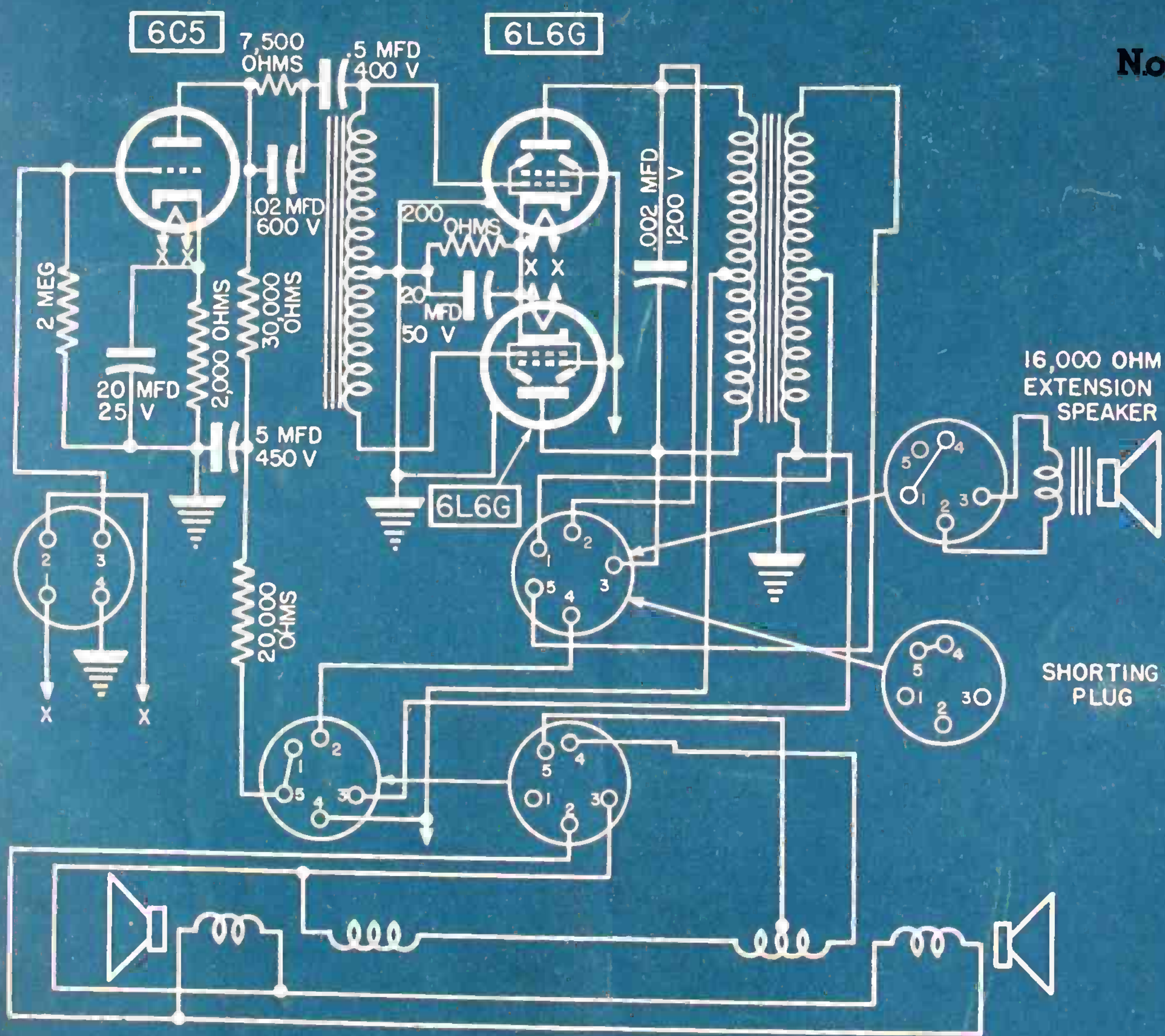
RADIO · TELEVISION · ELECTRONIC

# SERVICE

November 1945

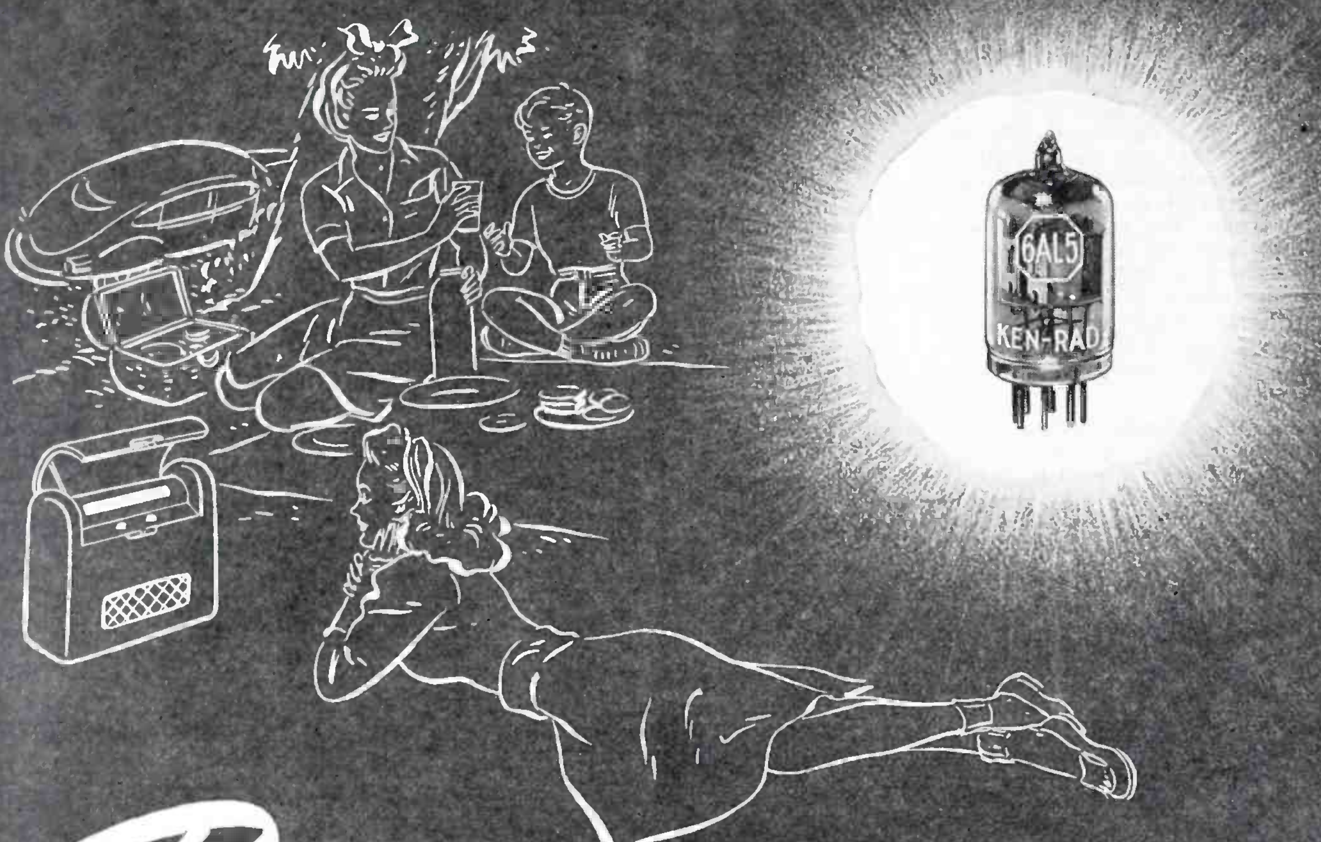



**High-fidelity 25-watt amplifier featuring bass-reducing control and provision for dual speaker operation.** **(See pages 46 and 47.)**

A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE

# KEN-RAD

## Little Giant MINIATURE TUBES




# *Better than ever*

● Power-packed Ken-Rad Miniature Tubes have helped to popularize the friendly companionship of portable radios . . . Now still finer tube performance is assured by Ken-Rad's association with new, large research and engineering facilities . . . The ever-growing consumer demand for Ken-Rad *quality* means increased *profits* for Ken-Rad Tube Dealers!

*Write for your copy of "Essential Characteristics" the most complete digest of tube information available.*

**KEN-RAD**

DIVISION OF GENERAL ELECTRIC COMPANY
OWENSBORO, KENTUCKY

179-313-8850

# EDITORIAL

THE intensive postwar expansion plans of the aircraft industry, indicating a production of around 50,000 planes for civilian travel, projects many unusual opportunities for the Service Man. For this large program will require wide-scale installation, servicing, and maintenance facilities for the planes' receivers and transmitters . . . a program that will tax the present facilities.

Servicing of this equipment will, of course, demand not only a specialized knowledge of aircraft units, but the acquiring of either of two licenses; a first-class commercial license for transmitter tests and a CAA license to permit testing of equipment, as well as installation, or any necessary plane alteration to accommodate equipment changes. While these license examinations will require schooling and hours of study, the results should prove quite profitable.

The hundreds of airports scheduled for construction will demand one or more shops on the field for radio equipment servicing. Such servicing will call for quite a profitable rate structure, commensurate with the specialized training needed for the aircraft activities. In most instances, it will be possible to arrange for a weekly maintenance and service fee, since some equipment will require checkups quite often.

Components, accessories and battery sales will also be a profitable feature of aircraft service shops. Battery sales alone will be substantial, since all planes will use battery-operated units, dry and wet. The wet-cell batteries will require charging, another medium of income.

The CAA has published a list of current airports and will soon publish a list of those airports to be constructed. You can secure such listings from the CAA department of information.

Aircraft radio servicing offers many advantages. Study its possibilities in your community now.

THE postwar f-m receivers covering the new bands are scheduled to feature an unusual tuning-dial numbering system. The first frequency (88.1 mc) will be designated as 201. The second assignment (88.3 mc) will be known as 202. This will continue up to 300. It had been planned to begin with *1* for the first channel, but the FCC said that the bands may be extended up or below the new assignments and thus provision should be made for such extensions.

This is a standard that will undoubtedly be adopted by all manufacturers to simplify f-m tuning. A wise move!


# SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reg. U. S. Patent Office

Vol. 14, No. 11 November, 194

LEWIS WINNER
Editor

ALFRED A. GHIRARDI
Advisory Editor

F. WALEN
Managing Edito


Pag


Crystal-Controlled Oscillators. By J. George Stewart .......... 1

Crystal Filters Used in Communications Receivers. By Thomas T. Donald .......... 22

C-R Oscillographs (Applications . . . Servicing . . . Part V). By S. J. Murcek .......... 34

Electronic Alarm Systems. By Willard Moody .......... 24

I-F Amplifiers. By L. E. Edwards .......... 18

Old Timer's Corner .......... 54

Ser-Cuits. By Henry Howard .......... 41

Servicing Helps. (Recentering Loudspeaker Cones). By Frank C. Keene .......... 16

Superheterodyne Mixers (Part II). By Martin W. Elliott .......... 32

Volume and Tone Control Resistors (Part IX of a Series on Receiver Components). By Alfred A. Ghirardi .......... 26

**Circuits**

Air King 4034 (I-F Amplifier) .......... 20
Allied D-366 (I-F Amplifier) .......... 18
Detrola 571 (Postwar Model) .......... 41
Detrola 568 (Postwar Model) .......... 44
Garod High Fidelity Receiver .......... 44
G.E. L-243 (I-F Amplifier) .......... 20
G.E. 60 (I-F Amplifier) .......... 48
Hallicrafters SX 18 (Crystal Filter) .......... 23
Hallicrafters SX 28 (Crystal Filter) .......... 23
Hammarlund Super-Pro (Crystal Filter) .......... 50
Lafayette C-37 (Mixer) .......... 32
Magnavox A-3001C (Cover) .......... 46
Meck Industries RC-5C5 (Postwar Model) .......... 41
National NC 100 XAB (Crystal Filter) .......... 22
RME 41-43 (Crystal Filter) .......... 50
Spiegel 1-40 (I-F Amplifier) .......... 18
Ward O4WG-2672 (I-F Amplifier) .......... 20
Ward 62-262 (Mixer) .......... 32
Ward 62-319 (I-F Amplifier) .......... 48
Wells-Gardner A-7 (I-F Amplifier) .......... 48
Westinghouse WR 678 (I-F Amplifier) .......... 18
Westinghouse M 104 (I-F Amplifier) .......... 48

**Cover**

High Fidelity Amplifier (Magnavox A-3001 C) .......... 46

**Servicing Helps**

Recentering Loudspeaker Cones .......... 16

**Index to Advertisers** .......... 64

**Manufacturers**

News .......... 56
New Products .......... 61
Jots and Flashes .......... 64





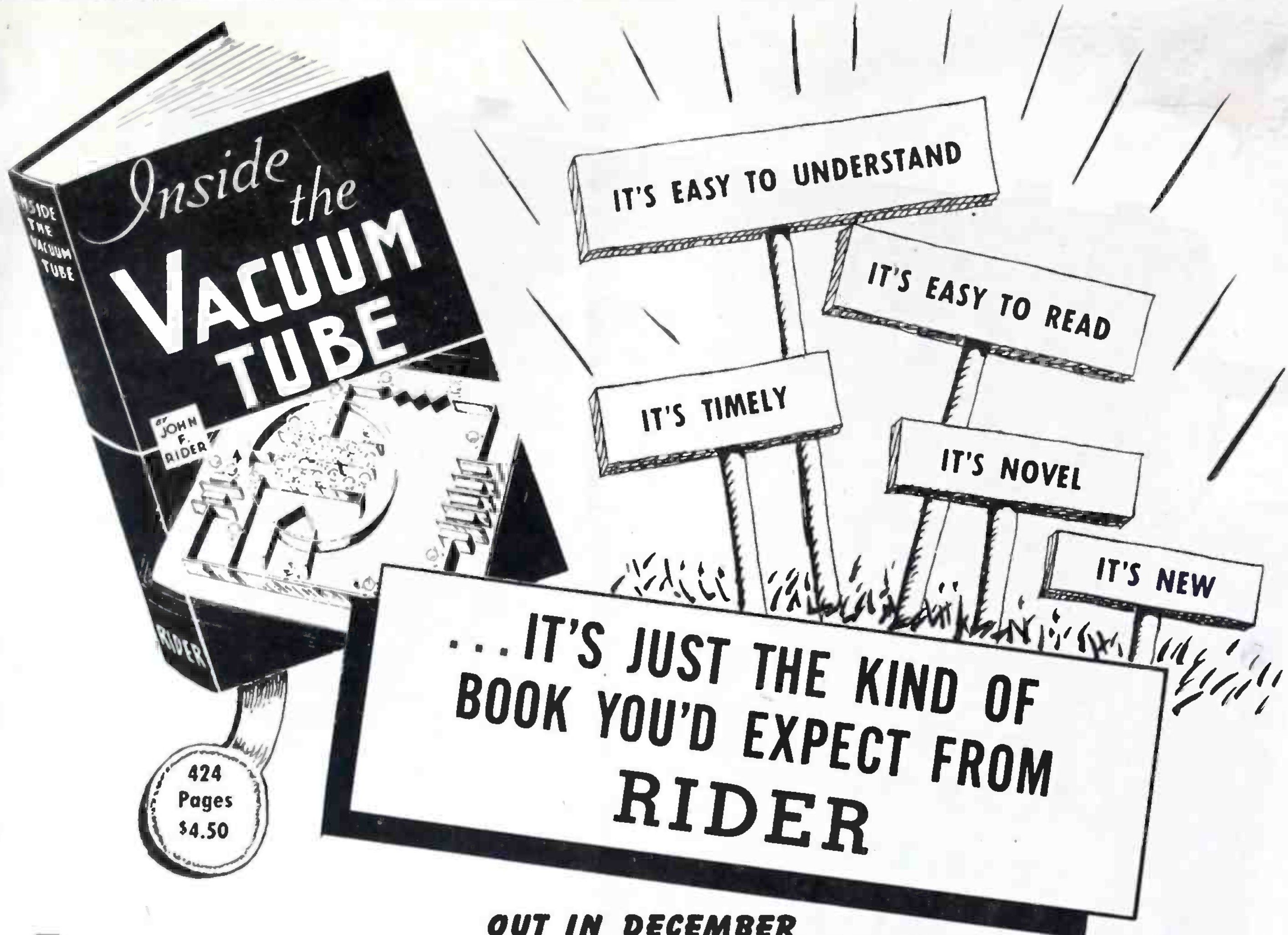
**Published monthly by Bryan Davis Publishing Co., Inc.**
**52 Vanderbilt Avenue, New York 17, N. Y. Telephone MUrray Hill 4-0170**

**Bryan S. Davis, President**
**Paul S Weil, Vice Pres.-Gen. Mgr.**

**A. Goebel, Circulation Manager**
**F. Walen, Secretary**

**James C. Munn, 10515 Wilbur Avenue, Cleveland 6, Ohio: Telephone SWeetbriar 0052**
**Pacific Coast Representative: Brand & Brand, 1052 W. Sixth St., Los Angeles 14, Calif.; Telephone Michigan 1732**

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.




## OUT IN DECEMBER

This is not just another book on the vacuum tube, but a typical Rider Book, offering a new approach to the subject—presented with a technique that makes its message clear and easy to understand. Here is a solid, elementary concept of the theory and operation of the basic types of vacuum tubes upon which can be built more advanced knowledge.

After explaining the electron theory, the text presents a discussion on electrostatic fields, on the theory that the reader's understanding of the distribution and behavior of the fields within a tube will give him a better picture of why amplification is accomplished within a tube and how the grids and plates are interrelated.

To give a clear physical picture of its subject, the book employs novel physical devices. For example, certain diagrams and graphs are repeated, to reduce to a minimum the bother of turning pages back and forth to read text and drawings. Another innovation is the use of anaglyphs, "three-dimensional" pictures of phenomena heretofore seen only in two dimensions. Viewed through glasses supplied with the book, they are invaluable aids toward the rapid understanding of the text.

Although this is an elementary book on a fundamental subject, therefore a goldmine for the student; developments in radio and the new fields of television and microwaves make it a must for the libraries of servicemen, amateurs and engineers. Place your order today.

## OTHER RIDER BOOKS

**RIDER MANUALS (14 VOLUMES)**

Volumes XIV to VII . . $12.50 each volume
Volumes VI to III . . . 9.50 each volume
Abridged Manuals I to V (1 volume) . . . . . . . . . . . $15.00
Automatic Record Changers and Recorders . . . . . . . . . 7.50
The Cathode Ray Tube at Work — Accepted authority on subject . . . 4.00

Frequency Modulation — Gives principles of FM radio . . . $2.00
Servicing by Signal Tracing — Basic Method of radio servicing . . 4.00
The Meter at Work — An elementary text on meters . . . 2.00
The Oscillator at Work — How to use, test and repair . . . . 2.50
Vacuum Tube Voltmeters — Both theory and practice . . . . . 2.50

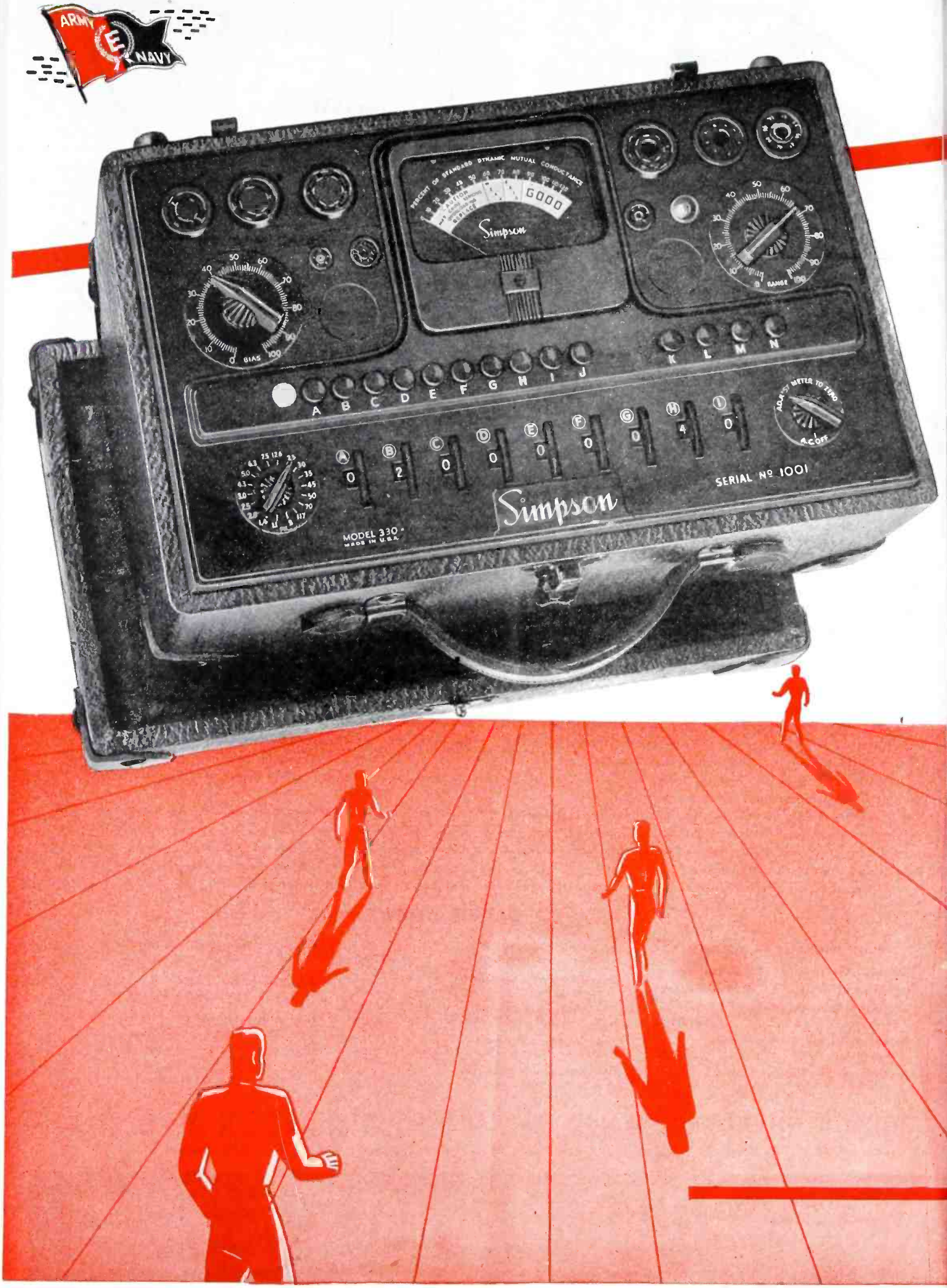
Automatic Frequency Control Systems — also automatic tuning systems . . $1.75
A-C Calculation Charts. Two to five times as fast as slide rule . 7.50
Hour-A-Day-with-Rider Series—
On "Alternating Currents in Radio Receivers"
On "Resonance & Alignment"
On "Automatic Volume Control"
On "D-C Voltage Distribution" . 1.25 each

**JOHN F. RIDER PUBLISHER, INC. 404 FOURTH AVE., N. Y. 16, N. Y.**

Export Division: Rocke-International Electric Corp. 13 E. 40th Street, New York Cable: ARLAB

**—and Don't Forget RIDER MANUALS are Now Complete in 14 Volumes**

They Provide Schematics and Essential Servicing Data on American Made Radio Receivers.


ARMY
E
NAVY
PERCENT OF STANDARD DYNAMIC MUTUAL CONDUCTANCE
GOOD
Simpson
BIAS
RANGE
A B C D E F G H I J
K L M N
ADJUST METER TO ZERO
A.C. OFF
SERIAL No 1001
Simpson
MODEL 330
MADE IN U.S.A.

# With this instrument a new era in tube testing begins

## ... Remember ...

As you read below the many other features of this pioneering instrument, remember this: It is a Simpson instrument, with all that implies in creative engineering research, in controlled testing and manufacture. Simpson products are not "assembled", they are engineered and built in the Simpson plant. Practically every component part, from the dial and movement to the beautifully designed panels and the bakelite cases and panels, is made by Simpson. It is this that makes Simpson's the "instruments that *stay* accurate" with ideas that *stay* ahead.

**SIMPSON MODEL 330 MUTUAL CONDUCTANCE TUBE TESTER**

1. Size—15½" x 9½" x 6½".
2. Case—Sturdy plywood construction, with heavy fabricoid covering, corners trimmed in leather, rustproof hardware—removable cover with slip type hinges.
3. Panel—Heavy molded bakelite, beautiful satin grained finish. All characters, numerals, and dial divisions are engraved and filled in white, insuring long wearing qualities.
4. Meter—4½" rectangular of modern design with artistic four-colored dial indicating good, fair, doubtful, and bad—also "Percentage of Mutual Conductance" scale.
5. Sockets provided for all types of tubes with two spare socket positions.
6. Neon glow tube incorporated to indicate shorted tubes.
7. New simplified revolutionary switching arrangement (see description above).
8. The tube chart provided is arranged for quickly identifying the tube and setting the controls.
9. Tests tubes with voltage applied automatically over the entire operating range and under conditions approximating actual operation in a radio set.

***Ask Your Jobber***

## The New Simpson Mutual Conductance Tube Tester Brings To Radio Servicemen and Dealers An Entirely New Method of Testing Tubes And A Revolutionary New Switching Arrangement!

Tube manufacturers consider that a radio tube has reached the end of its usable life when it falls to 70% of its rated value. Until now there has never been an instrument to test tubes in percentage terms.

But now here *is* such an instrument. The new Simpson Model 330 tests tubes in terms of percentage of rated dynamic mutual conductance—a comparison of the tube under test against the standard rated micromho value of that tube. The colored zones on the dial coincide with the micromho rating or the percent of mutual conductance, indicating that the tube is good, fair, doubtful or definitely bad. Thus, at a glance, you can check the tube against manufacturers' ratings. If, for any reason, it becomes desirable to know the actual value in micromhos, the percentage reading may be easily converted.

This is the way tubes should be tested—the way testers always should have worked—but Simpson is first again in bringing this needed development. It tests tubes with voltage applied automatically over the entire operating range, reproducing more completely than ever before the actual conditions under which a tube functions in a radio set. No instrument, not even delicately adjusted laboratory devices, can do this 100%. But this new Simpson Mutual Conductance Tester approaches perfection as never before.

Besides this revolutionary new method, Simpson offers you an equally revolutionary switching arrangement. The circuit is so arranged that, even though there are numerous combinations possible, very few switches require moving to test any one tube. Many of the popular tubes are tested in the "normal" position without moving any of the nine tube circuit switches.

Ten push button switches and nine rotating switches of six positions each provide infinite combinations in tube element and circuit selection. Only a few settings are necessary for the most complicated tube. The tube chart provided is arranged for quickly identifying the tube and setting the controls.

When you have finished a tube test, the Automatic Reset takes over to speed and simplify the next test. Just press the reset button and instantly all switches, both push button and rotary, return to normal automatically!

Here is the test instrument you have had a right to expect from Simpson. With greater flexibility in its circuit and switching arrangement than any other tester can provide, it gives maximum provision against obsolescence. It's the tester of a new era.

SIMPSON ELECTRIC COMPANY
5216 W. KINZIE ST., CHICAGO 44, ILLINOIS

**Simpson**

INSTRUMENTS THAT STAY ACCURATE

# SPRAGUE TRADING POST

## A FREE Buy-Exchange-Sell Service for Radio Men


## THE IDEAL REPLACEMENTS FOR ALL DRY ELECTROLYTIC CAPACITOR TYPI

**FOR SALE**—Philco 32 v. receiver and 800 Delco 32 v. plant, with or without fairly good batteries. Ted Hamilton, What Cheer, Iowa.

**SELL OR TRADE**—500 tubes. Want 0-500v d-c panel meter and other individual range types. Walter F. Kapinos, 304 Front St., Chicopee, Mass.

**WANTED**—Complete recording set. M. Taonouchi, 6713 A. Siskya Ave., Newell, Calif.

**SELL OR TRADE**—Hammarlund variable condensers and several sets of plug-in coils for Comet Pro. What have you? D. Pommiss, 401 Schenectady Ave., Brooklyn, N. Y.

**WANTED**—Recorder for amplifier. Describe fully. Oliver Berliner, 1007 N. Roxbury Drive, Beverly Hills, Calif.

**FOR SALE**—Four 4' morning glory horns; 4' flat horn for car; 4 Fox driver units with 1000 ohm fields; 1 Fox driver unit with 6 volt field; 4 Rola G-12 6 volt heavy duty field speakers; $150 for lot. Also 6 volt 20-watt amplifier and 30-watt electric, $50 ea.; G-E portable recorder and record player; Federal symphonic 16 complete and large supply recording disc. Loren Beatty, 2408 Queen Ave., Middletown, Ohio.

**WILL TRADE**—Triplett portable lab model 1181; multimeter and signal generator. Want 12" P.M. speakers or a condenser analyzer. A. T. Zintner, 3152 Agate St., Phila., 34, Pa.

**SELL OR TRADE**—SW-3 with coils and power pack. Want camera or record player. Walt Woestman, 2310 Midlothian Drive, Altadena, Calif.

**WANTED**—RCA #816K chassis, less tubes and speaker. State condition and price. Kuehne Radio, Bryan, Ohio.

**WILL TRADE**—Ihagee revolving back camera with Carl Zeiss Tesser f4.5 lens focal plane shutter 1/15 to 1/1000 sec. filters and accessories. Want medium power transmitter or good communications receiver. John T. Craig, 611 S. Silver, Deming, New Mex.

**WILL TRADE**—Wells-Gardner Model 6F, 16 tube. Want ultra stratosphere "10" or other long-wave radio. R. F. Teisinger, 1256 Walker St., Waterloo, Iowa.

**FOR SALE**—Tubes and parts at bargain prices. Send for list. Want to rent code tape machine and tapes. Fred Humphrey, 117 N. 20th St., Philadelphia 3, Pa.

**WANTED**—Riders #6, 7, 8 and 10. Elliott Reames, 1149 Washington Ave., Muskegon, Mich.

**FOR SALE**—Triplett #1212 tube tester, complete with instructions and wiring diagram; A-1 condition $18 postpaid. F. S. Tourtellatte, 11 Lauren Park, Norwich, Conn.

**SELL OR TRADE**—Dumot 5" scope model #148. Want communications receiver, test equipment or camera. Ben L. Sandberg, 36 Washington Village, Asbury Park, N. J.

**WANTED**—Echophone model EC-1 or Hallicrafters model S-36. Joseph C. Baker, Weedsport, New York, R.F.D. #2.

**FOR SALE**—New tubes at list; Meissner ac-dc kits, 2-tube, $7; 3-tube, $8 plus 20c. postage per kit. Need test instruments. Edward Howell, Route 2, Dillon, S. Carolina.

**WANTED**—Multitester, signal generator, tube tester and set tester in good condition. Write, stating full description and price. Wm. H. Womack, Box 589, Mayfield, Ky.

**FOR SALE**—Teco tube tester T-10, almost new; Philco auto radio and one home radio; also meters, parts, etc. Write for list. Harold Mueller, Box 323, Rugby, N. Dak.

**URGENTLY NEEDED**—Communications receiver with or without tubes; any condition. Will pay cash or trade broadcast receivers, radio parts and test equipment. Wm. Briton, 4 O'Brien St., Norwalk, Conn.

**FOR SALE**—12- beam power radio tube SC1632, $1 ea. Lewis, Room 702, Boyce Bldg., Chicago 10, Ill.

**FOR SALE**—Western Electric 5" oscilloscopes with 5 BP4 white television tube. Extra heavy duty transformers, chokes, condensers, etc., complete with 12 tubes and carrying case. Tested and demonstrated, $50. Island Instrument Co., 368 Willis Ave., Mineola, N. Y.

**WANTED**—Rider's Manuals, late model tube checker, signal tracer or vacuum tube voltmeter. Bill's Radio Service, 11 Halsey St., Providence 6, R. I.

