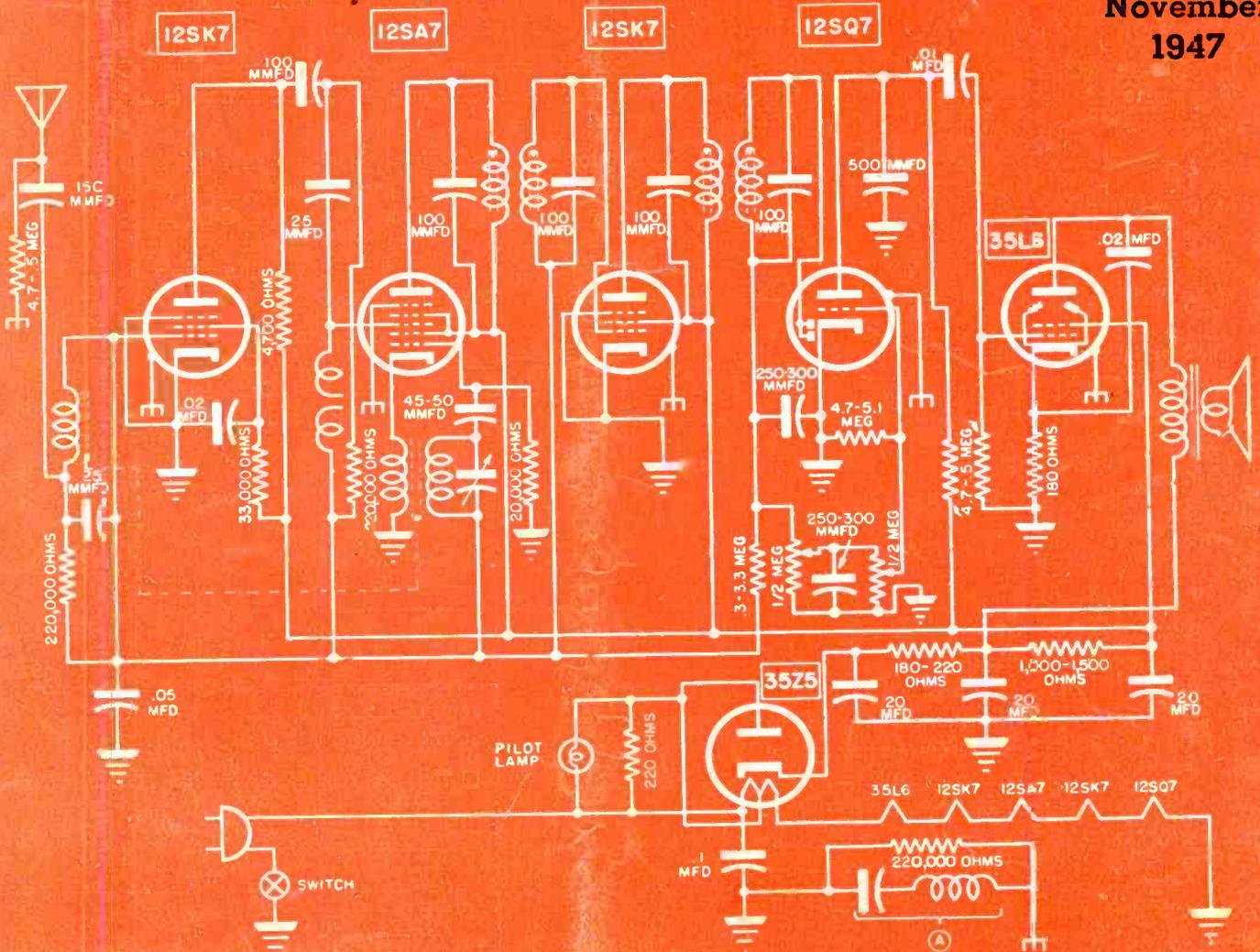
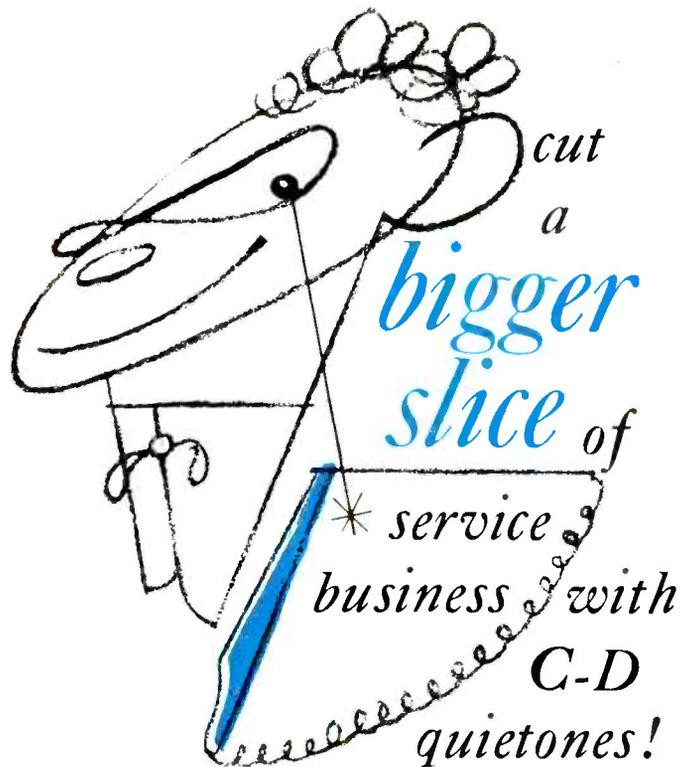


# SERVICE

November  
1947



Five-tube a-c/d-c receiver, with slug-tuned i-f's, developed for coin-operated use.  
[See page 2]



**EARN EXTRA PROFITS** with these standard C-D Quietone Interference Filters. Other types available for difficult cases, including television. Every radio home is a live prospect for these man-made noise eliminators.

Radio repairs alone bring you bread-and-butter business. But you can have *that* and a rich "cake" too.

Thousands of successful servicemen have already discovered how C-D Quietones step up their profits *over and above* their normal business. And it's easy as pie!

Here's a popular, proven method. Simply hook up an old-fashioned brush-type fan, or any noise-making modern appliance, right on your sales counter. Plug in the customer's own set — cut the C-D Quietone in and out — and then and there your demonstration will "wrap up" an extra, profitable sale. Sound easy? It *is* — and you'll multiply your profits with every customer who steps into your shop.

Broaden your profit opportunities NOW with famous C-D Quietones. Mail coupon below for complete descriptive catalog. Cornell-Dubilier Electric Corporation, Dept. S11 South Plainfield, N. J. Other large plants in New Bedford, Brookline, and Worcester, Mass., and Providence, R. I.

**FREE!** Your permanent subscription to "The Capacitor" — the serviceman's own monthly magazine.

Illustrates and describes latest circuits, equipment, etc. — free want-ads and swap notices for servicemen — exclusive hints on repairing every type of radio, phonograph, television set, etc.

**MAIL COUPON NOW** — your free subscription starts at once.



**CORNELL-DUBILIER ELECTRIC CORP., DEPT. S11  
SOUTH PLAINFIELD, NEW JERSEY**

- Rush my copy of Catalog No. 195A describing C-D Quietones.
- You bet I want "The Capacitor". Please start my FREE subscription at once.

Name.....

Address.....

City..... Zone..... State.....

CAR OWNERS ARE LISTENING  
for this suggestion —



A NEW



# AUTO ANTENNA



Big name programs are on the air and here is the big name antenna that will bring in those programs most effectively — General Electric.

Quality-built to withstand the severe conditions of winter driving, these antennas provide real customer satisfaction in radio reception.

They also provide real cash-register satisfaction for you because:

1. They are designed for any type installation—any body contour.
2. Provision is made for quick, easy installation.
3. Ceramic insulators are used for better insulation.
4. With your order—a colorful display board that does a swell selling job every minute.

These are the features that make G-E antennas outstanding values—quick sellers.

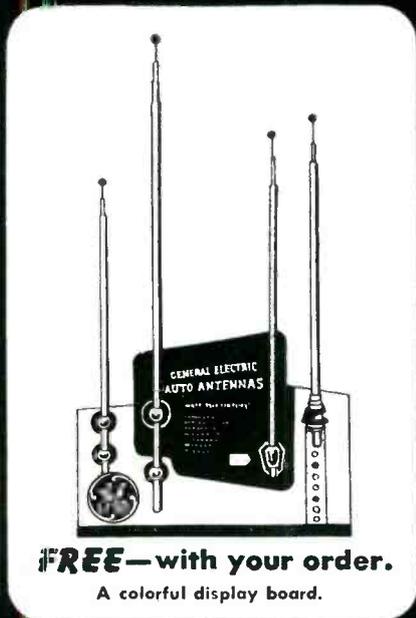
- Completely equipped with a newly developed low capacity, low loss lead-in cable.
- Interference-proof lead-in coupling arranged for speedy installation.
- Ferrule-set connection with bayonet adapter.
- Rattle-proof, no-slip, fluid

type construction.

- High efficiency, low resistant silver-to-silver contacts.
- Finest Admiralty brass, beautifully chrome plated.

Mail your order today to your nearest G-E distributor.

For additional information on General Electric Universal Parts write: *General Electric Company, Electronics Park, Syracuse, New York.*



**FREE—**with your order.  
A colorful display board.

**GENERAL  ELECTRIC**

169-F9

# EDITORIAL

THE INCREASED ADOPTION of *codes of ethics* by Service Men and Servicing associations is a commendable move, serving to accent the sincerity, and business and technical acumen of the industry.

Communities and cities, too, have reported enthusiastic approval of the trend. Local boards of trade and broadcasting stations have applauded and supported this program widely.

The codes in the main, have featured such factors as workmanship, price, conduct and guarantees. In the Philadelphia Radio Service Men's Association code, which appears on the *Association News* page (36) of this issue, an unusually important statement appears: "I will make a sincere effort to improve my knowledge of the technical and business requirements of my job, thereby enabling me to render still better radio service." Here's a solid guarantee of *know-how* approach!

The foregoing code and others we have seen are not frothy, wordy and issue-straddling. They are compact, specific and factual. They mean business... good business for the Service Man. And they can work anywhere. There's no need for licensing or municipal policing, with a code in operation.

Another approach to the code system was recently suggested for the New York City area, with *authorized Service Men* designated by dealers and distributors. The plan suggested by the RMA service committee calls for an advertising campaign by distributors and dealers recommending that receivers be serviced by *trade-authorized Service Men*, who are *experienced* and *competent*. Details of the plan, expected in about a month, will be covered in *SERVICE*. Watch for this analysis!

THAT CLINIC PROGRAM, announced in these columns a few months ago, will be conducted in Philadelphia, at the Bellevue-Stratford Hotel, on January 11, 12 and 13. There'll be papers on television, f-m, test equipment, and business methods by leading Servicing specialists.

Twenty manufacturers will display and demonstrate their test equipment for clinic attendants. There'll also be several question and answer sessions during the days.

Here's the perfect Service program... and there'll be no admission charge.

Remember the dates... one eleven, twelve and thirteen!

# RADIO · TELEVISION · ELECTRONIC SERVICE

Vol. 16, No. 11

November, 1947

**LEWIS WINNER**

Editor

**ALFRED A. GHIRARDI**  
Advisory Editor

**F. WALEN**  
Managing Editor

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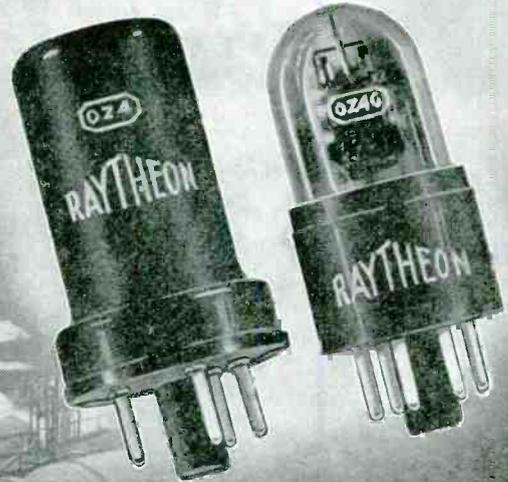


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TEN TIMES MORE GASOLINE than this switchyard of tank cars could carry has been saved by Raytheon 0Z4 and 0Z4G tubes.

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RADIO RECEIVING TUBE DIVISION  
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*Excellence in Electronics*

RADIO RECEIVING TUBES  
SPECIAL PURPOSE TUBES  
TRANSMITTING TUBES  
HEARING AID TUBES

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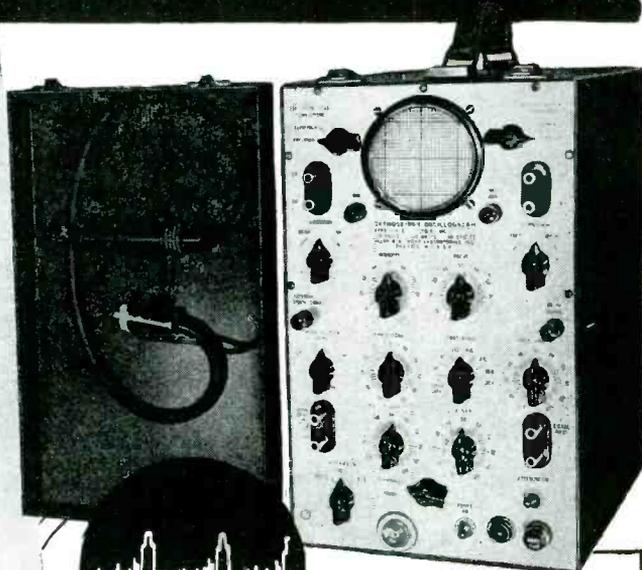
that keep you on the beam for that up-to-date

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*For Television...*

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**DU MONT TYPE 224-A OSCILLOGRAPH**  
 LOW COST • LIGHT AND PORTABLE • 3-INCH PICTURE TUBE

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**YOU DON'T HAVE TO WAIT FOR EITHER OF THESE INSTRUMENTS!**

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*For FM & AM Radio...*

Handle More Business, Make More Money, Save Valuable Time, with the **DU MONT TYPE 274 OSCILLOGRAPH**  
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The big tool in radio servicing is the cathode-ray oscillograph. And for the serviceman, Du Mont has designed this Type 274. It's inexpensive, dependable, all-around equipment. Features latest developments from servicemen's point of view, including the big 5" tube for convenient observation. Greatly simplifies radio servicing especially since you receive the complete instruction manual telling, in clear, easy-to-follow language, how to use it. Typical service problems demonstrated and explained. Your 274 can be put right to work, paying itself off by savings in time, money and headaches, plus a better job performed.

Technical specifications on request. Or see the instruments at your jobber's.



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## Precision Electronics & Television

ALLEN B. DUMONT LABORATORIES, INC., PASSAIC, NEW JERSEY • CABLE ADDRESS: ALBEEDU, PASSAIC, N. J., U. S. A.



(Above photo taken at servicing bench of the Heppie Co., Phila.)

# ALL 16 RIDER MANUALS!

Ever stop to think how many successful servicing shops, with which you are personally acquainted, have complete sets of Rider Manuals? Ever notice how many photographs of servicing benches, illustrating success stories in magazines, show all Rider Manuals? This is more than coincidence. It is irrefutable evidence of how Rider Manuals profitably meet the day-in-day-out data needs of busy shops.

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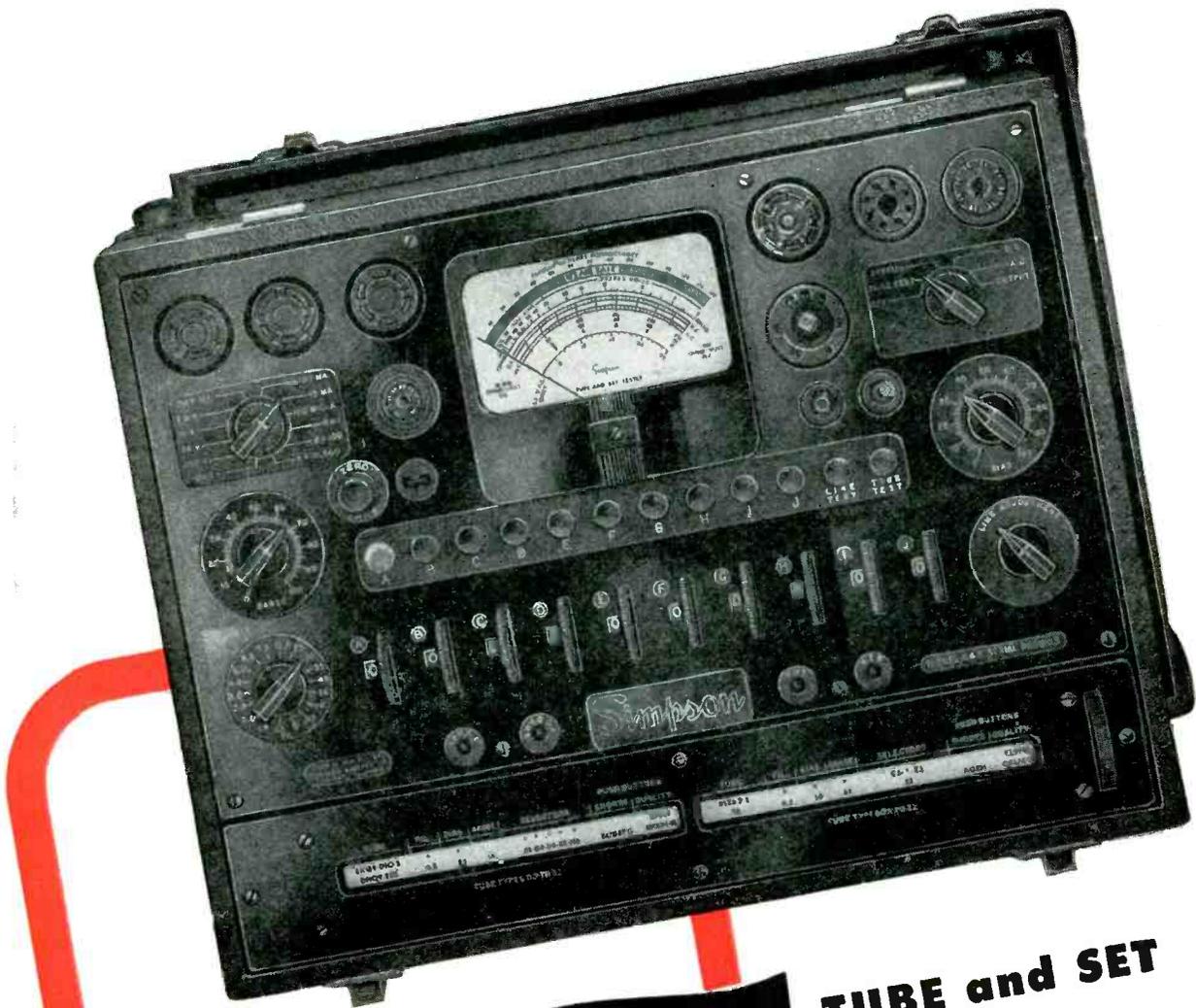
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Broadcast Operator's Handbook



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Model 445 embodies a *tube* tester of the plate conductance type. The dial indicates percentage of rated plate conductance which can also be considered as percentage of mutual conductance since, in most cases, the amplification factor remains constant. When a tube test is finished the Simpson Automatic Reset mechanism clears the meter for the next test. Just press the button and instantly all switches, both push button and rotary, return to normal automatically. Sockets for all types of tubes are provided, including the new 9-pin miniature; also the sub-miniature as used in hearing aids, etc.

The volt-ohm-milliammeter set tester provides the ranges that have made the Simpson Model 260 the most famous set tester in the world. At 20,000 ohms per volt D.C., it has no peer for sensitivity in its price range. Model 445 is housed in a durable, easy-to-carry case. Its panel is of heavy molded bakelite with all letters and figures recessed and filled in white for easy reading.

ASK YOUR JOBBER

## TUBE and SET TESTER...

with the famous Simpson "No Backlash" Roll Chart

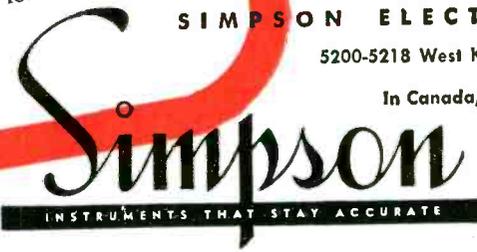
### RANGES

- Volts (20,000 ohms per volt D.C., 1000 ohms per volt A.C.): 0-2.5, 10, 50, 250, 1000, 5000.
  - Milliamperes (D.C.): 0-10, 100, 500.
  - Microamperes (D.C.): 0-100.
  - Decibels (5 ranges): -10 to +52 DB.
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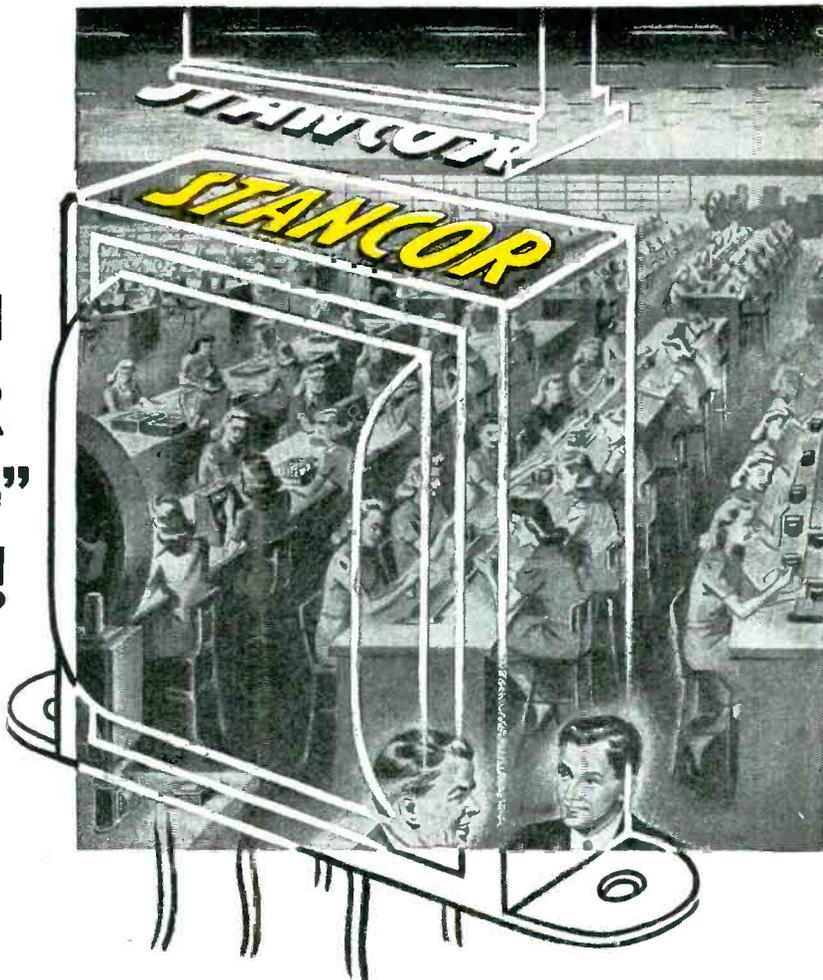
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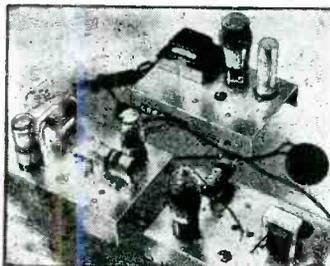
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## Good for Both FREE

MR. J. E. SMITH, President, Dept. 7M23  
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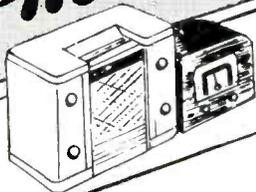
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Age.....  
Name.....  
Address.....  
City.....State.....

(Please include Post Office zone number)

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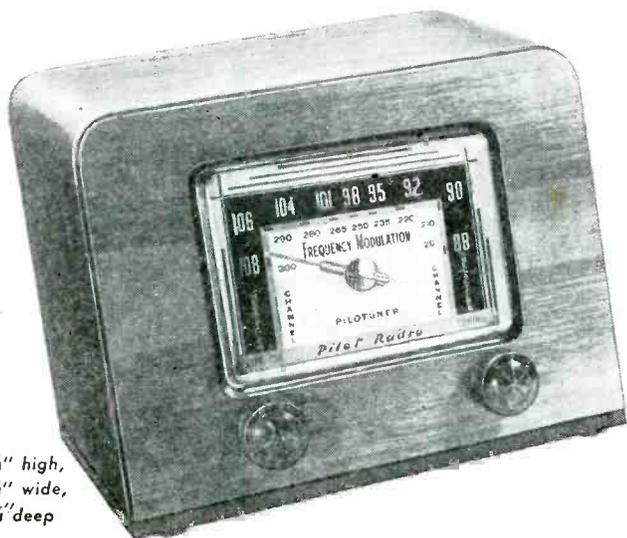
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 who owns **ANY**  
**RADIO** can enjoy  
 thrilling **FM** with  
 the amazing  
***Pilotuner***



# GOLD MINE

*for Radio Service Dealers*

# FM *Pilotuner*



6 3/4" high,  
 8 3/4" wide,  
 5 3/4" deep

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## HERE'S THE RIGHT ANSWER 9 OUT OF 10 TIMES

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The 112 Volume Controls and 5 Switches That Solve Over 90% of Your Replacement Problems . . . . .

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- 16 Popular Type Controls with Fixed Shafts
- 8 Clutch Type Controls with Fixed Shafts
- 7 Dual Controls with Fixed Shafts
- 9 Controls for Specific Service Used with Fixed Shafts
- 2 Special Controls for Power Requirements with Tap-in Shafts
- 5 Switches



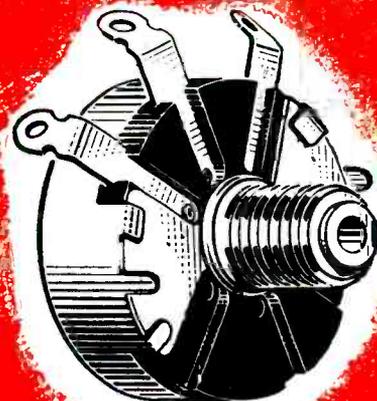
Bring yourself up to date with the new No. 4 Edition of this amazingly popular and useful manual. Contains detailed replacement information on nearly all models up to 1946. Complete listing of 1941-42 models . . . the ones now coming in for repair. 156 pages. 25c at your IRC Distributor.

