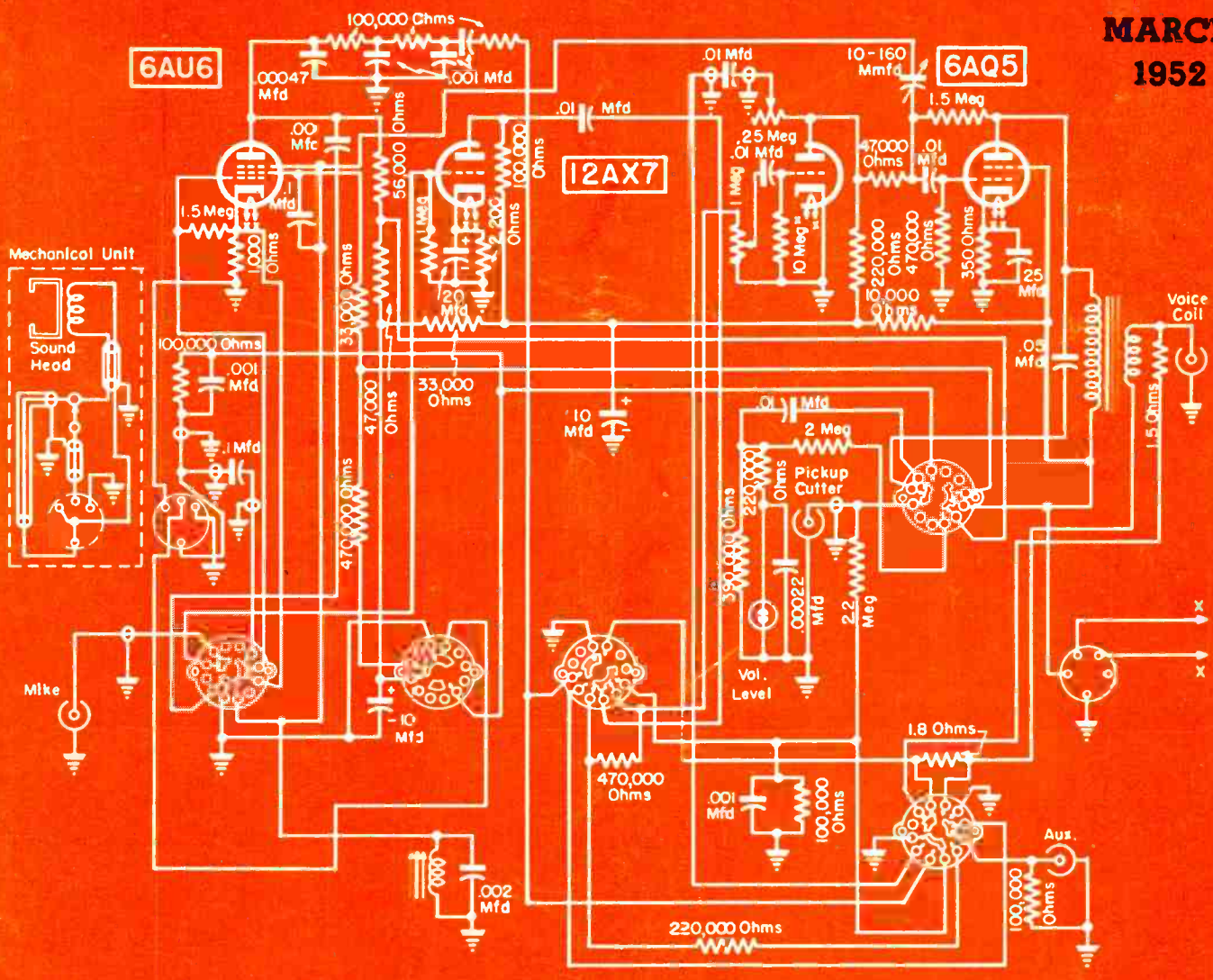
RADIO · TELEVISION · ELECTRONIC

SERVICE

MARCH
1952

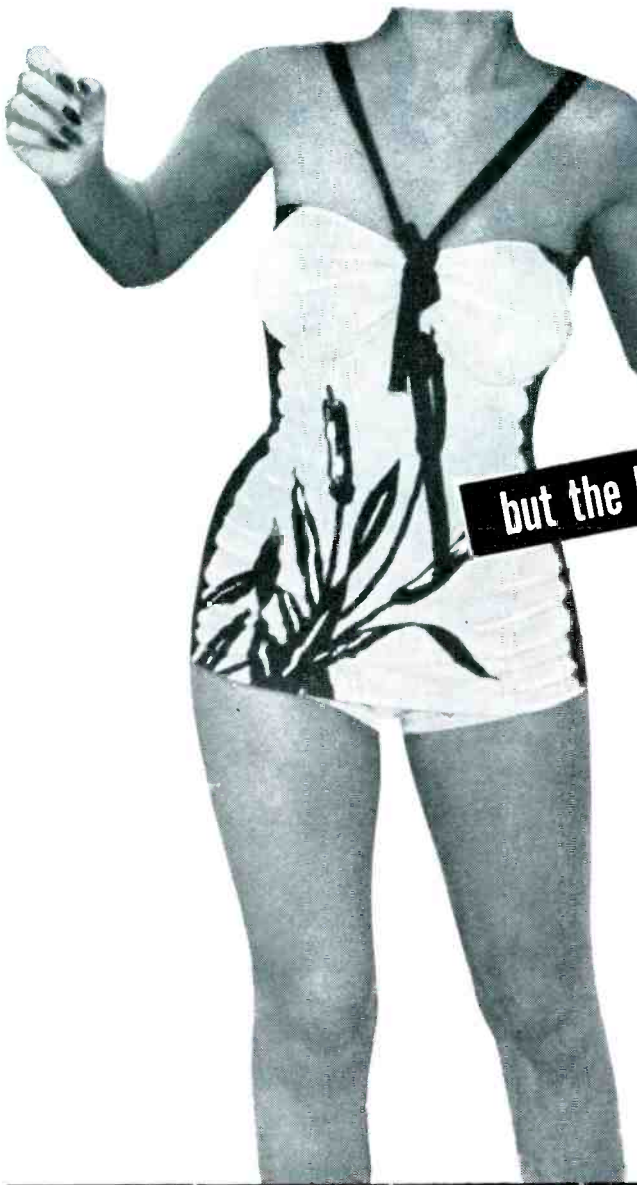


Amplifier circuit for tape-disc recording assembly.

[See page 2]

THE TECHNICAL JOURNAL OF THE RADIO TRADE

there's something missing here



but the RADIART ANTENNA LINE has EVERYTHING

From conicals to yagis . . . from indoor "rabbit-ears" to hi-los and strate-lines — RADIART has everything *good* to be had in antennas! There's nothing missing in your antenna "picture" when you handle RADIART because there is a type and model for every need . . . quality engineered for peak performance . . . and made to outlast them all! GET RADIART — because it means you've got the best!

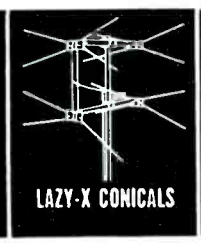
AND . . . don't forget our quality antenna accessories . . . like the "hottest" lightning arrestor on the market . . . the "SPEE-DEE" chimney mount . . . and our famous TELE-ROTORS!

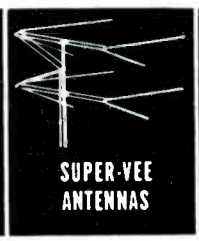

YAGI ANTENNAS


HI-LO ANTENNAS


INDOOR ANTENNAS


STRATE-LINE ANTENNAS


LAZY-X CONICALS


SUPER-VEE ANTENNAS


FM ANTENNAS

RADIART

SUBSIDIARY OF

THE RADIART CORPORATION CLEVELAND 13, OHIO

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

HOW TO PLEASE 1,000,000 MUSIC LOVERS

WQXR Depends on G-E Pickups and Styli to Capture Full Brilliance of Recorded Music

Rated tops by professional users like WQXR, the radio station of The New York Times, G-E audio equipment is at a peak of popularity with lovers of good music. The same superb cartridges and styli employed in WQXR studios are available for installation in home phonographs or sound systems—at prices your customers will appreciate.

Highest sales in G.E.'s history are being chalked up today by this outstanding line of high fidelity speakers, tone arms and pre-amplifiers. Don't miss your share of a fast-growing market that's currently rated in the millions! Call your General Electric distributor for full information.

Ask Us for This New Free Phono Accessories Folder

Complete line-up of G-E audio equipment is listed here. Write: *General Electric Company, Section 332, Electronics Park, Syracuse, New York.*

GENERAL ELECTRIC

Vol. 21, No. 3

RADIO · TELEVISION · ELECTRONIC
SERVICE

March, 1952

LEWIS WINNER
Editor

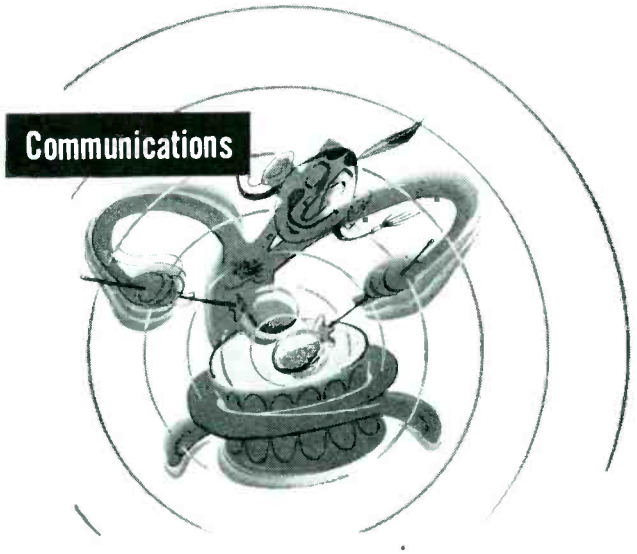
F. WALEN
Assistant Editor

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

Published monthly by Bryan Davis Publishing Co., Inc.
52 Vanderbilt Avenue, New York 17, N. Y. **Telephone MUrray Hill 4-0170**

Bryan S. Davis, Pres. Paul S. Weil, Vice-Pres., Gen. Mgr. F. Walen, Sec. A. Goebel, Cir. Mgr.
Mid-West Representative: Stuart J. Osten, 333 N. Michigan Ave., Chicago 1, Ill. Telephone: DEarborn 2-3507
East-Central Representative: James C. Munn, 2253 Delaware Dr., Cleveland 6, Ohio. Telephone: ERieview 1-1726
Pacific Coast Representative: Brand & Brand, 1052 W. Sixth St., Los Angeles 14, Calif. Tel.: Michigan 1732
Suite 1204, Russ Building, San Francisco 4, Calif. Telephone: SUtter 1-2251

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

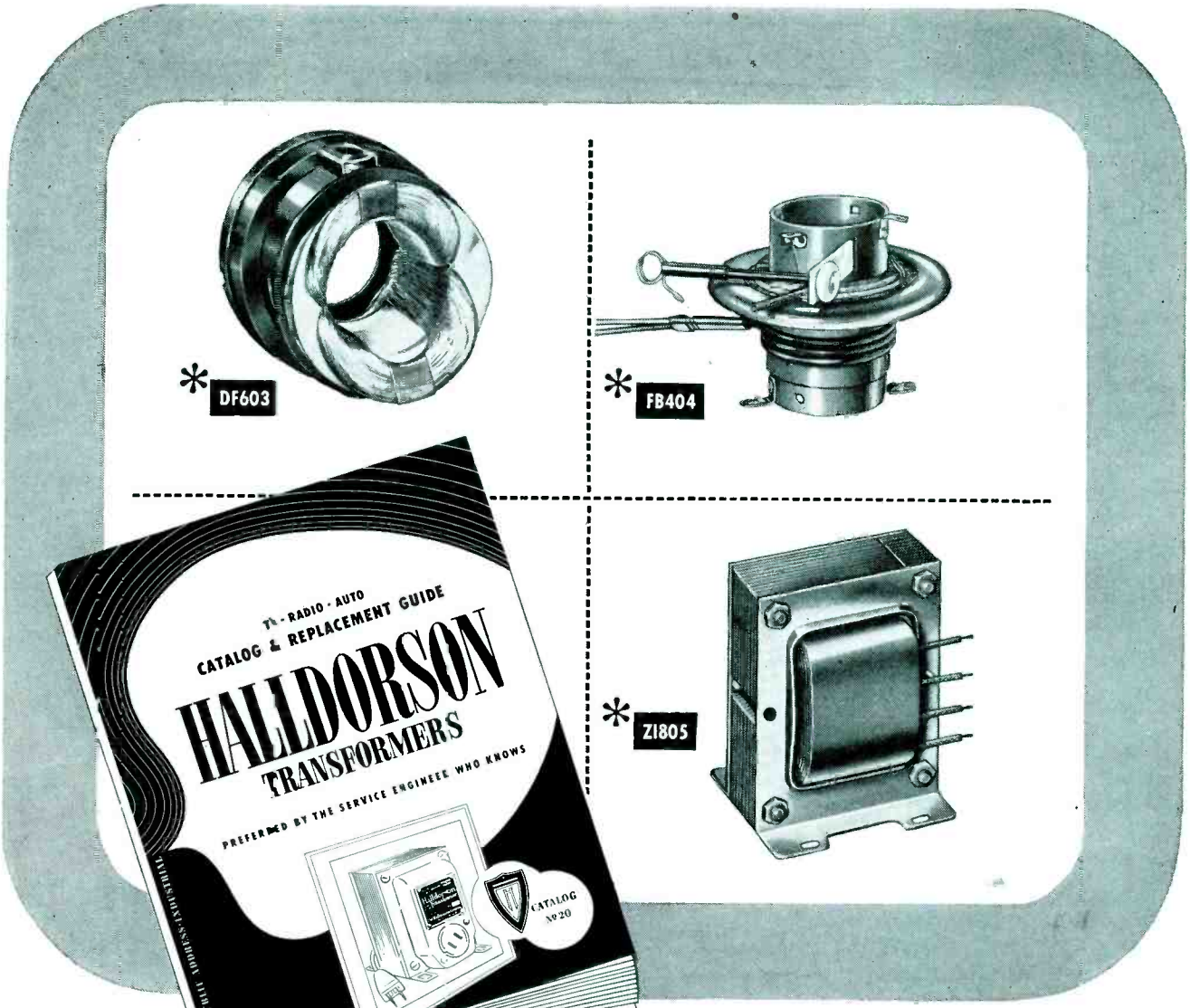


Those who know...choose Sangamo

for every radio and electronic application

SANGAMO Capacitors have been the choice of discriminating users for a quarter of a century. Radio servicemen, amateurs, electronic engineers, the Armed Services—all testify to the design, construction, honesty of characteristics, and conservativeness of ratings of Sangamo capacitors.

SANGAMO
ELECTRIC COMPANY
MARION, ILLINOIS
IN CANADA
SANGAMO COMPANY LIMITED, LEASIDE, ONTARIO



Completely New!

Transformer Catalog and TV Replacement Guide

Direct-Drive Components for Replacement in over Seventy Popular RCA, Emerson, and Capehart TV Models

* **DF603** — 70° cosine ferrite-core deflection yoke. Horizontal scanning coil, 30 MH. Vertical scanning coil, 3.5 MH. List price $10.75

* **FB404** — High-voltage air-core flyback transformer to work with DF603 deflection yoke. List price $7.00

* **Z1805** — Vertical output transformer to match vertical scanning coil of DF603 yoke. Turns ratio, 44:1. List price $5.20

Halldorson's new catalog will become your constant companion. It has the components you need, well classified for easy selection.

This highly active line has been super-charged with 114 new items. Special attention is given to TV replacements. A self-contained guide section quickly tells you where they are used.

Here's extra value, too. Halldorson prices actually have been reduced, but Halldorson quality is even better than ever.

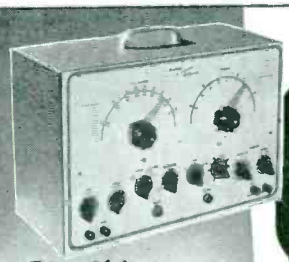
Don't be without this new catalog another minute. Pick up your free copy at your Halldorson distributor today—or write direct.

THE HALLDORSON COMPANY, DEPT. 523-S
4500 N. RAVENSWOOD AVENUE
CHICAGO 40, ILLINOIS

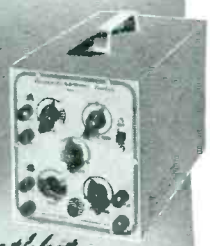
Halldorson

QUALITY *Transformers* SINCE 1913

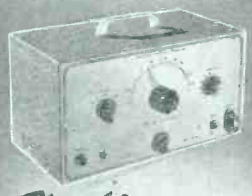
New 1952 HEATHKITS



Heathkit TELEVISION GEN. KIT $39.50

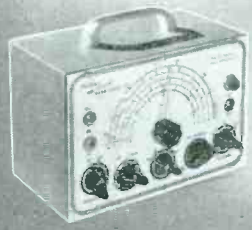


Heathkit ELECTRONIC SWITCH KIT $19.50



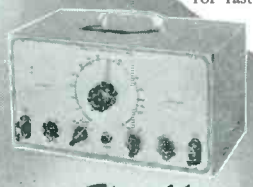
Heathkit AUDIO GEN. KIT $34.50

Heathkit CONDENSER CHECKER KIT $19.50



Heathkit R. F. SIGNAL GEN. KIT $19.50

Heathkit A.C. VOLTMETER KIT $29.50



Heathkit SQUARE WAVE GEN. KIT $29.50

Heathkit 5" OSCILLOSCOPE KIT

- New "spot shape" control for spot adjustment — to give really sharp focusing.
- A total of ten tubes including CR tube and five miniatures.
- Cascaded vertical amplifiers followed by phase splitter and balanced push-pull deflection amplifiers.
- Greatly reduced retrace time.
- Step attenuated — frequency compensated — cathode follower vertical input.
- Low impedance vertical gain control for minimum distortion.
- New mounting of phase splitter and deflection amplifier tubes near CR tube base.
- Greatly simplified wiring layout.
- Increased frequency response — useful to 5 MC.
- Tremendous sensitivity .03 RMS per inch Vertical .6V RMS per inch Hor.
- Dual control in vernier sweep frequency circuit — smoother acting.
- Positive or negative peak internal synchronization.
- Multivibrator type Wide Range Sweep Generator.

A brand new 1952 Heathkit Oscilloscope Kit with a multitude of outstanding features and really excellent performance. A scope you'll truly like and certainly want to own.

The kit is complete with all parts including all tubes, power transformer, punched and formed chassis, etc. Detailed instruction manual makes assembly simple and clear — contains step-by-step instructions, pictorials, diagrams, schematic, circuit description and uses of scope. A truly outstanding value.

MODEL 0-7
SHIPPING WT. 24 LBS.

$43.50

Heathkit VACUUM TUBE VOLTMETER KIT

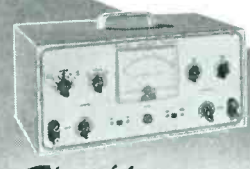
- New styling — formd case for beauty.
- New truly compact size — Cabinet 4⅛" deep x 4-1/16" wide x 7⅜" high.
- Quality Simpson 200 microamp meter.
- New ohms battery holding clamp and spring clip — assurance of good electrical contact.
- Highest quality precision resistors in multiplier circuit.
- Calibrates on both AC and DC for maximum accuracy.
- Terrific coverage — Reads from ½V to 1000V AC, ½V to 1000V DC, and .1 to over 1 billion ohms resistance.
- Large, clearly marked meter scales indicate ohms, AC Volts, DC Volts, and DB — has zero set mark for FM alignment.
- New styling presents attractive and professional appearance.

The 1952 Model Heathkit Vacuum Tube Voltmeter! Newly designed cabinet combines style and beauty with compactness. Greatly reduced size to occupy a minimum of space on your work-bench. Covers a tremendous range of measurements and is easy to use. Uses only quality components including 1% precision resistors in multiplier circuit for greatest accuracy. Simpson 200 microamp meter with easy to read scales for fast and sure readings.

All parts come right with kit, and complete instruction manual makes assembly a cinch.

MODEL V-5
SHIPPING WT. 5 LBS.

$24.50



Heathkit INTERMODULATION ANALYZER KIT $39.50

Heathkit AUDIO FREQ. METER KIT $34.50

YOU SAVE BY ORDERING DIRECT FROM MANUFACTURER

EXPORT AGENT
RADIO INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
Cable Address: RADIOLAB, N.Y.

The HEATH COMPANY
. . . BENTON HARBOR 11, MICHIGAN

PHONO NEEDLE REPLACEMENT IS

Buried Treasure...

ARE YOU GETTING YOUR SHARE?

Jensen NEEDLES

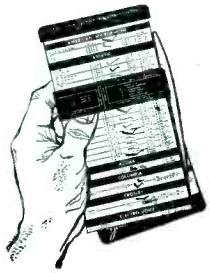
Mean extra profit on every service call!

HERE'S YOUR MARKET!

In the last two years, over 10 million phonographs have been manufactured in all three speeds. And today there are over 21 million turntables in use. Here's real "buried treasure"—replacing needles on all these phonographs *right now and at least once a year!*

GO AFTER THIS MARKET! Every phonograph owner . . . every record collector . . . should be told that needles must be changed at least once a year to save valuable and expensive records. You can do this on your regular TV or radio service calls if you take along a kit of Jensen Replacement Needles.

REPLACEMENT IS EASY! Average Jensen Needle replacement time is one minute. And Jensen's own JENSELECTOR quickly gives you exact needle replacement number for any record player without knowing model or cartridge number.



JENSEN—The Oldest Name in Sound Engineering

Jensen INDUSTRIES, INC.
331 South Wood St., Chicago 12, Ill.
Canadian Branch: Duplate Canada Ltd.
50 St. Clair Ave. West, Toronto 5, Canada
Export Sales: Scheel International, Inc.,
4237 Lincoln Ave., Chicago 18, Ill.
Cable: Harsheel

anybody can make claims . . . we back them up!

GUARANTEED PERFORMANCE OR YOUR MONEY BACK!

Yes, your money back if this booster does not give you as fine a picture as any booster on the market! **(1)** New, balanced input and output circuits for greatest gain. **(2)** Built-in power transformer (not AC-DC) with long-life selenium rectifier. **(3)** Utilizes finest turret tuner ever designed. **(4)** Fine tuning control. **(5)** Smart metal cabinet finished in wear-resisting mahogany enamel. **(6)** Pilot light illuminates selected channel.

TVB-2BX **television booster** $39.95 list

See your nearest National distributor

National

NC

EST. 1914

NATIONAL COMPANY, Inc.

MALDEN, MASSACHUSETTS

Your dollar buys more "instrument" ... in our Model #630

by R. L. Triplett
PRESIDENT

Because we build every major part of our instruments the quality is carefully controlled. For example, we know we have more torque driving our pointers because we designed and built the complete instrument. We know we have sustained dependence in the shafts and switch contacts of our test equipment for the same reason. Cycle tests for switches exceed several times the rigid requirements of the armed forces.

There is another important value to you. Because we make our own components we eliminate the profit another manufacturer would make in selling them to us. And this "profit" is passed on to you.

Consider these features of Model 630 V.O.M., for example—

One Hand Operation—One switch with large recessed knob has a single position setting for each reading. Leaves one hand free. Eliminates switching errors, trouble, saves time.

Ranges—AC-DC Volts: 3-12-60-300-1200-6000 (AC, 5000 Ohms/Volt; DC, 20,000 Ohms/Volt). 60 Micro-Amps. 1.2, 12, & 120 Mil Amps. DB scales at 1.73V on 500 Ohm line, 0-66 DB output.

Highest Ohm Reading—To 100 Meg. in steps of 1000-10,000-100,000 Ohms—100 Megohms.

Yes, with us it's a matter of personal pride to make "Triplett" stand for better construction and more service for your test equipment dollar.

R. L. Triplett
PRESIDENT
TRIPLETT ELECTRICAL INSTRUMENT CO.
Bluffton, Ohio

Model #630
Volt-Ohm-Mil-Ammeter

For service, accuracy, highest dependability, buy

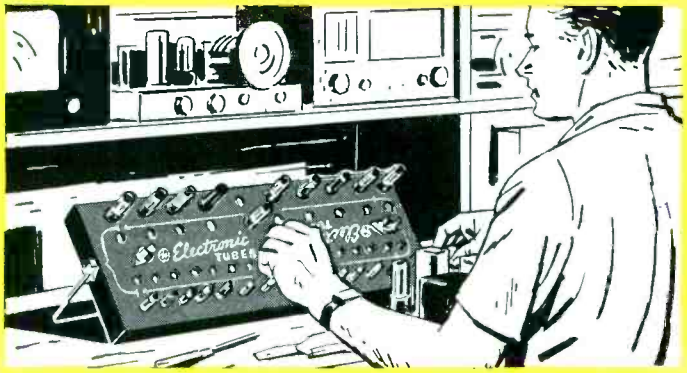
Triplett

TRIPLETT

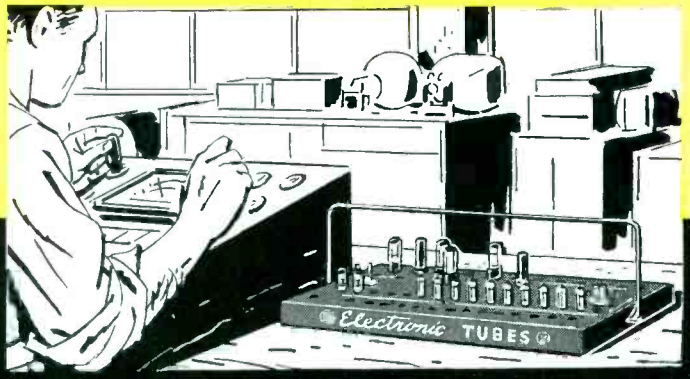
SAVE TUBES- WITH G.E.'S NEW

TUBESAVER

Says Al Mirus of Mirus TV Service Shop (left), 6579 Glenway Ave., Cincinnati, O.: "Our G-E Tubesavers do just what the name says. That's why we have one at every bench. A Tubesaver holds up to 52 tubes in their proper sequence, gripping the tubes so tightly they can't fall out. Built-in pin-straighteners help, too. The best and most practical device we've seen!"



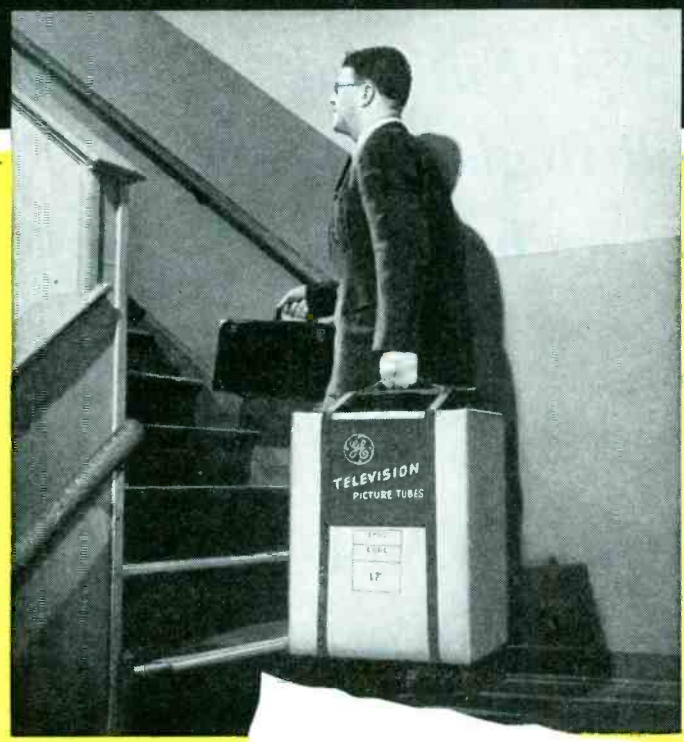
NO MORE WORRY ABOUT PUTTING TUBES BACK IN THE WRONG SOCKETS!... The systematic layout of the G-E Tubesaver keeps tubes in their exact order. Moreover, they stay that way because rubber inserts keep them from dropping out—*even if you tip the Tubesaver sharply!* With its convenient handle design, the Tubesaver can be laid flat on the bench, angled, or hung on the wall nearby.



NOW YOU CAN TEST TUBES FAST AND ACCURATELY!... Place tubes in the inner holes of the G-E Tubesaver. Test them one-by-one. Put the good tubes in the outer set of holes, and return rejects to the inner set. Interruptions are no handicap—the Tubesaver keeps tubes correctly arranged till you resume work. *In their proper order* you now show the full tube complement of the receiver — which tubes are usable, which not!

SEE YOUR G-E TUBE DISTRIBUTOR FOR FULL DETAILS!

SAVE TIME-
SERVICE AIDS!



PICTURE-TUBE CARRIER

Here's a practical aid that enables you to carry a cartoned picture tube safely and easily with one hand, leaving the other free for service equipment. Heavy canvas straps—quickly adjusted—hold the tube carton firmly. Rounded leather grip fits snugly in the hand. Blue and yellow colors are attractive. Save extra steps with this new convenience!

DROP-CLOTH

Use this handy G-E drop-cloth to cover fine rugs or cabinets. It's durably woven, with a soft texture that won't harm the most delicate surface. A plastic top coating takes hard wear, resists hot solder, can be wiped clean in a jiffy. Customers will appreciate your protecting their furnishings from dust, grime, and stray particles of metal!

MAKE MORE CALLS PER DAY

... with these G-E-tube service aids! They cut time and costs, build customer goodwill. Your General Electric tube distributor will be glad to help you obtain them. Phone or write him today! *General Electric Company, Electronics Division, Schenectady 5, New York.*

161-1A1

You can put your confidence in—

GENERAL ELECTRIC

"At National Cash Register we believe . . ."

STANLEY C. ALLYN
President, National Cash Register Company

"At National Cash Register we believe a thrifty employee is a better employee and a better citizen. By providing the Payroll Savings Plan for U. S. Defense Bonds we help our employees practice the thrift habit and build up a backlog of savings for their future security. By buying Bonds they become shareholders in their country."

The employee who joins the Payroll Savings Plan becomes *a man with an objective*—a young fellow who realizes that the systematic purchase of Defense Bonds is a sure way to the down payment on a home . . . a father who wants to provide for Junior's college education . . . an older man, with an eye to retirement and personal security.

The man with an objective is a better employee. He knows that a day lost from work is just that much out of his take-home savings. He doesn't take chances—wants to stay off the accident list. He has a new realization that better work on his part will lead to advancement—and a larger monthly allotment for Defense Bonds.

The man with an objective is a better citizen, holds his head a little higher. He is buying a growing share in America . . . helping to combat inflation . . . making a real contribution to the defense effort.

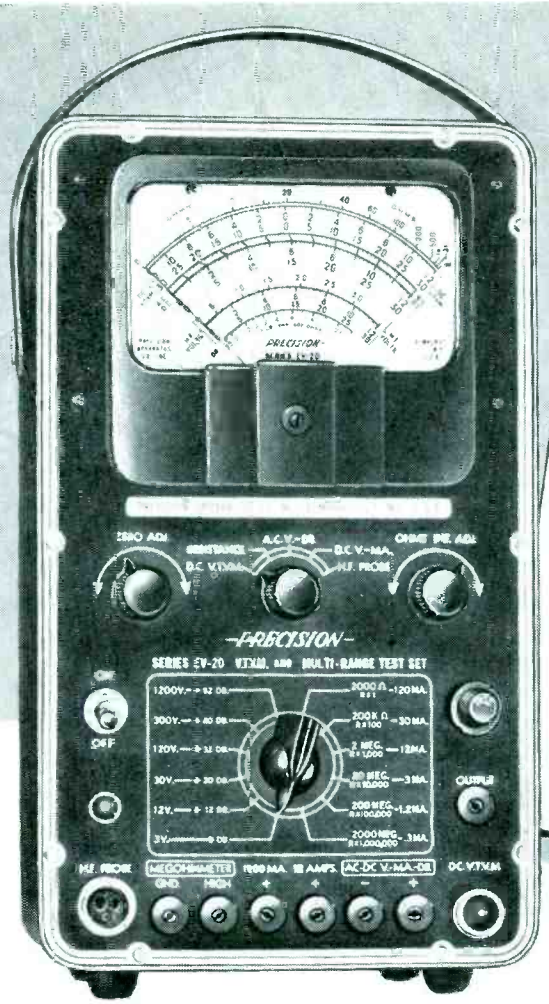
These employee and *employer* benefits of the Payroll Savings Plan are reflected in the records of thousands of companies. Figures show that as employee participation in a Payroll Savings Plan grows to 60%, 70% or higher, absenteeism decreases, the "Lost Time Accidents" curve goes down and production goes up.

If 60% or more of your employees are not Men With Objectives, do something about it. Phone, wire or write to Savings Bond Division, U.S. Treasury Department, Suite 700, Washington Building, Washington, D. C., and your State Director, Treasury Department, will show you how to install a Payroll Savings Plan, or how to build an existing Plan.

During 1951, over 1,500,000 employed men and women joined the Payroll Savings Plan.

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

SERVICE



A Compact, Versatile, Portable Circuit-Testing Laboratory for TV — FM — AM

The New PRECISION SERIES EV-20 VTVM and Multi-Range Test Set

Net Selling Price ... $68.25

A Modern, Portable VTVM—Megohmmeter.
TRUE ZERO-CENTER on ALL VTVM ranges
PLUS Direct Peak Reading High Frequency Scales
ALSO, complete, standard 1000 ohms per volt functions
48 RANGES TO
1200 Volts*, 2000 Megohms, 12 Amperes, +63DB

* D.C.-VTVM ranges to 12,000 and 30,000 Volts when used with Series TV Super-High Voltage Test Probe.

Range Specifications

- ★ SIX ALL-ZERO CENTER VTVM RANGES: —13⅓ Megs. Constant Input Resistance. ±3, ±12, ±30, ±120, ±300, ±1200 volts. Direct Reading to ±12 KV and ±30 KV with Series TV Super-High Voltage Test Probe
- ★ SIX SELF-CONTAINED OHMMETER-MEGOHMMETER RANGES: 0-2000 - 200,000 ohms. 0-2-20-200-2000 Megohms.
- ★ FOUR DIRECT READING HIGH FREQUENCY VTVM RANGES: 0-3-12-30-120 volts. *(When used with RF-10A High Frequency Vacuum Tube Probe, Net Price $14.40. No crystal rectifiers employed.)*
- ★ SIX AC-DC AND OUTPUT VOLTAGE RANGES at 1000 ohms/volt. 0-3-12-30-120-300-1200 volts.
- ★ EIGHT D.C. CURRENT RANGES: 0-300 microamps. 0-1.2-3-12-30-120-1200 milliamps. 0-12 Amperes.
- ★ SIX DECIBEL RANGES from —20 to +63DB. Calibrated for 600 ohm, 1 mw., zero DB reference level.