**FOR SALE**—Green Flyer dual speed phono motor ,type 3DG4, complete with turntable and speed dials, $12. A. P. Bonfigli, 509 Hancock St., Wollaston 70, Mass.

**WANTED**—Majestic model 60 or 160 tuning moter; Majestic 60 chassis and speaker G5. Reasonable. Will sell 4 years back Radio World Weekly. C. E. Peters, 2925 Apple St., Lincoln, Nebr.

**FOR SALE**—Over 2,000 tubes at O.P.A. list prices or less, many pre-war. M. E. Dominick, Chicago, Ill.

**WANTED**—National SW58 or Sargeant regenerative radio. Must be in good condiiton. J. W. King, 525 Meridian, Anderson, Ind.

**FOR SALE**—Two used Philco auto radios and used Arvin 8-tube radio, $25 ea.; also two ¼ h.p. motors, $14 ea., and one 25 Cabbes automatic, $15. Paul Capito, 637 W. 21st St., Erie, Pa.

**SELL OR TRADE**—Martin handcraft cornet and case, cost $150. Want signal generator, multimeter and Rider's Manuals. Francis E. Manigold, Box 3003 Sta. A, El Paso, Texas.

**FOR SALE**—Crosley car radio, single unit, with lead-in, $12; other radios; small assortment volume controls, resistors, PM and dynamic speakers; earphones; condensers; coils; power and audio transformers, and some tubes. Also 28 back issues Radio Craft; 20 of Radio News, and 13 of Radio. Hal Bundy, 119 Chippewa Ave., Manistique, Mich.

**FOR SALE**—Sensitive d-c relays, coil resistance, 8,000 ohms, contacts; single pole, double throw, rated 2 amps. at 115v a-c, $1 ea. Mack, P. O. Box 123, New Hyde Park, N. Y.

**WANTED**—Rider's Manuals 1 to 14. Write, giving number, condition and price. Melvin Kelch, 1625 Natura Road, Towson 4, Md.

**SELL OR TRADE**—Pilot Super Wasp, also SW5, both with coils, tubes and speakers; also two short-wave radios, 3 and 4 tubes, plug-in coils in panel, built-in power supply. G. H. Gerhold, 9307 114th St., Richmond Hill, Long Island, N. Y.

**WANTED**—Receiver, 550 kc to 40 or 42 mc. Will pay cash. J. Kalenak, 30 Joralemon St., Brooklyn 2, N. Y.

**FOR SALE**—Used radios and tubes. Will buy good used radios and tube tester. Glenn E. Cruzan, Osgood, Ind.

**WILL TRADE**—Hockey type shoe skates, size 8, almost new. Want Ghirardi Radio Physics course. George E. Aldrich, 150 W. 98th St., Apt. 31-W, New York 25, N. Y.

**FOR SALE**—Superior signal generator, 100-105 mc; 955 type tubes, $1.95 ea.; 1,000 nu 2½ meter chokes, 5c. ea.; Isalanitite 1⅞" x ¼" diameter forms, threaded 2½ meter work, 5c. ea., and point stand off insulators, 2½ meter, ea. H. Arras, 277 E. 1st St., Mansfi Ohio.

**SELL OR TRADE**—Radio Physics Cou Radio Troubleshooters Handbook 3rd vised 1943, by A. A. Ghirardi, Mathematics for Electrician and Ra men, by Cooke. Want 8" rim-drive tu table top, 1-117Z6, 1-35Z3, 1-25Z5, tubes. William C. Stadtler, 49 Mi Ave., Brooklyn 7, N. Y.

**FOR SALE**—New R.C.P. #804 tube set tester, $87. Triplett new #1213 t tester, $30. I. J. Lubin, 2049 McG Ave., New York 62, N. Y.

**WANTED**—Transmitter plate transfor (1500, 1750 or 2000 volt); also, 200 300 m.a. swinging and smoothing chok Louis C. Sciez, 357 S. 1st St., Ishpemi Mich.

**FOR SALE**—Vacuum tube voltmeter re grid bias; AVC voltage, oscillator volt without affecting receiver operation. Re to 600v d-c in four ranges; also a-c; co plete with tubes. Used, but perf $19.50. John S. Jackson, 166 North Sie Bonita, Pasadena 4, Calif.

**SELL OR TRADE**—G.E. unimeter UM Readrite tube tester #432-A; and S perior signal generator #1230. John Grunigen, Jr., 1113 Hudson St., Harr burg, Pa.

**FOR SALE**—Weston tube, condenser a resistance checker. Tests all tubes Acorn. Price $45. John H. Oxried 1905 - 17th Ave., Vero Beach, Fla.

*5 TIMES HONORED by distinguished service citations*

ARMY E NAVY

### YOUR OWN AD RUN FREE!

For three wartime years, the Sprague Trading Post helped radio men sell, trade or buy needed materials. Now, with the advent of Peace, this free advertising service will continue as long as the need exists.

We'll gladly run your ad free in the first available issue of one of the 5 magazines in which the Trading Post appears. All we ask is that it be written clearly and concisely, that it be confined to radio materials, and that it fit in with the spirit of this service.

As always we know we can count on you to use Sprague Condensers and Koolohm Resistors—and to ask for them by name!

HARRY KALKER, Sales Manager

**Dept. S-115, SPRAGUE PRODUCTS CO., North Adams, Mass.**

SPRAGUE

# SPRAGUE CONDENSERS
# KOOLOHM RESISTORS

TM. REGISTERED U. S. PATENT OFFICE

**Obviously, Sprague cannot assume any responsibility, or guarantee goods, services, etc., which might be exchanged through the above advertisements**


A background of *Performance* – over 50 years – is the *inside story* of the popularity that has brought leadership to *Thordarson* transformers. Performance over the years, after all, is the only true test of product quality.

Consumer acceptance will continue because *Thordarson* research and design engineers are never satisfied just keeping abreast of the times. These men are continually developing many transformer components which are instrumental in the production of new and better performing devices and equipment for the electronics industry.

This same pioneering spirit has been responsible for many new *Thordarson* transformer applications and developments during the war . . . all of which will be available shortly for civilian requirements.

*Thordarson's* well-tested methods of sales promotion and distribution will continue their joint task of making *Thordarson* Transformers, together with complete information on their applications and use, available to everyone in the field.

***Always think of Thordarson for top-notch transformers!***

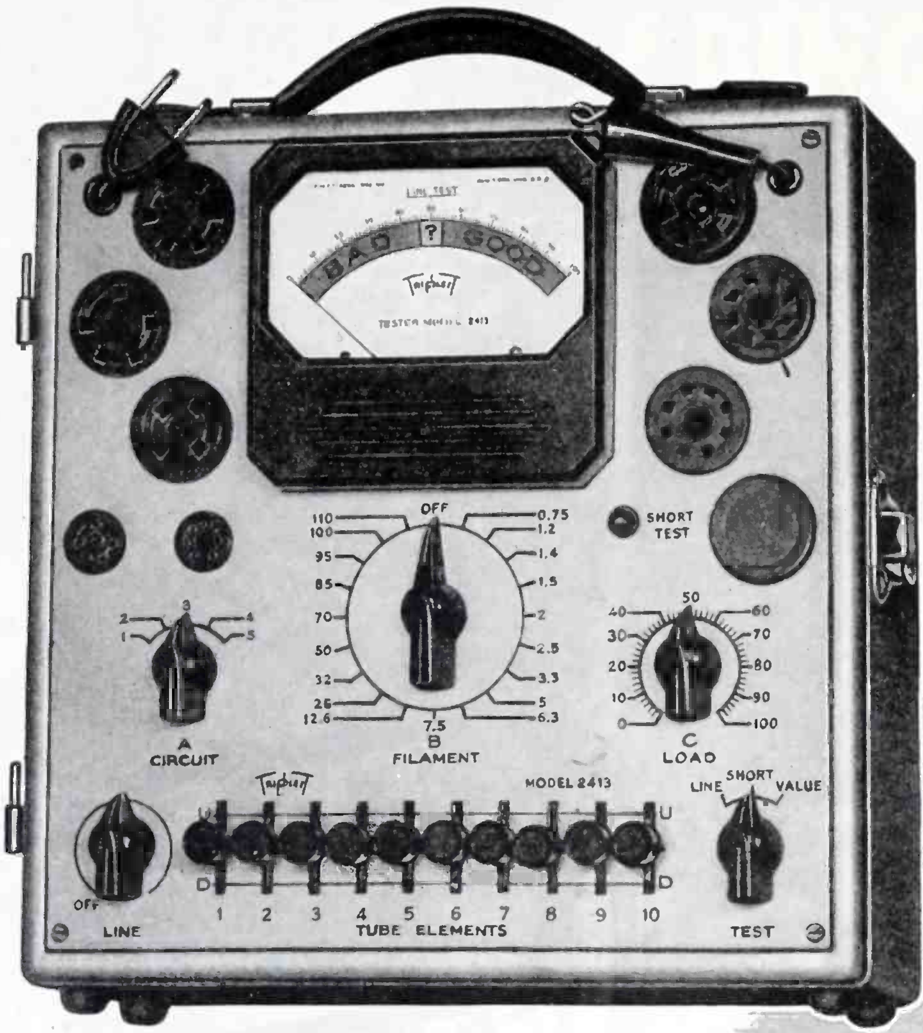
500 WEST HURON ST., CHICAGO, ILL.

ORIGINATORS OF TRU-FIDELITY AMPLIFIERS

**THORDARSON**

*ELECTRIC MANUFACTURING DIVISION*

MAGUIRE INDUSTRIES, INCORPORATED




**MODEL**
**2413**
is another member of the NEW TRIPLETT Square Line

# *The New* Speed-Chek Tube Tester

## MORE FLEXIBLE • FAR FASTER • MORE ACCURATE

Three-position lever switching makes this sensational new model one of the most flexible and speediest of all tube testers. Its multi-purpose test circuit provides for standardized VALUE test; SHORT AND OPEN element test and TRANSCONDUCTANCE comparison test. Large 4" square RED • DOT life-time guaranteed meter.

Simplicity of operation provides for the fastest settings ever developed for practical tube testing. Gives individual control of each tube element.

New SQUARE LINE series metal case 10" x 10" x 5½", striking two-tone hammered baked-on enamel finish. Detachable cover. Tube chart 8" x 9" with the simple settings marked in large easy to read type. Attractively priced. Write for details.

### *Additional Features*

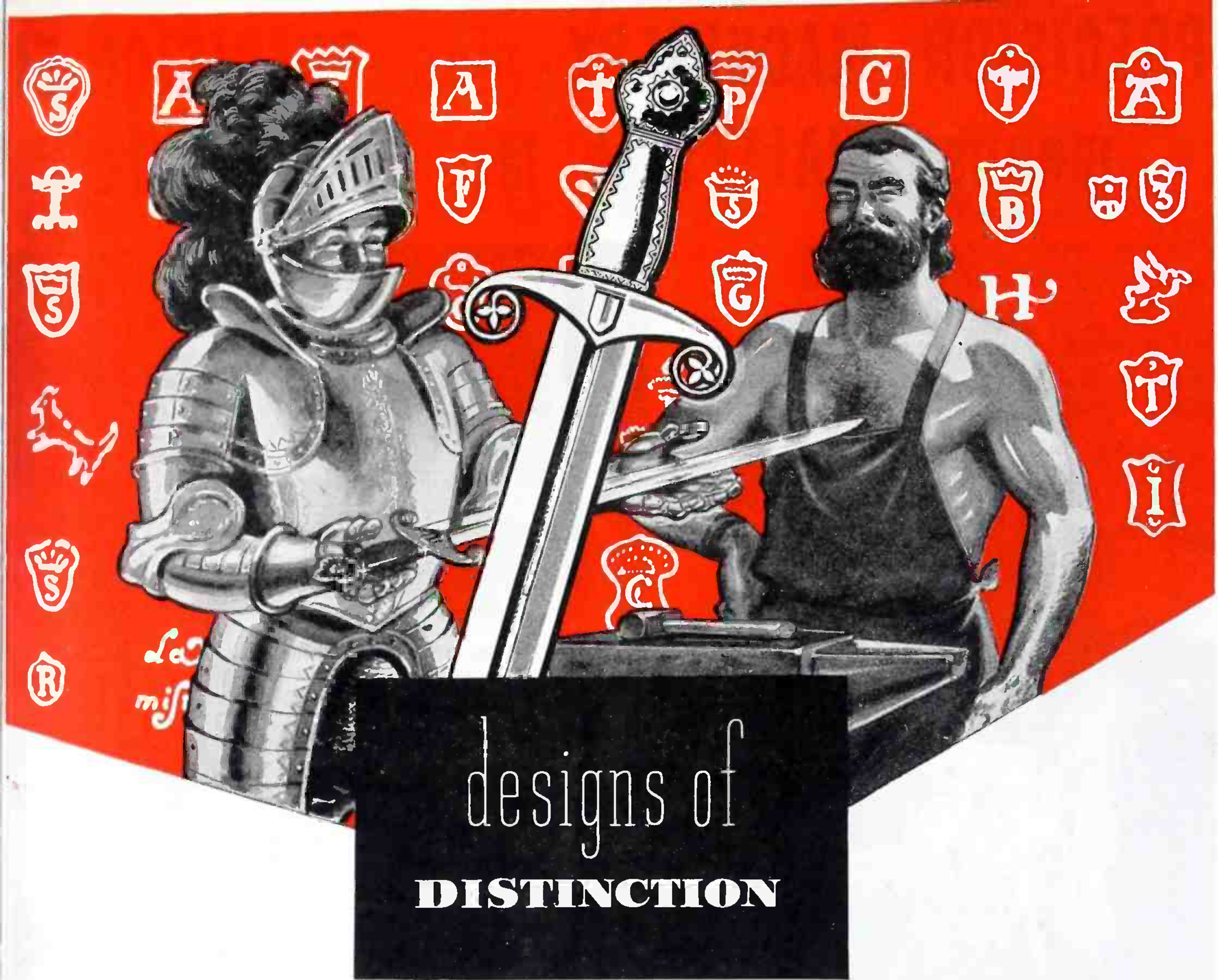
- Authoritative tests for tube value; shorts, open elements, and transconductance (mutual conductance) comparison for matching tubes.
- Flexible lever-switching gives individual control for each tube element; provides for roaming elements, dual cathode structures, multi-purpose tubes, etc.
- Line voltage adjustment control.
- Filament Voltages, 0.75 to 110 volts, through 19 steps.
- Sockets: One only each kind required socket plus one spare.
- Distinctive appearance with 4" meter makes impressive counter tester — also suitable for portable use.

STANDARDS ARE SET BY TRIPLETT

*Precision first ...to last*

# Triplett

**ELECTRICAL INSTRUMENT CO.** BLUFFTON, OHI



# designs of DISTINCTION

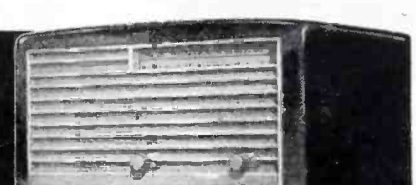
In medieval times discriminating knights journeyed to Toledo, Spain, to obtain hand-wrought blades of steel. Only the famed guildsmen of Toledo could produce the flawless metal from which they fashioned graceful foils and swords of sleek beauty.

For hundreds of years these proud guildsmen stamped their guild marks or signatures on their creations.

A few firms today still preserve that spirit of craftsmanship. You find it in the plants of Detrola Radio. That is why the "guild mark" of Detrola Radio on a radio receiver, record changer or other electronic instrument is a guarantee of production quality. The world's finest merchants, and their customers recognize the value of this mark.

**DIVISION OF INTERNATIONAL DETROLA CORPORATION DETROIT 9, MICHIGAN**

*Detrola Radio*



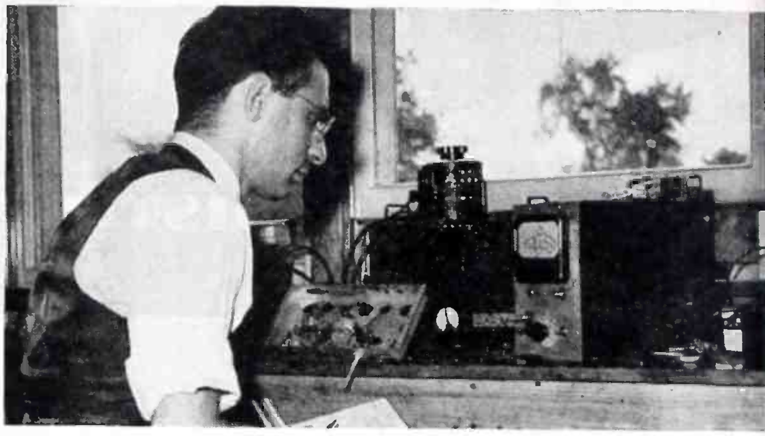
# PRECISION MACHINERY plus PRECISION-EL means QUALITY in Mt. Carmel, Ill.

Precision machinery is part of Meissner's famed "precision-el" corps, too, and the men and women who build Meissner quality electronic equipment are the first to share the credit with their bench and tool-room friends. The photographs on this page show typical precision-el "teams" at work.

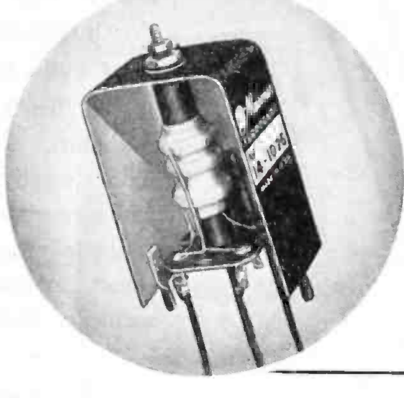
**Here's a man who smiles proudly** as his "helper"— a precision lathe—does a good job of holding extremely close tolerances.


**His "partner" receives** a delicate adjustment with all the skill he can command. This care of equipment by Meissner *precision-el* has meant higher quality and fewer shut-downs for repairs on a big war job.

**Here's another winning combination.** Even the smallest parts warrant careful machining at Meissner. It's another reason for precision performance by Meissner products.



**This is the proof of the pudding.** "Rejects" are surprisingly few, even under the sharp eye of the sensitive testing instruments used by this member of Meissner's *precision-el.*



**Replace Broadcast Band Coils Easily**

These Adjustable-Inductance Ferrocart (iron core) coils will replace Antenna, RF or Oscillator coils without the trouble of locating "exact duplicates" because they are continuously variable in inductance over a wide range. The inductance of the old coil is easily matched by simple screwdriver adjustment. Ferrocart iron cores add gain and selectivity to the receiver. Available shielded or unshielded, shipped with complete instructions. Order by number. 14-1026 Univ. Ant. Coil; 14-1027 Univ. R.F. Coil; 14-1028 Univ. Osc. Coil. Price $1.50 each.

# MEISSNER

MANUFACTURING COMPANY • MT. CARMEL, ILL.

***ADVANCED ELECTRONIC RESEARCH AND MANUFACTURE***

*Export Division: 25 Warren St., New York; Cable: Simontrice*

# *The New Model CA-11*

# SIGNAL TRACER

**Simple to operate . . . because it has only ONE connecting cable- NO tuning controls!**


INTRODUCED in 1939-1940 Signal Tracing, the "short-cut" method of Radio Servicing quickly became established as the accepted method of localizing the cause of trouble in defective radio receivers. Most of the pre-war testers (including ours) were bulky requiring a number of connections before the unit was "set for operation" and included a tuned amplifier which had to be "retuned" to compensate for signal shift.

The new model CA-11 affords all the advantages offered by the pre-war models and only weighs 5 lbs. and measures 5"x6"x7". Always ready for immediate use without the necessity of connecting cables, this amazingly versatile unit has NO TUNING CONTROLS.

Essentially "Signal Tracing" means following the signal in a radio receiver and using the signal itself as a basis of measurement and as a means of locating the cause of trouble. In the CA-11 the Detector Probe is used to follow the signal from the antenna to the speaker—with relative signal intensity readings available on the scale of the meter which is calibrated to permit constant comparison of signal intensity as the probe is moved to follow the signal through the various stages.

## *Features*

- ★ **SIMPLE TO OPERATE** — only 1 connecting cable — NO TUNING CONTROLS.
- ★ **HIGHLY SENSITIVE** — uses an improved Vacuum Tube Voltmeter circuit. Tube and resister-capacity network are built into the Detector Probe.
- ★ **COMPLETELY PORTABLE** — weighs 5 lbs. and measures 5"x6"x7".
- ★ Comparative Signal Intensity readings are indicated directly on the meter as the Detector Probe is moved to follow the Signal from Antenna to Speaker.
- ★ Provision is made for insertion of phones.

*ease place your order with your regular radio parts jobber. If your local jobber cannot supply u kindly write for a list of jobbers in your state who do distribute our instruments or send ur order directly to us.*

**ne Model CA-11 comes housed in a beautiful hand-rubbed wooden cabinet. omplete with Probe, test leads and instructions.**

**NET PRICE $18.75**

**SUPERIOR INSTRUMENTS CO.**
**DEPT. B—227 FULTON STREET NEW YORK 7, N. Y.**

# SYLVANIA NEWS
## RADIO SERVICE EDITION

NOV. *Published by* SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa. 19

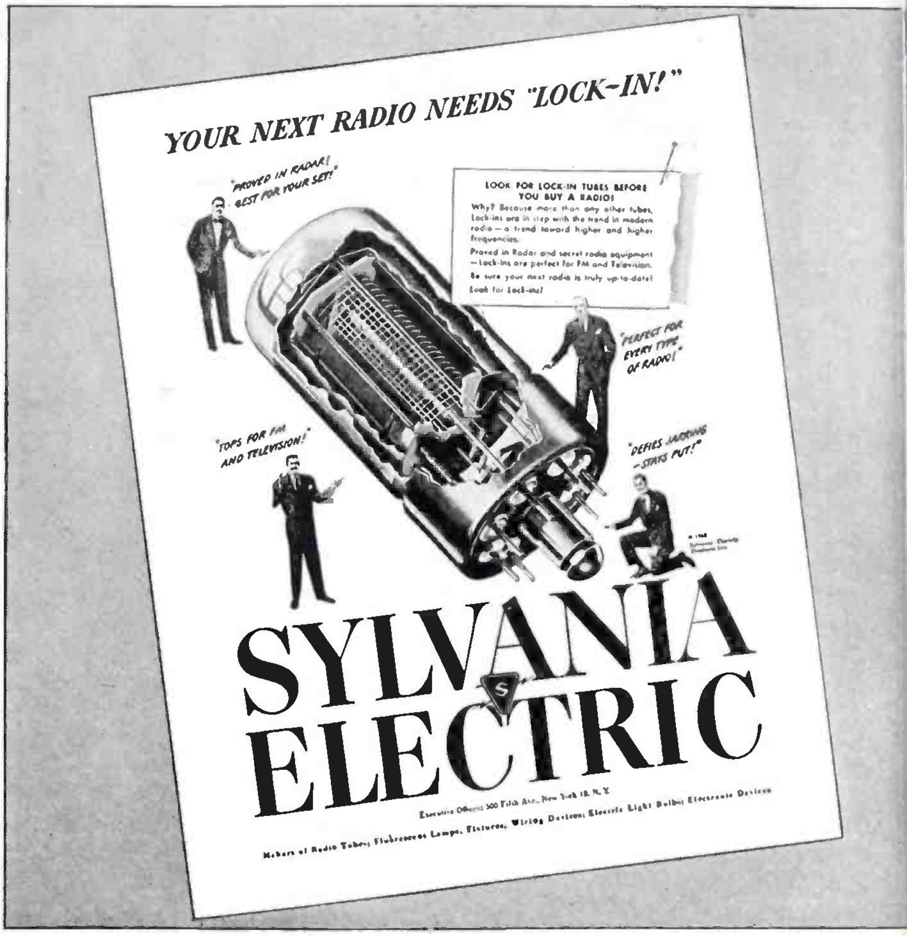

# SYLVANIA "LOCK-IN" ADVERTISEMENTS SEL THIS SUPERIOR TUBE TO NATION'S MILLION


A large, attractive, three-color display banner featuring the phrase "Complete Radio Service" is now ready for distribution to servicemen by Sylvania.

The banner measures 46 by 28 inches, is printed in black, green and white on special weather-proofed "duckine" material, making it suitable for use either inside or outside of the store. It has six metal grommets to provide extra reinforcement.

This useful, durable and attractive display banner may be obtained for only $.40—or three for a dollar—from your local Sylvania distributor, or by writing to me at Sylvania Electric Products Inc., Emporium, Pa.

This banner is only one of the items on an extensive list of Sylvania promotional material designed to help servicemen merchandise both their own service and Sylvania radio tubes.




Servicemen will find even more people asking about the war-famed Sylvania Lock-In Tube—because of big, full-page Lock-In advertisements appearing in eight national magazines. These ads are telling over ten million people that Lock-Ins have advantages possessed by no other radio tube.

Lock-Ins are noted for their electrical efficiency and rugged durability. Element leads are brought directly through a low-loss glass header to become sturdy socket pins—effecting a much desir reduction in lead inductance and inte element capacitance. Support rods a stronger and thicker. There are few welded joints and no soldered joint

These remarkable tubes are design and built to handle the high and ultr high frequencies of FM and Televisi —as well as the lower frequencies. T day, set-manufacturers are looking the Lock-In Tube as the perfect ele tronic unit for all new radios.

SERVICE

A Monthly Digest of Radio and Allied Maintenance

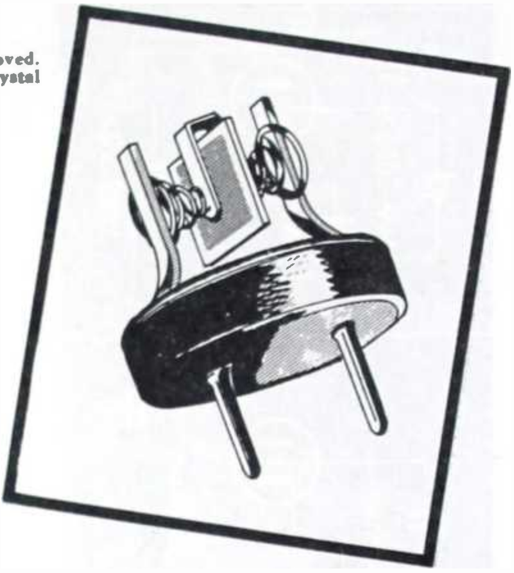


Fig. 1 (right). A crystal unit in its holder, with the cover removed. The two springs serve to hold the electrodes against the crystal surface. (*Courtesy Crystal Research Laboratories*)

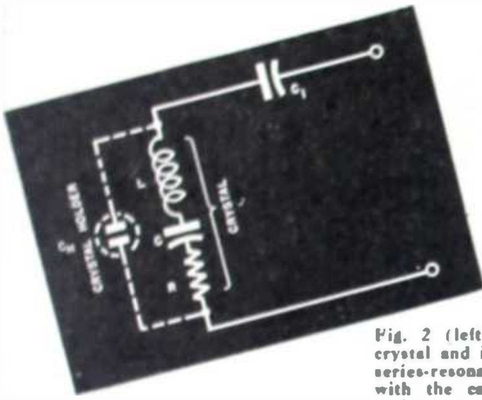



Fig. 2 (left). The electrical equivalent of the crystal and its holder. In effect, the crystal is a series-resonant circuit, consisting of *L*, *C*, and *R*, with the capacitance of the holder across the entire system. $C_1$ represents the series capacitance between the crystal proper, and the electrodes.

# CRYSTAL-CONTROLLED OSCILLATORS

## by J. GEORGE STEWART

IN many types of postwar receivers crystal-controlled oscillators will be quite an important feature. The extensive use of these oscillators in Army-Navy equipment has developed crystal manufacture to the point where they are economically feasible for mass production. At the winter IRE meeting last January, we were shown a receiver which tuned the entire b-c band through the use of push-button crystal oscillators.

Most of the new f-m receivers will use crystal-controlled oscillators. Stability requirements in the newly assigned v-h-f band will create a need for double superheterodyning, in which one of the fixed oscillators will probably be crystal controlled.

In the past most Service Men have had little opportunity to work with crystal controlled oscillators, since their use has been restricted to transmitters and fixed frequency receivers.

### Physical Properties of Crystals

Physically, the quartz crystal is less than an inch square and only several thousandths of an inch thick. This crystal is *sandwiched* between two small, flat squares of metal, called electrodes, which serve as surface contacts. Spring pressure is usually applied to these metal squares to hold them firmly in place, and leads are brought out from these electrodes to external pins or contacts. The entire assembly is housed in a unit called the crystal holder. This has been the practice in the past. However, cost economy factors in receiver design may change the form of crystal holder, so that a simpler device embodying the same principles may be used.

### Electrical Crystal Properties

The crystal may be likened to a two-plate condenser, with the crystal acting as the dielectric, Fig. 1.

Electrically, the crystal is equivalent to a high *Q*, parallel resonant-tuned circuit, whose frequency is largely determined by the physical dimensions of the quartz crystal. Its electrical equivalent is shown in Fig. 2, where *L*, *C* and *R* are the series electrical constants of the crystal unit, and $C_H$ represents the capacitance between the metal electrodes, with the crystal acting as the dielectric. $C_1$ represents the series capacitance between the crystal proper, and the electrodes.

### Crystal Operation

When an electrical current of approximately resonant frequency is applied across the crystal, sympathetic vibrations are set up in the crystal structure. This vibration, in turn, causes large voltages to appear between the electrodes. For this reason, the crystal may be used in place of an *LC* element in the grid circuit of an oscillator to supply the necessary grid driving voltage. Since the physical dimensions of the crystal are constant, and do not expand appreciably with heat, and since these same dimensions determine the frequency of operation, in the same way that the dimensions of a tuning fork determine its audible frequency, it can be seen that a high degree of frequency stability is thus obtained.

### Grid Circuit Activity

When installed in the grid circuit of an oscillator, the value of $C_H$ is further increased by the input capacitance of the tube, and the capacitance of the associated wiring. The resul-

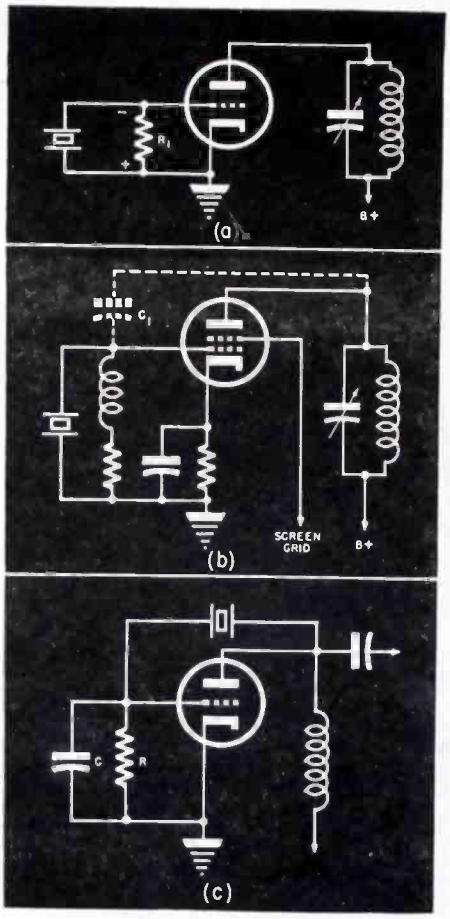



**Fig. 3. Three circuits employing crystals for frequency control. In *a*, a triode circuit in its simplest form is shown. In *b*, we have a pentode circuit, while *c* shows the Pierce oscillator, which does not require a resonant circuit in the plate.**

tant influence on the crystal frequency is quite small, and insofar as related to receivers, may be considered negligible.

#### Crystal Outputs

Crystal units are capable of delivering large values of r-f voltage, depending on the tube used, and the circuit voltages. However, in receiver applications, the amount of power required is small, and the circuit components reflect this in their size.

Any of several standard circuits may be employed using a crystal as the frequency-controlling element. Three typical circuits are shown in Fig. 3*a*, *b*, and *c*.

