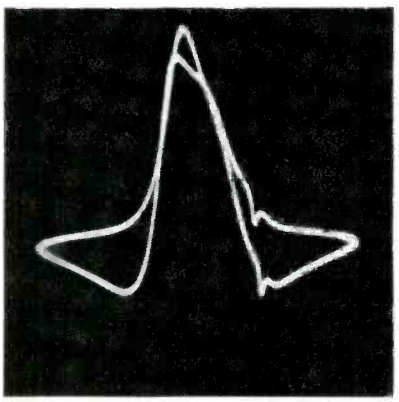
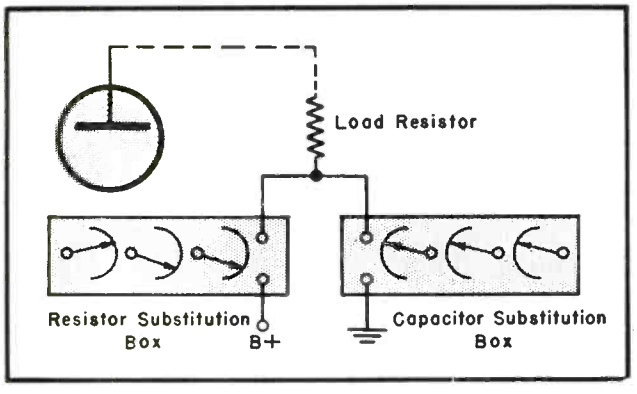


Fig. 6. If the 'scope amplifier introduces tilt into a reproduced 60-cycle square wave, it will introduce loop distortion into a reproduced response curve, as shown. Proper low-freqeuncy compensation of the 'scope amplifier eliminates this difficulty. (From Technician's Timesaver.)

(Below, left)

Fig. 7. How to arrange resistor and capacitor substitution boxes to determine the required values of R and C in the low-frequency compensation circuit, to obtain distortionless 60-cycle square-wave response. Use of the boxes makes an extremely rapid determination of optimum values possible, without endless soldering and unsoldering of capacitors and resistors.



(Above)

Fig. 7. Resistor-capacitor substitution box setup.

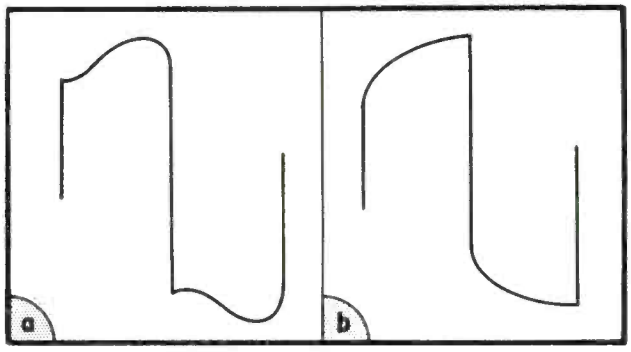


Fig. 8. Two typical examples of incorrect values of R and C in the low-frequency compensating circuit of the 'scope amplifier. When both R and C are properly chosen, the top of the reproduced square wave will be quite flat, and will exhibit no tilt.

Connecting The Cable In The Community TV System

by T. C. MASTERS, *Chief Engineer, Television Signal Service*

Cable Selection . . . Use of Line Amplifiers . . . Tapoffs . . . Line Splitters

IN LAYING OUT a community antenna system, it is particularly important to consider carefully the placement, gain and spacing of line amplifiers, and the determination of cable losses, to insure the maintenance of a constant signal level throughout the entire system. One must take into account such factors as cable types, amplifier gain, and number of tapoffs and line splitters.

In the overall community layout, amplifier locations are determined by the losses in the cable runs, also by the type of cable used. Amplifier gain is rated in db, usually at a 0 level of 1,000 *uv* at 100 mc. This is a fairly common base adopted by manufacturers of this type of equipment.

Where the high channels are to be used the cable loss must be figured at 220 mc, instead of 100 mc. An equalizer must be used in front of each amplifier to bring the low-channel signals down to equality with the high-channel signals. The high-band loss is much greater, per foot of cable; thus we'd have unbalance, crosstalk, and several other undesirable effects, if not properly equalized out at each amplifier input.

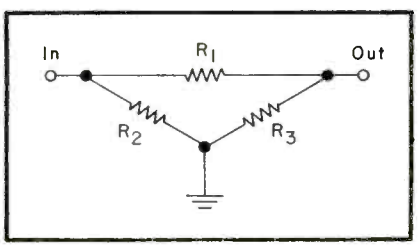
Large coax cable[1] has a loss of about 1.4 db per 100′ at 220 mc. A 40-db amplifier will drive a signal for 2900′ in this cable, before another amplifier is needed. RG-11/U cable, with a rated loss of 3.1 db per 100′ at 220 mc, will carry a signal for 1300′ before more amplification is needed. These figures, of course, are for an unbroken run of cable. Where line-branching networks and customer tapoffs are used between amplifiers, these losses must also be computed. Tapoff loss is usually around .5 db, and the passive line-splitters have a loss of around 3.5 db for a two-way split, or 6.5-db loss for a four-way divider.

Where a straight run of cable is being installed, but future developments make it likely that several tapoffs may be cut in later, the loss of these units should be taken into consideration when designing the line. Without proper compensation, overdriving of the amplifier would result; therefore, pads must be inserted in the amplifier input to add enough loss to take care of future needs. Later, when the tapoffs or line-splitters are actually installed, these pads may be removed, leaving the line properly balanced and driven. This eliminates the need for relocating the line amplifier, an expensive and time-consuming operation.

Equalizers, line splitters, and pads are available in packaged form, or they can be constructed. The pad, usually just a simple resistive network (*Fig. 1*), is normally built up to provide 3, 6, 10, and 20-db losses. If it is made up of ½-watt resistors, it can be built inside of a coax connector,[2] with a contact[2a] receptacle soldered onto one end. This item simplifies installation in the input circuit of an amplifier.

There are several types of line amplifiers that can be used for community TV. Probably the most popular type is the *broadband* variety,[3] with a frequency response of from 50 to 220 mc, using a single strip. Some manufacturers make use of two separate strips for the high and low channels, giving complete coverage from channels *2* to *13*. For adjacent-channel work, it is best to use a special unit designed for the job. Recently there has appeared an amplifier,[4] which it is said carries five adjacent channels, *2* through *6*, with a high gain rating. The desirable feature of this unit is that all channels are in the low *vhf* bands, at which frequencies cable losses are much lower, thus permitting longer runs between line amplifiers.

Regardless of the type of amplifier in use, there are two basic factors to remember; the amplifiers must be neither under- nor over-driven. Underdriving can cause snow and fading, while overdriving can cause crosstalk, smearing, *windshield-wiper* interference, and if the amplifiers use *agc*, sync clipping, too. Line levels must be calculated very carefully, and frequent tests made with signal-strength measuring equipment, to insure that the proper levels are being maintained over the entire system.



[1]Such as K-14.
[2]Amphenol 83-15P. [2a]Amphenol 83-1R.
[3]Such as Amplivision 100. [4]Entron.

(Left)

Fig. 1. Resistive pad for adding loss to amplifier, if needed. Values for given losses are— 3 db: R1, 27 ohms; R2 and R3, 430 ohms . . . 6 db: R1, 56 ohms; R2 and R3, 220 ohms . . . 10 db: R1, 110 ohms; R2 and R3, 150 ohms . . . 20 db: R1, 370 ohms; R2 and R3, 100 ohms.

Effects of Antenna Height on Signal Strength in Fringe Areas

While experimenting with one of our community-TV antennas recently, several unusual observations were made during the lowering and scaling of towers and poles. At one site, a 4-wavelength curtain rhombic, cut for channel *4*, had been installed to pick up a TV station 85 miles (airline) away. The antenna was suspended from towers, almost 90′ from ground level, atop a mountain. We found signals fading badly, and general results

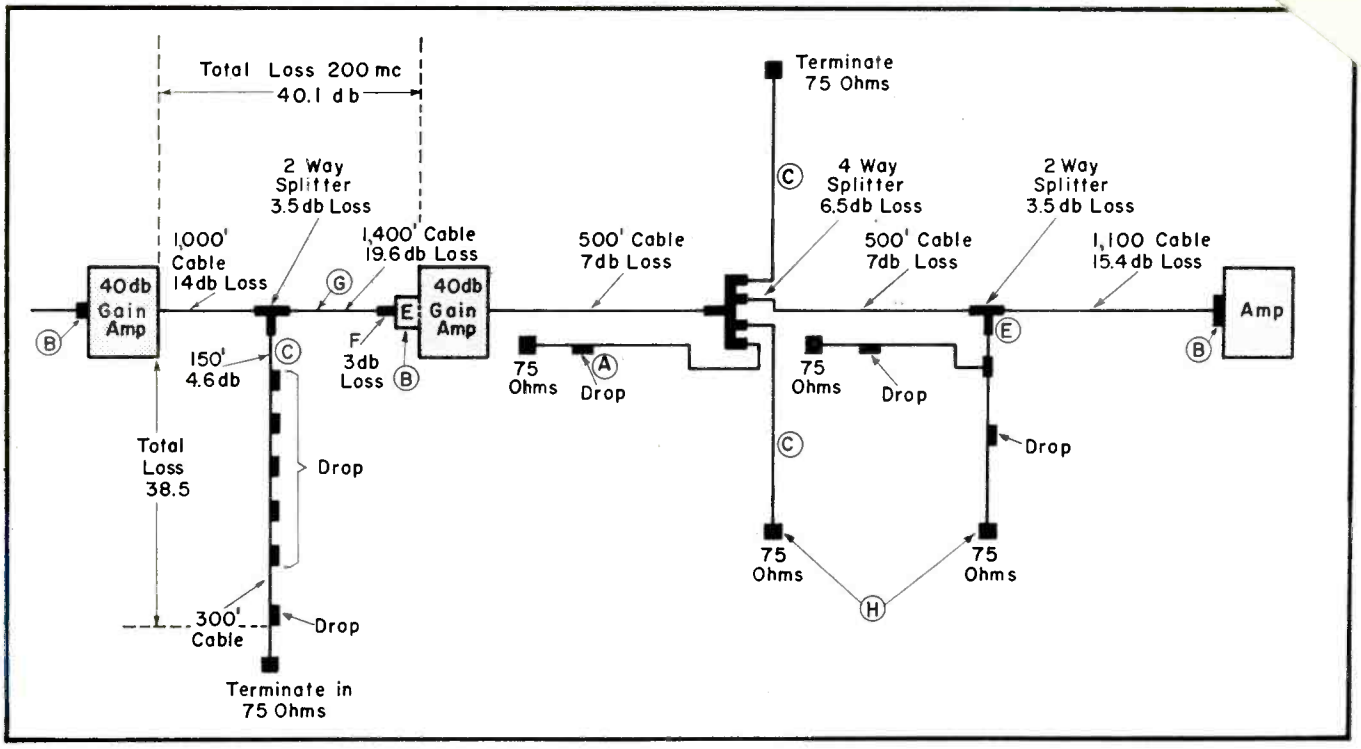


Fig. 2. Typical layout for a section of a community-TV, showing line amplifiers, cable sizes, losses, drops and pads necessary. A: It is recommended that RG-11/U be spun back over the large cable for making tapoffs rather than disturbing the trunk line. There is a tapoff available for heavier cable, where this method is not practical. B: Equalizer, for dropping low channel signals down to same level as the high channels. C: Branch line of RG-11/U cable. D: Drops into subscribers homes, or RG-59/U. E: Two two-way line splitters used to keep trunkline losses down to 3.5 db. F: A 3-db pad. Another line-splitter could be used here or at point G, and the pad removed. G: Insertion point of future two-way line splitter. H: Amplifiers are installed in any branch line, when the signal has to be carried farther.

queer. After some testing, it was decided to lower the antenna and check the spacers and termination lines. Field-strength measuring equipment happened to be left hooked up while the antenna was lowered. Suddenly someone noticed that as the antenna was being lowered signals increased.

Effective Heights

At about 45′ from the ground we found a decided improvement in signal. Further testing disclosed that the best signals could be received at a point not over 25′ from the ground. Signal strength at this point was more than four times what it had been at 90′, and all fading had disappeared.

Groundwave-Skywave Signal Behavior

This odd situation appeared because of *groundwave* and *skywave* signal behavior. At a point these signals will tend to stratify, producing alternate layers of signal addition and cancellation. Thus, the antenna would register a large gain when raised from a cancellation point to an addition point. In this area, additional height could place the antenna much nearer to an actual *line-of-sight* shot to the transmitting antenna, which would improve the signal.

However, at this distance from the transmitter, the groundwave has long since vanished, due to normal attenuation, and only the skywave remains. At a normal receiving site, that is one not directly shadowed by mountains or other terrain features, the signal seems to reach a peak at an effective height of around 25′ from ground level. This phenomenon was noted many times during the first summer's work installing receiving antennas. We used an adjustable *crank-up* tower that could

(*Continued on page 64*)

Fig. 3. A two-way line splitter which can be built in shop. Needed are a 38" piece of shielding braid from RG-11/U, and two pieces of RG-59/U, 38" long, with outside braid removed. In constructing, two pieces of RG-59/U are slipped into the RG-11/U braid, and braid pulled tight. Then, one should fold wire in the center, and wind one over the other (four turns), about two inches in diameter. Turns can be soldered together; then wind other end in the same direction. Two coils can be placed side by side and soldered in place. Two center conductors should be terminated at the one end with a 150-ohm resistor. The other two ends can be tied together. Then, the item should be installed in some kind of weatherproof housing, and standard coax fitting used for connections.

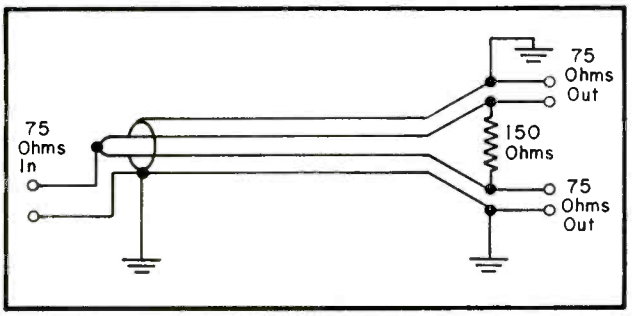
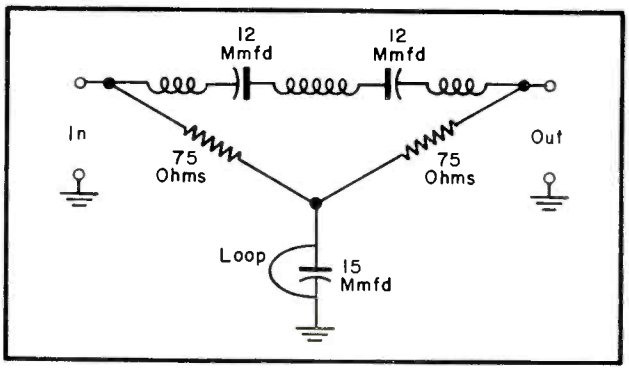


Fig. 4. Line equalizer for 1,000′ of RG-11/U. Used to equalize gain of amplifier, and compensate for unequal transmission losses of high and low-channel signals. Loop in center-tap return is made of center conductor of RG-59/U, 15" long when completed. Coils shown are 3/16" in diameter, wound from uncut leads of small capacitors.* Losses on the low channels may be cut down, if needed, by increasing the size of the series capacitors. This equalizer can be constructed with regular coax fittings or with screw-terminal strips.

*Sprague #5GA-Q12 and 5GA-Q15.



SER-CUITS

[*See Front Cover*]

by M. W. PERCY

Amplifier for Two-Speed Tape Recorder-Reproducer . . . Equipment Design and Operation . . . Troubleshooting Notes

THE MODERN TAPE recorder-reproducer, which is becoming a favorite member of the audio family in a constantly-increasing number of homes, has also attained a top-popularity standing among a growing number of Service Men. For the machines have been found to offer a healthy source of income for repair and maintenance.

New Model Features

Types in use today feature use of dual speed systems (7½ and 3¾) and amplifiers with substantial response. On the cover and in Fig. 1 we have an excellent example of the efficient amplifiers now being included in tape equipment.[1]

Tube complement here consists of 12AX7 and 12AU7 as audio amplifiers, a 6E5 record-level indicator, 6X4 rectifier and 12AU7 oscillator.

The complete equipment, designed for standard 19″ rack or cabinet mounting, is capable of recording music or speech from a microphone, phono pickup, radio or TV.

Input Feeds

The tape recorder input may be connected directly across the volume control of the radio. On some types of radios this connection will be more satisfactory than the voice-coil method and may be left attached at all times. Extreme care must be taken when connecting to an *ac-dc* type radio, because of the possibility of shock which exists without proper isolation.

The output from most crystal pickups can be connected directly to a record *input playback output* jack, if the pickup is equipped with a standard RETMA pin type plug. Thus, it becomes possible, without the use of auxiliary equipment, to use the record changer or phono turntable to copy disc recordings on tape.

Preamp Needs

To use a phono equipped with a magnetic or reluctance-type pickup it is necessary to use a preamp equipped with its own power supply.

The inputs on the tape unit are automatically disconnected when the *record-off-playback* switch is in the *off* position. Therefore, it is possible to connect the unit permanently at any point in the existing home installation without affecting the operation of other units.

The High Output

The *hi* output from the recorder is connected to the radio-input connection labeled *phono, television,* or *FM-phono-TV;* it may be necessary to operate a switch variously termed *bandswitch, phone switch,* or *independent control.* The volume control on the radio may not affect the loudspeaker volume, but the recorder's volume control will always be effective. The *hi* output has 50,000-ohm impedance with 1 *v* obtainable from it. The *lo* jack has a .25 *v* output.

Dual Capstans Used

The recorder is provided with two capstans which allow for two-speed operation. A smaller capstan (with a larger pressure roller) provides for the 3¾″ per-second tape speed, while a larger capstan and smaller pressure roller provides for the 7½″ per-second tape speed. Changing these capstans and rollers merely requires the removal of knurled screws holding them in place, slipping the capstan and roller off and replacing them with others. It is imperative that the surfaces of the shaft and capstan bore be extremely clean for proper fit.

Fast-Forward Switch

The unit is also equipped with a switch marked *fast forward* to the right of a *rewind-stop-forward* switch. This engages a large idler with the take-up reel shaft, driving it at a rate of 8 times the normal capstan or drive speed. It permits fast cueing or editing of any recorded tape. This fast-forward switch is spring loaded, and the farther it is depressed, the faster the forward action.

Recorder-Playback Troubleshooting

If the motor runs, but the flywheel fails to turn, the problem will probably be found in a poor contact between the idler wheel and the motor pulley. The speed control shaft should be checked to see if it is properly positioned. If the control shaft is midway between the *lo* and *hi*-speed setting, the idler wheel will not engage the motor pulley.

On occasion the tape might fail to wind on the takeup wheel, when in

[1] RCA SRT-1.

the play or the record position. In this instance, one should check the takeup belt, which may be broken. Or the takeup pulley may be loose on the shaft; to remedy, one need only tighten. The takeup spindle may be binding. This should be removed and cleaned.

Poor Recording-Playback

Poor recording and playback may be caused by a number of conditions. The pole pieces of the magnetic heads are subject to an accumulation of tape recording residue, which is worn off as the tape passes the heads. This condition may render incomplete erase and cause poor recording. This accumulation can be removed with carbon tet and a small cotton swab on the end of a toothpick.

Defects in recording and playback might also be due to an incomplete contact of the tape with the heads. The spring holding the idler wheel may not be connected or broken. If this spring is loose the pressure-arm lever will not be actuated when the control knob is turned to either play or record. This will prevent the pressure pads from bearing against the tape and in turn the pole piece of the heads.

If the machine plays back, but does not record, the microphone should be checked; also the connection to the plug. A defect in the oscillator can also cause trouble. In addition, audio contacts between the radio and preamp may be poor.

Speed variation or wow could be caused by oil or foreign material on the motor pulley, idler wheel, flywheel capstan or pressure roller. In addition to cleaning, it is also necessary to check to see if the pressure roller is making positive contact with the capstan.

Head Realignment

Normally, the record-playback head should not require realigning. If it is necessary to realign the head, an alignment tape should be procured; or one should use a tape from any aligned unit that has a 7,000-cps tone at 7.5" per second.

While this tape is playing, the head-aligning screw should be adjusted on the record-playback head for maximum output, either by using a suitable meter across the output or by ear. There is no need to align the erase head.

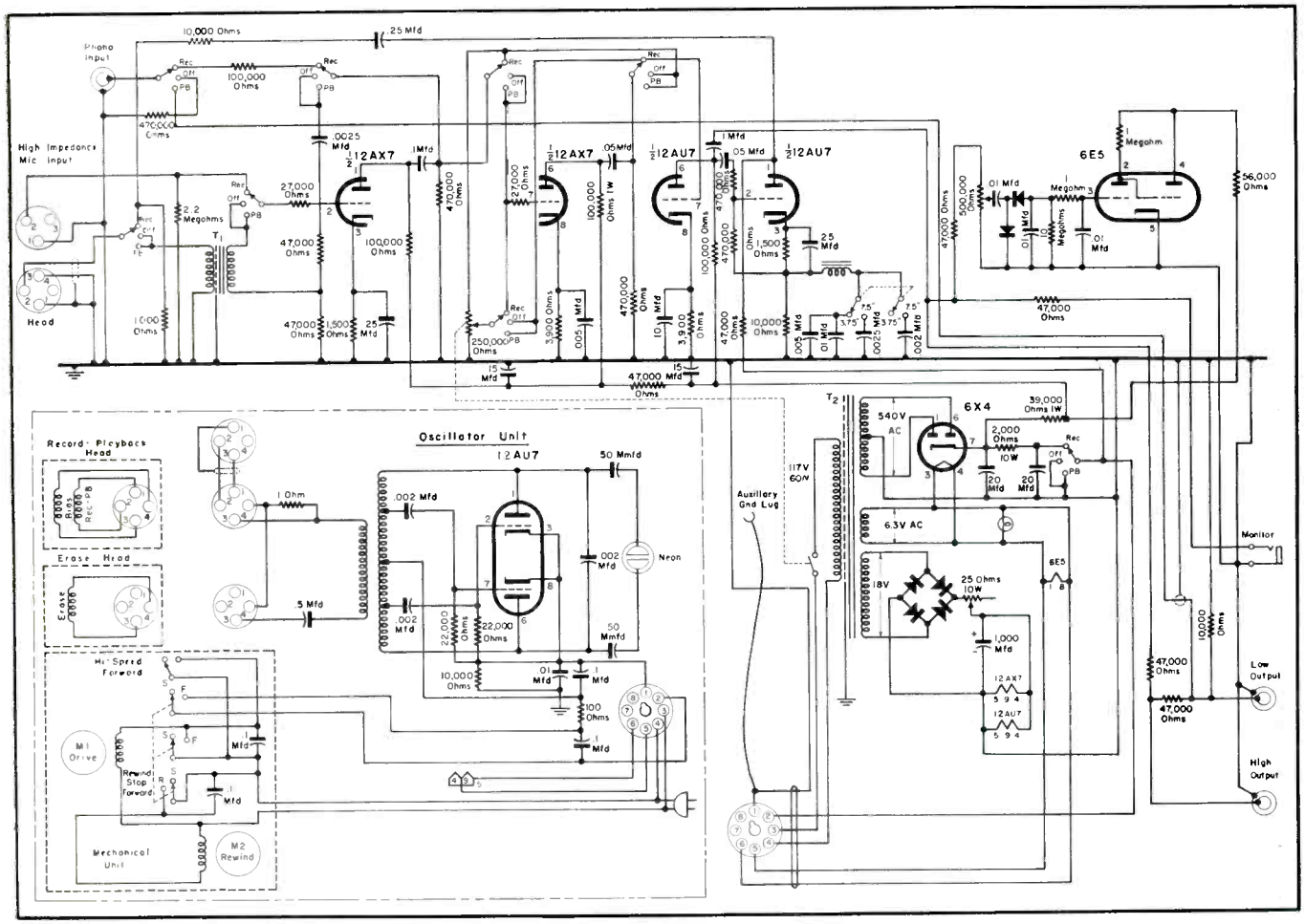
Editing of Tape

If it is desired to remove or insert a section of tape for editing purposes, or if the tape is accidentally torn, the ends may be spliced together easily. Two ends are cut at a 45° angle, the ends are butted smoothly together and a short length of splicing tape is placed over the joint on the shiny or top side of the tape. The edges of the tape should be trimmed so it does not catch on the reel or adhere to other layers of tape. This can be done without removing the reels, by splicing across the top of the head shield.

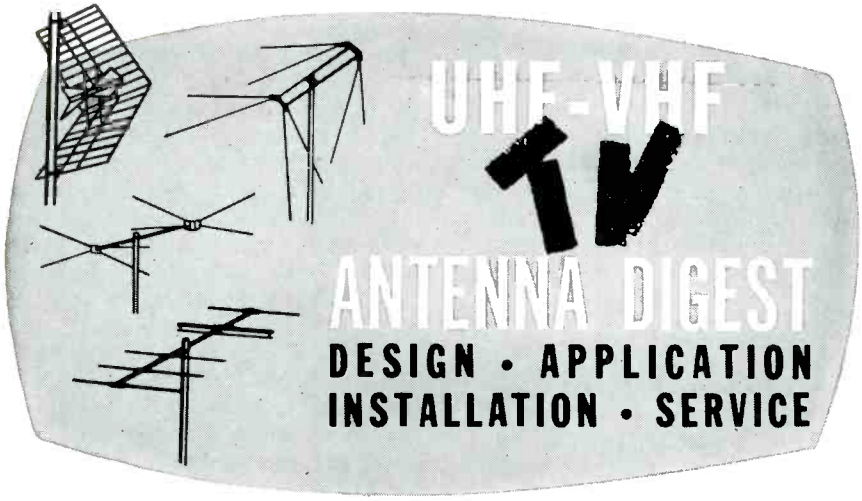
One should not use cellophane tape. The adhesive will *bleed* and cause adjacent layers of tape to stick together. And one should also be careful to avoid use of magnetized implements for cutting or trimming splices.

As noted, for good tape contact, the heads should be cleaned occasionally with a solvent (carbon-tetrachloride or acetone). Oil should be used only on motor bearings, and then moderately; one must not over-oil. It should not be necessary to oil more than twice a year. Excess oil is the most common source of trouble.

Fig. 1. Amplifier for the RCA SRT-1 tape recorder-reproducer; oscillator unit section, shown here, also appears on the cover.



COLOR-TV Antenna System Frequency-Response Considerations



by EDWARD M. NOLL

In a color receiver the bandwidth of the input system from the antenna to the demodulator must be adequate to provide proper amplification of the picture carrier and sidebands, the sound carrier and sidebands, plus the color or chrominance subcarrier, and be shaped properly to prevent cross-talk between the various signals. The distribution of information is such, that the chrominance data is at one end the spectrum, while the monochrome carrier is at the opposite end. Thus full bandwidth amplification is required and neither end of the spectrum may be compromised, as in present monochrome economy designs. If we sacrifice the picture carrier end, the system will suffer from poor frequency response, sync instability, or other disturbances; if we sacrifice the color subcarrier end, we'll have a loss of our two new bits of information, or color sync and chrominance.

Though as much as a 2 to 4 db overall differential can be tolerated over the bandpass without serious degradation of color picture, it is advisable to confine the bandwidth of each segment to more restricted tolerances, because a slight deficiency in each segment (antenna, transmission line system, tuner and *if* amplifier) can cause a serious overall loss.

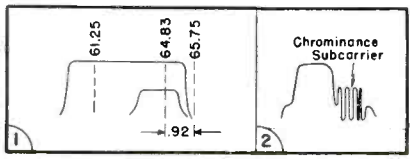
Antenna System

The very same antenna characteristics (gain, pattern, bandwidth, and stray resonant conditions) that influence monochrome reception also influence color reception. Antenna gain in the fringe area is important in the reception of the color signal, if best signal-to-noise ratio and stability is to be obtained, with the necessarily extended bandwidth of the receiver and antenna system. Antenna pattern is also important because we have added additional information to the received spectrum, and the presence of reflections and interference can cause color displacement and chrominance instability, as well as the usual picture detail displacements. Thus, it is necessary to have a clean pattern and good front-to-back ratio for peak reproduction of the color signal.