**INTERNATIONAL RESISTANCE COMPANY**

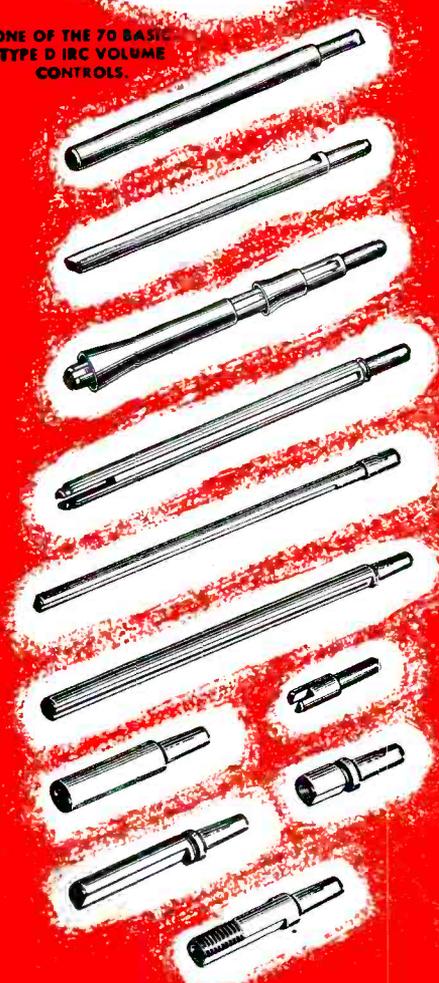
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Wherever the Circuit says 

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ONE OF THE 70 BASIC  
TYPE D IRC VOLUME  
CONTROLS.



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— FOR ALMOST EVERY REPLACEMENT NEED.

# SPRAGUE TRADING POST

## SWAP-BUY OR SELL

**SELL OR TRADE**—Approved electronic signal generator A-200, \$25; in good condition. Will answer all inquiries. Barnes Radio Service, West End St., Camden, Tenn.

**WANTED**—Instruction book on SCR-522. C. C. Erhardt, 84-53 Dana Court, Rego Park, Long Island, N. Y.

**FOR SALE**—Hickok 156 traceometer used one week, \$130; 5" scope \$100; volumes 1 & 2 Sam's Potofact, \$28. Robert L. Batchelor, 36 Washington St., Canton, Pa.

**FOR SALE**—RCA Rider channelist 162C never used, \$130. I. E. Hardy, Jr., 309 N. Hill St., Mokenna, Ill.

**WANTED**—Power transformer for Du-Mont 30B-B oscilloscope; also technical manual 11-468 Radar Fundamentals, John Mader, 522 N. 8th St., LaCrosse, Wis.

**FOR SALE**—DB-20 preselector, \$19.50; RMD-45 receiver, \$149.50; both late models, perfect condition. H. Jankowski, P. O. Box 27, Tribes Hill, N. Y.

**SELL OR TRADE**—Complete radio parts assortment and Simpson V.O.M. #215, nothing surplus, most items new, \$95 or what have you? E. A. Sheour, 542 West 112th St., N. Y. 25, N. Y.

**FOR SALE**—Tubes, speakers, resistors, output transformers for less than wholesale cost at present day prices. P. O. B. George L. Litchfield, 314 S. 2nd St., Rogers, Ark.

**WANTED**—Used a-c signal generator and army surplus receivers, have about \$40 worth of used model railroad equipment to trade. George H. Hague, 6 Carver St., Fall River, Mass.

**FOR SALE**—CA-11 Superior signal tracer in perfect condition, going out of business, \$14. Edward O'Malley, 1601 Williams St., McKeesport, Pa.

**FOR SALE**—Hard to get tubes at list prices; in lots of 20 assorted, 50% off August list. Write for types you want. Goodwin Radio Shop, Rankin, Ill.

**FOR SALE**—New volt-ohm-milliammeter. Cost \$10, sell for \$4; 16 tubes like new \$3.50; Meissner 456 K.C. Iron Core, 1-f's both \$1.50; Silver 8 tube radio \$4; 3 gang condenser, \$1; six tube chassis punched and drilled, \$1; 1 Utah 10" speaker and output transformer cost \$7, sacrifice \$3; also speaker for 6V8 single tube. Write for details, Henry Skorowski, 1501 Crown Ave., Scranton 5, Pa.

**WANTED**—Hallcrafters CN3 or CN5, fm converter in good condition. F. W. Jones, Gabbs, Nev.

**FOR SALE**—Weston power level indicator, 695 type 3A, calibrated in decibels and 0/1.5/6/15/60/150 a-c volts A-1 condition \$15. H. A. Doll, Box 210, Louisiana, Va.

**FOR SALE**—ICA deluxe signatone code oscillator, like new \$6; also radio textbooks of all kinds, used 1/2 off. Francis Conlogue, 5 Norfolk St., Roxbury 19, Mass.

**FOR SALE**—S-38 Hallcrafters receiver like new; will sell \$30. Larry Popelbaum, 127 West Symmes, Norman, Okla.



## FREE! This Giant Sprague TEL-U-HOW WALL CHART

— from your Sprague Distributor

Ask your nearest Sprague jobber for your copy of the SPRAGUE TEL-U-HOW WALL CHART. Just the thing for hanging on the wall of your shop. Its professional appearance impresses customers. The material it contains will help you do jobs easier, better, faster.

Beautifully lithographed in colors, size 22" x 28", the chart includes handy service application data; diagrams and descriptions of common circuit troubles involving capacitors; general replacement data on electrolytics; formulas; transformer, resistor and capacitor color codes; schematic; and similar invaluable service information. Everything is arranged for quick, easy reference. Popular Sprague Capacitors and Koolohm Resistors are illustrated. Don't miss it!

**SELL OR TRADE**—Jackson 3" oscilloscope, good condition, \$50; RCA signal generator 153 perfect, \$42.50 or trade either or both items for what you have. G. S. Preston, Hamilton, Va.

**FOR SALE**—Hallcrafters S-41W; Philco PT-2 cabinet, and many pieces, misc. parts, etc. Need ham gear, Rider manuals and test gear. Will sell or trade. Eddie Howell, Rt. 2, Dillon, S. C.

**FOR SALE**—Treasure finder, Osborne RFO type, as described Radio News Nov. 1946; excellent condition; complete with batteries and loop, \$125 W. R. Donovan, Apt. 2; 906 Gramercy Drive, Los Angeles, California.

**SALE OR TRADE**—14-6 x 5-gt; 2-5B4-gt; 4-2E24; 30-6AL5; 15-6AK5; 18-6AK6; 4-9001; all or part, Ralph Chrisman, Box 93, Elon College, N. C.

**FOR SALE**—Latest model Zenith trans-oceanic clipper portable radio; eight tubes, push-button shortwave tuning and broadcast bands; AC-DC battery operation. C. E. Wampole, 1927 Pearl St., Anderson, Indiana.

**FOR SALE**—Oscilloscope, converted Army RC-112A (WE) 5" chassis & power supply, sweep, horizontal & vertical amplifiers, all tubes including 6BP4, 115 v. 60 cycle input; ready to use; no chassis changes necessary. Want high fidelity equipment, speaker, P.M. etc., \$75 f.o.b. P. H. Prokes, 9216 S. Menard Ave., Oak Lawn, Illinois.

**FOR SALE**—Supreme 546-A oscilloscope complete instructions; new, H.C.P. Signal generator model 705-A and signal tracer Superior Instrument Co. CA-11; perfect. E. A. Godfrey, 608 Center Avenue, River Edge, L. I.

**FOR SALE**—Well established radio and appliance sale and service store, latest equipment, large stock tubes, parts, radios and appliances, best franchises, five room apartment furnished, building air conditioned—\$14,500. Andes Radio Center, Andes, New York.

**FOR SALE**—Triplett 2413 tube tester and 2432 signal generator; new—\$100. L. R. Kurtz, 136 W. Clark St., Albert Lea, Minn.

**FOR SALE**—Simpson voltmeter, 260 and precision tube checker series 912. Jacquelyne Schleuter, Star Route, Belton, Texas.

**FOR SALE**—Messinger analyst 9-1040, all test leads and instruction book, A-1 condition, \$80. L. Ray DeForest, Unadilla, New York.

**FOR SALE**—RCP 419 multimeter with instructions, carrying case, built in fuses, etc., excellent condition—\$37. Donald L. Chase, 1303 Reddy Ave., Medford, Oregon.

**SALE OR TRADE**—Victor 40B 16 mm sound-silent movie projector, A-1 condition, complete accessories, 72" da-lite screen, Craig master splicer, 7000 ft. movie film, 8-1000 watt bulbs. Want—Precision tube tester, RCA rider channelist 162C or Hallcrafters SX-42, Yen Radio Service, 343 Louis St., Rockford, Michigan.

**SALE**—Precision 920P tube and set tester \$75; EV-10-MCP VTVM—\$60; Rider manuals 1-5, 6, 8, 10, 12, 13, 14, 15—\$13 each; all new, Jerry Dewey, 159 1/2 Park Ave., Allegan, Mich.

**FOR SALE**—Edwards FM tuner \$45; Silver 2 1/2 meter rec. with tubes \$40; Vomax \$50; SW-3 with 10 coil sets \$35; BC-625A \$9; Bogen A-20 amplifier \$35; SCR-211 with power supply \$50; Jensen 12" co-axial speaker \$25; S-40 \$80. P. L. West, Box 722, Martinsburg, W. Va.

**FOR SALE**—6' relay rack cabinet, 28" deep, with panels and castors \$15. W. H. Knebbe, WENPE, 101-21 Astoria Boulevard, Corona, L. I., N. Y.

**SELL OR TRADE**—General Electric #140 camera size portable broadcast receiver, new, four tube set, rectifier, \$45. Want—35 mm. camera or enlarger. S. B. Bates, Bates Hill, Summerfield, Ohio.

**FOR SALE**—Shop stock—tubes, parts, supplies, bargain prices. For information write Radio-Electric Labs., J. C. Thimljan, Prop., 715 North 7th Street, Lake City, Minnesota.

**FOR SALE**—Step down auto transformer, 230 volts a.c. to 113 volts a.c., rating 250va., never used, \$2.50; transmitting filter condenser 1 mfd at 4000 volts d.c. new, \$4. Radio Communication Service, 4175 Myrtle Street, San Diego 5, Calif.

**FOR SALE**—Triplett signal generators; laboratory sets 100 kc-120 meg. for F.M. and television. Will check regular sets also, 30% discount. Write B. Teitelbaum, 712 E. 131 St., Cleveland 8, Ohio.

**SWAP**—3" Buckeye air drill, pistol type, geared Jacob chuck; 3" Chicago pneumatic air gun, pistol type. Cost over \$100. Want—S-38 Hallcrafters or similar receiver. Robert Moore, 2727 Vee Street, Sacramento, Calif.

**FOR SALE**—ACA100 D.C. music amplifier, used 6 months, factory condition, 23 watts, 20-20,000 c.p.s. expansion and scratch suppression, rack mounting, \$135. Elmer F. Seavey, 79 Chenango St., Buffalo 13, New York.

**WILL TRADE**—Royal de luxe portable typewriter and Mercury II, 35mm camera. Want—signal generator or what have you. Edwin R. Deans, Box 138, Hammond, N.Y.

**FOR SALE**—Unused tubes: 3-807's; 4-803's 2-845's; 5-837's; 1-808; 1-RK34; 4-3S4 and 4-6J6. E. P. Cornwall, 4002 34th West, Seattle 99, Washington.

**FOR SALE**—Hand wound, spring driven, governor controlled variable speed phonometer; also 12" turntable. Both removed from Columbia phonograph, good condition \$5.00 plus shipping charges. Gabriel Novick, 768 Rockaway Avenue, Brooklyn 12, New York.

**FOR SALE**—Collection of early issues QST, Everyday Engineering, Science and Invention, Practical Electric, Radio News, Radio, Popular Radio, etc., Embury L. Hovio, P. O. Box 1081, Clovis, N. M.

**FOR SALE**—Complete business, radio and appliance sales and service, modern service bench and fixtures. Strategically located in prosperous community. Write for particulars, Ted Carrico, Radio & Electric, Fruita, Colorado.

## YOUR OWN AD RUN HERE FREE

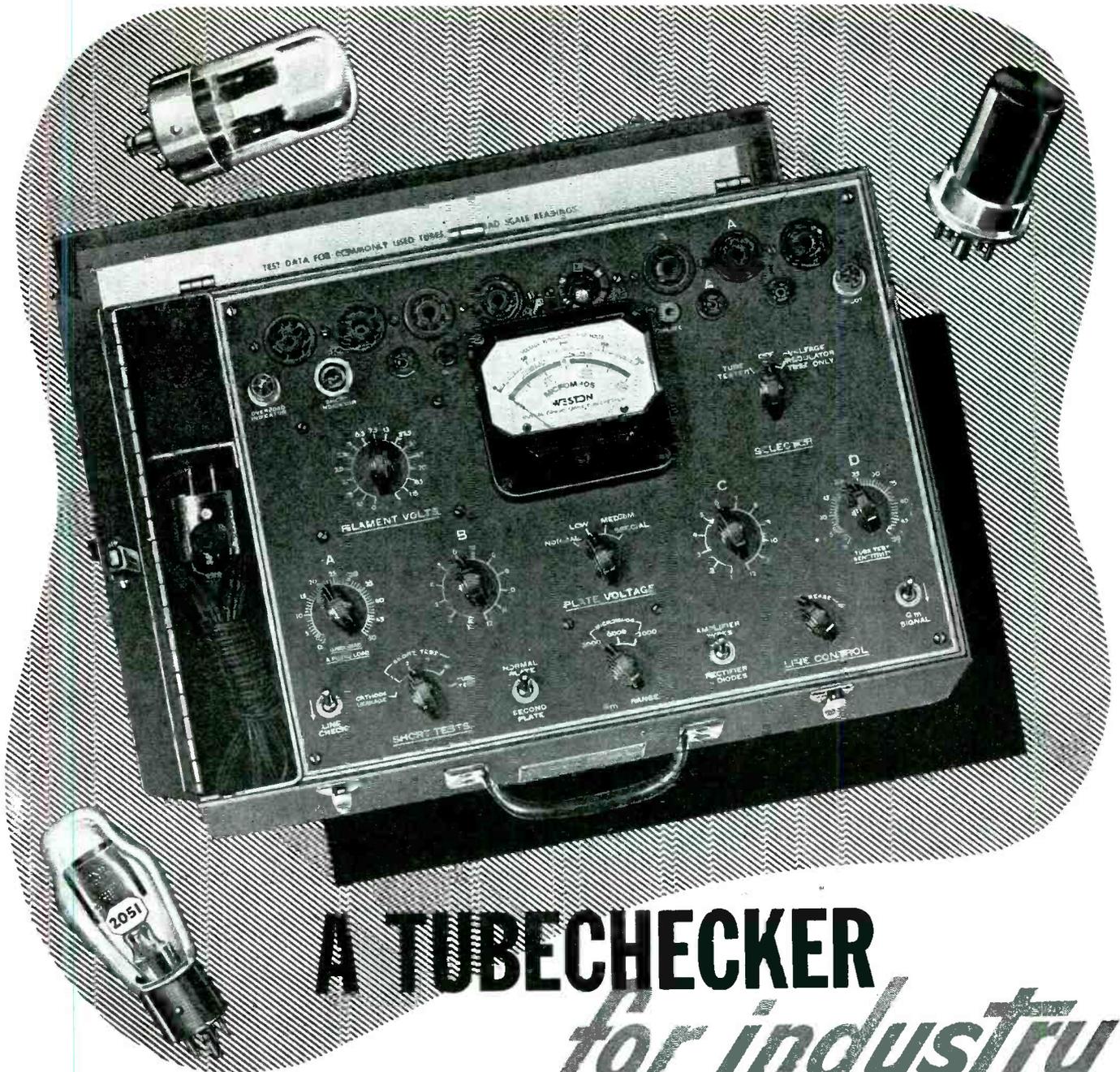
The Sprague Trading Post is a free advertising service for the benefit of our radio friends. Providing only that it fits in with the spirit of this service, we'll gladly run your own ad in the first available issue of one of the six radio magazines in which this feature appears. Write CAREFULLY or print. Hold it to 40 words or less. Confine it to radio subjects. Make sure your meaning is clear. No commercial advertising or the offering of merchandise to the highest bidder is acceptable. Sprague, of course, assumes no responsibility in connection with merchandise bought or sold through these columns or for the resulting transactions.

Dept. S117, SPRAGUE PRODUCTS COMPANY  
North Adams, Mass.

(Jobbing distributing organization for products of the  
Sprague Electric Co.)

ASK FOR SPRAGUE CAPACITORS and \*KOOLOHM RESISTORS by name!

\*Trademark Reg. U. S. Pat. Off.



# A TUBE CHECKER *for industry*

**TESTS:** Receiving Tubes, Voltage Regulator Tubes, low power Thyratrons

The WESTON Model 798 Mutual Conductance Tubechecker provides, for the first time, adequate tests on voltage regulator tubes, light-duty Thyratrons such as the 884, 885, OA4, 6D4, 2A4, 2050, 2051 in addition to tests on regular receiving tubes. Ranges of 12,000, 6,000, 3,000 micromhos as well as "Good-Bad" indications cover

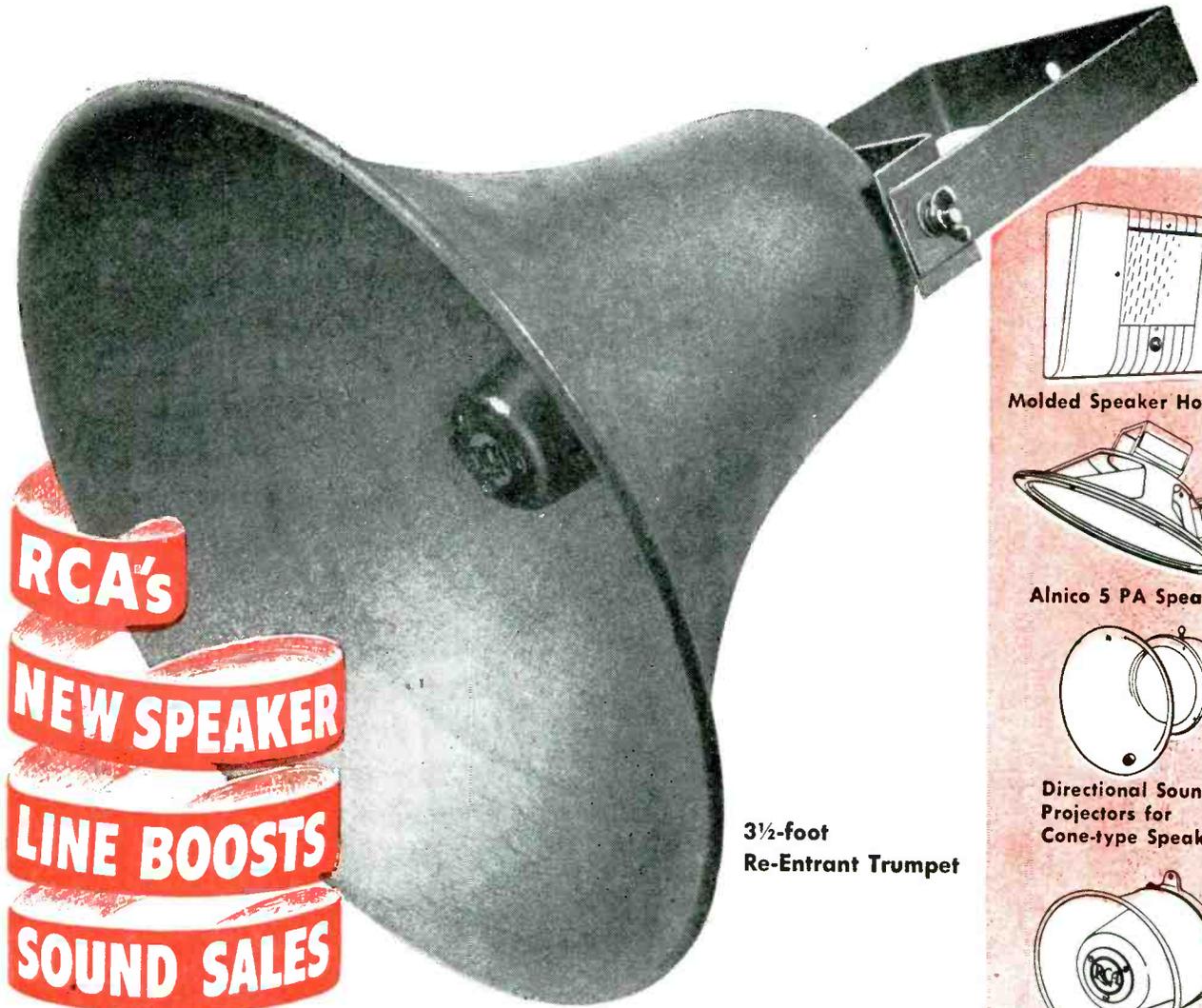
the tube checking requirements of electronic control and radio circuits. Housed in rugged aluminum case to withstand rough usage in shop or field.

For full details consult your local WESTON representative, or write . . . WESTON Electrical Instrument Corp., 617 Frelinghuysen Ave., Newark 5, N. J.

## WESTON *Instruments*

ALBANY · ATLANTA · BOSTON · BUFFALO · CHARLOTTE · CHICAGO · CINCINNATI · CLEVELAND · DALLAS · DENVER · DETROIT · JACKSONVILLE · KNOXVILLE · LITTLE ROCK · LOS ANGELES · MERIDEN · MINNEAPOLIS · NEWARK  
NEW ORLEANS · NEW YORK · PHILADELPHIA · PHOENIX · PITTSBURGH · ROCHESTER · SAN FRANCISCO · SEATTLE · ST. LOUIS · SYRACUSE · IN CANADA, NORTHERN ELECTRIC CO., LTD., POWERLIFE DEVICES, LTD.

SERVICE, NOVEMBER, 1947 • 13



**RCA's**  
**NEW SPEAKER**  
**LINE BOOSTS**  
**SOUND SALES**

**3 1/2-foot  
 Re-Entrant Trumpet**

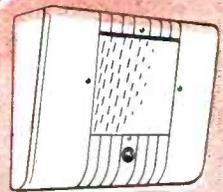
## A full line of Speakers for your sound installations

Now you can select the right speakers for your sound systems. This RCA speaker line provides high-quality distribution of voice and music . . . indoors and outdoors . . . to cover large or small areas effectively.

RCA's Package Sound Line also includes a wide variety of microphones, amplifiers and turntables . . . precision-matched with these speakers. Also available is the popular RCA Two-Station Intercom System. Together these units represent a beautifully balanced line which you can purchase

complete through one source—RCA. The line is built right and priced right for a steady volume of profitable business.

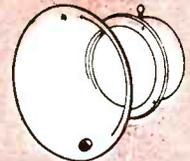
Get this new speaker folder, and its companion folders on microphones, amplifiers and intercoms. They contain specific information on RCA package sound items . . . just printed and waiting for you. Address: Dept. 76-K, Sound Equipment Section, RCA, Camden, New Jersey.



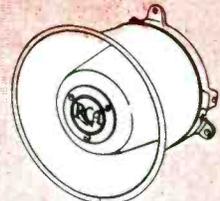
**Molded Speaker Housings**



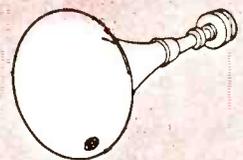
**Alnico 5 PA Speakers**



**Directional Sound Projectors for Cone-type Speakers**



**6 in. Re-Entrant Horn (including 5-watt mechanism)**



**Narrow Beam Paging Baffles**



**Complete line of Speaker Mechanisms for all trumpets and baffles**



**SOUND EQUIPMENT**  
**RADIO CORPORATION of AMERICA**  
**ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N. J.**

In Canada: RCA VICTOR Company Limited, Montreal

## Coin-Operated Receivers

THE COIN-OPERATED RECEIVER has become extremely popular in hotels, clubs and restaurants, and Service Men have found the interest to be extremely profitable. For many Service Men have secured substantial contracts to install and service these receivers and many others have setup sales-service arrangements, offering a complete package to coin-operated set users.

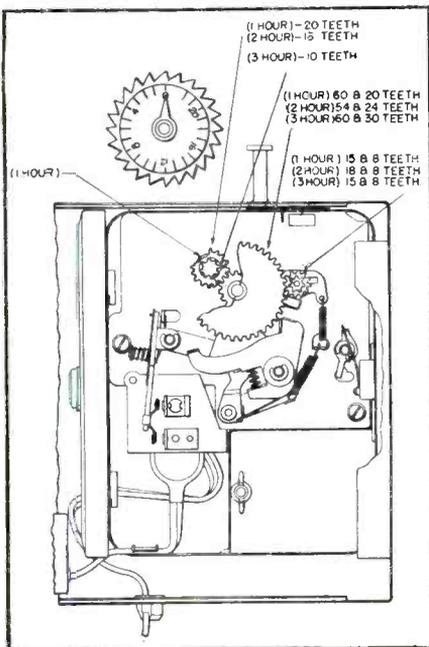
### Tradio Model

The receivers feature unique timing systems. In the Tradio model, for instance, a series of accurately cut gears are used; Fig. 1.

The circuit of this receiver, *front cover*, is an a-c/d-c type and employs permeability tuning. Values in the filtering system, *A*, in front cover diagram, used to reduce hum, depend on use of line ground or chassis.

The operation of the receiver is

Fig. 1. Timer assembly of the Tradio coin-operated receiver.



[See Front Cover]

### by WILLARD MOODY

simple, a quarter starting the set playing.

#### RCA System

RCA has also developed a coin-operated a-c/d-c receiver with a 12SG7 r-f, 12SA7GT/G converter, 12SK7 i-f, 12SQ7 detector-avc, and 35L6GT.

In Fig. 3 appears the coin and timer mechanism circuits used.