#### Triode-Crystal Oscillators

In Fig. 3*a* is shown a triode-crystal oscillator in its simplest form. This circuit is essentially a tuned-plate tuned-grid oscillator, with the feedback supplied by the grid-plate capacitance of the tube. Since the crystal itself is a discontinuous d-c circuit, the grid of the tube is returned to ground through the resistor $R_1$. This resistor serves a second purpose, since it also limits the r-f current in the grid circuit. This grid current limitation is important, since the permissible current through the crystal must be kept below the crystal rating, else the crystal may be punctured and rendered inoperative. Expressed another way, the activity of the crystal is a function of the r-f voltage across it. If this voltage exceeds the limits of the crystal, the overactivity will shatter the crystal. Therefore, decreasing the value of the grid resistor reduces the current through the crystal. In Fig. 3*a* the cathode has been returned to ground, so that the grid bias is a function of the grid current which creates the bias across the grid resistor.

#### Pentode Circuit

In Fig. 3*b* a pentode has been substituted for the triode. Since the gain of a pentode is higher than that of a triode, less grid excitation is needed. The feedback from the plate to the grid has been reduced by the lower g-p capacitance inherent in the pentode structure. If this capacitance is too low, an external coupling capacitor represented by *C*, is added, so that sufficient feedback is available. The size of the grid resistor for pentode crystal oscillators is usually 20,000 ohms or less. Since the lower value of resistor may shunt the crystal too effectively, and prevent oscillation, a r-f choke is usually added in series with the resistor. The choke supplies the necessary a-c impedance to reduce the shunting effect of the resistor, at the same time introducing a negligible amount of d-c resistance. Where cathode bias is used, the size of the grid resistor is reduced.

#### Crystal Excitation

The crystal excitation is a direct function of the plate and screen voltages used, and they must be watched carefully to make sure that they are not excessive. Since power is not important in a receiver, high value grid resistors, and low grid and plate voltages may be used.

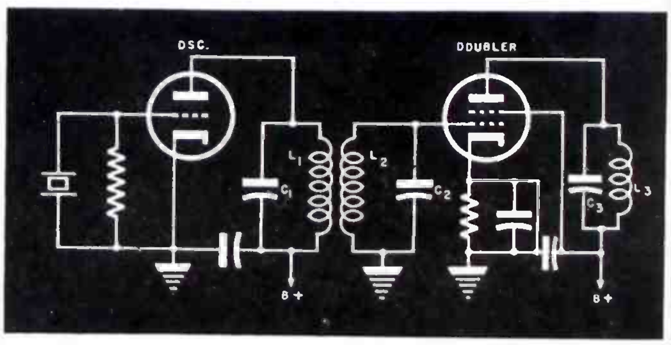
#### Pierce Oscillators

Fig. 3*c* shows a third method of crystal control for frequency stability the Pierce oscillator circuit. A triode is used, although a pentode may be used too. Here, the crystal is used as the coupling element between the plate and grid circuits. Note that the plate circuit is untuned. Its use in a circuit of this type is similar to a crystal filter, in which only resonant voltages are passed by the crystal, the crystal performing as a series resonant circuit. For all other frequencies, the crystal acts as a pure capacitor. $C_1$ and the crystal may be considered as a load across the output of the tube. Therefore increasing the value of $C_1$ increases the load across the output circuit and the resultant grid current. Because of its position in the circuit the crystal is subject to high voltage strains. Therefore the plate voltage of Pierce oscillators is usually lower than for other crystal circuits.

#### Harmonic Oscillators

Fundamental frequency operation of crystal oscillators is limited by crystal size to about 15 mc. Crystals for frequencies above 6 or 7 mc are very expensive. To overcome this condition, the crystal may be cut to operate on a mechanical harmonic of its fundamental frequency, or may be employed in a circuit where some harmonic of the fundamental frequency of the crystal is amplified. When the crystal is operated on a mechanical harmonic of its fundamental frequency, the resonant circuit in the plate of the oscillator is tuned to the desired harmonic. The crystal then behaves as though it were oscillating fundamentally at the harmonic frequency. When the crystal is used to drive the frequency multiplier,

**Fig. 4. A method for doubling the frequency of the crystal circuit. The first r-f transformer is tuned to the crystal frequency, while $L_3C_3$ is tuned to twice the crystal frequency.**



he crystal first oscillates at its fundamental frequency. This fundamental requency is then used to drive the multiplier stage. Sometimes, where he desired frequency is quite high, oth methods are used concurrently.

### Frequency Multiplier

Fig. 4 shows a typical crystal oscillator and frequency multiplier. In this ircuit, $L_1C_1$ and $L_2C_2$ are tuned to he crystal frequency. $L_2C_2$ is tuned o twice the crystal frequency. Thus, he output of the doubler stage is twice he fundamental or crystal frequency.

### Tri-tet Circuits

This same principle may be so used hat only one tube is necessary for oth operations. For example, the rystal oscillator may be one-half of a win triode, and the doubler may be he other half. Or, a pentode may be sed, as shown in Fig. 5. This circuit s known as the *tri-tet*. Here, the control grid, cathode, and screen grid perform as a triode-crystal oscillator. The screen grid serves as the plate of he triode. The plate of the tube is hen used as the multiplier, with $L_2C_2$ uned to the desired harmonic. This ircuit is usually used where even nultiples of the fundamental frequency re desired. The circuit of Fig. 6 is sed where odd multiples of the fundamental frequency are desired. This ircuit is known as the *grid-plate* scillator. The essential difference between the two circuits is that in Fig. 5 the crystal is returned to ground hrough the resonant circuit $L_1C_1$, whereas in Fig. 6 the crystal is returned to ground directly.

### Resonant Circuit and Cathode Return

Actually, the circuit of Fig. 6 is a Pierce oscillator, since the screen grid, which is being used as the plate of a riode oscillator, and the crystal return, are connected together through heir common ground terminals. Since the cathode of a tube may be considered as a continuation of the plate circuit, the placing of the resonant circuit in the cathode return does not change the relationship, other than placing the actual plate of the tube at r-f ground.

### Oscillator Tuning

All crystal oscillators are tuned in essentially the same way. Fig. 7 shows a typical plate-current characteristic

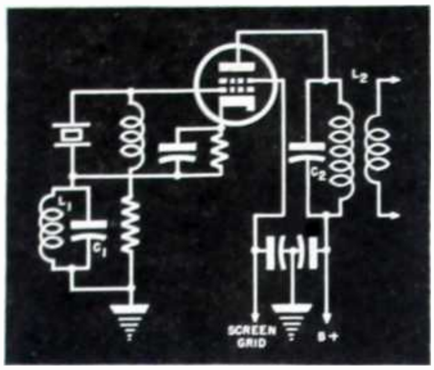



Fig. 5. A crystal frequency multiplier using one tube. $L_1C_1$ is tuned to the crystal frequency, while $L_2C_2$ is tuned to a multiple of this frequency. This circuit is used where even multiples of the crystal frequency are desired.

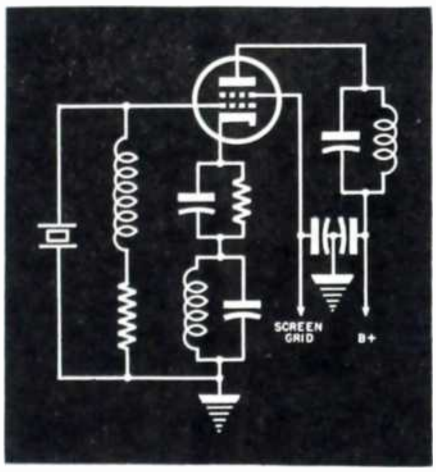



Fig. 6. This multiplier circuit is used where odd multiples of the crystal frequency are desired. The crystal portion of the circuit is essentially a Pierce oscillator, with the screen grid acting as the plate of a triode oscillator.

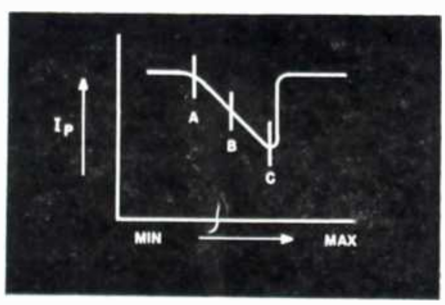



Fig. 7. Plate current characteristic of a crystal oscillator. For stability requirements, the circuit is tuned so that the current is in the vicinity of point *B*. This also prolongs the life of the crystal.

for a crystal oscillator. When the oscillator is in the non-oscillating stage, the plate current will be found to be at some high level. As the plate-tank tuning capacitor is tuned from minimum capacitance, the plate current will dip as shown in Fig. 7; the current decreases slowly until it reaches some minimum value, and then rises sharply. The maximum oscillation will take place at the point of minimum plate current. However, for stability purposes, it is best to operate the crystal oscillator at some point about halfway between maximum and minimum plate current. This point of operation also limits the amount of r-f current in the crystal, and will help prolong its useful life.

### Causes of Non-Oscillation

If the crystal oscillator stops oscillating, the cause may be traced to physical and electrical problems.

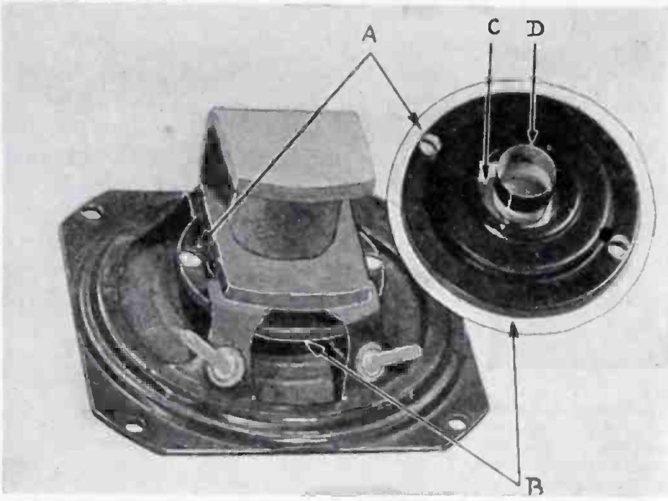
For instance, dirt on the crystal faces will interfere with oscillation. To clean crystals, carbon tetrachloride should be used. The faces of the crystal should be immersed in the liquid and then carefully dried on some lint-free cloth. The faces of the crystal should never be touched with the fingers, since a light film of grease is thus deposited on the crystal impairing its performance. The crystal should always be picked up by its edges, and care should be exercised not to chip the edges. The electrodes should receive similar care, since dirt or grease on their faces will produce the same effects as they would on the crystal.

### Tight Coupling

If the crystal oscillator is coupled too tightly to the load, oscillations will cease. This condition will be rare in receivers, but is mentioned here in case some variable coupling method is used.

### Other Sources of Trouble

Detuning of the plate tank circuit is another source of trouble. The cure is obvious. All bypasses and coupling capacitors should be checked if some unusual condition appears. For example, an open g-p coupling capacitor, or if a variable coupling capacitor is used, a low value of coupling capacitance will prevent oscillations from starting. An open screen-grid bypass, or a reduction in its value, may cause excessive excitation of the crystal. Another cause of excessive excitation is high bias. This should be checked with a v-t voltmeter in the grid circuit. For other troubles, the crystal-controlled oscillator may be treated in the same manner as any oscillator.




Construction of the Adjust-A-Cone assembly; the spider is kept in position with a pressure or clamping ring, which in turn is held down by two machine screws. In insert view, we have a closeup of pressure ring, which is underneath at B. At C is the spider; D shows the voice coil.

# SERVICING HELPS

# RECENTERING LOUDSPEAKER CONES WITH QUAM-NICHOLS ADJUST-A-CONE

by FRANK C. KEENE

THE loudspeaker is a device for the conversion of electrical energy into sound. It is composed of electrical and mechanical parts which acting in conjunction with each other make the conversion possible. Thus the electrical components control the mechanical ones, and the electrical impulses to which the loudspeaker is subjected are converted into mechanical action which creates the sound waves.

#### Analysis of Two Types

In this discussion we will consider only two types of loudspeakers (though there are at least three others). The most commonly used, namely, the electro-dynamic and the permanent magnet type will be discussed. Both of these function exactly alike, the sole difference lying in the method employed to obtain the magnetic flux in the field in which the voice coil moves. In the former, it is created by an electromagnet and in the latter by a permanent magnet.

The electrical parts of the loudspeaker are the magnet, pot assembly, and the voice coil; while the mechanical parts are the housing and the cone or diaphragm. The voice coil assembly, known as the driver mechanism, is rigidly attached to the cone so that whatever movement is electrically caused in the driver is transmitted directly to the cone. The movement of the cone against the air in contact with it causes the radiation of air waves, or sound.[1]

In order for the voice coil to function, it must be concentrically located around the end of the magnetic pole-piece of the loudspeaker with a clearance between it and the pole-piece. The clearance between the pole-piece and the pot is very close so that the air gap energy is held at a maximum. It is the action of the audio currents through the voice coil while it is in the direct-current magnetic field that causes the voice coil to move in and out.[2] This movement, when transmitted to the cone to which the voice coil has been rigidly attached, causes the propogation of sound waves and hence sound.[3]

#### Clearances

Clearances must be close for optimum results, but it is imperative that the voice coil ride free within the space between the pole-piece and the pot which is termed the gap. If, for instance, grit or dust gets into the gap, the efficiency and work of the voice coil is thereby impeded. Similarly, the voice coil cannot rub either against the pole-piece or against the pot and give good reproduction.

To center the voice coil within the gap, a membrane, called a spider is built into the loudspeaker assembly. This supports the voice coil at the pole-piece, while the housing (or basket, as it is termed) supports the outer edge of the cone. The spider normally permits movement of the voice coil parallel with the side of the pole-piece, but restricts all side-way movements. If the spider itself gets off center, then the voice coil is no longer concentrically located over the end of the pole-piece and a rubbing voice coil results. The same would occur if the voice coil itself were bent at its junction with the spider.

#### Rubbing Voice Coils

A rubbing voice coil not only causes losses in power because of the friction developed between the voice coil and the pole-piece or the pot, as the case may be, but it also introduces distortion.[4] Such off-center operation is apparent in the reproduction in the sound by rasps and rattles and by highly distorted frequency responses. This widely divergent output response from that of a normal speaker cannot be reconciled by the human ear which, while not intolerant of small aberations and distortions,[5] does and can register those of this magnitude.

The result is that the user of a loudspeaker with an off-center or rubbing voice coil usually calls in the Service-Man to restore the quality which has

(*Continued on page* 51)

[1]Terman, *Radio Engineering*, page 767.
[2]Terman, *Radio Engineering*, page 765.
[3]Olson-Massa, *Allied Acoustics*; Massa, *Electronics*, Feb. 1936; Seabert, *Electrodynamic Speaker Design Considerations*, Proc. IRE, June 1934.

[4]Knowles, *Electronics*, Sept. 1933; Terman, *Radio Engineering*, page 774.
[5]Terman, *Radio Engineering*, page 763.

**Many headlines like this have raised the question**


**Should Radio Service Dealers be Licensed?**

# RAYTHEON HAS THE ANSWER!

## *and will announce it shortly . . .*

Screaming headlines in the New York Times, the World Telegram, the Herald-Tribune, articles in *The Reader's Digest* — *you* know the unfavorable talk they have helped spread, the hardship they have worked on every *honest* radio service dealer.

### DEALER LICENSES DISCUSSED

You are well aware that federal regulation, *dealer-licensing* and even finger printing, are being suggested and discussed by a lot of influential people.

What's the answer? *Raytheon will announce it shortly* for Raytheon has been working for years on a new, foolproof way to protect the public—and to help the *ethical radio service man.* A revolutionary new merchandising plan that will raise the public's opinion of the radio servicing profession and protect the reliable service dealer from outside interests.

### GREAT COMPETITIVE ADVANTAGE

You can see the tremendous competitive advantage this Raytheon plan will give every dealer who can qualify! Watch for all the facts on the Raytheon program to protect the public — and help the honest service-dealer!


RAYTHEON
*Radio Tubes*

*Raytheon Manufacturing Company*
RADIO RECEIVING TUBE DIVISION
NEWTON MASSACHUSETTS · LOS ANGELES · NEW YORK
CHICAGO · ATLANTA



DEVOTED TO RESEARCH AND THE MANUFACTURE OF TUBES FOR THE NEW ERA OF ELECTRONICS

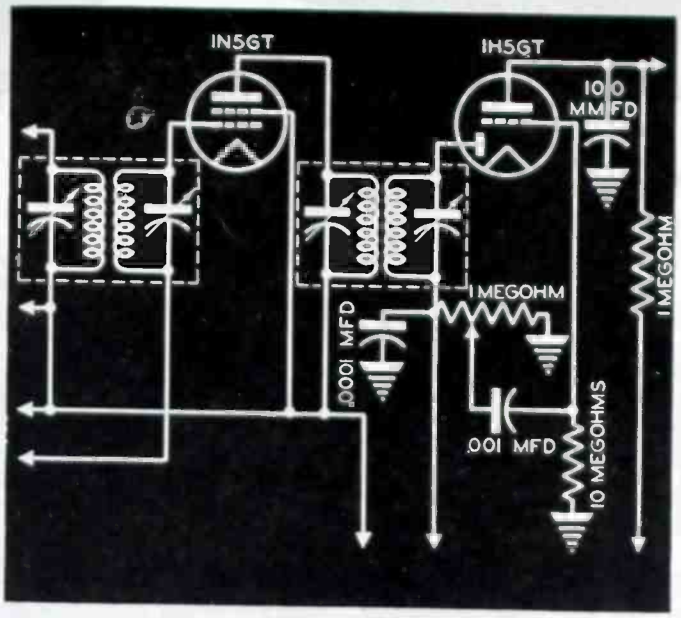



Fig. 1. The i-f system of the Westinghouse WR-678. The sensitivity of portable-receivers is about 30 μv for an output of 50 mw. Most of this gain is supplied by the high gain i-f stage.

by L. E. EDWARDS

# I-F AMPLIFIERS

DURING the past few months we have been discussing some of the important circuit systems that constitute the modern receiver. Thus far we have covered inputs. (Martin W. Elliott's analysis of mixers appeared last month and continues in this issue on page 32.) In the i-f amplifier we have another vital element of receivers. For this section provides both sensitivity and selectivity.

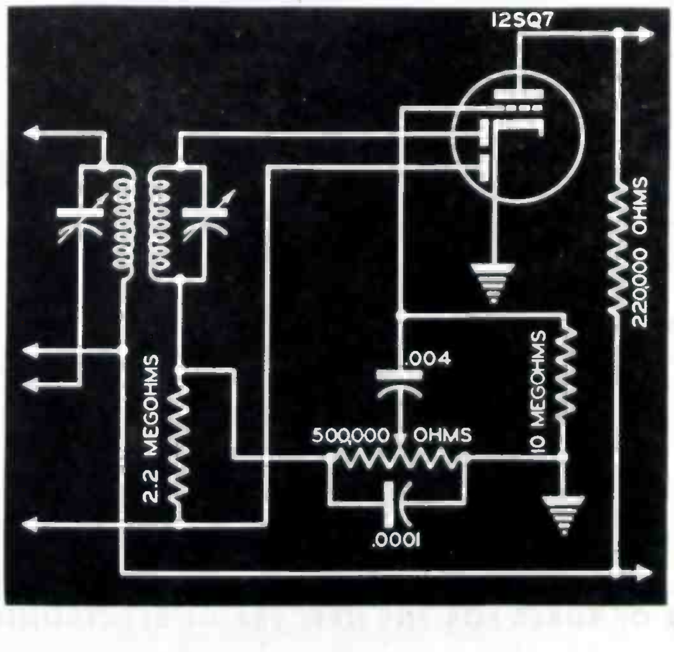
High-gain remote cut-off pentodes are the most suitable amplifier tubes, allowing a wide range of avc control without detuning, and have thus been used in most i-f amplifiers.

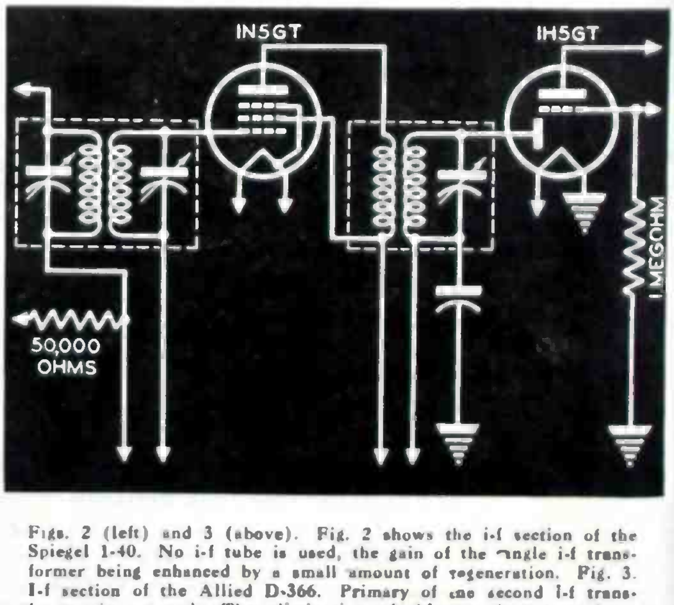
### I-F Transformers

I-f transformers may be divided into two classes based upon their inductance; high-inductance coils of 2.0 to 2.5 mh and low-inductance coils of 1.0 mh or less. The former are tuned to 455 kc by low-capacity trimmers of 50 to 100 mmfd, giving a high *L/C* ratio and a high anti-resonant impedance which presents a good match to the pentode plate resistance. However, this arrangement is extremely critical to adjust to resonance and still harder to keep there because the trimmer is subject to change with temperature and age. Mechanical fatigue and warping are also annoying. Therefore, the attainable gain is not usually obtained for very long. On the other hand, low *L* transformers can use larger tuning capacitors, 150 mmfd and up, which are less subject to mistuning or detuning because they are not so critical. Small changes in capacity cause less change in resonant frequency.

Personal receivers using only 45 or 67 volts *B* must use very high quality, high *Q* transformers of the order of *80* to *100*, to obtain sufficient overall gain. Some of these types are potted, forming a closed magnetic circuit like two *E* laminations, or shell type which greatly reduces absorption in the shield, or even eliminates the shield in some instances.

I-f coils of the low-priced a-c/d-c receivers are wound with No. 37 or 38 solid copper, while the higher-priced receiver i-f's use 3 to 5 strand Litz for the input and either solid or Litz for the output, or second detector transformer. The i-f's of the very high




Figs. 2 (left) and 3 (above). Fig. 2 shows the i-f section of the Spiegel 1-40. No i-f tube is used, the gain of the single i-f transformer being enhanced by a small amount of regeneration. Fig. 3. I-f section of the Allied D-366. Primary of the second i-f transformer is untuned. The elimination of this tuned stage reduces both the gain and the selectivity of the receiver.


# HOW'D YOU LIKE TO GET THESE 2 GHIRARDI BOOKS *for* CHRISTMAS?

What could be finer for Christmas, more appreciated or long remembered, than a gift that will help for years to come in building for a successful future in Radio-Electronic servicing? And so here's a Christmas gift tip: If you're buying a gift for a radio-inclined friend give him one or both of these helpful money-making books — or, take advantage of the combinaton offer and buy one for him and keep the other for yourself. Or, if a friend or relative is wondering what to get you this year, why not drop a hint that nothing would please you more than a Ghirardi book? Hand him the the coupon below!

## CUTS TESTING TIME *IN HALF* STOPS GUESSWORK ON SERVICE JOBS

A. A. Ghirardi's **RADIO TROUBLE-SHOOTER'S HANDBOOK** is a service "short cut" **that really works.** Actually, it is a definite, dependable guide for diagnosing, locating and repairing troubles in almost every receiver ever made. Tells you WHAT to do—exactly HOW to do it on over 4,800 different receiver models. Eliminates useless testing! Saves time! Helps you make more money!

When a receiver comes in for repairs, simply look up the notes on that particular make and model in the 404-page Case History section. **Nine times out of ten** you'll find EXACTLY the information you require. The Handbook tells you what the trouble is, how to repair it. Ideal for training new helpers, handling tough jobs in half the usual time, repairing cheap sets rapidly—or substituting tubes and parts properly. Hundreds of additional pages are devoted to I-F alignment peaks; transformer troubles; tube substitution data; and literally dozens of charts, graphs, diagrams, data and helpful hints designed to help you do every job easier, better and a whale of a lot faster. Pays for itself in time saved the very first time you use it! Weighs 4½ lbs., contains 744 big manual-size, fully-indexed pages. Only $5 complete—on our 5-Day Money-Back Guarantee offer.

## THE ONLY COMPLETE GUIDE TO MODERN *Professional* SERVICE WORK

A. A. Ghirardi's **MODERN RADIO SERVICING** gives you a COMPLETE, MODERN EDUCATION in truly professional service methods of the kind that will be your "Open Sesame!" to the big-money opportunities that only **well-trained** servicemen will be in a position to grasp. Now as never before the call is for HIGHLY TRAINED MEN having a broad knowledge of modern test equipment and testing techniques—**NOT** for "screw-driver" mechanics of only limited ability and technical understanding.

**MODERN RADIO SERVICING** is a complete servicing course from A to Z. Nothing is omitted. Nothing is condensed. You'll be amazed how easily understandable it makes subjects that other books and courses make seem highly complicated. And, even though you've been in service work for years, you'll be pleasantly surprised how this big book will serve as a "refresher" to help you handle almost every job, quicker, faster and more profitably. From beginning to end, it brings you the kind of modern, professional "Know How" that will pay you big dividends for years to come. 1300 pages; 706 clear illustrations; 720 self-test review questions. $5 ($5.50 foreign). Absolute 5-Day Money-Back Guarantee.

## OVERS EVERY CONCEIVABLE SERVICE SUBJECT!

ollowing are only a few of the subjects covered in **MODERN RADIO ERVICING:** Milliammeters, ammeters and voltmeters; Methods and struments for measuring resistance; How, Why, When, Where to use struments of all types; How to build your own; Tube checkers; Set alyzers; Point-to-Point testing; Test oscillators; Preliminary trouble ecks; AVC and QAVC circuits; Troubleshooting; Testing components; oscure Radio Troubles; Aligning and neutralizing; Auto radios; All-ave radio servicing; Marine radio; Interference reduction; How to art a successful Radio-Electronic service business . . . and dozens of hers.

**MONEY-SAVING OFFER!** *We'll send you BOTH of the big books listed above — a total of over 2040 pages of the finest, most helpful service data on the market — for only* $9.50 ($10.50 *foreign*). *Use coupon.*

## 5-DAY MONEY-BACK GUARANTEE

MURRAY HILL BOOKS, Inc., Dept. S115,
232 Madison Ave., New York 16, N. Y.

☐ Enclosed find $ ...... for books checked, sent postpaid; or ☐ send C.O.D. (in U.S.A. only) for this amount plus postage. If not fully satisfied, I may return the books within 5 days and have my money refunded.

☐ Ghirardi's RADIO TROUBLE-SHOOTER'S HANDBOOK $5 ($5.50 foreign)

☐ Ghirardi's MODERN RADIO SERVICING, $5 ($5.50 foreign)

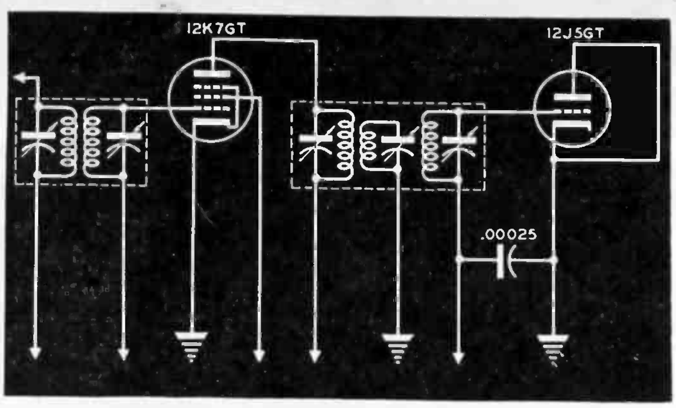
☐ **MONEY-SAVING COMBINATION OFFER — Both big books** (Over 2040 pages of invaluable data for only $9.50 for the two ($10.50 foreign).)

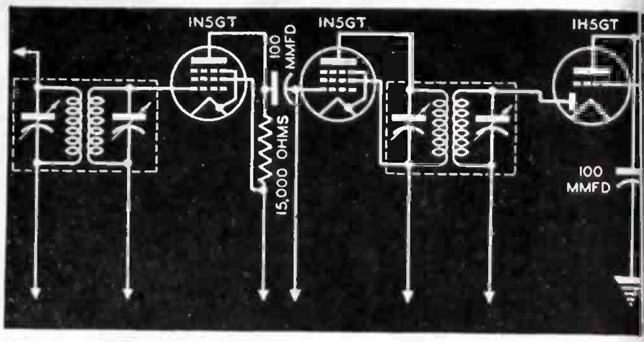
Name ..............................................................

Address ..............................................................

City & Dist. No........................................State..............

## The books that help you repair ANY kind of Radio equipment EASIER—BETTER—*FASTER*—MORE PROFITABLY




quality receivers have been wound with 7 to 10 strand Litz on larger coils, and often are triple-tuned or iron-cored, and encased in cans. For improved stability, the tuning capacity is often divided between a fixed silver mica capacitor and a small trimmer, any variation in the latter representing only a small part of the total.

### Westinghouse WR-679

In Fig. 1 we have a conventional i-f amplifier of a portable, Westinghouse WR-679, using a 1N5GT with standard dual air-core transformers. Portables of this type have a sensitivity of about 30 microvolts from converter grid to speaker for an output of 50 milliwatts, the principal part of the gain coming from the i-f. For comparison, a typical a-c/d-c job has a sensitivity of about 180 microvolts.

The detector transformer is loaded by a 1H5 diode and its load resistance, a 1-megohm volume control. It is important that the second detector be well grounded to the chassis to prevent coupling to the loop antenna. Sometimes eddy currents are formed in the chassis which act as coupling loops. This condition is worse where the loops are poorly designed, since this prompts broad tuning because the i-f frequency of 455 kc is quite close to the 540-kc setting at the low end of the band.

Figs. 4, (above left) and 5 (above right). In Fig. 4 appears the i-f system of the Air-King 4034. Triple tuning in the second i-f transformer provides good gain. At the same time the band-pass characteristic is improved, resulting in high fidelity reception. Fig. 5. Resistance coupling in an i-f stage in the Ward O4WG-2672. This is an inexpensive way of increasing the gain of a receiver with very few parts. The increase in gain is of the order of 12-20.

### Spiegel 1-40

The i-f section of a midget 3-tube and rectifier superhet without an i-f amplifier tube is shown in Fig. 2. In this receiver, Spiegel 1-40, a 12SA7 modulator feeds a 12SQ7 second detector through the single i-f transformer. Sensitivity and selectivity are both enhanced by regeneration by returning the primary tuning capacitor to an *RC*-feedback element in the cathode circuit. One diode is used as detector, the other as a gate on the avc system.

### Allied D-367

In Fig. 3, we have another portable receiver, Allied D-367, which contains a conventional i-f input transformer but uses a single-tuned detector transformer. This transformer is a cartwheel type, wound on a single ceramic base, with the windings very clos coupled. This type of unit hasn't m selectivity.

### Air-King 4034

In Fig. 4 appears the i-f system the Air-King model 4034. In this sy tem we have a triple-tuned second de tector transformer which provides go gain and, at the same time, bandpa characteristics for passing a wide ba for high fidelity. This may be acco plished by staggering the tuning of t three circuits so they resonate at thr equally separated frequencies. T added tank circuit is grounded to pr vent electrostatic coupling. The d tector is a 12J5 used as a diode with ½-megohm load resistance. The inp i-f transformer is standard.