Proper orientation is a special consideration if the very best color picture is to be obtined in a weak-signal area or in an area subject to reflections. With most antennas, orientation is also frequency selective and the antenna pattern changes at a faster rate at one end of the bandpass than the other, and can cause possibly either the picture section or the color section to be attenuated a greater amount than the opposite end of the spectrum, if orientation is not exact. It is therefore necessary that installers observe the picture very carefully during the orientation period to eliminate the possibilities of smear, echoes, instability, and spurious color displacements.

Antenna bandwidth must be uniform over the color channel to be received. There should be no serious gradual or sharp dips in the response of the antenna over the desired channels upon which color is to be received. It will be found that good color pictures can be obtained with rather serious attenuation at the channel ends (this often occurs with low-band high-gain yagis) if the remainder of the receiver is operating at peak. However, this

(*Continued on page 62*)

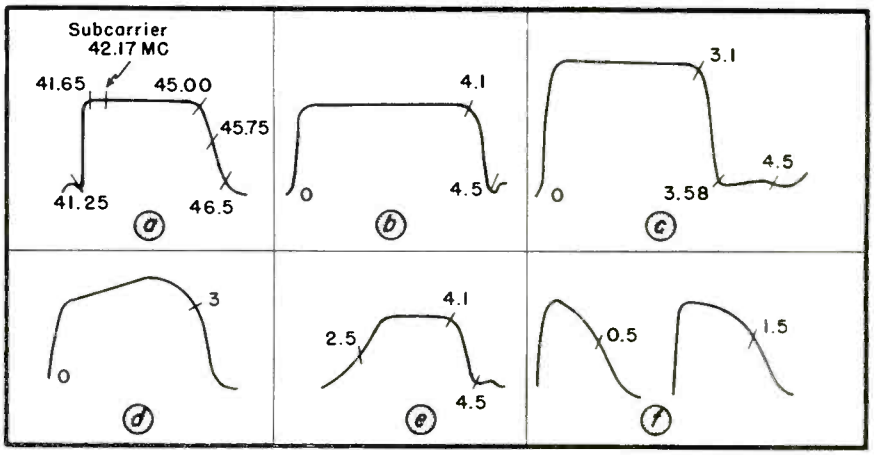


(Above)

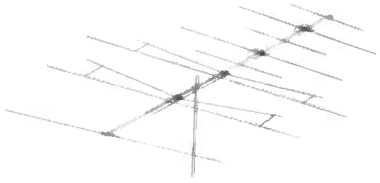
Figs. 1 and 2. In Fig. 1 is illustrated the distribution pattern of a color signal transmitted on channel 3. How the chrominance subcarrier appears during the horizontal-blanking period is shown in Fig. 2.

(Right)

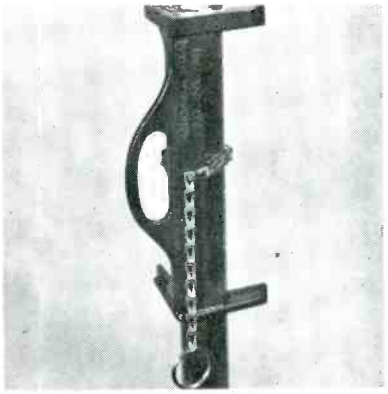
Fig. 3. Typical response curves in a color receiver. In (a) is the overall if response; first video (b); video after burst (c); overall video (d); bandpass amplifier (e); and Q and I channels (f).



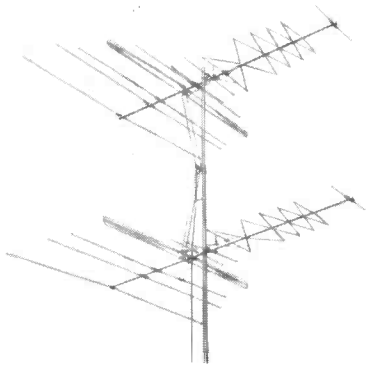
UHF/VHF TV Antenna-Accessory Review



Loop-phased, multi-element beamed power array for vhf fringe and sub-fringe TV reception. Element functions are duplexed through variable impedance phasing loops. Features compensated T match for high and low-band operction. Back rejection is claimed to range to 25 db. Has reactance-compensated feed system to provide resistive match to 200-300 ohm line. Standard stacking and special harnesses for selective channel emphasis are available. (Thunderbird Series T-100; Telrex, Inc., Asbury Park, N. J.)

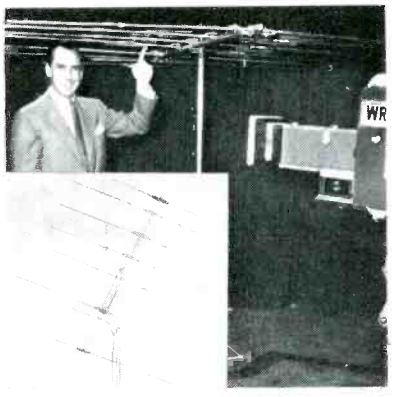


Bubble plumb for TV antenna-mast installations. Consists of two level vials mounted on right angle arms to enable operator to line any object vertically plumb. Right angle levels provide reference of all directions. Fastening devices permit attachment to objects ½" up to 4½", round or square. Holds itself in place. Size is 4" x 10" overall; all-aluminum. (Clark and Newcomb, 305 Chapman St., Greenfield, Mass.)

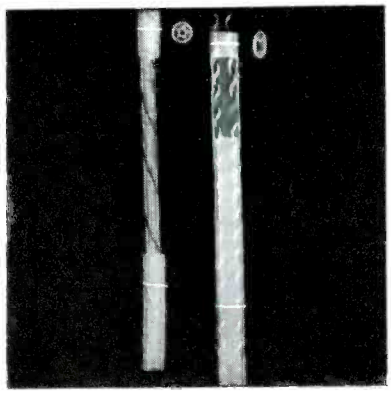


Helical yagi with front-end modification for peaking channel 13. Employs an added director and delta-matched helical section, and shortened stub at center of helix. Flat microwave helical section is composed of individual non-linear additive collectors, each tuned separately for one high band channel. Constructed of aluminum; preassembled. (Super-Star-Helix; JFD Manufacturing Co., Inc., 6101 - 16th Ave., Brooklyn 4, N. Y.)

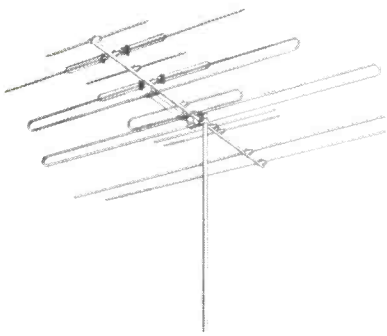
Antenna switch for coupling two antennas to TV set. Features silverplated switch contacts. May be used for uhf-vhf, vhf-vhf, and uhf-uhf combinations. (UV-1; Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y.)



All-aluminum single-boom vhf fringe antenna, using 24 elements on high band and seven elements on low bands, introduced recently on a national TV program. All elements are in same plane; said to require no boom braces on 1¼" crossarm. Assembled by means of spring-loaded quick-rig design. Incorporates penta-phase principle, said to overcome loss of signal because of wave distortion. (Super Trapper; Technical Appliance Corp., Sherburne, N. Y.)



Transmission line designed for color-TV installations. Line has a star-shaped air-spaced former to equalize capacity of both conductors. (Twistube; Fenton Co., 15 Moore St., New York 4, N. Y.)

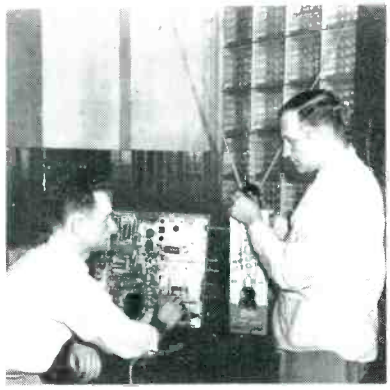


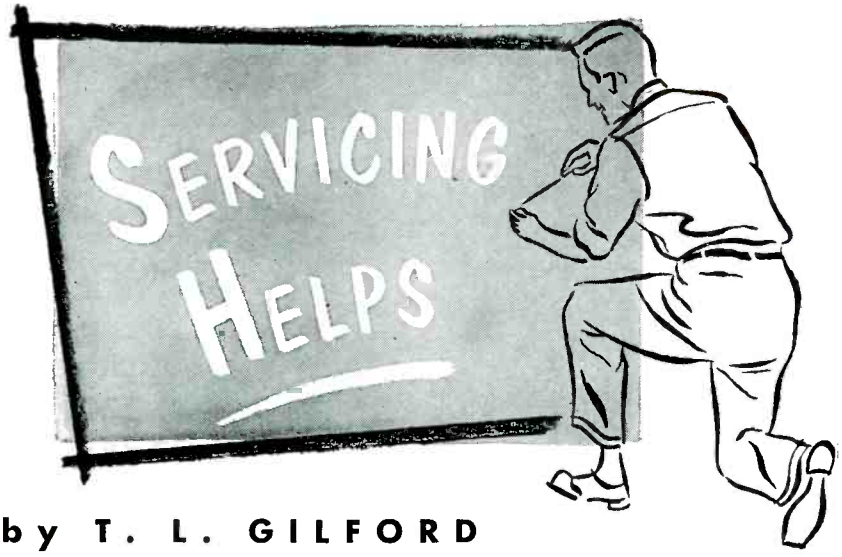
(Left)

All-channel antenna with elements that function on both high and low bands. Two models are available: 110, all channel vhf-fringe antenna; and 220, all-channel vhf antenna with multiple elements. (Zee-Beam; Welco Manufacturing Co., Burlington, Iowa.)

(Right)

Snyder Directronic indoor (and outdoor) antennas now being used for training purposes at Radio Electronics Institute in Philadelphia.





by T. L. GILFORD

Cures for Horizontal Instability* . . . Remedies for Arcing Troubles . . . Improving the 'Scope Sweep Horizontal Linearity . . . Color TV Receiver Damper Tube Substitutions . . . Removing Top of Picture Foldover . . . Vertical Oscillator Tube Changes . . . Reducing Horizontal Pull

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BASICALLY, horizontal instability of any kind may be due to faults other than in the horizontal oscillator circuit itself.

This is true because no horizontal oscillator operates completely independently, without making use of the horizontal sync pulses that are an integral part of the composite video signal. This signal, as received, passes through the *rf*, *if*, second detector, video amplifier and sync separator circuits prior to reaching the horizontal *afc* circuit for direct control of the horizontal multivibrator.

It is obvious then that malfunctioning of any of these circuits that may tend to be discriminatory to the horizontal sync pulses, can cause poor horizontal stability or locking.

Horizontal Pulling

Let us consider horizontal pulling. Here, the horizontal oscillator circuit generally is not responsible for what is suspected to be a horizontal deficiency.

The difficulty can be due to an overload condition (in average type *agc* sets) caused by a defective third *if* tube or video detector crystal. To determine definitely (other than by tube or crystal changing), one should first connect a 5-megohm potentiometer from the *agc* line to ground. Then a *vtvm* should be connected across the video detector load resistor (pin *3* of the test receptacle to ground).

With a medium-to-strong signal applied at the antenna terminals, the resistance of the potentiometer should be slowly reduced until the negative voltage across the detector load reaches a peak. Further reduction of the potentiometer will cause a condition of overload and the detector voltage will fall below the peak.

If the peak voltage, as indicated on the meter, is less than 13 volts negative, the third *if* tube (6CB6) or the video detector crystal should be replaced. (Area selector switch must be in local position.)

Keyed AGC Chassis Problems

In keyed *agc* type sets (Motorola TS-525, etc.) a defective third *if* tube or video detector crystal may be the trouble. To determine, both *agc* buses should be shorted to ground. A signal generator should be attached to the antenna terminals set to the mid-frequency of any channel. The receiver under test should be tuned to this signal and the output of the generator increased, while observing the developed *dc* diode voltage with a *vtvm*. The voltage must increase to a minimum of 13 volts negative. If limiting is observed, the crystal diode or last *if* tube should be replaced.

It is also possible that grid current is being drawn by one or more tubes in the *agc* circuit.

Negative voltages, as indicated on a *vtvm*, from pins *1* and *3* (in average type *agc* sets) of the test receptacle to ground, should normally be equal. Area selector switch must be in the *local* position. A good means of checking an *if agc* overload condition in average *agc* systems is to change the area selector switch from the *local* to *suburban* position. If the overload condition is removed or lessened, you can suspect a defective tuner tube.

In keyed *agc* type sets, either the first or second *if* tube may draw grid current. To determine, the ratio of the *if agc* voltage to the plate voltage of the keyed *agc* tube should be checked. It should be in the order of 1 to 3.5 *v*. If the ratio is lower than this, these *if* tubes should be checked.

If excessive screen current is drawn by the third *if* tube, one should check for low screen grid voltage.

Where there is insufficient clipping in the first or second clippers, or unbalanced output from the phase detector, resistors should be checked for incorrect value.

Poor high voltage regulation may be caused by a poor picture tube aquadag connection to chassis ground. In this instance, you have complete raster pulling which is observable by reducing width and looking at raster edges. Correction is obvious.

Further, in any set, lead dressing may be a factor in the elimination of these troublesome cases. Any dressing that may permit undesirable video or horizontal sync pulses coupling should be remedied. Leads from the horizontal hold control to the multivibrator tube itself (which are physically far removed in many instances) are subject to this type coupling. Or, leads from contrast or brightness controls (which may be in close proximity to the horizontal hold control — since these controls are mounted close together on the control panel) are sub-

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**Based on Motorola data for chassis TS-402, 418, 502, 518, 525, 531, 603 and 609.*

ject to this same scrutiny and redressing. Use of suitable bypass capacitors at vital points may help in removing this coupling. One such case involves the addition of a .005 mfd to .01-mfd ceramic capacitor disc from the arm of the brightness control (right at the control) to chassis ground, on those sets that do not have such a bypass, and where the brightness control is in the cathode circuit of the picture tube.

Color TV Damper Tube Substitution

IN LATE PRODUCTION of the RCA 21CT55 color chassis the 6BL4 damper tube was replaced with a 6AU4GT. Since there is no difference in base pin connections the tubes are interchangeable in the field. If the damper tube requires replacement, the 6AU4GT tube type is recommended.

Magnavox Chassis Repair Notes

ARCING IN early Magnavox 250 series, between the high-voltage compartment cover and the high-voltage transformer at the point where the 1B3 plate lead leaves the transformer, chassis can be eliminated by placing a piece of vinylite tape on the cover adjacent to the 1B3 plate lead exit on the transformer.

Corona at the high-voltage anode button is due to moisture accumulation and can be eliminated by cleaning the area thoroughly with carbon tet or similar drying agent.

Scanning Line Troubles

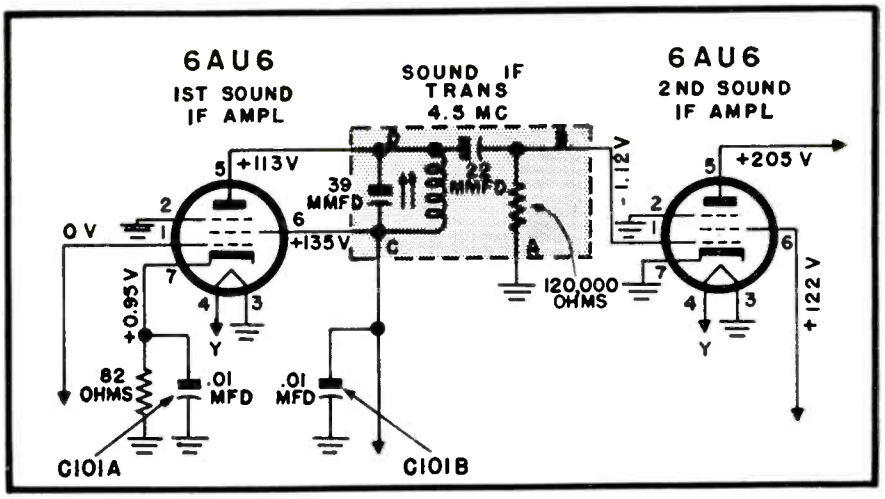
UNDER SOME SIGNAL conditions, in the Magnavox 300 and 350 TV series, there is a tendency to horizontal pull and pairing of scanning lines. This can be corrected by installing a .1 mfd capacitor between the B+ line (terminal *6*) of the *vhf* tuner and ground.

This capacitor is located on the terminal strip adjacent to the tuner in recent production sets.

To eliminate a slight foldover at the top of the picture in the Magnavox 600-series chassis (vertical with 90° deflection), resistors R_{323} and R_{324} (across the vertical deflection coils) have been changed from 180 to 220 ohms.

Changing Vertical Oscillator Tubes

BECAUSE OF manufacturing variations in 6SN7GTA tubes, changing the vertical oscillator tube in the Magnavox 250 and 260 chassis may cause the vertical hold control to allow roll in one direction only. If this occurs one should check the value of the grid resistors in this circuit; R_{313} (connected to pin *4*) should be 1 megohm, R_{315} (connected to pin 1) should be 1.8 megohms. These values will allow the use of any replacement tube.



Sound if amplifier stage in RCA KCS-83 series TV chassis where oscillation may occur because the screen bypass capacitor, C_{101B}, decreases in value causing the 6AU6 to oscillate at a frequency within the range of 2 to 3 mc. When this condition occurs, the result is a raspy buzz in the sound and a severe beat pattern in the picture. To cure, the dual capacitor, C_{101A} and $_{B}$, should be replaced; the C_{101A} with a .01-mfd positive temperature coefficient type, and the C_{101B} with a 1000-mmfd positive temperature coefficient type. Note: The recommended replacement value of C_{101B} is 1000 mmfd.; the original capacitor was .01 mfd. Whenever replacements of this type are made particular attention should be given to proper lead dress. Bypass capacitors should always have very short leads and the connections should be made to the same points as for the original components.

Negative Picture Troubles

FIELD REPORTS have indicated that certain 5AN8 tubes have a tendency to crush whites producing a negative picture. To correct this trouble in the Sparton Highlander series chassis the 5AN8(V_{9A}) video amplifier should be checked by substitution with a different brand tube if possible.

A similar symptom may occur when a video peaking coil is open.

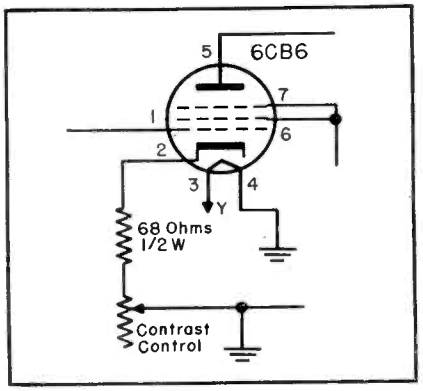
It has also been found that the picture tube, in a majority of cases, has been the least common offender.

Resistive Isolating Probes

WHEN DIRECT-CONNECTION test leads or probes are applied to points in somewhat critical circuit areas (such as the converter grid or TV front ends), one may find a feedback loop established between the receiver, 'scope amplifier and power line, often producing undesired takeoff or oscillation, necessitating the use of a resistive isolating probe.

Value of Resistive Loss

The resistive loss introduced by the isolating probe is said to suppress this tendency, *isolating* the test circuit from the 'scope feedback circuit. In addition, the isolating probe acts as a low-pass filter, filtering out the higher-frequency beat components from the marker, yielding a sharp needle-pointed marker indication on the 'scope screen. The time constant of this filter arrangement must be one that will prevent *marker displacement* (which could be caused by excessive time delay in the filter), even on the steepest portions of the response curve.



Circuit modification to eliminate video overload (white compression) due to variations between 6CB6 video amplifier tubes, in Emerson models, with following chassis: 120 195-D, 120 206-D, 120 197-B/D, 120 211-D/F, 120 182-D, 120 196-B, 120 208-D. As a result of the high video gain of some 6CB6 tubes, it is normal to expect some picture overload (white compression) in strong signal areas at maximum settings of the contrast control; the degree of overload varies with 6CB6 tubes. In most cases, sufficient contrast can be achieved well before overload takes place. However to avoid this problem in Emerson sets, the suppressor grid (pin 7) of the 6CB6 video amplifier should be connected to the screen grid (pin 6) instead of the cathode (pin 2). The tube will thus operate as a screen-grid tube rather than as a pentode. The contrast control lead, which was wired to pin 7 should be wired to pin 2 (cathode). When making this change a 68-ohm ½ watt resistor should be added between the top side of the contrast control and pin 2 (cathode) of the video amplifier, if one is not already there.

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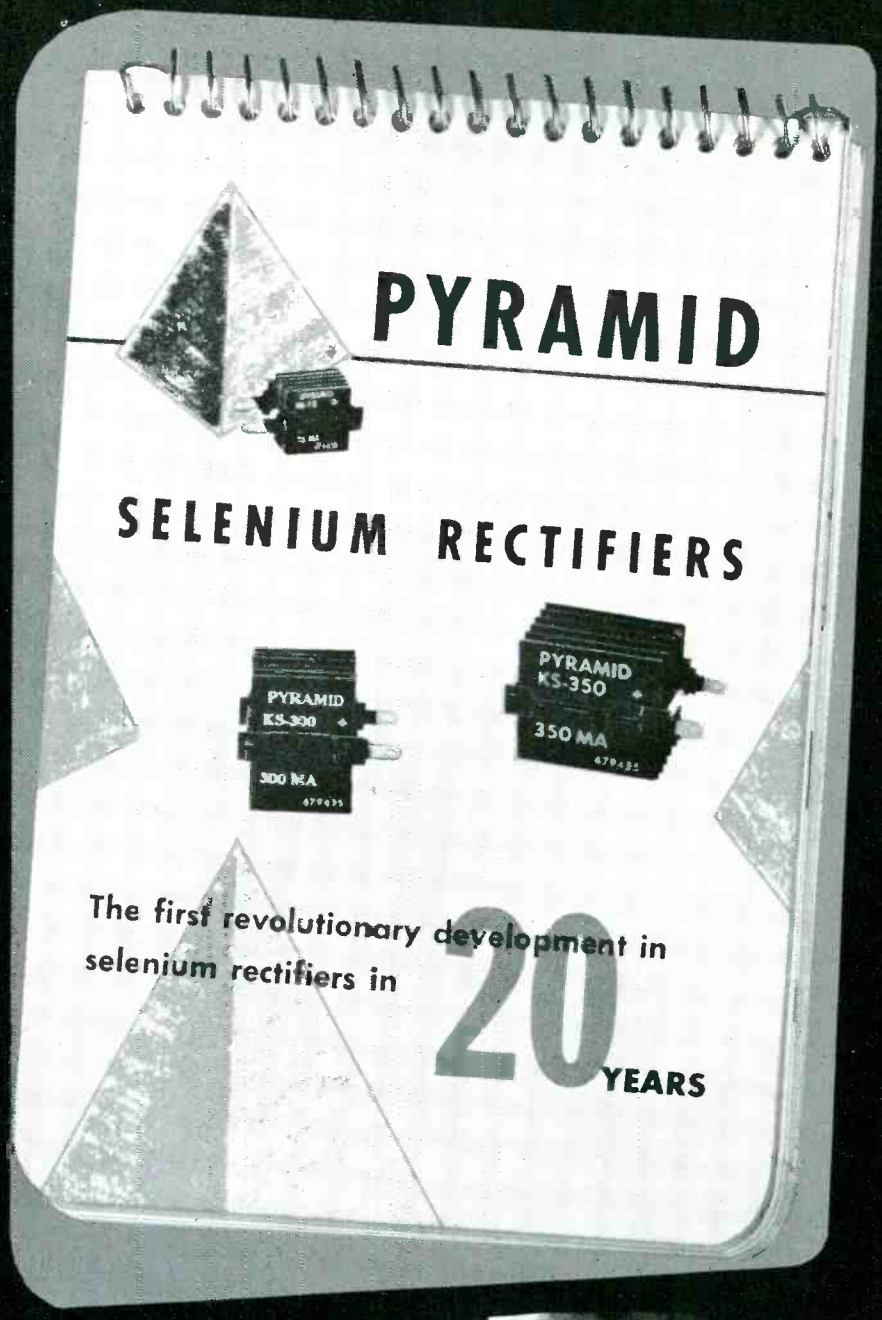

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SERVICE...The National Scene

NEW TRENDS IN AUDIO-COMPONENT-INSTRUMENT DESIGN AT CHICAGO PARTS SHOW--A host of novel innovations developed for a wide assortment of equipment and parts will be unveiled at the giant electronic parts show in Chicago. Audio will be in the limelight. On view will be new types of changers featuring free-floating tone arms engineered for minimum torsional and lateral pressure. Turntables in these units are ball-bearing mounted and covered by electrostatic flocking that, it is claimed, stands fibers permanently on end to cushion record drop and prevent slipping. Dynamically-balanced four-pole shaded-type motors have been designed for the changers. . . . The potentials in audio replacements will be emphasized in many booths. One manufacturer will display a line of twenty-three different types of phono and recorder drives that, it is said, will serve to replace the drives for 85 per cent of all of the changers on the market. In many of the drives, neoprene rubber has been included to avoid losses due to hardening and cracking. . . . Sound-distribution equipment including speaker baffles, enclosures and grilles, designed to disperse voice or music through 360° at controlled-ear levels, will also be shown.

PLATED-BOARD ASSEMBLIES, with some of the smallest replacement components ever made will also be on exhibition. Tiny parts on view will include fixed and variable capacitors, ifs, resistors and sockets, ranging in size from a quarter of an inch to about 1½". Truly midget speakers, but 3" in diameter, will be there too. . . . Printed-circuit components, designed for the plated chassis, as well as for standard-size equipment, will also be on display. The p-c technique has been applied not only to the popular array of parts, but to such unusual items as connectors, filters, lightning arresters, speaker networks, phono amps and instrument accessories. . . . Many will also reveal extensive lines of components designed to withstand brutal punishment from use and temperature and humidity variations, thanks to new concepts in research, design and manufacture.

INSTRUMENTATION ROW at the show will also sparkle. Push-button control and automatic-counting systems will be found as a feature of a number of troubleshooting testers. . . . On view will be a push-button dot generator for convergence and linearity adjustments in color receivers; the instrument's selector provides horizontal and vertical bars, crosshatch, and dots. Both modulated rf, which is continuously tunable from channels 2 to 6, and video output are also available. . . . Accurate markers, essential for the proper alignment of video if strips in color sets, will also be demonstrated. . . . To observe the video response of various sections of the color chassis, many manufacturers have designed test gear incorporating video sweep and required video markers. Such units for color-set alignment will also be exhibited.

SERVICE will be at this national show in display room 659.

FACTORY COLOR-TV SERVICE TRAINING PROGRAMS EXPANDING--In Chicago, several manufacturers have begun to enlarge their color schools for Service Men. . . . One set maker, who has had a training plan in operation since last September and taught about 200, has announced that he is doubling his facilities, immediately. They are now taking reservations for July, and will be able to accommodate about 20 to 25 for a class. . . . Curriculum will cover color fundamentals, basic color systems, the compatible color signal, tricolor picture tubes and the color set. . . . Program arrangements are under the direction of distributors who will contact dealers, who will select the Service Men for the training courses. . . . Hotel accommodations will be provided by the manufacturer. . . . Those who pass examinations will receive a diploma; those who fail will be permitted to sign up for another course later on.