IMPORTANT FEATURES

- ★ VOLTAGE REGULATED—BRIDGE CIRCUIT.
- ★ DIRECT READING, **ALL ZERO-CENTER** VTVM —indicates BOTH Polarity and Magnitude without switching or test lead reversal.
- ★ MASTER RANGE AND FUNCTION SELECTORS eliminate frequent and inefficient shifting of test leads.
- ★ SHIELDED CONNECTORS for both D.C.—VTVM and RF—VTVM. Permits simultaneous and non-interfering connection of both Circuit Isolating Test Probe and optional H.F. Vacuum Tube Probe Series RF—10A.
- ★ HI-FREQ. VOLTAGE SCALES—Direct Peak Reading.
- ★ DUAL-BALANCED ELECTRONIC BRIDGE OHMMETER—MEGOHMMETER uses two 1.5 volt flashlight cells easily replaced at rear of cabinet.
- ★ 1000 OHMS/VOLT MULTI-RANGE FUNCTIONS permit simple AC-DC voltage, DB and current measurements free of power line requirement.
- ★ 4⅝" RECTANGULAR METER—200 microamperes, ± 2%. Double-Sapphired, D'Arsonval construction.
- ★ 1% Film type, Metallized and Wire-Wound resistors for all shunts and multipliers.
- ★ Heavy gauge, round-cornered, louvred steel case with plastic handle. Etched, anodized, aluminum panel.

***NET SELLING PRICE* $68.25**

Complete with coaxial Circuit Isolating Test Probe, Shielded Ohmmeter Test Cable, Standard #227 Super-Flex Test Leads, Ohmmeter battery and full operating instructions.
Case dimensions—10½" x 6¼" x 5"
Shipping Weight: 11 pounds. *CODE:*—Party

Also ask to see the "Precision" **Series EV-10A, DeLuxe VTVM—Megohmmeter with extra-large 7" meter.** 59 self-contained ranges to 6000 volts and 70 DB.

Series EV-10A, affords to the discriminating instrument purchaser, and equipment-conscious service-laboratory, the **ultimate** in visibility and performance.
EV-10A-P
(Closed portable)—$97.25
EV-10A-MCP (Illustrated)
(Open Lab. Type)—$94.50

See complete **EV-10A** specifications on page 4 of latest "Precision" catalog, available at leading radio equipment distributors or write directly to factory for full details.

PRECISION APPARATUS CO., INC.
92-27 Horace Harding Boulevard, Elmhurst 7, New York
Export Division: 458 Broadway, New York, U.S.A. • Cables—Marhanex

Today's wary customers want to know *how you do business* as well as *how capable a technician you are.* That's why thousands of Radio and Television Service Dealers across the nation are discovering that, all other things being equal, their status as RAYTHEON *Bonded* Electronic Technicians tips the scales in their favor.

If you don't know how this exclusive Raytheon *Bonded* Program builds customer confidence and good will by cash-protecting your radio and television service 90-day guarantee, *at no cost to you*, you'd better get in touch with your Raytheon Tube Distributor. He'll be happy to tell you whether you can qualify for this important sales aid.

RIGHT...FOR SOUND AND SIGHT

RAYTHEON®

RAYTHEON MANUFACTURING COMPANY

Receiving Tube Division

Newton, Mass., Chicago, Ill., Atlanta, Ga., Los Angeles, Calif.

Excellence in Electronics

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

RADIO · TELEVISION · ELECTRONIC

SERVICE

Musical Engineering Enters Audio Scene

AUDIO, which has streaked to striking popularity during the past few years, acquiring an evergrowing audience of enthusiasts, has also captured the interest of many outstanding scientists who have continually sought to effect improvements. One of the most active of these specialists, Dr. Harry F. Olson, who has contributed a stream of major developments, proclaimed a short while ago that audio has become so dominant a factor that it merited a thorough probe. A few weeks ago the results of such an investigation appeared in a book, entitled *Musical Engineering,* which will undoubtedly become a bible in industry.

Doc has analyzed each aspect of sound production, pickup and reproduction, from a physical, scientific and practical standopint. *Musical engineering,* it was indicated, explains the properties of sound waves, and describes the various performance characteristics of musical instruments and the human voice, such as timbre, directional patterns, volume and frequency range, growth, decay and duration. Each of these problems were surveyed in relation to their reproduction in theatres, studios or living rooms.

Here is a text which everyone engaged in design, servicing, installation and selling will find extremely informative and helpful.

Booming New Market Areas

NEW BUSINESS OPPORTUNITIES in model communities now under construction, described in these columns a few months ago as racing ahead, have during the past few weeks become truly a roaring feature. In many communities throughout the country where industry expansion is at a peak, unparalleled possibilities have loomed.

In the critical defense area of Buck county, for instance, there is now under construction a complete city of 16,000 homes with provision for a half-mile long shopping center, parking space for 5000 cars, and shop facilities for over 350 firms. It is expected that nearly a million dollars will be spent in this area for radio and TV receivers and accessories.

Many Service Men have begun to capitalize on the advantages offered in these new communities. In Long Island, for instance, where a town of 15,000 was established a short time ago, over a million dollars has been spent for chassis and allied gear, including installation and servicing.

Service Men appear to have before them more opportunities than ever before to build successful servicing businesses.

The Rebuilt Pix-Tube Dilemma

WHEN MONTHS AGO it appeared as if picture tubes would be scarce, many decided that the problem could be readily solved by rebuilding. A few introduced an effective service, but too many had and still have distorted views on the subject of rebuilding, and the results have been quite disastrous.

Not only have the flash rebuilders produced unsatisfactory tubes, but they have used every deceptive means to sell, often labeling the rebuild as a new item and fully guaranteed. The problem has become so acute that the Federal Trade Commission has included a set of strict rules in their new proposed trade-practice policy which would make it unlawful to identify rebuild as a new item. When the ruling becomes official, it will become imperative to indicate that the tube has been reconditioned, repaired or rebuilt, and it will become illegal to obliterate the original manufacturer's name and trademark from the product. It is expected that shipping cartons will also be identified properly, and the selling price will reflect the fact that the tube is a repaired item.

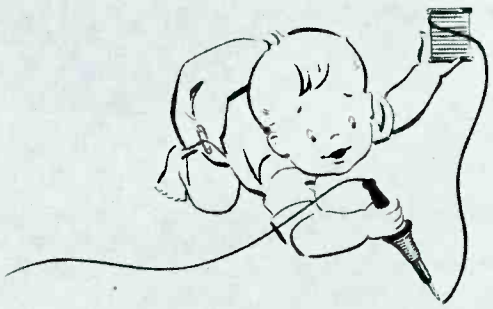
No one condemns the practice of repairing a tube, provided no attempt is made to assure a user that such a tube will provide the same maximum results as a thoroughly new tube that has never seen service before. Several factors have been found to contribute to the difficulty of assuring perfect results with a rebuild. In the main, screen defects have been the cause of most picture-tube trouble. Usually, rebuilders will leave the original screen intact and simply replace the gun, reneck, and reprocess. The loss of light transmission in the glass faceplate has been found to be another acute problem. Even when a rebuilder might reneck, rescreen, reexhaust and reprocess, the tube might not provide the same results as a new one because of the definite loss of light transmission in the glass faceplate, prompted by prior use. While the initial results might be satisfactory, it will be necessary to create a stronger beam current for the equivalent brightness of a new tube, and the cathode of the rebuild will have to work harder, with a resultant loss in tube life.

It is obvious, therefore, that tube rebuilding is quite a complex problem, and certainly not within the sphere of operations of a service shop or even a small tube plant who might not have the facilities for uniformly processing the tube and controlling their quality, or providing suitable glass inspection to prevent implosion, or adequate baking to outgas the tube.

If it does become necessary to provide a rebuilt tube because of type unavailability, the consumer should be told that the tube has been repaired and as such cannot provide the maximum efficiency which the tube was able to offer in its brand-new stage.

The Service Man's Responsibilities

Service Men can play a key role in keeping the public posted on what should be generally expected from a rebuilt picture tube, and how to identify a rebuild. It's an important assignment which no Service Man should shirk. Mr. and Mrs. Consumer will be extremely grateful for this valuable counsel.—L. W.



SO SIMPLE...

KESTER "RESIN-FIVE" CORE SOLDER

SO SIMPLE... to give good service

- Non-corrosive and non-conductive . . . in diameters of $\frac{3}{32}$", $\frac{1}{16}$" and smaller.

KESTER'S "Resin-Five" Core Solder has long enjoyed the greatest popularity as the best solder for all electronic work, radio and TV. That's because it was originally developed to save you time and money . . . the right combination of tin and lead—flux, too—to simplify and speed up your work. And it's true also of Kester's companion product, Plastic Rosin-Core Solder. Choose either one . . . and you have the best!

Your Jobber has Kester. Tell him you want "Resin-Five" or "Plastic Rosin" . . . both genuine Kester Solders. You'll be glad you did!

KESTER SOLDER COMPANY
4248 Wrightwood Ave., Chicago 39
Newark 5, New Jersey • Brantford, Canada

KESTER SOLDER

SERVICE...The National Scene

DEMAND FOR EIGHT TO ELEVEN-MILLION TV ANTENNAS PREDICTED--This year should see a market for from 8-11 million TV antennas, according to members of the Antenna Manufacturers Industry Advisory Committee, who met recently in Washington with NPA to discuss antenna material requirements. It was estimated that this quantity of antennas would be needed to accommodate the 4 to 5-million sets installed before '50, and the new receivers that are being installed and will probably be sold before the year is over. The growing popularity of fringe TV, where two to five-bay antennas are required, was also cited as another factor in setting the anticipated demand. . . . Discussing the material needs, committee members pointed out that industry had displayed extreme ingenuity in finding alternates for scarce aluminum and copper, the substitutes including wood masts and cross bars (silver painted or incorporating a conductive element), plastics, fiberglas rods and steel. Many extremely effective designs have been involved using these alternate materials, it was said.

INDUSTRY RECEIVES SELENIUM ALLOCATION INCREASE--Operation of selenium rectifier plants, many of which were on the verge of a virtual shutdown a few weeks ago because of a short supply of the precious metal, has now been assured by an allocation of about 25,000 pounds, which will permit continuing production. In commenting on this allocation, NPA reported that the increased amount was made possible by reducing producer's stocks and including the third of production held back in February to build up inventories. It was also disclosed that a source of supply has been developed in recent months from selenium received from defective and scrap rectifier plates. It was said, too, that reclaimed selenium from this source, reportedly of good quality, is being imported by rectifier manufacturers in this country. Refined selenium is also being received from Canada, industry members disclosed. April supplies of selenium for the rectifier industry may be increased by about 6500 pounds of commercial grade, made available for refinement to a high purity grade. It was hoped that it would be possible to continue supplying rectifier manufacturers with sufficient quantities of the rare element selenium (obtained as a by-product of copper smelting and refining), so that rectifier manufacture will be able to produce cells on an equitable basis.

TRADE PRACTICE RULES APPROVED BY INDUSTRY ASSOCIATIONS--The stern FTC trade practice rules, detailing procedures which all will be obliged to follow in advertising and selling, under consideration for nearly a year, have now been generally approved by RTMA, NARDA and NEDA, and should become a government-approved procedure very soon. Many stringent regulations will have to be followed when these rules go into effect. For instance, manufacturers will be obliged to avoid any deceptive description of the size of the actual viewable picture. In detailing the number of tubes used in any type of receiving equipment, it will be necessary, according to the new regulations, to avoid and prevent any misleading references to the number, through the inclusion of ballast tubes or rectifiers. It will not be possible for advertisements to state that any AM receiver can bring in foreign or domestic stations with sharp, clear or distinct reception, or with ease, simplicity or regularity, unless such claims can be completely supported. Other problems covered by the new regulations include the proper identification of converters or adapters, truthful representation of the capabilities of indoor and outdoor antennas, as well as the reproducing properties of TV receivers, particularly for color or black and white.

SERVICE...The National Scene

RTMA DENOUNCES TV HOME-REPAIR BOOK ADS--The roaring TV fix-it-yourself book advertisements, appearing in the general press and popular magazines, have been sharply criticized by the Radio-Television Manufacturers Association's service committee. According to Albert Coumont, who heads the service committee for the association, most of these texts have . . . "inconsequential technical value." He noted that the ads contained . . . "misleading and untrue statements . . . belittling the need for specialized skills in servicing TV receivers, as well as the implications that Service Men were incompetent and fraudulent." Coumont urged members of RTMA's service committee to issue strong protests against these advertisements, and enlist the help of local BBBs, manufacturers and service groups to aid in the drive.

BARGAIN RATES SCORED BY CAPITOL SERVICE MEN--A driving campaign to combat the misleading $1.98-2.98 service call advertisements now appearing in newspapers in Washington, D. C., has been initiated by a group of Service Men. Several firms have contributed to a general fund for the drive which may take the form of newspaper copy. The Service Men report that these bargain-price operators use the low-service charge as bait, and actually charge excessive fees for routine repairs. This worthy move merits the praise of everyone in the servicing industry.

NETSDA REELECTS LIEBOWITZ PREXY--Max Liebowitz, president of the Associated Radio-Television Servicemen of New York, has been reelected president of the National Electronic Technicians and Service Dealers Associations. Other officers elected for '52 include: Roger Haines, vice president; Richard G. Devaney, recording secretary; David VanNest, corresponding secretary; T. L. Clarkson, treasurer; and John Wheaton, sergeant-at-arms.

ULTRAHIGH TUNERS NOW ON PRODUCTION LINE--In anticipation of the freeze lift and the allocation of channels for the new ultrahigh band, many accessory and receiver manufacturers have set up production lines for tuners, converters, and even front ends. One setmaker in Chicago has announced that his uhf tuners are now in volume production, and that they will be installed at the factory as optional equipment on new receivers for $29.95, and will also be available for field installation for a total cost of $39.95, allowing a $10 charge for installation. Within the next few weeks, it is expected that most manufacturers will announce their plans for factory and field installations.

SETMAKER TO ROUTE DISTRIBUTOR CHASSIS SERVICING TO SERVICE MEN--Within the next few weeks, one of the largest receiver manufacturers will discontinue his distributor servicing department and direct all calls to local Service Men. In explaining this plan, the set producer said that it has been found that independent Service Men can render a highly effective service, which will not only be completely acceptable to consumers, but conducive to an improved relationship with the factory. It was pointed out that the distributor should not maintain service facilities which would be in competition with independent Service Men. To support this move, this manufacturer also announced that it will supply Service Men with continued educational training, technical information, and shop and clinic assistance. It was also indicated that dealers will receive the names of independent service shops who are in a position to handle the dealer's service requirements in an efficient and capable manner. Several other manufacturers have indicated that they might follow this same course, a move which all Service Men will applaud loudly.--L. W.

Rauland - the Original

LOW FOCUS VOLTAGE ELECTROSTATIC TUBE

Perfected in Rauland Electronics Laboratories, this tube that gives edge-to-edge sharpness of focus without coils and magnets is proved and ready as the materials pinch becomes painful

BETTER in all ways! Gives better over-all focus—hair-line sharpness from edge-to-edge —with NO critical materials for focusing . . . and STAYS SHARP under considerable variation in line voltages.

REQUIRES NO re-engineering of present television chassis . . . NO added high voltage focus circuit . . . NO added receiver tubes . . . NO additional components except an inexpensive potentiometer or resistor.

FOCUSES by using D.C. voltage already available in the receiver.

ELIMINATES focusing coils and magnets . . . saves critically scarce copper and cobalt.

• • •

This new Rauland development is now available in substantial quantities in 17 and 20 inch rectangular tubes. For further information, address . . .

THE RAULAND CORPORATION

Perfection Through Research

4245 N. KNOX AVENUE • CHICAGO 41, ILLINOIS

The Stratford, Conn.

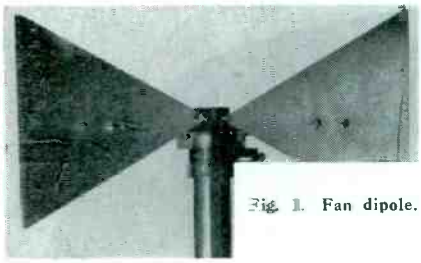


Fig. 1. Fan dipole.

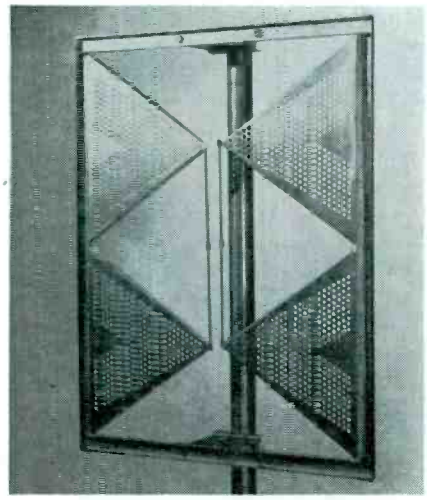


Fig. 2. Two-stacked fan dipole.

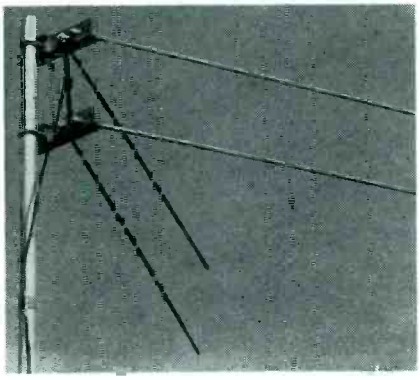


Fig. 3. Stacked *V* antenna.

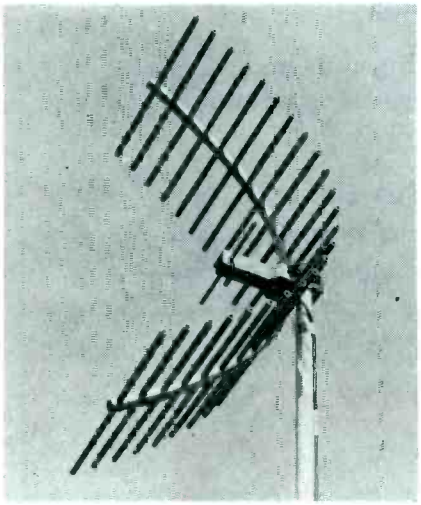


Fig. 4. Parabolic reflector type of antenna used at *uhf*.

THE RAPID GROWTH of the television industry, during the past few years, has created a need for additional channels. To meet that need, the FCC has proposed the allocation of spectrum space in the *uhf* region for over 2,000 stations throughout the country on channels 14 to 83, covering the 470 to 890-mc band.

It has been found that the existing 108 *vhf* stations can provide television for only 60 per cent of the nation's population, with a limited number of stations in any one given area. Therefore, the proposed *uhf* allocations are necessary to the industry and to the public if the full TV potential of the country is to be realized.

A great deal of thought and planning has been devoted to *upstairs television* by the FCC and industry, and both are continuing their work to make sure that manufacturers, broadcasters, and Service Men will be prepared for *uhf* operation.

Long before the FCC proposal to allocate channels in the *uhf* region for commercial television, an extensive *uhf* test and experimental program was initiated. These studies began in July,'46, when experimental transmissions and tests were conducted in New York at 288, 510, and 910 mc. In September, '48, equipment was made available and tested in Washington, D. C., at 504-510 mc.

After the Washington tests, the *uhf* project was moved to Stratford, near Bridgeport, Conn. Tests were made at this location at 530 mc, and are continuing at 850 mc.

Development of UHF

The Stratford station, KC2XAK, was set up to operate on 529 to 535 mc with an effective radiated power of 13.9 kw. The transmitting antenna was placed 250 feet above the ground. Because this station was intended to represent a typical broadcast operation, such as might be located in the future in many American cities, its planning, construction, and operation were patterned to conform to the routine established for commercial *vhf* stations.

The format featured relaying of program material to the Stratford station via a 2000-mc relay link from WNBT, in New York City. Consistent transmitter operation has been maintained on this program material from WNBT for approximately 340 hours per month, throughout the year.

With these *uhf* facilities, extensive field tests were undertaken to check transmitting and receiver antenna characteristics, receiver installation problems, effects of terrain and foliage, effects of weather, ground propagation, *uhf* receiver converters, transmission lines, and many other factors.

UHF Antennas

To date, numerous antennas with commercial possibilities in *uhf* have been designed and tested.‡ There has been selected a group of antennas that will handle many of the special requirements of *uhf* reception. Here, as in *vhf*, antenna problems must be weighed carefully. Such things as gain, directivity, installation time, wind and ice loading, cost and other factors must be considered.

Since wavelengths in the *uhf* band are much shorter than those in the currently operating *vhf* channels, antenna types which were previously deemed impractical warranted reconsideration. Such types as the rhombic, stacked rhombic, parabolic, helix, corner reflector, fan dipole and endfire broadside antennas, heretofore considered only by the dyed-in-the-wool television DX enthusiasts, were found to have very evident UHF possibilities. Familiar antennas such as the half-wave dipole, *V* type, and yagi have also been considered.

Specific Antenna Types

Indoor antennas of the built-in and cabinet-top types have proved to be generally less satisfactory for fringe area use than outdoor antennas. A person moving or standing near the indoor antenna may cause a serious momentary effect on the picture quality. Venetian blinds, awnings, and similar objects also affect the signal received with indoor antennas. Thus, the tests revolved about the relative advantages of several types of outdoor antennas.

The Fan Dipole

One of the antennas tested was the fan dipole whose characteristics are similar to a *uhf* half-wave dipole, with almost unity gain and a nearly bi-directional *figure eight* directivity pattern. It was found to be light in

‡Designs and checks by RCA engineers in conjunction with RCA Service Co.

*In the antennas analyses, all standards of comparison, such as maximum usable range, were based on the power output and antenna height of the Stratford experimental station. These are considerably lower than the maximum allowable power and antenna height specified by the FCC.

UHF TV TESTS

by RUSSELL J. HALL

RCA Service Company, Inc.

Resume of Results of Studies Undertaken to Check Receiver Antenna Characteristics, Installation Problems, Effects of Terrain, Foliage and Weather, Ground Propagation, Converters, and Transmission Lines.

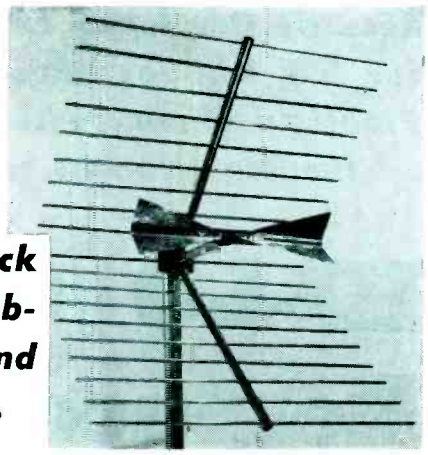


Fig. 6. Corner reflector antenna.

weight, easy to construct and offered an orderly appearance desireable for roof installation. Its limited gain and directivity, however, was found to restrict its use to strong, relatively ghost-free signal areas within a short distance of the transmitter.

Two-Stacked Fan Dipole

The double fan antenna was also tried. It naturally, has a greater usable range than the single fan. There has been completed production design work on a single metal stamping for this type of antenna which shows definite possibilities. This antenna is low in initial cost, easy to install, and compact in design, and has higher gain and better directivity, than the single fan.

The Stacked V

Also studied was a stacked *V* antenna. This type was found to have a gain of 5.7 db over a reference tuned dipole at 500 mc. This antenna was also found to be comparatively low in cost, less critical as to placement and orientation than those previously described, and with a considerably greater range. Although more costly from an installation viewpoint, it has shown good possibilities as a combination *vhf-uhf* antenna. Each element of the antenna is two full wavelengths up to 500 mc and resonant as a half-wave dipole cut for the low end of the *vhf* band.

Considerable experimenting has been done with rhombic antennas, usually two or more wavelengths to a side. The rhombic exhibited good directivity and gain, a very sharp horizontal directivity pattern, and proved efficient in eliminating ghosts. It was found more costly to build and install than some other types tested, however, and less attractive in appearance.

The Parabolic Reflector Antenna

The parabolic antenna proved to have the highest gain (7.5 db over a resonant dipole) with a very sharp vertical directivity pattern. The horizontal directivity is very broad, and for this reason the antenna is not the best for eliminating ghosts. In some instances the parabolic antenna has been out-performed by a stacked *V* with a larger aperture. The principle of this antenna is good, although it is heavy and cumbersome to install.

In the modified form illustrated, this antenna has been applied to excellent advantage, inexpensively and efficiently.

The Corner Reflector Antenna

The corner reflector antenna, also studied, was found to have characteristics very similar to the parabolic reflector, with a slightly lower gain of 6.5 db. This antenna was found to be a little easier and less expensive to manufacture than the parabolic; problems of wind and ice loading, weight, and similar factors have been overcome to a great extent. Service range is excellent, and it is likely to be one of the first types put into commercial service.

The Helix Antenna

The helical antenna was considered during the tests because of its excel-

(*Continued on page* 53)

Types	Impedance	Losses (db/100') 200 mc	500 mc
Flat twin	*280*	*1.6*	*2.5*
Tubular twin..	*280*	*1.5*	*2.5*
Twinex (braid shield).....	*220*	*4.5*	*7.2*
Twinex (foil shield).....	*220*	*3.75*	*6.2*
RG59/U coax.	*75*	*5.6*	*9.3*

Fig. 5
Recapitulation of characteristics of five types of leadins.

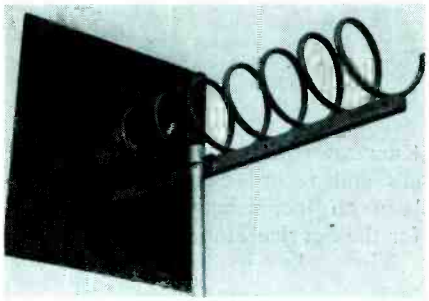


Fig. 7. Helix type of antenna tested at *uhf*.

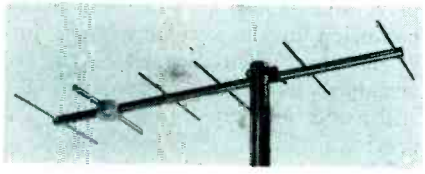


Fig. 8. A six-element yagi probed during the *uhf* tests.

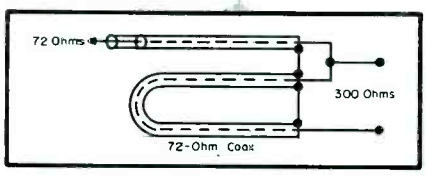


Fig. 9. Circuit of balun, used as a matching section, which performs dual function of matching 300-ohm to 72-ohm impedance and unbalanced coax line to balanced antenna.

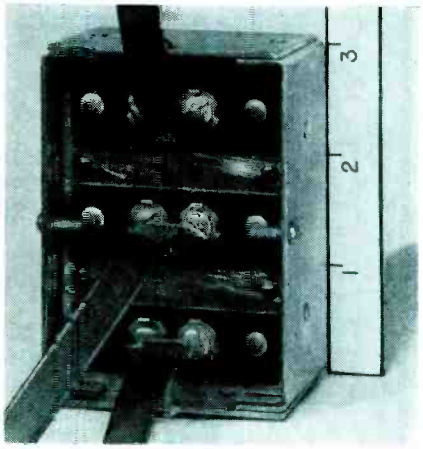


Fig. 10. A crossover network, which can be used for separate *uhf* and *vhf* antennas; center terminals connect to converter or receiver.

Recently Developed Two-Output Universal Cartridges for 78 Phonos, Found to Minimize Inventory Problems, Eliminate Repeat Calls and Efficiently Meet the Requirements of Most Reproducer Systems.

HI-LO OUTPUT 78 RPM Replacement Cartridges

by J. G. HASKELL

Webster Electric Company

KEEPING THE OWNERS of record players and record changers happy has been an increasingly perplexing job for the Service Man in recent years.

Time takes its toll and more and more of the older phono sets are calling for repair work. Introduction of the various new types of multi-speed players has added a further element of confusion in the servicing field, just at a time when Service Men are swamped with the demands of the still newer and rapidly expanding TV service problem.

Then, of course, there is the manpower problem. The days when Service Men could pick up a likely looking high school graduate and develop him into a valuable repair assistant are gone, at least for the time being. Uncle Sam gets the first crack at him. So it is that Service Men are face to face with these repair problems with a definite dearth of experienced help.

As all of us realize, the crystal cartridge in a record player or record changer should be replaced periodically.

It has been found that the average life of a crystal cartridge is from three to five years. Its performance is affected by extreme variations in temperature and its life expectancy is shortened by exposure to extremely humid or extremely dry atmospheres which prevail in certain sections of the country.

The greatest demand for the replacement of these crystal cartridges comes from the owners of the older 78 *rpm* changers. This is because the greater part of the 33⅓ and the 45 changers in service have not been in service long enough to require many cartridge replacements.

While there is much pressure today on owners to replace the one-speed 78 changers with the newer, all-speed players, there still remains an estimated 10,000,000 owners of the older sets. Many of these have built up highly-prized libraries of 78 records and are well satisfied with their present machines and willing to pay for their repair.

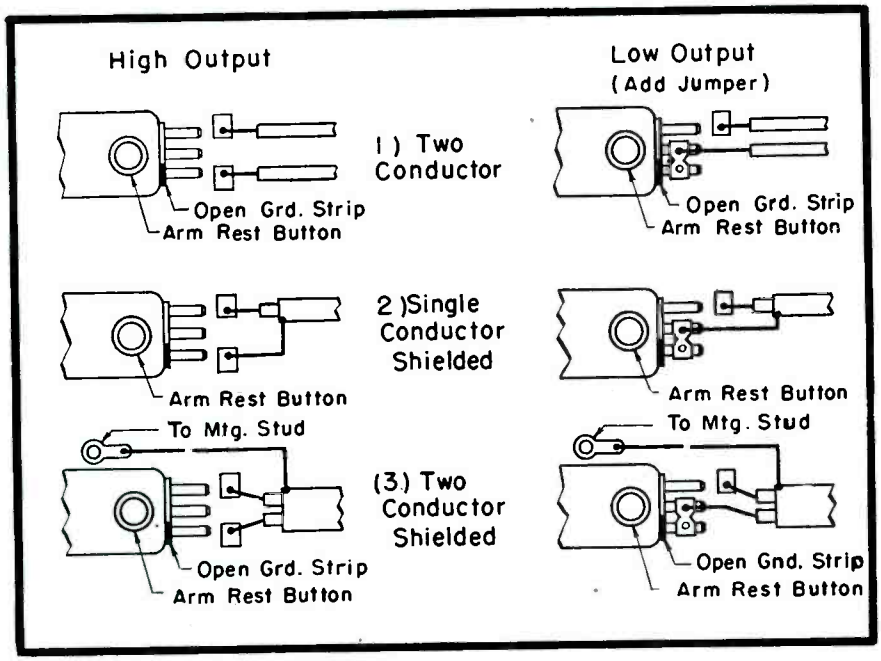
This brings us to the reason why manufacturers of replacement crystal cartridges are so concerned with the replacement problem and what they are doing in the way of developing new cartridges to enable the Service Man to profit from the enormous market for replacement of cartridges in the 78 changers.

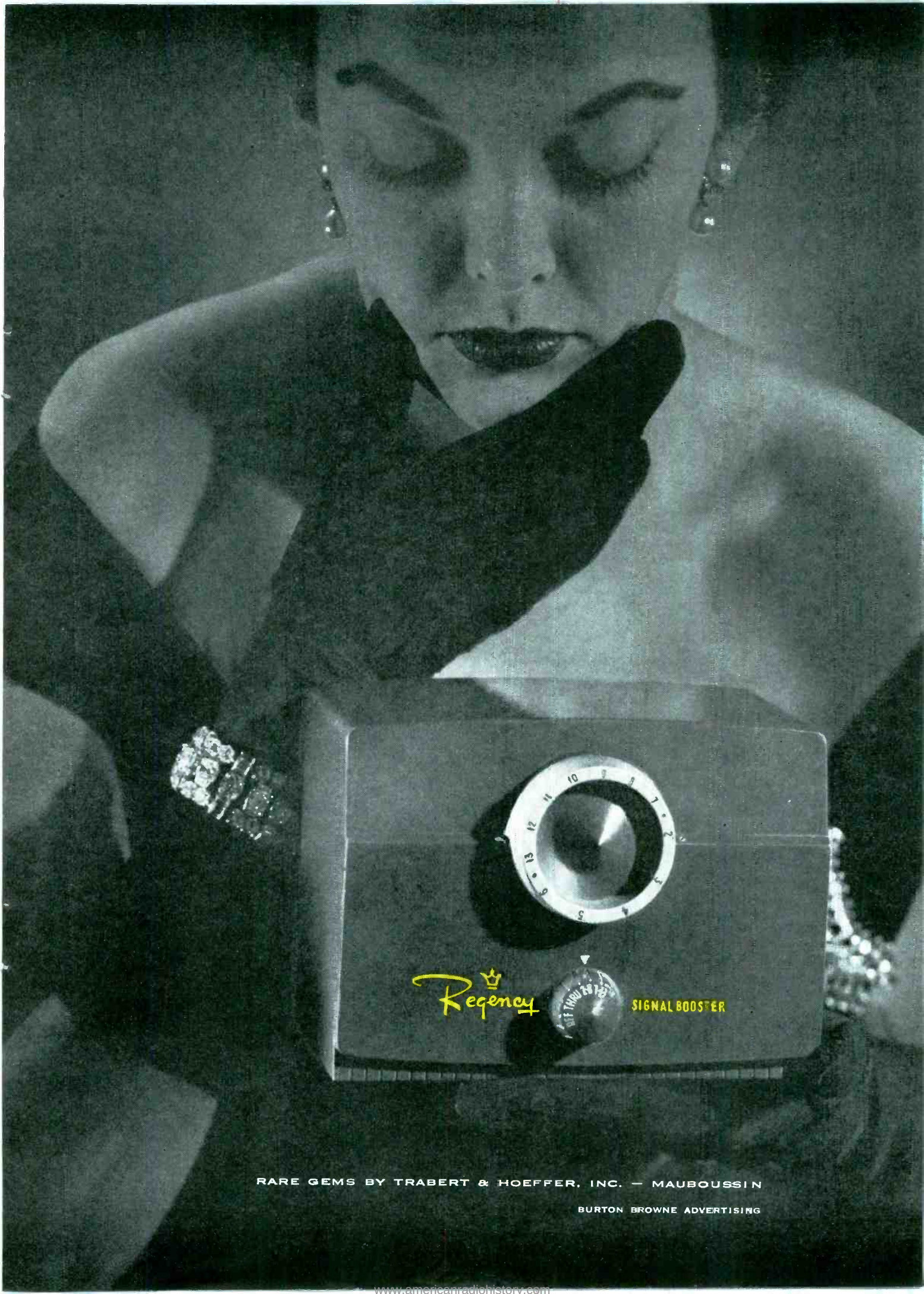
The greatest deterrent to profits in this field, of course, has been the necessity of replacing an inoperative cartridge with one of the same manufacture and with the exact model number of the original cartridge. Service Men could not be expected to carry some 200 or more different types of cartridges with him. Accordingly, it was often necessary to make two calls for a small dollar unit sale. Often, hours were spent hunting for the exact model cartridge for a particular job.

A study of the problem revealed that the large over-all volume of replacements involved only two categories: high output and low output with standard RTMA ½" mounting. While there are still some special cartridges which must be replaced exactly,

(*Continued on page* 58)

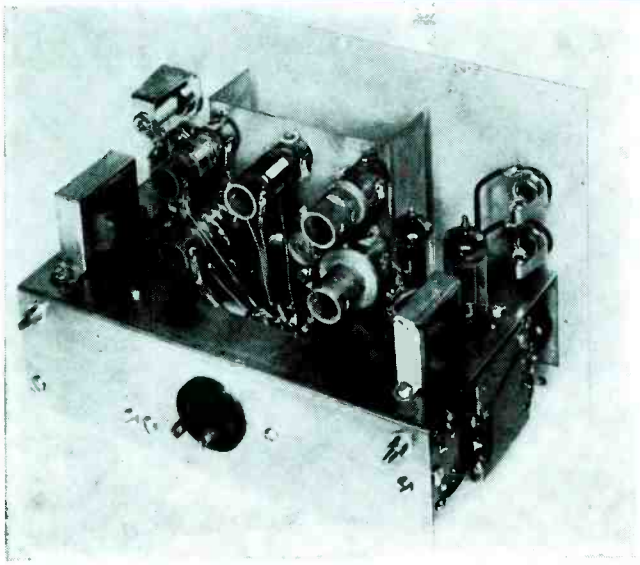
Possible output connections for a dual-output replacement cartridge.