### Ward 04WG-2672

A Ward portable, model O4W( 2672, with a resistance-coupled secon i-f stage, is shown in Fig. 5. Th method is ideal for portables, since provides an additional gain of 12-2 with but one extra tube, two resisto and a coupling capacitor. Its use generally limited to applications i which selectivity is not a problen There is a further disadvantage in th reduction of the signal/noise rati With the additional i-f gain in this typ of receiver, the circuits are pretty *ho* compared to the standard single i-f cir cuits; hence, such items of stability a bypass capacitors must be watche carefully. Replacement units must b of good quality and adequate capacity

The first i-f plate load consists o 15,000 ohms. Some designers hav used up to 75,000 ohms. The couplin capacitor is 100 mmfd.

### G. E. L-643, 653, 663, 673

In Fig. 6 (G. E. L-643, 653, 663 673), we have an iron-core i-f inpu system, with a large air-core unit fo the second detector, the pair providin exceptionally good i-f gain without th use of high-inductance coils. In som receivers the cores are sometimes mad

(*Continued on page* 48)

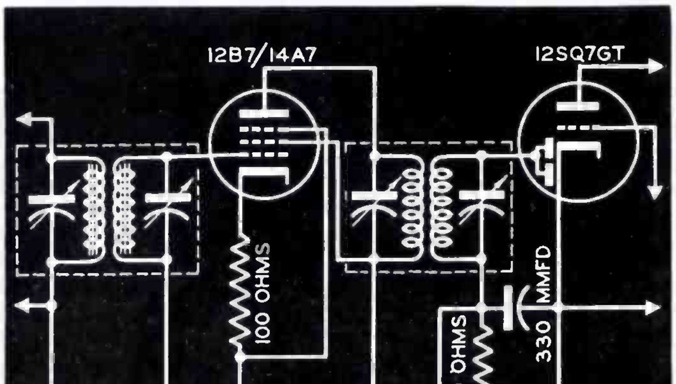
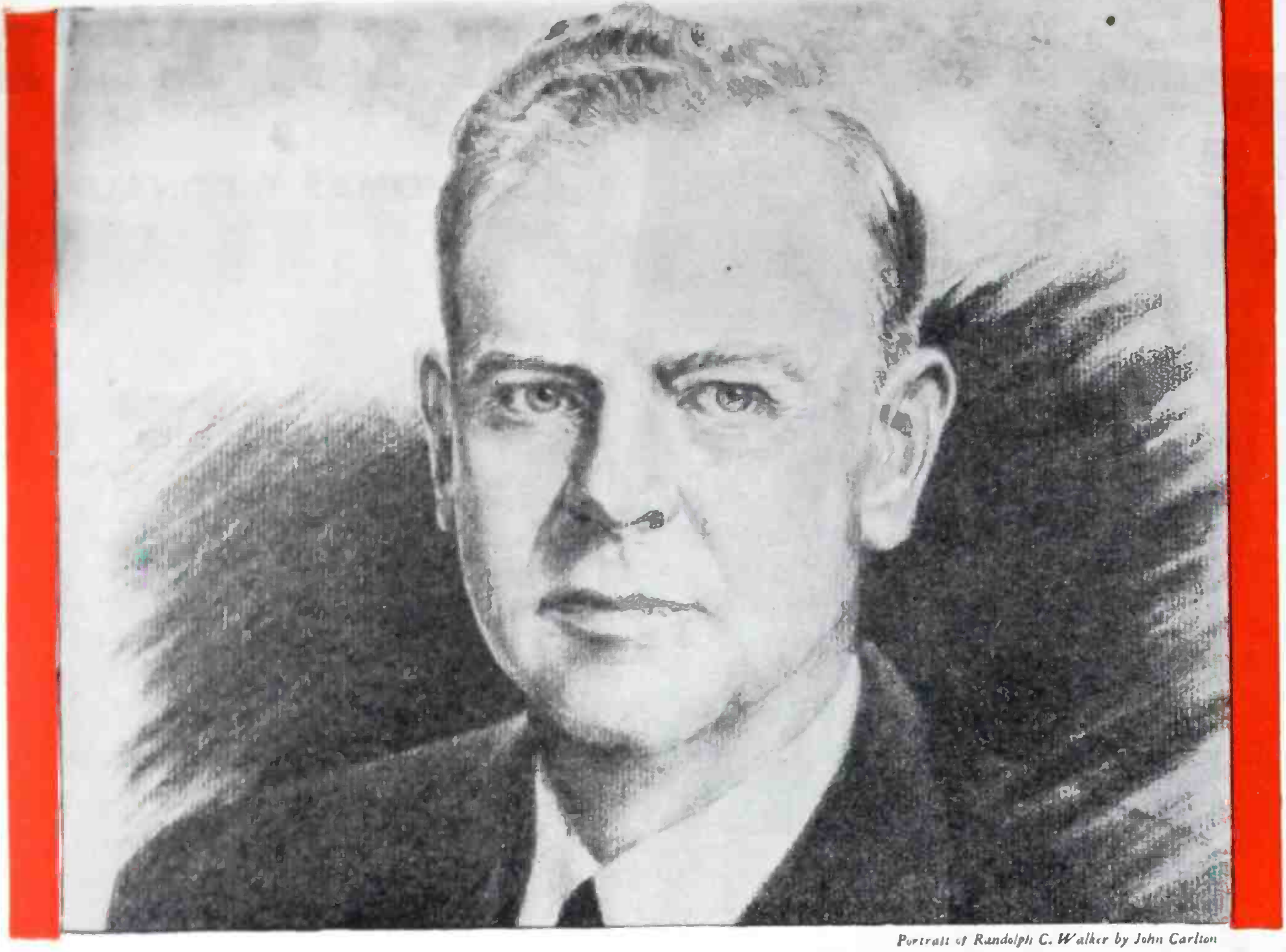



Fig. 6. The G.E. L-243 i-f system. Iron core coils are used to improve the Q of the i-f system. In some receivers, the cores are made adjustable, permitting the use of stable, fixed capacitors.



*Portrait of Randolph C. Walker by John Carlton*

# *Engineers of Victory*
## NOW SERVE MEN AT PEACE

The creative engineering which armed our fighting men for Victory has no less a responsibility in the years of peace ahead. Now that the war is won, we have the job of making this a better world.

AIREON produced huge quantities of communications and radar equipment and other machinery for waging war. Its achievements were equal to its heavy responsibilities, and its workers established an outstanding record of performance.

AIREON enters peacetime production with a notable engineering organization, highly skilled personnel and great confidence in the future. We have developed many products which will contribute to better living, for the manufacture of which all 15 AIREON plants will continue in production.

In order to extend our usefulness we recently established an experimental laboratory in Greenwich. AIREON's creative engineering in radio communications, electronics, musonics and hydraulics will team with production proficiency in contributing devices for future service.

In peace, as in war, AIREON will stand for quality and performance.

Randolph C. Walker
PRESIDENT

**Cinaudagraph Speakers**
**A DIVISION OF Aireon**
**3911 SOUTH MICHIGAN AVENUE, CHICAGO**

# CRYSTAL

by THOMAS T. DONALD

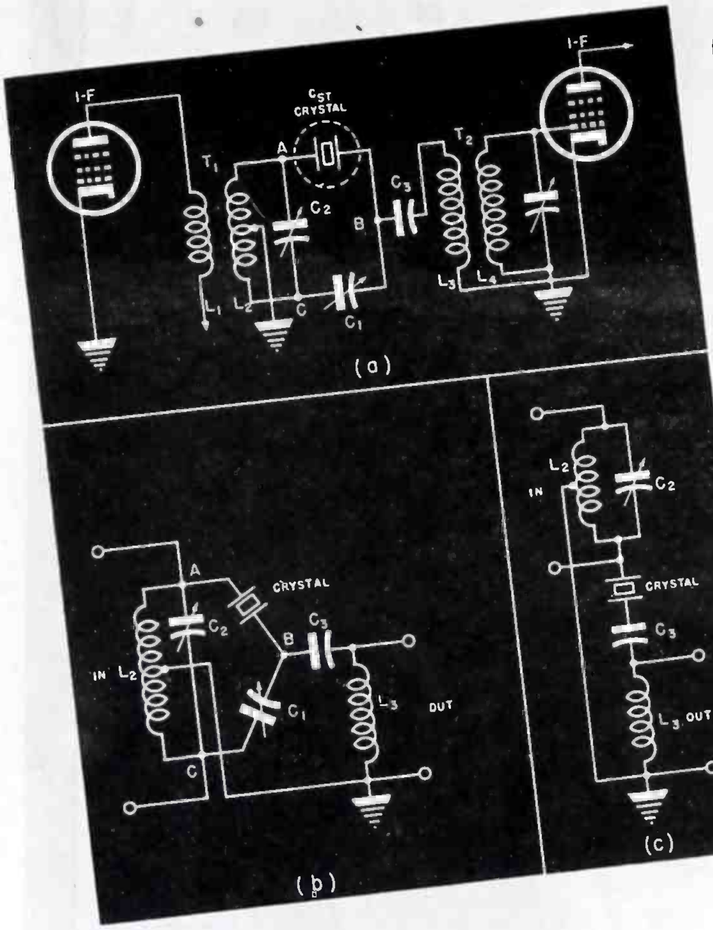



Fig. 1. A typical crystal filter i-f network. In *a*, the crystal filter circuit is shown; *b* shows its close relationship to a balanced-bridge type network; *c* shows how the series resonant characteristic of the crystal is used to provide extreme selectivity.

MANY types of communications receivers feature single-signal circuit design for c-w or code reception.

In c-w (continuous waves) we have the transmission of an r-f carrier only, with no audio modulation. The carrier is then broken up into short and long dashes, or coded. Since there is no audio modulation, the only means of detecting the signal, is through the use of a beat-frequency oscillator or b-f-o which was analyzed in last month's article. However, in the bands used for this type of communication, two adjacent signals may be no more than a few cycles apart, since the volume of air traffic is quite heavy. Therefore, the selectivity of a broadcast type receiver, and its band acceptance of ten kc required to accommodate the side band transmissions necessary for true fidelity of music and voice, would be unacceptable for c-w work. It therefore becomes necessary to improve the selectivity of the receiver to a point where the band acceptance is 100 cycles or less. The best method for accomplishing this is through the use of a crystal filter. In addition, a narrow band acceptance helps to reduce static as well as other types of interference. Many Service Men may have noted that when European pickups are retransmitted in this country c-w signals are heard in the background. With a sharp crystal filter, it is possible to receive the code signal, and almost completely obliterate the broadcast signal.

### Crystal Filter Positions

Crystal filters are usually installed between the first detector of a superheterodyne receiver, and the following i-f stage, or between i-f stages. A typical crystal filter i-f network is shown in Fig. 1*a*. It is redrawn in Fig. 1*b* to show its close relationship to a bridge type, or balanced network. In this figure $C_1$ is the *phasing* control. If the crystal could be installed in the circuit without the accompanying capacitance introduced by the crystal holder and associated wiring, $C_1$ as well as the balanced type circuit, would be unnecessary. However, due to the introduction of this stray capacitance, represented by $C_{ST}$ in Fig. 1*a*, it is necessary to balance out its effect. This is accomplished with $C_1$, the phasing control. If this were not done, the circuit enclosed by the dotted line in Fig. 1*a*, would act as a coupling capacitor, with the crystal assuming the role of a dielectric, serving to link $T_1$ and $T_2$, and permitting the passage of all r-f signals present in $T_1$. However, when $C_1$ is adjusted so that it is equal in value to $C_{ST}$, any non-crystal-resonant voltage developed between points *A* and *B*, is cancelled out by a like voltage between points *C* and *B*. A study of Fig. 2*b* shows how the balanced-type circuit accomplishes this. For crystal resonant voltages, the crystal acts as a series resonant circuit, thereby providing a coupling path between $T_1$ and $T_2$.

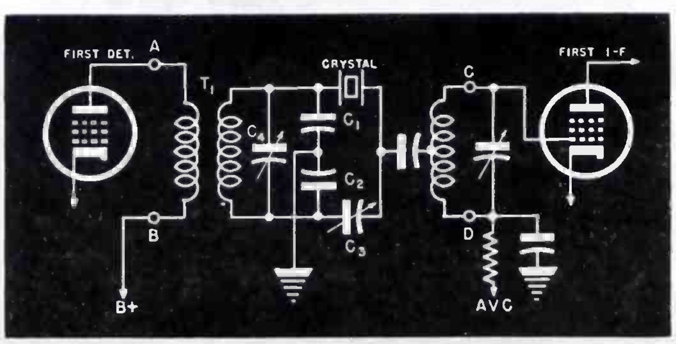



Fig. 2. The crystal filter network of the National NC 100 XAB. $C_1$ and $C_2$ split the secondary of the first i-f transformer capacitively. $C_3$ is the phasing control. This is a plug-in type stage, *A*, *B*, *C*, and *D* representing the four prongs of the plug.

### Phasing Controls

The phasing control, $C_1$, also performs another function. Since it is a

# FILTERS USED IN COMMUNICATIONS RECEIVERS

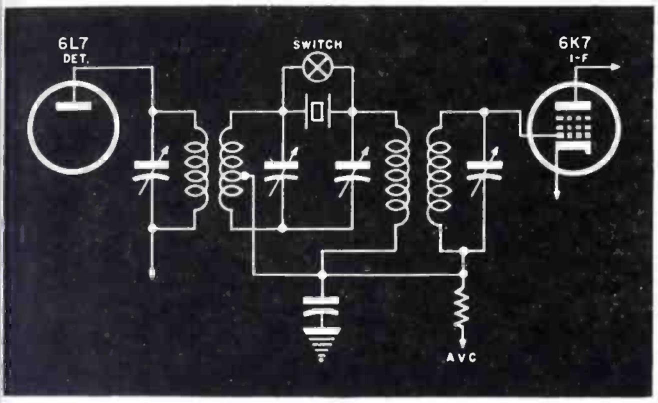



Fig. 3 (above). Crystal filter of the Hallicrafters SX 18. Here, the transformer is split inductively. A panel switch is provided to cut out the crystal for voice reception.

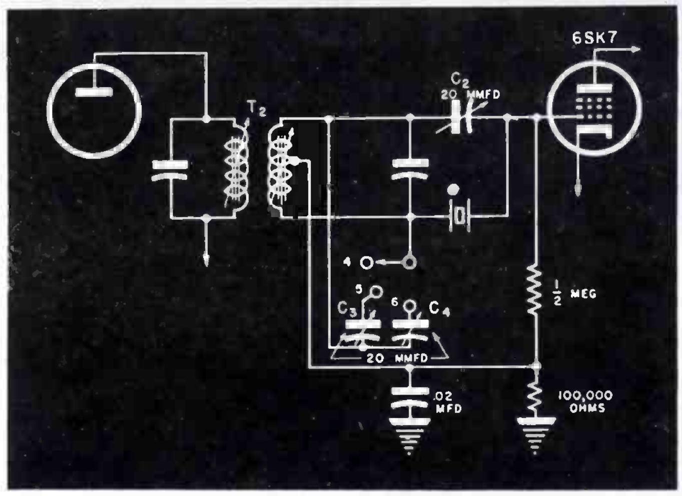



Fig. 4. The variable-selectivity system used in the Hallicrafters SX 28. Capacitors $C_3$ and $C_4$ detune the secondary of $T_2$, thereby increasing the effectiveness of the crystal and improving the selectivity of the system.

ancelling agent, any partial concella-ion of the distributed capacity in the rystal circuit would tend to decrease ts selectivity. Therefore, the phasing ontrol may also be used to control the electivity of the crystal filter.

#### Selectivity Control

The adjustment of $C_2$, which tunes $_1$, may also be used as a selectivity ontrol. When $C_2L_2$ is tuned to the esonant frequency of the crystal, it laces a high resistance in series with he crystal, since, at resonance, a par-llel tuned circuit offers the greatest mpedance, or resistance. (The cir-uit is shown in Fig. 1*c*.) Therefore he effectiveness of the crystal *Q* is educed, since it only represents a mall portion of the entire resistive etwork represented by $L_2C_2$, the rystal, $C_3$, and $L_3$. However, if $L_2C_2$ s detuned, the resistance of this por-ion of the network is reduced to the eactance of either $L_2$ or $C_2$, which-ver is smaller, and the effectiveness f the crystal is increased. Thus, the electivity of the circuit is increased.

#### Basic Designs

The three points previously dis-ussed are important since they are ot only the basis of most of the rystal-filter network communications receiver designs, but a major factor in servicing and alignment.

#### National NC 100 XAB

Figs. 2 to 6 show the crystal-filter networks used in typical communica tions receivers.

Fig. 2 is the crystal-filter circuit of the National NC 100 XAB. $C_1$ and $C_2$ are used to split the secondary of $T_1$ to obtain a balanced circuit. $C_3$ and $C_4$ are the phasing and selectivity controls, respectively. This particular model is so arranged that a standard i-f transformer of the plug-in type may be used instead of the crystal-filter unit, which is also a plug-in type. The plug-in points are represented by *A*, *B*, *C*, and *D*. The selectivity of the crystal unit is preset, before insertion.

#### Hallicrafters SX 18

Fig. 3 shows the crystal system used in the Hallicrafters SX 18. Here, the primary of the first i-f transformer is tuned, and its secondary split inductively. A panel switch is provided to cut out the crystal when the set is used for b-c reception. Note the similarity of this circuit to Fig. 1*a*.

#### Variable Selectivity Filters

The circuits shown previously have been simple versions of crystal filters. More expensive types of communications receivers feature a variable selectivity i-f system, with and without crystal filters.

All variable selectivity crystal-filter systems revolve around some method of decreasing the *Q*, or band acceptance, of the crystal. This is necessary, since it permits easier tuning of c-w signals when noise conditions are not restrictive. It can be appreciated that when dialing for a signal with an i-f channel that is only 100-cycles wide, the slightest movement of the dial would pass over the signal. Figures 4 to 6 show three such systems.

#### Hallicrafters SX 28

Fig. 4 shows the variable selectivity system used in the Hallicrafters SX 28. Three positions, *4*, *5* and *6*, are provided for crystal *broad*, *medium*, and *sharp*. In position *4*, $T_2$ is tuned accurately to the crystal frequency. This causes broad-band acceptance, as explained in Figure 1*c*. Position *5* adds trimmer $C_3$, which detunes $T_2$ slightly, thereby increasing the effectiveness of the crystal filter. Position *6* further

(*Continued on page* 50)

# ELECTRONIC ALARM SYSTEMS

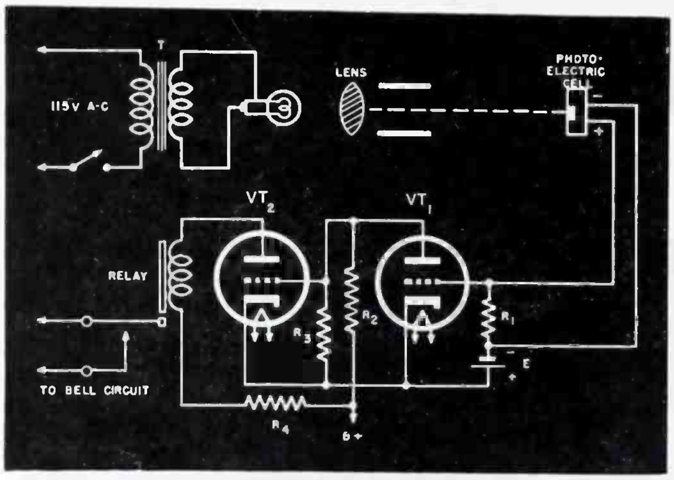



Fig. 1. An elementary photoelectric alarm system. Interruption of the light source reduces the voltage across $R_1$, which is bucking the bias voltage. This reduces the plate current, and thereby actuates the bell system.

**by WILLARD MOODY**

ELECTRONIC circuit developments have introduced many unusual tube applications, such as the electronic alarm. During the war electronic alarms were used in a variety of installations. The postwar era will see an extensive use of these alarms in industry and the home.

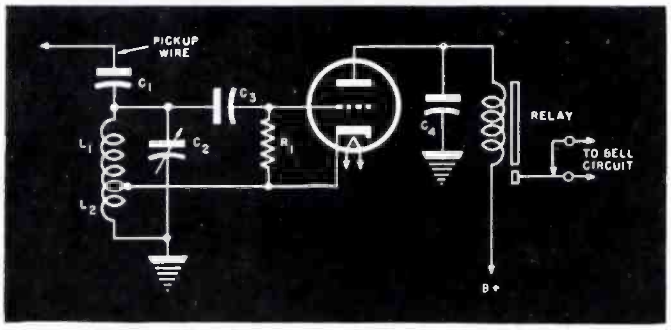



Fig. 2. A circuit typical of r-f types of alarm systems. Variation in the capacity across the grid circuit of the oscillator causes a decrease in plate current, which in turn closes or opens a relay.

#### *Types of Alarm Systems*

There are several types of electronic alarm systems. In Fig. 1 we have one where light from an auto type bulb is directed through a lens and barrel-like tube to a photoelectric cell which may be four or five feet away. In some cases a filter is used in front of the barrel for passing invisible infra-red days only. In other cases, ordinary white light is used. In operation, the light strikes the photocell which develops a potential across the cell terminals. This voltage is applied to the grid of the first tube and is bucked out by a bias voltage. When light no longer strikes the cell, the voltage is zero and the grid bias potential causes a decrease in the plate current, since the bias is more negative.

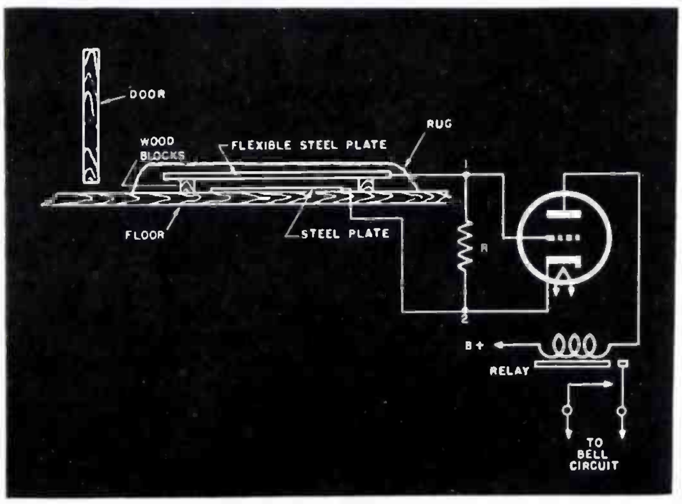



Fig. 3. A step-operated type of alarm system. Resistor *R* is usually of the order of 10 to 15 megohms. Shorting of the flexible steel plates by stepping on them shorts out the grid resistor, causes the plate current to rise, and actuates the relay.

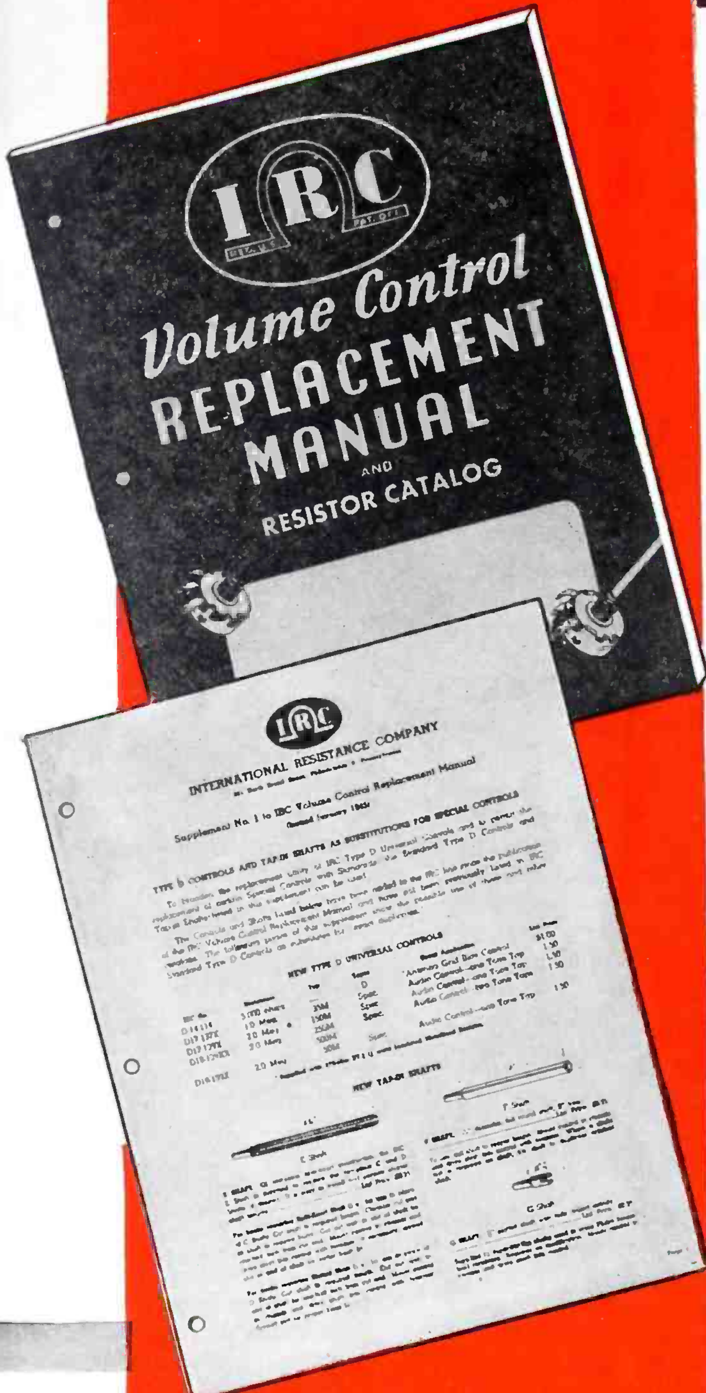
#### *Relay Activity*

The interruption of the light beam thus actuates the alarm system. That is, the drop in plate current, with an increased negative grid potential, causes less current flow in $R_2$ and a decreased voltage drop across $R_2$. Then, the increased positive potential on the grid of the second tube causes a rise in plate current and the relay closes. A latching or lock-in arrangement may be used on the relay, so that

(*Continued on page* 38)

# IT'S A HUNDRED TO ONE YOU'LL FIND THE RIGHT CONTROL

## In IRC'S New CENTURY LINE




**HERE'S WHY...** In order to keep Servicemen supplied with the volume controls they require for a vast majority of their replacement needs, IRC recently introduced the "Century Line." Through concentration of manufacturing efforts on these carefully selected, one hundred controls you are assured sufficient quantities in a selection that will solve over 90% of your day-to-day service problems. All controls included in the "Century Line" are of the same high IRC quality for which the industry has always shown preference.

**HERE'S HOW...** To select the right control for the job at hand, look up the make and model of the set in the alphabetical listing in IRC's Volume Control Replacement Manual. Chances are you'll find the IRC control number listed right there. If however, an exact duplicate is called for, one further step is necessary. Look up the "J" number (exact duplicate) in Supplement No. 1. Directly opposite the duplicate part number you'll find the IRC "Century Line" number you can use for satisfactory replacement. It's as easy as that!

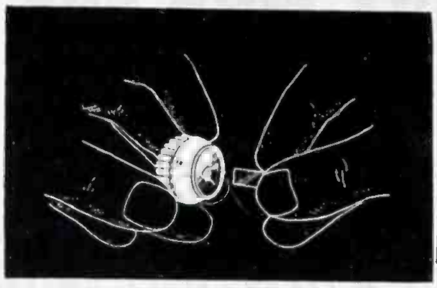
*If you do not have an IRC Volume Control Replacement Manual or a copy of Supplement No. 1 you can readily obtain one from your IRC Distributor—or by writing direct to Dept.*

PREFERRED FOR PERFORMANCE · FIXED & VARIABLE RESISTORS · IRC

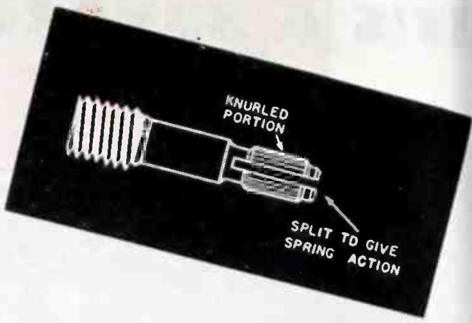
**INTERNATIONAL RESISTANCE CO.**

**401 N. BROAD STREET • PHILADELPHIA 8, PA.**

*IRC makes more types of resistor units, in more shapes, for more applications than any other manufacturer in the world.*



Figs. 1 (left) and 2 (right). Fig. 1. How the metal spacer is inserted in the knob against the flat spring in push-on type knobs requiring only a 1/32" flat. (*Courtesy P. R. Mallory & Co., Inc.*) Fig. 2. Split-knurl type shaft that makes a set screw or spring in the control knob unnecessary.




# VOLUME AND TONE CONTROL RESISTORS

**Part Nine of a Series on Receiver Components**

**by ALFRED A. GHIRARDI**
**Advisory Editor**

VOLUME and tone controls have, in part, reached standardization of certain mechanical dimensions. In general, the tendency has been toward a reduction in overall size, particularly for automobile and midget receiver applications. Perhaps the greatest variance in the controls used as original equipment concerns the length of shaft and the method of fastening the control knob to the shaft.

### Control Shafts and Knobs

The knobs used on most of the home and portable receivers have been of two general designs, the *set-screw* type and the *push-on* type knob. The shaft diameter has (practically from the start) been ¼" in diameter and the bushing ⅜" in diameter, so from the replacement-control angle, the main problem involves the providing of a universal means which will allow the use of either the screw type or the push-on type of knob.

Provision of a *flat* on the shaft accommodates the screw type; it provides a secure mounting. The *push-on* type also utilizes a flat on the shaft, but in the design of such knobs two sizes have been developed, one which uses a shaft milled down 3/32" and one which uses a 1/32" milling. The former was extensively used in earlier receivers. The problem of making a universal line of home receiver controls has been met by one manufacturer by milling all shafts to 3/32". This covers the majority of *push-on* type knobs and also accommodates the *screw* type. Then, for those cases which require a 1/32" milling, a small 1/16" metal insert or spacer is used on the deeper milling to bring it up to 1/32". This spacer is inserted in the knob, resting it on the flat spring member (as illustrated in Fig. 1) before assembling the knob to the shaft. When this assembly is pushed on the shaft, it provides a secure and simple method of application. The milled side of the shaft is turned to the downward position allowing the insert to remain in the proper location in the knob during assembly.

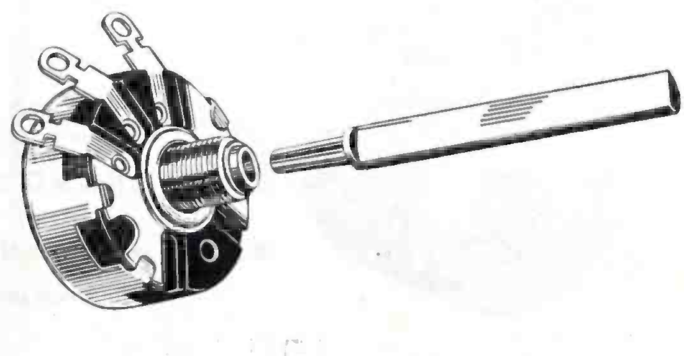
Split-knurled shafts and correspondingly knurled knobs also have become popular, especially in auto-radio receivers, because the spit gives a spring action and no additional set-screw or spring insert is needed in the knob. Furthermore, the knob can be pushed on the shaft in any relation to the sliding contact arm of the control. A split-knurled shaft is illustrated in Fig. 2. The knobs for split-knurled shafts will not fit the conventional flattened shaft.