SERVICE...The National Scene

BROADCASTER SETS UP PLAN TO PUSH HI-BAND VHF ANTENNA SALES TO WIN VIEWERS--An extensive promotion, costing over $300,000, to get more TV set owners to tune in to their channel-8 station, has been initiated by WOOD-TV, Grand Rapids, Michigan. Two types of antennas, specially cut for the station's frequency, are being offered through distributors and Service Men; one is a folded dipole and the other is a five-element yagi for fringe pickup. Management of the station expect the yagi to bring them lookers 75 to 100 miles away. . . . The need for the drive was prompted by the transfer of the station's antenna some months ago from a point south of the city to a northeast location; power was also stepped up at that time. Station operators found that viewers neglected to install a new antenna for pickup, where necessary, and also did not have their antenna reoriented in the direction of the station's new transmitting site. . . . Air announcements, point-of-sale pamphlets and window stickers are emphasizing the importance of the new antenna, and the fact that antennas should be aimed in the right direction for channel-8 sight and sound signals.

APPRENTICE TV TRAINING PROGRAM SUGGESTED BY ASSOCIATION IN SOUTH--A dealer association in Alabama has recommended a program that will serve to teach Service Men the basics of TV repair, using the training facilities of the Department of Labor's bureau of apprenticeship.

LOCAL HIGH-POWER STATIONS HAMPER RECEPTION, EXPERT TELLS WASHINGTON--Noting that the proposal to limit TV transmitter-tower sites to areas within five miles of a principal city, is a grave error, a tuner maker told members of the Commission recently that the increased signal strength would harm, rather than improve reception. . . . The FCC has sought to tighten up allocation principles and prevent stations from wandering away to other cities, instead of giving prime attention to those communities where they were assigned. . . . The tuner manufacturer pointed out that it was in the public interest to have the higher power-high towers located more than the five miles from concentrated areas of population. He felt that the stations should be at least fifteen to twenty miles away. . . . At that increased distance, he said, viewers would receive much better service and much of the ghost and all of the blanketing effects would be eliminated. . . . Because of the design of today's low-priced sets, he added, overload is common when the receivers are subjected to high-intensity signals.

NEW ELECTRIC CODE FOR ANTENNAS-ACCESSORIES UNDERWAY--Complete revision of article 810 of the National Electric Code, to cover TV and FM antennas, lightning arresters, rotators, and guy and transmission lines, is now being prepared by a special committee of RETMA. . . . The new code is expected to spell out methods and equipment suitable for mast grounding, location of four-wire rotators, and securing of the line. Other points that it is planned to cover are minimum specs for accessory-installation material, minimum distances above roof levels for transmission lines and guy wires in apartment building installations, and minimum separation of antennas on rooftops.

ASSOCIATION PREPARES DETAILED LIST OF BASE CHARGES FOR TV SERVICE--A comprehensive billing form, for presentation to set owners, containing recommended minimum charges for video repair has been compiled by members of an association in the northwest. Noting that the charges listed in the schedule are for troubles that appear steadily without interruption, the form states that circuit faults that occur intermittently require additional time for test and observation, and thus will be charged at a higher rate than indicated. Also detailed are charges for pickup and delivery, callbacks, calls in the city and out-of-city limits, estimates in the home and shop, plus complete charges for repair in the shop, and antenna installation and repair. . . . Congratulations to the alert association members who prepared this practical field and bench service rate guide.--L.W.

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FIELD TESTED Thoroughly tested under the most rugged field conditions, Ward Dura-ramic aerials have been proved electronically satisfactory by famous electronic testing organizations. The aerial length has been proven long enough to give good reception without static—short enough to clear all garage doors.

SELF SELLING PACKAGING Dura-ramic aerials are available in handsome display cartons which tell the whole Dura-ramic story and show an assortment of the six complimentary Dura-ramic colors. The package is a salesman you add to your staff. Dura-ramic aerials are also offered in the attractive individual package shown below. Ward Dura-ramic aerials are the most sales stimulating revolution in the auto-radio accessory field today. Cash in on the great trend to multi-colored autos. Sell the superior Ward Dura-ramic aerial to compliment any color car.

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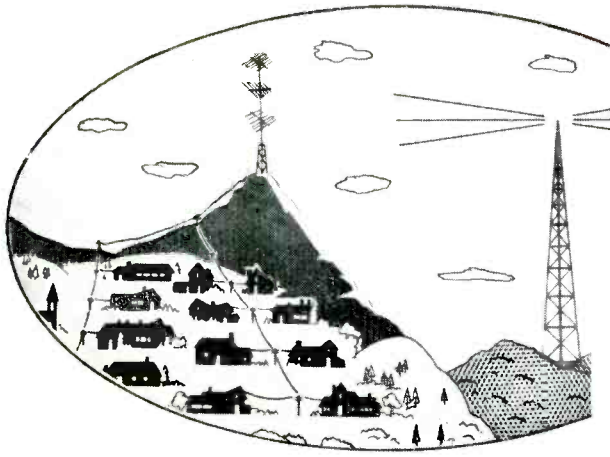


Fourth Annual Community-TV Convention Preview

by WYN MARTIN

THE DRAMATIC progress achieved by community-TV systems, now serving nearly one-thousand areas, dotting the nation, will keynote the forthcoming fourth annual June convention of the National Community Television Association in New York City.*

About a year ago, there were only about three-hundred systems in operation, and in the main they were installed in the larger centers. Today, the tie-in idea has spread and even tiny walled-in villages, completely blacked out of the TV picture, have become members of the sprawling network of master antennas, mounted on hilltops and mountains, installed to provide a reliable video service.

A number of scientists, engineers and management specialists will report on this amazing progress at the convention.

Another of the highlights of the conclave will be a talk on radiation and the controls the Federal Communications Commission has proposed to authorize.

As disclosed earlier in community-TV reports, the long isolated lengths of coax represent a radiation-field problem. In a typical community antenna system, several lengths of coax, usually carrying signals of different strength, in different directions, are lashed to a metallic messenger wire, with a spiral wrapping of metallic lashing wire. The overall result, therefore, is a system of coupled transmission lines of different phase and attenuation characteristics, and excited by cable gradients of different phase and intensity and directions. The external field is then further complicated by poles, cable, tapoffs, cable intersections, ground wires, amplifier cabinets, mutual coupling to power or telephone conductors, and direct pick-up of signals from one or more TV stations.

The FCC has proposed a regulation requiring that the radiation field should not exceed 10 microvolts per meter at a distance of ten feet or more from any point of the system. To meet these requirements, it has been found that signals above 30 db should not be carried on single-braided cable, signals above 50 db should not be carried on double-braided single-jacketed cable, and signals above 65 db should not be carried on double-braided jacketed cable.

In reviewing the FCC proposal, association members declared that under ideal conditions it may be possible to attain the 10 *uv* level, but in practice a number of problems can occur. *Frank G. Kear,* the association's consulting engineer, will discuss the practical problems that obtain in the field and why a number of changes will have to be made in the suggested ruling, particularly for the high bands. On the higher channels, the association's experts have found that up to 25 microvolts per meter will have to be permitted; on the low bands, the 10-*uv* standard will be satisfactory, with a few minor variations.

The subject will also be reviewed by a panel covering cable specifications. Representatives of most of the coax manufacturers engaged in the manufacture of lead for community-TV applications will participate in this forum.

Another timely topic that will be covered will be line automatic-gain control. In the early days of community TV, *agc* of the individual video carriers was found to be a must, because of many variables caused by changes in the troposphere characteristics and resultant variations in signal areas. The first systems were equipped with *agc* at the first amplifier, located at the antenna site. Soon, however, it was found that temperature variation effects on cable attenuation were important in long-line tieins. It was noted, for instance, that if a pair of amplifiers were separated by about 2000′ of coax, the average night-time loss of the cable would be about 44 db on channel 6. With a 30° temperature increase during the day, the loss was found to rise to about 46 db. While this rise of 2 db was not too significant, when compounded by as many as 40 amplifiers in cascade, a serious problem was on hand. As a solution, it became standard to use *agc* units within the entire system, with one placed at every third amplifier. As community-TV grew, expanding into deep fringe areas, another problem appeared; selective fading. This was found to cause sound bars, and even complete loss of sound. To solve that problem, sound *agc* was developed; this permitted the establishment of fixed levels of sound and video.

In the *agc* analysis at the meeting, conferees will be told about the continued development that has resulted in the design and production of equipment that permits compensation for practically all of the effects of frequency and diversity changes, tube aging, and temperature on the attenuation of cable.

Another subject that will be commented on will be maintenance and the methods and techniques now available for that job. It is also expected that one of the association's experts will deliver a talk on cochannel and adjacent channel interference elimination.

A staff member of the Commission also will be on hand to discuss the use of common-carrier microwave-relay systems that can be used to beam signals to community-TV receiving antennas.

Meetings and exhibition will be at the Park-Sheraton Hotel, June 6, 7 and 8.

Portable Power Supply For Field-Strength Meter

by JACK DARR

Vibrator-Pack Unit Designed For Mountain-Top TV-Antenna Installations

A RECENT ANTENNA INSTALLATION, atop one of the Arkansas mountains, a thousand feet or more from any source of *ac* supply, demanded the use of a portable field-strength meter. No vehicle road existed, so that it was not possible to use a small gasoline-powered generator, mounted in a truck. This brought the choice down to some sort of a power supply that could be carried by hand; this meant a dry-cell battery system.

Battery Versus Vibrator

Originally it was felt that a standard battery-pack, of the type used on portable radios, might do; this was discarded due to drain problems. The meter we wanted to use[1] required 6 *v* of filament power at .7 ampere, and at least 180 *v* of *B* at around 20 ma. Use of pack-batteries here would have been prohibitively expensive; they would have only lasted one afternoon. Some other more economical method, therefore, had to be evolved.

A search disclosed that we had several vibrator-type power supplies about. Checking we found that they had been originally designed for low drain work and thus were ideal for our purpose. Each provided around 180 *vdc* at 30 ma, and consumed but 1.1 ampere. This low drain would allow us to use either a *6-v lantern battery*, or four telephone-type dry cells.

Constructional Details

Having decided on our power supply, we then removed the instrument from its cabinet, disconnected the *ac* primary leads, and extended them to about 8". At a point where the line cord entered the cabinet, a hole was punched out to ⅞" and a recessed-male socket mounted. The primary leads were connected to plug pins *1* and *7*; Fig. 1. Heater leads were disconnected at the first tube; this left the rectifier tube connected to the transformer. The two filament leads were extended, and connected to pins *2* and *5*. The lead to the tubes went to terminal *2*, and the lead from the transformer to point *3*. As one side of the filament was grounded to chassis, it was left connected, and a wire run from the ground to *5*.

Plug Connections

Next, the high-voltage lead was disconnected, at the filter input, and leads run from the rectifier cathode, pin *8*, and the filter input to pins *4* and *8*. This completed the wiring of the chassis plug. (This socket could be mounted upon the rear apron of the chassis, if desired, but it would be necessary to punch a large hole in the cabinet to permit use of the rather large plugs.)

The plugs which fit this socket were female type. For the *ac* plug, the line cord was connected to pins *1* and *7*, and short jumpers were tied from *2* to *3*, and from *4* to *8*. Thus, when this plug was inserted, the circuit was completed through these jumpers.

Battery Hookup

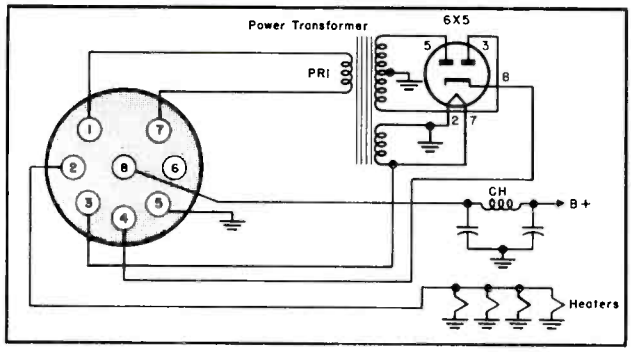
For battery operation, another plug was hooked up. A wire was run from pin *2* to the positive lead of the battery, and another from pin *5* to the negative lead. This completed the filament circuit. The power pack was connected to the battery through two more wires; one should note connections of the wiring when leads are removed. The high-voltage output was connected to pin *8*, and the negative to pin *5*; this was ground. Due to hasty construction, we did not use an *on-off* switch, but merely disconnected the battery. A switch mounted on the power-pack chassis, disconnecting both the vibrator and meter filaments would be much more convenient.

For a test, the meter should be connected to an *ac* power supply, and a signal generator inserted, tuning to

(*Continued on page 64*)

[1]Simpson 488.

Fig. 1 (below). The ac plug connections for a field strength meter. Note: filament and high voltage connections to socket may be broken by removing plug. This socket may be mounted on back of cabinet or rear apron of chassis. Any type of plug with at least eight contacts can be used.



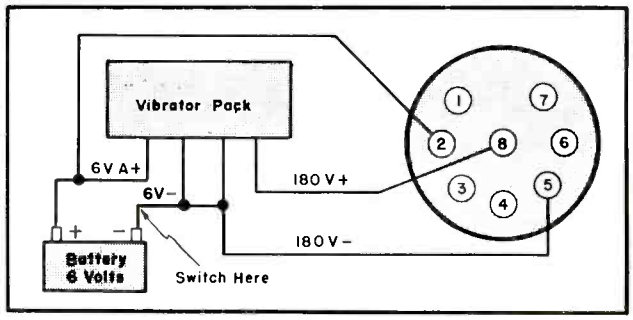
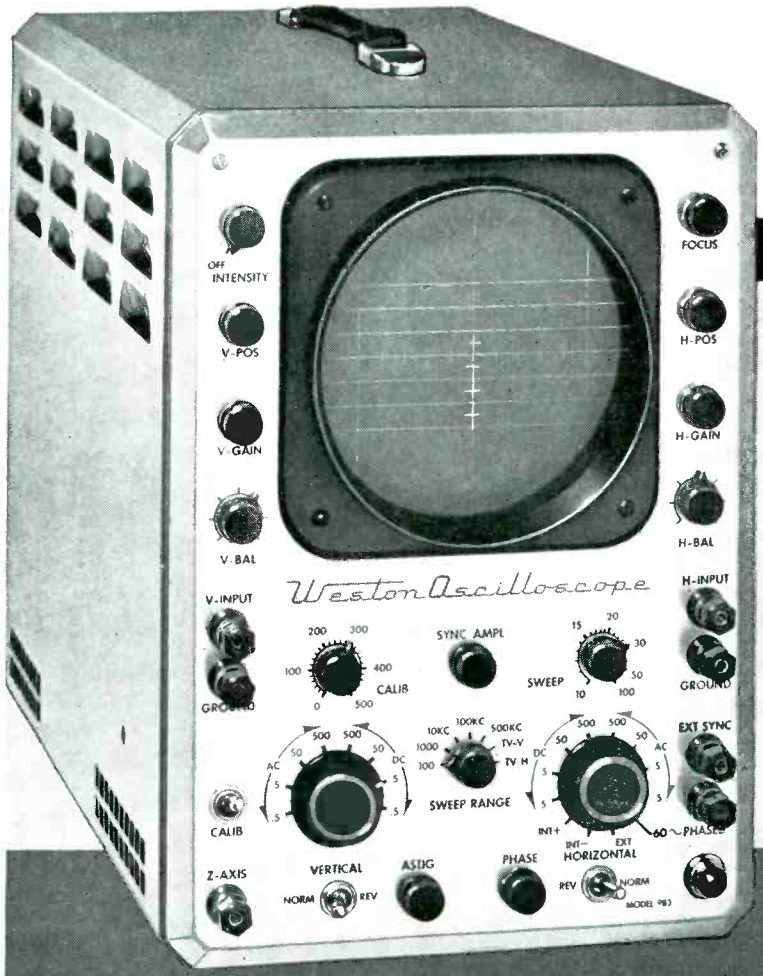
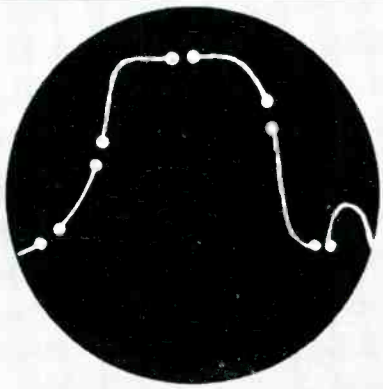


Fig. 2. Battery-operation plug and circuit.

NOW...



WAVEFORM ANALYSIS



Response curves accurately displayed. Ideal for use with Weston intensity marker display. A fast, retrace sweep circuit with cathode follower output prevents pattern distortion.

WESTON

The Model 983 is a high gain, wideband Oscilloscope designed to accurately reproduce waveforms comprising a wide band of frequencies. High sensitivity of 15 millivolts per inch RMS makes this Oscilloscope ideal for—SETTING RESONANT TRAPS...SIGNAL TRACING IN LOW LEVEL STAGES ...AS A GENERAL NULL INDICATOR...for PHASE CHARACTERISTIC MEASUREMENT IN INDUSTRIAL APPLICATIONS...and for SWEEP FREQUENCY VISUAL ALIGNMENT OF TV RECEIVERS.

The scope contains identical vertical and horizontal push-pull amplifiers with a choice of AC or DC coupling without affecting either sensitivity or bandwidth. Both amplifiers have compensated step attenuators and cathode follower input.

It has excellent square wave reproduction with overshoot of only 2 to 5% with a rise time of 0.1 microsecond. The scope response is essentially flat throughout the specified range of 4.5 mc and is usable to 6 mc.

The unit has provisions for internal calibration, internal phased sine wave, and Z-axis intensity modulation. Reversal of polarity of both horizontal and vertical signals is easily accomplished by means of toggle switching. *Tube replacements are non critical, and etched circuitry facilitates quick and rapid maintenance.*

The Model 983 Oscilloscope is now available through local distributors. For complete literature, return the coupon today. WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, New Jersey.

Price . . . $329.50

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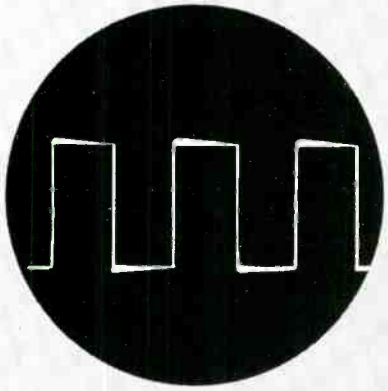
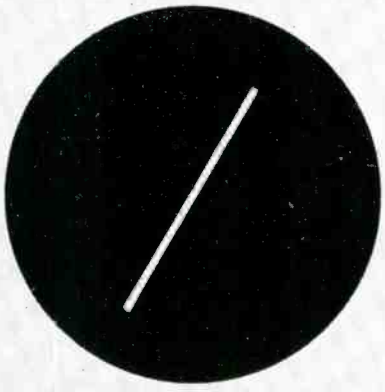
the All-purpose Scope!

SQUARE WAVE RESPONSE



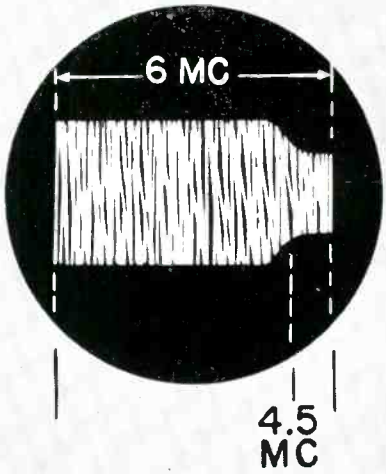
Overshoot is only 2 to 5%. Rise Time is 0.1 Microsecond. Square wave depicted 250 kc.

PHASE MEASUREMENTS



Phase shift between horizontal-vertical amplifiers, 0-100 kc-0°, to 1 mc within 2°; by internal adjustment with gain controls at max 0° phase shift possible on any specific frequency to 6 mc.

RESPONSE CHARACTERISTIC



Note flatness throughout specified range; usable to 6 mc.

980 LINE OSCILLOSCOPE

SPECIFICATIONS: MODEL 983 OSCILLOSCOPE

Wide Band Frequency Response: Flat within 1.5 db from 0-3.58 mc and within -3 db to 4.5 mc on both vertical and horizontal amplifiers. Transient response: overshoot 2 to 5%. Rise time: 0.1 microsecond.

High Deflection Sensitivity: 15.0 millivolts per inch, RMS, on both vertical and horizontal amplifiers.

Phase Shift: Between horizontal-vertical amplifiers, 0-100 kc-0°, to 1 mc within 2°; by internal adjustment with gain controls at max 0° phase shift possible on any specific frequency to 6 mc.

Calibrating Voltages: 500 millivolts, 5 volts, 50 volts, 500 volts, peak to peak. Readily available and adjustable by front panel controls.

Z-Axis Modulation: Input terminal mounted on front panel.

Sweep Frequencies: 10-500,000 cps, variable. Preset TV/V position—30 cps. Preset TV/H Position—7875 cps. Retrace Time—better than 2% to 100 kc; at 500 kc less than 10%.

Internally Phased Sine Wave: Adjustable through 170°.

Vertical and Horizontal Polarity: Reversible.

Input Impedance: Vertical Amplifier (without Shielded Cable), 1 meg shunted by 60 mmf. Vertical Amplifier (with Shielded Cable), 1 meg shunted by 120 mmf. Vertical Amplifier (with Low Capacitance Probe), 10 meg shunted by 12 mmf. Horizontal Amplifier (without Shielded Cable), 1 meg shunted by 60 mmf.

Power Supply: 105/125 volts, 50/60 cycles.

Tube Complement: (1)-1V2, (1)-5U4-GA, (6)-6BQ7A, (4)-12BY7A, (4)-6AH6V, (1)-6U8, (1)-5UP1, (1)-0D3, and (1)-5NO60T.

Case: Grey hammertone finished steel.

Panel: Aluminum finish with etched, black markings.

Size: 10" x 14" x 19.5" **Approx. Weight:** 40 lbs.

OTHER WESTON 980 LINE INSTRUMENTS

980 Volt-Ohm-Milliammeter
981 Tubechecker
982 Vacuum Tube Voltmeter
984 Sweep Generator
985 Calibrator

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Please send literature on the 983 Scope and other 980 Line Instruments.

NAME_____

ADDRESS_____

COLOR TV Alignment Hints

by ROBERT E. RICKETTS

Chief Engineer, Radio City Products Co., Inc.

THE COLOR TV receiver, with all of the circuitry found in b-w TV receivers, includes an *afc* circuit used in conjunction with the *I* and *Q* circuits. Service notes containing alignment data for the *I* and *Q* circuits, indicate the need for a crystal oscillator or a very stable, standard signal generator and a peak-to-peak *vtvm*. A sweep generator should be used in these circuits for signal tracing.

Color Set IF-Video Circuits

The *if* and the video circuits in color *TV* receivers require a considerably wider sweep signal than is used for black and white alignment. Manufacturer's literature usually suggests a bandwidth requirement. However, it would be wise to set the sweep width control to at least a ten per cent greater bandwidth than the width mentioned.

Dual Marker Signals

The use of dual marker signals, via tunable signal generators or a crystal oscillator (two specific signals or two specific generators) is desirable to assure the proper waveshape and bandwidth in the signal alignment of the color *TV* video and *if* stages.

Color Sync Control

The sides of the swept picture normally are considerably steeper than noted in black and white chassis. Thus, by means of the dual markers, the bandwidth or alignment points can be rapidly and carefully positioned on the sweep picture of the 'scope, so that adjustment of any of the tuning slugs or capacitors will permit improving the response without loss of bandwidth. This is essential if color synchronization is to be maintained.

Front End Alignment

The front end (*rf* oscillator sections) of the color TV receivers have wider bandwidth characteristics on channels *2* to *6*, than the conventional b-w TV receivers; channels *7* to *13* will average about the same bandwidths as the present b-w sets. Front end, video and *if* alignment also require more care when the sweep generator is used. However, since the bandwidth of the model under test usually exceeds the manufacturer's specifications, one will find that the steepness or sharpness of the sides of the sweep picture is not as critical to maintain as in the video stages. Normally, setting the sweep width for a slightly wider sweep than specified will be sufficient to assure proper alignment of the color-TV front ends.

Trap Alignment

The wider bandwidth characteristics of the color TV front ends, however, require more careful alignment of traps to avoid adjacent channel interference. One should refer to service notes for information on trap alignment after the overall responses have been adjusted. A final touch-up of the front ends may be necessary after trap adjustment.

Key check points in color set	Insert following instrument to input of receiver:	Insert following signal, to:	Key check points in color set	Insert following instrument to input of receiver:	Insert following signal, to:
High-voltage regulator	Sweep, at 60 mc; tune to channel *3*	.....	41.25 - sound traps; third and fourth *if* transformers	Sweep; set to 40 mc; width 8 mc	Tunable marker jack
Phase control, detector balance, local oscillator and quadrature transformer	Sweep; set to 3.58 mc	.....	.....	.....	.....
Sweep set to *if* frequency	.....	.....	Adjacent sound trap; second video; adjacent picture trap	Sweep; set to 38 mc; width 10 mc	Tunable marker jack
Burst amplifier, line driver, cathode trap, R-Y and B-Y traps. Chroma amplifier and 4.5 mc trap	Sweep; set to 3.2 mc; sweep width set to 4 mc	Tunable marker	First video *if*; sound trap; mixer plate	Sweep; set to 38 mc; width 8 mc	Tunable marker jack
Sound *if* coils, detector quieting control, hue and saturation control, B-Y gain and buffer transformer, G-Y gain and G-Y matrix	Sweep; set to 4.5 mc with 500-kc width	Audio modulator or color-bar marker input jack	Tuner or front end	Sweep; set to 195 mc; width 20 mc	.....

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RF High-Voltage TV Power Supplies

by JAMES A. McROBERTS

Oscillator Circuitry Features . . . Special Components Used . . . Servicing of HV Systems That Will be Found in Old Timers And Some of the New Models

THE RF HV supply has decreased in popularity with the passing years due to the development of the flyback systems and their greater efficiency. However, there are still a number of electrostatic-type models about using the *rf* supply and a few new chassis, too, with this power system, that must be serviced.

In a typical *rf*-power supply we have a *power rf* oscillator generating an appreciable *rf* power output in its tank circuit, to which is coupled a pie-wound high-voltage section as its load. The filament of the high-voltage rectifier also constitutes a load on the oscillator tank coil. The high-voltage section acts as a stepup transformer to supply a high voltage between the rectifier plate and ground which becomes *hv dc* between the filament and ground, and is the output of the system. Filtration may be rather sketchy since the frequency is very high; most oscillators work above 250 kc. Experimenters have utilized similar devices for observing gaseous glow discharges and other phenomena with or without rectification by a rectifier tube.

Power-Oscillator Circuitry

The power oscillator may take several forms. Fig. 1 shows a tickler type, while Fig. 2 illustrates a clamp feedback type. Push-pull circuits have been employed also. The tubes are always power tubes, usually audio output types. The high-voltage rectifier tube is similar to the type used in flyback service; 1B3, etc. The tickler feedback type invariably uses the plate as the tuned-*tank* circuit and has the tickler in the grid circuit. The clamp-feedback type dispenses with the tickler coil and employs a clamp in the form of a metal plate or spring on the high-voltage rectifier to return enough energy to the grid to enable it to oscillate. Push-pull and parallel circuits may require (parallel will require always) antiparasitic resistors.

The tank coil, *hv* winding, rectifier filament winding, and any tickler coil employed, are wound on the same form. The filament winding is particularly critical as to its coupling with the tank coil. Because of the low voltage on the *hv* rectifier filament, since the coil is too far away from the tank coil to which it is coupled, too low a high voltage results. The high voltage coil is impregnated with a non-hygroscopic varnish to prevent it from absorbing moisture from the atmosphere and leaking across the pie wound sections; any spark will soon lead to another such spark and soon the carbon path of carbonized particles can render the entire unit worthless. The coils must be handled with extreme care in order that this outer layer should not be broken, and furthermore, to prevent short-circuited turns which creep up ever so easily in pie and bank-wound coils, such as the linearity and the width coils in flyback service.