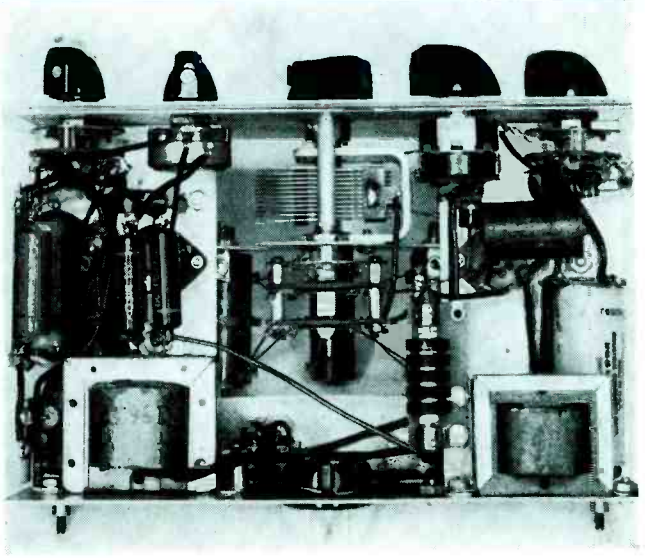




RARE GEMS BY TRABERT & HOEFFER, INC. — MAUBOUSSIN

BURTON BROWNE ADVERTISING





Improving SIGNAL-

MANY OF THE SMALLER signal generators which normally are two-tube affairs, with a Colpitts *af* oscillator modulating a Hartley *rf* oscillator, and usually equipped with a range switch and multiple tank coils, perform quite well insofar as the *rf* output and calibration are concerned, but are unsatisfactory in their overall performance; usually the deficiencies involve hum, poor regulation, low percentage of modulation, asymmetrical modulation, *rf riders* on the *af* output, and shift of the *rf* frequency when the modulation is switched on and off.

Typical Generator Circuit

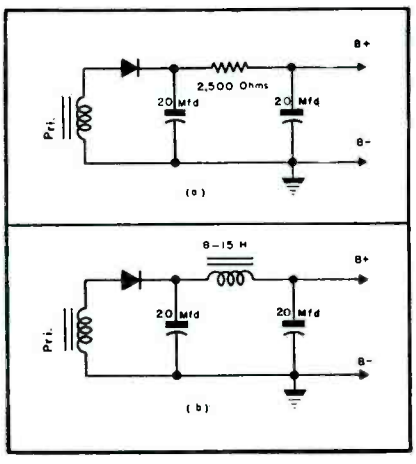
A typical circuit of such a small signal generator, less switching arrangements appears in Fig. 1. It will be seen that the device comprises a perfectly workable *rf* oscillator, which is plate modulated by a reasonably good *af* oscillator, and a power supply, which is usually under-filtered. Many generators of this general type have only 15-25 per cent modulation.

Power Supply Difficulties

Most power supplies for small signal generators consist of a half-wave rectifier, followed by a pi-section *rc* filter; Fig. 2*a*. Replacement of the resistor by a choke having a higher reactance at 60 cycles and a lower ohmic value will automatically reduce hum and raise output voltage. This change is shown in *b*. To compute the inductance, the following formula, for the reactance of a choke, can be used: $X_1 = 2\pi fL$. For the choke to cause a reduction in ripple, its inductance, in henries, must exceed the resistance it replaces divided by 377. Thus, a choke of from 8 to 15 henries, with a carrying capacity of 20 or more milliamperes‡ will usually be adequate.

‡Such as Thordarson T20C53 or Stancor C1003 or C1708.

Fig. 2. In *a* appears a typical power supply, a half-wave unit, used in a signal generator. To reduce hum and raise output voltage, a choke having a higher reactance at 60 cps and lower ohmic value, can be used as shown in *b*.



Modulation System Improvement

Improvement of the modulation system is somewhat more difficult, as there just isn't enough *af* power in the output of the *af* oscillator to plate modulate the *rf* oscillator to a reasonably high percentage. Grid modulation would be an easy solution for the low frequency ranges of the oscillator, but this introduces so much capacity to ground that the higher frequency ranges of the signal generator would be inpaired by its use.

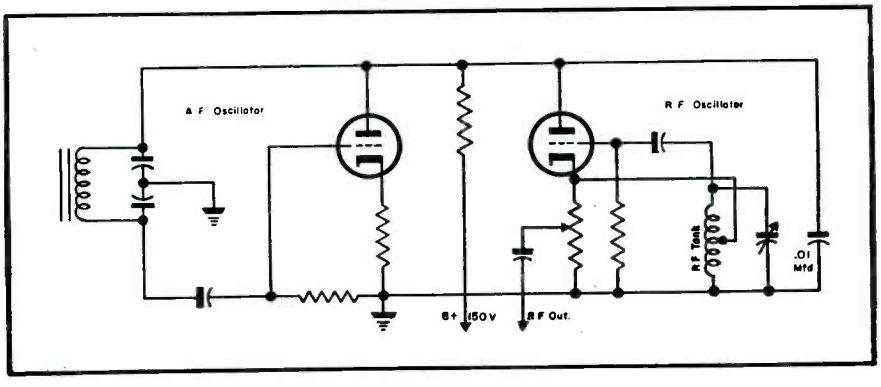
Three Solutions

Three related workable solutions to this problem are shown in Fig. 3. All require an additional *af* stage, but all will give clean modulation up to 80 per cent, and distorted modulation to higher values.

The Modulator Circuit

The complete modulator circuit consists of an *af* oscillator, an amplifier, and a coupling device. This, with choke

Fig. 1. Circuit of a typical signal generator. Switching arrangements are not shown.



Left: Top and bottom views of modified signal generator. Top view shows added pentode and filter choke. In the underside view appears the added *af* and *rf* chokes. It will be noted that the additions have not complicated the chassis layout. To remove the nuisance of a dangling cord, provision has also been made for an *ac* male plug at the rear of chassis.

Circuitry Alterations Included in Typical Signal Generator Serves to Minimize Hum, Increase Output Voltage and Improve the Modulation System So That It Can Be Varied from 0 to About 80 Per Cent At Will With Clean Waveforms. Overmodulation Can Also Be Produced If Desired.

GENERATOR Performance

by RONALD L. IVES

coupling to the *rf* oscillator, is shown in *a*. The coupling choke should have a minimum value of about 6 henries, and a carrying capacity of about 15 milliamperes. Many small filter chokes perform well in this position, but a few of the cheaper *ac-dc* chokes have a peculiar flyback characteristic which often messes up the *af* waveform.

Coupling Devices

Coupling to the *rf* oscillator is from the plate of the *af* amplifier to the plate of the *rf* oscillator through an *rf* choke, which keeps *rf* out of the *af* system.

Alternative Outputs

Alternative output devices include a tapped choke, which may be the primary of a push-pull output transformer (Fig. 3*b*), and a small stepup transformer (Fig. 3*c*). Both of these outputs give an appreciable voltage stepup, so that undistorted modulation closely approaching 100 per cent is possible at medium settings of the *af* volume control, and extreme overmodulation can be produced at will, by turning up the volume control. Choke coupling is not only the simplest and cheapest method, but is entirely adequate for most service and experimental work.

Pentode AF Stage Problems

Addition of a pentode *af* amplifier stage places an additional load on the power supply of the signal generator amounting to .15 ampere at 6.3 volts (filament) and about 15 ma at 150 volts (plate and screen). Unless the power transformer in the original signal generator will carry this added load, there is little point in making these improvements, unless a transformer of adequate capacity is substituted.

Modified Generator Features

When modified, the signal generator will produce all the *rf* output that it did originally, or a little more, with less hum. It will be found that modulation can now be varied from 0 to about 80 per cent at will, with clean waveforms, and overmodulation can be produced if desired. *AF* output, at oscillator frequency, can be produced at any power level desired from zero to about 1 watt, the load having no effect on the frequency.

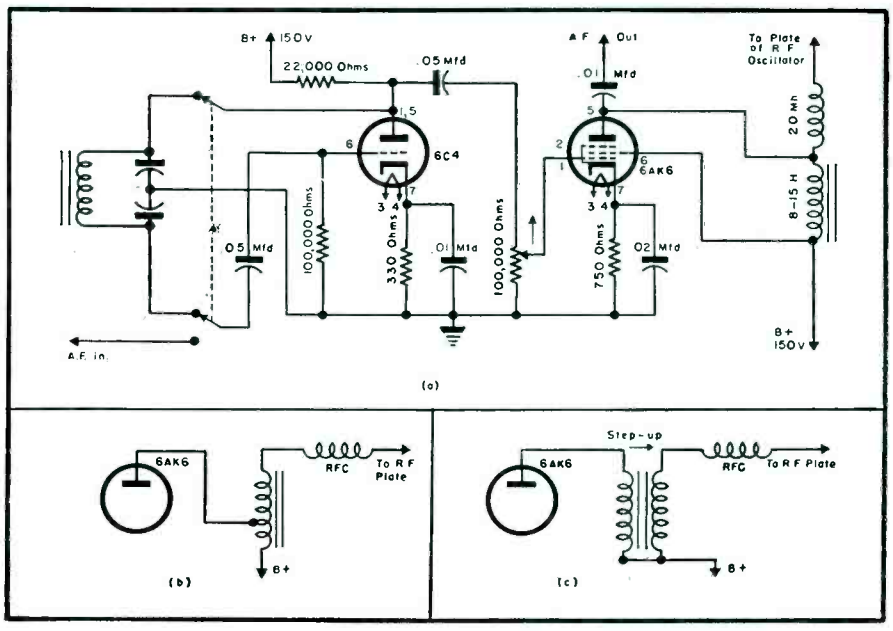


Fig. 3. Improved *af* modulation circuits. In *a* appears a complete modulator circuit which has an *af* oscillator, amplifier and a coupling device: System using choke coupling to the *rf* oscillator is shown here. In *b* and *c* appear alternative output devices which include a tapped choke and small stepup transformer.

AUDIO installation and service

Phono-Tape-Wire-PA-Amplifiers-Speakers

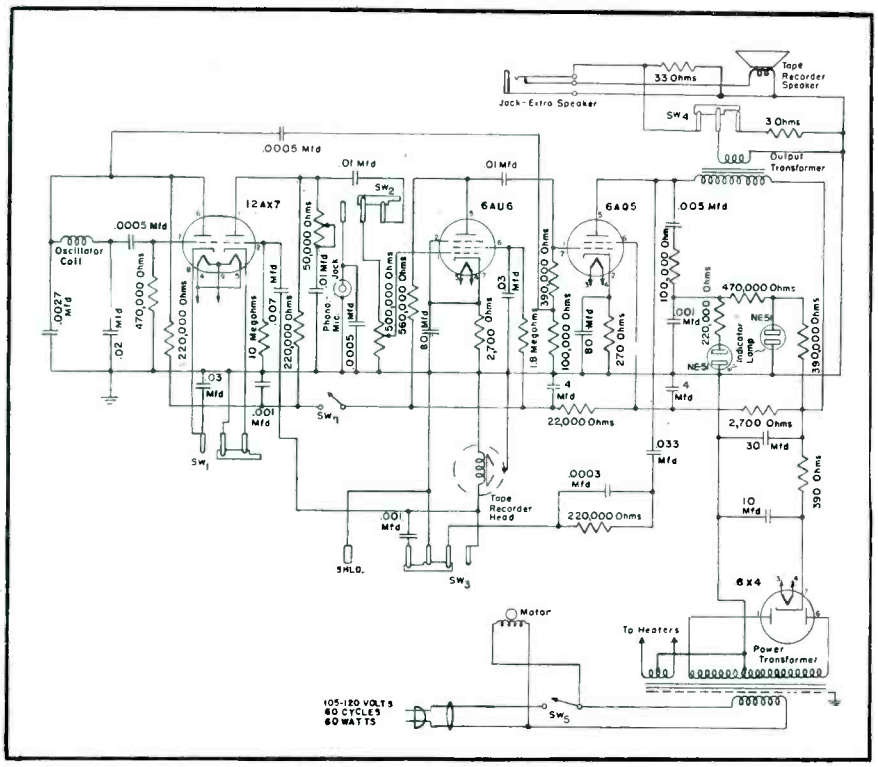
by KENNETH STEWART

Bias-Recording Current and Gain, and Distortion Checks in Magnetic Tape Equipment . . . Design Features of Tape-Phono Units . . . Tape Recorder Service Hints . . . Binaural Systems.

IN TESTING the operation of magnetic tape equipment, there are several unusual checks that must be made.

As an example, it is particularly important to check bias current. To illustrate, in the Ampro 731 tape unit (Fig. 1), this can be done by disconnecting the grounded lead from the recording head at a *play-record* switch, and switch to *record* position. Then a *dc* microammeter should be inserted and a check for current made if current exceeds 1 microampere; the .003-mfd capacitor in the plate circuit of the 6AQ5 should be replaced. The bias current should then be measured by inserting a 20 ohm non-inductive (or carbon) resistor between the recording head lead and the switch terminal from which it was disconnected and a vtvm connected across the resistor. The bias current will produce .015 volt ± 10%. Voltages are also subject to the same tolerance as the specific resistor being used in the test circuit. If the current is not within the limits specified, the oscillator and associated resistors and capacitors must be checked. If component values are correct, then plate and grid leads of the 6AQ5 should be pushed together to reduce current or separated to increase current.

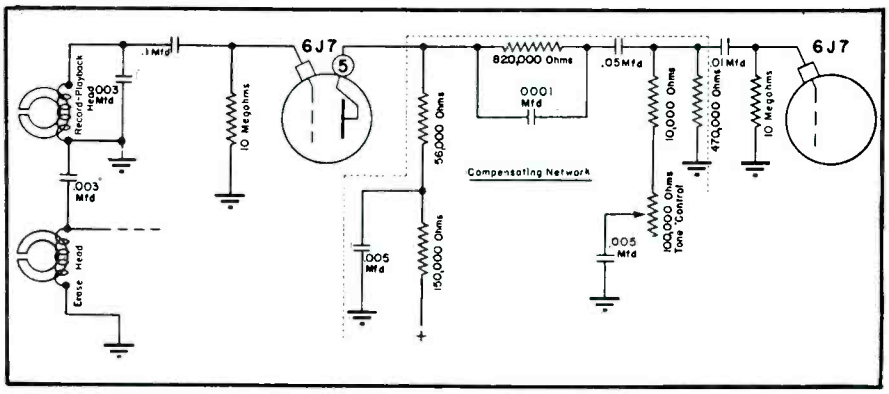
Fig. 1. Magnetic tape recorder and playback unit circuitry; *Ampro model 731.*



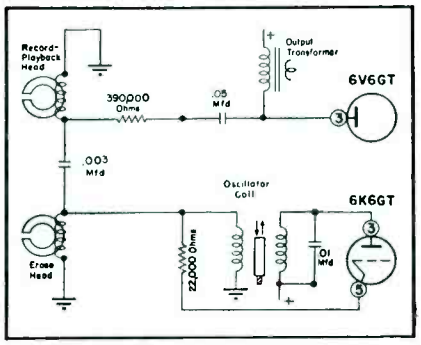
Recording current should also be checked. Either lead from the oscillator coil must be disconnected to stop the oscillator. An audio oscillator should be connected to the input jack. The *play-record* switch should then be placed in the *mic* position and the *volume-control* should then be set to the maximum clockwise position; the audio oscillator for 400 cps and the output adjusted so that the neon flashes faintly; *not a sustained glow.* A vtvm and a 20-ohm resistor, when connected as previously described, will indicate .001-.002 volt (plus or minus tolerance on resistor). The waveform, when viewed on a 'scope connected across a 3-ohm resistor in the record-listen switch circuit will be free from distortion. If the current is not correct, it will be necessary to change the neons, supplied as a matched and aged set, and recheck. If current is low the oscillator level should be increased to produce proper current and waveform checked. If wave is free from distortion, all resistors and capacitors in the neon lamp circuits should be checked. If the wave is distorted, the indicator lamp circuit can be assumed to be correct and recording head or associated supply network is at fault.

Gain and distortion checks are also important. In this instance, the recording-head circuit should be restored to normal, leaving the oscillator circuit open. The output of an audio oscillator should be loaded with a non-inductive resistor of the proper value and the ground terminal of the oscillator output connected to the amplifier

Simplified playback head circuit of Revere tape recorder. A coil is used for both recording and playing back. A .003-mfd capacitor, shunting, resonates the coil to intensify the higher audio frequencies.



Recording head circuit of Revere tape recorder. When the recorder is in *record* position, coil is energized with a 25-kc erase signal. Frequency compensation occurs during playback only.



chassis. A 20,000-ohm carbon resistor should be connected between the *hot* terminal on the oscillator output and the ungrounded lead from the recording head; resistor and connecting lead should be shielded and shield should be grounded. The volume control should be turned to maximum clockwise position and *play-record* control to *play* position. The *motor* switch should then be turned *on*. Oscillator should be adjusted to 400 cps and *.01* volt; measured across oscillator load resistor. An output meter connected across the speaker terminals should read *2 to 3.5* volts and the output wave form should be free from visible distortion. If distortion is present or output is low, the tubes should be checked, substituting one at a time; then starting at the output stage, the waveform at each plate and grid should be checked to locate the stage in which the distortion is occurring.

Adjustment of the erase head is extremely important, since an accurate adjustment will insure complete removal of all recorded material and leave the tape in a demagnetized state. The adjustment can be made by a harmonic distortion method, which requires an audio frequency oscillator producing 400 cps, free from second harmonic distortion or equipped with filter to attenuate 800 cps harmonic by at least 75 db; matching transformer or network to couple oscillator to input of recorder, and a distortion meter (harmonic).

The audio oscillator should be checked with the distortion meter to be sure that the 400 cps tone is free from harmonic distortion. Use a filter if necessary. The oscillator should be matched to the input of the recorder. The distortion meter should be connected to the output of the recorder, using the procedure recommended by the manufacturer for connecting to a 3.75-ohm source.

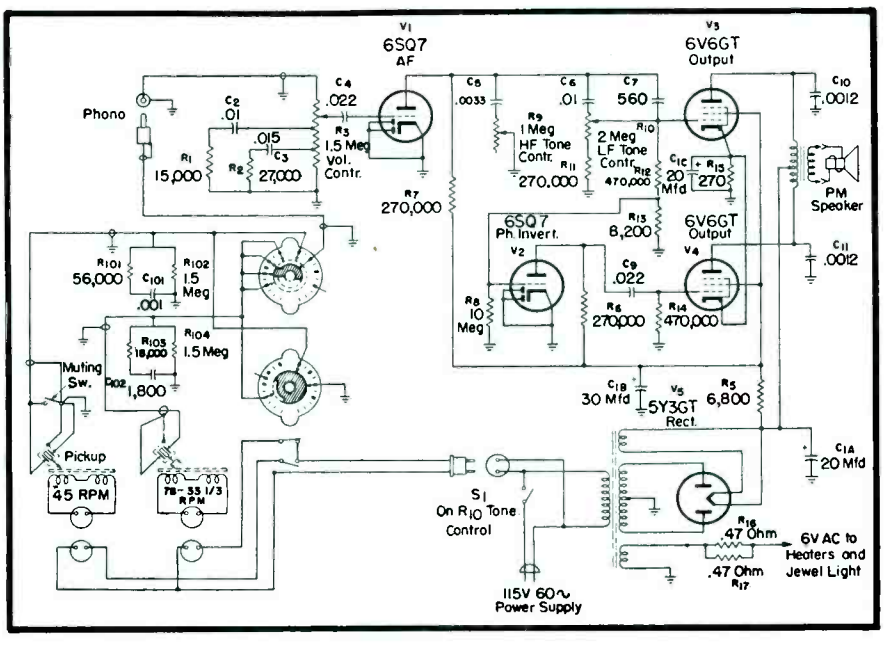
The recorder should then be turned on, switch placed in phono-radio position and the volume control adjusted to produce a faint flash from the recording lamp. The output of the recorder should be checked to be sure that the level being used produces negligible harmonic distortion. If the output is distorted, the amplifier should be serviced before attempting to adjust the erase head.

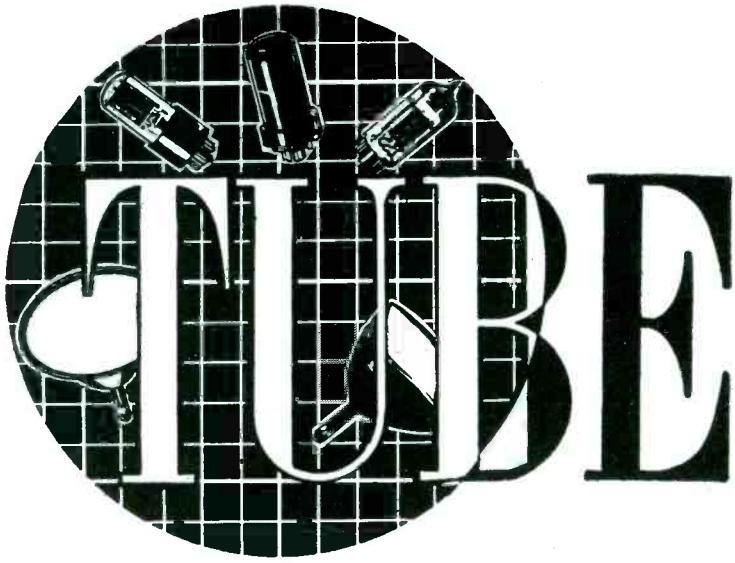
The recorder should now be threaded with brown oxide tape and about 5′ of tape recorded. The tape should be rewound, switch turned to *play* position and the harmonic distortion measured. The screw which holds the magnet guard in place should be loosened and the guard moved about .005″ in either direction. The recording and playback operation should be repeated and again the distortion measured. If the distortion has decreased, the guard should be moved in the same direction and the test repeated until a position which produces minimum distortion has been located. As the point of minimum distortion is approached, the guard should be moved approximately .001″ per step; this can be accomplished by only loosening the retaining screw slightly and tapping the guard with a light tool.

If a considerable number of recorders are to be serviced, the process can be speeded up by placing a second recorder (known to be in good condition) alongside of the one being adjusted and using it as a continuous playback unit to monitor a loop of tape upon which a recording is being made continuously by the unit being adjusted. Slack should be left in the tape as it passes between the two recorders. This produces an additional

(*Continued on page* 59)

Circuit of *RCA* model *15E* record demonstrator, which features an automatic 45 rpm player with a 14-record capacity mount, and a manual player for 33 1/3 or 78 records up to 12-inch type. A 6SQ7 is the *af* amp; another 6SQ7 is a phase inverter; a pair of 6V6GTs are in the output and a 5Y3GT is the rectifier.





News

by L. M. ALLEN

Ultrahigh Tube Design and Application . . . Sound TV Tubes . . . Picture Tube Production Techniques . . . Cylindrical Face Picture Tubes . . . Electro-Magnetic-LV Electrostatic-Automatic Focus Type Picture Tubes...Transistors.*

THE ULTRAHIGH REGION, which has begun to interest everyone, has become a particularly popular favorite among tube researchers. As a result there have appeared many unusual projects.

In designing tubes for these frequencies, it has been necessary to consider, first, the maximum frequency at which conventional tubes will operate. This is determined by three groups of phenomena:

(*1*) Effects of the finite electron transit time. These effects manifest themselves at frequencies where the duration of one cycle is no longer great in comparison with the time required by an electron to traverse the clearance between the cathode and the anode. At such frequencies the mutual conductance decreases, the input circuit is damped and the signal-to-noise ratio diminishes.

(*2*) Undesired couplings, caused by the capacitances, the self-inductances and the mutual inductances of the electrodes and their connections.

(*3*) Losses which, in general, increase with the frequency and which may be distinguished as dielectric losses in the glass, and dissipative losses in the electrode connections and in the electrodes themselves. At *uhf* the latter losses are predominant.

*Based on notes supplied by Amperex.

Transit Time

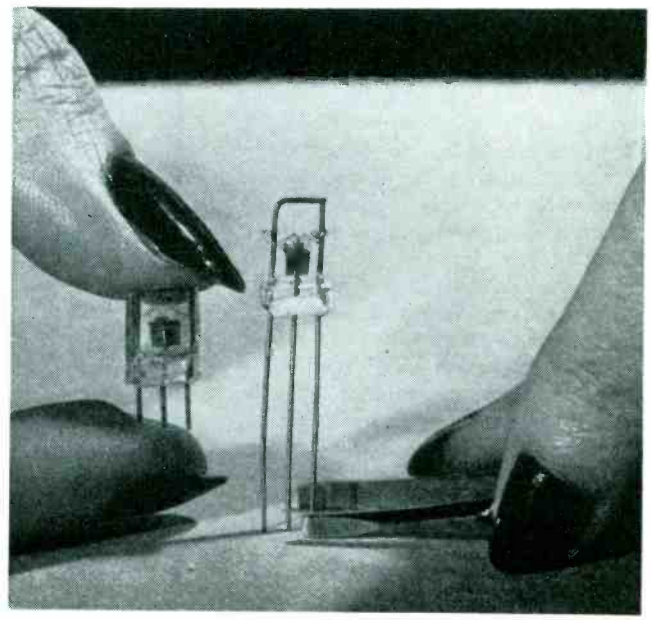
It has been found that the most obvious modification is to reduce the clearance between the electrodes, thus shortening the transit time. Especially important is the spacing between cathode and grid, where the electron velocity is low, and the time for the electrons to traverse this space is therefore relatively high.

By bringing cathode and grid closer together, their capacity is however increased; but since the mutual conductance is also increased, it has been found that the net result can be an improvement of the tube's properties at high frequencies.

Coupling Effects and Losses

Studies have shown that a reduction can be obtained by shortening the

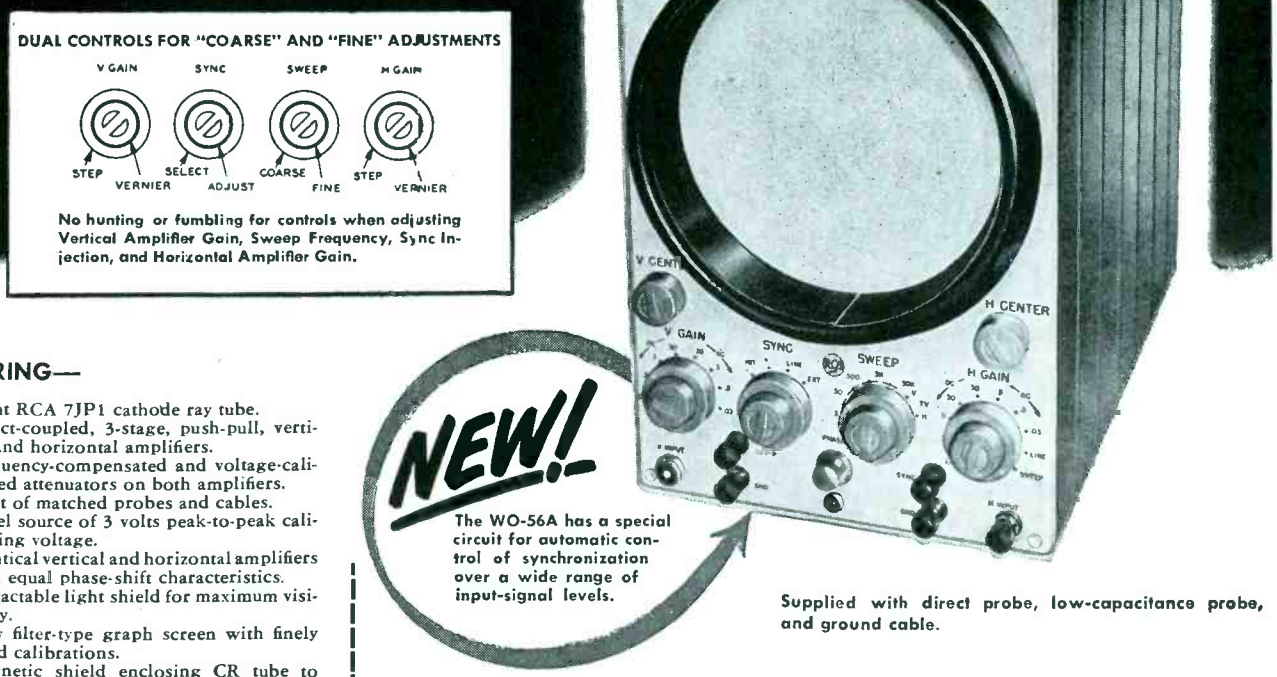
(*Continued on page* 30)



Two views of developmental transistor unveiled recently. The transistor performs many of the functions of a tube and can substitute for it in many applications. Because of its minute size and low-power requirements, the transistor is expected to point the way to a wide range of miniaturized electronic products. At right is a transistor in an advanced stage of construction. At left is the finished transistor, with its components embedded in a protective casing of plastic. *(Courtesy RCA)*

The 7" TV scope for professionals

RCA WO-56A



DUAL CONTROLS FOR "COARSE" AND "FINE" ADJUSTMENTS

No hunting or fumbling for controls when adjusting Vertical Amplifier Gain, Sweep Frequency, Sync Injection, and Horizontal Amplifier Gain.

NEW!

The WO-56A has a special circuit for automatic control of synchronization over a wide range of input-signal levels.

Supplied with direct probe, low-capacitance probe, and ground cable.

FEATURING—

- Giant RCA 7JP1 cathode ray tube.
- Direct-coupled, 3-stage, push-pull, vertical and horizontal amplifiers.
- Frequency-compensated and voltage-calibrated attenuators on both amplifiers.
- A set of matched probes and cables.
- Panel source of 3 volts peak-to-peak calibrating voltage.
- Identical vertical and horizontal amplifiers with equal phase-shift characteristics.
- Retractable light shield for maximum visibility.
- New filter-type graph screen with finely ruled calibrations.
- Magnetic shield enclosing CR tube to minimize hum-pickup from internal and external fields.

SPECIFICATIONS—

- Vertical Deflection Sensitivity: 10.6 rms millivolts per inch.
- Frequency Response: Flat within −2 db from dc to 500 kc; within −6 db at 1 Mc; useful response beyond 2 Mc.
- Input Capacitance: Less than 10 uuf with WG 216A Low-Capacitance Probe.
- Square-Wave Response: Zero tilt and overshoot using dc input position. Less than 2% tilt and overshoot using ac input position.
- Linear Sweep: 3 to 30,000 cps with fast retrace.
- Trace Expansion: 3 times screen diameter with corresponding centering control range.
- Power Supply: 105-125 volts 50/60 cycles; power consumption 65 watts.
- Size 13⅜" h, 9" w, 16⅝" d. Weight only 31 pounds (approx.).

ADVANCED SWEEP FACILITIES—

- Preset fixed sweep positions for vertical and horizontal television waveforms.
- Positive and negative syncing for easy lock-in of upright or inverted pulse waveforms.
- 60-cycle phase-controlled sweep and synchronizing.

Built for laboratory, factory, or shop use, the WO-56A combines the advantages of high-sensitivity and wide-frequency range in a *very small* instrument with a *large* cathode-ray tube.

Designed with the user in mind, this new 'scope can be depended upon to provide sharp, bright, large, and accurate pictures of minute voltage waveforms over the entire useful surface of the 7JP1 screen.

The amplifier selector switches are provided with both "AC" and "DC" positions so that measurements can be made with or without the effects of any dc component.

Square-wave reproduction is excellent, whether the application is low-frequency TV sweep-alignment or observation of high-frequency steep-fronted sync and deflection voltage waveforms.

A special sync-limiter circuit automatically maintains proper synchronization of the sweep oscillator over a wide range of input-signal levels without the need for manual adjustment of the sync-vernier control.

The excellent linearity and fast retrace of the sweep or time base are functions of the Potter-type oscillator. Undistorted reproduction of the sawtooth waveform is assured by use of a horizontal amplifier with a wide-band characteristic. The preset sweep positions provide rapid switching between vertical and horizontal TV waveforms.

Truly, the WO-56A is a most useful and practical instrument for everyday work in the fields of television, radio, ultra-sonics, audio, and a wide array of industrial applications.

For details, see your **RCA Distributor**, or write RCA, Commercial Engineering, Section CX56, Harrison, N. J.

RADIO CORPORATION of AMERICA

TEST EQUIPMENT **HARRISON, N. J.**

Tube News

(*Continued from page 28*)

length of the connections between the electrodes and the exterior contacts. In one series of tubes designed in Holland, which will soon be available in this country, the electrode system has been mounted on a flat glass bottom with moulded-in connecting pins; thus very short distances between the electrodes and the external circuit are possible in this way.

Chrome iron connecting pins, as well as nickel connectors between the pins and the electrodes, are covered with a layer of silver or copper, reducing their resistance at a frequency of 300 mc by a factor of about 10.

Another member of this tube family features a different structure, with the concentric electrode system replaced by plane, parallel electrodes. This form is said to allow very close spacing required for extremely short transit times.

Anode and grid connecting pins have been replaced by copper discs, fused into, and protruding beyond, the wall of the glass bulb. The outer parts of these discs have been shaped in a special way, so that the tube can be inserted in coax line circuits.

This tube, a disc-seal triode, was developed for application in receivers and small transmitting installations. In receivers the tube can be used as a high-frequency amplifier and local oscillator, and in transmitters, as a self-excited, controlled and impulse modulated transmitting tube.

The tube is mainly intended for use in coax line circuits. When the tube is used as an oscillator in a coax line circuit, the output power with an anode input of 10 watts is about 2.8 watts at 1000 mc and about 0.5 watt at 3000 mc. The grid of this tube is composed of stretched wires so that buckling due to heating is avoided; the result is that the frequency drift is very small. Moreover, the grid, and the disc to which it has been attached, function as a screening between the anode and the cathode, so that the coupling between the input and output circuits is very small.

Cooling of the anode is achieved mainly by thermal conduction to the line circuit.

G. E. Uhf Tube

An ultrahigh *rf* amplifier, announced by G.E. during the recent IRE national convention, was also noted as featuring unusual design and serving as a complement to the 6AF4, an oscillator tube for *uhf* tuners, introduced a few months ago.

Sound TV Tubes

From G.E. has also come a new tube, 6BK5, which it is said, in conjunction with a 6BN6 in the sound circuit of TV receivers will result in the elimination of two tubes.

The 6BK5 is a power output pentode, while the 6BN6 is a combination limiter and discriminator. Used together, it is claimed that they eliminate use of a first audio amplifier tube and a limiter tube; the 6BK5 is specifically designed for use with the 6BN6.

When operated with 250 volts on the plate and screen, the 6BK5 can deliver 3.5 watts at seven per cent distortion. The grid driving voltage required for full audio output is said to be only five volts peak. The tube has a plate dissipation of nine watts.

Picture Tube Production*

One of the most important steps in the manufacture of picture tubes is the process of making the screening solution for the faceplate.

The first step in preparing the screening solution is to purify the water used. At the G.E. tube plant, this is done by running ordinary tap water through a series of tanks containing ion-exchange resin. The water is then mineral-free as it emerges from the tanks.

The mineral-free water is then run through a series of filters to remove sedimentary particles. Sample tests of the pure water are made daily.