#### Slug Rejector System

When a coin of a predetermined diameter is inserted into the slug rejector, the coin falls upon a cradle and

is straddled between two lugs which extend into the coin receiving pathway. The weight of the coin will rotate this cradle and pass the coin through the magnetic field. If a coin, of lesser diameter than the standard coin, is deposited, it will not operate the cradle but fall through the two lugs, a part of the cradle, and pass out as a rejection.

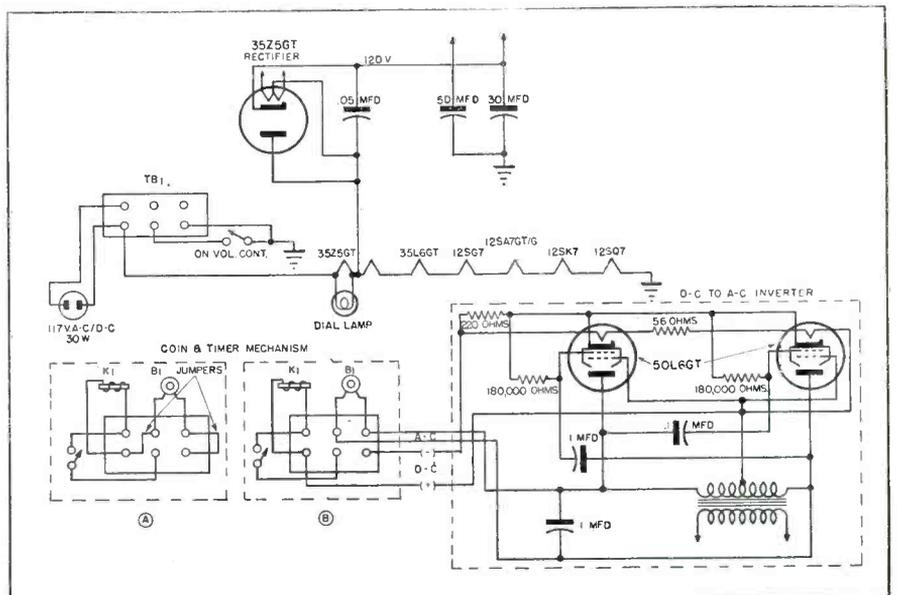
#### Lightweight Coins

When a lightweight coin such as fibre, aluminum or paper is inserted in the device, the coin or token will rest on top of the cradle between the two lugs and will not operate the cradle, and becomes lodged in the passage.

The coin can be dislodged manually by operating a scavenger lever, which will operate the scavenger door and move the cradle away from the pas-

(Continued on page 53)

Fig. 2. Coin and timer mechanism system, and d-c to a-c inverter of the RCA coin-operated model, MI-13174; at *a* is the connection for a-c operation; at *b*, connection for d-c.



# Tommy Tinker's Shop In Boulder, Colorado

THREE YEARS AGO 21-year-old Tommy Eaton began *Tommy Tinker's Radio and Television* shop with \$50 worth of equipment and supplies in a chickenhouse behind his home on the edge of Boulder, Colorado, a city of 15,000.

Today Tommy has a \$40,000 to \$50,000 business in a modern building employing four men and known throughout the area as the place to go for anything in radio.

At 10, Tommy Eaton launched himself into the realm of television by bothering an engineer for two hours at a display at the Chicago's World Fair. At 12 he was sweeping out a radio shop in Fort Dodge, Iowa, and tickled to death when he was allowed to test a tube. Since then he has ground telescope lenses, learned a big chunk of photography, and otherwise delved into just about every kind of science that was handy. After three years of electrical engineering at the University of Colorado in Boulder, he joined the Army. Seven months later he was out on a disability discharge, returned to Boulder, and ground crystals for several months.

When his sister's set was returned by a Service Shop with one replaced capacitor, no work on a bad volume control, and a charge of \$7.50, Tommy said, "Looks like an opportunity for the right man," and immediately took over the new 20 x 29 chickenhouse in back of his home. He acquired one d-c and two a-c voltmeters, built his own cro, picked up some odd tools around town, and bought out the few remaining supplies of a shop going out of business.

The venture was an instant success. Most of the other shops in town had given up to shortages, radios and sup-

## Well-Equipped Shop, Conscientious Servicing and an Alert Advertising Campaign in Newspapers, School and Church Journals, Produces A \$50,000 Annual Business for Service Man, Who Opened Shop Three Years Ago With an Investment of \$50

by ROBERT R. KULL

plies seemed unobtainable, and faulty sets remained on the shelf for months for lack of parts. People wanted receivers. Tommy ordered kits, assembled them, and found ready buyers. People wanted sets repaired. Tommy found tubes the major trouble and exact replacements hard to get, so he took similar tubes and rewired circuits until they worked. Pleased customers were good advertisers, and he *rede-signed* over a thousand sets before he was through.

By January, 1945, the business was driving him out of his shop, so Loyd his dad, took up the option on a building, *Just Across From the Post Office*, and Tommy moved in. Repair men were hard to find, and for a long time night work was necessary. Loyd pulled chassis while Tommy serviced, and they managed to keep up with the business. Several repair men came and went until Tommy took a marine vet under the GI bill and hired an ex-RCA man who came to Boulder to live. Today they do most of the servicing, Loyd handles the salesroom,

and Tommy does installation and p-a work, and meets the public.

Tommy's success is based on two factors: well-planned advertising and a determination to have satisfied customers. His newspaper ads regularly include a cartoon showing him at the receiving window, customers with radios, and a little girl with a doll, with each customer saying, "It won't talk."

*Just Across From the Post Office* has also become a by-word. It is painted on the side of the sound truck, and the commercial on Tommy's new program over the local radio station follows with: "... and, just as reliable."

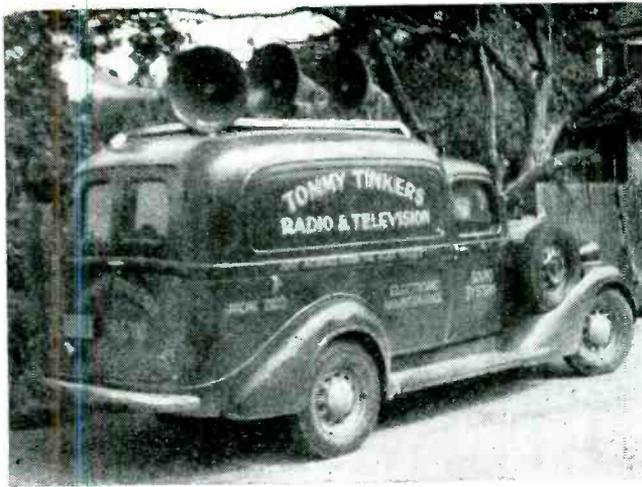
Once in a while when faulty sets are stacked up in the shop and more are coming in by the hour, Tommy closes shop for a few days. The public is notified in a newspaper ad, and a copy of the ad is hung on the front door of the shop. Tommy has found that these notices announcing that they have to catch up on their work impresses the folks, shows that everyone has faith in



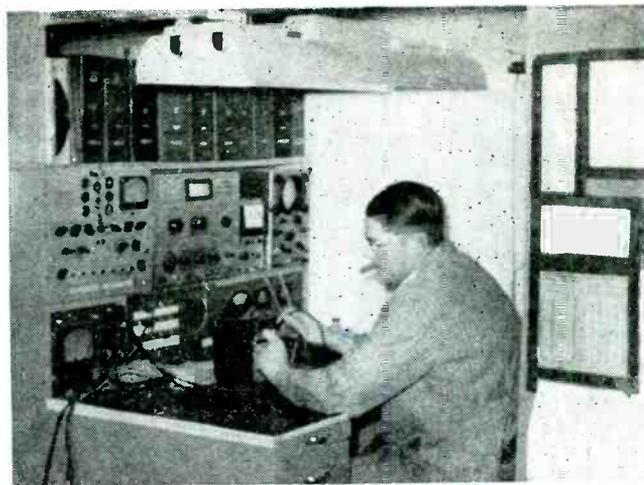
Advertisements used by Tommy Eaton in his local paper, and school and church journals.

**We Will Be Closed**  
**MONDAY - TUESDAY - WEDNESDAY**  
August 18 - 19 - 20  
*In Order to Catch Up on Our Repair Work*

**Tommy Tinker's Radio & Television**  
Repair Service  
1920 15th St. Phone 2922



Sound truck of Tommy Eaton.



Tommy Eaton at his service bench.

them, and thus creates more business.

Besides the daily newspapers in Boulder and nearby towns, Tommy advertises in several small publications in the area; grade schools, high school, a girl's school, the university, and several of the churches.

Tommy reports, "I don't know how much business the ads bring in, but each one helps us make a new group of friends. Whenever those school kids want to fill ad space, they say, 'Let's go to Tommy Tinker's!' I figure we're building future business."

This kind of good-will investment recently gained Tommy the business of a church congregation.

He said, "They were asking contributions for a new church, and mine happened to be larger than that of any other business in town. The following Sunday the parson commended us in church. Since then we've had a lot of their business."

Odd window displays are a specialty with Tommy, "and they are darned good advertising!" he claims. "People are curious, and if you can show them something they've never seen before or know little about, they'll give you a minute of their time."

A radio-fed cro gained crowds of gazers plus a nice feature story in the daily paper. Odd-shaped transmitting tubes stopped passers-by for a couple of weeks, and an electric lawnmower on the showroom floor in front of the door drew many of the curious inside. Tommy is thinking about a capacity-operated relay which will operate a phonograph, window sign, or spotlight when someone passes by. "And it might be a good idea to change what it operates from time to time to keep them guessing," he says.

"Another thing that shows how curious people are," Tommy continues, "is the word *Television* in the name of the shop. People know that we don't have television in this area, but they have to stop and see what we're getting at. It also makes them television conscious, and when it does come here, Tommy Tinker's is the place where they will go."

Because Tommy's shop is the supply store for the local radio station and several of the other shops in town, his jobber business is large and much sought after. He deals with only one jobber and is treated well. "If I want something they don't have, they go out and get it for me," he says.

Tommy has several regular customers for service work and is gaining more. He maintains the radio equipment in three cars for the sheriff and one for the game warden; he does the bulk of the auto-radio work in town (several garages send people to him), and handles most of the work at the local airport. He installed 18 juke boxes and serviced them for a time. And he has a taxi-fleet owner and a cleaning establishment considering two-way communications equipment in their cabs and trucks.

P-a business seemed to beckon, so Tommy got a panel truck, installed six trumpets<sup>1</sup> on top, and built a 125-watt amplifier for it. When newspaper advertising brought few results, he began playing on curiosity again and started driving the truck on service calls. "Well, the speakers drew attention," he says, "and the truck became its own advertiser. After the first week I drove it I had seven jobs."

Several local stores began using the truck to advertise around town, and

<sup>1</sup>University reentrant type.

when this became hard on the vocal cords, Tommy installed a wire recorder to do the talking.

For small jobs, Tommy has three portables; two 15-watt amplifiers and one 25-watt. They bring \$10 the first night and \$5 for each additional night, and supply a steady income.

"People are finally realizing that outside functions call for a p-a system," says Loyd, who handles the portables, "and the university organizations—fraternities, sororities, and others—and civic organizations call for them a great deal."

According to Loyd, they also do considerable *charity* work with the portables, loan them for charity functions and even for kid's rodeos during the summer.

"We generally give the portable, though it can get to be a habit; but I think it's good business because it creates friends."

#### Municipal P-A Jobs

The city began calling Tommy for its p-a work as soon as its other contracts expired, and he now has the huge fireworks program in the university stadium on the Fourth of July and the annual three-day rodeo. He recently signed a contract for the high school football games, and he's now after the university football games.

"Right now there's about \$1,500 worth of p-a business a year in Boulder alone," Tommy says, "and I believe there's about \$6,000 a year in the nearby area. I hope to get some of that in the near future.

"The radio business? I like it fine! But you have to give good service, deal fairly, and advertise."

# Sound Systems For Church Towers

THE EVER-INCREASING DEMAND for church-steeple sound-distribution systems has created quite an opportunity for the alert and progressive Service Man.

The need for the church to advertise, to make its presence known and appreciated in the community which it serves, is a fact often overlooked. The most often used mediums are radio, newspapers, bulletin boards, lighted crosses, and bells and chimes in the church tower. The latter is the most accepted and dignified manner in which the church, for ages, has broadened its influence, by carrying sacred music to the surrounding environs.

## Disadvantages of Bells or Chimes

Tower bells and chimes of the traditional type possess a number of disadvantages which can provide an entering wedge for the sales-minded Service Man. Initial installation cost is high usually from \$20,000 to \$30,000 minimum. Weight is excessive, re-

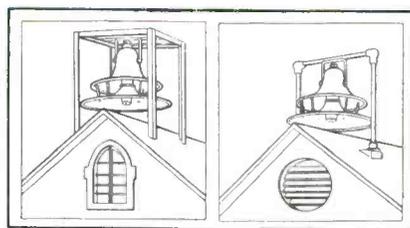


Fig. 1. Alternate speaker locations in church.

quiring masonry and steel construction to support from 10,000 to 50,000 pounds. Pitch is inconsistent and will vary with temperature. Exposure to weather will often cause failure of the striker mechanism and in many instances cracked bells and chimes will result in high maintenance costs and poor tone quality. Sound radiation is uncontrolled and can be very objectionable in the immediate vicinity of the church. Last but not least, conven-

<sup>1</sup>From data prepared by University Loudspeakers, Inc.

tional bells and chimes lack the versatility inherent in amplified systems.

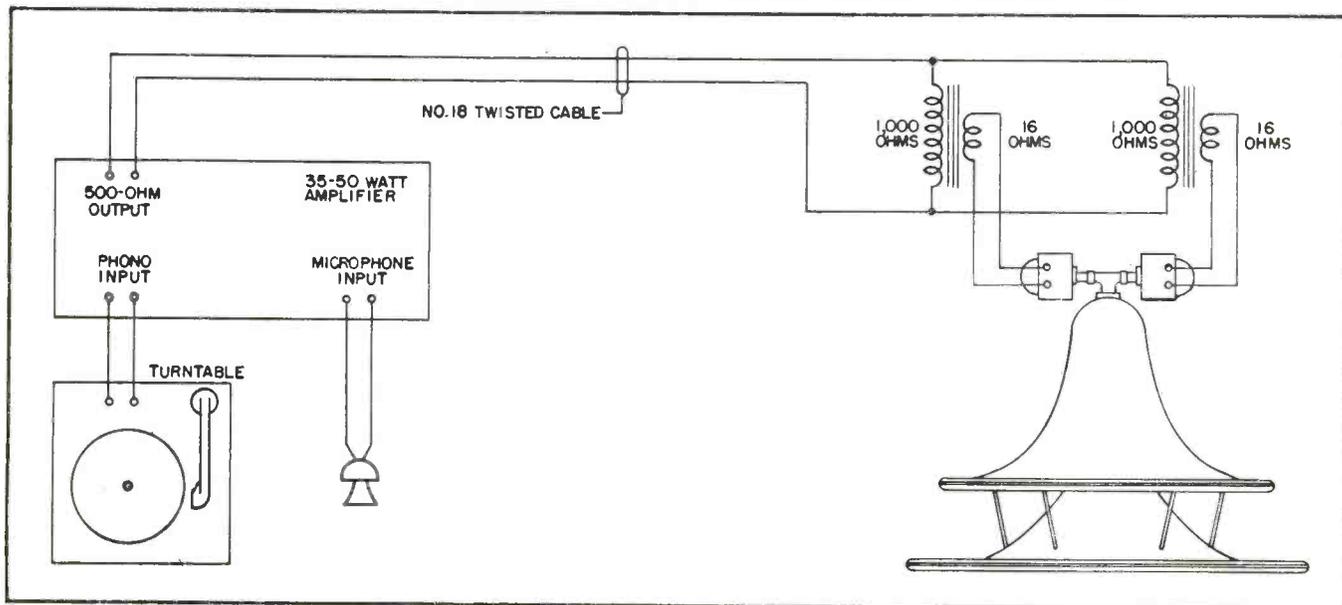
## Advantages of Electronic Sound System

The foregoing disadvantages are sales arguments which can be used effectively in favor of electronically-amplified sound distribution systems. Amplified systems are inexpensive. The budget-minded church can purchase electronic systems for less than 2% to 3% of the cost of bells or chimes and be assured of incomparable quality of tone, virtually no maintenance costs and controlled and increased sound radiation. A tremendous amount of flexibility can be obtained by such refinements as microphone pickup for organ, organ chimes and choir for steeple sound distribution, indoor sound reinforcement and hard-of-hearing aids for within the church.

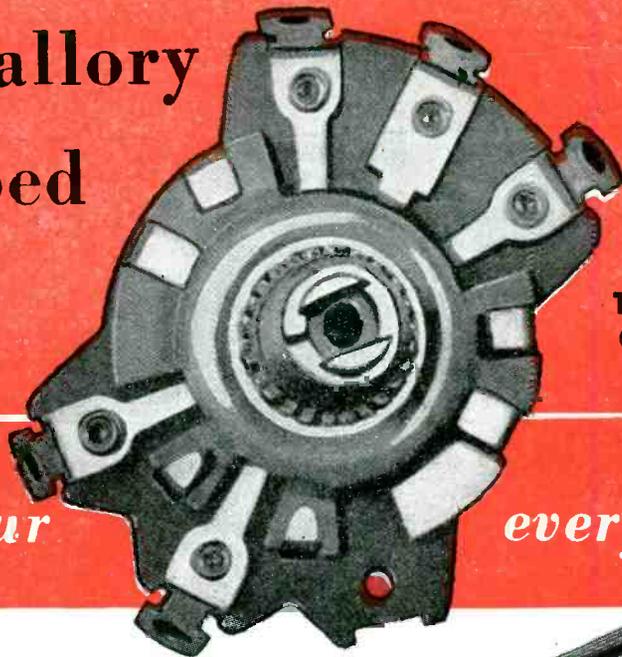
## Equipment Requirements

The essentials of a church steeple sound distribution system are a record

Fig. 2. A typical church-steeple installation. The line transformers are 25-watt weatherproof types for feeding each driver. The speaker, 360° type, is located in the belfry and equipped with two 25-watt 16-ohm driver units, which are uniformly phased.



# 10 Resistance Values in Mallory Double-Tapped Controls ...



TYPE DTM  
(DOUBLE TAP)

To supply your every need

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Speaker	Driver Unit	Power	Sound Distribution
Radial reflex trumpet <sup>1</sup>	25 watt (5¼" diam.) <sup>1</sup>		
Radial reflex trumpet <sup>1</sup>	Two 25 watt <sup>2</sup> units	20-25 watts per driver unit	⅛-¼ mile
Trumpet (with 6½' air column <sup>3</sup> or 4½' air column <sup>4</sup> )	25 watt <sup>2</sup>		
Trumpet (with 6½' air column <sup>3</sup> or 4½' air column <sup>4</sup> )	Two 25 watt <sup>2</sup> units		¼-½ mile
Super power loudspeaker <sup>5</sup>	Four 25 watt <sup>2</sup> units		1 mile

<sup>1</sup>Type RLH. <sup>2</sup>Type PAH. <sup>3</sup>Type GH. <sup>4</sup>Type LH. <sup>5</sup>Type 4A4.

Outdoor loudspeaker power requirements.

player, an amplifier and outdoor loudspeakers. In view of the thousands of people who will listen and pass judgment on the quality of music, there should be no compromise in the quality of the individual components. Since chime and bell music have high audio peaks, the amplifiers and loudspeakers should have ample reserve power. Separate bass and treble controls should be incorporated in the amplifier to permit any desired degree of tonal range.

The response characteristics of horns and driver units should be carefully checked to insure a proper degree of low-frequency reproduction. Attention to these important details will result in a quality of amplified music above criticism by the most discriminating listener.

Special chime records are available, and there are some excellent recordings of chime numbers made at Notre Dame, St. Peters, University of Chicago Chapel, St. Paul's Cathedral of New York, etc. These records are ideal and will give perfect reproduction. For best results, records of this

type should be played individually on a manual record player, rather than an automatic record changer. The motor must have exceptionally uniform speed, as slight irregularities in speed will result in a *wow* or momentary change in pitch, which is extremely objectionable during musical numbers. The motor should be mechanically insulated by means of shock-absorbing rubber cushions or springs, so that the motor vibrations are not transmitted to the motorboard and thus to the pickup arm. A lightweight pickup, carefully checked for needle scratch, should be used in conjunction with a good transcription-type motor. Too much emphasis cannot be placed on the careful choice of motor and pickup.

#### Loudspeaker Locations

Where churches have towers, the upper ventilation windows may be used for mounting the speakers. For churches having no towers, the speak-

<sup>1</sup>University type RLH.  
<sup>2</sup>University type PAH.  
<sup>3</sup>University type 2YC.  
<sup>4</sup>University type LH and GH.

ers may be placed in the opening of the parapet, where the bell is usually located, or a simple framework may be fabricated for roof mounting the speakers; Fig. 1.

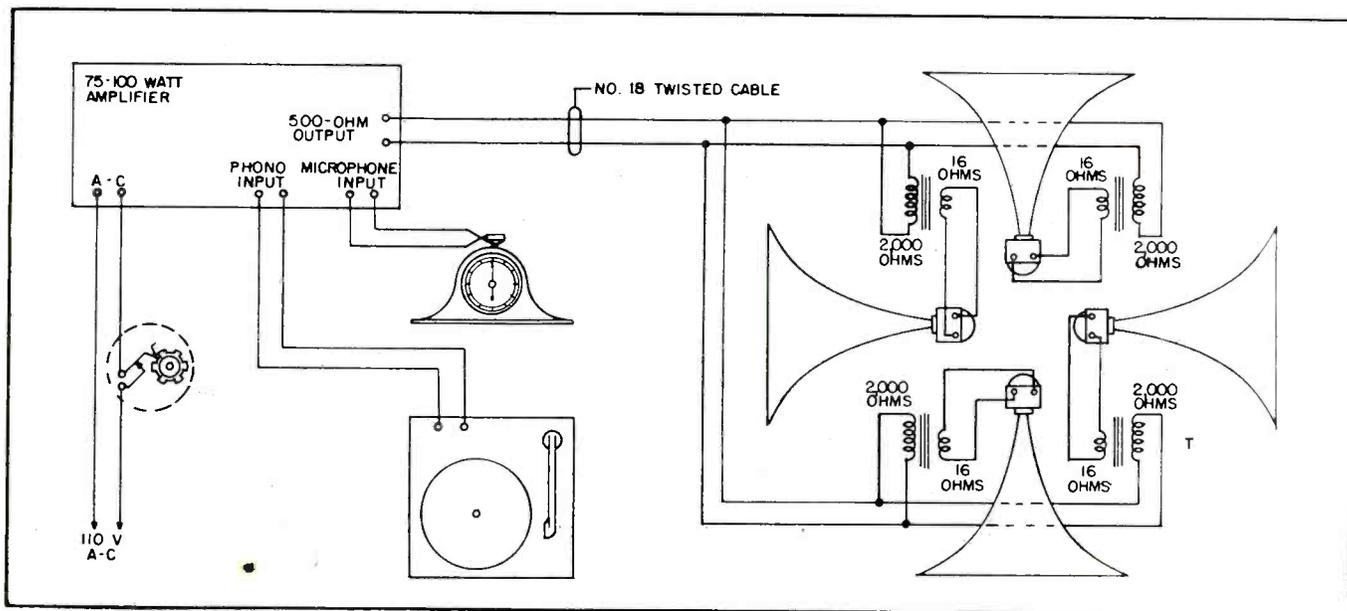
#### Loudspeaker Requirements

Loudspeakers must be of the outdoor type of heavy gauge metal construction. Corrosion resistant finishes on both horns and hardware are essential to permit withstanding any degree of exposure, such as wind, rain and snow. Driver units should be of the permanent-magnet type, and in addition to possessing good low-frequency response, should provide high-conversion efficiency to permit economical choice of an amplifier. The diaphragm material must be immune to sudden changes in temperature and humidity, and have a high fatigue characteristic. The entire driver unit assembly should be enclosed in a hermetically sealed housing.

A variety of reflex trumpets and driver units are available for every type of installation. Where extreme distance is not a factor, a radial reflex trumpet<sup>1</sup> with a 25-watt driver unit<sup>2</sup> will provide effective 360° distribution. Power up to 50 watts may be obtained by using a connector<sup>3</sup> with two 25-watt driver units. For systems requiring greater radius coverage, trumpets<sup>4</sup> with 4½' and 6½' air-columns and 25-watt driver units are the solution. These may be installed in the belfry and the quantity will depend on the number of directions to be covered. Four speakers will usually be neces-

(Continued on page 38)

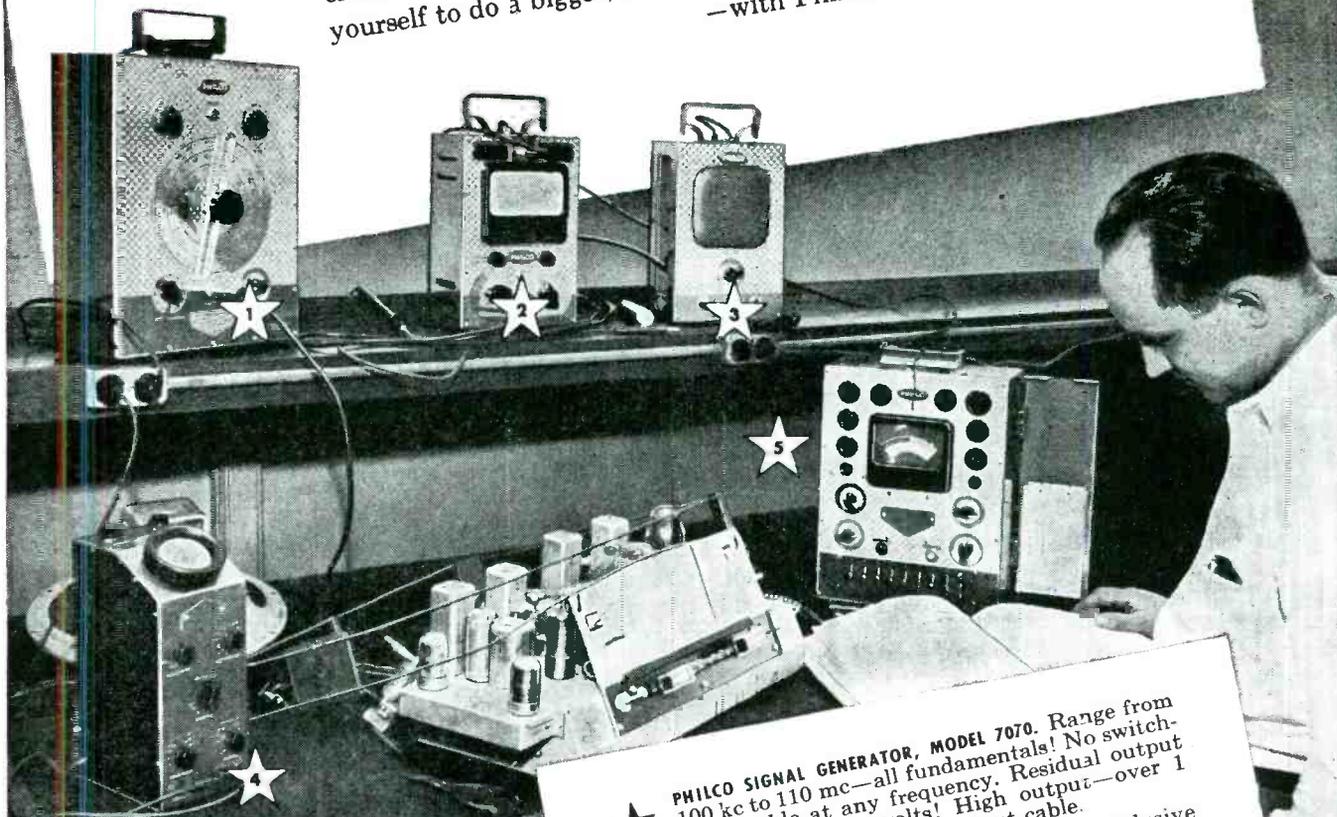
Fig. 3. A 75 to 100-watt church-steeple installation. Reflex horns, with a 4½' to 6½' air column, are mounted in the belfry. Each is equipped with a 25-watt driver unit, uniformly phased. An electric time clock serves to turn on the amplifier five minutes before striking of chimes, and to turn off the amplifier after striking. A crystal-type contact microphone is fastened to the rear of the clock, which is the chime type.