The shielding of *rf* supply units must be thorough or the picture will show the *rf* hash as a background mottle which may become very fine bars in some instances. *All the screws that are removed have to be replaced in exactly the same manner as they were removed; the shield containers must not be bent or otherwise distorted.* Sometimes, lock washers may be needed additionally to furnish more complete grounding of the parts of the shield to each other. You can test for adequate fulfilment of the bonding between sections by a small triangular file that will bite into the metal; one with an insulated handle should be used. If the interference on the picture disappears, one then must make better contact between the two pieces of metal into which the file bites and makes contact. Often cleaning the mating surfaces with steel wool to remove such corrosion as present will be sufficient: it is important to be careful that more trouble

(*Continued on page* 56)

Fig. 1. Schematic of tickler type of feedback.

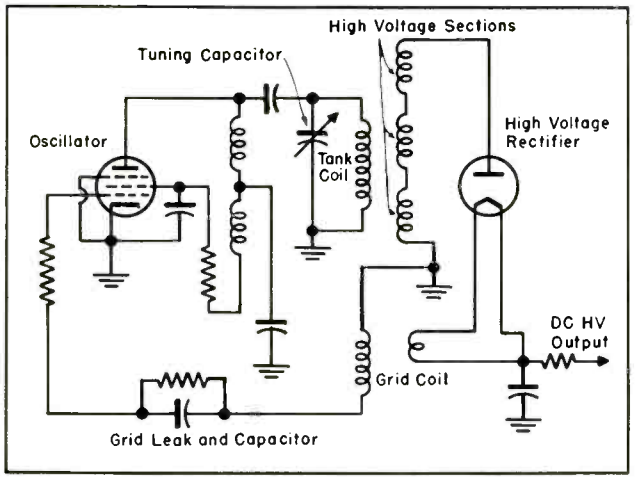
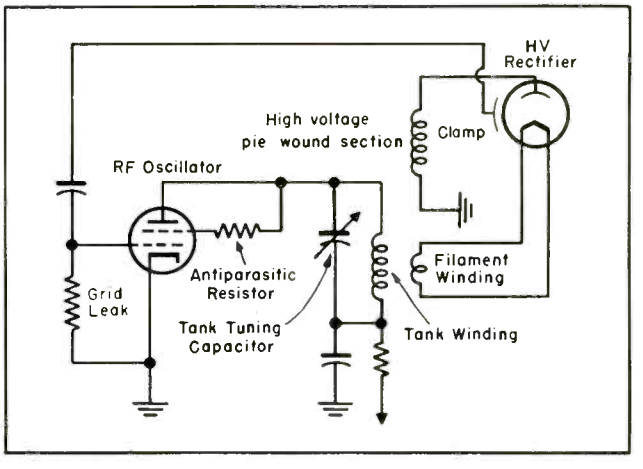


Fig. 2. Diagram of clamp type of feedback.

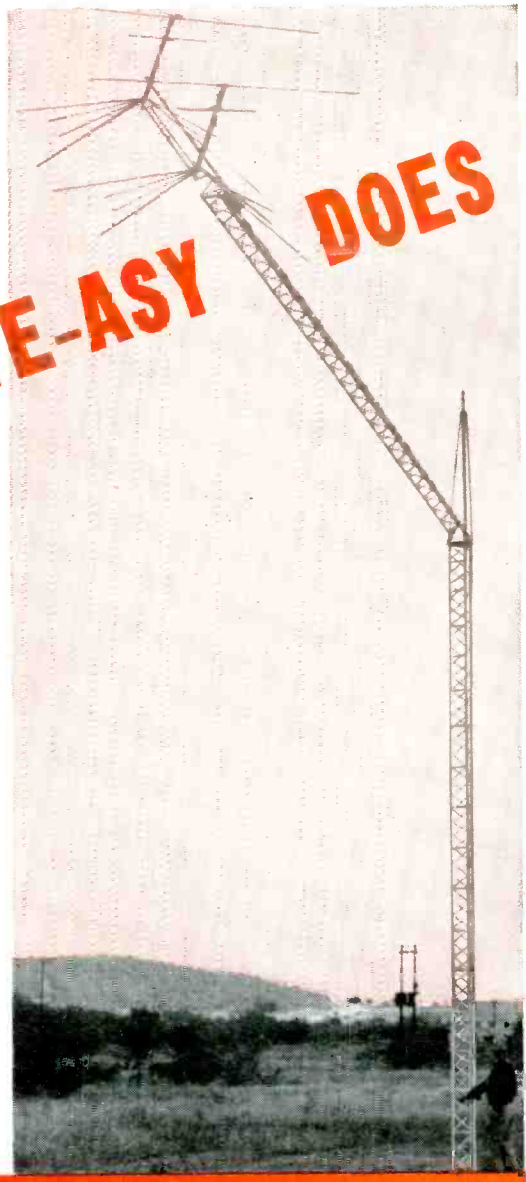


EE-EE-ASY DOES IT...

Alprodco's

Pop-Up Tower

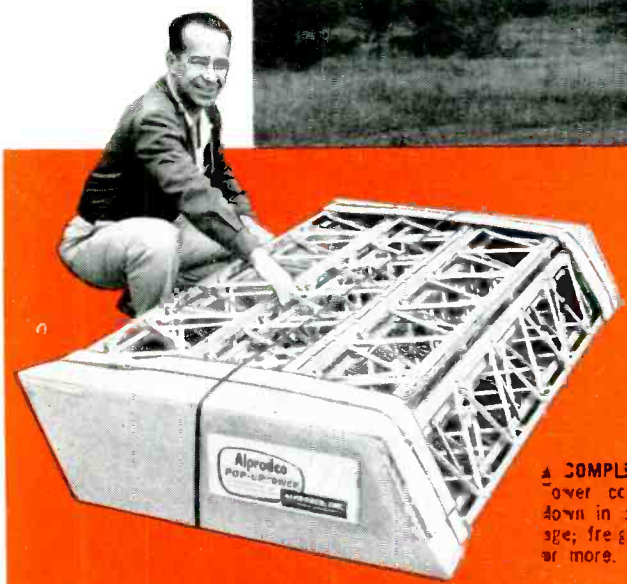
with "Magic Elbow" Action



"MAGIC ELBOW" ACTION: The tower goes up jack-knife fashion. Note how the "magic elbow" swings the top section into place.

ALPRODCO'S exclusive "magic elbow" eliminates climbing entirely. Just bolt the sections together, install the base and the "magic elbow" swings the top half into position quickly and easily. Swings down just as easily.

ALPRODCO'S Pop-Up Tower is available in three sizes (dealer prices listed for each): 49 ft.—$53.25; 61 ft.—$64.45; 73 ft.—$75.65. Guaranteed to withstand 90 mph winds.



COMPLETE PACKAGE: Tower comes knocked down in compact package; freight FREE on 5 or more.

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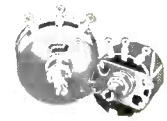
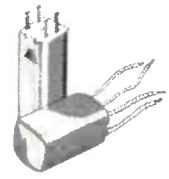
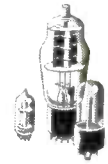


CONTROLS

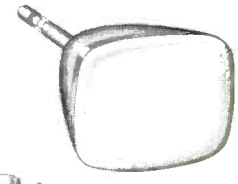


COILS

CAPACITORS

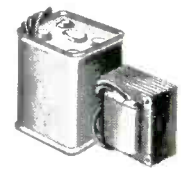


RECEIVING
TUBES



PICTURE TUBES

CONDENSERS



TRANSFORMERS

TUBE News

Nine Pin Miniatures for 600-Ma Series-String TV Chassis . . . Special Tubes for TV Replacements

by A. M. KELWOOD

A VARIETY of 9-pin miniatures have been designed for the new streamlined *series-string* type TV models. Among these tiny tubes are types 5AM8 and 6AM8*, with a high-perveance diode and a sharp cutoff pentode in one envelope. The diode unit may be used as video detector, *dc* restorer, and *agc* delay diode. The pentode unit is useful as an *if* amplifier, video amplifier, and *agc* amplifier.

In comparison with the 6AM8 whose heater operates at 6.3 *v*/.45 ampere, the 5AM8 has a heater which operates at 4.7 *v*/.6 ampere, and is controlled for warmup time to insure dependable performance in TV receivers utilizing a 600-*ma* series-heater string arrangement.

Another 600-*ma* chassis tube, the 6AW8*, contains a high-mu triode and a sharp-cutoff pentode in one envelope. It has a 6.3-*v*/.6 ampere heater. The pentode unit may be used as video amplifier, *agc* amplifier, and reactance tube. The triode unit is well suited for use in sync-separator, sync-clipper, and phase-splitter circuits.

For beam power use, in 600-ma chassis, a 12AC5* has been developed. It has a 12.6-*v*/.6-ampere heater. Can also be used in the *af* output stages of radio sets.

Beam Power Tubes

For horizontal deflection amplifier TV-set service three high-perveance beam power tubes (6BQ6-GTB/6CU6, 12BQ6-GTB/12CU6, and 25BQ6-GTB/25CU6) have been developed.*

In comparison with previous BQ6 versions, these tubes retain the same desirable characteristics, but feature a modified mount design to provide higher perveance and to permit higher ratings. As indicated by their double-branding, these types may be used as direct replacements for the 6CU6, 12CU6, and 25CU6.

The 6BQ6-GTB/6CU6 has a maximum peak positive-pulse plate voltage rating of 6000 *v* (absolute), a maximum peak negative-pulse plate voltage rating of 1250, and a maximum *dc* plate supply voltage of 600. These ratings, in addition to a plate dissipation of 11 watts, and a grid-*2* input of 2.5 watts, are said to enable a single 6BQ6-GTB/6CU6 in suitable circuits to deflect fully picture tubes having deflection angles up to 90°.

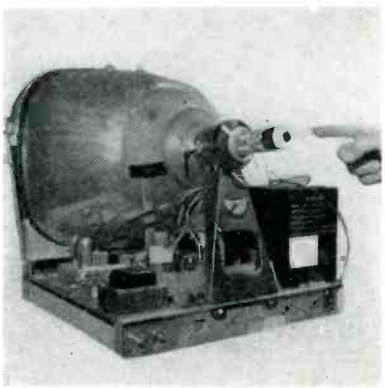
The 12BQ6-GTB/12CU6 is like the 6BQ6-GTB/6CU6 except that it has a 12.6-*v*/.6-ampere heater having controlled heating time. This type is useful in sets employing a single 600-milliampere series-connected heater string.

Tubes for Transformerless Application

The 25BQ6-GTB/25CU6 is like the 6BQ6-GTB/6CU6 except that it has a 25-*v*/.3-ampere heater. It is intended primarily for use as a horizontal-

(*Continued on page* 65)

*RCA.

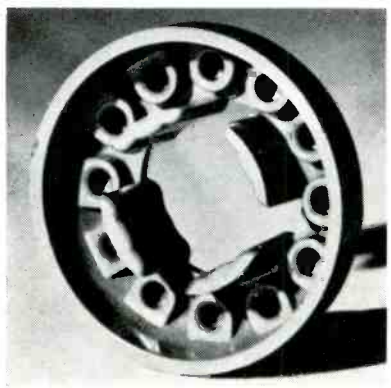


(Left)

Plastic base protective cap pin cushion, **which fits over the base pins of a picture tube, and which has been found to reduce accidental damage to base pins. Caps are said to prevent bent or broken pins. In addition, it is claimed, the cap keeps the pins clean, and makes it easier to slide the ion trap magnet over the tube base.**

(Right)

A close-up of the pin cushion **protective cap for picture tubes.** (Sylvania)



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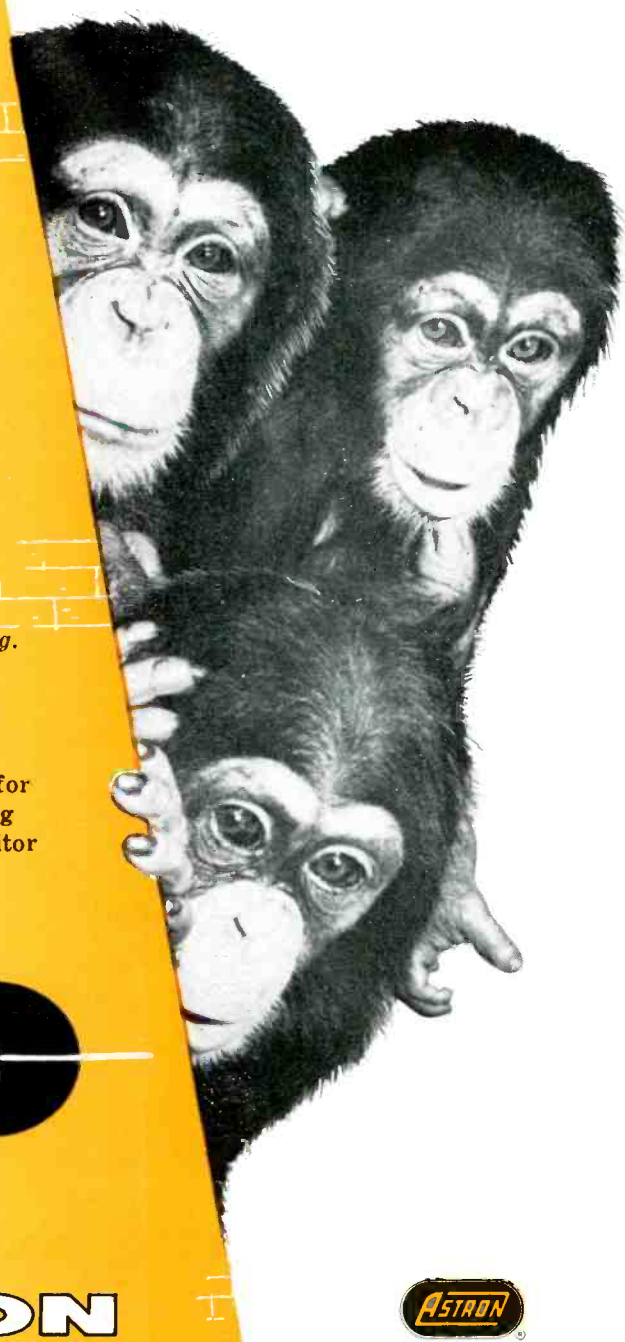

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Multiple LOUDSPEAKER System Installation Methods

by JESSE DINES

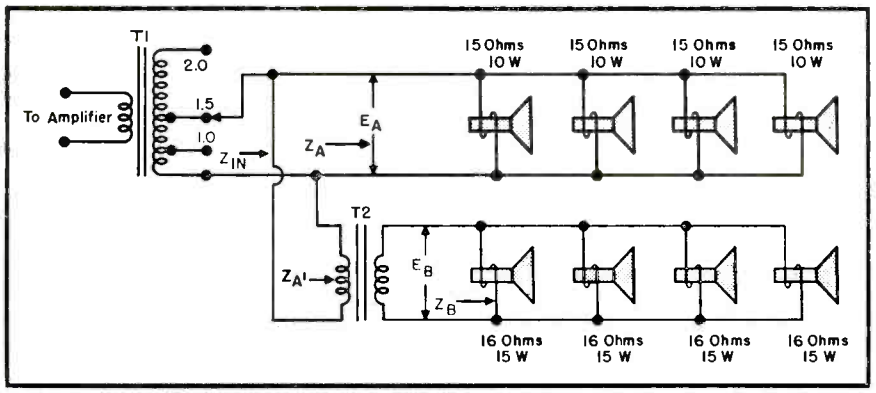
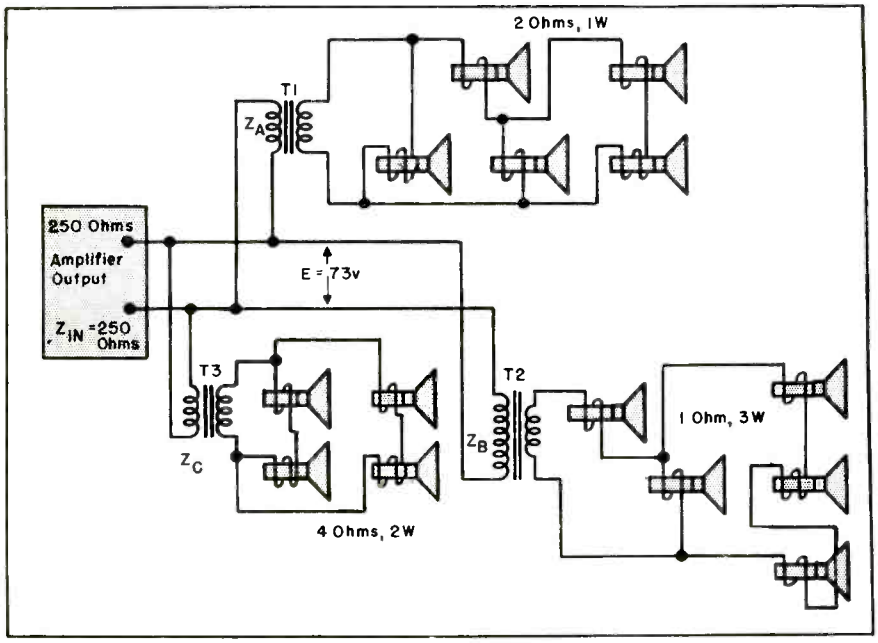


Fig. 1. An audio-system problem where we are concerned with the power and impedance requirements of different loudspeakers when operated from a single amplifier source. Specifically we must determine the secondary tap that is to be used on T_1 and the turns ratio of T_2. In leg A, we find that $Z_A = 15/4 = 3.75$ ohms. $P_A = 10 + 10 + 10 + 10 = 40$ watts. $E_A = 12$ v. In leg B, $Z_B = 16/4$ ohms. $P_B = 15 + 15 + 15 + 15 = 60$ watts. $E_B = 16$ v. Therefore, $Z_A' = (E_A/E_B)^2 \times Z_B = (12/16)^2 \times 4 = 2.24$ ohms. $Z_{In} = Z_A' \times Z_A/Z_A' + Z_A = 3.75 \times 2.24/3.75 + 2.24 = 1.4$ ohms; thus we use a 1.5-ohm tap on T_1. $P_{In} = P_A + P_B = 40 + 60 = 100$ watts.. Turns ratio of $T_2 = E_A/E_B = 16/12 = 4{:}3$.

Fig. 2. Method used to match a fourteen speaker (three type) system to an amplifier (250 ohms) and determine both the primary impedances and turns ratio of the matching transformers. Here $T_1 = 1.4$ ohms; $T_2 = 1.75$ ohms and $T_3 = 4$ ohms. The total power dissipated by each section is: $P_A = 1 + 1 + 1 + 1 + 1 = 5$ watts; $P_B = 3 + 3 + 3 + 3 + 3 = 15$ watts; $P_C = 2 + 2 + 2 + 2 = 8$ watts. Thus, the total power dissipated by the system is $5 + 15 + 8 = 28$ watts. Since the primaries are all in parallel, the voltage across each is 73 volts. Therefore, $Z_A = E^2/P_A = (73)^2/5 = 1035$ ohms. $Z_B = E^2/P_B = (73)^2/15 = 355$ ohms. $Z_C = E^2/P_C = (73)^2/8 = 666$ ohms. Now, since the turns ratio = $\sqrt{\text{primary impedance/secondary impedance}}$, $T_1 = \sqrt{1065/1.4} = 27.7{:}1$; $T_2 = \sqrt{355/1.75} = 14.3{:}1$; $T_3 = \sqrt{666/4} = 12.9{:}1$.



AUDIO INSTALLATION often require that two different sets of speakers be used. For instance, it might be necessary to line up four 15-ohm, 10-watt and four 16-ohm, 15-watt speakers, as shown in Fig. 1; with connection to one of the secondary taps (1, 1.5, and 2 ohms) of the matching transformer. To determine which tap of the *mt* or T_1 is to be used, one must determine the impedance, power, and voltage of each leg. The impedance *looking into the primary of* T_2, or Z_A', can be calculated by applying the following formula: $TR = E$ (primary)$/E$ (secondary) $= \sqrt{Z \text{ (primary)} / Z \text{ (secondary)}}$. The input impedance *looking away from the secondary of* T_1, Z_{in} will be found to be 1.4 ohms; this result is obtained through this formula: R (total) $= R_1 \times R_2/R_1 + R_2$ (for two parallel resistors). The tap which is closest in value to 1.4 ohms is the 1.5-ohm tap; thus the speakers are connected to it. The turns ratio of T_2 is computed as 4:3 through the use of the TR formula employed for looking into the primary of T_2.

14-Speaker Problem

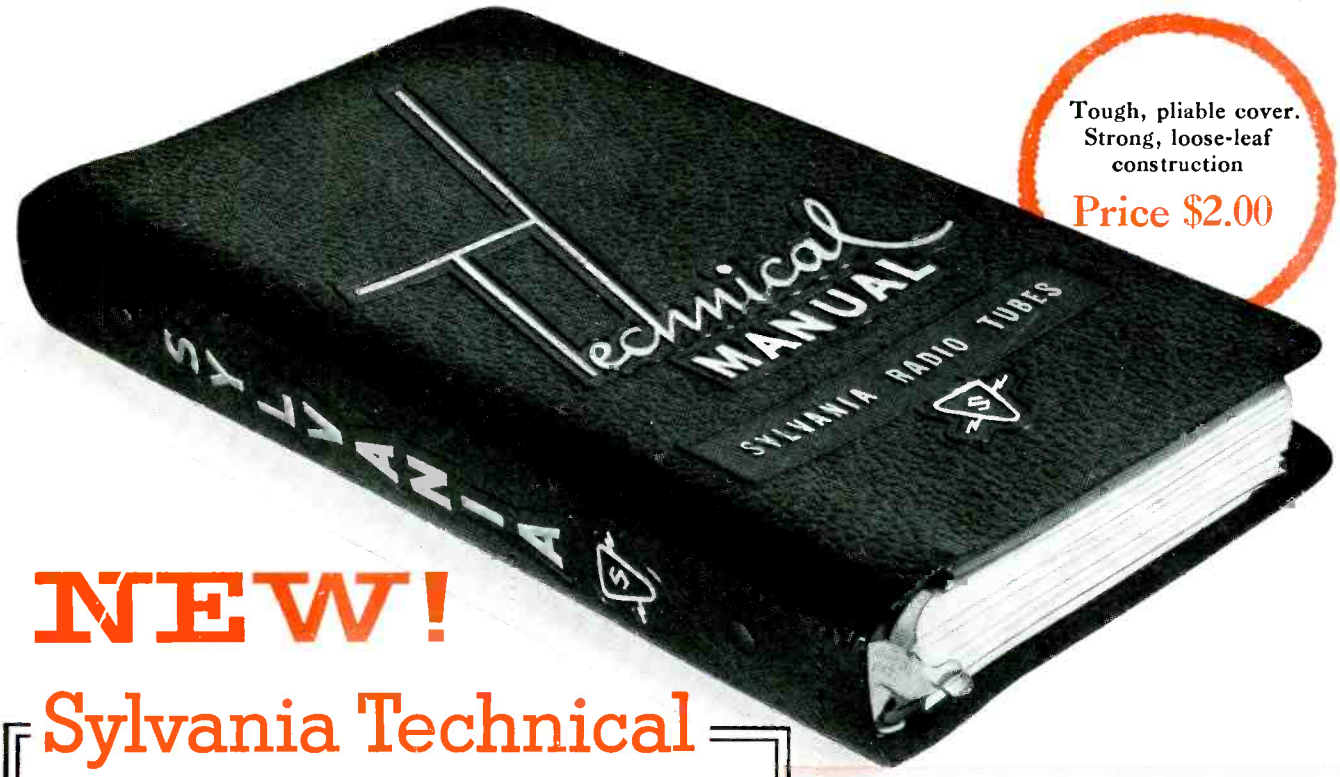
A more involved, yet not difficult, variation of the preceding problem is shown in Fig. 2. Here we have fourteen speakers with three different ratings matched to a 250-ohm amplifier. To simplify calculations, three different equivalent circuits, one for each set of speakers, are included in the schematic. A solution can be obtained by calculating, in the following order: secondary impedances of the *mt* (from equivalent circuits using formulas below*); power absorbed by each speaker group; secondary impedances of the *mts*‡ and the $P = E^2/R$ and the TR formulas.‡

*R (total) $= R_1 + R_2 + R_3$ (for series resistors).

R (total) $= R_1 \times R_2/R_1 + R_2$ (for two parallel resistors).

R (total) $= R$ (of one resistor)/number of resistors (for more than two parallel resistors equal in value).

‡See *June* and *July*, 1954, SERVICE, for supplementary audio chart, speaker layout and equation data.



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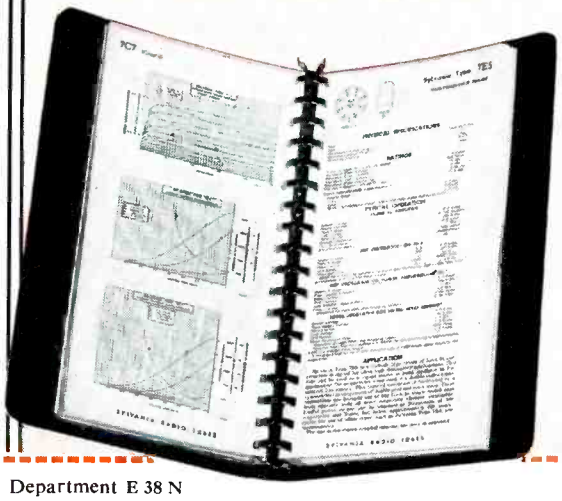

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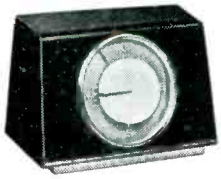

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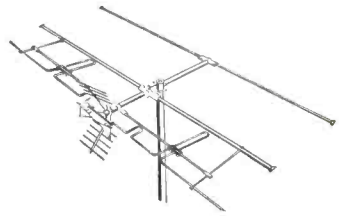

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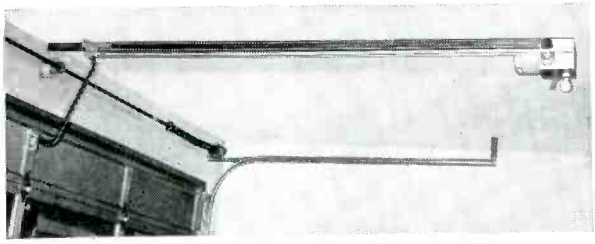

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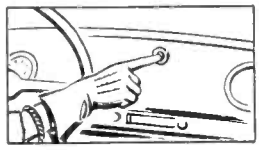
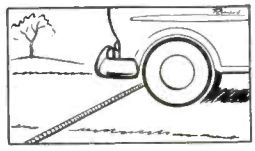
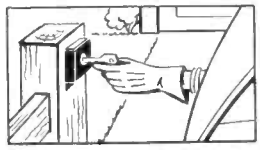


Radio Control—operates from push-button on car dash.



Hydraulic Control—from hose across driveway.



Key-Switch Control—from driver-level post box.

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Service Engineering — field and shop notes

by MAXWELL ALBERTS

THE INCREASED INTEREST and use of visual training aids and 16-mm home movie projectors, with sound, have created a zooming market for maintenance and service.

The amplifiers in these projectors are quite conventional, except for the input circuits, which have been arranged to take photoelectric cell inputs. Otherwise, they are standard *pa* amplifiers, ranging from five to ten watts in output, with the customary taps; 4, 8, 16 and sometimes 500 ohms. In most amplifiers, a special circuit will be found to furnish excitation voltage for an exciter lamp.

Input Circuits

The input circuits have a very high resistance and are supplied with a small polarizing voltage, from the amplifier's *dc* power supply. In testing the amplifier one simply removes the *pe* cell plug, and touches the plug. If a loud *honk* results, the amplifier has passed. If the complaint were *weak* or no sound, and the honk is heard, then the trouble is elsewhere; part of the optical system or in the sound head itself.

In the sound-film mechanism, the film passes over a sound head, and is held firmly against it by two driving rollers. These are driven by a projector mechanism. Sometimes this part will incorporate a large *flywheel* drum, to aid in maintaining a constant film speed; often, it will be merely a smooth arc of metal, over which the film is drawn by the rollers. This will vary from type to type, but basically the approach is the same. As the sound track of the film passes over a small slot in the head, a beam of light from the exciter lamp passes through it. Variations in the density produce variations in the amount of light reaching the photocell; the output current of the photocell then assumes variations identical to those of the sound track. The beam of the exciter lamp is focused by a lens, and aided by a reflector.