Following this purifying process, the water is piped into insulated stainless-steel storage tanks and subsequently piped down to the screening room and mixed with other ingredients to form the screening solution.

Preparation of the ingredients used to make the screening solution is made in the lab and then piped down to the screening room to be mixed with phosphor powder and de-ionized water to form the screening solution.

It has been found that the process of mixing these ingredients together must be exact, since the inclusion of too much of one or too little of another will result in a poor screen.

Cylindrical Face Picture Tubes

To eliminate annoying specular reflection, there has been developed a 17" rectangular, all-glass picture tube incorporating a cylindrically shaped face plate.**

In addition to this feature, the tube is magnetically focussed and deflected, and, also, has a single ion-trap gun design, neutral density face plate for better contrast, and external conductive coating for increased anode supply filtration and radiation shielding.

In another picture-tube development, there have appeared tubes‡ which provide for three methods of focus: Standard electromagnetic focus used with a focus coil, low voltage electrostatic focus, and automatic focus.

The only difference in the external appearance of two of these tubes is that the electromagnetic focus tube has a 5-pin base, whereas the low voltage, electrostatic focus tube has a 6-pin base.

Tube may be used as a standard magnetic focus tube by utilizing the regular focus coil and making no connection to the *6* base pin. By utilizing this method, the low voltage, electrostatic focus tube can be used as a standard electromagnetic tube.

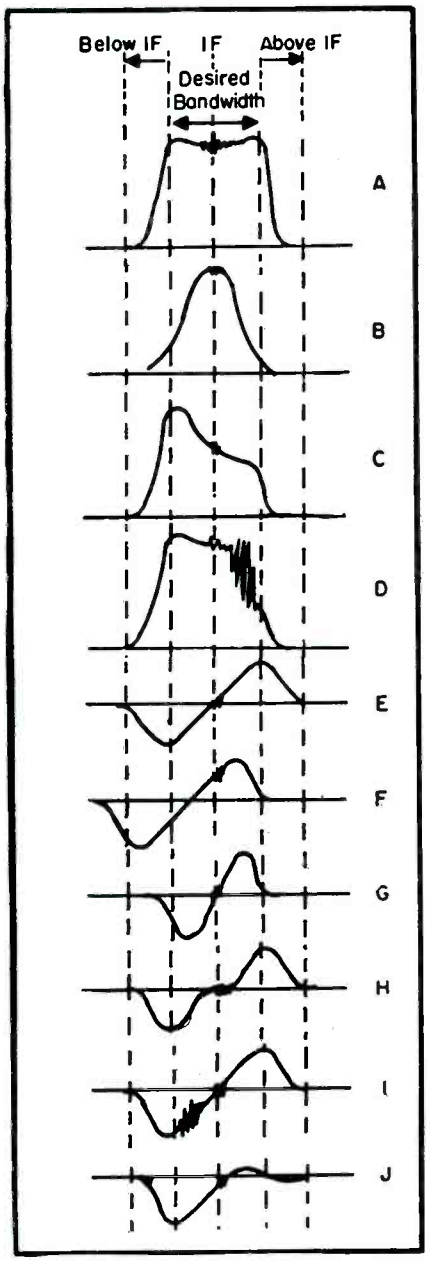
In the event that there is no focus voltage supply, the *6* base pin can be connected to the chassis for ground.

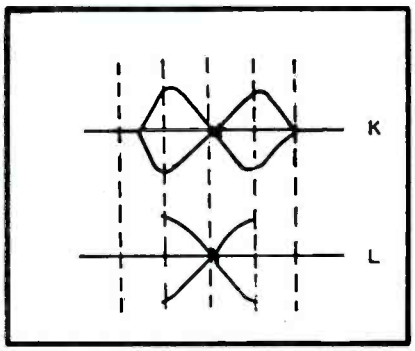
*From notes prepared by G.E.
**Hytron 17 QP4. ‡Sheldon Electric.

FM Servicing-Alignment

by RUDOLF F. GRAF*

Part II . . . Ratio-Detector 'Scope Alignment





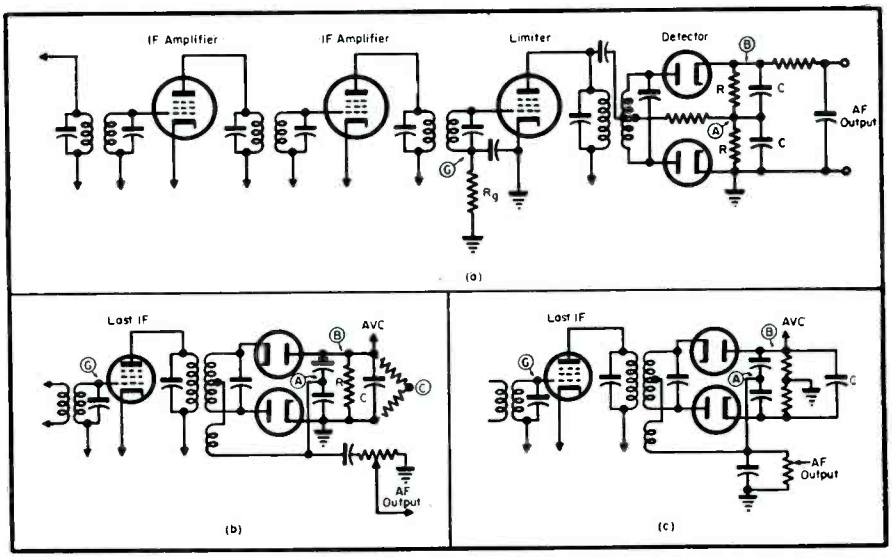


Fig. 1. FM detector circuits and test points. In *A* appears a discriminator type of FM detector, while in *B* and *C* appear unbalanced and balanced ratio detectors, respectively.

ANALYZING THE ALIGNMENT of the *if* stages, in the initial installment[1], it was indicated that the vertical input lead should be connected to the limiter grid (point *G* in the circuitry) and the sweep generator leads should be connected to the grid of the mixer grid. All of the *if* transformers should be aligned to obtain the desired *if* response curve. It is important to be sure to keep the input signal to the mixer grid as small as possible; otherwise the limiter will be driven beyond saturation and the curve will flatten out. The overall bandwidth of the *if* stages can be checked at a glance, by changing the marker frequency over the complete response curve. The overall alignment of the circuit can be checked by leaving the generator connected at the mixer grid and moving the 'scope's vertical input terminals back to point *B*. Then the *S* curve can be observed. If necessary the alignment can now be touched up slightly to straighten out any irregularities.

Fig. 2, *left*. Quick reference charts for *S* curves and *if* response curves. *Above*: *A* = proper response curve at the limiter grid. It will be noted that the curve is almost flat over the entire bandwidth. *B* = response curve which is too narrow at the limiter grid. It is, therefore, necessary to realign *if* stages to obtain greater bandwidth. *C* = unsymmetrical *if* response curve at the limiter grid. The *if* stages must be realigned for greater symmetry. *D* = response curve at the limiter grid showing oscillating condition in the *if* or *rf* stages. In this instance, it is necessary to check the bypass capacitors, grounds, shielding, tubes, *avc* and decoupling filters. *E* = proper *S* curve at FM detector output. *F* = detuned *S* curve. Here it is necessary to readjust the primary and secondary and check tuned circuits. *G* = *S* curve which is too narrow, which causes the sound to become distorted. The cause may be similar to that indicated in *B*. *H* = non-linear *S* curve, where it is necessary to readjust the secondary. *I* = an *S* curve showing oscillations. In this instance, the checks suggested in step *D* should be followed. *J* = *S* curve showing low emission of one of the diode tubes. This may also be due to a shorted turn in half of the secondary. May also be caused by the troubles indicated in step *C*. *K* = butterfly response curve obtained when 'scope sweep frequency is one-half that of sweep generator. *L* = same as *K*, but with reduced sweep generator width.

Analyzing the Alignment: In receivers employing ratio detectors it is usually best to align the detector first and then turn to the *if* stages. The following alignment procedure holds equally true for balanced or unbalanced ratio detectors:

The vertical input lead should be connected from the 'scope to point A, through a 10,000-ohm isolating resistor and the sweep-generator output with the marker signal connected to the grid of the last *if* stage. This is point *G* in Fig. 1*b* and *c*. Now, the primary and the secondary of the transformer can be adjusted for proper symmetry and linearity, as before. Next, the sweep signal should be moved to the mixer grid and the 'scope input leads connected through the isolating resistor to point *B*. The electrolytic, *C*, connected from point *B* to ground, must be temporarily disconnected when the 'scope is at point *B*; otherwise there will be no pattern on the screen. All *if* stages should be aligned for a symmetrical response curve, similar to the one shown in Fig. 2*a*. After the *if* stages are aligned, the electrolytic should be reconnected.

When servicing the FM receiver, there are a number of symptoms that

(*Continued on page 77*)

*Formerly, Instructor, Gotham Radio Institute.

[1]SERVICE; February, 1952.

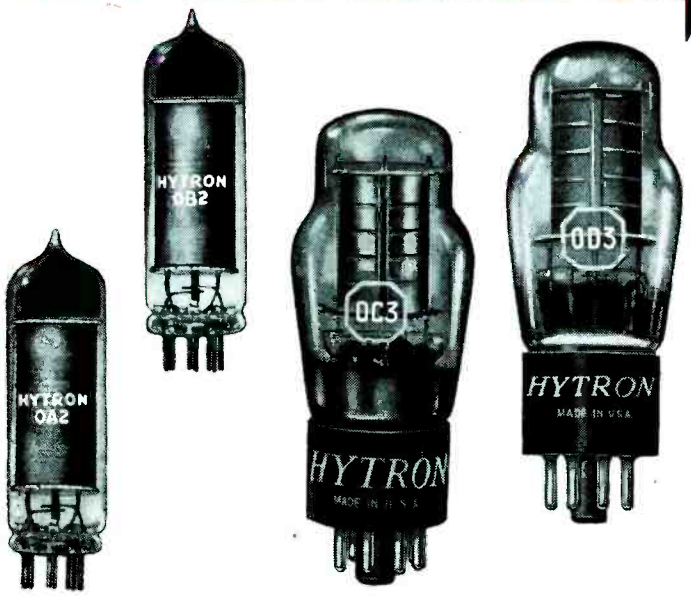
"When we think of V-R tubes, we think of CBS-HYTRON"

TUBES ARE KNOWN BY THE COMPANY THEY KEEP

It's automatic with scores of top-flight manufacturers. They turn to CBS-Hytron for the miniature OA2, OB2 and standard OC3, OD3.

That's only natural. They know CBS-Hytron has the know-how...know-how gained from making over 15,000,000 voltage regulators. They know CBS-Hytron supplies these apparently simple tubes to either JAN or commercial specifications. (In fact, CBS-Hytron's factory tests of VR tubes are much tougher than JAN.) And they know CBS-Hytron . . . top producer of VR tubes . . . can be depended upon for prompt delivery.

Follow the leaders yourself. Buy the best. Order *your* gaseous voltage regulators from CBS-Hytron.



Write for Complete Free Data on

CBS-HYTRON voltage-regulator tubes

CBS HYTRON RADIO TUBES

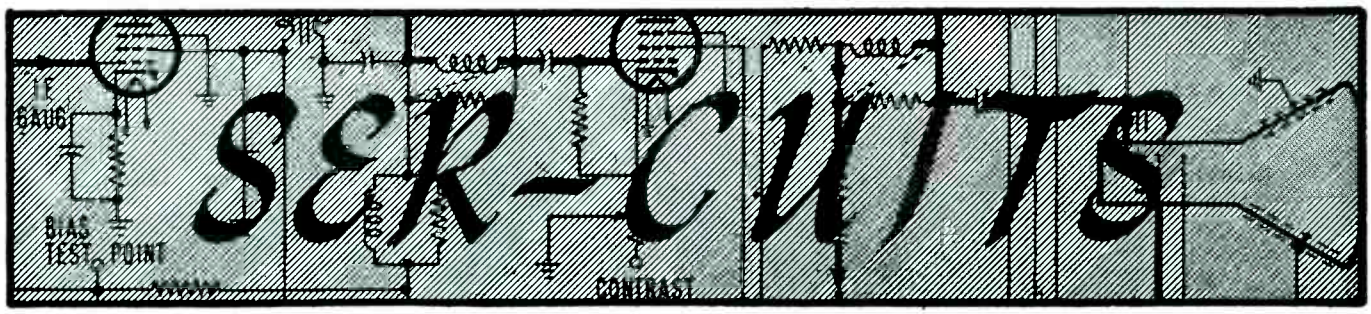
MANUFACTURERS OF RECEIVING TUBES SINCE 1921
HYTRON
RADIO AND ELECTRONICS CO.
A DIVISION OF COLUMBIA BROADCASTING SYSTEM, INC.

MAIN OFFICE: Salem, Massachusetts

Reads like the blue book of electronics... this list of famous companies who from long experience buy the best in voltage-regulator tubes... CBS-Hytron.

Admiral Corporation • Airborne Instruments Lab., Inc. • Aircraft Armaments, Inc. • Aircraft Radio Corp. • Airesearch Mfg. Co. • Applied Physics Corp. Applied Research Laboratories • Arma Corporation A.R.F. Products, Inc. • Atomic Instrument Co. Audio Products Corp. • Ballantine Laboratories, Inc. • Arnold O. Beckman, Inc. • Bell Aircraft Corp. • Bell Telephone Laboratories, Inc. • Bellaire Electronics, Inc. • Bendix Aviation Corp. • Berkeley Scientific Corp. • Bill Jack Scientific Instrument Co. • Bright Radio Laboratories • The Brinnell Co. Browning Laboratories, Inc. • J. H. Bunnell & Co. Cambridge Instrument Co., Inc. • The Allen D. Cardwell Mfg. Corp. • CBS-Columbia, Inc. • CBS Television • Collins Radio Co. • Connecticut Telephone & Electric Corp. • Consolidated Vultee Aircraft Corp. • Cornell-Dubilier Electric Corp. • Crosley Division, Avco Mfg. Corp. • DDD Manufacturing Co. • Douglas Aircraft Co., Inc. • Allen B. DuMont Laboratories, Inc. • Edo Corporation • Eicor, Inc. • Electro-Physical Laboratories, Inc. • Electrotechnic Corp. • El-Tronics, Inc. • Fada Radio and Electric Co., Inc. • Fairchild Guided Missiles Div., Fairchild Engine and Airplane Corp. • Federal Manufacturing and Engineering Corp. • Federal Telecommunication Laboratories, Inc. • Federal Telephone and Radio Corp. • Ford Instrument Co., Div. of Sperry Corp. • Gaveco Laboratories, Inc. • General Communication Co. General Precision Laboratory, Inc. • General Radio Co. • Gilfillan Bros., Inc. • Gonset Company • The Gray Mfg. Co. • The Hallicrafters Co. • The Hammarlund Mfg. Co., Inc. • Harvey-Wells Electronics, Inc. • Hazeltine Electronics Corp. • Hewlett-Packard Co. • Hickok Electrical Instrument Co. • Hoffman Radio Corp. • Hubbell & Miller Co. • Industrial Control Co. • Industrial Development Engineering Associates, Inc. • Jack & Heintz, Inc. Jackson Electrical Instrument Co. • Kepco Laboratories, Inc. • Lavoie Laboratories, Inc. • Lear, Incorporated • Lewyt Corporation • Link Radio Corp. • Loral Electronics Corp. • Lyman Electronic Corp. • Lysco Mfg. Co., Inc. • P. R. Mallory & Co., Inc. • The Glenn L. Martin Co. • The W. L. Maxson Corp. • McDonnell Aircraft Corp. • McElroy Manufacturing Corp. • Melpar, Inc. • Midwest Engineering Development Co., Inc. • Minshall-Estey Organ, Inc. • Motorola, Inc. • National Company, Inc. National Electrical Machine Shops, Inc. • National Research Corp. • National Research Council, Canada • New London Instrument Co. • Nuclear Measurements Corp. • Nutone, Inc. • Photobell Co. Pilot Radio Corp. • Portable Electric Tools, Inc. Precision Apparatus Co., Inc. • Press Wireless Mfg. Co., Inc. • Radiation, Inc. • Radio Development & Research Corp. • Radio Engineering Laboratories, Inc. • Rauland-Borg Corp. • Raymond Rosen Engineering Products, Inc. • Raytheon Mfg. Co. Reed Research, Inc. • Sanborn Company • Sangamo Electric Co. • Schuttig & Company, Inc. • Sentinel Radio Corp. • Servomechanisms, Inc. • Setchell Carlson, Inc. • Shallcross Mfg. Co. • F. W. Sickles Div., General Instrument Corp. • Sierra Electronic Corp. • A. F. Smuckler & Co., Inc. • Sonar Radio Corp. • Spencer-Kennedy Laboratories, Inc. • The Stamford Electronics Co. • Fred Stein Laboratories • The Superior Electric Co. • The Technical Materiel Corp. • Telechrome, Inc. • Tel-Instrument Co., Inc. • Times Facsimile Corp. • Tracerlab, Inc. • Trad Television Corp. • Transducer Corp. • United Scientific Laboratories, Inc. • Varo Mfg. Co., Inc. Wells-Gardner & Co. • Western Electric Co. • Western Sound & Electric Labs., Inc. • Westinghouse Electric Corp. • Weston Electrical Instrument Corp. • Weston Laboratories • Wilcox Electric Co., Inc. • Witco Mfg. Co.

In addition to many other prominent manufacturers, the U. S. Army, Navy, Air Force, Coast Guard, AEC, CAA, FCC, National Bureau of Standards, government development laboratories and other government agencies, well-known research laboratories and universities, foreign countries, and the nation's leading electronic parts distributors.



by M. W. PERCY

Analysis of 24-Inch G. E. Chassis: The 45.75/41.25 IF System . . . Video Amplifier . . . Keyed AGC . . . Sync System . . . Vertical Sweep and Retrace Blanking . . . AFC . . . Audio Circuit.

DURING THE LAST FEW MONTHS it has been noted that the newer line of chassis are featuring many extremely unusual circuitry developments devised to provide higher gain, improved hold and better pictures.

In Fig. 1 appears an excellent example of a circuit with the foregoing features. Specifically this model, a G. E. 24C101, has a two-stage *rf* amplifier, keyed *agc*, automatic horizontal frequency control, advanced type of intercarrier sound system, an *if* interference trap at input, provision for *uhf* converter connection and a 24-inch round picture tube.

IF System Analysis

This receiver incorporates four video *if* amplifiers which are followed by a crystal diode and associated video amplifier. First two stages are conventional pentode amplifiers whose bandwidth is relatively broad, passing both the video and audio carrier *if* frequencies. Their high-*if* frequency cutoff is determined by a pair of 47.25-mc absorption traps. The plate circuit of the second stage passes the two *if* frequencies and their associated sidebands to the grid of the third video *if* amplifier as well as to the sound takeoff amplifier.

Sound takeoff amplifier is also a fairly broad stage and is similar to a conventional video *if* amplifier in this respect. Its response is relatively broad compared to the bandwidths normally encountered in audio *if* stages. At this point the signal is still a composite one, containing both *if* carrier frequencies, audio and video, whose relative amplitude ratio is determined by the tuning of an output tank circuit, L_{212}, and to some extent by the pass band characteristics of preceding tank circuits. The output of this stage drives a crystal diode wherein mixing and detection take place, the resultant of which is a 4.5-mc sound *if* signal. From this point to the audio system, the signal passes through a conventional FM *if* system, consisting of an amplifier, limiter and ratio detector.

Now that the audio portion of the transmission has been obtained, it is necessary to dispense with the audio *if* carrier frequency; 41.25 mc. This is accomplished in the next two (third and fourth) video *if* amplifiers by means of absorption traps L_{207} and L_{208}. These two stages may be aligned in such a manner that their response, together with the response of the preceding stages, will have a wide bandwidth characteristic. The video *if* signal is passed to a crystal diode, V_{209}, in a detector-can assembly.

The video amplifier circuit employs a pentode-type tube whose output is coupled through a capacitor to the picture-tube cathode. The screen voltage of the video amp is varied by the contrast control.

Since there is a *dc* connection between the *agc* keyer tube grid and the video amplifier plate, a variation in the amplifier screen voltage will affect the *agc* keyer tube bias.

Keyed AGC‡

The keyed *agc* system in this chassis differs from other systems in that the *agc* keyer tube, V_{117}, is made to conduct only for a short duration of a keying pulse supplied at the horizontal sweep frequency of 15,750 cps. Since the tube does not conduct between pulses, its susceptibility to noise is reduced in proportion to its shortened conduction time which is said to result in an improvement of approximately six to one.

The keyer tube, a 6AU6 pentode, is biased beyond cutoff except during the application of the positive sync pulses of the signal to the grid.

The plate of the keyer tube is essentially at ground potential as far as *dc* voltage is concerned. Plate current flows when positive-going keying pulses obtained from a winding on the width control are applied to the plate. The plate current develops the *agc* bias across a 150,000-ohm resistor.

Since the plate current of the 6AU6 is independent of plate voltage, the keying pulse amplitude has negligible effect in establishing the *agc* bias. This is controlled entirely by the peak amplitude of the signal applied to the grid circuit of the component. Therefore, the video signal is applied with its *dc* component, by taking it off the plate of the video amplifier, V_{108}.

If the station signal increases suddenly, the positive sync pulse amplitude at the grid of the keyer tube also increases and the decrease in bias causes a greater current, resulting in an increased *agc* bias which biases the tubes of the video *if* amplifier so that the gain is reduced. The opposite action takes place when the signal de-

(*Continued on page 62*)

‡See article by Charles Bowers; this issue.

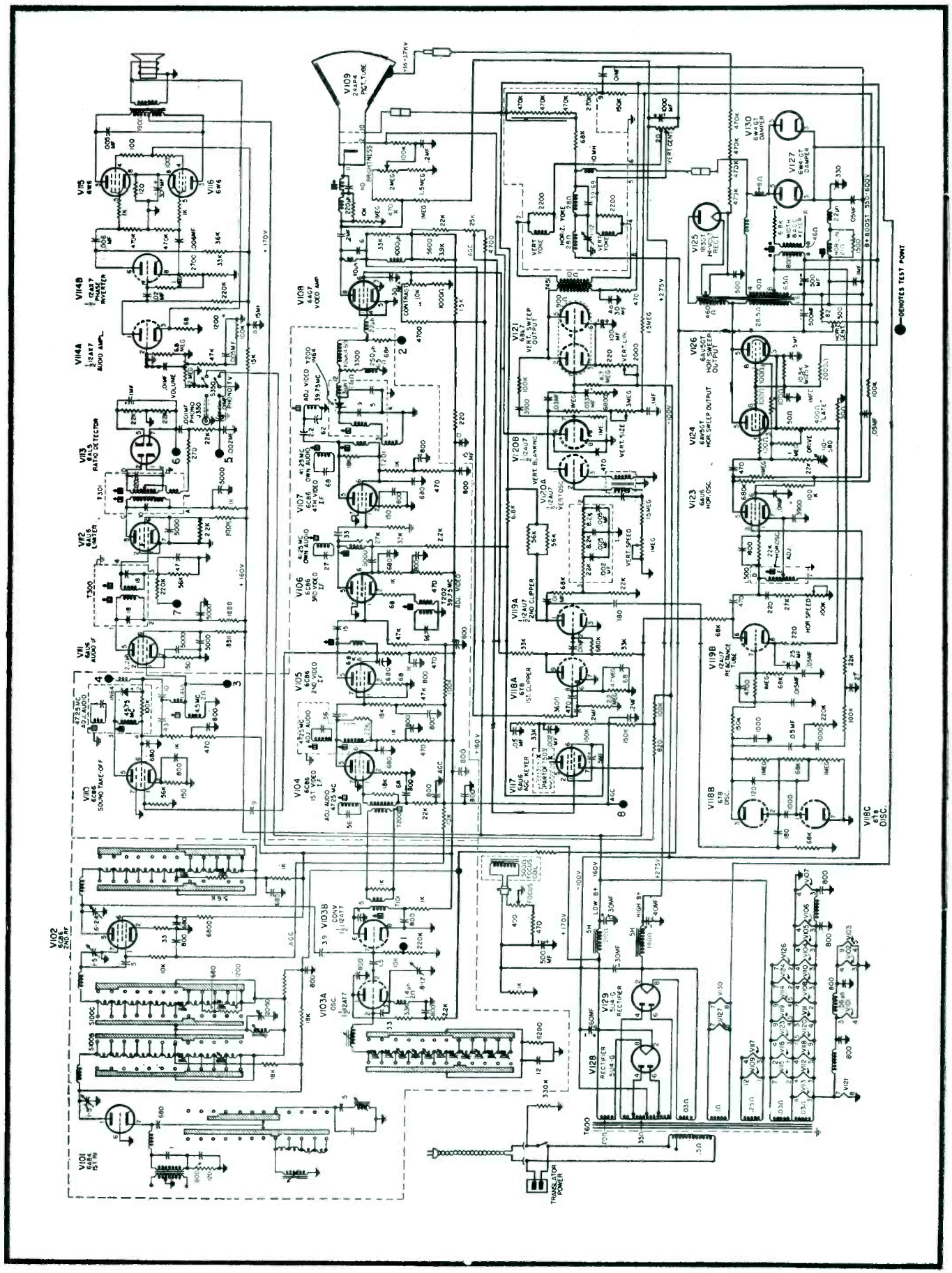


Fig. 1. Circuit of the G.E. 24C101 chassis.

Some Plain Talk about Making More Money

HOW WE CAN HELP

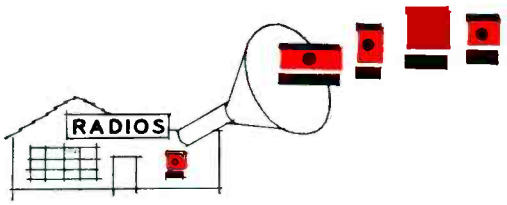
...with the RCA Battery Line

As Radio men, we can do it by working together

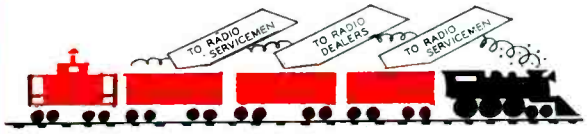
Here's how we'll help you build a more profitable business with RCA BATTERIES:

1 **We will advertise you,** *the Radio Service-Dealer on national network radio and TV programs.* We'll tell millions of listeners that *you* are *best qualified* to *sell and install* RCA Radio Batteries.

2 **We will help you advertise** *for repeat sales on the RCA Battery carton.* Millions of volume-type RCA Batteries will carry a printed message directing the user to *come back to you* for replacements. Below this message will be a space where you can stamp *your own name* with a personalized stamp which you may obtain from your RCA Battery Distributor.



3 **We will continue to channel our principal battery distribution** *to you as a Radio Dealer and Serviceman* which means that you get profitable repeat business with RCA BATTERIES.



4 **We will continue to provide speedy, dependable service** backed by the only nation-wide warehousing and distribution organization geared to the needs of the radio trade.

DOESN'T THIS MAKE SENSE TO YOU?

As a *Radio* man, you should handle the *Radio* Battery line of the *Radio* Company that *wants to help you prosper.* By doing this, you get extra help . . . *four-way* help. And you *make more money.* It's as simple as that.

for Local Radio Dealers and Servicemen:

YOU MAKE MORE MONEY

With the RCA line you get ALL THESE EXTRA BENEFITS, TOO

You get **TREMENDOUS BRAND ACCEPTANCE** . . . because RCA is the best-known, most-advertised name in the radio field. This means your battery sales are fast, easy, profitable with RCA.

You get **COMPETITIVE PRICES.** RCA Batteries are priced to sell against the toughest competition.

You get **TERRIFIC SELLING AIDS** . . . signs, banners, displays, kits, merchandisers that are unique . . . to mark your store as headquarters for RCA Batteries.

You get **RADIO-ENGINEERED BATTERIES** . . . power-packed for *extra* listening hours . . . and built to exacting standards of quality. They represent the combined skills of both battery engineers and radio engineers.

You get a **ROUNDED LINE** to fill virtually every portable and farm radio requirement. Seven popular types will fill about 80% of your needs. You cut down on stocking problems . . . are sure to have the right batteries on hand—at the right time!

Get started with RCA Batteries . . . NOW

Let us help you make this your banner year for battery sales. Call your RCA Battery Distributor right now. Get set with the *Radio Battery* for the *Radio Trade*... RCA. And *let us help you make more money . . . starting TODAY.*

Why YOU are so important to us.

You're in the *Radio Business.* So are we.

You're interested in promoting the sale and use of *Radio products.* So are we.

If you prosper, so do we!

That's why we channel our battery distribution to *you as a Radio outlet.*

That's why we advertise *you, the Radio-Service Dealer* on national radio and TV programs. That's why we help promote your store right on the actual RCA Battery.

You're a Radio Man.
We're a Radio Company.
Let's prosper together!

RADIO CORPORATION of AMERICA
RADIO BATTERIES **HARRISON, N. J.**

TAPE-DISC Recorder Amplifier System

by WYN MARTIN

[*See Front Cover*]

IN THE DESIGN of amplifiers for tape recorders several unusual factors must be considered. For instance, it is not desirable to use an amplifier with absolutely flat characteristics. As indicated in earlier discussions, the very nature of recording tape is such that its recording characteristics are not uniform at all frequencies, and the low-frequency as well as the high-frequency end of the recording spectrum require additional amplification over that of the middle portion of the spectrum.

There are several ways in which the proper equalization can be injected into the recording or playback amplifier. One approach is illustrated in the circuit on the *cover* wherein frequency discrimination is used. In this type of circuit, a small amount of voltage is taken from the plate circuit of one of the tubes and fed back to the plate circuit of the preceding tube. This is commonly known as inverse feedback and serves to improve the harmonic distortion of the particular stage in which the feedback is used. What actually happens is that the output voltage is fed back 180° out of phase, and if for any reason it is not identical to the input voltage, the gain at the point of distortion is changed so as to actually alter the input signal 180° out of phase; thus after being amplified it appears as an undistorted signal.

If it is then desirable to change appreciably the gain characteristics of the amplifier at different frequencies, it can be accomplished by incorporating into this feedback loop, frequency discriminating networks. As will be noted from the circuit, the pair of 100,000-ohm resistors, and .001 and .00047-mfd ceramics in the plate circuit of the 6AU6 would have a tendency to short-circuit or minimize the low frequencies which could be fed back to the plate of the tube. The capacitor-resistor series combination would minimize the high frequencies which could be fed back to the plate. With this type of arrangement only the middle spectrum of frequencies would be fed back and consequently would decrease the gain of the first section of the 12AX7 by the amount of feedback voltage. Since no low frequencies or no high frequencies are being fed back the full gain of the amplifier is utilized at these frequencies, and the middle range of frequencies is quite appreciably attenuated. With the values of components in the frequency discriminating feedback loop as shown in the circuit, the recording characteristics of the tape are very nearly the direct opposite of the playback characteristics of the amplifier which results in an overall flat response characteristic.

In recording, the input signal of the microphone is applied to the grid of the first section of the 12AX7 and in turn applied to the grid of the second section which drives the output tube. When recording from phono or an auxiliary input, the voltage is applied to the grid of the second section of the 12AX7 and in turn applied to the output tube. During tape recording processes, the 6AU6 tube acts as a bias oscillator and its output voltage is fed through a 10-160 mmfd trimmer capacitor to the grid of the output tube and thus amplified with the signal which is being recorded.

During playback of tape a higher gain is needed; the output of the head is applied to the grid of the 6AU6, which in turn drives the grid of the 12AX7, then to the second grid of the 12AX7, and on to the output tube resulting in a high-gain four-stage amplifier.

If the tape-disc recorder amplifier is to be built, special care must be taken to hold hum to an obsolute minimum; this can best be accomplished by building the power supply on a separate chassis. Amplifiers have been successfully built by using the power transformer and power supply on the same chassis, although extreme care is required. In any event, it is recommended that the amplifier be built on an aluminum chassis, thus holding eddy currents at an absolute minimum. Special care also must be taken in mounting the input tube, the 6AU6, to keep away from any microphonic effects when the speaker is mounted close to the amplifier assembly. Several types of resilient sockets are available, or it is possible to merely mount a standard miniature socket on rubber grommets to give the desired resilient mount.

In wiring the filament circuit of the amplifier, it is not desirable to ground one side of the filament to the chassis, as is normally done with steel chassis; it is recommended that separate wires be run for each side of the filament circuit to eliminate any possibility of voltage drop in the chassis between the various tubes.

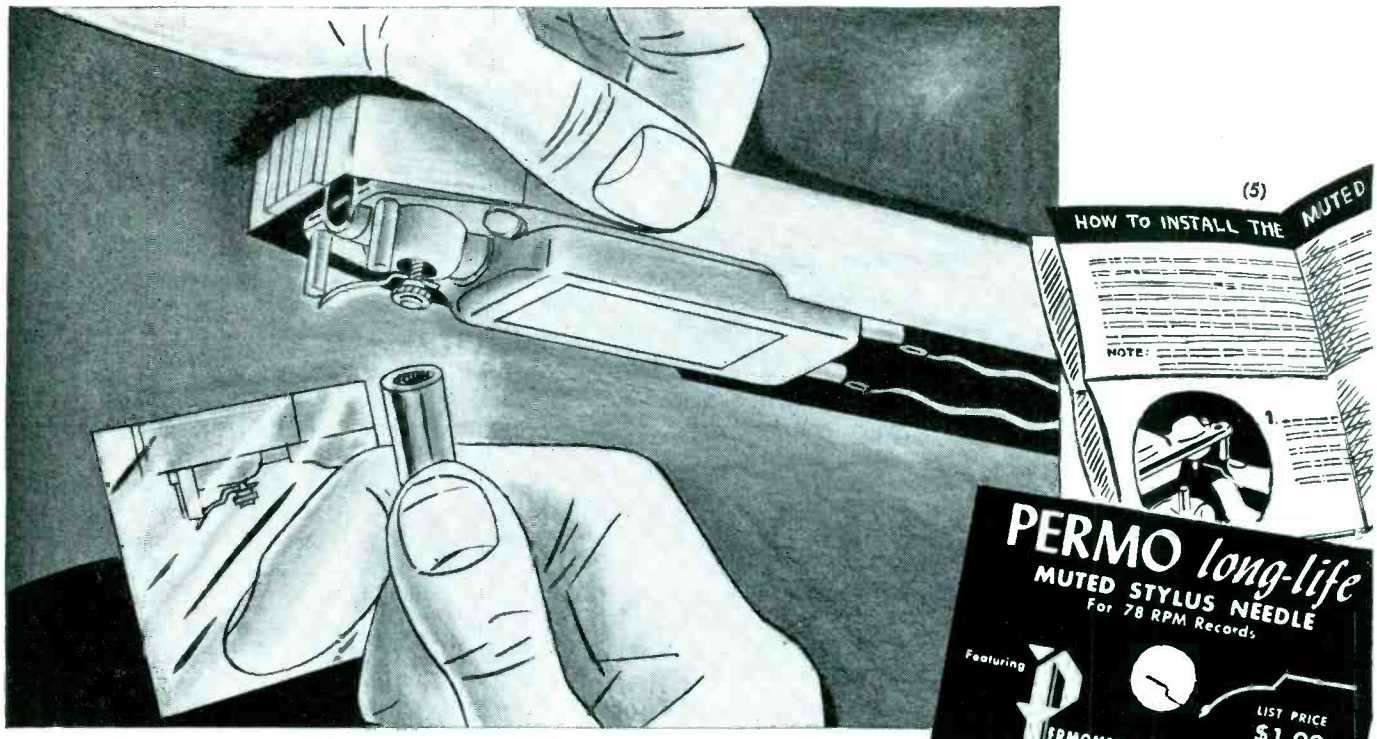
Upon completing the amplifier, it is desirable to check first the plate voltage of the power supply; this should be approximately 285 volts, as measured from pin *2* of the power supply socket or at the screen of the output tube which is pin *6*. After the amplifier has been found to pass a signal, it is desirable to adjust the oscillator bias frequency and the oscillator bias current.