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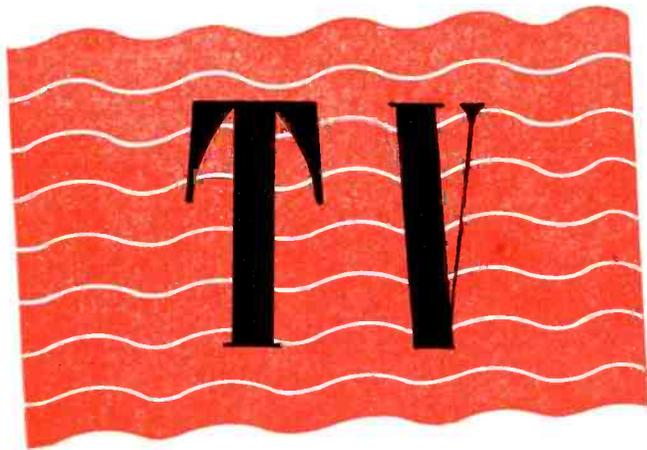
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# Video Detectors

## Analysis of Signal Polarity, Diode Detection, Frequency Response, D-C Coupling and Typical Detector Circuits

THE VIDEO DETECTOR removes the picture modulation from the picture i-f carrier. This modulation consists of picture, sync and blanking and is in the form of the composite television signal formed at the transmitter. The composite signal, of course, is a single polarity signal and the diode detector must be connected to develop a signal of the proper polarity for utilization at the picture tube. The video detector must be designed to detect the highest frequency component of modulation and at the same time reject the lowest frequency component of the i-f spectrum.

### Signal Polarity

It is necessary that we have a negative-going composite signal applied to the grid of the picture tube. Thus the darkest portion of the televised scene and the blanking level of this signal occurs at a point where the instantaneous grid voltage is far enough negative to cause the picture to be dark or to be cut off. During the brighter portion of the scene there is less negative voltage applied to the grid of the picture tube and the screen is illuminated.

Since the detected output of the video detector is the composite television signal, the polarity of the diode detector output must be such that the polarity of the composite signal, when it reaches the control grid of the picture tube, is negative. If there are an even number of video stages between the detector and grid of the picture tube, the detector output must be negative; for an odd number of stages, positive. If the signal is applied to the

by **EDWARD M. NOLL**

*Instructor In Television  
Temple University*

cathode of the picture tube, as in a new G. E. receiver, a positive signal must be applied to the cathode of the picture tube. This necessitates a positive detected signal when an even number of stages are used and a negative signal when an odd number of stages are used. Two typical detectors, one of each polarity, are shown in Fig. 1. When the plate of the diode is connected above i-f signal ground a posi-

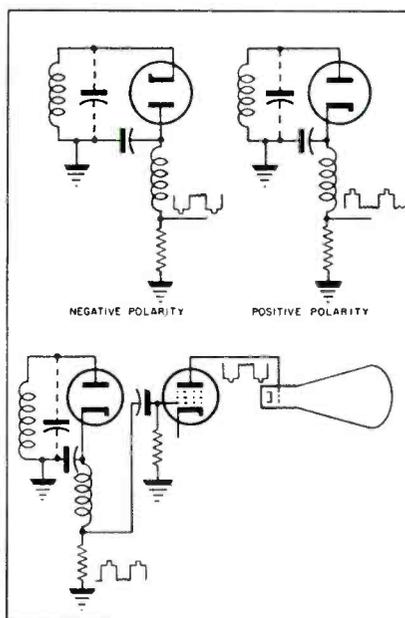
tive polarity signal develops across the diode load resistor. When the cathode is above i-f signal ground a negative signal appears across the diode load resistor. The latter is the preferred connection because the tube capacity shunted across the output diode load resistor (plate to ground capacity) is less.

### Frequency Response

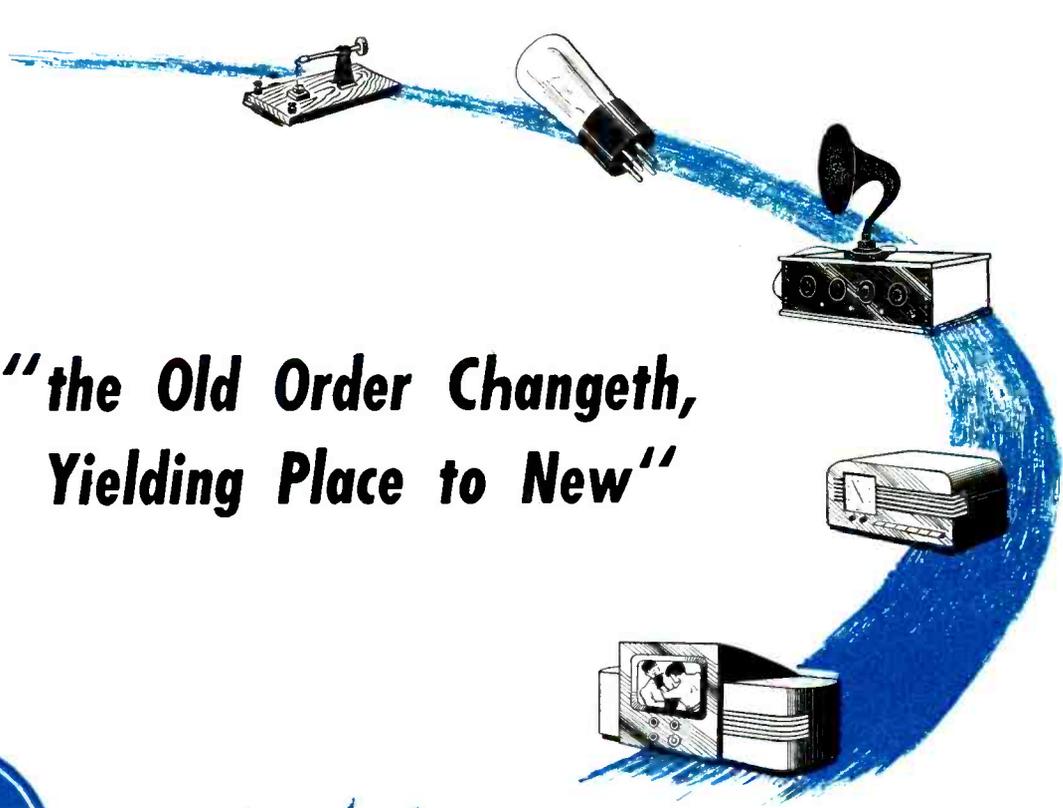
It is an inherent characteristic of the diode detector to develop a stronger signal at the middle range of frequency than at the higher frequency ranges because of the degenerative effects of shunt capacity across the diode-load resistor. For detection of a-f alone, this defect is not serious, the size of a typical diode-load resistor varying from .5 to 5 megohms. However, in television where we detect video frequencies as high as four megacycles it is necessary to drastically lower the size of the diode load resistor to prevent degeneration at these frequencies in comparison to the middle range of frequencies. Thus the decreasing reactance of the distributed capacity at high frequencies does not reduce seriously the value of the output load resistance.

Typical video diode load resistors vary from 2,000 to 5,000 ohms. The efficiency of the diode detector is seriously reduced when the value of the diode load resistor is decreased to such a low value. Consequently, the amplitude of the developed signal is much lower and it is necessary that the i-f amplifier have a much higher gain than the i-f system used in broadcast receiver service. It is apparent there-

Fig. 1. Relation of detector and picture-tube signal polarities.



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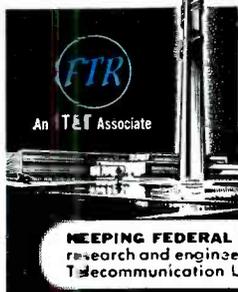
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fore, that a multi-tube i-f system is necessary for picture reception, not only because of the bandwidth of the i-f bandpass required but because of the need for a much higher amplitude signal as applied to the video detector.

It is not only necessary for the video detector to detect the high-frequency components of modulation up to 4 mc, but the detector output circuit must also filter the i-f frequencies. Inasmuch as the lowest frequency i-f component is not very much higher in frequency than the highest frequency component of modulation, it is necessary to use a bandpass filter which passes the high frequency component of modulation, but has sufficient attenuation to remove the lower frequency components of the i-f frequency spectrum. Such a bandpass output circuit is shown in Fig. 2. It will be noted that the filter is a simple low-pass filter, which passes components of frequency up to 4 mc, but after that point begins to reject frequencies and causes all of the i-f components to be filtered out. In the case of the prewar television receivers, this bandpass filter had to be critically designed because the lowest frequency component of i-f signal was at approximately 8.5 mc, which is only double the highest frequency component of modulation at 4 mc. With the new i-f frequencies in the 25-mc range this bandpass filter is not as critical.

### D-C Coupling

In many television receivers the output of the video detector is direct coupled to the first video amplifier. Inasmuch as the output of the detector is a single polarity signal, this d-c component of signal is not lost when the signal is direct coupled to the succeeding video amplifier, instead of coupling through a capacitor which will change the d-c level as the average brightness varies. A typical d-c coupled stage is shown in Fig. 3. In this circuit the grid of the video amplifier is connected directly to the top of the diode load resistor. Consequently the no-signal current, which flows through the diode resistor because of contact potential, sets the no-signal bias of the grid of the video amplifier. This bias is, of course, negative. When signal is applied to the video detector the output of the diode load resistor swings negative in accordance with the instantaneous amplitude of the i-f signal. The darker the scene transmitted, the further negative is the voltage across this diode resistor and, consequently, the further negative the grid of the first video amplifier is driven. However, the applied signal can only make

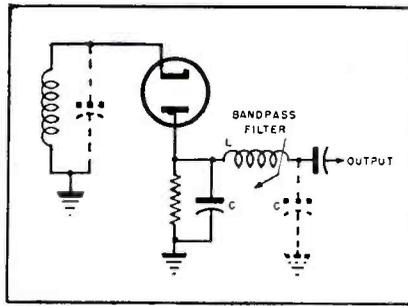


Fig. 2. Bandpass filter used in the output of a video detector.

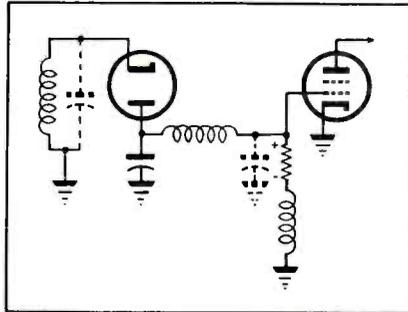


Fig. 3. A typical d-c coupled video-detector stage.

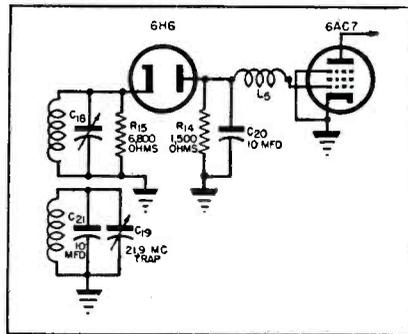


Fig. 4. The direct-coupled video detector used in the G.E. 801.

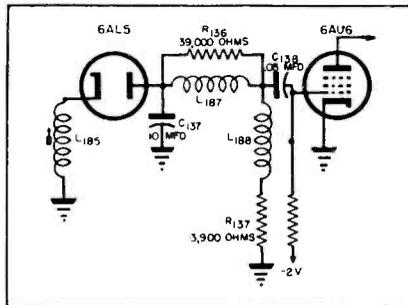
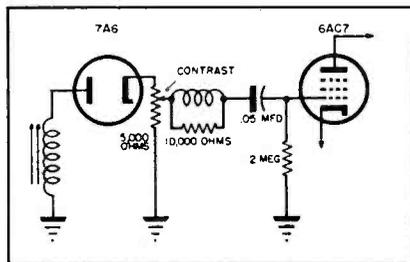


Fig. 5. The RCA 630TS video detector.

Fig. 6. Viewtone VP101A video detector.



the output signal swing negative and consequently the grid signal will only swing negative with respect to its d-c component of bias. This constitutes direct coupling to the video amplifier.

It will be noted in the circuit that a coil is connected between the low side of the diode resistor and ground. This inductor is a shunt-peaking coil and boosts the output impedance of the diode circuit at high frequencies. Actually it forms a partially resonant circuit with the distributed circuit capacity, which counteracts the decreasing reactance of the shunt capacity, which is so effective in degenerating the high frequencies. Thus, most diode detectors in addition to the series bandpass filter inductor, also employ the shunt peak coil to further boost the high-frequency components of modulation.

### Typical Video Detector

A typical direct-coupled negative polarity video detector appears in Fig. 4, G. E. 801. The i-f signal is applied between cathode and ground on the detector and develops a negative polarity signal across resistor,  $R_{14}$ , a 1,500-ohm diode load resistor. The bandpass filter of the detector consists of capacitor  $C_{20}$ , inductor  $L_6$ , and the input capacity of the video amplifier. The grid bias on the video amplifier is represented by the very small voltage drop across  $R_{14}$ , caused by the static diode current.

Resistor  $R_{15}$  is the load for the video detector tuned circuit. A proximity trap tuned to 21.9 mc removes any trace of sound from the picture i-f signal.

### RCA 630TS Detector

The video detector of the RCA 630 TS receiver, Fig. 5, also develops a negatively polarized signal across the output resistor,  $R_{137}$ . However, this output is capacitively coupled to the grid of the first video amplifier which receives its negative d-c component of bias from an external d-c source. The lost d-c component of signal, when the signal is coupled through the capacitor, must be reinserted at a later point by a d-c restorer. The output circuit of the RCA detector consists of a bandpass filter consisting of  $C_{137}$ ,  $L_{187}$  and the input capacity of the following stage, plus a shunt-peaking coil,  $L_{188}$ . The input circuit of the diode detector consists of variable inductor,  $L_{185}$ ,

(Continued on page 41)

# COMPARE Before You Buy Your Service Data

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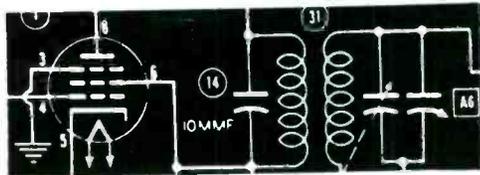
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## Cascade Converter Circuit

One such special feature is the double superheterodyne or cascade converter circuit, as employed by the G. E. model JFM-90 translator. By using this method of dual conversion, a considerable amount of gain is realized ahead of the i-f amplifier. This increase in sensitivity insures adequate receiver sensitivity for proper limiter operation.

The typical cascade converter circuit employs two 6AB7s as converter tubes and a 7A4 as an oscillator tube; Fig. 1. The tuning capacitors for the antenna, r-f, and oscillator are ganged together as usual. In this instance, the antenna circuit tuned the old f-m band from 42 to 50 mc, the r-f circuit cov-

ered the 23.15 to 27.15 mc band, and the oscillator from 18.85 to 22.85 mc.

The oscillator voltage is inductively coupled to the grid of the first converter tube,  $V_1$ . This produces, by heterodyne action, a signal to which the plate circuit of  $V_1$  is tuned.  $V_1$  provides a gain of unity for the oscillator frequency and accordingly the oscillator voltage is also applied to the grid of  $V_2$ .

$V_2$  operates as a second converter and the oscillator signal on the grid of  $V_2$  heterodynes with the tuned signal appearing in the plate circuit of  $V_1$ , which is coupled to the grid of  $V_2$ , and produces an i-f of 4.3 mc in the output of the second converter, the plate circuit of which is tuned to 4.3 mc.

To illustrate the action, let us consider an f-m signal of 42 mc to which the receiver might be tuned. The

<sup>1</sup> This was the old i-f frequency. The new one is 10.7 mc.

oscillator frequency for this setting of the tuning control is 18.85 mc and it heterodynes in the first converter tube, in the usual way, with the 42-mc signal to form a signal of 23.15 mc (the difference between 42 and 18.85 mc). This 23.15-mc signal appears on the grid of  $V_2$  along with the oscillator frequency of 18.85 mc, and this 23.15-mc signal in turn beats with the oscillator signal of 18.85 mc producing a 4.3-mc signal in the plate circuit of the second converter tube. Since the primary of the first i-f transformer (which is tuned to 4.3 mc) is connected to the plate of the second converter, we have an i-f of 4.3 mc<sup>1</sup> which will be amplified by the i-f system.

## Cascade Limiters

Another refinement is in the use of cascade limiters instead of just one limiter, which provides more satisfaction. (Continued on page 42)

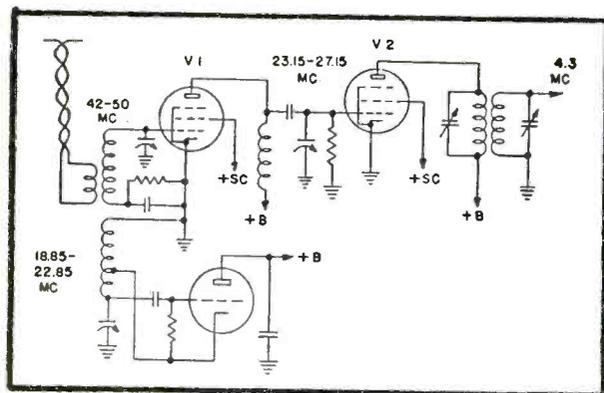


Fig. 1. Cascade converter circuit.

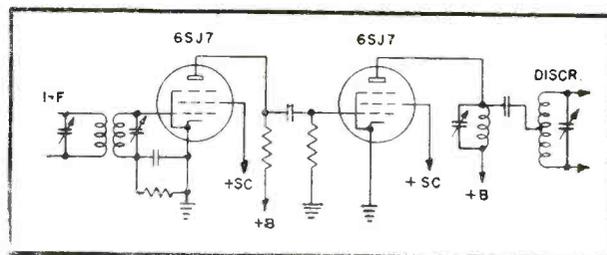


Fig. 2 (above). Cascade limiter circuit.

# Seven to Twenty Times

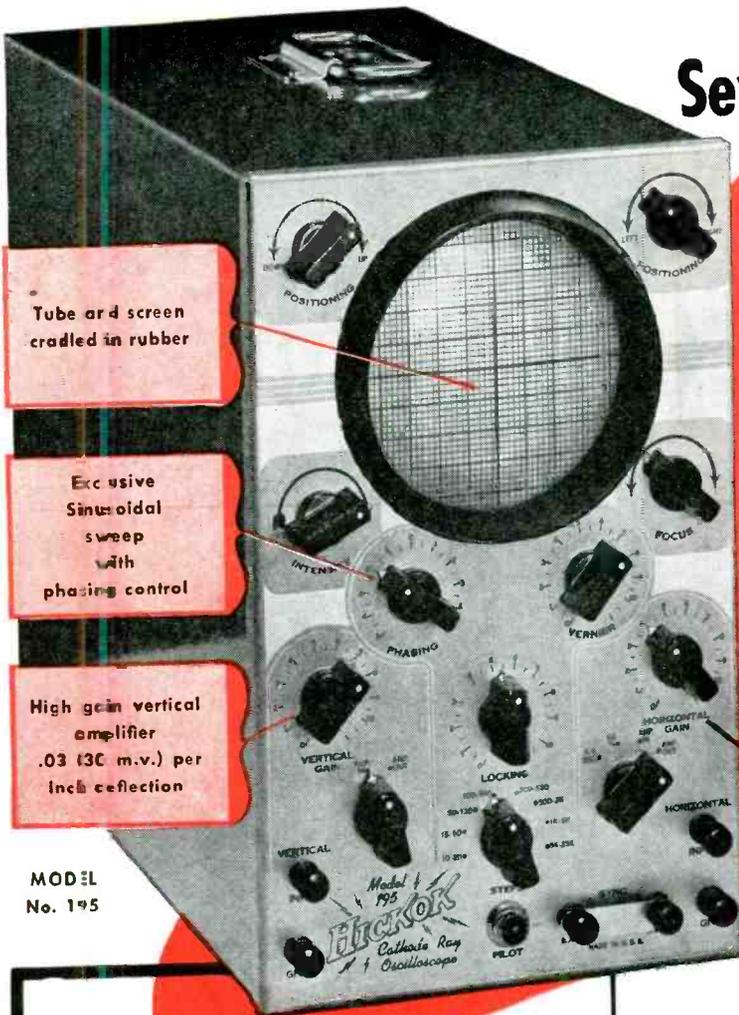
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  - Horizontal, Direct—20 Volts (rms) per inch
- Input Impedance:
  - Vertical—1 meg, 25 mmf
  - Vertical, Direct—2.2 meg
  - Horizontal—4 meg, 35 mmf
  - Horizontal, Direct—2.2 meg
- Frequency Range:
 

Amplifier, Vertical—30 cycles to 50 kc  
Amplifier, Horizontal—10 cycles to 50 kc
- Tube Complement:
 

Tube	Function
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1 884	Sweep Circuit Oscillator
1 6AC7	Vertical Amplifier
1 6X5	Low Voltage Rectifier
1 5Y3	High Voltage Rectifier
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- Big 5" screen—using the new 5 UP-1 Cathode Ray Tube, completely cradled in rubber.
- Extra high gain vertical amplifier.
- Sinusoidal sweep circuit.
- Phasing control for proper L.F., R.F. and discriminator alignment.

We take pride in offering this instrument with its extremely high sensitivity of .03 Volts per inch for use in visual alignment with FM receivers. Being recommended by five leading manufacturers of FM receivers it comes to you with added assurance of superior performance. No progressive, well-equipped radio dealer's service department can afford to be without it.

# TUBE News

THREE NINE-PIN MINIATURES, the 12AT7 twin-triode, and the 19T8 and 6T8 triple-diode triodes have been developed for f-m receivers.

The 12AT7, designed for converter service at 100 mc, has two high- $\mu$  triode sections with individual cathode connections and a center-tapped 12.6-volt 150-milliamperer heater, which permits use in either a-c/d-c receivers or

in receivers having a 6.3-volt heater supply.

The 19T8 contains a triode section similar to that of the 6AT6 and three high-perveance diodes for f-m and a-m detection. Has a 18.9-volt 150-milliamperer heater for series operation in a-c/d-c receivers.

The 6T8 is identical with the 19T8 except that its heater is designed for

6.3-volt operation at 450 milliamperes.

In Fig. 1 appears a 100-mc twin-triode converter circuit using the 12AT7. One triode section is used as an oscillator, and its output is coupled to the grid of the other section by a 1-mmfd capacitor,  $C_1$ . In this circuit, grid injection of the oscillator voltage is used.

A trimmer capacitor,  $C_2$ , which is across the i-f transformer primary, is quite important and placed in a rather special manner, approximately 1" from the plate terminal of the mixer section, instead of inside the i-f transformer shield can. This is done because the grid-to-plate capacitance in a triode causes inductive reactance in its plate circuit to appear as negative conductance across its input terminals, and the 1"-plate lead supplies a slight amount of inductance in the plate circuit. This causes sufficient negative conductance across the input terminals, partially to offset the effects of transit-time and cathode-lead inductance loading and circuit dissipation, but not enough to cause the total input circuit conductance to become negative with resulting oscillation.

Cathode injection of the oscillator voltage is used in the circuit of Fig. 2. This system provides a more uniform conversion gain, with the relatively wide variation of frequency in the a-m band than can be obtained with the grid injection method of Fig. 1.