Trouble Sources

Possibilities of trouble in the system are numerous. Low output from the exciter lamp can cause a loss in volume. This may be due to aging of the lamp (blackening of the glass bulb causing loss of light), low voltage on the exciter lamp filament, dirt or dust on lens, reflector or bulb. Incidentally, for obvious reasons, the exciter lamp cannot use 60-cycle *ac* on its heater; this would cause a severe hum. Therefore, the filament of the exciter lamp, in commercial projectors, are heated by either *dc*, picked off the *bottom* of the high-voltage supply through a resistor, or a supersonic oscillator, using a power-type tube such as a 6V6 to generate enough voltage to supply the filament at a frequency of about 30 kc.

Volume Control Via Lamp Voltage

Some types use exciter lamp voltage to control volume. These can be easily identified: one can check to see if the

(*Continued on page* 52)

Panel-mount dc vacuum-tube voltmeter. Consists of a 4" rectangular meter with housing extending approximately 3" from rear of the meter movement. Complete amplifier and power supply circuits are contained within housing; terminals are available for dc signal input and 60-cycle power input. Front panel contains two controls; a switch to remove the input signal, and a zero adjustment. Additional control at rear for calibration adjustment. Input impedance of 10 megohms. (Model F; Trio Laboratories, Inc., 3293 Seaford Avenue, Wantagh, Long Island, N. Y.)

Audio oscillator which covers 10 cps to 1 mc in 5 steps. Will drive impedances from 600 ohms. Output level is ± 1 db from 10 cps to 1 mc. Power output is 160 milliwatts/10v open circuit. (Model 301A; Shasta Division, Beckman Instruments, Inc., P. O. Box 296, Station A, Richmond, Calif.)

AC 'scope for 5 cps to 10 mc. Sweep circuits provide triggered or recurrent sweeps from 0.1 to 10,000 microseconds per centimeter. Internal 1-kc square wave is available for calibration and adjustment of attenuators and probes. Cathode follower outputs for external gate and sweep connections provide synchronization for auxiliary equipment. (Models 701 and 701-D; Browning Laboratories, Inc., 750 Main St., Winchester, Mass.)

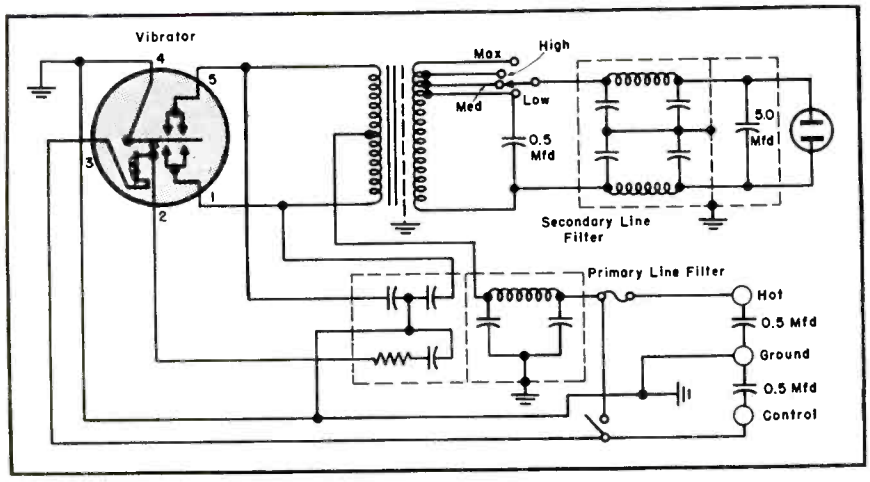


Fig. 1. Schematic of a 6-volt dc inverter. (ATR type 12, model RSE.)

exciter lamp brilliance changes with the volume control setting.

Another common difficulty is misalignment of the sound head, where the beam of light either does not strike the slot in the sound head, or it does not strike the photocell itself. Some machines use a round metal cover for the exciter lamp housing, which may be replaced wrongly.

If sound is weak, with a good amplifier, good exciter lamp, and a properly-aligned sound head, there is a possibility that the photocell may be low in output. To check this, one should turn on the amplifier and remove the photocell compartment cover. The beam of a penlight-type flash should be directed into the photocell; now one should snap the flashlight case with a fingernail. This should should cause a fairly loud *pong* in the amplifier, like a small bell. If you find it difficult to get into the interior of the unit, you can shine the light through the slot in the sound head, and tap the light. Since the small photocells are difficult to test accurately, the best check is replacement of the cell itself.

Vibrator Troubleshooting

THE FIRST STEP in servicing defective vibrator packs is to sectionalize the fault; sectionalization means tracing the fault to the circuit responsible for the abnormal operation of the set. The second step is to localize the fault; localization means tracing the fault to the defective part responsible for the abnormal condition. Some faults, such as burned-out resistors, shorted transformers, and burned-out or stuck vibrators, can be located by sight, smell, or hearing. The majority of faults, however, must be localized by checking voltage and resistance.

Input Circuit Filters

In some vibrators, such as the 6-12 *v* model described last month[1], a .5-mfd capacitor is used to filter out *rf* hash from across the input leads.

A pair of .5-mfd capacitors serve to filter out *rf* hash from across each of the input leads and chassis ground. They also help to filter out *rf* hash from across the two input leads.

Two .1-mfd capacitors are employed to reduce *rf* hash across the upper and lower pairs of vibrator power contacts.

An 11-microhenry choke keeps *rf* hash out of the upper half of the transformer's primary; another 11-μh choke keeps *rf* hash out of the lower half of the primary of the transformer.

A .5-mfd capacitor and a pair of 10-ohm resistors, in parallel, prevent arcing across the vibrator driver contact.

In circuit sectionalization and localization, the trouble should be localized to a single circuit. Then the trouble may be isolated within that circuit by appropriate voltage, resistance, and continuity measurements.

Preventive Maintenance

Preventive maintenance plays a key role in vibrator-supply installations; it serves to keep the equipment in good working order so that breakdowns and interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble-shooting and repair since its object is to prevent certain troubles from occurring. In such a program, a number of operations are involved. For instance, to remove corrosion, *0000* sandpaper should be used. And one should use a clean, dry, lint-free cloth or a dry brush for cleaning. If necessary, except for electrical contacts, the cloth or brush can be moistened with a standard cleaning solvent, and

(*Continued on page 78*)

[1] SERVICE; April, 1955: *Signal Corps* model designed by *ATR*.

(Right)

Radio control relay, factory set to operate at 10 milliwatts. User can adjust it down to 2 milliwatts, or any desired pickup or dropout, by means of screw contacts. Coil resistances: 4000, 6500 and 10,000 ohms. Contact arrangement is single pole, double throw. Occupies 1⅛" x 1 7/32" x 1¼" space. (Model SO; Advance Electric and Relay Co., 2435 N. Naomi St., Burbank, Calif.)

(Left)

Decade isolation amplifier that can be used as a general-purpose preamp or as isolation amplifier ahead of vacuum tube voltmeters and 'scopes. Has an input impedance of 250 megohms shunted by 3 mmfd, gains of .1, 1, 10, 100, and 1000, and a frequency response of 3 cps to 300 kc. (Model 102A; Keithley Instruments, 3868 Carnegie Ave., Cleveland 15, O.)

PERSONNEL

JACK S. BELDON has been appointed marketing manager of the General Electric radio and television department.

* * *

ROLAND S. WITHERS has been promoted to general manager of United Motors Service division of General Motors. He succeeds *Walter N. Potter*, who died recently.

Roland S. Withers

Carl J. Harshbarger

CARL J. HARSHBARGER, formerly district manager of the radio-television division of Westinghouse Electric Corp., has been appointed general sales manager of Kay-Townes Antenna Co., Rome, Ga.

* * *

LEO J. JACOBSON has been appointed chief engineer of the Philadelphia plant of International Resistance Co. . . . GEORGE WILLIAMS is now a group leader, product engineering. . . . BENJAMIN F. GERDING has been promoted to manager, manufacturing engineering. . . . CARL SMITH has been named manager, quality control.

* * *

JOHN STEPHENS, formerly sales manager of Abelard-Schuman, Inc., has joined The Herman Catalog Service, 23 W. 47th St., New York 36, N. Y., as assistant to the managing director.

* * *

EDMOND SHERMAN has been named chief engineer of Transitron, Inc., 154 Spring St., New York 12, N. Y.

* * *

ALFRED E. BOURASSA has been promoted to merchandising coordinator at CBS-Hytron, Danvers, Mass. He was formerly assistant ad manager.

* * *

E. C. SLAUGHENHAUPT has been named vice president in charge of manufacturing at Rola Co., Inc., Cleveland, Ohio. . . . KENNETH E. PHILLIPS is now vice president and director of purchases.

* * *

WALTER A. WEISS has been named general manager of the radio tube division of Sylvania Electric Products, Inc., Emporium, Pa. . . . HERBERT A. EHLERS is now general manufacturing manager of the division.

Walter A. Weiss

Herbert A. Ehlers

AUDIO Maintenance and Service Tips

by FRED R. SAILES

WHEN, a few years ago, the 45s were introduced, a novel changer was developed for the small slow-speed discs. Now, another unusual type of player[1] has been designed for these records. It's a single-play affair, but it is operated by simply sliding a record through a slot in a cabinet and then raising a play control.

Raising the play control starts the turntable rotating and automatically permits the pickup stylus to set on the record.

The mechanism stops automatically after the selection has been played and the record can be withdrawn. Should one wish to stop the mechanism while in operation, the play control is pushed in and the record is withdrawn after play control drops down.

Dual-Assembly Mechanism

The mechanism is made up of a lower and upper subassembly. The lower subassembly is provided with a power switch mounting bracket, pickup-arm mounting bracket, pickup-arm lever and a hinged support for the upper subassembly.

The upper subassembly provides the necessary facilities to mount the drive motor, turntable, idler wheel, trip lever, reject lever, latch, bumper, record stop and guides.

The turntable is driven by a conventional idler-wheel assembly which gives additional speed reduction by coupling together two rubber drive wheels of different diameters.

Tripping Adjustment

The mechanism is provided with a tripping adjustment screw that must be adjusted, so that the mechanism trips when the stylus is approximately 1¼" from the edge of the record center hole.

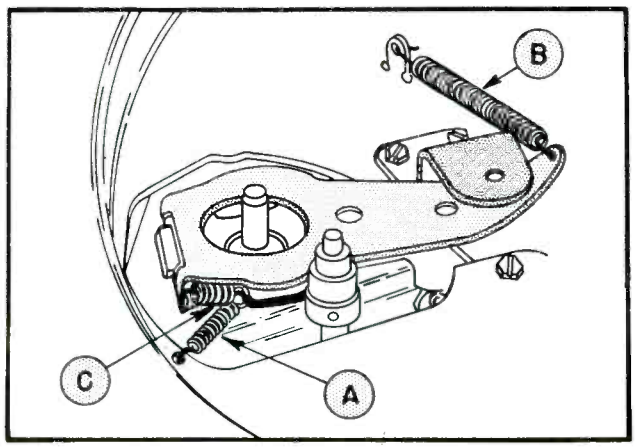
Pickup Inward Travel Limit

The inward travel of the pickup stylus should be limited to $1\frac{3}{16}$" from the edge of the center hole, so the stylus cannot enter the record label area. This limit is governed by bending of a metal tab.

Landing Control

The contact between the pickup arm lever and a metal tab extending upward from the lower subassembly, limits the outward travel of the pickup arm. This outermost position coincides with the landing position of the pickup. The tab must be bent so that the pickup stylus lands approximately 2⅝" from the record center hole; halfway between the outer edge and the recorded section of a standard record.

[1] *RCA RP-199 Slide-O-Matic.*



Cutaway view of Magnavox phono mechanism showing changes required to remove rumble and flutter. See illustration details on pages 55 and 76.

Pickup Height Adjustment

The pickup height should be adjusted so the pickup rises approximately ⅛" when the play control is raised to move the record into playing position; one should adjust to the desired height by bending metal tab.

Cycle of Operation

A record is slid over the turntable (through slot in cabinet) until the record touches the stop, at which time the record will set on the turntable correctly.

The play control, mechanically connected to the upper subassembly, should be raised; the upper subassembly (which is pivoted at the rear of the lower subassembly) rises with it. This action causes a small arm extending from the bottom of the upper subassembly to actuate the power switch and start the turntable rotating.

As the play control is raised up, the record on the rotating turntable gently meets the pickup stylus in the starting groove and the record starts playing.

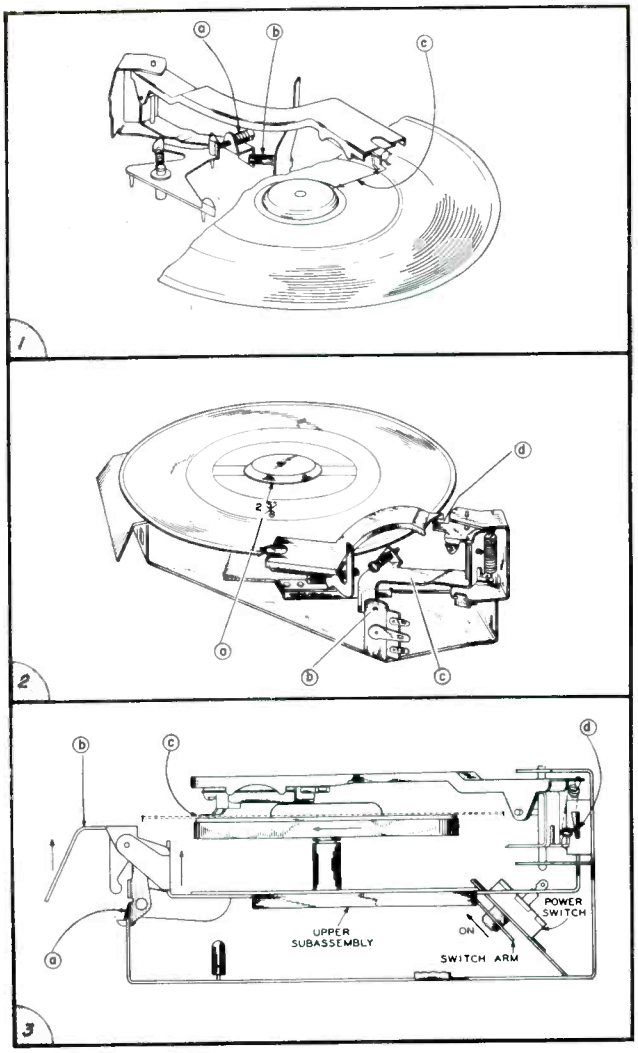
When the play control is raised fully the upper subassembly becomes latched in the up position.

As the record plays the pickup arm moves inward and the pickup arm lever contacts and gradually rotates the trip lever inward toward the turntable.

Mechanism Trips

When the stylus has moved into finishing grooves of the record, the trip lever has rotated sufficiently to make contact with the trip finger extending from the bottom of the rotating turntable. As the two meet, considerable force is transmitted from the rotating

Remedies for Trip Failure and Groove Skipping in RCA 45 Single-Record Automatics . . . Eliminating Rumble and Flutter in Magnavox Record Changers . . . Baffle-Mount Suggestions . . . Troubleshooting Phonos



(Right)

Figs 1, 2 and 3. How the 45 slot-record player operates is illustrated here. Three vital adjustment points are shown in Fig. 1: The tripping adjustment screw (a); the inward travel limit (b); and the 1¼" distance from center hole at which tripping should occur (c). Fig 2, shows the landing position, which is ⅝" from center (a); the pickup arm outward limit adjustment (b); the pickup arm lever (c); and the pickup height adjustment (d). In Fig. 3 we have a detailed cutaway of assembly. At (a) appears the upper subassembly latched in up position (a); play control (b), turntable and record rising to meet stylus (c), and the upper assembly pivot (d). Entire upper subassembly drops, causing turntable and record to drop away from pickup stylus, when cycle is complete.

(Below)

Figs. 4, 5 and 6. Service hints for the Slide-O-Matic. If the mechanism fails to trip, the trouble may be due to trip adjustment improperly set, limit tab bent out too far, bind in trip slide, defective trip lever, bind in latch bearing, or burrs on latch. These problems are illustrated in Figs. 4 and 5. Three of the causes are shown in Fig. 4: Excessive friction in bearings (a); improper setting of tripping adjustment (b); and improper bending of the limit tab (c). Binding of bearing (a), failure of trip finger to contact and push lever (b), binding of reject lever (c) and burrs jamming mechanism (d), are illustrated in Fig. 5. Group--skipping problems are noted in Fig. 6: Stylus guard may be bent (a); pickup height adjustment may be set improperly (b); pivots may be binding (c); end of counterbalance spring may be touching top of bracket (d); set screw may be loose or pickup-arm lever assembly may be too high or too low (e). Pickup ar mlever is shown at (f).

turntable to the trip lever. As a result the reject lever (coupled to the trip lever) is actuated and the latch, holding the upper subassembly in the up position, is released.

Automatic Stop

When the latch is released and the upper subassembly drops, the turntable and record drop away from the pickup stylus. At this time the power switch lever actuates the power switch and the mechanism stops.

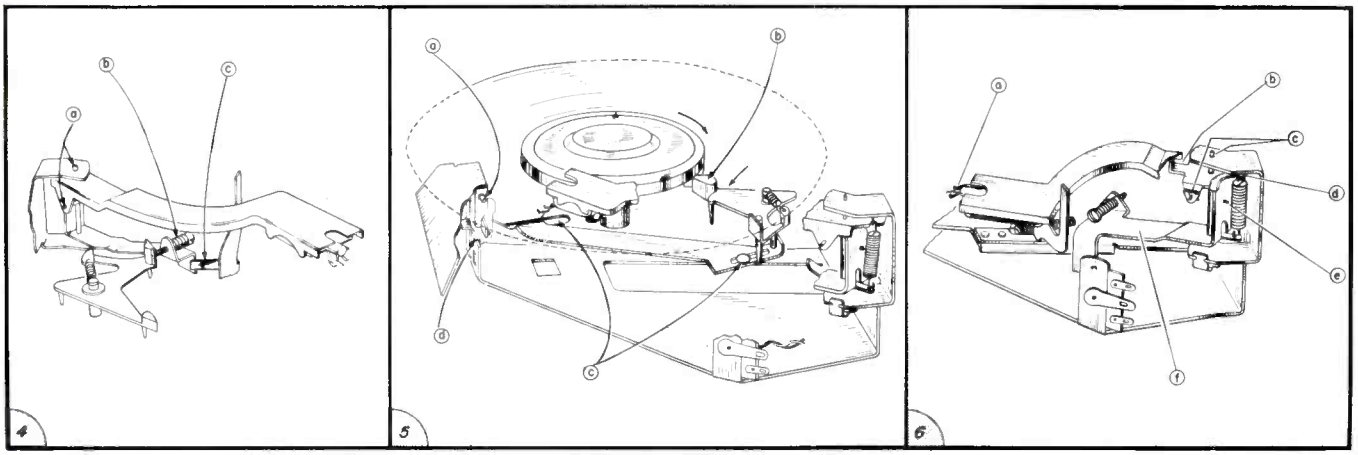
The pickup arm is returned to its outermost position (landing position) as a result of a slight push derived from the reject-lever return spring, directing a force through the trip lever and pickup-arm lever assemblies. There is, however, a tendency for the pickup arm to return to its outermost position because of its weight distribution and its slightly forward tilt.

To remove the record, it is pulled forward out of the slot in the cabinet.

Eliminating Rumble and Flutter

To eliminate rumble and *flutter* in Magnavox 521736 and 521739 record

(*Continued on page 76*)



RF Power Supplies

(*Continued from page 42*)

is not introduced by abrading away any copper plating, or other plating, which is present to help make contact, and has only formed a film of oxide on its surface; just make the surface bright. More screws may be needed in critical spots.

Adjustments

The *rf* oscillators are designed to work at maximum efficiency at a certain narrow band of frequencies. Here, the curve has two peaks with a dip in the curve between the peaks. It is necessary to tune the oscillator tank circuit to one of these peaks; the higher-frequency peak. To do this, tuning is started with the trimmer tuning capacitor at its minimum capacity; the plates should be out as far as they can go and as you turn in the adjusting screw, the picture tube brightness will increase to a peak, then get slightly darker and become brighter again. The first brightness peak is the correct adjustment because too much of the available energy is dissipated in the capacitor for the low-frequency peak and serves no purpose while in the high-frequency peak; more is across the tank coil with lesser drain on the power oscillator.

The foregoing has assumed that the oscillator is oscillating. These power oscillators are tested in the conventional manner by the measurement of the *dc* grid bias voltage; no voltage means no oscillation. About a volt or so of contact potential may be present; this small voltage does not mean that the tube is developing grid bias due to oscillation, however. Before the oscillator can deliver power, it must oscillate and the grid bias check is the sure test for such oscillation; lack of oscillation may be due to an old tube, another tube should be tried, if in doubt. No oscillation is frequently due to lack of sufficient feedback in the clamp arrangement type of feedback; one should try adjusting the position of the clamp with an insulated stick by moving it up and down on the rectifier tube. At the correct position, the set should be shut off and the clamp fastened in place with a piece of scotch tape. New rectifier tubes of the same brand and type may require different positions of the clamp. Oscillation can be prevented very readily by a short-circuited turn or so on the tank coil or the tickler coil if such is employed. Due to the low values of ohmage in these coils, even

the most careful checking with an ohmmeter may not reveal such a condition. The only true check is the substitution of a new coil for the old one; one must be careful in handling the new coil as a short-circuited turn or so can happen very, very easily. Prior to the actual removal of a coil, after all other tests indicate that the trouble lies within the coil, you should try resoldering all the leads to it; that is, heating them with a soldering iron and running the solder slightly. Sometimes a high resistance joint will form; this may not appear as an appreciable resistance on the ohmmeter but it can still prevent oscillation or so lower the Q of the coil that inadequate high voltage is developed.

The filament of the *hv* rectifier is heated by *rf* current picked up from the tank coil by the closeness of the coupling to it. Too much or too little of this energy can be extracted, with the result that the filament is overheated or underheated. You can not measure this energy with a meter, so you must observe it in a darkened room and if need be, you can compare with another tube whose filament is heated by a 1.5-*v* dry-cell battery. In adjusting the filament coil is moved closer to the tank coil or further away from it; in some extreme cases a turn may have to be added to increase the brilliance of the filament or a turn may have to be removed for the converse reason. The coil must be moved with the set on, so an insulated rod or stick should be used; alternately, the set could be shut off each time, but it is difficult to estimate easily the brilliance of the filament by the off-on method of adjustment.

Another cause of oscillation failure are the screen and plate bypass capacitors losing their capacity. These capacitors can be tested by shunting with another known to be good; do not shunt as a permanent cure.

Summary

To get the oscillator working, it should be tested for oscillation by grid-measurement or by drawing a spark from the plate. If not oscillating, you should substitute tubes; check electrode voltages; adjust feedback clamp; check continuity of feedback tickler coil; and finally test the *rf* coil assembly by substitution. Do not overlook a shorted tuning capacitor across the tank coil; check with ohmmeter while varying it throughout its tuning range.

In the next step, it is important to see that the high voltage is working. The spark (*rf*) from the *hv* rectifier plate cap should be greater in length than the spark at the oscillator plate.

Audio Amp Component Replacements

by NORMAN CROWHURST

How to Select the Proper Values, Ratings and Tolerances for Resistors and Capacitors When Used as Replacements in Audio Systems

IN AUDIO equipment component values are, in the main, carefully selected, and identical-value replacements must be made. If exactly the same value is not readily obtainable in a single unit, one can make a multiple substitution, using, say, a couple of resistors connected in parallel that would provide the same equivalent value.

Let us suppose, a 43,000-ohm resistor must be replaced and none are available; we could take a 51,000-ohm unit and also one having a resistance of 270,000 ohms. These two, connected in parallel, combine to produce almost exactly 43,000 ohms, and the tolerance is very nearly the same. The 43,000-ohm resistor is in the 5% group, and so is the 51,000-ohm unit; although the 270,000-ohm resistor is in the 10% group, since it has the larger value of the two in parallel, the overall variation is not more than 5%, which would not affect system performance.

Then there is the question of resistor ratings: Is a half watt, or a 1 or 2-watt resistor required? This is not a very difficult problem. If the original resistor had been a quarter, third or-half watt (of more or less minimum size), then from a performance viewpoint, there would be no disadvantage in using a larger rating resistor. In audio circuits, the only question is whether the larger physical size will fit conveniently into the space available. If it is necessary to mount the resistor into a different position, because it is too large to fit into the original position, and additional wires must be run or leads routed so that they pass over or parallel to other components, performance may suffer because of the stray wiring effects.

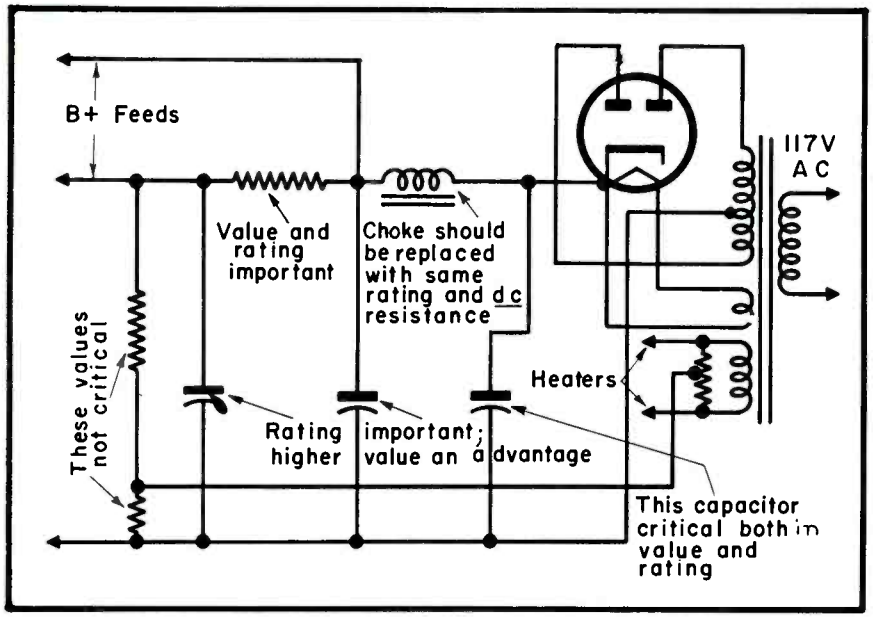
On the other hand, if the original resistor has a one or two-watt rating, then it is extremely improbable that a lower-rating resistor will serve equally well. Manufacturers are not in the habit of installing two-watt resistors where half-watt resistors will do, because the two-watt resistors are more expensive. However, to be absolutely sure, one can calculate the dissipation, by finding out what the voltage is across the resistor and using the $\frac{V^2}{R}$ formula to find out the actual dissipation in the resistor.

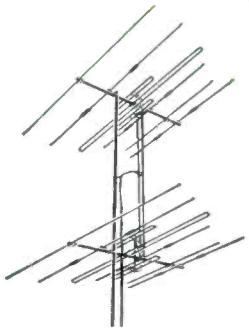
A point worth remembering though, is this: A heavier wattage rating can be built up by connecting resistors of lower rating together. For example, let us suppose we require a 10,000-ohm resistor of 2-watt rating; this could be obtained by connecting two 20,000-ohm 1-watt resistors in parallel, or four 39,000-ohm half-watt resistors in parallel would produce the desired result. Often the correct value can be more conveniently built up by connecting values in series, but usually it is preferable to find an arrangement of parallel resistors that will provide the right combination. This arrangement is easier to manage mechanically, a group of resistors strung together (in series) can be very unmanageable; and there is the possibility that a short circuit might develop at a later date, because of string resistor movement.