The oscillator adjustment can be easily accomplished by inserting a 100-ohm carbon resistor in series with a lead (orange) from the recording head which is a part of the recording mechanism, and which connects to pin *2* of the recording head plug. With the amplifier in *record-tape* position, a voltage can be read across this 100-ohm resistor, measured on an *ac vtvm* or a good high-resistance voltmeter. It is necessary to adjust the bias frequency by controlling the inductance of the 100-ohm coil, parallel to the .002-mfd capacitor in the input switch circuit. This adjustment is not particularly critical; if a horizontal linearity control is used†, a 30-kc bias frequency is usually obtainable when the adjusting slug is approximately 7/8" out of the top mounting screw surface. If test equipment is available, the frequency of the bias can be determined

(*Continued on page* 52)

**Based on data supplied by General Industries for amplifier suggested for model 250 tape-disc recorder.*

†RCA 201R3.



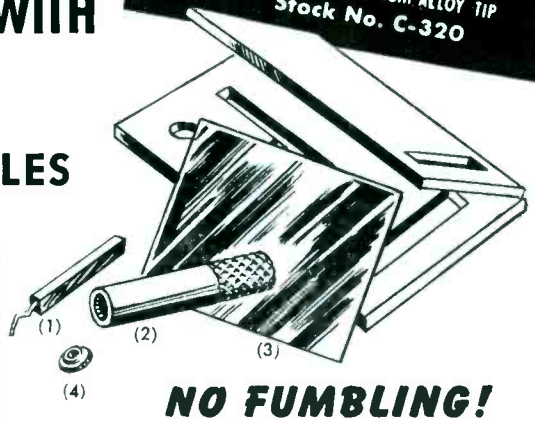
YOU SAVE TIME — MAKE MONEY — WITH PERMO *long-life* PHONO NEEDLES

Here's why:

1. COMPLETE *"Facts"* — Here is a needle replacement guide that's complete, authentic, *accurate*—one that tells *specifically* what needle goes *where*. It's Permo's "Phonograph and Needle Facts", and Permo took the time to do it right. A guide that gives you *everything* you need to know for fast, easy replacement needle sales.

2. COMPLETE NEEDLE STOCKS —Individually packaged Permo Long-Life Phono Needles come to you on convenient display cards. Each display card carries a full set of replacement needles for one manufacturer's sets.

3. REASONABLE INVESTMENT — Complete initial needle stocks and "Facts" for all post-war Admiral and Philco sets are yours for less than $12.00 dealer cost. Make high profits selling the easy-replacement needle line—Permo Long-Life!



NO FUMBLING!

YOU GET EVERYTHING YOU NEED IN ONE PACKAGE

Permo Long-Life Phono Needles are individually packaged with *installation tools* where necessary, *spare parts* (nuts, screws, etc.) and *complete installation instructions*. The C-320 Muted Stylus package (above) for example, contains: (1) needle (2) wrench (3) mirror (4) extra nut (5) installation instructions. You get *everything* you need in one complete package when you buy Permo Long-Life needles.

NOW AVAILABLE

Admiral, Columbia and Philco "Facts" and Replacement Needles. Others coming soon! Write for your free copies of the "FACTS".

PERMO

PERMO, INC. *Champion of Perfection*

6401-33 N. RAVENSWOOD AVE. CHICAGO 26, ILLINOIS

Servicing Helps

by M. A. MARWELL

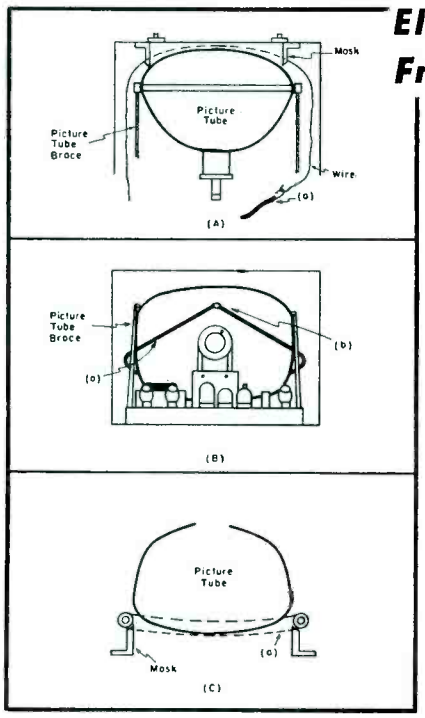
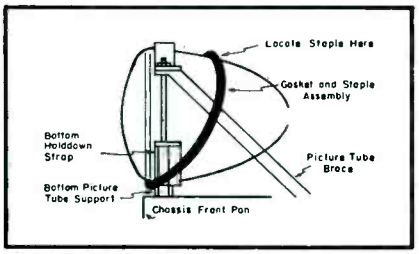


Fig. 1. Views of Sylvania chassis illustrating installation of dust seals in 17-inch models. A mask and gasket assembly may be installed with the chassis either in or out of the cabinet. With the chassis in cabinet a piece of moderately flexible wire approximately three feet long should be threaded around the inside of the cabinet in front of the picture table bottom supports, making sure that it passes above both control shafts (*a*). Staple should be unhooked from one end of gasket; one end wire should be attached to stapled end of gasket. Free end of wire should be pulled through until it is possible to grasp both ends of gasket at sides of chassis. Ends of gasket should then be hooked together with staple as shown in (*b*), making sure that gasket passes outside picture-tube braces. Finally, gasket should be pressed forward on picture tube until it falls evenly into groove between mask and picture tube as in (*c*).

Fig. 2. With the chassis out of the cabinet, the gasket should be stretched over face of picture tube with staple at top, making sure that the gasket lies between bottom hold-down strap and chassis front pan. Chassis should then be slid into cabinet and chassis-mounting bolts secured. Gasket should then be pushed forward on picture tube until it falls into gap between picture tube and mask, making sure gasket fits snugly.



Eliminating Washout . . . Picture Sync Improvement . . . Fringe Compensator Adjustment . . . Picture Centering

OCCASIONALLY, WASHOUT is encountered when the contrast control is advanced to its nearly full clockwise position; the black part of the picture reaches a maximum black and then turns gray with further rotation of the contrast control. This condition has been observed in Philco chassis employing the Colorado tuner because the video level at the output stage tends to be high. Washout is actually evidence that the amplifier system is being overloaded. In those cases where washout occurs without sync instability, it is evident that the overload must occur after the sync pickoff point. In most cases, the overload occurs in the video output stage.

To correct washout, the supply point for the $B+$ to the screen of the 6AQ5 video output tube should be changed, to permit the tube to handle a large signal. (In the circuit, the screen grid is connected to the same $B+$ line as the *if* strip. Since the $B+$ at this point varies in response to the *agc* voltage or signal level in the *if* strip, the voltage applied to the video output tube screen grid will also vary in step with the change in $B+$.) The new supply point will provide a higher screen voltage and a voltage which does not vary as much with variations in *agc* voltage. It has been established that the change in screen voltage actually aggravates and contributes to the washout condition in areas of intermediate signal strength. At the same time that the screen voltage is changed, the control grid bias must also be increased. The control grid bias can be increased by changing the position of the two resistors in the grid circuit, or placing the 1.2-megohm resistor where the 1.8-megohm unit is, and vice versa.

Washout is in many cases very similar to overload of the audio system, which can be brought about simply by turning the volume control full on. In other words, washout in some cases indicates that the contrast control is being advanced too far. It should, therefore, be kept in mind that although the changes suggested extends the contrast range before overload occurs, there must necessarily be some signal level at which overload will be inevitable.

In some chassis employing the Colorado tuner, it is possible that with very strong signals applied to the antenna, washout will occur when the contrast control is only about ¾ toward its maximum clockwise position. In these cases the *agc* control system to the tuner may be modified so that the signal delivered to the video output stage is maintained more nearly constant. In areas of extremely high signal level, it is also necessary to reduce the time constant in the grid of the first common *if* stage. This can be done by reducing the value of the 470-mmfd capacitor from the plate of the mixer to the grid of the first *if* down to 100 mmfd, and connecting a 40-microhenry choke across the grid resistor of the first *if*.

Picture Sync Improvement

To improve picture sync under adverse noise conditions, Emerson models 700D and 701D (chassis 120158B) coded with a *triangle A* should have the pigtail of the 2.2-megohm resistor, R_{38}, connected to the chassis instead of the + 150-v line.

Triangle B chassis incorporates an adjustable type *fringe compensator*. It can be turned off when the receiver is used in strong signal areas, and adjusted for best picture performance in electrically noisy fringe areas. In most locations this added protection will not be necessary, and the fringe compensator should remain in the *off* position. Improper adjustment or application of the fringe compensator may result in excessive audio buzz or picture wiggle.

Fringe Compensator Adjustment

To adjust the fringe compensator the set should be tuned to a low-

(*Continued on page* 64)

STIKIT-UP!

the NEW AMAZING

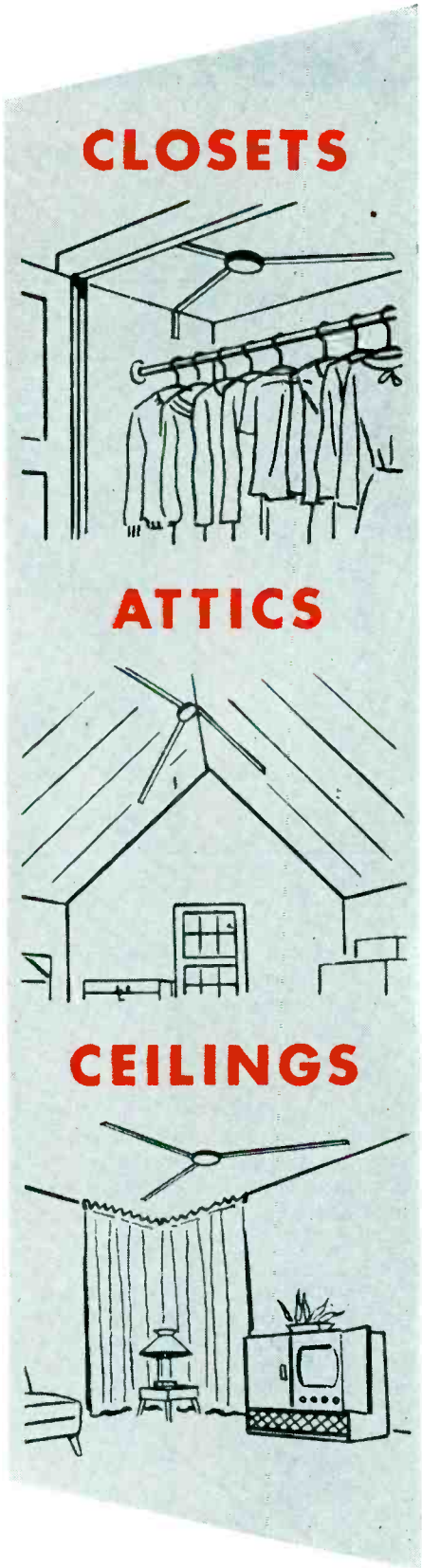
INDOOR

Directronic

TV AERIAL SYSTEM

- ALL CHANNELS
- ANYONE CAN INSTALL
- ADHERES TO ANY SURFACE
- 360° ELECTRONICALLY-SWITCHED BEAM
- FLICK OF SWITCH CLEARS PICTURE

9.95 LIST



SNYDER MFG. CO. PHILADELPHIA

DALIS, New York • ALMO, Philadelphia • RADIO PARTS, Chicago
FRESHMAN, Cleveland • WHOLESALE RADIO, Baltimore • KAEMPER & BARRETT, San Francisco
VAN DER HOUT, Canada • Export: ROBURN AGENCIES, New York • AND OTHER DISTRIBUTORS, *EVERYWHERE*

Fast-Acting AGC SYSTEMS

by CHARLES E. BOWERS

Staff Engineer, Bendix Radio

Part III . . . Modifying Circuits for Keyed AGC Operation . . . Features of the Keyed AGC Amplifier . . . General Troubleshooting

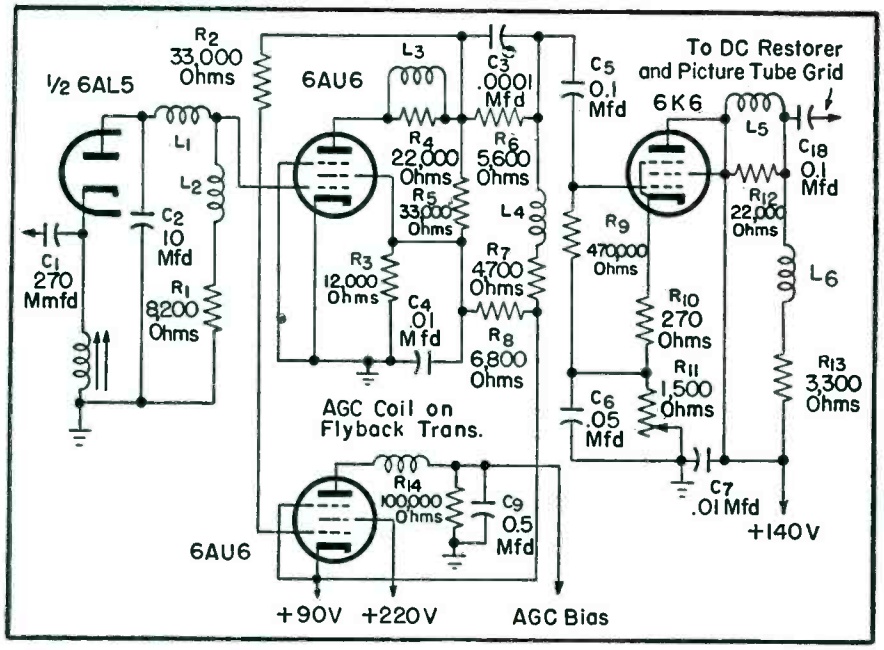


Fig. 1. Video amplifier with two video stages, in which a direct connection is made from the second detector to the grid of the first amplifier to preserve the *dc* component.

IN THE KEYED AGC systems, the keying pulse is, of course, a key factor. In the circuits illustrated and described last month*, this pulse is obtained from an additional winding on the horizontal output transformer. In experimental studies, this has been a small universal wound coil mounted over the secondary between the primary and the filament winding for the 1B3 on a standard RCA horizontal output transformer. With this type of coil it has been found that the peak-to-peak amplitude of the pulse voltage is about 300 to 350. However, the amplitude of this keying pulse is not critical, as long as it falls within the two following limits: It must be sufficiently above the cathode-to-ground potential of the *agc* stage to assure that the tube is operating above the knee of the I_p-E_p characteristic in the high portion of that curve, so that changes in the amplitude of the keying pulse are not too important. Also, the upper limit of the pulse must not go above the plate voltage rating of the tube in use.

It is also important to remember that the cathode of the *agc* tube must always be sufficiently positive, with respect to the control voltage reference point, to prevent plate current from flowing during any spurious variations which may take place in the plate pulse wave, such as the damping effect gotten from the horizontal output.

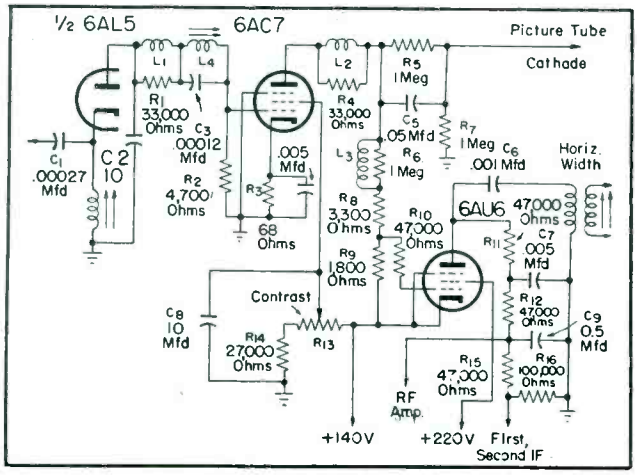


Fig. 2. Keyed *agc* circuit with single stage of video where cathode of picture tube is driven with picture signal. A 33,000-ohm resistor is used to reduce effect of peaking.

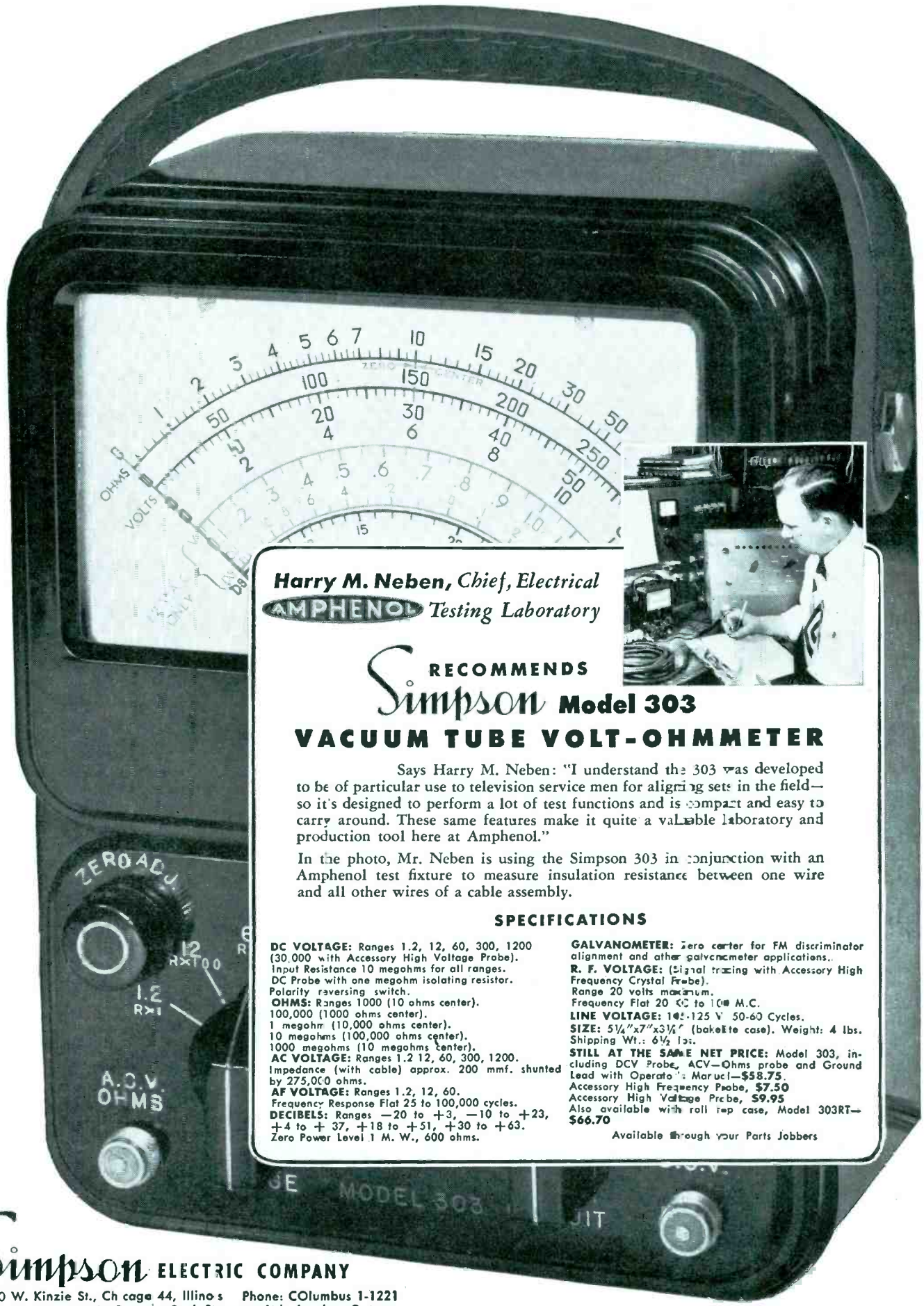
Keyed AGC Now in Use

The first step in changing any circuit to keyed *agc* is to make a direct connection from the second detector to the grid of the first video amplifier. The original circuit calls for a 3-volt bias on the grid, but that can be neglected if the plate voltage of this tube is dropped to 90. This also has an advantage; no special filament transformer is required for the *agc* tube since the cathode-to-filament potential is rated at approximately 100 volts.

The resistance network from the plate circuit of the first video amplifier to the *agc* tube is required to keep the tube capacity of the *agc* tube from altering the frequency response of the video stages. A 5,600-ohm resistor shunted by a 100-mmfd capacitor are inserted to help equalize the video frequency response.

The next major change is to find a source for the flyback pulse to key the *agc* tube. In the Fig. 1 circuit an additional winding on the flyback transformer has been used; about 80 turns of No. 34 enameled wire, wound on a $\frac{7}{16}$" diameter form and slipped on the flyback transformer in the space between the main winding and the filament loop for the 1B3 high-voltage rectifier. The flyback transformer must be dismounted, and the holding

*SERVICE; February, 1952.



Harry M. Neben, *Chief, Electrical*
AMPHENOL *Testing Laboratory*

RECOMMENDS

Simpson Model 303
VACUUM TUBE VOLT-OHMMETER

Says Harry M. Neben: "I understand the 303 was developed to be of particular use to television service men for aligning sets in the field—so it's designed to perform a lot of test functions and is compact and easy to carry around. These same features make it quite a valuable laboratory and production tool here at Amphenol."

In the photo, Mr. Neben is using the Simpson 303 in conjunction with an Amphenol test fixture to measure insulation resistance between one wire and all other wires of a cable assembly.

SPECIFICATIONS

DC VOLTAGE: Ranges 1.2, 12, 60, 300, 1200 (30,000 with Accessory High Voltage Probe).
Input Resistance 10 megohms for all ranges.
DC Probe with one megohm isolating resistor.
Polarity reversing switch.
OHMS: Ranges 1000 (10 ohms center).
100,000 (1000 ohms center).
1 megohm (10,000 ohms center).
10 megohms (100,000 ohms center).
1000 megohms (10 megohms center).
AC VOLTAGE: Ranges 1.2 12, 60, 300, 1200.
Impedance (with cable) approx. 200 mmf. shunted by 275,000 ohms.
AF VOLTAGE: Ranges 1.2, 12, 60.
Frequency Response Flat 25 to 100,000 cycles.
DECIBELS: Ranges —20 to +3, —10 to +23, +4 to + 37, +18 to +51, +30 to +63.
Zero Power Level 1 M. W., 600 ohms.

GALVANOMETER: Zero center for FM discriminator alignment and other galvanometer applications.
R. F. VOLTAGE: (Signal tracing with Accessory High Frequency Crystal Probe).
Range 20 volts maximum.
Frequency Flat 20 KC to 100 M.C.
LINE VOLTAGE: 105-125 V. 50-60 Cycles.
SIZE: 5¼"x7"x3¼" (bakelite case). Weight: 4 lbs. Shipping Wt.: 6½ lbs.
STILL AT THE SAME NET PRICE: Model 303, including DCV Probe, ACV—Ohms probe and Ground Lead with Operator's Manual—**$58.75**.
Accessory High Frequency Probe, **$7.50**
Accessory High Voltage Probe, **$9.95**
Also available with roll top case, Model 303RT—**$66.70**

Available through your Parts Jobbers

Simpson ELECTRIC COMPANY
5200 W. Kinzie St., Chicago 44, Illinois Phone: COlumbus 1-1221
In Canada: Bach-Simpson, Ltd., London, Ont.
World's Largest Makers of Electronic Test Equipment

BURTON BROWNE ADVERTISING

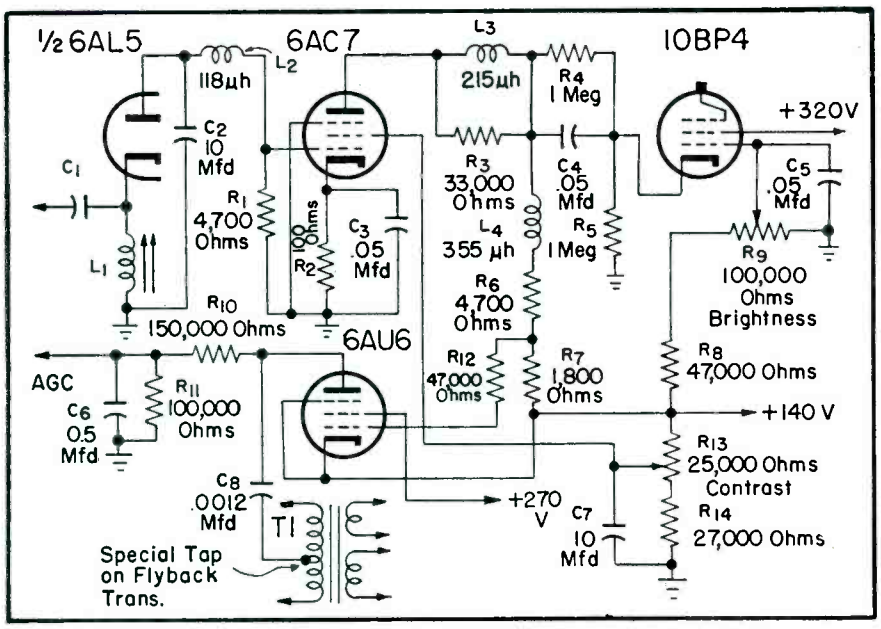


Fig. 3. A keyed *agc* circuit featuring use of a single 6AC7 video amplifier, with *agc* voltage obtained through voltage divider and decoupling net; 4700, 1800 and 47000-ohm resistors.

clamps removed, and the powdered iron core pushed out. Then, the main winding and its bakelike form can be slid out, and the *agc* coil slipped in place.

In place of the contrast control previously used a 1,500-ohm potentiometer must be connected in the cathode lead of the 6K6 video output tube. The .05-mfd cathode bypass should be located close to the cathode pin of the 6K6 and returned to the same ground as the .01-mfd screen bypass. If this is done a long lead can be brought to the contrast control mounted on the front panel.

A keyed *agc* system, which is very effective, is shown in Fig. 2. A single stage of video amplification is used here, and the cathode of the picture tube is driven with the picture signal. Since a direct connection exists between the second detector and the video amplifier and then to the picture tube, no *dc* restoration is necessary. The picture signal is brought to the grid of the *agc* tube through a voltage divider and decoupling network, consisting of 3,300, 1,800 and 47,000-ohm resistors in the plate circuit of a 6AC7 video amplifier. The cathode of the *agc* tube is connected directly to the 140 volts $B+$ point, and although this means that the cathode-to-filament potential is higher than rated, actual life tests have shown that as long as this is a *dc* potential no harm will be done to the tube.

The screen grid of the *agc* tube is connected to a convenient source of about 220 volts *dc*. The plate receives the flyback pulse through a 1,000-mmfd coupling capacitor from a special winding over the horizontal width control. The other side of this winding is connected to ground and polarities chosen so that a positive pulse reaches the plate of the *agc* tube. This special winding provides a reduced cost in production, since changes or additions in the flyback transformer are much more costly than another winding over the horizontal width coil.

The contrast control consists of a voltage divider which determines the screen grid voltage of the 6AC7 video amplifier and thus the gain of that tube. The range of the contrast control is from about 65 to 140 volts, sufficient to give a proper picture or cut off the video signal completely. The *agc* bias filter and voltage divider are unconventional, only inasmuch as a slightly larger bias is applied to the *rf* amplifier than to the grids of the first two *if* stages.

In a variation of the keyed *agc* network, used in the previously mentioned receiver, a single 6AC7 video amplifier is used, as shown in Fig. 3; the *agc* voltage is obtained through a voltage divider and decoupling network consisting of 4,700, 1,800 and 47,000-ohm resistors. The contrast control is the same as in the previous model, but the method of obtaining the flyback pulse is different. Here, a special tap has been incorporated in the horizontal flyback transformer and the pulse coupled from that tap through a 1,200-mmfd capacitor to the plate of the *agc* tube. The filter and voltage divider network for the *agc* bias are also different, providing a short time constant for fast *agc* action.

Field Test Results

Actual field tests of this circuit in the New York area indicated greatly improved noise characteristics especially on channel *13*, received poorly in many locations. The *agc* bias voltages varied from 5 to 2 volts negative from channels *4* to *13* in one location, where the former was received with about 5,000 microvolts, and the latter

(*Continued on page 76*)

Fig. 4 (right). Basic circuitry of a keyed *agc* amplifier.

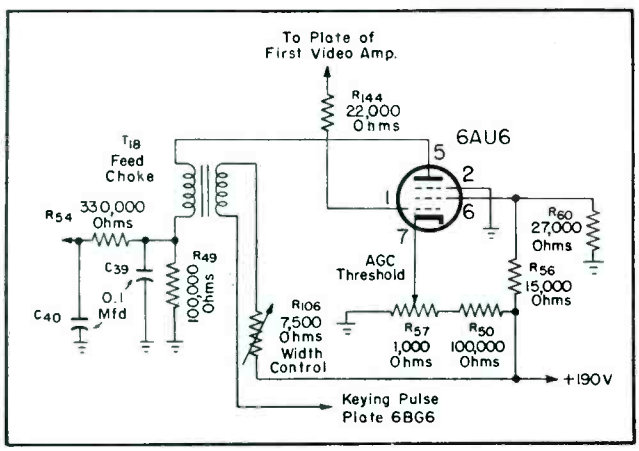
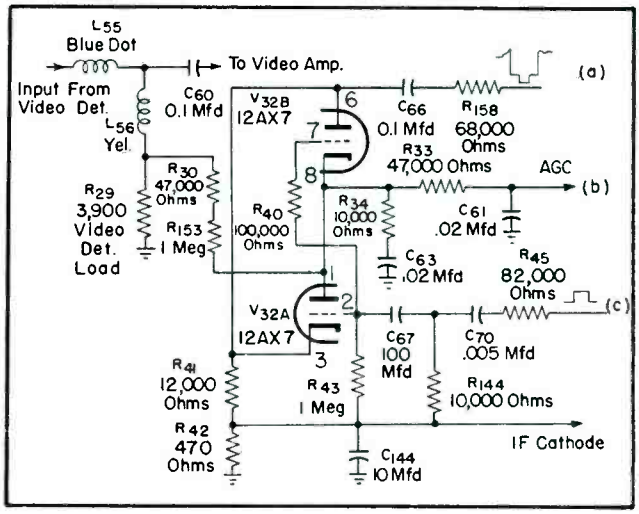


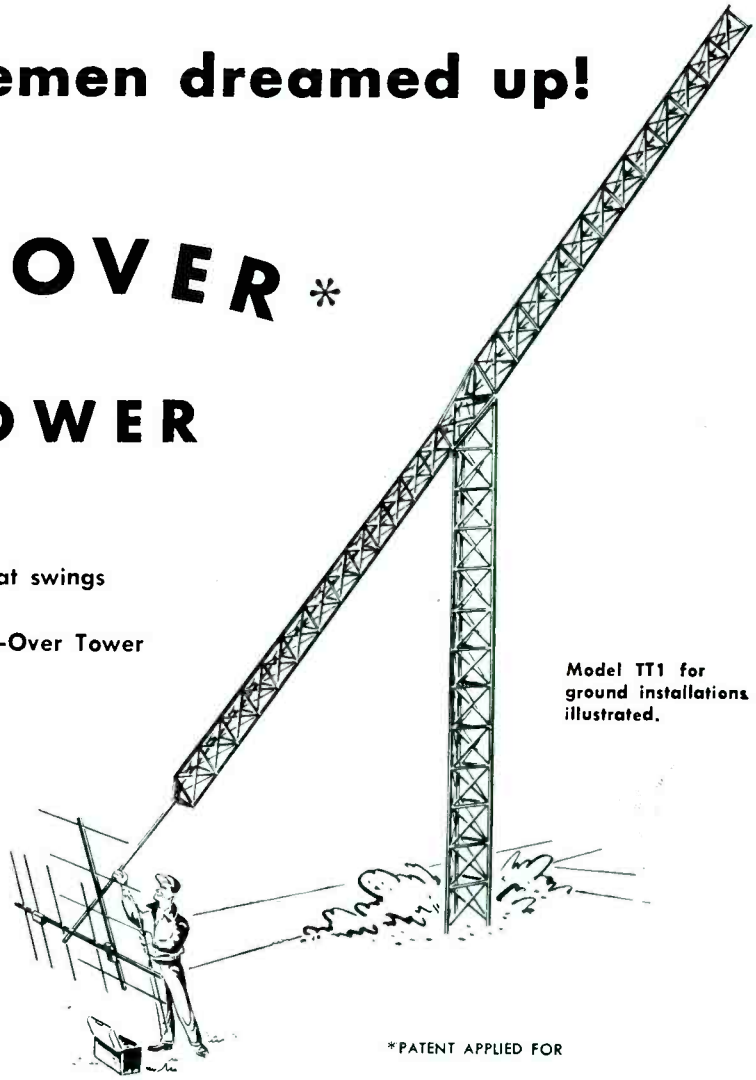
Fig. 5. Simplified circuit of a keyed *agc* system.



the tower servicemen dreamed up!

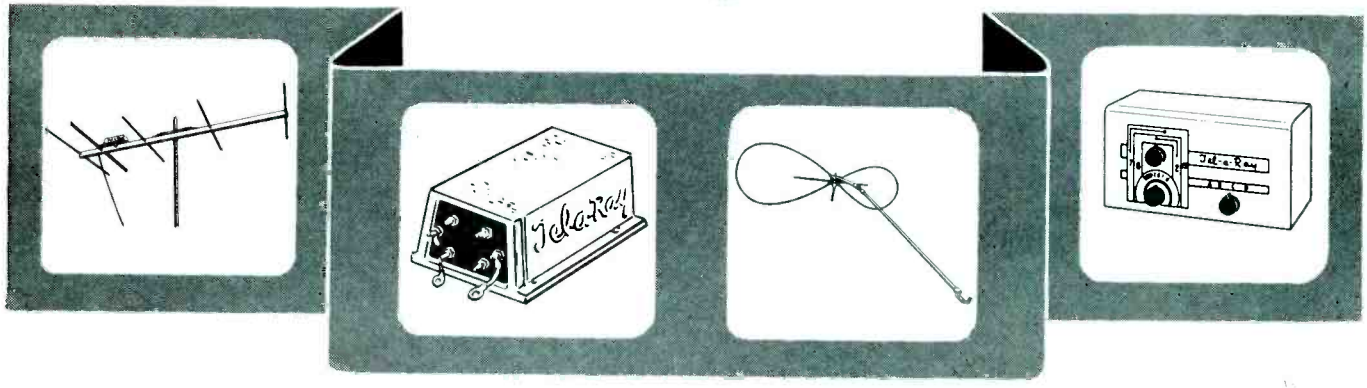
the TEL-A-RAY SWING-OVER* TOWER

A serviceman's dream — an antenna tower that swings over to the ground for servicing — now being produced by Tel-a-Ray! The Swing-Over Tower makes all other types obsolete because it is the easiest tower for servicing ever made. Built from steel angles with welded construction, the Swing-Over Tower is guaranteed to withstand wind and weather. Yet one man can lower the tower top to the ground, or raise it, in just three minutes. Competitively priced and guaranteed, the Swing-Over Tower will be your biggest item in 1952.