Efficient operation of the oscillator together with optimum conversion gain is obtained by using an oscillator coil tapped at two points. The proper oscillator injection voltage was found to be approximately 2.5 volts rms. A 110-turn coil was used, with the lower tap 10 turns and the upper tap 50 turns

(Continued on page 54)

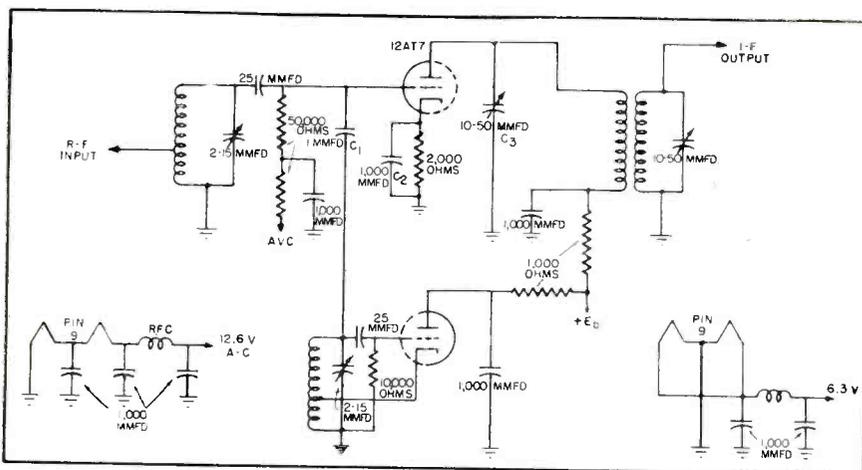
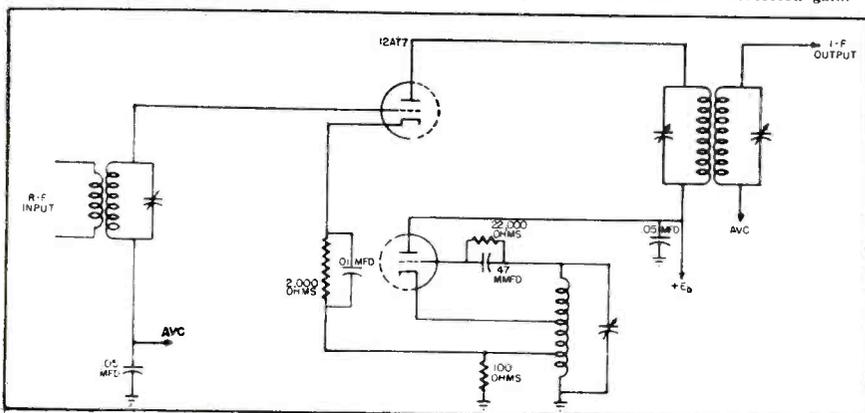
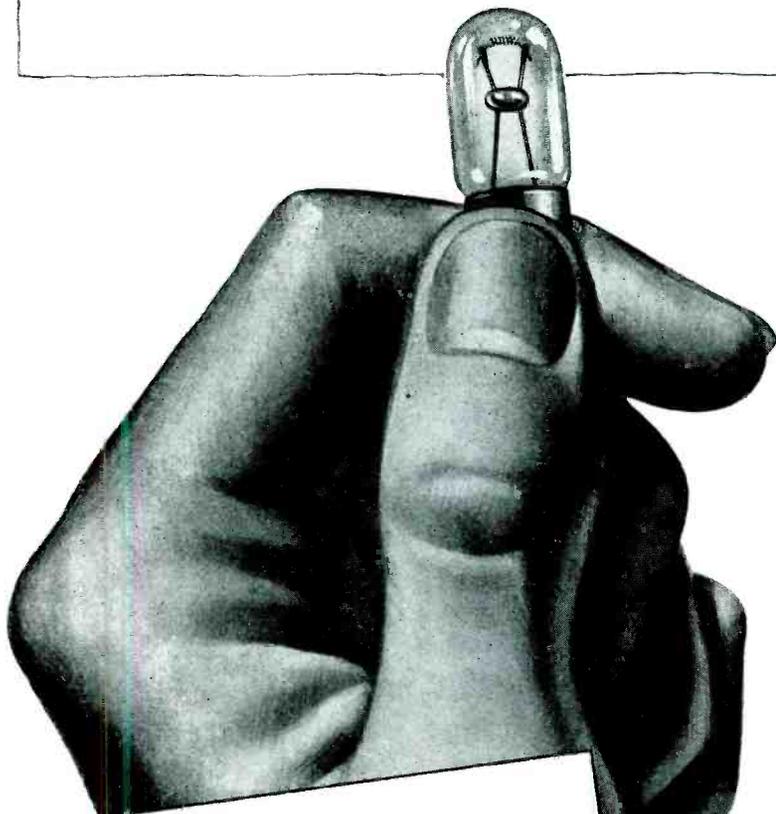


Fig. 1. Twin-triode converter circuit for 100 mc.

Fig. 2. Circuit using cathode injection of oscillator voltage to provide uniform conversion gain.

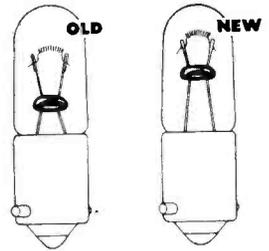


The little lamp  
that learned to  
love sopranos



Radio  
Dial Lights

**T**IME was when certain high notes played havoc with radio panel lamps. G-E Lamp research engineers investigated. A soprano's "high C", they discovered, often caused vibrations severe enough to tear the filament apart. One simple trick helped to solve this problem. By making filament supports longer and moving the bead closer to the coil, they greatly reduced the effects of vibration. Now G-E dial lamps can take the shrillest soprano in stride!



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3. Low current consumption.
4. Long life.
5. Profitable to handle.
6. Greater dealer acceptance.

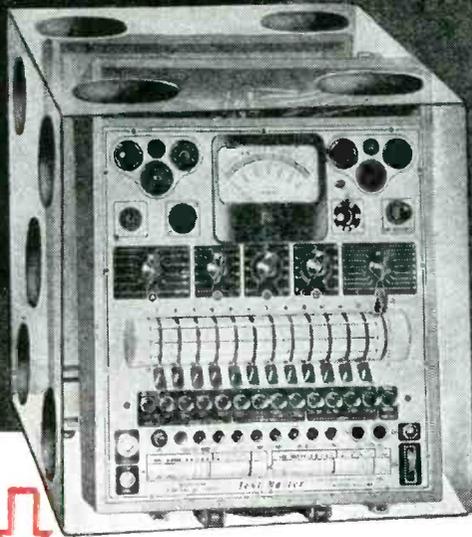
FOR INFORMATION on prices and types of G-E miniature lamps, see your nearby G-E Lamp Office. Or write to General Electric Co., Div. 166-S-6, Nela Park, Cleveland 12, Ohio.

**G-E LAMPS**  
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- ★ Absolute Free-Point element short-check and performance test selection regardless of varying or multiple pin and cap terminations.
- ★ Employs standard tube basing numbering system on all element selectors, permitting most simplified operation and comprehension of test results.

### CIRCUIT AND BATTERY TESTING HIGHLIGHTS

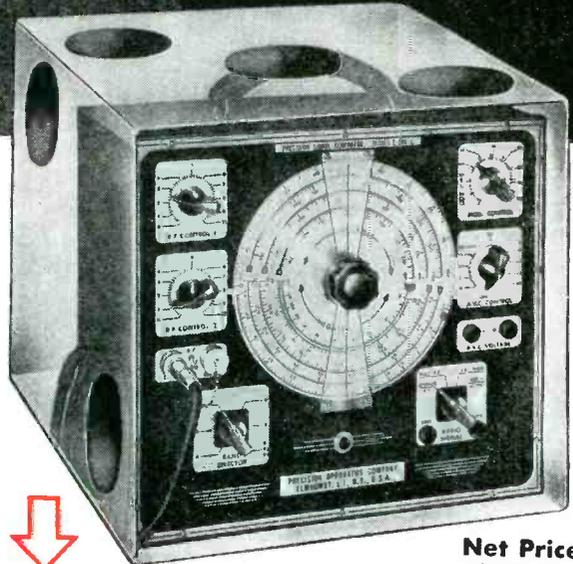
- ★ 35 A.C. and D.C. ranges to 6000 volts, 60 microamperes, 12 amperes, 70 DB, 60 megohms.
- ★ 20,000 ohms per volt D.C., 1,000 ohms per volt A.C.
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- ★ All standard ranges at Only Two polarized tip jacks.
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# Servicing Helps

## Use of the Isolation Transformer... Application of Resistors for Checking Series-Connected Filament Circuits in A-C/D-C Receivers... Servicing Notes on Auto Sets

THE ISOLATION-TYPE transformer<sup>1</sup> is a very handy part to have around, particularly when testing a-c/d-c receivers on a-c. With such a transformer in the circuit, neither side of the isolated a-c line is *hot* with respect to ground; Fig. 1. Therefore it is impossible under any circumstances to receive an electrical shock between chassis and physically grounded objects, or to cause damage in any way to test equipment, or the chassis itself, if the chassis is grounded. Balanced condenser action within the transformer itself allows chassis to be essentially zero r-f ground potential at all times, whether or not the chassis itself is physically grounded.

### Other Advantages

No portion of the chassis or radio circuits are *hot* with respect to ground. Test equipment may then be connected into the chassis in any way desirable, with only normal precautions being necessary. Very little, if any, hum

will be induced to interfere with test procedure.

### Line Noise Filtering

The electrostatic shield, used in the isolating transformer, generally consists of a non-magnetic metal sheet or screen—copper, brass, etc.—placed between the primary and secondary windings, and grounded to the iron core. For complete electrostatic shielding, the transformer should then be physically grounded.

The shield acts as a filter to interference from electric signs, X-ray and diathermy apparatus, natural static, etc.,

*<sup>1</sup>An isolating transformer consists of two windings wound in a 1:1 ratio. One winding is placed across the a-c line, while the other is used to feed the receivers under test and the test equipment, if the power handling capabilities of the isolating transformers are great enough. It is recommended that the isolating transformer have an electrostatic shield, and have a capacity rating sufficiently high for all needs, preferably 250 watts or more.*

that normally would arrive via the a-c line. Thus, reception may often be possible by the use of an isolation transformer, when otherwise noise would drown out received signals. This noise-filtering is especially valuable in these modern days of revived loop reception, and is equally applicable to either a-c/d-c or straight a-c receivers.

[Data courtesy Bendix Radio.]

### Checking A-D/D-C Battery Type Sets

IN SERVICING A SERIES-CONNECTED filament a-c/d-c battery receiver with a tube filament burnout, it is important that the filament circuit be checked before a new tube is inserted.

For this purpose, we must use a resistor whose ohmage and wattage rating are equal to the tube filament. If the set uses 1½-volt 50-ma tubes the equivalent value is 30 ohms. In one method, we can use old tube bases with 30-ohm ¼-watt resistors wired across the filament terminals. For a 3Q5 or equivalent 3-volt type tube, a 60-ohm resistor should be used.

Another method involves the use of a resistor representing the resistance of the entire tube complement. For instance, a 180-ohm unit would be used for a 5-tube receiver, where we have a 3Q5 in the output.

After the foregoing steps have been taken, the filament drop across the

(Continued on page 52)

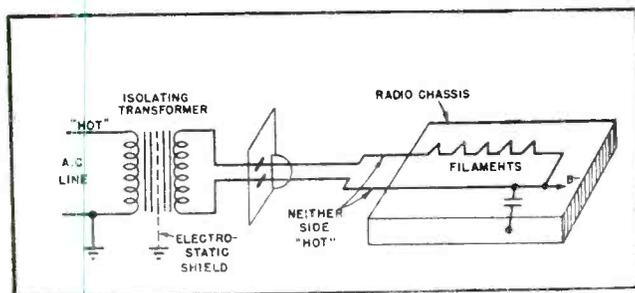
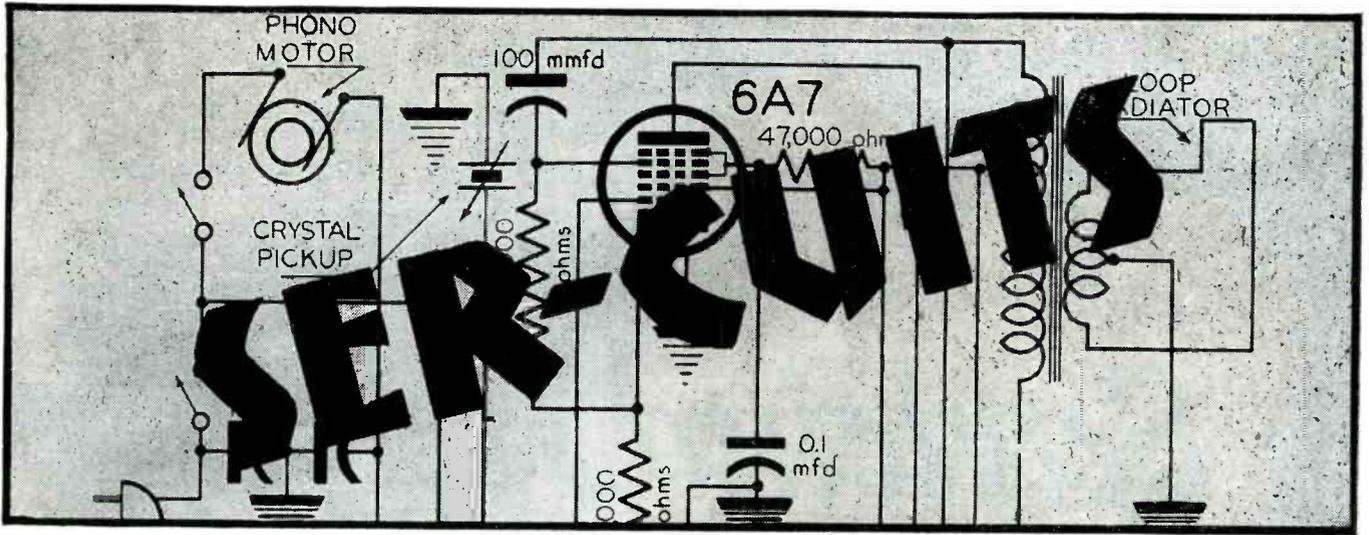


Fig. 1. A line-isolation transformer installation.



THE PERSONAL BATTERY RECEIVER appears to have outgrown its seasonal novelty interest and become an all-year unit. The sports fan and traveler have found these personal receivers to be quite handy and extremely efficient.

**G.E. 140**

In Fig. 1 appears an excellent example of this personal type of receiver; the G. E. model 140. A superhet model, it employs four tubes; a 1R5

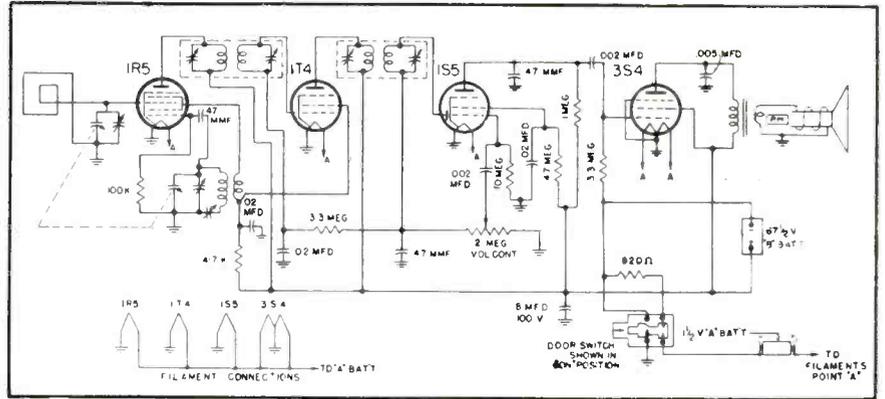
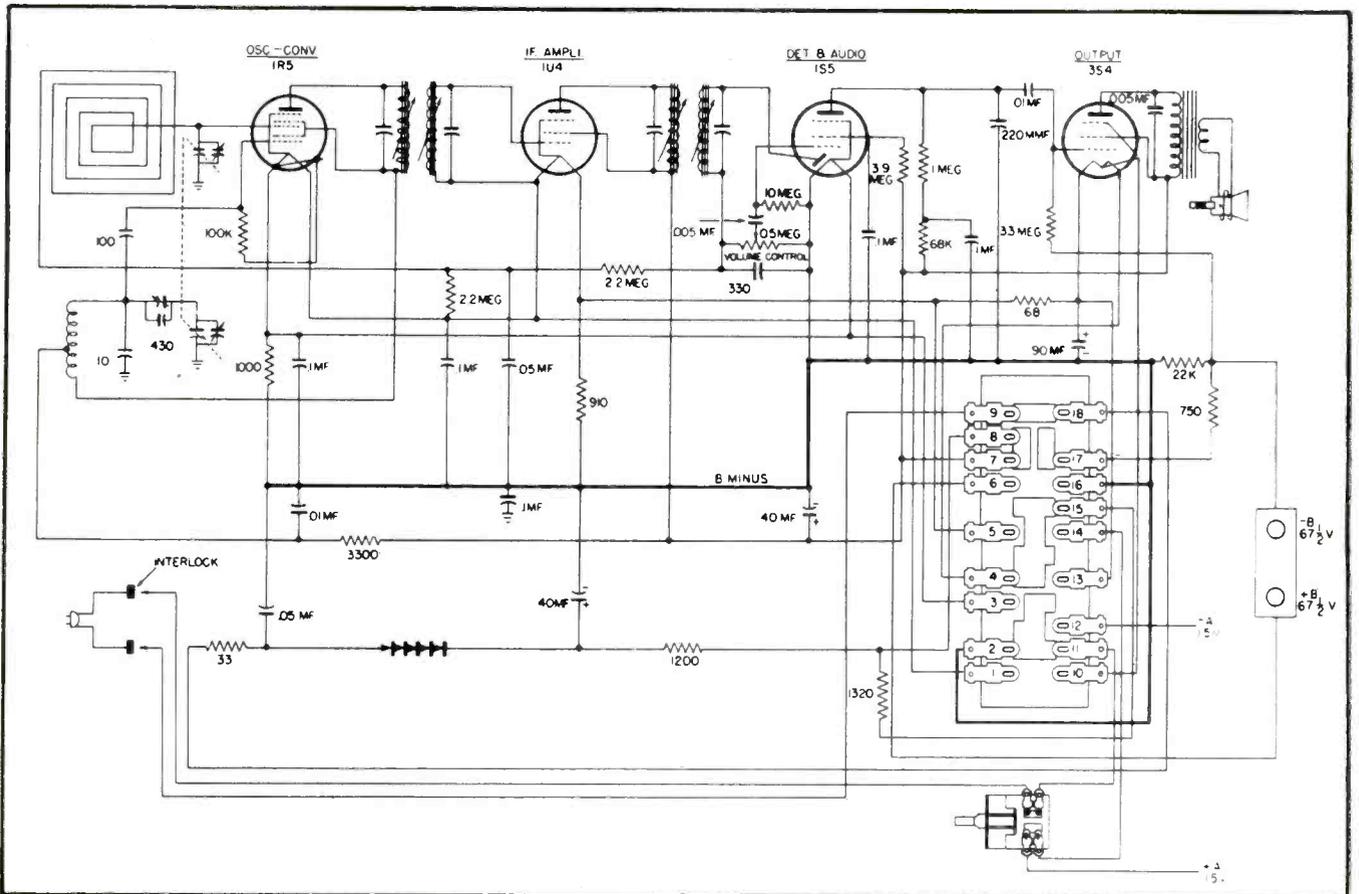


Fig. 1. The a-c-d-c/battery personal portable of G.E., model 140.

Fig. 2 (above). Garod 4A-1/4A-2 4-tube battery receiver.



oscillator-converter, a 1U4 i-f amplifier, a 1S5 detector-audio and a 3S4 in the power output.

This little job has an undistorted power output of .06 watt.

#### Multiple-Power Uses

The receiver is designed to work on a-c, d-c or battery. For battery operation, two 1½-volt *A* and one 67½-volt *B* batteries are used.

#### Selector Power Switch

The selector switch, providing a-c or d-c operation, is connected in an interesting circuit. In the a-c/d-c position, the switch connects the tube filaments in a series circuit fed by *B*+ voltage and a return to *B*-bus. With the switch in the battery position, the tube filaments are paralleled and connected to the 1½-volt *A* battery circuit. In the battery position, pins 1 and 7 of the 3S4 are connected together and to *A*+, while the filament tap (pin 5) goes to *B*-. In the a-c/d-c position, we have a connection to pins 1 and 7, while pin 5 remains open.

In aligning the receiver, the r-f frequencies used are 1,620, 1,500 and 580 kc; the i-f frequency is 455 kc.

#### Garod 4A-1/4A-2

In Fig. 2 appears another type of personal battery receiver, the Garod 4A-1/4A-2 four-tuber.

In this model a 1R5 is also used as a converter, but we have an 1T4 as an i-f amplifier. The model also uses a 1S5 as a detector, avc and audio amplifier, while a 3S4 is used as a power amplifier. A two-gang variable appears in the tuning system, and two i-f stages are used.

The oscillator trimmer is designed for 1650 kc use and antenna trimmer is for 1500-kc.

#### Challengaire Marine Radio

In Fig. 3 appears a circuit of a marine radiotelephone unit with many novel features, particularly in the ignition noise suppression system.<sup>1</sup>

#### Marine Car Noise Suppression

To suppress marine-engine ignition noise, it is necessary to use a system different from that in the ordinary car. Marine engines are usually operated at the top of their rated horsepower,

(Continued on page 50)

<sup>1</sup>From data prepared by Max Alth.



Meet Alfred A. Ghirardi—servicing expert and author of the most widely used books in radio technical publishing history.

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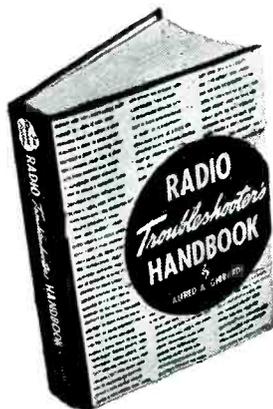
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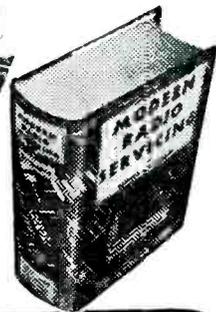
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# NEW PRODUCTS

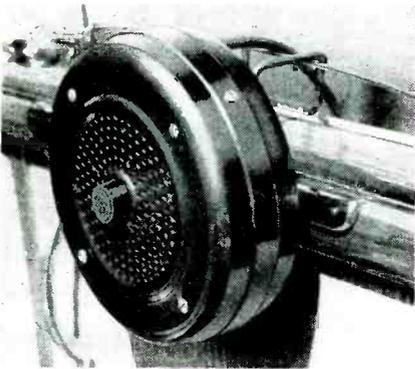
## JENSEN IN-CAR REPRODUCER

Speakers for drive-in theatres, model RK-51 In-Car Reproducer, have been announced by the Jensen Radio Manufacturing Company, 6601 S. Laramie Avenue, Chicago.

Reproducer is powered by a weather-proofed 5" p-m speaker with Alnico 5. Speaker is protected by a splash screen within the case. The front of the reproducer has a pattern of extruded holes with volume control knob mounted in its center. Volume is controlled by a constant input impedance L-pad. Space, within the case, is available for mounting a transformer on the speaker if desired.

Attachment of the speaker to the car is achieved by a heavy wire, rubber-covered hanger which fits over the car door sill, when the glass is rolled down, or over the partly opened glass in cold or inclement weather.

Input impedance, 3-4 ohms; Power sensitivity, .02 watt.



\* \* \*

## UTAH RADIO AUTO-REPLACEMENT SPEAKERS

Three auto radio e-m replacement speakers, models SE5S6, SE6S6 and SE7Y6, in five, six and seven-inch sizes, have been announced by Utah Radio Products, division of International Detrola Corporation, Huntington, Indiana.

Models have a 3-ohm voice coil and 4-ohm field coil. Speaker mountings are square type.



## AMPERITE VELOCITY P-A MICROPHONE

A velocity microphone that is said to offer high-fidelity reproduction on either close talking or distant pickup has been announced by the Amperite Co., Inc., 561 Broadway, New York 12, N. Y.

There is said to be very little difference in pick-up as you pull away from the microphone.

Harmonic distortion is said to be less than 1%. The ribbon itself has a peak of 10 cps; above that, it is said to be practically flat. Frequency response, 50 to 11,000 cps  $\pm$  2 db. Output is -62 db.

The discrimination with angle from 60 to 10,000 cps is said to be less than 5%.

Microphone available in two models: model RBHG (high impedance); model RBLG, 50-200 ohms.



\* \* \*

## SYLVANIA TEST BENCH

A console type test bench, with a 7' bench top, for Service Men has been announced by the radio tube division of Sylvania Electric Products, Inc., 500 Fifth Avenue, New York 18, N. Y.

Includes sloping panel for permanent mounting of meters, prod test outlets, tube testers and other tools. Has drawers for dust proof storage of oscilloscopes, vacuum tube voltmeters, etc.

Bench top is covered with linoleum.

Bench is available in knock-down, unpainted form on order to Sylvania distributors or directly to Sylvania Electric Products Inc., Emporium, Pa.

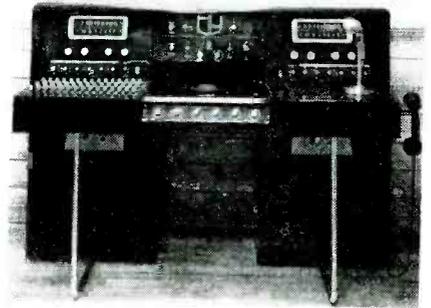


## OPERADIO SOUND UNIT

A sound system, the *program master*, engineered as a central sound control to operate through loudspeaker outlets in various rooms, departments, auditoriums, cafeterias, etc., has been announced by Operadio Mfg. Co., St. Charles, Ill.

Standard unit, No. 60, incorporates an a-m/f-m set, a dual speed transcription player, 60 switches for room selection, two 50-watt amplifiers, two *program selector* panels, control panel, microphone, and six inputs.

With system, two programs may be transmitted simultaneously to different rooms, or groups of rooms. With an optional intercommunication panel, two-way conversation may be carried on, with selected rooms, without interfering with the program channels.



\* \* \*

## JFD PHONO NEEDLE

A line of eight phono needles, one juke box sapphire needle and two cutting styli, have been announced by the JFD Manufacturing Company, Inc., Dept. A, 4117 Fort Hamilton Parkway, Brooklyn 19, New York.

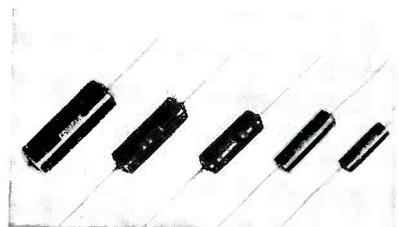
\* \* \*

## SPRAGUE PHENOLIC MOLDED TUBULARS

A line of phenolic-molded paper tubulars which are said to be highly heat- and moisture-resistant, non-inflammable, and conservatively rated for operation from -40° to +85° C have been announced by Sprague Electric Company, North Adams, Mass.

Available types include all popular capacities in 200, 400, 600, 1000 and 1600-volt types.

Sprague engineering bulletin 210, containing complete details, is available from manufacturer.