So much for generalizations. Now let's analyze the importance of the foregoing factors in different circuit positions. In a typical amplifying stage, the cathode resistor value, used for providing bias for the tube, is usually not highly critical, unless it happens to be part of a feedback loop;

(*Continued on page 72*)

Fig. 1. A power supply unit designed for an audio amplifier; important replacement characteristics of various components are noted.





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R-C Substitution Box

(*Continued from page* 21)

scribed. If, during the course of the test, it is observed that the square wave exhibits tilt on the bottom, but not on the top (or vice versa), as shown in Fig. 11, the *'scope amplifier is being overloaded with too much input signal.* In this instance, the output from the generator should be reduced below the overloading point.

'Scope *Attenuator* Settings

This situation can also result from an improper setting of the vertical attenuators of the 'scope, as shown in Fig. 12. Fine attenuation is usually obtained as a potentiometer control in the cathode circuit of a cathode-follower stage, while coarse attenuation is usually obtained as a stepped-voltage divider in the grid circuit of the cathode-follower stage. Thus, if the fine control is set nearly to zero, full-screen deflection can be maintained by advancing the step control toward maximum.

But, *this procedure can lead to grid over-drive,* and clipping of the waveform in the cathode-follower stage, with the result shown in Fig. 11. Hence, to avoid this possibility of trouble, one must always make it a habit to run the *step attenuator as low as possible,* and the *fine attenuator as high as possible.*

LF Compensation Circuit

Thus, it is apparent that arranging a low-frequency compensation circuit

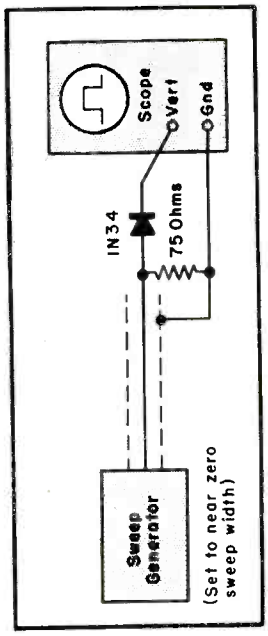


Fig. 9. How to convert a sweep generator for use as a 60-cycle square-wave generator for checking low-frequency compensating network of a 'scope. The sweep generator must provide a zero-volt reference-line blanking function to be used in this application.

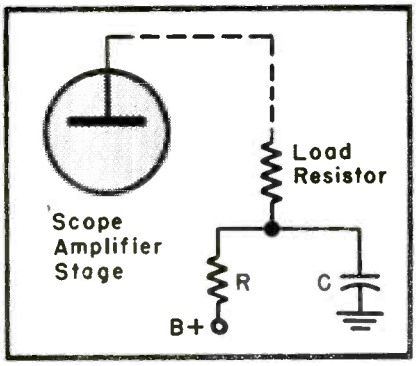


Fig. 10. Tilt, as seen in Fig. 5 (p. 21) can be compensated, and the 60-cycle square-wave response of the 'scope brought to the point shown in Fig. 2 (top—p. 20) by suitable adjustment of the values of R and C, the compensating resistance and capacitance in the 'scope-input stage.

is a very simple and rapid procedure, when the principles are understood, and when capacitance and resistance substitution boxes are utilized.

Trimming Up 'Scopes

Many of the older 'scopes, which are considered unsuitable for visual-alignment applications because of the tilt which they introduce into 60-cycle square waves, *can be trimmed up for satisfactory service at the alignment bench* by means of the compensating arrangement described. Of course, this compensating procedure can be applied equally to all video amplifiers, such as those used in TV receivers, audio amplifiers, and lab utility amplifiers.

Tilt in 60-Cycle S-W Response

In the case of a TV-receiver, tilt in the 60-cycle square-wave response causes a change in shading from top to bottom in the background of the picture. *This difficulty can be eliminated* by means of the low-frequency compensating network described.

Fig. 11. Unsymetrical tilt in the reproduced square wave may mean that the input signal is too strong. But it may also mean that the settings of the fine and step attenuators of the scope are incorrect.

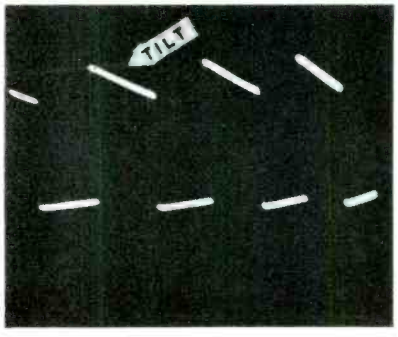
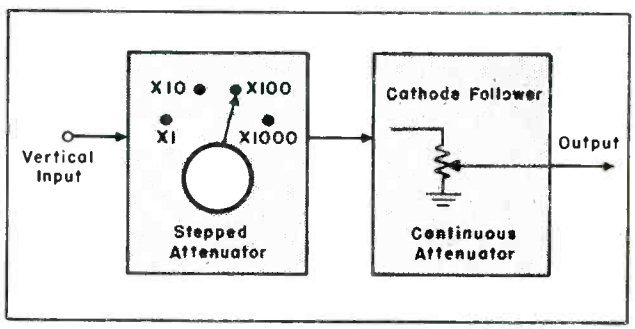


Fig. 12. The coarse attenuator drives the grid of a cathode-follower input stage, while the fine attenuator is a potentiometer control in the cathode circuit of the input stage. It is apparent that if the coarse attenuator is set too high, so that the grid is driven into grid current or beyond cutoff, clipping of the input signal is inevitable. Good operating practice requires that the step attenuator be operated as low as possible, while the fine (continuous) attenuator is operated as high as possible.



TV Antennas

(*Continued from page 26*)

deficiency should not be encouraged because, as mentioned, slight defects in all segments of the receiver can add up to a very serious defect because of their cumulative influence.

On occasion, an antenna will have a sharp dip in its response characteristics on certain channels, because of resonant conditions in cross-arm, mast, and insulator arrangements. Such a dip near the chrominance information could harm the stability and accuracy of the color information. Thus, antennas should have the uniform bandwidth detailed and sharp departures must be corrected.

Transmission Line

A poor standing-wave condition on the transmission line can affect the presentation of a color picture adversely. The presence of very serious standing waves can, of course, introduce smear or reflections. This type of disturbance is serious in a monochrome receiver and becomes even more so in the color receiver, because of the presence of the color information at a widely separated frequency from the picture carrier. In fact, as a function of the length of transmission line, a poor standing-wave condition could cause the picture carrier frequency to be near a maximum of the standing-wave cycle at the tuner input, while the chrominance carrier (some 3½ mc separated) could be at a minimum at the input. Thus, chrominance data would be very much attenuated, as compared to the picture carrier, and chrominance stability and fidelity could be affected seriously.

When receiving a color picture from a *uhf* station it is necessary to route the transmission line carefully away from nearby metallic objects; and one should do everything possible to avoid use of standoff insulators and lightning arresters that could set up standing-wave conditions on the line.

By observing a composite horizontal sync and blanking period on a 'scope (at the output of the video demodulator) the influence of standing waves can be checked. By tuning the transmission line at the tuner input, one will observe that the actual overall sync and blanking amplitude does not vary in exactly the same manner as the color burst amplitude, riding on the back porch of the horizontal period. In other words, the overall horizontal amplitude does not coincide with the peak amplitude of the color subcarrier as the transmission line is tuned. This condition serves to demonstrate the change in standing-wave conditions on

the line as a function of frequency within a given channel.

To prevent the cumulative effect of bandwidth defects the tuner response should be essentially uniform over each channel; this requires closer tolerances on valleys and dropoffs, and certainly more careful alignment and adjustment.

The wide bandwidth is necessary because of the additional information conveyed in the color signal. The dropoff of the response curve is a bit more critical, since it minimizes adjacent-channel interference with the greater bandwidth to be received and the nearness of adjacent channel picture to chrominance subcarrier. It is not advisable to peak the tuner for fringe-area reception, because it will be necessary to sacrifice either the picture carrier end or the chrominance-information end of the video spectrum. Accordingly, a better noise factor can only be attained with a more critical design of the tuner itself and not with a bandwidth sacrifice.

Tuner Stability

Tuner stability is also important because the color subcarrier is so close to the sound carrier. This point is illustrated in Fig. 1 (p. 26) which shows the distribution of signal information for a color signal transmitted on channel 3. Actually the chrominance subcarrier is separated only 920 kc from the sound carrier. Consequently, the video channels in the receiver must have the least response to the sound carrier, but still have a peak response to the chrominance subcarrier spectrum. Thus, it is necessary that the fine tuning control of the tuner should be set exactly to prevent crosstalk and interference between the sound and chrominance information; this can cause a disturbing bar pattern on the color picture.

It is necessary also that customers be instructed carefully on fine tuning control adjustment to obtain the least interference between sound and chrominance. Tuner stability must also be good to prevent a drift in this adjustment and the reappearance of the crosstalk in the color picture after the fine tuning control has been set.

Flat IF Requirements

The *if* system of the receiver must also have a flat uniform bandwidth to amplify, as well as prevent crosstalk between the information carried through the video *if* section. In Fig. 3 (p. 26) we can see that the video *if* bandpass extends flat to within a fraction of a megacycle of the sound-carrier frequency. The economy-type narrow-band *if* system is therefore not satisfactory for color reception because of its early dropoff and what would amount to loss of the chrominance information. The *if* section of a typical color receiver must have a greater bandwidth and will involve one or two more stages of amplification. With broader bandwidth there are additional problems of more critical trapping to prevent interference from the associated and adjacent channel sound frequencies, the elimination of interference between chrominance and sound information, plus the usual intercarrier trouble and critical design when using a broadband *if* amplifier.

Alignment and The IF

If the design of the *if* system is more critical, so becomes the alignment of that segment of the receiver. The accuracy expected of one's marker generator can be judged when it is necessary to set a frequency within a small fraction of a megacycle compared to another frequency.

Community TV System

(*Continued from page 23*)

attain a height of 45′-50′; in no case was any improvement noted after the 25′ level was reached.

This may be due to a sort of *ground-cushion* effect; the signal striking the ground in front of the antenna and being reflected back up, arriving in phase at that height, so as to increase the signal level. At any rate, the 25′ point was found to be the most effective height, for the average receiving antenna. And this height also served to make a more economical and sturdier installation; this height can easily be reached with a ten-foot mast atop the average dwelling. Thus, with the heavy antennas and rotators needed in fringe areas, installations can be kept *in the air* with ease and one need not worry about problems of winds that have a habit of ripping up some tall masts.

•

Portable Power Supply

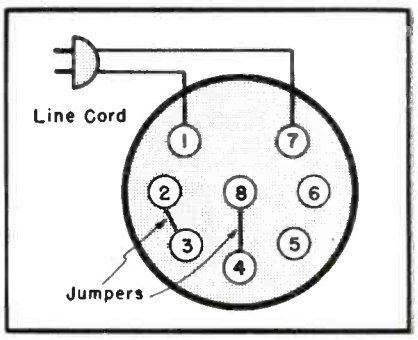
(*Continued from page 36*)

any channel. One should note the reading, or adjust for full-scale deflection on the lowest, or 50-*uv* scale. Then the *ac* plug should be disconnected and the battery-pack connected and checked for any difference in reading. Even if there might be quite a difference, say 25% lower than the *ac*, the instrument will still be usable, if the equivalent readings are known. Field-strength readings are normally a matter of comparison; in this case all that was needed was an indication of rough signal strength, and the proper orientation for the antenna.

The supply was also found useful as a power source for the meter in a car (or truck), with a probing dipole antenna, for chasing TVI. A cord of the type used with portable trouble lights could be used, and plugged into the cigarette lighter socket.[2]

[2] *ATR* has a packaged supply that can be used for this application.

Fig. 3. Connections for ac line cord and plug for converted meter. Note jumpers which complete filament and plate circuits when this plug is used.



Tube News

(*Continued from page* 46)

deflection amplifier in *transformerless* type TV sets.

Another series of tubes, especially designed for replacement applications, is now also available.**

One of the types, included in this group, is a 6BG6-GA, which is said to have a new beam shield that masks off stray electron bombardment from micas and bulb. The bulb is straight-sided, narrower and shorter. The tube is also claimed to be more shock-resistant than its prototypes, with the bottom mica now braced against the glass.

Also in this series are a pair of sweep tubes (6CD6-GA and 25CD6-GA), said to have a mica design that prevents arcover which causes horizontal picture streaking. Plate areas have been increased to provide for 7000-*v* positive-pulse peak and 20-watt plate dissipation, as compared with 6600-*v* and 15-watt ratios of prototypes.

To match other heaters in series-string circuits and thus provide even warmup time, a tube with a 10.5-second heater warmup has been designed; 6SN7-GTB. The tube incorporates all features of the 6SN7-GTA, with which it is interchangeable.

Also available for receivers employing a series-heater string is a 6BA8‡, a miniature, 9-pin, medium-*mu* triode and sharp cutoff pentode,

The pentode section of the 6BA8 has a plate dissipation rate of 3.25 watts and is designed to serve as a video amplifier. The triode section has a *mu* of 18 and is suitable for applications where a low-*mu* triode is desirable, such as sync amplifiers, etc.

Class B Transistor Amplifier Distortion‡‡

RECENTLY IN AN experimental investigation of distortion in class *B* amplifiers, data was taken on about forty to fifty different junction transistors, all of the standard 50-*mw* audio type. It was found that distortion in almost all of these followed a remarkably consistent pattern.

In the grounded-base circuit, it was found that distortion in the collector circuit was negligible unless the signal clips. Distortion here is independent of load and of frequency in the audio range, and independent of power output until clipping starts if the collector current swing is kept constant as the load varies.

The distortion, in this instance, is all in the input circuit due to the nonlinearity of the emitter resistance, which varies inversely with current. This has been analyzed earlier for class *A* amplifiers, and it has been pointed out by engineers that a small amount of forward emitter bias will put this circuit out of the worst part of the nonlinear region of the emitter current-emitter voltage curve.

What is of interest is how moderate distortion figures (2 to 5% third harmonic) may be obtained at very small collector current drains (70 to 150 microamps). This allows a minute standby power drain and prolongs battery supply considerably, and is of importance because low power drain should be the primary reason for using transistors in these circuits.

As in class *A* amplifiers distortion decreases with increase in source impedance, but gain suffers. For a constant emitter bias odd harmonic distortion starts at a very low level for low collector current output swings,

(*Continued on page* 66)

**G.E.

‡Sylvania.

‡‡From IRE convention report by *Maurice V. Joyce*, Polytechnic Institute of Brooklyn.

(*Continued from page 65*)

rises to a maximum and then falls off for large circuit swings. Gain falls off with low signal current, especially for low emitter bias current. This is due to the fact that at very low currents the input impedance is quite high, but the emitter current-emitter voltage curve is fairly linear; you can get below the knee of the curve.

Distortion continues to fall off up to swings of about 30 milliamps. Beyond this point distortion will arise gradually due to a slow decrease of alpha at high currents. Where this starts will, of course, vary quite a bit from one type of transistor to another. However, it seems that this upper region is above the real region of operating interest for most 50-milliwatt transistors.

It is possible to obtain around 0.25 to 0.30 watt output with 2 per cent odd harmonic distortion and around one per cent even harmonic distortion (which varies very little with bias or current swing), and about 100 microamps collector bias current. This is with no feedback.

*Tube-Transistor Element Comparison**

THERE IS SOME similarity between the elements of a vacuum tube and those of a transistor. Functionally, the transistor *emitter* corresponds to the cathode of a triode tube; the *base* to the grid; and the *collector* to the plate. However, the voltage applied to the collector in a transistor using *n*-type germanium is negative in polarity as opposed to the plate of the vacuum tube. The current, of course, is in the opposite direction.

Unlike the vacuum tube, the transistor functions by the control of the flow of electrons through a solid. This solid, usually germanium, is a semiconductor which, in the early point-contact type transistors, had two fine *cat whiskers* contacting its surface and separated from each other by a few thousandths of an inch. The flow of current in one of the fine point contacts controlled the flow of current in the other. The junction transistor is quite different in structure and has been found to be far more stable in operation. A very thin layer of germanium of one electrical type is sandwiched between two regions of germanium of a different electrical type; the two boundaries or *junctions* between these regions serve the same functions as the two *cat whiskers* in the point-contact device. These junction transistors have remarkable properties. With respect to noise, they compare favorably with the best vacuum tubes.

*From Philco notes.

Part X of a Series of System-Component Evaluation and Progress Reports

LF-HF Cutoff Filter and Compensator Applications*

SEVERAL ATTEMPTS have been made to establish basic standards for modern recordings. None of these attempts have been successful and consequently there exists today a wide variance between characteristics found in records. Imported recordings differ from domestic. Domestic recordings, even those issued by a single company, contain characteristics different than any others. Other factors, too, affect the frequency response of modern recordings; acoustics of the recording studio, location of instruments and voices with respect to the microphone, and the condition of the record at the time it is reproduced. In addition, the recording engineers, the conductor or the artist may deliberately accentuate various instruments or frequency ranges to achieve a certain desired effect.

Because of this wide variation in recordings, there can be no guarantee that a certain record will sound best on a pre-determined setting of the reproducing system controls. When individual preferences and the acoustic properties of loudspeaker, enclosure and listening area are factored in with the many characteristics present in a modern record collection, it is not difficult to see why home music systems must have great flexibility of control. This control is provided by a *filter* which limits the systems' frequency response to the proper degree.

Three-Way Filter

To provide this control when a variable-reluctance cartridge[1] is used, a three-way record filter[2] has been de-

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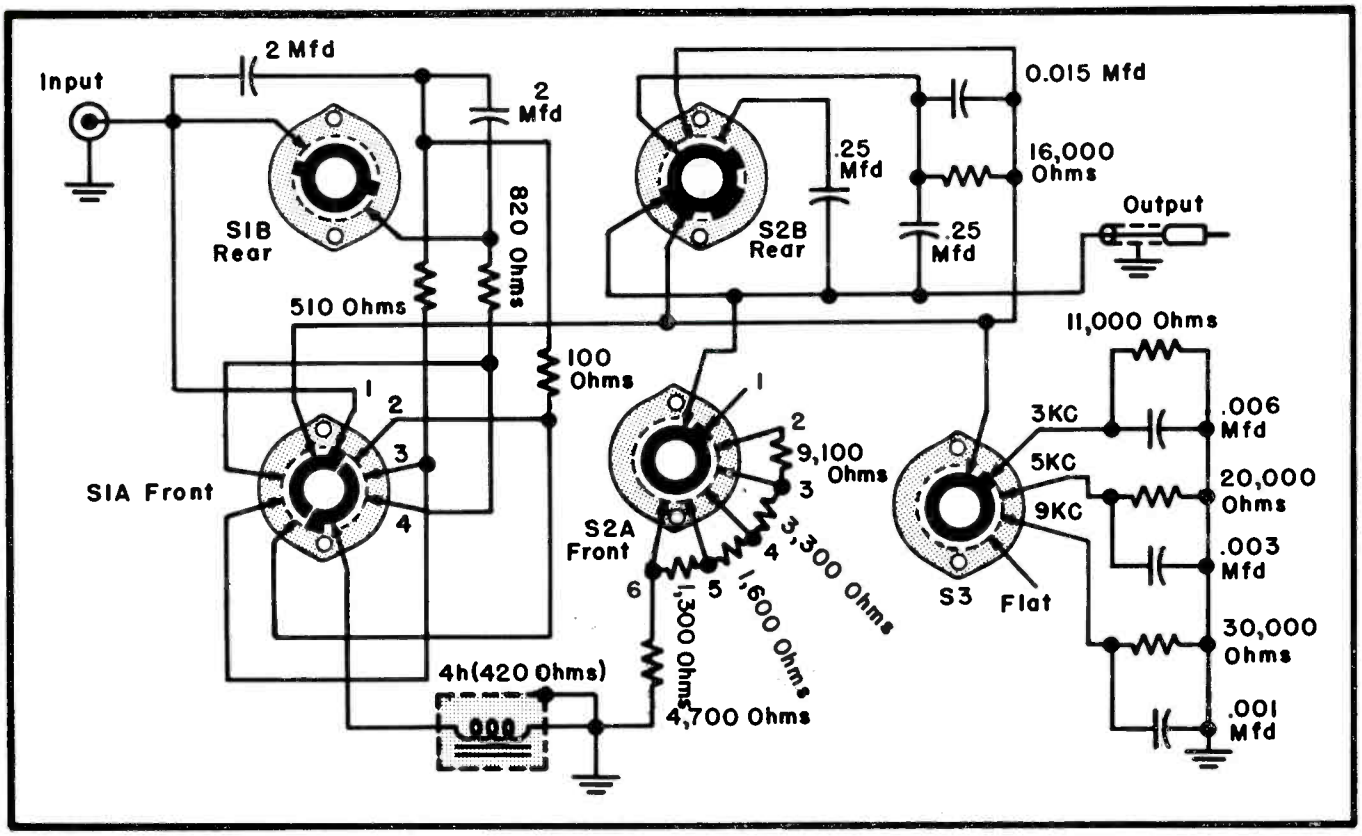
[1]G.E. [2]G.E. model A1-901.

From notes prepared by **Electronics Division, G.E.*

Fig. 1. Schematic of the G. E. A1-901 record filter.



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signed. It consists of a low-frequency cutoff filter, record compensator and a high-frequency cutoff filter.

The filter has been designed to reduce or eliminate unwanted low and high-frequency noise signals and provide proper tonal balance for the playback of virtually all types of recordings. Its three functions can be controlled independently or in any desired combination.

Installation

To avoid the possibility of hum pickup, the *filter* must be located at least two feet away from power transformers and one foot away from phono motors. If closer location is required, it may be necesary to determine the orientation of the *filter* for minimum hum.

The *filter* is installed between the cartridge and the preamp input. A shielded lead, from tone arm or record changer to the *filter*, must be kept short to avoid loss of high frequencies. This length ordinarily should not exceed three feet; connection should be made to an input connection jack furnished on the filter.

In installation, the shielded output lead should be plugged directly into the preamp input jack provided for low-level magnetic cartridges. One must check the loading resistance at this jack and if less than 50,000 ohms, it should be changed to a higher value. An input impedance of 100,000 ohms or more is recommended for best results.

Operation

A *lo-cutoff* control is used for the suppression of turntable rumble and vibration, and of any spurious low-frequency signals which may be caused by irregularities in the record; this control has four positions marked *0* for no cutoff, *40* for 40 cps cutoff, *60* for 60 cps cutoff and *80* for 80 cps cutoff. The rate of attenuation in the *40, 60,* and *80* positions is 12 db per octave. The *rumble* filter is entirely removed from the circuit in the *0* position.

The *hi-cutoff* control is used for the suppression of record scratch and high-frequency distortion. It has four positions; *3, 5, 9* and *flat*. A sharp cutoff of 12 db per octave is obtained starting at 3 kc in the *3* position, 5 kc in the *5* position and 9 kc in the *9* position, when the *compensator* con-

trol is in the *flat* position; when the *hi-cutoff* control is in the *flat* position, it is entirely removed from the circuit. The *hi-cutoff* control may also be used to reduce unwanted noise or distortion when the *compensator* control is in any position.

The *compensator* control provides electrically-correct playback characteristics for virtually all domestic and foreign recordings.‡ It adjusts automatically the bass and treble equalization in the playback system to the electrical-recording characteristics of the record being played; numerals on the panel indicate the number of db attenuation at 10 kc. When a recording is made, the high frequencies are preemphasized a certain degree, depending on the record manufacturer. For example, a manufacturer, recording under the *AES*[3] curve would preemphasize the high frequencies a total of 12 db at 10 kc. Therefore, when playing this record the compensator would have to be set at *12-AES*, thus attenuating the highs 12 db at 10 kc, and producing a resultant output which is fed to the amplifier substantially identical to the way it was picked up by the microphone in the recording studio.

In the *flat* position, the compensator is removed from the circuit; this feature is useful when it is desired to use the filter unit with some amplifying systems having their own *record-compensator* control. The position may be used to obtain maximum brilliance from records having very low surface noise and distortion.

For the 78-rpm English Decca, HMV, London, and other records having a 300-cycle bass turnover, there is a *EUR-78* position.

For most 33-rpm London FFRR records a *Lon LP* position is available. Some older London *lp* records employ a *COL LP*[4] characteristic. Checking London records on both positions will determine which should be applied.

Application

The *filter*, designed for use only with standard variable reluctance car-

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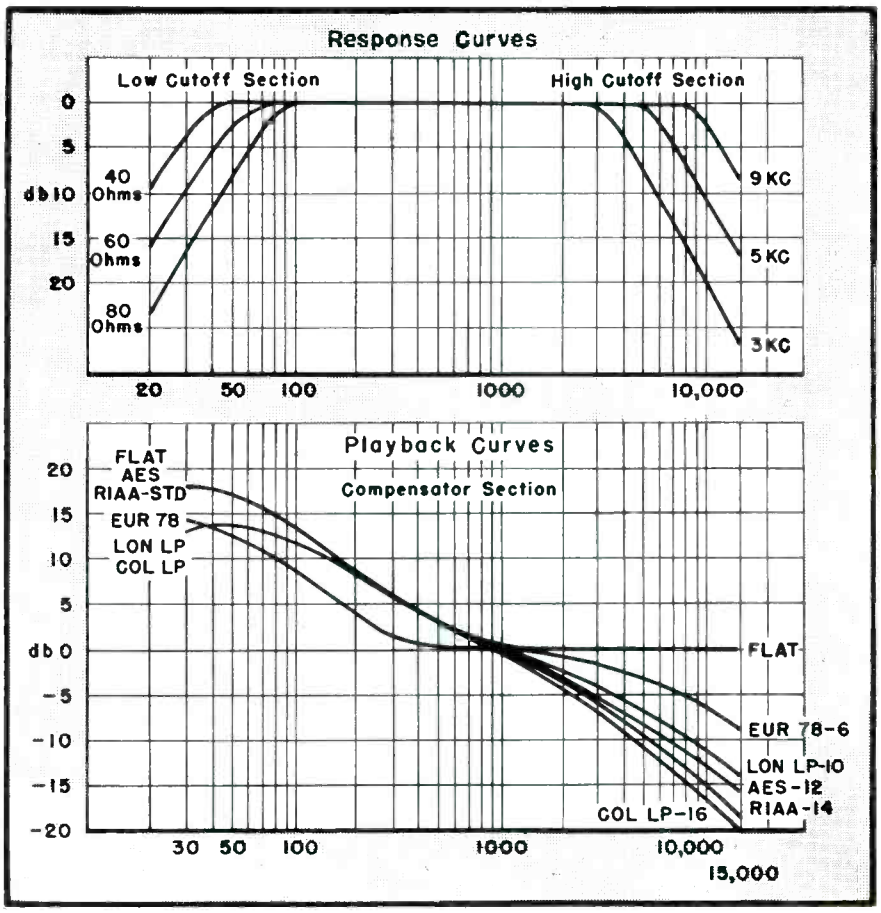
Fig. 2. Response and playback curves of filter.



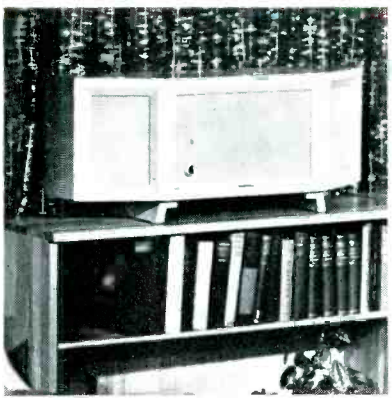
[3]The *AES* position establishes the old *AES* playback characteristic as proposed as a standard in '51 by the Audio Engineering Society.

[4]*COL LP*, the Columbia LP characteristic, was used in Columbia LP recordings and many other makes, until the recent adoption of the RIAA standard.