### Plug-in Shafts

The *plug-in* type shaft is a recent innovation in universal shaft design. Such shafts are made in plug-in form to fit a special line of controls made by the particular manufacturer. The shaft is easily attached or detached to a special fitting in the bushing, and is held rigid. A recent shaft design employing a tapered plug-in portion is illustrated in Fig. 3; a complete line of plug-in shafts is illustrated in Fig. 4. With this entire set, the Service Man is sure of always having the right replacement control shaft at hand for nearly every job. For household receivers a kit comprising eight shafts (SS1, 2, 5, 16, 18, 22, 25 and 26) answers most needs. For automobile radios, a kit comprising twenty-two shafts (SS1, 2, 3, 4, 6, 10, 11, 12, 14, 15, 17, 19, 20, 21, 23, 24, 27, 28, 29, 30, 31 and 32) will meet all requirements.

Plug-in type shafts are becoming increasingly popular for the following reasons: (*1*)—They result in a tremendous increase in the flexibility of control applications, for only a few types of controls are required to service the large majority of receivers. Hence they reduce the stocking and inventory problem. (*2*)—They either replace the original shaft exactly, or they can be made into exact replicas by simply cutting to the required length.

Fig. 3. A recent design of tap-in (plug-in) shaft. (*Courtesy IRC*)



# more efficient ...in miniature

ACTUAL SIZE

The old quill was picturesque but it lacked the compactness, convenience and dependability of our modern fountain pen. Its development was the usual evolution. Changes and reduction in size made for greater efficiency. The same took place in the development of the modern miniature electronic tube.

While the reduced size of TUNG-SOL Miniatures alone warrants a preference for them, their greater efficiency has resulted in their general adoption, especially for high frequency circuits. Smaller elements make them more rigid. Shorter leads result in lower lead inductance. TUNG-SOL Miniatures have low capacity and high mutual conductance.

The many advantages of TUNG-SOL Miniatures will cause them to be used in much of the new equipment. It is important that TUNG-SOL Jobbers and Dealers are in position to supply miniatures as well as G-Gt's-metal and large glass tubes.

# TUNG-SOL

*vibration-tested*

**ELECTRONIC TUBES**

TUNG-SOL LAMP WORKS INC., NEWARK 4, NEW JERSEY

*Also Manufacturers of Miniature Incandescent Lamps, All-Glass Sealed Beam Headlight Lamps and Current Intermittors*

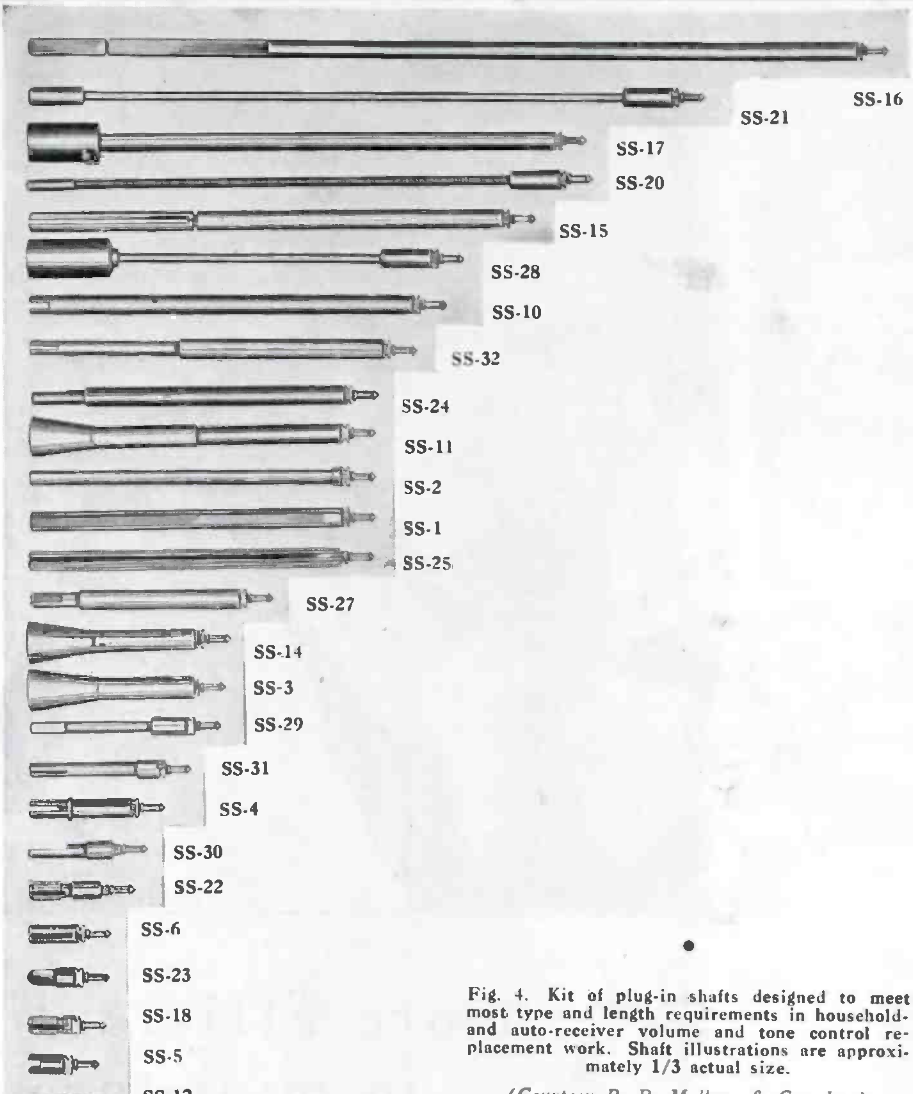
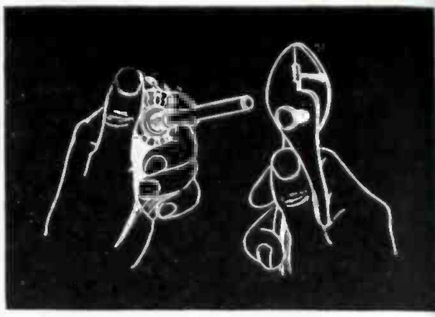



Fig. 4. Kit of plug-in shafts designed to meet most type and length requirements in household- and auto-receiver volume and tone control replacement work. Shaft illustrations are approximately 1/3 actual size.

(*Courtesy P. R. Mallory & Co., Inc.*)



A sharp tap is all that is necessary to drive the shaft into the control.

(*3*)—They speed up volume and tone control replacement in the many receivers in which other components are crowded against the back of the control. In such cases, the replacement control may be inserted in place *before* attaching the shaft, thus eliminating the necessity of first having to disconnect and remove nearby components from behind the control to provide sufficient space in which to work. (In such cases, if the defective control that is to be replaced is constructed so its shaft is not removable, it may be slipped out from a crowded place by first cutting off its shaft as close to the panel as possible by means of a hacksaw).

The length of shaft used on controls in receivers is a variable. It depends on the chassis mounting, thickness of the receiver panel, etc. This dimension varies from ½″ to 6″ or more, with the majority of controls having shaft lengths of 1″ to 1½″. To adapt a line of fixed-shaft replacement controls to all receivers, the shaft usually is made 3″ or 4″ in length. For the few receivers having longer shaft controls, extension shafts are obtainable. For shorter shaft controls the ordinary shaft (which usually is made from a special grade of aluminum or other fairly soft alloy) can be notched at the required length by means of a file or knife, as shown in Fig. 5, after which it can be easily broken, as shown.

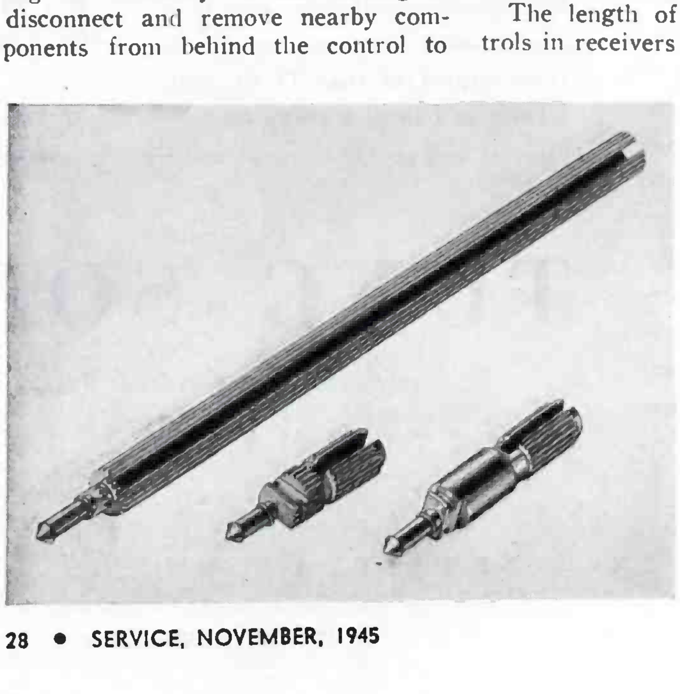
A set of knurled, plug-in shafts of three different lengths up to 4″, illustrated in Fig. 6, provide a flexible kit for plug-in shaft type replacement controls where a simple type of shaft is required. These may be cut to the required dimensions to make plug-in shafts of any desired shorter lengths.

### Clutch Type Controls

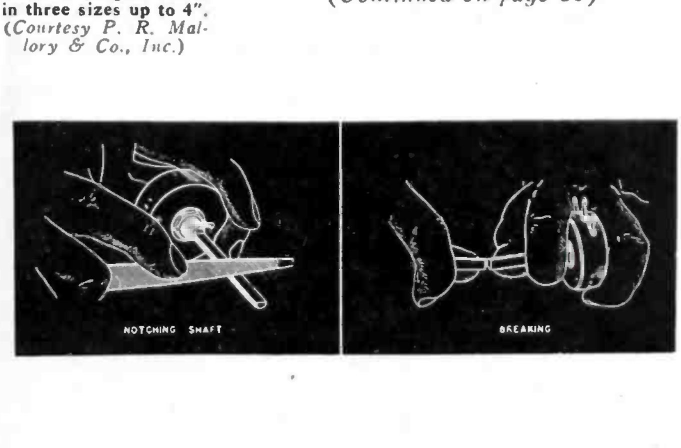
A large number of auto-radio receivers have been constructed with the *on-off* switch that is in or upon the control head located on the car instrument panel, instead of being attached to the volume control in the receiver, Fig. 7.

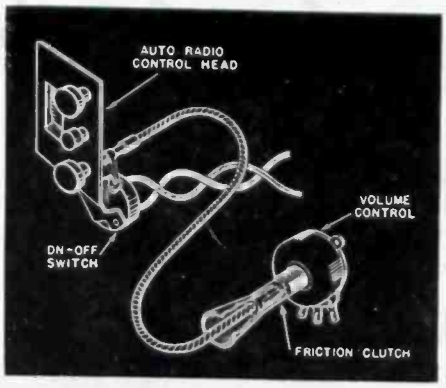
This arrangement requires a special type of control known as the friction *clutch type* because it contains a friction clutch which permits the shaft to

(*Continued on page* 30)

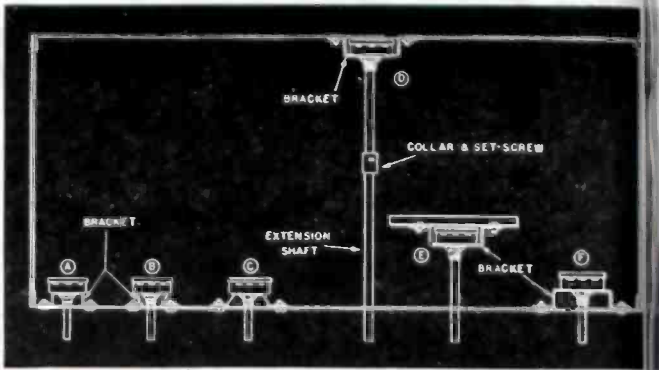


**Figs. 5 (below) and 6 (left). Fig. 5 Shortening a long shaft to the correct length. Fig. 6. Knurled plug-in shafts in three sizes up to 4″.** (*Courtesy P. R. Mallory & Co., Inc.*)






Figs. 7 (left) and 8 (right). Fig. 7. Application of special type controls having a friction clutch-drive arm which permits the shaft to slip. Used in auto sets. Fig. 8 illustrates the use of brackets for mounting volume and tone controls to front panel and sub panels; also the use of an extension shaft where an extra long shaft is required.
*(P. R. Mallory & Co., Inc.)*




slip in order to allow alignment of the contact arm of the control with the knob indicator on the tuning head so that the *on-off* switch operates at the correct postion. When installing a repaired or replacement control of this type, we must first install the control and insert the driving shaft; then the control knob is turned through its full rotation in both directions. The result is the proper alignment of the contact arm of the control with the driving knob so that the switch operates at the correct position.

Controls having this clutch feature are usually provided with a plain cover, but with a proper portion of the resistance shorted out, so the volume control does not begin to function until the switch has been operated.

Several clutch-type control shaft assemblies of the plug-in type and in different lengths for various models of auto-radio receivers are illustrated at SS-3, SS-14 and SS-11 in Fig. 4.

### Mounting Brackets, Extension Shafts and Bushings

Metal mounting brackets with slotted mounting holes are available to enable the Service Man to accommodate available replacement controls to most of the special methods of control mounting which are found in some radio chassis, or for attaching the controls to special mounting brackets provided on the receiver chassis. Fig. 8 illustrates several ways of using such brackets.

A narrow bracket may be used, as shown at *A*, *B*, and *C*, where the control is to be fastened to the panel by means of two screws instead of by its bushing. In arrangements *B* and *C* the bracket is simply bent so that the spacing between the centers of its mounting-screw holes will be the same as that of the holes already in the receiver panel.

Illustration *D* shows the use of a longer mounting bracket, and an extension shaft with its collar and setscrew, when the control is to be mounted to a panel behind the front panel of the receiver. Notice the inverted position of this longer bracket.

In *E* we see the same type of mounting where however the shaft of the control is long enough to make the use of an extension shaft unnecessary. The mounting bracket can be used in the same way as in illustration *F*, if more convenient.

In some types of receivers, particularly auto-radio and communications-type receivers, many parts are mounted by means of such brackets, so some should be included in the Service Man's kit as a matter of convenience and to promote rapid replacement work.

Most controls employed as original equipment on receivers use a standard bushing ⅜" long. This has been adopted as standard by the RMA standards committee. Accordingly, a standard ⅜-32 bushing, ⅜" long is supplied on most commercial replacement controls.

In a few cases it is necessary to mount replacement controls on extr thick panels. To accomplish this at minimum cost, hex-type shoulder nu are available as accessories to the co trol and are sold separately. In usi these hex-type shoulder nuts, it necessary to enlarge the hole in t panel slightly by reaming it. Th these nuts are screwed on over t standard bushing; the regular flat n supplied with all controls is not use

### Wire-Wound/Composition-Element Control Applications

Two broad types of volume contr are in general use . . . the compo tion-element or so-called *carbon* typ and the *wire-wound* type[1]. The forme ly popular applications of volume co trols in cathode and voltage-supply ci cuits required controls having fair low resistance but a definite curren carrying capacity. Thus wire-wour controls were mostly employed in su circuits. However, the increasing popular practice of using a volun control that controls the audio circui in avc receivers, calls for a high-r sistance type control which is not r quired to dissipate much power.

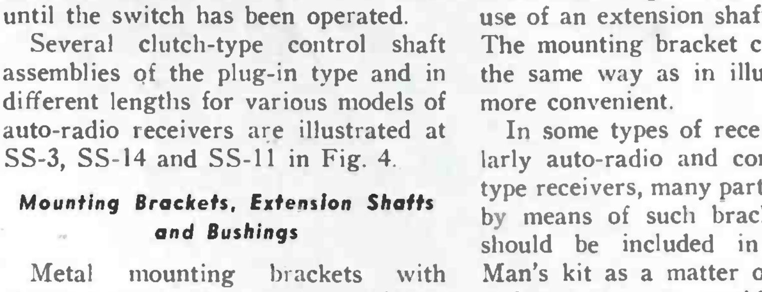
Because it is possible to manufactu the carbon-type control in a great resistance range and flexibility in t matter of resistance taper[2], it is t type most used for such control ci cuits today, especially when intrica resistance tapers are required.

It is obvious that both types hav a definite receiver application. It ca not be said that either one type c another is best for all purposes, fo each has distinct advantages and dis advantages. Consequently, each typ of control is limited in its applicatio to the circuits or conditions requirin the particular advantages of its typ

### Substituting Controls

Although volume- and tone-contro manufacturers offer both types of con

*(Continued on page 61)*



High-voltage insulating coupler applied to control that must be used in high-voltage circuits such as in television, c-r oscillographs, etc.
*(Courtesy Clarostat Mfg. Co., Inc.) [Additional data on these couplers will appear in next month's installment.]*

[1]See *Part 6* of this series, August 194 SERVICE.

[2]See *Part 7* of this series, September 194 SERVICE.

# WELDING GLASS TO METAL
# "COULDN'T BE DONE"...


## ... but here it is!

If you want to have a look at the Capacitors and Resistors of tomorrow, step in and see what has been going on in the Sprague Engineering Laboratories (if wartime restrictions would permit!). Then it will be easy to understand why Sprague has been a FIVE TIME WINNER of the coveted Army-Navy "E" Award!

A typical example is the Sprague Electric Co. glass-to-metal seal. This amazing development answers the old problem of sealing Capacitors and Resistors against leaks and moisture, guarding them against shock—and doing it without the use of glass bushings or adjacent metal rings with "matched" temperature coefficients of expansion. Actually, there were many "scientific" reasons why glass could not be fused to metal—but Sprague not only proved that it could be done, but done economically and in tremendous quantities.

This sort of accelerated wartime engineering is reflected throughout the entire Sprague line—and that means unsurpassed quality for every unit used on every day radio work!

### THE TRADING POST CONTINUES!

Sprague's famous free buy, sell, or exchange advertising service "THE SPRAGUE TRADING POST" appears on page 6 —of this issue—and will continue to appear as long as wartime shortages create a need for it. Meanwhile, we'll appreciate it if you continue to use Sprague Capacitors and Koolohm Resistors—and to ask for them by name!

**SPRAGUE PRODUCTS COMPANY, North Adams, Mass.**

*(Jobber Sales Organization for Products of the Sprague Electric Co.)*

# SPRAGUE


**CAPACITORS FOR EVERY SERVICE, AMATEUR AND EXPERIMENTAL NEED**

# SUPERHETERODYNE

# MIXERS

by MARTIN W. ELLIOTT

*[Part Two]*

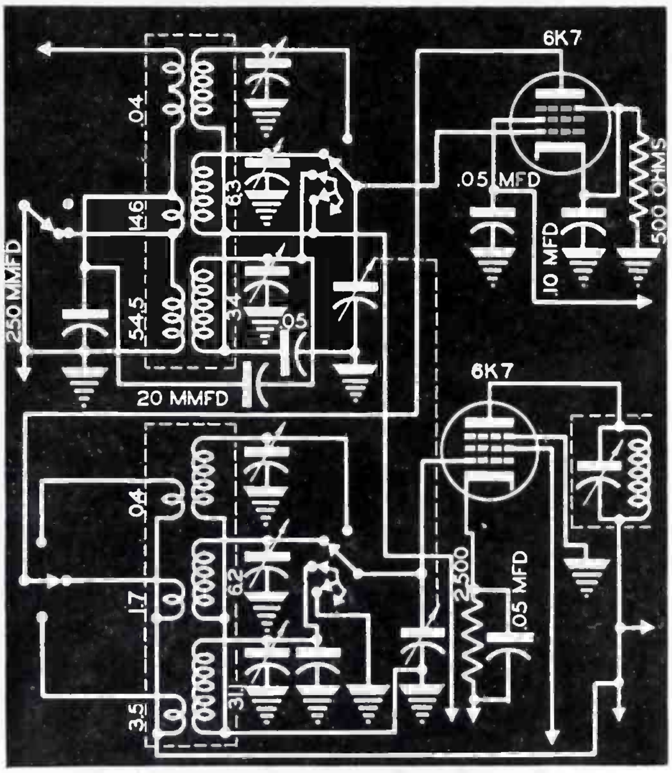
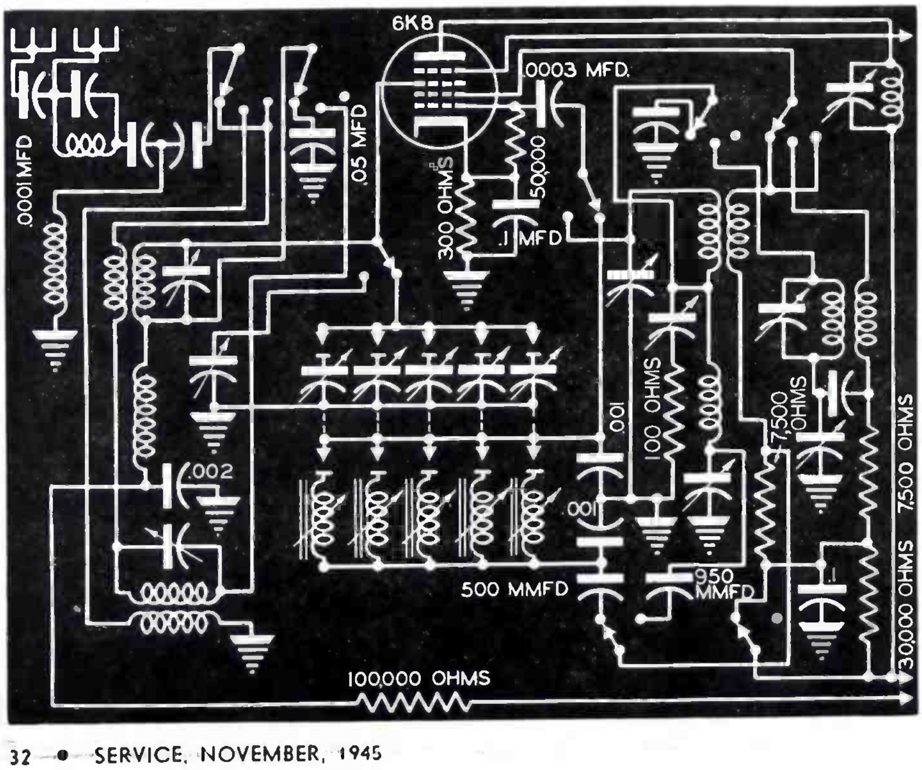



Fig. 11. Mixer circuit of the Ward 62-262. Here, a separate oscillator, not shown, is used. Coupling to the mixer tube is accomplished by tying the oscillator plate to the mixer screen grid.

Fig. 10 (below). Mixer circuit of the Lafayette C-37. A Colpitts-type oscillator is used to simplify the wiring, since only two terminals are required. Note the d-p-d-t switch used to change from manual to automatic tuning.




THE mixer of a 3-band receiv Lafayette C-37, using a 6K8, shown in Fig. 10. Provision made for long and short antennas, 456-kc i-f wavetrap, a shunt r-f cho isolated by two capacitors and pus button automatic tuning with capacit tuning for the signal frequency, a permeability tuning for the oscillat frequency. A 300-ohm cathode resis and 50,000-ohm grid leak provide t biasing. A Colpitts oscillator circ with the grid at one end of the coil a the plate at the other end, and t cathode at the potential of the cent of the coil by virtue of two .001-m capacitors affords a convenient ty circuit because only two coil termina are required. The grid is connect through a large .0003-mfd grid cap citor, while the plate is connect through a .0005-mfd capacitor. Th is called a shunt-feed system. A 5( 000-ohm leak is connected between t grid and cathode. Manual to au matic tuning is controlled by a d-p-d switch.

### Capacitor-Tuned Oscillator Contro

The capacitor-tuned oscillator us in the manual position is also unco ventional. On the s-w position show the grid is connected to the top of th oscillator-tuned circuit. The plate connected through a tickler coil and .00075-mfd capacitor to the opposi end of the tuned circuit. The junctio of the two coils in the tuned circu is connected to ground through trimmer and 100 ohms, also through switch to ground through a .0065-m capacitor, virtually shorting the low coil. On the police band the low coil is shunted by a grid coil of second oscillation transformer. Th

*(Continued on page 39)*

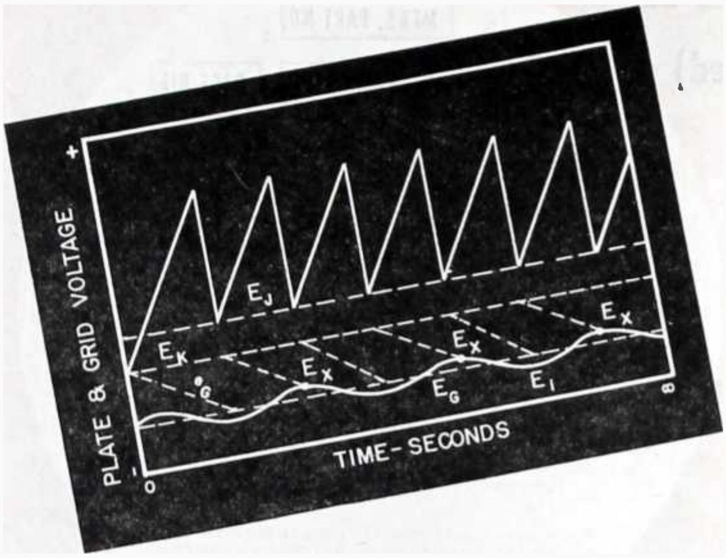



Fig. 1. Graphical synchronization of the linear time-base oscillato system. The critical grid voltage $C_g$, at which the thyratron con ducts, is proportional to the plate-to-cathode voltage $E_p$. Thus when the timing capacitor voltage, which is the thyratron plat voltage, is near a maximum value, the signal voltage component E exceeds the critical grid-to-cathode voltage level. This conditio occurs at the critical grid voltage level $E_x$, and the thyratro relaxes the capacitor charge synchronously with the arrival of th maximum positive potential level of the signal voltage.

# C-R OSCILLOGRAPHS

## SERVICING...APPLICATIONS...

[Part Five of a Series]

by S. J. MURCEK

WHERE the oscillograph is utilized to provide a visual analysis of voltage variations, under the condition that the linear time-base oscillation system is not synchronized to oscillate in phase with the frequency of the variation under observation, the image appearing on the screen appears to be in continuous motion. This condition results from the existence of the heterodyne or beat frequency which is developed between the frequency of the voltage under analysis and that of the linear time-base system output.

In order that the waveform appearing on the screen be stationary, it is imperative that the frequencies of the incoming signal voltage and of the linear time-base oscillator synchronize perfectly. Thus, if the image or waveform which is written on the screen varies in exactly the same pattern with each positive motion or sweep of the electron beam, the image of the waveform is written on the screen in exactly the same manner with each succeeding sweep. If, however, the subject waveform occurs earlier in each of the succeeding sweeps of the electron beam, the waveform written on the screen is altered in position with each sweep. Moreover, since the waveform is recurrent earlier in each charging of the linear time-base timing capacitor, the resulting image of the waveform on the electron screen appears to *move* to the *left*. Again, if the waveform should occur later in each positive motion of the electron beam, a similar alteration of the wave image position obtains, and the image appears to move to the *right*.

As a direct consequence of the definite motion which is imparted to the wave image written on the screen by the beat which is present between the two frequencies, it becomes possible to determine accurately the frequency of the voltage variation which is under visual analysis. This, if the motion of the written image is in a left hand direction, the frequency of the signal voltage is greater than that of the linear time-base oscillator. Conversely, if the image motion is in a right hand direction the signal voltage frequency is less than that of the linear time-base oscillator. Zero beat, or synchronization of the two frequencies, occurs when the image is stationary.

For wave- or voltage-variation analysis, it is essential that the image remain stationary. This, in turn, requires that the oscillation of the linear time-base oscillator occur in exact synchronism with the voltage variation which is under analysis. Commercial oscillographs are, therefore, provided with suitable means for the necessary synchronization of the linear time-base system and the signal voltage frequencies. In all of these oscillographs, the synchronization is usually effected through the modulation of the linear time-base relaxation tube grid bias potential by a portion of the voltage variation.

The synchronizing system utilized in the du Mont 164E oscillograph is shown in the circuit diagram, Fig. 2. Here, the voltage which is under observation is impressed across the synchronization system input terminals *H* and *G*. Since the capacitance of the dynamic coupling capacitor $C_{12}$ is large, and the resistance of the *synchronization* potentiometer $R_8$ is high, the voltage variation impressed across the input terminals *EXT* and *G* appears, in the greatest part, across the resistance element of the synchronization control potentiometer. Further, since a portion of this potential appears between the slider arm and the grounded terminal of the synchronization control potentiometer, and is thus directly in series with the control grid of the *2B4* thyratron, together with the grid current limiting resistor $R_{28}$, a part of the signal voltage variation is effectively in series with the thyratron control grid-to-cathode bias potential, the latter maintaining the thyratron control-grid negative. Hence, each positive alternation of the signal voltage effects a reduction of the negative grid-bias voltage present between these electrodes.

The effects of the signal-voltage modulation of the *2B4* grid-to-cathode potential are evident from the graphical illustration of Fig. 1. Here the


Here's your big, profitable tube market!
—the millions of radio owners who
HEAR
G-E programs on the air
READ
G-E magazine advertising
USE
G-E lamps and appliances
These people all are G.E. conscious. In
7,000,000 homes they listen to programs
featuring General Electric tubes and radio
sets. National magazines with a total circu-
lation of 30,000,000 give them a similar
message. And everywhere they see the fa-
mous G-E monogram on lamps, refrigera-
tors, ranges, electric irons, and other home
appliances.
YOU can profit from this big, hungry
market by selling G-E radio tubes. Arrange
now for a sharp increase in your tube busi-
ness in the months ahead. Write for infor-
mation about G-E tube selling rights to
Electronics Department, General Electric
Company, Schenectady 5, N. Y.
Electronic TUBE
MADE IN U.S.A.
30
Hear the G-E radio programs: "The World
Today" news, Monday through Friday,
CBS. "The G-E All-Girl Orchestra," Sun-
day, NBC. "The G-E House Party," Mon-
day through Friday, CBS.
GENERAL ELECTRIC
176-05-8850

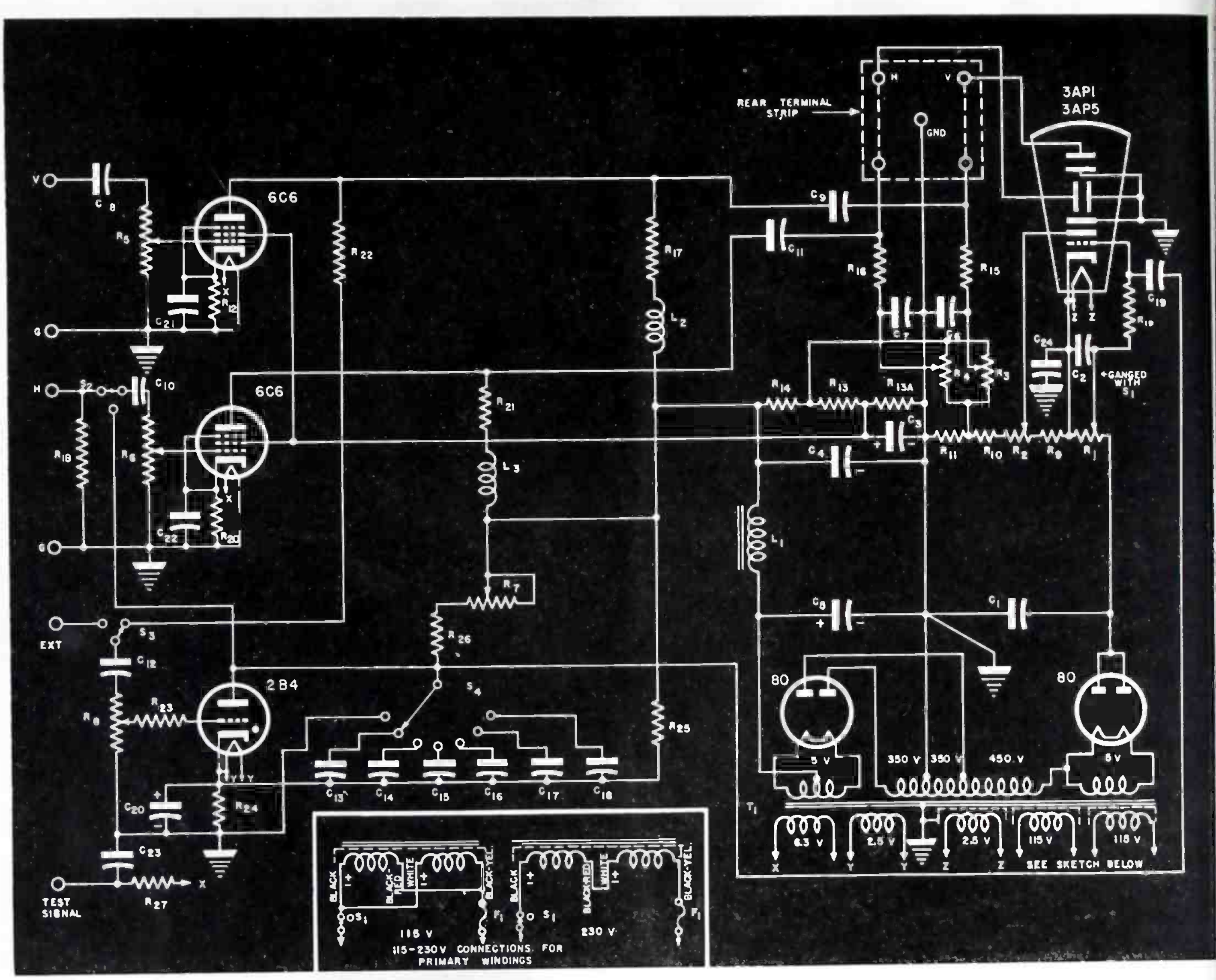



Fig. 2. Circuit of Du Mont 164 E oscillograph.

relations of the various voltage variations occurring in the synchronized linear time-base oscillator operation are plotted with respect to the *2B4* cathode potential level $E_k$. The d-c component of $E_c$, which is negative, is shown to be modulated by a portion of the signal voltage variation $E_i$. Since the critical grid potential $E_g$ is increasingly negative with each increase of the plate-to-cathode potential, $E_p$, and the latter increases directly in proportion with the charge on the timing capacitor, the positive variations of the grid-to-cathode control voltage eventually exceed the critical voltage $E_x$. Thus the control grid of the thyratron is effectively positive and becomes conductive, at which instant the tube relaxes the charge on the timing capacitor. Therefore, when the linear time-base oscillation circuit is so adjusted that the frequency of the relaxations is near that of the signal voltage, as we see in Fig. 1, each relaxation must occur in synchronism with each positive alternation or peak of the signal voltage.