Model TT1 for ground installations illustrated.

*PATENT APPLIED FOR



These Tel-a-Ray products are bringing more and better reception to television viewers every day . . . and bigger profits to their dealers: Left: The Model T antenna pulls in good reception up to 200 miles away! Cannot rust or corrode. Perfect for all fringe area reception. Left center: To complement the Model T antenna, the only antenna-mounted, low-cost preamplifier on the market, the model TB. High signal gain, low noise ratio make it outstanding.

Right center: The low-priced Butterfly antenna . . . receives 13 channels and FM radio in primary areas . . . completely guaranteed . . . swivel-mount permits erection anywhere! Right: The new Switching Booster (Model PTB1) — for areas where more than one channel can be received with separate antennas. Switches channels and antennas with one knob. Four antenna inputs. Furnishes high gain from antenna and voltage for four preamplifiers. A necessity in the fringes.

WRITE TODAY FOR COMPLETE INFORMATION

Tel-a-Ray
ENTERPRISES, INCORPORATED
BOX 332S
HENDERSON, KENTUCKY
TRADEMARK

Speeding Up

Part II . . . Accelerating Trouble Shooting Through Careful and Deliberate Checks...Use of Measurement Equipment Properly . . . Gain Checks . . . Avoiding Misleading Voltage and Resistance Readings . . . Using Correct Parts in the Proper Part of the Circuit... Systemic Application of Circuit and Analysis Data . . . Typical Examples of Troubles and Cures

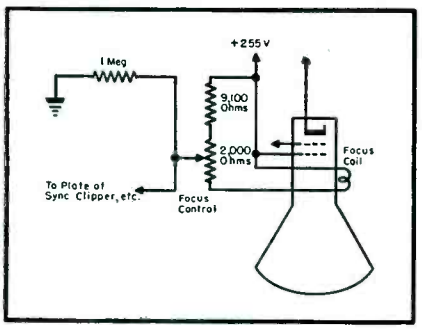


Fig. 1. Partial schematic of Motorola TS-52, showing focus circuit.

Fig. 2. Setup which can be used to check for a leaky paper or mica capacitor, one end of the capacitor being connected to a high potential point, the other end unsoldered and placed in series with a voltmeter to ground.

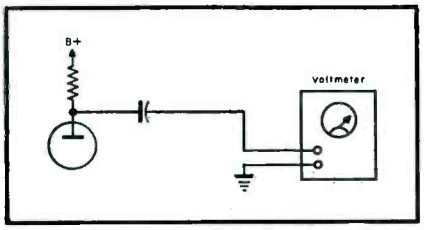


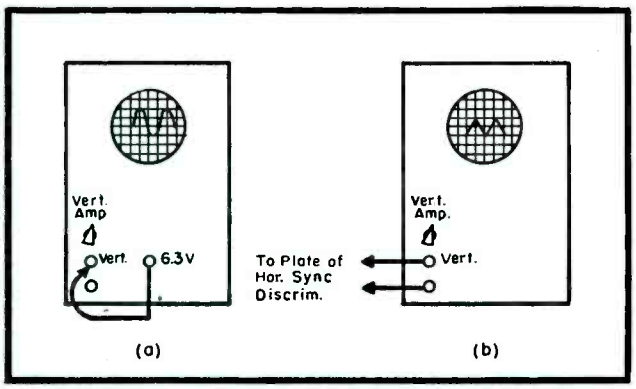
Fig. 4 (right, below). Circuitry which illustrates problem when C_1 is shorted, placing C_2 from grid to ground of first audio stage, when the pot is all the way up. Grid is shorted to ground through C_2.

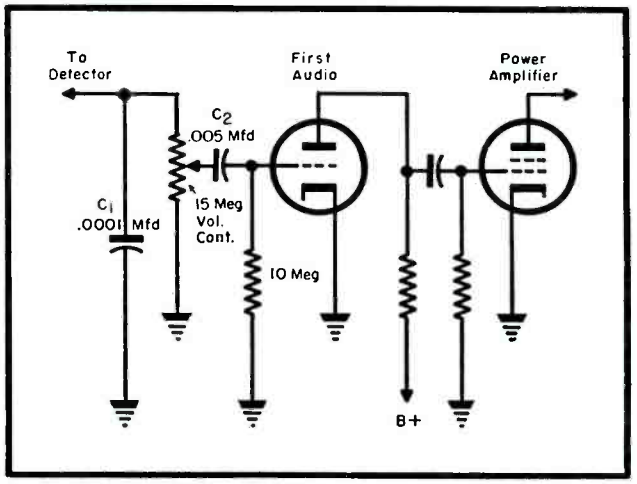
As a Rule, only inexperienced technicians fail to make necessary checks, noting how the operation of various controls affect the symptoms of trouble, or failing to observe or to follow through on obvious clues from the picture tube or speaker. Possibly the greatest time-waster for some more experienced Service Men is the failure to localize the trouble to a defective stage. Suppose, in a split sound set, sound and raster are okeh, but the picture information is missing. The trouble is in the video strip; the video *if* stage, video detector or video amplifiers. To start a voltage and resistance check of the whole strip, to find the bad component, instead of first locating the defective stage is unnecessarily time-consuming. The same is true of any trouble which may originate in more than one stage. Some method should be used, if at all possible, to find the defective stage before looking for the defective part. This, of course, is the great advantage of good test equipment, such as a 'scope and a signal generator. They can help considerably in tracking down the defective stage quickly in many kinds of trouble.

Failure to change a bad tube is another common oversight. Usually, other tubes are changed, but for some reason the bad one is overlooked. Once in a while, the Service Man will have the unfortunate experience of replacing one bad tube with another bad tube, and not finding out the sad news until some time later, when all the other possibilities of trouble have been eliminated. The moral of this is: Make certain all replacement tubes are good by checking them, if necessary, on an operating set.

All TV Service Men realize the importance of changing tubes first, before spending time on further trouble-shooting. When a tube is not changed, it is not usually because of carelessness, but because of a failure to realize how it affects circuit operation. As an example, on one occasion, horizontal tearing appeared in an RCA 8T241. All of the horizontal and sync tubes were changed in the home, or at least the Service Man thought so, and no improvement was noted. The chassis was pulled. In the shop, a check with the schematic showed that ½ of a 6AL5 was used as a video detector and the other half as a clamping diode in the sync section. This tube had

Fig. 3. Use of a 'scope as an *ac* voltmeter. In (*a*) the 'scope is calibrated, with a 6.3-volt test signal, which is 18 *v p* to *p*. When test signal is made, three boxes high, each box equals 6 *v*. In (*b*), method of measuring amplitude of a waveform in circuit is shown. Since the observed waveform is two boxes high, it has a peak-to-peak voltage of 12; 6 x 2 = 12 *v*.





TV TROUBLESHOOTING

by CYRUS GLICKSTEIN

American Radio Institute

not been changed previously. Changing the tube cured the trouble.

In the second point under faulty techniques, we have the problem of unnecessary checks. Generally, if a necessary check is omitted, a great many unnecessary ones will be performed before the trouble is found. But aside from such situations, there are other instances where unnecessary checks are made. Most Service Men at some time have tracked down trouble to a particular stage and then have made complete measurements around that stage several times, without seeming to be able to put their finger on the trouble. Very often this situation occurs because the Service Man is reluctant to make the obvious deduction about the part which is at fault. This generally is true when he does not have a replacement part on hand and the component is one he prefers not to buy, unless he is certain the part in the receiver is defective.

An interesting example of the latter problem occurred in a Motorola receiver, model TS-52, with a defective focus coil. Sound was normal and pix information appeared to be okeh, but it was impossible to focus the picture properly. Turning the focus control had no effect at all on the focusing. A resistance check of the focus control showed the correct resistance value, according to the schematic. A voltmeter was placed across the focus coil and the focus pot was rotated. There was a normal variation of voltage across the focus coil as the pot was turned, indicating a normal change in the amount of current going through it. A resistance reading across the focus coil was inconclusive, since the schematic did not show any resistance value for the coil. Since all of the other components in the circuit checked properly, it was obvious that the focus coil was the culprit. Yet, the Service Man repeated the measurements several times. For some time, he was unwilling to accept the possibility of a defective focus coil, because he had no replacement on hand to check the diagnosis.

In another example, vertical foldover appeared in a Crosley, chassis 331. The trouble had been traced to the vertical oscillator stage by a quick check with a 'scope. Careful voltage and resistance measurements were made, but the circuit checked normal. No capacitors checked leaky, but they were replaced. A good deal of time was used in making repeated checks, although the possibility of trouble had actually been narrowed down to the only other component in the circuit, the blocking oscillator transformer.

To avoid unnecessary repetition of measurements, certain rules are helpful:

(1) An ohmmeter, when operating, gives reliable information concerning the value of resistors. The cold value and value under operating conditions will not be appreciably different.

(2) Paper and mica capacitors can be checked for leakage most effectively by having one end connected to a high-potential point and the other end unsoldered. A *dc* voltmeter should then be placed in series with the capacitor to ground. A leak will show up as a steady voltage reading on the meter, with the set on.

(3) To check whether there has been a change of capacity in a capacitor, a different capacitor of the correct value should be substituted.

Suppose, then, trouble has been localized to a given circuit, such as the Crosley horizontal oscillator circuit, previously mentioned. We find the tube had been changed for a known good tube. Ohmmeter readings showed that the resistors had not changed value. Capacitors were not leaky, but substitutions were made on the possibility that one or more may have changed value. The trouble still existed. The only other component in the stage was the transformer which provided a normal resistance reading. The Service Man at this point, had to blame either the transformer or gremlins. Repeating the readings around the circuit just once would be desirable, to recheck the capacitor and resistor situation. But there is very little point in an endless repetition of readings or going off to check another stage, simply because a replacement is not immediately available for the one component in the circuit which is indicated as defective, even though the defect may not show up conclusively in a resistance check.

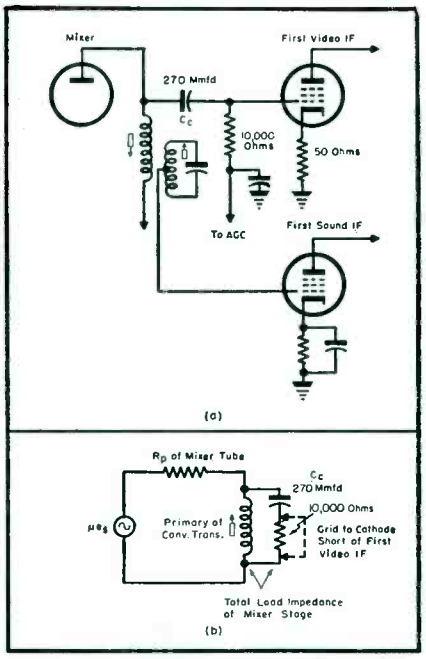


Fig. 5. Circuits illustrating (*a*) grid-to-cathode short in the first video *if* stage, which shorts out *both* pix and sound. In (*b*) appears an equivalent circuit of a mixer stage, which shows how such a short reduces the total load impedance of the stage. As a result, there is no output from the mixer.

There often appears the situation which results in unnecessary repetition of measurements. This occurs when an inconclusive method is used to find a defective stage. For example, sound may be low, but video information is normal. Disturbance tests are used to try to find which stage in the sound strip has low output, but the tests are not conclusive. Instead of repeating the disturbance tests several times or starting a voltage and resistance check around the entire audio strip, it is preferable to switch to another, *more conclusive method* to find the defective stage; *gain checks.* It is a simple matter to feed in an audio signal to the grid of the *pa* stage, not the output, turn down the gain until the signal can barely be heard, and then feed the signal into the grid of the preceding stage, the first audio. The amount of amplification can be noted. This test can be repeated in the *if* stages using an *AM if signal.* In more difficult cases, the actual gain per stage can be measured.

In the third faulty technique point we find the problem of readings which mislead. Most Service Men, early in their career, learn how to interpret

(*Continued on page* 65)

Here's why it saves you Centralab switches —

You'll get the switch you want...when you want it...at one source! Your nearby Centralab distributor offers the most complete line of switches, kits and parts available to the industry!

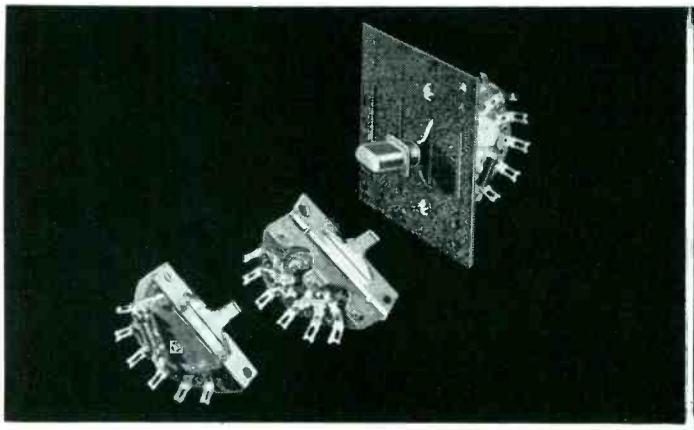
"If it's available at all — my Centralab distributor will have it."

That's what more and more servicemen are saying. And that's why the trend to Centralab is growing every day. Today's servicemen know that Centralab carries the most complete line of switches and switch parts available to the industry.

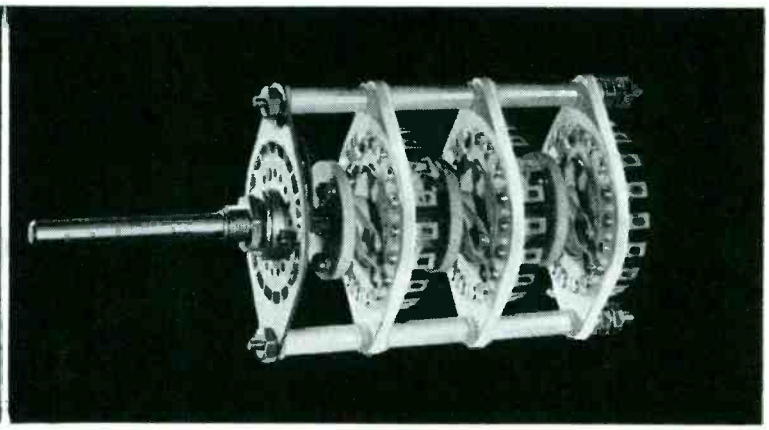
If you need standard or special-purpose switches for AM, FM or TV repair, intercom installations, P. A. systems or medium-duty power applications — your Centralab distributor has them in stock. Single- and multi-pole. Rotary or lever action (phenolic or steatite). Shorting or non-shorting contacts.

If you are building your own switches for test gear, etc. — you'll find switch parts, indexes, kits in Centralab's standard or "DD" line that meet your requirements. And that goes for highly rated switches for custom installations or high fidelity power supply, too.

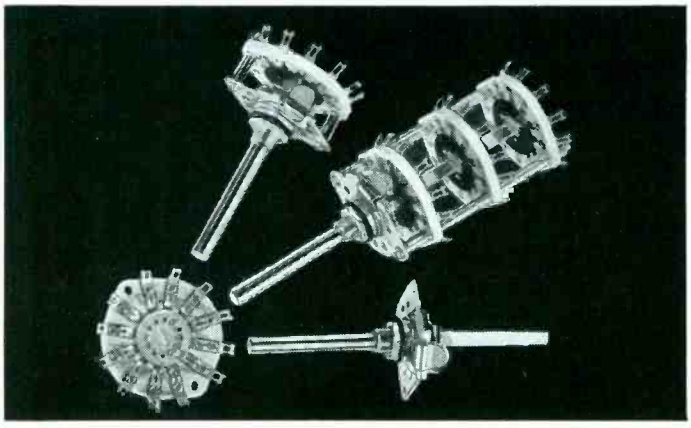
When you need switches or switch parts, make your choice Centralab — the most complete line available.



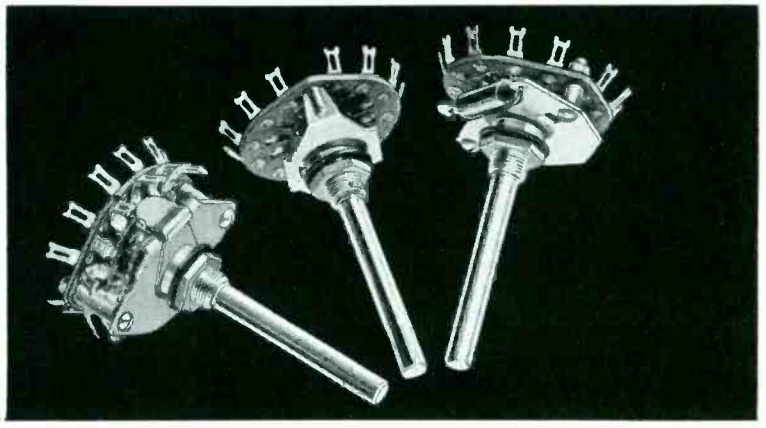
LEVER ACTION SWITCHES—for speech input equipment for line and program switching-monitoring, transceivers, band change, P. A. and intercoms, model railroad systems and industrial test equipment. Available in positive, spring return or combination. Coil spring index has minimum life of 150,000 switching cycles.



MEDIUM DUTY ROTARY SWITCH — for medium high power and excellent accuracy in transmitter, industrial control and balancing, laboratory testing, power supply converter and many other special applications. Rated at 750 watts (7½ amps, 60-cycle, 115 volts AC). 1, 2 or 3 poles...18 contact sections...up to 20 sections per shaft.

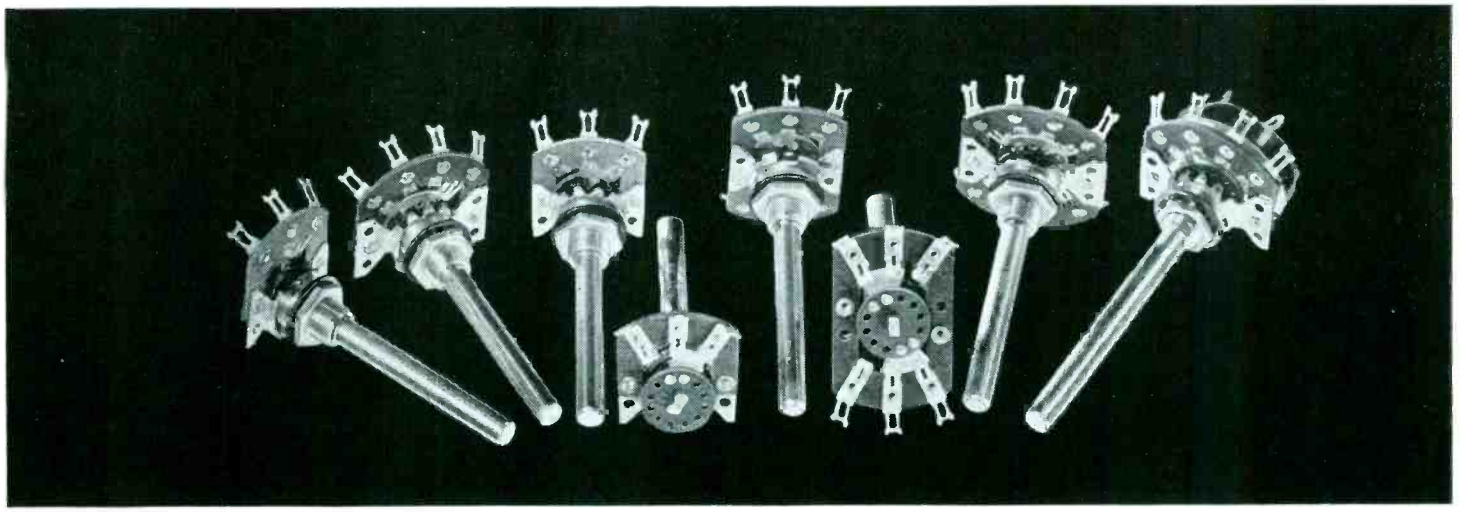


ROTARY SELECTOR SWITCHES — for use in fast, positive band switching in critical radio frequency circuit applications — in the oscillator, buffer or final amplifier stages of transmitters with input up to 75 watts and plate voltages up to 850 v.d.c. Also amateur rigs, test equipment and low current switching. Steatite or phenolic insulation.

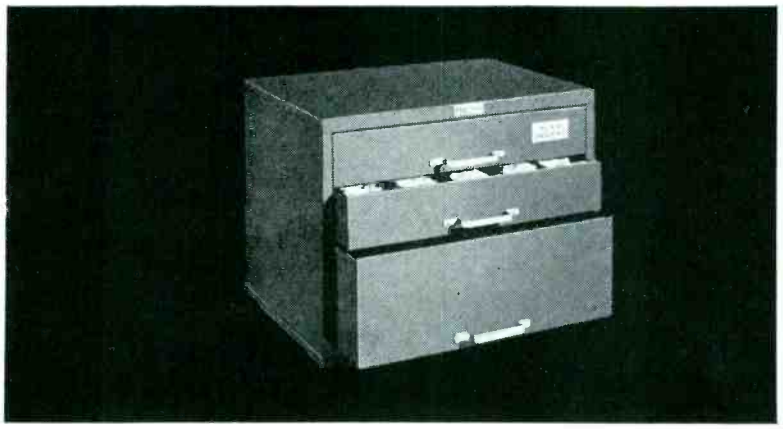


ROTARY ACTION FLAT SWITCHES—for program switching — monitoring, transceivers, band change, P. A. and intercoms. Phenolic insulation. Cadmium plated metal parts. A 4-pole, 2-position, non-shorting type with positive leaf spring index. Can be used a SPST, SPDT, DPST, DPDT, 3PST, 3PDT, 4PST or 4PDT.

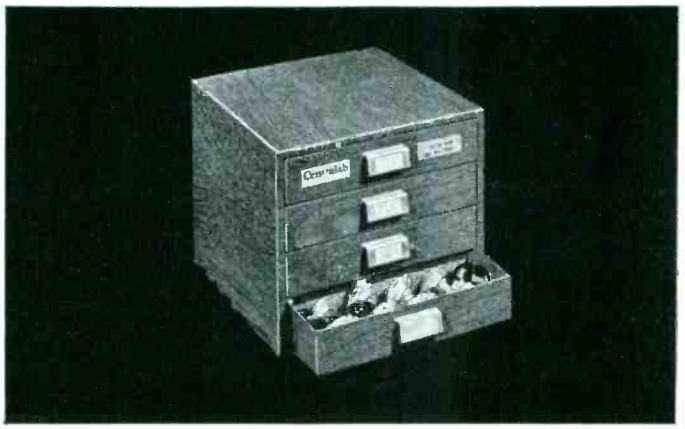
time and money to buy



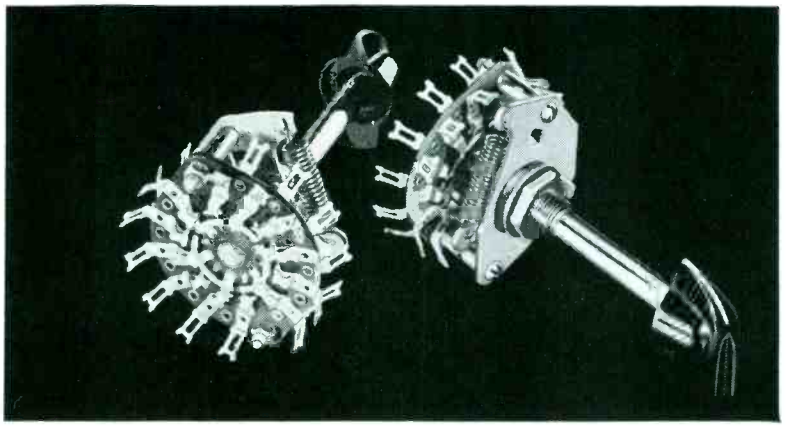
SMALL GENERAL PURPOSE SWITCHES—on-off and step control switches for radio, P. A. channel selectors, wave band, meter reversing, meter selector, intercom talk-listen, momentary line or remote speaker return and dual auto radio speaker control. Clips and contacts heavily silver plated. Phenolic insulation. SPST, SPDT, DPST, DPDT, etc.



414-419 ROTARY SWITCH KITS—give you a convenient, easily available source of stock sections, indexes and hardware for assembling practically any standard or special switching arrangement desired. Contain Centralab "DD" Index and Section construction. Attractive steel cabinet, fits standard steel shelving. 17" x 11 15/16" x 12 3/4".



1500 SELECTOR SWITCH KIT — ideal convenience for labs, design and service engineers, industrial electronic maintenance departments, hams and experimenters. 33 standard rotary switch phenolic sections, 16 index assemblies and adequate supply of flat shafts, spacers, nuts, bolts, lockwashers and knobs. 8" x 8" x 7".



INTERCOM SWITCHES — for public address and intercom talk-listen systems. Six pole, 3 position. Available in two types — spring return from both sides to center and spring return one side, positive opposite side. For long, hard use in industrial test equipment. They are Centralab De luxe, "DD", style.

Centralab

CRL

A Division of Globe-Union Inc.

980 E. KEEFE AVE., MILWAUKEE

Get the whole story of Centralab switches for electronic and industrial uses. Write for Centralab Catalog.

ASSOCIATIONS

ESFETA

DELEGATES and guests from seven associations in New York State were present at a recent meeting of the Empire State Federation of Electronic Technicians Associations held in Poughkeepsie, N. Y.

Methods of increasing interest of Service Men in existing associations and in forming new associations were discussed. Exchange of ideas was urged, and an invitation was extended to the secretaries of all associations within the state and of federations of other states. Ed Fisk, 234 Knickerbocker Ave., Rochester, N. Y., was named as the coordinator of the plan.

The next meeting of the group will be held in the Hotel Arlington, Binghamton, April 27.

ARTSNY

AT A RECENT meeting of the Associated Radio and Television Servicemen of New York, Max Liebowitz was re-elected president. Ted Kaumont was elected vice president; O. Capitelli, recording secretary; John Wagonny, corresponding secretary; Edward Eisen, treasurer; and Jack Katz, sergeant-at-arms.

Many different types of test instruments have been donated to the club room by various manufacturers. A variety of servicing material has also been contributed for the clinic and library.

RTG, FLORIDA

AT THE FIRST annual installation dinner of the Radio and Television Technicians Guild of Florida, Dade County Chapter, at Jackie Heller's Dinner Key Terrace Restaurant, the newly elected officers were officially installed. Among those at the dinner were Bob Collins, president; O. E. Smith, vice president; S. J. Petruff, secretary; A. E. Stevens, treasurer, and Charles W. Davis, John C. Gilbert, John E. Lockhart, John C. Ryan, Shan DesJardin, Samuel Kessler, Thomas Middleton, and R. H. Smithey, Jr., members of the board of directors. Guest for the evening was Mayor Chelsie J. Senerchia.

Sam Kessler was chairman in charge of arrangements.

RTSA, Pittsburg

GEORGE SHARPE has been elected president of the Radio Television Servicemen's Association of Pittsburgh.

B. A. Bregenzer has been appointed program chairman, and will also act as editor for all news pertaining to the association.

During a recent meeting of the Long Beach Radio Technicians Association, Long Beach, Calif., when the executive body presented to Harry E. Ward, public relations officer, a life membership in the RTA of southern California, in appreciation for his fine efforts for the past years serving in that capacity. President Hal Myers (standing) presented the award. Ward, public relations officer for eleven years, will retain the position in the national field. Ward is also chairman of the radio-television committee of apprenticeship training, and also secretary to the over-all committee for all allied apprenticeship training. He is also a member of the Television Arts and Sciences. Looking on during the presentation: Left, Les Huckins, secretary of the RTA, and seated (right), Charles Becken, an apprentice soon to graduate.

TEN YEARS AGO

From the Association News Page

MASTER RADIO SERVICEMEN, INC., of N. Kentucky and Greater Cincinnati, announced a mutual assistance agreement with radio station WCKY, and received two spot announcements daily, stating that the work of each individual member is guaranteed by the entire association. E. C. Helmers was elected president of the association. Others elected were: William Stephenson, first vice president; William Halpin, second vice president; Ray S. Rohrer, treasurer; and Bob Pepper, secretary. . . . Radio Serviceman's Association of Pittsburgh held a dinner at the Hotel Keystone in honor of Dr. G. A. Scott, Dean of the College of Electrical Engineering, University of Pittsburgh. After the dinner, Dr. Scott addressed the association on the subject of *Electronics and Radio*. . . . Edward Nowicki, owner of Voss Sales Co., of Nanticoke, Pa., was host to the Radio Serviceman's Association of Luzerne County, the radio amateurs of this region, and the saff of WBAX, Wilkes-Barre, Pa., at the Nanticoke Quoit Club Rooms, Nanticoke, Pa. C. Foster Hick was master of ceremonies and introduced the officers of the association: Edward Buckman, president; J. Austin Renville, vice prexy; John Kennedy, treasurer; Walter Neeld, secretary; and the board of directors which included C. F. Hick, Dan Davis, Edward Tischler, Spencer Eddy, Pat Maneval and Edward Nowicki. Arrangements were made for John F. Rider to address the association.

Selenium Rectifiers‡

SELENIUM RECTIFIERS are claimed to be a long-lived and trouble-free component; yet instances do occur when faulty operation may appear. This may be due to the rectifier becoming open circuited, short circuited, high in forward resistance, or low in reverse resistance. If trouble occurs, a visual inspection of the rectifiers and other components of the power supply may show whether replacement is necessary. As failure is not always accompanied by physical changes, an electrical test may be necessary to determine whether the rectifier is damaged.

Removal and Replacement

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

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

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

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

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

In radio and TV chassis, a line resistor is connected in series with the rectifier. While omission of this resistor will increase the voltage of the $B+$ supply, it serves an important purpose in protecting the rectifier and capacitor from heavy surge currents. These currents may damage or shorten the life of the rectifier or electrolytic.

‡From an article by *Walter F. Bonner* appearing in *Replacement Guide*, published by Federal Telephone and Radio Corp., 100 Kingsland Rd., Clifton, N. J.; priced at $.50.

Tape-Disc Amplifier

(*Continued from page* 38)

by connecting a 'scope across the 100-ohm resistor and applying this voltage to the vertical deflection plate through the appropriate amplifier. An audio oscillator can then be applied to the horizontal deflection plate through an amplifier and adjustments made so as to procure lissajous type figures in which the frequency of the bias can be established against the known frequency of the audio oscillator. For all practical purposes, this critical adjustment is not necessary. Frequently amplifiers are used in which the bias frequency may be adjusted anywhere from 30 to 50 kc.

After the bias frequency has been established, it is then necessary to adjust the bias current. This is accomplished by adjusting the 10-160 mmfd trimmer until a voltage of .3 is read across the 100-ohm resistor, which had been placed in series with the (orange) lead of the recording head. If it is necessary to drastically change the original setting of the trimmer, it may be well to recheck the bias frequency.

After the bias has been adjusted, it is then necessary to establish the recording level. Quite likely, the neon bulb will just fire on the proper recording level. This recording level represents ¼ milliamp flowing through the recording head. To definitely check this current, the 6AU6 tube should be moved from its socket; this will eliminate the bias source and then only the recording level or the recorded signal will be measured as voltage across the 100-ohm resistor which is in series with the orange lead of the recording head. After this has been definitely established at .025 volt, which would represent the ¼ milliamp flowing through the head, the 6AU6 bias oscillator tube can be again placed in its socket and immediately the voltage will go back up to the .3 volt across the 100-ohm resistor which is the bias current. What actually happens in tape recording is that the audio or modulating signal will modulate the 40-kc bias in the recording head.

It is frequently desirable to record from the microphone when recording from phono records. This type of recording can be used when it is desirable for one to sing or play a musical instrument into the microphone in accompaniment with music recorded on phonograph records. This can be accomplished by adding a 2-megohm volume control and a double-pole, single-throw switch which can be attached to the volume control proper. The

switch used on the volume control can be a standard switch.

When it is desirable to mix microphone with recorded phono records, it is first necessary to establish the microphone recording level by setting the controls for tape recording of microphone. It is then necessary to rotate the 2-megohm volume control so as to close the double-pole, single-throw switch. This will then connect the phonograph input into the grid circuit of the second section of the 12AX7. The control should be advanced to the point where the volume level of the recorded music and the microphone is approximately correct when heard through the loudspeaker. Normally, when recording from microphone, the speaker is eliminated from the output circuit to minimize the feedback effect from the speaker back to the microphone. In this setup, it will be necessary to keep the microphone some distance from the speaker to eliminate feedback effect.

UHF Tests

(*Continued from page 21*)

lent gain (6 db), good directivity, extended service range, and apparent lack of side lobes. However, this antenna was found to be bulky and rather expensive to manufacture and install. A typical model consisted of seven turns of half-inch copper tubing, with the turns seven and three-quarters inches in diameter and spaced five inches apart. The helix was fed between one end of the coil and a reflector plate perpendicular to the coil axis, and oriented with the axis pointed toward the transmitter.

The Six-Element Yagi

Yagi antennas have proved extremely valuable for special fringe applications on *vhf*, and it seems likely that this type will find similar use in *uhf*. Tests indicated that the shorter *uhf* wavelengths will make compact, lightweight multi-element yagis even more popular than at present. A characteristic of the yagi, however, is its limited frequency response range, which normally includes only one or two channels.

Existing *vhf* anennas have been found to be usable in strong *uhf* signal areas where reflection problems are not severe. In some other areas, a few minor changes in the existing *vhf* installation may be sufficient for satisfactory *uhf* reception.

Of the antennas tested, the corner reflector, the stacked fan dipole, the

(*Continued on page 54*)

UHF Tests

(*Continued from page* 53)

stacked *V* and the yagi appeared to be the best types for *uhf* use.

Transmission Lines

Five types of transmission lines were tested‡; flat twin, tubular twin, twinex (braid and foil shield) and coax. In Fig. 5 appears a tabulation of the results obtained with these leads.

During the *uhf* field tests in Washington, D. C., flat 300-ohm twinlead was used. It proved to be susceptible to moisture conditions and weathering, with considerable losses resulting. Reception was also seriously affected by proximity to guy wires, rain gutters, and power lines. Supporting the line was also difficult because the position of standoff insulators along the line was critical.

Open-wire transmission lines were tested, and despite the apparent low-loss characteristics, they proved unsatisfactory because of problems in support, routing, cost, and impedance matching. In cases where flat twinline proved unsatisfactory, tubular twinline was substituted. It showed much better weather characteristics and was not so critical as to placement.

‡See tabulation on page 21, this issue.

RG59/U coaxial line was used to a great extent in the Stratford tests, despite its high initial loss of 9.5 db per 100′ at 500 mc. This type of line was found to be weatherproof, free of interference from nearby noise sources, and could be routed conveniently without being affected by other objects in the immediate vicinity. Since RG59/U has 72 ohms impedance, unbalanced, the transmission line was matched to the antenna with a *balun* (balanced to unbalanced) matching device.

The Balun Lightning Arrester

The balun replaced the *bazooka* as a matching section because it could be much more quickly constructed. It also performed the dual function of matching 300-ohm to 72-ohm impedance, besides matching unbalanced coax line to a balanced antenna.

Extensive tests on commercial lightning arresters showed that attenuation of signal voltage through the arrester was marked in most locations. To overcome this, a combination matching transformer-lightning arrester was designed for use in conjunction with tubular balanced transmission line.