**TRIPLETT TUBE TESTER/VOLT-OHM-MILLIAMMETER**

A combination tester for tube testing and voltage, current and resistance analyses, model 3480, has been announced by Triplett. Has a fully-balanced, multi-purpose test circuit for emission, short and open element tests. One socket is used for each tube base type. Tests all receiving type tubes, gaseous rectifiers, resistor and ballast tube continuity, and pilot lamps. Has a roll tube chart.

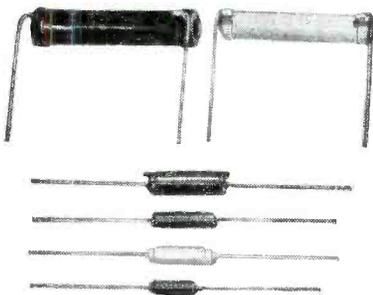
The a-c/d-c voltage ranges are 0 to 1200, at 10,000 ohm/volt for d-c, and 2000 ohms/volt for a-c. The d-c ma range is 0 to 120; d-c amp. 0-12. Ohms range is 0-1000-100,000; megohms, 0-1-50.

\* \* \*

**OHMITE R-F PLATE CHOKES**

Six r-f chokes have been announced by the Ohmite Manufacturing Company, 4954 Flournoy Street, Chicago.

Operating ranges are: 7 to 35 mc (No. Z-14) Z-28, 20 to 60 mc; Z-50, 35 to 110 mc; Z-144, 75 to 190 mc; Z-235, 160 to 350 mc; and Z-460, 320 to 520 mc. The first two units are rated at 600 ma. The other four are rated at 1000 ma. Ohmite's lowest frequency model, formerly designated as Z-3, will now be designated Z-7. It covers from 3 to 20 mc.



\* \* \*

**ILLINOIS CONDENSER TWIST-PRONG UNITS**

A twist-prong, hermetically-sealed, dry-capacitor has been announced by the Illinois Condenser Corporation.

\* \* \*

**RCA F-M ANTENNA**

A folded dipole antenna, type 228, for f-m has been announced by the renewal sales section of the RCA tube department.

Antenna is supplied with aluminum cross and elements, a five-foot wooden mast, heavy-duty mounting brackets and installation hardware.

\* \* \*

**ELECTRO-VOICE STRING INSTRUMENT CONTACT MICROPHONE**

A contact pickup microphone, model 805, that can be used on all vibrating musical instruments, has been announced by Electro-Voice, Inc., Buchanan, Michigan.

Frequency response 40 to 8000 cps. Can be used with any amplifier having a high impedance input. Output level: .1 to 1 volt, depending on type of instrument.

Generating element is an inertia-type

(Continued on page 45)

# FIVE POPULAR ASTATIC PICKUPS

**Are now Available  
with the New**

## "QT" CARTRIDGE

QT-508

QT-510

FP-QT

HP-QT

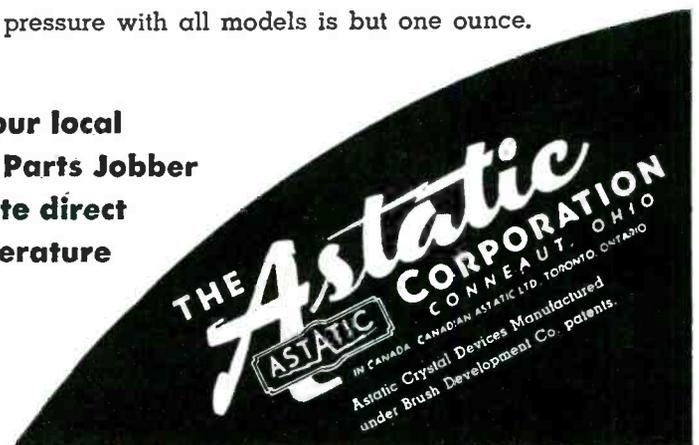
QT-400

### For Home or Studio TONE ARM REPLACEMENTS

The "QT" Cartridge, now famous for its rare beauty of tone reproduction and freedom from annoying needle scratch is, because of popular demand, being supplied in the five Astatic Low Pressure Pickups illustrated above. The specially designed needle with which the "QT" Cartridge is equipped is replaceable and is available with sapphire or precious metal playing tip.

Pickup Models QT-508, QT-510 and FP-QT, with standard mounting centers, may be used for reproduction of 10" and 12" Records. Transcription Models QT-400 and HP-QT may be used for reproduction of all lateral transcriptions. Needle pressure with all models is but one ounce.

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# ASSOCIATIONS



At a recent meeting of the Long Beach, California, RTA, left to right: Harry Ward; Bill Molitor, GE; Harvey Stephens; and Jack Meyers, G.E. Supply chief service engineer.

## PR SMA

WALTER S. KOOP, chairman of the publicity committee of the Philadelphia Radio Service Men's Association, has submitted a new *code of ethics* which is being distributed to all PRSMA members for display in their shop.

The code is quite interesting and says in part:

"I will at all times, without any ex-

ceptions, perform my work to the very best of my knowledge and ability. In addition, I will make a sincere effort to improve my knowledge of the technical and business requirements of my job, thereby enabling me to render still better radio service.

"I will conduct myself and my business in an honest and straightforward manner, meriting and inspiring the confidence of my customers.

"I will, whenever practicable and desirable, prefer to use original factory

replacement parts. In other cases, I will use replacement parts known to be of equal or better quality, thus insuring satisfactory performance.

"Realizing that an extremely low price does not permit good workmanship and an unreasonably high price will prompt justifiable criticism and loss of patronage, I propose to charge a just and fair price for all my work, based upon my ability and qualifications to render satisfactory radio service.

"I will exercise all reasonable care in handling my customers' property.

"I will guarantee all radio work performed, which has been authorized and for which payment has been received, for a minimum period of not less than 90 days.

"I will not engage in any unfair or unethical practices condemned or disapproved by the Philadelphia Radio Service Men's Association, such as misleading or untruthful advertising, making unreasonable promises or statements, unjustly criticizing a fellow man's actions or ability and such other practices as may be brought to the attention of the Philadelphia Radio Service Men's Association, that would lead to an unjustifiable lack of confidence in PRSMA or any of its members."

Complaints are referred to the PRSMA board of governors who act promptly. An investigating committee calls on the customer issuing the complaint and examines the equipment and bill (if available) which was repaired. If the committee finds the Service Man at fault, he is given three days in which to correct the trouble. If the correction is not made during this time, the equipment is taken to the shop of a PRSMA member for proper repair and then returned to the customer. The original Service Man is then billed for this work. If this bill is not paid, the Service Man is dropped from membership of the PRSMA, and notice of this action appears in the *PRSMA News*.

It is reported that at least 85% of the complaints are against non-PRSMA members. Nevertheless, all cases are investigated and although there is no procedure to compel non-members to pay for the mistakes, PRSMA exposes these cases by publicity.

When complaints are received from the Better Business Bureau or through broadcasting stations who also cooperate with PRSMA in maintaining the

## TEN YEARS AGO

*From the Association News page of SERVICE, November 1937.*

THE CLEVELAND IRSM has applied for an RSA charter. . . . Many technical representatives of industry appeared before a meeting of the IRSM of Cleveland. Floyd Wenger of Triplet discussed the "Howitzer" type of scope. Tim Alexander of Motorola told the boys all about pushbutton tuning. Tony Dorazil of Cleveland Distributing Co., presented the Spartan version of pushbutton tuning. The story on the Zenith sets was detailed by John Oros ex-IRSM member and with the Arnold Wholesale Corporation. . . . The IRSM news also revealed that John Yost, RCA service engineer with Moock Electric, local RCA distributors, had returned from a

twelve-day lecture course in Camden. . . . The extreme interest in the Radio Service Men of America, Inc., was disclosed in an RSA report. Chapters were being formed in Cleveland, Chicago, Binghamton, Denver and Duluth. . . . Morrie Green of PRSMA had become the father of a daughter. . . . Dave Krantz of PRSMA reported that he is having quite a time with distributors, they tell him one thing and do the opposite. . . . The ART-British Columbia Convention was host to delegates from Long Beach, Spokane, Seattle, Tacoma, Kamloops and various parts of the Dominion. . . . The a-f-c type circuits were discussed by Warren Kimball of RCA at a PRSMA meeting.

code, the PRSMA Committee swings into action, too.

#### Hudson Valley Radio Service Men's Assn.

AT A RECENT MEETING of the association, Irving Einhorn of Tung-Sol Lamp Works, Ken Burkaw of Cornell-Dubilier and Hy Steinberg, C-D manufacturers' rep, presented interesting talks on tubes and capacitors, respectively.

Mr. Einhorn offered a motion picture describing the manufacture of a 6AK5. Mr. Burkaw and Mr. Steinberg discussed the manufacture, usage and inventory control of fixed capacitors.

The meeting was sponsored by Chief Electronics of Poughkeepsie, New York.

#### Long Beach, California, RTA

AN INTERESTING F-M AND TELEVISION service talk by General Electric engineers was a feature of a recent meeting of this association.

Jack Meyers, Harvey Stephens and Wayne Williams participated in the talks during which demonstrations of high-fidelity equipment were held.

A very instructive question and answer period was conducted at the conclusion of the talks.

At another meeting, George Korntved of Gough Industries and Ray Robertson of Philco discussed the Philco projection receiver.

Harry Ward was the chairman of the first meeting and Glenn Hollway was chairman of the second meeting.

#### Associated Technicians of B. C.

THE ANNUAL CONVENTION of the A. R. T. of British Columbia was held at the Stanley Park Pavilion in Vancouver.

The convention featured an interesting exhibit of test equipment and components and quite a few papers on broadcasting and f-m servicing.

Dr. Frank Noakes of U. B. C. presented an interesting paper on test equipment used to locate breaks or leaks in power and communications lines.

Nick Foster, instructor at Edison Vocational School, Seattle, Washington, discussed f-m and television servicing and analyzed the various types of equipment required for the work.

Door prizes were donated by jobbers representing Marconi, General Electric, General Battery, Burgess Battery and RCA Victor.



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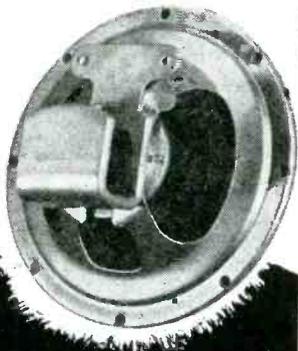
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## Sound Systems

(Continued from page 20)

sary to provide 360° distribution. The connector may also be used with two driver units for each trumpet for concentrated sound power.

Many churches may wish to invest in systems where reliable sound distribution a mile or more is important. A super-power loudspeaker<sup>5</sup> is ideal for this purpose. Where certain installations may require greater radius coverage in one direction than another, the super-power speaker may be combined with a number of trumpets to provide the required sound distribution.

### Typical Church Tower Installation

A typical and economical type of church steeple installation appears in Fig. 2. Consisting of a 35-50 watt amplifier, turntable and a 360° radial speaker with two driver units, it is capable under average noise conditions of covering an area approximately one-quarter mile in diameter.

In churches where the amplifier is located within a radius of 50' of the chime cabinet, a good quality high-impedance crystal or dynamic microphone will prove satisfactory. The cable must be shielded to prevent hum pickup and extraneous electrical noises. An over-all outer insulating cover of rubber will provide the necessary mechanical protection, and eliminate rustling and scraping noises from the loudspeakers as a result of the shield rubbing against metallic objects.

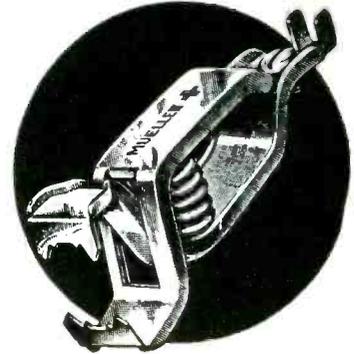
Where microphone cable length exceeds 50', loss in output or frequency discrimination will occur due to the capacitive effects of the shielding. A much better practice is to employ a low-impedance dynamic microphone (50-200 ohms) which will permit long cable runs with a minimum loss of output and attenuation of high frequencies. If the amplifier does not incorporate a low-impedance input, a cable-type matching transformer may be employed.

### Use of Additional Mikes

If it is necessary to provide a microphone for use at the pulpit, for sound reinforcement within the church, an additional microphone input stage should be provided. An alternate method could be devised by using the chime cabinet microphone input for both purposes. A simple switching

<sup>5</sup>University model 4A4.

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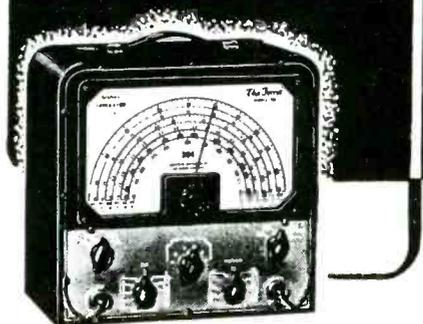
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arrangement in the amplifier could connect either microphone to the common input, since at no times would the chimes and pulpit microphones be operated simultaneously. A similar type of switch could transfer the amplifier output to either the outdoor projectors or the indoor sound reinforcement speakers.

Although line matching transformers have been specified, their need will depend on the length of transmission line required. In general, where the distance between the amplifier and loudspeakers is less than 200', lines run at voice coil impedances are satisfactory, provided sufficiently heavy cable is employed to minimize line losses. Table 1 indicates the wire sizes required for a given length of line (2 wires) at various voice-coil impedances. Wire sizes and lengths in this table are calculated for a power loss of 15%.

Wire Size (B & S)	Load Impedance		
	4 ohms	8 ohms	16 ohms
14.....	125'	250'	450'
16.....	75'	150'	300'
18.....	50'	100'	200'
20.....	25'	50'	100'

Table 1. Maximum length of line for 15% power loss; low-impedance lines.

As an example, in an installation where the distance from the speaker is approximately 150', the two 16-ohm driver units may be paralleled for a total impedance of 8 ohms and connected directly to the 8-ohm output tap of the amplifier, dispensing with the line matching transformers entirely. A transmission line consisting of a pair of 16 B & S conductors would then be required to keep within the permissible 15% power loss.

In installations where the distance between speakers and the amplifier is greater than that indicated, for a given wire size, or where a lower power loss than 15% is required, it is preferable to work at higher impedances. High impedance lines normally run from output transformer impedances of 125-600 ohms to impedance-matching transformers. The impedance-matching transformers, in turn, match the line impedance to the various voice-coil impedances.

A table of wire sizes and lengths of transmission line (2 wires) for various line impedances is given in table 2. Since high-impedance lines require matching transformers, which in themselves possess inherent losses, all cal-

(Continued on page 40)

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## Sound Systems

(Continued from page 39)

Calculations in this table are based on a line power loss of 5%.

Wire Size (B & S)	Load Impedance		
	100 ohms	250 ohms	500 ohms
14.....	1000'	2500'	5000'
16.....	750'	1500'	3000'
18.....	400'	1000'	2000'
20.....	250'	750'	1500'

Table II. Maximum length of lines for 5% power loss; high-impedance lines.

A word of caution with respect to driver units. To insure long life and foolproof operation, it is essential that the low-frequency response of each loudspeaker be carefully controlled. As an example, where a trumpet and driver unit have a low frequency cut-off of 120 cycles, feeding a signal at a frequency lower than cut-off will result in excessive diaphragm movement due to insufficient loading at this frequency. Although the unit may not fail entirely, distortion and rattle will result. It is important, therefore, to control bass response within the cut-off limits of the loudspeaker.

Many churches wishing to install amplified sound systems may have delayed purchase due to the lack of a steeple for speaker placement. A simple solution is the fabrication of a framework for roof mounting similar to the ones illustrated in Fig. 1. Built of 2" angle iron or standard pipe and finished with a few coats of anti-corrosion paint, it should provide lasting satisfaction at a relatively low cost.

### 100-Watt Church Tower Installation

A 75-100 watt system is shown in Fig. 3. In this system hourly chimes are provided by a chime-type electric clock.<sup>o</sup> Hourly on-off operation of the amplifier is accomplished automatically by an electric time clock which can be set to turn on the amplifier five minutes before the hour and off upon completion of the hourly chimes.

Where additional microphone inputs are required, they may be built in or modifications of existing inputs may be made as previously described. Precautions regarding low and high impedance transmission lines, microphone shielding, etc., are equally applicable to the circuit of Fig. 3. Again, where

<sup>o</sup>G. E. and Telechron types.

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transmission lines are relatively short, the 16-ohm driver units may be paralleled for a total impedance of 4 ohms and connected directly to the 4-ohm output tap of the amplifier. However, the use of individual line-matching transformers will prove invaluable for installations where unequal power distribution is required. Situations of this type arise where intervening buildings may cause an obstruction, necessitating an increase or decrease in sound level in a particular direction, or where for reasons of its own, the church may desire wider coverage over certain areas than others. Although it is possible to wire speakers at voice-coil impedances for unequal power distribution, this method lacks flexibility and usually involves wiring a portion of the speakers in series or series parallel. Series connections are to be avoided, since if one unit fails, all the speakers in a particular bank become inoperative. Line matching transformers provide the simplest and most accurate method for obtaining pre-determined power levels.

## TV Detectors

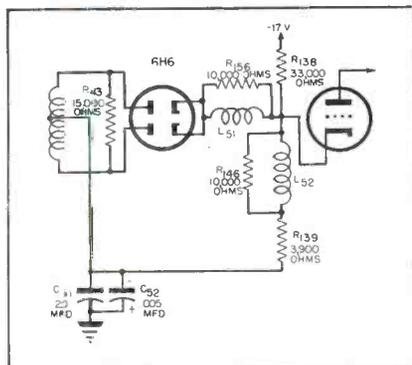
(Continued from page 24)

which is resonated with the input capacity of the diode to the proper i-f frequency. A resistor,  $R_{136}$ , shunts the series coil of the output circuit to load this coil and prevent transients.

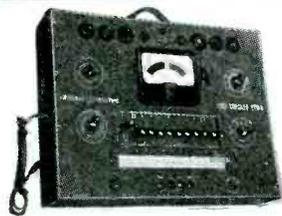
The i-f signal is applied between plate and ground in the Viewtone VP-101A television receiver, Fig. 6. Consequently, a positively polarized signal appears across the 5,000-ohm diode load potentiometer. In this receiver the potentiometer represents the contrast control of the receiver and varies the amplitude of the picture signal applied to the grid of the video amplifier.

To develop a higher amplitude detected signal, a push-pull detector is

Fig. 7. RCA TRK-12 pushpull video-detector system.



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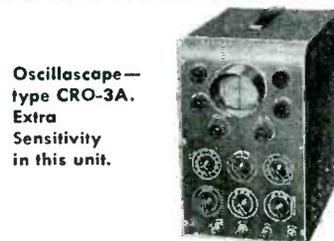
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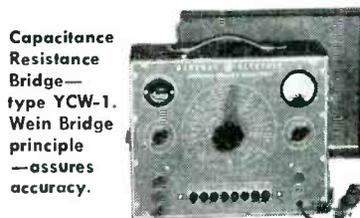
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used in the RCA TRK-12, Fig. 7. The i-f signal is applied in push-pull across the diode plates, one diode conducting on one alternation of the i-f signal and the second diode on the other. A positive polarity signal is developed across the diode resistor  $R_{138}$ , and direct coupled to the cathode of the following stage.

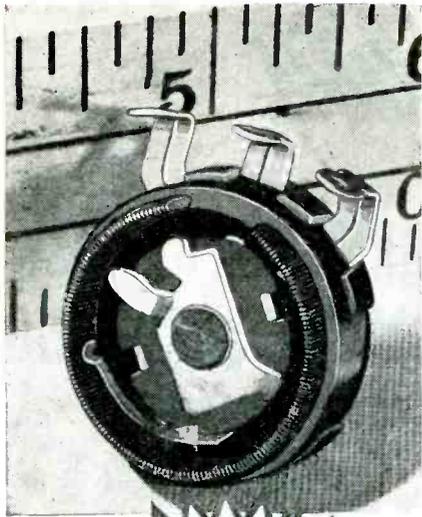
### CORRECTIONS

IN THE EXPLODED DIAGRAM of the i-m portion of the Bendix 847S Facto-Meter, which appeared in the October issue of SERVICE, the grid and cathode of the 7F8 should not be connected.

The 5-megohm resistor in the tone control circuit is a .5 megohm unit.

### Pickup Circuits

The crystal-pickup circuit shown in Fig. 8 on page 33 of October, SERVICE, illustrates compensation possible with the system. The low-frequency response of a cartridge is proportional to the value of load resistance which is used. When optimum low-frequency response is obtained by proper adjustment of this load resistance, further compensation of the crystal reproducer may then be accomplished using the circuit shown, and properly adjusting the values of  $R_1$  and  $C$ .



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## F-M Features

(Continued from page 26)

tory noise limiting. With the conventional single tube limiter of the grid bias type, the time constant of the grid resistor-capacitor combination is too slow to properly follow short duration impulse noises, such as result from automobile ignition systems, if the time constant is of such value as to provide for good balance of the limiter over a wide range of input levels at the limiter grid. Therefore, a compromise is made between a good balance and the reduction of impulse noise.

However, these deficiencies can be essentially removed by the use of a cascade limiter; Fig. 2. The circuit consists of two resistance-coupled 6SJ7 tubes in series. Each limiter operates at zero initial bias and low plate voltage. Both grid circuits are designed for self-biasing and the use of capacity-resistance networks provide enough time delay to retain the grid bias between signal peaks. The action of the limiter is such that as soon as a signal is applied to the grid of the tube, the grid draws current. This grid current charges up the capacitor across the grid resistor and at the same time establishes a bias through current drain in the resistor. Between positive signal peaks the capacitor discharges through the resistor maintaining the grid bias. The circuit is so designed that negative signal peaks are all beyond plate current cut-off and positive signal peaks are cut-off by plate-current saturation. The time constant of the first limiter capacity-resistor network is low enough to limit peaks due to impulse noise satisfactorily. This arrangement leaves the second limiter with the very much simplified task of reducing the remaining noise and provides for good balance of the limiter over a wide range of input levels. In addition, the effectiveness of the receiver on weak signals is improved since additional gain is provided by the use of two limiter stages.

### Squelch Circuit

The limiter circuit of an f-m receiver will only remove noise when an f-m signal of sufficient strength is present at the input of the limiter to provide good limiting action.

Since the noise-limiter circuits only operate when an f-m carrier is present, noise between stations will ride through with undiminished amplitude. To remove this undesirable effect, some f-m receivers use an f-m station silencer or

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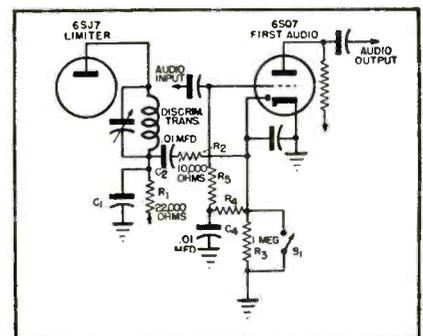


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squelch circuit which operates on the amplitude-modulated noise signals present between stations to produce squelch or quieting of the audio amplifier.

A typical squelch circuit is shown in Fig. 3. The noise signal appears in the limiter plate circuit and develops a voltage across  $R_1$ , which is in series with the primary of the discriminator transformer. This voltage is applied to one diode of the 6SQ7 tube through  $C_2$  and  $R_2$ , and is rectified by the diode. The current due to rectification of this noise voltage flows from the diode to the cathode which is grounded, through  $R_3$ , and back to the diode.

Fig. 3. Squelch circuit.



thus developing a voltage across  $R_3$ , with the grounded end positive with respect to the end connected to the diode plate. This rectified voltage is applied to the grid of the 6SQ7 first audio tube through  $R_4$  and  $R_5$ , making the grid more negative than the cathode by an amount equal to the rectified voltage developed across  $R_3$ . This rectified voltage is sufficient to completely bias off the 6SQ7 so that no audio signal is passed.

When an f-m signal is received that is strong enough to satisfactorily operate the limiter, the noise or amplitude-modulated signal is removed altogether or greatly reduced by the operation of the limiter. Therefore, the voltage developed across  $R_3$ , due to a noise signal, is removed or greatly reduced so that little or no current flows in the diode circuit containing  $R_3$ , and consequently the cut-off bias previously applied to the grid of the 6SQ7 is removed and the tube amplifies the audio signal, passing it on in the normal manner.

If it is desirable to receive f-m stations that are too weak to satisfactorily operate the limiter, the squelch voltage can be manually removed by closing switch  $S_1$ , which simply shorts out  $R_3$  and places the grid of 6SQ7 at ground potential. However, considerable noise is likely to be present when receiving such weak signals.

#### Troubles in F-M Receivers

There are some troubles encountered in f-m receivers, which have the same symptoms as in a-m receivers but may be due to quite a different cause.

**Weak Reception:** This trouble could be due to any or all of the possible causes as found in a-m receivers, plus the following:

- The f-m antenna not properly oriented with respect to transmitting antenna.
- Improper matching of transmission line between antenna and receiver.
- Improper operating conditions of the limiter circuit.
- Insufficient gain ahead of limiter.
- Misalignment of discriminator or other faults in discriminator circuit.
- Defects in the corrector network used for de-emphasis.

**Distortion:** In addition to the usual causes of distortion, we have:

- Improper operation of the limiter due to defective components in the limiter circuit.
- Improper operation of the limiter due to insufficient gain

ahead of the limiter, resulting in distortion of the dynamic range of the signal as transmitted.

- Improper response to the full deviation range due to oscillator drift.
- Improper response to the full deviation range due to regeneration which narrows the response curve of the i-f amplifier.
- Misalignment of i-f transformers.
- Improper operation of the discriminator due either to mis-

alignment or defective components.

**Noise:** There are two sources of noise which affect a receiver; that which is due to static (man-made or otherwise) and that which is generated in the receiver itself. The first source of noise can be eliminated by action of the limiter provided there is sufficient signal picked up by the antenna and also provided that there is sufficient gain ahead of the limiter.

The second source is due to faulty components such as noisy resistors,

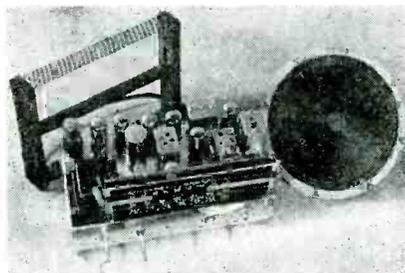
(Continued on page 44)

there's a new horizon for PROFITS!