Further study of Fig. 1 indicates that thyratron breakdown and the relaxation of the charge on the timing capacitor occur when the signal voltage attains its maximum positive crest, under the condition that the signal voltage wave is of sine wave form. Since the maximum positive voltage level in any sine wave alternation occurs 90° after the inception of the cycle, the relaxations of the linear time-base capacitor charge occur 90° out of phase with the signal voltage variation. The wave image written on the screen is consequently initiated at the maximum positive potential level in its pattern.

Studying the circuit of Fig. 2, we note that the signal voltage variation required for the synchronization of the linear time-base oscillations is obtained either from the plate circuit of the vertical amplifier, or from the external signal synchronizing voltage source, available through the input terminals *EXT* and *G*. A convenient switch, $S_3$, is provided to connect the ungrounded terminal of the synchronization control potentiometer, $R_8$, to either voltage source. The series resistor, $R_{22}$, connected between the *INT* contact of the switch $S_3$ and the plate of the vertical amplifier pentode prevents excessive loading of the vertical amplifier plate circuit by the linear time-base synchronizing input circuit. Only a very small portion of the vertical amplifier output voltage is necessary to effect satisfactory synchronization of the two frequencies.

In general, modern electronic apparatus is designed for synchronous operation from low-frequency commercial power sources. Hence, synchronization of the horizontal sweep frequency in the oscillograph with that of the voltage variations usually encountered in industrial electronic apparatus, is most effectively accomplished through a linear time-base synchronization circuit connected directly to a voltage source of the same frequency. This type of operation is especially important where the phase relation of the voltage variation under observation to that of the source voltage wave must be ascertained, inasmuch as such phase relationships are not evident when the synchronizing system is activated by the plate circuit of the vertical amplifier.

Where the synchronization of the

linear time-base frequency to that of the voltage under study is accomplished by exciting the plate circuit of the vertical-amplifier pentode, relaxation of the timing capacitor charge must always occur at the maximum positive voltage level attained by the amplified signal voltage.

Thus, if the maximum positive voltage crest occurs when the vertical-amplifier output voltage is completely out of phase with that of the voltage source wave, the linear time-base capacitor relaxations occur at the maximum positive peak of the *amplifier output voltage* and are, therefore, completely out of phase with relation to the source voltage wave. Further, if the phase position of the amplifier positive peak voltage swing varies with relation to its initial position, the linear-time base capacitor relaxations must also vary in phase position, and the wave image written on the screen shows no resultant motion. This factor is of great importance where the signal voltage is, for example, the a-c component of a phase-controlled rectifier grid-to-cathode control potential, where the phase position of the a-c component must be shown to vary directly with the operation of the phase-control potentiometer.

When it is necessary to synchronize the oscillograph horizontal sweep voltage with that of the line frequency, or that of the source, it is only necessary to connect the terminal, *test signal,* to that marked *EXT,* and to operate the switch, $S_3$, to the *EXT* position. Then the horizontal sweep voltage will be synchronized with the a-c or source voltage frequency, at a 90° phase lead angle. When the oscillograph is operated with this form of horizontal frequency synchronization, application of the input voltage results in the development of a wave image which is initiated at the *positive* zero voltage inflection of the sine voltage wave. The maximum positive crest of the signal potential is shown clearly as a positive peak or cusp in the screen image. Moreover, if the phase position of the signal voltage wave with relation to that of the source voltage wave is varied, the extent of the variation is clearly visible in the motion of the screen image.

Where the oscillograph is operated from a stable voltage source, the voltage present across the phase-shifting capacitor, $C_{23}$, may be readily utilized to calibrate the vertical deflection system. The calibration is accomplished through connection of the capacitor terminal, *test signal,* to the vertical amplifier input terminal, *V,* and the subsequent adjustment of the vertical gain control to such a position that the height of the vertical motion of the luminous spot on screen is twice the division number.

The horizontal voltage sweep-frequency range is arranged for operation over a frequency range extending from a low frequency limit of approximately 12 cps to a high-frequency limit approaching 50 kc. Since this extended range cannot be practicably arranged in a circuit comprising a single capacitor and a single variable resistor or potentiometer, a multiplicity of capacitors, $C_{13-14-15-16-17-18}$, of various capacities are used, together with a *vernier frequency* control potentiometer, $R_{20}$, and range selector switch, $S_4$. Each of these capacitors is so selected that the frequency ranges covered appreciably overlaps the ranges covered by the capacitors adjacent to the former. It should be observed here that the shield terminal of each capacitor is common with the cathode of the relaxation thyratron, and that the maximum potential which is developed across these capacitors is relatively low in level. Further, because of the low-capacitor operational potential, the charge stored is correspondingly low, necessitating the application of high capacitances in the lower-frequency ranges.

It is the horizontal deflection system, together with the linear time-base oscillator, which must be generally depended upon to effect the writing of recognizable waveforms on the screen. Where the signal input or dynamic voltage variation applied to the input terminals of the vertical deflection amplifier is subject to sporadic disturbances or interruptions, the continuous horizontal motion of the beam, effected by the linear time-base oscillator and the horizontal deflection amplifier, prevents accidental damage to the screen which would result with a stationary luminous spot. Hence, before any cathode-ray oscillograph is placed into actual operation, it is prudent to be sure that the beam will be in motion when the cathode of the tube reaches operating temperature.

In the du Mont unit of Fig. 2 the *intensity* or beam control is ganged with the primary or power input control switch, $S_1$. Thus, when the unit is placed into operation, it is only necessary to partially turn the intensity control to the a-c line control switch, $S_1$ to the *on* position. The slider arm is then placed so that the grid is maintained quite negative. This prevents further development of an electron beam during the period in which the tube heaters rise to operating temperature. Then, it is necessary to see that the horizontal amplifier input control switch, $S_2$, which is usually ganged with the linear time-base *coarse-frequency* control switch, $S_4$, is in the linear sweep position, if no other form of horizontal deflection potential input is to be used. In this way we can be sure that the beam will be in motion when the beam is permitted to strike the screen.

Since the first plate, or accelerating electrode, is effective in the development of the beam, it is necessary to turn the *focus* control potentiometer knob a complete half-turn in a clockwise direction. The *vertical* and *horizontal* positioning controls determine the normal or *idle* position of the electron screen pattern.

The length of the horizontal sweep pattern is governed by the amplification level at which the horizontal amplifier operates. Inasmuch as no actual deflection of the electron beam occurs if this control is left in the minimum or zero position, it is advisable to advance the horizontal or *X* axis amplifier gain control, in a clockwise direction, at least to the 50% dial position. At this time, the intensity control may be advanced in a clockwise direction until a visible green trace is written on the screen. The intensity of the luminous trace is then carefully adjusted to the desired level or brightness, and focussed to the desired clarity, by manipulation of both the intensity and the focus control potentiometers. Here, it may be found that the horizontal sweep voltage causes the written trace to extend beyond the edges of the electron screen area, causing a visible parasitic glow at either of its extremities. This condition is corrected by appropriate reduction of the horizontal amplifier gain. The final position of the trace may be brought to the geometric center of the screen by the proper manipulation of the vertical and horizontal positioning controls. In the instance of the vertical control, the screen pattern moves *upward* when the vertical control is turned in a clockwise direction, and, in the instance of the horizontal control potentiometer, the pattern moves to the *right* when the control is turned in a clockwise direction.

Under the condition that the controls are in the position just described, the pattern written on the screen will be a short, straight line. If, at this time, an a-c potential is applied to the input terminals *V* and *G* of the vertical amplifier, and the vertical gain control is advanced slightly, the beam will be subjected to deflection voltages which operate at a right angle with respect to each other. Briefly, the vertical deflection is perpendicular to the horizontal deflection. The pattern written on the screen is reformed into rectangular coordinates, the actual

(*Continued on page* 52)

# ELECTRONIC ALARMS

*(Continued from page 24)*

once it is tripped it remains closed until opened manually. $R_4$ limits the plate voltage on tube *2*, so that the plate current will not be too high for the positive grid condition of operation.

Although circuits of this kind can be developed experimentally, it usually is better to purchase commercially manufactured products which have had the kinks removed.

Another type of alarm control is shown in Fig. 2.* The operation is very simple. The oscillator may be tuned to a fairly high frequency, perhaps 7000 kc. If a small change in capacity occurs in the grid circuit, the oscillator plate current will change. Adding capacity to the grid circuit causes a decrease in the operating frequency, which, in turn, causes the oscillator plate current to rise. This increase in current may be sufficient to cause the closing of a sensitive relay in the plate circuit of the oscillator tube. When the relay contacts close, an external bell system circuit is set in operation, giving the alarm.

In this circuit, $C_1$ is a small capacitance to limit the detuning effect. $L_1$ and $L_2$ represent the oscillator coil, the lower section $L_2$ serving to provide inductive coupling between grid and plate circuits and develop oscillations. $C_2$ the tuning capacitor to set the frequency of operation. $C_3$ and $R_1$ are the usual gridleak and capacitor, and $C_4$ is a plate circuit r-f bypass capacitor which keeps the plate-circuit impedance low in value, and aids oscillation.

In a typical installation the pickup wire would be connected to the object to be protected. If the object were a safe, it would be insulated from the ground by rubber pads and serve as the pickup wire. Anyone coming near the safe would upset the capacity of the circuit and detune the oscillator, setting off the alarm. Anyone approaching a door or window where the pickup would be located would also cause the alarm to be set off.

Another type of alarm is shown in Fig. 3. Two metal plate electrodes are used. Normally, they are separated, but when anyone exerts pressure on them the plates touch and the alarm is set off. Once the alarm is set, the relay stays closed, due to a locking arrangement, until turned off manually. Normally, with the plates not touching, the grid circuit of the tube is open, since *R* may have a value of 10 or 15 megohms. Closing the grid circuit causes the plate current of the tube to rise and the relay swings into operation, causing the alarm to go off.

Thin steel plates are probably the best to use, for they are quite tough and flexible.

Electrically, the steel is not very conductive, but since the resistance can be fairly high and still permit efficient operation of the tube this is no particular disadvantage.

Alarm circuits may also be devised to actuate cameras. The cameras may be concealed in the walls. The relay contacts are simply connected in series with a flashbulb circuit using a couple of dry cells to set off the bulb. The shutter on the camera can be left open. The speed of the flash explosion is sufficient to catch the action without using intricate timing arrangements.

*Some of these circuits are covered by patents and cannot be duplicated for sale to others.

## MIXERS

(*Continued from page* 32)

plate is switched to the tickler of the second transformer. On b-c both the coils of the first transformer are used in series. The plate voltage is increased for automatic tuning by shorting a 30,000-ohm series resistor in the *B* supply.

### Ward 62-262

A complex mixer system with a tuned r-f stage, 3-gang capacitor and a separate 6C5 triode oscillator, Ward 62-262, is shown in Fig. 11. This model uses 6K7s for both r-f amplifier and mixer. Three bands are covered; 148 to 380 kc, b-c and s-w. The antenna transformer has three primary coils in series with a shorting switch for the l-f and b-c primaries, as well as a .00025-mfd capacitor across them. A 20-mmfd coupling capacitor links the b-c primary and the l-f secondary for additional l-f coupling. A separate secondary is used for each band with a combination selector and shorting switch for wavechanging. The interstage transformer is similar except that the r-f amplifier plate is switched to individual primaries.

The oscillator transformer uses separate cathode ticklers for l-f and b-c and a combination of cathode-tapped Hartley and plate tickler for s-w. The mixer tube is excited by cathode-to-cathode coupling through a bias resistor of 2500 ohms and its .05-mfd bypass. The oscillator plate is also directly connected to the mixer screen. The plate is at ground potential at l-f and b-c but is *hot* on the short-wave band because of the plate tickler. Therefore, this tie to the screen constitutes an additional source of excitation. In some receivers with a separate oscillator, supplementary short-wave coupling is supplied to the signal grid. Still other sets use magnetic coupling between oscillator and converter by winding the coils on the same coil form.

•

### VIDEO WINDOW DISPLAY


**One of a series of five window displays used by Gimbels-Philadelphia to promote the RCA intra-store television demonstration being staged by Gimbels.**

*You've Made Money on Radio Sets, Parts, Service, RCA Tubes—*

# NOW YOU HAVE A NEW OPPORTUNITY WITH RCA RADIO BATTERIES—

## The Batteries That Are Radio-Engineered For Extra Listening Hours!


RCA Radio-Engineered Batteries for All Types of Sets...and a Complete Line of RCA Dry Batteries.

"RCA All The Way" means even more today—for the new RCA battery line is a volume builder that can't be beat! The battery line ties in perfectly with other RCA products you sell...whether it be tubes, parts, radio sets, or your own service.

**Small Inventory**—In RCA radio batteries you get a high-volume line of merchandise that can be handled on a small inventory. The RCA battery line has been streamlined—only 35 types enable you to replace batteries in 99% of all battery-operated sets, both portable and farm types.

**Customer Acceptance**—Radio-set owners respect the name RCA. They know it represents a quarter of a century of radio experience

**National Advertising Keeps RCA Products Moving**—Your RCA products—including batteries—benefit from all of RCA's continuing national advertising. Top-flight sales-promotion ideas are developed to keep your RCA products moving in a steady stream from factory to your customers. Counter displays, booklets, catalogs, and many other items, will be made available to you to help sell RCA batteries.

Get in touch with your RCA tube distributor *today*. Let him help you get on the RCA battery bandwagon of profit.

**MAIL THIS COUPON TODAY!**

Dear Mr. RCA Tube Distributor:

I'm interested in increasing my battery profits by handling the new line of RCA *Radio-Engineered* batteries. Please mail me all details of the RCA battery plan as soon as possible.

Name..............................................

Company..............................................

Address..............................................

City.................................State..............

62-6736-107

*Listen to* "THE RCA SHOW," Sunday, 4:30 P. M., EST, NBC Network

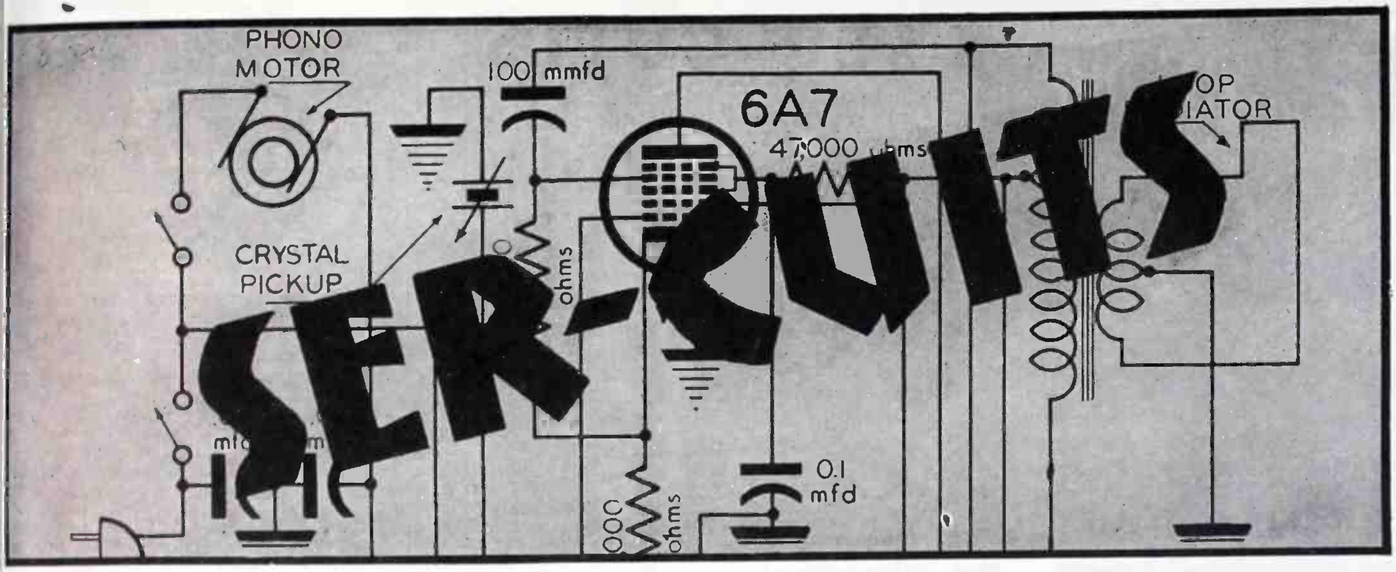
BUY BONDS

RCA

**RADIO CORPORATION OF AMERICA**

TUBE DIVISION • HARRISON, N. J.

LEADS THE WAY... In Radio... Television... Tubes... Phonographs... Records... Electronics

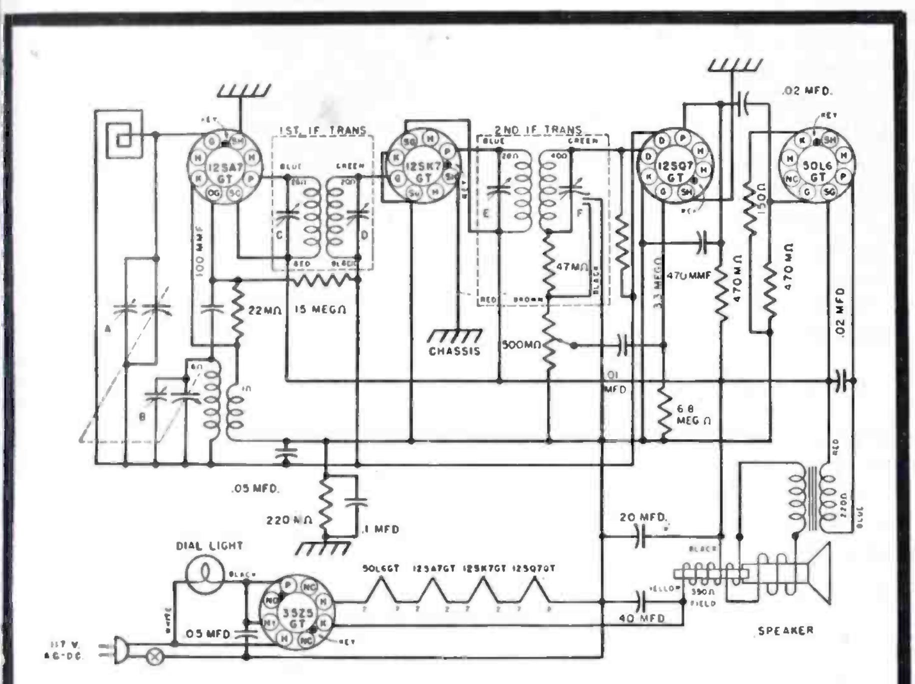



THE postwar receivers, long anticipated, have now begun to come off the production line. From the circuits of several of the models, just received, we find that quite a few interesting features have been included.

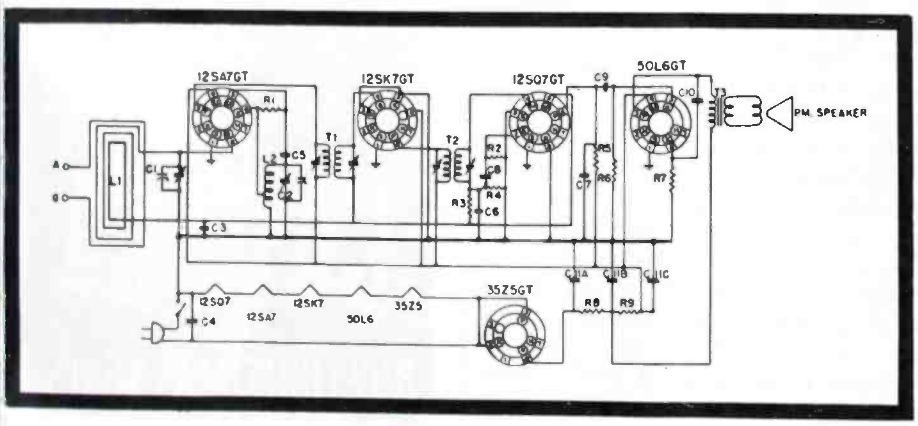
**by HENRY HOWARD**

In Fig. 1 we have a Detrola postwar a-c/d-c 4-tube and rectifier unit, model 571. One of the features of this model is a fixed bias for the avc bus. This may be considered delayed avc and is obtained from the rectified grid voltage developed by a 12SA7 oscillator across a 22,000-ohm grid leak. Since this voltage is usually of the order of 5 volts, it is necessary to reduce it considerably. This is done by a 15-megohm resistor. This resistor also serves as a filter in cooperation with a .05-mfd bypass capacitor. The filter is required to keep oscillator r-f out of the avc system.

The oscillator uses a cathode-type tickler circuit. Chassis is connected to the *B*-supply through a 0.1-mfd capacitor and 0.22-megohm resistor in parallel. A 350-ohm series field speaker supplies the only series filter element; no resistors are used in the power supply.




**Figs. 1 (above) and 2 (below). Fig. 1. Detrola 571. Fig. 2. Meck Industries RC-5C5. List of parts at right.**




### Meck RC-5C5

In Fig. 2 appears a Meck Industries postwar loop receiver, model RC-5C5. Provision for an external antenna is also provided in this model. The oscillator is a grounded-plate hot-cathode type Hartley. To afford a negative bias one of the 12SQ7 diodes is directly connected to the avc bus. The 150-ohm bias resistor of the 50L6 power tube is not bypassed.

A p-m speaker is used, necessitating a two-section resistance filter consisting of 200 ohms and 1,000 ohms, the

(*Continued on page* 42)

| Circuit Symbol | Description | Model |
|---|---|---|
| C1, C2 | Condenser-Variable, with pulley | RC-5C5 |
| C1, C2 | Condenser-Variable, with pulley | RC-5C5-A |
| C1, C2 | Condenser-Variable, with pulley | RC-5C5-B |
| C1, C2 | Condenser-Variable, with pulley | RC-5C5-C |
| C3, C4, C10 | Condenser-Paper, 0.05mfd. 400V | All |
| C5 | Condenser-Mica, 0.00005mfd. | All |
| C6, C7 | Condenser-Mica, 0.00025mfd. | All |
| C8, C9 | Condenser-Paper, 0.01mfd. 400V | All |
| C11A, C11B, C11C | Condenser-Electrolytic 20/20/20 mfd 150V | All |
| R1 | Resistor-Carbon, 20,000 ohms ½ watt | All |
| R2 | Resistor-Carbon, 10 megohms ½ watt | All |
| R3 | Resistor-Carbon, 2 megohms ½ watt | All |
| R4 | Control-Volume, with switch, 1 megohm | All |
| R5 | Resistor-Carbon, 250,000 ohms ½ watt | All |
| R6 | Resistor-Carbon, 500,000 ohms ½ watt | All |
| R7 | Resistor-Carbon, 150 ohms ½ watt | All |
| R8 | Resistor-Carbon, 200 ohms ½ watt | All |
| R9 | Resistor-Carbon, 1000 ohms ½ watt | All |
| L1 | Antenna-Loop, | RC-5C5, A, B, |
| L1 | Antenna-Loop | RC-5C5-C |
| L2 | Coil-Oscillator | RC-5C5, A, B, |
| L2 | Coil-Oscillator | RC-5C5-C |
| T1 | Transformer-1st I.F. | All |
| T2 | Transformer-2nd I.F. | All |
| T3 | Transformer-Output | All |
| SPKR | Speaker-P.M. 6" round, less T3 | All |
| SPKR | Speaker-P.M. 6" round, with T3 | All |

# SER-CUITS

(*Continued from page 41*)

electrolytic being a triple 20-mfd capacitor.

### Detrola 568

A postwar a-c/dc 2-band receiver, Detrola, model 568, is shown in Fig. 3 (page 44). This model has an unusual bandswitch system. The signal grid of a 12SA7 is switched to either the short-wave or broadcast transformer. A supplementary 2.2-mmfd capacitor acts as a capacity coupling from antenna to grid, boosting the high-frequency end. In the circuit diagram the switch is shown in short-wave position. Here the antenna is connected to the short-wave primary through a .002-mfd capacitor, the primary circuit being completed through the bandswitch to *B* –. The same switch member also shorts the unused broadcast oscillator coil, completing the short-wave oscilliator circuit to *B* –. A third section of the switch connects the 12SA7 cathode to a tap on the short-wave oscillator coil, or to the cathode tickler of the broadcast coil.

A 150-ohm resistor is connected in series with a 100-mmfd grid capacitor. A 5100-mmfd padder is in series with the oscillator coils. Bias for the 50L6 is supplied by an unbypassed 150-ohm resistor. The chassis is connected to *B*- through a 0.1-mfd capacitor and 220,000 ohms, in parallel.

### Garod High-Fidelity Receiver

A prewar high-fidelity a-m receiver with several interesting design features is shown in Fig. 4 (page 44). This model has a variable bandwidth and separate low and high-frequency p-m speakers. The tuner and power amplifier are built on separate chasses, each with its own power supply. A 2-section 10-kc low-pass filter has been included. This may be switched into the audio amplifier between the tuner and power amplifier to minimize interference in the high-frequency audio range, including the 10-kc beat between adjacent channel carriers.

In the input is an iron-core antenna transformer, designed for a short antenna or a long antenna, in series with a .0001-mfd capacitor. A .006-mfd blocking capacitor prevents grounding the antenna. In the tuned secondary circuit is a 150-ohm series resistor. There is a similar 50-ohm unit in the tuned first detector circuit to broaden the response of these circuits for acceptance of an extended treble range.

A 6SA7 converter employs a 300-




**STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933**

Of SERVICE, published monthly at New York, N. Y., for October 1, 1945.

State of New York } ss.:
County of New York }

Before me, a Notary Public, in and for the State and county aforesaid, personally appeared B. S. Davis, who, having been duly sworn according to law, deposes and says that he is the Business Manager of SERVICE, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit: 1. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, Bryan Davis Publishing Co., Inc., 52 Vanderbilt Avenue, New York 17, N. Y.; Editor, Lewis Winner, New York, N. Y.; Managing Editor, F. Walen, Union City, N. J.; Business Manager, B. S. Davis, Ghent, N. Y., 2. That the owners are: Bryan Davis Publishing Co., Inc., 52 Vanderbilt Avenue, New York 17, N. Y.; B. S. Davis, Ghent, N. Y.; J. C. Munn, Union City, Pa.; A. B. Goodenough, Port Chester, N. Y.; P. S. Weil, Great Neck, N. Y.; F. Walen, Union City, N. J.; G. Weil, Great Neck, N. Y.; L. Winner, New York, N. Y. 3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities, are: None. 4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock, and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) B. S. DAVIS, Business Manager.

Sworn to and subscribed before me, this 27th day of September, 1945.

(Seal) FRANKLIN B. GOOLD, Notary Public. Commission expires March, 1948.

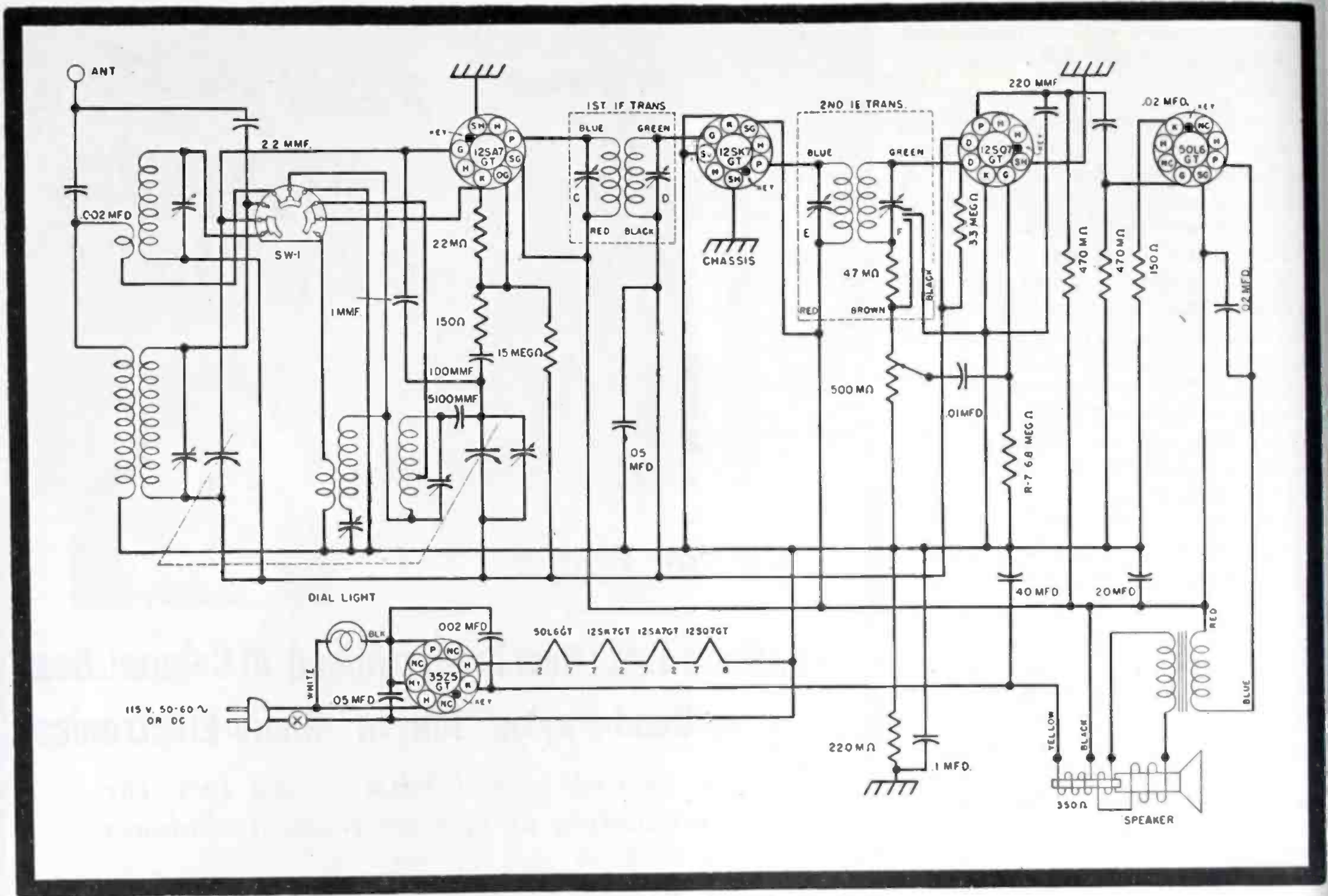
hm bias resistor without bypass and a decoupling filter of 5,000 ohms and ).1 md.