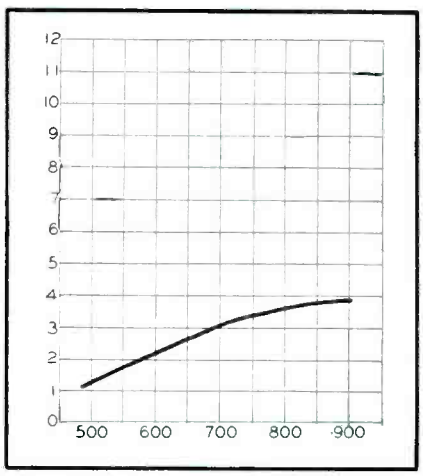
Crossover Network

For receivers having a single input, there has also been developed a crossover network. An outer sets of terminals permits connection to separate *vhf* and *uhf* antennas. Center terminals provide contact to the converter or receiver, through a single transmission line.

Evaluation of UHF Reception

The *uhf* antennas developed for this field test project, the special receivers and converters, and installation materials and devices required were tested at great length in Washington and

Fig. 11. Plot of gain in db (ordinate) of fan dipole.



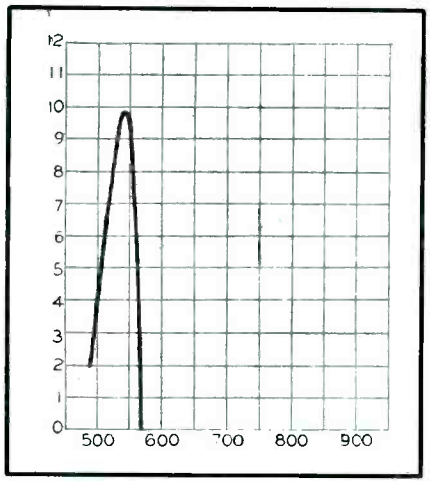


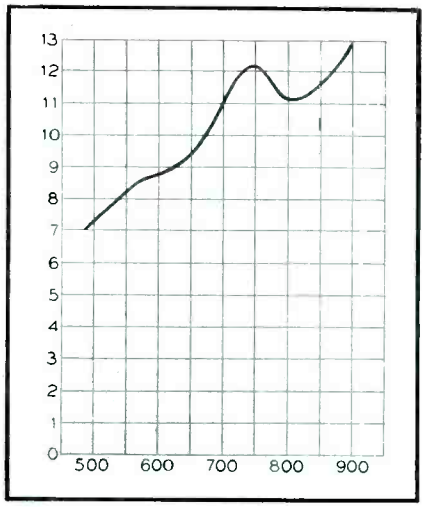
Fig. 12. Results achieved with a 6-element yagi; gain in db shown on ordinate and frequency on abscissa.

Stratford during the past three years. Approximately 150 complete installations were made in private residences and commercial locations throughout both areas, under all conditions and at a wide range of distances from the transmitters. Periodic observations were made at each test site, and the information compiled proved invaluable in deciding on specific product designs.

Every installation site was thoroughly surveyed for optimum results before a *uhf* antenna was installed. Often it was found that the fan dipole antenna did not produce sufficient pickup. In such cases, a stacked V was substituted. If this proved inadequate, a corner reflector antenna was tried. If improvement was insufficient with substitution of antennas, the height of the antenna was increased. Where signals were received by reflection, the best position of the antenna was found to be critical, as to orientation and height. A distance of a few

(*Continued on page* 56)

Fig. 13. Corner reflector gain in db (ordinate) plotted against frequency (abscissa).



(Continued from page 55)

inches horizontally or vertically made a great difference in picture quality.

Where *uhf* and *vhf* antennas had to be installed, it was found that a survey had to be made for the *uhf* channel, since it was more critical as to location. In many installations, the *uhf* antenna may be mounted on the *vhf* supporting mast. However, it was found that sometimes separate masts were necessary.

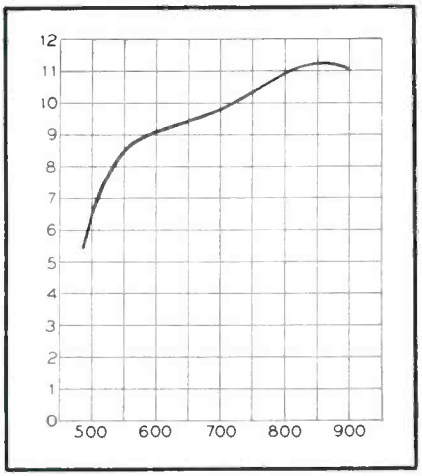
Multipath reflections are present in *uhf* as in *vhf*, and can be eliminated for the most part by directive antennas.

The greater directivity obtainable with *uhf* antennas of practical size makes it possible to select a signal coming from a single direction to better advantage than with *vhf* antennas.

No interference from diathermy has been reported in the Stratford area, despite the fact that one location is directly across the street from a medical building with active diathermy equipment in use throughout the day.

Ignition interference is practically eliminated in *uhf*, except under the most unfavorable conditions. Even

Fig. 14. Plot of the results obtained with a rhombic, gain in db being shown on ordinate and frequency on abscissa.



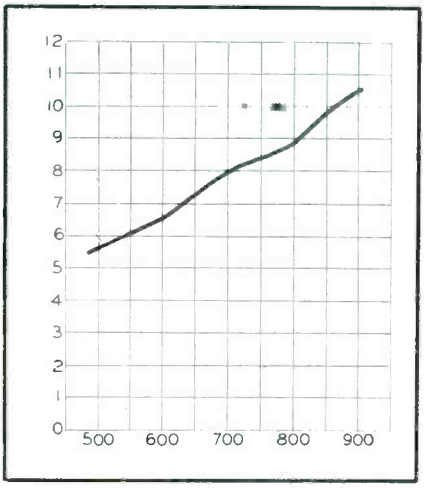
when present, this type of interference is so slight that it will probably go unnoticed by the layman.

Summer static produces no interference in *uhf* reception, although local lightning flashes may produce impulses sufficient to affect vertical synchronization momentarily and cause the picture to roll a few frames.

Where the choice of installation materials and methods was not the best, very heavy rain and snow storms attenuated *uhf* signals, because of higher losses in wet transmission line and increased propagation losses.

In such cases, tubular twinlead produced good pictures without noticeable vulnerability to wet weather, as evidenced by voltage measurements at the receiver with the line coated with ice and rain.

Fig. 15. Stacked *V* results, with gain in db appearing at left.



* * *

SYLVANIA TV-RADIO SERVICE PROMOTION

National promotion of TV-radio Service Men during 1952, has been announced by Sylvania Electric Products, Inc., Emporium, Pa.

Sylvania will use national weeklies and monthlies to carry messages from Jane Russell, Ann Blyth, June Havoc, Laraine Day and Leo Durocher to the public. These celebrities will testify that the TV-radio Service Man displaying the Sylvania seal does a good job. They will also tell the public how to select a reliable Service Man.

TV program presentations, also included in the plan, will stress the fact that TV repair requires a specialist; that he must study constantly to keep up with ever-changing TV circuit design in more than 1000 set models; that he must maintain a stock of more than 600 different types of tubes and parts; that he must purchase expensive test and repair equipment; and that he must be familiar with at least 300 possible trouble sources.

Tied in with this national advertising are local dealer advertising campaign kits that include window displays; counter cards; window streamers; 8" and 12" fluorescent service emblems for windows, doors, and trucks.

Replacement Cartridges

(*Continued from page 22*)

records indicate that they now represent less than ten per cent of the total number of players in use.

The high output cartridge will be found in the record player or children's phono type of reproducer. The higher the output of the replacement cartridge, the greater volume from the speaker. The low output cartridge appears in the record changer or radio-phono combination where the sound is amplified to a greater degree. The majority of these applications have standard ½" RTMA mountings. This means that the mounting holes of the cartridge are on ½" centers in accordance with the industry standards.

To simplify the replacement problem, there was evolved about a year ago, a universal replacement cartridge to fit almost all these old 78 sets to deliver the exact type of output required for best reproduction from the individual set.

This cartridge was designed to fit into the standard ½" RTMA mounting and produce two voltages or outputs; a high and low output. It was produced with three terminals for adjustment to the requirements of either high or low output reproducers, and supplied with a 3-mil osmium tipped needle and mounting accessories.

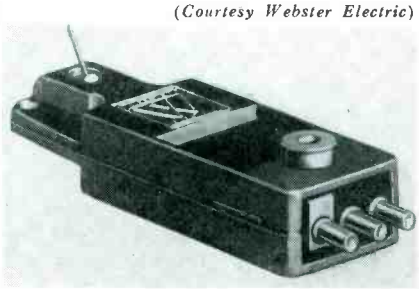
Other manufacturers followed along, offering cartridges to meet the dual output problem. High output cartridges, they can be adjusted to low output by means of a harness which affixes a capacitor to the cartridge.

The three-pronged cartridge weighs 25 grams and has tracking pressure of ¾ of an ounce, a light weight which has been found to minimize record wear.

The universal cartridge features protection against humidity and moisture, via a special seal.‡ This protective coating has been found to prolong the life of the cartridge and is particularly important in sections of the country which are unusually humid or unusually dry.

‡Developed by the Brush Development Company, who supply all manufacturers with rochelle salt crystals.

Three-terminal dual-output cartridge.
(*Courtesy Webster Electric*)



SOUTH RIVER METAL PRODUCTS FACILITIES BOOKLET

A 12-page booklet describing plant facilities and equipment has been released by South River Metal Products, Inc., South River, N. J.

Audio

(*Continued from page 27*)

lag in the record-reproduce process, but prevents spurious readings which might be caused if the tape was under abnormal tension in the monitor unit.

Tape-Recorder Service Aids

Some early production model *Soundmirrors** have been reported to have given some difficulty with high hiss in erase due to parasitic oscillation of the erase oscillator. This difficulty can be eliminated by installing a 22,000-ohm carbon resistor in series with the .0001-mfd feedback capacitor and the grid pin *4* on the 6SN7 oscillator.

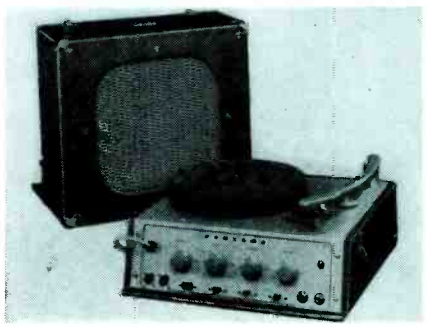
It is often necessary to modify recorders to alter the operating speed and recording time. Generally, three changes are required: the capstan must be changed if the recorder is being converted to slower speed; the motor pulley must be replaced; and the amplifier equalization adjusted. In converting a slow-speed recorder to a recorder of higher speed, it is not necessary to change the capstan. When a recorder is converted to slower-speed operation, flutter will become more objectionable due to reduced inertia of the flywheel, and it is therefore necessary to use a heavier flywheel. It should be pointed out to the customer that the increasing of recording time does mean slowing down the tape speed with a resulting loss of fidelity; 3¾-inch speed is always satisfactory for speech recording, but is usually not too satisfactory for the recording of music.

In early models of the *Soundmirror* series, the output plug was mounted

(*Continued on page 60*)

*Brush BK 441-443.

Variable speed 10-watt portable player and public-address combination which plays all records, any speed, any size up to 17¼". A two-pound 10" turntable acts as a flywheel. Unit also has individual bass and treble tone controls; 12" Alnico 5 *pm* dynamic speaker, and dual needle variable reluctance magnetic pickup. (*Model TR-16AM; Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Calif.*)



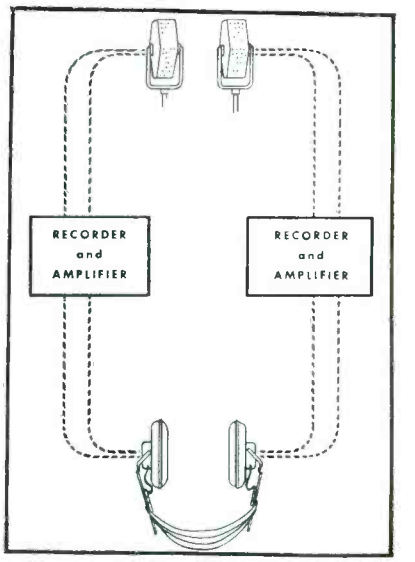
Audio

(*Continued from page 59*)

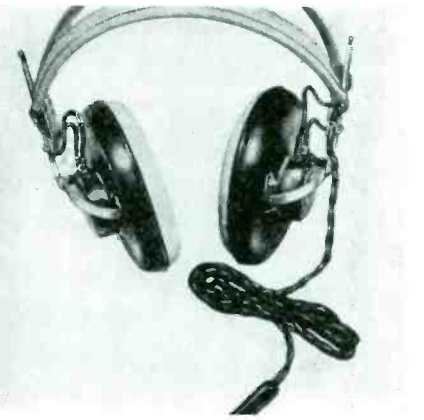
so that the shell of the plug could come in contact with the chassis, and it was possible for a short circuit to occur from $B+$ to ground through the metal shell of this plug. This failure caused a loud hum and often a burnout of either the rectifier or the output transformer. This can be remedied through the addition of an insulating washer over the prongs of the output plug, making it impossible for the plug shell to ground to the chassis; this change appears in later models. All recorders should be checked to see that either the output plug socket has been remounted, so that the plug shell cannot short, or the insulating washer is present.

Excessive hum in these recorders has been found to be due to improper placement of the grid lead of the first 6J7. This lead should be carefully oriented for minimum hum.

In some models difficulty has been encountered in the motor system, the switch failing to operate because the actuator ball has jumped out of the switch. If the ball is replaced and the



Arrangement for a binaural reproducing system, in which a pair of dynamic headphones, using moving-coil type motor assemblies, are used for listening. (*Courtesy Permoflux*)



recorder tripped into automatic rewind, it will be found that the blade on which this ball rides almost escapes from under the ball. This switch should be carefully adjusted so that the ball remains positioned over the edge of the blade and the ball cannot escape. After this has been done, the switch should be checked to see that when the control lever is in the neutral position, the ball is actually in the center of the dimple made to receive it. In later models, a protuberance was staked out on the side of the actuator lever so that the ball is not permitted to escape. In most recent construction, the pivot tongue* has been lengthened so that this pivot point can be adjusted by bending the tongue to prevent difficulty in adjustment of the motor switch.

*Binaural Systems***

Recently, the subject of binaural recording and reproduction of sound, also referred to as stereophonic or third dimension, has become extremely popular.

Stereophonic reproduction is not new to the audio art. It was first demonstrated as early as '33, but due to technical difficulties, it was not developed to any extent until the arrival of tape. This recording medium made binaural reproduction feasible.

For many years it has been known that the slightly different length of paths taken by a sound travelling from its source to each of our ears accounts for our ability to determine the direction and distance of the sound. If we cannot sense the location of the sound, it does not seem natural to us. In an artificial hearing system, such as the conventional monaural recorder, only one microphone channel or ear is used and the actual sense of sound location is lost.

To overcome this defect, it was decided to use a pair of microphones spaced about eight inches apart, about the same distance which obtains between the ears. The versatility of present day recording tape makes it possible to record the output of each of these mikes simultaneously, but separately. Standard quarter-inch recording tape is used and the output of each mike occupies one-half of the width of the tape and remains completely isolated from the other half.

This pair of sound channels, when played back through separate amplifiers and separate earphones, provide an accurate reproduction of sound. Effectively, the listener's ears are transported by means of the recording playback system to the position occupied by the two microphones.

Just as stereophonic photography makes each element of the picture stand out in proper relationship to the surrounding elements, so does the binaural system allow each instrument in an orchestra to be heard in its proper relationship to the other instruments. In a sense, it photographs a three-dimensional sound picture.

Reproduction of stereophonic sound is possible with two properly balanced loudspeakers in an acoustically-treated room, or headphones.‡ Listening through such headphones is said to offer an unusual degree of realism.

Besides providing the hi-fi fans with natural reproduction of music, binaural recording may be used in business, education and industrial research. When used for recording conferences and board meetings, it is said to provide an accurate record of the proceedings and permits a stenographer, when transcribing for the written record, to identify and concentrate on an individual voice when several are speaking at once.

*Brush part 092. ‡Permoflux BDHS—17B.
**Based on notes supplied by Permoflux.

Ser-Cuits

(*Continued from page* 34)

creases which results in good *agc* action.

To improve this system, it is important to operate the video amplifier stage as a noise limiter. Therefore, the signal applied to the grid of the video amplifier should be of such an amplitude that the plate current cutoff is almost reached on the peaks of the sync pulses. A large noise pulse is made harmless by clipping it, so that it extends only slightly beyond the tips of the sync pulses. For strong signal reception, a high *agc* bias voltage has to be developed, while for weak signal reception, a lower *agc* bias is required; *agc* level is adjustable through a 25,000-ohm resistor.

Sync System Analysis

Composite sync and video is taken from the video amplifier circuits and delivered to the first and second clipper tubes, V_{118A} and V_{119A}. The output signal consists of stripped sync which is divided as follows: A high-pass network, consisting of a 180-mmfd capacitor and 68,000-ohm resistor is used to couple sync to the horizontal phase detector ½ of a 6T8, V_{118b}, for control of the horizontal oscillator frequency. A low-pass network, known as the *integrator* has been included to remove the high-frequency sync information and by combination of the equalizing pulses and the super-sync, forms the vertical sync pulse. This is then coupled to the vertical oscillator, ½ 12AU7, V_{120A}, to control the vertical scanning frequency.

Vertical Sweep and Retrace Blanking

The receiver uses a twin triode, V_{120}, as a blocking oscillator and vertical retrace blanking tube. The vertical oscillator in conjunction with a parallel-connected twin amplifier, V_{121}, provides the vertical sweep voltage which is delivered to the deflection yoke.

The vertical blanking action occurs as follows: The retrace portion (a steep positive *spike*) of the vertical sweep is fed to the grid of the blanking triode. The *rc* time constant in this grid circuit, together with the positive *spike* pulse, causes a high-negative bias to be developed. This bias causes the blanking tube to be cut off. The plate voltage, therefore, reaches a maximum which is determined by the setting of the brightness control. Since the picture tube grid is directly tied to the blanking tube plate, it will

follow the plate voltage variations. The picture tube, therefore, conducts during the next sweep sawtooth period. At the end of this sawtooth, the positive spike again drives the blanking tube to heavy conduction, thereby causing the plate and consequently picture-tube grid voltage to fall to a very low value. At this time, the vertical retrace period, the picture tube is cutoff, thus accomplishing vertical retrace blanking.

AFC

The *afc* circuit maintains automatic control of the horizontal sweep oscillator over a considerable range above and below the horizontal frequency of 15,750 cps.

The horizontal oscillator tube, a 6AU6, V_{123}, is of the electron-coupled type with the screen grid acting as a grounded plate in a conventional class *C* oscillator circuit. Its tank circuit consists of an inductance and a pair of capacitors; 220 and 3,900 mmfd, respectively. The 220-mmfd capacitor has a variable resistance arm in series with it; therefore, the net capacitive reactance across the coil can be varied by the setting of a 100,000-ohm horizontal-hold control, thereby changing the oscillator tank circuit's natural resonant frequency. A 470-mmfd capacitor is also tied across the tank circuit, but is in series with the plate resistance of a 12AU7 serving as a reactance control tube, V_{110B}. Any change in this tube-plate reactance, such as may be caused by a change in its *dc* grid voltage, will again modify the tank circuits natural resonant frequency. It is only necessary, therefore, to obtain a suitable source of voltage for the reactance tube's grid which will be in proportion to any frequency or phase difference between the horizontal sweep oscillator and the incoming sync pulses. This voltage is obtained from the horizontal-phase detector (discriminator) by comparing the incoming sync pulses with a sample of the horizontal sweep output. The circuit is so designed that any difference in frequency or phase between the sync and sweep pulses will create a voltage proportional to the degree of displacement. If the horizontal oscillator natural speed is too low, this developed voltage will be negative in polarity. If the horizontal oscillator natural speed is too high, the developed voltage will be positive in polarity. There will be a zero-net developed correcting voltage when the incoming horizontal sync pulses and the horizontal sweep oscillator are at the same frequency and in phase. This voltage is applied to the reactance tube grid after suitable filtering. This filter and its associated *anti-hunt* network, consisting of 4,700-mmfd and .05-mfd capacitors and 150,000-ohm and 1-megohm resistors, is so designed that the time constant will not be too long and thereby permit hunting, nor shall it be too fast and allow the passage of random noise or permit fed-back horizontal sweep pulses to pass, which would cause undesirable feedback known as the *gear-tooth* effect.

Audio System

The audio system consists of a 12AX7 and two 6W6s. One-half of the 12AX7 is the first audio amplifier stage which is followed by the other half, a phase inverter. The push-pull balanced output of the phase inverter drives push-pull pentode power amplifiers, which in turn deliver audio power to the loudspeaker circuits.

Negative Feedback

A portion of the output voltage delivered to the loudspeakers is fed back to the cathode of the audio amplifier. This negative feedback is said to stabilize and enhance the audio system performance.

Servicing Helps

(*Continued from page* 40)

frequency channel in a normal fashion; if no low channels are available, a higher channel can be used. The fringe compensator switch should then be turned on, and the potentiometer adjusted to the center of its mechanical range. All channels normally received in the area should be checked and readjusted if necessary for best performance. *Note*: At the time *triangle B* was incorporated, a lead from each side of the horizontal phase coil was brought out to a 2-lug terminal strip which is mounted on the top-rear of the chassis next to the *hv* cage. This was done to facilitate alignment of the *miracle picture lock*; the horizontal phase coil can be shorted out without removing the chassis from the cabinet.

Stromberg-Carlson Notes

Removal of Horizontal Size Potentiometer (Model 317): On all receivers date coded 51-32 and later, the horizonal size potentiometer has been removed from the circuit and the horizontal-size coil has been repositioned to the rear chassis flange so as to be accessible for adjustment from the rear of the receiver.

Lead Dressing in HV Power Supply (321 Series): To avoid arcing, certain precautions must be observed in dressing the lead wires in the *hv* power supplies:

(*1*) The insulated lead from the flyback transformer to 1B3 rectifier plate cap should be dressed clear of the 6W4 damper tube envelope by running it midway between the 6W4 and 6AU5. If there is any excessive length, the 1B3 plate cap can be turned slightly so that the lead falls to the rear of the 6W4 toward the 1B3 supporting board.

(*2*) The white and red leads, from terminals *5* and *6* of the 6W4 socket to the fuse, should also be dressed clear of the 6W4 envelope.

It is important that these precautions be observed when replacing 1B3s or 6W4s in the field. It will be observed that the glass envelope on the 6W4s varies in length and that there is less possibility of arcing if the shorter envelope 6W4s are used in these receivers. Destruction of the 6W4 will occur if sustained arcing is permitted between the 1B3 plate lead and the 6W4 envelope.

Picture Centering

If it is impossible to center the picture on Stewart-Warner 9127 series chassis without producing *neck shadow*,

the following circuit modifications should be included (these changes have already been incorporated in chassis which include the letter *C* in the series coding):

(1) Disconnect the yellow lead of focus coil socket from 340 *v* B+ supply and reconnect it to the red lead coming from pin 7 of the deflection yoke socket.

(2) Disconnect the 12,000-ohm 2-watt resistor (363) in the screen circuit of horizontal-output tube from the 340 *v* B+ supply and reconnect it to the red lead coming from pin 7 of the deflection yoke.

Speed Troubleshooting

(*Continued from page 47*)

faulty voltage and resistance readings. They find that such readings are invaluable in indicating defective components. We are, therefore, not referring to elementary errors such as not being able to interpret properly meter readings around a circuit. However, as a Service Man becomes more experienced, he finds that voltage and resistance readings mean more to him. As a result, he is sometimes misled where a less experienced man may not be.

For example, let us suppose voltage readings are made around a circuit and a plate reading is found lower than the manufacturer's voltage chart by more than 20 per cent. The experienced Service Man may start tracking down possible troubles in the plate circuit; change of resistor value, leaky capacitor, etc. On the other hand, the less experienced man may continue checking the whole circuit and find a much more serious discrepancy in one of the other measurements. The point involved is: When taking measurements around a circuit, *complete them* before deciding what trouble is indicated. Many receivers have readings in some circuits which differ *considerably* from those provided by the manufacturer. *Yet the circuit operates normally.*

After *complete* readings are taken around the tube socket, then *all* of the readings can be analyzed carefully to decide what to do next. Additional checks made on the basis of incomplete readings may only serve to provide false clues and to waste time.

Another type of misleading reading sometimes occurs when the Service Man is in a hurry and forgets to check the amplitude as well as the waveform in using a 'scope. The 'scope may show the correct waveform at various points in the circuit. However, the amplitude may not be correct. It is very important to note whether the proper quantity, as well as the proper waveshape, is present before deciding whether a given stage is operating correctly. The 'scope can be easily calibrated to show amplitude by using a known value of a signal, such as a 6.3 *v ac* test signal. The known signal can be fed into the vertical input terminals of the 'scope. The 'scope vertical amplitude control is used to make this signal a certain number of boxes high on the 'scope mask. For example, the 6.3 *v* signal can be made 3 boxes high. Now 6.3 *v* is actually 18 *v* peak-to-peak, since 6.3 *v* is the effective value and approximately 9 *v* is the peak voltage of *each* half of the sine wave. Therefore, if an 18 *v*-signal is made 3 boxes high, each box represents 6 *v* (6 × 3 = 18 *v*). When the 'scope is used to observe any other waveform, the amplitude can easily be checked, provided the vertical amplitude control of the 'scope is not moved after the above calibration. It is merely necessary to note how many boxes high the

(*Continued on page 66*)

(Continued from page 65)

observed waveform is and multiply by the number of volts each box represents.

In the fourth point under faulty techniques are incorrect repairs. Service Men generally understand the importance of using good quality replacement parts and it is unnecessary to stress this point. On occasion, the technician may inadvertently use an incorrect replacement, wire in a correct part incorrectly, or leave some other part of the circuit unwired or incorrectly wired. The result may be either no improvement on the original trouble or the original defect may be gone and a new trouble appears. In any event, it is always advisable to check any replacement part carefully before wiring it into the circuit.

If a part is replaced and the original trouble remains, it is necessary: (*a*) to recheck the part or try a new replacement or (*b*), if there was some question whether that was the faulty part, to check the other possibilities of trouble in the circuit.

Whenever *new* trouble appears immediately after a repair is completed and the set is turned on for testing, the experienced Service Man will check the repair. In most cases, it will be found that some error has been made which accounts for the new trouble.

The final factor which delays troubleshooting is lack of information. Particular servicing problems may be difficult because of insufficient information about theoretical circuit operation or servicing techniques or the individual peculiarities of the receiver being checked. Books, technical periodicals such as SERVICE, manufacturers' literature and lectures have all been helpful in providing new theoretical and servicing information. A complete file of commercial *TV* schematics helps overcome lack of information about specific models.

There will always be a certain number of unusual troubles which will greatly broaden the Service Man's background—after they are found. Some examples are:

(*1*) Emerson, model 609; set went out of horizontal sync intermittently. At first, trouble was suspected in the horizontal *afc* circuit or in the sync section. Then, it was noticed that there seemed to be a slight distortion in the sound when this occurred. Trouble was found to be a bad *rf* amplifier tube in the tuner.

(*2*) Dumont, model RA-105; pix had a broad vertical stripe about two inches wide running down the left side of the picture tube. A broad white stripe appeared on the right side of

WHEN YOU CHANGE YOUR ADDRESS

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

the picture tube when the brilliance was turned up. The picture was poor and unsteady. The pix circuits were checked and found normal. The trouble was found to be an open .01 bypass on the screen grid of the *crt*. The same voltage point connected to the *crt* screen and to the horizontal output circuit. There was a horizontal ripple component in this supply which showed up on the screen with an open bypass.

Circuit Oddities

Occasionally, the Service Man learns some theoretical points which many textbooks omit:

(*1*) A short on the plate of a previous stage can, in certain cases, prevent a signal from going through a following stage, even when a signal is injected at the grid of the following stage. An illustration of this appeared in circuit with a shorted bypass across a volume control. A finger applied to the grid of the first audio stage did not produce a hum in the speaker. It was logical to suspect that the trouble was between the grid and the speaker. Yet, the shorted bypass effectively placed the coupling capacitor, from grid to ground, when the pot was all the way up, thus acting to short or partially short the grid to ground. It may be helpful to remember this possibility of trouble in making checks at the grid of a given stage.

(*2*) The reverse can also be true. A short from grid to ground does not simply short out the signal at the grid, but at the plate of the *preceding* stage. For example, a short between the grid and cathode of the first video *if* stage will not only short out the video signal, but also the *sound*. This is because the coupling capacitor is thrown from plate to ground in the mixer stage. The capacitor in parallel with the plate load impedance reduces the total value of load impedance. The result is that most of the output is across the internal resistance of the tube and very little appears across the load.

The conclusion to be drawn from the two examples just cited is that in certain types of defects, it may be necessary to check immediately after or immediately before the usual point where trouble is indicated.

TV Service Men deal with one of the most complicated mechanisms, for its size, in modern industry. It is only because of his overall skill and ability that TV has been available on a continuing basis to the American public.

DUMONT INSTRUMENT DIVISION APPOINTMENTS

Five members of the instrument division, Allen B. Du Mont Laboratories, Inc., 1500 Main Avenue, Clifton, New Jersey, have been promoted to new posts within the division.

Dr. P. S. Christaldi has been named assistant division manager. He was formerly engineering manager. G. Robert Mezger has been named engineering manager. He was formerly technical sales manager. Emil G. Nichols, formerly assistant technical sales manager, has been appointed technical sales manager. Melvin B. Kline and William G. Fockler have been appointed assistant engineering managers.

AMPHENOL OPENS NEW SALES OFFICE IN N.Y.C.

The American Phenolic Corporation of Chicago has realigned its industrial sales staff in both the city and state of New York, and opened new offices in the Empire State Building, 350 Fifth Avenue, suite 7323.

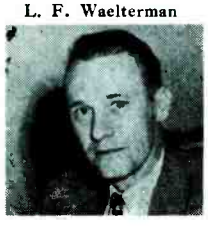
Office, which will handle industrial sales only, is staffed by four men, headed by Ray Whitmore, district sales manager. He will be assisted by Herbert Brontsema, Herbert Motz and Henry Le Blanc.

D. R. Bittan Company, New York City, will continue to handle distributor sales.

Rep Talk

R. W. WOODBURY, formerly a partner in Electronic Equipment Distributors, now represents Sprague Products Co., in southern California. . . . *Gordon Marshall Co.*, 40 S. Los Robles, Pasadena, Calif. (southern California); and *Ken Randall Co.*, 121 N. Broad St., Philadelphia, Pa. (Pennsylvania, Washington, Delaware and Maryland), have been appointed reps for Ward Products, Division of the Gabriel Co. . . . *Walter J. Brauer and Associates*, 15631 Lakewood Heights Blvd., Cleveland, Ohio; *Jack Brown*, 1631 Walton Ave., New York, N. Y.; *Herb Erickson Co.*, 201-09 N. Main St., Chicago, Ill.; *Cassner and Clark Co.*, 6349 N. Clark St., Chicago, Ill.; *Laub-Dale, Inc.*, 1951 University Ave., St. Paul, Minn.; *Sidney M. Levin*, Main P. O. Box 405, St. Louis, Mo.; *Jim Packard and Co.*, P. O. Box 7, Fort Smith, Arkansas; *Technical Representation*, 506 Wyndmoor Ave., Philadelphia 18, Pa.; *Emmet J. Tydings*, 1565 McFarland Rd., Pittsburgh 16, Pa.; and *Meyer and Ross*, 1355 Market St., San Francisco, Calif., are now representing Kenwood Engineering Co., Inc. . . . *Gordon C. Leroy*, 29 Bancroft Dr., Rochester, N. Y. (New York State except metropolitan New York City); and *Ellinger Sales Co.*, 6663 Northwest Highway, Chicago, Ill. (northern Illinois), have been appointed reps for the David Bogen Co., Inc. . . . *James C. Schnitter*, formerly manager of Radio Supply Co., Syracuse, N. Y., has been added to the sales staff of Land-C-Air Sales Co., and will cover upstate New York from Albany west to Buffalo. . . . *Charles B. Wirth* has been appointed engineering rep for Audio and Video Products Corp. . . . *D. G. Wilson* has formed his own rep agency at 549 West Randolph St., Chicago 6, Ill. He formerly was sales manager of D. M. Steward Manufacturing Co. in Chattanooga, Tenn. . . . *Byron H. McDonald Co.*, Los Angeles, Calif., has been named rep for Industrial Television, Inc. . . . *Gerry Moch*, formerly purchasing agent of Tele-Tone Radio Corp., has joined Wally Shulan and Co. as associate manufacturers rep. . . . *William N. Mooza*, National Sales Engineering Co., 60 E. 42nd St., New York City (metropolitan New York City); and *George Davis*, 5127 Whittier Blvd., Los Angeles, Calif. (southern California), have been appointed reps for Tricraft Products Co. . . . *L. F. Waelterman Co.* has been named rep for Permoflux Corp., in Kansas, Missouri, Iowa and Nebraska (except Sioux, Scotts Bluff, Banner and Kimball counties). . . . *Charles J. Nace*, treasurer of W. Bert Knight Co., Inc., has been elected to senior membership in the Los Angeles chapter of the Reps. Richard A. Strassner has been elevated from associate to senior, and two new associate members, *Larry Lindsey* of W. S. Harmon Co. and *Rick Stone* of Carl Stone Associates, were also elected.

L. F. Waelterman



Business Aids . . .

[In response to many requests, arrangements have been made to feature every month in SERVICE *a column devoted to a discussion of Business Aids for the Service Shop, based on queries submitted by readers of* SERVICE. *Topics to be reviewed will include advertising, bookkeeping, customer relationship, filing systems, displays, direct mail, etc. These columns are being conducted by a veteran Service Man with over a quarter of a century experience in the field, who is currently operator of a large Service Shop, and is also extremely active in association affairs. If you have a business-aid problem, send it to ye editor, and every effort will be made to publish a solution in an early edition of* SERVICE.*]*

Dear Editor:

I had been plagued by complaints from customers claiming that they were not informed and did not understand that all repairs and service work done by our shop was on a C O D basis. To void this misunderstanding and resulting ill will I set up a charge and billing system. Now I find that many are very slow in paying their bills. As my shop is a two-man business the chore of trying to collect is tieing us up. Can you advise what might be done to solve this vexing problem?—*D. J. P.*

Dear D. J. P.:

Your complaint is common. Many independent Service Men have been confronted with it for years. According to the experiences of yours truly and many Service Men queried recently, a number of practical solutions are available.

Signs should be placed in a conspicuous place in the shop where customers will see that all work is on a C O D basis; the same information should also be placed on all bills, receipts, and service work orders. On receiving service calls in person or by phone, callers should be advised that the Service Man is to be paid when work is completed. When receiving set or chassis in the shop or picking up from a home, a receipt should be left with the customer with terms clearly indicated, advising customer that when set or chassis is returned the Service Man is to be paid for work done.

It is also important to remember that customers must be contacted before making delivery to advise C O D charges. This approach can also be used when advising that work on chassis, that has been left in the shop, has been completed.

When arriving at a customer's home they should be advised that their set is being returned on C O D terms. Customer should be given an itemized bill on which should be stamped C O D.

It is also important to impress on employed Service Men that they must collect all C O D's or be held responsible for same. Calling the customer to advise him that his set will be returned at a certain date will also save many *not-at-home* calls. In the event that the customer may not be home, arrangements can be made for someone else to receive the set. The advanced call also permits the customer to provide either the exact amount of cash necessary to pay for set or a check covering the bill.