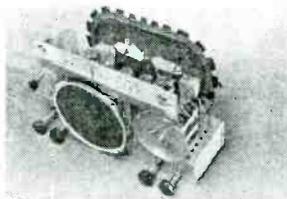
# ESPEY

## CUSTOM-BUILT CHASSIS

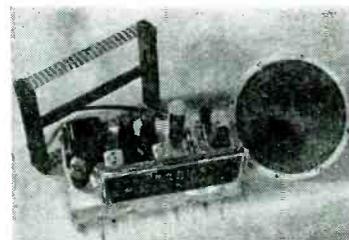
Keep in step with the times! Custom installations allow the serviceman to cash in on a profitable and untapped field. Write us today for full information on these custom-sales opportunities.



Model RR-14: Another "natural"! Eight-tube (inc. rectifier) superheterodyne receiver covering AM and two short-wave bands. Operates on same current as 7-B above. Volume and tone controls, 10" Alnico No. 5 speaker. Wired for phonograph operation. Built-in loop antenna, with provision for external antenna if desired. Lighted slide rule dial. Supplied complete with tubes, knobs, speaker, antenna and all necessary hardware to install in table or console cabinet.



Model 97-A: 6-tube (inc. rectifier) superheterodyne receiver, operating on same current requirement as models above. Features Alnico No. 5 speaker, automatic volume control. Receives on broadcast and one shortwave band. Wired for phonograph, lighted slide rule dial, built-in loop antenna. Like both models above, the 97-A is licensed under RCA and Hazeltine patents, and is RMA listed. Supplied complete with tubes, fully wired, and ready for operation.



Model 7-B: Here is a beauty! AM-FM superheterodyne, with 11 tubes, including rectifier. Operates on 105-125 volts AC, 50-60 cycles. Features automatic volume control, tone control, 10" Alnico No. 5 speaker, slide rule dial, loop antenna for AM, and folded Dipole for FM reception. Wired for phonograph operation. RMA listed. This superbly engineered receiver is supplied, ready to operate, with tubes, speaker, antennas, and all necessary hardware for mounting in a table or console cabinet.

For full details about these chassis, and the custom field, WRITE TODAY

ESPEY MANUFACTURING COMPANY, INC.

528 EAST 72<sup>ND</sup> STREET-NEW YORK 21, N. Y.

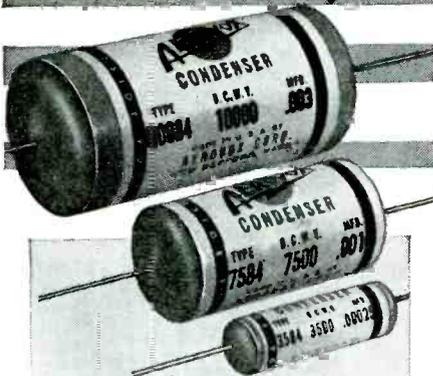
# HIGH-VOLTAGE

# PAPER

# TUBULARS

for TELEVISION,

OSCILLOGRAPHS, etc.



• Interested in higher-voltage, dependable yet inexpensive paper capacitors? Here's the Aerovox answer:

The popular Aerovox Type "84" paper tubulars are now available in extended-voltage ratings — 2500, 3500, 5000, 7500 and 10,000 volts D. C. W. Capacitances of .0001 to .05 mfd. Compact dimensions—from 3/8" dia. by 1-1/2" long for smallest, to 1-3/8" dia. to 3" long for largest. Oil-impregnated wax-filled. Sturdy insulating tube. Sealed ends. Bare pigtail leads that won't work loose. Bright yellow-red-black label jacket. And tough!

• See Our Jobber ...

These extended-voltage paper tubulars are now available. Order your needs from our jobber. Ask for latest catalog.



FOR RADIO-ELECTRONIC AND INDUSTRIAL APPLICATIONS

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Export: 13 E. 40th St., New York 16, N.Y. • Cable: 'ARLAB'  
In Canada: AEROVOX CANADA LTD., Hamilton, Ont.

## F-M Features

(Continued from page 43)

loose connections, noisy tubes, etc. In connection with tube noise, there is liable to be a certain amount of noise in the form of a hiss which originates in the plate circuit of the mixer tube when the receiver is tuned to a weak f-m signal.

**Regeneration:** Since the r-f and i-f stages of an f-m receiver operate at a higher frequency than a-m receivers, they are more susceptible to regeneration and special attention should be given to the following possible causes:

- Critical leads not properly dressed.
- Loose shields and ground connection.
- Open or defective bypass capacitors.
- Improper screen or plate voltages.
- Misalignment of tuned circuits.

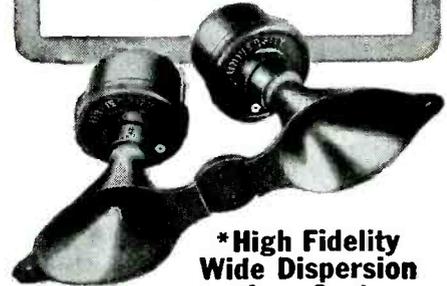
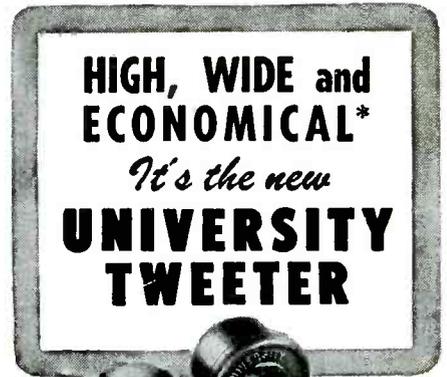
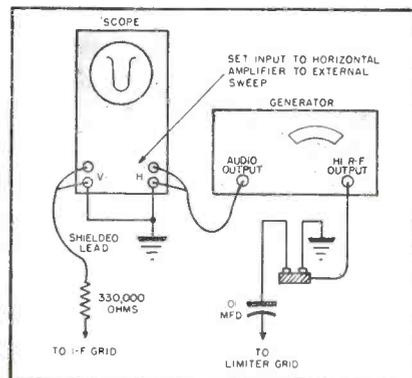
**Interference:** There are several forms of interference which might be encountered, such as interference from a station operating on the same channel, adjacent channel interference, and interference from a signal at or near the i-f frequency.

The first form of interference, a station operating on the same channel, is not nearly so serious as is the case with a-m receivers, since the desired signal need not be more than twice as strong as the undesired signal for the undesired signal not to be heard. This condition is due to the action of the discriminator and is very helpful in eliminating this type of interference.

The second form of interference, adjacent channel interference, should be eliminated by the i-f amplifier system, but may exist due to improper alignment of the i-f transformers, so that the i-f response curve is much broader than need be, or may also exist due to some defect in the i-f transformer itself which broadens the response curve.

The third form of interference, i-f signal interference, due to some signal

Fig. 4. A visual alignment setup used in f-m work.



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Wide Dispersion  
Low Cost

It's the new UNIVERSITY Tweeter! Extends the range of any cone speaker to 15,000 cycles. Install it in your present equipment by merely attaching two wires to the voice coil terminals of the existing speaker, without creating any electrical unbalance. Simply connect, listen and enjoy. Twin units provide 100° horizontal and 50° vertical dispersion. Three models to choose from—walnut cabinet type, and single or dual unmounted types. Priced from \$20.00. Write today for complete details to UNIVERSITY LOUDSPEAKERS, INC., 80 South Kensico Avenue, White Plains, N.Y.

*University Loudspeakers*

at or near the i-f center frequency, can only be eliminated by the use of a wave trap at the i-f frequency or in the realignment of the i-f system to a different center frequency.

[From notes on the principles of f-m prepared by the G. E. technical service section.]

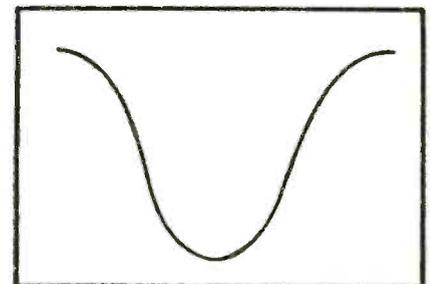
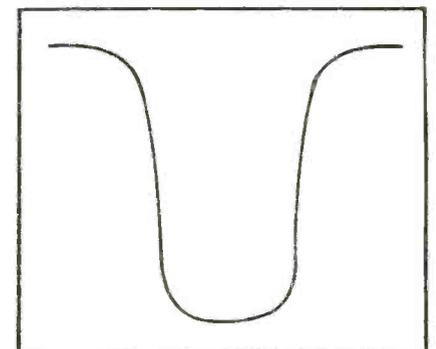


Fig. 5. Scope pattern of i-f curve for one stage.

Fig. 6. Overall i-f curve pattern as viewed on the scope.

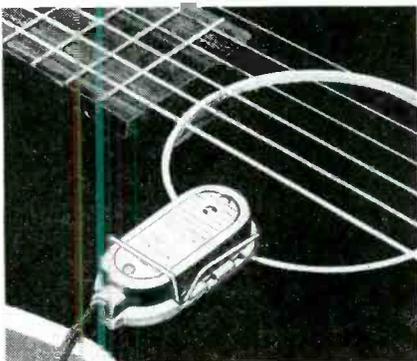


## New Products

(Continued from page 35)

crystal, sealed against moisture and acoustic feedback.

Pick-up has snap-on clip. Weighs 2 ounces and measures 2 1/4" x 1" x 1 1/8".



\* \* \*

### SHALLCROSS MINIATURE PRECISION RESISTORS

Four small-size *akra-ohm* precision resistors have been announced by the Shallcross Manufacturing Company, Collingdale, Pa. Type 136 has a maximum wattage rating of 0.25 and is 1 5/32" long x 3/8" in diameter; maximum resistance is 150,000 ohms.

Types 137, 133 and 134 are 2-, 3-, and 4-section units with 2, 3 and 4 leads respectively and with 0.25 watt maximum load per section. Maximum resistance of 550,000 ohms is available in type 133.

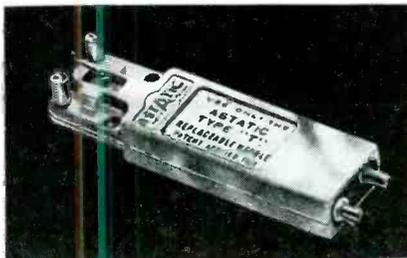
Resistors have 2" tinned copper wire leads.

\* \* \*

### ASTATIC CRYSTAL CARTRIDGES

Type LT low needle-talk crystal phono cartridges have been announced by The Astatic Corporation, Conneaut, Ohio.

Output voltage 1 (average) at 1,000 cps. Minimum needle pressure, 3/4 ounce. Cutoff frequency, 4,000 cps. Has a replaceable type T needle with electro-formed precious metal playing tip.



\* \* \*

### G. C. KNOB KITS

Four plastic knob kits have been announced by General Cement Mfg. Co., 919 Taylor Avenue, Rockford, Illinois. Kits include 35 assorted push-on knobs and needle cup; 28 assorted spring knobs and needle cup; 24 assorted set screw knobs and needle cup; and 30 assorted all-type knobs and needle cup.

\* \* \*

### HICKOK NINE PIN SOCKETS

Hickok Electrical Instrument Company has announced the availability of a nine

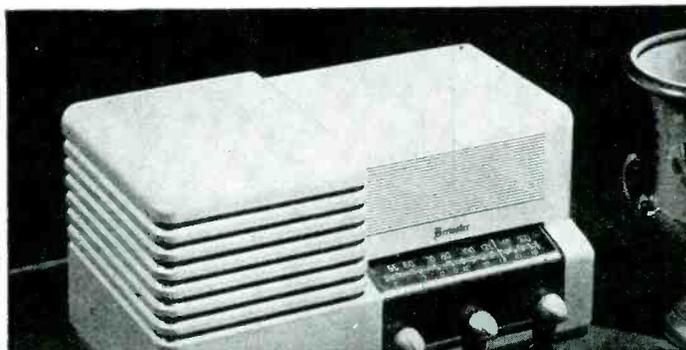
# MEISSNER

PRESENTS THE NEW *Brewster Line*  
OF TABLE MODEL RADIOS! . . .

Here at last is the outstanding line of table model radios you have been waiting for! Superbly designed, unmatched for sheer beauty of tone, these quality sets reflect the skill and craftsmanship that have made the name Meissner a byword for quality in the trade.

Smartly designed, quality engineered, these new Brewsters are being manufactured for exclusive distribution through parts jobbers only. No quotas, no high pressure tactics, no sales direct to dealers or special distributors . . . nothing that might interfere with your merchandising this exclusively-jobber line to the hilt. And Meissner unconditionally guarantees these new Brewsters against price reduction for the balance of the year.

*This line is available for delivery now. Write today for full information, catalog and prices.*



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**EXPORT-SCHEEL INTERNATIONAL INC.**

4237 N. LINCOLN AVE., CHICAGO 18, ILL. • CABLE-HARSHEEL

pin socket which may be adapted to Hickok tube testers. Conversion may be made by drilling a larger diameter hole where the present socket is now retained.

\* \* \*

### CLIPPARD POCKET-SIZED SIGNAL GENERATOR

A pocket-size signal generator, the Signalette, producing r-f, i-f and a-f from approximately 2500 cycles through 20 mc, has been announced by Clippard Instrument Laboratory, Inc., 1125-33 Bank Street, Cincinnati, Ohio.

Working either on 110 volts a-c or d-c, the unit has a fundamental frequency of approximately 2500 cycles modulated by

(Continued on page 46)





**A FULL LINE**

**OF PM AND**

**ELECTRO-DYNAMIC**

**SPEAKERS**  
for the trade, in

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MANUFACTURING DIVISION  
3120 E. PICO BLVD.  
LOS ANGELES 23, CALIF., U.S.A.

## New Products

(Continued on page 45)

60-cycle supply when used on a-c; modulation is not present when used on d-c.

Approximately 9¼" long and 1½" in diameter. Weighs 9 ounces. Has an adjustable output attenuator.

Uses a fundamental frequency of approximately 2500 cycles to provide a separation of 2.5 kc between successive harmonics.

\*\*\*

### AEROVOX HIGH-CAPACITANCE LOW-VOLTAGE MIDGET-CAN ELECTROLYTICS

High-capacitance low-voltage midget-can electrolytics, type PRS, have been announced by Aerovox Corporation, New Bedford, Mass.

Units are available in six ratings: 6, 12, 15, 18, 25 and 50 volts d-c working. High-capacitance ratings are: 100, 250, 500, 1000, 1500, 2000, 3000 and 4000 mfd, in different voltages.

These high-capacitance electrolytics are used mainly in electric fence assemblies and other similar applications.



\*\*\*

### RMC EQUALIZER

Equalizer, type EL-3, allowing use of one arm for vertical only and one arm



for lateral only on one turntable or separate tables, has been announced by Radio-Music Corporation, Port Chester, N. Y.

Switching equalizer from vertical equalization to lateral allows changing from one arm to the other; at the same time, the correct equalization is thrown in.

\*\*\*

### WELLER SOLDERING GUN WITH SPOTLITE TIP

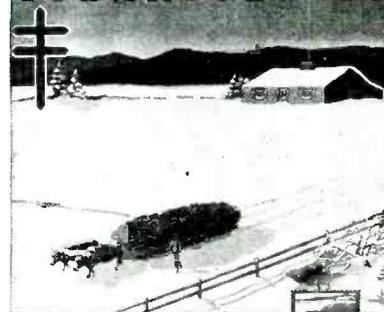
A soldering gun with a spotlight tip has been announced by the Weller Manufacturing Company, 805 Packer St., Easton, Pa.

The spotlight goes on automatically when the trigger switch for heating the gun is closed. Gun has 5-second heating. Power is on only while the tool is in use.

Two models are available: one with a single heat of 100 watts; another with a dual heat control, with 100 watts normal heat and a 35% instantaneous reserve heat.



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TUBERCULOSIS



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Christmas Seals

### RCA TUBE REFERENCE BOOK

The 1948 edition of the vestpocket RCA tube reference book has been published and is now available from RCA, Cunningham and RCA Victor tube distributors.

The reference book contains up-to-date data on RCA receiving tubes, condensed data on over 260 RCA non-receiving tubes, RCA color codes on mica and ceramic capacitors and resistors. Has, in addition, a world atlas with maps in full color, including an 8-page section of the United States.

Included also is a replacement directory covering tubes for industry, communications, and special uses, and a listing of directly interchangeable RCA tube types, as well as a listing of similar RCA types. Additional features are a battery interchangeability chart, glossary of television

terms, charts for calculating series resistance and parallel capacitances, and a table of metric equivalents.

\* \* \*

### E. M. BRAUN BECOMES MAGUIRE JOBBER S-M

E. M. Braun has been appointed jobber sales manager for Maguire Industries, Chicago. Mr. Braun will be charge of all jobber sales for the Meissner, Radiart and Thordarson divisions of Maguire.

Prior to his appointment, Mr. Braun was sales coordination manager of the electronic distributor and industrial sales department of Maguire Industries.



E. M. Braun

\* \* \*

### SNYDER FACTORY REP DIVISION FORMED

A separate sales division, composed of factory representatives, to promote the sales of microphone stands, house antennas, auto antennas and other allied equipment, has been formed by the Snyder Manufacturing Company, Philadelphia.

\* \* \*

### INSULINE CATALOG

A 52-page catalog, N-48, illustrating and describing a variety of parts has been prepared by Insuline Corporation of America, Long Island City, N. Y.

Dimensional drawings are presented in the catalog.

\* \* \*

### SEAMAN NOW WEBSTER-CHICAGO AD MAN

S. T. Seaman has been appointed advertising manager of Webster-Chicago, 5610 W. Bloomingdale Ave., Chicago.

John W. Walt has become supervisor of phonograph needle sales of Webster-Chicago. Mr. Walt will head sales promotion operations on the recently announced black nylon and the ivory nylon phonograph needles.

\* \* \*

### RIDER MANUAL VOLUME XVI AVAILABLE

Rider manual volume XVI, containing circuits of receivers made by ninety-four manufacturers has been published by John F. Rider Publisher, Inc., 404 Fourth Avenue, New York 16, N. Y.

Manual, with 768 pages, features *clari-*  
(Continued on page 48)



## Technical Tips

### Effects of low transconductance on receiver performance

• The tubes used in the r-f and i-f stages of modern receivers have relatively high transconductance. Circuit designs depend on the resulting high tube gain for top performance. Hence, a reduction in transconductance due to a decrease in cathode emission may result in a severe loss in receiver sensitivity and a corresponding reduction in the signal-to-noise ratio.

In AM receivers this condition is characterized by low or inaudible output from distant stations though local reception is satisfactory. In FM receivers, where the effects are more serious, the condition is characterized by noise and distortion even on local signals.

In any case, it's good practice—and good customer relations—to recommend the replacement of any questionable tubes with new Cunninghams.

For more service—TURN THE PAGE →

# Cunningham

## Electron Tubes

A product of  
RADIO CORPORATION OF AMERICA  
Harrison, N. J.

### 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, 1947.

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

Before me, a notary, 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. Gooderough, 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 23d day of September, 1947.

(Seal) FRANKLIN B. GOOLD,  
Notary Public.

Commission expires March 30, 1948.

# The Right Combination

For All Receiver Servicing



MODEL 641—SIGNAL GENERATOR

- AM—100 KC to 120 MC fundamental. Metered output 0-100,000 microvolts. Variable percentage and audio frequency modulation.
- FM—100 KC to 160 MC. Variable frequency deviation 0-400 KC (800 KC total sweep) at variable audio rate.
- AUDIO—100 to 10,000 cycles. Audio available for direct connection to audio circuits.
- THE 645 VTVM gives you all necessary measuring facilities. With the new probe the frequency is extended to 200 MC.

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The 641 Gives You  
All Three  
AM—FM—AUDIO  
for  
Complete Circuit Testing  
and Alignment



MODEL 645

**JACKSON**

*Radio Testing Equipment*

THE JACKSON ELECTRICAL INSTRUMENT CO., DAYTON, OHIO

**EXTRA Protection for EVERY Service Job!**

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## VITROHM RESISTORS

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Fixed Type in 8 Sizes  
from 5 Watts to 200 Watts  
Adjustable Type in 7 Sizes  
from 10 Watts to 200 Watts

You can guarantee dependable, trouble-free performance when you install VITROHM wire-wound resistors. Windings are held in place and protected by a special WL vitreous enamel which is tough, crazeless, moisture and acid-resistant. They give long service, avoid call-backs, build satisfied customers and greater profits. Available in wide range of resistance values.

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## News

(Continued from page 47)

fed-schematics and breakdowns of multi-band radio receivers.

Accompanying the manual is a separate *How It Works* book and Index. Book covers the theory of new circuits, and contains chapters on *FM Receiving Antennas, Television Picture Maladjustment or Interference, The Selenium Rectifier, Pre-Emphasis and De-Emphasis, Special AVC Circuits, Tuning Indicators for F-M Receivers, Television H-V Power Supplies and Battery Charging Circuits.*

\* \* \*

### TECHNICAL APPLIANCE MOVES TO SHERBURNE, N. Y.

Technical Appliance Corporation has moved from Flushing, N. Y., to its own plant building at Sherburne, N. Y., 40 miles south of Utica.

\* \* \*

### AMPLIFIER CORP. OF AMERICA MAGNETAPE RECORDER DATA

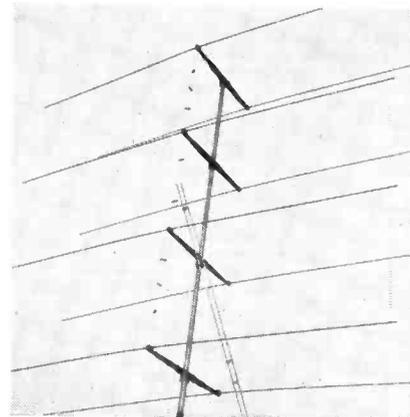
A series of 10 *Magnetape* recorders and accessory equipment are described and illustrated in an 8-page circular, issued by the magnephone division, Amplifier Corp. of America, 398-3 Broadway, New York 13, N. Y.

Units are said to feature extended frequency response up to 12,500 cycles, ad-

### TV ANTENNA SYSTEM



Above: Alfred C. Denson, president of the Denson Television Corp., Rockville, Conn., and inventor of the recently announced VEE-D-X television antenna system. Below: The VEE-D-X antenna, which is made by the La Pointe-Plascomold Corp., Unionville, Conn., of which Jerome Respass is president.



justable tape speed portability. An 8-hour continuous play model is also available.

\* \* \*

**HYTRON TUBE TAPPER**

A tube tapper, in the form of a pencil, for discovering intermittent shorts and opens, has been announced by Hytron Radio & Electronics Corp., 76 Lafayette Street, Salem, Massachusetts. Tube tapper can be ordered in lots of 25 for \$1.25.

\* \* \*

**JFD REVOLVING CHEMICAL DISPLAY**

An electrically-driven revolving display for radio chemicals has been announced by JFD Manufacturing Co., Inc., 4117

Fort Hamilton Parkway, Brooklyn 19, N. Y.

Bulletin 8473 describes display.

\* \* \*

**FERREE NOW IRC SALES MANAGER**

Robert D. Ferree has been appointed sales manager of the IRC merchandise division.

Mr. Ferree succeeds Bob Baggs who leaves IRC to become general manager of the Harry P. Bridge Co., advertising agency.

Bob Ferree has been associated with IRC's jobber and industrial sales activities for seven years.



Bob Ferree (standing), and Bob Baggs.

\* \* \*

**H. F. BERSCHE BECOMES MANAGER OF RCA RENEWAL TUBE SALES DEPT.**

Hal F. Bersche has been named manager of the renewal sales force for the RCA tube department. He will coordinate field sales activities of RCA tubes, batteries, test equipment, electronic components, and package sound products sold through distributors.



H. F. Bersche

**TAPE RECORDER REHEARSAL**

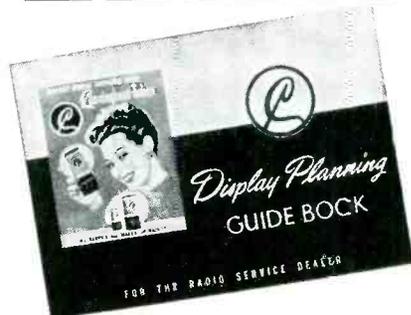


W. L. McKnight, president of the Minnesota Mining and Mfg. Co. (right), with program producer, Max Karl, in the WMIN control room, St. Paul, Minn., during rehearsal of a tape-recording transcription program.



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How to give your shop more sales per square foot



● Now you can create a modern, active selling atmosphere in your own shop without the costly aid of a professional decorator. Cunningham's new Display Planning Guide Book tells you exactly how to utilize inexpensive Comaras and Posters to transform windows and interiors into dramatic and colorful selling displays. Without cost to you, you get the display planning experience of one of the foremost merchandising organizations in the country! GET YOUR COPY TODAY FROM YOUR CUNNINGHAM DISTRIBUTOR.

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50 • SERVICE, NOVEMBER, 1947

**Ser-Cuits**

(Continued from page 33)

while auto engines are not. Because of the greatly increased pressure which exists just before combustion, when a motor is loaded up, any reduction of ignition voltage prevents complete combustion and usually results in the dilution of the crankcase lubricant and often ruin of the engine.

**Shielding**

Because of this difference in loading, an auto radio can use a comparatively simple suppressor in the ignition circuit without damage to the engine. Suppressors, however, cannot be used in a marine engine. Instead it has been necessary to use extensive shielding. This shielding problem has been

(Continued on page 51)

**RCA DRY BATTERY DISPLAY**



A. C. Duncan, in charge of battery sales for the RCA tube department, viewing a battery window display set up in the reception room of the RCA Harrison, N. J., plant.

**PRECISION APPARATUS WINDOW DISPLAY**



Precision Apparatus window display at Leonard Radio, 69 Cortlandt Street, New York City.

solved in the Challengaire model by employing a modification of the familiar static bucking system, with a noise antenna in the engine compartment of the ship feeding a noise signal into the antenna circuit of the receiver, the voltage being equal to the noise pickup of the regular antenna, but 180° out of phase with it.