Two 6SK7 i-f stages are coupled by special variable-selectivity transformers having a third winding, tapped to provide regeneration or degeneration. This is accomplished by connecting the tertiary to the secondary in a series-aiding or series-opposing manner. Series resistors of 25 or 39 ohms are also involved in obtaining the correct amount of selectivity in both transformers. The third i-f transformer is more conventional, although a tap is provided for the diodes. This would be expected to sharpen the tuning and thus be inconsistent with the rest of the amplifier. However, considerable damping is provided by parallel diodes which allows the passage of a wide band.

The r-f, converter and two i-f screens are tied to a common supply. The first three stages are supplied with avc bias. The r-f detection components are filtered out by a low-pass filter consisting of 50 mmfd, 100,000 ohms and another 50 mmfd. A ¼-megohm resistor is connected in series with the volume control to prevent overloading of the detector with the consequent distortion. The treble tone control is connected in parallel with the volume control. When the grounded arm is at the lower end of the control, a .001-mfd capacitor is connected in shunt with the volume control, cutting the highs. When the arm is at the top, the .001-mfd unit is in series with a ½-megohm resistor making the shunting ineffective. However a .05-mfd capacitor is connected across a 2,000-ohm cathode bias resistor which causes an increase in highs. This action may be called selective degeneration because the bypassing action of the .05-mfd unit is confined to the treble only, increasing the gain in proportion to the frequency. Low frequencies are not bypassed, so the full amount of degeneration is present.

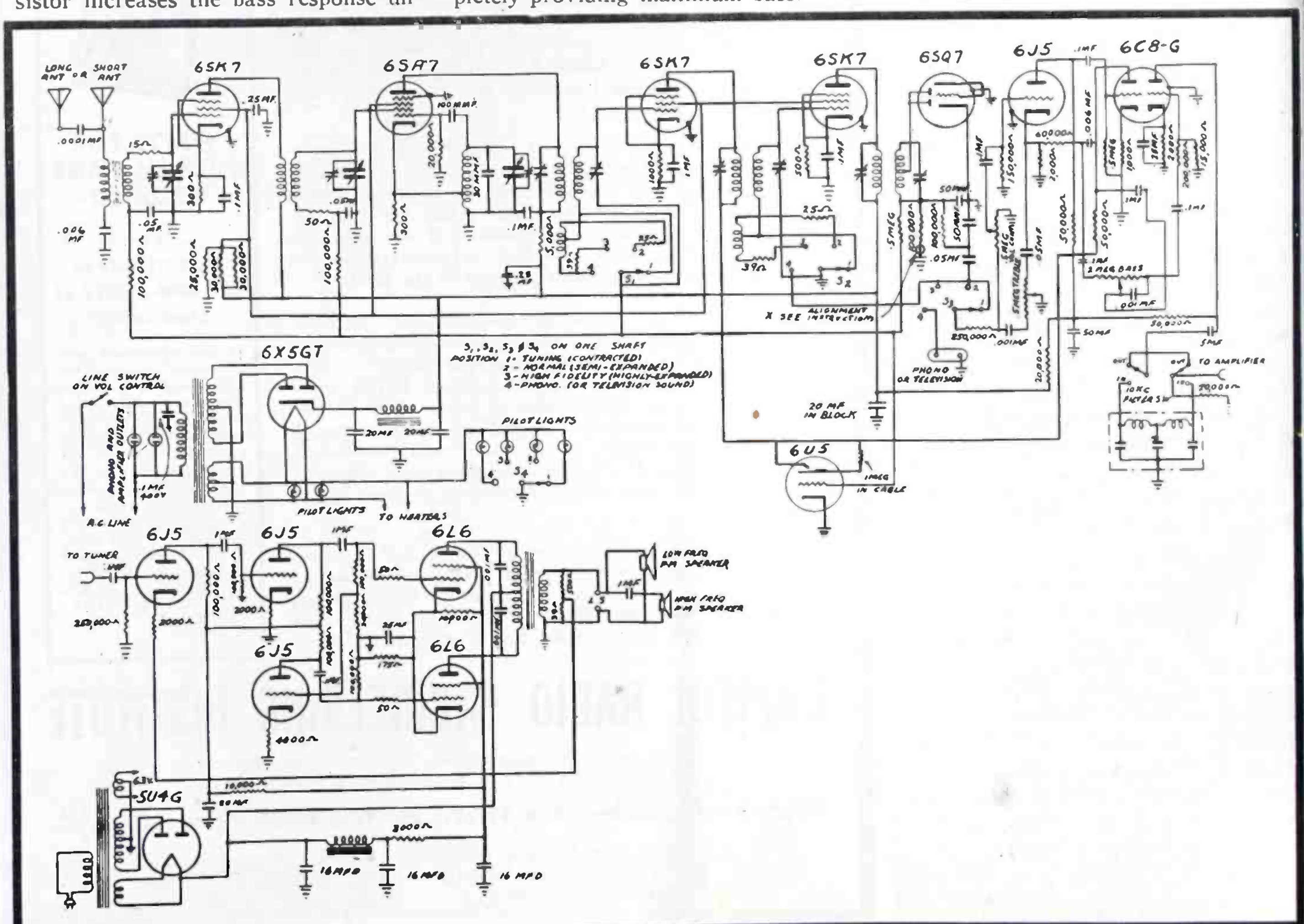
The 6J5 first audio has a grid leak of only 150,000 ohms. A 6C8G is used for the second and third a-f stages, the gain being limited by inversed feedback from the second audio plate to the first audio cathode and by a 1,000-ohm second a-f bias resistor without bypass. There is also some attenuation in the bass tone control and the associated 15,000-ohm grid leak in the third a- f stage. This control consists of a 2-megohm potentiometer which acts as a variable shunt to a .001-mfd audio-coupling capacitor. The capacitor is so small

(*Continued on page* 44)




that only the treble is passed without attenuation. Thus, shunting the resistor increases the bass response until the capacitor is completely shorted, when the resistance is cut out, completely providing maximum bass.

**Figs. 3 (above) and 4 (below). Fig. 3. Detrola 568. Fig. 4. Garod high-fidelity receiver.**



# HIGH FIDELITY AMPLIFIER

*(See Front Cover)*

A 25-WATT high-fidelity phono amplifier system, Magnavox A-3001C, has been diagrammed on this month's cover.

### Pickup-to-Input Circuit

To effect a complete trace of the circuit, the pickup to the first-audio input plug part of the system appears in a separate diagram, Fig. 1. A high-impedance pickup terminates in a 2-pin plug for easy servicing. An equalizer consisting of a .003-mfd capacitor in series with a ¼-megohm resistor is connected directly across the pickup and a 1-megohm volume control. A 50,000-ohm resistor and bass tone control are located between the control arm and the plug feeding the input grid.

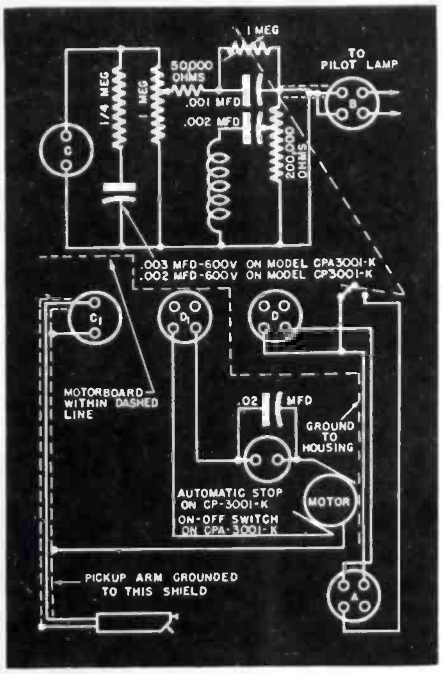



Fig. 1. Input plug system of amplifier, showing pickup and equalizer circuit.

### Tone Control Use

This tone control, which is attached to the *on-off* switch operates a .001-mfd audio coupling capacitor which favors the high frequencies. This is shunted by a 1-megohm control which brings up the bass notes as the resistance is decreased.

### Reactance Ratios

Analyzing the actual capacitor-reactance ratios and their effect on bass control we find that a 1-mfd capacitor has a reactance of about 2,600 ohms at 60 cycles and 1,300 ohms at about 120 cycles, which is usually in the vicinity of the lowest bass note reproduced. So a .001-mfd capacitor has a reactance of about 1.3 megohms at 120 cycles and about 32,000 ohms at 4,800 cles which is around the highest ›te normally reproduced, a difference 40 to 1. The 1-megohm shunt helps e bass along but it has little effect on e treble. As the resistance is de- eased, we note that the bass is in- eased considerably while the treble increased only slightly.

### Treble Booster

A treble-boosting tone control is so included. More correctly, per- aps, this control should be termed a ass-reducing control as it shunts a ioke coil across the line which by- sses the low frequencies but allows ost of the highs to go by unmolested. .002-mfd capacitor in series with e choke makes the control non- near, particularly near the resonant equency of the choke and capacitor.

### Hum and Decoupling Filter

A 2-megohm grid leak establishes e input impedance of the amplifier 2 megohms for bass frequencies and bit less than 2 megohms for the reble. The 6C5 first audio is biased by 000 ohms and a 20-mfd capacitor. Iere we also have a separate *R-C* um and decoupling filter. Coupling the power stage is completed by a 0,000-ohm plate resistor and a center- apped grid choke. An equalizer, .02- nfd and 7,500 ohms, is in series with he blocking capacitor.

### External Speakers

Two output impedance taps, 1.12 and 2.25 ohms, and an extra plug is provided for an external speaker. The voice coils are arranged in parallel with the fields in series, excitation be- ng provided by the current in the 6L6 screens and 6C5 plate. A .002- nfd 1,200-volt bypass capacitor is connected from plate to plate in the output stage. The entire record player draws an average of 134 watts from he power line.

•

## FIRST G.E. SETS ON BIG MO

Captain S. S. Murray, U.S.S. Missouri skipper, and Commander A. F. Spring, executive officer, with the first home G.E. sets produced. Presentation was made by Dr. W. R. G. Baker (left), G.E. vice president, and J. L. Busey, G.E. Supply Corp. president.

# I-F AMPLIFIERS

(*Continued from page* 20)

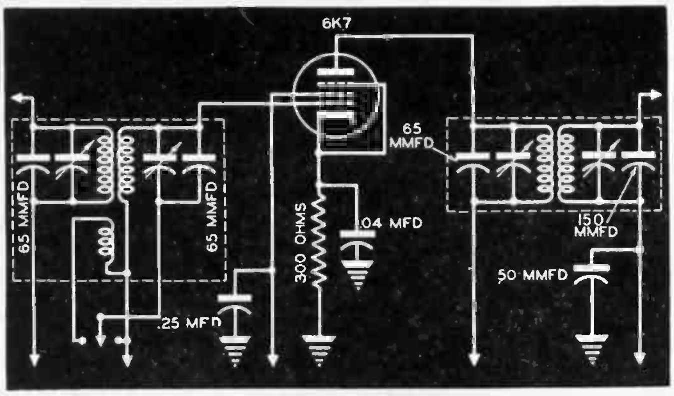



Fig. 7. The Wells-Gardner A-7 variable-width i-f transformer system. The tertiary winding provides tight coupling between primary and secondary, broadening the i-f response. The tertiary winding is shorted out for greater selectivity.

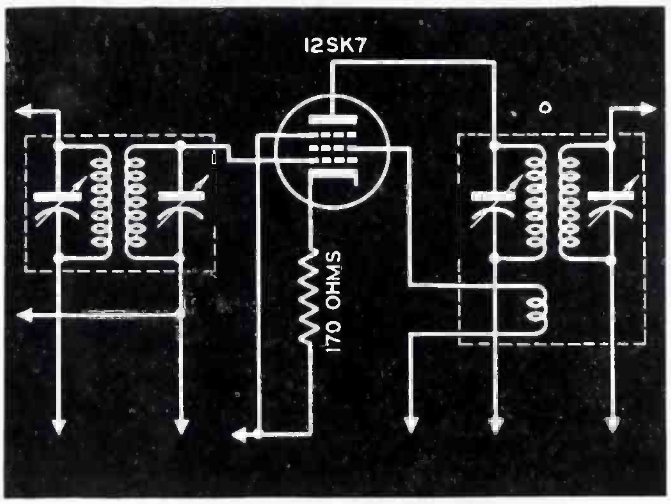



Fig. 8. I-f system of the Westinghouse M-104. The gain of this i-f system is increased by feedback, introduced into the circuit by coupling the screen grid of the i-f tube back into the detector transformer.

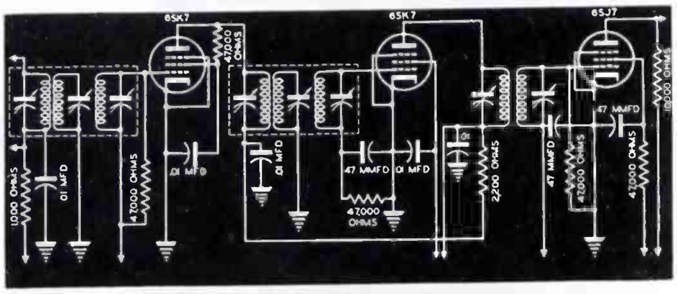



Fig. 9. The f-m i-f of the G.E. 60. Because of the high i-f frequency, and the broad-band response, the gain of the i-f stage is reduced considerably. For this reason two i-f stages are usually necessary.

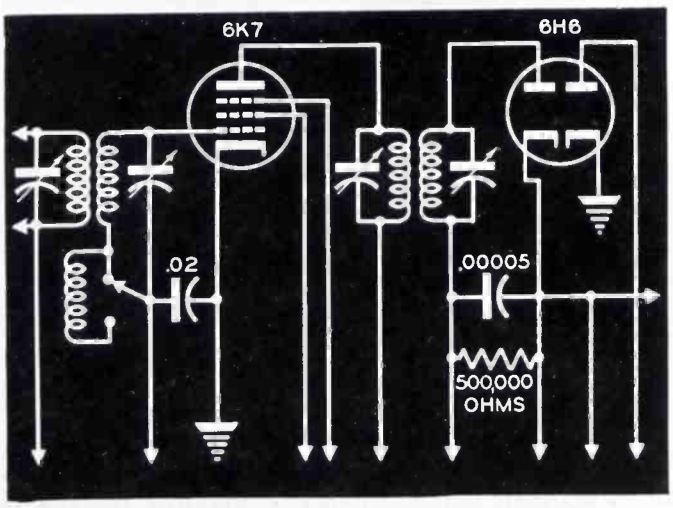



Fig. 10. The sharp-broad i-f system of the Ward 62-319. This circuit is similar to that shown in Fig. 7. A switch across a tertiary winding broadens or increases the frequency admittance of the i-f system.

adjustable, eliminating the need for trimmers. Silver mica fixed capacitors are used instead.

#### Wells-Gardner A-7

Fig. 7, from a Wells-Gardner model A7, introduces another type of i-f with variable selectivity transformers. The input transformer from a 6J7 first detector has a tertiary winding which is connected in series with the secondary for wide-band reception. It is cut out of the circuit for sharp tuning, the trimmers being adjusted for the sharp position. The band is widened by virtue of the tight coupling provided by the tertiary.

Other methods of selectivity control in i-f amplifiers have included the insertion of resistance in the tank circuit, shunting of the primary or secondary with resistance, moving the coils mechanically and coupling variation by means of a variometer. Combinations of these systems have also been used.

In this model fixed silver-mica tuning capacitors are used in both primary and secondary circuits of both i-f transformers, the first three having a value of 65 mmfd, the detector capacitor, 50 mmfd.

#### Westinghouse M-104, 204

It is often desirable to introduce regeneration into the i-f amplifier to increase gain or selectivity, or both. Westinghouse uses a method of screen-grid feedback in the detector transformer in models M-104 and 204, shown in Fig. 8. Improved performance is obtained without expensive transformers, but at the expense of critical tuning.

Other means of adding regeneration include removing the bypass from the screen grid and placing a small r-f choke in series with the screen. A 2 to 1 improvement in gain is often possible by such devices, enabling the Service Man to pep up a deficient receiver. If the amplifier tends to oscillate with the series choke, wire should be removed until stability returns.

#### G. E. 60, 80

The broad band i-f channels of f-m sets preclude the possibility of obtaining high gain per stage, hence at least two stages are required. Also, the gain is not as high at 4.3 mc as at 455 kc, all other factors being equal. The high i-f is necessary, of course, to obtain a wide band simply. In Fig. 9 we have an f-m model of G. E., type 60/80, with a dual 6SK7 amplifier, the first two transformers being triple-tuned. The

(*Continued on page* 52)

# CRYSTAL FILTERS

(*Continued from page 23*)

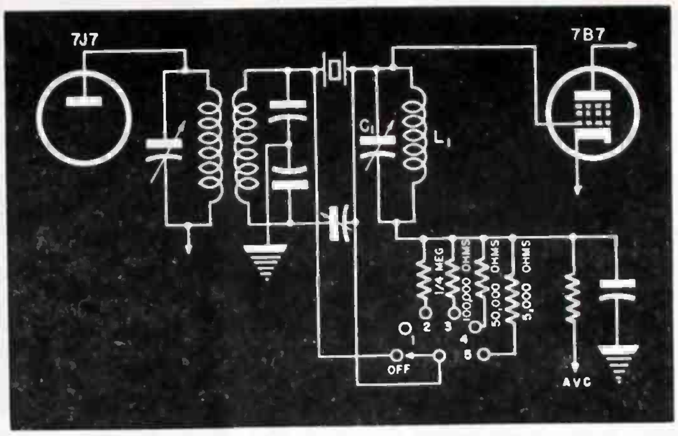



Fig. 5. The variable se- lectivity system of t RME 41-43. Varia selectivity is acco plished by varying t size of the resist across $L_1C_1$, the larg the value of resistan the greater the sele tivity.

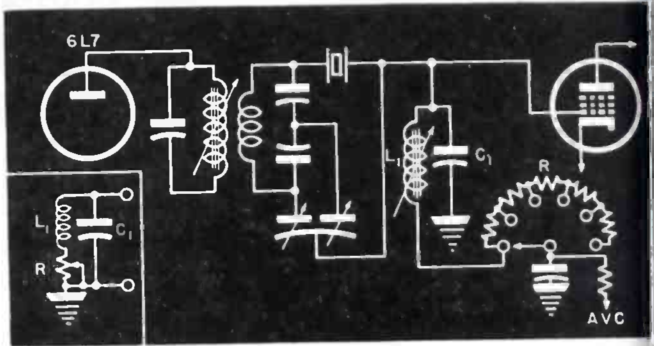



Fig. 6. Hammarlund Super-Pro variable selectivity system. Here, the selectivity is varied by inserting resistance in series with $L_1C_1$. Increasing the value of resistance improves the selectivity by increasing the effectiveness of the crystal.

detunes the circuit, and permits the crystal to exert its greatest influence on circuit $Q$, or sharpness of resonance.

### RME 41-43

Fig. 5 shows the variable-selective circuit used in the RME model 41-43. The tuned circuit here is on the crystal output side instead of the input. The effective resistance of the tuned circuit represented by $C_1$ and $L_1$ in series with the crystal is varied by shunting it with various size resistors, in very much the same manner as is used to broaden the response of i-f transformers used in f-m receivers. The lower the value of the shunting resistor, the greater will be the effectiveness of the crystal and the resultant selectivi

### Hammarlund Super-Pro

In Fig. 6 we have the method a plied in the Hammarlund Super-Pr Here again, resistance is used to d crease the effectiveness of a tuned c cuit in series with a crystal filt However, the resistance is used d ferently than for the circuit shown Fig. 5. The $Q$ of a coil is a functi of its reactance over its resistance, $Q = X/R$. Since the resistance is troduced into the tuned circuit so th it is in series with $L_1$, and $C_1$ is acr both the resistance and the inductan the effective resistance of the circ as represented by $L_1C_1R$ is reduc and $C_1$ then acts as a bypass capacit Thus the effectiveness of the crys is increased.

## CENTERING CONES

(*Continued from page* 16)

lost. Every effort is made by the facturer to build his loudspeaker so t will stand up not only for normal tion, but that it has a safety factor will permit some limited amount use or abnormal operation without ing the performance.

en confronted with a rubbing voice he Service-Man can do one of two . First, he can replace the whole er with a new one and second, he ry to repair the one that is dam- In these days when production he demand so much, there is little in trying to replace the unit when ances of getting a new speaker are indeed. Therefore, the Service usually tries to repair it.

new development, the *Adjust-A-* unit, developed by Quam-Nichols, an effective solution to the rub- oice-coil problem. In this unit, the , instead of being permanently or fastened to the housing, is kept sition with a pressure or clamping which is in turn held down by two ne screws. This construction is ated at A in Figure 1, the inset ng a closeup of the pressure ring, is underneath, at *B*, and the spider The voice coil is designated at *D*. sening the screws holding the pres- ring (*A* in the illustration) will a small amount of movement of ider in a lateral manner which will the voice-coil to be centered around le-piece and within the gap.

s to be noted that the screws hold- he clamping ring are so positioned t will be often unnecessary for the ce Man to remove the loudspeaker the cabinet to re-center the voice In conditions of severe rubbing coils, a better job can be done by ing the speaker from the cabinet; h in either instance, no audio sig- enerator is necessary, and only the radio (or public address system) or voice signals are required for g and maintenance.

e repair of a speaker with this new is quite simple. Before attempting -center the voice coil, one first de- nes on which side the voice coil is ng by pushing it up and down in ap. Then it is necessary to loosen amping ring screw nearest the point the rubbing is found. Using the s, the voice coil is gently pulled ds the loosened clamping screw. screw is then tightened and a check de to see if the voice coil now rides Caution should be used at this not to be too violent with the anism because of the possibility of ying the juncture of the voice coil r and the cone neck.

this operation does not correct the ng voice coil, another method will to be employed. One must first re- the felt dust cap over the voice by saturating it with lacquer or nt thinner, allowing it to soak a few ents before picking it off. Then strips of ordinary wrapping paper ximately 5/16" wide by 1½" long d be cut.

th clamping ring screws should be ned until the clamping ring is free, the wrapping paper shims are in-

(*Continued on page* 52)

## C-R OSCILLOGRAPHS

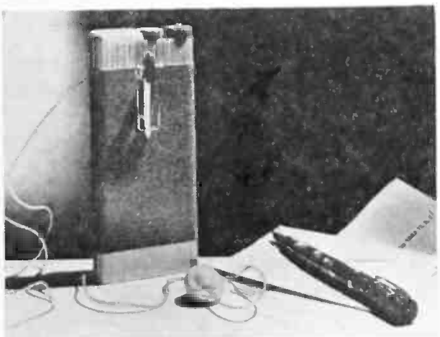
(*Continued from page 37*)

form depending on the settings of the linear time-base oscillator controls. In any event, the characteristic sine wave form of the a-c supply frequency waveform is evident in the pattern.

Manipulation of the linear time base *coarse* and *vernier sweep frequency* controls permits the reduction of the pattern written on the screen to either a single a-c wave pattern, or to a pattern containing a number of similar a-c cycle forms, whichever may be desired. In either case, the pattern will appear to be in motion, and complete synchronization of the sweep frequency with that of the a-c supply source will be found difficult. If, however, the *test signal* terminal is connected to the linear time-base synchronizing voltage input terminal *EXT*, synchronization control selector switch, $S_3$, turned to the *EXT* position, and the *synchronization* control potentiometer advanced slightly, the written wave pattern will stabilize completely. The wave pattern being written from the positive zero voltage inflection due to the phase-shift will be effected by the positioning capacitor $C_{23}$.

•

**MINIATURE POCKET SETS**



Five-tube pocket receivers produced by Belmont, using Raytheon sub-miniature tubes. Case is 3" wide, ¾" thick and 6¼" high. Weighs 10 ounces, including batteries. Circuit is superheterodyne. Cases will be supplied in solid gold, sterling silver, morocco, suede, etc.

## RECENTERING CONES

(*Continued from page 51*)

serted between the voice coil and the pole-piece (the inside of the voice coil). The three strips are not used one on top of the other, but merely to assure that at least one thickness of the shim circumscribes the pole-piece entirely. As the final step the clamping ring screws should be tightened a little at a time, tightening first one, then the other, gradually and alternately so as to bring the clamping action to bear on the ring evenly all around.

This should result in a perfectly centered voice coil. The wrapping paper shims can then be removed, and the felt dust cap glued back on with lacquer cement.

•

## I-F AMPLIFIERS

(*Continued from page 48*)

third transformer which feeds the first limiter stage is a conventional double-tuned job.

**Ward 62-319, 329, 409, 419**

Another receiver using sharp-broad tuning (i-f of 465 kc) is shown in Fig. 10, Ward 62-319, 329, 409, 419. The input transformer has a switchable tertiary winding similar to that shown in Fig. 7. The output transformer feeding the 6H6 detector is standard.

# OLD TIMER'S CORNER

**by SERVICER**

WE had quite an unusual session at an end-of-the-day get-together some weeks ago, a session that provided many unusually interesting and useful facts.

It all began when Roy walked in quite pleased with himself.

"What's with you, Roy?" I asked. "You sure look spirited."

"Well, fellows," said Roy with a grin, "I have just made a swell contact."

"What kind?" we asked.

"With a manufacturer of capacitors," answered Roy. "With my plans I will be able to cut out everybody except the manufacturer. No more distributor, and no more company representative for me. I'll deal right with the capacitor maker, direct."

"What will that mean in dollars and cents?" we asked him.

"Well, I should be able to buy at better prices. Then deliveries will be faster, and also I'll have a wider choice than any of you have been able to get from John's Radio Company, the distributor up here. That in itself is worth the deal to me. But best of all I will be buying at rock-bottom, manufacturer's prices!"

"I think you're dead wrong, Roy," said Bill.

### Bill's Opinion

We picked up our ears. Bill was one of the older crowd who usually did not have anything much to say. He and his type just went ahead year in and year out, not making a very big splash in the waters of radio servicing business, but at the same time syphoning off a fair share of profits and keeping themselves high in the opinions of the community. Bill was not only conservative, but he was also highly respected for his ethics, business acumen and community pride. He was no world-winner, but his hard-headedness and carefully thought out plans often wrung a lot of silent (and sometimes not so silent) acclaim from our gang.

So when Bill fired his opinion at Roy, we were quite surprised.

"You see, boys, Roy thinks that he has made a world-winning deal by cutting out the distributor! Well, instead he has just done himself a great disservice! Sure, this particular manufacturer probably now has almost everything in stock that Roy could want. And he's anxious to get it out. So he'll do almost anything to see that Roy gets what he wants. But wait until this man-rer—and I'm sure that he is not the old line men—gets going. He ave a big business some day. And e will recognize that it doesn't have Roy's orders lying for, say, en 25-mfd 25-volt electro's, and two dozen .05 mfd's and a couple en half mikes at 450 volts. He is to tell his production men to set der aside until he gets into those runs for a set manufacturer. Thus of the capacitors Roy wants, will be ly run through with the manufac- lot. Now the .05 mfd's that are made for the set manufacturer are y different in size than the type rdered before, and so Roy gets the ze which may or may not fit. Also ice may be different each time, due hange in specifications.

#### Replacement Problems

d that isn't all. Suppose that Roy ed some faulty capacitors. Can ure immediate replacements? No, nnot, for at that very time the type rd is out of stock, and another size ng run through, a size of no use to So poor Roy will have to wait the manufacturer runs through of the kind Roy wants before he et his replacements. Now since as been dealing with the manufac- directly, he not only has lost con- with the local distributor, but he lso encouraged that worthy to dis- him. As a result, Roy can't get capacitors from the distributor . So he must go out and buy them or hope that one of you—or me l help him out for the time being. normally, we would be more than g to help out a fellow Service —especially Roy, because we all like But business is business, and we l like to have the returned capaci- o be similar to those we gave Roy. are not interested in the few cents the capacitors cost. What we is some of Roy's units when his ment gets in. But Roy isn't going ceive the same standard parts we been using, even when his ship- arrives. And we are not sure of exactly he is going to get. So on't let him have any of ours, and will find himself in quite a spot!

#### Virtues of Distributors

ow, if Roy trades with the local butor he'll get what he needs right the distributor's stock. The dis- or pools all of his orders and sends in to his standard manufacturers e they make, taking in all the Serv- Men accounts of the distributor, and order and quite a run. If some- goes bad with the units, the manu- rer cannot afford to ignore the dis- or, and so he makes it good. The butor knows that and will replace tive units for Roy on sight. Then, the distributor is a local man. y time Roy buys from him and pays ill promptly, he establishes a better t. That may come in handy when ime rolls around and Roy needs a reference. Some of the boys just think much of references from out-of-the-state place where people know each other except via the ge stamp route.

"So if you want some sound advice, play ball with your local distributor. The prices may *seem* a bit higher than those a manufacturer selling direct may offer. But when the smoke clears away, you are getting so very much more for your dollar in the form of reputation, good will and fine service, that in reality the costs are cheaper."

#### No Sale

"I think you have something there, Bill," said Roy. And from the way he spoke, I guess that a certain manufac- turer, who sells capacitors directly to the radio Service Man, had just lost a fairly nice account.



**POSTWAR RECEIVER**

Receiver of the future shown at a recent postwar display by the Hallicrafters, Chicago.

# NEWS

## RAYTHEON BONDED SERVICE MAN PROGRAM

A *Bonded Electronic Technician Program* to improve standards of practice among Service Men and provide work guarantees, has been announced by the Raytheon Manufacturing Company. The program provides for the bonding of Service Men through the facilities of Raytheon distributors, Raytheon and a bonding group.

According to Arthur E. Akeroyd, distributor sales manager, the program will assist the Service Man in building a solid foundation for postwar activities.

It will offer deserving newcomers such as returning veterans, the opportunity to establish themselves in business, without being handicapped by the questionable practices of some widely publicized repairmen.

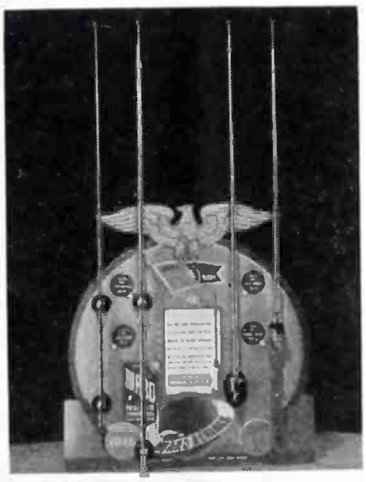
Mr. Akeroyd said that it was felt that the plan should be based on guarantees to the much maligned Service Man as well as the customer. Every radio shop is entitled to a legitimate profit, he said. Thus with widely divergent costs under different conditions and in different locations, any bonding program must not interfere with the established business policies of the ethical shop. By the same token, the program must also recognize the fact that the majority of Service Men are honest. The bond provided by this program will assure the public of the Service Man's honesty and integrity, said Mr. Akeroyd.