If the customer does not have a phone, it is then advisable to mail a notice of the charges and delivery date. It is also recommended that self-addressed envelopes be included for the customer to fill out and return. In case there is no phone or both man and wife are employed during the day and thus find it impossible to contact the shop during the day, the self-addressed envelope will be found very convenient.

All of these approaches have been used and have helped to reduce problems like yours. Of course, you will still have to do a certain amount of billing, especially on accounts that you've been serving for some time. It will be found profitable to extend this service to these old customers.

Sincerely,
DON KAY.

NEWS

RCA TUBE SOCKET MANUAL

A revised edition of the *Triple Pindex* socket manual with socket-connection diagrams for more than 660 receiving tubes and picture tubes, has been announced by the Commercial Engineering Division, RCA Tube Department, Harrison, N. J.

Priced at $.75, book is divided into three identical horizontal sections, each connected to a flip-over-type binding, enabling the Service Man to refer to a single composite page for simultaneous reference to any three socket diagrams.

Revised edition also contains a cross-index reference supplement which lists a variety of tube types used only occasionally. Although socket-connection diagrams for these tubes are not indicated in the *Pindex* section of the book, reference is made in each case to another tube with an identical socket arrangement, for which a diagram is included.

* * *

NEW RIDER TEK-FILE RELEASE

Packs 17 through 32, of the Tek-File series, are now available from John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y.

Packs contain manufacturers' data on 734 models.

* * *

BRACH APPOINTS SLAWSON JOBBER SALES MANAGER

William J. Slawson has been appointed distributor sales manager of Brach Manufacturing Corp., Division of General Bronze Corp., Newark, N. J. Slawson was formerly associated with John F. Rider Publisher, Inc. as sales manager.

William J. Slawson

* * *

DUMONT DISTRIBUTOR MANUAL

A 115-page manual, *Service Operations of the Du Mont Distributor,* has been published by the teleset service control department, Allen B. Du Mont Labs, Inc.

Guide consists of fourteen chapters, ranging from administrative service structure and personnel to distributor service operations in newly-opened TV areas. Included is information on distributor relations with factory, dealer, consumer and sales department. Also detailed is shop work control, equipment, service department layout and training of service personnel.

* * *

R. SAICHEK NAMED EICOR ADVERTISING MANAGER

Robert S. Saichek, formerly technical data director, has been appointed advertising and public relations director for Eicor, Inc., 1501 Congress St., Chicago, Ill.

W. J. DOYLE NOW ASTATIC V-P

William J. Doyle, former general sales manager of The Astatic Corporation, Conneaut, Ohio, has become vice president in charge of sales.

W. J. Doyle

* * *

GHIRARDI SERVICING BOOK FOLDERS

The detailed contents of each of the 38 chapters in the first two volumes of the new Ghirardi *Modern Radio and Television Servicing Library* appear in two illustrated circulars issued by Rinehart Books, Inc., 232 Madison Avenue, New York 16, N. Y.

These books, 669-page *Radio and TV Receiver Troubleshooting and Repair*, and 822-page *Radio and TV Receiver Circuitry and Operation* by Ghirardi and Johnson, provide timely practical circuitry and servicing information.

Free copies of these circulars are available from the publishers.

* * *

HEATH CATALOG

A catalog covering a line of test equipment and amplifiers has been released by the Heath Co., Benton Harbor, Michigan.

Detailed are schematics, inside views, uses, specifications and circuit descriptions of the instruments.

* * *

CRESCENT APPOINTS ROLLINS AND GIETL

William L. Rollins has been named vice president in charge of industrial sales for Crescent Industries, Inc., Chicago, Ill.

Edward M. Gietl has been named manufacturing executive, and will be in full charge of production of speakers, 3-speed intermix record changers, other record changers, wire recorders and allied products.

Edward M. Gietl

William L. Rollins

SUNDBERG TO DIRECT OXFORD SALES

Hugo Sundberg, vice president and general manager of Oxford Electric Corp., Chicago, Ill., will direct future sales policies in addition to his other executive duties. John A. Proctor, Jr., formerly general sales manager of the firm, has resigned.

* * *

EICO DIRECT-MAIL BOOKLET

A booklet on basic instrument kits, for follow-through promotion, is now available to jobbers from Electronic Instrument Co., Inc., 84 Withers St., Brooklyn 11, N. Y. Will fit either standard number 10 or 6¾ envelopes.

GRAYBURNE BULLETIN

An equipment catalog, which includes an analysis of the specific market potential for products, now available, has been issued by the Grayburne Corp., 103 Lafayette St., New York 13, N. Y.

Described are ferri-loopsticks and variloopsticks, interference filters, tube carriers and TV-if signal boosters, etc.

* * *

RICE NOW MANAGER OF DUMONT PICTURE TUBE DIVISION

Fritz P. Rice has been named manager of the picture tube division, of Allen B. DuMont Laboratories, Inc., Clifton, N. J.

MARESCA PROMOTED BY INSULINE

Joseph Maresca has been appointed assistant to Bernard L. Cahn, general sales manager of the Insuline Corporation of America, 36-02 35th Avenue, Long Island City 1, N. Y. In addition to his new duties, he will continue to act as manager of the sales order department, a post he has held for the past five years.

Joseph Maresca

* * *

MORSE NAMED EICOR TAPE RECORDER SALES MANAGER

Donald Morse has been named sales manager of the tape recorder division at Eicor, Inc., 1501 W. Congress St., Chicago 7, Ill. In his new position, Morse takes over the entire department and will be responsible for supervision of the manufacturer's reps.

Donald Morse

* * *

PERMOFLUX PRICE CHANGE

A decrease in prices on the champion line of replacement speakers, has been announced by the Permoflux Corp., Chicago, Ill.

Decreases on the individual models are said to range from 8% to 14%; the overall reduction is 11.2%.

* * *

LA POINTE PLASCOMOLD BUYS PRESS WIRELESS

LaPointe Plascomold Corp. has acquired Press Wireless Manufacturing Co., Inc., Hicksville, Long Island, and Springville Mill, Rockville, Conn., a four-story brick building with 156,000 square feet of production space.

AT RMS SALES MEETING

Sid Pariser, president RMS, and Marty Bettan, sales manager, with guest Maurice McDermott, Boston Red Sox pitcher, during their recent sales conference at Grossinger's Hotel and Country Club, in the Catskills, N. Y.

TV Parts

SNYDER INDOOR TV ANTENNA

An indoor *directronic* TV antenna system, that is said to be an all-channel antenna offering 360° orientation without the use of motors or electric power, has been announced by the Snyder Manufacturing Co., 22nd and Ontario Sts., Philadelphia 40, Pa. A selector, mounted on or near the TV set, provides remote control of element combinations.

Antenna has flexible tape elements which are said to adhere in a horizontal position to any ceiling for concealed installations.

* * *

NATIONAL TV BOOSTER

A TV booster, model *TVB-2BX*, has been announced by the National Co., Malden and Melrose, Mass.

Booster features a balanced input and output circuits, built-in power transformer (not *ac-dc*) with a selenium rectifier, turret tuner, and a pilot light to illuminate the selected channel.

* * *

TRICRAFT INDOOR ANTENNA

An indoor antenna, *Tenna-Boat* model *400*, in the form of a ceramic sailboat in three colors, dark green, crimson and golden harvest, has been introduced by Tricraft Products Co., 1535 North Ashland Ave., Chicago 22, Ill. Sails are of pastel shaded plastic.

Boom of the boat is movable thereby allowing the user to orient the antenna for best reception without moving the boat itself. Features a variable capacitor, operated with a knob in the form of a mooring peg.

VEE-D-X YAGI PHASING HARNESS

A phasing harness, *LJH*, has been designed for stacking Vee-D-X *Long Johns*. To minimize coupling effect between bays and maintain 300-ohm match, it was necessary to design this harness, which, it is said, permits assembly of a double-stacked 8-element yagi and produces 50% more gain than a single unit.

* * *

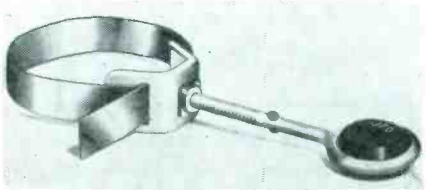
DAVIS FRINGE ANTENNA

A TV antenna, *Super-Vision*, has been announced by Davis Electronics, 3047 West Olympic Blvd., Los Angeles 6, Calif. Antenna designed for fringe areas is said to reduce or eliminate ghosts and, provide 10 db or more gain on high channels.

JFD STANDOFF

A strap-type screw-eye standoff with six machined threads has been introduced by the JFD Manufacturing Co., Inc.

Standoff features an arch-bridge construction for the buckle area that is said to prevent any bending of the clamp. Fits masts up to 2½" *od*.

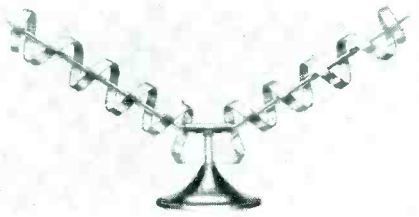


CLEARBEAM LEADIN AND ANTENNA

Air-spaced TV twin leadin, *Spaceline*, which is said to eliminate 50 per cent of the signal loss, and an indoor TV antenna, *Inductenna*, that works on the inductance principle, have been announced by Clearbeam TV and Accessories, 100 Prospect Ave., Burbank, Calif.

Leadin is made of 20-gauge copper-wire and 55-mil polyethelyne, and is available in 1000' spools.

Antenna features copper-colored spirals with a walnut base.



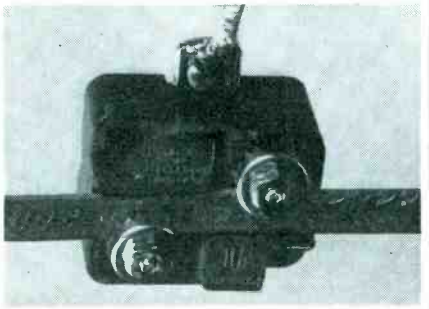
Clearbeam Inductenna.

* * *

INSULINE TV LIGHTNING ARRESTER

A molded phenolic TV lightning arrester (U.L. Approved), has been announced by the Insuline Corporation of America, Long Island City 1, N. Y. Contact to the latter's wires is made by means of cup-shaped washers with serrated teeth.

The new arrester is made in two styles: *6113*, which has a binding post for a ground wire, and *6114*, which has a grounding strap that fits around the usual metal pipe of the TV antenna.



* * *

TODD-TRAN ANTI-CORONA COMPONENTS

Anti-corona deflection components, which include a sealed-in-plastic flyback transformer, and a sealed-in-plastic deflection yoke, have been developed by Todd-Tran Corp., 156 Gramatan Ave., Mt. Vernon, N. Y. This type of construction is said to minimize corona radiation and breakdown due to dust and grease particles attracted to or precipitated by deflection components. A universal mounting bracket is used for the flyback transformer so it can be mounted either vertically or horizontally.

TV9

TACOPLEX CHANNEL SEPARATOR

A two or three channel separator, *1512-1513,* for use with master antenna distribution systems in community installations, is now available from Technical Appliance Corp., Sherburne, N. Y.

Unit separates the TV channel signals traveling along a common transmission line and feeds the separated signals through individual outputs to their respective amplifier strips; employed in a community system at all booster stations. Basic principle of the unit is to provide proper termination of the transmission line and to select the proper channel without amplification of adjacent channels.

Separators are housed in a compartmented metal housing that shields each individual channel filter. Each channel section is a pi-section type bandpass filter. Circuitry is said to have sharp cutoffs on both sides of the specified 6-mc bandwidth. Units are available for any combination of two or three low-band channels, not including adjacent channels, except 4 and 5.

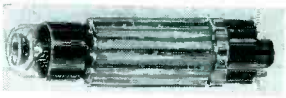
* * *

RMS TV TESTER TUEE

A test instrument, *Pix-Eye,* which is said to permit on-the-spot checks of picture tubes and of receiver circuits, has been announced by Radio Merchandise Sales, Inc., 1165 Southern Blvd., New York 59, N. Y.

Instrument, it is claimed, will check picture tube for shorts, intermittents and opens, and permit spot check of brightness control, contrast control, low voltage and filament voltage circuits, without removing the picture tube or chassis.

Tube is plugged into the picture-tube socket of the receiver and various indications in the eye tube serve to guide the Service Man.

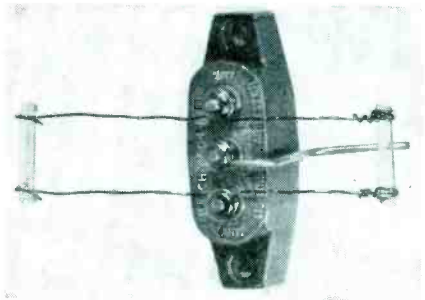


* * *

BRACH OPEN-WIRE LINE ARRESTER

A lightning arrester, *4004,* for open-wire transmission lines, has been introduced by the Brach Manufacturing Co., Newark, N. J.

Arrester uses a rare-gas tube in which the charges are carried to electrodes sealed into this tube where they are instantaneously dissipated before they can enter and destroy TV receiver equipment.



KENWAY ANTENNAS-ACCESSORIES

Four TV antenna products are now available from Ken-Way Products Inc., Owensboro, Kentucky: a 5-element high-channel yagi and a low-channel yagi, a low-priced booster and 300-ohm leadin.

Yagis are said to provide a 9-db gain. Booster, model *6J1,* is claimed to have a balanced input and output for 72-300 ohms and a balanced amplifier that features a push-pull neutralized *6J6* triode.

* * *

JFD INDOOR ANTENNA

An indoor antenna, *TA137,* which has two 3-section telescoping dipoles of aluminum, has been introduced by the JFD Manufacturing Co., Inc., 6101 16th Ave., Brooklyn 4, N. Y.

Antenna is said to be tip-proof.

CHANNEL MASTER TWO-CHANNEL YAGI

A two-channel yagi antenna, model *645,* featuring a Z-match system, is now available from Channel Master Corp., Napanoch Road, Ellenville, N. Y.

Covering both channels 4 and 5, this antenna provides match to 300-ohm line, in both single and stacked arrays. A single bay is said to give over 8 db measured gain on each channel, and four stacked models a gain of over 14 db on each channel. In stacking, the center bar is removed from the larger folded dipole of each antenna, and center bars are then used as stacking bars. This action is claimed to reduce the impedance of each 300 ohm antenna, so that a 300-ohm match for the entire stacked array is obtained.

AGC Systems

(*Continued from page 44*)

with about 75 microvolts signal strength.

The Keyed AGC Amplifier

In the keyed *agc* system, the 6AU6 functions to adjust automatically the sensitivity of the receiver in accord with the strength of the received signal. Fig. 3 (p. 44) illustrates how the system basically designed to have a high immunity to noise, operates.

The horizontal output system of this receiver uses a high impedance deflection coil connected directly to the plate of the horizontal output tube without the need of a transformer. The *dc* plate current of the horizontal output tube is supplied through a choke T_{18}. During the retrace period, which is approximately 6 per cent of the scan time of one line, a high-amplitude pulse is developed, due to the collapse of the field in the horizontal deflection coils. This pulse appears across the choke and is applied to the plate of the *agc* control tube by the second winding on this choke. The resulting pulse, applied to the plate of this tube, is its only source of plate voltage and the polarity of connections to the choke are such that when current flows in the plate circuit it will develop a negative voltage across the 100,000-ohm resistor, R_{49}. The plate current of the *agc* amplifier consists of *dc* pulses at line frequency rate and these pulses must be filtered into a steady *dc* voltage before the voltage is applied to the controlled tubes. A 330,000-ohm resistor, R_{51}, and a pair of .1-mfd capacitors, C_{39} and C_{40}, serve to provide this filtering.

The magnitude of the *agc* control voltage is made dependent upon the strength of the received signal by connecting the grid of the *agc* amplifier tube to the plate of the first video amplifier tube. Direct connection is permitted, and normal operating conditions for the tube are obtained by the circuit design of the *dc* power distribution system.

Since pulse plate voltage appears at the plate of the *agc* amplifier only during retrace time and this interval coincides with the time of the sync pulses. the video signal influence on *agc* voltage is only during the sync interval.

From the foregoing it becomes evident that this system of *agc* inherently possesses a high degree of noise immunity, since the circuit is quiescent during line scan period and becomes active only during the retrace or synchronizing interval. This also accomplishes the desired condition of obtaining *agc* voltage that is proportional to the amplitude of the synchronizing pulses only.

An adjustable 1,000-ohm resistor, R_{57}, is provided in the cathode circuit of the *agc* amplifier tube to adjust the operating bias of this tube. Under average conditions the optimum value of this bias is one volt and the control is so adjusted on the receiver before leaving the factory. If the receiver is operated in an area of extremely strong or weak signals, it may be found advantageous to alter this adjustment. If overload from a strong signal is evident the control may be changed to reduce the bias on the 6AU6 and thereby obtain more *agc* voltage. In weak signal areas, the overall receiver sensitivity can be increased by increasing the bias on the tube and thereby delaying and reducing the *agc* voltage.

Operation

In Fig. 4 (p. 44) appears another *agc* circuit in simplified form. For clarity the 12AX7 is represented as two triodes, V_{32A} and V_{32B}. The circuit has two signal inputs: a constant amplitude, positive, horizontal sync pulse from the sync separator tube, and the composite video signal, with negative sync pulses, from the second video amplifier. The pulse from the sync separator tube is fed to the grids of the two triode sections of the 12AX7 and acts as a keying pulse to allow the triodes to conduct only during the horizontal sync pulse time; this means that the *agc* circuit makes a bias correction only at peak carrier amplitude and is independent of picture content. The composite video signal is applied to the plate of V_{32B} and to the cathode of V_{32A}, and the amplitude of the sync pulse of this signal determines the *dc* bias developed in the circuit.

The positive keying pulse is applied to the grid of tube *A* through the differentiator circuit consisting of capacitor C_{37} (100 mmfd) and resistor R_{43} (1 megohm), which filters out the vertical sync component. The peak-to-peak amplitude of this pulse is about 7 volts under normal conditions. At the same time, in a given case, the composite video signal, with negative sync pulses, applied to the cathode of tube *A* may have a peak-to-peak amplitude of about 9 volts. The grid-cathode bias developed would be about 8 volts, cutting off tube *A*. During the sync-pulse interval the grid is driven positive by the keying pulse from the sync separator tube, and the cathode is driven negative by the sync pulse in the composite signal.

[To Be Continued]

FM Servicing

(*Continued from page 32*)

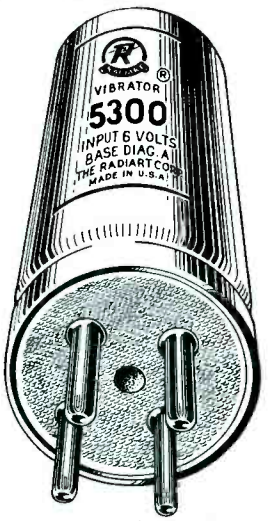
may appear due to trouble in the detector stage. Usually it will be one or a combination of the following: No output, distorted output, weak output, high-frequency hiss, noise or static. It is true that some of these symptoms may be caused by trouble in other stages, and it is important that the trouble is localized to the detector stage before looking for trouble in that stage. Trouble in the mixer, *if* or *af* stages should be found easily by the usual methods of troubleshooting. If the set incorporates facilities for a phono input, the audio stages can be checked quickly by connecting the output from a pickup to the phono terminals and listening to the output. If there is no distortion and sufficient volume, the trouble must be before the audio stages. Switch trouble must also be considered. To check the stages before the discriminator, a signal should be applied at the *if* to the mixer grid and the voltage, across the discriminator grid-leak resistor, measured at point *G*. If there is a negative voltage developed when the signal is applied, the *if* stages are operating.

Tools . . . Instruments Parts . . .

RADIART AUTO-RADIO VIBRATORS

Replacement auto-radio vibrators, that feature an automatic vent incorporated in the base, has been introduced by the Radiart Corp., Cleveland, Ohio.

Vent is wax sealed, which is said to prevent oxidation of the points prior to being put in use. When the vibrator is put into use, the temperature rise inside the vibrator melts out the wax and permits air circulation.



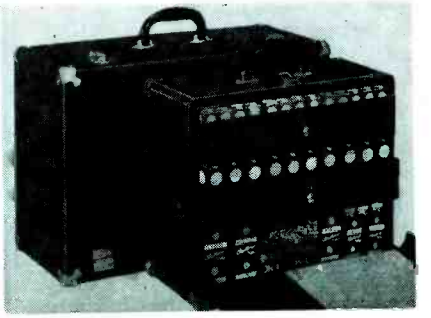
* * *

ARGOS JUNIOR TUBE CADDY

A smaller-size, leatherette-wood cabinet, *Tube Caddy Junior TC-2,* designed to carry up to 143 receiving tubes, has been announced by Argos Products Co., Genoa, Ill.

Model has two drawers at top for miniature and medium size tubes, plus space at the bottom for larger tubes. Partitions in drawers are removable. Small tools or a meter can also be carried. Cover is fitted with slip-out hinges. There are clips inside the cover to hold a mirror for use in picture tube adjustment or a price list.

Measures 15½" long, 13" high, and 8" wide. Carrying weight is 8 pounds, 2 ounces.



RCA MASTER VOLTOHMYST

A voltmeter, *WV-87A Master Volt-Ohmyst,* that includes facilities for the direct measurement, on separate scales, of peak-to-peak voltage values of complex waveforms and the rms voltage values of sine waves, has been introduced by the RCA Tube Dept., Harrison, N. J. Also reads *dc* voltage, resistance, and direct current.

Furnished with the instrument is a set of multi-purpose probes and cables for use in making measurements in all types of electrical equipment. Included are a direct probe and cable, a *dc* probe, an ohms probe and cable, a negative current cable, a positive current cable, and a ground cable.

Measures *dc* currents from 10 *ma* to 15 amps in seven continuous ranges. Instrument will also measure *dc* voltages in high-impedance circuits with *rf* present, *dc*-current input to automobile radios and other equipment operating from *dc* sources, and resistances of low-power devices, such as the filaments of miniature vacuum tubes. Meter is electronically protected against burn-out on all *ac* and *dc* voltage and resistance ranges.

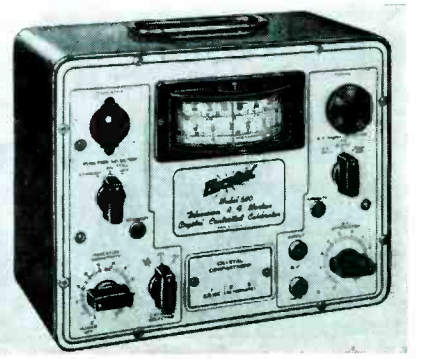
In *ac*-voltage measurements, instrument will read directly the peak-to-peak values of unsymmetrical complex waves from 0.2 volt to 2,000 volts, peak-to-peak values of symmetrical complex waves from 0.2 volt to 4,200 volts, and *rms* values of sine waves from 0.1 volt to 1,500 volts. *DC* voltages from 0.02 volt to 1,500 volts and resistance values from 0.2 ohm to 1,000 megohms may also be read directly.

* * *

HICKOK TV RF MARKER AND CALIBRATOR

A TV *rf* marker and crystal-controlled calibrator, model *680,* that is said to be accurate to .05 per cent, has been announced by the Hickok Electrical Instrument Co., 10521 Dupont Ave., Cleveland 8, Ohio.

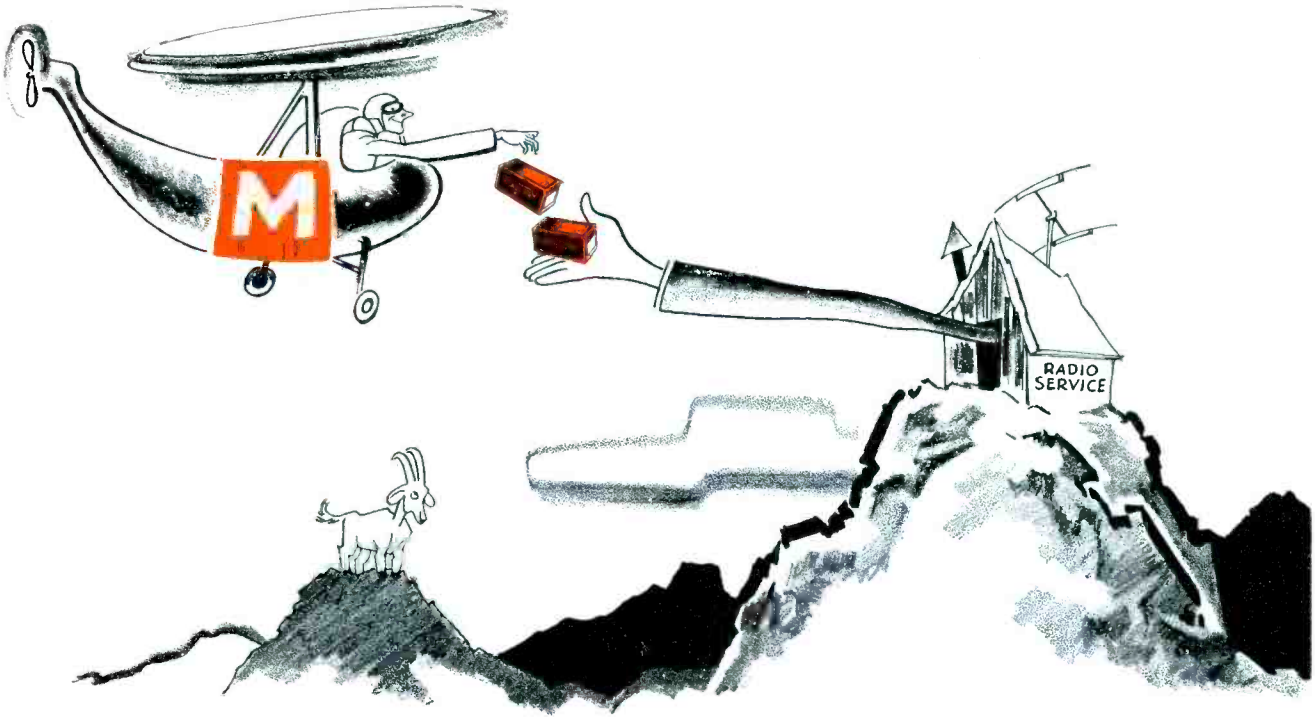
Instrument features an *rf* signal generator calibrated to cover the ranges from 53-89 mc and 174-217 mc on fundamentals, and to 868 mc on harmonics; a crystal-calibrated marker generator from 53-89 mc and 174-217 mc, in two bands; a crystal oscillator from 500 kc to 20 mc on fundamentals; a 2.5-mc crystal; a heterodyne frequency meter for calibrating other generators up to 900 mc; usable harmonics output on *vhf* and *uhf* bands; sound and picture frequencies for all 12 TV channels; variable frequency oscillator providing 31 crystal check points; tuning drive ratio of 11-1; and a built-in magic eye to provide a zero-beat indicator.



JOTS AND FLASHES

SERVICEABILITY has been cited as a major TV set feature by several manufacturers in their new-chassis announcements. An interesting illustration of this new trend appeared in a news note from *DuMont*, which declared that their new models features a simplified open layout, selected test points which are outside the chassis and can be used for preliminary trouble-shooting without removal of the chassis from the cabinet, a removable front safety glass to simplify cleaning or the removal of the picture tube, and an *afc* look point permitting alignment of the horizontal oscilator without removal of the chassis. . . . In an announcement from *Emerson*, a simplified scheme for picture-tube cleaning was also emphasized. It was pointed out that this facility, known as a *snap-on removable bezel* and *safety-glass device*, will permit the removal of the front plate without the aid of tools. . . . There are 861,653 TV sets in the Boston coverage area, according to *WBZ-TV* and *WNAC-TV*. . . . Metal-shell TV picture tubes, *RCA* reported recently, account for nearly 30 per cent of the total picture-tube sales. . . . The '52 *Audio Fair in Chicago* will be held at the Conrad Hilton Hotel, May 23-24. . . . The sixth in the series of *Most-Often-Needed 52 TV Servicing Information* manuals has been issued by Supreme Publications, 3727 W. 13th St., Chicago 23, Ill. . . . Thirty-four persons from seventeen firms of sales reps of *Howard W. Sams* and Co., Inc., attended a two-day sales conference recently, at which company sales plans, promotions and policies for the Photofact publications were discussed. They were greeted by *Mayor Alex Clark* of Indianapolis, at a luncheon at the Indianapolis Athletic Club, where the reps were quartered. *Jack Keith*, vice president in charge of sales, presided at the general meetings. Speakers included *Howard W. Sams*, president; *Donald B. Shaw*, vice president-treasurer; *William D. Renner*, manager sales engineering department, and *Joe O. Goetz*, assistant sales manager. . . . *Louis B. Calamaras*, executive vice president of NEDA, has been appointed a member of a special Wholesale Trade Advisory committee. . . . A corrugated fibreboard carton for mailing and remailing individual reels of sound recording tape is now available from Minnesota Mining and Manufacturing Co. . . . *Roland J. Kalb*, vice president of Steelman Phonograph and Radio Co., has been re-elected president of Phonograph Manufacturers Association. Membership also reelected *Ben Birns*, president of Sonic Industries, as vice president, and *Joseph Dworken*, president of Dynavox Corp., as vice president and secretary-treasurer.

ADVERTISERS IN SERVICE—MARCH, 1952



TOPS with Servicemen Everywhere . . .

MALLORY VIBRATORS

That's right! In a recent survey, more servicemen preferred Mallory vibrators than all other brands combined. And manufacturers use more Mallory vibrators as original equipment than all other brands combined. Here are the reasons . . .

1— Slow contact impact for minimum wear

2— High contact pressure for low resistance

3— Fast contact break for reduced arcing, pitting

You get that vibrator combination *only* from Mallory—thanks to a patented, tuned mechanism. That's why Mallory vibrators give you and your customers long, trouble-free service. When you order vibrators, always . . .

Make Sure! Make it Mallory!

With Just ONE of Mallory's Special Vibrator Deals You Can Service 47 Different Makes of Radios

Think what that means from the standpoint of fast service for your customers . . . and smaller inventory for you—6 Mallory vibrators are all it takes to fix 47 radio makes. When you purchase one of these Mallory vibrator deals at *your regular discount price*, you get a handy parts cabinet at no additional cost. See your distributor today.

P. R. MALLORY & CO. Inc.

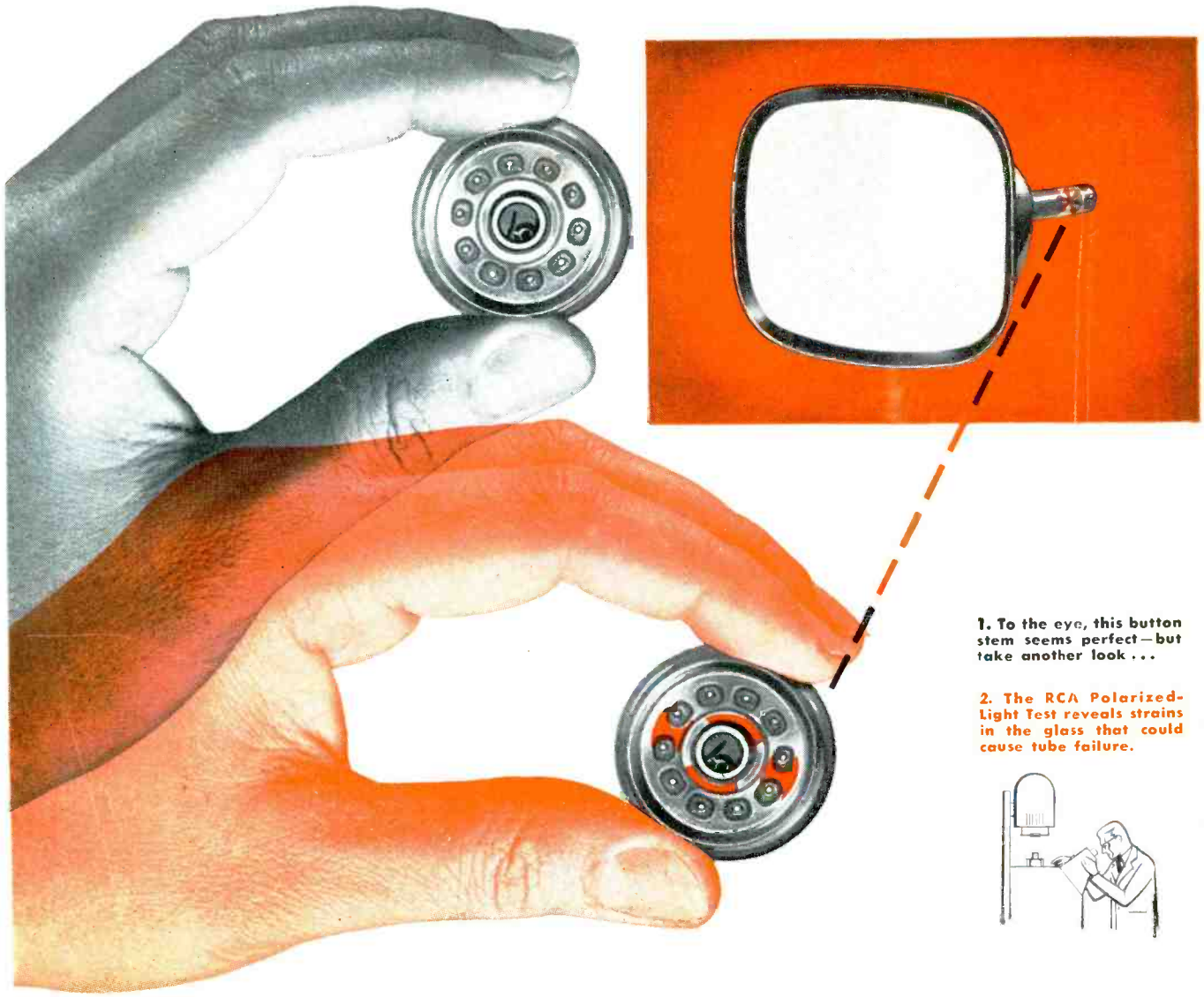
MALLORY

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

*Reg. U.S. Pat. Off.

APPROVED PRECISION PRODUCTS

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



1. To the eye, this button stem seems perfect—but take another look . . .

2. The RCA Polarized-Light Test reveals strains in the glass that could cause tube failure.

A DOUBLE-TAKE

to safeguard your reputation

AT FREQUENT INTERVALS throughout the day, RCA production inspectors pick finished button stems hot off the griddles of the sealing machines, and subject them to an ingenious "polarized-light test." Reason? Even slight variations in sealing temperature can, and do, set up strains in the areas of glass-to-glass and glass-to-metal seals that could result in fractures. The Polarimeter . . . especially designed for RCA . . . reveals these otherwise invisible strains, and prevents imperfect assemblies from reaching the final production line.

By taking a second look, RCA virtually licks a possible fracture before it occurs . . . not only on button stems, but also neck-to-flare seals and the faceplate section adjacent to the rim seal of metal-shell picture tubes.

This constant vigilance and *quality control* at *all* stages of manufacture assure that RCA standards will be met on the final assembly line. In this way, RCA closely guards its own reputation for quality . . . *and yours as well.*

In RCA picture tubes, the difference is *top-quality control*. That's why, dollar for dollar, RCA picture tubes have no equal.

With RCA Receiving Tubes, as well as RCA Kinescopes, TOP-QUALITY CONTROL makes the difference.

RADIO CORPORATION of AMERICA

ELECTRON TUBES

HARRISON, N. J.