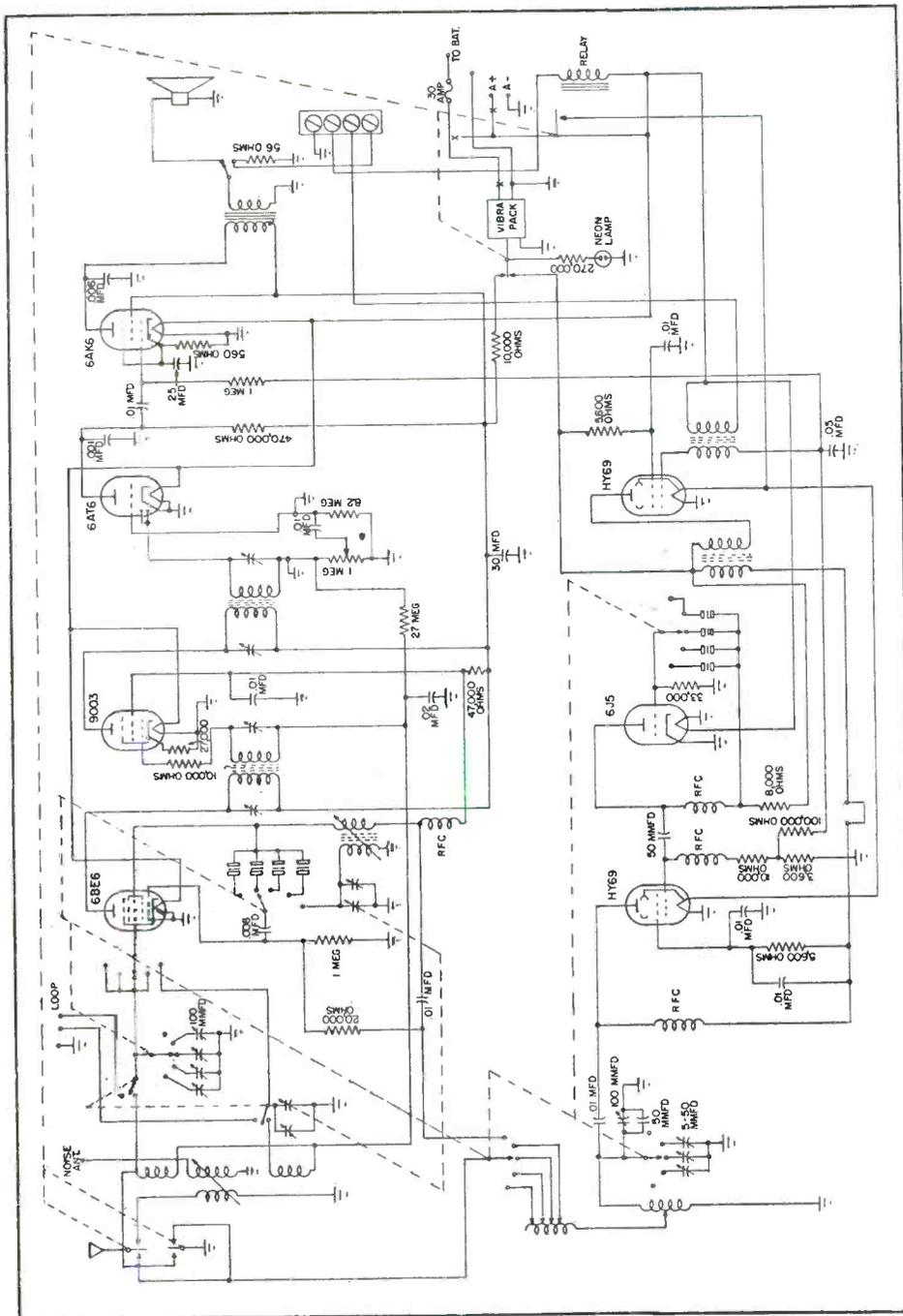
**Noise-Antenna Length**

The noise antenna is the length of the shielded cable, with sufficient

shielding pulled back to expose a length of wire which acts as the antenna. The exact length is determined by experiment on each boat. The exposed portion is installed nearer the ignition wiring. The shielding prevents pick up of any other noise. The noise is coupled to the grid coil used for receiver input and controlled by means of a vary-coupler.

A noise-adjusting setscrew, on the chassis, is used for noise control.

Fig. 3. Challengaire (model 109) radiotelephone marine receiver which features a novel ignition-noise suppression system.



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IN CANADA: Atlas Radio Corp., 560 King St., W., Toronto, Ont., Canada



## Servicing Helps

(Continued from page 31)

entire circuit or any individual circuit may then be safely checked.

### Auto Servicing Notes <sup>1</sup>

*Pontiac Auto Radio, Model 983776:* A shot OZ4, in one of these sets, revealed a rather interesting problem. After a check of the power supply showed nothing abnormal, a new tube was put in. The set played fine for awhile, in fact for about an hour and then cut off completely. Shaking and jarring the chassis brought back reception for only a few seconds.

On checking through the set with a vtvm, it was found that there was no voltage reading from the oscillator grid to ground. A visual check in the oscillator circuit disclosed a peculiar looking object connected from the grid to ground, and from it oozed a black paste. A resistance check indicated the grid was shorted to ground and through the above mentioned part. The only identification on this part was its part number 7240038. It was found to be a .000007-mfd temperature compensating capacitor. Since a replacement was not obtainable, the unit was cut out. A slight adjustment on the oscillator padder adjustment screw was sufficient to account for the decrease in capacity. The slight drift due to the elimination of the capacitor was not too noticeable.

*Silvertone 110.426:* This is a combination radio and phono, in which pickup-skip trouble has been encountered. After being in operation for some time the pickup on these sets will skip back several grooves on the record as if the record were defective. The trouble has been traced to the wires encased in loom at the rear of the cabinet. The vibration set up, when the set is in use, causes the wires to gradually move up against the bottom of the pickup mount. Dressing the wires up out of the way and securing them with a clamp to the cabinet will prevent future trouble from this source.

*Auto Set Capacitors:* The continual vibration on the road has made snapped leads on the larger bypass capacitors a common occurrence. This shows up as severe howling, motorboating, etc. As a permanent remedy, these capacitors should be replaced with the metal or bakelite cased types having lug terminals. Thus the mounting is rigid and the effect of the vibration minimized.

<sup>1</sup>Prepared by John W. Findarle.

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## Coin-Operated Receivers

(Continued from page 15)

sageway, and therefore release the lightweight coin. Thus it can be seen that the cradle serves to gage the diameter of the coin, as well as its weight, and deliver the coin with a uniform speed through the magnetic field.

Every slug rejector is thoroughly inspected at the factory and therefore should give long service without trouble. However, cleaning may occasionally become necessary, depending on the machine use. Best results are secured when the slug rejector is mounted level in the machine. Should it become necessary to remove it from the cabinet, it must be handled on a clean bench, free of steel or magnetic particles.

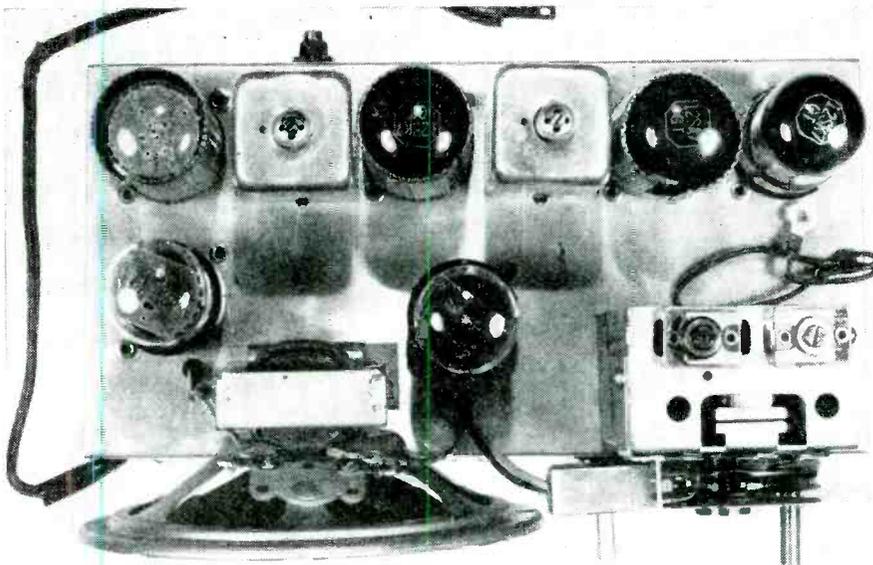
At no time should any part of the rejector system be oiled or greased. If any moving part does not operate as freely as desired, it is never a matter of lubrication, but rather of adjusting that particular part to its original



Front view of the Tradio receiver.

shape (for it might accidentally have been distorted or bent). Or more likely, it may need cleaning with a brush or cloth, using a little naphtha or alcohol. Files, sandpaper or any other abrasive should never be used when cleaning the slug rejector, which should be clean and dry at all times. No tools are required to dismantle the slug rejector for cleaning purposes.

View of the Tradio chassis.



## JOHN RIDER SAYS ...

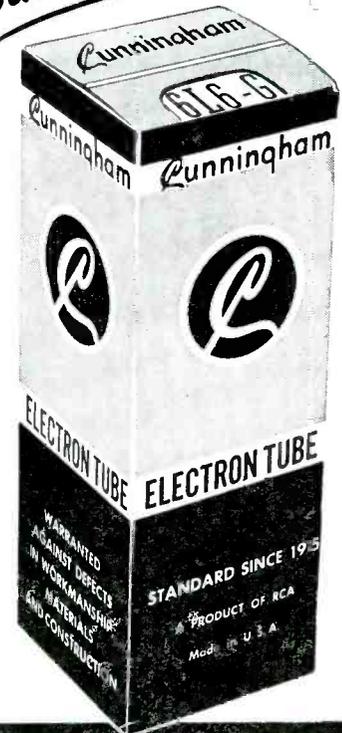
### Systematize Your Servicing



● Most technical activities are planned and accomplished by means of a systematic working method. Servicing is no different. Often, system is described as "red tape," and frowned upon, but even red tape has its place, where it prevents indiscriminate starting and stopping of activities.

In the servicing field the possession of test equipment permits planned and systematic operation. Sometimes, the application of a planned method of procedure may seem roundabout, but in the long run it is the fastest and most efficient way to conduct a servicing business. As an operator becomes accustomed to systematic operation he becomes more and more rapid with his work; the various steps become almost automatic and so does his association of thoughts related to the diagnosis of a troublesome problem. Try it for a while—say, three months or so—and you'll be surprised at the good results.

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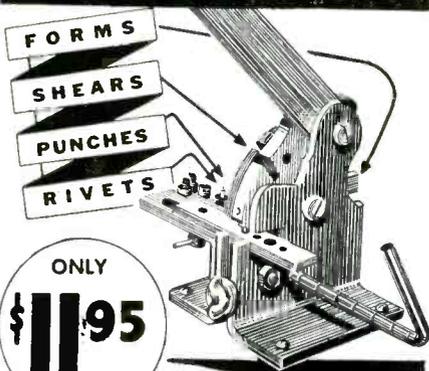
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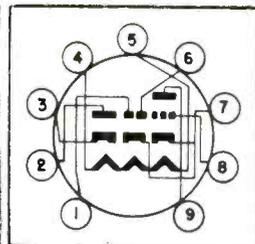


Fig. 4 (left). The internal connection of the 19T8 tube.

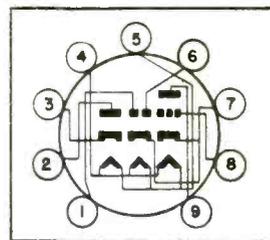


Fig. 5. Internal connection of 6T8.

## Tube News

(Continued from page 28)

from the bottom. Connection of the 100-ohm resistor between the lower tap and ground was found to contribute to uniformity of operation over the frequency band.

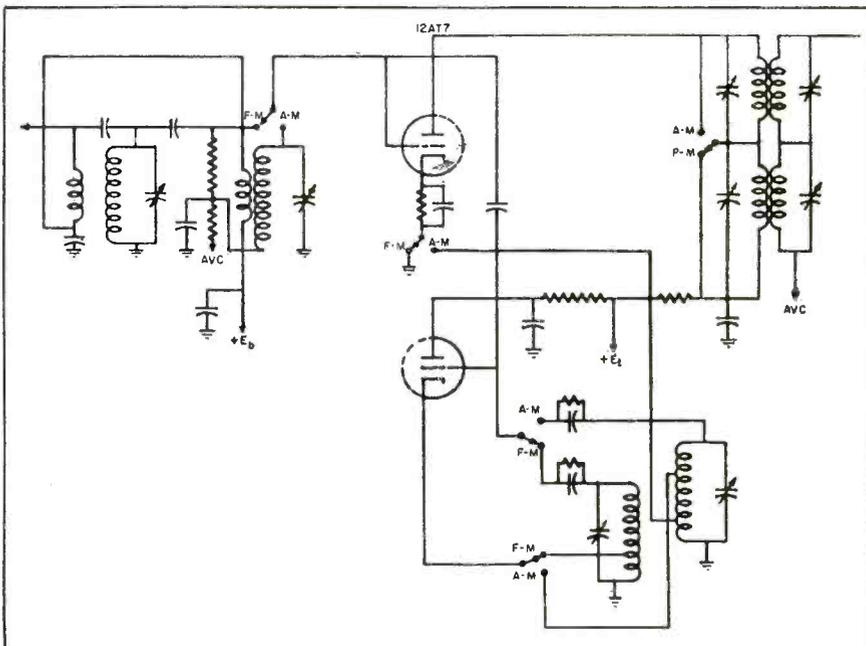
Fig. 3 shows a suggested circuit for operation of the 12AT7 as a converter in both f-m and a-m bands, with provision for switching between the two. This circuit provides for operation of the 12AT7 with grid injection in the

f-m band and with cathode injection in the a-m band.

The 19T8 and the 6T8 nine-pin miniature tubes consist of a high-mu triode in the same envelope with three high-perveance diodes. One diode is provided with a separate cathode connection, permitting the tube to be used as both an f-m and a-m detector.

The internal structures of the 19T8 and the 6T8 are the same, except that in the 19T8 the three heater sections are connected in series, as shown in Fig. 4, to permit operation of the tube in series with the 150-milliamper

Fig. 3. Circuit using 12AT7 as a converter for a-m and f-m.



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heaters of other tubes in a-c/d-c receivers. In the 6T8 the three heater sections are connected in parallel as

shown in Fig. 5, and 0.45 ampere at 6.3 volts is required for the heater.

A circuit for f-m and a-m detection using the 19T8 or 6T8 is shown in Fig. 6. Diodes 2 and 3 are connected in a ratio-detector circuit for f-m. Because a ratio detector does not respond readily to amplitude modulation, a limiter tube is not necessary. In this circuit  $L_1$  and  $L_2$  are closely coupled.  $R_1$  provides the desired amount of overdrive. The value of  $C_1$  was chosen to afford an effective time constant of .2 second with  $R_1$ .

For a-m detection, diode 1 is used in the conventional circuit. With the output voltage of either a-m or f-m detector as input, the triode section of the 19T8 or 6T8 provides enough output voltage to drive a 35B5 or 50B5 power output tube.

[Data based on application information prepared by G. E.]

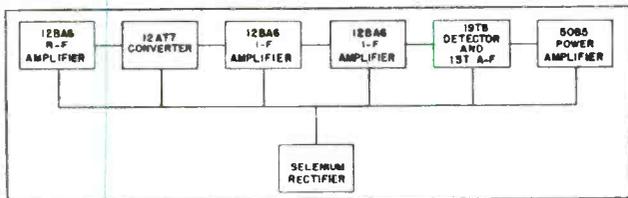


Fig. 7 and 8. Block diagrams for a-m and f-m, using the 12AT7 and 19T8 tubes.

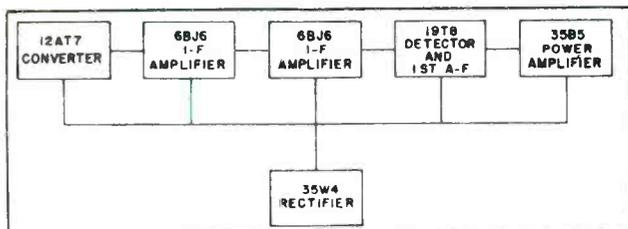
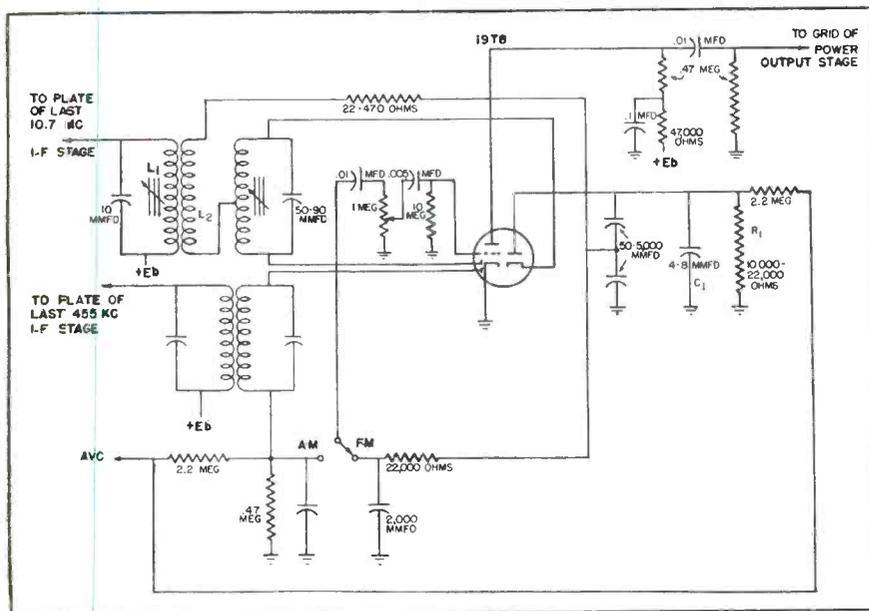


Fig. 6. Circuit for f-m and a-m detection using a 19T8 or 6T8.



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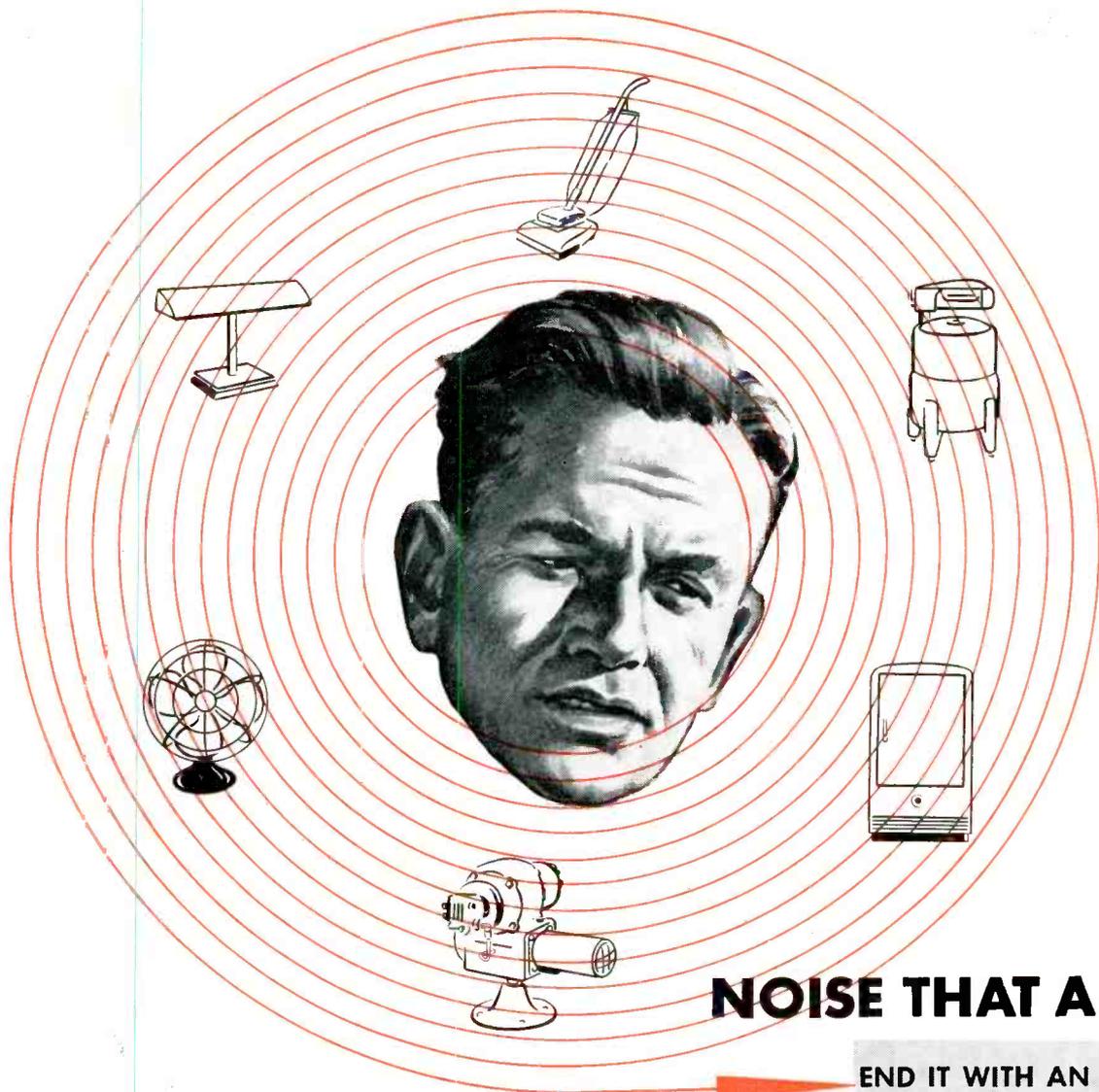
## JOTS AND FLASHES

PRODUCTION OF TV RECEIVERS by quite a few manufacturers is now in full swing, the past few weeks having seen the entry of new and veteran companies in the tv manufacturing field. Fada has announced that it will begin shipments of its tv receivers shortly before Christmas. . . . The Preston Television Mfg. Company, Bayside, N. Y., have begun making deliveries on a 12" direct-viewing model. . . . Sonora has reported that they will begin delivery of their television receivers in a few weeks. . . . DuMont has brought out their tv table model version, which is selling at a very moderate price. . . . It is believed that the early weeks of December will see some two dozen manufacturers in the tv receiver field. . . . Raymond B. George is now sales promotion manager of Philco. . . . The industry was shocked to hear of the death of Robert Williams, sales manager of Hickok Electric Instrument Company. He was 70 years. . . . The Wholesale Supply Company, Nashville, Tennessee, have been named Bendix Radio distributors. . . . Floyd Makstein has been named service manager of Emerson Television Service Corp. . . . Hoffman Radio have included a magnetic wiring unit in their new a-m/fm receiver. . . . Major General Roger B. Colton (Ret.) has been elected vice president of Federal Telephone and Radio Corp. . . . Electronic Measurements Corp. is now located at 423 Broome Street, N. Y. C. Morris Lieblich is president and Lou Stans, executive vice president. . . . Radio Electric Service of Pennsylvania have been appointed Air King distributors in the Philadelphia, Allentown, Camden, N. J., Wilmington, Del., and Easton, Pa., areas. Chamrose Distributors, 170-16 Jamaica Avenue, Jamaica 3, Long Island, have also been appointed Air King distributors. . . . John J. Moran has become sales manager of the accessory division of Philco. . . . Robert Y. Chapman is now executive engineer of David Bogen Co. . . . A. D. Adams has been named advertising manager of Air King Products Company, Brooklyn, N. Y. . . . L. K. Alexander is now assistant manager of the receiver division of the G. E. electronics section at Syracuse, N. Y. . . . The Pioneer Radio Supply Corporation, 2115 Prospect Avenue, Cleveland, Ohio, has been named distributors of RCA tubes, batteries, parts and test equipment. Max G. Bauer is vice president and general manager of Pioneer. . . . Michael Scott has resigned from Radio Wire Television, Inc. Ernest J. Calnan has been named manager of the Boston branch.

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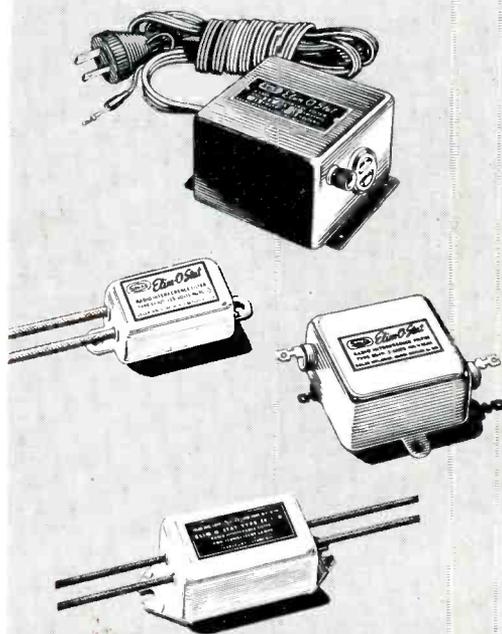
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### RCA Presents Unique Battery Kit for Personal Type Radios

**N**OW—to help you make *extra* holiday profits—RCA brings you this new *matched-performance* kit of battery power for virtually all personal type radios...packaged for the Christmas trade. Each kit contains an RCA VS-016 B battery, and *six* RCA VS-036 sealed-in-steel A batteries...an ample and convenient supply of A power to last the full life of the B battery.

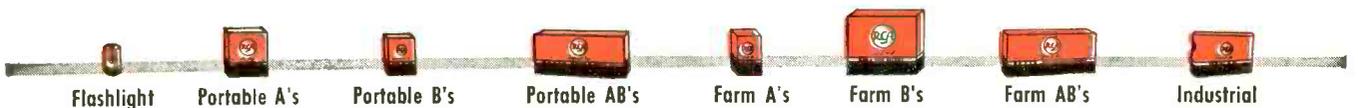
This new and easy way of buying battery power

for personal radios will appeal instantly to Christmas shoppers in search of practical gifts. Each carton lists the makes of personal radios the kit is equipped to power.

After the holidays, you can cash in on the repeat battery kit business that's bound to follow.

Place your order now with your RCA Distributor to insure early delivery.

**RCA BATTERIES—THE COMPLETE LINE FOR THE ELECTRONIC DISTRIBUTOR**



**TUBE DEPARTMENT**

**RADIO CORPORATION of AMERICA**

**HARRISON, N. J.**