To qualify as a *Raytheon Bonded Electronic Technician*, a Service Man will have to meet certain qualifications of experience, reputation and ability, and also state that he has and will use adequate equipment to do skilled service work efficiently.

The Service Man's application will have to be approved by his Raytheon distributor, Raytheon and the bonding company. When accepted by all parties, he will become bonded for the period of one year by the Western National Indemnity Company of the Firemen's Fund Group. The bond states that the Service Man agrees to guarantee complete satisfaction

•

## POSTWAR ANTENNAS



Ward store display featuring four postwar antennas. Highlights of the antennas are said to be H-Q low-loss detachable polyethylene lead with silver-to-silver contact; one man installation and fluid type anti-rattle construction.

...ry radio repair job for 90 days, ...tlines a *code of ethics* that he ... to observe in the conduct of his ...s.

Mr. Akeroyd said that the requirements ...tification have been drawn up so ...ey parallel the now generally ac... practices and standards of the ...ent qualified Service Man. The re...ents do not represent the ideas of ...ngle group, but rather the sugges...nd opinions of hundreds of Service ... Adequate provision is said to be ...d to prevent the exclusion of any ...: Men from this program, without ... in the event that they feel rejec... as not justified.

A. E. Akeroyd

* * *

### GRENBY BUYS CARDWELL

...h Grenby Mfg. Co., Plainville, Conn., ...quired full control of The Allen ...dwell Mfg. Corp., Brooklyn, N. Y. ... Gray, president of Grenby, has ... chairman of the Cardwell board. ... the sales and development engi...g departments of Cardwell will ...ue to operate from their present lo...at 81 Prospect St. The manufactur...vision has been moved to Plain... Conn.

...h H. Soby, vice president and di... of Grenby, has been elected pres... of Cardwell, following the retire... of Mr. Cardwell. Joseph K. Fabel ...ontinue to serve as vice president ...ales manager of the Cardwell de...ent and engineering division. Ray ...rehouse will also continue as Card...ales manager.

C. A. Gray

* * *

### ...APACITOR COLOR CODE CARDS

...or code charts and cards for small ...capacitors with RMA six-dot color ...nd three-dot color code as well as ...rmy-Navy standards, have been pre-

(*Continued on page 58*)

●

### ...S N.U. DISTRIBUTOR ON RANCH

... Olsen, National Union distributor in ...tonio, with Jack Clune, N.U. sales manager, on the Olsen ranch.

# NEWS

(*Continued from page 57*)

pared by Cornell-Dubilier Electric Co poration, New Bedford, Mass.

The basis of the code is the use of distinct color for every number fr zero to nine inclusive.

* * *

### TECHNICAL APPLIANCE CONSOLI DATES PLANTS

Technical Appliance Corporation consolidated its wartime New York C and Flushing plants and will hereafter located at 41-06 DeLong Street, Flu ing, N. Y.

The postwar Taco line will inclu antenna systems and kits for broadc reception and also for f-m and televis purposes.

* * *

### RADIONIC EQUIPMENT CATALOG

A 32-page catalog listing compone test instruments, sound equipment and cessories, and technical books, has b released by the Radionic Equipment C pany, 170 Nassau Street, New York N. Y.

* * *

### NEWS OF THE REPRESENTATIVE

John B. Tubergen, 1406 S. Grand A Los Angeles 15, and Joe W. Marsh, 1 West Pica Blvd., Los Angeles 15, h become members of the Los Ang chapter. Jerry W. Miller, 5917 S. M St., Los Angeles 3, Cal., has become associate member of the Los Ang chapter.

T. M. Graner, 600 Camelia St., B ley, is now a California chapter mem

O. N. Jones, 1085 The Arcade, Cl land 14, O., is now a member of Buckeye chapter.

At a recent meeting of the Wolv chapter, H. E. Walton was elected p ident; J. C. P. Davenport, vice presid and Robert Milsk, secretary-treasur

The Hoosier chapter elected Leslie DeVoe president; Chuck Southern, president; Bruce McPherson, treasu and Bud M. W. Fisch, secretary.

Martin Friedman, a member of Mid-Lantic chapter has moved to Real Estate Trust Bldg., Philadelph Pa.

* * *

### H. E. HARRIS PROMOTED BY BE SOUND

Harry E. Harris, formerly sales e neer of the Bell Sound Systems, Columbus, Ohio, has been appointed eral sales manager of the manufactu and jobbers sales division.

* * *

### CANNON CONNECTOR BULLETI

A revised 64-page edition of the non Electric K bulletin on electric nectors has been released by Ca

•

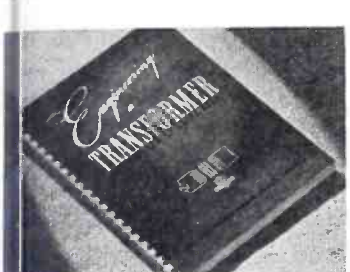
### AT EASTERN AMPLIFIER "E" CEREMONIES


Left to right, Lt. Col. Harold L. Lister Comdr. William J. Warburton, Harry Friedl and Leonard Meyerson of Eastern Amp Corp., and Major Meredith J. Roberts ctr Development Company, 3209 nl dt St., Los Angeles 31, California. s ition contains data on receptacles, t ps, junction shells, stowage re- tacs for instruments, radio, motors, gieral electrical applications.

* * *

**NOR TRANSFORMER BROCHURE**

n 38-page brochure, *Engineering a nsformer*, covering lamination size, de gage and magnetic performance; e ze, type and gage; winding de- n; transformer-reactor physical and tr al aspects; electrical-mechanical si rations of core laminations; im- g ion, assembling and casing; and ti and sealing, has been released by n rd Transformer Corporation, Chi- o ll.




* * *

**A ORY REPLACEMENT VIBRATOR GUIDE**

 -page replacement vibrator guide i eplacement listings for auto radio attery-operated household receiv- ffer circuit diagrams, installation e cross references of vibrators and l tions, buffer capacitor reference u l, and notes on an assortment of vibrators, has been published by P. R. Mallory & Co., Inc., Indianapolis 6, Indiana.

* * *

**CAMBURN TO PRODUCE AUTO/FM/ TELEVISION ANTENNAS**

A variety of antennas for auto sets, and f-m, television and marine receivers will be included in the postwar line of the Camburn Products Company, 490 Broome Street, New York 13, N. Y.

A new plant will be built on Long Island to produce the new postwar items. M. B. Bernstein is president of Camburn Products Co.

* * *

**BROWNING JOINS NORMAN B. NEELY**

Robert Browning has been appointed special field engineer for Norman B. Neely Enterprises, Hollywood, California.

Mr. Browning was formerly with Western Electric as a radar field engineer.

* * *

**PLYTUBE F-M MAST KIT**

A plytube antenna kit for f-m and television has been announced by the Plymold Corporation, Lawrence, Massachusetts.

The mast is supplied with fittings for attachment atop a roof or side of a building. Mast, antenna system, and all fittings are offered as a unit.

* * *

**JACK BEEBE JOINS SWAIN NELSON**

Jack Beebe has joined the transformer division of the Swain Nelson Company, Glenview, Illinois, and will be in charge of manufacturing and distributing of S-N-C transformers. Mr. Beebe was formerly general sales manager of the Thordarson Electric Manufacturing Company.

* * *

**MUELLER INCREASES PLANT FACILITIES**

A postwar plant expansion program has been announced by the Mueller Electric Co., Cleveland.

The first step in this program provides for the installation of new plating and finishing facilities.

* * *

**BURGESS BATTERY REPLACEMENT GUIDE**

A guide listing replacement batteries for approximately 1,000 models of portables and farm type receivers has been prepared by the Burgess Battery Company, Freeport, Ill. Included also are a list of private brand portables. Also

(*Continued on page 60*)

# NEWS

(*Continued from page 59*)

presented is a numerical and alphabetic listing of all Burgess Battery products.
Free copies of the guide are availab[le] from department RG.

* * *

## JENKINS JOINS FORSHAY

Victor E. Jenkins, formerly test equi[p]ment sales manager for the Weston Ele[c]trical Instrument Corp., has joined J. M. Forshay, 27 Park Place, N. Y., N. Y., factory representative in Ne[w] York City and New Jersey for Simp[son] Electric Company and Industrial C[on]denser Corporation.

* * *

## COLEMAN NOW ASST. DIRECTOR RCA VICTOR ENGINEERING DIV.

J. B. Coleman has been named assist[ant] director of engineering for the RCA V[ic]tor division. M. C. Batsel has bec[ome] chief engineer of engineering products.
Mr. Coleman will make his he[ad]quarters at the company's home office, Camden, N. J.
Previous to his new assignment, Batsel was chief engineer at the R[CA] Victor plant in Indianapolis, Ind.

* * *

## COMMUNICATIONS PARTS MOVES NEW PLANT

Communication Parts has moved 1101 North Paulina Street, Chicago.

•

## POSTWAR RECEIVERS

Portable and phono-table postwar models Westinghouse. Unit, above, can be mounted wall or set up on flat surface. Combination, low, can be operated as a phono-receiver or with separate units, it being possible to re[move] receiver and using as a straight table m[odel].

## VOLUME AND TONE CONTROLS

(*Continued from page* 30)

in practically all the necessary ance values and tapers in the d range of resistance wherein type may be used, the Service should make it a policy, when nted with the replacing of con- of either type, to replace an al *wire-wound* control with a le *wire-wound* control, and an al *carbon type* control with a le *carbon type* control whenever ossible to do so. By adhering to policy, customer dissatisfaction e avoided in most cases.

circuit design of many receivers ntly includes special considera- which make it necessary for r operation to replace the volume ol with one of the same type. are many receivers (especially lder models) in which the use wire-wound control is definitely ted, and where the carbon type l not give satisfactory service. -wound units are frequently used ntrol circuits which require a aratively high circuit-carrying ity. Compact, low-resistance of this type can be made to han- r greater currents than a carbon- control. They are also used in critical circuits where it is nec- y to have a higher degree of re- ce permanence, or much closer ance tolerance, than is possible the carbon type.

ere are certain conditions where it might be desirable or even neces- sary to change the type of control; i. e., use a carbon control having the proper resistance value, taper and wattage rating to replace an original wire-wound control or vice versa. This is a matter of discretion for the Service Man. Unless it cannot be avoided, the exchange should not be made unless the advantages to be gained are *not* offset by the disadvantages of the particular type control. Quite often this can be correctly ascertained only by trial and error.

### Midget Versus Large Size Controls

In some receivers, particularly in *off brand* or a few *trade name* receivers in which small midget-type volume controls are used in current-carrying circuits of the *antenna-bias* type, repeated volume-control trouble due to the overheating may be experienced. If the original midget control is damaged or burned out and a check reveals that the failure is due to excessive current in the control, the defective unit should be replaced with one of the larger type controls if there is space available.

On the other hand, a midget type may be used to replace a large type control in an *audio* type of control circuit whenever this procedure tends to simplify a crowded installation.

*(To Be Continued)*

## NEW RODUCTS

### NE-O-LITE TESTER

est unit, *Ne-O-Lite Test-Lite,* for g a-c lines, checking polarity of d-c, and tracing ground lines, has announced by the Ne-O-Lite Mfg. Rockford, Illinois.

ts voltage from 60 volts a-c to 550 a-c or d-c by variable light intensity. a neon lamp. Has a clear plastic d shell and insulated test points.

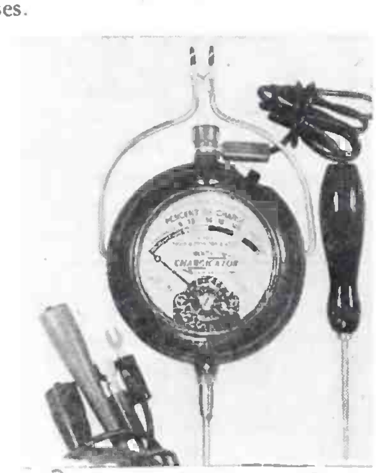

* * *

### HICKOK CHARGICATOR

*Chargicator* to indicate electrically quivalent gravity of any lead-acid ge battery, regardless of size or volt- has been developed by the Hickok rical Instrument Company, 10521 nt Avenue, Cleveland 8, Ohio.

Probe type, illustrated, gives instantaneous measurement of battery condition. It shows what charging rate to use, either for trickle charging or for an efficient, safe, high-rate charge. It indicates the percentage of charge and charging danger and warns of destructive overcharging.

Has a four-color scale dial. All models are sealed in molded acid-proof bakelite cases.



* * *

### RADIART MIDGET VIBRATORS

Midget vibrators, type VR-2, 2⅛" high x 1⅛" in diameter, have been announced

(*Continued on page* 62)

by the Radiart Corporation, 3571 W. 62nd St., Cleveland 2, Ohio. Designed for operation from a small 6-volt storage battery.

Vibrator frequency, 185 cps ± 10%; input voltage (nominal), 6.0; input voltage range, 4.5 to 7.5; input current, 1.5 amperes maximum at 6.0 v; output voltage, 200 d-c maximum; and potential difference between primary reed and secondary reed, 25 v maximum.


* * *

### INSULINE MIDGET JACKS

A series of midget-sized jacks has been developed by the Insuline Corporation of America, Long Island City, N. Y.

Models include single closed-circuit,

## NEW PRODUCTS

(*Continued from page 61*)

single open-circuit, and three-way microphone types. Jacks have a tooled-brass body with phosphor-bronze spring members, nickel plated.

* * *

### SHALLCROSS AXIAL LEAD RESISTORS

Fixed wirewound axial lead 1-megohm, 1-watt resistors have been announced by the Shallcross Manufacturing Co., Jackson & Pusey Avenues, Collingdale, Pa.

Known as Akra-Ohm type 188, the resistors are 1 3/16" long x ⅜" diameter. Axial leads, 3" long, of No. 20 tinned copper wire. Standard tolerance is said to be ± 1%.


* * *

### WESTON DIRECT-READING INSULATION TESTER

A direct-reading insulation measuring device, model 799, providing a single range for .1 to 10,000 megohms with the 10,000 mark at 8% of the scale length, has been announced by Weston Electrical Instrument Corporation, 617 Frelinghuysen Avenue, Newark 5, New Jersey.

The circuit is said to have a test potential of less than 50 volts d-c. Its uses include checking leakage between windings in transformers, leakage of low-voltage paper and mica condensers, etc. Size 5⅜" x 3¼" x 4⅞".


* * *

### REINER VACUUM-TUBE VOLTMETER

A vacuum-tube voltmeter, 451, a[nd] amplifier, 101, featuring 25 millivolts a[t] on the lowest range, 1,000 volts on t[he] highest range, 10 cps to 700 mc frequen[cy] range, and 7 mmfd input capacity h[as] been announced by Reiner Electroni[cs] Co., Inc., 152 West 25th Street, N[ew] York 1, N. Y.

Model 451 ranges are: *a-c volts*, 0-.02 .1-.25. (with amplifier)-2.5-10-25-100-25[0] 1,000; *d-c volts*, 0-2.5-10-25-100-25[0] 1,000; *d-c current*, 0-2.5-10-25-100-25[0] 1,000; ohms; 1 ohm to 1,000 megohm[s]

-c requency range, 10 to 5,000 cps, w amplifier) 50 cps to 700 mc. D-c ohm and current accuracy is said 2% on full scale. A-c volt accuracy to be 2%, 50 cps to 50 mc; entire ency range 5% accuracy. Weight, 20 ls. Size, 10¾" x 9" x 8".

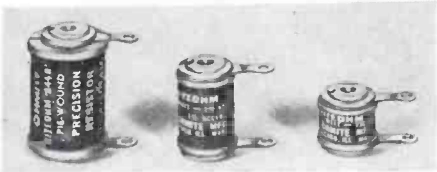
* * *

### HMITE PIE-WOUND RESISTORS

series of pie-wound resistors, Rite- types 844A/844B/842A, that can be nted by means of a through-bolt, has announced by the Ohmite Manufacturing Company, 4835 Flournoy St., Chi- 44, Ill.

ailable in 3 sizes: 9/16" diameter x 1" long, 9/16" diameter by ⅞" long, and ¾" diameter x 1 3/16" long. The smallest is a 2 pie while the other two are 4-pie units. The minimum resistance is 1 ohm for the 2-pie unit and small 4-pie unit, and .10 ohm for the large 4-pie unit. The maximum resistance is 200,000 ohms for the 2-pie, 400,000 ohms for the small 4-pie, and 1.5 megohms for the large 4-pie unit.

Uses enameled alloy resistance wire non-inductively pie-wound on a non-hygroscopic ceramic bobbin.



* * *

### CARTER MOTOR FREQUENCY-CONTROLLED D-C TO A-C CONVERTER

A frequency-controlled d-c to a-c rotary converter has been announced by Carter Motor Company, 1608 Milwaukee Avenue, Chicago, Illinois.

Designed with the frequency control in the base, including a vibration reed-type meter to visually indicate the frequency of the output.

In the 110-120 volt d-c to 117-volt a-c models, the output control is said to be within ± 10 volts at 60 cycles, over a ± 10-volt d-c fluctuation.

Models can be supplied with input voltages ranging from 6 through 64 volts for battery conversion and also 110-120 volts d-c for line conversion. Wattage ranges are from 40 through 250, continuous duty.

## JOTS AND FLASHES

OVER 10,000,000 f-m sets will be sold during the next two or three years, according to Frank Mansfield, director of sales research of Sylvania, who based his data on a survey recently completed. . . . Irving P. Wolfe has become a distributor and opened a store at 224 Main Street, Poughkeepsie, New York. His company will be known as Chief Electronics. . . . Olson Radio Warehouse, 73 E. Mill Street, Akron, Ohio, have been appointed distributors for Philco. . . . John Meck Industries now have a Cessna T 50 plane for transportation of company personnel and special equipment. . . . Jack Kaufman, former president of Heintz and Kaufman, Ltd., has been named vice president of Aireon Manufacturing Corporation and manager of the San Francisco office of Aireon. . . . A one-story plant on a 7½-acre tract on Skokie Highway near Waukegan, Illinois, has been purchased by Belmont Radio. This will supplement the Belmont plant on Dickens Avenue, Chicago for receiver production. . . . Ray T. Schottenberg, jobber sales manager of Astatic Corporation, visited jobbers in the New England states recently. H. A. Chamberlin, Astatic New England rep., accompanied Mr. Schottenberg. . . . George Balsam has been named ad manager and director of sales promotion of Aerovox Corporation, New Bedford, Mass. . . . Westchester Electronic Supply Company, 333 Mamaroneck Avenue, White Plains, N. Y., was recently appointed distributor for RCA, IRC and Cornell-Dubilier. . . .T. R. McElroy, president of the McElroy Manufacturing Corporation, 62 Brookline Avenue, Boston, Mass., has rejointed the Merchant Marine as a radio operator, Lt. Senior Grade, and is now making the regular run between Europe and U. S. . . . Amphenol Phenolic Corporation, 1830 South 54th Avenue, Chicago, Ill., are expanding their plastics manufacturing facilities and building a three-story building next to their present plant. . . . V. Hutto has been named Georgia factory representative for Universal Microphone Company, Inglewood, Calif. . . . Radiart Industries, Cleveland, Ohio, has been bought by Maguire Industries, Inc., Leslie K. Wildberg and William H. Lamar of Radiart have sold all their common and preferred stock to Maguire. . . . James H. Hickey has been appointed general manager of the Zenith Radio Distributing Corporation.

## ADVERTISERS IN THIS ISSUE

### SERVICE INDEX—NOVEMBER, 1945


ADAPTOL CO. ....
Agency: Hart Lehman, Advertising
AEROVOX CORPORATION ....
Agency: Austin C. Lescarboura & Staff
AMERICAN PHENOLIC CORPORATION ....
Agency: Evans Associates, Inc.
THE ASTATIC CORPORATION ....
Agency: Wearstler Advertising, Inc.

BURSTEIN-APPLEBEE CO. ....
Agency: Frank E. Whalen Adv. Co.

CAPITOL RADIO ENGINEERING INSTITUTE ....
Agecny: Henry J. Kaufman & Associates
CINAUDAGRAPH SPEAKERS DIV. AIREON ....
Agency: Michael F. Mayger
CITY RADIO CO. ....
CLAROSTAT MFG. CO., INC. ....
Agency: Austin C. Lescarboura & Staff
CORNELL-DUBILIER ELECTRIC CORP. .... Inside Front C
Agency: Reiss Advertising, Inc.

DETROLA RADIO DIV. INTERNATIONAL DETROLA CORP. ....
Agency: Zimmer-Keller, Inc.
DRAKE ELECTRIC WORKS, INC. ....
Agency: William Hoffman & Associates

ELECTRICAL REACTANCE CORP. ....
Agency: Scheel Adv. Agency

GENERAL CEMENT MFG. CO. ....
Agency: Turner Adv. Agency
GENERAL ELECTRIC CO. .... 35,
Agency: Maxon, Inc.
GUARDIAN ELECTRIC ....
Agency: Kennedy & Co.

HICKOK ELECTRICAL INSTRUMENT CO. ....
Agency: White Adv. Co.

INTERNATIONAL RESISTANCE CO. ....
Agency: The Lavenson Bureau

JACKSON ELECTRICAL INSTRUMENT CO. ....
Agency: Kircher, Helton & Collett, Inc.

KEN-RAD DIV. GENERAL ELECTRIC CO. ....
Agency: Maxon, Inc.

LAKE RADIO SALES CO. ....
Agency: Sander Rodkin Adv. Agency
LIFETIME SOUND EQUIPMENT CO. ....
Agency: The Miller Agency Co.

McELROY MFG. CORP. ....
Agency: Shappe-Wilkes Inc.
THE MacMILLAN CO. ....
Agency: Atherton & Currier, Inc.
M. V. MANSFIELD CO. ....
MARION ELECTRICAL INSTRUMENT CO. ....
Agency: Shappe-Wilkes Inc.
MEISSNER MFG. CO. ....
Agency: Gardner Adv. Co.
MUELLER ELECTRIC CO. ....
MURRAY HILL BOOKS, INC. ....
Agency: The Harry P. Bridge Co.

NATIONAL RADIO DISTRIBUTORS ....
Agency: Burke & Wayburn Adv. Co.
NATIONAL UNION RADIO CORP. .... Back C
Agency: Hutchins Adv. Co., Inc.
NEWCOMB AUDIO PRODUCTS CO. ....
Agency: Gail Hall Advertising

OHMITE MFG. CO. ....
Agency: Henry H. Teplitz, Advertising

PARAGON RADIO DISTRIBUTORS ....

RADIART CORPORATION ....
Agecny: Kenneth H. Kolpien
RADIO CITY PRODUCTS CO. ....
Agency: Reiss Avertising, Inc.
RADIO CORPORATION OF AMERICA .... 29,
Agency: Kenyon & Eckhardt, Inc.
RADIO DEALERS SUPPLY CO. ....
RADIO EQUIPMENT CO. ....
RADIONIC EQUIPMENT CO. ....
Agency: Hirshon-Garfield Co.
RADIO SUPPLY & ENGINEERING CO. ....
Agency: Karl G. Behr Adv. Agency
RADIO WIRE TELEVISION, INC. ....
Agency: S. T. Seidman & Co.
THE RADOLEK CO. ....
Agency: Turner Adv. Co.
RAYTHEON MFG. CO. ....
Agency: Burton Browne, Advertising
JOHN F. RIDER PUBLISHER, INC. ....
Agency: Lansford F. King

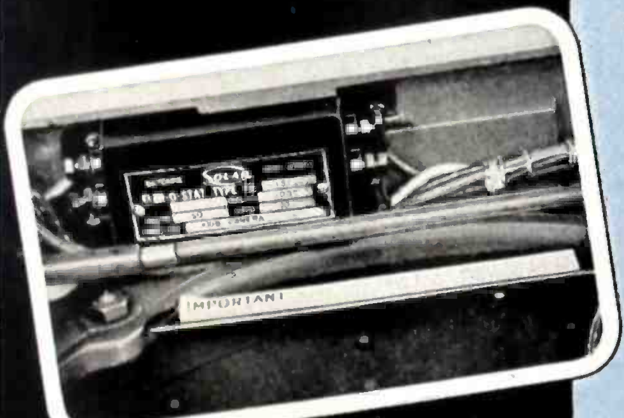
SCENIC RADIO & ELECTRONICS CO. ....
SIMPSON ELECTRIC CO. .... 4,
Agency: Kreicker & Meloan, Inc.
SOLAR CAPACITOR SALES CORP. .. Inside Back C
Agency: O. S. Tyson & Co., Inc.
SPRAGUE PRODUCTS CO. .... 6,
Agency: The Harry P. Bridge Co.
STANDARD TRANSFORMER CORP. ....
Agency: Burnet-Kuhn Adv. Co.
SUPERIOR INSTRUMENTS CO. ....
Agency: Mitchell Adv. Agency
SYLVANIA ELECTRIC PRODUCTS, INC. ....
Agency: Newell-Emmett Co.

THORDARSON ELECTRIC MFG. DIV. MAGUIRE INDUSTRIES, INC. ....
Agency: Park City Adv. Agency, Inc.
TRIPLETT ELECTRICAL INSTRUMENT CO. ....
Agency: Western Adv. Agency, Inc.
TUNG-SOL LAMP WORKS, INC. ....
Agency: E. M. Freystadt Associates

UNITED TRANSFORMER CORP. ....
Agency: Shappe-Wilkes Inc.

THE WARD PRODUCTS CO. ....
Agency: Burton Browne, Advertising
WELLER MFG. CO. ....
Agency: Beaumont, Heller & Sperling, Inc.
WESTON ELECTRICAL INSTRUMENT CO. ....
Agency: G. M. Basford Co.
WHOLESALE RADIO LABORATORIES ....
Agency: Pfeiffer Adv. Agency


Quick as a wink the Fairchild Night Owl Camera records enemy movements intended to be hidden by darkness. Quick as a flash the radio of the photo-reconnaissance plane keeps touch with its base — and clearly — for Solar Elim-O-Stats are part of the electronic equipment of these highly perfected cameras.




This is but one of many instances where Solar Elim-O-Stats are being used to absorb local interference and keep speech channels free.

Let Solar advise you on radio-noise suppression.

**BACK AGAIN!**

Solar Elim-O-Stats for noise suppression in all Household Electrical Appliances. Order now from your Solar Distributor.

SOLAR

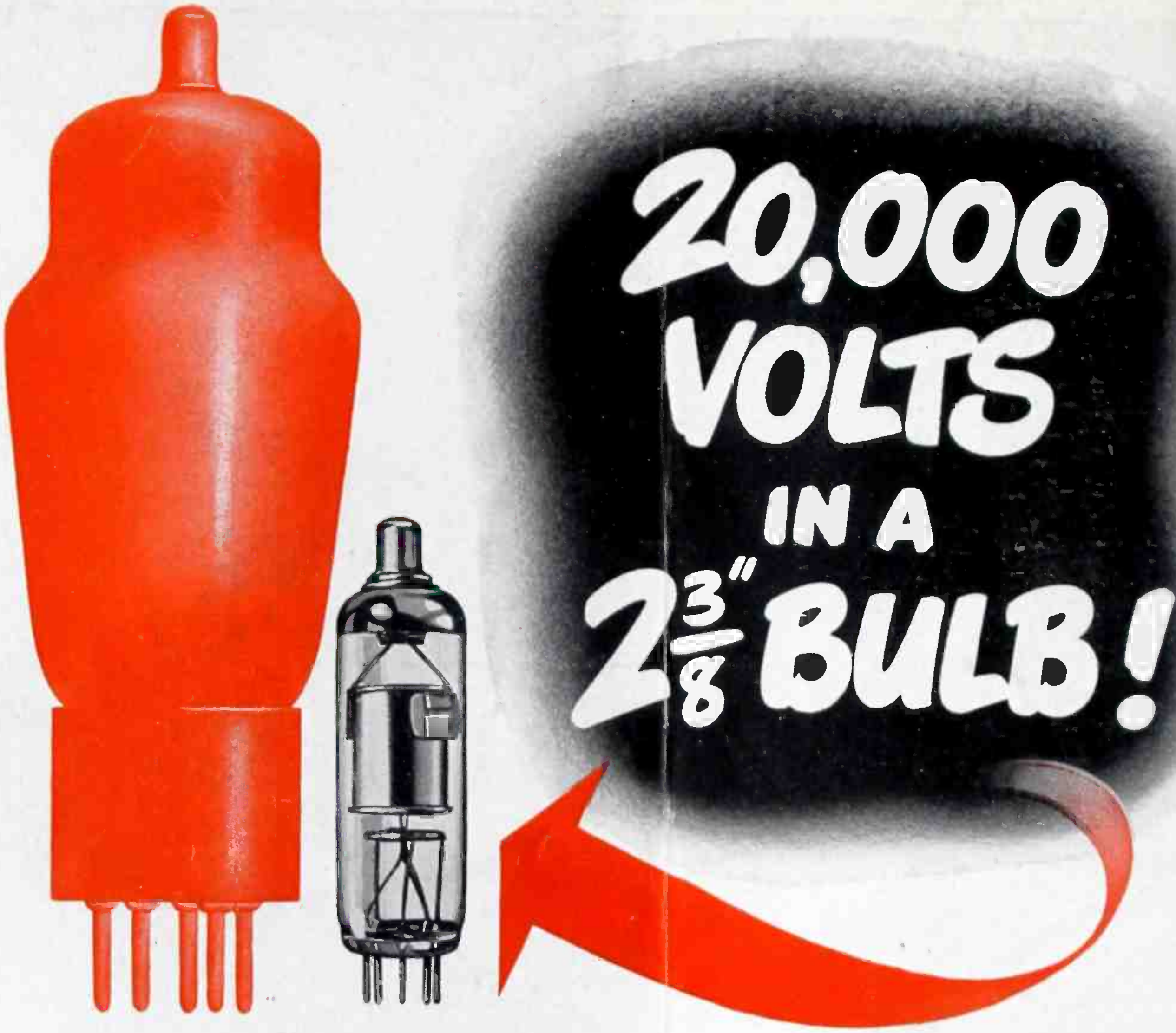
WEST N. Y. PLANT · BAYONNE PLANT

A TOTAL OF TEN ARMY-NAVY EXCELLENCE AWARDS

**SOLAR MANUFACTURING CORP.**

**285 Madison Avenue • New York 17, N. Y.**

8013




**ANOTHER "FIRST" BY NATIONAL UNION RESEARCH LABORATORIES**

AN example of how war-time research by National Union engineers is helping to lay the foundation for vastly improved post-war Television, FM and radio reception, is this new half wave high vacuum rectifier—the NU 1Z2.

Here is a miniature with the voltage handling capabilities heretofore possible only in full size tubes. For a high voltage rectified supply in the operation of radar and television equipment, the NU 1Z2 saves space—operates with increased efficiency—is exceptionally rugged. Its low filament power consumption suggests many new fields in circuit design and application, especially to the "ham" and experimenter.

For the distributor and service dealer, such original N. U. electron tube developments are creating new opportunities for profitable N. U. Tube replacement sales—today and in the future.

*National Union 1Z2*
*High Voltage Rectifier*

| | |
|---|---|
| Inverse peak anode voltage-max. | 20,000 volts |
| Peak anode Current | 10 ma. |
| DC Output Current | 2 ma. |
| Filament Voltage | 1.5 volts |
| Filament Current | 300 ma. |

The NU 1Z2 is designed to withstand shocks in excess of 500 G's.

| | |
|---|---|
| Maximum overall length | 2.70" |
| Maximum seated height | 2.37" |
| Maximum diameter | .75" |
| Bulb | T5½ |
| Base Miniature Button | 7 pin |
| Mounting position | Any |

**NATIONAL UNION**
**RADIO AND ELECTRON TUBES**

NATIONAL UNION RADIO CORPORATION · NEWARK 2, N. J.