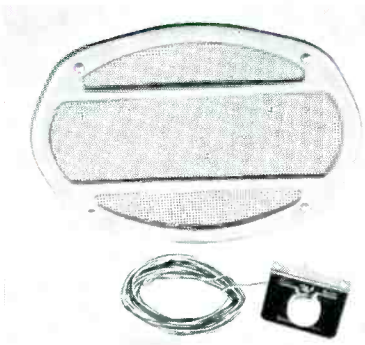
[5]*RIAA-STD* represents the recording-industry standard playback curve adopted early in '54 by the Record Industry Association of America. This standard is frequenly referred to as new AES, new NARTB and RCA-Ortho. Recent recordings of most manufacturers use RIAA.

‡*See p. 71 for listing of records and compensator positions.*

Latest in Audio

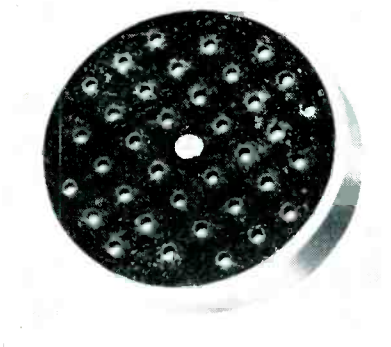


Three-way loudspeaker system with two tapered horn ports which load a coax-type low-frequency and mid-range reproducer from 70 to 3500 cps; very-high-frequency tweeter said to take over at 3500 cps to beyond audibility. Low-frequency and mid-range reproducer employs E-V Radax principle; large cone reproduces the lower frequencies and mechanical crossover is made to a smaller cone operating from approximately 1500 cps upwards. (Skylark; Electro-Voice, Inc., Buchanan, Mich.)

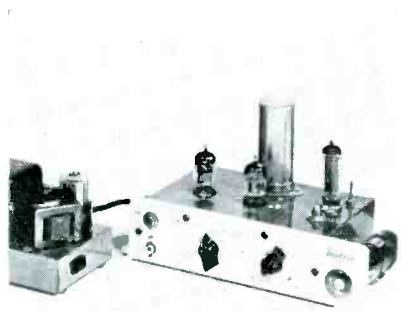


Rear seat speaker grille kit for car radios. Available in two sizes: 5" x 7" and 6" x 9". Battle plate and metal grille screen are finished in gray hammertone. Included in kit are baffle plate with screening, 15' of cable, hardware, and crossover switch for selecting front, rear, or both speakers. (Walsco Electronics Corp., 3225 Exposition Place, Los Angeles 18, Calif.)

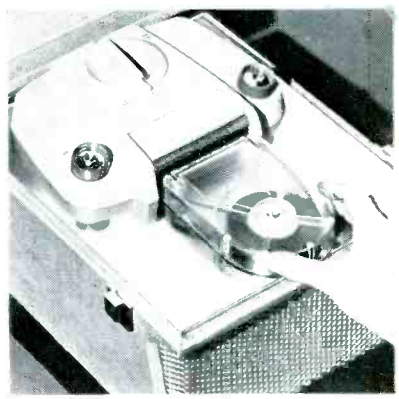
Portable wireless-intercom for home and office. Has a noise-silencing control said to reduce noise normally present on power lines. Can be used for small paging systems; any number of stations can be set up in the same system and all stations will receive any message transmitted by any one. (Mark Simpson Mfg. Co., Inc., 32-28 49th St., L. I. C. 3, N. Y.)



High impedance crystal tweeter that can be incorporated into plate circuit of output tube for wide-range response. Blocking capacitor in tweeter circuit is said to attenuate effectively the lower frequencies; frequency correction is in the form of a damping network tuned to resonant frequency of crystal, which damps resonance without decreasing sensitivity at other frequencies, is built into unit. Filter is an acoustic network. (Ronette Acoustical Corp., 135 Front St., N. Y. 5, N. Y.)



Tape preamp designed to provide disc amplification and playback preamplification as well as a bias/erase oscillator stage for Fen-Tone Tape-Deck. Consists of two separate chassis, one for preamp proper and the other for power supply interconnected with a 7-conductor cable. Has adjustable hum balance control. Features two high-impedance inputs; one for mike, and the other for phono, tuner, radio or amplifier tape output. Tubes used are 6E5, 6X5GTA, 6AQ5, 12AT7 and 5879. (TPR-1; Fenton Co., 15 Moore St., New York 4, N. Y.)



Clip-in tape magazine designed to eliminate threading and rewinding of magnetic recording tape. Fully-enclosed in magazine, tape is locked into playing position with, it is said, slight finger pressure. Magazine is automatically ejected from machine when the control knob is turned to eject. Tape is 300' long and reels in counter-clockwise direction. At end of 300' span a loop arrangement automatically transfers playback or recording to the opposite side. (American Molded Products, 2727 W. Chicago Ave., Chicago 28, Ill.)

(Left)

Replacement phono-cartridge in sealed-in-plastic 4 11/16" square package with identification interchangeability chart and instructions. (Blister-Pak; Electro-Voice, Buchanan, Mich.)

(Right)

Wall-mounted master station that may originate calls to five other master stations and accept and reply to calls from any number of similar stations. Has a privacy button. Available in flush-mount for recessing flush with the wall, where remodelling or new construction is contemplated, and surface-mount for simple installation on existing walls. (Model 6000; Executone, Inc., 415 Lexington Ave., New York 17, N. Y.)

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tridges[5], will not function properly with other makes of cartridges or with broadcast type cartridges.

The associated amplifier equipment must be equipped with an input connection designed for magnetic cartridges, and have the required bass equalization of about 17 db at 50 cps to provide RIAA (*standard*) bass equalization. Amplifier input sensitivity should be 10 *mv* for full output.[6]

Record Filter Output

The output of the record filter has been designed to plug into an input impedance of about 100,000 ohms or more, although operation is satisfac-

(*Continued on page 72*)

[6]A G.E. UPX-003A preamp may be used to obtain proper equalization.

[7]When the *filter* is used with the G.E. A1-200 preamp control unit, the selector switch on the filter should be left in the *flat* position.

Record Company	Compensator Position
Am. Rec. Society	RIAA-STD
Angel	RIAA-STD
Atlantic	RIAA-STD
Bach Guild	COL-LP
Bartok	RIAA-STD
Blue Note	AES
Caedmon	RIAA-STD
Canyon	AES
Capitol	AES
Capitol Cetra	AES
Cetra-Soria	COL-LP
Columbia	COL-LP
Concert Hall	RIAA-STD
Cook	RIAA-STD
Decca	RIAA-STD
Elektra	RIAA-STD
EMS	AES
Epic	RIAA-STD
Esoteric	RIAA-STD
Folkways	RIAA-STD
Good Time Jazz	RIAA-STD
Haydn Society	COL-LP
London	LON-LP
Lyrichord	RIAA-STD
MGM	RIAA-STD
Mercury	AES
Oceanic	COL-LP
Philharmonia	AES
Polymusic	RIAA-STD
RCA-Victor	RIAA-STD
Remington	COL-LP
Tempo	RIAA-STD
Urania	RIAA-STD
Vanguard	COL-LP
Vox	COL-LP
Westminster	RIAA-STD

Domestic and foreign records and their recording characteristics: The RIAA-STD position is recommended for virtually all discs recorded after May, '54. For most domestic 78 records, the recommended compensator setting indicated, should be used in conjunction with the desired setting of the hi cutoff control. For older domestic 78 recordings (before '42) compensator should be set at flat and the hi cutoff at 3 kc. For older foreign 78 records EUR-78 and hi cutoff should be used.

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tory with input impedances as low as 50,000 ohms.[7]

The insertion loss is zero when all controls are in the *0* or *flat* position. In this position, all circuit elements are disconnected. The *compensator* section introduces only the degree of loss that is required for proper equalization. At 1000 cps this variation is about ±1½ db above 100 cps. Insertion loss for the *hi-cutoff* section is zero.

The *AAC Audio Forum* is being 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 reports feature technical and merchandising information on amplifiers, preamps, 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.

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Audio Replacements

(*Continued from page* 58)

that is, if there is a resistor connected from a later stage to the top end of the cathode resistor. In the latter instance, the exact value must be retained, but in early stages of amplification replacement of the cathode resistor by one slightly higher or lower does not usually make noticeable difference to performance.

The plate-coupling resistor may usually be increased by one preferred value without detrimental effects, and in the case of low-level input stages, a value or two higher than the original may be acceptable.

In the case of pentodes, the screen-feed resistor may require replacing. This, too, may be higher in value, without any serious effects; except that an increase of the screen-feed resistor will reduce tube gain. If such a reduction in gain cannot be accommodated, then exactly the same value as the original should be sought or one must resort to an equivalent, built up out of more than one resistor.

The grid resistor in a stage is usually not very critical. A value up or

down from the original will not make serious difference. The exception here appears in phase-splitting stages, or any half of a stage operating in pushpull, where the two halves of the pushpull arrangement must be maintained identically. This is true of plate and cathode resistors in pushpull stages.

Most audio preamps have quite a number of resistors associated with the equalizer circuits. These circuits have been designed to give a specific frequency response according to one of the various established standards; use of wrong values in an equalizer circuit will invalidate the frequency response it is intended to give. Thus, any resistor connected with an equalizer circuit should be carefully replaced with a correct value, either as a single unit or by building it up from available values.

Resistor Values In Output

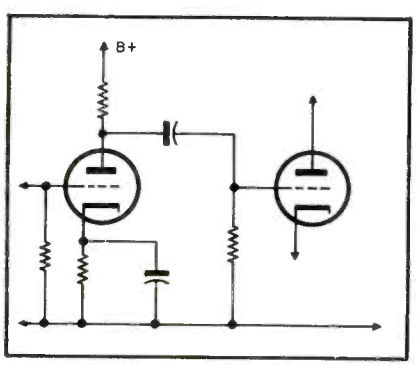
As we come toward the output end of audio equipment the importance of resistor values increases. A bias resistor in a output tube circuit is usually extremely critical, if nominal power is to be obtained from the output. For this reason, one finds very unusual resistor values in the bias circuit of output tubes; values as 230 or 240 ohms being quite frequently encountered. In the event of these resistors becoming defective, an effort should be made to replace them with precisely the correct value, either by obtaining exactly the right resistance, or by matching it up with two or more resistors connected together.

The only other resistors, usually associated with output stages, are the stopper resistors in the grid, plate and screen. Usually these are of quite nominal values (such as 100 ohms), so it is not difficult to replace them with their original value.

Finally there is the supply circuit. Here we usually have a variety of

(*Continued on page 74*)

Fig. 2. Typical triode stage at front end of audio amplifier. None of the components in this stage are highly critical, unless negative feedback is applied.



Audio Replacements

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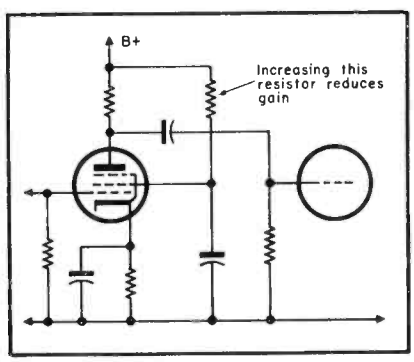
dropping resistors to obtain the required supply voltages for different points in the amplifier. Since these values have been carefully chosen to give the correct supply voltages, one must carefully replace these resistors, using precisely the same value, and with adequate wattage rating. Here it may be well to draw attention to a common error. If a 5-watt 2,000-ohm resistor is required, then two 4,000-ohm 3-watt resistors connected in parallel will give the correct value with a little margin on the dissipation. But, although a 2,500-ohm resistor, in parallel with a 10,000-ohm resistor will give the correct *value* of 2,000 ohms, if they each have a rating of 3 watts, the combined rating will *not* be 6 watts, because most of the current will pass through the 2,500-ohm resistor; so the rating of the combination will be not much more than 3 watts. Therefore, this combination would not be a satisfactory substitution for a 2,000-ohm 5-watt resistor.

Capacitor Replacements

Capacitors are about as liable to become defective as are resistors. In replacing capacitors we face the same questions: Will a nearby value do, or the same value, but of different voltage rating? The answer to this again depends upon the position of the component in the circuit.

It is probably wisest to assume that the voltage rating selected for the original is about the lowest safe one to use, although the reason may not always be obvious. Perhaps the capacitor has to be subjected to a higher-than-normal voltage during the warm-up period of the equipment, and hence a higher voltage than the operating voltage is required. Sometimes, it will be found that the manufacturer had

Fig. 3. Typical pentode front-end stage. Components here are little more critical than for the triode stage shown in Fig. 2.



not made allowance for this contingency and the capacitor has become defective because of excessive voltage during the warmup period. In this case, it becomes necessary to install a component with a voltage rating higher than the original to prevent the defect from repeating.

Values of capacitors, associated with cathode decoupling connected across the bias resistor of the earlier stages in an amplifier, are usually of a fairly common value, such as 50 mfd electrolytics; there is no serious problem here in replacement by using a component of precisely the same value. Coupling capacitors are usually not very critical, and a fairly common value is usually used in the original.

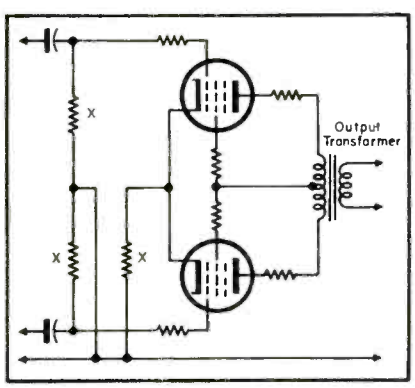
If the amplifier is of a feedback type, then the value of coupling capacitors is quite frequently somewhat more critical, to insure low-frequency stability. If a particularly unusual value is found in such a position, there is usually a good reason for it and care should be taken to install the same value in replacement.

Capacitors associated with equalizer circuits are usually of close tolerance value, to assure correct equalization characteristic; these capacitors are rather unlikely to become defective, and therefore it is not very likely that these will need to be replaced. The most likely defect that can occur here would be lead breakoff due to vibration.

Filter capacitors, used for smoothing the supply, are usually of standard values and can be replaced with precisely the same value as in the original. However, if the particular value is not handy, and one wonders whether a larger or smaller capacitance will serve, the following facts must be considered: If the input capacitor is involved (the one that immediately follows the rectifier), the original value is probably the largest one that can

(*Continued on page 76*)

Fig. 4. A typical push-pull output stage. The components marked X are critical for correct balance and operating conditions in stage.



Audio Replacements

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safely be used, without possible damage to the rectifier. A larger value capacitor is liable to result in high rectifier mortality, and a smaller one will result in increased hum level and possibly reduced B+ available. So this first filter capacitor has a value which is quite important. Other filter capacitors, following chokes or smoothing resistors, are not critical; generally, it is advantageous to use larger values, because this will result in further reduction of supply ripple on the B+ voltage. What is important with all supply-filter capacitors is that the voltage ratings, whether for electrolytics or paper types, must be adequate for the voltage at the point where they are connected; in particular, ratings must be adequate for the voltage which appears during the warm-up period, while the tubes are cold.

Any capacitors and resistors, associated with feedback loops have usually been carefully determined to give the best possible performance, in terms of square-wave response, frequency response, etc., and must be carefully replaced with their correct values.

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Audio Tips

(*Continued from page 55*)

changers, the following changes should be made (see explanatory illustration on page 54):

The idler wheel should be removed and the turntable speed selector moved to the 33⅓ position. A spring (*B*) should be installed in the position shown in the illustration. Spring (*A*) should be removed and discarded. Another spring (*C*) should be installed in the position shown using the mounting holes already provided.

Now the rubber idler wheel should be replaced and its position checked to make sure it is parallel to the changer base. If slanted up or down, the idler slide assembly should be grasped and carefully bent to place the idler in a position parallel to the base.

Speed Selector Setting

Finally, the speed selector should be set to *N*. Now the turntable can be replaced and the idler wheel guided to the inside of the turntable rim with a thin blade; the turntable should be spun as it seats into position. This is necessary to prevent the weight of the turntable from forcing the idler wheel out of its parallel position.

The springs listed will be supplied by the Magnavox service department

at no charge when needed for field modification.

If the modification does not reduce the rumble or *flutter* sufficiently, it will then be necessary to install a new motor.

Magnasonic Speaker Baffle Mounting

The speaker baffle in the Magnavox 251MX and 252MX differs from earlier versions of Magnasonic instruments in that shipping screws are no longer used. The baffle is now floating on rubber bushings at the sides, but is held rigid in the center by metal brackets at top and bottom. One should not remove these brackets as acoustical feedback may result.

Admiral Phono Troubleshooting Hints

If the phono sounds weak or distorted, needles should be checked for wear. A worn needle will cause excessive needle scratch and a harshness of treble tones.

Excessive hum can often be minimized by reversing the line cord plug in the wall output. A faulty 12AX7 tube will also cause hum.

Audio Instrument Checks

The amplifier can be checked for gain and frequency response by using the following tests using an audio oscillator, preferably with flat output from 20 cycles to 30 kc; an isolation transformer, with primary to secondary turns ratio of 1:1 (at least 65 watts) and a *vtvm*, preferably with a *db* scale.

In checking, amplifier is connected to isolation transformer secondary; isolation transformer goes to *ac* source. Record changer motor plug is then connected to socket on chassis; audio input plug is disconnected from socket on chassis. Tone arm should be unclamped from tone arm rest and *REJ-ON-OFF* pointer slid to *ON* position. (If record changer goes into change cycle and shuts off, pointer should be slid to *ON* position again.)

Use of Audio Oscillator

The audio oscillator ground lead should now be connected to common ground, pin 5 of 12AX7. Audio oscillator signal lead then goes to the audio input socket on chassis; allow several minutes for oscillator and amplifier to warm up.

Now one adjusts audio oscillator for .2 volt at 1.000 cycles input to audio input; measured with the vacuum-tube voltmeter from input point to common ground. This voltage calibration must

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Audio Tips

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be made every time a response check at a new frequency setting is to be made. Output across voice coil leads should be measured from output transformer with speakers connected.

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Service Engineering

(*Continued from page 52*)

the parts wiped with a cloth. Electrical contacts should be cleaned with a cloth moistened with carbon tet; then wiped dry with a dry cloth.

If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places.

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Component Sales Programs

Preview of display card designed by Littelfuse for jobbers. Left to right: Herb Cornelius, Littelfuse sales manager; Walt Clements, sales engineer; Joe Reuter, purchasing agent, and Mel Brown, president and owner of Melvin Electronics, 541 W. Madison St., Oak Park, Ill.

R. A. Elliot (left) manager, distributor division, Erie Resistor Corp., and Campbell Rutledge, Jr., general sales manager, new products division, Corning Glass Works, looking over agreement noting that Erie would market through parts distributors Corning's line of fixed glass capacitors; direct traverse and midget rotary glass trimmer capacitors; and various types of precision and high power glass resistors.

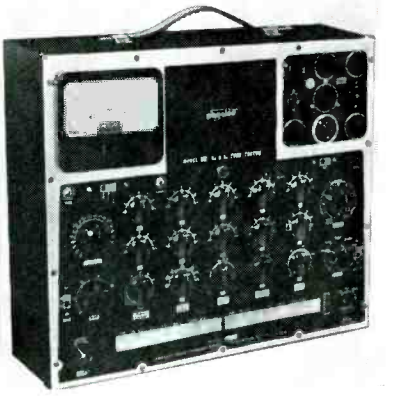
Rep Talk

WALLY B. SWANK, president of The Reps, has appointed a professional services committee consisting of *Norm Neely* (laboratory and industrial equipment), *Leory Beier* (industrial components and materials), and *Dan Bittan* (distributor products). . . . *Moulthrop and Hunter* have moved to 165 11th St., San Francisco 3, Cal. . . . *Ron Merritt Co.*, 120 W. Thomas St., Seattle, Wash., has been named to rep Browning hi-fi tuners in the Pacific Northwest. . . . Clear Beam Antenna Corp. has appointed *Jules J. Bressler*, 4808 Bergenline Ave., Union City, N. J., to rep for the company in metropolitan New York, Long Island and northern New Jersey. . . . *Don V. Hamilton and Co.*, Minneapolis, Minn., has become industrial and jobber rep for Pyramid Electric Co. in Minnesota, N. Dakota, S. Dakota and western Wisconsin. . . . *H. F. Winkeler* has joined L. F. Waelterman Co. as head of their Kansas City, Mo., office, 3405 E. 55th St. . . . Radio Receptor Co., Inc., semi-conductor division, has named Inter-State Radio and Supply Co., 1200 Stout St., Denver, Col., to rep its products in Colorado. . . . *Martin Mann Associates*, 8346 Beverly Blvd., Los Angeles, Cal., will rep in southern California for RAM Electronics Sales Co. . . . The Hoosier chapter has chosen the following '55 officers: *Joseph Clancy*, president; *Charles N. Hoemig*, vice president; *James Thomas*, secretary; and *Walter Bieberich*, treasurer. . . . California chapter has elected *Philip A. Belchamber*, president; *Sherwood P. French*, vice president; and *Harold L. Newman*, secretary-treasurer. . . . *Lloyd S. Lund*, president; *John B. Guenther*, vice president; *Hal F. Corry, Sr.*, secretary; and *Mrs. Delores Smith*, treasurer are the new officers of the Southwestern chapter. . . . New England chapter named *Henry Lavin*, president; *P. H. White*, vice president; *Michael A. Scott*, secretary; and *Irving Gerber*, treasurer. . . . Buckeye chapter has distributed more than 1,700 copies of its '55 buyers' guide. . . . *Bee Sales Co.*, 4200 Sherry Lane, Dallas, Tex. (Texas, Louisiana, Oklahoma and Arkansas); *David Ellis Co.*, 91 E. Foothill Blvd., Altadena, Cal. (southern California, Arizona and Las Vegas, Nev.); *International Buyer Service*, 217 Bond Bldg., Washington 5, D. C. (Cuba); G. E. Lewis, Inc., 5420 W. Fullerton Ave., Chicago 39, Ill. (Illinois, Wisconsin and Minnesota); *Ed Lips*, 1565 McFarland Rd., P. O. Box 8046, Pittsburgh, Pa. (Ohio, W. Virginia and western Pennsylvania except metropolitan Pittsburgh); *Active Radio and TV Distributors*, 58 Spadina Ave., Toronto, Ont. (Canada); *H/V Associates*, 136 Liberty St., New York, N. Y. (New York and New Jersey down to Trenton); and *Ward Paden Co.*, Box 569, Jefferson City 1, Mo. (Missouri, Kansas, Iowa and Nebraska) have been appointed reps for Fretco, Inc. . . . Peerless Products Industries, have named *Ray R. Hutmacher Associates*, Inc., Chicago, Ill., to rep its products in Illinois and Wisconsin. . . . *Don V. Hamilton and Co.*, 6516 Normandale Rd., Minneapolis 10, Minn., have been appointed Oxford Electric reps in N. and S. D., Minn., and northwestern Wisconsin.

Instrument Developments

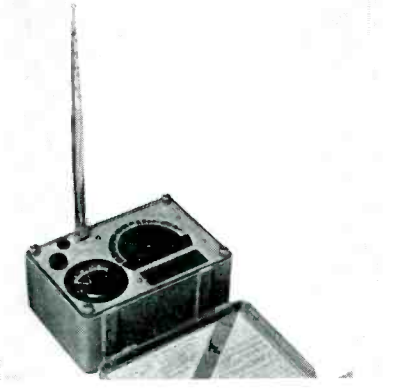
(Left)
Color TV pattern generator producing from one to eight rainbows on face of color tube. Serves as a demonstrator and a servicing tool. Modulated rf output is provided on channels 2 to 6, or chroma signal output at same output terminals. Has channel tuning and rainbow selector controls. Service applications include adjustment of reference oscillator, master phase control and color demodulator phases, matrixing and chroma circuit gains. May also be used to test and align chroma circuits in either I/Q, R-Y, or B-Y systems. (Model 150; Winston Electronics, Inc., 4312 Main St., Philadelphia 27, Pa.)

(Right)
Tube tester (kit or factory-wired) for checking both emission and mutual conductance. Provides voltage sapper, gas and simplified short checks. (Model 111; Precise Development Corp., Oceanside, L. I., N. Y.)

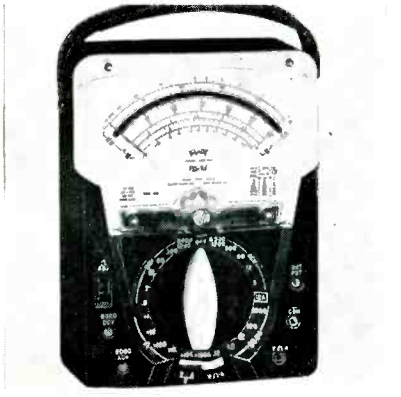


Portable 3" 'scope featuring unitized circuit construction. Circuit sections are replaceable individual units. Features dc amplifiers, compensated vertical and horizontal attenuators. 'Scope tube inclined at 20° angle with retractable light shield. Frequency ranges: Vertical amp . . . dc to 4 mc; horizontal amp . . . dc to 500 kc, and sweep oscillator . . . 3 cps to 50 kc. Input impedance of vertical and horizontal amp is 2.2 megohms at 25 mmfd. (Model 385; Hickok Electrical Instrument Co., 10521 Dupont Ave., Cleveland 8, Ohio.)

TV tube reactivator designed to analyze performance characteristics, locating and removing interelement shorts, repairing open elments, welding open filament circuits and restoring emission. Dynamic sweep between cathode and grid removes gas ions and stale emitting material from cathode surface. Life test function is said to provide information on approximate life expectancy of tube. May be used without removing picture tube from cabinet. (Vitameter; Electronic Test Instrument Corp., 13224 Livernois Ave., Detroit 38, Mich.)

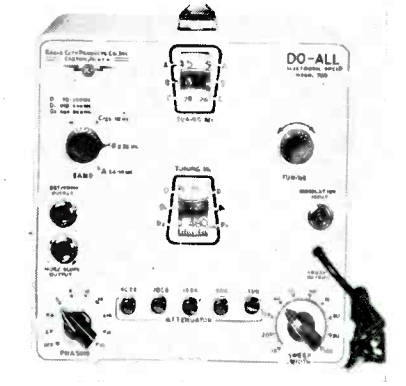


Field strength meter designed to provide indication of relative field strength and approximate frequency (within 5%) within 100-400 mc band. Has a six-section telescoping antenna, carried in the cover. A 90° joint at base of antenna permits it to be extended horizontally or vertically with case placed either with the control panel in a horizontal or vertical position. Tuning knob adjusts butterfly-tuned circuit to desired frequency. Meter is a 50-microampere, hermetically-sealed unit. (Model H-W509; Harvey-Wells Electronics, Inc., Southbridge, Mass.)



(Left)
A volt-ohm-mil-ammeter, with 70 ranges and frequency compensation up to 20 kc, for readings over audio range. Unit accuracy said to be 1½% dc to 1,200 v and 3% ac to 1,200 v. Features temperature compensation. Has double-wiping contact switches and banana plugs. (Model 630-NA; Triplett Electrical Instrument Co., Bluffton, Ohio.)

(Right)
TV sweep generator for checking community antenna systems and aligning front end circuits. Has a 34-mc sweep width; amplitude linearity within 2db at 54 to 88 mc. Features continuous tuning, triple-shielded attenuator with push-button fixed positions and additive combinations. (Model 780; Radio City Products Co., Inc., Centre and Glendale Sts., Easton, Pa.)



Associations

RTSA

THE ANNUAL SPRING convention of NATESA, with the Radio Television Service Association of Western New York, as hosts, was held recently in the Statler Hotel, Buffalo.

At a special service clinic, transistors, printed circuits and color TV were discussed.

The occasion was highlighted by a proclamation issued by the Mayor of Buffalo proclaiming the weekend, when the meeting was held, as *Television-Radio-Electronic Service Days.*

In issuing the proclamation, the Mayor said that . . . "independent service has been indispensable in advancing the television industry, both as a medium of education and of entertainment; and in addition, the television, radio and electronics industry plays an important part in the life of our community. . ."

* * *

TSDA

THE MONTHLY MEETING of the Television Service Dealers Association of Philadelphia, featured a talk by *Charles Knoell,* association prexy, on a membership drive.

Commenting on the program, he said that only through . . . "a larger and stronger trade association can we meet our problems on an equal footing. Our voice will then be louder and our greater strength and potential buying power will be something that the other segments of the industry will recognize."

To spark the drive, the membership committee, under the chairmanship of *Charles Settle,* has prepared a series of mailing pieces that will be sent out every ten days.

In one of the circulars, TSDA emphasized that their trade group had been formed to combat unethical practices and discourage anything that would hurt any member. . . . As a group, the association continued, they are able to meet, arrange and attend functions where they have the opportunity to question and listen to important people who are able to help them.

Stressing the need for associations, the group pointed out that those who are not association members should stop being lone rangers and . . . "get busy and start the ball rolling in the right direction."

* * *

TRT

THE TELEVISION AND RADIO TECHNICIANS Association of Kansas City, Missouri, recently offered during its panel of lectures a talk on color bar generators by *L. A. Betros* of the Central Technical Institute.

At the award luncheon of the Federation of Radio Servicemen's Association of Pennsylvania, during which the FRSAP plaque was given to ye ed. **At the head table, left to right:** Charles Knoell, **FRSAP vice prexy;** Art Guild, **one of the founders of the state group;** L. B. Smith, **treasurer of the group;** ye ed; Bert Bregenzer, **association prexy;** Leon Helk, **secretary of the association; and** Harold Schulman, **chairman of the service committee of RETMA and assistant to president, CBS-Columbia, who was a guest speaker. In foreground, delegates from chapters in Philadelphia, Pittsburgh, Altoona, Harrisburg, Chambersburg, Reading, Wilkes-Barre, Ephreta, Williamsport and Scranton.**

RTG

AN EXCELLENT review of the license bills now pending or in existence, appears in the current issue of the *Guild News,* published by the Radio and Television Guild of Long Island. Prepared by *Jack Wheaton,* the report comments on the ordinance now in force in Wisconsin, and those up for consideration in Utah, Louisiana and New York.

Wheaton reveals that the Wisconsin bill, set up to ". . . provide minimum regulations to insure safety to persons and property, safe and stable design and good workmanlike methods of construction . . ." offers three licenses: Radio and TV technicians (all electronic devices); sound technicians (limited to devices operating within audio range); and radio and TV dealers. In the Utah measure, according to Wheaton, licenses would be issued to service contractors, service dealers, TV-radio technicians and TV radio apprentices. The Louisiana approach provides for licenses to a technician (class B, specialty type), technician (radio and TV, class A; applicants must be qualified for radio and TV, public address and intercom servicing), industrial electronic technician, and medical electronic technician.

The New York bill stipulates that licenses would be issued to TV service contractors, TV service dealers, TV service technicians and TV service apprentices. The latter would be issued as a permit.

* * *

IRTSA

B. F. O'CONNELL has been elected president of the Indian Head Radio-Television Servicemen Association of Northwestern Wisconsin.

Others named include: *Earl Kratch,* vice president; *Upton C. St. Clair,* secretary; and *Sherwood Stolp,* treasurer.

Serving now on the board of directors are *Charles Steimke* and *Rudy Frick.*

* * *

RATET

A SERIES OF lectures on color, test equipment and antennas has been scheduled by the Radio-TV Electronic Technicians Association of New York City.

Participating manufacturers include Zenith, JFD, RCP and Sylvania.

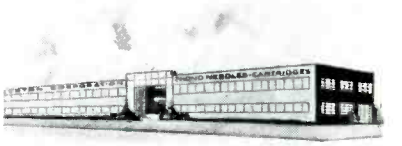
TEN YEARS AGO IN SERVICE

MISREPRESENTATIVE, BAIT-TYPE inspection-checkup advertisements, appearing in newspapers and direct-mail circulars, were sharply criticized by associations; the practice was described as one which destroys faith in Service Men. A general cleanup program was proposed. . . . Plans for general reconversion and production of tubes and parts were announced. . . . A projection-TV receiver, providing a 3' x 4' image, was demonstrated by DuMont. . . . *Julius Haber* was appointed assistant direcor of the advertising and sales promotion department of the RCA Victor division. . . . *Harold D. Desfor* was named director of the advertising and sales promotion department of radio and electronics were outlined in a booklet by Brig. Gen. *David Sarnoff,* RCA president. Gen. Sarnoff suggested that the *electronizing* of industry might prove to be an attractive occupation. . . . A pinup chart of recommended tube types was released by Sylvania. . . . *Charley Golenpaul* celebrated his fifteenth year with Aerovox. . . . Wire-recording magazines, providing one hour of recording-playback, were demonstrated.

NEWS

RECOTON EXPANDS

Recoton Corp., manufacturer of phono needles, cartridges and phono accessories, has moved into a new plant at 52-35 Barnett Ave., Long Island City, N. Y.



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C-D CELEBRATES 45TH ANNIVERSARY; OPENS WEST COAST PLANT

The 45th anniversary of Cornell-Dubilier Electric Corp. was highlighted recently by the opening of a new C-D west coast division plant at 4144 Ocean Park Boulevard, Venice, Cal.

Dr. Lee de Forest received a bronze bust for his contribution to the advancement of the industry, during an evening ceremony at the celebration.

The C-D organization was represented at the opening by Octave Blake, president; William Dubilier, vice president in charge of research and development; Haim Beyer, executive vice president; Paul McK. Deeley, vice president in charge of plants; and William M. Bailey, vice president and chief engineer.

Cornell-Dubilier has a network of 14 wholly owned and operated manufacturing plants.

* * *

WALSCO NOW DIVISION OF TELAUTOGRAPH

The Walsco Electronics Corp. has become an associated division of TelAutograph Corp.

The operation of the firm will continue under the direction of Walter L. Schott, as president. There will be no change in personnel.

Louis R. Kurtin (left), chairman of the board of TelAutograph, and Walter L. Schott, Walsco president.

MILLER TELEVISION NAME CHANGE

Miller Television Co., 2840 Naomi St., Burbank, Cal., has announced change of the company's name to *Miller Electronics.*

Company recently entered the magnetic recording field and is now producing pre-recorded magnetic tape under the trade name *Tune-Tape,* raw magnetic tape, *Hollywood Recorda-Tape,* and a phono-tape recorder which operates on existing record players.

* * *

RAYTHEON TUBE PROMOTION

A receiving tube promotion program, featuring tube caddies, has been announced by the Raytheon Manufacturing Co., Newton 58, Mass.

Caddy holds more than 200 tubes, plus tools, and features movable partitions in bottom compartment. Tube type numbers are in full view. Case has lock-cornering, luggage styling.

•

VACATION CONTEST PRIZES

Peter Hagedoorn, president of the Jersey Specialty Co., assembling a partial group of the prizes in the Time of Your Life Vacation contest, recently announced for Service Men and distributors. Contest ends August 10th.

PACE MOVES TO LARGER QUARTERS

Pace Electrical Instrument Co., Inc., meter manufacturing division of Precision Apparatus Co., Inc., has moved into the new Precision plant at 70-31 84th St., Glendale 27, N. Y.

* * *

WESTON MERGES WITH DAYSTROM

Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark, N. J., has been merged into Daystrom, Inc.

Weston operations will be continued under same management and personnel as at present. The Weston name will be retained on its products.

* * *

INSTRUMENT SALES OPENS WISCONSIN OFFICE

Instrument Sales Co., 3947 Lawrence Ave., Chicago, Ill., has established an office at Genoa City, Wisc., to handle sales.

•

CAPACITOR SWING BIN

Plastic and metal Swing Bin which contains 90 Blue Point molded plastic tubulars of 18 different values, with a maximum of 5 of each type, announced by Astron. Clear plastic construction provides for visual stock control. Bin can be attached on wall or under work bench; each of 6 bins individually swing out 180°.

Coming Events —

May 16-19: The Electronic Parts Distributor Show. Conrad Hilton Hotel, Chicago, Ill.

June 6-7-8: The Community TV Association Conference. Park-Sheraton Hotel, N. Y. C.

WHEN YOU CHANGE YOUR ADDRESS

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

TV Parts... Accessories

TRANSVISION TV CHASSIS KIT

A TV chassis, kit, *E1*, designed so color TV may be added, has been announced by Transvision, Inc., New Rochelle, N. Y. Available in 17", 21", 24", and 27" sizes, with remote control as an optional feature.

* * *

MICROTRAN AUTOMATIC LINE-VOLTAGE STABILIZER

An automatic line-voltage stabilizer, *LVS-153*, that is claimed to maintain output line voltage at 115 *v* ± 3% over an input voltage range of 95 to 125 *v*, has been introduced by Microtran Co. Div., Crest Laboratories Inc., 84-11 Blvd., Rockaway Beach, N. Y.

Automatically turns on and off with TV set or appliance; covers wattage range from 100 to 300.

VIDAIRE ILLUMINATED CHANNELITE

A lucite pilot-light dial-plate assembly, *DL-10*, for Standard Coil tuners, has been introduced by Vidaire Electronics Manufacturing Corp., 576 W. Merrick Rd., Lynbrook, N. Y.

Unit features long lead for clipping on to filament pin of 6.3 *v* octal tube.

* * *

ROGERS REPLACEMENT FLYBACK TRANSFORMERS

Replacement flyback transformers, *EFR-148*, for early Zenith TV sets, have been developed by Rogers Electronic Corp., 43 Bleecker St., New York, N. Y.

Transformer, which is said to incorporate improvements correcting faults found in original part, can be installed without drilling. Packaged individually with schematics.

PEERLESS TV LAMP

An indirect light, *Modern TV Lamp*, for illuminating the TV viewing area, has been introduced by Peerless Products Industries, 812 N. Pulaski Rd., Chicago 51, Ill.

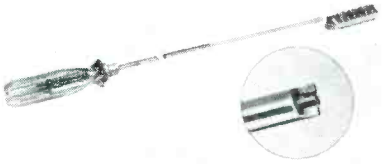
Lamp features a fiberglas shade and gold-finish base with a thick felt pad.

* * *

G-C TUNING SLUG RETRIEVERS

Tuning slug retrievers, *9096-7*, designed to recover tuning slugs on oscillator coils of channel strips used in Standard Coil tuners, have been developed by General Cement Manufacturing Co., 919 Taylor Ave., Rockford, Ill.

Tools, 12" and 15" long, fit wide-slotted slug and deep-seated tuning units. Can also be used to reclaim screws and start set screws in hard-to-get-at spots. Tools have alloy blades and Tenite handles.



RADIO RECEPTOR CLIP-TYPE RECTIFIER

A snap-in type rectifier, *Qui-klip*, featuring a clip arrangement which requires no tools for assembly, has been announced by Radio Receptor Co., Inc., 240 Wythe Ave., Brooklyn, N. Y.

Unit is said to need only two round holes for snapping into position. Solderless connectors are available to make electrical contact.

•

AEROVOX INSULATED CARBON 2-WATT RESISTORS

A 2-watt insulated carbon resistor, *1099*, has been introduced by Aerovox Corp., New Bedford, Mass.

Unit is said to have a safety factor nearly twice as great as conventional 2-watt carbon resistors. Available in same values, tolerances and markings as ½ and 1-watt types.

•

CONDENSER PRODUCTS POLYSTYRENE CAPACITOR

A high-insulation resistance polystyrene capacitor, for use as a charge storage capacitor and capacitance divider, has been developed by Condenser Products Co., Div., New Haven Clock and Watch Co., 140 Hamilton St., New Haven, Conn.

Capacitor, except for studs and aluminum foil winding, is completely plastic.

•

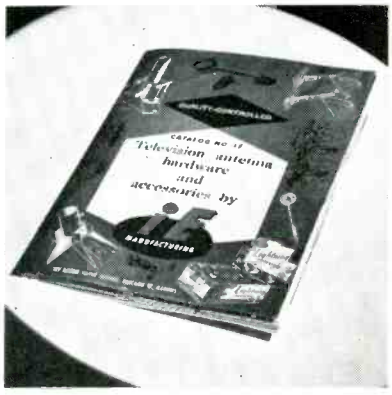
AT IRE CONCLAVE

Howard Orcutt, (left) chief engineer of the rectifier division of Pyramid Electric, chatting with engineers John Hultquist and Carl Osborn at a company cocktail party held during recent IRE show in New York.

AUTO-ANTENNA FLEXIBILITY TEST

Larry H. Kline, general sales and merchandising manager of Ward Products, demonstrating flexibility of the Dura-ramic fiberglass auto antenna, now in production at Ward. The aerial, available in six colors—red, blue, yellow, white, brown, and green—comes in front mount, rear mount, and twin rear mount models.

TV ANTENNA HARDWARE CATALOG



TV antenna hardware catalog describing indoor and outdoor antennas, antenna and chimney repair kits, TV detents, safety cords, and aerosol spray paints. Includes details on chimney, roof, wall, vent pipe and eave mounts, standoffs, ground rods, tubing, and other related TV hardware. (No. 17 (32 pages); Ie Manufacturing, 325 N. Hoyne Ave., Chicago, Ill.)

Bench-Field Tools . . .

ADCOLENE SQUEEZABLE LIQUID DISPENSERS

Squeezable liquid dispensers, *Adcolene,* featuring adjustable spouts, flexible tips and interchangeable nozzles, have been announced by Electronics Division of Aids Development Co., Inc., 1194 Croyden Rd., Cleveland 24, Ohio.

One unit, *Sqeezi-Aid,* has been designed to clean contact and controls; tuners and controls can be serviced while chassis is in cabinet. Also available is *Nu-Aid,* with interchangeable nozzle, spouts and brush attachments, used for lubricating, cleaning and servicing record changers, mechanisms and radio-TV chassis.

Both have controlled flow.

* * *

MUELLER MINIATURE ALLIGATOR CLIPS

A miniature alligator clip, *Mini-gator,* for use with No. 20 or smaller wire, has been developed by Mueller Electric Co., 1573 E. 31 St., Cleveland 14, Ohio.

Unit, $1\frac{1}{16}$" long with 11/64 *od* nose, is made in both cadmium plated steel and solid copper. Separate insulators of high-dielectric vinyl plastisol are available in both red and black. Features jaw opening to $\frac{5}{16}$", and slotted tips to keep nose and teeth covered on all outside surfaces.

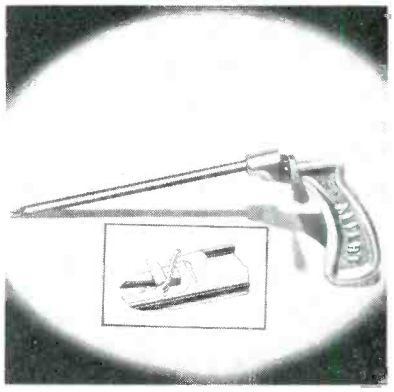
ADVERTISERS IN SERVICE

MAY, 1955

ALPERT ROTO-CUTTER

A wire-cutting and trimming tool, *Roto-Cutter,* designed to reach chassis areas inaccessible to standard diagonal cutters, has been announced by Alpert Manufacturing Co., 2873 N. Holton St., Milwaukee, Wisc.

Unit, ¼" in diameter and 6" long, features rotary shearing action. Cuts copper wire up to 14 gauge.



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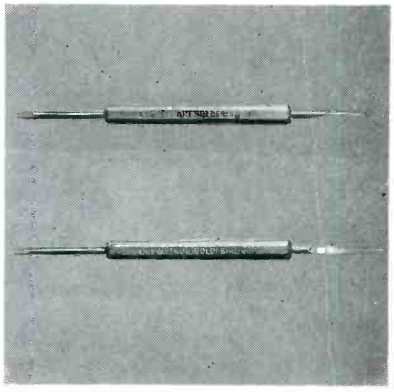
CBS-HYTRON SOLDERING AIDS

Two hexagonal-handled soldering aids (*SH20A,* straight reamer tip or *SH20B,* angled tip) have been introduced by CBS-Hytron, Danvers, Mass.

Units feature flat-sided handles and fork tips. May be used to probe, scrape, separate and position wires, lugs and contacts, grip wire to be soldered, guide it through and around lug and hold it in place for hot iron. Both reamer and fork tips are insulated from handle.



* * *

KENRU FUSED OUTLET BOX

A portable, multiple-electric outlet box, *Safcorde,* that features fused leads, has been developed by The Kenru Co., Box 121, Parsippany, N. J.

Three models are available: *IW-1,* rated at 1,200 watts, has switch that provides control without pulling individual cords, six heavy duty outlets, pilot light and 10-amp fuses. *IW-11* has two outlets which are always hot and not controlled by switch, and *W-111,* rated at 1,800 watts, for either 120 or 240 *v* operation, contains eight outlets without switch or pilot light.

* * *

WILLIAMS ADJUSTABLE WRENCH

A self-locking adjustable wrench has been announced by J. H. Williams and Co., 400 Vulcan St., Buffalo 7, N. Y.

Unit is said to offer rapid adjustment and positive lock. Available in 8", 10" and 12" sizes, ranging in capacity from 0 to 1 5/16".

JOTS AND FLASHES

PORTABLE RADIO sales will jump ten per cent this year, rivaling the clock radio as the second most popular type manufactured. So forecast *Robert Windt,* CBS-Columbia sales manager for radio, recently. His prediction, which anticipates that close to 1,700,000 portables will be sold in '55, was based on a nationwide survey. . . . The public relations and advertising committee and the sales managers committee of RETMA recently reviewed plans for a cooperative nationwide merchandising campaign to be held during *National Radio and Television Week* beginning Sept. 18. The association also disclosed that they are considering the sponsorship of a *Golden Jubilee of Electronics* in '56; this event would mark the 50th anniversary of the invention of the grid audion by *Dr. Lee De Forest.* . . . A series of TV forums, that it is expected will be held in every major TV area in the country, has been inaugurated by RAM Electronics Sales Co., Irvington, N. Y. Meetings will feature talks by *Albert Friedman,* product development engineer, covering the troubleshooting of high voltage sweep and deflection circuits, theory and application of sweep circuits, relation of monochrome sweep circuits to color and repair and service techniques and hints. . . . The TelAutograph Corp. has appointed *R. G. Leitner* to the post of chief engineer. . . . A 15-minute color film on antennas and allied products has been produced by Walsco. . . . The Espey Manufacturing Co., Inc., 528 E. 72nd St., New York 21, N. Y., has opened a 105,000-square foot plant in Saratoga, N. Y. . . . All of the voting stock of the Freed Electronics and Control Corp. was acquired recently by Fairchild Camera and Instrument Corp. Freed will hereafter operate as a subsidiary of Fairchild. . . CBS-Hytron has changed its brand name to CBS. . . . *Irving P. Wolfe* has purchased the entire inventory and assets of Mattson's, Inc., 519 W. Broad St., Richmond, Va., from *Carl E. Mattson.* New corporation will operate under the name of Mattson's Electronics, Inc. Officers of the new corporation are: *Kenneth A. Minter,* president; *F. Hugh Garnett,* vice president; and *Wolfe,* secretary-treasurer. . . . Radio Receptor has taken a five-year lease on a newly-completed $750,000 factory building at 80 N. 5th St., Brooklyn, N. Y. . . . The battery committee of National Electronic Distributors Association has announced that the '55 NEDA Battery Index will be available in May.

P.R. MALLORY & CO. Inc.
MALLORY
APPROVED PRECISION PRODUCTS

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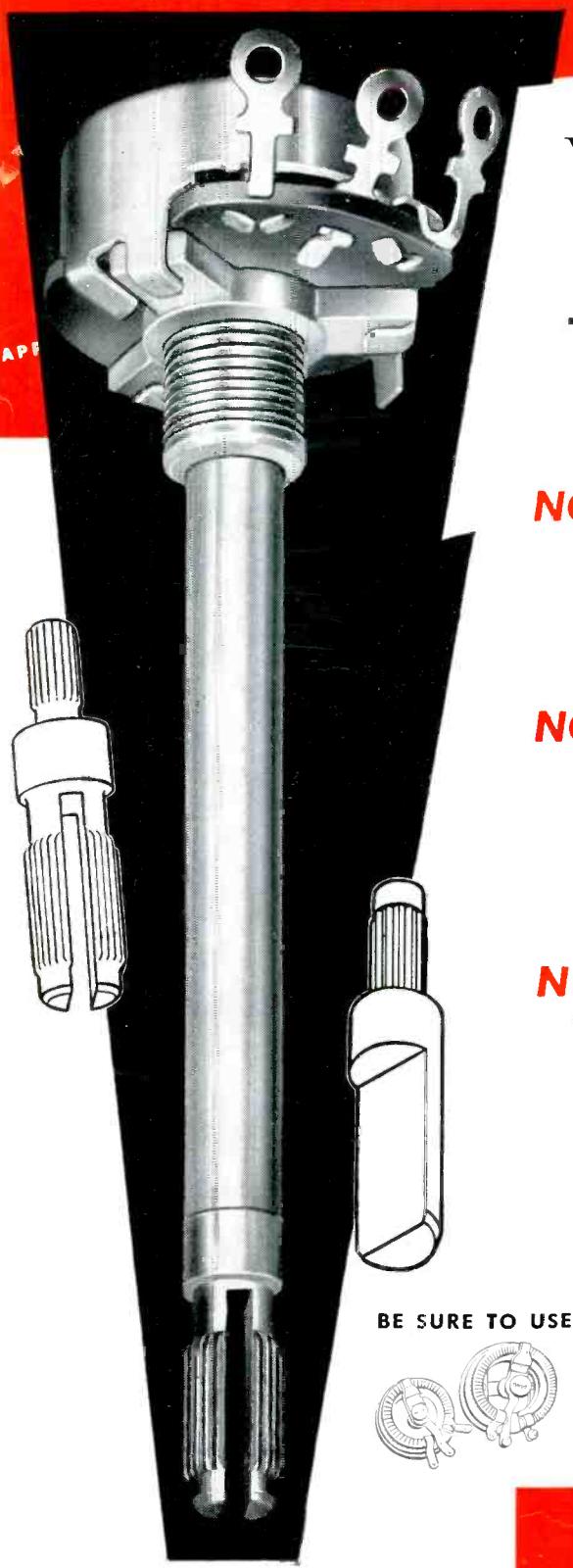


Your customers will like Mallory Midgetrols® —and so will you

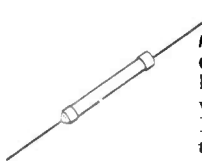
NO FUSS—Midgetrols cut replacement time to minutes. The round, tubular shaft is simple to cut to exactly the length you need . . . and it's easily adapted to split-knurl, flatted or set screw type knobs. Attaching an AC switch is a cinch, without taking the control apart.

NO KICK-BACKS—Midgetrols give your customers the long, trouble-free service that makes lasting friends. You can count on them for performance that equals or exceeds that of original equipment, because they're engineered to provide accurate resistance, superior stability, in any radio or TV set . . . in any climate.

NO DOUBT ABOUT IT—Midgetrols save you time and money. Your local Mallory distributor is ready to supply a special Mallory Control Kit that will set you up to service more than 50 models of radio and TV sets. You'll get a stock selected on the basis of set popularity in your own area . . . plus a free metal storage cabinet. Call your Mallory distributor today, or write to P.O. Box 1558, Indianapolis, Indiana.

BE SURE TO USE . . .

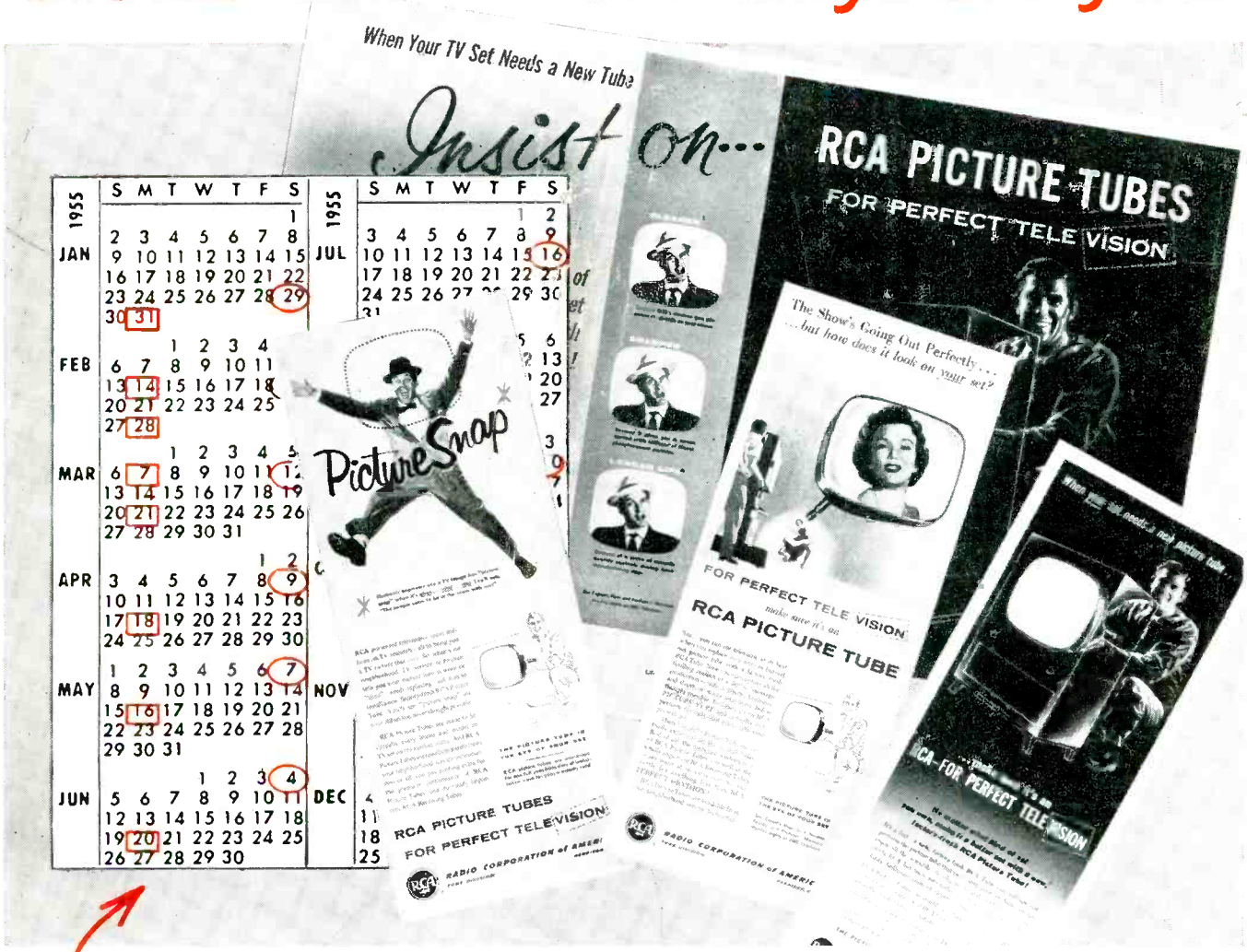
MALLORY POWER RHEOSTATS . . . vitreous enamelled, in ratings from 25 to 500 watts, with exclusive hinged contact arm for positive contact.



MALLORY DEPOSITED CARBON RESISTORS . . . high stability resistors with tolerances of 1% or 10% . . . at lower cost than wire-wounds.

P.R. MALLORY & CO. Inc.
MALLORY
CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS
RECTIFIERS • POWER SUPPLIES • FILTERS • MERCURY BATTERIES
APPROVED PRECISION PRODUCTS
P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

"Red Letter" days for RCA mean "BIG BUSINESS" days for you



Here's how RCA is telling Mr. & Mrs. America about RCA Picture Tubes in LIFE . . . in TV GUIDE

RCA consumer ads are reaching 30,000,000 prospective TV replacement tube buyers, over and over again in 1955—many of them are *your* customers and prospective customers.

And here's why more and more TV technicians find RCA Picture Tubes are fast becoming their easiest-selling and largest-volume line of replacement picture tubes:

- Premium performance at no extra cost
- Full 12-month warranty to consumer
- Hottest consumer ad program in the industry

To minimize call-backs—to assure your customer of premium-performance, install a new RCA Picture Tube whenever replacement is indicated.

RADIO CORPORATION of AMERICA
TUBE DIVISION HARRISON, N. J.